

Predictive Modeling for Beach Water Quality

How Modeling is Used Around the World +
Review of the California NowCast System



Presentation to the Southern California BWQWG

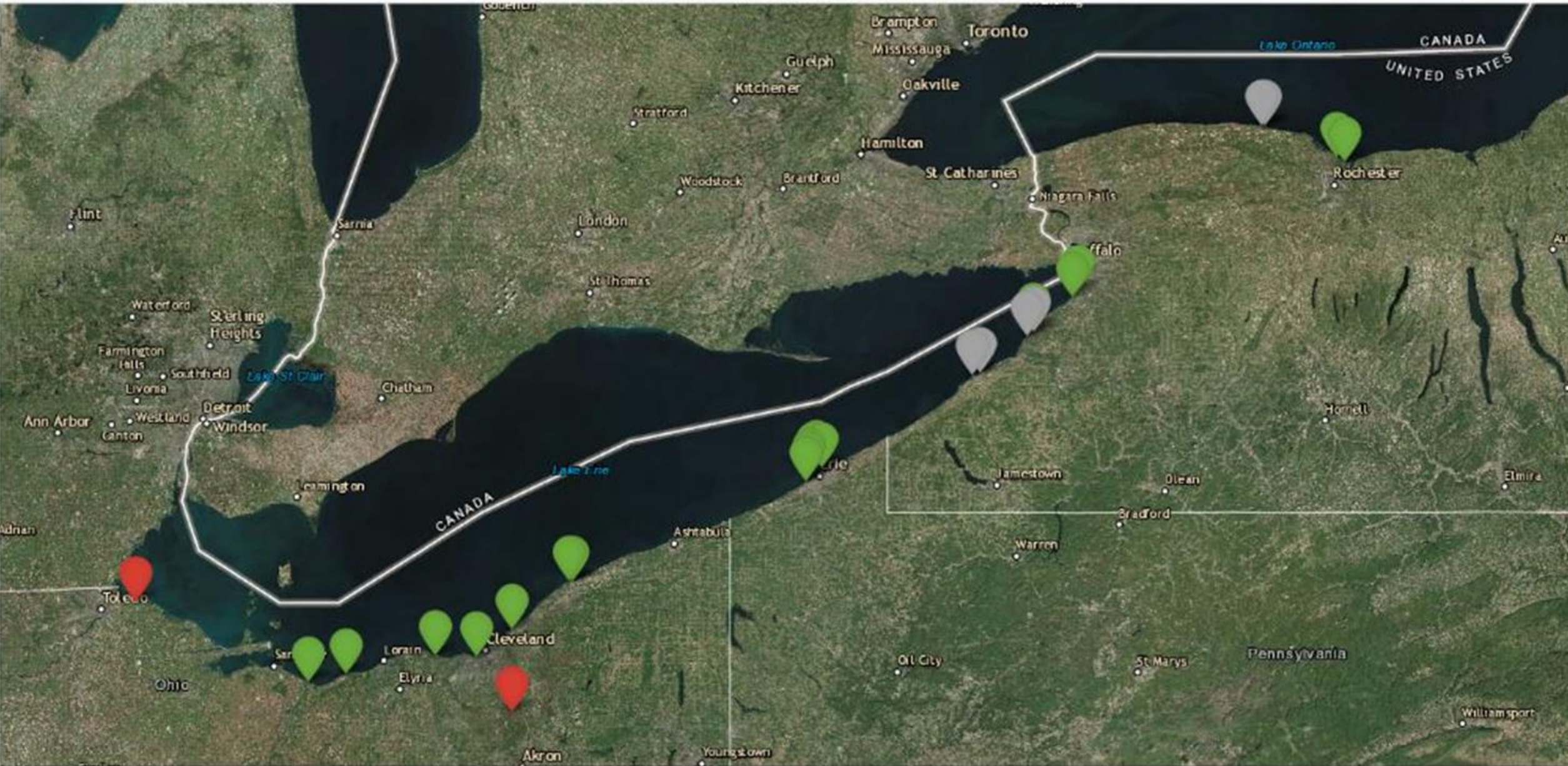
November 14th, 2018

Predictive Modeling for Water Quality Around the World



The US Great Lakes





Huntington Conditions

Current Conditions

Recent Conditions

Huntington Details

Date: 2018-08-21

Beach Name: Huntington

Lake Temperature (°F): 73.8

Condition: Off-Season

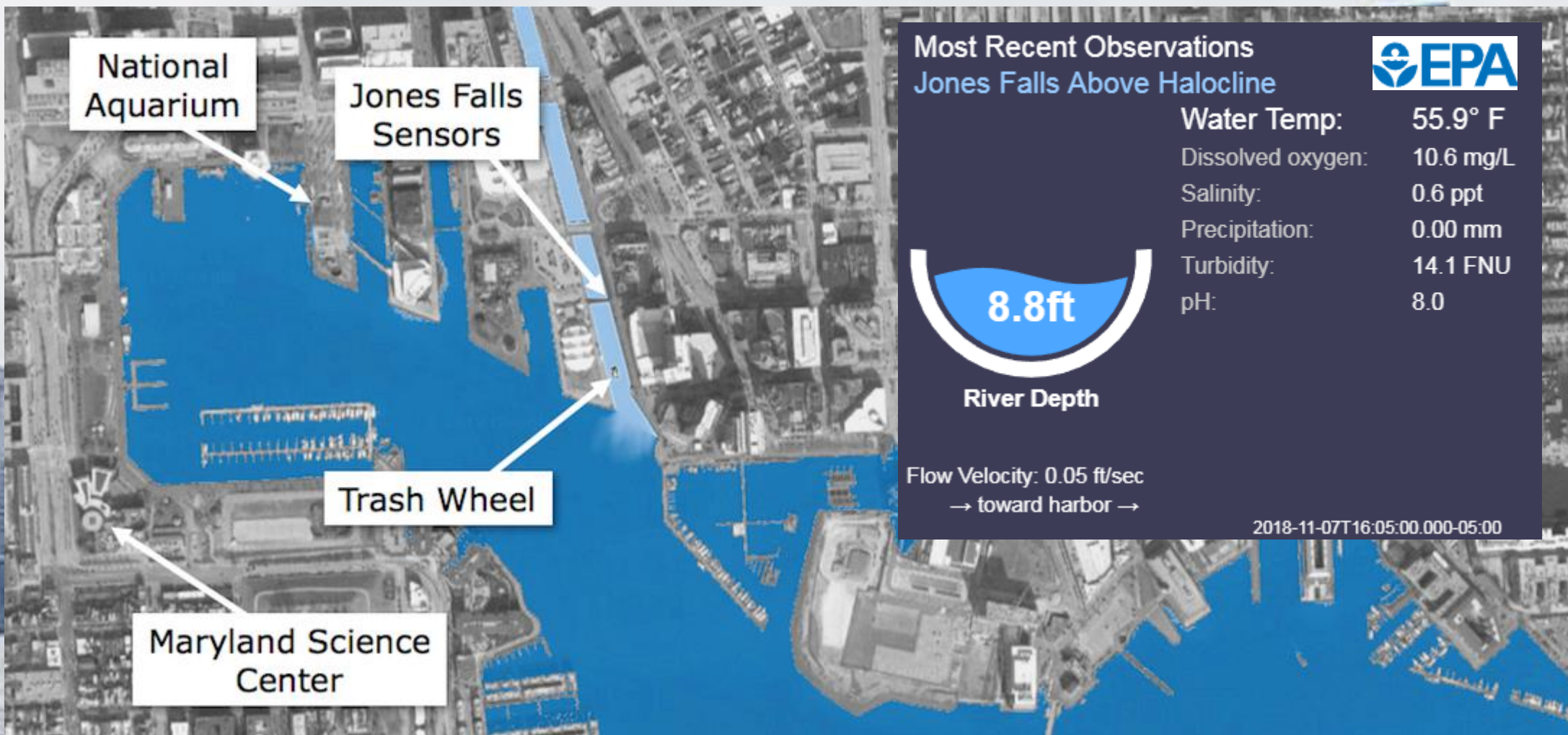
Additional water-quality information may be available at [BeachGuard](#) operated by Ohio Department of Health.



Directions



Baltimore





Hong Kong



Project
WATERMAN

Beach Water Quality Forecast

Please click a beach for details: Prediction results for 07/11/2018 (updated daily at 8:00 AM)



<http://www.waterman.hku.hk/beach/>



Hong Kong

Butterfly Beach



Beach Length: 252 m
Beach Orientation: South
Lifeguard service: Apr - Oct
Slope: 2:100
No. of visitors per day in 2014 (weekdays/weekends): 793 / 1,484

Beach Description
 Pollution Source



Meteorological information
 ▲ **Rainfall:** Tuen Mun
 ▲ **Radiation Station:** King's Park
 ● **Wind Station:** Tuen Mun
 + **Beach Tide:** Lok On Pai
 Predicted high tide: 2.4m at 21:42
 Predicted low tide: 0.6m at 03:38

Beach Water Quality Forecast Index

07 Nov 2018



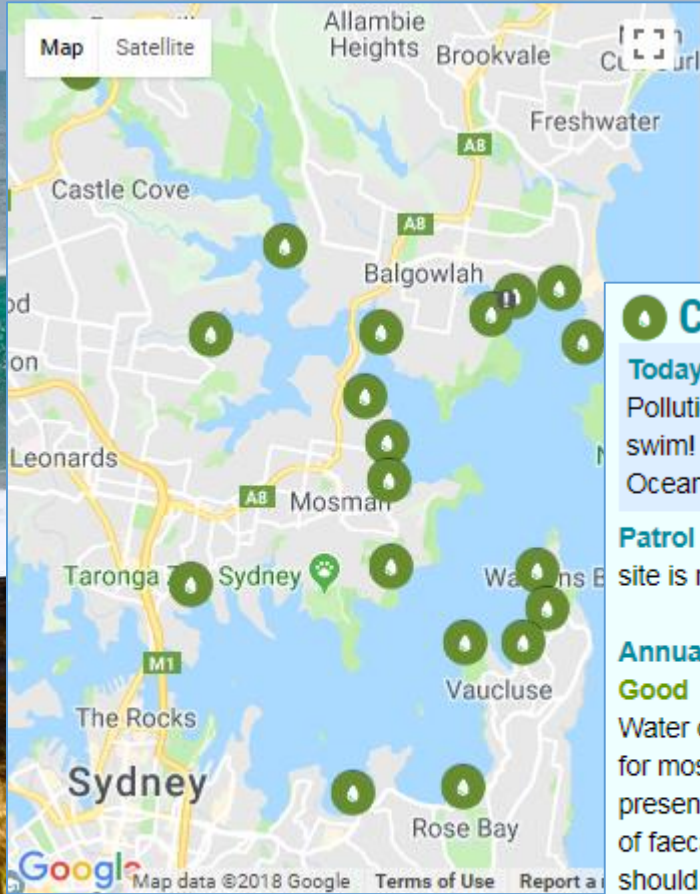
Forecast will be updated daily at 8:00AM

Beach Water Quality Forecast Index	Predicted <i>E. coli</i> concentration (counts / 100 mL)	Health risk *
	≤ 24	Negligible
	25 - 180	Low
	181 - 610	Moderate
	> 610	High

<http://www.waterman.hku.hk/beach/>



Australia (NSW)



Clontarf Pool
Today's beach conditions
Pollution is **unlikely**. Enjoy your swim!
Ocean temperature is 22° C


Patrol information: This swimming site is not patrolled.




Annual beach suitability grade
Good
Water quality is suitable for swimming for most of the time, but due to the presence of several potential sources of faecal contamination, swimming should be avoided following rainfall.


Star rating **Address**
★★★★
From Sandy Bay Road,
Clontarf (**zoom in**)
30/10/2018


Beachwatch Edwards Beach Full Site Info


1 hour ago



Pollution is possible
Take care


 MOSTLY SUNNY  20°
MAX TEMP
 22°
WATER TEMP

 **Weather Info**
Slight chance of a shower in the east early this morning. Mostly sunny afternoon.

 **Swell**
Southerly 1 to 1.5 metres, increasing to 1.5 to 2 metres around midday.

 **Wind**
S/SW 20 to 30 km/h turning SE 15 to 25 km/h in the early afternoon then becoming light in the evening.

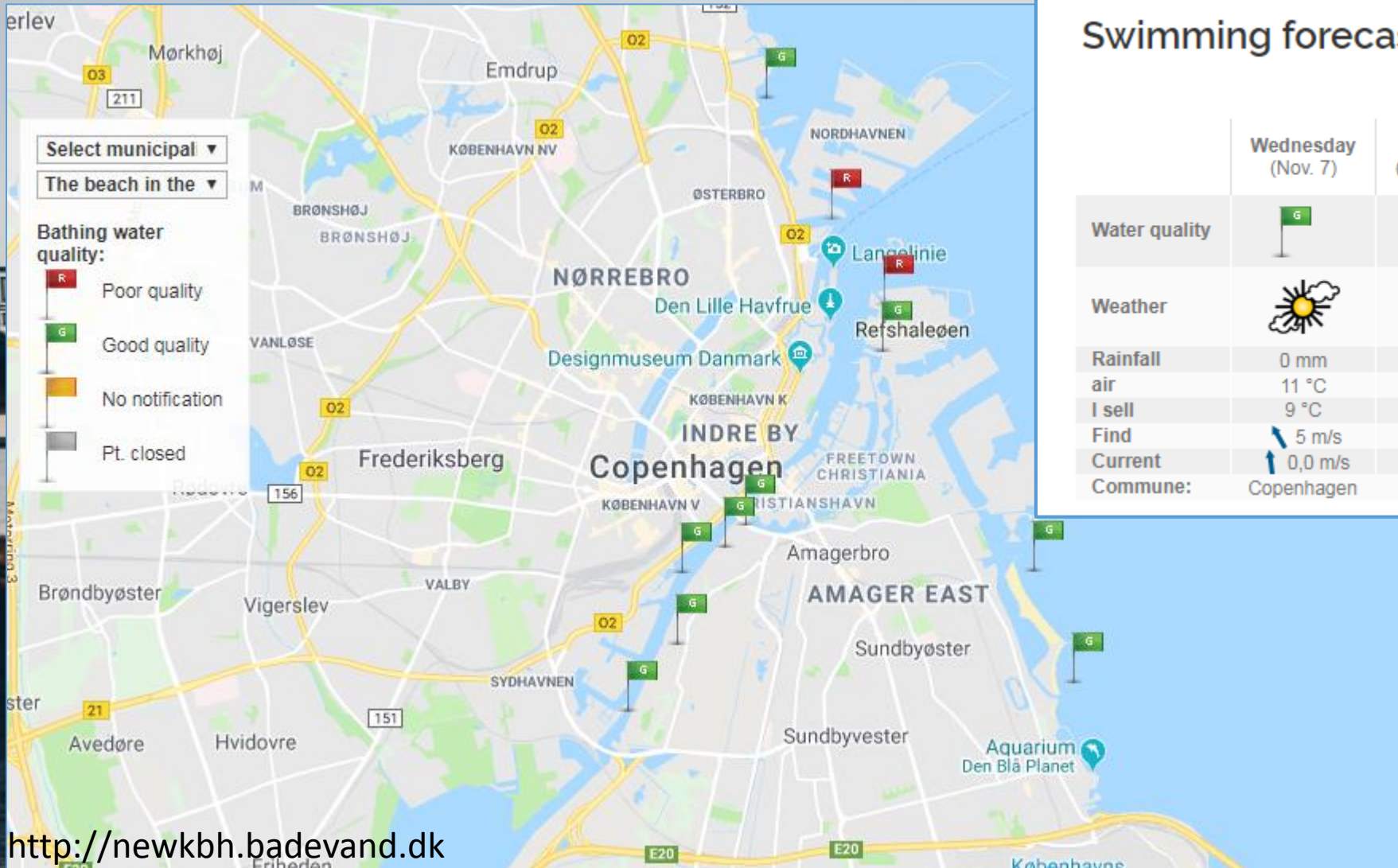
 **Patrol Info**
This beach is not patrolled.

 **Rainfall**
18.5mm in the previous 4 days.

<https://www.environment.nsw.gov.au/topics/water/beaches>

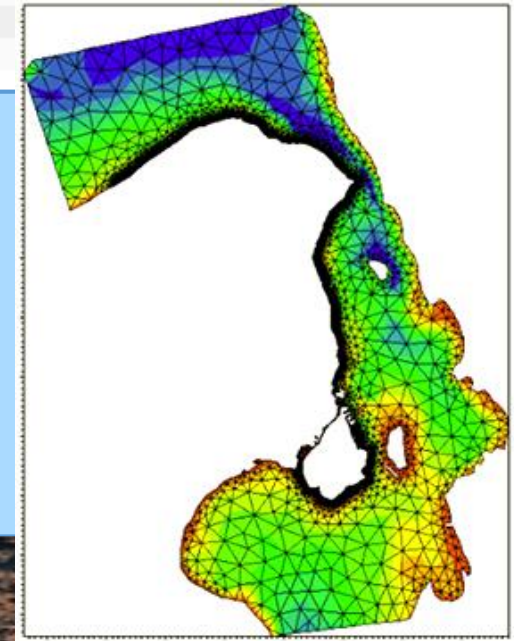


Copenhagen, Denmark



Swimming forecast for the beach in the Swan Bay bay

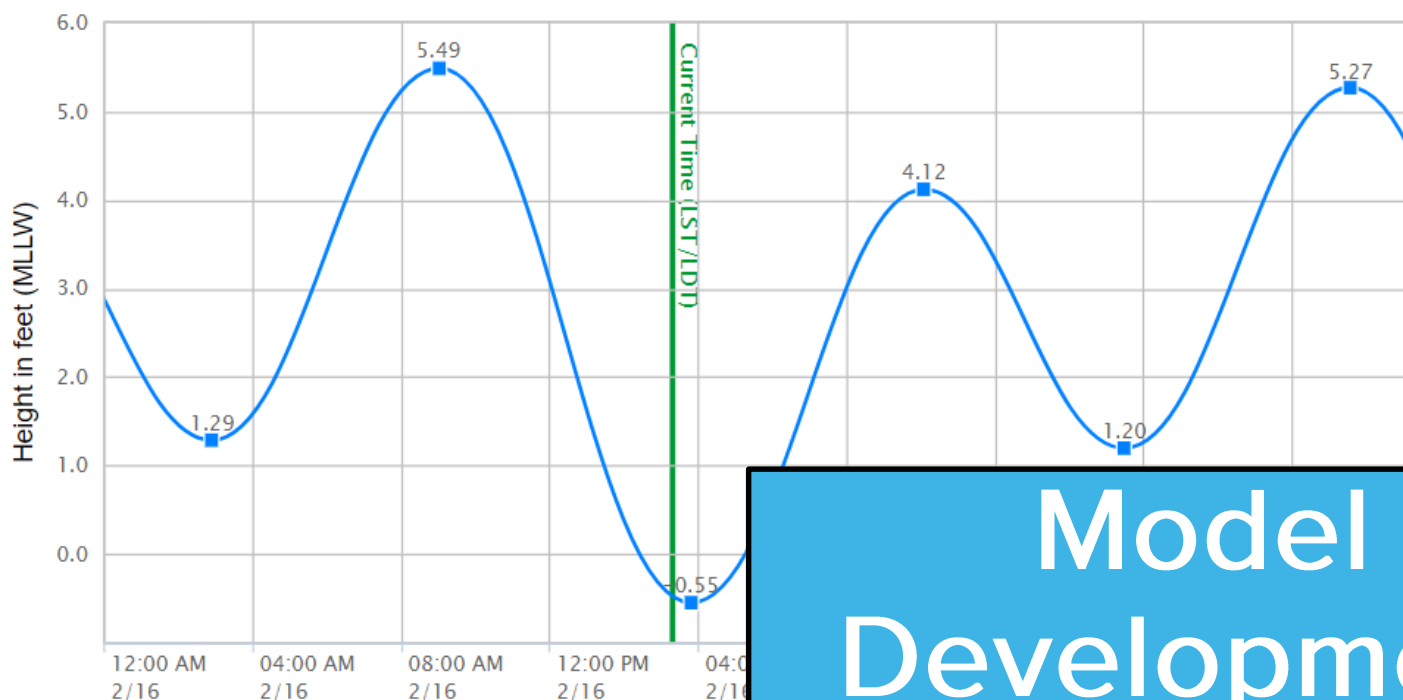
	Wednesday (Nov. 7)	Thursday (8th of November)	Friday (Nov. 9)	Saturday (10th of November)
Water quality				
Weather				
Rainfall	0 mm	0 mm	1 mm	1 mm
air	11 °C	11 °C	8 °C	8 °C
l sell	9 °C	10 °C	9 °C	9 °C
Find	5 m/s	2 m/s	3 m/s	9 m/s
Current	0,0 m/s			
Commune:	Copenhagen			



<http://newkbh.badevand.dk>

The California NowCast System

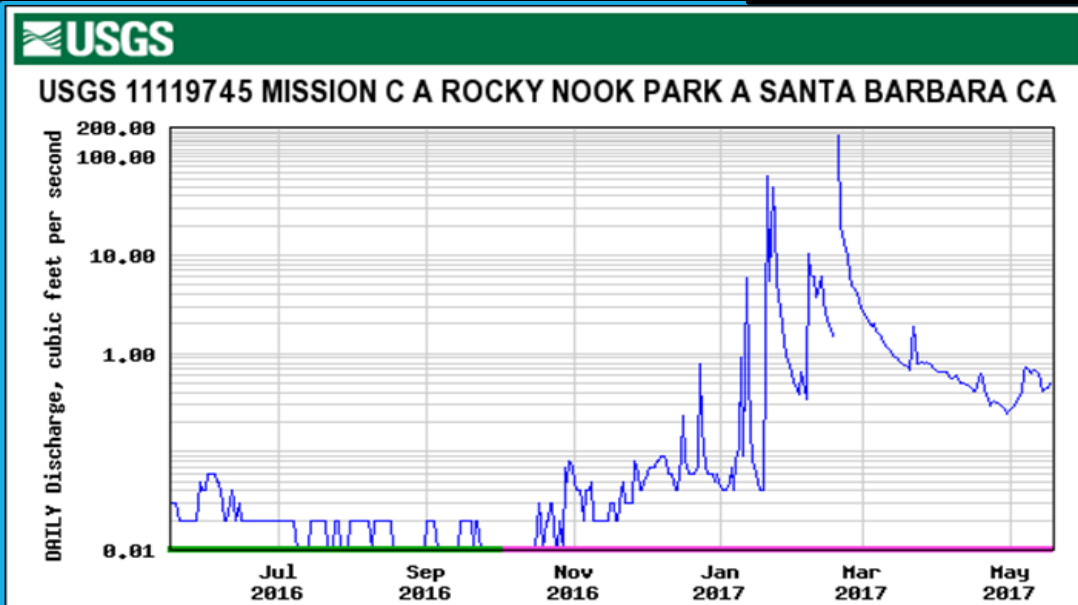




Model Development

HYPERION SHORELINE BACTERIA SAMPLES

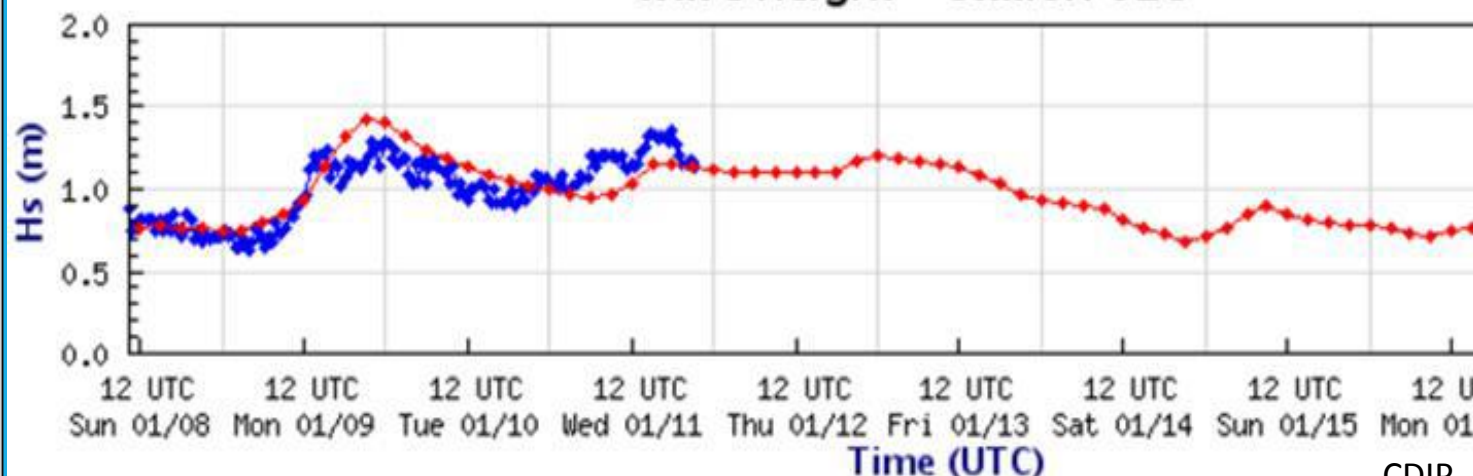
Hyperion Shoreline - S1 (SMB TMDL: SMB-MC-2) Malibu Crk, Malibu Lagoon County Bch Pt. Zero	Tot > Ec Ent	13,000 280 10	a X
Hyperion Shoreline - S2 (SMB TMDL: SMB-1-18) Topanga Cyn, Topanga County Bch Pt. Zero	Tot Ec Ent	1,000 430 87	b X
Hyperion Shoreline - S3 (SMB TMDL: SMB-2-04) Pulga Cyn SD, Will Rogers SB Pt. Zero	Tot Ec Ent	 	
Hyperion Shoreline - S4 (SMB TMDL: SMB-2-07) Santa Monica Cyn SD, Santa Monica SB Pt. Zero	Tot < Ec < Ent <	67 67 10	
Hyperion Shoreline - S5 (SMB TMDL: SMB-3-03) Santa Monica Cyn SD, Santa Monica SB	Tot Ec Ent	1,500 1,100 53	a b X
Hyperion Shoreline - S6 (SMB TMDL: SMB-3-04) Santa Monica Cyn SD, Santa Monica SB	Tot > Ec < Ent >	13,000 3,900 2,000	a b c



Santa Monica Bay, CA Conditions + Forecast

Observations: C
 Forecast: NOAA

Wave height - Station 028



Standard NowCast Performance Criteria

- Sensitivity shall be greater than or equal to 0.30
- Sensitivity shall be greater than or equal to 0.10 greater than the sensitivity of the Current Method*
- Specificity shall be greater than or equal to the lesser of 0.85 and the specificity of the Current Method+

** Current Method performance for a particular FIB is evaluated by comparing all sample results taken during the season to their respective previous sample results*

+Occasionally, models may be calibrated and validated to adjusted performance criteria due to a high exceedance rate at the beach after consultation with the local beach manager.

NowCast for Manhattan (28th St) (Date: 02/16/2018)

Collecting environmental data:

Grabbing wave parameters at CDIP buoy 028 for a sample time

Wave variables obtained

Tide variables obtained

Weather variables obtained

Checking rain advisory status:

Manhattan (28th St) is not under a rain advisory

Environmental data collected and saved to Manhattan_(28th_St)

Running FC model (Manhattan (28th St)):

Variable	Coefficient	Value
rainH_b	0.412	0.00000
lograin4T	0.097	-2.30103
pres1	-0.459	30.10000

Constant: 15.731

PM: 1.415

FC (Predicted): 248 CFU/ 100 mL

Posting Decision: No Post

Running ENT model (Manhattan (28th St)):



← Back to results

Santa Monica Beach at the Pier



NowCast

12 hours ago



Good

Dry Grade

4 days ago



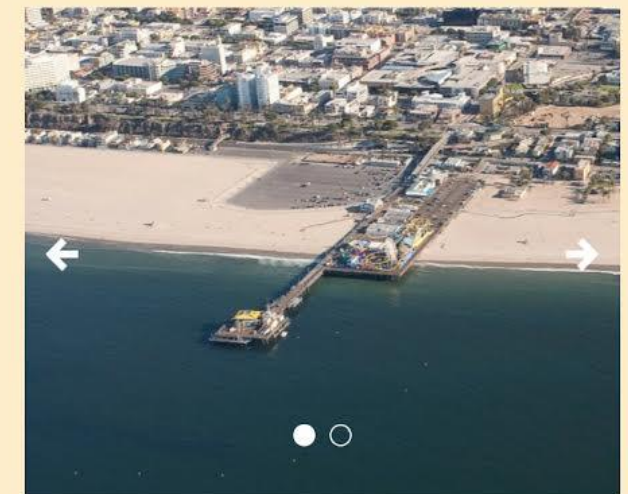
C

Wet Grade

4 days ago



ns

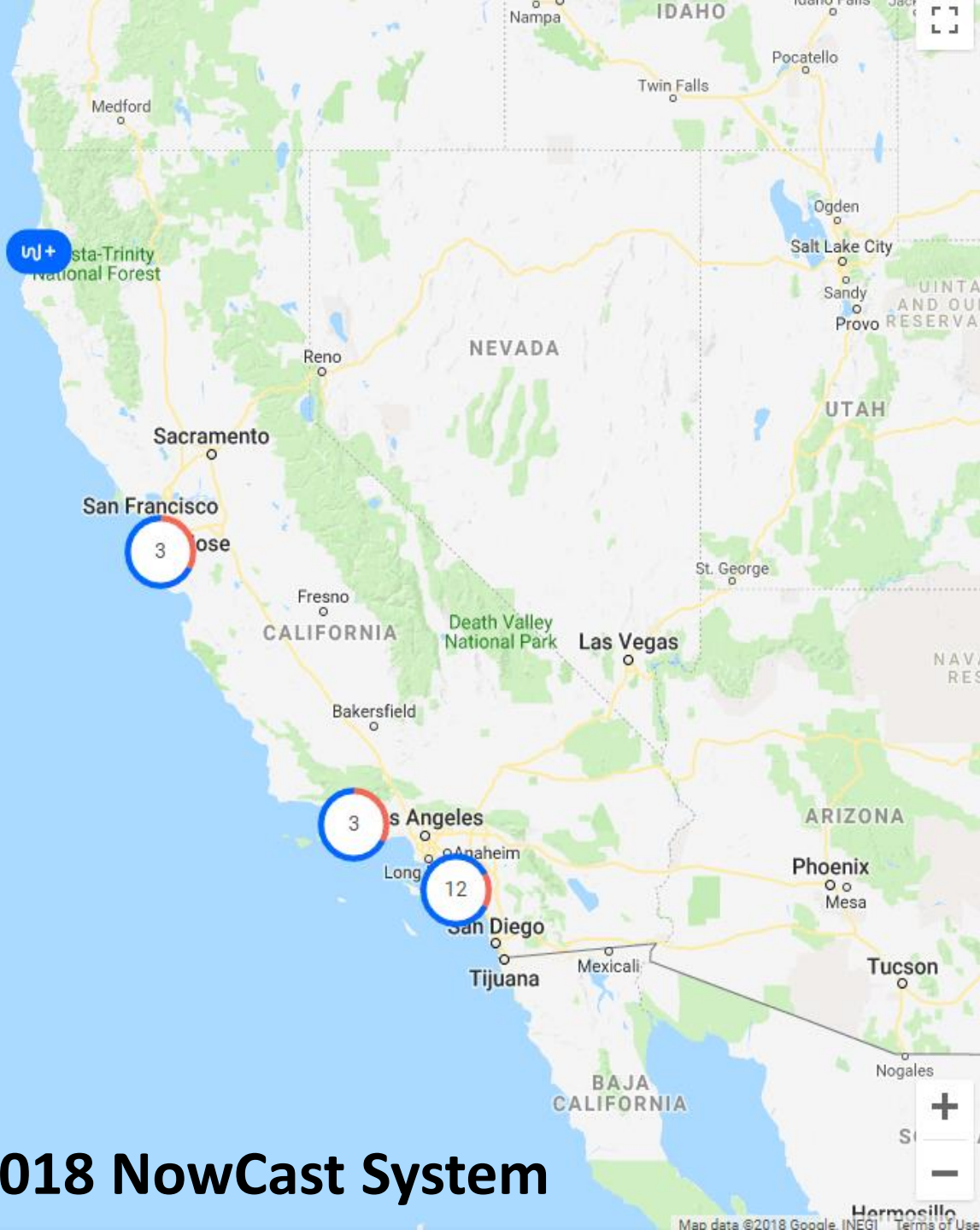


In-Season Performance Monitoring Categories

Good	Model performance meets or exceeds the Standard NowCast Performance Criteria
Acceptable	Sensitivity: <ul style="list-style-type: none">- If at least 2 exceedances have been measured, sensitivity is greater than or equal to the sensitivity of the Current Method (CM) Specificity: <ul style="list-style-type: none">- Greater than or equal to the lesser of 0.80 and the specificity of the CM
Under Notification	Sensitivity: <ul style="list-style-type: none">- If at least 2 exceedances have been measured, sensitivity is less than, but no less than 1/2, the sensitivity of the CM Specificity: <ul style="list-style-type: none">- No less than 0.15 below the lesser of 0.80 and the specificity of the CM
Poor	Sensitivity: <ul style="list-style-type: none">- If at least 2 exceedances have been measured, sensitivity is less than 1/2 the sensitivity of the CM Specificity: <ul style="list-style-type: none">- Less than 0.15 below the lesser of 0.80 and the specificity of the CM
Unknown	Model performance cannot be evaluated due to unavailability of sample data

BEACH REPORT CARD

WITH NOWCAST



Search For Your Favorite Beach

All NowCast Grades Alerts



Huntington State Beach
projection of Brookhurst St.

NowCast: **Good**
8 hours ago



Redondo State Beach
100 yards south

NowCast: **Poor**
8 hours ago



Manhattan Beach
projection of 28th

NowCast: **Good**
8 hours ago



Venice City Beach
at the pier

NowCast: **Good**
8 hours ago



Santa Monica Beach
at the Pier

NowCast: **Good**
8 hours ago



Doheny State Beach
San Juan Creek Interface

NowCast: **Good**
8 hours ago

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Summer 2018 NowCast System



Summer 2018 Beaches



1. Luffenholtz State
2. Ocean (Sloat Blvd.)
3. Cowell
4. Rio Del Mar
5. Arroyo Burro
6. Leadbetter
7. East (Mission Creek)
8. Santa Monica Pier
9. Venice Beach Pier
10. Manhattan (28th St.)
11. Redondo Beach Pier
12. Long Beach City Beach (5th Pl.)
13. Belmont Pier
14. Long Beach City Beach (72nd Pl.)
15. Seal Beach Pier
16. Huntington State (Brookhurst Ave.)
17. Doheny State
18. Oceanside (San Luis Rey River)
19. Moonlight

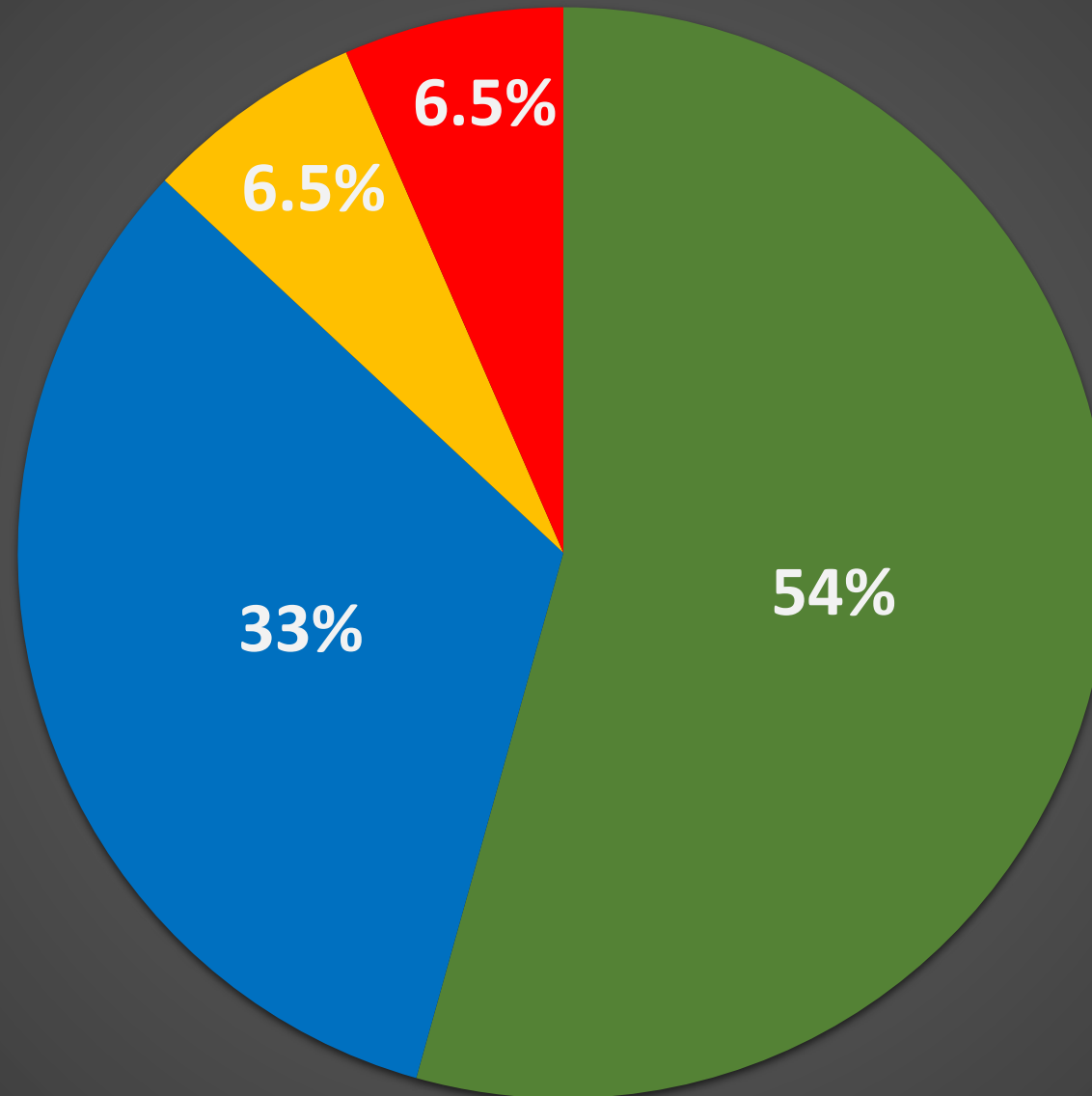
Summer 2018 Results – FIB Samples

- Season: April 1st – October 31st, 2018 (214 Beach Days)
- NowCast Beaches: 19
- Total # of Samples: 1058
 - Median – 34 samples per beach
- Single Sample Standard Exceedances:
 - TC – 8 total
 - FC – 82 total
 - ENT – 65 total

Summer 2018 Results – Programmatic Summary

- Number of Predictions Made (Missing): 3997 (60)
- “Post” Predictions Made: 667 (16.7%)
- Additional Days of WQ Info from Predictions:
 - Total – 2939 Beach Days
 - Median – 178 Beach Days

Summer 2018 – Model Performance



■ Good ■ Acceptable ■ Under Notification ■ Poor

Winter 2017/2018 NowCast Models

Table 3: Model Performance – Winter 2017/2018 Season

Beach	FIB	Model	Sensitivity	Specificity	Total Correct	Exceedances	Monitoring Samples
VB	FC	BLR-T	0	0.93	0.82	2	17
		Current Method	0	0.87	0.76	2	17
	ENT	MLR-T	NA	0.82	0.82	0	17
		Current Method	NA	0.88	0.88	0	17
MB	FC	MLR-T	0.67	0.94	0.93	3	90
		Current Method	0.67	0.98	0.97	3	90
	ENT	MLR-T	0.8	0.87	0.87	5	90
		Current Method	0.6	0.96	0.94	5	90
SB	FC	MLR-T	1	0.69	0.71	2	41
		Current Method	0	0.92	0.88	2	41
	ENT	MLR-T	0.57	0.76	0.73	7	41
		Current Method	0.43	0.82	0.76	7	41
HB	ENT	MLR-T	0	1	0.95	1	20
		Current Method	0	0.89	0.85	1	20
SA	ENT	MLR-T	NA	1	1	0	38
		Current Method	NA	0.97	0.97	0	38

VB – Venice Beach (Windward); MB – Manhattan Beach (28th St.);
 SB – Seal Beach (1st St); HB – Huntington City Beach (Beach Blvd.); SA – Santa Ana Rivermouth

Winter 2018/2019 NowCast Protocol

- No Total Coliform models
- Calibrated on DRY WEATHER SAMPLES only
 - Predictions will be withheld on wet weather days
 - Predictions will also be withheld when Rain Advisories are issued
- Model performance will continue to be compared to samples taken during the season
- Public notification includes daily email to stakeholders and through the Beach Report Card
 - Agencies will ideally continue to post predictions through their own media, and signage on the beach

Winter 2018/2019 NowCast Beaches

1. Venice Beach
(Windward Ave.)
2. Manhattan Beach
(28th St.)
3. Redondo Jetty
(Herondo St. Storm Drain)
4. Huntington Beach
(Beach Blvd.)
5. Santa Ana Rivermouth

Contact Information



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Publications/reports available upon request
beachreportcard.org