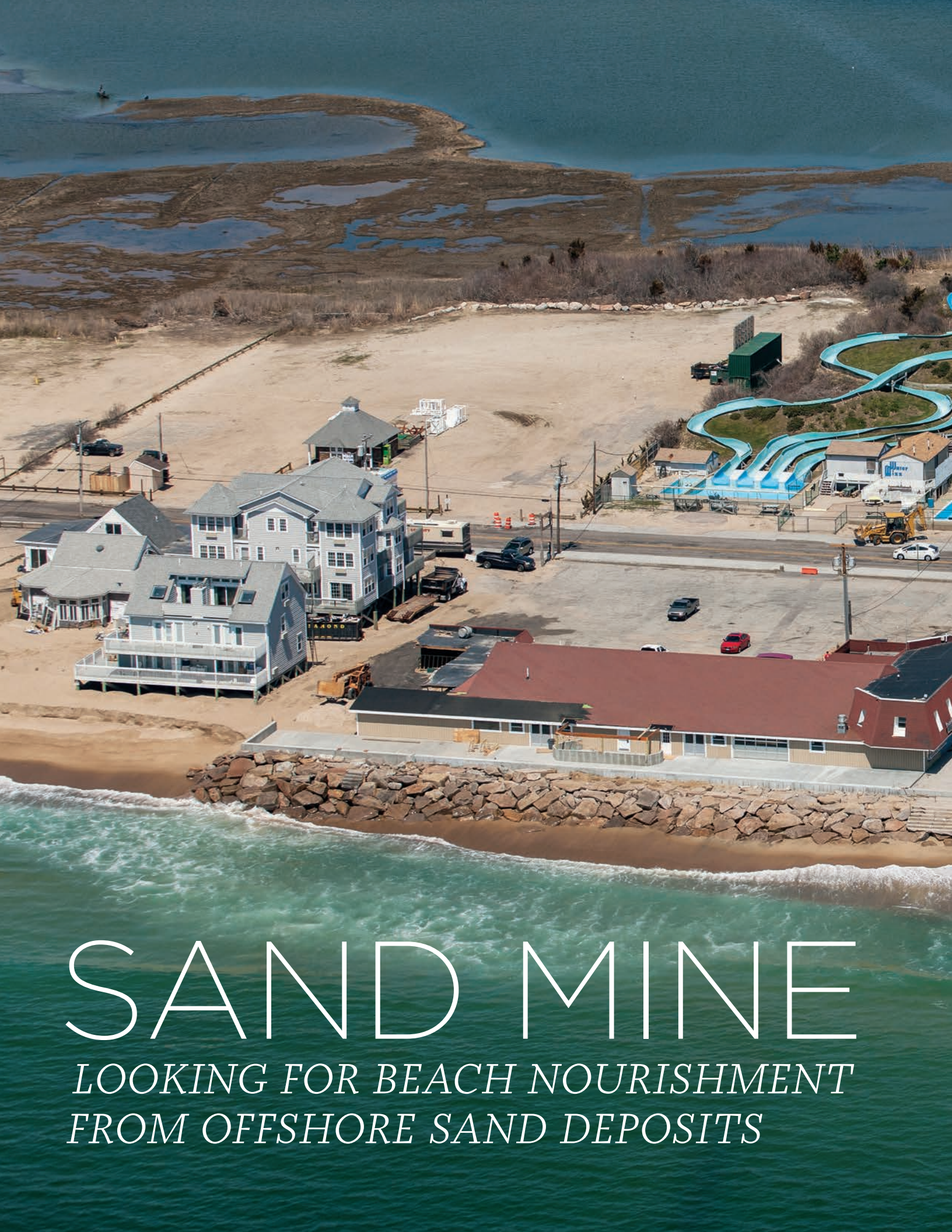
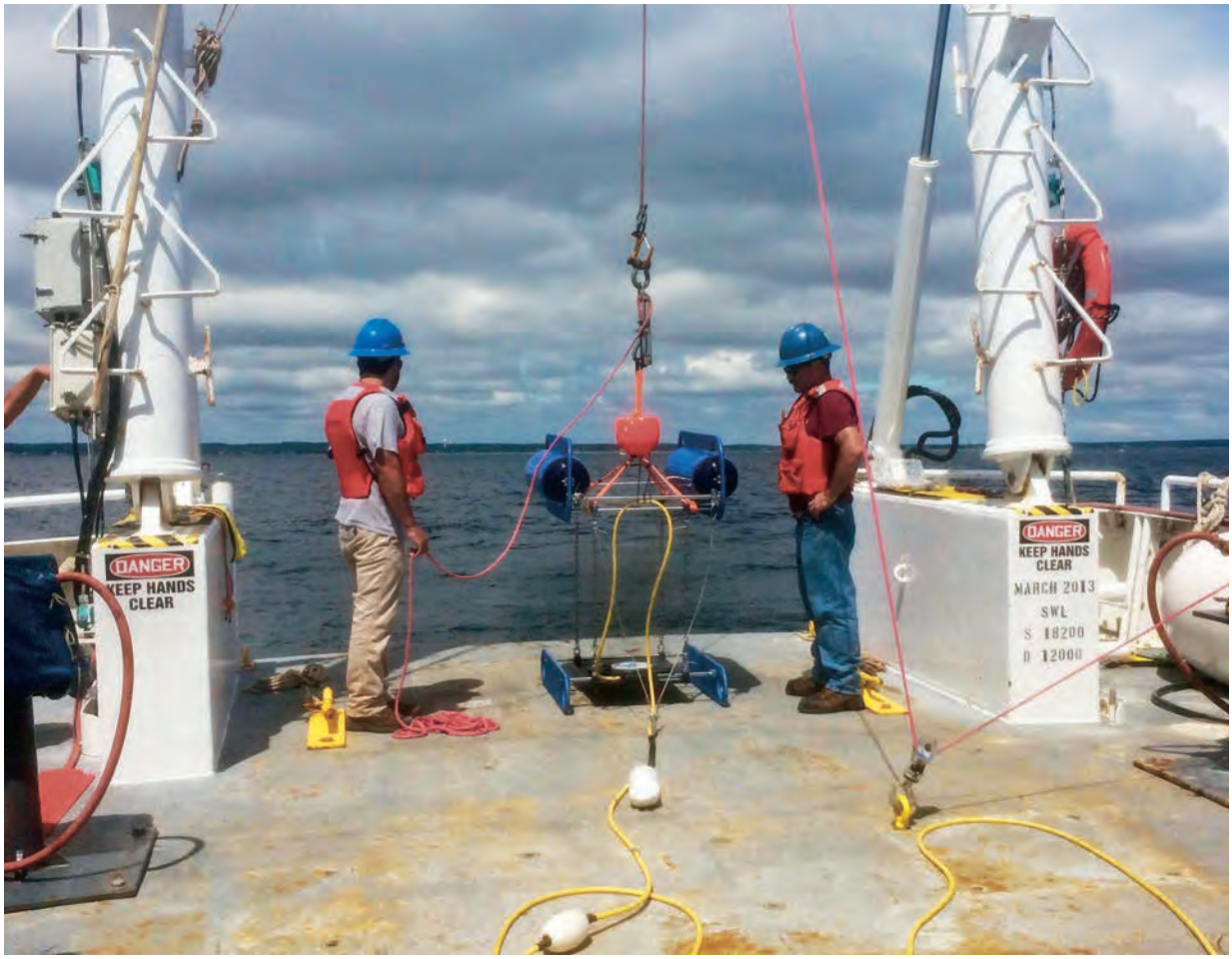


SAND MINE

LOOKING FOR BEACH NOURISHMENT FROM OFFSHORE SAND DEPOSITS

by **Meredith Haas**

Aerial photograph by **John Supancic**



Researchers prepare to deploy a seismic "bubble gun" to survey the sand and gravel deposits on the sea floor. This tool uses a low-frequency signal that can penetrate through coarse sand and gravel to produce high-resolution images of seafloor sediments. This method helps locate pockets of sand and determine their volume.

Since the frequency emitted from the bubble gun has the potential to disturb marine mammals, there is always an observer aboard to make sure there are no animals in the area.

After Superstorm Sandy in 2012, bulldozers, trucks, dredges, and barges were put to use hauling sand from every available source to restore beaches that protected waterfront properties and infrastructure, as well as critical habitats along the Atlantic coast. While Rhode Island was spared the worst as the storm turned toward New Jersey, the 5-foot storm surge and 15-foot waves still caused some hefty damage to exposed areas —primarily in Westerly, where the badly damaged Misquamicut State Beach was replenished in 2014 with more than 84,000 cubic yards of sand trucked in from an inland quarry in Charlestown. It was one the most extensive beach restoration efforts in Rhode Island and it most likely won't be the last one.

Rhode Island, however, is running out of sand and gravel options for similar large-scale projects in the future, says Grover Fugate, director of Rhode Island's Coastal Resources Management Council (CRMC). He explains that the state has moved to evaluate offshore sand resources as an option for beach restoration because while inland resources may be abundant, "a vast majority of sand and gravel assets are tied up in areas

that are either land trusts or state parks, which are unlikely to be tapped," he says.

Inland sources of sand can also be costly for large-scale beach replenishment efforts because each truck holds only a limited amount of sand, adds Jeffrey Waldner, an oceanographer with the Bureau of Ocean Energy Management's (BOEM) Marine Minerals Program, the federal agency charged with managing offshore development and mineral resources. The replenishment at Misquamicut alone required approximately 3,000 truckloads at a cost to the federal government of $3.1 million through Sandy relief funds. And inland sources of sand are sold at higher construction rates for a variety of uses beyond beach nourishment.

These problems affect not only Rhode Island, but all states along the Atlantic. In 2014, Rhode Island was one 13 states to sign a cooperative agreement with BOEM to map and identify offshore sand resources that could potentially be used for beach restoration projects. If enough sand deposits are identified and can be extracted (which is dependent on whether such a process would be harmful to the environment and/or conflict with other users of the area, such as fishermen) the costs for beach restoration could be significantly less. Dredging vessels, for example, can carry 2,500 to 5,000 times more cubic yards of sand than one truckload, and their use avoids the additional costs of damage to roadways from heavy construction vehicles carting sand along them.

"Offshore sand has a high upfront cost of $3 (million) to $5 million for mobilizing dredges, but it is cheaper long term," says Waldner. "When projects get big, all fingers point offshore. It's more economical."

Significantly more economical, according to researchers working with BOEM and CRMC to determine how much viable sand is in the federal waters adjacent to Rhode Island and how much sand the southern shore would need to be sustained.

"If you wanted to replenish 20 kilometers of shoreline (to the extent Misquamicut was), from Napatree to Point Judith, taking out the undeveloped stretches, you're adding about 1.3 million cubic meters of sand," says Bryan Oakley, a geoscientist at Eastern Connecticut State University, explaining that to replenish Rhode Island's southern coast at this level would cost about $60 million if using inland sand resources. "It would probably be around $25 million based on estimates on what it cost to get [offshore] sand in New Jersey."

But these numbers, according to Oakley, reflect estimates for the lower-end scenario regarding sand volume and costs, and do not account for the frequency of replenishment needed to keep pace with rising seas and erosion. Oakley notes that about 35 percent of the sand that was trucked in for Misquamicut has already been swept away over the course of two years without any major storms.

> "THE WORST TIME TO BE MAKING A DECISION IS RIGHT AFTER THE STORM"

"Replenishment doesn't work everywhere and, in most cases, doesn't work for very long," he says. "Sand wants to be where the sand wants to be, and the response of the shoreline is to move landward as storm surge pushes sand from the beach back onto the dunes, marsh, or whatever is behind it."

Despite the drawbacks, replenishment is the single most popular approach to deal with erosion because it's one of the few that are permitted, unlike hard structures, such as seawalls, Oakley says. But is there enough sand offshore for Rhode Island to potentially use if another Sandy, or worse, rolls around? According to geological oceanographer John King of the University of Rhode Island Graduate School of Oceanography, there is.

"We found a huge amount of sand out there that straddles the state line … It's probably enough sand for beach replenishment for quite a long time," says King, describing a deltaic deposit holding about 290 million cubic yards of sand 10 to 15 meters thick and several miles wide that formed from a river delta that used to dump into a glacial lake off the coast nearly 21,000 years ago. "If you compare the numbers, we are looking at 10 times the necessary sand for beach restoration [in Rhode Island] for the next decade."

This information will help the state to create an inventory of offshore sand and gravel assets to prepare for the next storm. "The worst time to be making a decision is right after the storm," says Fugate, explaining that there are multiple factors that need to be considered before extracting sand offshore, which shouldn't be done as a reaction to a disaster but as a response from a well-thought out plan. Now that the extent of the sand resource has been determined, Fugate says, "we move into the discussion phase about what the impacts are, who is affected, and should we be doing this?"