Barriers to Public Access on Rhode Island's Microtidal, Wave-Dominated Southern Shoreline

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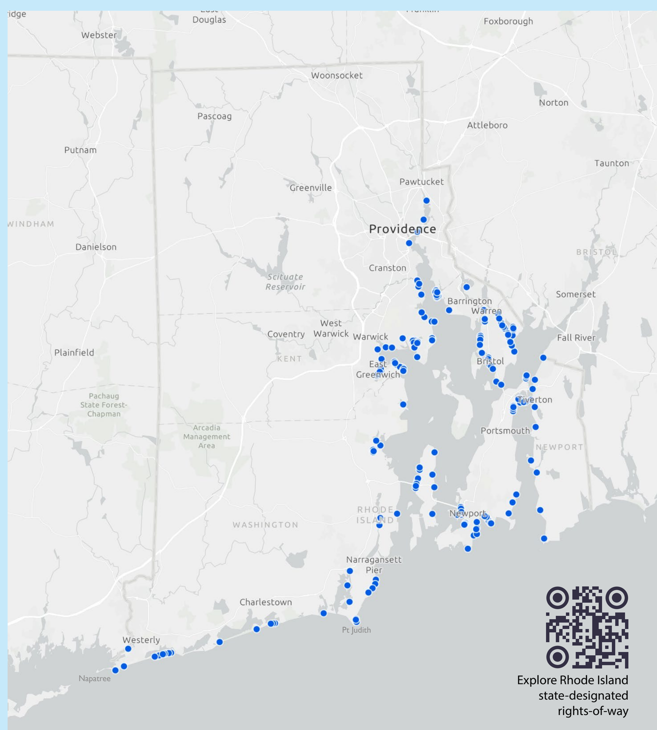
Introduction

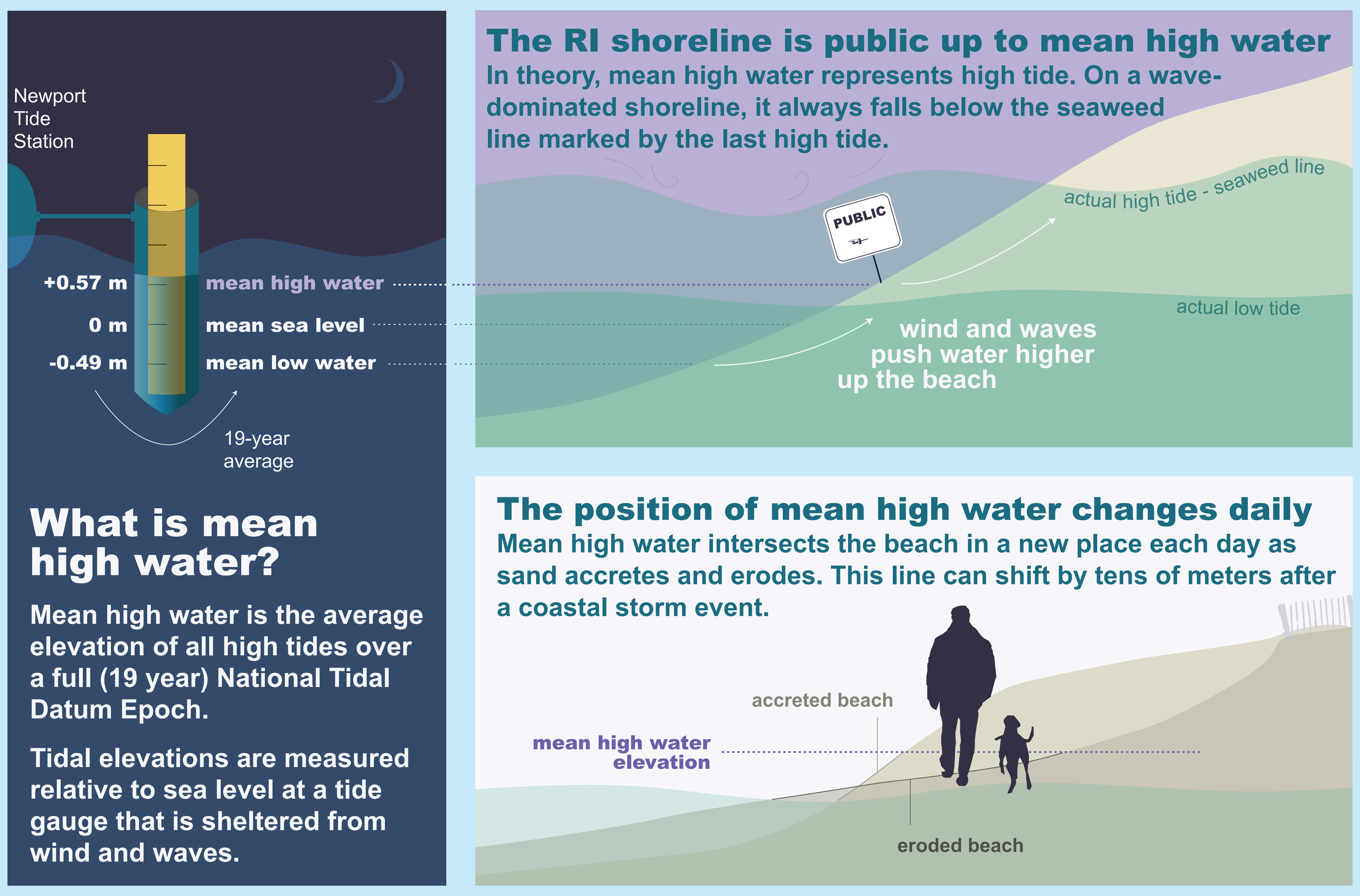


With over 90-percent of households living within a 20-minute drive of the coast, access to the Rhode Island shoreline is critical for the sustenance, livelihoods, recreational opportunities, and general quality of life of the state's residents. The right of the public to access the shoreline appears in the state's founding Charter (1663), which codified the *public trust doctrine* in Rhode Island – the notion that resources like the coastline are so important that they are held by the government in trust for the people's use. In fact, the RI state constitution gives all residents the right to access the shoreline for fishing, recreation, gathering seaweed, and other "shoreline privileges."

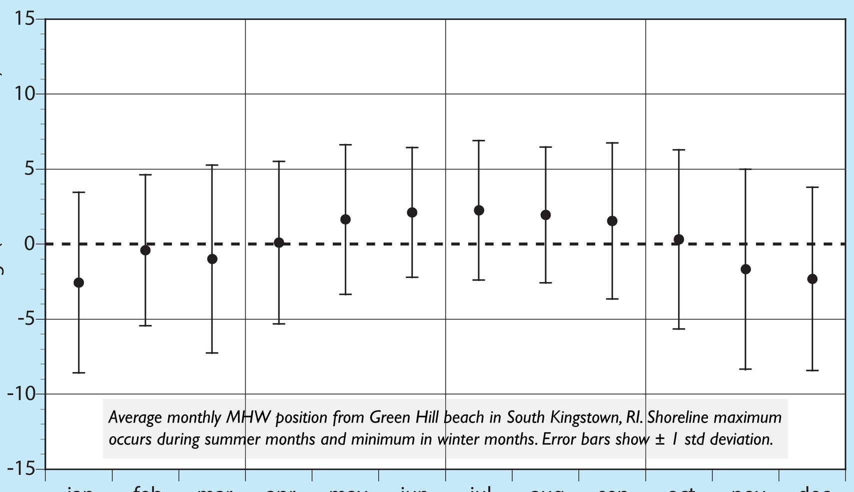
Public access is provided at over 230 state-designated rights-of-way (ROW)[1] and at hundreds of other locations managed for the public, ranging from narrow footpaths and boat ramps to beaches and fishing piers. In addition, the public has the right to alongshore passage for the entirety of Rhode Island's 400+ miles of shoreline below mean high tide.

What Do You Mean, Mean High Tide?

Rhode Island, like most coastal states, defines marine boundaries using tidal datums[2] – long-term averages of water level at particular phases of the local tidal cycle. In 1982, a State Supreme Court decision[3] established the mean high water tidal datum as the legal property boundary between public trust and private land in RI. ***Mean high water (MHW)*** is the arithmetic mean of all high water heights – two per day in RI – over the 19-year National Tidal Datum Epoch (currently 1983-2001). The MHW line is the location where the plane of MHW intersects the coastal profile. Seaward of this line, the public can exercise its constitutionally granted shoreline rights, including lateral passage. Landward, private property can be held.

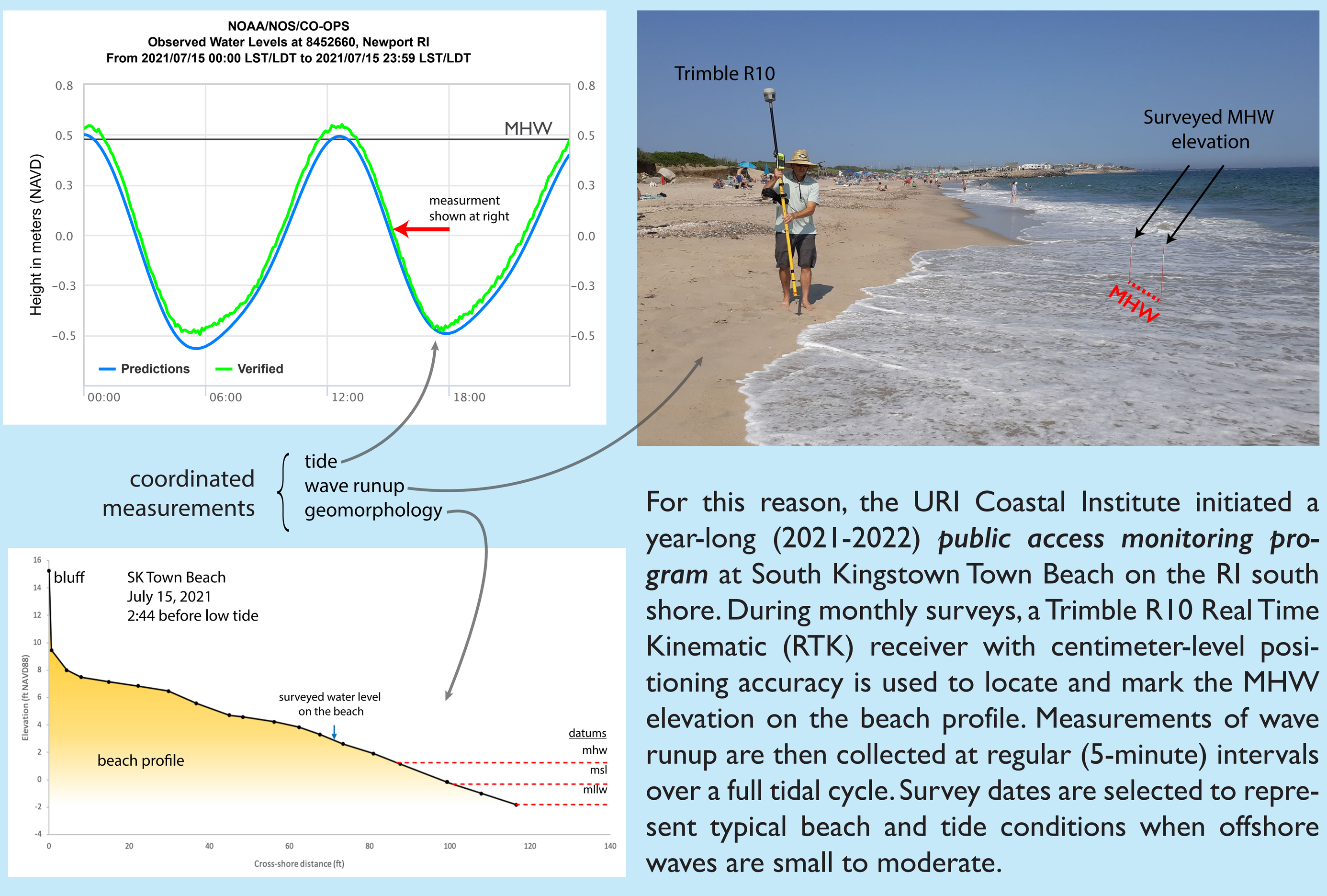


However, the application of tidal datums to define property boundaries in an environment like Rhode Island's south shore can be problematic for many reasons. The south coast is a microtidal, wave-dominated, mainland-segmented, barrier coastline[4,5]. The 33-km stretch between Point Judith and Napatree Point is comprised of a series of barrier spits that extend between till and glaciofluvial headlands. A series of shallow, shore-parallel, coastal lagoons are situated behind the barriers. Since 1962, URI has maintained a bi-weekly survey program to measure and quantify morphological changes along the south shore barriers. Regular cross-shore elevation profiling at eight survey transects has documented significant variability in the MHW line from week to week and after storm events, and a marked annual signal[6].



Tide-Coordinated GPS Surveys

URI's long-term beach profile records have been used in studies documenting morphological change and post-storm recovery processes[7]; seasonal and annually repeated patterns of accretion and erosion[8]; trends in alongshore sediment transport[9]; and offsets between datum-based and visible shoreline indicators[6,10]. However, transect surveying is rapid and therefore cannot quantify the extent to which public trust lands (*i.e.* below the MHW line) are accessible and alongshore passage is possible.

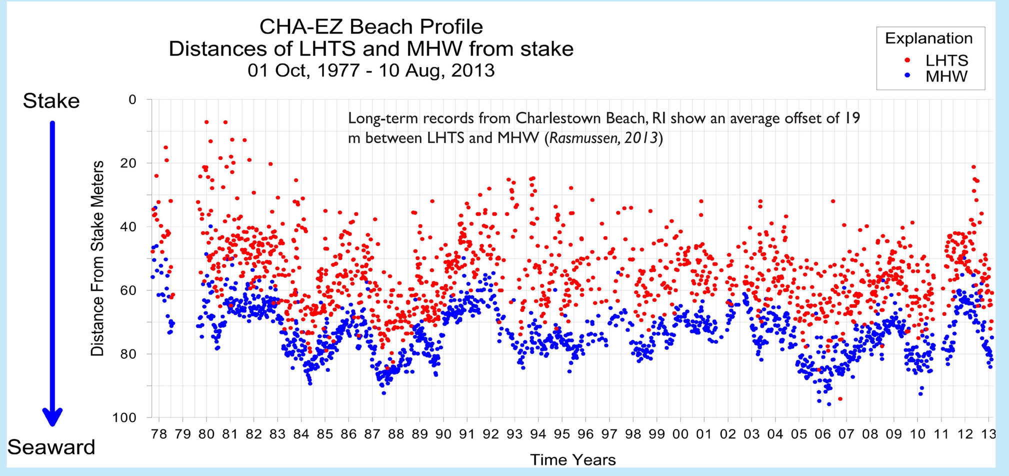


For this reason, the URI Coastal Institute initiated a year-long (2021-2022) ***public access monitoring program*** at South Kingstown Town Beach on the RI south shore. During monthly surveys, a Trimble R10 Real Time Kinematic (RTK) receiver with centimeter-level positioning accuracy is used to locate and mark the MHW elevation on the beach profile. Measurements of wave runup are then collected at regular (5-minute) intervals over a full tidal cycle. Survey dates are selected to represent typical beach and tide conditions when offshore waves are small to moderate.

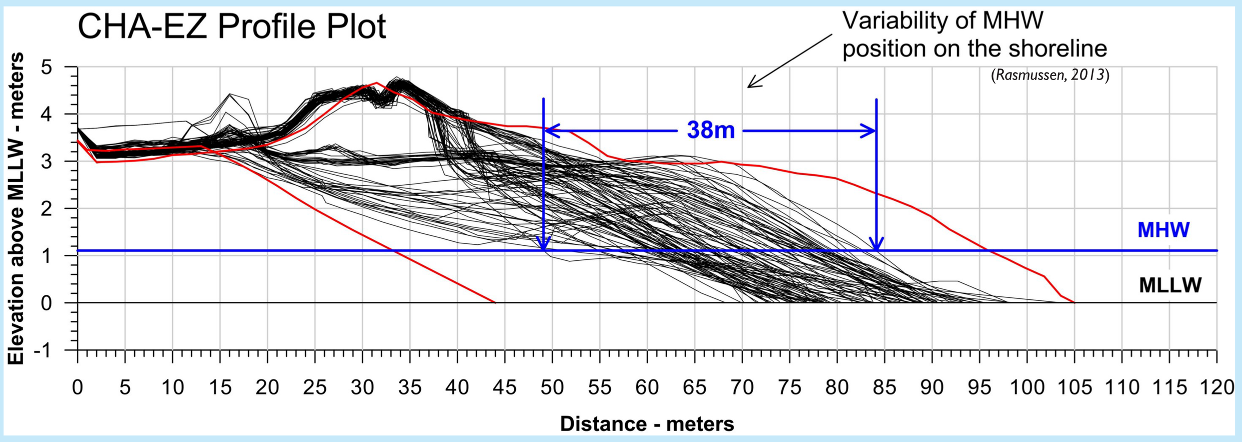
Obstacles to Lateral Access

Datum-based boundaries cannot be seen and are impossible to enforce.

MHW is a tidal elevation and must be located in real time with precise GPS surveying. It cannot be seen by the casual beachgoer and is not where the public has historically identified high tide. The seaweed line, or last high tide swash (LHTS) is a recognizable indicator of the extent of the most recent high tide. However, on the RI south shore the MHW line is always seaward of the last high tide swash with an average horizontal offset of 18-19 meters.



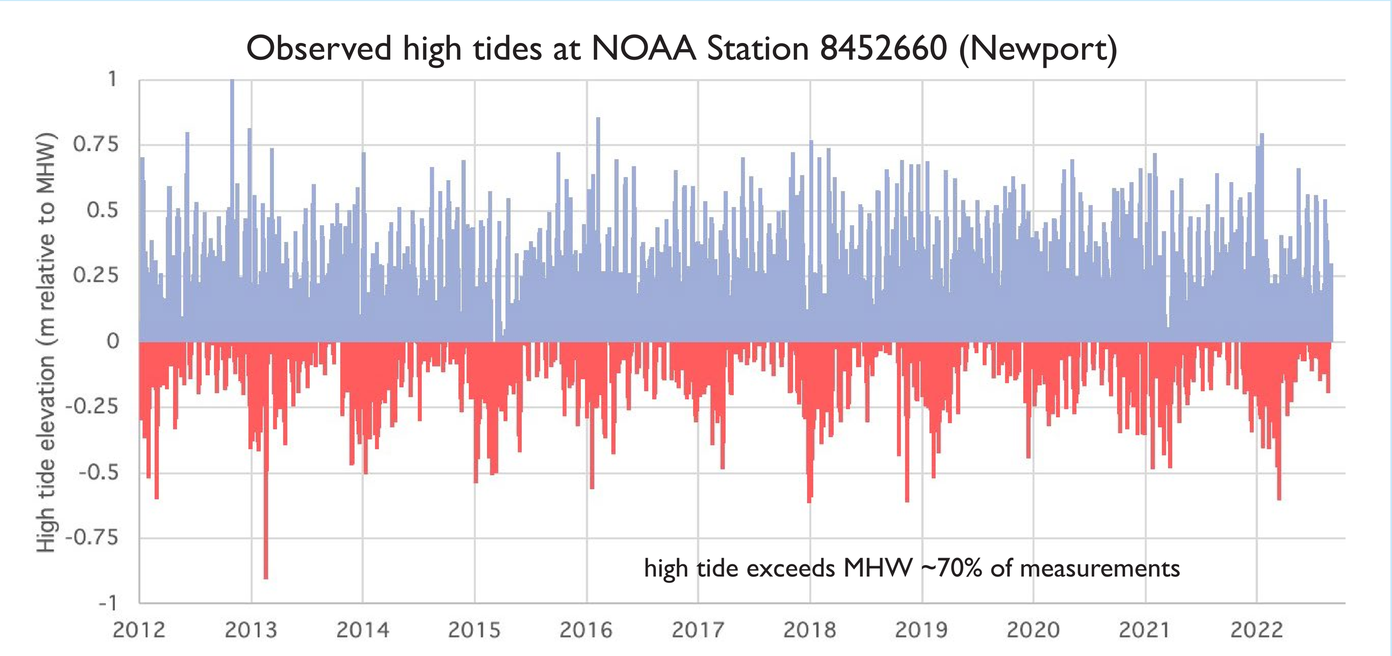
Beach profiles constantly evolve and so does the location of the mean high water line.



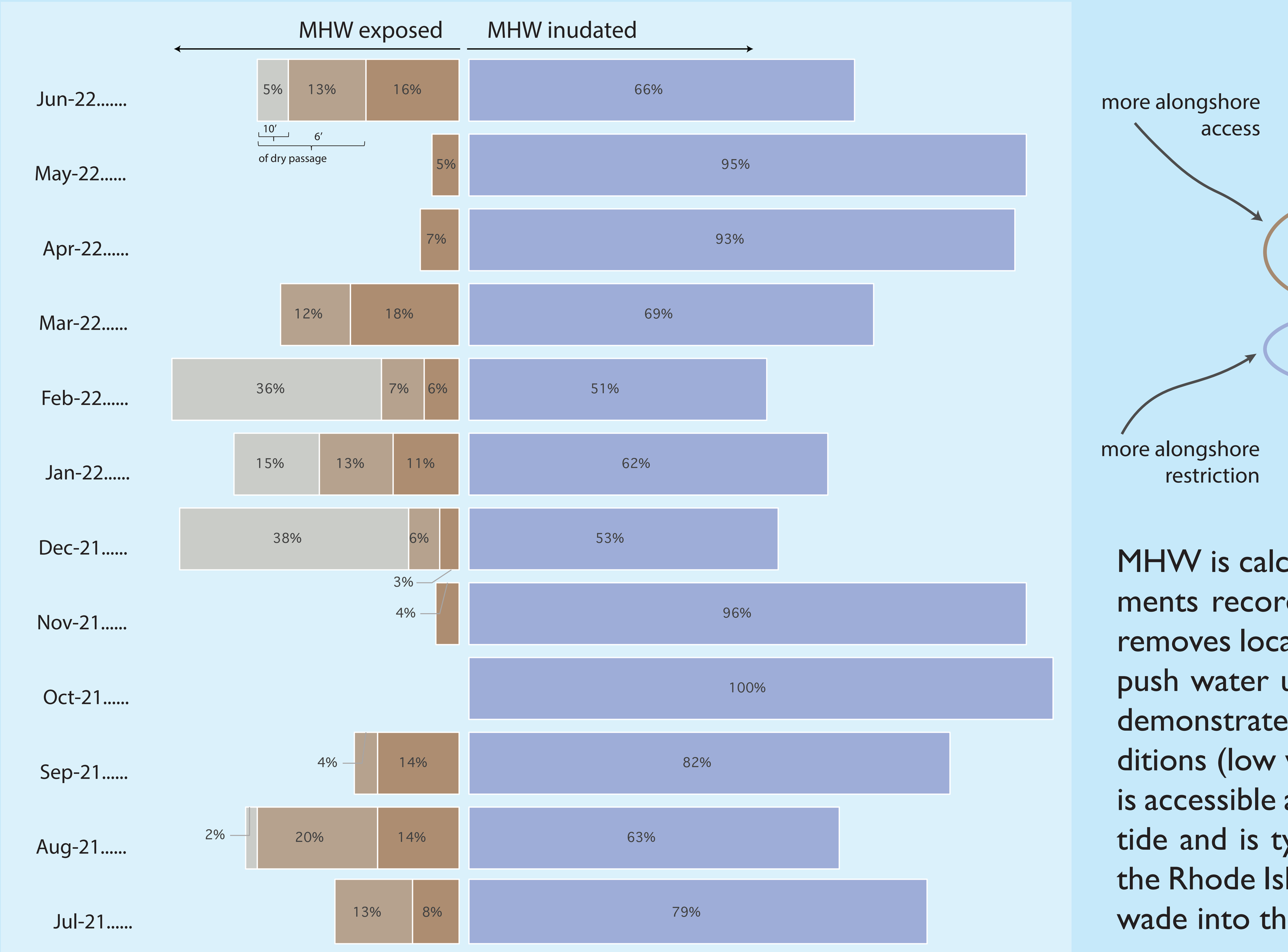
Even when the MHW line can be found and monitored with precise surveying equipment, its position is continuously changing as normal coastal processes like tides, currents, and waves transport and redistribute beach sediment. A two-year study of morphological changes in response to low wave energy conditions at the nearby Charlestown barrier spit found the intersection of MHW on the beach profile fluctuated by a total of 38 meters[10].

Tidal datum shorelines are backward looking. They do not reflect current sea level.

While tidal datums like mean high water can be calculated with precision, the calculations are based on past sea level measurements. The present National Tidal Datum Epoch (NTDE) used by NOAA relies on water levels recorded between 1983 and 2001. Since that time, relative sea level in Rhode Island has risen by approximately 16 cm. As sea levels change the existing NTDE becomes less accurate in representing tide conditions at coastal stations. This phenomenon is reflected in observed water levels from NOAA station 8452660 (Newport, RI), where high tide measurements are above MHW more often than not.



Rhode Island's public trust "lands" are mostly underwater.

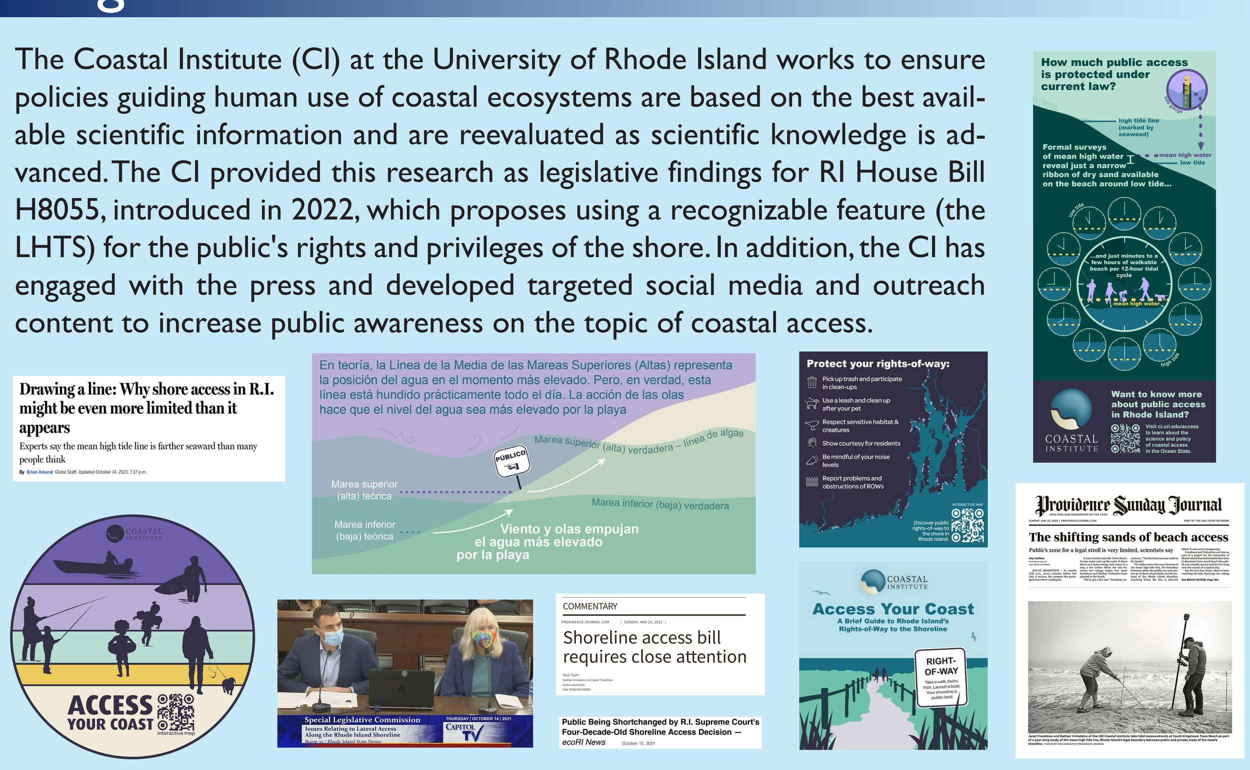


	Tide elev. (m MHW)	Hs (m)	Wind spd. (ms^{-1})	Wind dir.	Beach vol. (m^3)
Jun-22	*0.220*	*0.64*	*1.33*	*ENE*	*59.9*
May-22	*0.229*	*1.03*	*4.34*	*S*	*61.9*
Apr-22	*0.035*	*1.35*	*1.35*	*NE*	*57.8*
Mar-22	*-0.129*	*0.87*	*0.51*	*E*	*55.2*
Feb-22	*-0.093*	*1.27*	*7.52*	*S*	*52.4*
Jan-22	*0.061*	*1.02*	*2.42*	*W*	*51.4*
Dec-21	*0.013*	*2.17*	*4.57*	*WNW*	*40.9*
Nov-21	*0.117*	*1.88*	*5.54*	*W*	*46.8*
Oct-21	*0.341*	*1.01*	*5.33*	*SSW*	*69.0*
Sep-21	*0.007*	*1.32*	*3.67*	*NNE*	*66.6*
Aug-21	*0.011*	*0.47*	*3.17*	*SSW*	*66.2*
Jul-21	*0.068*	*0.74*	*3.91*	*SSW*	*64.8*

MHW is calculated from long-term water level measurements recorded inside a tide gauge, an instrument that removes local processes like wind and wave runup, which push water up the beach profile. RTK tide surveys have demonstrated that even under ideal environmental conditions (low wave energy, tides, and wind) the MHW line is accessible at most for a few hours on either side of low tide and is typically underwater for most of the day on the Rhode Island south coast. That means the public must wade into the ocean to legally walk along the shore.

Targeted Outreach

The Coastal Institute (CI) at the University of Rhode Island works to ensure policies guiding human use of coastal ecosystems are based on the best available scientific information and are reevaluated as scientific knowledge is advanced. The CI provided this research as legislative findings for RI House Bill H8055, introduced in 2022, which proposes using a recognizable feature (the LHTS) for the public's rights and privileges of the shore. In addition, the CI has engaged with the press and developed targeted social media and outreach content to increase public awareness on the topic of coastal access.



Acknowledgments

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