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## **2016 Beach Water Quality Report Card for the 2015 Swimming Season**

Each year on Memorial Day Weekend Save the Harbor/ Save the Bay's releases an annual **Boston Harbor Region Beach Water Quality Report Card** to help the public and policy makers evaluate water quality on the region's public beaches From Nahant to Nantasket. **Here are the results for 2015.**

**This report** is based on an in-depth analysis of more than 1,000 samples taken by the Department of Conservation and Recreation (DCR) and the Massachusetts Water Resources Authority (MWRA) during the 2015 beach season. The samples were collected at 33 testing sites on 15 public beaches in nine communities including Nahant, Lynn, Revere, Winthrop, East Boston, South Boston, Dorchester, Quincy and Hull.

**Table 1**  
**Primary Beach Safety 2015**

<b>Beach</b>	<b>Primary Beach Safety</b>	<b>Test Frequency</b>	<b># of Sampling Locations</b>
City Point	100.00%	Weekly	1
M Street	100.00%	Weekly	1
Nantasket	100.00%	Weekly	4
Pleasure Bay	100.00%	Weekly	3
Winthrop	100.00%	Weekly	1
Nahant	98.44%	Weekly	4
Carson	97.06%	Weekly	2
Savin Hill	94.12%	Weekly	1
Revere	91.67%	Weekly	3
Constitution	89.26%	Daily	3
Malibu	86.67%	Daily	1
Wollaston	85.56%	Daily	4
Short Beach	84.21%	Weekly	1
King's Beach	75.56%	Daily	3
Tenean	71.43%	Daily	1
All Beaches	92%	N/A	33

In 2015, overall water quality on the Boston Harbor Region's public beaches was 92%, down from 96% in 2014, primarily as a result of contaminated storm water from frequent summer rains. Though total rainfall measured at Boston's Logan

Airport was down from 10.21 inches in 2014 to 8.9 inches in 2015, there were more than 30 days with some rain during the 2015 swimming season.

City Point, M Street, and Pleasure Bay in South Boston and Nantasket Beach and Winthrop Beach topped the list this year, with perfect scores of 100%.

King's Beach in Lynn and Swampscott scored just 75% and Tenean Beach in Dorchester scored just 71%, failing to meet the state swimming standard more than once every 5 days during the 2015 swimming season.

The wet weather had little or no impact on the region's cleanest beaches in South Boston, Revere, Winthrop and Hull. The impact of these frequent summer rains was strongest on King's Beach in Lynn and Swampscott and Tenean Beach in Dorchester, which were closed once every five days in 2015. Other beaches in East Boston, Dorchester, Quincy and elsewhere were also affected.

**While last year's results are instructive, this year Save the Harbor/Save the Bay completed a 5 year review of water quality to help the region's residents and visitors make informed choices about when and where to swim.**

**Table 2  
Comparison of Overall Beach Safety - 2011-2015**

Beach	5 Year Average	2015	2014	2013	2012	2011
City Point	100%	100%	100%	100%	100%	99%
M Street	99%	100%	100%	99%	99%	99%
Nantasket	99%	100%	98%	100%	98%	100%
Carson	98%	97%	100%	99%	99%	97%
Pleasure Bay	97%	100%	100%	96%	94%	95%
Revere	95%	92%	100%	94%	100%	88%
Winthrop	95%	100%	94%	94%	100%	85%
Nahant	93%	98%	100%	91%	89%	89%
Constitution	93%	89%	96%	97%	89%	93%
Short Beach	92%	84%	100%	94%	100%	83%
Savin Hill	92%	94%	87%	100%	88%	92%
Wollaston	90%	86%	94%	88%	93%	89%
Malibu	87%	87%	93%	76%	89%	92%
King's Beach	81%	76%	88%	83%	86%	73%
Tenean	78%	71%	95%	63%	82%	80%
All Beaches	93%	92%	96%	92%	94%	90%

Of the 15 beaches studied, 7 earned primary beach safety scores 95% or higher, while 6 scored between 85% and 95%. King's Beach in Lynn and Swampscott and Tenean Beach in Revere received the lowest scores during the 5 year study period, failing to meet the state swimming standard more than once every 5 days during the swimming season.

In 2014, Save the Harbor asked nearly 1,000 people who took part in public hearings of the Metropolitan Beaches Commission to tell us how many days they expected their beach to be safe for swimming each year.

The overwhelming majority of those who took part in the survey indicated that they expected their beach to be safe for swimming at least 95% of the time. Clearly the situation at King's and Tenean fails to meet this standard, and continues to put the public's health at risk.

### **Metrics and Methodology**

This report card is based on methodology developed by Save the Harbor/ Save the Bay's **Beaches Science Advisory Committee** (BSAC), Co-Chaired by Dr. Judy Pederson of MIT Sea Grant Program and Dr. Jim Shine of the Harvard School of Public Health.

Save the Harbor uses quantitative metrics for assessing beach water quality and beach management on the Boston Harbor region beaches. *Enterococcus* is the current microbial indicator of gastro-intestinal (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 that exceeded the state swimming standard of 104 colony forming units (cfu) of *Enterococcus* per 100 ml of water.

Another useful metric is the geometric mean (GM), which indicates the central tendency of a set of numbers, calculated from the root of the product of their values. Geometric mean is used to calculate averages for datasets that are exponential in nature. For our analysis, we calculated the GM based on bacterial counts from the previous five days without rain. A GM of 35 cfu/100 ml or greater is considered statistically significant in water quality analysis, and is included with bacterial exceedances when determining Overall Beach Safety.

This data is particularly useful on beaches such as King's Beach and Tenean Beach which have persistent pollution problems which do not always exceed the single daily sample standard but may threaten the public's health.

The total number of samples collected varies across these beaches. Some are sampled weekly and others are sampled daily throughout the swimming season. Also, some beaches have as many as four sampling locations that are sampled simultaneously, while others have only one location. Protocols have been

established by DCR in consultation with the MWRA and Save the Harbor’s BSAC to define how often beaches should be sampled and how many locations at each beach must be below the bacteria threshold for the beach to be considered safe for swimming.

### Beach Flagging and Management

The metrics for assessing Beach Management and the Flagging Program include Sensitivity, Positive Predictive Efficiency, Specificity, Negative Predictive Efficiency, and Overall Predictive Efficiency. Beach Flagging and Management metrics are only available for beaches that are tested on a daily basis.

- **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.”

### All Beach Metrics 2015

A summary of metrics, including flag accuracy is presented in table 3. A total of 125 red flags were flown in 2015, compared with 51 in 2014 and 109 in 2013. Of these, 67 were correct for the day they were posted. Rainfall thresholds triggered 21 of the 67 correct flags with 10 of the 21 rainfall triggers being correct.

**Table 3**  
**Summary of 2015 Beach Metrics**

Beach	Test Freq.	Total # of samples	# of Exceedances by site	# of Exceedances by Beach	Primary Beach Safety %	# Red Flags	Positive Predictive Efficiency	Negative Predictive Efficiency	Sensitivity
City Point	Weekly	16	0	0	100.00	0		100	
M Street	Weekly	16	0	0	100.00	0		100	
Nantasket	Weekly	64	0	0	100.00	0		100	
Pleasure Bay	Weekly	48	0	0	100.00	0		100	
Winthrop	Weekly	16	0	0	100.00	0		100	
Nahant	Weekly	64	1	0	98.44	0		100	
Carson	Weekly	34	1	0	97.06	0		100	
Savin Hill	Weekly	17	1	0	94.12	1		100	
Revere	Weekly	72	6	2	91.67	0		100	

Constitution	Daily	270	29	9	89.26	13	38.5	94.9	55.6
Malibu	Daily	90	12	13	86.67	8	25	86.6	15.4
Wollaston	Weekly	360	52	17	85.56	21	38.1	87.1	47.1
Short	Weekly	19	3	3	84.21	2	50	94.1	33.3
King's Beach	Daily	270	66	27	75.56	27	63	84.1	63
Tenean	Daily	91	26	46	71.43	53	69.8	76.9	80.4

1. # of Exceedances represents the number of individual samples that exceeded the 104 cfu threshold.
2. Beach Safety is calculated based on individual samples (total exceedances / total samples).
3. Beach Exceedance uses the beach multi-site protocol to define total beach quality.
4. Flags are posted based on bacterial exceedances or rainfall.
5. Sensitivity can't be calculated for weekly sampled beaches.
6. Wollaston should have posted 11 flags. One was missed due to a flagging error.
7. Savin Hill should have posted 0 flags. One flag was posted due to a misreading of the back-to-back protocol.

### **Flagging Accuracy**

In 2014, the Department of Public Health changed the flagging protocol for beaches that have historically proven to be clean, so that only back-to-back exceedances on successive days would result in a red flag.

This protocol applied to Savin Hill Beach, Nahant Beach, Short Beach, Revere Beach, Carson Beach, Pleasure Bay, M Street Beach, City Point Beach, and Nantasket Beach. This new policy, which was supported by DCR and Save the Harbor/Save the Bay's Beaches Science Advisory Committee, eliminated four inaccurate red flags in 2015.

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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](mailto:bruce@bostonharbor.com)

You can see the data and learn more about the methodology on which the report card is based at <http://www.savetheharbor.org/Content/beachesreportcard/>