



Tara P. Marden, B.A., M.S.
Coastal Geologist

Expertise

Ms. Marden has more than 20 years of experience in the areas of coastal geology and coastal process evaluation. During the past five years, her focus at Woods Hole Group has been managing and implementing regional dredging and beach nourishment programs for local municipalities and private homeowners, often forging effective public-private partnerships. Ms. Marden works closely with the clients, regulators and contractors to ensure that every facet of the project, from the initial site assessment through design and permitting and ultimately construction, is successfully and seamlessly implemented. Ms. Marden is also involved in long-term monitoring for many of these projects.

During her tenure at Woods Hole Group, Ms. Marden has specialized in many projects related to tidal inlet and sediment transport processes, sand resource investigations for beach nourishment as well as design, permitting (local, state, and federal) and construction oversight for a myriad of coastal structure and bio-engineered projects. She is experienced with all facets of environmental impact analyses, ranging from the collection of field data to engineering design, alternatives analyses, and design for mitigation. Ms. Marden also has experience in the use of GIS technology to display and analyze spatially-related data for coastal and marine mapping projects.

Qualification Summary

- 20 years experience in coastal and geologic processes evaluation.
- Specializes in managing and implementing multi-faceted dredging and beach nourishment programs for local municipalities and private homeowners.
- Specializes in all facets of environmental permitting at the local, state, and federal levels.
- Experienced with all facets of environmental impact analyses including field data collection and alternatives analyses, engineering design and mitigation planning.
- Experienced with the design, permitting and installation of bio-engineered alternatives for dune and bank stabilization.
- Responsible for design, permitting (local, state, and federal) and construction oversight for a myriad of coastal structure projects.
- Manages multi-disciplinary coastal and marine projects requiring team management, scientific analysis, environmental sensitivity, diverse coordination, and cost-effective solutions.
- Strong written, communication, and organizational skills including expert testimony

Education

M.S., Geology -1999 UNC at
Wilmington
B.A., Geology – 1996
Northeastern University

Professional Affiliations

The Geological Society of
America (GSA)
American Shore and Beach
Preservation Association
(ASBPA)

Work Experience

1999-Present Woods Hole Group,
Inc.
1996-1999 University of North
Carolina at
Wilmington’s Center for
Marine Science
Research
1994-1996 Camp, Dresser &
McKee, Inc.

**Publications and
Presentations:**

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Key Projects

Field Data Collection, Engineering Design and Permitting for the Town of Edgartown's 10-year Comprehensive Permit, Edgartown, MA – Project Manager

The Town of Edgartown has innovatively set the stage for the Federal Comprehensive Permit process for Coastal Municipalities within Massachusetts, with the acquisition of an interchangeable permit for dredging and beach nourishment at thirty-nine different sites within the Towns of Edgartown and Oak Bluffs. With many coastal communities still very much site-specific/project orientated, the Town of Edgartown took a risky but successful approach to the federal permit process for its local dredging and beach nourishment program. The Town invested the time and money, with the help of private contributions, to acquire a Town-wide Ten-year Comprehensive Permit from the Army Corps of Engineers as well as numerous State and Town agencies, for a blanket permit that allows compatible dredged material from any of the fourteen historic dredge sites to be placed on any one of the twenty five disposal sites within the Town, and several additional sites in Oak Bluffs. This flexibility provided by this multi-jurisdictional comprehensive Federal permit is unprecedented.

Woods Hole Group, Inc. was contracted by the Town of Edgartown Dredge Advisory Board to collect field data, perform engineering design, and prepare the application for the Ten-year Comprehensive Permit. Bathymetric surveys were performed at fourteen (14) different dredging locations and topographic surveys were conducted at twenty-five (25) beach nourishment locations. Engineering drawings were produced for each site, many of which incorporated special requirements for rare and endangered species habitat. Fifty (50) vibracores and forty (40) grab samples were collected within the various footprints and grain size analyses were performed on over 100 samples to characterize the depositional environments. A total volume of approximately 248,000 cubic yards of sediment will be hydraulically dredged from navigation projects within the two Towns over 10 years, with beneficial reuse of the dredged material at various beach nourishment locations. The Comprehensive Permit is designed to provide flexibility by allowing dredge material from any of the dredge sites to be placed at any of the compatible beach nourishment sites.

As no single navigational source will ever provide sufficient sand volume necessary for the ongoing regional program which includes much needed beach nourishment at the Towns most densely used public beaches and with narrow dredging windows due to fisheries restrictions, the option for combining dredging sources from around the Town has been integral to getting high-profile, public benefit projects done with private monies over the past two years. The process of designing and permitting thirty-nine sites under one comprehensive permit has been complex, but the results are already being realized throughout the coastal community and will greatly benefit the municipalities and the public and private stakeholders for years to come.

The measures implemented to prevent scour and bank slumping included installation of eight (8) terraced biodegradable sand-filled coir envelopes at the toe of the bank, stabilized by 12-inch piles, stacking of four (4) coir fiber rolls above the sand envelopes, annual beach nourishment, and restoration of the coastal bank with high-density plantings of Cape American beach grass (*Ammophila breviflorata*). The project was successfully constructed during the winter and spring of 2011, and is the largest project of its kind to have been permitted and built on Cape Cod to date.

Improving the Coastal Resilience of Popponesset Spit and Bay, Mashpee, MA – Project Manager

Save Popponesset Bay received funds through the MA Coastal Zone Management Green Infrastructure for Coastal Resilience Grant Program, to improve the coastal resilience of the publicly accessible beach on Popponesset Spit, which suffers from a sand deficit, is eroding and experiences overtopping during even moderate storms. Woods Hole Group was contracted to evaluate and design a preferred alternative green infrastructure solution for restoration of the Spit, which is predominantly owned by Save Popponesset Bay but also by Mass Audubon. The scope of work includes design alternatives for dune restoration, beach nourishment and improvement dredging. Preliminary analysis by Woods Hole Group indicates ~25,000 and

Key Projects (cont.)

100,000 cubic yards of sand are required to restore the dunes and beach respectively. Both upland sand and sand dredged from various navigation channels is expected to be suitable, and is being investigated with Grant funding. Design considerations for improving the functionality of the main navigation channel in the Bay, including making it wider, deeper or longer, which could help maintain the navigation channel longer into the season, improve safety and reliability, and provide a sediment source for the beach nourishment, is being evaluated. Engineering design plans and specifications will be developed for the recommended beach nourishment, and dredging alternative, if applicable. The project will be advanced through the permitting stage.

Green Infrastructure for Coastal Resilience on Barges Beach, Cuttyhunk, Town of Gosnold – Project Manager

Cuttyhunk Island is a small, remote island located within the Town of Gosnold, ~12 miles off the southeastern coast of the MA. Cuttyhunk is the farthest island in the unique 16 mile long Elizabeth Islands chain that extends southwest from Woods Hole and separates Buzzards Bay to the north from Vineyard Sound to the south. Cuttyhunk Harbor and adjacent Barges Beach, the barrier spit that delineates the right margin of the channel, have become a precious beach and boating resource for many commercial mariners, recreational boaters and tourists. Cuttyhunk channel provides the only means of access to and from Cuttyhunk Island, and is the life-line to the mainland for the delivery of critical material and equipment, especially oil for heat and electricity. An open channel is also essential for emergency transport to the mainland and emergency shelter for mariners. Over the past twenty years, severe winter storms have caused significant overwashing of Barges Beach, causing the barrier to become extremely low and vulnerable and allowing sand, cobble, and rocks to frequently wash into Cuttyhunk Channel making navigation hazardous. Despite ongoing efforts by the Town and the ACE to stabilize the Barges Beach and protect the Federal Channel and Harbor of Safe Refuge, navigation is imminently threatened and the barrier beach is in a fragile condition.

Woods Hole Group was contracted by the Town of Gosnold to implement the Green Infrastructure for Coastal Resilience on Barges Beach project that was funded through a MA Coastal Zone Management Green Infrastructure for Coastal Resilience Grant. Woods Hole Group performed a comprehensive coastal processes analysis utilizing the spectral wave model STWAVE Version 4.0 (Smith, Sherlock, and Resio, 2001), developed by the U.S. Army Corps of Engineers Waterways Experiment Station, and a process-based sediment transport model to determine regional sediment transport trends in the presence of time-variable (in direction and height) waves. The data that was generated from the coastal processes analysis were used to design several green infrastructure design alternatives. The SBEACH model was used to simulate cross-shore beach, berm, and dune erosion produced by storm waves and water levels on each of the alternatives and a preferred alternative was chosen based on the results. An engineering design for the preferred beach nourishment and dune restoration was drafted using a combination of sand, gravel and cobble. The project is currently being reviewed by the regulatory agencies in MA.

The Town of Gosnold intends to implement this nature based solution to improve the coastal resilience of the publicly accessible Barges Beach which will dramatically improve storm damage protection, wildlife habitat restoration, safe, reliable navigation, and recreation. Improving the coastal resilience of Barges Beach provides immeasurable environmental, recreational, and economic benefits to the Gosnold community and the Commonwealth. Stabilizing the beach will also result in less overwash and siltation into the Harbor, which also means protection of that fragile ecosystem. For the residents of Cuttyhunk Island, it will help to assure a sustainable year-round community with significant economic and public safety benefits.

Key Projects (cont.)

Bio-engineered Coastal Bank Stabilization, Bayswater Seaside LLC, New Seabury Mashpee, MA – Project Manager

Woods Hole Group was contracted to design, permit and oversee construction of a large bio-engineered coastal bank stabilization project at Bayswater Seaside LLC properties in the ocean front community of New Seabury, Mashpee, MA. Three waterfront parcels in this development have experienced long-term erosion rates of approximately one to two feet per year (1845-1994), but recent storms and end-effects from nearby revetments have exacerbated the erosion rate to approximately 10 feet per year over the past decade. Property owners have been nourishing the beach and steep coastal bank since the 1980s, but recent nourishments of 20,000 cubic yards annually along the 250-foot shoreline made apparent the need for a more sustainable and cost-effective solution.

Due to regulatory restriction prohibiting a traditional “hard” coastal engineering structure on the undeveloped parcels, an innovative and effective bio-engineered solution was designed to protect the toe and upper portions of the bank. The bio-engineered design was accepted by the Town and Massachusetts.

DEP as an appropriate “soft” solution design, and thus was permissible for the site for erosion protection in accordance with the State and Local Wetland Regulations. High-energy wave impacts were a complicating factor at the site that factored into the design. Most soft solutions have been found effective in low impact sites, but the nature of this site demanded a more robust solution to withstand wave and debris forces at the site.

Chapin Beach Erosion Management Plan, Dennis, MA – Project Manager

Accelerated beach erosion heightened concerns about the disappearance of Chapin Beach, a dynamic barrier beach and an important public asset within the Town of Dennis, MA. After major storms resulting in particularly severe erosion in 2009 and 2010, the Town of Dennis was interested in exploring both short and long term solutions for erosion management in the area. To address this concern, Woods Hole Group, Inc. was contracted by the Town of Dennis to complete an Erosion Management Plan for Chapin Beach, which investigated the causes of erosion, evaluated alternatives for managing the ongoing erosion, and presented management recommendations for the Town’s planning purposes.

The Erosion Management Plan identified priority areas of concern, proposed and evaluated erosion control alternatives based on effectiveness, cost and longevity, and provided a review of the regulatory process and required permits for the erosion control alternatives discussed.

To define and describe the existing conditions of Chapin Beach, Woods Hole Group performed historical background document research, completed a GIS-based shoreline change analysis, and utilized engineering and coastal processes models to adequately describe the existing conditions and sediment transport processes at the site. This information was then used to guide the selection and evaluation of the various erosion management alternatives. To evaluate the different options, Woods Hole Group incorporated feasibility, cost, effectiveness, longevity, impact to natural resources, and regulatory and permitting concerns to rank the potential success for each option.

Regional Dredging and Beach Nourishment Planning, Design, Permitting and Oversight Edgartown, MA – Project Manager

The Edgartown Beach and Dune Restoration project on Martha’s Vineyard is an example of a successful private/municipal partnership, where vital private funding revived the Town’s dredging and beach nourishment program, to restore local beaches. With much needed economic support provided by the private Cow Bay Corporation to the Town of Edgartown, a public/private partnership between the two entities was established in 2007, and a \$4M regional nourishment project began to restore the badly eroded County, Town, and private beaches located in Edgartown. The project was designed to beneficially reuse

Key Projects (cont.)

dredged sediments from local navigational projects to provide safe boating in navigable waterways within the Town and to keep the private beaches private by using municipal navigation dredge spoils for nourishment.

As no single navigational source would provide sufficient sand volume necessary for the regional program, and with very narrow dredging windows due to marine fisheries restrictions, the project was phased and a detailed investigation of navigational sources of sand for the beach nourishment ensued. Phase I of the Edgartown Beach and Dune Restoration project was initiated in October of 2009 and included dredging, dewatering, barging, trucking and grading of 30,000 cubic yards of sand. The beach compatible sand was placed along a 3,140-foot stretch of shoreline to reconstruct the almost non-existent dunes on the public Bend in the Road and private Cow Bay Beaches.

During the summer of 2010, the neighboring Town of Oak Bluffs, undergoing financial hardship and anxious to perform dredging within their navigation channel in Sengekontacket Pond, joined the municipal/private partnership with the Town of Edgartown and the Cow Bay Corp. The partnership expedited Phase II of the project by allowing use of a combination of dredged sand from both Towns and upland sand barged from off-Island to meet the design template. Construction commenced in October of 2010 and the 100,000 cubic yard regional beach nourishment project was finished in March 2011.

Each Phase of this multi-faceted project required daily communication with various Town of Oak Bluffs and Edgartown departments, the Edgartown Dredge Advisory Board, numerous contractors and project stakeholders, and various state and federal regulatory agencies. The complexities associated with design, permitting and coordination of this project was complex, but the results greatly benefit storm protection, recreation, and wildlife habitat.

This beach nourishment project was recently awarded one of five National Best Restored Beach awards from the American Shore and Beach Preservation Association.

Sylvia State Beach Management Plan, Martha's Vineyard, MA – Project Manager

Woods Hole Group worked with a coalition of stakeholders under the auspices of the County of Dukes County to prepare a Beach Management Plan for Joseph A. Sylvia State Beach on Martha's Vineyard. State Beach is one of the most heavily used public beaches on the island. The beach is located on a barrier beach, which contains two structured inlets that connect Sengekontacket Pond to the open waters of Nantucket Sound. The narrow barrier beach is also the site of a state highway that provides a primary access route between two of the largest towns on the island. State Beach is owned by the Massachusetts Department of Conservation and Recreation, managed by the County of Dukes County, and regulated locally by the Towns of Edgartown and Oak Bluffs. Portions of the beach also provide habitat to threatened and endangered species of shorebirds.

Woods Hole Group worked with stakeholders and members of a Barrier Beach Task Force to develop the Management Plan and to provide recommendations for long-term management that balances interests of the stakeholders. Recommendations for monitoring beach response through profiling, digital photography, and bathymetric surveys were developed. On-going activities associated with routine maintenance of the beach, such as planting, fencing, and beach access, were reviewed and recommendations provided for improved management. Opportunities for beach and dune restoration were examined, as were activities associated with education, outreach, enforcement, and fund raising. A component of the Management Plan also included strategies for emergency response following a major storm event. Recommendations for a number of emergency preparedness action items were developed. Points of contact for responsible officials, local contractors, and materials suppliers were developed as part of the emergency preparedness activity. In addition, a range of possible emergency response actions based on extent of storm damage was examined. The purpose of developing the emergency response strategy was to expedite roadway protection as well as beach and/or dune restoration following a major storm event.

Key Projects (cont.)

Triton Way Homeowners Environmental Permitting and Revetment Repair – Project Manager

During the past twenty years, WHG has been serving individual homeowners along Triton Way, Mashpee, MA with environmental permitting and revetment repairs for a number of individual shore protection structures. WHG maintains the proper permits including local Orders of Conditions, and state and federal licenses to ensure that a number of individual clients whose homes are situated at the top of a coastal bank, along a severely eroding shoreline of Nantucket Sound, are always in compliance. In addition, WHG is responsible for performing quarterly site inspections at each of these properties and coordinating revetment repairs as necessary with local contractors, as well as lining up access agreements with adjacent homeowners and developers. WHG performs also the construction oversight during repairs and yearly beach nourishment.

Dune Restoration Design – South Shore of Long Island, New York – Project Manager/Coastal Geologist

WHG has performed a number of coastal damage assessments for individual homeowners along the southern shore of Long Island, New York. Many of these included an analysis of storm damage protection ability of the existing coastal dune using the numerical model EDUNE. The purpose of the modeling is to identify the level of protection afforded by an existing dune during 10-, 50- or 100-year storms and to develop design specifications for the coastal dune that would result in enhanced storm damage protection and flood control. WHG defines the appropriate width and height of the dune and calculates the volume of fill required for the restoration. WHG also makes recommendations for planting and sand fence placement.

Publications and Presentations

Marden, T.P. 2015. “Case Studies and Lessons Learned” EJP Coastal Erosion Control Workshop, Edgartown, Massachusetts

Marden, T.P. 2015. “Green Infrastructure for Coastal Resilience Grants Pave the Way for Barrier Beach Restoration on Cuttyhunk Island and Popponesset Spit, MA” American Shore and Beach Preservation Association National Coastal Conference, Abstracts With Programs, New Orleans, Louisiana

Marden, T.P. 2014. “Innovative Cobble Berm Design to Combat Erosion and ‘Create Living Shoreline” American Shore and Beach Preservation Association National Coastal Conference, Abstracts With Programs, Virginia Beach, Virginia

Marden, T.P., and L. Weishar. 2013. “Engineers versus Regulators...the Ongoing Coastal Debate” American Shore and Beach Preservation Association National Coastal Conference, Abstracts With Programs, South Padre Island, Texas

Marden, T.P., and L. Weishar. 2012. “If you share permits, you can share sand, The Federal Comprehensive Permit Process, Edgartown, MA”, American Shore and Beach Preservation Association National Coastal Conference, Abstracts With Programs, Sand Diego, California

Marden, T.P. 2011. Martha’s Vineyard Beaches Restored Through Successful Public/Private Partnership”, American Shore and Beach Preservation Association National Coastal Conference, Abstracts With Programs, New Orleans, Louisiana

Marden, T.P. 2010. “Public/Private Partnership for Dune Restoration at Cow Bay, Martha’s Vineyard, MA. Florida Shore and Beach Preservation Association National Coastal Conference, Abstracts With Programs, Clearwater Beach, Florida

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- Marden, T.P.. 2009. "EIR Preparation for Sengekontacket Pond Beach Nourishment Analysis and Engineering Design, Edgartown, MA." Northeast Beaches Conference, Woods Hole, MA
- Marden, T.P., D. FitzGerald, I. Buynevich, C.D. Johnsen, and A. Knierim. 2004. "State-of-the-Art Animation Depicts the Evolution of a Historical Inlet, Georgetown County, SC." Geological Society of America Abstracts with Programs, Washington, D.C.
- Cleary, W.J., D. FitzGerald, I. Buynevich, T.P. Marden, A. Knierim, and D. Doughty. 2004. "Inlet-Associated Marsh Island, North Inlet, South Carolina." Geological Society of America Abstracts with Programs, Washington, D.C.
- Marden, T.P., D. FitzGerald, I. Buynevich, C.D. Johnsen, E. Pendleton, M.L. Fields, and M. Rits. 2003. Delineation of Historical "New Inlet", Debidue Island, SC. Proceedings of the Coastal Sediments 2003 Conference, Clearwater Beach, Florida. 16 p.
- Marden, T.P., D. FitzGerald, I. Buynevich, C.D. Johnsen, E. Pendleton, and M.L. Fields. 2001. "Identification of a Paleo-tidal Inlet Using Ground-Penetrating Radar and Sediment Cores, Debidue Island, SC." Geological Society of America Abstracts with Programs. Boston, MA.
- Marden, T.P., D. FitzGerald, I. Buynevich, C.D. Johnsen, E. Pendleton, M.L. Fields, and J.R. Tabar. 2002. Delineation of Historical "New Inlet", Debidue Island, SC." Proceedings of the National Conference on Beach Preservation Technology Conference, Biloxi, MS. 17 p.
- Marden, T.P., M.L. Fields, and K.F. Bosma. 2000. "Using GIS as a Tool for Managing Coastal Systems: Two Case Studies." Florida Shore and Beach Preservation Association, Abstracts with Programs, Sanibel Island, Florida.
- Cleary, W.J., T.P. Marden, C.W. Freeman, and M. Sault. 2000. Inlet Related Management Issues in Southeastern North Carolina, USA, Symposium on Brazilian Sandy Beaches, Morphology, Ecology, Uses and Resources, UNIVALI, 23 p.
- Marden, T.P. 1999. "Holden Beach, North Carolina: Historic and Contemporaneous Barrier Island and Inlet Changes." Master's Thesis. The University of North Carolina at Wilmington, Wilmington, NC. 75 p.
- Marden, T.P. and W.J. Cleary. 1999. "Barrier Morphology and Inlet Types: Low Energy Flank of the Cape Fear Foreland, NC." Proceedings of the Coastal Sediments '99 Conference. Hauppauge, NY. 16 p.
- Cleary, W.J. and T.P. Marden. 1999. "Shifting Shorelines: A Pictorial Atlas of North Carolina's Inlets." NC Sea Grant Special Publication #UNC-SG-99-04. North Carolina Sea Grant, NC State University, Raleigh, NC. 51 p.
- Marden, T.P., W.J. Cleary, N. Grindlay, W.B. Harris. 1999. "Seafloor Mapping Using Digital Sidescan Sonar and Reflects Cretaceous-Aged Prograding Clinofolds, Long Bay, NC" Geological Society of America Abstracts with Programs, V. 31, No. 2.

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- Johnsen, C.D., W.J. Cleary and T.P. Marden. 1998. "Sand Resources on Hardbottom Dominated Shorefaces in Southeastern North Carolina." Geological Society of America Abstracts with Programs, V. 30, No. 1.
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- Marden, T.P., K. Robinson, M.E. Sault and W.J. Cleary. 1997. "Coastwise Variations of Inlet Types: A Preliminary Report on North Carolina's Inlet Initiative." Geological Society of America Abstracts with Programs, V. 29, No. 1.

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- Marden, Tara and M. Leslie Fields. 2012. Chapin Beach Erosion Management Plan, Technical Report Prepared for the Town of Dennis.
- Marden, Tara and M. Leslie Fields. 2012. Costs and Benefits Analysis for Erosion Stabilization Activities at Chapin Beach and Corporation Beach, Dennis, MA , Technical Report Prepared for the Town of Dennis.
- Marden, Tara and M. Leslie Fields. 2008. Beach Management Plan, Sylvia State Beach, Martha's Vineyard, MA, Technical Report Prepared for the County of Dukes County.
- Fields, M. Leslie and Tara Marden. 2006. Shoreline and Beach Evaluation Chappaquiddick Outer Harbor Coastline, Martha's Vineyard, MA Technical Report Prepared for the Chappaquiddick Homeowners Association.
- Marden, T.P. and L.L. Weishar. 2005. Analysis of Shoreline Change, Carlin Property, Chilmark, Martha's Vineyard. Woods Hole Group, Inc. Technical Report Prepared for Choate, Hall and Stuart, Boston, MA.
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- FitzGerald, D.M., M. Rits, T.P. Marden, C.D. Johnsen, and I. Buynevich. 2004. "Investigation of the Stratigraphy Along Central Debidue Island, South Carolina." Woods Hole Group, Inc. Technical Report Prepared for Kenneth Mitchum, Mitchum Law Firm, 34 p.

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- Marden, T.P. 2004. "Triton Way, New Seabury, Ten Year Comprehensive Report, Prepared for Nirenberg, Bovarnick and Oktem, DEP SE 43-330." Woods Hole Group, Inc. Technical Report, 25 p.
- Marden, T.P. 2004. "Comprehensive Report for SE 43-1618, David and Cheryl Bovarnick, 40 Triton Way, New Seabury" Woods Hole Group, Inc. Technical Report. 15 p.
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- Marden, T.P. and M.L. Fields. 2002. "Historical Shoreline Change Analysis for the Surfside, Nantucket Coastline." Prepared for Earth Tech, Concord, MA. 20 p.
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