



2013 Beaches Report Card Data Summary: Water Quality and Flagging Accuracy

Save the Harbor / Save the Bay's annual **Boston Harbor Region Beach Water Quality Report Card** is based on an in-depth analysis of thousands of samples taken by the DCR and the Massachusetts Water Resources Authority (MWRA) in 2012. The samples were collected at 34 testing sites on public beaches in 9 communities including Nahant, Lynn, Revere, Winthrop, East Boston, South Boston, Dorchester, Quincy and Hull. The report card is based on methodology developed by the Save the Harbor/Save the Bay's Beaches Science Advisory Committee (BSAC), Co-Chaired by Dr. Judy Pederson of MIT's Sea Grant Program and Dr. Jim Shine of the Harvard School of Public Health.

Water Quality

Save the Harbor / Save the Bay uses quantitative metrics for assessing beach water quality and management at the Boston Harbor region beaches. Enterococcus is the current microbial indicator of GI illness used in marine waters, as established by the EPA. To assess and compare the water quality and conditions on each beach, we looked at the percentage of test samples exceeding the state swimming standard of 104 colony forming units (cfu) of Enterococcus/100 ml of water. This metric is called "Beach Safety," and is a metric that is independent of the flagging program.

Another indicator of water quality is the geometric mean (GM). The GM indicates the central tendency of a set of numbers from the product of their values. For our analysis, we calculated the GM based on bacterial exceedance values from the previous five days without rain. A GM of 35 cfu/100ml or greater is considered statistically significant in water quality analysis, and is included with bacterial exceedances when determining Overall Beach Safety.

The total number of samples collected varies across these beaches, as some are sampled weekly and others are sampled daily throughout the swimming season. Also, beaches vary in the number of sampling locations; some have only one location whereas others have as many as four.

Beach Flagging and Management

The metrics for assessing Beach Management with the Flagging Program include Sensitivity, Positive Predictive Efficiency, Specificity, Negative Predictive Efficiency, and Overall Predictive Efficiency.

- **Sensitivity** tells us when the beach is not safe for swimming, what fraction of the time the beach is correctly labeled with a red flag. This is expressed as, “When this beach is not safe for swimming, it is correctly labeled with a red flag x% of the time.” 100% yields a perfect Sensitivity score.
- **Positive Predictive Efficiency** measures what fraction of the time a posted red flag is correct.
- **Specificity** tells us when the beach is safe for swimming, what fraction of the time the beach is correctly labeled with a blue flag. This is expressed as, “When this beach is safe for swimming, it is correctly labeled with a blue flag x% of the time.” 100% yields a perfect Specificity score.
- **Negative Predictive Efficiency** measures what fraction of the time a posted blue flag is correct.
- **Overall Predictive Efficiency** measures what fraction of the time the flags are in general correct. This metric can be expressed as, “The flags correctly indicate that the beach is safe or unsafe for swimming x% of the time.”

Beach Flagging and Management metrics are only available for beaches that are tested on a daily basis.

Overall Beach Safety

Beach	Overall Beach Safety (2012)	Overall Beach Safety (2011)	Test Frequency	# of sampling locations
Revere Beach	100.00%	87.50%	weekly	4
Winthrop	100.00%	84.60%	weekly	1
Short	100.00%	83.30%	weekly	1
South Boston*	99.12%	98.17%	daily	4
Nantasket	98.33%	100.00%	weekly	4
Pleasure Bay**	93.86%	94.50%	daily	3
Wollaston***	93.20%	88.73%	daily	4
Nahant	89.29%	88.50%	weekly	4
Malibu	88.89%	91.70%	weekly	1
Constitution	88.60%	93.20%	daily	3
Savin Hill	88.24%	91.70%	weekly	1
King's****	86.40%	73.20%	daily	3
Tenean	81.82%	79.50%	daily	1

*South Boston includes M Street Beach, City Point, and Carson Beach.

**Pleasure Bay increased sampling locations from 1 to 3 sites in 2012 for better understanding of water quality.

***Wollaston Beach includes the Milton St, Channing St, Sachus St, and Rice Road sampling locations.

****King's Beach changed one of its sampling sites in 2012 to more accurately reflect water quality.

Testing frequency also increased from weekly to daily in 2012.

Individual Beach Summaries

Nahant

Nahant Beach is located in Nahant, MA and has four sampling locations that are tested weekly for bacterial counts. In 2012, Nahant received an Overall Beach Safety score of 89.29%, which was higher than the previous year's score of 88.50%. There were 3 bacterial exceedances and 3 GM exceedances in the 56 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	56
Bacterial Exceedances	3
Test Frequency	weekly
Overall Beach Safety	89.29%

Nahant posts a red flag when there is a bacterial exceedance at 2 or more of its sampling locations. In 2012, Nahant had one red flag posting. As previously stated, the metrics on flagging accuracy cannot be computed for beaches with weekly testing.

King's Beach

King's Beach is located in on the Lynn and Swampscott line. It has three sampling locations that were tested daily in 2012, an increase in testing frequency from 2011, when it was tested weekly.

In 2012, King's received an Overall Beach Safety score of 86.40%. This was higher than the previous year's score of 73.20%. There were a total of 31 bacterial exceedances in the 228 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	228
Bacterial Exceedances	31
Test Frequency	daily
Overall Beach Safety	86.40%

King's Beach posts a red flag when there is a bacterial exceedance at 1 or more of its sampling locations, or when the geomean is above 35. In 2012, King's had 10 red flag postings.

King's Beach Management Metrics	
Sensitivity	30.30%
Positive Predictive Efficiency	100.00%
Specificity	100.00%
Negative Predictive Efficiency	65.15%
Overall Predictive Efficiency	69.74%

Revere

Revere Beach is located in Revere, MA and has four sampling locations that were tested weekly for bacterial counts in 2012. In 2012, Revere Beach received an Overall Beach Safety rating of 100% as it did not produce any bacterial exceedances on the days sampled. This was higher than the previous year, when Revere received a score of 87.50%.

Beach Safety 2012	
Total # Samples	56
Bacterial Exceedances	0
Test Frequency	weekly
Overall Beach Safety	100.00%

Revere posts a red flag when there is a bacterial exceedance at two or more of its sampling locations on the previous day. In 2012, there were no red flags posted on Revere Beach. Since Revere Beach is tested on a weekly basis, beach management metrics are not computed.

Short Beach

Short Beach is located in Revere, MA and has one sampling location that was tested weekly for bacterial counts in 2012. In 2012, Short Beach received an Overall Beach Safety score of 100% as it did not produce any bacterial exceedances on the days sampled. That score was higher than the previous year's score of 83.30%.

Beach Safety 2012	
Total # Samples	15
Bacterial Exceedances	0
Test Frequency	weekly
Overall Beach Safety	100.00%

Short Beach posts a red flag when there is a bacterial exceedance greater than 104 cfu. In 2012, there were no red flags posted on Short Beach. Since Short Beach is tested on a weekly basis, beach management metrics are not computed.

Winthrop

Winthrop Beach is located in Winthrop, MA and has one sampling location that was tested weekly for bacterial counts in 2012. In 2012 Winthrop received an Overall Beach Safety score of 100% as it did not produce any bacterial exceedances on the days sampled. That score was higher than the previous year's score of 84.60%.

Beach Safety 2012	
Total # Samples	15
Bacterial Exceedances	0
Test Frequency	weekly
Overall Beach Safety	100.00%

Winthrop Beach posts a red flag when there is a bacterial exceedance greater than 104 cfu. In 2012, there were no red flags posted on Winthrop Beach. Since Winthrop Beach is tested on a weekly basis, beach management metrics are not computed.

Constitution Beach

Constitution Beach is located in East Boston and has three sampling locations that were tested daily for bacterial counts in 2012. In 2012, Constitution received an Overall Beach Safety score of 88.60%, which was lower than the previous year's score of 93.20%. There were a total of 19 bacterial exceedances and 7 GM exceedances in the 228 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	228
Bacterial Exceedances	19
Test Frequency	daily
Overall Beach Safety	88.60%

Constitution posts a red flag when there is a bacterial exceedance at two or more of its sampling locations. In 2012, there were 8 red flags posted on Constitution Beach.

Constitution Management Metrics	
Sensitivity	100.00%
Positive Predictive Efficiency	62.50%
Specificity	95.77%
Negative Predictive Efficiency	100.00%
Overall Predictive Efficiency	96.05%

Pleasure Bay

Pleasure Bay is located in South Boston and has three sampling locations that were tested daily for bacterial counts in 2012. In 2012 Pleasure Bay received an Overall Beach Safety score of 93.86%, lower than the previous year's score of 94.50%. There were 10 bacterial exceedances and 4 GM exceedances in the 228 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	228
Bacterial Exceedances	10
Test Frequency	daily
Overall Beach Safety	93.86%

Pleasure Bay posts a red flag when there is a bacterial exceedance at one or more of its sampling locations. In 2012, there was one red flag posting on Pleasure Bay Beach.

Pleasure Bay Management Metrics	
Sensitivity	10.00%
Positive Predictive Efficiency	100.00%
Specificity	100.00%
Negative Predictive Efficiency	88.00%
Overall Predictive Efficiency	88.16%

M Street

M Street beach is located in South Boston and has one sampling location that was tested daily for bacterial counts in 2012. In 2012, M Street received an Overall Beach Safety score of 98.68%, which was higher than the previous year's score of 98.60%. There was a total of 1 bacterial exceedance in the 76 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	76
Bacterial Exceedances	1
Test Frequency	daily
Overall Beach Safety	98.68%

M Street Beach posts a red flag when there is a bacterial exceedance greater than 104 cfu. In 2012, there were no red flags posted on M Street Beach.

M Street Management Metrics	
Sensitivity	0.00%
Positive Predictive Efficiency	n/a
Specificity	100.00%
Negative Predictive Efficiency	98.68%
Overall Predictive Efficiency	98.68%

Carson Beach

Carson Beach is located in South Boston and has two sampling locations that were tested daily for bacterial exceedances in 2012. In 2012, Carson received an Overall Beach Safety score of 98.68%, which was higher than the previous year's score of

97.30%. There were a total of 2 bacterial exceedances in the 151 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	151
Bacterial Exceedances	2
Test Frequency	daily
Overall Beach Safety	98.68%

Carson posts a red flag when there is a bacterial exceedance at one or more of its sampling locations. In 2012, there was one red flag posting on Carson Beach.

Carson Beach Management Metrics	
Sensitivity	50.00%
Positive Predictive Efficiency	100.00%
Specificity	100.00%
Negative Predictive Efficiency	98.67%
Overall Predictive Efficiency	98.67%

City Point

City Point is located in South Boston and has one sampling location that was tested daily for bacterial exceedances in 2012. In 2012, City Point received an Overall Beach Safety score of 100% as did not produce any bacterial exceedances on the days sampled. This was higher than the previous year's score of 98.60%.

Beach Safety 2012	
Total # Samples	75
Bacterial Exceedances	0
Test Frequency	daily
Overall Beach Safety	100.00%

City Point posts a red flag when there is a bacterial exceedance greater than 104 cfu. In 2012, there were no red flag postings on City Point Beach.

City Point Management Metrics	
Sensitivity	n/a
Positive Predictive Efficiency	n/a
Specificity	100.00%
Negative Predictive Efficiency	100.00%
Overall Predictive Efficiency	100.00%

Malibu Beach

Malibu Beach is located in Dorchester and has one sampling location that was tested weekly for bacterial exceedances in 2012. In 2012, Malibu received an Overall Beach Safety score of 88.89%, which was lower than the previous year's score of 91.70%. There were a total of 2 bacterial exceedances in the 18 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	18
Bacterial Exceedances	2
Test Frequency	weekly
Overall Beach Safety	88.89%

Malibu posts a red flag when there is a bacterial exceedance greater than 104 cfu. In 2012, there were 2 red flag postings on Malibu Beach. Since Malibu Beach is tested on a weekly basis, beach management metrics are not computed.

Savin Hill Beach

Savin Hill is located in Dorchester and has one sampling location that was tested weekly for bacterial exceedances in 2012. In 2012, Savin Hill received an Overall Beach Safety score of 88.24%, which was lower than the previous year's score of 91.70%. There were a total of 2 bacterial exceedances in the 17 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	17
Bacterial Exceedances	2
Test Frequency	weekly
Overall Beach Safety	88.24%

Savin Hill posts a red flag when there is a bacterial exceedance greater than 104 cfu. In 2012, there were 2 red flag postings on Savin Hill Beach. Since Savin Hill is tested on a weekly basis, beach management metrics are not computed.

Tenean

Tenean is located in Dorchester and has one sampling location that is tested daily for bacterial exceedances. In 2012 Tenean received an Overall Beach Safety score of 81.82%, which was higher than the previous year's score of 79.50%. There were a total of 5 bacterial exceedances and 9 GM exceedances in the 77 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	77
Bacterial Exceedances	5
Test Frequency	daily
Overall Beach Safety	81.82%

Tenean posts a red flag when there is a bacterial exceedance greater than 104 cfu. In 2012, there were 15 red flag postings on Tenean Beach.

Tenean Beach Management Metrics	
Sensitivity	100.00%
Positive Predictive Efficiency	33.33%
Specificity	86.11%
Negative Predictive Efficiency	100.00%
Overall Predictive Efficiency	87.01%

Wollaston Beach at Milton Road

Milton Rd is one of the four sampling locations on Wollaston Beach in Quincy, MA that was tested daily for bacterial exceedances in 2012. In 2012, Milton received an Overall Beach Safety score of 96.05%, which was higher than the previous year's score of 87.70%. There were a total of 3 bacterial exceedances in the 76 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	76
Bacterial Exceedances	3
Test Frequency	daily
Overall Beach Safety	96.05%

Milton Rd posts a red flag when there is a bacterial exceedance greater than 104 cfu. Wollaston Beach posts a red flag at all four sampling locations when there is a bacterial exceedance at three or more locations. In 2012, there were 2 red flags posted at Milton Rd.

Milton Rd	
Sensitivity	33.33%
Positive Predictive Efficiency	50.00%
Specificity	97.26%
Negative Predictive Efficiency	98.61%
Overall Predictive Efficiency	97.30%

Wollaston Beach at Channing Street

Channing St is one of the four sampling locations on Wollaston Beach that was tested daily for bacterial exceedances in 2012. In 2012, Channing received an Overall Beach Safety score of 87.18%, which was lower than the previous year's score of 87.70%. There were a total of 10 bacterial exceedances in the 78 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	78
Bacterial Exceedances	10
Test Frequency	daily
Overall Beach Safety	87.18%

Channing St posts a red flag when there is a bacterial exceedance greater than 104 cfu. Wollaston Beach posts a red flag at all four sampling locations when there is a bacterial exceedance greater than 104 cfu at three or more locations. In 2012, there were 11 red flags posted at Channing St.

Channing St	
Sensitivity	80.00%
Positive Predictive Efficiency	72.73%
Specificity	95.59%
Negative Predictive Efficiency	97.01%
Overall Predictive Efficiency	93.59%

Wollaston Beach at Sachem Street

Sachem St is one of the four sampling locations on Wollaston Beach that was tested daily for bacterial exceedances in 2012. In 2012, Sachem received an Overall Beach Safety score of 94.81%, which was higher than the previous year's score of 86.30%. There were a total of 4 bacterial exceedances in the 77 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	77
Bacterial Exceedances	4
Test Frequency	daily
Overall Beach Safety	94.81%

Sachem St posts a red flag when there is a bacterial exceedance greater than 104 cfu. Wollaston Beach posts a red flag at all four sampling locations when there is a bacterial exceedance greater than 104 cfu at three or more locations. In 2012, there were 6 red flags posted at Sachem St.

Sachem St	
Sensitivity	75.00%
Positive Predictive Efficiency	50.00%
Specificity	95.89%
Negative Predictive Efficiency	98.59%
Overall Predictive Efficiency	94.81%

Wollaston Beach at Rice Road

Rice Rd is one of the four sampling locations on Wollaston Beach that was tested daily for bacterial exceedances in 2012. In 2012, Rice received an Overall Beach Safety score of 94.74%, which was higher than the previous year's score of 93.20%. There were a total of 4 bacterial exceedances in the 76 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	76
Bacterial Exceedances	4
Test Frequency	daily
Overall Beach Safety	94.74%

Rice Rd posts a red flag when there is a bacterial exceedance greater than 104 cfu. Wollaston Beach posts a red flag at all four sampling locations when there is a bacterial exceedance greater than 104 cfu at three or more locations. In 2012, there were 4 red flags posted at Rice Rd.

Rice Road	
Sensitivity	50.00%
Positive Predictive Efficiency	50.00%
Specificity	97.22%
Negative Predictive Efficiency	97.22%
Overall Predictive Efficiency	94.74%

Nantasket Beach

Nantasket Beach is located in Hull, MA and has four sampling locations that were tested weekly for bacterial exceedances in 2012. In 2012, Nantasket received an Overall Beach Safety score of 98.33%, which was lower than the previous year's score of 100%. There was a total of 1 bacterial exceedance in the 60 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	60
Bacterial Exceedances	1
Test Frequency	weekly
Overall Beach Safety	98.33%

Nantasket posts a red flag when there is a bacterial exceedance at three or more of its sampling locations. In 2012, there were no red flag postings on Nantasket Beach. Since Nantasket Beach is tested on a weekly basis, beach management metrics are not computed.

Aggregated Data for South Boston Beaches

The South Boston beaches at M Street Beach, Carson Beach, and City Point received an aggregated Overall Beach Safety score of 99.12% in 2012, which was slightly higher than the previous year's score of 98.17%.

Beach Safety 2012	
Total # Samples	303
# Exceedances	3
Test Frequency	daily
Overall Beach Safety	99.12%

South Boston posts a red flag at all three beaches when at least one sampling location has a bacterial exceedance greater than 104 cfu. In 2012, there was a total of one red flag posting on all of the South Boston beaches.

South Boston	
Sensitivity	25.00%
Positive Predictive Efficiency	100.00%
Specificity	100.00%
Negative Predictive Efficiency	99.12%
Overall Predictive Efficiency	99.12%

Aggregated Data for Wollaston Beach: All Sampling Locations

In 2012, Wollaston received an Overall Beach Safety Score of 93.20%, which was higher than the previous year's score of 88.73%. There were a total of 21 bacterial exceedances in the 307 total samples taken in 2012.

Beach Safety 2012	
Total # Samples	307
Bacterial Exceedances	21
Test Frequency	daily
Overall Beach Safety	93.20%

Wollaston posts a red flag when there is a bacterial exceedance at three or more of its sampling locations. In 2012, there were 15 red flag postings on Wollaston Beach.

Wollaston Beach	
Sensitivity	100.00%
Positive Predictive Efficiency	6.67%
Specificity	83.72%
Negative Predictive Efficiency	100.00%
Overall Predictive Efficiency	83.91%

Save the Harbor / Save the Bay would like to thank Dr. Jim Shine and Dr. Judy Pederson, Co-Chairs of our Beaches Science Advisory Committee, Dr. Andrea Rex and Kelly Coughlin of the MWRA, DCR's Gary Briere, and SH/SB's Staff Assistant for water quality Jacqueline Sussman for their help with this report.

For more information on Save the Harbor / Save the Bay's **Beaches Report Card**, contact Bruce Berman on his cell at 617-293-6243 or email bruce@bostonharbor.com

You can find the data and learn more about the methodology on which the report card is based at www.savetheharbor.org/beachesreportcard