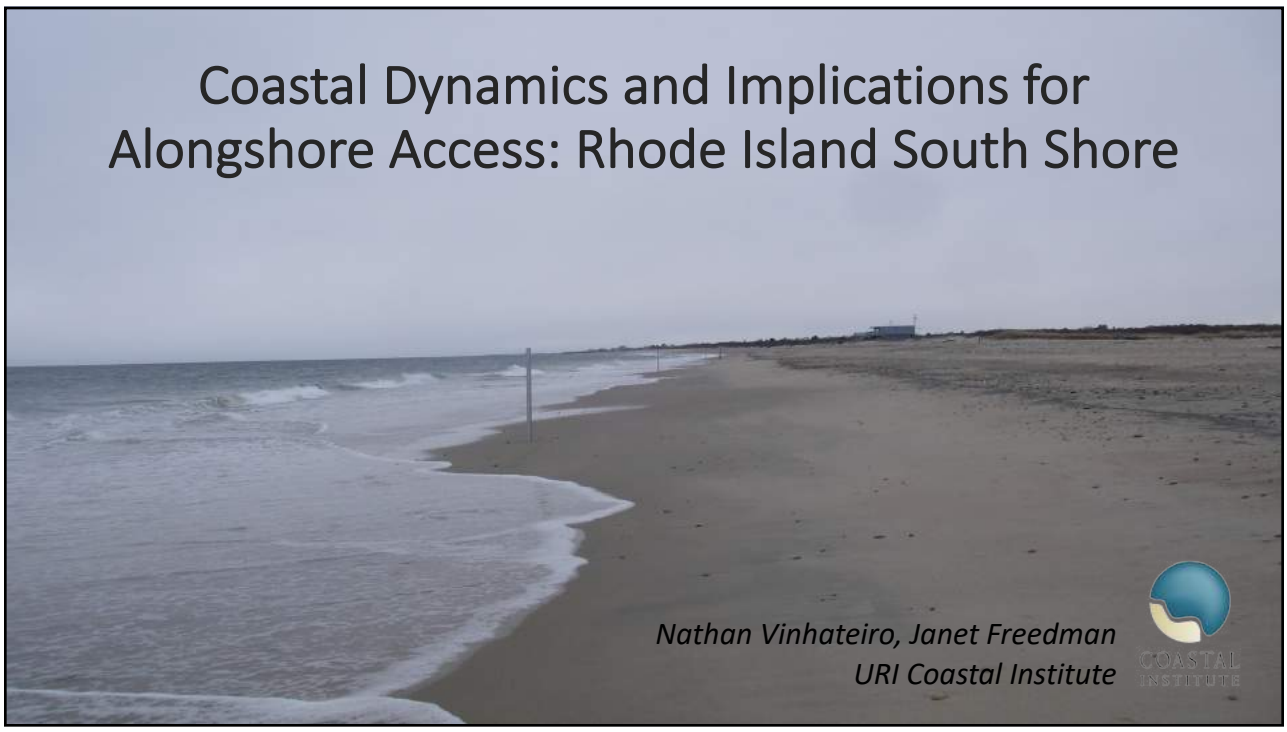
Coastal Dynamics and Implications for Alongshore Access: Rhode Island South Shore



Nathan Vinhateiro, Janet Freedman
URI Coastal Institute

1

Where is the shoreline?

The people shall continue to enjoy and freely exercise all the rights of fishery, and the privileges of the shore, to which they have been heretofore entitled under the charter and usages of this state, including but not limited to fishing from the shore, the gathering of seaweed, leaving the shore to swim in the sea and ***passage along the shore****;*

—Rhode Island State Constitution (Article 1 Section 17)

We concur in this analysis and ***apply the mean-high-tide line as the landward boundary of the shore*** *for the purposes of the privileges guaranteed to the people of this state by our constitution. This court has held that the common law governs the rights and obligations of the people of the state unless that law has been modified by our General Assembly.*

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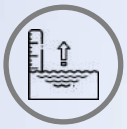
2

Presentation Overview



Tides and tidal datums

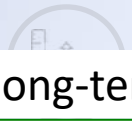
Visible high tide indicators

Coastal processes

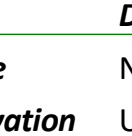
Field surveys

3

Presentation Overview



Tides and tidal datums



Visible high tide indicators

RI long-term environmental datasets

	Dataset	***Location***	***Record***
Tide	NOAA Station 8452660	Newport	1930-present
Elevation	URI beach transects	RI South Shore	1962-present
Waves	NDBC Waverider Buoy 44097	Block Island	2009-present

Coastal processes

Field surveys

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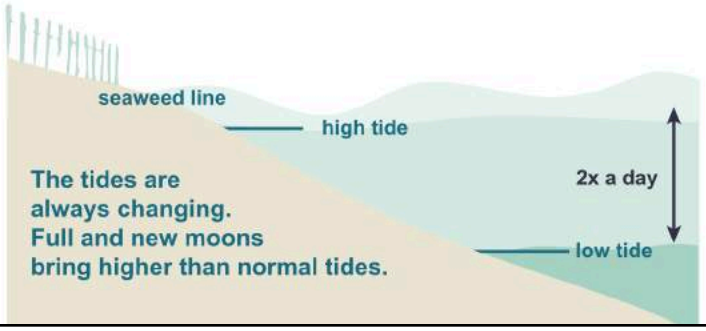
What is the tide?

Rhode Island has *semi-diurnal tides*, meaning the level of the sea rises and falls twice each day. This is caused by the interaction of gravitational forces (gravity and inertia) between the earth, moon and sun.



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Tides represent a still water level

- Tides are measured at stationary tide gauges on the coast
- Tide gauges remove the effects of waves, creating a "still water level"
- Early continuous tide gauges
  - San Francisco 1854
  - Baltimore 1902
  - Sandy Hook 1910
  - Atlantic City 1911
  - The Battery 1920
  - Boston 1921
  - Newport 1930

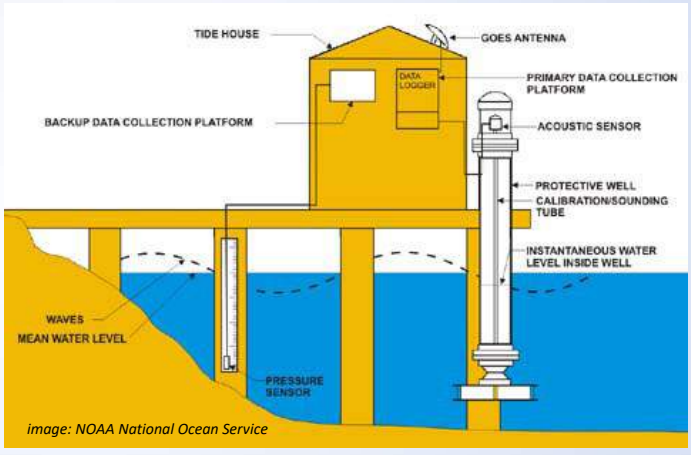

image: NOAA National Ocean Service

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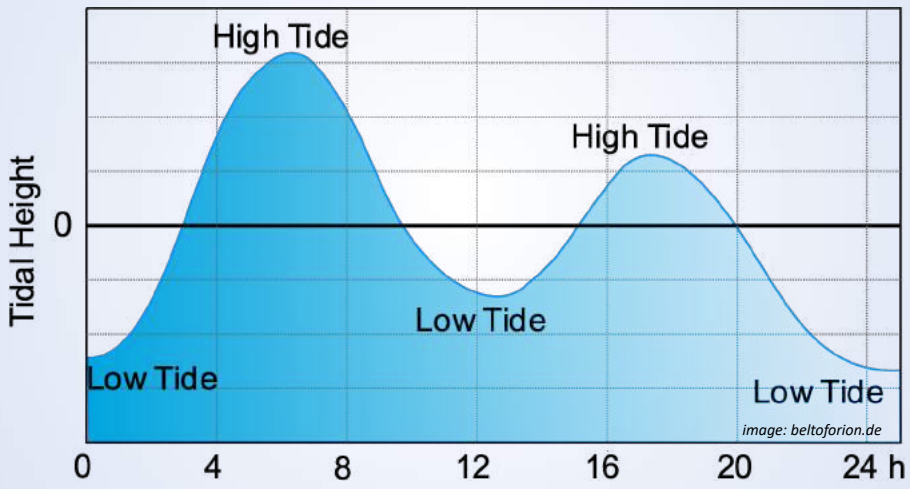
Rhode Island has semi-diurnal tides



Approximately two highs and two lows each day

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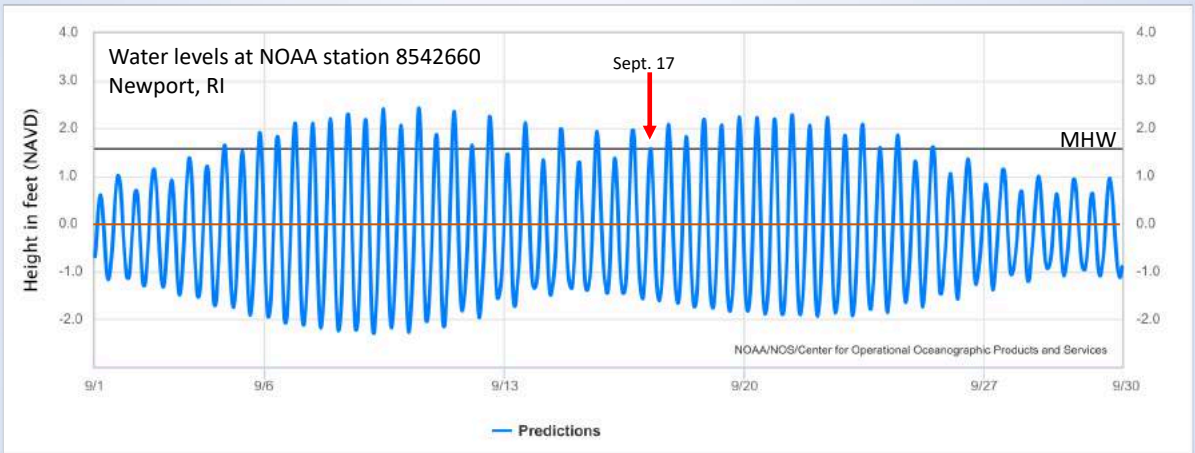
Tidal datums are long-term averages

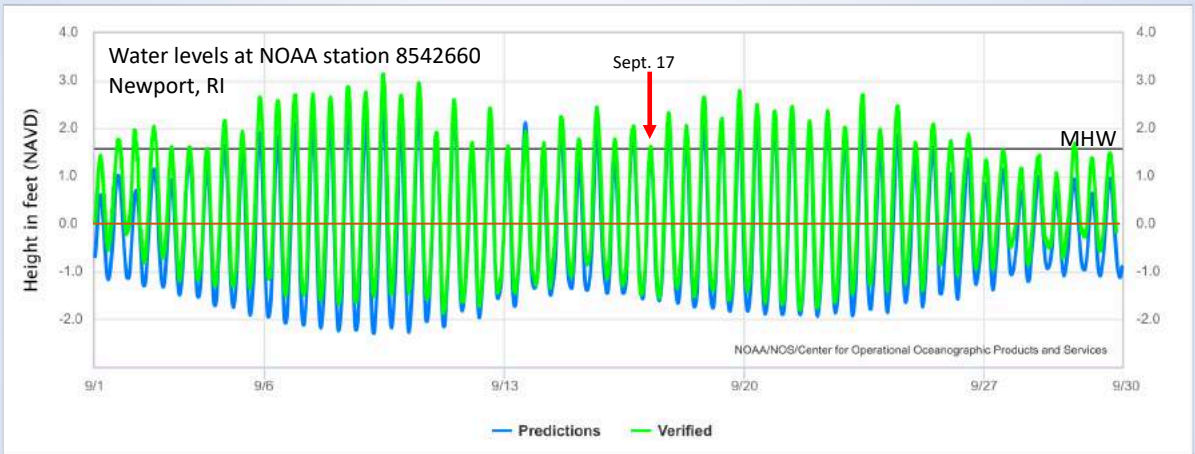


National Tidal Datum Epoch

1924-1942, 1941-1959, 1960-1978, 1983-2001 *(current)*

8

Tidal datums are long-term averages



National Tidal Datum Epoch

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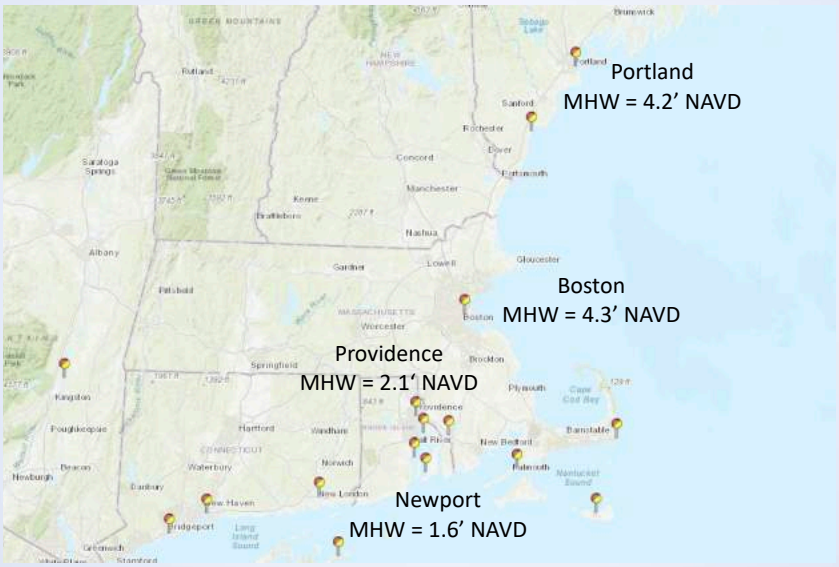
Tidal datums change alongshore



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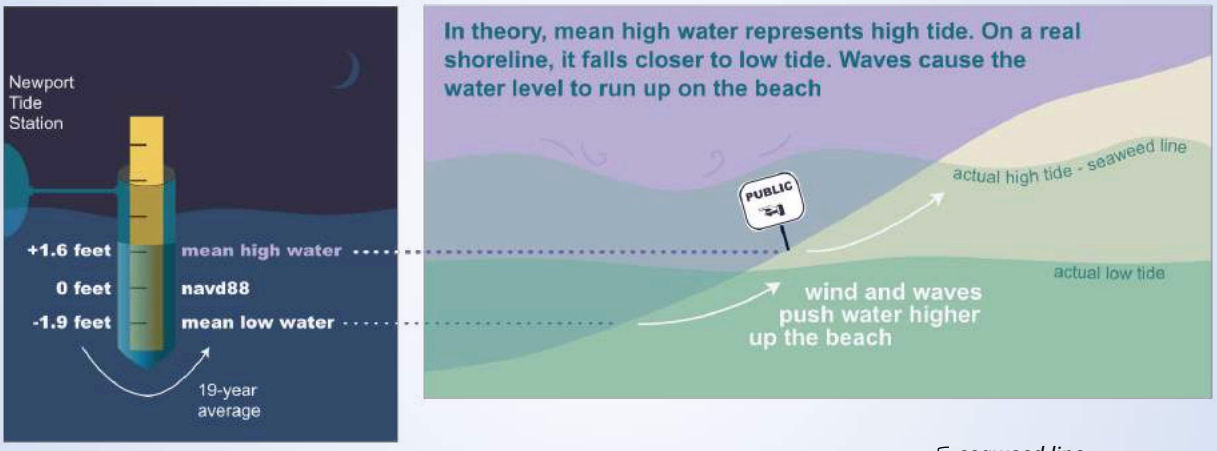
Tidal datums can't be seen on the beach



What <u>can</u> be seen is the Last High Tide Swash (LHTS), also called

- *seaweed line*
- *wrack line*
- *high water line*
- *high tide mark*

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South Kingstown Town Beach
17 September 2021
LHTS
39-ft
MHW

13


South Kingstown Town Beach
17 September 2021
MHW
LHTS

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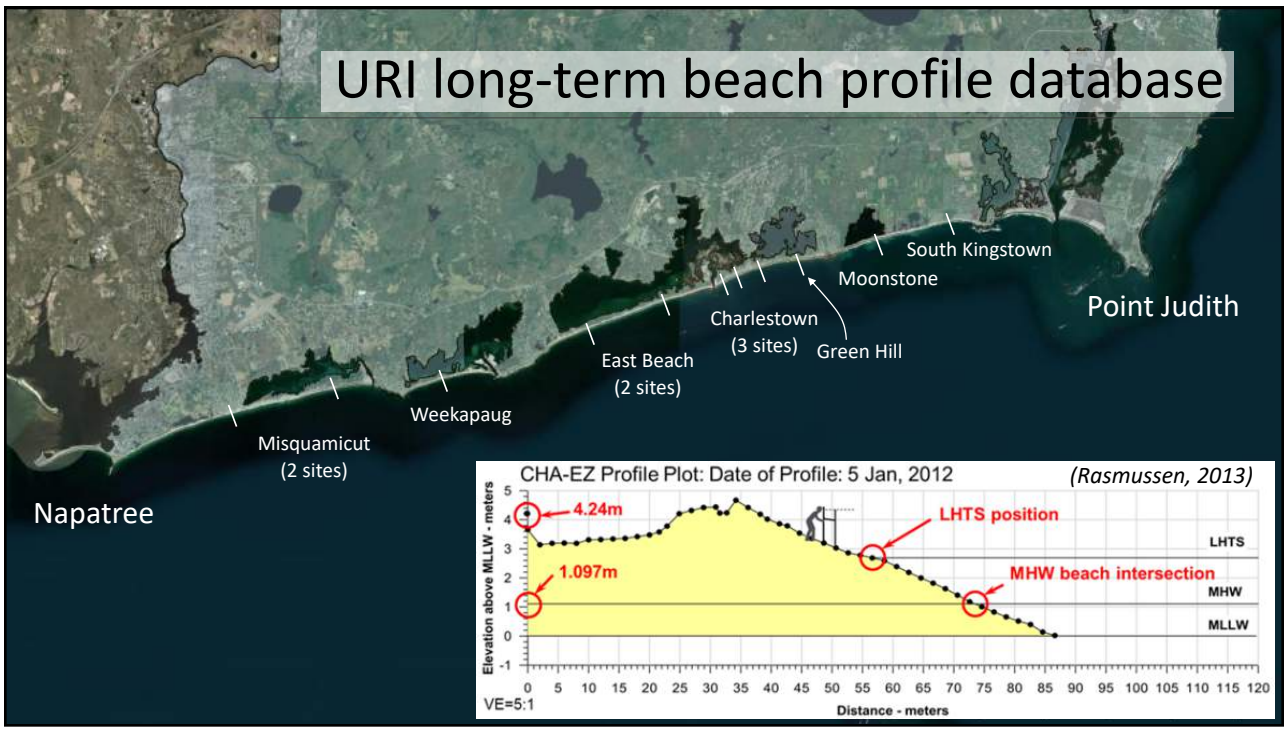
URI long-term beach profile database



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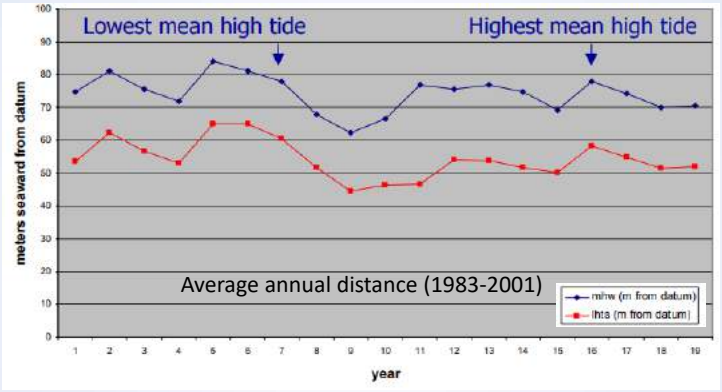
LHTS is **always** landward of MHW

ocean

land



Analysis of long-term profile records show that:

- Average horizontal offset is > 60 ft
- Annual offset is consistent over time
- For periods of exceptionally low wave energy, the average difference is still > 40 ft
- Similar offset for all RI south facing beaches

(Freedman and Higgins, 2003; Vinhateiro, 2012; Rasumussen, 2013)

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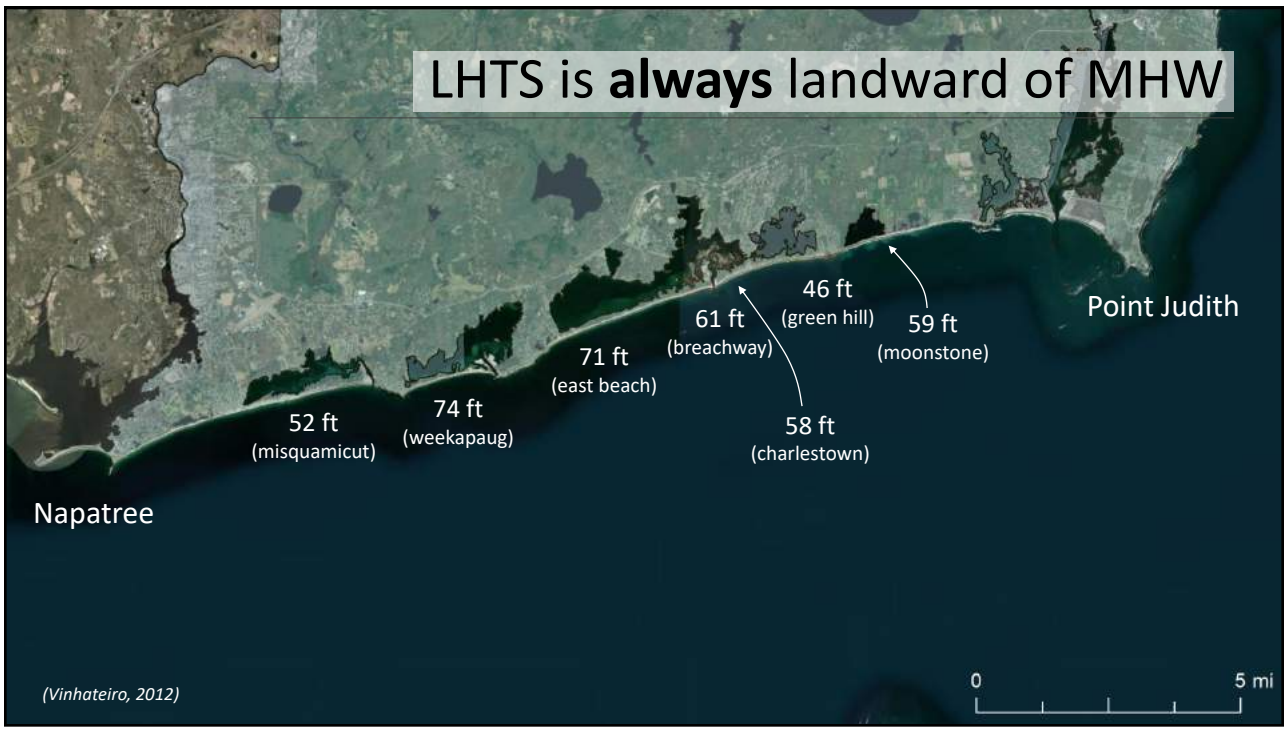

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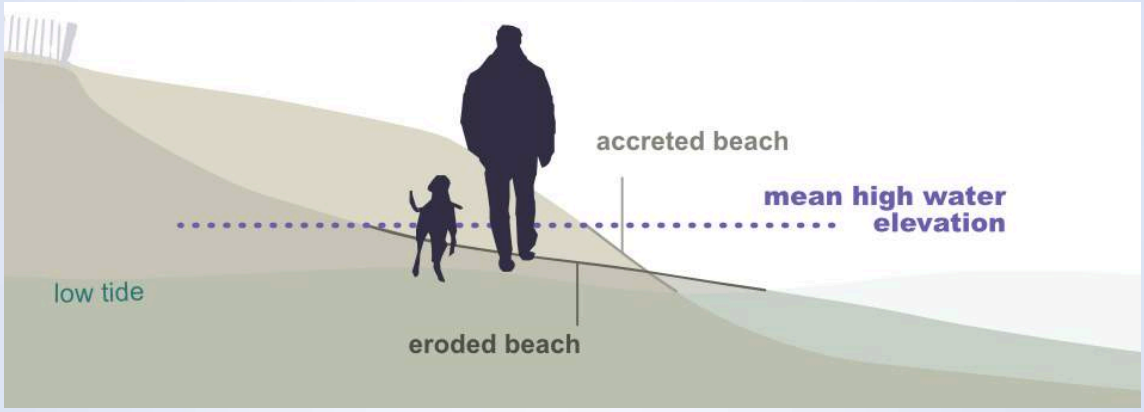
The beach profile can change daily



The location where MHW intersects the beach changes as waves move sand onshore, offshore, and alongshore.

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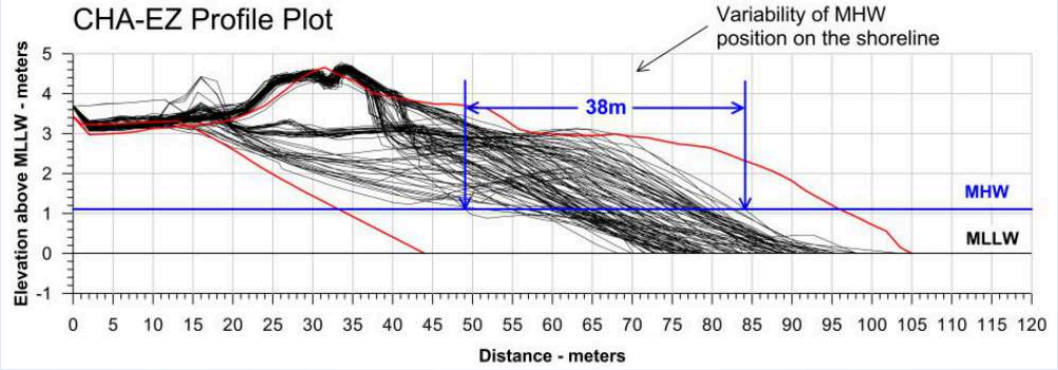

Two years of near weekly beach transects in Charlestown show that the position of **the Mean High Water line migrated back and forth across 125 ft** swath of the beach profile.

Rasumussen (2013)

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SK pavilion
Willow Dell
Roy Carpenter's
South Kingstown Town Beach
2011

21


SK pavilion
Willow Dell
Roy Carpenter's
South Kingstown Town Beach
2021

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Borax v. City of Los Angeles (1935)

"In view of the definition of the mean high tide, as given by the United States Coast and Geodetic Survey, that `[m]ean high water at any place is the average height of all the high waters at that place over a considerable period of time,' and the further observation that `from theoretical considerations of an astronomical character' there should be a `periodic variation in the rise of water above sea level having a period of 18.6 years' the Court of Appeals directed that **in order to ascertain the mean high tide line with requisite certainty in fixing the boundary of valuable tidelands, such as those here in question appear to be, `an average of 18.6 years should be determined as near as possible**.' We find no error in that instruction."

—U.S. Supreme Court, Borax Consolidated Ltd. v. Los Angeles (1935)

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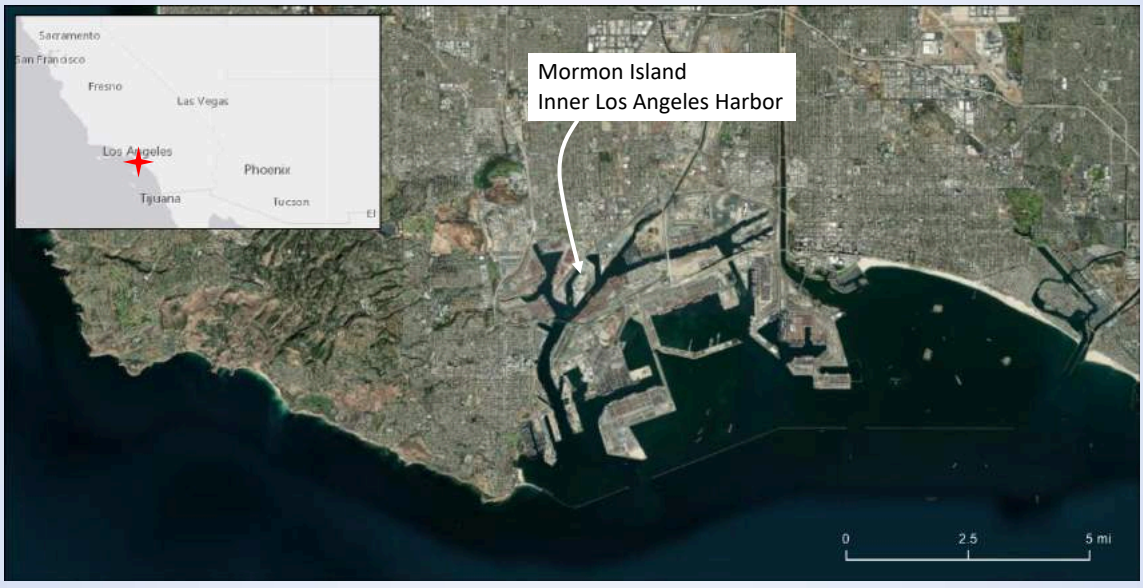

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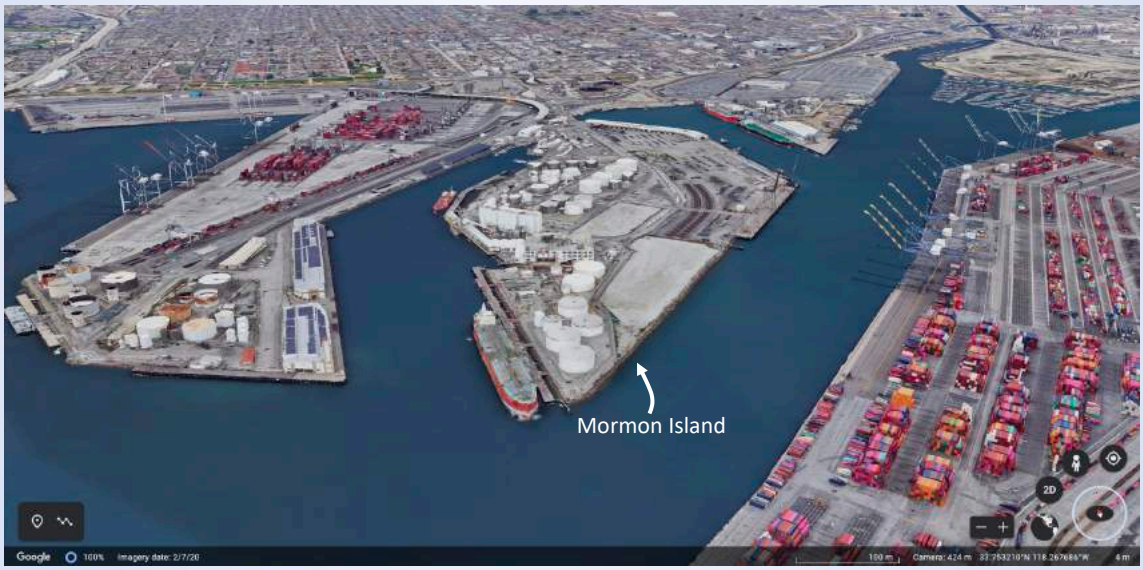

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For how long can the public access the shore?

Our perception – for most, if not all of a typical day

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Date	*High Tide*	*Low Tide*	*Tide Height (ft NAVD)[1]*	*Offshore Wave Height (ft)[2]*
July 15	12:35 PM	6:23 PM	1.7	2.5
August 18	4:41 AM	10:46 AM	1.6	1.6
September 17	5:44 AM	12:07 PM	1.6	4.0

Notes: 1. MHW elevation - 1.6 ft
2. Average offshore wave height – 4.5 ft

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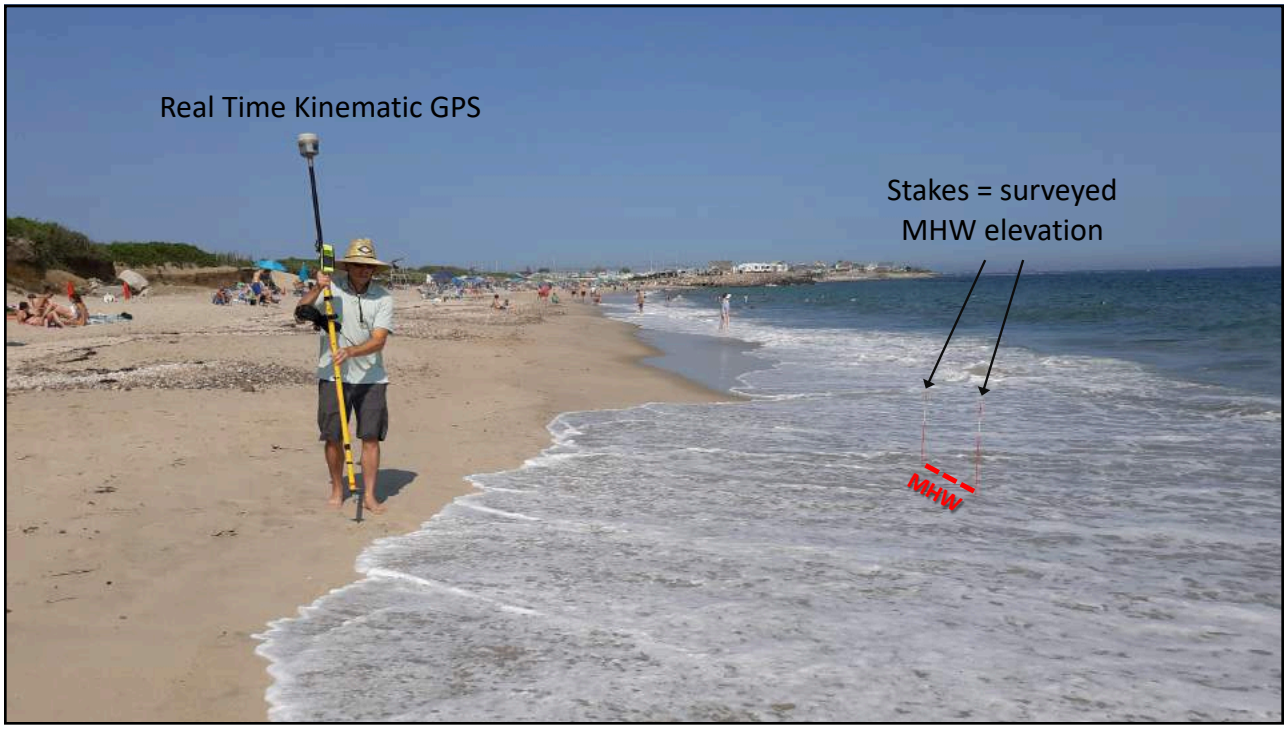

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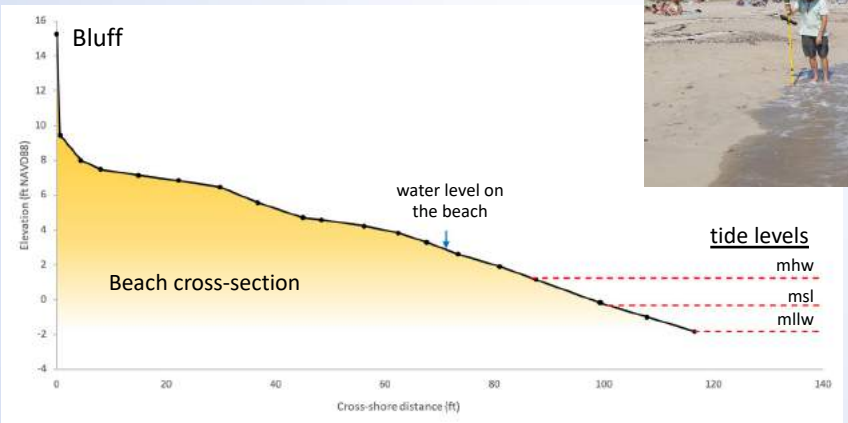
RTK beach survey

South Kingstown Town Beach
July 15, 2021
2:44 before low tide

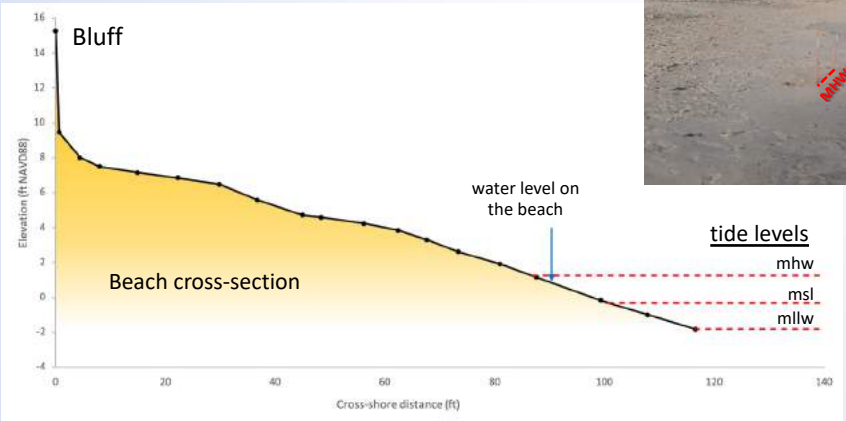


Wave runup is 16 ft
landward of MHW

30

RTK beach survey

South Kingstown Town Beach
July 15, 2021
0:18 after low tide



Wave runup is 3 ft *seaward* of MHW

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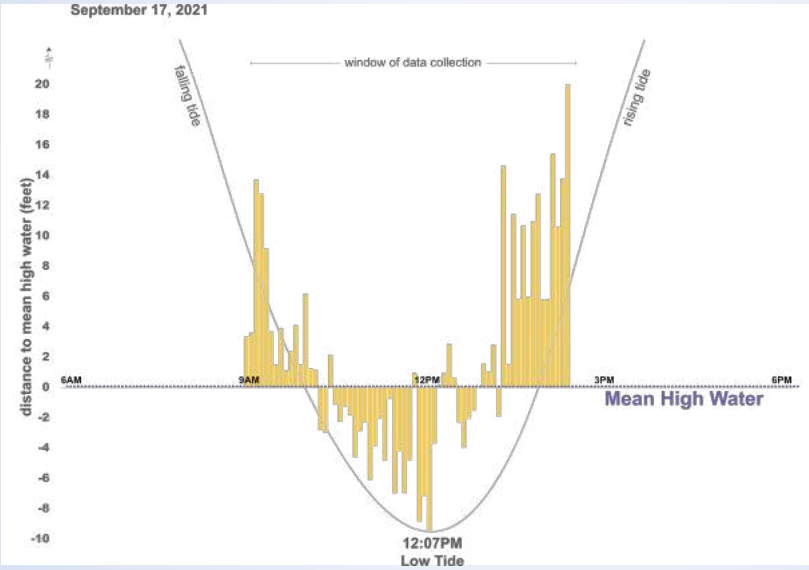
Survey results



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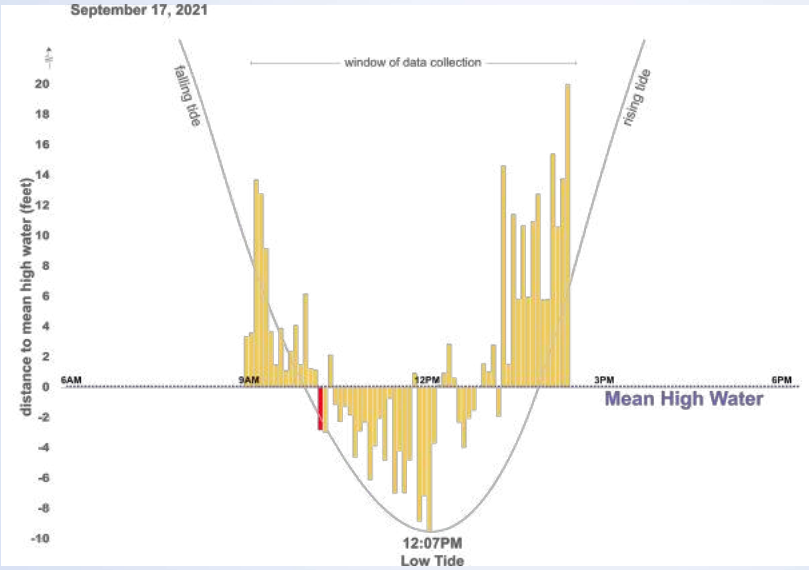


10:20 AM
MHW first becomes accessible (1 hr 47 min before low tide)

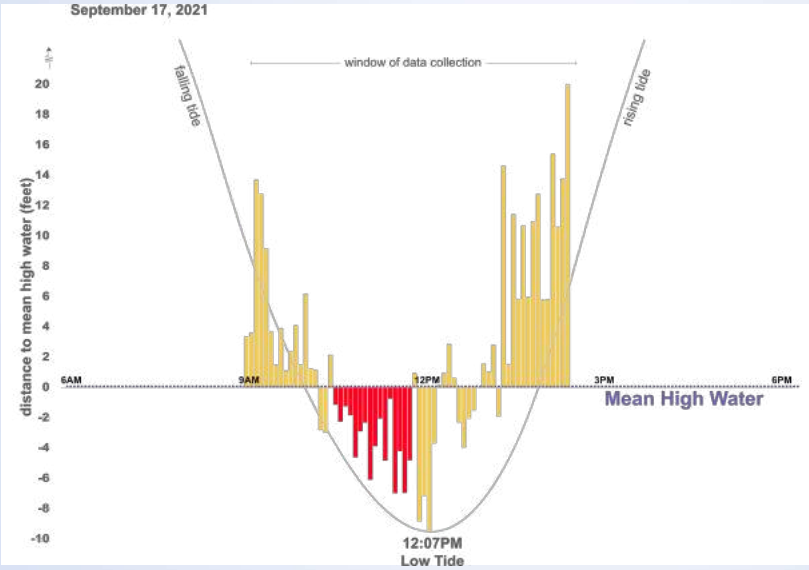
10:35 AM – 11:50 AM
Continuous access seaward of MHW (1 hr 15 min)

30 minutes
Beach width is 6 ft or greater below MHW

1:20 PM
MHW becomes inaccessible (1 hr 13 min after low tide)

33

Survey results



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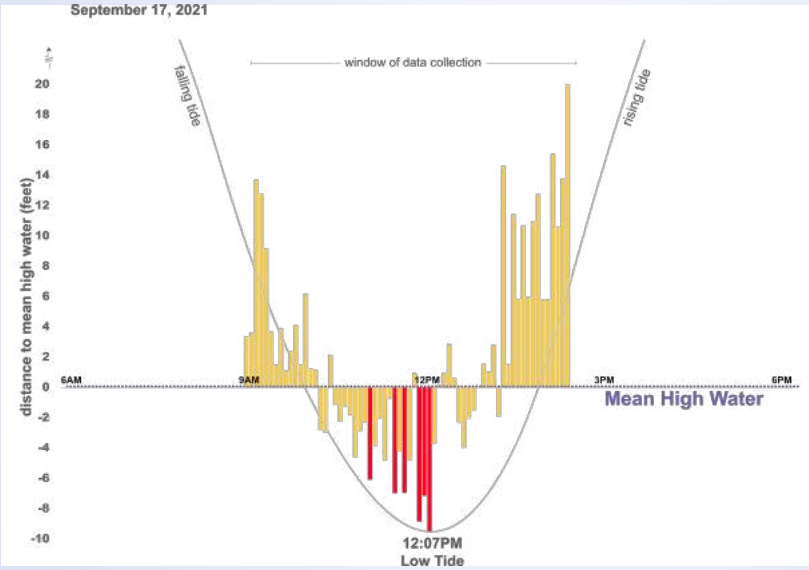

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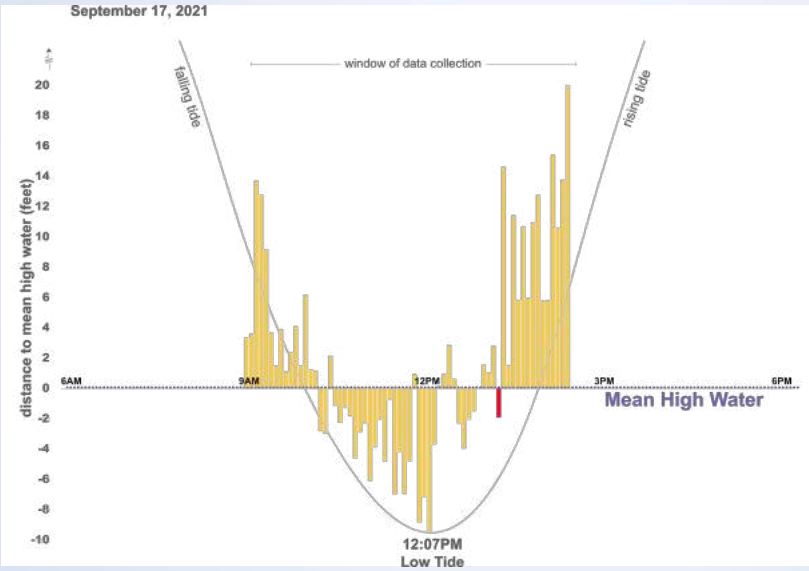

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Survey results

Date	*MHW Accessible*	*Continuous Access*	*"Walkable Beach" (>6 ft)*	*Offshore Wave Height (ft)*
July 15	2 hr 20 min	1 hr 30 min	0 min	2.5
August 18	4 hr 30 min	3 hr 45 min	2 hr 30 min	1.6
September 17	2 hr 15 min	1 hr 15 min	30 min	4.0

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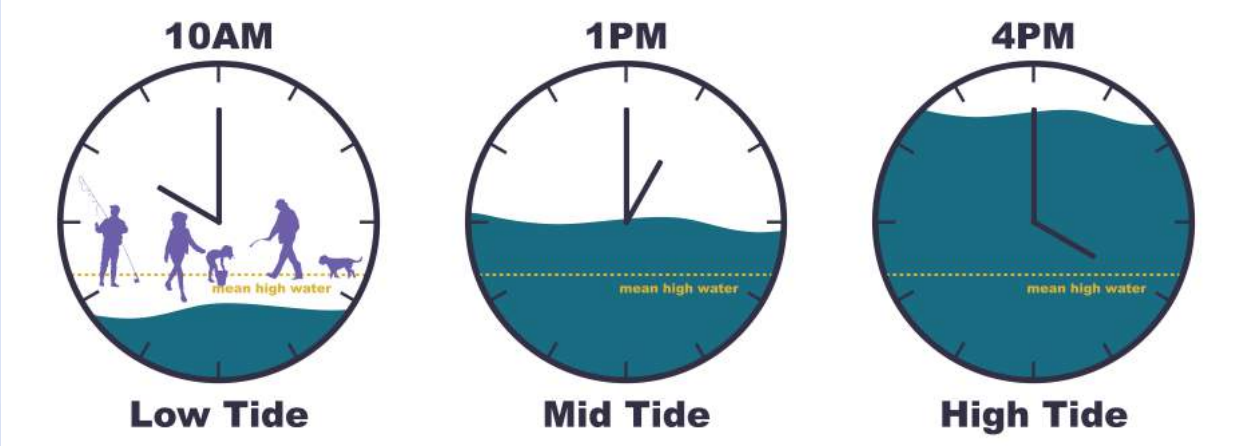
For how long can the public access the shore?



Our reality – at most, a few hours around low tide

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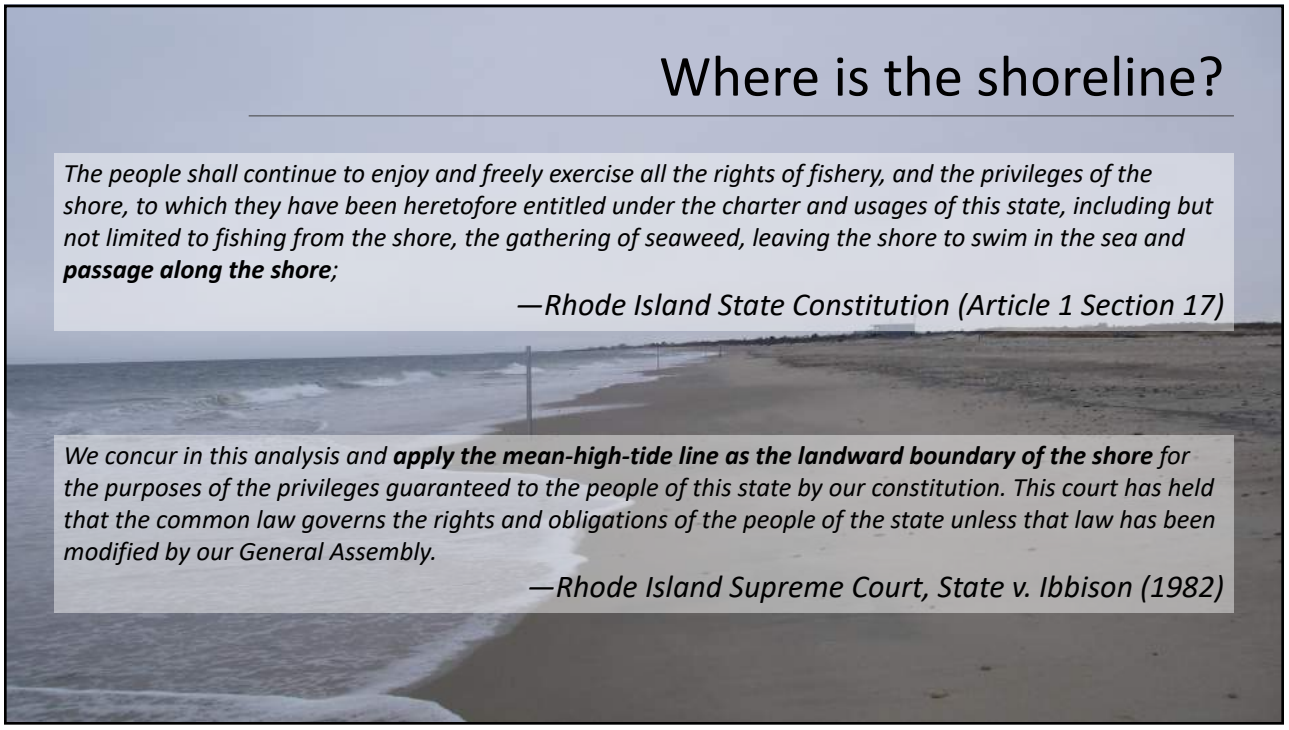
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