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Report to the Senate and House of Representatives on water quality at beaches under the care and control of the Department of Conservation and Recreation

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Executive Summary

This report on the water quality of Massachusetts Department of Conservation and Recreation (DCR) state property beaches is being submitted by the Massachusetts Department of Environmental Protection (MassDEP), in consultation with DCR, the Massachusetts Department of Public Health (DPH), the Massachusetts Water Resources Authority (MWRA), and Save the Harbor/Save the Bay to the General Court of the Commonwealth of Massachusetts in fulfillment of House Bill No. 4384. This Bill directed "*the department of environmental protection to report on water quality at beaches under the care and control of the department of conservation and recreation; and provided further, said report shall include, but not be limited to, an assessment of water quality at all department of conservation and recreation beaches, actions to be taken by the department to improve water quality levels and recommendations for actions to be undertaken by federal, state, local authorities as may be required to improve water quality at said beaches.*"

Bathing beach water quality at all public and semi-public bathing beaches in Massachusetts is regulated by DPH under Massachusetts General Law and the Code of Massachusetts Regulations (M.G.L. c. 111, ss. 3, 5S, and 127A and 105 CMR 445.000). These regulations require regular monitoring for bacteria consistent with state and federal Beaches Acts. This report includes an evaluation of water quality at 26 marine and 63 freshwater DCR beaches between the years of 2008 and 2012 (see Figure 1). This report does not include 2013 water quality data because it was not available through DPH's beaches database at the time this report was developed. In addition to monitoring water quality at DCR's state beaches, monitoring is also conducted by other entities at approximately 1,000 additional beaches statewide that are not discussed in this report.

Many factors can influence water quality at beaches rendering them unsuitable for swimming. Foremost among these is the presence of elevated bacteria and freshwater harmful algae blooms (HABs). When bacteria concentrations exceed the state's numeric water quality criteria, or if other potential health threats exist, the beach must be posted with a sign that advises against swimming. For the purposes of this report, water quality at DCR beaches was evaluated based on the frequency at which the bacteria concentrations met water quality standards at each beach every year from 2008 through 2012. Bacteria data collected by DCR and reported to DPH were used for this water quality evaluation. The presence of HABs at beaches which rendered water quality unsuitable for swimming was also used in this evaluation.

Between 2008 and 2012, the five-year period reviewed for this report, DCR's beaches were safe for swimming on average, over 90 percent of the time. For the DCR beaches which have experienced more frequent bacteria concentration exceedances, the culprit has often been identified and actions, when possible, have been or are being taken to remedy the source of the bacterial contamination. Additional monitoring at one pond with two DCR beaches that is experiencing prolonged algal blooms is also being conducted to identify the source(s) contributing to the problem.

In addition to providing an evaluation of water quality at the 89 DCR beaches, this report provides a brief summary of actions that have been undertaken to address problems and recommendations for improving water quality at these beaches. The most prevalent threat to beach water quality is bacteria laden stormwater runoff from large rain events into beach areas. Stormwater runoff affects urban, suburban and rural beach areas whether by storm water outfalls, combined sewer overflows (CSOs), or other more diffuse nonpoint sources of bacteria pollution. Illicit sewer connections to storm drains, septic tanks, nearby agriculture or residential areas can also contribute both elevated bacteria and nutrient levels that may result in HABs. The presence of nuisance wildlife such as geese near a freshwater beach area, or pet waste that has not been picked up and disposed of properly, can also contribute to elevated bacteria levels. Lastly, heavy use of many of DCR's beaches can also contribute to elevated bacteria concentrations.

General recommendations that can be applied to all of the beaches to keep them open, safe, usable, and enjoyable for the public during the beach season, are included at the end of this report. First and foremost, there is a need for continued and enhanced funding to support bathing beach monitoring, staffing at bathing beaches, and the implementation of projects and best management practices (BMPs) that will reduce the potential for contamination. BMP and other literature that have been developed to help inform beachgoers, operators, planners, engineers and regulatory staff about effective tools to reduce bacteria levels and restore good water quality conditions at DCR beaches are provided as Appendices (B, C, and D) to this report. All recommendations, both specific and general, are the result of efforts made by DCR, DPH, MassDEP, MWRA, and Save the Harbor/Save the Bay to improve water quality at DCR's beaches.

For more information on the water quality of bathing beaches throughout the state, DPH produces annual beach reports (www.mass.gov/dph/beaches). Save the Harbor/Save the Bay also produces an annual beach report card, reporting on beach safety for 13 Boston Harbor area beaches each year (www.savetheharbor.org). Additionally, in 2007, the Metropolitan Beaches Commission released a report outlining recommendations for improving metropolitan Boston area marine beaches, a follow-up report was released in June of 2014 both reports can be downloaded from www.savetheharbor.org.

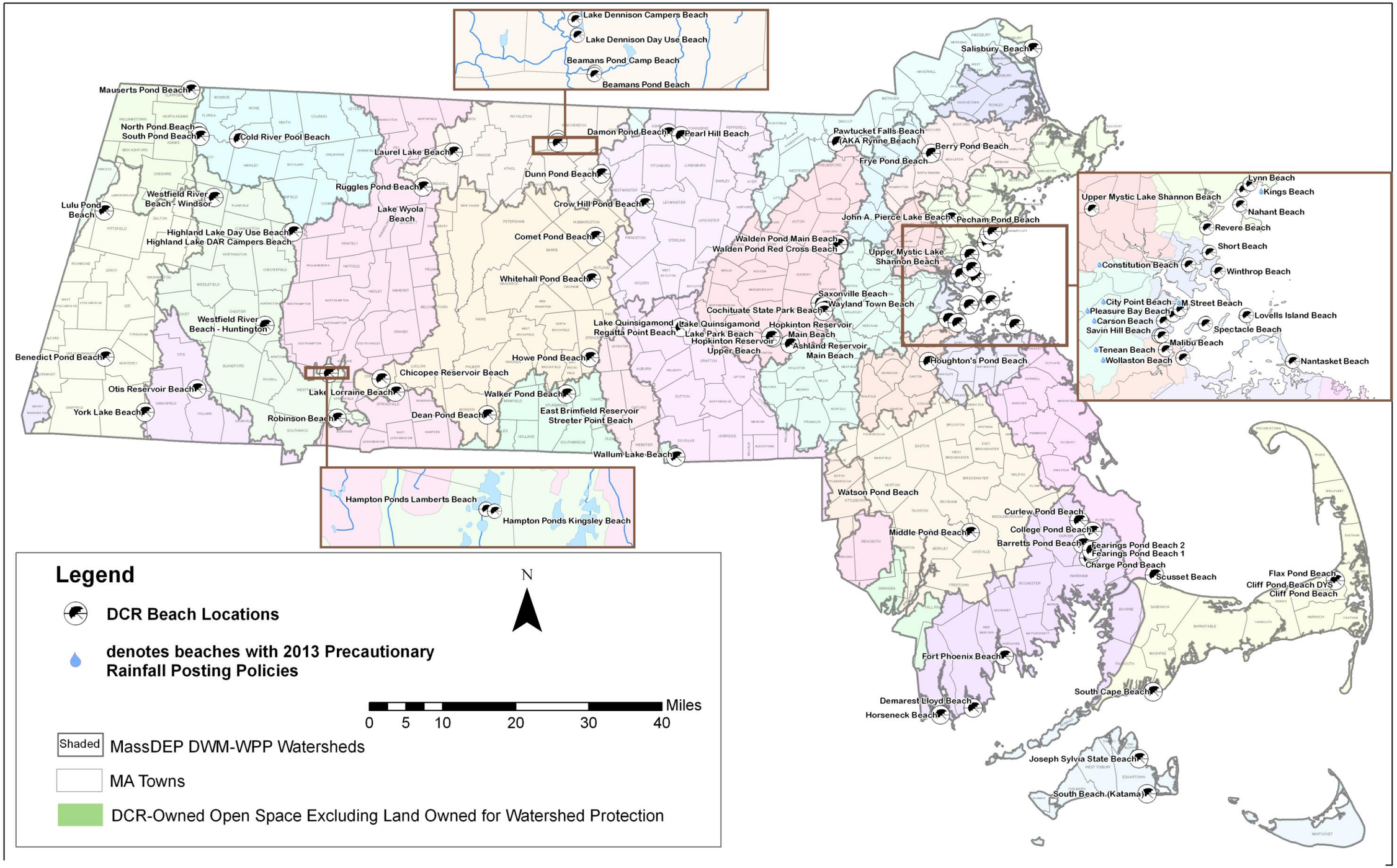


Figure 1. Location of Massachusetts's Department of Conservation and Recreation state park, reservation, forest, and recreation area public beaches.

Introduction

An important and valued public use of water bodies, freshwater or marine, is swimming. Bathing beach water quality at all public and semi-public bathing beaches in Massachusetts is regulated by DPH under Massachusetts General Law (MGL Chapter (C) 111, § Section (S) 5) and the Code of Massachusetts Regulations (105 CMR 445.000: Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII)). These regulations require that all public and semi-public beaches in the state be monitored for fecal indicator bacteria, and on occasion other environmental contamination during the bathing beach season. Marine water must be analyzed for the bacteria enterococci and freshwater must be analyzed for the bacteria enterococci or *Escherichia coli (E. coli*) Data from all beach water quality sampling must be provided to DPH.

DCR maintains bathing beaches at many of its parks, forests, reservations, and recreation areas. There are several beaches within these state properties that are operated by the local municipalities. Most DCR swimming beaches are open to the public between Memorial and Labor Day. During that time, DCR or the municipality conducts regular water quality testing as required by DPH. Beach water quality sampling is conducted following the standards and procedures established by DPH to ensure that all public swimming beaches meet bacteria-related water quality requirements. The presence of HABs may require additional testing.

In August 2012, the passage of House Bill No. 4384 resulted in a directive to MassDEP to "*file a report with the clerks of the house of representatives and senate relative to water quality at all beaches under the care and control of the department of conservation and recreation; and provided further, said report shall include, but not be limited to, an assessment of water quality at all department of conservation and recreation beaches, actions to be taken by the department to improve water quality levels and recommendations for actions to be undertaken by federal, state, local authorities as may be required to improve water quality at said beaches."* This report is being submitted by MassDEP, in consultation with DCR, DPH, MWRA, and Save the Harbor/Save the Bay, in fulfillment of the General Court of the Commonwealth of Massachusetts' request.

DCR collects enterococci bacteria samples at all of its beaches. The local municipalities operating a few of the freshwater DCR property beaches occasionally collect *E. coli* bacteria samples. When the concentration of enterococci or *E. coli* bacteria in the water exceeds the state's numeric water quality criterion for bacteria (or if another potential health threat such as a HAB exists), the beach is required to be posted with a sign that advises against swimming. This is referred to as "posting" a beach. However, it is important to note that even while the bathing waters are posted, the facilities at the bathing beach generally remain open. A beach posting cannot be removed until follow-up sampling indicates safe water quality conditions (i.e., the bacteria concentrations must be low enough to meet the swimming criteria or the algal bloom has dissipated to safe levels). DCR is responsible for posting its own beaches (MA DPH 2013b). DCR report both their bacteria data and posting information to DPH staff who maintain all beach water quality data in a database. DPH staff use these data to prepare an annual beach water quality reports. These annual reports are available online at: www.mass.gov/dph/beaches.

In general, DPH requires weekly bacteria water quality sampling at bathing beaches, and, as mentioned previously, in the event that the numeric water quality criterion for bacteria is exceeded, DCR must post the beach. There are several exceptions to both DPH's sampling and DCR's posting procedures. DCR samples the water quality at most of its beaches on a weekly basis although several of its beaches along the metropolitan Boston area's shoreline are sampled on a daily basis. Some of the metropolitan Boston area beaches are also sampled at multiple locations. There are also two state park beaches that require less frequent water quality testing because they have no known pollution problems (i.e., they have Tier Three beach status under the DPH

regulations as described in DPH (2013b) and need to be tested no more frequently than once every two weeks). Of the 18 metropolitan Boston-area marine beaches, eight had precautionary rainfall posting procedures in place in 2013 (Appendix E), whereby beaches are posted if specific rainfall thresholds are exceeded. These precautionary posting, or beach closure, procedures tie a stipulated volume of rainfall to an automatic beach closure, regardless of the most recent bacteria sampling results. These procedures were introduced by DCR because, at certain urban beaches, the previous day's rainfall volume was identified as a better predictor of poor water quality than using only the prior day's enterococci counts. This procedure helps to protect the public from potentially elevated bacteria levels due to stormwater runoff. DCR's precautionary rainfall posting procedures, developed in conjunction with MWRA, are provided in Appendix E.

While the main body of this report does not include a discussion of beach postings, the frequency of postings at each beach (and sampling location) was calculated and can be found in Appendix A of this report. Marked improvements in water quality at several of the metropolitan Boston-area marine beaches resulting from improved stormwater and CSO controls in the area can be seen from these data. Figures depicting these improvements have been included in the results section of this report.

A brief summary of precipitation data collected at four weather stations in the state is provided below to illustrate the beach season conditions between 2008 and 2012. These data were summarized from records obtained from the National Oceanic and Atmospheric Administration (NOAA) for 2008 through 2012, http://www.nws.noaa.gov/climate/index.php?wfo=box, as cited in MA DPH (2013b). Although weather patterns fluctuate greatly during the summer months throughout Massachusetts, between 2008 and 2012, as shown in Figure 2, three of the five years were wetter than normal with the exception of the Cape Cod area.

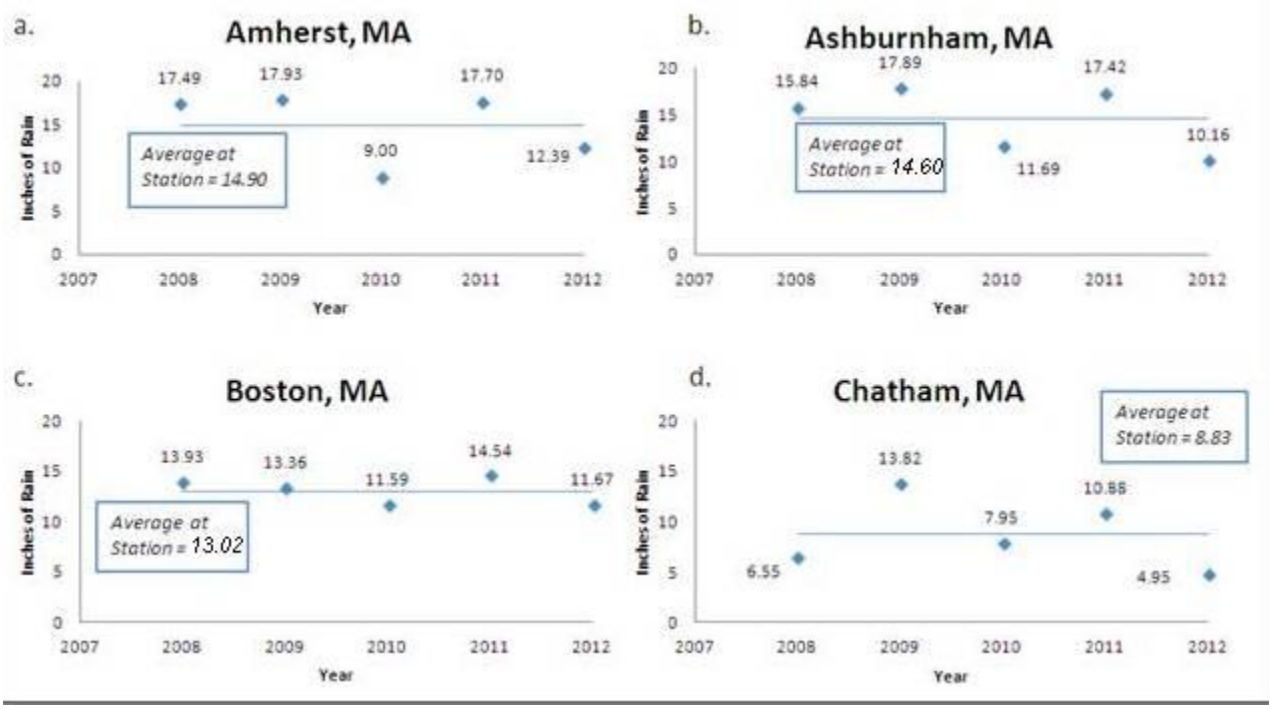


Figure 2. Yearly summaries of precipitation (in inches) at four Massachusetts weather stations a) Amherst, b) Ashburnham, c) Boston, and d) Chatham during the months of June, July, and August 2008 through 2012. The average at these stations is indicated by the horizontal line.

Methods

Many factors influence water quality at beaches, some rendering them unsuitable for swimming. Foremost among these threats are elevated concentrations of fecal indicator bacteria and HABs. Other factors that can lead to unsuitable swimming conditions relate to safety (e.g., reduced visibility) or poor aesthetics. For the purposes of this report, a measure of beach safety was evaluated based on bacteria sampling results and the presence of cyanobacteria blooms in waters reported to DPH and recorded in their Beaches and Harmful Algal Bloom Databases. These data were used as the primary means by which to evaluate the status of water quality conditions at DCR state park, reservation, forest, and recreation area public beaches. The few DCR beaches managed or leased and operated by the local municipalities are also included in this report.

The bacteria results from samples collected at the DCR beaches, as reported to DPH, were compared to the single sample maximum numerical criteria for bacteria contained in the Massachusetts Surface Water Quality Standards (314 CMR 4.00). These criteria are the same as those contained within the DPH bathing water standards. These criteria, dependent on both the indicator being tested (i.e., enterococci or *E. coli*) and whether the water is fresh or saline (see Table 1), are one of the two numeric bacteria criteria at swimming areas in the State's standards.

Table 1. Single sample maximum numeric water quality criteria for enterococci and *E. coli* bacteria at bathing beaches as defined by the Massachusetts Department of Public Health (105 CMR 445.000).

Beach Type	Enterococci Single Sample Maximum Numeric Criteria	*E. coli* Single Sample Maximum Numeric Criteria
Freshwater	61 colonies/100 ml	235 colonies/100 ml
Marine	104 colonies/100 ml	Not applicable

Data contained in DPH's beaches database were used to calculate the frequency that the numeric water quality criteria for bacteria (almost always enterococci) was met during the 2008 to 2012 beach seasons. As noted previously, the various DCR beaches are sampled at different frequencies, so there are more water quality samples for some beaches (e.g., metropolitan Boston-area marine beaches are generally sampled daily, whereas many of the freshwater beaches are sampled weekly). This percentage provides a measure of beach safety (100 percent representing the highest safety measure since none of the bacteria counts in samples collected from that beach during that bathing season exceeded the single sample maximum numeric bacteria criteria). When bacteria samples collected from the swimming area did not meet the single sample maximum numeric water quality criteria, the beach safety score drops below 100 percent, an indication of a decline in water quality due to elevated bacteria counts.

Yearly Beach Safety Scores

For each beach evaluated in this report, the percentage of samples that met the single sample maximum numeric water quality criteria for bacteria was calculated for each sampling year (2008 through 2012). In other words, the total number of samples meeting the numeric single sample maximum water quality bacteria criteria was divided by the total number of bacteria samples taken that year. Where multiple locations were sampled at a beach all of the data were pooled for the calculation. This percentage is representative of each beach's yearly safety score.

Overall Beach Safety Scores

An overall average of the yearly beach safety scores was also calculated for beaches with at least two yearly beach safety scores. This overall percentage simply provides an average beach safety measure for each beach during the period of 2008 through 2012. It is not, however, a weighted average overall safety score.

Results

For the purposes of this report, DCR beaches were first separated into two categories, marine beaches and freshwater beaches. The marine beaches were further categorized into two subgroups, those located within metropolitan Boston and those located elsewhere to account for differences in beach management in the two areas. The metropolitan Boston area beaches are located in a highly urbanized area and have a unique suite of challenges. Of the 89 DCR beaches included in this report (Figure 1), there are 26 marine beaches, 18 are in the metropolitan Boston area while the remaining eight are located along the Massachusetts coast mostly in southeastern Massachusetts. There are 63 freshwater DCR beaches.

Within each of the three categories of DCR beaches (metropolitan Boston area marine beaches, other coastal marine beaches, and freshwater beaches), the beaches are organized in alphabetical order by town or city and then beach name. The three tables include the following information: the city or town where the beach is located, the beach name, the DCR beach identification number, the yearly beach safety scores for 2008 through 2012, and the overall beach safety score. Pertinent notes are also included in the table. During the five-year reporting period, bacteria sampling was not conducted during at least one year for 15 of the 89 beaches, two beaches were not sampled at all, five beaches were only sampled for one year, one beach was sampled only two years, one beach was sampled only three years, and six beaches were sampled for four of the five years. The lack of bacteria data is an indicator that during that year, the beach was not open for swimming. This may be the result of staffing shortfalls, construction at or around the beach, poor water quality, or another reason. DPH's database only includes the bacteria data and posting information and does not specify why a beach was not sampled during a given beach season.

A total of 63 of the 89 DCR beaches had overall safety scores of greater than or equal to 90 percent over the five-year period (2008-2012) (Figure 3). These included 88 percent of the marine beaches and 63 percent of the freshwater beaches. This is not surprising given the differences in hydrology. The marine beaches are mostly well flushed via tidal action whereas freshwater beaches are often located on ponds and reservoirs with minimal mixing. The marine beaches with lower overall safety scores (King's Beach in Lynn, Tenean Beach in Boston and Wollaston Beach in Quincy) are still in need of additional bacteria source reduction efforts, primarily resulting from stormwater. The freshwater beaches with lower overall safety scores have more diffuse sources of bacteria and two beaches on Cliff Pond in Brewster are experiencing prolonged closures due to HABs. Beach-specific management recommendations to improve water quality conditions made by consultants or state agencies are included for both the metropolitan Boston area marine beaches and freshwater beaches categories below. Overarching recommendations that are applicable to any public beach are included in the General Recommendations Section at the end of the report.

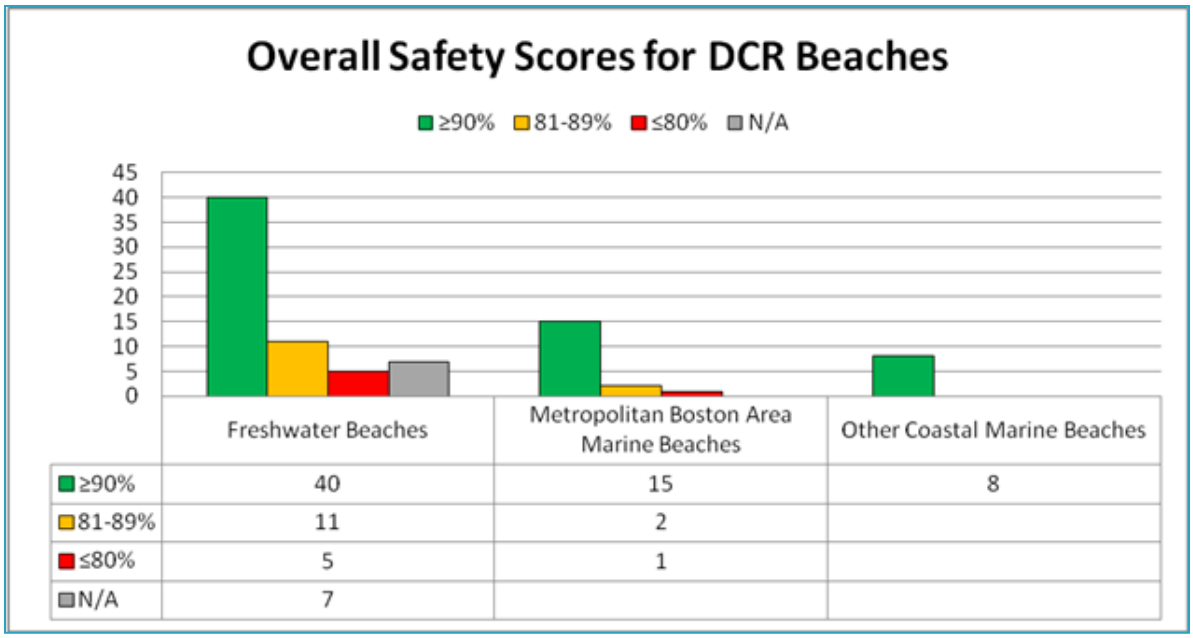


Figure 3. Summary of overall safety scores for the DCR freshwater, metropolitan Boston area marine, and other coastal marine beaches reporting period 2008 through 2012.

Metropolitan Boston Area Marine Beaches

Eighteen (18) of the 89 DCR beaches included in this report are marine beaches located in the metropolitan Boston area (Table 2). Fifteen of these 18 beaches (83 percent) have overall safety scores of at least 90 percent. The remaining three with overall safety scores of less than 90 percent are Tenean Beach in Boston (overall safety score is 84 percent), Kings Beach in Lynn (overall safety score is 61 percent), and Wollaston Beach in Quincy (overall safety score is 86 percent).

Also included within just the metropolitan Boston area beaches portion of this report are beach posting data. The discussions for individual beaches include a graphic showing the percentage of time during the beach season that each beach was posted. The posting statistic, unlike the beach safety statistic, captures beach closures resulting from precautionary postings as well as closures due to elevated bacteria concentrations. The posting graphic also displays the impact of completed CSO abatement projects on beach postings. For each beach, the posting graphic displays data from all sampling locations at each beach and for each year, the number of beach days is included in parentheses.

Table 2. DCR beach safety scores for metropolitan Boston area marine beaches based on 2008 through 2012 data maintained by DPH in their beaches database.

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012, Overall Safety Score, and any pertinent notes						
Town/City	Beach Name	Beach ID (sampling location)	2008	2009	2010	2011	2012	Overall	Notes:
Boston	Carson Beach	2647	88%	86%	90%	98%	99%	**92%**	Daily sampling at two locations, has precautionary rainfall posting requirement ≥ 2.0" rain
Boston	City Point Beach	2641	99%	94%	96%	99%	100%	**98%**	Daily sampling at one location, has precautionary rainfall posting requirement ≥ 2.0" rain
Boston	Constitution Beach	2646	90%	87%	97%	92%	92%	**92%**	Daily sampling at three locations, has precautionary rainfall posting requirement ≥ 1.0" rain
Boston	Lovells Island Beach	2648	100%	100%	100%	100%	100%	**100%**	Weekly sampling at one location, season generally runs from the end of June to Labor Day weekend
Boston	Malibu Beach	2645	88%	94%	89%	94%	89%	**91%**	Weekly sampling at one location
Boston	M Street Beach	2649	88%	98%	100%	99%	99%	**97%**	Daily sampling at one location, has precautionary rainfall posting requirement ≥ 2.0" rain
Boston	Pleasure Bay Beach	2644	97%	94%	100%	95%	96%	**96%**	Daily sampling at one location 2006 and 2011, daily sampling three locations 2012, other years weekly sampling one location, has precautionary rainfall posting requirement ≥ 2.0" rain
Boston	Savin Hill Beach	2643	88%	94%	100%	94%	88%	**93%**	Weekly sampling at one location
Boston	Spectacle Beach	5384	100%	100%	100%	100%	100%	**100%**	Weekly sampling at one location, season generally runs from the end of June to Labor Day weekend
Boston	Tenean Beach	2642	77%	81%	84%	85%	94%	**84%**	Daily sampling at one location, has precautionary rainfall posting requirement ≥ 0.25" rain
Hull	Nantasket Beach	2913	95%	100%	98%	100%	98%	**98%**	Weekly sampling at four locations

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012, Overall Safety Score, and any pertinent notes						
Town/City	**Beach Name**	**Beach ID (sampling location)**	**2008**	**2009**	**2010**	**2011**	**2012**	**Overall**	**Notes:**
Lynn	Kings Beach	2929	48%	58%	67%	59%	73%	**61%**	Prior to mid-2011 weekly sampling, daily sampling since mid-2011 at three locations, Stacy Brook outlet sampling location changed in 2012, precautionary rainfall posting requirement (see detail sampling location) as described in Appendix E
Lynn	Lynn Beach		100%	100%	100%	88%	100%	**98%**	Sampling for Lynn Beach comes from a surrogate sampling site along Nahant Beach. The "Nahant, North of Bathhouse "weekly sampling data are represented here.
Nahant	Nahant Beach	2989	95%	100%	100%	91%	95%	**96%**	Weekly sampling at four locations
Quincy	Wollaston Beach	3099	86%	82%	83%	87%	93%	**86%**	Daily sampling at four locations, has precautionary rainfall posting requirement (see detail sampling location) as described in Appendix E
Revere	Revere Beach	3101	98%	96%	98%	92%	100%	**97%**	Weekly sampling at four locations
Revere	Short Beach	3102	100%	84%	100%	87%	100%	**94%**	Weekly sampling at one location
Winthrop	Winthrop Beach	3217	100%	89%	100%	88%	100%	**95%**	Weekly sampling at one location

Metropolitan Boston Area Marine Beaches–Discussion and Recommendations

Boston – Carson Beach, Castle Island Complex

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary rainfall posting (Figure 4 and Appendix E). Factors influencing the levels of bacteria include stormwater discharges and intense use by residents (and historically CSO discharges). Prior to the opening of MWRA's North Dorchester Bay Storage Tunnel, water quality criteria exceedances were common at Carson Beach. Carson Beach is sampled daily at two locations (Bathhouse and I Street), so that any bacterial exceedances that occur are likely to be identified (MA DPH 2013b). The completion of the MWRA's North Dorchester Bay CSO abatement plan in 2011 appears to have resulted in a marked increase in water quality at Carson Beach (Table 2). Since the MWRA CSO abatement project was completed in May 2011, no CSO discharges have occurred in the area of South Boston beaches (Figure 4). Stormwater discharges have occurred only once in the two subsequent beach seasons covered in this report—with one event being Tropical Storm Irene in August 2011. Stormwater inputs to Carson Beach have been reduced to a frequency of 5-year storms, and CSOs reduced to a frequency of 25-year storms (Reilley 2013). Continued implementation and compliance with the National Pollution Discharge Elimination System (NPDES) permits described in City Point Beach summary will also help to improve water quality conditions at this beach.

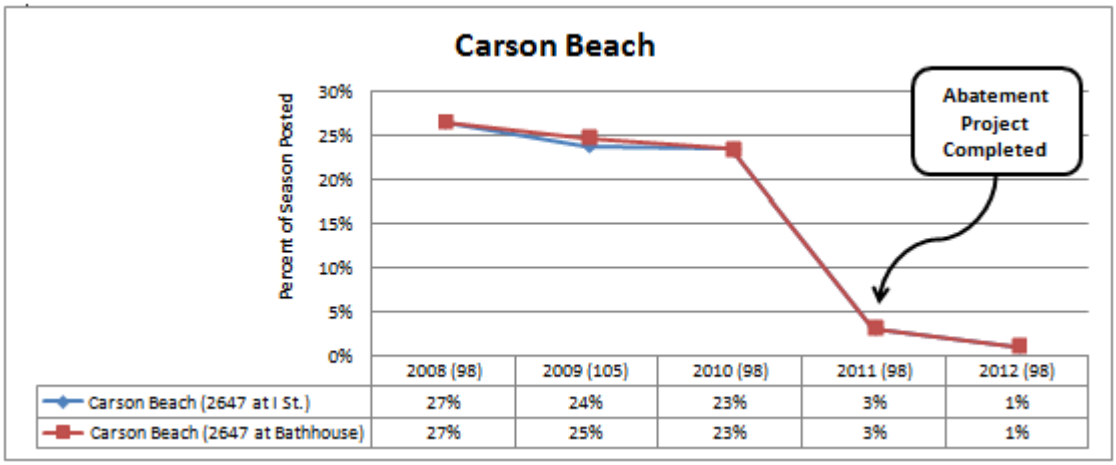


Figure 4. Carson Beach - Percent of Beach Season Posted 2008-2012

Boston – City Point Beach, Castle Island Complex

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary rainfall posting (see Figure 5 and Appendix E). Factors influencing the levels of bacteria include stormwater discharges and intense use by residents (and historically CSO discharges). Prior to the 2011 opening of the North Dorchester Bay Storage Tunnel, water quality criteria exceedances were frequent at City Point Beach but have since declined dramatically. The completion of the MWRA's North Dorchester Bay CSO abatement plan in 2011 has substantially eliminated wet weather inputs. Stormwater inputs to Carson Beach, M Street Beach, and City Point Beach only occur for storms equivalent to a 5-year storm event or larger, and CSOs only occur for storms equivalent to a 25-year storm event or larger. Since the MWRA CSO abatement project was completed in May 2011, no CSO discharges have occurred in the area of South Boston beaches. Stormwater discharges have occurred only once in the two subsequent beach seasons covered in this report—once event being Tropical Storm Irene in August 2011 (Reilley 2013). City Point Beach is sampled daily, so that any bacterial exceedances that occur are likely to be identified (MA DPH 2013). Several storm water outfalls in the vicinity of City Point Beach were identified by MassDEP in 2009 as contributing bacterial loads to the swimming area (MassDEP 2010b). The rate of bacteria exceedances was much reduced in 2011, some of which may be attributed to actions taken as a result of the implementation and compliance with NPDES permits. According to MassDEP and Beaudoin (2010) the following permits are in place and actions have been taken to address pollution problems in Dorchester Bay and affecting this beach.

- Boston Water and Sewer Commission (BWSC) (Permit MA0101192) Outfalls BOS 081 – 087 discharge to South Boston beaches. There are four major infrastructure projects to abate CSO's from these outfalls. As noted above, this work has been completed and resulted in eliminating the CSO discharges for all storms up to and including a 25-year storm event (regulator structures will remain open to relieve the system for larger events). A secondary benefit is stormwater will also be collected and diverted from the beaches for all storms up to a 5-year event). Work completed to date includes the following:
    - North Dorchester Bay Storage Tunnel, completed December 2009
    - Pleasure Bay Storm Drain Improvements, completed March 2006
    - Morrissey Blvd. Storm Drain, completed June 2009
    - Conley Terminal Pump Station and Odor Control Facility, completed May 2011
    - Excerpt from BWSC online "The Morrissey Boulevard Drainage Conduit Project (MBDC) is being undertaken by the Boston Water and Sewer Commission (Commission) on behalf of the Massachusetts Water Resources Authority (Authority) in conjunction with the Authority's North Dorchester Bay CSO Storage Tunnel Project (NDBST). This work will help improve water quality in North Dorchester Bay. The MBDC was included in the Authority's 2004 Supplemental Facilities

Plan and Environmental Impact Report on the Long-Term CSO Control Plan for North Dorchester Bay and Reserved Channel and is part of the court-ordered cleanup of Boston Harbor. The MBDC and NDBST will enable the BOS087 outfall located near Mother's Rest to be eliminated. Stormwater flows generated from smaller storms will be conveyed to the NDBST while stormwater flows generated from larger storms will be redirected to the MBDC. Along the northbound (in-bound) Frontage Road of Morrissey Boulevard, all stormwater flows will be conveyed to the MBDC. Construction of the MBDC began in September 2007 and was completed in July 2009. Stormwater monitoring of the MBDC will be conducted for 2 years following the completion of the MWRA's North Dorchester Storage Tunnel Project which is currently scheduled to be completed in May 2011."

- MWRA (Permit MA0103284): CSO outfall 209 Fox Point via BOS088/089: eliminated in 2007 as a result of sewer separation work in South Dorchester Bay.
- BWSC (Permit MAS01000)
- City of Quincy (Permit MAR041081)

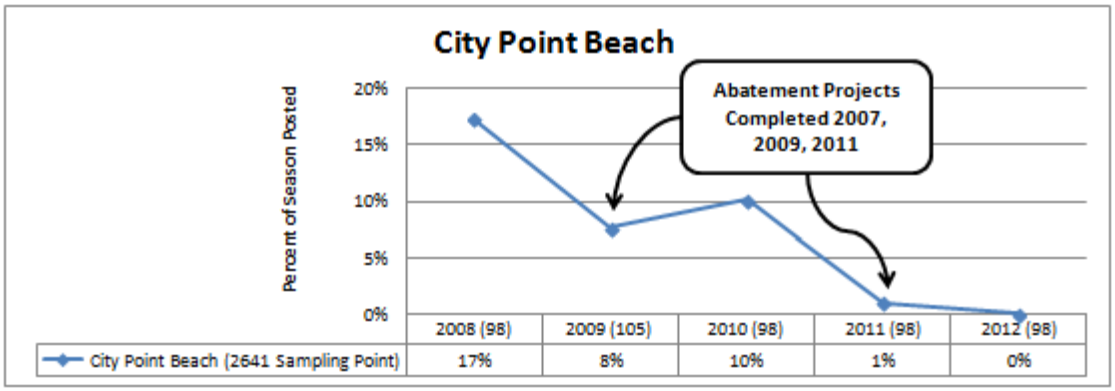


Figure 5. City Point Beach - Percent of Beach Season Posted 2008-2012

Boston – Constitution Beach, Belle Isle Reservation

Postings at this beach are the result of elevated bacteria concentrations or based on a precautionary rainfall posting (Figure 6 and Appendix E). Factors influencing the levels of bacteria include stormwater discharges and intense use by residents (and historically CSO discharges). Frequent and occasionally prolonged water quality exceedances are very common at Constitution Beach. Constitution Beach is located within a highly urbanized watershed, which leads to substantial run-off affecting the beach during and immediately after storm events. Constitution Beach is also located in an area with limited circulation and is near the mouth of Belle Isle Inlet, which drains Belle Isle Marsh.

Constitution Beach is sampled daily, so that any bacterial exceedances that occur are likely to be identified (MA DPH 2013b). Enterococci samples are collected daily from a minimum of three sampling locations (Middle, Rec Center, and North Point) (Appendix A). Like other Boston-area beaches stormwater outfalls have a substantial impact. An MWRA sewer separation completed in 2000 eliminated CSO discharges at Constitution Beach and the CSO treatment facility located at near the beach was decommissioned (Brander 2012). However, MassDEP sampling in 2008 showed high *E. coli* counts, detergents, and ammonia-nitrogen concentrations from stormwater discharges near the beach (Birnbaum and Zink 2009a). The ongoing work to reduce storm water pollutant loads into Constitution Beach, including identification and elimination of wastewater connections (Brander 2012, MassDEP 2010b) is continuing under the terms and conditions of a Consent Decree between BWSC and the U.S. Environmental Protection Agency (EPA) executed on August 23, 2012. These efforts will help ensure that stormwater outfalls are not contributing bacterial loading to the beach.

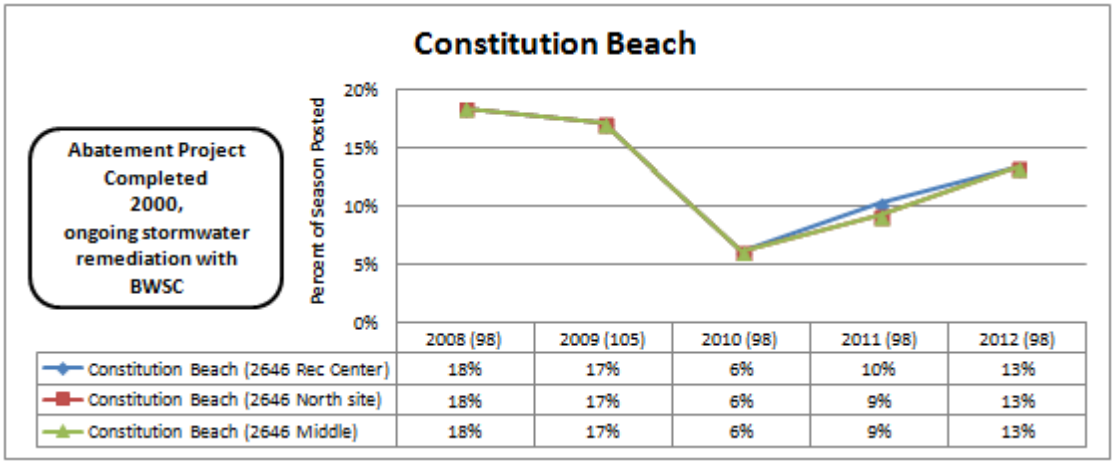


Figure 6. Constitution Beach - Percent of Beach Season Posted 2008-2012

Boston – Malibu Beach, Dorchester Shore Reservation

Postings at this beach are the result of elevated bacteria concentrations or based on a precautionary rainfall posting (Figure 7 and Appendix E). Factors influencing the levels of bacteria include stormwater discharges and intense use by residents. MWRA has been working since 1997 to reduce CSO discharges into South Dorchester Bay. MWRA (Permit MA0103284) CSO outfall 209 Fox Point via BOS088/089 was eliminated in 2007 as a result of the sewer separation work in South Dorchester Bay. The South Dorchester Bay Sewer Separation Project, a $126 million project to improve water quality at Boston area beaches including Malibu Beach was completed in 2007 (Brander 2012). This has resulted in a marked improvement in water quality conditions.

The ongoing work to reduce storm water pollutant loads into Dorchester Bay, including identification and elimination of wastewater connections (Brander 2012, MassDEP 2010b) is continuing under the terms and conditions of a Consent Decree between BWSC and EPA executed on August 23, 2012. These efforts will help ensure that stormwater outfalls are not contributing bacterial loading to the beach.

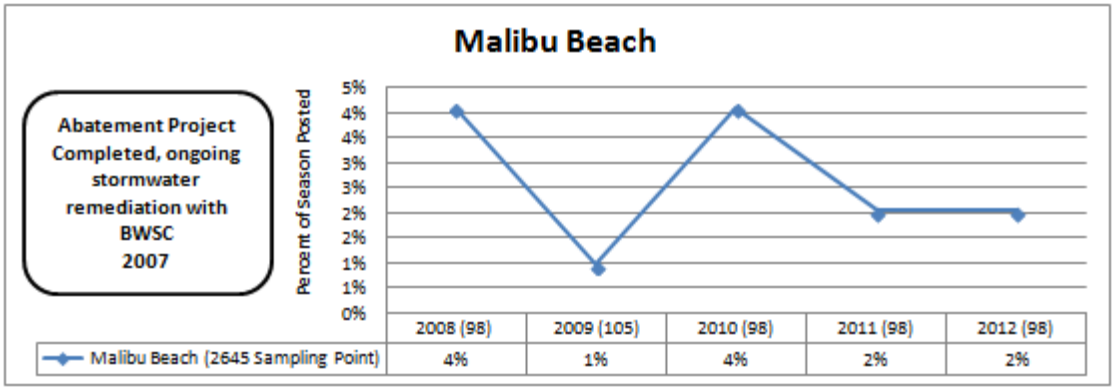


Figure 7. Malibu Beach - Percent of Beach Season Posted 2008-2012

Boston – M Street Beach, Dorchester Shore Reservation

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary rainfall posting (see Figure 8 and Appendix E). Factors influencing the levels of bacteria include stormwater discharges and intense use by residents. Water quality has increased at M Street Beach following the opening of the North Dorchester Bay CSO storage tunnel in May 2011. As stated previously, stormwater inputs to M Street Beach have been reduced to a frequency of 5-year storms, and CSOs reduced to a frequency of 25-year storms

(Reilley 2013). Given that this beach is within a highly urbanized area it was subject to substantial run-off during and immediately after storm events. M Street Beach is sampled daily, so that any bacterial exceedances that occur are likely to be identified (MA DPH 2013b). The completion of MWRA's North Dorchester Bay CSO abatement plan in 2011 appears to have resulted in a marked increase in water quality. These are likely attributable to actions taken to protect the beach, including those described for City Point Beach. Continued implementation and compliance with the NPDES permits described in City Point Beach summary will also help to improve water quality conditions at this beach. These efforts will ensure that stormwater runoff and CSOs are not contributing bacterial loading to the beach.

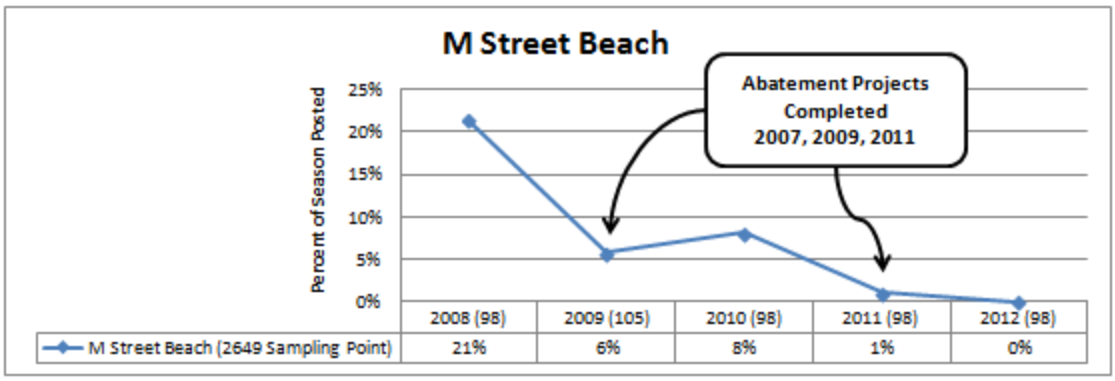


Figure 8. M Street Beach - Percent of Beach Season Posted 2008-2012

Boston – Pleasure Bay Beach, Castle Island Complex

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary rainfall posting (see Figure 9 and Appendix E). Factors influencing the levels of bacteria include stormwater discharges and intense use by residents (and historically CSO discharges). The MWRA has been working since 1997 to reduce CSO discharges into North Dorchester Bay. In 2006, all wet weather discharges to Pleasure Bay were eliminated, with the closure of all stormwater outfalls (Reilley 2013). In addition, the North Dorchester Bay combined sewer overflow/stormwater (CSO/SW) Storage Facility, a $261 million project to improve water quality at Boston area beaches including Pleasure Bay Beach was completed in 2011 (Brander 2012). Results of daily testing during the beach season indicate that while occasionally elevated bacteria levels are found they are neither frequent nor prolonged.

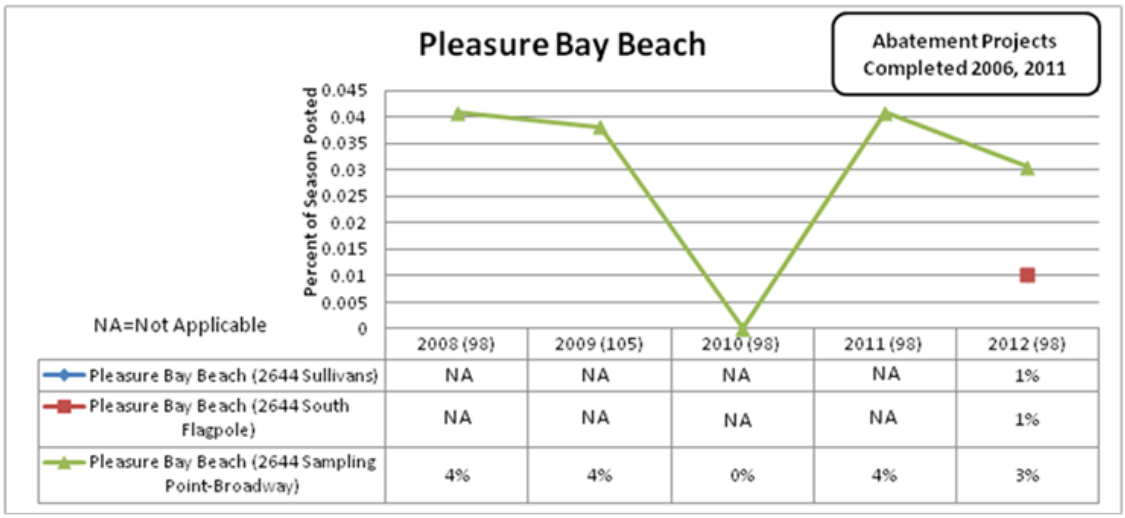


Figure 9. Pleasure Bay Beach - Percent of Beach Season Posted 2008-2012

Boston – Savin Hill Beach, Dorchester Shore Reservation

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary rainfall posting (see Figure 10 and Appendix E). Factors influencing the levels of bacteria include stormwater discharges and intense use by residents. MWRA has been working since 1997 to reduce CSO discharges into South Dorchester Bay. MWRA (Permit MA0103284) CSO outfall 209 Fox Point via BOS088/089 was eliminated in 2007 as a result of the sewer separation work in South Dorchester Bay. The South Dorchester Bay Sewer Separation Project, a $126 million project to improve water quality at Boston area beaches including Savin Hill Beach, was completed in 2007 (Brander 2012). While occasional elevated bacteria levels are found they are no longer frequent or prolonged.

The ongoing work to reduce storm water pollutant loads into Dorchester Bay, including identification and elimination of wastewater connections (Brander 2012, MassDEP 2010b) is continuing under the terms and conditions of a Consent Decree between BWSC and EPA executed on August 23, 2012. These efforts will help ensure that stormwater outfalls are not contributing bacterial loading to the beach.

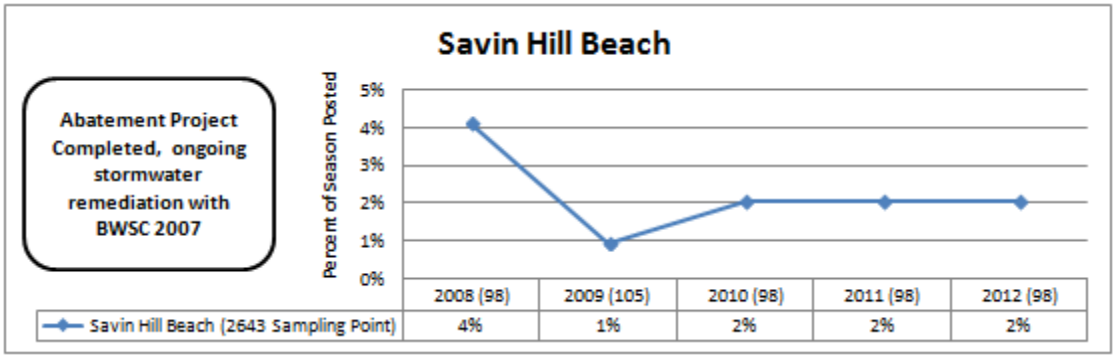


Figure 10. Savin Hill Beach - Percent of Beach Season Posted 2008-2012

Boston – Tenean Beach, Dorchester Shore Reservation

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary rainfall posting (Figure 11 and Appendix E). Given that this beach is within a highly urbanized area, it is subject to substantial run-off during and immediately after storm events. The high use of the beach itself can also be a source of bacteria. Tenean Beach is sampled daily, so that any bacterial exceedances that occur are likely to be identified (MA DPH 2013b).

Tenean Beach has shown consistently elevated bacteria levels each year since before 2008. The MWRA has been working since 1997 to reduce CSO discharges into South Dorchester Bay. A $126 million project to improve Tenean and Malibu beaches by eliminating CSO discharges was completed in 2007. However, in 2008, samples containing enterococci concentrations above 11,000 most probable number per 100 milliliters (MPN/100mL) were collected from a stormwater pipe that is a former CSO outfall and discharges near Tenean Beach in Boston (Birnbaum and Zink 2009a). This indicates that there may still be illicit sewer connections and CSO outfalls contributing to Tenean Beach's bacteria load. Tenean Beach is located at the mouth of the Neponset River. It should be noted here that the Neponset River (MassDEP Segment MA73-04) is listed in Category 5 of the 2012 Integrated List of Waters report (MassDEP 2013). A Total Maximum Daily Load (TMDL) for bacteria (fecal coliform and enterococci bacteria) was developed and approved by EPA (MassDEP 2002). A TMDL is the allowable load of a pollutant to a waterbody that ensures that the waterbody will meet water quality standards. Each TMDL also includes an implementation plan.

Tenean Beach is still heavily impacted by elevated bacteria counts. Continued implementation and compliance with the NPDES permits described above for City Point Beach as well as actions to remediate illicit connections and stormwater runoff impacts are also needed to help improve and restore water quality at this beach. The recommendations in the EPA approved TMDL for bacteria should also be implemented (MassDEP 2002).

The ongoing work to reduce storm water pollutant loads into Tenean Beach, including identification and elimination of wastewater connections (Brander 2012, MassDEP 2010b) is continuing under the terms and conditions of a Consent Decree between BWSC and EPA executed on August 23, 2012. These efforts will help ensure that stormwater outfalls are not contributing bacterial loading to the beach.

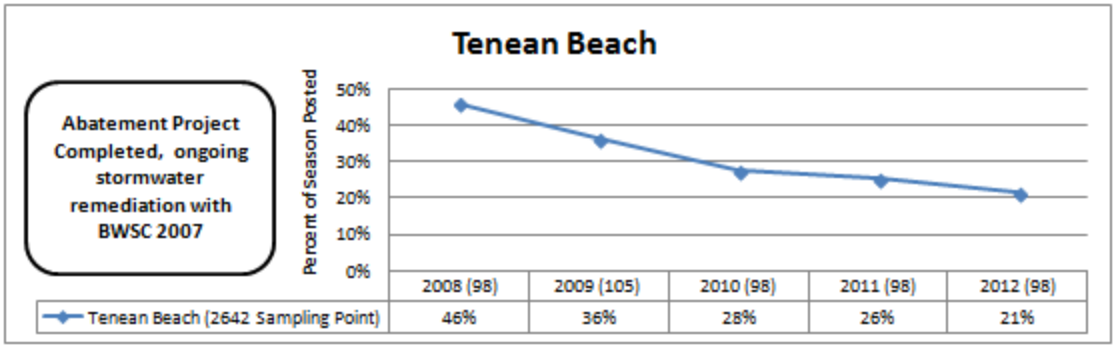


Figure 11. Tenean Beach - Percent of Beach Season Posted 2008-2012

Lynn – Kings Beach, Lynn Shore Reservation

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary CSO-discharge posting. Frequent water quality exceedances have been very common at Kings Beach. Given that this beach is within a highly urbanized area, it is subject to substantial run-off during and immediately after storm events. The high use of the beach itself can also be a source of bacteria. Samples were collected weekly until mid-2011 from three sampling locations (Kimball Road, Stacy Brook Outlet, and Ocean Terrace) (Figure 12 and Appendix A). It was discovered in July 2011 that the samples associated with Stacy Brook Outlet were routinely collected from the freshwater discharging from the outlet and not the marine water sampling location where waters mixed in the bathing zone (thus, historically some proportion of results from the Stacy Brook Outlet location were of freshwater and not bathing marine bathing beach water). After this discovery, subsequent water samples were collected in the marine water. Starting in 2012, bathing water samples were collected daily and the sampling location across from Ocean Terrace was changed to be across from Pierce Road. DCR has placed signs at the Stacy Brook outlet that warn people to stay out of the outlet water. Similar to several of the other urban beaches, CSOs and stormwater outfalls are problematic at Kings Beach. A precautionary posting of Kings Beach will be made if there is a discharge of Lynn's CSO Outfall #006 (a.k.a. Stacy Brook outfall).

Samples were collected from a CSO outfall (which had not overflowed prior to sample collection) that discharges to King's Beach in Lynn (NahB01p). Samples were sent to MassDEP's Wall Experiment Station (WES) laboratory, the laboratory in turn used an internal algorithm that takes into account the weight of evidence of human sources of bacteria, which can then be ranked as "none," "inconclusive," "weak," or "strong." The samples were ranked "weak" because there was some indication that human sources of bacteria (due to the presence of the Bacteroidetes human marker and fluorescent whitening agents) were present (Birnbaum and Zink 2008). To date, some of the work done to address CSOs affecting King's Beach includes the following projects (and additional details follow the bulleted list):

- Construction of a separate sewer and drain system in the Stacy Brook Watershed, which has reduced CSOs to King's Beach - completed in 2008.

- A monitoring and sampling program within the storm-drain system to detect illegal wastewater connections began in 2009 pursuant to a Notice of Noncompliance (NON) from MassDEP to the Lynn Water and Sewer Commission (LWSC).
- Elimination of discharges from three properties in Lynn illegally discharging into the storm-drain system, and identification of two more (Brander 2012).
- Elimination of a number of illegal wastewater connections to the storm-drains in the town of Swampscott.
- Disinfection of discharges from a stormwater treatment facility in Swampscott to the beach through addition of hypochlorite.
- Monitoring/sampling of key points in the drain system in Swampscott during the summer of 2012 along with dye testing to confirm the wastewater connections of various properties in the drainage area.
- Increased funding for removal of the algae to improve aesthetics to increase beach cleanups to every week and a half (Bradley 2006).

LWSC is under a federal/state consent decree (CD) to address CSO discharges that include discharges to King's Beach via the Stacy Brook outfall, which discharges directly onto Kings Beach. The LWSC is also under a MassDEP NON and an EPA Administrative Consent Order (ACO) to address wastewater discharges to the storm-drain system. Since the early 1990's, the City has been under a state/federal CD to plan, design, and construct improvements to the sewer system to address CSO discharges. Since 2000, the City has implemented a plan to construct a separate sewer and drain system in the Stacy Brook watershed, which has dramatically reduced the number of CSO events to King's Beach. To date, the City has spent over $80 million on this work. Critical pipe work to separate the sewer and drain systems was completed in the fall of 2008 to eliminate wastewater discharges for all but very large storm events. CSO discharges to King's Beach have dropped from a baseline number of 30 per year (2005) to an average of two per year for the three year period of 2009 to 2011. LWSC remains under the terms of the CD, and will be transmitting a supplemental CSO report in the fall 2013 to determine if higher levels of CSO control are affordable and technically feasible. As an element of the MassDEP's ACO, LWSC now reports any and all CSO discharges on a real-time basis to beach resource managers (and agencies).

Since the sewer separation work has been completed, stormwater flows formerly tied in to the sewer system now flow to the Stacy Brook drainage outfall onto King's Beach. The Stacy Brook outfall captures stormwater from a large portion of Lynn and Swampscott. MassDEP and EPA have been collecting water quality samples at this location for many years to determine pollutant loads in the stormwater discharge. The sample results have varied considerably; however, sampling results from MassDEP, EPA, and DCR have often indicated that bacteria counts exceed the standard for primary contact recreation, which contributes to beach postings. On November 20, 2009 MassDEP issued a NON to LWSC to address high bacteria counts to the Stacy Brook culvert. Pursuant to the NON, LWSC undertook a program to monitor/sample various points in the storm-drain system to detect illegal wastewater connections to the storm-drain. LWSC has eliminated connections to the Stacy Brook drain from three properties that were found connected to the storm-drain system, and, with MassDEP assistance, LWSC has recently confirmed two additional properties tied into the drain line, including a middle school. EPA has also taken action against LWSC for wastewater discharges to the storm-drain system, entering into an ACO with them in the summer of 2012. Efforts to identify and eliminate illegal wastewater connections to the storm-drain system continue. MassDEP continues to provide technical assistance through participation in field investigation efforts and through sample analyses (Brander 2012).

MassDEP entered into an ACO with the Town of Swampscott in 2007 (modified in June 2008). It requires the Town to identify wastewater connections to the storm-drain system (discharging to the beach) and to remove these connections. Swampscott does not have combined sewers, but has a network of separate sewers, storm-drains, and under-drains, all of which have been determined to interconnect indirectly, causing higher bacteria counts in the storm-drain system. The Town continues to move forward with construction work, completing

additional infrastructure improvements and in June 2013 intended to address the indirect connection of these systems. The Town is now conducting a post-construction sampling program to determine if any illegal wastewater connections remain in the storm-drain system. Until the work to find and eliminate wastewater connections to the storm-drain is complete, the storm-drain discharges to the beach are disinfected through addition of hypochlorite at a stormwater treatment facility in Swampscott. The Town is required to sample the discharge three times each week over the beach season, and to meet a bacteria limit to protect the users of the beach. Their discharge monitoring reports indicate that their system has been effective in treating the storm drain flows and in achieving bacteria limits. Once they are able to find and eliminate the cross-connections in the sewer/drain system, the disinfection process may no longer be necessary (Brander 2013).

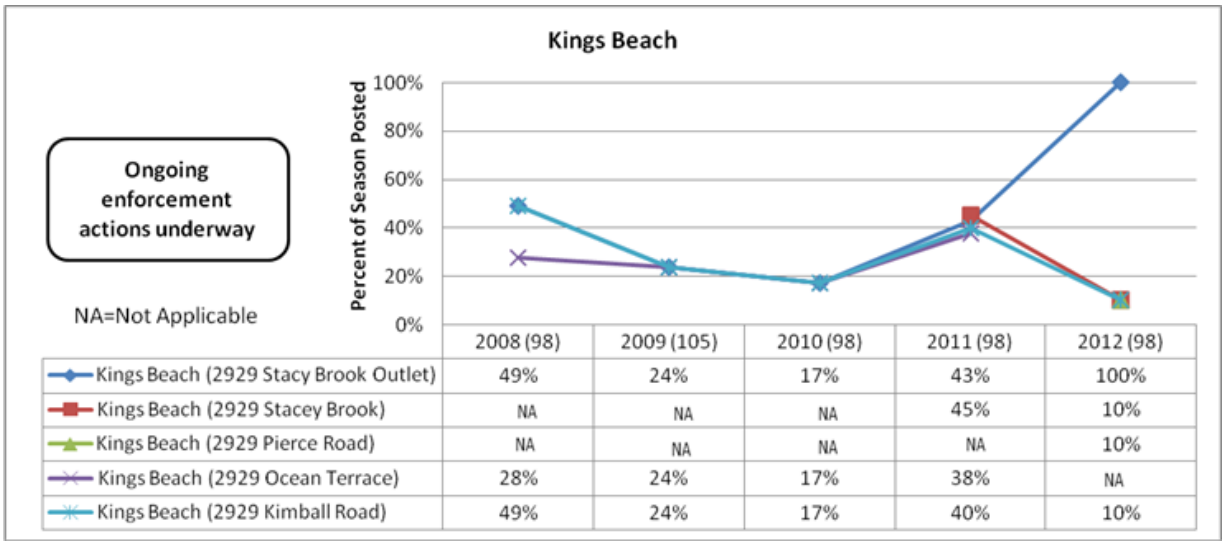
It should also be noted here that Nahant Bay experiences a locally abundant, but globally very rare algal species, *Pilayella litoralis*, which may at times cover large portions of the beach with a thick brown mat. The alga affects the entire bay and shoreline from Nahant all the way to Swampscott. Decomposition of the algae that washes up on the beach results in objectionable odors. Funding for removal of the algae to improve aesthetics was increased from $35,000 to $50,000 in 2006 for beach cleanups up to every week and a half (Bradley 2006). Although studies have been conducted and no specific cause(s) have been identified. Wilce *et al*. (1987) concluded that nitrogen concentrations in Massachusetts Bay water were sufficient to support the Nahant Bay free-living *P. littoralis* population (MassDEP 2007).

There is a need to continue implementation of the sewer separation program, along with work to identify and remove infiltration and inflow sources, so that CSO discharges to Stacy Brook are eliminated. Specific recommendations (MassDEP 2007) include the following:

LWSC (MA0100552) should:

- Continue implementation of the sewer separation program in the #006 area, along with work to identify and remove infiltration and inflow sources, so that CSO discharges to Stacey Brook are eliminated.
- Implement illegal connection identification and removal program in the Stacey Brook watershed, in Lynn and Swampscott, to identify and remove any wastewater connections to the storm-drain system.
- Assess the sewer and storm-drain system in Swampscott, to identify any connections between the sewer and drain systems, through underdrains or direct connections, and take actions to separate these systems.
- Implement stormwater management programs in Swampscott and Lynn, to address pollutant sources to King's Beach.

The City of Lynn and the Town of Swampscott should continue their implementation and compliance with their stormwater NPDES permits MAR041044 and MAR041064, respectively. The municipalities should also implement recommendations in the Department of Fish and Game's Division of Marine Fisheries' (DMF) shellfish management plan for shellfish growing areas N22.0, N22.1, N23.0 and N24.0. The development of a monitoring plan to evaluate conditions contributing to the free-living *P. littoralis* population in Nahant Bay is also recommended.



	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Kings Beach (2929 Stacy Brook Outlet)	49%	24%	17%	43%	100%
Kings Beach (2929 Stacey Brook)	NA	NA	NA	45%	10%
Kings Beach (2929 Pierce Road)	NA	NA	NA	NA	10%
Kings Beach (2929 Ocean Terrace)	28%	24%	17%	38%	NA
Kings Beach (2929 Kimball Road)	49%	24%	17%	40%	10%

Figure 12. Kings Beach - Percent of Beach Season Posted 2008-2012

Quincy – Wollaston Beach, Quincy Shore Reservation

Postings at this beach have been the result of elevated bacteria concentrations or based on a precautionary rainfall posting. Precautionary postings at Wollaston Beach are posted when rainfall is equal to or exceeds 0.25 inches, although an increase for the precautionary threshold to 0.5 inches or more of precipitation had been proposed (FWB 2009). Two sampling locations (Milton Street and Rice Road) now have the higher (0.5 inches) precautionary threshold (Figure 13 and Appendix E). Given that this beach is within a highly urbanized area, it is subject to substantial run-off during and immediately after storm events. The high use of the beach itself can also be a source of bacteria.

Wollaston Beach is sampled daily, so that any bacterial exceedances that occur are likely to be identified (MA DPH 2013b). Enterococci samples are collected daily from a minimum of four sampling locations (Sachem Street, Channing Street, Milton Street, and Rice Road) (Appendix A). Like other Boston-area beaches, stormwater outfalls have a substantial impact. As part of EPA-New England's Beach Initiative, DPH designated Wollaston Beach as one of three Massachusetts Flagship beaches. These beaches were selected by DPH for focused study. As part of this Flagship Beach Project specific activities at these beaches included seven rounds of targeted monitoring for indicator bacteria between September 2004 and August 2005 for indicator bacteria, taking into account non-point and stormwater pollution sources and discharges of untreated sewage as identified by detailed sanitary surveys (Tetra Tech and MA DPH 2007). The results of the Flagship Beach sampling showed that the likely sources of the majority of bacterial contamination at Wollaston Beach were the eight stormwater outfalls. These outfalls were a major conduit to transport bacteria from the drainage area and deposit bacteria directly on the beach with no treatment. The wrack line also was identified as having the potential to be significant bacterial source, but it could be mitigated by mechanical raking during the beach season.

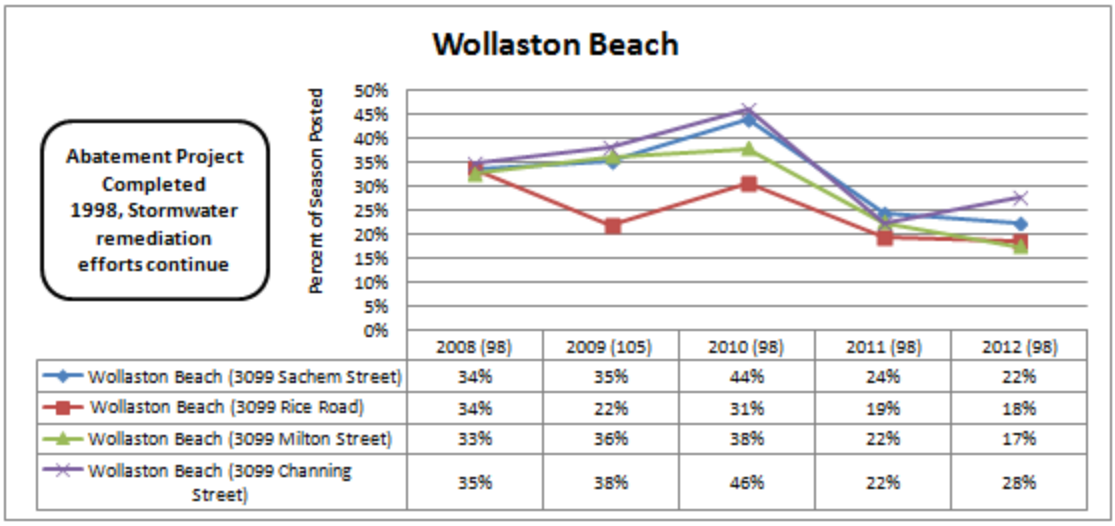
For many years, the City of Quincy, DCR, MWRA, and the Wollaston Beach Task Force have been extremely active in attempting to reduce the amount of fecal bacteria present at Wollaston Beach. Together these organizations have accomplished many activities in and around Wollaston Beach in order to improve water quality at the beach. Some of these activities include:

- Installed 17 "mutt mitt" stations in the Wollaston neighborhood;
- Amended city ordinances to provide for a "pooper scooper ordinance," which allows for fines to be imposed if pet waste is not disposed of properly;
- Replaced over 32,000 feet of sanitary sewer;
- Rehabilitated 42,000 feet of sewer lines through trenchless technology;
- MWRA constructed a new pump station to serve the Wollaston area;

- Replaced or rehabilitated over 750 building sewer services;
- Replaced over 150 storm drain covers and rehabilitated 110 sewer manholes;
- The City of Quincy is involved in a number of public education programs;
- Vactor trucks, street sweepers and a television inspection truck were purchased by the City;
- MWRA eliminated overflows from the Nut Island Wastewater Treatment Plant into Quincy Bay;
- MWRA rehabilitated a corroded 30-inch force main along entire length of Wollaston Beach; and
- DCR began mechanically raking the wrack from along Wollaston Beach.

While the results of the above mentioned efforts are beginning to be realized, additional work is needed. Continued implementation and compliance with the City of Quincy's stormwater NPDES permit (MAR041081) is also necessary to protect water quality at Wollaston Beach. Additional recommendations for reducing bacterial contamination to Wollaston Beach include the following (Tetra Tech and MA DPH 2007):

- Investigation of the storm drain system to confirm there are no illicit connections to wastewater systems.
- Best management practices in and around the beach area, including:
    - Trash cans should be covered to prevent and discourage birds and other wildlife from foraging;
    - Signs should be placed at several places along to beach warning the public to not feed birds;
    - Public education programs, such as those suggested in the Phase II Storm Water Management Plan would likely reduce potential pollution at the Wollaston Beach as well as raise public awareness;
    - Additional water samples should be taken once major work on the sewer and stormwater systems are complete; and
    - More in-depth samplings focusing on the impacts of beach wrack and the influence of the Black's Creek Area.



	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Wollaston Beach (3099 Sachem Street)	34%	35%	44%	24%	22%
Wollaston Beach (3099 Rice Road)	34%	22%	31%	19%	18%
Wollaston Beach (3099 Milton Street)	33%	36%	38%	22%	17%
Wollaston Beach (3099 Channing Street)	35%	38%	46%	22%	28%

Figure 13. Wollaston Beach - Percent of Beach Season Posted 2008-2012

Revere – Revere Beach and Short Beach, Revere Beach Reservation

The MassDEP entered into an Administrative Consent Order with Penalty against the City of Saugus, in May 2005, following a series of serious sanitary sewer overflow events that resulted in sewage discharges to the Saugus River. One event resulted in a preemptive posting of downstream Revere Beach. The City is now proceeding on a 9-year, $27 million project to address excessive infiltration and inflow into the City's sewer system (Brander 2012). In 2010, Mass DEP and EPA also entered into a CD with the City of Revere to address sewer overflows which included discharges onto Revere Beach Parkway that affected Revere Beach. The City is

proceeding with extensive work to rehabilitate and replace major elements of the sewer and drain system, which will serve to protect Revere's extensive beach resources. The City has already committed $25 million to this work, but the full spectrum of work is expected to cost upwards of $50 million. The City's Comprehensive Wastewater Management Plan must be submitted to the agencies by December 31, 2013 (Brander 2012).

MassDEP also recommends the continuation of work to address and mitigate sewer overflows, and supports the development of a water quality monitoring and bacteria sampling plan to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities. Bacteria source tracking, as needed, can also be utilized to help identify undocumented sources. Recommendations from the DMF shellfish management plans for shellfish growing areas N26.0 and N26.2 should also be reviewed and implemented for bacteria source reduction actions.

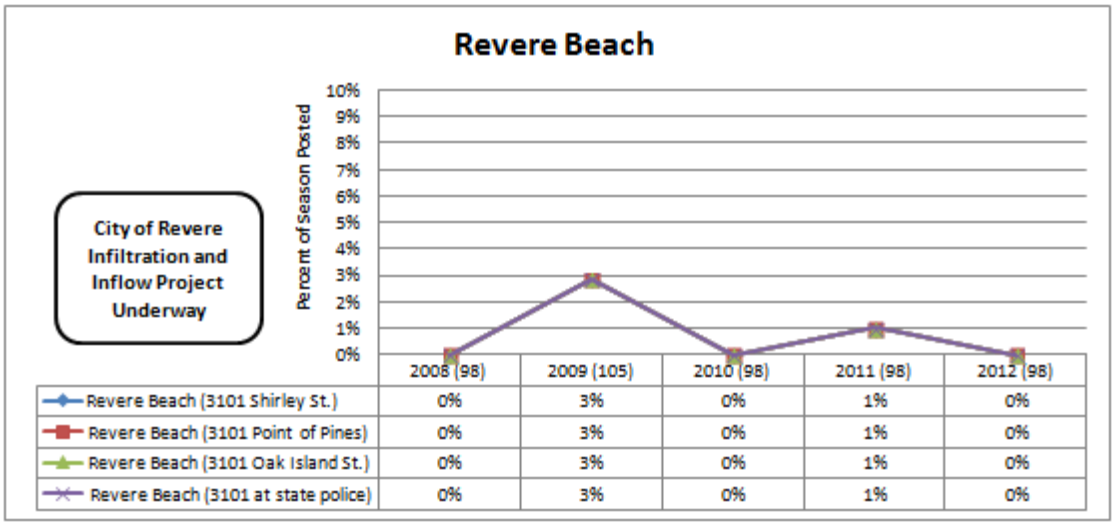


Figure 14. Revere Beach - Percent of Beach Season Posted 2008-2012

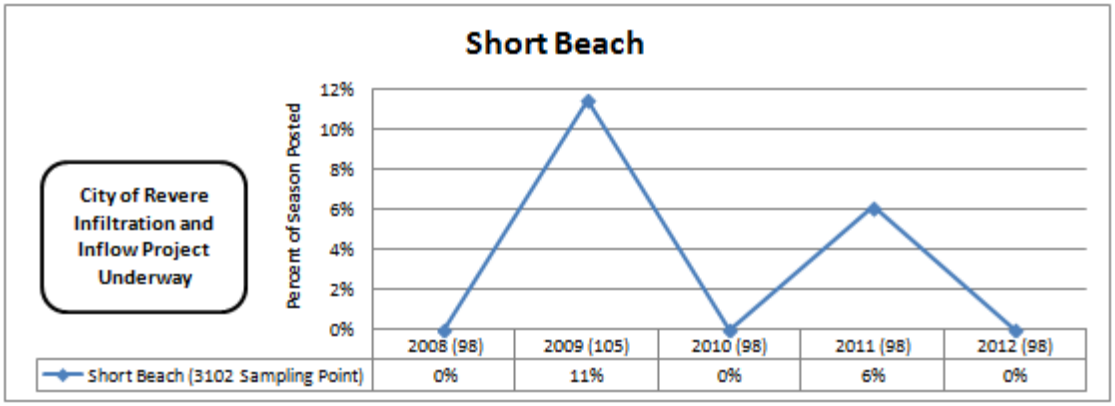


Figure 15.Short Beach - Percent of Beach Season Posted 2008-2012

Other Coastal Marine Beaches

Eight (8) of the 89 state property marine beaches are located along the Massachusetts coastline in Salisbury, Buzzards Bay, Cape Cod and the Islands (Martha's Vineyard) (Table 3, Figure 1). These beaches all have overall safety scores of greater than 90 percent. Only one beach, Fort Phoenix Beach in Fairhaven, had yearly safety scores that were lower than 90 percent; in 2009 and 2012 the yearly safety scores were equal to 81 and 84 percent, respectively. No specific recommendations have been made for any of these beaches, rather continued protection efforts and measures should be employed to maintain their high water quality conditions.

Table 3. DCR beach safety scores for marine beaches outside of the metropolitan Boston area based on 2008-2012 data maintained by DPH in their beaches database.

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012,Overall Safety Score , and any pertinent notes						
Town/City	**Beach Name**	**Beach ID (sampling location)**	**2008**	**2009**	**2010**	**2011**	**2012**	**Overall**	**Notes:**
Dartmouth	Demarest Lloyd Beach	2733	93%	100%	100%	100%	100%	**99%**	Weekly sampling
Edgartown	Joseph Sylvia State Beach	2811	100%	100%	100%	100%	100%	**100%**	Tier 3 Status Beach: monthly sampling
Edgartown	South Beach (Katama)	2800	100%	100%	100%	100%	100%	**100%**	Tier 3 Status Beach: monthly sampling
Fairhaven	Fort Phoenix Beach	2820	93%	81%	94%	100%	84%	**90%**	Weekly sampling
Mashpee	South Cape Beach	2961	100%	100%	100%	100%	100%	**100%**	Weekly sampling
Salisbury	Salisbury Beach	3123	100%	100%	100%	100%	100%	**100%**	Weekly sampling
Sandwich	Scusset Beach	5163	93%	94%	94%	100%	100%	**96%**	Weekly sampling
Westport	Horseneck Beach	3203	100%	94%	93%	100%	100%	**97%**	Weekly sampling

Freshwater Beaches

The majority, 63 of the 89 DCR state property beaches (approximately 71 percent) are freshwater (Table 4). It should be noted that two of these beaches, Howe Pond Beach in Spencer and Westfield River Beach-Huntington in Huntington, were not open for public swimming (thus not sampled) from 2008 through 2012 and five others were not open for swimming from 2009-2012 (i.e., Ashland Reservoir Main Beach in Ashland, Berry Pond Beach in North Andover, Lake Lorraine Beach in Springfield, Middle Pond Beach in Taunton, and Westfield River Beach-Windsor in Windsor).

With the exception of the seven freshwater DCR beaches with no or too little data to calculate an overall Safety Score, the majority (63 percent) of the freshwater DCR beaches have overall safety scores of greater than 90 percent (Table 4). Sixteen freshwater beaches however had overall safety scores of less than 90 percent with scores ranging from 35 to 89 percent. Four of these beaches had overall safety scores of less than 80 percent, including: Cold River Pool Beach in Charlemont (overall safety score is 78 percent), and Upper Mystic Lake Shannon Beach in Winchester (overall safety score is 75 percent). The lowest yearly average safety scores were at the Cliff Pond Beach and Cliff Pond DYS Beach in Brewster which were the result of two HABs that rendered water quality unsuitable/unsafe for swimming in 2012.

Table 4. DCR beach safety scores for freshwater beaches based on 2008-2012 data maintained by DPH in their beaches and harmful algal bloom databases.

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012 and Overall Safety Score (NS=Not Sampled) and any pertinent notes						
Town/City	**Beach Name**	**Beach ID (sample location)**	**2008**	**2009**	**2010**	**2011**	**2012**	**Overall**	**Notes:**
Agawam	Robinson Beach	5183	94%	100%	92%	81%	88%	**91%**	
Andover	Frye Pond Beach	4759	100%	89%	82%	94%	100%	**93%**	
Ashby	Damon Pond Beach	4531	78%	100%	88%	65%	83%	**83%**	
Ashland	Ashland Reservoir Main Beach	4533	94%	NS	NS	NS	NS	**--***	Impoundment of Cold Spring Brook See recommendations in text below
Ashland	Hopkinton Reservoir Upper Beach	4935	88%	100%	100%	94%	94%	**95%**	Impoundment of Indian Brook See recommendations in text below
Ashland	Hopkinton Reservoir Main Beach	4934	88%	94%	94%	82%	89%	**89%**	Impoundment of Indian Brook See recommendations in text below

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012 and Overall Safety Score (NS=Not Sampled) and any pertinent notes						
Town/City	**Beach Name**	**Beach ID (sample location)**	**2008**	**2009**	**2010**	**2011**	**2012**	**Overall**	**Notes:**
Brewster	Cliff Pond Beach	4572	100%	60%*	94%	100%	35%*	**78%**	*While there were no problems with bacteria exceedances at either Cliff Pond beach, HABs in 2009 and 2012 occurred resulting in these safety scores (Davis 2014). These recent declines in water quality are of noted concern.
Brewster	Cliff Pond Beach DYS	4574	93%	60%*	100%	100%	35%*	**78%**	
Brewster	Flax Pond Beach	4573	100%	100%	100%	100%	100%	**100%**	
Brimfield	Dean Pond Beach	5180	88%	NS	NS	NS	91%	**90%**	Sampling recommenced in 2012
Charlemont	Cold River Pool Beach	4589	68%	88%	88%	69%	75%	**78%**	
Chicopee	Chicopee Reservoir Beach	5172	94%	100%	94%	94%	100%	**96%**	
Clarksburg	Mauserts Pond Beach	4600	82%	79%	94%	64%	82%	**80%**	
Concord	Walden Pond Red Cross Beach	4605	100%	100%	NS[1]	NS	100%	**100%**	[1]Sampled only once in 2010 season - no beach safety calculation
Concord	Walden Pond Main Beach	4604	88%	100%	100%	94%	100%	**96%**	
Douglas	Wallum Lake Beach	4620	100%	94%	100%	100%	100%	**99%**	
Erving	Laurel Lake Beach	5357	94%	100%	100%	100%	100%	**99%**	
Framingham	Saxonville Beach	5325	100%	100%	100%	91%	NS	**98%**	
Gardner	Dunn Pond Beach	5181	94%	100%	94%	88%	93%	**94%**	See discussion in text below
Goshen	Highland Lake DAR Campers Beach	4662	100%	100%	100%	100%	100%	**100%**	

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012 and Overall Safety Score (NS=Not Sampled) and any pertinent notes						
Town/City	**Beach Name**	**Beach ID (sample location)**	**2008**	**2009**	**2010**	**2011**	**2012**	**Overall**	**Notes:**
Goshen	Highland Lake Day Use Beach	4663	100%	100%	100%	100%	100%	**100%**	
Hubbardston	Comet Pond Beach	4940	100%	100%	100%	100%	100%	**100%**	
Lowell	Pawtucket Falls Beach (AKA Rynne Beach)	4702	67%	87%	91%	82%	NS	**82%**	
Milton	Houghton's Pond Beach	4732	93%	100%	94%	79%	94%	**92%**	
Monterey	Benedict Pond Beach	4733	93%	83%	100%	88%	NS	**91%**	See recommendations in text below
Natick	Cochituate State Park Beach	4745	82%	100%	94%	94%	100%	**94%**	See discussion in text below
North Andover	Berry Pond Beach	4758	100%	NS	NS	NS	NS	**--***	See recommendations in text below
Otis	Otis Reservoir Beach	4779	100%	100%	100%	100%	100%	**100%**	
Pittsfield	Lulu Pond Beach	4792	67%	94%	88%	NS	74%	**81%**	
Plymouth	Barretts Pond Beach	4628	100%	94%	94%	83%	100%	**94%**	
Plymouth	Charge Pond Beach	4629	100%	100%	100%	88%	100%	**98%**	
Plymouth	Curlew Pond Beach	4631	100%	100%	82%	83%	100%	**93%**	
Plymouth	Fearings Pond Beach 1	4632	100%	100%	88%	88%	100%	**95%**	
Plymouth	Fearings Pond Beach 2	4632	100%	100%	82%	83%	100%	**94%**	
Plymouth	College Pond Beach	4630	100%	100%	94%	79%	100%	**95%**	
Rutland	Whitehall Pond	4833	100%	100%	94%	100%	100%	**99%**	

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012 and Overall Safety Score (NS=Not Sampled) and any pertinent notes						
Town/City	**Beach Name**	**Beach ID (sample location)**	**2008**	**2009**	**2010**	**2011**	**2012**	**Overall**	**Notes:**
	Beach								
Sandisfield	York Lake Beach	4834	94%	100%	100%	88%	93%	**95%**	
Saugus	John A. Pierce Lake Beach	4850	83%	94%	82%	82%	88%	**86%**	
Saugus	Pecham Pond Beach	4851	83%	94%	94%	64%	70%	**81%**	Recent decline
Savoy	North Pond Beach	4852	100%	100%	94%	88%	100%	**96%**	See recommendations in text below
Savoy	South Pond Beach	4853	100%	100%	100%	94%	88%	**96%**	
Shutesbury	Lake Wyola Beach	5168	94%	100%	100%	94%	100%	**98%**	
Springfield	Lake Lorraine Beach	5169	69%	NS	NS	NS	NS	**--***	
Sturbridge	East Brimfield Reservoir Streeter Point Beach	5185	82%	NS	93%	100%	92%	**92%**	
Sturbridge	Walker Pond Beach	5186	88%	100%	94%	94%	94%	**94%**	See recommendations in text below
Taunton	Middle Pond Beach	4906	93%	NS	NS	NS	NS	**--***	
Taunton	Watson Pond Beach	4961	78%	84%	100%	94%	62%	**84%**	Recent decline
Templeton	Beamans Pond Beach	5170	83%	100%	100%	88%	100%	**94%**	
Templeton	Beamans Pond Camp Beach	5225	74%	94%	100%	83%	100%	**90%**	
Townsend	Pearl Hill Beach	4966	100%	94%	100%	74%	79%	**89%**	
Wayland	Wayland Town Beach	4982	100%	100%	100%	100%	NS	**100%**	
Wendell	Ruggles Pond	5187	100%	100%	94%	100%	100%	**99%**	

DCR Beach Location and Name			Beach Safety Scores 2008 through 2012 and Overall Safety Score (NS=Not Sampled) and any pertinent notes						
Town/City	**Beach Name**	**Beach ID (sample location)**	**2008**	**2009**	**2010**	**2011**	**2012**	**Overall**	**Notes:**
	Beach								
Westfield	Hampton Ponds Kingsley Beach	5177	94%	75%	94%	76%	70%	**82%**	
Westfield	Hampton Ponds Lamberts Beach	5178	94%	94%	93%	100%	94%	**95%**	
Westminster	Crow Hill Pond Beach	5033	88%	100%	100%	83%	100%	**94%**	
Winchendon	Lake Dennison Campers Beach	5182	83%	100%	100%	93%	94%	**94%**	
Winchendon	Lake Dennison Day Use Beach	5182	94%	100%	100%	100%	100%	**99%**	
Winchester	Upper Mystic Lake Shannon Beach	5173	64%	93%	68%	68%	83%	**75%**	
Windsor	Westfield River Beach - Windsor	4909	59%	NS	NS	NS	NS	**--***	
Worcester	Lake Quinsigamond Regatta Point Beach	4916	80%	94%	100%	82%	76%	**87%**	
Worcester	Lake Quinsigamond Lake Park Beach	4915	72%	100%	78%	88%	94%	**86%**	

--* denotes result not calculated because only one yearly (2008) safety score available.

Freshwater Beaches – Discussion and Recommendations

Andover – Frye Pond Beach, Harold Parker State Forest

This freshwater beach experiences occasionally elevated bacteria levels. However, more recent testing is indicative of improved conditions (MA DPH 2013a). Extensive duckweed and other aquatic plant cover have also been documented as problematic in the pond itself (MassDEP 2004b).

Ashby – Damon Pond Beach, Willard Brook State Forest

This beach area is located in a small impoundment formed by a stone dam along Willard Brook. Because of the frequent water quality concerns in 2005 and 2006, DCR commissioned a study of Damon Pond Beach. The 2006 study carried out between May and August was unable to trace the exceedances to a single source (GeoSyntec 2006). The study found about half of the water quality exceedances in 2005 and 2006 were preceded by precipitation, but several occurred during warm, dry weather.

A sanitary survey is recommended. GeoSyntec (2006) made the following additional suggestions:

- A comprehensive spatial sampling program to isolate potential pollution sources based on land use.
- Installation of a water-circulating device in order to dilute isolated high concentrations of bacteria throughout the pond.

Ashland – Ashland Reservoir Main Beach

During surveys of Ashland Reservoir Main Beach conducted between June and August 2004 several waterfowl were present and a small amount of their droppings were observed at the perimeter of the beach area (GeoSyntec 2005). Recommendations made were to implement a strengthened focus on beach cleaning, including daily raking of the beach preceded by pick-up and disposal of any waterfowl droppings from beach sand and adjacent waterfront areas. The beach water has not been sampled since 2008. Materials developed by DCR and DPH to deter waterfowl feeding and pick up after domestic pets should be posted at the beach if it is re-opened to the public (Appendix B, C, and D).

Ashland – Hopkinton Reservoir Upper and Main Beaches

Between June and August 2004, observations were made and bacteria samples (*E. coli*) were collected from five locations (at the two beaches and the inlet, outlet and center) of Hopkinton Reservoir (GeoSyntec 2005). Numerous geese were observed. No dog walking was observed, but a "Mutt Mitt" (i.e., pet waste disposal) station was present. The report noted that bird droppings were raked into the sand and not actually removed from the beach areas during the 2004 season. The report stated that this was not the practice conducted during prior summers. Recommendations were made to reinstate a policy of removing waterfowl droppings from the beaches before raking. This would require maintaining adequate staffing levels during the summer. Materials developed by DCR and DPH to deter waterfowl feeding and picking up after domestic pets should be posted at the beach (Appendix B, C, and D). Signage to deter waterfowl feeding should be considered, as well as a depredation permit (GeoSyntec 2005).

Brewster – Cliff Pond Beach and Cliff Pond Beach Department of Youth Services (DYS), Nickerson State Park

Cliff Pond Beach and Cliff Pond Beach DYS, in Brewster, did not have elevated bacteria concentrations from 2008-2012. However, while Cliff Pond is usually described as a very clear pond, HABs have become more problematic in the pond in recent years. Both Cliff Pond Beach and Cliff Pond Beach DYS were posted in 2009 due to an extensive cyanobacteria bloom – the posting lasted from August 4 to September 20 (MA DPH 2013a, MassDEP 2011). In 2012, cyanobacteria blooms occurred in Cliff Pond again and the beaches were posted from June 22 to July 12 and from August 9 to October 26 (Curran 2013). While the cause(s) of the blooms in 2009 and 2012 are unknown, it should be noted that 2009 was an unusually wet season while 2012 was a relatively dry season on Cape Cod (see Figure 2d Chatham weather station). There was also one other record of an HAB related problem in Cliff Pond. According to Milton (2009), "in 1998 two poisoned dogs died and several others sickened after swimming in Cliff Pond in Nickerson State Park in Brewster." The potential cause(s) and source(s) of the recent cyanobacteria blooms in Cliff Pond need to be determined. It should be noted here that in response to the apparent increase in frequency of cyanobacteria blooms over the past ten years, in 2013 DCR

commissioned a comprehensive study of Cliff Pond to better understand the causes and potential management options for the cyanobacteria blooms (Carroll 2013).

Clarksburg – Mauserts Pond Beach, Clarksburg State Forest

Elevated bacteria concentrations have been fairly common at this beach, as a result, GeoSyntec was contracted to perform a water quality-based study to determine the source of high bacteria levels and to make recommendations for corrective measures. The study was conducted between May and July 2003. The major conclusion was that the large population of geese on the pond was a major cause of the repeated failures (GeoSyntec undated). In an effort to discourage geese from lingering near the swimming area, natural buffers and bench-seat buffers were installed along the shore line. If these solutions do not correct the problem, other types of goose control methods should be attempted. Goose droppings should be removed from the beach each morning, particularly before beach raking or wet weather events.

Huntington – Westfield River Beach–Huntington, C.M. Gardner State Park

The Westfield River Beach-Huntington has not been sampled but has been posted for swimming since 2006 due persistent levels of bacteria above the state standard (MA DCR 2013b). In 2005, MassDEP conducted targeted sampling to locate possible sources of bacteria upstream of the beach. Intensive sampling was conducted in the river as well as nearby upstream tributaries, but no elevated dry weather counts were detected, and a potential source was never identified (Pioneer Valley Planning Commission 2010). During the bacterial source tracking work in and around the Gardner State Park, MassDEP staff found significant quantities of trash frequently left at the beach and nearby picnic area, including diapers, which may be contributing to bacterial loading at the beach. There is also a mud flat upstream in the river that may harbor bacteria in the sediment. When this sediment becomes periodically disturbed, bacteria could be reintroduced/re-suspended into the water column (Duerring 2013).

DCR recently removed the designated swimming area at the C.M. Gardner State Park. This decision was based on two factors --the elevated bacteria counts and safety issues when river flows were high. While the park still has a picnic area there are signs posted that say no swimming, therefore no bacteria samples are being collected (Briere 2013). The park area around the beach still needs to be kept clean (litter-free) and bacteria sources still need to be identified. Despite attempts to pinpoint sources of bacteria (MassDEP 2005) a sanitary survey should be conducted to identify any non-point sources of bacteria in the vicinity of the beach.

Monterey, Benedict Pond Beach, Beartown State Forest

Between June and August 2004, observations were made and bacteria samples (*E. coli*) were collected from five locations in Benedict Pond (GeoSyntec 2005). The beach area was reported to be clean with no signs of waterfowl, other wildlife, or domesticated animals. Beaver lodges were observed in the corners of the pond. Signs were present at the parking and boat launch area stating “All Pets Must Be Leashed.” GeoSyntec (2005) recommended that regular clean-up and raking of beach be conducted. Materials developed by DCR and DPH to deter waterfowl feeding and picking up after domestic pets should be posted at the beach (Appendix B, C, and D). The beach was not sampled in 2012 because of work on the Benedict Pond dam, which is located in close proximity to the beach (Briere 2013).

North Andover – Berry Pond Beach

During surveys of Berry Pond Beach conducted between June and August 2004 no notable wildlife activity, dog walking, or other potential bacteria sources were noted. The beach area was clean and in very good condition on all sampling dates (MA DCR 2005). The report concluded that no specific management actions were warranted, although signage could be considered to deter waterfowl feeding and to clean up after pets (GeoSyntec 2005). The beach water has not been sampled since 2008. Materials developed by DCR and DPH to deter waterfowl feeding and pick up after domestic pets should be posted at the beach if it is re-opened to the public (Appendix B, C, and D).

Pittsfield – Lulu Pond Beach, Pittsfield State Forest

According to the DCR state park website (http://www.stateparks.com/pittsfield_state_forest_in_massachusetts.html) an earthen dam at Lulu Brook holds clear, cold spring water perfect for a brisk swim. However, with the exception of 2009 and 2010, frequent postings have been common at Lulu Pond Beach. Postings at this beach have been the result of elevated bacteria concentrations. Most of the postings in 2008, 2009, 2010 and 2012 were usually short however several postings have been prolonged: three week long (7-day) day postings in 2008, and 2012 (MA DPH 2013a). If beach postings continue to occur in 2013, a sanitary survey should be conducted in order to identify and address potential sources of bacterial contamination to the beach area.

Saugus – Pecham Pond Beach, Breakheart Reservation

Pecham Pond Beach has been occasionally posted as a result of elevated bacteria concentrations. In June and August of 2011, water quality was reportedly impacted by stormwater runoff (The Boston Globe 2011). Elevated enterococci levels also resulted in more beach postings in 2012. It should also be mentioned that both the Saugus River (MassDEP's segment MA93-35) which appears to be directly connected to Pecham Pond (see Figure 17 below) and Hawkes Brook (MassDEP's segment MA93-33), which flows around the western side of the pond, are listed in Category 5 of the 2012 Integrated List of Waters report and both require that TMDLs be developed for bacteria (fecal coliform) (MassDEP 2013). It is highly likely that under high flow conditions both of these waterbodies may be contributing elevated bacteria to the pond.

Figure 16. Screen capture depicting drainage area in the vicinity of Pecham Pond Beach.

MassDEP entered into an ACO with penalty against the City of Saugus in May 2005, following a series of serious sanitary sewer overflow events that resulted in sewage discharges to the Saugus River. The City is now proceeding on a nine-year, $27 million project to address excessive infiltration and inflow into the City's sewer system (Brander 2012). Whether or not these sanitary sewer overflow discharges occur upstream from Pecham Pond and may contribute to the elevated bacteria counts is unknown at this time, but it warrants further investigation. It is recommended that a sanitary survey be conducted at Pecham Pond Beach given the frequency of the beach postings in the last two years.

Savoy – North Pond Beach, Savoy Mountain State Forest

Because of a high rate of water quality exceedances in prior years, in 2006 DCR commissioned a study of North Pond Beach in Savoy in order to identify potential sources of bacterial contamination. The study, conducted from May to August 2006, found that there was not a strong correlation between rainfall and exceedances. The study suggested that wildlife in and around the pond may have been the source(s) of bacteria. Beavers, which were observed around the pond, were particularly suspected. Subsequent to the study and the 2007 beach season, postings have not been frequent or prolonged. Based on these data it appears that elevated bacteria levels are no longer problematic at North Pond Beach. GeoSyntec (2006) suggested that beaver activity in the pond be monitored, including the bank lodge located along the western shore and an abandoned lodge located along the northern shore. If elevated bacteria continue to be problematic at the beach, DNA ribotyping of bacteria is recommended in order to identify the source of the bacteria. DNA ribotyping may be conducted to identify specific wildlife sources of bacteria pollution. The evidence of the DNA ribotyping could then be used to provide a basis for a depredation permit to remove beavers (GeoSyntec 2006).

Springfield – Lake Lorraine Beach, Lake Lorraine State Park

This beach has not been sampled in the last four years. During bacterial source tracking surveys in 2005, MassDEP staff noted that Lake Lorraine is a kettle hole pond with no surface water tributaries or outlets. However, the pond receives overland flow from the watershed and has seven storm-drains, which drain into the pond during runoff events. Lake Lorraine is in an area of dense residential landuse, and also contains some unsewered areas directly abutting the shoreline. Concentrations of geese droppings were observed at several locations and an Environmental Police Officer indicated that diapers may also be a source of contamination to the lake (Duerring 2005).

Specific recommendations by Duerring (2005) include: bacteria monitoring should be conducted in order to determine whether postings due to bacterial exceedances at the beach are connected with wet-weather events, implementation of a sanitary survey, and continued bacteria source tracking should be conducted during wet weather conditions to determine whether the storm outfalls are sources of bacterial contamination. Implementation of goose control techniques such as goose buffers around the beach and ongoing pick-up of goose feces and other litter, including diapers, from the beach area are also recommended.

Sturbridge – Walker Pond Beach, Wells State Park

Surveys of the beach area were conducted in June, July, and August 2004 with the following observations (GeoSyntec 2005): the Camper's Beach area was found to be very clean during all site visits. Several duck feathers were observed, but no other evidence of waterfowl. A "Please do not feed the geese" sign was present at the beach area. Beavers are active in two major tributaries to the pond. While most postings since then have not been prolonged (i.e., lasting three days or less) there was one prolonged (8 day) posting between July 22 and July 29, 2008. Routine management and continued weekly bacteria monitoring and best management practices (as described in Appendix B, C, and D) should be implemented at Walker Pond Beach. GeoSyntec (2005) did not identify any high priority management recommendations, but they did suggest that the grassy areas adjacent to beach provide an unnecessary magnet for waterfowl. They also suggested daily disposal of waterfowl droppings should be conducted and that additional pet signage and a "mutt mitt" station be provided.

Taunton – Watson Pond Beach, Watson Pond State Park

Surveys were conducted at Watson Pond Beach, pond and inlets between June and August 2004 (Geosyntec 2005). An abundance of goose droppings on the state park beach and adjacent areas were present on all dates surveyed. Swans and cygnets as well as one dog were also observed. GeoSyntec (2005) made the following recommendations:

- Limited excavation to remove muck and re-establish a sandy bottom;
- Till grass that has encroached on beach and layer beach sand on top;
- Daily clean-up of waterfowl droppings;
- Construction of a small retaining wall to prevent soil erosion and deter geese;
- A gravel filled trench up gradient of the retaining wall to capture surface runoff before it reaches the beach;
- Regular bacteria monitoring; and
- Install signage to discourage waterfowl feeding and clean up after pet walking.

Templeton – Beamans Pond Beach and Beamans Pond Camp Beach, Otter River State Forest

Because of high rates of bacteria exceedances at Beamans Pond in years past, DCR commissioned a study in 2006 to identify potential sources of bacteria near the beach. During the study between May and August 2006, 10 out of 12 sample failures at Beaman Pond were either during or within 24 hours of rain. The report concluded that it is likely that storm water runoff from the Beaman Pond Brook is contributing bacterial pollution to the pond, including non-point sources such as agriculture, wildlife, and leaking septic and sewer systems (GeoSyntec 2006). While Canada geese were in the general vicinity of the beach area on two of the sampling dates, the beach and surrounding areas were clean on all sampling dates, with no goose droppings observed. No obvious park-related sources of bacterial pollution (e.g. goose droppings, dog walking, etc.) were identified during the limited monitoring program conducted as part of this study. The combined GeoSyntec and DCR monitoring data indicated that elevated bacterial levels at the inlet and beaches correlate to storm events. Therefore, it is likely that stormwater runoff from the Beaman Brook watershed is a source of bacterial pollution to the pond.

A sanitary survey should be conducted if another prolonged posting occurs at either beach. GeoSyntec (2006) suggested that a more comprehensive spatial bacteria source tracking program to identify and address sources of pollution within Beaman Brook's catchment area. A field-sampling program should include sampling at multiple locations along the stream to isolate individual stream reaches based on land uses (e.g., residential areas, agricultural land, etc.). Sampling locations should be modified throughout the sampling program to "bracket" samples that result in high bacteria levels. This will enable the program to isolate sources of bacterial pollution and prioritize areas for watershed improvements. DCR should continue to monitor the activity of Canada geese at the beach area. As stated above, it appears that ongoing beach maintenance activities have been sufficient to keep the beach area clean despite the presence of a limited number of geese at the park.

Townsend – Pearl Hill Pond Beach, Pearl Hill State Forest

The Pearl Hill Pond Beach is located on Pearl Hill Brook Pond in Townsend. DCR commissioned a study of Pearl Hill Pond Beach in 2006 due to historically high levels of bacterial exceedances. GeoSyntec (2006) suggested that periods of low flow during the summer months resulted in limited flushing of the beach area. In order to remediate that problem, installation of a water circulation device in the vicinity of the main beach was recommended. A sanitary survey and bacteria source tracking are recommended to identify and remediate as necessary, source(s) of bacteria pollution.

Westfield – Hampton Ponds Kingsley Beach, Hampton Ponds State Park

In 2006 DCR staff commissioned a study of this beach and Lambert Beach (GeoSyntec 2006). Based on the combined GeoSyntec field observations conducted between May and September 2006 and DCR monitoring data goose droppings appear to present on ongoing threat to water quality at both Pequot Pond beaches (Pequot Pond is located in Hampton Ponds State Park). A large number of geese visit the park and goose feces were observed in the beach areas during all sampling events, including areas immediately adjacent to pond edge. Park staff reported to GeoSyntec that goose droppings were regularly raked into the sand by use of a tractor with a York rake attachment. Modifications to this practice were suggested to the DCR beach management staff by the consultant (Geosyntec 2006). Daily pickup of goose feces from the beach and adjacent waterfront areas were recommended prior to beach raking. The goose feces need to be removed from the sand and should never be raked into the sand. Goose feces should be removed from the beach areas and properly disposed of or buried in an area that is at least 100 feet away from the pond.

GeoSyntec (2006) made the following suggestions:

- The installation of a water circulation device in the vicinity of the main beach, such as the Oloid or other water circulating device. The device could be installed at the north end of the main beach swimming area and directed to the south to generate flow through the swimming area. Pequot Pond is an ideal candidate for a circulating device, because of (1) the documented source of bacteria loading in the beach area from geese, and (2) sampling data indicate that a low bacteria levels are consistently found in other areas of the pond (e.g. at the pond center), even when elevated bacteria levels are found at the beach.
- Extending the vegetated buffer along a section of shoreline to the south of the main beach to the north to the limit of the maintained beach area.
- The physical boundary of the both swimming beach areas are poorly defined, with no clear delineation between the maintained sand and adjacent grassy areas. The limit should be defined by establishing a vegetated buffer between the maintained beach and the adjacent grass area. Where feasible, the maintained sand beach could also be expanded to reduce the food source that attracts geese. Expanding the sand beach would require tilling the grass and layering a minimum of four inches of beach sand on top of the tilled area.
- Signage related to discouraging waterfowl feeding and cleaning up after pets should be installed near the picnic areas adjacent to Kingsley Beach.

Westfield – Hampton Ponds Lamberts Beach, Hampton Pond State Park

In 2006, DCR staff commissioned a study of these beaches (GeoSyntec 2006). Based on the combined GeoSyntec field observations between May and September 2006 and DCR monitoring data, goose droppings appear to present an ongoing threat to water quality at both Pequot Pond beaches. A large number of geese visit the park and goose feces were observed at the beach areas, including areas immediately adjacent to pond edge, during all sampling events. Park staff reported to GeoSyntec that goose droppings were regularly raked into the sand by use of a tractor with a York rake attachment. Suggested modifications to this practice were made to DCR beach management staff by the consultant (Geosyntec 2006). Daily pickup of goose feces from the beach and adjacent

waterfront areas was recommended prior to beach raking. The goose feces need to be removed from the sand and should never be raked into the sand. Goose feces should be properly disposed of or buried in an area that is at least 100 feet away from the pond.

GeoSyntec (2006) had made the following additional suggestions:

- Extending the vegetated buffer along a section of shoreline to the south of the main beach and north to the end of the maintained beach area.
- A vegetated goose buffer for the eastern side of the Lambert Beach area, where an expansive grassed area is located adjacent to the water.
- The physical boundary of the both swimming beach areas are poorly defined, with no clear delineation between the maintained sand and adjacent grassy areas. The limit should be defined by establishing a vegetated buffer between the maintained beach and the adjacent grass area. Where feasible, the maintained sand beach could also be expanded to reduce the food source that attracts geese. Expanding the sand beach would require tilling the grass and layering a minimum of four inches of beach sand on top of the tilled area.
- Signage related to discouraging waterfowl feeding and cleaning up after pets should be installed at the state park boat ramp and parking areas near Lamberts Beach.

Winchester – Upper Mystic Lake – Shannon Beach, Middlesex Fells Reservation

Because of previously high rates of bacterial contamination, DCR commissioned a study of the beach in 2006. That study, conducted between June and August 2006, documented that there was an obvious problem with a nuisance Canada goose population as witnessed by their droppings at the beach and grass area to the west of the parking lot. GeoSyntec staff consistently observed a moderate number of other waterfowl during sampling events, including cormorants and two pair of resident swans. DCR park staff reported that goose feces were picked-up from the beach and grass area and were discarded in a compost pile adjacent to the west side of the beach, near the shore. Park staff also reported that organic matter and debris are often wind blown into the beach area during the summer months. The park staff reported that visitors often feed waterfowl in the picnic area adjacent to the west side of the beach. The combined GeoSyntec field monitoring program and DCR monitoring data supported the conclusion that goose activity may be a significant source of the bacteria load contributing to exceedances at Shannon Beach. The report suggested that regular clean-up of goose feces was necessary, including proper disposal of them at least 100 feet away from the pond (GeoSyntec 2006). The report also suggested maintenance of the goose buffer would decrease goose presence near the beach, including amending the entrances so that no clear line-of-sight exists for geese between tall grass and the pond.

Installation of a water-circulating device was also recommended, along with signage postings encourage picking up after pets and discouraging feeding of waterfowl (GeoSyntec 2006). GeoSyntec (2006) also recommended ongoing inspection of sanitation at the facility and beach.

In late August 2009 an outbreak of *Shigella sonnei* occurred among visitors at the Shannon Beach Recreational Area. Based on an epidemiologic investigation conducted by DPH's Bureau of Infectious Disease Services (BIDS), thirty confirmed cases and thirty-seven additional probable cases of *Shigella sonnei* infections were associated with some type of exposure at the recreational facility. In response, beach water and sand samples were collected from the beach area and the entire recreational area was inspected. Inspections revealed poorly maintained restroom and changing facilities, with no hand washing soap or towels provided. The beach sand was tested for *Shigella sonnei* and the results were negative. Although the actual source of *Shigella sonnei* was unknown, the unsanitary conditions in the bathroom and on-going case identification led DPH to recommend that DCR temporarily close the recreational facilities at the Mystic River Reservation on August 22, 2009. Intensive disinfection of bathrooms and playground equipment areas occurred in September and was followed by reopening all areas of the reservation except the beach and bathrooms. Given that *Shigella sonnei* will die-off over the winter, the beach reopened for the 2010 beach season (MA DPH 2010).

In July 2010, DPH's Bureau of Environmental Health (BEH) was contacted by DPH's Bureau of Communicable Disease Control (BCDC) regarding a number of cases of *Shigella sonnei* reported among individuals who visited the Shannon Beach Recreational Area. Given the history and an apparent reoccurrence of *Shigella* in 2010, BEH beaches staff conducted several site visits to assess the sanitary conditions (MA DPH 2011).

Routine management and continued weekly bacteria monitoring and best management practices (as described in Appendix B and C) should be implemented at Shannon Beach. GeoSyntec (2006) also made the following suggestions:

- Conduct regular cleanup of waterfowl droppings from the beach and adjacent grass area. Daily (at a minimum) cleanup activities should focus on the beach and any other areas frequented by waterfowl within 20 feet of the shoreline. The beach area and grass area should be picked-up prior to any beach resurfacing or lawn mowing maintenance activities. Goose feces should be removed from the beach areas and properly disposed of or buried in an area that is at least 100 feet away from the pond.
- Maintain the vegetated buffer along the northern side of the grass area adjacent to the parking lot. The existing buffer has gaps that allow a clear pathway for geese between the pond and food source. These gaps should be re-configured to allow for pedestrian access without providing a clear line-of-sight from the pond to the grass.
- The installation of a water circulation device near the beach, such as the Oloid or other device. The device should be installed at the east end of the swimming area and directed to the west to generate flow through the swimming area. In addition to potentially mitigating the buildup of high bacteria levels in the swimming beach area, a circulating device may also help reduce the amount of floating debris that accumulates in the beach area as a result of prevailing southeast winds. Although GeoSyntec's 2006 monitoring documented one bacteria exceedance at the center of the south basin (during a wet weather sampling), bacteria levels at the pond center appear to be consistently lower than those at the beach and were quite low on all other sampling dates. As such, it appears likely that improved circulation and flushing at the beach area would help to reduce beach bacteria exceedances.
- Post signage and provide "Mutt-Mitt" bags and trash receptacles along the west side of the parking area. Most dog walking activity appears to occur through the southwest corner of the parking area near the maintenance road entrance. Post education signage related to waterfowl feeding in the picnic area adjacent to the west side of the beach.

Worcester – Lake Quinsigamond Regatta Point and Lake Park beaches, Quinsigamond State Park

Continued implementation and compliance with the City of Worcester's stormwater and Upper Blackstone Water Pollution Abatement District's NPDES permits (MAS010002 and MA0102369, respectively) are also necessary to protect water quality at these beaches.

General Recommendations

Keeping the DCR beaches clean and safe takes the skill, time, cooperation, and dedication of a number of partners, notably DCR and DPH. For some beach-specific issues MassDEP, EPA, and local government, as well as neighborhood associations can play a role. The public also has a role and responsibility to clean up after themselves and their pets. Common threats to beach water quality, particularly in our urban areas, include large rain events, illicit sewer connections, stormwater outfalls, and CSOs, while in our more suburban and rural areas, nearby agriculture, septic tanks, stormwater, and the presence of nuisance wildlife. With such a variety of threats to water quality, tactics specific to each beach must be employed to address particular situations. Beach-specific recommendations to maintain water quality and address water quality impairments were included in the *Results* section of this report. Overarching recommendations that will help to ensure good water quality at DCR's beaches include:

Routine sampling

First and foremost is the need for routine sampling. Beach monitoring data is the basis for the information provided to the public regarding beach safety. DPH is continuing to improve the quality of its beach monitoring data by providing training to local public health departments, conducting beach inspections to ensure postings, and maintaining a direct online-reporting tool for marine water samples. Additional financial resources for DCR and DPH would enhance all beach monitoring and would help both Departments ensure prompt and accurate posting information reaches the public in a timely manner.

Sanitary surveys and bacteria source tracking

For occasional and problem beaches where pollution sources are unknown, sanitary surveys are recommended in order to determine potential sources of pollution. A sanitary survey is a method of investigating the sources of fecal contamination to a water body. Sanitary surveys are typically used for drinking water, shellfish, and watershed protection programs. They can also be used at beaches. Sanitary surveys help state and local beach program managers and public health officials identify sources of beach water pollution, assess the magnitude of pollution, and identify priority locations for water testing.

Beach sanitary surveys involve collecting information at the beach, as well as in the surrounding watershed. Information collected at the beach may include: number of birds at the beach, slope of the beach, location and condition of bathrooms, and amount of seaweed or algae on the beach. Information collected in the watershed may include: land use, location of storm water outfalls, surface water quality, and residential septic tank information. Beach managers can use the sanitary survey results to prioritize state or county resource allocations to help improve bathing beach water quality. In addition, they can use sanitary survey data (e.g., bacteria levels, source flow, turbidity, rainfall) to develop models to predict bathing beach water quality using readily available data.

An example of a comprehensive sanitary survey is the DPH survey for Wollaston Beach (Tetra Tech EM, Inc. and MA DPH 2007). Sanitary surveys may also be supplemented by bacterial source tracking sampling in order to identify the bacteria source(s). Bacterial source tracking utilizes a number of techniques to determine the sources of fecal bacteria and establish whether fecal bacteria are being introduced into water bodies through human, wildlife, agricultural, or pet wastes.

Sufficient staffing

The cleanliness of the beach area as well as the bathroom and changing facilities requires sufficient staffing. The removal of trash, animal waste, and vegetative matter from the beach must be performed daily in order to prevent contamination of the water. Without appropriate numbers of staff, insufficient cleaning and

maintenance may result in communicable diseases (e.g., Shigellosis), as well as beach postings due to unsanitary conditions.

Unstaffed beaches are not sampled for water quality. While many of DCR's beaches are sampled on at least a weekly (and several on a daily) basis there are some beaches where sampling has not been conducted due to resource and staffing constraints. Of the 89 beaches in this report, 15 (approximately 17 percent), of the DCR beaches were not sampled for one or more years during the period of 2008-2012. Generally these beaches were not sampled due to a lack of resources at DCR or within the town responsible for the beach.

BMPs implemented to control the quantity and quality of stormwater discharging to recreational waters require operation and maintenance programs. Staff resources may be needed to conduct periodic inspection and maintenance of mitigation measures that have been enacted. Requirements of an operation and maintenance program depend on the specific BMPs employed. The effectiveness of operation and maintenance activities at reducing pathogen concentrations are dependent on the specific BMP in question.

Outreach and education (Appendix B, Appendix C, and Appendix D)
Common sources of bacteria can often be eliminated or reduced by simple means. Signs warning against feeding wildlife should be posted. Trash cans and 'mutt-mitt' stations (to enable people to clean up after their pets) should be provided and maintained at all the DCR beaches. Staff should ensure that existing educational materials developed by DCR and DPH are posted at all beaches and distributed to beachgoers. For locations severely affected by stormwater runoff or nuisance animal populations, landscaping can often be effective in mitigating pollution. Septic system management (maintenance, repair), where appropriate, should also be implemented.

Reducing stormwater impacts
The 1998 National Water Quality Inventory Report to Congress identified urban runoff as one of the leading sources of water quality impairment in surface waters. Urbanization and development drastically change the hydrology of our watersheds by increasing the amount of surface runoff. Urbanization begins with the removal of trees, vegetation, and topsoil. These natural features play an important role in allowing rainfall to slowly infiltrate and provide continuous recharge to streams, wetlands and aquifers. Replacing these features with impervious surface (highways, roads, parking areas, sidewalks, roofs, shopping centers, and malls) increases the amount of rainfall that runs off a given area. This runoff is usually collected on roadsides, directed into catch basins, and discharged into the nearest stream, pond, or wetland. Runoff washes bacteria from a myriad of sources into stormwater systems and eventually into surface waters. Stormwater runoff from urban areas may also carry a variety of other pollutants, including sediment, organic matter, nutrients, metals, fertilizers, and pesticides.

Stormwater runoff can be categorized in two forms: point source discharges and non-point source discharges (includes sheet flow or direct runoff). Many point source stormwater discharges to waters of the United States and the Commonwealth are regulated under the NPDES Phase I and Phase II permitting programs. Boston and Worcester are the only communities in Massachusetts subject to Phase I requirements. Municipalities that operate municipal separate storm sewer systems (MS4s) are subject to phase II stormwater requirements and must develop and implement a stormwater management plan (SWMP) which must employ, and set measurable goals for six minimum control measures. Each of these six minimum control measures is described in fact sheets available at: http://cfpub1.epa.gov/npdes/stormwater/swfinal.cfm?program_id=6.

Reducing bacteria and nutrient runoff into beaches via storm water runoff can be accomplished in different ways. Strategies for controlling stormwater are described in *Mitigation Measures to Address Pathogen Pollution in Surface Waters* at http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/impguide.pdf and include the following:

Stormwater Infiltration/Retention: Stormwater infiltration and retention BMPs store runoff and allow it to gradually infiltrate to groundwater. Retention BMPs, also known as exfiltration systems, include infiltration basins, trenches, swales, and vegetated filter strips. These systems must be designed with sufficient storage capacity to hold runoff long enough to permit gradual infiltration. Infiltration systems remove pathogens by filtration through the soil matrix and reduce stormwater volume.

Stormwater Detention: Stormwater detention BMPs are structures that temporarily store runoff and slow its release to the watershed. These methods are primarily designed to reduce stormwater surges and the concentrations of sediments and nutrients in stormwater. Stormwater detention may also reduce pathogen concentrations in stormwater to a limited extent. Stormwater detention practices may take the form of created wetlands or extended detention ponds. Created wetlands are shallow pools that create conditions suitable for the growth of marsh or wetland plants. These systems achieve pathogen reduction through sedimentation, exposure to ultraviolet radiation, chemical reactions, natural die-off, and predation by zooplankton. Extended detention ponds are designed, as the name suggests, retaining stormwater in the pond and slowing its release to the watershed. There are two types of extended detention ponds for mitigating stormwater impacts, wet and dry detention ponds. Wet extended detention ponds include a storage volume above a permanent pool. Dry ponds drain completely between precipitation events.

Stormwater Treatment: In addition to treatment methods that rely on infiltration and detention, there are a number of other methods for treating stormwater. These include chemical disinfection, alum treatment, sand filters, oil and grit chambers, and catch basins with sumps and hoods.

Low Impact Development Strategies (LIDS): LIDS are a set of tools intended to restore or maintain the hydrology of the watershed by reducing runoff rates and volume and increasing groundwater recharge. Strategies include the preservation/protection of environmentally sensitive site features such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands and highly permeable soils. One of the most effective LIDS is “disconnecting” impervious areas. If runoff from paved surfaces is allowed to flow over pervious or vegetated surfaces before entering a drainage collection system, some or all of the runoff from small rain events will be intercepted and percolated into the ground. This can eliminate stormwater’s contribution to pathogen impairment during small storm events. Other LIDS include the use of bioretention, porous pavement, green roofs and rain gardens.

CSO Management: CSO management techniques may involve sewer separation or prevention practices. Sewer separation is the practice of separating the combined, single pipe system into separate sewers for sanitary and stormwater flows. Separating part or all of combined systems into distinct storm and sanitary sewer systems may be feasible. In a separate system, stormwater is conveyed to a stormwater outfall for discharge directly into the receiving water. This eliminates overflow events and the discharge of untreated sanitary waste. CSO prevention practices are intended to both reduce the volume of pollutants entering a combined sewer system and to reduce the frequency of overflows. The volume and frequency of CSO events can be reduced by implementing many of the stormwater management measures described above.

Beach Facilities

In addition to having adequate beach staff to maintain the cleanliness of the beach area and beach area bathroom and changing facilities, additional information regarding the beach facilities (what facilities are present and where they are located) and wastewater collection system details (i.e., septic system or sewered) for each beach would help DPH best determine the potential for health impacts. With this information, DCR and DPH could help mitigate potential causes of illnesses resulting from visiting a beach, including: malfunctioning or poorly maintained septic systems, unsanitary bathroom and changing facilities, and unsanitary portable restroom facilities.

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Appendix A: DCR Beach Closure Statistics developed at beach sampling locations from DPH Beaches and Harmful Algal Bloom Databases Memorial Day through Labor Day Weekends 2008 through 2012

MassDEP utilized DPH's database to calculate the percentage of time a given DCR beach's recreational water was "posted" during each beach season, each year for the period of record from 2008 through 2012. Postings lasting for longer than three consecutive days were considered prolonged. This methodology is consistent with the evaluation methodology used by MassDEP for developing the "Integrated List of Waters" report and is described in more detail in the Massachusetts Consolidated Assessment and Listing Methodology (CALM) Guidance Manual (MassDEP 2012). For the purpose of this analysis, hurricane-related (e.g., Bob) and Tropical Storm Irene postings which affected much of Massachusetts in late August and early September 2011, were excluded from the calculations (these severe weather postings were preemptive and not based on bacteria sampling). An analysis was completed for each DCR beach using the number of days the beach was posted (i.e., date posted to date re-opened), summed for each year, and divided by the number of days in that beach season.

Table 5. DCR Beach Closure Statistics for DCR property beaches alphabetically organized by Town and Beach Name. [Note: This table provides a summary of beach closure postings for the swimming seasons 2008 through 2012 as derived from the DPH Beaches Database and these data are presented as the percent of the season closed (season length in days between Memorial Day through Labor Day weekends).]

DCR Beach Closure Statistics – 2008–2012				Sampling year (Season length in days)				
Town	Beach Name	BeachId	SampleLocationId	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Agawam	Robinson Beach	5183	Sampling Point	2%	0%	2%	10%	2%
Andover	Frye Pond Beach	4759	Sampling Point	7%	5%	9%	2%	0%
Ashby	Damon Pond Beach	4531	Sampling Point	11%	0%	3%	20%	8%
Ashland	Hopkinton Reservoir Upper Beach	4935	Sampling Point	4%	0%	0%	2%	2%
Ashland	Ashland Reservoir Main Beach	4533	Sampling Point	2%	NS	NS	NS	NS
Ashland	Hopkinton Reservoir Main Beach	4934	Sampling Point	4%	2%	4%	7%	4%
Boston	Carson Beach	2647	at I St.	27%	24%	23%	3%	1%
			at Bathhouse	27%	25%	23%	3%	1%
Boston	City Point Beach	2641	Sampling Point	17%	8%	10%	1%	0%
Boston	Constitution Beach	2646	Rec Center	18%	17%	6%	10%	13%
			North site	18%	17%	6%	9%	13%
			Middle	18%	17%	6%	9%	13%
Boston	Lovells Island Beach	2648	Sampling Point	0%	0%	0%	0%	0%
Boston	M Street Beach	2649	Sampling Point	21%	6%	8%	1%	0%
Boston	Malibu Beach	2645	Sampling Point	4%	1%	4%	2%	2%
Boston	Pleasure Bay Beach	2644	Sullivans	NS	NS	NS	NS	1%
			South Flagpole	NS	NS	NS	NS	1%
			Broadway	4%	4%	0%	4%	3%
Boston	Savin Hill Beach	2643	Sampling Point	4%	1%	2%	2%	2%

DCR Beach Closure Statistics – 2008-2012				Sampling year (Season length in days)				
Town	Beach Name	BeachId	SampleLocationId	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Boston	Spectacle Beach	5384	Sampling Point	0%	0%	0%	0%	0%
Boston	Tenean Beach	2642	Sampling Point	46%	36%	28%	26%	21%
Brewster	Cliff Pond Beach	4572	Sampling Point	0%	45%	1%	0%	47%
Brewster	Cliff Pond Beach DYS	4574	DYS	1%	45%	0%	0%	47%
Brewster	Flax Pond Beach	4573	Sampling Point	0%	0%	0%	0%	0%
Brimfield	Dean Pond Beach	5180	Sampling Point	6%	NS	NS	NS	0%
Charlemont	Cold River Pool Beach	4589	Sampling Point	20%	6%	4%	17%	23%
Chicopee	Chicopee Reservoir Beach	5172	Sampling Point	2%	0%	2%	2%	0%
Clarksburg	Mauserts Pond Beach	4600	Sampling Point	9%	10%	2%	11%	9%
Concord	Walden Pond Red Cross Beach	4605	Sampling Point	0%	0%	3%*	NS	0%
Concord	Walden Pond Main Beach	4604	Sampling Point	3%	0%	3%	2%	0%
Dartmouth	Demarest Lloyd Beach	2733	Sampling Point	1%	0%	0%	0%	0%
Douglas	Wallum Lake Beach	4620	Sampling Point	0%	2%	0%	0%	0%
Edgartown	Joseph Sylvia State Beach	2811		0%	0%	0%	0%	0%
Edgartown	South Beach (Katama)	2800		0%	0%	0%	0%	0%
Erving	Laurel Lake Beach	5357	Sampling Point	2%	0%	0%	0%	0%
Fairhaven	Fort Phoenix Beach	2820	Sampling Point	1%	14%	3%	1%	5%
Framingham	Saxonville Beach	5325	Sampling Point	0%	0%	0%	2%	NS
Gardner	Dunn Pond Beach	5181	Sampling Point	2%	41%	2%	8%	6%
Goshen	Highland Lake DAR Campers Beach	4662	Sampling Point	0%	0%	0%	0%	0%
Goshen	Highland Lake Day Use Beach	4663	Sampling Point	0%	0%	0%	0%	0%
Hubbardston	Comet Pond Beach	4940	Middle	0%	0%	0%	0%	0%

DCR Beach Closure Statistics - 2008-2012				Sampling year (Season length in days)				
Town	Beach Name	BeachId	SampleLocationId	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Hull	Nantasket Beach	2913	Water St.	2%	0%	0%	0%	0%
			Park St.	2%	0%	0%	0%	0%
			North site	2%	0%	0%	0%	0%
			Bathhouse	2%	0%	0%	0%	0%
Huntington	Westfield River Beach - Huntington	4944	Sampling Point	NS	NS	NS	NS	NS
Lowell	Pawtucket Falls Beach (AKA Rynne Beach)	4702	Sampling Point	0%	0%	2%	0%	NS
Lynn	Kings Beach	2929	Stacy Brook Outlet	49%	24%	17%	43%	10%
			Stacy Brook	NS	NS	NS	45%	10%
			Pierce Road	NS	NS	NS	NS	10%
			Ocean Terrace	28%	24%	17%	38%	NS
			Kimball Road	49%	24%	17%	40%	10%
Lynn	Lynn Beach	2928	Sampling Point	1%	0%	0%	3%	0%
Mashpee	South Cape Beach	2961	Sampling Point 1	0%	0%	0%	0%	0%
Milton	Houghton's Pond Beach	4732	Sampling Point	2%	0%	1%	4%	1%
Monterey	Benedict Pond Beach	4733	Sampling Point	2%	8%	0%	3%	NS
Nahant	Nahant Beach	2989	South site	1%	0%	0%	3%	1%
			Parking section 9	1%	0%	0%	3%	0%
			N. of bathhouse	1%	0%	0%	3%	0%
			Flagpole	1%	0%	0%	3%	1%
Natick	Cochituate State Park Beach	4745	Sampling Point	9%	0%	3%	2%	0%
North Andover	Berry Pond Beach	4758	Sampling Point	3%	NS	NS	NS	NS

DCR Beach Closure Statistics - 2008-2012				Sampling year (Season length in days)				
Town	Beach Name	BeachId	SampleLocationId	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Otis	Otis Reservoir Beach	4779	Sampling Point	0%	0%	0%	0%	0%
Pittsfield	Lulu Pond Beach	4792	Sampling Point	13%	1%	4%	NS	13%
Plymouth	Barretts Pond Beach	4628	Sampling Point	0%	1%	1%	3%	0%
Plymouth	Charge Pond Beach	4629	Sampling Point	0%	0%	0%	2%	0%
Plymouth	Curlew Pond Beach	4631	Sampling Point	0%	0%	2%	3%	0%
Plymouth	Fearings Pond Beach 1	4632	Fearings Pond Beach 1	0%	0%	1%	2%	0%
Plymouth			Fearings Pond Beach 2	0%	0%	3%	3%	0%
Plymouth	College Pond Beach	4630	Sampling Point	0%	0%	4%	4%	0%
Quincy	Wollaston Beach	3099	Sachem Street	34%	35%	44%	24%	22%
			Rice Road	34%	22%	31%	19%	18%
			Milton Street	33%	36%	38%	22%	17%
			Channing Street	35%	38%	46%	22%	28%
Revere	Revere Beach	3101	Shirley St.	0%	3%	0%	1%	0%
			Point of Pines	0%	3%	0%	1%	0%
			Oak Island St.	0%	3%	0%	1%	0%
			at state police	0%	3%	0%	1%	0%
Revere	Short Beach	3102	Sampling Point	0%	11%	0%	6%	0%
Rutland	Whitehall Pond Beach	4833	Sampling Point	0%	0%	1%	0%	0%
Salisbury	Salisbury Beach	3123	Sampling Point	0%	0%	0%	0%	0%
Sandisfield	York Lake Beach	4834	Sampling Point	2%	0%	0%	6%	2%
Sandwich	Scusset Beach	5163	Sampling Point	1%	1%	1%	0%	0%
Saugus	John A. Pierce Lake Beach	4850	Sampling Point	7%		3%	10%	2%
			Breakheart		3%			
Saugus	Pecham Pond Beach	4851	Sampling Point	6%	1%	1%	18%	26%
Savoy	North Pond Beach	4852	Sampling Point	0%	0%	2%	2%	

DCR Beach Closure Statistics - 2008-2012				Sampling year (Season length in days)				
Town	Beach Name	BeachId	SampleLocationId	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Savoy	South Pond Beach	4853	Sampling Point	0%	0%	0%	2%	4%
Shutesbury	Lake Wyola Beach	5168	Sampling Point	2%	0%	0%	2%	0%
Springfield	Lake Lorraine Beach	5169	Sampling Point	33%	NS	NS	NS	NS
Spencer	Howe Pond Beach	4869	Sampling Point	NS	NS	NS	NS	NS
Sturbridge	Walker Pond Beach	5186	Sampling Point	9%	0%	2%	2%	2%
Sturbridge	East Brimfield Reservoir Streeter Point Beach	5185	Sampling Point	11%	NS	2%	0%	2%
Taunton	Middle Pond Beach	4906	Sampling Point	1%	NS	NS	NS	NS
Taunton	Watson Pond Beach	4961	Sampling Point	4%	6%	0%	1%	31%
Templeton	Beamans Pond Beach	5170	Sampling Point	10%	0%	0%	5%	0%
Templeton	Beamans Pond Camp Beach	5225	Sampling Point	14%	2%	0%	7%	0%
Townsend	Pearl Hill Beach	4966	Sampling Point	0%	3%	0%	13%	14%
Wayland	Wayland Town Beach	4982	Sampling Point	0%	0%	0%	0%	NS
Wendell	Ruggles Pond Beach	5187	Sampling Point	0%	0%	1%	0%	0%
Westfield	Hampton Ponds Kingsley Beach	5177	Sampling Point	2%	10%	2%	29%	20%
Westfield	Hampton Ponds Lamberts Beach	5178	Sampling Point	2%	2%	2%	0%	2%
Westminster	Crow Hill Pond Beach	5033	Sampling Point	4%	0%	0%	6%	0%
Westport	Horseneck Beach	3203	Sampling Point	0%	1%	3%	0%	0%
Winchendon	Lake Dennison Campers Beach	5182	North Camp	7%	0%	0%	2%	2%
Winchendon	Lake Dennison Day Use Beach		Day Use Area	2%	0%	0%	0%	0%

DCR Beach Closure Statistics – 2008–2012				Sampling year (Season length in days)				
Town	Beach Name	BeachId	SampleLocationId	2008 (98)	2009 (105)	2010 (98)	2011 (98)	2012 (98)
Winchester	Upper Mystic Lake Shannon Beach	5173	West	NS	NS	NS	NS	NS
			Sampling Point	23%	1%	8%	9%	3%
			Middle	NS	NS	NS	NS	NS
Windsor	Westfield River Beach – Windsor	4909	Sampling Point	26%	NS	NS	NS	NS
Winthrop	Winthrop Beach	3217	Sampling Point	0%	4%	0%	2%	0%
Worcester	Lake Quinsigamond Regatta Point Beach	4916	Sampling Point	24%	2%	0%	7%	15%
Worcester	Lake Quinsigamond Lake Park Beach	4915	Sampling Point	32%	0%	10%	5%	4%

* Walden Pond Red Cross Beach only sampled once in 2010

Appendix B: DCR Beach Closure Informational Pamphlet: Why is the beach closed today?

Stormwater Runoff

"Paved surfaces allow rapid runoff of stormwater . . ."

Unlike the porous terrain of forests and wetlands, paved surfaces prevent stormwater from soaking into the ground. Paved surfaces allow rapid runoff of stormwater, which can carry bacteria and other pollutants directly to waterbodies.

Agriculture can also be a source of bacteria if manure is exposed or if livestock drink and graze near waterbodies.

Do...

- Promote "buffer zones" of natural vegetation between waterbodies and areas of stormwater runoff such as lawns, parking lots, roads and livestock areas.
- Provide livestock with a water source far away from waterbodies.

Don't...

- Don't expose manure piles to rainfall and snowmelt.

Contact Information

For more information on beach closures or how you can help keep our lakes and ponds clean, please contact the Massachusetts Department of Conservation and Recreation at:

Department of Conservation and Recreation
Lakes & Ponds Program
251 Causeway Street, Suite 800
Boston, MA 02114-2104
(617) 626-1411
www.mass.gov/lakesandponds

department of Conservation and Recreation | dcr

The Department of Conservation and Recreation is an affirmative action, equal opportunity employer. In compliance with the Americans with Disabilities Act (ADA), this information is available in other formats upon request.

Commonwealth of Massachusetts
Mitt Romney, Governor
Kerry Healy, Lt. Governor

Executive Office of Environmental Affairs
Ellen Roy Herzfelder, Secretary

Department of Conservation and Recreation
Stephen R. Pritchard, Acting Commissioner

This brochure was developed by GeoSyntec Consultants

GeoSyntec Consultants 280 Great Road, Suite 105 Acton, MA 01720 Ph: (978) 263-9588

Why is the Beach Closed Today?

Understanding Pathogens in Our Swimming Beaches

department of Conservation and Recreation | dcr

What are Pathogens?

E.coli bacteria

Pathogens are disease causing microorganisms, including viruses, parasites and bacteria found in the feces of warm-blooded animals such as humans, pets, livestock, and wildlife. At unsafe levels, these pathogens can be transmitted from water to humans, causing diarrhea, abdominal pain, vomiting, fever and other symptoms.

In MA, public beaches are required by law to test weekly for either *E.coli* or *Enterococci* bacteria. These indicator bacteria, found in the intestines of warm-blooded animals, can indicate the presence of harmful pathogens. When elevated levels of these indicator bacteria are detected, the beach is closed and can only re-open if follow-up tests pass.

This brochure describes common sources of pathogens that contribute to beach closures and suggests steps that homeowners and park users can take to help keep our beaches clean and open.

For more information, contact your local Board of Health or the Massachusetts Department of Public Health (www.mass.gov/dph, 617-624-6000).

Common Sources of Pathogens

Pets

Pet waste contains bacteria and nutrients that degrade water quality and can make it unsafe to swim boat, and fish. When exposed to rainfall and snowmelt, pet waste can be washed into our lakes and ponds.

Do...

- Pick up after your pet! Dispose of pet waste in the trash or bury in a 5-inch trench far away from waterbodies.
- Use biodegradable doggie bags to collect pet waste.

Don't...

- Don't leave pet waste on the street, sidewalk, lawn or beach.
- Don't dispose of pet waste by placing in a storm drain.

Humans

Some common ways that human waste can enter waterbodies include:

- Poorly maintained and failing septic systems, which can leak nutrients and bacteria to groundwater and surface waters.
- Illegal wastewater connections to stormdrains that empty into waterbodies, and
- Leaky diapers in the water at swimming beaches

Do...

- Inspect your septic system annually and pump it out at least every two to three years.
- Put a fresh diaper and rubber panties on your infant before entering the water.

Don't...

- Let your infant enter the water with a soiled diaper.

Wildlife

"Feeding waterfowl discourages natural winter migration, can lead to aggressive behavior..."

Like pet waste, waste from wildlife such as waterfowl, beaver and deer contribute bacteria to our lakes and ponds. Geese and ducks tend to concentrate in areas where humans feed them and can become a major source of bacteria.

Do...

- Enjoy wildlife viewing responsibly by allowing wildlife to maintain a healthy, natural diet...keep wildlife wild!

Don't...

- Don't feed waterfowl, including ducks, geese and swans.
  - Bread and snack food is harmful to waterfowl. These foods lack the roughage and nutrients of a natural diet and can lead to malnutrition.
  - Feeding waterfowl discourages natural winter migration, can lead to aggressive behavior, and encourages large resident bird flocks that degrade our parks and beaches with droppings.

Appendix C: DCR Informational Pamphlet: Bacteria Control Guide for Swimming Operations, 2007

MA-DCR

Bacteria Control Guide

for Swimming Operations

department of
Conservation and Recreation
dcr

DCR Lakes and Ponds Program
(617) 626-1411

department of
Conservation and Recreation
dcr

Introduction

This guidebook is intended for DCR staff managing properties with lakes, ponds and swimming beaches. This guidebook describes common sources of bacteria that contribute to beach closures and suggests steps that DCR park staff can take to help keep our beaches clean and open.

For more information on beach closures or for technical support related to addressing the sources of bacterial contamination discussed in this guidebook, please contact the DCR Lakes and Ponds Program staff at:

DCR Lakes and Ponds Program
(617) 626-1411

TABLE OF CONTENTS

Potential Sources of Harmful Bacteria at Our Beaches

The Problem

Bacteria are disease causing microorganisms found in the feces of warm-blooded animals such as humans, pets, livestock, and wildlife. Public beaches are required to test weekly for bacteria to ensure that the levels are safe for swimming. When elevated levels of bacteria are detected, the beach is immediately closed until safe levels return. At unsafe levels, these bacteria can be transmitted to humans, causing diarrhea, abdominal pain, vomiting, fever and other symptoms

Pets

Pet waste contains bacteria and nutrients that degrade water quality and can make it unsafe to swim. When exposed to rainfall and snowmelt, pet waste can be washed into our lakes and ponds.

Wildlife

As with pet waste, waterfowl, beaver and deer can contribute bacteria to our lakes and ponds. Geese and ducks tend to gather in areas where humans feed them and can become a major source of bacteria.

Humans

Bacteria from human waste can enter waterbodies from several sources, including failing septic systems, illegal wastewater connections to stormdrains, and leaky diapers in the water at swimming beaches.

Stormwater runoff

Unlike the porous terrain of forests and wetlands, paved surfaces prevent stormwater from soaking into the ground. Paved surfaces allow rapid runoff of stormwater, which can carry bacteria and other pollutants directly to waterbodies. Agriculture can be a source of bacteria if manure is exposed to rainfall or if livestock drink and graze near waterbodies.

Keeping Our Beaches Clean and Safe... A Guide for DCR Facility Staff

In order to keep our beaches open and our visitors safe and happy, the steps discussed in the following sections should be implemented.

Beach Maintenance

Daily beach maintenance, including cleanup of waterfowl droppings, is a critical part of any long-term strategy to minimize beach closures due to bacterial contamination.

- Pick up and dispose of waterfowl droppings daily, prior to beach sand raking.
- Cleanup activities are particularly critical prior to rain events to minimize contaminated runoff.
- Cleanup activities should focus on the beach and any other adjacent areas frequented by waterfowl within a minimum of 25 feet from the shoreline.
- Beach raking with mechanical equipment (e.g. tractor with a York Rake attachment) should never be carried out without first picking up waterfowl droppings. If not removed prior to raking, waterfowl droppings become mixed with beach sand and remain a potential source of bacterial loading to the water as well as an aesthetic problem for visitors.

Landscaping/Physical Barriers

Grassy areas adjacent to water are attractive to geese as areas for grazing. As described below, grassy areas within and adjacent to public beaches can easily be modified to make the site less attractive to geese:

- Plant trees and shrubs to create a visual and physical barrier between open water and grassy feeding areas. Native vegetation can also be used to obscure escape routes from predators, making the area feel less safe and less appealing to geese.

Daily Beach Maintenance Checklist

- Assign staff responsible for daily beach cleanup.
- Check weather forecast to ensure that beach cleanup is conducted prior to rain.
- Remove and dispose of all waterfowl droppings on the beach and other areas frequented by waterfowl within 25 feet from the shoreline. Conduct this cleanup prior to beach raking.
- Waterfowl droppings should be properly disposed of or buried in an area that is at least 100 feet away from the pond.
- Make sure all Mutt-Mitt dispensers are fully stocked.
- Clean up any garbage or food that may attract wildlife in beach and adjacent picnic areas

Vegetated Goose Buffers:

Geese prefer grazing in grassy areas that offer unobstructed access from the water. The "goose buffer" shown above was installed at Lake Wyola State Park in 2006. As the shrubs mature, they will provide a visual and physical barrier between the lake and the grassy areas of the state park beach.

Native shrub species planted in the buffer included Silky Dogwood, Red Osier Dogwood, Bayberry, Pussy Willow, Meadowsweet, Wild Raisin, and Northern Arrowood. These shrubs will filter stormwater draining towards the lake, while also providing food and habitat for local wildlife.

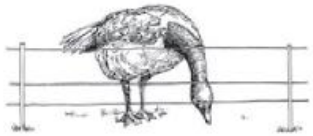
- **Allow grass to grow taller**. Geese do not like to walk through tall grass.
- Reduce grassy areas by planting **ground cover** (e.g., pachysandra) or convert a lawn to a **wild flower** meadow. Geese do not like to eat or walk through such plantings.
- **Remove grass** that has encroached on the beach area and re-surface with three inches of screened, washed beach sand. Where possible, a 20- to 25-foot minimum width for beach sand is recommended.

At Mauserts Pond (Clarksburg State Park), grass encroaching on the beach area was tilled and re-surfaced with three inches of beach sand.

Feeding Deterrents

- Several products are available to deter waterfowl from feeding on grassy areas. ReJex-iT is a non-toxic grape juice derivative that makes grass unpalatable to geese. Grassy areas can be treated with a spray applicator. Repeat applications are required after rain.

- **Fences and other Physical Barriers** can be effective tools to restrict goose movement. In most situations, Canada geese tend to walk, not fly, to and from water to feed. A low fence or other barrier to prevent access may discourage geese from accessing a beach/day-use area.
- **Temporary fencing** can be installed around a beach area (e.g. prior to the summer beach season or after hours) to discourage bird access to adjacent grassy areas for grazing. Sectional "string" fencing systems are designed to discourage waterfowl. These systems use narrow posts and retractable strings, creating minimal visual disruption while discouraging the passage of geese. If needed, this type of fencing could be kept in place from early spring through the end of the summer beach season and used to fence an entire day use area.



String fencing can be an effective deterrent, particularly when geese have flightless goslings or during the molting season.

"Sectional "string" fencing systems are designed to discourage waterfowl."

Scaring Techniques

- **Visual and audio deterrents** are used to make geese feel unsafe at a site, usually through the use of decoys or sounds that mimic the presence of a predator. Although these types of deterrents can be effective, results tend to diminish quickly as geese become accustomed to their presence.

  Visual and audio deterrents work best in combinations with each other and with other deterrents. Visual deterrents include predator decoys (e.g. fox, coyote), kites, Mylar tapes, and balloons. Audio deterrents (e.g. recorded distress calls, predator calls, explosive noises, and propane cannons) are generally not appropriate for a park setting.

Geese become accustomed to predator decoys unless moved frequently.

- **Trained border collies** can be used during the spring to discourage nesting and summer to disrupt the regular feeding patterns of local flocks. Although effective, this technique is expensive and is not likely to be feasible in most parks as an ongoing management strategy.

Waste Prevention: Signage/Mutt-Mitts

Signage and Mutt-Mitt stations should be posted at the beach/day-use areas to (1) discourage park visitors from feeding waterfowl and (2) encourage park visitors to pick up after their pet. The signs and Mutt-Mitt dispensers shown below are available from the MA-DCR Lakes and Ponds Program. Contact DCR staff at (617) 626-1353 for information on obtaining signs and dispensers.

Mutt-Mitt dispensers provide bio-degradable pick-up mitts that park visitors can use to clean up after their dog.

Depredation Permits

In extreme cases where waterfowl droppings pose a persistent threat to public health and safety, a depredation permit may be sought to reduce a goose population by egg addling or shooting outside of the permitted hunting season. The DCR Lakes and Ponds Program has been issued a depredation permit by the U.S. Fish and Wildlife Service for use on DCR properties. For more information regarding use of a depradation permits, contact the DCR Lakes and Ponds Program at (617) 626-1411.

"In extreme cases where waterfowl droppings pose a persistent threat to public health and safety, a depredation permit may be sought…"

Other Beach Management Concerns

In addition to the sources of bacteria that are discussed in this guide, DCR park staff also should report any unusual conditions that may impact water quality to the DCR Lakes and Ponds Program, including the following:

Non-Native Invasive Aquatic Plants

Non-native aquatic plants such as Eurasian milfoil, Fanwort and Water Chestnut can rapidly infest and degrade a waterbody. Report any new or unusual plant sightings to the DCR Lakes and Ponds Program. Contact the Lakes and Ponds Program for staff training and field guides on invasive plant identification. Information is also available at: http://www.mass.gov/dcr/waterSupply/lakepond/invasive_1.htm

Nuisance Algae Blooms

Nuisance algae blooms can reduce water clarity to below the state swimming beach standard of four feet. Blue-green algae blooms can, in some cases, produce toxins that make it unsafe to swim.

Sediment Plumes

Sediment plumes entering a waterbody from a tributary may indicate runoff from land disturbance activities (e.g. construction) that could require stabilization and regulatory action.

Fish Kills

Natural fish kills can occur due to low oxygen levels, most frequently around ice-out time and during long stretches of high temperatures in the summer. Fish kills should be reported to the MA-Division of Fisheries and Wildlife at (508) 389-6300 on Monday through Friday between 8:00 AM and 4:30 PM. After normal business hours or on holidays and weekends, contact the Environmental Law Enforcement's Radio Room at 1-800-632-8075.

Appendix D: Pet Waste Guidelines for Pet Owners

• Pet Waste is Natural

However, efficient drainage systems and roads now make it easy for pet waste to reach beach waters.

Waste left on the ground either passes through storm sewers untreated or washes directly into oceans, lakes, and streams.

Pet waste is unpleasant and can pose health risks when left on beaches or in other recreational areas

To make sure your pet isn't contributing to the problem, always clean up after your pet and deposit waste in an appropriate manner.

Quick Tips

Reuse old bags: grocery, sandwich, newspaper, produce and bread bags to pick up and contain pet waste.

Keep a supply of bags near your dog's leash.

Tie bags onto the leash if you don't have a pocket or pack.

Do More to Protect the Shore

- Always carry a plastic bag to pick up your pet's waste.
- Do not throw pet waste near a storm drain; use a trash can. Pet waste can also be flushed down a toilet, but please don't flush the bag.
- Make sure to dispose of pet waste in a sealed bag so it doesn't spill during trash collection.
- Do not flush pet or wildlife waste from your deck or dock into the water.
- Obey local leash laws and seasonal bans at beaches.

For More Information

Bureau of Environmental Health
MA Department of Public Health
250 Washington Street, 7th fl
Boston, MA 02108

MA Bathing Beaches Project Website:
www.mass.gov/dph/beaches

Phone: 617-624-5757
Fax: 617-624-5777
TTY: 617-624-5286

Revised July 2007

Pet Waste and Bathing Beaches

Guidelines for Pet Owners

This brochure will educate pet owners on environmentally sound waste disposal practices to protect the recreational waters of Massachusetts.

Bureau of Environmental Health
Massachusetts Department of Public Health

Health Risks Possibly Associated with Pet Waste

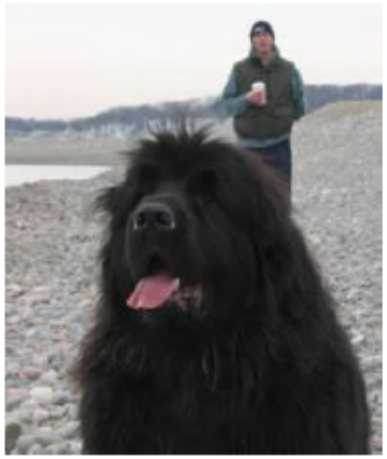
Pet waste can contain bacteria and parasites, causing infections such as the following:

Campylobacteriosis: A bacterial infection that causes diarrhea in humans.

Giardiasis: A protozoan infection of the small intestine that can cause diarrhea, cramping, fatigue, and weight loss.

Salmonellosis: Symptoms include fever, muscle aches, headache, vomiting, and diarrhea.

Toxocariasis: An animal to human infection that is caused by roundworms found in the intestines of dogs. The parasite can cause vision loss, rash, fever or cough, and is a particular threat to children exposed to parasite eggs in sand and soil.



Why is Pest Waste A Concern?

There are a lot of pets, producing a lot of waste, and while pet waste is not the most significant pollutant, it can contribute to pollution over time.

Why pick up after my dog, won't the tide wash it away?

Dog waste may pose a health threat to swimmers, wildlife, surfers and other dogs. It can pollute the water and lead to beach closures and closure of shellfish beds.

I only have a small dog; it can't really harm the water, can it?

It can be hard to picture how a single dog depositing a small amount of waste can result in water pollution. However, studies have shown that the combined impact of all pets and wildlife within a watershed can be significant when it comes to water quality and human health.

Be Aware

- When animal waste ends up in the water it decomposes, using up oxygen. During summer months, low dissolved oxygen levels harm fish and other aquatic life.
- Beaches and shellfish beds may be closed, if evidence that disease-causing bacteria and viruses might be present is found on routine water testing. Pet waste can be a cause of test results that close beaches and shellfish beds.
- The majority of water pollution comes from small sources – especially at the household level.

Many towns have "pooper scooper" ordinances that require pet owners to pick up and remove fecal matter from public property. Fines can be imposed on those caught violating these laws.

Appendix E: Department of Conservation and Recreation's Rain Related Precautionary Closure Information for Boston Area Beaches

A summary of the rainfall (in inches) induced precautionary (red flag) postings at the Boston area beaches between 2005 -2012 are provided in Table 6.

The written rain related precautionary posting policy of the Massachusetts Department of Conservation and Recreation for the 2013 swimming season at their Boston area beaches follows.

According to Briere (2013), the first written precautionary rainfall posting policy for the MA DCR's Boston area beaches was developed for the 2006 swimming season. MA DCR staff made adjustments over the years based on data analysis provided by MWRA, insights from DPH, Save the Harbor and others. Significant shifts occurred in 2010 through some strong data analysis and again in 2011 with the opening of the MWRA stormwater tunnel project. Since too limited data (primarily weekly) were available to make very good projections for Savin Hill and Malibu beaches, the precautionary rainfall posting thresholds were removed in 2010.

Table 6. Summary of MA DCR's rain-related precautionary postings (in inches of rain) for Boston Area marine beaches 2005 -2012.

DCR Beaches with Precautionary Rainfall Posting Policies	2005	2006	2007	2008	2009	2010	2011	2012
Kings Beach	NA[1]	NA	NA	NA	NA	NA	NA	NA
Constitution Beach	NA	0.5	0.5	0.5	0.5	1	1	1
Carson Beach	NA	0.5	0.5	0.5	0.5	0.5	2	2
City Point Beach	NA	0.5	0.5	0.5	0.5	1	2	2
Pleasure Bay Beach	NA					2	2	2
M Street Beach	NA	0.5	0.5	0.5	0.5	0.5	2	2
Tenean Beach	NA	0.2	0.2	0.2	0.2	0.25	0.25	0.25
Wollaston/Channing	NA	0.2	0.2	0.2	0.2	0.25	0.25	0.25
Wollaston/Sachem	NA	0.2	0.2	0.2	0.2	0.25	0.25	0.25
Wollaston/Milton	NA	0.2	0.2	0.2	0.2	0.5	0.5	0.5
Wollaston/Rice Street	NA	0.2	0.2	0.2	0.2	0.5	0.5	0.5
Malibu Beach	NA	0.5	0.5	0.5	0.5	NA	NA	NA
Savin Hill Beach	NA	0.5	0.5	0.5	0.5	NA	NA	NA
Spectacle Beach	NA	NA	NA	NA	NA	NA	NA	NA
Lovells Island Beach	NA	NA	NA	NA	NA	NA	NA	NA

[1] NA= Not Applicable

Reference

Briere, G. (Gary.Briere@state.ma.us). 2013. *RE: Precautionary Rainfall postings -- a little more info would be good*. Email to Laurie Kennedy, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 19 July 2013.

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF CONSERVATION AND RECREATION

PROCEDURE DIRECTIVE **DATE: 6/14/2013**

SUBJECT: **Rain-Related Precautionary Closure of Boston Area Beaches**

SECTION INDEX: I. GENERAL POLICY
II. PROCEDURE
A. Harbor Beaches in Program
B. Rainfall Monitoring Sites
C. Standards for Precautionary Posting
D. Notification of Precautionary Posting
E. Follow up Enterococci Testing
F. Documentation of Precautionary Posting

I. General Policy

It is the policy of the Department of Conservation and Recreation (DCR) to provide the highest quality swimming waters possible. Whereas rainfall has a proven impact on swimming water quality, particularly in the Boston Harbor area, the agency shall conduct a program of rainfall monitoring in partnership with the Massachusetts Water Resources Authority (MWRA), the Boston Water and Sewer Commission (BWSC) and other interested parties to access timely rainfall data to inform agency decisions regarding posting water quality warnings on Boston Harbor Beaches.

II. Procedures:

A. Harbor Beaches in Rainfall Monitoring Program

The following beaches and/or sections of beaches shall be included in the Rainfall Monitoring Program.

Kings Beach@ Eastern Ave., Lynn
Kings Beach@ Pierce St, Lynn
Kings Beach @ Kimball Rd, Lynn
Constitution Beach @ North Site, East Boston
Constitution Beach @ Middle, East Boston
Constitution Beach @ Rec. Center, East Boston
City Point Beach @ Farragut Road, Dorchester
Pleasure Bay @ Broadway, Dorchester
M Street Beach @ M Street, Dorchester

Carson Beach @ I Street, Dorchester
Carson Beach @ Bathhouse, Dorchester
Tenean Beach @ Middle Site, Dorchester
Wollaston Beach @ Milton Road, Quincy
Wollaston Beach @ Channing Street, Quincy
Wollaston Beach @ Sachem Street, Quincy
Wollaston Beach @ Rice Road, Quincy

B. Rainfall Monitoring Sites

The Department shall collect rain data from gauges as close to the impacted beach as possible. Preferred gauge locations for each beach are as follows.

Beach	Rain Gauge	Owner	Distance
Constitution Beach	Charlestown,	BWSC	1.5 Miles
Pleasure Bay& South Boston Beaches	Union Park	BWSC	1 Mile
Tenean Beach	690 Adams St Dorchester	BWSC	.75 Miles
Wollaston Beach	690 Adams St Dorchester	BWSC	2 Miles

C. Standards for Precautionary Posting

Rainfall can have varying degrees of impact on swimming beach waters depending on storm intensity, stormwater infrastructure and its available capacity, watershed characteristics, tides and other factors. While recognizing this complexity, DCR believes the rainfall standards below would be consistently likely to contribute to unhealthy swimming water conditions. Wollaston Beach will be flagged depending on the results of the tests at each testing location. If three of the four beaches have a positive test, all four beaches will be posted with a Red Flag.

Beach	Rain Event	Action
Kings Beach	Discharge of Lynn CSO # 006	Red Flag Precautionary Closure
Constitution Beach	=> **1.0** inches	Red Flag Precautionary Closure
Carson Beach	=> **2.0** inches	Red Flag Precautionary Closure
City Point Beach	=> **2.0** inches	Red Flag Precautionary Closure
Pleasure Bay	=> **2.0** inches	Red Flag Precautionary Closure
M St. Beach	=> **2.0** inches	Red Flag Precautionary Closure
Tenean Beach	=> **.25** inches	Red Flag Precautionary Closure
Wollaston/Channing	=> **.25** inches	Red Flag Precautionary Closure
Wollaston/Sachem	=> **.25** inches	Red Flag Precautionary Closure
Wollaston/Milton St	=> **.5** inches	Red Flag Precautionary Closure
Wollaston/Rice St.	=> **.5** inches	Red Flag Precautionary Closure

D. Notification of Precautionary Posting

Precautionary closures due to rainfall shall be communicated to beach facilities through normal communications channels as established for water quality notifications. Notification to post shall be made within two hours of day time rain events or by 9:00AM for overnight rains. Red beach quality flags and signage stating

Warning:
No Swimming
Swimming May Cause Illness
Water Contains Elevated Bacteria

MDPH requires that signage must be appropriately displayed in conspicuous locations. Flags alone are not satisfactory.

E. Follow up Enterococci Testing

DCR shall collect a water sample as soon as practical to verify the presence of bacteria at the location.

F. Documentation of Precautionary Posting

DCR shall document the date and time of the precautionary posting, the amount of rain and rain gauge location and the results of the follow up enterococci analysis.