

Final

**Borrow Site Characterization of Offshore Sand
Resources in Selected Study Areas
Final Report of Findings**

Project No. 631038625

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Table of Contents

1.0	INTRODUCTION	1-1
2.0	DESKTOP STUDY RESULTS AND FIELD PLANNING	2-1
2.1	Study Area 1: Merrimack River.....	2-1
2.2	Study Area 2: Nantasket Beach	2-2
2.3	Study Area 3: Duxbury Beach	2-2
2.4	Study Area 4: Sandwich	2-3
2.5	Study Area 5: Cuttyhunk.....	2-4
3.0	SURVEY SYSTEMS AND EQUIPMENT	3-1
3.1	Survey Vessels.....	3-1
3.2	Navigation and Positioning	3-2
3.2.1	Xylem's HYPACK 2025®.....	3-2
3.2.2	Trimble Global Navigation Satellite System.....	3-2
3.3	Seismic Sub-bottom Profiler	3-2
3.4	Sidescan Sonar	3-3
3.5	Magnetometer	3-3
3.6	Bathymetric Survey	3-4
3.7	Vibracore System	3-4
4.0	GEOPHYSICAL OPERATIONS	4-1
5.0	VIBRACORE OPERATIONS.....	5-1
5.1	Vibracore Sampling Protocol	5-1
6.0	DATA PROCESSING AND INTERPRETATION METHODS.....	6-1
6.1	Bathymetric Processing	6-1
6.2	Sidescan Sonar Processing	6-1
6.3	Magnetometer Processing.....	6-2
6.4	Seismic Sub-Bottom Processing	6-3
6.5	Isopach Creation	6-4
6.6	Vibracore Sample Processing	6-4
6.6.1	Mechanical Sieve Analysis	6-6
6.6.2	Carbonate Test.....	6-8
6.6.3	Miniature Vane Shear Tests	6-8
6.7	Cultural Resources Assessment	6-8
7.0	RESULTS	7-1
7.1	Study Area 1 Merrimack River.....	7-2
7.1.1	Bathymetry	7-2
7.1.2	Sidescan Sonar	7-3
7.1.3	Magnetometer	7-3
7.1.4	Seismic Sub-bottom	7-3
7.1.5	Vibracore	7-5
7.2	Study Area 2 Nantasket Beach	7-5
7.2.1	Bathymetry	7-5
7.2.2	Sidescan Sonar	7-6
7.2.3	Magnetometer	7-6
7.2.4	Seismic Sub-bottom	7-6
7.2.5	Vibracore	7-7
7.3	Study Area 3 Duxbury Beach	7-8
7.3.1	Bathymetry	7-8
7.3.2	Sidescan Sonar	7-8



Table of Contents (continued)

7.3.3	Magnetometer	7-9
7.3.4	Seismic Sub-bottom	7-9
7.3.5	Vibracore	7-10
7.4	Study Area 4 Sandwich	7-11
7.4.1	Bathymetry	7-11
7.4.2	Sidescan Sonar	7-11
7.4.3	Magnetometer	7-12
7.4.4	Seismic Sub-bottom	7-12
7.4.5	Vibracore	7-13
7.5	Study Area 5 Cuttyhunk.....	7-14
7.5.1	Seismic Sub-bottom	7-14
7.5.2	Vibracore	7-15
8.0	GEOTECHNICAL AND ISOPACH RESULTS	8-1
8.1	Study Area 1.....	8-2
8.2	Study Area 2.....	8-4
8.3	Study Area 3.....	8-6
8.4	Study Area 4.....	8-8
8.5	Study Area 5.....	8-10
9.0	FUTURE PLANNING	9-1
9.1	Phased Approach to Sand Search Investigations	9-1
9.2	Future Investigation Recommendations	9-4
10.0	SUMMARY	10-1
11.0	MAPS	11-1
12.0	REFERENCES	12-1
13.0	APPENDICES	13-1



List of Figures

Figure 1: Vibracore Processing Upon Completion of Sample Collection	6-5
Figure 2: Seismic profile along Line 06 in Study Area 1A displaying a mottled shoal overtop a coarse sand unit, ground-truthed by MA-CZM-2025-VC08. Trackline for seismic example highlighted in yellow.....	7-4
Figure 3: Line 55 in Study Area 3A MA-CZM-2017-VC01 Displaying a large shoal overtop a unit of fine sand that has accumulated over an incised valley. Trackline for seismic example highlighted in yellow.....	7-7
Figure 4: Line 93 from the 2025 investigation with identified deposits and shoal. Trackline for seismic example highlighted in yellow.....	7-10
Figure 5: Line 115 from the 2025 investigation displaying a large shoal overtop an elongate valley. Trackline for seismic example highlighted in yellow.....	7-13
Figure 6: Line I174f1 of the USGS Legacy Dataset displaying a large shoal overtop two small, isolated channels. Trackline for seismic example highlighted in yellow.....	7-15
Figure 7: Flow Diagram Showing the General Investigation Sequence Followed by Aptim During a Typical Marine Sand Search Investigation	9-2

List of Tables

Table 1: Project Results Summary.....	ES-6
Table 2: Granulometric Analysis Mesh Sizes by Unified Soil Classification System (USCS) based on the ASTM D2487/2488 standards.....	6-7
Table 3: Sorting scales devised by Folk and Ward, with approximate mm conversions	6-8
Table 4: Geophysical Data Allocation Per Study Area	7-1
Table 5: Results of Vibracore Field Operations.....	7-2
Table 6: Regional Composite Results for Merrimack River Vibracores.....	7-5
Table 7: Regional Composite Results for Nantasket Beach Vibracores	7-8
Table 8: Regional Composite Results for Duxbury Beach Vibracores	7-11
Table 9: Regional Composite Results for Sandwich Vibracores	7-14
Table 10: Regional Composite Results for Cuttyhunk Vibracores.....	7-16
Table 11: Isopach Results for Each Study Area.....	8-1
Table 12: Preliminary Sand Volumes for Merrimack River Study Area	8-3
Table 13: Focus Composite Results for Merrimack River Focus Area Vibracores.....	8-3
Table 14: Preliminary Sand Volumes for Nantasket Beach Study Area.....	8-5
Table 15: Focus Composite Results for Nantasket Beach Focus Area Vibracores	8-6
Table 16: Preliminary Sand Volumes for Duxbury Beach Study Area	8-7
Table 17: Focus Composite Results for Duxbury Beach Focus Area Vibracores	8-8
Table 18: Preliminary Sand Volumes for Sandwich Study Area	8-10
Table 19: Focus Composite Results for Sandwich Focus Area Vibracores	8-10
Table 20: Preliminary Sand Volumes for Cuttyhunk Study Area.....	8-12
Table 21: Focus Composite Results for Cuttyhunk Focus Area Vibracores.....	8-12
Table 22: Proposed additional survey line mileage and vibracore sampling required to advance Study Focus Areas to design level.....	9-6



List of Maps

Map 1. Study Area 1—Merrimack, Historic Data.....	11-1
Map 2. Study Area 2—Nantasket Historic Data	11-2
Map 3. Study Area 3—Duxbury Beach, Historic Data.....	11-3
Map 4. Study Area 4—Sandwich, Historic Data.....	11-4
Map 5. Study Area 5—Cuttyhunk, Historic Data	11-5
Map 6. Study Area 1—Merrimack, Proposed Data	11-6
Map 7. Study Area 2—Nantasket, Proposed Data.....	11-7
Map 8. Study Area 3—Duxbury Beach, Proposed Data	11-8
Map 9. Study Area 4—Sandwich, Proposed Data	11-9
Map 10. Study Area 5—Cuttyhunk, Proposed Data.....	11-10
Map 11. Study Area 1—Merrimack, As Run Geophysical Tracklines	11-11
Map 12. Study Area 2—Nantasket, As Run Geophysical Tracklines.....	11-12
Map 13. Study Area 3—Duxbury Beach, As Run Geophysical Tracklines.....	11-13
Map 14. Study Area 4—Sandwich, As Run Geophysical Tracklines	11-14
Map 15. Study Area 1—Merrimack, Sidescan Sonar Features and Geotiffs	11-15
Map 16. Study Area 2—Nantasket Beach, Sidescan Sonar Features and Geotiffs.....	11-16
Map 17. Study Area 3—Duxbury Beach, Sidescan Sonar Features and Geotiffs.....	11-17
Map 18. Study Area 4—Sandwich, Sidescan Sonar Features and Geotiffs.....	11-18
Map 19. Study Area 1—Merrimack, Sidescan Sonar Contacts and Magnetometer Anomalies.....	11-19
Map 20. Study Area 2—Nantasket Beach, Sidescan Sonar Contacts and Magnetometer Anomalies	11-20
Map 21. Study Area 3—Duxbury Beach, Sidescan Sonar Contacts and Magnetometer Anomalies	11-21
Map 22. Study Area 4—Sandwich, Sidescan Sonar Contacts and Magnetometer Anomalies	11-22
Map 23. Study Area 1—Merrimack, Chirp Features	11-23
Map 24. Study Area 2—Nantasket Beach, Chirp Features.....	11-24
Map 25. Study Area 3—Duxbury Beach, Chirp Features.....	11-25
Map 26. Study Area 4—Sandwich, Chirp Features.....	11-26
Map 27. Study Area 1—Merrimack, Bathymetric Surface.....	11-27
Map 28. Study Area 2—Nantasket Beach, Bathymetric Surface	11-28
Map 29. Study Area 3—Duxbury Beach, Bathymetric Surface	11-29
Map 30. Study Area 4—Sandwich, Bathymetric Surface	11-30
Map 31. Study Area 1—Merrimack, Vibracore As-Builts.....	11-31
Map 32. Study Area 2—Nantasket Beach, Vibracore As Built.....	11-32
Map 33. Study Area 3—Duxbury Beach, Vibracore As-Builts.....	11-33
Map 34. Study Area 4—Sandwich, Vibracore As-Builts.....	11-34
Map 35. Study Area 5—Cuttyhunk, Vibracore As-Builts	11-35
Map 36. Study Area 1—Merrimack, Overall Isopach Map	11-36
Map 37. Study Area 2—Nantasket, Overall Isopach Map.....	11-37
Map 38. Study Area 3—Duxbury Beach, Overall Isopach Map	11-38
Map 39. Study Area 4—Sandwich, Overall Isopach Map	11-39
Map 40. Study Area 5—Cuttyhunk, Overall Isopach Map.....	11-40
Map 41. Study Area 1—Merrimack, Focus Area Isopach Map	11-41
Map 42. Study Area 2—Nantasket, Focus Area Isopach Map.....	11-42
Map 43. Study Area 3—Duxbury Beach, Focus Area Isopach Map	11-43
Map 44. Study Area 4—Sandwich, Focus Area Isopach Map	11-44
Map 45. Study Area 5—Cuttyhunk, Focus Area Isopach Map.....	11-45



List of Appendices

Appendix A	Bathymetric XYZ (digital only)
Appendix B	Sidescan Contact Reports
Appendix C	Magnetometer Anomaly Table
Appendix D	Seismic Web Project (digital only)
Appendix E	2025 APTIM Vibracore Logs
Appendix F	2025 APTIM Vibracore Photographs
Appendix G	2025 APTIM Individual Vibracore Granulometric Report
Appendix H	2025 APTIM Individual Grain Size Distribution
Appendix I	2025 APTIM Carbonate Analysis Report
Appendix J	2025 APTIM Vibracore Mini Vane Shear Test Results
Appendix K	2025 APTIM Overall Study Area Composite Tables
Appendix L	2025 APTIM Focus Area Composite Tables
Appendix M	Cumulative Composite Curves



Acronyms and Abbreviations

~	approximately
%	percent
AGC	Automatic Gain Control
APTIM	Aptim Environmental & Infrastructure, Inc.
ASTM	American Society for Testing and Materials
BOEM	Bureau of Ocean Energy Management
BUAR	Board of Underwater Archaeological Resource
cm	centimeters
CMEC	Construction Materials Engineering Council, Inc.
CORS	Continuously Operating Reference Station
cy	cubic yards
CZM	Massachusetts Office of Coastal Zone Management
DGPS	Differential Global Positioning System
EPA	Environmental Protection Agency
EGN	Empirical Gain Normalization
FM	frequency modulated
ft	feet
ft/ms	feet per millisecond
GNSS	Global Navigation Satellite System
GPS	global positioning system
Hypack	Xylem's HYPACK 2025®
kHz	kilohertz
km	kilometer
lb.	pounds
m	meter
m/ms	meters per millisecond
mm	millimeters
m ²	square meters
m ³	cubic meters
mp	megapixel
MEPA	Massachusetts Environmental Policy Act Office
nm	nautical miles
NAVD88	North American Vertical Datum, 1988
NEPA	National Environmental Policy Act Office
NGS	National Geodetic Survey
NHESP	National Heritage and Endangered Species Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Association
nT	nanotesla
ODMDS	Offshore Dredge Material Disposal Site
OFR	Open File Report
OMP	Ocean Management Plan
QMA	Qualified Marine Archaeologist
RTK	Real Time Kinematic
RTN	Real Time Network



Acronyms and Abbreviations (continued)

SVP	Sound Velocity Profiler
USACE	United States Army Corps of Engineers
USCG	U.S. Coast Guard
USCS	Unified Soil Classification System
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
Vac	volts, alternating current



Executive Summary

The Commonwealth of Massachusetts Office of Coastal Zone Management (CZM) contracted Aptim Environmental & Infrastructure, Inc. (APTIM) to conduct a borrow site characterization for offshore sand resources in selected study areas in Massachusetts state waters. The selected study areas consisted of five (5) areas located offshore of Massachusetts, Study Area 1—Merrimack, Study Area 2—Nantasket, Study Area 3—Duxbury, Study Area 4—Sandwich, and Study Area 5—Cuttyhunk. The project consisted of an historic data review, the collection of 174 nautical miles (nm) of full suite geophysical data, the collection of 20 vibracores, and associated sediment analysis and data processing. This investigation included a geophysical investigation that ran from April 2, 2025, to April 10, 2025, with a pause in operations and finished on June 25, 2025, and a geotechnical operation that ran from April 14, 2025, through April 16, 2025, with a pause in operations and finished between June 28, 2025, and June 29, 2025.

The first phase of the project consisted of a desktop study, where APTIM performed an extensive search for previous geophysical and geotechnical investigations conducted within the five (5) Study Areas, building off APTIM's 2018 Report, "Preliminary Characterization of Offshore Sand Resources in Selected Study Areas: Final Report of Findings, Project 631038625." After reviewing all available data, only one (1) new dataset was discovered that had been published since the APTIM 2018 Report, High-resolution Geophysical and Geological Data Collected in Cape Cod Bay, Massachusetts during the U.S. Geological Survey Field Activities 2019-002-FA and 2019-034-FA (Ackerman et al., 2022). This dataset provided bathymetric and seismic data within the previously un-surveyed Study Area 4—Sandwich. APTIM re-processed this seismic data set as well as re-visited the historic data sets in other study areas to identify new investigation areas for this study. The desktop study phase led APTIM to re-design certain study areas from their previous extents to target areas containing the thickest volumes of potentially sandy material. The 2018 Study Area 1 was reduced and re-designed as Study Area 1A, the 2018 Study Area 2A was expanded and redesigned as Study Area 2A-1, the 2018 Study Areas 3A and 3B remained the same, the 2018 Study Areas 4A and 4B were expanded and redesigned as Study Areas 4A-1, 4A-2, and 4B-1, while the 2018 Study Areas 5A and 5B remained the same.

APTIM, and the CZM conducted a planning meeting on December 4, 2024, to discuss the allocation of geophysical data as well as vibracore samples across the five (5) study areas. Based on existing data coverage, the proposed 155 nm of full suite geophysical data were allocated to Study Areas 1 to 4 and the 20 vibracores were spread across all five study areas. The proposed geophysical and geotechnical data collection effort was allocated to study areas as follows: 36.96 nm of geophysical data and four (4) vibracores in Study Area 1 offshore of the Merrimack River, 44.76 nm of geophysical data and four (4) vibracores in Study Area 2 offshore of Nantasket Beach, 35.74 nm of geophysical data and four (4) vibracores in Study Area 3 offshore of Duxbury Beach, 38.53 nm of geophysical data and four (4) vibracores in Study Area 4 offshore of Sandwich, and no geophysical data collection, but four (4) vibracores in Study Area 5 offshore of Cuttyhunk.



Upon the completion of field investigations, the geophysical data were processed and interpreted while the vibracores were sent to APTIM's Construction Materials Engineering Council, Inc. and United States Army Corps of Engineers accredited geotechnical laboratory in Boca Raton, Florida for description and analysis. Vibracores were processed to determine sedimentary properties by strata in terms of thickness, color, texture (grain size), composition and presence of clay, silt, sand, gravel, or any other identifying features. Samples from individual layers were extracted for grain size distribution analysis. Results from the vibracore analysis were correlated to the newly acquired and historical seismic sub-bottom data to create isopach surfaces of the potential sand resources in each of the study areas and delineate subsections of focus areas for future investigation. Focus areas were created by incorporating both historical data and results from the 2025 investigation, with boundaries refined to target either coarse- or fine-grained sediment based on native beach requirements. This refinement was achieved by integrating vibracore sediment data with correlated seismic reflectors, allowing for the precise delineation of resource zones. Future investigation efforts may be tailored to these focus areas for further identification and delineation of beach compatible sands, which contain similar characteristics to the native beach proposed for nourishment. Table 1 provides a breakdown of the investigation results per study area.

Study Area 1 was identified during the 2018 investigation, where an initial isopach was generated providing an estimated preliminary volume of approximately ($\sim$) 99,730,000 m³ (130,442,000 cubic yards [cy]) of potential sand resources. During the 2025 investigation, APTIM proposed to collect new geophysical and geotechnical data targeting areas with the thickest volume of sands, now redefined as Study Area 1A. Seismic interpretation of Study Area 1 identified thin shoaling and coarse sand surficial units overlying scoured channels and valleys filled with chaotic, low-amplitude deposits. Low amplitude reflections in seismic data occur when the reflection produces a small change in signal intensity on a seismic trace. This can be indicative of a variety of scenarios but is most commonly attributed to a gradual lithologic change or high attenuation due to sediment type.

The newly collected data, when combined with the 2018 dataset, provided an updated analysis indicating that Study Area 1 contains an estimated preliminary volume of 137,255,000 cubic meters (m³) (179,523,000 cy), with a mean composite grain size of 0.50 millimeters (mm) (1.00 phi) and 1.84 percent silts. APTIM then identified the most likely beach compatible, coarse sediment deposits and delineated Study Area 1A Focus Area, which contains an estimated preliminary volume of 36,433,000 m³ (47,652,000 cy), with a mean composite grain size of 0.66 mm (0.60 phi) and 1.29 percent silts.

Study Area 2 was identified during the 2018 investigation and consisted of three sub-areas: Study Areas 2A, 2B, and 2C. The 2018 investigation eliminated Study Area 2B as no viable resources were identified. The 2018 investigation generated initial isopachs of Study Areas 2A and 2C, which contain a combined estimated preliminary volume of 3,600,00 m³ (4,708,600 cy) of potential sand resources in each area. During the 2025 investigation and after incorporating the results of the new desktop study, APTIM expanded Study Area 2A to the west and redefined the Study Area as 2A-1, while Study Area 2C remained



the same. Seismic interpretation of Study Area 2A-1 reveals thin shoals capping extensive valley systems. The shoals vary in composition, ranging from chaotic to mottled with little evidence of lamination, or very thin parallel layers of sediment. After incorporating the additional survey coverage from the 2025 investigation, new isopachs were generated, which increased the estimated potential sand resource volume for Study Area 2A-1 to 17,726,000 m³ (23,185,000 cy), with a mean composite grain size of 0.22 mm (2.20 phi) and 10.11 percent silts. APTIM further refined the target area using results from vibracores MA-CZM-2025-VC01 and MA-CZM-2025-VC02 to delineate a constrained zone of beach compatible fine sands (Study Area 2A-1 Focus Area), resulting in an updated potential resource volume of 14,786,000 m³ (19,339,000 cy), with a mean composite grain size of 0.18 mm (2.50 phi) and 6.26 percent silts. Study Area 2C is composed primarily of thin, silty shoals that appear chaotic, low-amplitude, and lacking in structure. APTIM's 2018 investigation estimated Study Area 2C contained potential sand resources of 3,600,000 m³ (4,708,600 cy). Incorporating the additional survey coverage from the 2025 investigation increased the estimated potential sand resource volume for Study Area 2C to 20,211,000 m³ (26,435,000 cy), with a composite mean grain size of 0.16 mm (2.60 phi) and 11.02 percent silts. Following a detailed review and refinement to target only fine sand, as no coarse grained sands existed within the 2C Study Area, a Focus Area was delineated, decreasing the potential volume of beach compatible sands to 6,574,000 m³ (8,598,000 cy), with a composite mean grain size of 0.16 mm (2.60 phi) and 11.02 percent silts. Seismic interpretation of the Study Area 2C Focus Area identifies a thick shoal of fine sand, reaching ~4.9 meters (m) (16 feet [ft] thick), overlaying a large valley system characterized by high-amplitude, thinly laminated strata. High amplitude in seismic data means a strong reflected energy, typically due to a large acoustic impedance contrast between two subsurface layers, either due to lithology or sediment type.

Study Area 3 was identified during the 2018 investigation and consisted of two sub-areas: Study Areas 3A and 3B. The 2018 investigation generated initial isopachs of Study Areas 3A and 3B, which contained estimated preliminary volumes of 46,940,000 m³ (61,395,200 cy) and 46,000,000 m³ (60,165,700 cy), respectively. During the 2025 investigation and after incorporating the results of the new desktop study, APTIM collected new geophysical data primarily in Study Area 3A where no historical data existed and in Study Area 3B filling in data gaps and targeting the thickest sand deposit. With the increased geophysical coverage from the 2025 investigation that expanded on the 2018 investigation, Study Areas 3A and 3B were later combined into one (1) study area, Study Area 3, as sufficient new and historical datasets existed. Seismic interpretation of Study Area 3 indicates a thick, chaotic shoal overlaying a semi-transparent unit, separated by a large valley, with the deposit thickening to the southwest. A semi-transparent unit in an acoustic facies is one that shows low amplitude, poorly continuous reflections, giving the appearance of a hazy or "see through" area within the seismic record. In the south, areas of exposed and buried hardbottom to a depth of 6 m (19.6 ft) are present. It should be noted that due to the poor quality of the USGS data, it is possible the buried hardbottom extends deeper than 6 m (19.6 ft) in some locations. A potential resource estimate for the newly recombined Study Area 3 was found to be 141,596,000 m³ (185,201,000 cy), with a composite mean grain size of 0.24 mm (2.06 phi) and 5.33 percent silts. After refining the target sediment to reflect the coarsest-grained sands, Study Area 3



Focus Area was delineated that contained an estimated 6,257,000 m³ (8,184,000 cy), with a composite mean grain size of 0.33 mm (1.60 phi) and 1.71 percent silts.

Study Area 4 was identified during the 2018 investigation and consisted of two sub-areas: Study Areas 4A and 4B. The 2018 investigation identified that Study Area 4B consisted of a US Army Corps of Engineers (USACE)/Environmental Protection Agency (EPA) Offshore Dredge Material Disposal Site and was not investigated. The 2018 investigation area generated an initial isopach of Study Area 4A, which contained an estimated preliminary volume of 51,670,000 m³ (67,581,800 cy) of potential sand resources. During the desktop phase, additional data sets were identified, which had previously not been reviewed in APTIM's 2018 investigation. These data were processed and interpreted, and new study areas were designed targeting the thickest potential sand deposits, Study Areas 4A-1, 4A-2, and 4B-1. APTIM proposed new tracklines throughout these survey areas. Results from the 2025 survey were combined with the historical data sets and isopachs were created for each Study Area. Study Area 4A-1 identified ~16,030,000 m³ (20,966,000 cy) with a composite grain size of 0.31 mm (1.70 phi) and 7.81 percent silts of potential sand resources. After refining the boundaries using both the 2018 and 2025 core data, Study Area 4A-1 Focus Area was developed to target the coarsest sand material, yielding an estimated volume of 6,642,000 m³ (8,688,000 cy) with a composite grain size of 0.47 mm (1.09 phi) and 1.00 percent silts. Seismic interpretation of 4A-1 reveals an extensive mottled shoal system overlaying a highly laminated valley with steeply dipping reflectors. Mottling within the seismic record is presented as irregular, discontinuous, or blotchy amplitudes. It is indicative of shallow, high-energy depositional conditions and often is reflective of shelly material. Study Area 4A-2, south of 4A-1, expanded slightly when the U.S. Geological Survey 2019-002-FA data were incorporated. Seismic interpretation of this area reveals a thin, mottled, coarse sand surficial unit that gradually thickens to the east. Preliminary estimates for the entire 4A-2 area total 5,654,000 m³ (7,395,000 cy) with a composite grain size of 0.28 mm (1.84 phi) and 3.09 percent silts, refined to 1,744,000 m³ (2,281,000 cy) with a composite grain size of 0.48 mm (1.06 phi) and 5.65 percent silts for the Focus area. Vibracore data collected from the 2025 survey indicate that the surficial layer of Study Area 4B-1, east of 4A-1, consists primarily of a clayey sand with a potential volume of 17,910,000 m³ (23,426,000 cy). Since this is not a beach compatible deposit, a Focus-level area for 4B-1 was not developed.

Study Area 5 was identified during the 2018 investigation and consisted of two sub-areas: Study Areas 5A and 5B. Sand deposits in Study Areas 5A and 5B are associated with a shoaling feature, with results from the 2018 investigation estimating a preliminary volume of 54,470,000 m³ (71,244,100 cy) and 7,460,000 m³ (9,757,300 cy) of potential sand resources, respectively. A shoaling feature is an upward shallowing deposit that indicates progressive deposition in shallower water conditions. No new geophysical data were proposed to be collected in these areas due to the density and quality of existing historical data sets, however, four vibracores were proposed to be collected. After incorporating the results of the newly collected vibracores no changes were identified to the 2018 volumes. However, the 2025 geotechnical data allowed for refinement of the resource boundaries within 5A to create a focus-level study area that more accurately delineates the coarser sands of the shoaling feature. This higher-



resolution assessment excludes lower-quality or finer grained sediments previously counted in 2018, resulting in a revised preliminary volume estimate of 54,032,000 m³ (70,671,000 cy) with a composite grain size of 0.25 mm (2.00 phi) and 1.98 percent silts. Study Area 5B contains a thin sand layer (~1.4 m [4.27 ft] thick) overlaying a paleochannel complex likely infilled with clays and silts, yielding a preliminary volume of ~ 7,460,000 m³ (9,757,000 cy) of potential sand resources. Due to the thin lens of sand overlying silts and clays in 5B, no focus level assessment was generated.

In total, APTIM identified a reconnaissance-level potential sand resource volume of ~410,852,000 m³ (537,375,000 cy) across all five (5) Study Areas, and a Focus-level estimate of 126,468,000 m³ (165,413,000 cy). These initial estimates are based on widely spaced reconnaissance-level geotechnical data and varying levels of geophysical data coverage. By focusing on areas with verified sediment characteristics, the focus-level estimates provide a more reliable representation of potential resources compared to the broader regional assessment.



Table 1: Project Results Summary

Region	Study Area	Vibracores (2018 and 2025 Investigations)	Geophysical Trackline Mileage (2025 Investigation) (nm)	Average Grain Size (mm)	Average Silt (%)	Mean Sand Thickness (m)	Area of Isopach (m ²)	Estimated Volume of Isopach (m ³)	Estimated Volume of Isopach (cy)
Merrimack River	1	8	39.44	0.5	1.84	2.76	49,515,000	137,255,000	179,523,000
	1A Focus	6	N/A	0.66	1.29	2.21	16,386,000	36,433,000	47,652,000
	2A-1	3	37.48	0.22	10.11	2.53	8,514,000	8,510,000	17,726,000
Nantasket Beach	2A-1 Focus	2	N/A	0.18	6.26	3.00	4,829,000	14,786,000	19,339,000
	2C	1	16.44	0.16	11.02	1.19	16,789,000	16,790,000	20,211,000
	2C Focus	1	N/A	0.16	11.02	3.12	2,059,000	6,574,000	8,598,000
Duxbury Beach	3	7	37.62	0.24	5.33	1.91	73,491,000	15,600,000	141,596,000
	3 Focus	4	N/A	0.33	1.17	2.46	2,478,000	6,257,000	8,184,000
	4A-1	3	16.60	0.31	7.81	2.41	6,579,000	6,580,000	16,030,000
Sandwich	4A-1 Focus	2	N/A	0.47	1.00	1.56	4,172,000	6,642,000	8,688,000
	4A-2	2	4.29	0.28	3.09	2.72	2,052,000	2,050,000	5,654,000
	4A-2 Focus	2	N/A	0.48	5.65	1.45	1,154,000	1,744,000	2,281,000
	4B-1	1	21.74	N/A	N/A	1.34	13,167,000	13,170,000	17,910,000
Cuttyhunk	5A	6	N/A	0.24	2.16	N/A	12,180,000	54,470,000	71,244,100
	5A Focus	4	N/A	0.25	1.98	5.81	9,162,000	54,032,000	70,671,000
	5B	3	N/A	0.22	8.08	N/A	5,339,000	7,460,000	9,757,300



1.0 INTRODUCTION

The Commonwealth of Massachusetts, Office of Coastal Zone Management (CZM) contracted Aptim Environmental & Infrastructure, Inc. (APTIM) to conduct an investigation to further characterize five (5) potential offshore sand resource areas identified in the 2021 Massachusetts Ocean Management Plan (OMP) with additional geotechnical and geophysical data collection. The project included five major tasks:

1. Reviewing the report “Preliminary Characterization of Offshore Sand Resources in Selected Study Areas: Final Report of Findings, Project 631038625.”
2. Assessing extant geophysical and geological data.
3. Making recommendations regarding data necessary to inform a potential sand mining project for beach nourishment.
4. Acquiring and analyzing of new geophysical and geological data.
5. Identifying any possible submerged cultural resources within the study area.

The results of the survey will be used to more accurately and fully characterize the deposits, characterize any cultural resources, and evaluate dredgeability of the sand resources for potential use as borrow area(s), as well as recommend future actions to continue borrow site characterization.



2.0 DESKTOP STUDY RESULTS AND FIELD PLANNING

In order to obtain an understanding of the geologic background and existing geologic conditions of the proposed study areas, APTIM built off the existing desktop study conducted by APTIM in 2018, Preliminary Characterization of Offshore Sand Resources in Selected Study Areas, Final Report of Findings, and reviewed any new geophysical and geotechnical data and associated information for the selected study areas. In addition to APTIM's extensive internal database, APTIM reviewed all remaining geologic data and information from the United States Geological Survey (USGS) and Board of Underwater Archaeological Resources (BUAR) provided to APTIM by CZM. Data analysis encompassed the review of historic bathymetry data, acoustic backscatter data, seismic-reflection profiles, sediment samples and photography from the five proposed study areas: Study Area 1—Merrimack, Study Area 2—Nantasket, Study Area 3—Duxbury, Study Area 4—Sandwich, and Study Area 5—Cuttyhunk. In addition to reviewing previous data, APTIM evaluated operational constraints, including restrictions that may affect future borrow area focus and dredgeability, like operational dredging depth limits and overburden, thicknesses and considered these factors when determining the best locations for geophysical tracklines as well as vibracore collection.

This desktop study of previously collected environmental and geologic data enabled APTIM to design an efficient and effective survey plan to make best use of the proposed 155 nautical miles (nm) (287.1 kilometers [km]) of geophysical data acquisition and 20 vibracores proposed for collection during this investigation to best support the preliminary characterization of offshore sand resources.

2.1 Study Area 1: Merrimack River

Study Area 1, the area surrounding the Merrimack River, was first characterized in APTIM's 2018 investigation as an area having a sandy seafloor. The Merrimack River Study Area has full coverage of historic USGS backscatter, bathymetry, surface grab samples, and photography from a study by Barnhardt et al. 2009 and published in the 2007-1373 Open File Report (OFR). These data were reviewed during APTIM's 2018 investigation and again during this desktop study. The Barnhardt et al. 2009 dataset in this area contains 90-meter (m) (295.3 feet [ft]) line spacing near the coast and 1,500 m (4,921.2 ft) line spacing further offshore with tie lines every 1,000 m (3,280.8 ft). The historic sub-bottom data indicated the presence of buried rock, sands, and potentially finer grained materials. In 2018, APTIM used the historic USGS sub-bottom data as well as the results of the five (5) collected cores to create a surficial sediment thickness isopach of the area, clipping out any rock outcrop areas, and calculated a potential volume of 99,730,000 cubic meters (m³) (130,442,000 cubic yards [cy]) of sands. To help refine this volume for future borrow area development, APTIM proposed 37 nm (68.5 km) of new geophysical data throughout the area. APTIM focused the new geophysical data collection efforts in the northern half of the study area, now referenced as Study Area 1A, where sand thicknesses are greatest. APTIM proposed tracklines with a spacing of 300 m (984.2 ft), down spacing the USGS 1,500 m (4,921.2 ft) tracklines. APTIM also proposed tie lines with a spacing of 500 m (1,640.2 ft), down spacing the USGS 1,000 m (3,280.8 ft)



tie lines. This provided APTIM with higher resolution data within the area with the greatest potential for future borrow area site development. APTIM proposed to review the geophysical data in the field and collaborate with CZM to determine core placement in this area. These desktop study results are presented in Section 11.0, Map 1, while proposed geophysical tracklines are presented in Map 6.

2.2 Study Area 2: Nantasket Beach

Study Area 2, the area surrounding Nantasket Beach, was first characterized in APTIM's 2018 investigation as an area having a sandy seafloor, which was divided between 3 regions, Study Areas 2A, 2B, and 2C. Study Area 2B was eliminated from further investigation after examining historic backscatter and high-resolution bathymetric data, which indicated the presence of surficial gravels as well as high relief ledges, likely rocky in nature, crossing portion of the study area. Interpretation of historic seismic sub-bottom data from Barnhardt et al. 2010 (2009-1072 OFR) and cores collected by APTIM in 2018 indicated preliminary estimates of potential sand resource volumes of over 3,600,000 m³ (4,708,600 cy) in Study Area 2A. Subsequently, APTIM extended this area to the west and renamed it Study Area 2A-1 due to sediment cover and surficial geology data from Pendleton et al. 2013 indicating a sand surface overlying a shelf valley extending to the nearshore ramp. Based on historical surficial backscatter data indicating limited surficial sands, Study Area 2C was constrained to an area with an estimated preliminary volume of 3,600,000 m³ (4,708,600 cy) of potential sand resources. To help refine the volume estimate for future borrow area development in Study Area 2, APTIM proposed 45 nm (83.3 km) of new geophysical data to be split between Study Areas 2A-1 and 2C. The proposed tracklines throughout both areas had a spacing of 300 m (984.2 ft) and tie line spacing of 500 m (1,640.4 ft). These lines were focused to match the line spacing of historical chirp data from Barnhardt et al. 2010. APTIM proposed to review the geophysical data in the field and collaborate with CZM to determine subsequent core placement in this area. These desktop study results are presented in Section 11.0, Map 2, while proposed geophysical tracklines are presented in Map 7.

2.3 Study Area 3: Duxbury Beach

Study Area 3, the area surrounding Duxbury Beach, was identified during APTIM's 2018 investigation as an area having a sandy seafloor, which was divided between two areas, Study Area 3A and 3B. Historic USGS data collected as part of a study by Andrews et al. 2010 and published in the 2010-1006 OFR covers only a small portion of Study Area 3A and the majority of Study Area 3B. These data were reviewed and interpreted during APTIM's 2018 investigation, including the vibracores collected by APTIM in 2018 and preliminary isopachs were generated. However, as most of Study Area 3A did not contain any geophysical data, an average thickness value was calculated and applied to the entire study area. A preliminary volume of potential sand resources was calculated for Study Area 3A in 2018, yielding a volume of 46,940,000 m³ (61,395,200 cy). A preliminary volume of potential sand resources was calculated for Study Area 3B in 2018, yielding a volume of 46,000,000 m³ (60,165,700 cy). To refine a volume estimate for future, borrow area development, APTIM proposed to collect 36 nm (66.7 km) of new geophysical data split between Study Areas 3A and 3B. APTIM proposed to collect new geophysical data throughout Study Area 3A where there was no historic data with a survey trackline spacing of 300 m (984.2 ft) and tie line spacing of 500 m



(1,640.4 ft). The resulting data would provide greater data coverage within the study area and allow for a more accurate volume to be calculated. In Study Area 3B, APTIM targeted the area, which contained the thickest sand volume and proposed to collect new geophysical data filling in a 500 m (1,640.4 ft) gap in the Andrews et al. 2010 dataset as well as down spacing the existing USGS tracklines with 300 m (984.2 ft) survey tracklines and 500 m (1640.4 ft) tie lines. APTIM proposed to review the geophysical data in the field and collaborate with CZM to determine subsequent core placement in this area. These desktop study results are presented in Section 11.0, Map 3, while proposed geophysical tracklines are presented in Map 8.

2.4 Study Area 4: Sandwich

Study Area 4, the area surrounding Sandwich in Cape Cod Bay, was identified during APTIM's 2018 investigation as an area having a sandy seafloor, which was divided between 2 areas, Study Area 4A and 4B. During the 2018 investigation, Study Area 4B was determined to be a United States Army Corps of Engineers (USACE)/ Environmental Protection Agency (EPA) Offshore Dredge Material Disposal Site (ODMDS) likely characterizable via historic dredging records and therefore doesn't need additional data collection and was discarded for future study as a potential borrow area. Prior to APTIM's 2018 investigation, minimal historical data existed in the Sandwich Study Areas. In 2019 USGS collected geophysical data as part of a study by Ackerman et al., 2022 and published in the 2019-002-FA and 2019-034-FA OFRs. The former study provided chirp, boomer, and backscatter data, and the latter study provided seafloor images with video and grab samples. APTIM re-processed the available USGS sub-bottom profiler data and created a rough isopach of unconsolidated surficial sediments. Based on this unconsolidated sediment thickness isopach, Study Area 4A was estimated to contain 16,030,000 m³ (20,966,000 cy) of potential sand resources. Based on this new isopach, the study areas were re-designed as 4A-1 to the north and 4A-2 to the south, and 4B-1 to the northeast, all of which were created in order to target the thickest potential sand resources. Geophysical and geotechnical data allocation to Study Area 4A-1 was designed to augment the historical data near an area containing up to 2.1 m (7 ft) thick surficial sediment. Boomer and chirp data from Ackerman et al. 2022 covered approximately ~2,438 m (~8000 ft) by 1,981 m (6500 ft) of the southeastern part of Study Area 4A-1 and loosely outlined the eastern edge, leaving a ~2.6 km² (~1 square mile) gap in geophysical data. To properly cover the data gap along Study Area 4A-1 APTIM proposed to collect 9 north-south tracklines with 15 nm (27.8 km) of uniform geophysical tracklines at 304.8 m (1,000 ft) spacing with tie lines every 457.2 m (1,500 ft). Geophysical and geotechnical data allocation to Study Area 4A-2 was designed to augment the historical data along a three (3) m (10 ft) thick surficial sediment deposit. Three and a half (3.5) nm (6.5 km) of tracklines were proposed to tie in existing tracklines, while extending coverage to the south. Geophysical and geotechnical data allocation to Study Area 4B-1 was designed to target surficial sediment 2.1 m (7 ft) to 4.6 m (15 ft) thick. Almost 20 nm (37.04 km) of uniform tracklines at 609.6 m (2,000 ft) spacing with tie lines every 609.6 m (2,000 ft) were proposed throughout this area to augment historical data and explore the thickest surficial sediment of the Sandwich area. APTIM proposed to review the geophysical data in the field and collaborate with CZM to determine core placement in this area. These desktop study results are presented in 11.0, Map 4, while proposed geophysical tracklines are presented in Map 9.



2.5 Study Area 5: Cuttyhunk

Study Area 5, the area surrounding Cuttyhunk in Buzzards Bay, was identified during APTIM's 2018 investigation as an area having a sandy seafloor, which was divided between two areas, Study Area 5A and 5B. APTIM kept the focus of the Cuttyhunk area investigation to Study Areas 5A and 5B for this 2025 investigation as no new data was identified during this desktop investigation. Sand deposits in Study Area 5A are associated with a shoaling feature with an estimated preliminary volume of 54,470,000 m³ (71,244,100 cy) of potential sand resources. Study Area 5B contains a thin (~1.4 m [4.27 ft] thick) sand layer overlaying a paleochannel complex likely filled with clays and silts yielding an estimated preliminary volume of ~7,460,000 m³ (9,757,300 cy) of potential sand resources. Both Study Areas 5A and 5B have extensive historic USGS data, which was previously reviewed in APTIM's 2018 investigation. In 2009, USGS gathered high-resolution geophysical data in Buzzards Bay, Massachusetts as part of a study by Ackerman et al. 2022, and published in the 2009-002-FA OFR. This study provided full chirp data coverage of Study Area 5A and the eastern portion of Study Area 5B at 100 m (328 ft) line spacing. The west end of Study Area 5B was surveyed in 2011 with a survey line spacing 76.2 m (250 ft) and 121.9 m (400 ft) tie line spacing in the 2011-004-FA OFR published by USGS providing full chirp coverage of the Study Area 5 deposits (Andrews et al., 2014). In 2018, APTIM collected three (3) cores in Study Area 5A and two (2) cores in Study Area 5B. Due to the extensive historical data coverage APTIM did not propose further geophysical investigation of the Cuttyhunk Study Area but proposed a total of four (4) vibracores to be collected in this area. To further develop the geotechnical characterization of Study Area 5A, APTIM placed three (3) vibracore sites throughout the study area roughly equidistant amongst the 2018 APTIM vibracore locations. The proposed sites targeted the thickest areas containing potential sand resources. APTIM proposed a single vibracore site in Study Area 5B, based on the 2009-002-FA OFR geophysical data, targeting the thickest area of surficial sediment. These desktop study results are presented in Section 11.0, Map 5, while proposed data collections are presented in Map 10.



3.0 SURVEY SYSTEMS AND EQUIPMENT

The geophysical investigation was split into two phases, the first phase occurred between April 2, 2025, and April 10, 2025, and the second phase occurred on June 25, 2025. The investigation included single-beam bathymetric, sidescan sonar, seismic reflection profiling, and magnetometer surveys. The survey systems are listed and discussed in detail below. The single-beam bathymetric, sidescan sonar, seismic reflection profiling, and magnetometer surveys were conducted concurrently. Geophysical data were collected under the responsible charge of Patrick Bryce, Professional Geologist.

3.1 Survey Vessels

The *R/V Peter M. Mahoney*, a U.S. Coast Guard (USCG) inspected and certified vessel, based out of Quincy, Massachusetts, was used for the first phase of data acquisition. Geophysical operations ran from April 2, 2025, to April 10, 2025, and vibracore operations from April 14, 2025, to April 16, 2025. The *R/V Peter M. Mahoney* is a 36.6 m (150 ft) Master Boat Builder hulled vessel, acquired with the primary purpose of geophysical, geotechnical, and biological surveys. The vessel features a clear deck of 27.4 m (90 ft) x 9.1 m (30 ft) and comes with multiple deck equipment including a knuckle boom crane, with a 1,400 kilogram (kg) (3,086 pound [lb.]) capacity at a fully extended length of 23 m (75 ft), and a 18,144 kg (20-ton) 4.3-m (14-ft) hydraulic A-frame, and a 11,340 kg (25,000 lb.) hydraulic winch. It comes equipped with two CAT 3508 MIU engines, and two CAT 3304T generators.

A hydraulically operated A-frame, located on the vessel's stern, offered sufficient height to raise, lower, and retrieve the vibracore system. Furthermore, the hydraulic A-frame added a level of safety for crewmembers in the retrieval and deployment stages of the vibracore, preventing any unnecessary overhang. The ample deck space allowed the vibracore to be laid on the back deck, permitting the safe and secure retrieval of vibracore samples for stowing on the vessel during operations.

The *R/V James K. Goodwin* a USCG inspected and certified vessel, also based out of Quincy, Massachusetts, was used for the second phase of data acquisition. Geophysical operations were run on June 25, 2025, and vibracore operations on June 28, 2025, and June 29, 2025. The *R/V James K. Goodwin* is a 33.5 m (110 ft) steel hulled vessel with the sole purpose of geophysical, geotechnical, and biological surveys. It comes equipped with twin 1692 Detroit diesel main engines, twin 471 Detroit diesel generators, one 8,165 kg (18,000 lb.) capacity hydraulic deck winch, 10 centimeters (cm) (4 inch [in]) down pole with variable mounting brackets, and a 9.1-MT (10 ton) capacity hydraulic A-frame. The vessel is equipped with crew and client quarters as well as a full galley with two heads including showers. As a USCG inspected vessel, the *R/V James K. Goodwin* safety features include fire extinguishers, life vests/survival suits, 50-man life raft, first aid kits, radar, very high frequency radios, an Emergency Position Indicating Radio Beacon with global positioning system (GPS), and more. These safety features and the level of experience and expertise from the captain and crew allows the *R/V James K. Goodwin* to operate safely and efficiently, providing proficient geophysical and geotechnical support throughout project operations.



3.2 Navigation and Positioning

3.2.1 Xylem's HYPACK 2025®

APTIM's navigation, magnetometer, and depth sounder systems were interfaced with an onboard computer and the data were integrated in real time using Xylem's HYPACK 2025® (Hypack) software. Hypack is a state-of-the-art navigation and hydrographic surveying system. The location of the towfish tow-point and transducer mount were measured in relation to the center of mass of the vessel and the primary GPS antenna. Vertical and horizontal measurements were recorded and entered into the Hypack survey program. The lengths of cable deployed between the tow-point and each towfish were also measured and entered into Hypack to monitor the position of each system in real time. Online screen graphic displays included the pre-plotted survey lines, the updated boat track across the study area, adjustable left/right indicator, as well as other positioning information such as boat speed, line bearing and offline distance. The digital data were merged with the GPS positioning data, video displayed and recorded to the acquisition computer's hard disk for post processing.

3.2.2 Trimble Global Navigation Satellite System

For Study Areas 1-3, a Trimble Global Navigation Satellite System (GNSS) SPS461, receiving Real Time Kinematic (RTK) corrections from the Massachusetts Real-Time Network (RTN), was used to provide real-time navigation to the helm and geophysical acquisition software. GNSS derived water level (tidal) corrections were applied to all soundings within these study areas and referenced to the North American Vertical Datum 1988 (NAVD88) vertical datum. For Study Area 4, an Applanix POS MV Wavemaster II was used to provide real-time navigation to the helm and geophysical acquisition software. Elevation data for Study Area 4 was tide corrected during post processing with nearby National Geodetic Survey (NGS) Continually Operating Reference Stations (CORS) and referenced to the NAVD88 vertical datum.

3.3 Seismic Sub-bottom Profiler

An EdgeTech 3200 SB-512i chirp sub-bottom system was used to conduct the chirp sub-bottom profiler survey. The 512i is a versatile wideband frequency modulated (FM) sub-bottom profiler capable of collecting digital, normal-incidence reflection data across a frequency range of ~0.5-12 kilohertz (kHz). This system produces high-resolution cross-sectional images of the seabed, with average penetrations between 6.1 m (20 ft) – 45.7 m (150 ft) depending on differing geologic strata observed between study areas. Navigation and horizontal positioning for the sub-bottom system was provided via Hypack utilizing the Hypack towfish layback correction.

The 3200 SB-512i transmits a linearly swept FM pulse (a "chirp pulse") across its full spectral range. This tapered waveform maintains nearly constant resolution with depth. During the survey, the chirp pulse settings were adjusted in real time to achieve the highest possible resolution of geological features and sequence stratigraphy (i.e., vertical sequence and lateral distribution of sediment bodies comprised of different grain sizes and sediment composition); thereby, optimizing data quality and enhancing subsequent interpretation. High frequency and/or short duration pulses were employed to improve near-surface resolution, yielding the clearest reflector images, and to enhance imaging in fine-grained



sediment. Conversely, low frequency or longer duration pulses were selected for coarse-grained sediments and situations requiring greater penetration. The primary interpretive objectives of the sub-bottom data were to identify potential sand deposits and to delineate subsurface rock or clay layers.

3.4 Sidescan Sonar

APTIM utilized an EdgeTech 4205 sidescan sonar system for this project. This system uses full-spectrum chirp technology to deliver wide-band, high-energy pulses coupled with high resolution and good signal to noise ratio echo data. The sonar packages included a portable configuration with a laptop computer running EdgeTech's Discover acquisition software and dual frequency towfish running in high-definition mode. This sonar system consists of dual frequency towfish operating at 230/540 kHz, with maximum range scales of 350 m (1,148 ft) to either side of the towfish (230 kHz), and 150 m (492 ft) to either side of the towfish (540 kHz). These range scales are the largest manufacturer recommended ranges for the frequencies listed above. However, geophysicists in the field based the recorded ranges on the field conditions and may not have used the maximum range scales. For data acquisition during this survey, frequencies and range scales were at 230 kHz/350 m and 540 kHz/150 m with the operation range set to high-definition mode. The sidescan sonar data were merged with positioning data via Hypack, displayed on video, and recorded to the acquisition computer's hard disk for post processing and/or replay. The location of the fish tow-point (as referenced to the vessel center of mass), together with the length of cable deployed from the tow-point, were entered into Hypack to account for the fish layback and provide accurate positioning of the sidescan towfish during the survey. The sidescan system was run by the EdgeTech Discover software program. All sidescan sonar data were collected in the default EdgeTech .jsf file format. The purpose of the sidescan sonar survey was to detect the presence of any surficial geomorphological features, potential underwater wrecks, submerged hazards, or other features that would affect borrow area delineation and dredging activities.

3.5 Magnetometer

A Geometrics G-882 digital cesium vapor marine magnetometer was used to detect magnetic anomalies within the investigation area. This magnetometer runs on 110 volts alternating current and can detect and aid in the identification of any ferrous, ferric, or other objects that may have a distinct magnetic signature. The purpose of the magnetometer survey was to establish the presence of any potential underwater wrecks, submerged hazards, infrastructure, or any other features of interest that would affect vibracore operations, borrow area delineation, and dredging activities. Factory set scale and sensitivity settings were used for data collection (0.004 nanotesla [nT]/ π Hz rms; typically, 0.02 nT peak-to-peak at a 0.1 second sample rate or 0.002 nT at 1 second sample rate). The magnetometer was towed at an altitude of no greater than 6 m (19.7 ft) above the seafloor and far enough away from the vessel to minimize boat interference. It was towed both in an independent configuration and in a piggy-backed configuration attached to the sidescan sonar. Navigation and horizontal positioning for the magnetometer were provided by the Trimble GNSS system via Hypack 2025 and using a towfish layback correction. Magnetometer data were recorded in the Hypack .raw format using Hypack 2025® survey software.



3.6 Bathymetric Survey

For Study Areas 1-3, a Teledyne Marine ECHOTRAC E20 single frequency portable hydrographic echo sounder was used to perform the bathymetric survey. The ECHOTRAC E20 operates at frequencies between 10 and 250 kHz and is a digital, survey-grade sounder. A 200 kHz, 4-degree transducer was pole mounted on the side of the vessel. Soundings were collected at the maximum ping rate to provide the greatest coverage of the seafloor. Teledyne Marine SBES UI software was used to monitor a cross-section echogram of the real time sounding data, which was simultaneously fed into Hypack. GNSS derived water level (tidal) corrections were applied to all soundings within these study areas and referenced to the NAVD88 vertical datum.

During data collection in Study Area 2C, an equipment malfunction resulted in a bathymetric-only data holiday ~701 m (2,300 ft) in length. The bathymetric data gap occurred along a line running northwest to southeast. However, a crossing line oriented southwest to northeast intersects the area allowing for the continuation of accurate contour generation. It should be noted that no sediment vibracores were collected within the affected region, and no other data types (e.g., geophysical or vibracore) were impacted by this issue.

For Study Area 4, a Teledyne RESON SeaBat T50 multibeam sonar was used for the bathymetric survey. The system was pole-mounted on the side of the vessel and operated at 400 kHz. The T50 provided high-density coverage of the seafloor and was monitored in real time using Teledyne's SeaBat UI, with data simultaneously logged and interfaced into Hypack. Although multibeam data were collected, only the single beam-equivalent depth data derived from the central beam of the multibeam sensor were processed and used, to maintain consistency with the other study areas that were surveyed using single beam echosounders. Elevation data for Study Area 4 were tide corrected during post processing with nearby National Geodetic Survey CORS and referenced to the NAVD88 vertical datum.

Sounder calibrations for Study Areas 1-4 were performed periodically throughout the survey (typically whenever the transducer down pole was raised or lowered). The sounder was calibrated via bar-checks and a sound velocity probe periodically. A Valeport SWiFT Sound Velocity Profiler (SVP) measured the speed of sound through the water column with the average speed used to calibrate the ECHOTRAC E20. Bar checks were performed from a depth of 4.6 m (15 ft) to 9.1 m (30 ft) in 1.5 m (5 ft) increments to verify the transducer draft and speed of sound. Echogram data showing the results of the bar check calibration were displayed on the sounder electronic charts during descent of the bar.

3.7 Vibracore System

APTIM utilized the SEAS VC-700 Vibracoring System, configured to collect undisturbed sediment vibracores up to 6 m (19.68 ft) in length. The SEAS VC-700 Vibracoring System is a single vibracore electric vibracoring system operational to depths of 200 m (656 ft). This electric vibracore system allows for the successful collection of vibracores in relatively deep-water depths, in the case of this project approaching 35 m (114.83 ft).



The self-contained, free-standing electrically operated vibrocore unit contains a SEAS VC-700 Vibracoring System vibrator head (4.4 kilowatt) configured to 415 Vac or 220 Vac 3-phase power, allowing for a user to operate the vibrocorer at fluctuating vibration frequencies to penetrate through otherwise unyielding strata. A 4-core Hydrofirm sea cable provided power to the drive unit of the vibrocore from a three phase 240-volt generator located on the deck of the vessel.



4.0 GEOPHYSICAL OPERATIONS

APTIM collected a total of 173.61 nm (321.53 km) of geophysical data spread across each of the four (4) proposed study areas in two phases between April 2, 2025 and April 10, 2025, and finishing the last survey area on June 25, 2025. Geophysical tracklines were defined prior to field operations commencing within the field survey plan. These geophysical tracklines targeted deposits with a higher potential for increased and/or thicker sand resources.

APTIM mobilized for geophysical operations in Quincy, Massachusetts, at the home dock of the *R/V Peter M. Mahoney*. The dock had facilities for secure equipment, supporting equipment for vessel mobilization and demobilization, and was centrally located for study areas. To start the first phase APTIM transited from Quincy to the northernmost Study Area 1 (Merrimack River) and began operations. The vessel worked its way south through the study areas and collected the required geophysical data. Operations were conducted during daylight hours only and remained on site or in transit to the next study area overnight. There was a pause in data collection and the APTIM team transited to dock in Quincy to demobilize the *R/V Peter M. Mahoney*. Operations were resumed for the second phase after remobilizing in Quincy, Massachusetts onto the *R/V James K. Goodwin* and finished data acquisition in Study Area 4 (Sandwich). APTIM geologists were performing rough processing and interpretations while offshore and communicated any results nightly to CZM. Once the vessel had finished and collected geophysical data, the vessel docked for two days to allow for the APTIM Team to transition operations to geotechnical operations as well as get final approval of vibrocore locations before resuming survey operations.



5.0 VIBRACORE OPERATIONS

5.1 Vibracore Sampling Protocol

APTIM collected a total of 20 4-m (13.1-ft) long vibracores spread across the five (5) proposed study areas in two phases, the first being between April 14, 2025 and April 16, 2025, and the second between June 28, 2025 and June 29, 2025. Vibracore sample locations for Study Areas 1-4 were determined based on the newly collected geophysical data while vibracore sample locations for Study Area 5 were determined based off historical geophysical data, with all samples targeting deposits with a thicker and higher potential for increased sand resources.

The first phase of vibracore operations was based out of Quincy, Massachusetts, at the home dock of the *R/V Peter M. Mahoney*. The dock had facilities for secure equipment and vibracore storage, supporting equipment for vessel mobilization and demobilization, and was centrally located for Study Areas 1 (Merrimack River), 2 (Nantasket Beach), and 5 (Cuttyhunk). To start the first phase, APTIM transited to Study Area 2 (Nantasket Beach) from Quincy and conducted operations on site, returning at the end of the day. The vessel transited overnight to Study Area 1 (Merrimack River) where all the vibracores in this area were collected during daylight hours before returning after the completion of operations in the area. The vessel transited overnight to Study Area 5 (Cuttyhunk) and commenced operations during daylight hours before returning to dock. The vessel returned to Quincy, Massachusetts to demobilize off the *R/V Peter M. Mahoney* and store equipment for a pause in operations. Operations were resumed for the second phase after remobilizing in Quincy, Massachusetts onto the *R/V James K. Goodwin* vessel. The vessel made its way to Study Area 3 (Duxbury) and Study Area 4 (Sandwich) where the remaining vibracores were collected over a two-day period. Vibracore collection was completed on the second day and the vessel transited back to Quincy, Massachusetts to demobilize.

Across all five Study Areas, the acceptable vibracore recovery was a minimum of 80 percent of the desired penetration depth through the unconsolidated strata. The desired depth of penetration was 4 m (13.1 ft); however, it was recognized that maximum penetration might not be achieved at all sample locations. When located over a boring site, APTIM made every reasonable effort to reach the required depth or to reach penetration refusal. Penetration refusal is reached when less than 0.30 m (1 ft) of advance is accomplished after 5 minutes of vibration (as measured by penetrometer). When refusal was met at less than 80 percent of the desired depth of penetration, APTIM removed the sampled portion and a new vibracore pipe was set up for a second attempt. Retries were accomplished until the desired penetration and recovery had been accomplished, or until two retries had been attempted (for a total of three attempts), whichever occurred first. A Master Geotechnical Digital Log (in .xlsx format) was maintained throughout the vibracore collection operations. This log contained information on each vibracore attempt including location, number of attempts, penetration depth, recovery, and other pertinent information and notes.



Once vibracore operations were completed, the vessel returned to its home dock in Quincy, Massachusetts. The vibracore samples were then shipped to APTIM's Construction Materials Engineering Council, Inc. (CMEC), a USACE-accredited geotechnical laboratory, for further onsite testing and analysis.



6.0 DATA PROCESSING AND INTERPRETATION METHODS

The following subsections describe in detail the methods used by APTIM to process and interpret the hydrographic, geophysical, and geotechnical datasets.

6.1 Bathymetric Processing

Upon completion of the field work, data were edited and reduced with APTIM's internal software programs, Hypack 2025®, and POSPac Mobile Mapping Suite. Following data collection, all data files were processed using Hypack's SBMAX64 program. Full sound velocity profiles, tide adjustments, and motion reference unit corrections were applied and analyzed for inconsistencies. Erroneous soundings were identified and removed within SBMAX64. For Study Areas 1-3, GNSS tides that were collected during geophysical operations were applied in post processing. For Study Area 4, POS GNSS base lines were postprocessed using POSPac Mobile Mapping Suite using NGS CORS, specifically, CORS stations MAPL, MATU, MACM, MAFA, MADA, and MAMV. Corrected GNSS strings were imported into Hypack Single Beam editor, improving the horizontal and vertical accuracies of the sounding data that was collected.

Hypack's SORT Program was then used to reduce sounding data and export to an .xyz file, which was used to create bathymetric maps. Hypack's Cross Check Statistics program was used to identify potential sounding inaccuracies. For surface and map creation, the final .xyz data files were processed through Golden Software's Surfer 28 for interpolation and grid creation. ESRI's ArcPro was used for final interpolation and presentation of surface results. Bathymetric maps can be found in Section 11.0, Map 27 to Map 30 and processed .xyz files are submitted in Appendix A.

6.2 Sidescan Sonar Processing

Sidescan sonar data were processed using Chesapeake Technologies, Inc. SonarWiz 8 software. The raw sidescan sonar data were imported into two SonarWiz 8 projects. One SonarWiz project was for low frequency, and a second for high frequency. Once the data were imported, they were bottom tracked to remove the water column (nadir) recorded in the data. Bottom tracking was achieved by applying an automated bottom tracking routine that determined the first return signal in the data and provided an accurate baseline representation of the seafloor that eliminated the water column from the data. In some cases, manual bottom tracking was necessary when the automated bottom tracking could not accurately determine the first return in the sidescan sonar record. For these cases, the APTIM geophysicist manually determined the first return in the data.

After bottom tracking, the data were processed to reduce noise effects and enhance seafloor definition. To do this, an Empirical Gain Normalization (EGN) table was built, which sums and averages the sonar amplitudes of every ping in the imported files by altitude and range. The EGN is a gain function that can be considered a replacement for Beam Angle Correction. A given sonar amplitude sample is placed in a



grid location based on the geometry of the ping, where the x-axis is range, and the y-axis is altitude. The resulting table quantifies the beam pattern of a sonar by empirically analyzing millions of data points.

Following the processing phase, the data were interpreted to identify contacts. Contacts are areas of potential seafloor hazards such as artificial reefs, submerged platforms, and the surficial geology of the seafloor. Potential areas of interest were digitized and categorized into subsection bottom types. APTIM geologists utilized backscatter intensity, distribution, and texture to make best professional interpretations of the features. The reflectivity of the sidescan sonar acoustic return is indicative of the density of the imaged material. The study areas displayed a spectrum of reflectivity from low to high. Softer seafloor material, such as silts/clays often display low reflectivity, while harder seafloor material, such as sands, reflectivity can vary depending on its attributes of fine to coarse-grained or intermixed levels of silt. The highest reflectivity materials are indicative of hardbottom or exposed surficial rock. The surveyed study areas recorded varying reflectivity sands throughout; however, some areas had lower reflectivity than others indicating finer grained sands, or sands intermixed with silts. Brighter, high reflectivity sands were also observed, which are often coarser or contain less silt material. The results section discusses the distribution of these varying sands throughout the study areas. However, these interpretations are based solely on the acoustic backscatter data and further ground-truthing is recommended for confirmation of the acoustic interpretation.

The survey lines collected throughout the study areas were sufficiently spaced to allow for full seafloor coverage and interpretation. Identified sidescan sonar targets are presented in Appendix B: Sidescan Contact Report and maps with sidescan sonar data can be found in Section 11.0, Map 15 to Map 22.

6.3 Magnetometer Processing

The magnetometer data were processed with Hypack 2024's Magnetometer Editing software to locate magnetic anomalies. The .raw data files were imported into and normalized manually to clean and remove any abnormal spikes or irregularities in the magnetic profile and to account for unwanted interference in the record, such as the survey vessel's effects or environmental and diurnal variations. Objects that possess any ferromagnetic mass (e.g., iron) can be detected with the magnetometer and are indicated by changes in magnetic intensity and visualized as monopoles, dipoles, and multi-component signatures in the profile view of the data. These varying signals distinguish the anomalies from the natural environment.

Each survey line was reviewed and interpreted in detail for the presence of magnetic anomalies. Upon completion of this review, anomalies were plotted and examined together with shapefiles of sidescan sonar contacts, charted shipwrecks and obstructions, artificial reefs, and buried transmission cables to find associations between the datasets. The maps presented in Section 11.0, Map 19 to Map 22, show the extent of the magnetometer data coverage of the investigation area and the spatial distribution of anomalies. The magnetometer anomalies are presented in table format in Appendix C.

A close-order survey with multiple survey lines using a tighter line spacing would be required to refine the magnetic record in the study area as it would provide an opportunity to generate a magnetic contour



map. State Historic Preservation Offices often require magnetic contour maps as part archaeological survey deliverables, as they can provide valuable insight into the magnetic anomalies present in an area such as their source, size, orientation, distribution, and signature.

6.4 Seismic Sub-Bottom Processing

Post collection processing of the sub-bottom data was completed using Chesapeake Technology, Inc.'s SonarWiz 7 software. This software allowed the user to apply specific gains and settings to produce enhanced sub-bottom imagery that were interpreted and digitized for specific stratigraphic facies relevant to the project goals.

The first data processing step was to calculate the approximate depth of the reflector below the sound source by converting the two-way travel time (the time in milliseconds that it takes for the “chirp pulse” to leave the source, hit the reflector and return to the source) to feet by utilizing an approximate value for the speed of sound through both the water and underlying geology. For this survey, a detailed hydrographic and geologic sound velocity structure was not available, so APTIM geophysicists used an estimated sound velocity of 1.6 meters per millisecond (m/ms) (5.25 feet per millisecond [ft/ms]) to convert two-way travel time to feet. This estimate of the composite sound velocity is based on several assumptions including the speed of sound through water, which is typically 1.5 m/ms (4.92 ft/ms) as well as on the speed of sound through the sediment that can vary from 51.6 m/ms (25 ft/ms) for unconsolidated sediment to greater than 1.7 m/ms (5.58 ft/ms) for limestone.

APTIM geophysicists then processed the imagery to reduce noise effects (commonly due to the vessel, sea state, or other natural and anthropogenic phenomenon) and enhance stratigraphy. This was done using the processing features available in SonarWiz, specifically the AGC and swell filter. The SonarWiz AGC is similar to the Discover-SB AGC feature, where the data are normalized to remove the extreme high and low returns, while enhancing the contrast of the middle returns. To appropriately apply the swell filter, the sub-bottom data were bottom tracked to produce baseline representation of the seafloor. Once this was done, through a process of automatic bottom tracking (based on the high-amplitude signal associated with the seafloor) and manual digitization, the swell filter was applied to the data. The swell filter is based on a ping averaging function that removes vertical changes in the data due to towfish movement caused by the sea state. The swell filter was increased or decreased depending on the period and frequency of the sea surface wave conditions, however, particular care was taken during this phase to not remove, or smooth over geologic features that are masked by the sea state noise. A blank water column function was also applied to cut any features such as schools of fish under the chirp system, which produce reflected artifacts within the water column.

The primary objectives of initial sub-bottom data interpretation were two-fold: 1) identify key geologic features such as valleys, paleochannels, shoals, and hardbottom or exposed rock outcrops that could serve as a sandy depocenter or influence sand resource distribution; 2) integrate legacy seismic data with the newly acquired 2025 dataset to refine and more accurately delineate potential sand resources through



the development of regional and focus area isopach maps for each study area. Results are presented in Section 11.0, Map 23 to Map 26.

Upon completion of interpretation and digitization, the sub-bottom data were exported as a “Web” based project of HTML/JPEG files viewable in standard web browser software packages and submitted in Appendix D.

6.5 Isopach Creation

The ASCII X/Y/Thickness file from SonarWiz, created by calculating the thickness value between the bottom of sand reflector and the seafloor, was then imported into Golden Software Inc.'s Surfer software program (software version 28), gridded, and reviewed for quality and accuracy (i.e., obvious visual inconsistencies, inaccuracies, and/or anomalies in the resulting gridded surface, like isolated holes, valleys, or obvious interpretation mismatches between survey lines). Upon review, if the resulting gridded thickness surface displayed discrepancies or clear artifacts (such as mismatched interpreted thicknesses at line crossings due to interpreting and digitizing different features on adjacent lines), the seismic sub-bottom data were reviewed and adjustments to the interpreted boundary location were made to the seismic sub-bottom digitization to fix these inconsistencies, ensuring that all interpreted and digitized features tied together in each study area. Once adjusted in SonarWiz, the X/Y/Thickness file was re-exported (as detailed above) and re-gridded in Surfer to review the resulting isopach surface. This process was repeated until all visual inconsistencies and tie issues in the seismic sub-bottom data were corrected. After this quality assurance/quality control step, a final ASCII X/Y/Thickness file was exported for each area and gridded into a raster isopach surface within ArcGIS. Output cell sizes (X, Y) of 15.24 m (50 ft) were used for the final surface

The volume of the resulting isopach surface was then calculated by using the Surface Volume tool in Surfer. This tool utilizes the difference between two (2) surfaces to determine a potential volume in cubic meters of the sand deposit. For this project, the volume was determined by comparing the clipped, computed isopach surface to a zero-thickness plane, generating a total potential volume of the sandy seafloor area.

It is important to note that the accuracy of the isopach and volume results is a function of the overall data density in each study area. Design level surveys (30 m spaced tracklines) produce isopachs of sufficient accuracy for, which borrow areas can reliably be designed from. While none of the study areas had data coverage consistent with borrow area design-level densities, all had sufficient coverage to make reconnaissance-level calculations of rough magnitude of potential volumes and locations of sand resources. Results are presented in Section 11.0, Map 36 to Map 45.

6.6 Vibracore Sample Processing

Upon collection of the vibracores and removal of the vibracore tube (Figure 1 Panel A), APTIM geologists measured, marked, and cut each vibracore into 1.52 m (5 ft) sections to prepare the vibracores for



transportation (Figure 1 Panel B). Each section was capped with bottom and top caps labeled with B or T respectively and numbered sequentially, with 1 being the first removed section (bottom of core), and 3 or 4 being the last section (top of core), depending on overall vibracore length. Each vibracore section was then labeled onboard the vessel (Figure 1 Panel C) with the sample identifier and the top and bottom measurements. After geotechnical survey operations were completed, all vibracore sections were transported to APTIM's CMEC and USACE-accredited geotechnical laboratory in Boca Raton, Florida. APTIM geologists split each vibracore lengthwise and logged them in detail. These logs included descriptions of sedimentary properties by layer in terms of layer thickness, wet Munsell color, texture (grain size), composition and presence of clay, silt, gravel, and any other identifying features. The vibracores were logged in accordance with the American Society for Testing and Materials (ASTM) Standard Materials Designation D2488-17e1 for the description and identification of soils using the visual-manual procedure. Miniature vane shear tests were performed during logging to characterize the clay material. They were conducted in accordance with ASTM Standard Test Methods of Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil (D4648/D4648M-16). Wet Munsell colors were determined from the methodology described in the Munsell Soil Color Book. Logging was consistent with USACE ENG Form 1836.

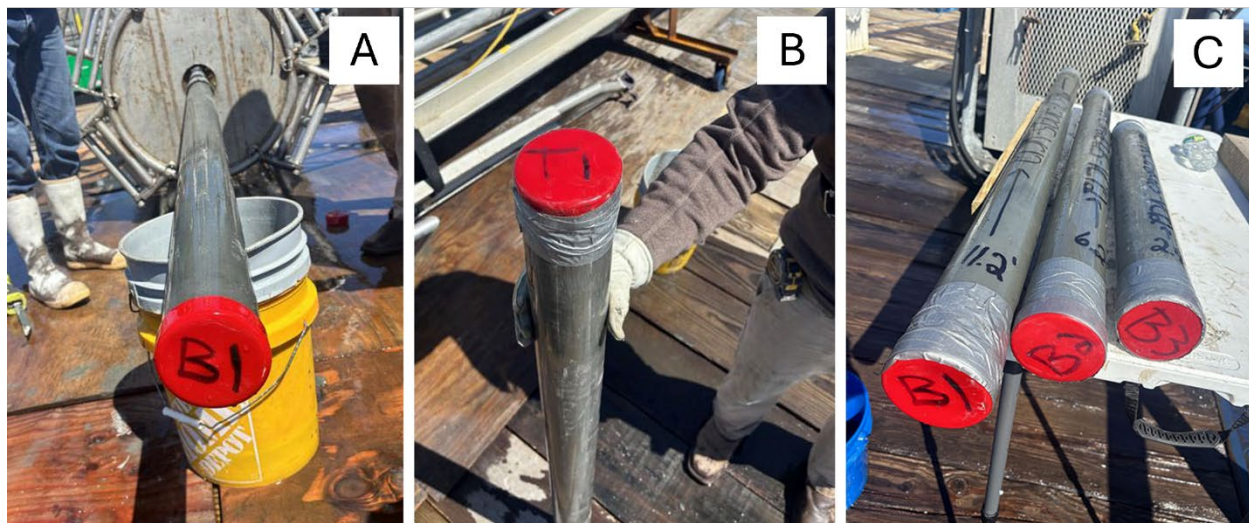


Figure 1: Vibracore Processing Upon Completion of Sample Collection

Note: A) Removal of vibracore tube from the coring barrel. B) Vibracore tube cut into 1.52 m (5 ft) sections, capped and labeled top (T) and bottom (B). C) Measured and fully labeled core sections prepped for transport to APTIM's geotechnical laboratory.

The split vibracores were photographed using a Ricoh WG-6 20-megapixel (mp) digital camera that was mounted on a frame directly above the vibracores. The photographs were taken using the normal image compression mode (shooting at "Normal" quality), and full spectrum overhead lighting. Each photograph included the relevant project name, vibracore name, depth interval, and scale. The photographs were downloaded from the camera as .jpgs, formatted with an 18 percent gray background for consistency, and then exported into the finalized .pdf format. This 18 percent gray background provides a known



reference color and is the standard reference value against, which all camera light meters are calibrated. Vibracore logs, photographs, granulometric reports, grain size distribution, carbonate results, and mini vane shear test results are presented in Appendices E through J, respectively (both attached to the report and provided digitally) and as-builts maps are presented in Section 11.0, Map 31 to Map 35.

Sediment samples were extracted from the vibracore sample halves at irregular intervals based on distinct stratigraphic layers and sediment quality. Strata with apparent high fines content were typically avoided for sieve analysis and miniature vane shear tests were performed instead when applicable. Layers that consisted predominately of clay with little to no sand or silt were sampled as a shear vane test and are categorized as Undistributed Samples within the vibracore logs. All physical samples extracted for grain size analysis are categorized as Distributed Samples and have sample data associated with them. The sample collection depths were noted on the logs, and the samples were stored in labeled plastic bags. The archived (unsampled) halves and sampled halves of the vibracore sections were then placed in labeled plastic sleeves and stored at APTIM to be available for additional review and sampling as needed. Archived vibracore halves were wrapped with plastic wrap prior to placement in the plastic sleeves, to reduce shifting of the sediments during storage and future transfer. The vibracore log descriptions were entered into the gINT® software program.

6.6.1 Mechanical Sieve Analysis

The sediment samples were analyzed to determine color and grain size distribution. During sieve analysis the wet, dry, and washed Munsell colors were noted. Dry and washed Munsell colors were determined from the methodology described in the Munsell Soil Color Book. Grain size distribution was determined through sieve analysis in accordance with ASTM Standard Materials Designation D6913/D6913M-17 for particle size analysis of soils. This method covers the quantitative determination of the distribution of sand particles. Sediment finer than the No. 200 sieve (3.75 phi) was analyzed following ASTM Standard Materials Designation D1140-17. Mechanical sieving was accomplished using calibrated sieves with a gradation of half-phi intervals. Additional sieves were included to represent key ASTM sediment classification boundaries, and the weights retained on each sieve were recorded cumulatively. The sieve stack used for mechanical analysis is provided in . Grain size results were entered into the gINT® software program, which computes the mean and median grain size, sorting, and fines (silt/clay) percentages for each sample using the moment method. Grain size results are displayed on the logs (Appendix E), granulometric reports (Appendix G), and grain size distribution curves (Appendix H).



Table 2: Granularmetric Analysis Mesh Sizes by Unified Soil Classification System (USCS) based on the ASTM D2487/2488 standards.

ASTM D2487/2488		APTIM Standard Sieve Stack		
		Sieve Number	Size (phi)	Size (mm)
Gravel	Coarse Gravel	3/4	-4.25	19.03
	Fine Gravel	5/8	-4.00	16.00
		7/16	-3.50	11.20
		5/16	-3.00	8.00
		3 1/2	-2.50	5.60
		4	-2.25	4.75
Sand	Coarse Sand	5	-2.00	4.00
		7	-1.50	2.80
		10	-1.00	2.00
	Medium Sand	14	-0.50	1.40
		18	0.00	1.00
		25	0.50	0.71
		35	1.00	0.50
		45	1.50	0.36
	Fine Sand	60	2.00	0.25
		80	2.50	0.18
		120	3.00	0.13
		170	3.50	0.09
		200	3.75	0.08
		230	4.00	0.06
Fines	Silt/Clay			

Grain size results were also used for composites. Composites for this project were generated mathematically and incorporate the historic 2017 vibracore data. Composites are the combination or mixture of representative samples, producing a single, average sample that reflects the overall characteristics of a larger area. Generating composites mathematically allows for fewer total samples to be analyzed while still capturing the overall sediment characteristics. The composites include wet and dry Munsell values, effective length of the samples, percent silt and both phi and converted mm values for sorting, mean and median. Composites values for each of these items are computed by calculating the weighted average (sample weighted by representative lengths of the sampled layer within the core). Composite statistics for each study area are then compiled by averaging the weighted results for all cores within the lateral and vertical limits of the area. Percent silt is based off the #230 sieve. Mean is the arithmetic average of all grain sizes in a sediment sample, median is the particle size at which 50 percent of the sample is finer and 50 percent is coarser and sorting is a measure of the range of grain sizes in a sediment and refers to the degree of uniformity of grains. Sorting is first calculated in the gINT software program using the Folk and Ward graphic standard deviation equation. These calculated values are typically expressed in phi units and fall within a given range associated with the descriptive terms described by Folk and Ward (1974). Folk and Ward's phi units were converted into approximate millimeter values (Table 3) to support correlation with the other data present in the composite result tables below in Section 7.0. Composite tables are provided in Appendix K and L.



Table 3: Sorting scales devised by Folk and Ward, with approximate mm conversions

Description	Phi	Approximate mm
Very well sorted	< 0.35	< 0.78
Well sorted	0.35 - 0.50	0.78 - 0.71
Moderately well sorted	0.50 - 0.71	0.71 - 0.61
Moderately sorted	0.71 - 1.00	0.61 - 0.50
Poorly sorted	1.00 - 2.00	0.50 - 0.25
Very poorly sorted	2.00 - 4.00	0.25 - 0.06
Extremely poorly sorted	> 4.00	> 0.06

6.6.2 Carbonate Test

Carbonate testing was performed on 15 sieved vibracore samples. Testing follows the acid leaching methodology described in Twenhofel and Tyler (1941), by using hydrochloric (muriatic) acid to burn off all carbonate composition within each sample. Samples are weighed pre and post reaction, calculating carbonate content by percent weight. Results were entered into the gINT® software program and are displayed on the granulometric reports and grain size distribution curves and histograms. Carbonate testing results are provided in Appendix I.

6.6.3 Miniature Vane Shear Tests

Miniature vane shear tests were conducted during vibracore logging in accordance with ASTM Standard Test Methods of Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil (D4648/D4648M-16). These tests were used, when possible, to characterize the clay material in the vibracores as outlined in Table 3. Clay layers with higher silt, sand, and/or shell content were avoided for testing as the presence of these sediment types tends to skew the results of the miniature vane shear test. The results presented represent miniature vane shear test results and are presented in Appendix J.

6.7 Cultural Resources Assessment

Prior to vibracore activities, APTIM's Qualified Marine Archaeologist (QMA) reviewed all geophysical survey data at each proposed vibracore location, in combination with reviews of wreck and obstruction databases, historic and present day nautical charts, potential hazard, submarine cable, and oil/gas shapefiles, and the known historical use of the area, to clear each proposed vibracore location of potential submerged cultural resources. There were no magnetic anomalies, sidescan sonar contacts, or sub-bottom features of archaeological interest identified within the 50 m (164 ft) buffers around any of the proposed vibracore locations. APTIM's QMA will provide photos of split vibracores and vibracore logs to the Massachusetts State Underwater Archaeologist at the Massachusetts BUAR for their record and review.



7.0 RESULTS

APTIM collected, processed, and interpreted a total of 173.61 nm (321.52 km) of newly acquired full-suite high resolution geophysical data (Table 4), as well as 20 newly acquired vibracores across the five study areas (Table 5). APTIM incorporated the results of the newly acquired datasets with all relevant historical data to provide information on sand resources across the study areas, the results of which are broken down between each individual study area described below. The composite results from each study area are divided into a regional assessment and a focus level assessment. The regional composite results are listed in the respective study areas in Sections 7.1.5, 7.2.5, 7.3.5, 7.4.5, and 7.5.2.

Table 4: Geophysical Data Allocation Per Study Area

Study Area	Proposed (km)	Proposed (nm)	Collected (km)	Collected (nm)
Merrimack River	68.45	36.96	73.04	39.44
Nantasket Beach	82.89	44.76	99.86	53.92
Duxbury Beach	66.19	35.74	69.67	37.62
Sandwich	71.36	38.53	78.95	42.63
Cuttyhunk	N/A	N/A	N/A	N/A
Total	288.89	155.99	321.52	173.61



Table 5: Results of Vibracore Field Operations

Vibracore	Number of Attempts	Top of Core Elevation (ft, NAVD88)	Penetration (ft)	Recovery (ft)	Recovery (%)	Study Area
MA-CZM-2025-VC01	1	-112.3	17.96	15.9	89	2
MA-CZM-2025-VC02	1	-135.6	17.92	12.2	68	2
MA-CZM-2025-VC03	1	-56.2	16.40	14.8	90	2
MA-CZM-2025-VC04	1	-45.0	17.30	17.1	99	2
MA-CZM-2025-VC05	1	-108.1	14.79	13.5	91	1
MA-CZM-2025-VC06	2	-85.5	19.10	15.1	79	1
MA-CZM-2025-VC07	1	-92.1	18.60	11.5	62	1
MA-CZM-2025-VC08	1	-89.1	17.02	16.9	99	1
MA-CZM-2025-VC09	1	-63.8	17.63	17.6	100	5
MA-CZM-2025-VC10	1	-66.2	18.26	17.4	95	5
MA-CZM-2025-VC11	1	-62.2	19.2	18.5	96	5
MA-CZM-2025-VC12	2	-56.8	20.00	11.02	56	5
MA-CZM-2025-VC13	1	-121.7	18.75	18.50	98	3
MA-CZM-2025-VC14	1	-105.3	17.90	18.60	104	3
MA-CZM-2025-VC15	1	-71.4	17.10	17.80	104	3
MA-CZM-2025-VC16	1	-65.9	17.22	17.6	102	3
MA-CZM-2025-VC17	1	-46.2	19.30	19.20	99	4
MA-CZM-2025-VC18	1	-43.2	19.50	18.20	93	4
MA-CZM-2025-VC19	1	-89.1	17.72	17.10	97	4
MA-CZM-2025-VC20	1	-52.1	18.23	15.2	83	4

7.1 Study Area 1 Merrimack River

7.1.1 Bathymetry

Bathymetric elevations for Study Area 1 range from -20.7 m (-68 ft) m to -40.5 m (-133 ft) NAVD88 across the mapped area. The interpolated contours indicate a consistent and gradual slope offshore, with deeper water observed toward the northeast extent of the survey boundary.



The seafloor morphology is relatively uniform, with minimal topographic variation or abrupt changes in relief. Contour spacing is relatively even throughout most of the study area, suggesting a gently sloping bottom profile. Minor undulations are present, particularly along the western edge of the site, but no significant shoals, depressions, or obstructions were identified. XYZ data are presented in Appendix A, and a bathymetric map is presented in Section 11.0, Map 27 to Map 30.

7.1.2 Sidescan Sonar

Sand ripples were observed in the eastern half of the study area, gradually diminishing towards the west. Silt deposits occurred along the northern edges, often interspersed with low reflectivity sands, which were also present in the southeastern and eastern portions of the region. Rock outcrops were noted in the southern part of the study area, as can be observed in Section 11.0, Map 15. Four contacts were identified and can be observed in Appendix B and Section 11.0, Map 19. Sidescan Contacts 1 and 2 were of high-intensity, unknown features with shadows; Contact 3 was a low intensity, small, unknown feature; and Contact 4 consisted of anchor scour marks.

7.1.3 Magnetometer

The magnetometer survey data revealed four (4) magnetic anomalies within Study Area 1, as shown in Section 11.0, Map 19, as well as Appendix C. Anomalies ranged from 18.06 nT to 338.62 nT in amplitude and from to (19.42 m [63.7 ft] to 185.87 m [609.81 ft]) in duration. Anomaly signatures consisted of 2 monopolar, 1 dipolar, and 1 multicomponent anomaly. One of the identified anomalies was potentially associated with, or representative of, sidescan sonar Contact 2, which was described as a high intensity object with shadow. None of the other anomalies were potentially associated with, or representative of, other features in the hazard shapefiles described in Appendix C.

7.1.4 Seismic Sub-bottom

Seismic interpretation of Study Area 1 identifies a laterally variable coarse sandy unit with average thicknesses ranging from 1.8 m (6 ft) to 4.3 m (14 ft) in the northeast, increasing in the southwest from 2.13 m (7 ft) to 4.9 m (16 ft). Vibracores MA-CZM-2025-VC06, MA-CZM-2025-VC07, and MA-CZM-2025-VC08 (Figure 2) confirm that this surficial unit in the northern section is primarily coarse-grained sediment with a mean grain size greater than 0.50 mm (1.0 phi). These sandy deposits typically occur as surficial layers or shoals and are characterized by chaotic, mottled, high-amplitude seismic facies. Small, localized features such as scoured valleys infilled with chaotic, low-amplitude sediments are also observed. While ground-truthing of these deeper features was not possible due to vibracore penetration limits, it is plausible that the mapped sandy unit extends to the base of some of these infilled valleys, rather than terminating at its current interpreted boundary (Figure 2). Ground-truthing by MA-CZM-2017-VC06 confirms that fine sand is present throughout the southern section, averaging between 2.7 m (9 ft) to 4 m (13 ft) and reaching a local maximum of 7.6 m (25 ft) along an elongate, shore-parallel shoal in the southwest.



Study Area 1A Merrimack River

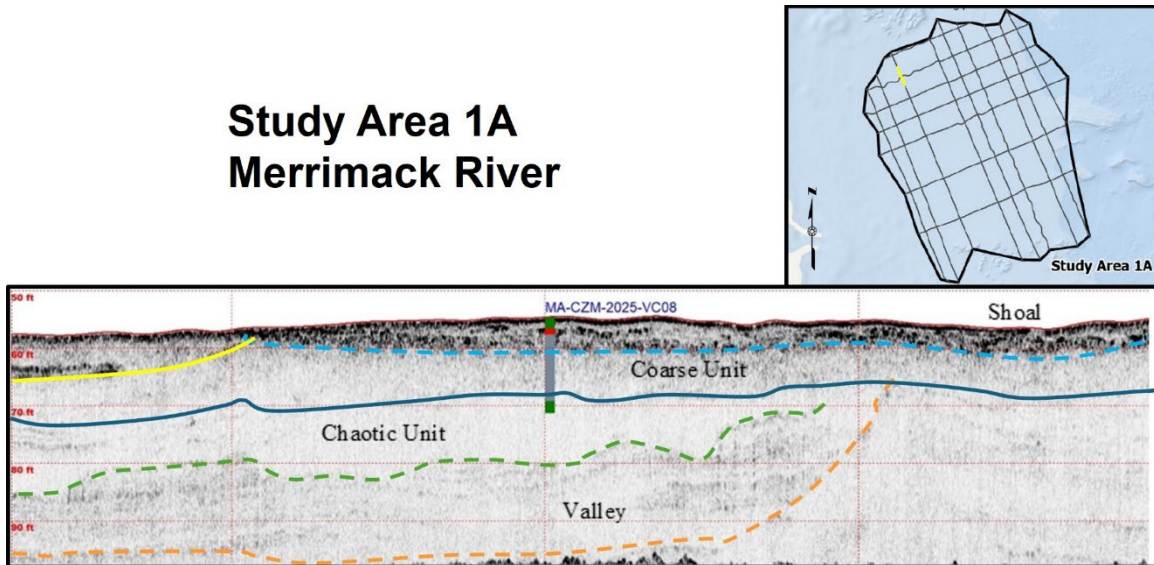


Figure 2: Seismic profile along Line 06 in Study Area 1A displaying a mottled shoal overtop a coarse sand unit, ground-truthed by MA-CZM-2025-VC08. Trackline for seismic example highlighted in yellow.

Note: MA-CZM-2025-VC08 color code: fine sand (green), clay (red), coarse sand (gray). Vibracore MA-CZM-2025-VC08 confirms the presence of a coarse-grained sand unit beneath the surficial shoal. At the base of the vibracore, a medium-grained, poorly sorted sandy unit is identified, which acoustically appears chaotic and lacks internal lamination. The strong basal reflector beneath the chaotic unit suggests a valley surface and indicates that the sandy deposit extends ~ 8 ft deeper than the vibracore termination. Orange dashed line Valley, Black line: Chaotic Unit, Green dashed line: Coarse Unit, Blue dashed line: Base of Shoal, Yellow line: Channel.

The entire study area is bounded by hardbottom or rock outcrops, which are exposed at the seafloor in several locations and are observed at depth throughout much of the interpreted section. In the northeastern portion of the study area, thinly laminated clays were ground-truthed beneath the sandy unit (MA-CZM-2017-VC08); these appear to taper out toward the south, where the seismic record becomes increasingly chaotic, and a strong surficial reflection often obscures underlying stratigraphy.

The thickest, coarse sand deposit, mapped at ~4.9 m (16 ft), occurs in the western portion of the study area, where the 2025 APTIM survey overlaps historical USGS survey lines. However, the USGS sub-bottom data in this area are of poor quality, lacking coherent, continuous reflectors and exhibiting significant vertical smearing, high noise levels, and rapid attenuation that limits imaging depth. Overamplification near the seafloor further clips the signal, masking critical shallow features. These limitations introduce considerable uncertainty and prevent the legacy dataset from providing the resolution necessary to refine the isopach derived from the 2025 APTIM data. Because the thickest portion of the deposit coincides with this poorly imaged area, recollection of high-resolution sub-bottom data is recommended to better constrain sediment thickness and extend the isopach model westward. The seismic results for Study Area 1 are presented in Section 11.0, Map 23.



7.1.5 Vibracore

Within Study Area 1, there were only four (4) historic vibracores collected during the APTIM 2018 investigation. Four (4) new vibracores were collected within the newly identified Study Area 1A, MA-CZM-2025-VC05, MA-CZM-2025-VC06, MA-CZM-2025-VC07, and MA-CZM-2025-VC08. MA-CZM-2025-VC05 consists of a mix of clayey sands, fat clays (cohesive, compressible, high plasticity clays that are also known as expansive clays because they can absorb large amounts of water that lead to significant volume changes when wet), silty sands, sandy clay, and sands. MA-CZM-2025-VC06 consists of 4.6 m (15.2 ft) of medium to coarse-grained sands, with silt contents not exceeding 2 percent. MA-CZM-2025-VC07 consists of 3.5 m (11.6 ft) of medium to coarse-grained sands, with silt contents not exceeding 2 percent. MA-CZM-2025-VC08 consists of sands with a layer of lean clay (characterized by low/medium plasticity due to relatively higher content of silt or sand, and minimal volume changes when wet due to it absorbing smaller amounts of water) between 0.6 m (2.1 ft) and 1 m (3.2 ft), whereas the rest of the 5.1 m (16.9 ft) vibracore contains fine- to coarse-grained sands with silt contents not exceeding 2 percent. Table 6 below provides a breakdown of the composite results for the Merrimack River Study Area.

Table 6: Regional Composite Results for Merrimack River Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt (%)	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC05	1	0.51	0.41	1.09	0.50	0.40	1.84
MA-CZM-2017-VC06	1	0.20	0.54	2.11			
MA-CZM-2017-VC07	1	0.46	0.50	3.36			
MA-CZM-2017-VC08	1	0.74	0.47	0.92			
MA-CZM-2017-VC09	1	0.42	0.33	3.07			
MA-CZM-2025-VC06	1	0.78	0.37	1.60			
MA-CZM-2025-VC07	1	0.57	0.46	1.13			
MA-CZM-2025-VC08	1	0.52	0.50	1.49			

7.2 Study Area 2 Nantasket Beach

7.2.1 Bathymetry

Bathymetric elevations for Study Area 2 range from -11.2 m (-38 ft) to -42 m (-138 ft) NAVD88. The area shows seafloor variability, with gently sloping regions and localized zones of steeper relief. The southwestern portion of the area is relatively shallow and uniform, while the northeastern and central regions contain multiple depressions and mounded features, indicated by the tightly spaced contours. These variations suggest the presence of natural bottom features such as scour holes or sediment ridges. XYZ data are presented in Appendix A, and a bathymetric map is presented in Section 11.0, Map 28.



7.2.2 Sidescan Sonar

Sidescan sonar interpretations for Study Area 2A revealed an extensive deposit of low reflective sands spanning the central portion of the subset study area, from the westernmost point to the easternmost. A large highly reflective sand deposit was identified along the eastern edge, flanked by rock outcrops on the outer margin (Map 16).

In Study Area 2B, highly reflective sands dominated the northwest and northeast sections, with another substantial deposit in the southeast. Low reflective sands occurred in scattered patches within the central portion, along the western edge, and as a larger deposit in the southeast. A sizable deposit of very low reflective sediment was located in the southwest, bordered by both high and low reflective sands. Additionally, a large patch of hardbottom surrounded by low reflective sands was mapped in the southeast (Map 16).

Only two contacts were picked in Study Area 2, both within Study Area 2B. Contact 5 was a large rock outcrop, while Contact 6 was a large, linear, high-intensity unknown object with a corresponding acoustic shadow.

7.2.3 Magnetometer

The magnetometer survey data revealed 120 magnetic anomalies within Study Area 2 as shown in Section 11.0, Map 20 as well as Appendix C. Anomalies ranged from 9.41 nT to 1256.18 nT in amplitude and from 5.53 m (18.15 ft) to 419.08 m (1,374.93 ft) in duration. Anomaly signatures consisted of 72 monopolar, 35 dipolar, and 13 multicomponent anomalies. One of the identified anomalies was potentially associated with, or representative of, sidescan sonar Contact 6, which is described as a large high intensity linear feature. None of the other anomalies were potentially associated with, or representative of, other features mapped in the hazard shapefiles described in Appendix C.

7.2.4 Seismic Sub-bottom

Study Area 2A contains a surficial sand unit ranging 0.9 m (3 ft) to 7.6 m (25 ft) thick, increasing in thickness from nearshore to offshore. This sand unit is acoustically homogeneous, exhibiting a chaotic internal structure, minimal lamination, and moderate to low amplitude reflections, interpreted as finer-grained, silty material (confirmed by MA-CZM-2025-VC03, MA-CZM-2025-VC04, and MA-CZM-2017-VC01) (Figure 3). The thickest sand accumulation (4.3 m [14 ft] to 7.6 m [25 ft]) occurs in the eastern portion, bounded by hardbottom. The USGS legacy seismic data in this area exhibit elevated acoustic noise, variable signal return, and data gaps, obscuring portions of the underlying stratigraphy.

Study Area 2C is characterized by thin shoals overlying extensive valley systems, with highly variable seismic facies. These range from chaotic, non-laminated, low-coherence deposits to thinly laminated, high-amplitude units, indicating differing depositional environments. Vibracores (MA-CZM-2025-VC01 and MA-CZM-2025-VC02) confirm that the underlying valley fill consists mainly of finer-grained sediments, such as silts and clays. Sand thickness ranges from 1.5 m (5 ft) to 4.9 m (16 ft) and is bounded by exposed or shallowly buried hardbottom. In the thickest section, seismic data reveal a scoured, thinly



laminated valley infilled with chaotic, low-amplitude sediment—possibly reworked shoal material—though this remains unverified due to the lack of direct ground-truthing. The seismic results for Study Area 2 are presented in Section 11.0, Map 24.

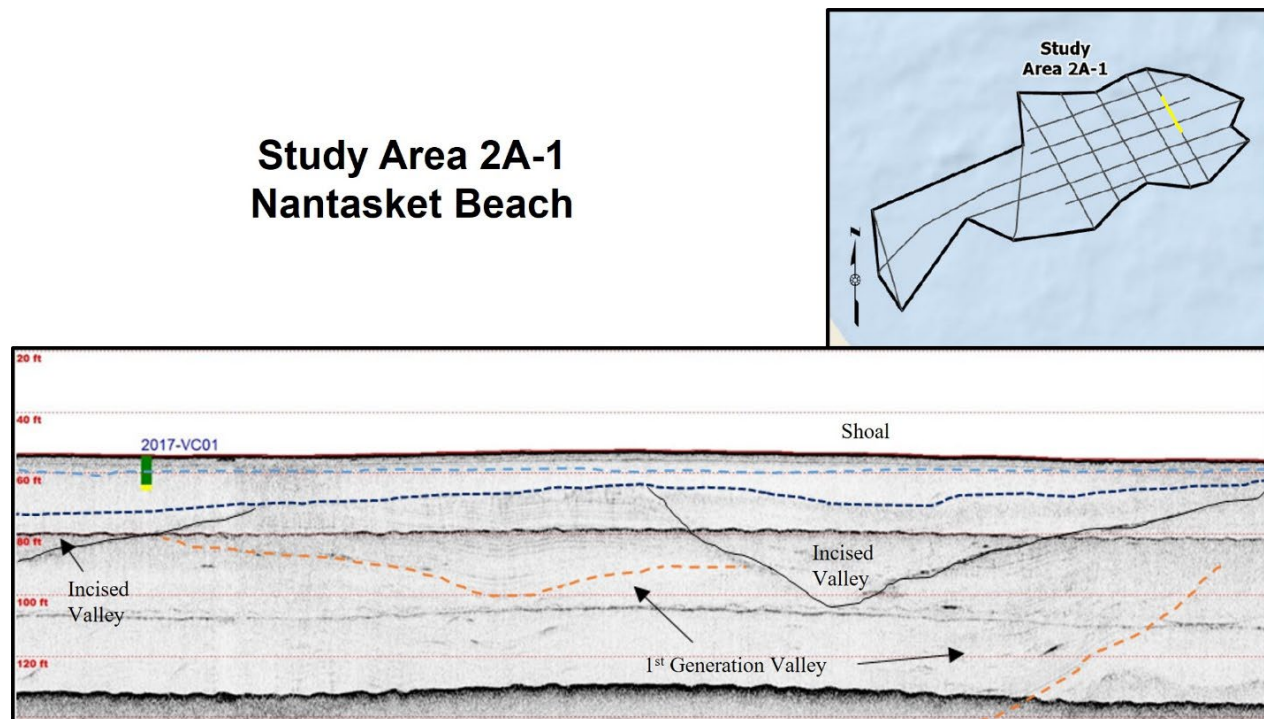


Figure 3: Line 55 in Study Area 3A MA-CZM-2017-VC01 Displaying a large shoal overtop a unit of fine sand that has accumulated over an incised valley. Trackline for seismic example highlighted in yellow.

Note: Green: Fine Sand with fines < 10%. Yellow: Fine Sand with fines > 10%. Purple dashed line delineates a ground-truthed unit of fine sand that extends below the shoal and caps the valley system. Blue dashed line: Base of Shoal; Black line: Incised Valley; Orange dashed line: 1st Generation Valley.

7.2.5 Vibracore

Within Study Area 2, there were only four (4) historic vibracores collected during the APTIM 2018 investigation, one (1) in Study Area 2A-1 and three (3) in Study Area 2C. Four (4) new vibracores were collected, two (2) in Study Area 2A-1 and two (2) in Study Area 2C. In Study Area 2A-1, MA-CZM-2025-VC03 sampled a large shoal and characterized the subsurface to 4.8 m (15.8 ft) as poorly graded sand, consisting of fine-grained material with a mean grain size of 0.21 mm (2.25 phi). This facies overlies sandy lean clay, which extends to the vibracore termination depth of 5.4 m (17.9 ft). Further inshore, MA-CZM-2025-VC04 penetrated the same shoal complex and indicates that the poorly graded, fine-grained sand unit thins to 1 m (3.4 ft). Below this, fines increase progressively and the section transitions into interbedded sands and clays. In Study Area 2C, MA-CZM-2025-VC01 characterized the subsurface as predominantly fat clay, with a single 0.9 m (3.1 ft) layer of fine-grained sand towards the top of the



vibracore. This layer with almost 20 percent sand was not included as part of the vibracore composite. Upon review of the available seismic sub-bottom data, this sand layer is associated with a buried channel complex. MA-CZM-2025-VC02 indicates that the subsurface geology is generally clay. Since the visual inspections of MA-CZM-2025-VC01 and MA-CZM-2025-VC02 indicate that they are predominantly clay; therefore, not beach-compatible, no sediment samples were analyzed for grain size content, and no composites were generated for these two (2) vibracores. Table 7 below provides the composite information for the collected vibracores.

Table 7: Regional Composite Results for Nantasket Beach Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt (%)	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC01	2A-1	0.16	0.52	10.87	0.22	0.56	10.11
MA-CZM-2025-VC03	2A-1	0.21	0.71	2.74			
MA-CZM-2025-VC04	2A-1	0.17	0.51	17.32			
MA-CZM-2017-VC04	2C	0.6	0.65	11.02	0.16	0.65	11.02

7.3 Study Area 3 Duxbury Beach

7.3.1 Bathymetry

Bathymetric elevations for Study Area 3 range from -19.5 m (-64 ft) to -48.8 m (-160 ft) NAVD88. The western portion features steep relief, with several prominent mounds and depressions indicated by tightly spaced contours. The northeastern section transitions into deeper, more uniform terrain, with gradually sloping contours and less variation. The northeastern portion shows a steep drop off with depths reaching -48.8 m (-160 ft) NAVD88. XYZ data are presented in Appendix A, and a bathymetric map is presented in Section 11.0, Map 29.

7.3.2 Sidescan Sonar

Sidescan sonar interpretations for Study Area 3A indicated that high reflective sand is prevalent throughout the area, with large deposits of low reflective sand along the eastern and western edges and additional low reflective sand patches in the center. Two rock outcrops were identified, one near the northeast edge and another in the center of the study area as can be observed in Map 17.

In Study Area 3B, low reflective sand dominated with patches of high reflective sand in the northern portion and additional high reflective sand deposits along the western and eastern edges. Sand ripples were observed at the northernmost point and rock formations were mapped along the northwest, northeast, and southern boundaries, as well as boulders atop high reflective sands in the eastern sector, as can be observed in Map 17.



Four (4) contacts were identified in Study Area 3, three (3) in Study Area 3A and one (1) in Study Area 3B as seen in Section 11.0, Map 21. Contact 9 was a high-intensity, linear, unknown feature. Contacts 7 and 8 were small, unknown, high-intensity features with associated acoustic shadows. Contact 10, located in Study Area 3B, consisted of several high-intensity points arranged in a linear pattern.

7.3.3 Magnetometer

The magnetometer survey data revealed 14 magnetic anomalies within Study Area 3, as shown in Section 11.0, Map 21 as well as Appendix C. Anomalies ranged from 5.26 nT to 29.43 nT in amplitude and from 7.92m (25.99 ft) to 35.23 m (115.59 ft) in duration. All the anomalies exhibited a monopolar signature. None of the identified anomalies were potentially associated with, or representative of, sidescan sonar contacts or other features mapped in the other hazard shapefiles described in Appendix C.

7.3.4 Seismic Sub-bottom

Study Area 3A is characterized by moderate thickness shoals that run parallel to the shoreline. These shoals are acoustically semi-transparent with mottled, chaotic internal structure and minimal lamination. Vibracore samples collected in this area (MA-CZM-2025-VC13, MA-CZM-2025-VC14, and MA-CZM-2025-VC15) confirm that the deposits consist predominantly of fine to medium-grained sands with a low percentage of fines. Beneath the shoals, a significant valley system reaches thicknesses exceeding 18.3 m (60 ft), with scattered channels and patches of exposed hardbottom (Figure 4). In some locations, a chaotic acoustically transparent unit occurs between the shoal and underlying valley, potentially representing unconsolidated sandy deposits; however, this interpretation remains unconfirmed due to the lack of direct vibracore sampling. Sand thickness ranges from 1.8 m (6 ft) to 9.1 m (30 ft) nearshore and 1.2 m (4 ft) to 4.6 m (15 ft) offshore.

Study Area 3B exhibits a similar shoal morphology but with an increased proportion of fines toward the base (MA-CZM-2025-VC16). Structurally, these shoals are mottled, chaotic, and acoustically transparent. The 2025 seismic data correlate with earlier USGS seismic lines, refining previous isopach interpretations. Sand thickness ranges from ~1.8 m (6 ft) to 9.1 m (30 ft), with the thickest deposits concentrated along a central shoal bounded by hardbottom. The seismic results for Study Area 3 are presented in Section 11.0, Map 25.



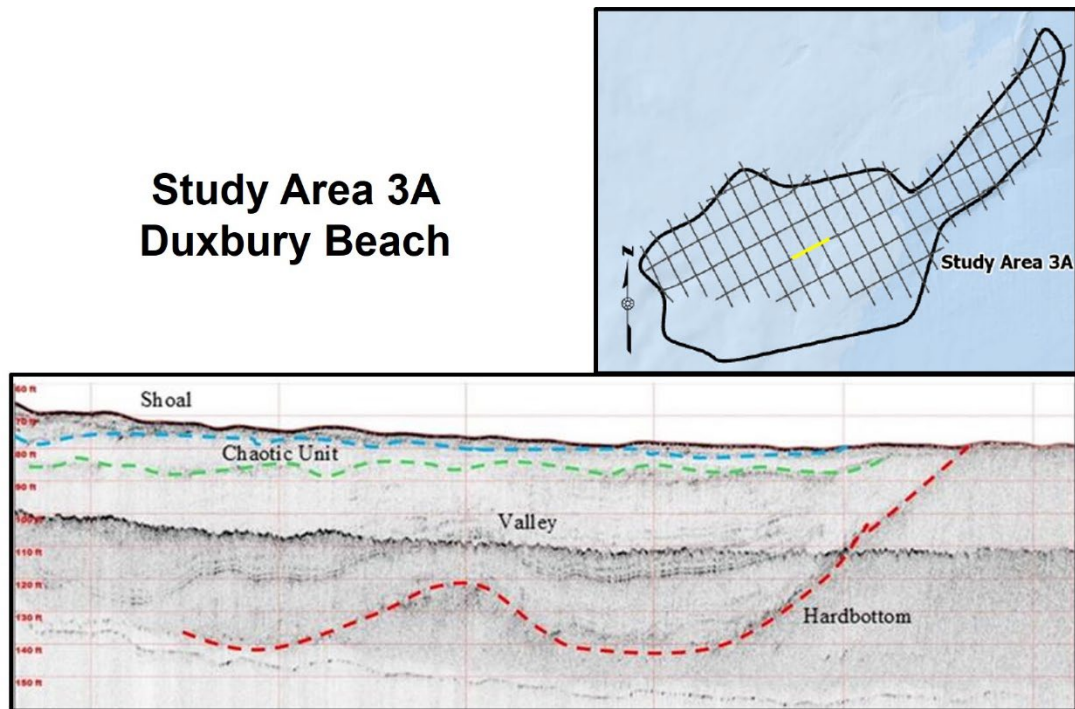


Figure 4: Line 93 from the 2025 investigation with identified deposits and shoal. Trackline for seismic example highlighted in yellow.

Note: Example of a thin shoal with minimal lamination overtop a chaotic, potentially sandy subunit and a 16.8 m (55 ft) thick valley bounded by hardbottom (red dashed). Blue dashed line: shoal. Green dashed line: chaotic unit. Red dashed line: hardbottom.

7.3.5 Vibracore

Within Study Area 3, there were only three (3) historic vibracores collected during the APTIM 2018 investigation area. Four (4) new vibracores were collected within Study Area 3. MA-CZM-2025-VC13, located in the northeastern section of Study Area 3, recovered predominantly fine sand to a depth of 5.4 m (17.7 ft), with a thin gravel lens (0.2 m [0.7 ft] thick) present at 1.1 m (3.8 ft). MA-CZM-2025-VC14, from the north-central section, consisting of coarse-grained sand to 3.5 m (11.6 ft). Below this, the deposit becomes poorly sorted and fines upward, transitioning to silty sand with elevated fines content at 15.7 ft. MA-CZM-2025-VC15 (northwestern section) and MA-CZM-2025-VC16 (southern section) display a similar stratigraphy, with thick deposits of fine-grained sand (mean grain size of 0.19 mm [2.40 phi]) extending to 5.4 m (17.9 ft). Table 8 below provides the composite information for the collected vibracores.

Table 8: Regional Composite Results for Duxbury Beach Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (%)	Silt (%)	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC15	3	0.24	0.60	1.53	0.24	0.46	5.33
MA-CZM-2017-VC16	3	0.24	0.49	9.57			
MA-CZM-2017-VC17	3	0.18	0.45	12.53			
MA-CZM-2025-VC13	3	0.19	0.41	7.13			
MA-CZM-2025-VC14	3	0.43	0.45	4.34			
MA-CZM-2025-VC15	3	0.21	0.52	2.72			
MA-CZM-2025-VC16	3	0.22	0.60	2.29			

7.4 Study Area 4 Sandwich

7.4.1 Bathymetry

Bathymetric elevations for Study Area 4 range from -10.4 m (-34 ft) to -28.6 m (-94 ft) NAVD88. The western portion is characterized by higher relief, with shallow features and abrupt slope changes represented by closely spaced contours. Moving eastward, the terrain transitions into deeper, more uniform bathymetry with a smoother slope. The eastern section reaches maximum depths near -28.6 m (-94 ft) NAVD88. XYZ data are presented in Appendix A, and a bathymetric map is presented in Section 11.0, Map 30.

7.4.2 Sidescan Sonar

Sidescan sonar interpretations for Study Area 4A-1 identified a large patch of high reflective sands in the center of the study area, extending from south to the north. Low reflective sands were observed along the eastern and western edges of this subsection. In Study Area 4A-2 high reflective sand is limited to a small central area, with the remainder of the subsection composed of low reflective sands. In Study Area 4B-1 high reflective sand dominates the eastern half, while low reflective sands are present in the western half along with a small, low reflective sand patch near the eastern edge. All sidescan sonar is presented in Section 11.0, Map 18.

A total of ten (10) contacts were identified in Study Area 4 presented in Section 11.0, Map 22 and Appendix B— eight (8) in 4B and two (2) in 4C. Contact 11 is a small, unknown, high-intensity feature, while Contact 12 is a round, high-intensity, unknown feature. Contacts 13 and 15 are long, high-intensity, linear features, and Contacts 14 and 18 are rubble fields. Contact 16 consists of multiple small, high intensity dots in a linear pattern, and Contact 17 is a cluster of unknown, high-intensity dots. In Study Area 4C, Contact 19 is a small, high-intensity, unknown feature with a correlating shadow, and Contact 20 consists of multiple small, high-intensity unknown features.



7.4.3 Magnetometer

The magnetometer survey data revealed 18 magnetic anomalies within Study Area 4, as shown in Section 11.0, Map 22 as well as Appendix C. Anomalies ranged from 5.15 nT to 69.52 nT in amplitude and from 9.31 m (30.56 ft) to 37.90 m (124.34 ft) in duration. Anomaly signatures consisted of 10 monopolar and 8 dipolar anomalies. None of the identified anomalies were potentially associated with, or representative of, sidescan sonar contacts or other features mapped in the other hazard shapefiles described in Appendix C.

7.4.4 Seismic Sub-bottom

Study Area 4A-1 is characterized by prominent shoals, ~4.6 m (15 ft) thick, overlying highly laminated paleovalleys. These underlying valleys can reach thicknesses of up to 6.1 m (20 ft) and are composed of interbedded silts and clays as confirmed by vibracore MA-CZM-2025-VC18. The shoals themselves consist of coarse to fine sands with minimal internal structure and localized mottling (Figure 5). Sand thickness is greatest in the central portion of the area, gradually thinning seaward and terminating along a mapped hardbottom boundary.

Study Area 4A-2 contains thinner shoals, ranging from 0.6 m (2 ft) to 2.1 m (7 ft) in thickness, overlying well-developed, highly laminated valley systems. Unlike the deposits observed in 4A-1 and 4B-1, these shoals exhibit little lamination but display high acoustic amplitude. Vibracore data indicate that the upper 1.2 m (4 ft) consist of coarse sand consistent with the observed high amplitude response underlain by ~2.4 m (8 ft) of finer-grained, chaotic, lower amplitude material. Total sand thickness ranges from 2.1 m (7 ft) to 3.3 m (11 ft), suggesting potential as a fine to coarse-grained sand resource.

Study Area 4B-1 is largely devoid of significant shoaling. Seismic data indicate a thin surficial layer (0.3 m [1 ft] to 1.2 m [4 ft] thick) of clayey sand, as observed in vibracore MA-CZM-2025-VC19, overlaying a broad paleovalley system composed primarily of fat clays. The clayey sand appears as a high-amplitude, chaotic unit with a distinct basal reflector. The underlying valley contains multiple channels characterized by steeply dipping reflectors and strong acoustic returns. Sand thickness is greatest (0.9 m [3 ft]) in the central portion, where a buried valley has been partially infilled with surficial sediment, and thins to 0.3 m (1 ft) toward the southeast. The seismic results from Study Area 4 are presented in Section 11.0, Map 26.



Study Area 4A-1 Sandwich

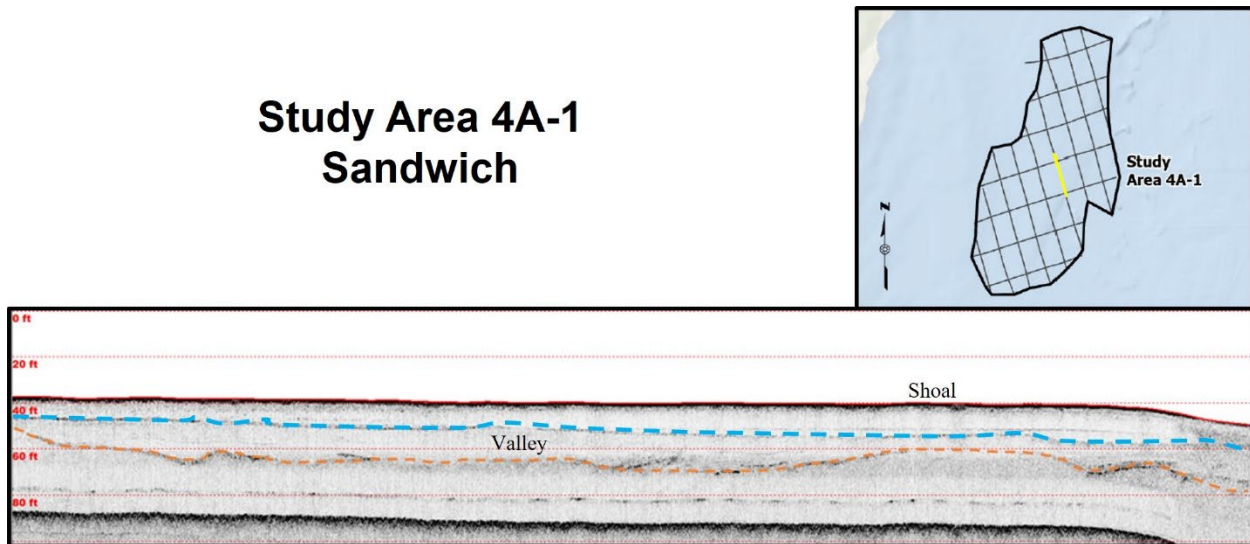


Figure 5: Line 115 from the 2025 investigation displaying a large shoal overtop an elongate valley. Trackline for seismic example highlighted in yellow.

Note: ~10 ft thick shoal overlaying large paleovalley system with a strong basal reflector. Blue dashed line: Bottom of Shoal; Orange dashed line: Base of Valley.

7.4.5 Vibracore

Within Study Area 4, there were only three (3) historic vibracores collected during the APTIM 2018 investigation. Four (4) new vibracores were collected within the newly identified Study Areas 4A-1, 4A-2, and 4B-1. Study Area 4A-1 was investigated with two (2) vibracores. Vibracore MA-CZM-2025-VC17, located in the northern section, encountered a surficial deposit of poorly graded sand with a mean grain size of 0.28 mm (1.84 phi). This material coarsens downward to well-graded sand with a mean grain size of 1.30 mm (-0.38 phi) at a depth of 2.3 m (7.6 ft). This sand sequence overlies a thick deposit of fat clay, which extends to the total vibracore depth of 5.9 m (19.3 ft). In contrast, MA-CZM-2025-VC18, from the southern section, recovered a surface layer of poorly graded sand with a mean grain size of 0.47 mm (1.10 phi), fining to poorly graded sand with silt at 1.6 m (5.2 ft). Beneath this, alternating layers of sand (poorly graded silty sand, clayey sand, silty clayey sand) and silt continue to a depth of 5.1 m (16.7 ft), underlain by a thin basal unit of lean clay.

Study 4A-2 was sampled by one (1) vibracore (MA-CZM-2025-VC20). The upper 1.5 m (5 ft) consists of interbedded poorly graded sand with silt and well graded gravel, containing shell fragments and rock clasts up to 8.2 cm (3.25 in) in. Below this, a sequence of poorly graded sand extends to 3.1 m (10.3 ft), with abundant shell fragments (up to 3.2 cm [1.25 in]) and minor silt. The basal section, from 3.1 m (10.3 ft) to 4.7 m (15.5 ft), is dominated by silty sand with gravel, containing clayey sand pockets and disseminated shell fragments. Recovery terminated at 4.7 m (15.5 ft) within this unit, with no additional material recovered to the total depth of 5.5 m (18.2 ft).



Study Area 4B-1 was sampled by one (1) vibracore. The surficial unit consists of clayey sand with gravel and rock fragments up to 2.54 cm (1 in) to a depth of 1.2 m (3.9 ft). This unit overlays a thick sequence of fat clays extending to 5.3 m (17.5 ft) (Table 9).

Table 9: Regional Composite Results for Sandwich Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (%)	Silt (%)	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC18	4A-1	0.44	0.61	0.99	0.31	0.47	7.81
MA-CZM-2025-VC17	4A-1	0.31	0.53	2.69			
MA-CZM-2025-VC18	4A-1	0.25	0.42	14.36			
MA-CZM-2017-VC20	4A-2	0.26	0.47	2.09	0.28	0.41	3.09
MA-CZM-2025-VC20	4A-2	0.31	0.36	4.16			

7.5 Study Area 5 Cuttyhunk

7.5.1 Seismic Sub-bottom

Study Area 5A, located south of Study Area 5B, comprises a shoal feature that is thickest in the southwest and gradually thins towards the northeast. The area is bounded by exposed and buried hardbottom and contains scattered paleochannels with shallow acoustic penetration (Figure 6). Vibracores collected from this area in 2025 (MA-CZM-2025-VC09 and MA-CZM-2025-VC10) and in 2018 (MA-CZM-2017-VC10 and MA-CZM-2017-VC11) indicate that the shoal consists of fine to medium grained sands, which correlate well with the chaotic, low-amplitude acoustic facies observed in the seismic data.



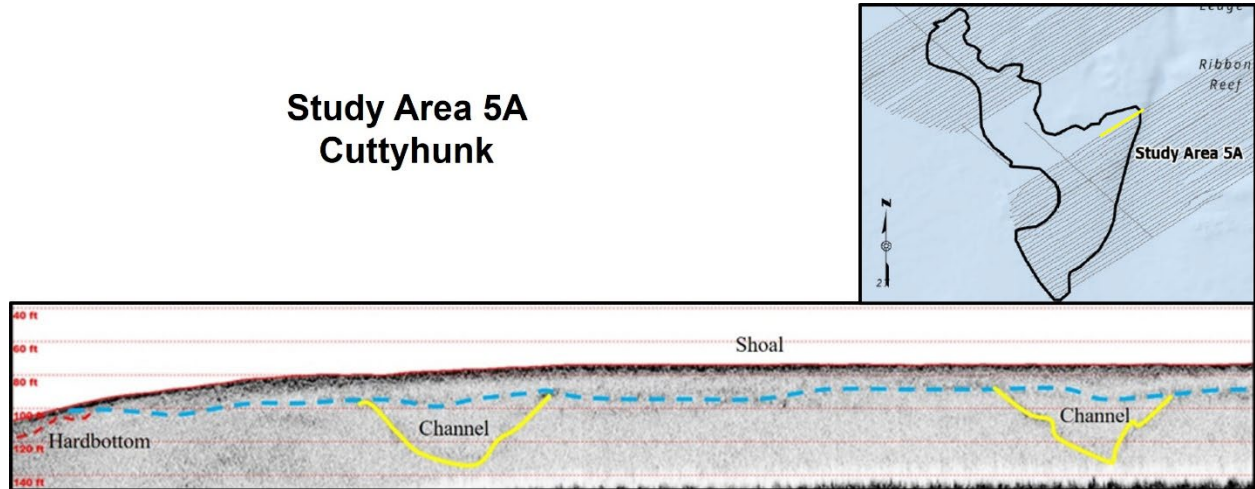


Figure 6: Line I174f1 of the USGS Legacy Dataset displaying a large shoal overtop two small, isolated channels. Trackline for seismic example highlighted in yellow.

Note: Shoal terminating along partially exposed hardbottom. ~9.1 m (30 ft) channels with chaotic, transparent infill beneath the shoal. Blue dashed line: Bottom of Shoal; Yellow line: Channel; Red dashed line: Hardbottom.

Study Area 5B consists of a thin surficial sand layer overlaying a large paleochannel system composed primarily of silts and clays. The area also contains scattered paleochannels as well as both buried and exposed hardbottom. Vibracores collected in 2025 (MA-CZM-2025-VC12) and 2018 (MA-CZM-2017-VC13 and MA-CZM-2017-VC14) indicate that the surficial sand layer is generally less than 1.5 m (5 ft) thick and directly overlies the underlying silts and clays.

7.5.2 Vibracore

Within Study Area 5, there were only four (4) historic vibracores collected during the APTIM 2018 investigation. There were four (4) new vibracores collected in Study Area 5. MA-CZM-2025-VC09, MA-CZM-2025-VC10, and MA-CZM-2025-VC11 were collected in Study Area 5A and MA-CZM-2025-VC12 was collected in Study Area 5B. MA-CZM-2025-VC09 (5.2 m [17.7 ft] recovery) and MA-CZ-2025-VC10 (5.3 m [17.6 ft] recovery) showed similar compositions with both vibracores being predominately fine-grained sand with silt content not exceeding 4 percent. MA-CZM-2025-VC11 had a much less desirable composition with only the top 0.5 m (1.8 ft) being fine-grained sand and the remainder of the 5.8 m (19.2 ft) vibracore being lean clay. MA-CZ-2025-VC12 is similarly made up of lean clay and clayey sand with the top 0.6 m (2.1 ft) of the vibracore being fine-grained sand. In both areas, the composite results only utilized the layers described as being mostly sand, which yielded a thicker sand layer in Study Area 5A and a thin sand deposit in Study Area 5B (Table 10).



Table 10: Regional Composite Results for Cuttyhunk Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (%)	Silt (%)	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC10	5A	0.22	0.64	1.83	0.24	0.60	2.16
MA-CZM-2017-VC11	5A	0.40	0.49	1.08			
MA-CZM-2017-VC12	5A	0.19	0.65	3.45			
MA-CZM-2025-VC09	5A	0.22	0.70	2.44			
MA-CZM-2025-VC10	5A	0.23	0.73	2.08			
MA-CZM-2025-VC11	5A	0.26	0.49	1.47			
MA-CZM-2017-VC13	5B	0.24	0.45	5.68	0.22	0.47	8.08
MA-CZM-2017-VC14	5B	0.23	0.53	5.56			
MA-CZM-2025-VC12	5B	0.15	0.46	18.69			



8.0 GEOTECHNICAL AND ISOPACH RESULTS

The following sections describe the sand isopach analysis, vibracore results, geotechnical composite results (where applicable), and resulting study area volumetric estimates. Sand grain size varied across the survey areas; therefore, the isopach maps were generated based on the dominant sand type observed within each area. Where coarse sand was limited or absent, a fine sand boundary was delineated and an isopach generated of the finer-grained deposits.

Where historic seismic sub-bottom data existed (Study Areas 1, 2A-1, 2C, 3A, 3B, 4A-1, 4A-2, 4B-1, 5A, and 5B), vibracore data from the 2025 geotechnical investigation were correlated to both the historic sub-bottom data and the 2025 geophysical investigation data to develop a sand thickness isopach of the individual Study Areas. These areas were then refined based on available sands within the study area and a Focus Area was delineated to further constrain the target sand resource. The results below (Table 11) show the average thickness and volumes of both the regional and focus area sand isopachs. The volumes shown are the actual calculated estimated volumes of the isopach in m³ rounded to the nearest 10,000 m³. The rounded m³ volume values were then converted to cy and rounded to the nearest 100 cy.

Table 11: Isopach Results for Each Study Area.

Region	Study Area	Mean Sand Thickness (m)	Area (m ²)	Estimated Volume (m ³)	Estimated Volume (cy)
Merrimack River	1A	2.76	49,515,000	137,255,000	179,523,000
	1A Focus	2.21	16,386,000	36,433,000	47,652,000
	2A	2.53	8,514,000	17,726,000	23,185,000
Nantasket Beach	2A Focus	3	4,829,000	14,786,000	19,339,000
	2C	1.19	16,789,000	20,211,000	26,435,000
	2C Focus	3.12	2,059,000	6,574,000	8,598,000
Duxbury Beach	3 Overall	1.91	73,491,000	141,596,000	185,201,000
	3A Focus	2.46	2,478,000	6,257,000	8,184,000
	4A-1	2.41	6,579,000	16,030,000	20,966,000
Sandwich	4A-1 Focus	1.56	4,172,000	6,642,000	8,688,000
	4A-2	2.72	2,052,000	5,654,000	7,395,000
	4A-2 Focus	1.45	1,154,000	1,744,000	2,281,000
Cuttyhunk	4B-1	1.34	13,167,000	17,910,000	23,426,000
	5A Focus	5.81	9,162,000	54,032,000	70,671,000
	5A	2.86	12,180,335	54,470,000	71,244,000
Focus Total				126,468,000	165,413,000
Overall Total				410,852,000	537,375,000

Sand thicknesses and resulting vibracore composite results are discussed for each study area below. It should be noted that the identified final composite values are only an estimate based on a few, widely spaced geologic samples, and that additional vibracores and geophysical data should be collected at a design-level spacing, described in Section 9.0, in order to more confidently determine the beach-



compatibility, volumes, hazards, protected resources, and dredgeability of potential preliminary borrow areas.

8.1 Study Area 1

Isopach mapping of Study Area 1 presented in Section 11.0, Map 36 and Map 41, reveals significant potential sand resources within a laterally variable coarse sandy unit. The 2018 investigation provided a preliminary volume estimate of ~99,730,000 m³ (130,442,000 cy), which was refined in 2025 through expanded coverage and improved data resolution, resulting in an updated estimate of 137,255,000 m³ (179,523,000 cy). Vibracores collected in 2025 (MA-CZM-2025-VC06, MA-CZM-2025-VC07, MA-CZM-2025-VC08) and 2018 (MA-CZM-2017-VC05, MA-CZM-2017-VC06, MA-CZM-2017-VC07, MA-CZM-2017-VC08, MA-CZM-2017-VC09) confirm that the surficial unit is dominated by coarse-grained sand with a mean grain size greater than 0.50 mm (1.0 phi), fining toward the south. Thickness modeling shows that the central and northern portions contain deposits between 2.4 m (8ft) – 4.3 m (14 ft) thick, while the thickest accumulations, up to 7.9 m (26 ft), are confined to the southwestern portion. A pronounced north-south trending thickness gradient across the southern half suggest deposition influenced by longshore sediment transport or the migration of shore-parallel shoal features.

When evaluated to target coarsest sediments, the focused isopach delineates a more conservative resource of 36,433,000 m³ (47,652,000 cy) and highlights the western shoal complex, where coarse sand thickness reaches 4.9 m (16 ft) thick. The pronounced heterogeneous distribution of sand thickness throughout the focus area and the sharp boundaries between thick and thin sandy areas support the interpretation of scoured valleys affecting accumulation patterns and hardbottom or exposed outcrops controlling deposition. Targeted high-resolution sub-bottom profiling along the western shoal complex is recommended to refine internal stratigraphy and confirm lateral continuity of the resource due to the poor quality USGS legacy dataset. Table 12 and Table 13 below detail the estimated sand volumes for the Merrimack River Study Area and the Focus Area composite results.



Table 12: Preliminary Sand Volumes for Merrimack River Study Area

Study Area	Vibracores	Interp. Sandy Area (m ²)	Mean Sand Thickness (m)	Volume (m ³)	Volume (cy)
1A	MA-CZM-2017-VC05	49,515,000	2.76	137,255,000	179,523,000
	MA-CZM-2017-VC06				
	MA-CZM-2017-VC07				
	MA-CZM-2017-VC08				
	MA-CZM-2017-VC09				
	MA-CZM-2025-VC06				
	MA-CZM-2025-VC07				
	MA-CZM-2025-VC08				
1A Focus	MA-CZM-2017-VC07	16,386,000	2.21	36,433,000	47,652,000
	MA-CZM-2017-VC08				
	MA-CZM-2017-VC09				
	MA-CZM-2025-VC06				
	MA-CZM-2025-VC07				
	MA-CZM-2025-VC08				

Table 13: Focus Composite Results for Merrimack River Focus Area Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt (%)	Composite Mean Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC07	1A Focus	0.58	0.52	1.85	0.66	0.43	1.29
MA-CZM-2017-VC08	1A Focus	0.74	0.47	0.92			
MA-CZM-2017-VC09	1A Focus	0.76	0.35	0.39			
MA-CZM-2025-VC06	1A Focus	0.78	0.37	1.60			
MA-CZM-2025-VC07	1A Focus	0.57	0.46	1.13			
MA-CZM-2025-VC08	1A Focus	0.55	0.50	1.52			



8.2 Study Area 2

Resource delineation along Study Area 2A presented in Section 11.0, Map 37, reveal a sand thickness of 2.4 m (8 ft) – 4.3 m (14 ft), forming a broad corridor through the middle of the study area. Localized shoals (~4.9 m [16 ft] – 7.3+ m [24+ ft]) cluster along the eastern/northeastern rim, where narrow, elongated ridges step up toward the mapped hardbottom boundary. A smaller, isolated lens of sand occurs in the central-western interior. Sand thickness systematically increases from the central/western portion toward the east, consistent with the mapped surficial, acoustically homogenous, chaotic unit with minimal lamination (finer, silty sand confirmed by MA-CZM-2025-VC04). The geometry of the central area, including a thin marginal fine sand drape overtop silts and clays, a mid-field 2.4 m (8 ft) – 4.3 m (14 ft) thick corridor, and a 6.1 m (20 ft) – 7.6 m (25 ft) thick depocenter bounded by mapped hardbottom, suggests shoal capping of an underlying valley system, with sediment trapping and eastward thickening where transport converges on a structural limit. The consistent eastward thickening and chaotic/mottled facies pattern seen in the shoals support a depositional model of reworked, finer sand shoals draped over valleys, with the thickest bodies pinned along the eastern boundary. The focus area of Study Area 2A is the 2.4 m (8ft) – 4.3 m (14 ft) broad corridor, or the eastern highs that are bounded by hardbottom.

Study Area 2A lacked coarse sands; therefore, was refined to target only fine sand for the Focus Area, presented in Section 11.0, Map 42, which reduced the preliminary volume estimate from 17,726,000 m³ (23,185,000 cy) to 14,786,000 m³ (19,339,000 cy), representing a potential target volume reduction of ~17 percent. Further geophysical and geotechnical acquisition in this area will help reaffirm these volumes for future design level work.

Across the fully mapped extent of Study Area 2C, isopach thickness ranges from less than 0.6 m (2 ft) along the western and southern edges to 5.5 m (18 ft) along the southeastern region. The average resource thickness within Study Area 2C falls within the 2.4 m (8ft) – 4.3 m (14 ft) range, concentrated in the central and northeastern portions with a gradual lateral thinning towards the northwest. The southeastern sector contains the thickest deposits of fine sand, which is verified by MA-CZM-2017-VC04, revealing a fine sand depocenter with a mean grain size of 0.16 mm (2.60 phi) extending to 2.7 m (8.7 ft), underlain by alternating sandy clay and fine sand down to 3.6 m (11.8 ft). Acoustic signals observed in the seismic data show chaotic to moderately laminated packages overlying valley systems that thin towards the exposed hardbottom area. The presence of patchy packages and rapid thinning indicate that the area has shifted between sediment reworking and quieter infill. The sand distribution suggests that the central-northeastern band of 2.4 m (8ft) – 4.3 m (14 ft) sand represents a stable shoal complex, while the southeastern thick zone marks a sediment sink, or a depocenter, likely formed by topographic confinement.

Like Study Area 2A, Study Area 2C also lacked coarse sands; therefore, the Study Area was refined to target only fine sands to delineate the Focus Area. This reduced the preliminary volume estimate from 20,211,000 m³ (26,435,000 cy) to 6,574,000 m³ (8,598,000 cy), representing a potential target volume reduction of ~67 percent.



The Focus Area for Study Area 2C is highlighted by a WSW-ENE shoal, approximately 1.8 m (6 ft) – 3.6 m (12 ft) thick. The shoal is flanked by a thin lens of fine sand 0.6 m (2 ft) – 1.2 m (4 ft) along the margins. A local maxima of 4.9 m (16 ft) – 5.5 m (18 ft) occurs in the central, eastern portion of the focus area that is expressed as a thick shoal overlying scoured, thinly laminated valley segments made up of chaotic, low amplitude deposits and bounded by areas of exposed or shallow hardbottom. Shoal thickening towards the ENE, together with the narrow crest and steep flanks, suggest topographic steering, with local transport convergence enhancing accumulation near the eastern crest.

Ground-truthing from 2025 vibracores (MA-CZM-2025-VC01 and MA-CZM-2025-VC02) shows silt/clay valley fill beneath the sand shoals and supports a stratigraphic stacking model, where the thickest parts of the Focus Area are fine sand-rich deposits over buried paleovalleys. The beach compatible resources are focused to the identified WSW-ENE shoal as well as the 4.9 m (16 ft) – 5.5 m (18 ft) shoal on the west. Legacy geotechnical data from the 2018 investigation (MA-CZM-2017-VC04) taken on the western shoal, indicates that the southeastern portion of the deposit consists of a 3.6 m (12 ft) fine-grained sand unit, followed by clayey sand at 4.3 m (14 ft) depth, and then coarsens to medium grained to coarse sand at a 5.2 m (17 ft) depth below seafloor. Further vibracores on the western shoal on the ENE area would confirm the deposit's continuity and whether the chaotic, low amplitude facies remain sand-dominated throughout the shoal. Table 14 and Table 15 below detail the estimated sand volumes and the composite results for the Nantasket Beach Study and Focus Areas.

Table 14: Preliminary Sand Volumes for Nantasket Beach Study Area

Study Area	Vibracores	Interp. Sandy Area (m ²)	Mean Sand Thickness (m)	Volume (m ³)	Volume (cy)
2A-1	MA-CZM-2017-VC01	8,514,000	2.53	17,726,000	23,185,000
	MA-CZM-2025-VC03				
	MA-CZM-2025-VC04				
2C	MA-CZM-2017-VC04	16,789,000	1.19	20,211,000	26,435,000
2A-1 Focus	MA-CZM-2017-VC01	4,829,000	3.00	14,786,000	19,339,000
	MA-CZM-2025-VC03				
2C Focus	MA-CZM-2017-VC04	2,059,000	3.12	6,574,000	8,598,000



Table 15: Focus Composite Results for Nantasket Beach Focus Area Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt (%)	Composite Mean Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC01	2A-1 Focus	0.16	0.52	10.87	0.18	0.60	6.26
MA-CZM-2025-VC03	2A-1 Focus	0.21	0.71	2.74			
MA-CZM-2017-VC04	2C Focus	0.16	0.65	11.02	0.16	0.65	11.02

8.3 Study Area 3

Isopach mapping for Study Area 3 presented in Section 11.0, Map 38 reveals a complex depositional system dominated by two distinct accumulation centers connected by a north-south trending sediment corridor. The northern lobe exhibits maximum thicknesses of ~7.6 m (~25 ft) – 9.1 m (30 ft) concentrated in discrete, oval shaped depocenters, that appear to be part of an elongated shoal system with steep thickness gradients. The southern lobe shows a more subtle relief with a thickness range of 4.6 m (15 ft) – 6.1 m (20 ft) distributed across several interconnected shoal complexes. In between the two lobes, a north-south trending sediment corridor displays intermediate thicknesses of 3 m (10 ft) – 4.6 m (15 ft) forming a depositional bridge between the two main accumulation areas. This geomorphology directly supports this investigations seismic interpretation of moderate thickness shoals running shore parallel with a mottled, chaotic internal structure. Scattered intermediate-thickness patches (3 m [10 ft] – 4.6 m [15 ft]) present in the northern and southern extents of the study area correspond chaotic, acoustically transparent subunits occurring between the shoals and underlying valleys, potentially representing unconsolidated sandy deposits, but remain unconfirmed without future targeted vibracores.

Ground-truthing from the 2018 geotechnical investigation (MA-CZM-2017-VC15, MA-CZM-2017-VC16, MA-CZM-2017-VC17) and the 2025 investigation (MA-CZM-2025-VC13, MA-CZM-2025-VC15, MA-CZM-2025-VC16) sampling both lobes and sediment corridor confirm that the thickest accumulations are clean fine to medium sands with low fines rather than mixed or muddy infill. The thickness range variation, from 1.8 m (6 ft) – 5.5 m (18 ft) nearshore to 1.2 m (4 ft) – 4.6 m (15 ft) offshore is clearly expressed in the isopachs by the shore parallel gradient, with maximum accumulation occurring in mid-shelf positions away from both nearshore wave reworking and offshore sediment starvation.

For resource development, the northern lobe could be developed into a significant fine-grained resource but would require further evaluation of facies continuity within the chaotic shoal architecture. The southern lobe provides a more laterally continuous resource with potentially more laminated, stable shoal geometry, while the central corridor could serve as an additional borrow area if the acoustically transparent intervals prove sand-dominated through targeted vibracoring.



By defining the Focus Area for Study Area 3 to target only the coarse sands the preliminary volume estimate was reduced from 141,596,000 m³ (185,201,000 cy) to 6,257,000 m³ (8,184,000 cy), which is concentrated in the northern lobe. This represents roughly a 96 percent reduction in potential resource volume for Study Area 3 due to the constraint on grain size and target resource.

Within the focus area boundary for Study Area 3, the isopach as presented in Section 11.0, Map 43 reveals a concentrated depocenter with a local maxima of 5.5 m (18 ft) – 6.1 m (20 ft) in the central western portion, that is part of a larger shoal complex, stepping down through 3.6 m (12 ft) – 5.6 m (15 ft) zones toward the northeast and southeast margins and eventually tapering out toward the distal ends. The peripheral zones exhibit 1.8 m (6 ft) – 3 m (10 ft) thickness, creating a broad band around the central high, with abrupt thinning to <1.2 m (<4 ft) at the focus boundary. The steep flanks and morphology of the shoal reflect topographic confinement by the underlying valley system and a strong structural control by hardbottom patches. Ground-truthing from MA-CZM-2025-VC14, which guided the coarse sand delineation, validates that the central 5.5 m (18 ft) – 6.1 m (20 ft) zone represents the highest-quality target material with low fines content and optimal grain size distribution for resource delineation. Table 16 and Table 17, below detail the estimated sand volumes and composite results for the Duxbury Beach Study and Focus Areas.

Table 16: Preliminary Sand Volumes for Duxbury Beach Study Area

Study Area	Vibracores	Interp. Sandy Area (m ²)	Mean Sand Thickness (m)	Volume (m ³)	Volume (cy)
3A	MA-CZM-2017-VC15	73,491,000	1.19	141,596,000	185,201,000
	MA-CZM-2017-VC16				
	MA-CZM-2017-VC17				
	MA-CZM-2025-VC13				
	MA-CZM-2025-VC14				
	MA-CZM-2025-VC15				
	MA-CZM-2025-VC16				
3A Focus	MA-CZM-2017-VC16	2,478,000	2.46	6,257,000	8,184,000
	MA-CZM-2017-VC17				
	MA-CZM-2025-VC14				
	MA-CZM-2025-VC16				



Table 17: Focus Composite Results for Duxbury Beach Focus Area Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt (%)	Composite Mean Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC16	3 Focus	0.34	0.44	1.36	0.33	0.45	1.71
MA-CZM-2017-VC17	3 Focus	0.38	0.40	1.14			
MA-CZM-2025-VC14	3 Focus	0.54	0.45	1.14			
MA-CZM-2025-VC16	3 Focus	0.22	0.59	2.29			

8.4 Study Area 4

Study Area 4A-1 isopach presented in Section 11.0, Map displays a complex depositional system dominated by three distinct accumulation zones: a primary western depocenter (low-lying area where sediment accumulates rapidly) with maximum thicknesses of 5.8 m (19 ft) – 6.4 m (21 ft), a secondary central high reaching 4.9 m (16 ft) – 5.5 m (18 ft) and a tertiary southwestern lobe with 4.6 m (15 ft) peaks. The western and central depocenters are connected by corridors of 2.4 m (8 ft) – 3.6 m (12 ft) thickness that create an interconnected shoal complex. The southwestern and southern margins of the study area exhibit rapid thinning to 1.8 m (6 ft), forming sharp depositional boundaries consistent with sediment layer change between coarse sand and silty sand seen in MA-CZM-2025-VC18. The primary western depocenter 5.8 m (19 ft) – 6.4 m (21 ft) maximum corresponds to the central portion of the deposit where sand thickness is greatest with gradual eastward and southward thinning that matches the seismic observation of seaward thinning terminating along mapped hardbottom boundaries. This overall architecture directly supports the seismic interpretation of extensive mottled shoal systems overlaying highly laminated paleovalleys with steeply dipping reflectors. The three-lobe geometry reflects the topographic control by the underlying valley network (filled with interbedded silts and clays per MA-CZM-2025-VC18), where prominent shoals have preferentially accumulated in structural lows and valley intersections.

The Focus Area Isopach for Study Area 4A-1 presented in Section 11.0, Map 44 reveals a dominant northwestern depocenter reaching maximum thicknesses of 2.3 m – 3 m (9.5 ft - 10 ft) and a secondary southern accumulation center with 2.4 m (8 ft) – 2.7 m (9 ft) peaks. There is an elongated northwest-trending shoal with steep eastern flanks dropping rapidly to 1.8 m (6 ft) thick and more gradual western slopes transitioning through 1.8 m (6 ft) – 2.4 m (8 ft) thick zones. A narrow corridor of 1.5 m (5 ft) – 2.1 m (7 ft) thickness links the two main accumulation zones, while marginal areas exhibit consistent 0.9 m (3 ft) – 1.5 m (5 ft) drape, suggesting widespread thin sand cover across the focus boundary.

The constrained boundary for the Focus Area for Study Area 4A-1 represents the coarse sand depocenters from the broader, mottled shoal system described previously. The northwestern 3 m (10 ft) maximum in the focus area corresponds to the thickest portion of the western prominent shoals ~4.6 m (15 ft) thick identified in the regional analysis, where coarse to fine sand transitions and minimal internal structure



concentrate the highest quality material. The steep eastern boundary is reflective of hardbottom control, while the northwest orientation is suggestive of topographic steering and the shoal's alignment with structural valleys.

The decrease in volume from the regional 4A-1 estimated at 16,030,000 m³ (20,966,000 cy) to the focus area estimate of 6,642,000 m³ (8,688,000 cy) represents roughly 60 percent resource reduction through sand quality-based targeting. This refined targeting eliminates a considerable volume indicating that much of the regional shoal system contains transitional or fine-grained material that could be unsuitable for target resource specifications. For future design initiatives, it is suggested that operations should initially exploit the northwestern 2.4 m (8 ft) – 3 m (10 ft) shoal identified in the focus area for maximum resource density, while the southwestern 2.1 m (7 ft) – 2.7 m (9 ft) zone could provide supplementary volume

The isopach for Study Area 4A-2 presented in Section 11.0, Map 39 displays a distinctive east-west trending linear depocenter with maximum thicknesses of 6.4 m (21 ft) concentrated in a narrow-elongated ridge along the eastern margin. This primary accumulation exhibits steep northern and southern flanks dropping rapidly to <2.4 m (<8 ft), while westward tapering creates a gradual thickness gradient through 3.6 m (12 ft) – 4.9 m (16 ft) zones toward the central and western portions. Secondary accumulations of 3 m (10 ft) – 4.3 m (14 ft) occur as discrete deposits in the northwestern and southwestern corners, separated by lows of 1.8 m (6 ft) – 3 m (10 ft). This architecture directly correlates with the seismic interpretation showing thin, mottled, coarse sand surficial units that gradually thicken eastward overlaying well-developed, highly laminated valley systems. Refining the study area to prioritize only coarse sand material reveals a northern depocenter reaching thicknesses of 2.1 m (7 ft) – 2.4 m (8 ft), gradually thinning to the southwest, plateauing in the central area.

There is a volume reduction from the regional 4A-2 estimate of 5,654,000 m³ (7,395,000 cy) to the focus area estimate of 1,744,000 m³ (2,281,000 cy), representing roughly 70 percent resource elimination. This quality-based refinement is reflective of a challenging depositional environment where thin shoals overlie complex valley systems with poorly sorted material. The 4A-2 Focus Area prioritizes sections of the study area where there is a sufficient volume of coarse sand to justify future investigations. Poor quality USGS legacy data was included in this interpretation and therefore it is recommended that future investigations should target the prominent shoals.

The isopach for Study Area 4B-1 shows several discrete areas of accumulation, with thicknesses ranging from 1.8 m (6 ft) – 2.7 m (9 ft), primarily located in the central and eastern sections. These deposits are separated by thin drapes of fine sand ranging in thickness from 0.6 m (2 ft) – 1.2 m (4 ft). A rapid decrease in thickness to ~0.6 m (2 ft) is observed on the southern flanks, correlating directly with the seismic interpretation of a thin surficial unit overlying buried and at times, exposed hardbottom along the southern extent. This contrasts with the more gradual thickness gradient observed from the central area to the north. The seismic data characterize the thin unit along the flanks as a high-amplitude, chaotic unit with a distinct basal reflector, which sits atop a paleovalley system of fat clays. Ground-truthing from MA-CZM-2025-VC19 confirms this stratigraphy, identifying a thin layer of clayey sand to ~1.2 m (~4 ft)



underlain by fat clays. As these materials are not suitable for resource allocation, no Focus Area was developed for Study Area 4B-1. Below are Table 18 and Table 19 detailing the estimated sand volumes and composite results from Sandwich Study and Focus Areas.

Table 18: Preliminary Sand Volumes for Sandwich Study Area

Study Area	Vibracores	Interp. Sandy Area (m ²)	Mean Sand Thickness (m)	Volume (m ³)	Volume (cy)
4A-1	MA-CZM-2017-VC18	6,579,000	7.91	16,030,000	20,966,000
	MA-CZM-2025-VC				
	MA-CZM-2025-VC				
4A-2	MA-CZM-2017-VC20	2,052,000	8.93	6,642,000	8,688,000
	MA-CZM-2025-VC				
4B-1	MA-CZM-2025-VC19	13,167,000	1.34	17,910,000	23,426,000
4A-1 Focus	MA-CZM-2017-VC18	4,172,000	5.12	5,654,000	7,395,000
	MA-CZM-2025-VC				
4A-2 Focus	MA-CZM-2017-VC20	1,154,000	4.75	1,744,000	2,281,000
	MA-CZM-2025-VC20				

Table 19: Focus Composite Results for Sandwich Focus Area Vibracores

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt (%)	Composite Mean Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC18	4A-1	0.48	0.59	0.96	0.47	0.58	1.00
MA-CZM-2025-VC18	4A-1	0.47	0.56	1.09			
MA-CZM-2017-VC20	4A-2	0.45	0.31	2.32	0.48	0.26	5.65
MA-CZM-2025-VC20	4A-2	0.51	0.22	8.33			

8.5 Study Area 5

Isopach mapping for Study Area 5A Focus Area presented in Section 11.0, Map 45 delineates a shoal-dominated depositional system characterized by a southwest-thickening sediment body, with maximum thicknesses reaching ~19.8 m (65 ft) and tapering to the northeastward to near zero values. The isopach geometry reflects a single, asymmetric accumulation center, bounded by exposed and buried hardbottom features that constrain lateral sediment distribution.



Seismic data reveal chaotic, low amplitude acoustic facies within the shoal, consistent with unconsolidated fine to medium grained sands confirmed by vibracores MA-CZM-2025-VC09 and MA-CZM-2025-VC10 in the 2025 investigation and MA-CZM-2017-VC10 and MA-CZM-2017-VC11 in the 2018 investigation. These facies lack internal stratification and exhibit mottled reflectivity, indicative of high energy depositional environments and minimal post-depositional reworking. The shoal's internal architecture is further supported by shallow acoustic penetration and scattered channel features, suggesting localized scour and infill processes. The refined isopach excludes hardbottom and rock outcrop zones, focusing on the acoustically transparent units that correlate with sand rich intervals.

Constraining the usable resources within Study Area 5A yielded a revised volume estimate of 54,032,000 m³ (70,671,000 cy) compared to the regional estimate of 54,470,000 m³ (71,244,100 cy) calculated during the 2018 investigation, due to the enhanced resolution and reliability of the sand resource assessment within the newly defined Study Area 5A Focus Area. Additionally, this analysis reflects the heterogenous nature of the broader shoal system, where much of the regional resource occurs in hardbottom-proximal areas or zones of mixed lithology unsuitable for extraction. The focus area selection prioritizes the southwestern depocenter where vibracore ground-truthing confirms ideal sand quality while eliminating thin sand layer located above the hardbottom. Resurveying areas of poor quality USGS data from 2019 and additional targeted surveys within the newly defined Study Area 5A Focus Area, would enable further isopach refinement and more precise resource estimation, particularly in the high-gradient southwestern margin.

Study Area 5B was also assessed for the feasibility of future focus level surveys; however, 2018 vibracores MA-CZM-2017-VC13 and MA-CZM-2017VC14 and 2025 vibracore MA-CZM-2025-VC12 confirmed the presence of clayey sands, indicating that the target sediment was not present in sufficient quantity to justify further study, therefore no focus area was identified. Below are Table 20 and Table 21 detailing the estimated sand volumes and composite results for Cuttyhunk Study and Focus Areas.



Table 20: Preliminary Sand Volumes for Cuttyhunk Study Area

Study Area	Vibracores	Interp. Sandy Area (m ²)	Mean Sand Thickness (m)	Volume (m ³)	Volume (cy)
5A	MA-CZM-2017-VC10	12,180,335	2.86	54,470,000	71,244,000
	MA-CZM-2017-VC11				
	MA-CZM-2017-VC12				
	MA-CZM-2025-VC09				
	MA-CZM-2025-VC10				
	MA-CZM-2025-VC11				
5B	MA-CZM-2017-VC13	5,338,989	0.64	7,460,000	9,757,000
	MA-CZM-2017-VC14				
	MA-CZM-2025-VC12				
5A Focus	MA-CZM-2017-VC10	9,162,000	5.81	54,032,000	70,671,000
	MA-CZM-2017-VC11				
	MA-CZM-2025-VC09				
	MA-CZM-2025-VC10				

Table 21: Focus Composite Results for Cuttyhunk Focus Area Vibracores.

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt (%)	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt (%)
MA-CZM-2017-VC10	5A Design	0.2	0.6	1.8	0.25	0.6	1.98
MA-CZM-2017-VC11	5A Design	0.4	0.5	1.1			
MA-CZM-2025-VC09	5A Design	0.2	0.7	2.4			
MA-CZM-2025-VC10	5A Design	0.2	0.7	2.1			



9.0 FUTURE PLANNING

9.1 Phased Approach to Sand Search Investigations

While the reconnaissance-level investigations conducted in 2018 and 2025 have provided a critical foundation for understanding the distribution, quality, and preliminary volumes of offshore sand resources, these results are not sufficient for the implementation of borrow area delineation and accurate resource characterization. When a specific beach nourishment or coastal restoration project is identified, it is essential that the identified Focus Areas be investigated in greater detail to confirm borrow area suitability. To advance from planning-level estimates to actionable project design, APTIM recommends a three-phase investigation approach, which has been adopted by both the Louisiana Coastal Protection and Restoration Authority and the Florida Department of Environmental Protection. This phased framework ensures that borrow area development progresses in a systematic and cost-effective manner, beginning with targeted data collection, followed by detailed geotechnical and engineering analysis, and ultimately culminating in borrow area design and permitting. By applying this methodology in Massachusetts, project sponsors can reduce uncertainty, optimize sediment compatibility with project needs, and streamline the transition from preliminary delineations to construction-ready borrow areas.

A systematic approach to marine sand searches has been developed over the years by the APTIM Coastal Geology and Geomatics team (e.g., Finkl, Khalil and Andrews, 1997; Finkl, Andrews and Benedet, 2003; Finkl, Benedet and Andrews, 2005; Finkl and Khalil, 2005). This approach has been modified to apply to any marine sediment investigation. In a comprehensive marine sand search, APTIM typically divides the investigation into three sequential phases (Figure 7). This phased approach can be modified to meet the scope of the investigation and accommodate the level of work previously performed. Regardless of the phases executed during a sand search, the APTIM investigation sequencing is preserved to maintain efficiency and completeness to provide confident results.

Phase I investigations typically consist of a comprehensive review of the recipient beach/project area and potential sediment resources offshore of the project area. This desktop study phase examines previously collected information within the geologic context of the investigation area to identify features having the highest potential of containing project-compatible sand. The geological background of the area is assessed to identify the geomorphic features that may contain material suitable for the project. Information related to previously investigated areas and potential sand resources and borrow areas is compiled and related back to the geomorphic features. Geophysical and geotechnical data previously collected within these areas, as well as any reports discussing the findings, are then reviewed. Based on this analysis, deposits potentially containing project-compatible material are identified. The results of Phase I are used to define the areas that will be surveyed during Phase II investigations.



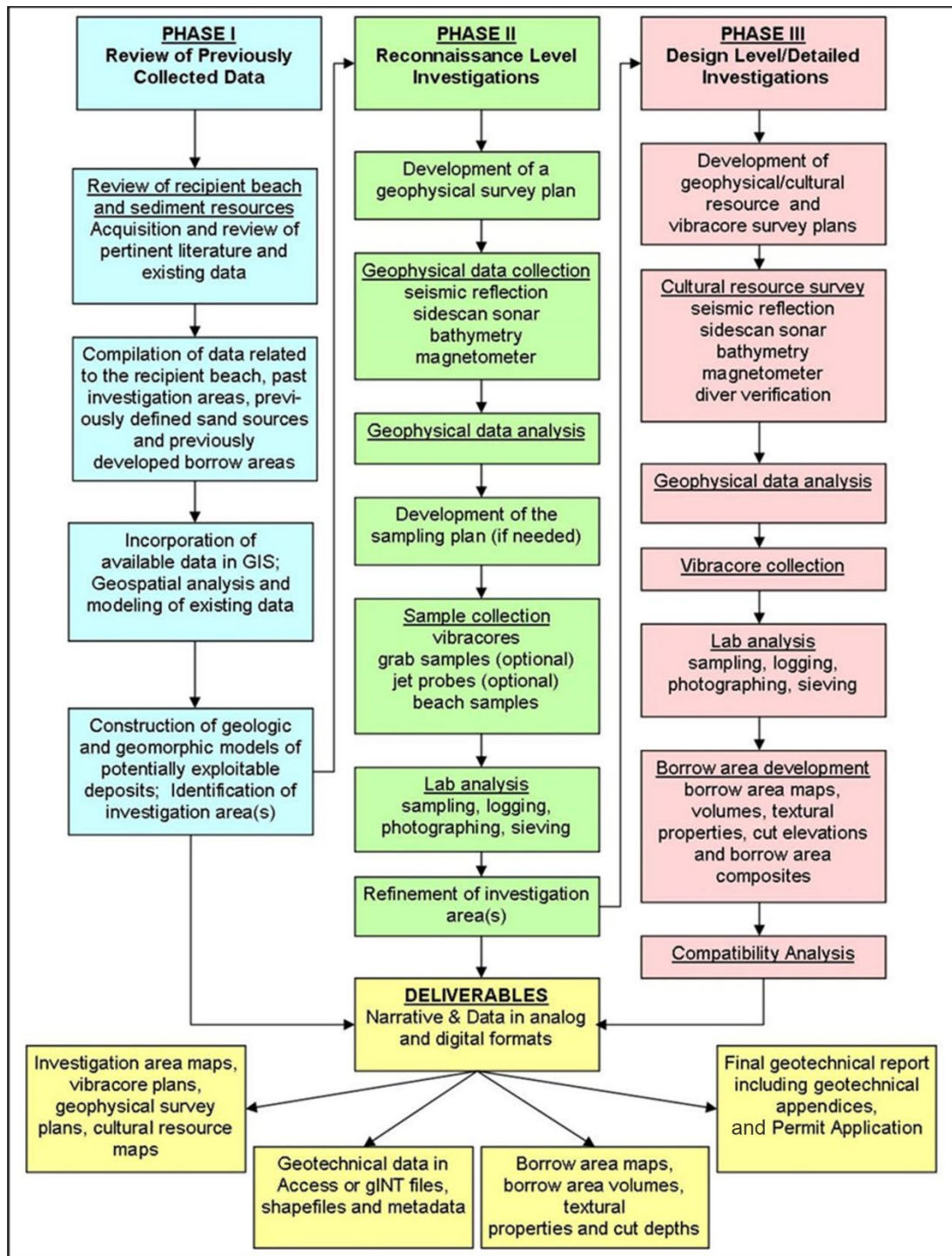


Figure 7: Flow Diagram Showing the General Investigation Sequence Followed by Aptim During a Typical Marine Sand Search Investigation

Phase II investigations usually consist of reconnaissance-level geophysical and geotechnical surveys. A joint geophysical investigation (typically collecting sub-bottom profiles, sidescan sonar images, magnetometer, and bathymetric data) is conducted at reconnaissance line spacing, which are typically a



wider derivative of the 30 m (98 ft) spacing associated with design level tracklines, usually 90 m (295.2 ft), 120 m (393.6 ft), or 150 m (492 ft), to assess the thickness of potential sand resources. The wide reconnaissance line spacing is designed to cover large expanses of seafloor. Therefore, the data coverage achieved during Phase II investigations may not be sufficient to develop a detailed sand thickness isopach map. The geophysical data collected during this phase are used to design a vibracore investigation plan. Vibracores are collected to determine the sediment characteristics within the areas identified through remote sensing. Typically, a limited number of vibracores are collected to ground-truth each potential sand resource. Sand resources within the investigation area are then analyzed using Geographic Information System procedures that integrate the sub-bottom profile and vibracore data to provide an estimate of deposit thickness and sedimentary characteristics. During this phase native or existing beach samples may also be collected from the project area to characterize the sediment required in terms of grain size, color, and composition. This will help identify the exact sand specifications required of the sand resource or borrow area. Beach samples are typically collected in transects spaced generally every 304.8 m (1,000 ft) along the project area. Sand samples are generally collected along each transect at specific locations, typically Top of Dune, Toe of Dune, Mid-Berm, Mean High Water, Mean Tide Level, Mean Low Water, Trough, Bar, and then at water depths every 1.2 m (4 ft) extending out to the toe of the proposed beach fill design. To ensure compliance with Marine Fisheries and future fish habitat permitting, it is recommended that a camera also be towed to record any benthic or significant habitats that the proposed project might pose a risk.

Phase III typically consists of design-level geotechnical and geophysical investigations, a cultural resource investigation, and borrow area design. In Massachusetts, Phase III would also include benthic surveys to characterize fisheries resources. A joint sub-bottom, sidescan sonar, magnetometer and bathymetric survey is conducted within the potential sand resource area(s). The data collected are used to identify possible cultural or environmental resources for avoidance and to develop isopach (sediment thickness) maps for borrow area design. These results are also used to target areas for additional vibracoring. To conform to standard geological and engineering practice, fulfill permitting requirements, and conduct geophysical and geotechnical surveys in an expeditious manner, vibracores are collected to provide a maximum spacing of 305 m (1,000 ft; industry standard spacing) within the potential resource area. Preliminary borrow area boundaries and excavation depths are developed from the data collected during the Phase I, II and III investigations.

A final submerged cultural resource investigation is required to fully permit borrow areas for use. During this investigation, additional geophysical data are collected within the proposed borrow area that utilizes design-level survey trackline spacing, typically no greater than 30 m (98 ft). Project specific coordination with the Massachusetts BUAR would be required to confirm design-level spacing for each project. A QMA who meets the standards set forth by the Secretary of the United States Department of the Interior is required to conduct the submerged cultural resource investigation. The geophysical data are used to identify any potential cultural resources, submerged hazards, or any other features that would affect borrow area delineation and dredging activities. Based on the results of the submerged cultural resource



investigation, the QMA compiles a report that recommends clearance of the area for dredging activities, which must be concurred with by the regulatory agency, the Massachusetts Board of Underwater Archaeology, and it may include recommendations for further investigation of any potentially significant targets or delineate buffers around them for avoidance. If further investigation of the potentially culturally significant targets is not conducted, the final borrow area design should then be modified to take the recommended buffers into account and should propose mitigation methods for avoiding adverse impacts to the potentially significant object/site.

During Phase III investigations, it is often encouraged, but not required, to meet with the applicable state and federal permitting entities to ensure that the data density will be sufficient for permitting the borrow area in the future and to give the agencies a heads up that the project may be coming in for permitting. Once the field investigations are complete, a preliminary borrow area has been designed, and a compatibility analysis has been completed for the identified recipient beach, it is encouraged for the project sponsor to meet with both the USACE district office regulatory staff and state permitting staff to discuss project viability and potential impacts before submitting a formal application. Preparing draft permit applications for the state and federal permitting and leasing entities, such as DEP, USACE, and BOEM (if sediment source is in federal waters), prior to the pre-application meeting is helpful to ensure sufficient information is being compiled for permitting and the appropriate environmental and cultural resource consultations with agencies such as CZM, BUAR, MEPA, NHESP, USFWS, and NMFS. The USACE Section 404 permitting process regulates the discharge of dredged or fill material into waters of the United States, which applies to the dredging of material from state or federal waters for placement during beach (re)nourishment projects. This process includes more than design of the physical borrow area but also identification of the potential significant impacts of dredging to both environmental and cultural resources. Ensuring that all requirements are met for the Clean Water Act Section 404 permit prior to application submission and formal consultation with the federal environmental agencies (U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service) should make the permitting process much smoother. The USACE will often work on a parallel timeline with the state permitting agency but may require the state permit and coastal zone determinations by state entities, such as CZM, BUAR, MEPA, Division of Fisheries, and Wildlife NHESP, be finalized prior to the issuance of a federal permit and the record of decision made on the environmental consultations. For these reasons, early coordination amongst the state and federal and environmental agencies is key.

9.2 Future Investigation Recommendations

To advance individual focus areas identified in this investigation to design level, it is recommended that a statewide desktop data and gap analysis be undertaken. This effort would compile and evaluate existing geophysical and geological datasets to identify areas where coarse-grained sediment may occur but remain poorly characterized. A systematic review would highlight spatial data gaps, prioritize regions with limited or low-quality coverage, and establish a roadmap for future survey efforts. By focusing on the identification of coarser material resources at the statewide scale, this analysis would complement



ongoing design level investigations within current focus areas and expand the potential for locating high-quality sand resources necessary for coastal resilience and restoration initiatives.

Building on the outcomes of this broader assessment, site specific geophysical surveys are also recommended to further refine the understanding of subsurface conditions within each study area. As suggested in Sections 7.1.4, 7.2.4, 7.3.4, 7.4.4, and 7.5.1 a close-order geophysical survey with multiple, < 30 m (< 98 ft) tightly spaced survey lines is recommended to refine the magnetic and seismic record as this approach would enable the generation of a detailed magnetic contour map and improve the spatial resolution of subsurface features (Table 22).

Among the focus areas, Study Area 1A is the only location where coverage may need to extend beyond the currently delineated bounds. The thickest portion of the deposit coincides with a poorly imaged section of the USGS legacy dataset; therefore, targeted high-resolution sub-bottom profiling along the western shoal complex is recommended to refine internal stratigraphy, confirm lateral continuity of the resource, and extend the isopach model westward where data quality is limited. The remaining study areas are not expected to extend beyond their delineated limits, but progression to design-level will refine internal volumetric estimates and better constrain the potential sand resources within each boundary.

In Study Area 2C, the thickest parts of the Focus Area are fine sand-rich deposits over buried paleovalleys. Additional mileage and vibracores along the western shoal in the ENE portion of the area are recommended to confirm deposit continuity and assess whether the chaotic, low amplitude facies remain sand-dominated throughout the shoal.

In Study Area 3, the northern lobe presents potential for development as a significant fine-grained resource, contingent upon further evaluation of facies continuity within the chaotic shoal architecture, whereas the southern lobe appears to provide a more laterally continuous, laminated, and stable shoal geometry. The central corridor may also serve as an additional borrow area if targeted vibracoring confirms that the acoustically transparent intervals are sand dominated.

For Study Area 4A-1, future design initiatives should prioritize exploitation of the shoals, particularly the northwestern 2.4 m (8 ft) – 3 m (10 ft) shoal identified within the focus area for maximum resource density, while the southwestern 2.1 m (7 ft) – 2.7 m (9 ft) zone could provide supplementary volume. The 4A-2 Focus Area prioritizes sections of the study area where there is a sufficient volume of coarse sand to justify future investigations. Poor quality USGS legacy data was included in this interpretation and therefore it is recommended that future investigations should target the prominent shoals.

For Study Area 5A, resurveying areas of poor quality USGS data from 2019 and additional targeted vibracore surveys within the newly defined Study Area 5A Focus Area, would enable further isopach refinement and more precise resource estimation, particularly in the high-gradient southwestern margin.



Table 22: Proposed additional survey line mileage and vibracore sampling required to advance Study Focus Areas to design level.

Focus Area	Additional Mileage (nm)	Additional Vibracores
Study Area 1	484.4	225
Study Area 2A	212.4	66
Study Area 2C	45.9	28
Study Area 3	83	36
Study Area 4A-1	160	57
Study Area 4A-2	33.4	16
Study Area 5A	174.5	126
Total	1193.6	554

Note: Additional mileage was calculated assuming a line spacing of 30 m (98 ft) for primary lines and 100 m (328 ft) for tie lines. Existing legacy datasets of sufficient quality were subtracted from the total mileage required to meet design-level coverage. The number of vibracores was estimated by dividing the total area of each focus area by the area represented by a circle with a 152 m (500 ft) radius.



10.0 SUMMARY

The CZM contracted APTIM to conduct a borrow site characterization for offshore sand resources in five (5) study areas in Massachusetts state waters. The project consisted of an historic data review, the collection of at least 155 nm (287.1 km) of full suite geophysical data collection, and the collection of 20 vibracores, and associated sediment analysis and data processing. Additionally, APTIM was tasked with conducting detailed logging and analysis of the collected geotechnical samples and estimating volumes of potential sand resources for future coastal restoration efforts.

The Merrimack River Study Area (Study Area 1) was identified during the 2018 investigation, where an initial isopach was generated providing an estimated preliminary volume of approximately $\sim 99,730,000 \text{ m}^3$ (130,442,000 cy) of potential sand resources. During the 2025 investigation APTIM collected new geophysical and geotechnical data targeting areas with the thickest volume of sands, now redefined as Study Area 1A. Seismic interpretation of Study Area 1 identified thin shoaling and coarse sand surficial units overlying scoured channels and valleys filled with chaotic, low-amplitude deposits. The newly collected data, when combined with the 2018 dataset, provided an updated analysis indicating that Study Area 1 contains an estimated preliminary volume of $137,255,000 \text{ m}^3$ (179,523,000 cy), with a mean composite grain size of 0.50 mm (1.00 phi). APTIM then identified the most likely beach compatible, coarse sediment deposits and delineated Study Area 1A Focus Area, which contains an estimated preliminary volume of $36,433,000 \text{ m}^3$ (47,652,000 cy), with a mean composite grain size of 0.66 mm (0.60 phi).

The Nantasket Beach region (Study Area 2) was identified during the 2018 investigation, and consisted of three sub-areas Study Areas 2A, 2B, and 2C. The 2018 investigation eliminated Study Area 2B as no viable resources were identified. The 2018 investigation generated initial isopachs of Study Area 2A and 2C, which contained estimated preliminary volumes of $3,600,000 \text{ m}^3$ (4,708,600 cy) of potential sand resources in each area. During the 2025 investigation and after incorporating the results of the new desktop study, APTIM expanded Study Area 2A to the west and redefined the Study Area as 2A-1, while Study Area 2C remained the same. Seismic interpretation of Study Area 2A-1 reveals thin shoals capping extensive valley systems. The shoals vary in composition, ranging from chaotic to mottled with little evidence of lamination. After incorporating the additional survey coverage from the 2025 investigation, new isopachs were generated, which increased the estimated potential sand resource volume for Study Area 2A-1 to $17,726,000 \text{ m}^3$ (23,185,000 cy), with a mean composite grain size of 0.22 mm (2.18 phi) and 10.11 percent silts. APTIM further refined the target area using results from MA-CZM-2025-VC01 and MA-CZM-2025-VC02 to delineate a constrained zone of beach compatible fine-grained sands (Study Area 2A-1 Focus Area), resulting in an updated potential resource volume of $14,786,000 \text{ m}^3$ (19,339,000 cy), with mean composite grain size of 0.22 mm (2.18 phi) and 6.26 percent silts. Study Area 2C is composed primarily of thin, silty shoals that appear chaotic, low-amplitude, and lacking in structure. APTIM's 2018 investigation estimated Study Area 2C contained potential sand resources of $3,600,000 \text{ m}^3$ (4,708,600 cy).



Incorporating the additional survey coverage from the 2025 investigation increased the estimated potential sand resource volume for Study Area 2C to 20,211,000 m³ (26,435,000 cy), with a composite mean grain size of 0.16 mm (2.64 phi). Following a detailed review and refinement to target only fine sand within the 2C Study Area, a Focus Area was delineated, decreasing the potential volume of beach compatible sands to 6,574,000 m³ (8,598,000 cy), with a composite mean grain size of 0.16 mm (2.64 phi). Seismic interpretation of the 2C Focus Study Area identifies a thick shoal of fine sand, reaching ~4.9 m (~16 ft) thick, overlaying a large valley system characterized by high-amplitude, thinly laminated strata. Together, these results highlight the potential for significant fine sand resources within both 2A-1 and 2C while narrowing the most prospective target areas for future borrow area development.

The Duxbury Beach region (Study Area 3) was identified during the 2018 investigation, and consisted of two sub-areas, Study Area 3A and 3B. The 2018 investigation generated initial isopachs of Study Area 3A and 3B, which contained estimated preliminary volumes of 46,940,000 m³ (61,395,200 cy) and 46,000,000 m³ (60,165,700 cy), respectively. During the 2025 investigation and after incorporating the results of the new desktop study, APTIM proposed new geophysical data to be collected primarily in Study Area 3A where no historical data existed and in Study Area 3B filling in data gaps and targeting the thickest sand deposit. With the increased geophysical coverage from the 2025 investigation that expanded on the 2018 investigation, Study Area 3A and 3B were later combined into one (1) study area, Study Area 3, as sufficient new and historical datasets existed. Seismic interpretation of Study Area 3 indicates a thick, chaotic shoal overlaying a semi-transparent unit, separated by a large valley, with the deposit thickening to the southwest. In the south, areas of buried hardbottom are present. A potential resource estimate for the newly recombined Study Area 3 was found to be 141,596,000 m³ (185,201,000 cy), with a composite mean grain size of 0.24 mm (2.06 phi). After refining the target sediment to reflect the coarsest-grained sands, Study Area 3 Focus Area was delineated that contained an estimated 6,257,000 m³ (8,184,000 cy), with a composite mean grain size of 0.33 mm (1.60 phi). While smaller than the preliminary 2018 estimates, this refined calculation provides a more realistic and geotechnically viable assessment of potential borrow area resources.

The Sandwich region (Study Area 4) was identified during the 2018 investigation, and consisted of two sub-areas, Study Area 4A and 4B. The 2018 investigation identified that Study Area 4B consisted of a USACE/EPA Offshore Dredge Material Disposal Site and was not investigated. The 2018 investigation area generated an initial isopach of Study Area 4A, which contained an estimated preliminary volume of 51,670,000 m³ (67,581,800 cy) of potential sand resources. During the desktop phase additional data sets were identified, which had previously not been reviewed in APTIM's 2018 investigation. These data were processed and interpreted, and new study areas were designed targeting the thickest potential sand deposits, Study Areas 4A-1, 4A-2, and 4B-1. APTIM proposed new tracklines throughout these survey areas. Results from the 2025 survey were combined with the historical data sets and isopachs were created for each Study Area. Study Area 4A-1 identified ~16,030,000 m³ (20,966,000 cy) of potential sand resources. After refining the boundaries using both the 2018 and 2025 core data, 4A-1 Focus Study Area was developed to target the coarsest sand material with a composite grain size of 0.31 mm (1.70 phi),



yielding an estimated volume of 6,642,000 m³ (8,688,000 cy). Seismic interpretation of 4A-1 reveals an extensive mottled shoal system overlaying a highly laminated valley with steeply dipping reflectors. Study Area 4A-2, south of 4A-1, expanded slightly when incorporating the U.S. Geological Survey 2019-002-FA data. Seismic interpretation of this area reveals a thin, mottled, coarse sand surficial unit that gradually thickens eastward. Preliminary estimates for the entire 4A-2 area total 5,654,000 m³ (7,395,000 cy), refined to 1,744,000 m³ (2,281,000 cy) for the Focus Area and consisted of a composite grain size of 0.28 mm (1.84 phi). Vibracore data collected from the 2025 survey indicate that the surficial layer of Study Area 4B-1, east of 4A-1, consists primarily of a clayey sand with a potential volume of 17,910,000 m³ (23,426,000 cy). Since this is not a beach compatible deposit, a Focus-level area for 4B-1 was not developed.

The Cuttyhunk region (Study Area 5) was identified during the 2018 investigation, and consisted of two sub-areas, Study Area 5A and 5B. Sand deposits in Study Area 5A and 5B are associated with a shoaling feature, with results from the 2018 investigation estimating a preliminary volume of 54,470,000 m³ (71,244,100 cy) and 7,460,000 m³ (9,757,300 cy) of potential sand resources, respectively. No new geophysical data was proposed to be collected in these areas, due to the density and quality of existing historical data sets; however, four vibracores were proposed to be collected. After incorporating the results of the newly collected vibracores no changes to the 2018 volumes were deemed necessary. However, the 2025 geotechnical data allowed for refinement of the resource boundaries within 5A to create a focus-level study area that more accurately delineates the coarser sands of the shoaling feature. This higher-resolution assessment excludes lower-quality or finer grained sediments previously counted in 2018, resulting in a revised preliminary volume estimate of 54,032,000 m³ (70,671,000 cy) and a composite grain size of 0.24 mm (2.06 phi). Study Area 5B contains a thin sand layer (~1.4 m [4.27 ft] thick) overlaying a paleochannel complex likely infilled with clays and silts, yielding a preliminary volume of ~7,460,000 m³ (9,757,000 cy) of potential sand resources and a composite grain size of 0.22 mm (2.20 phi). Due to the thin lens of sand overlying silts and clays in 5B, no focus level assessment was generated.

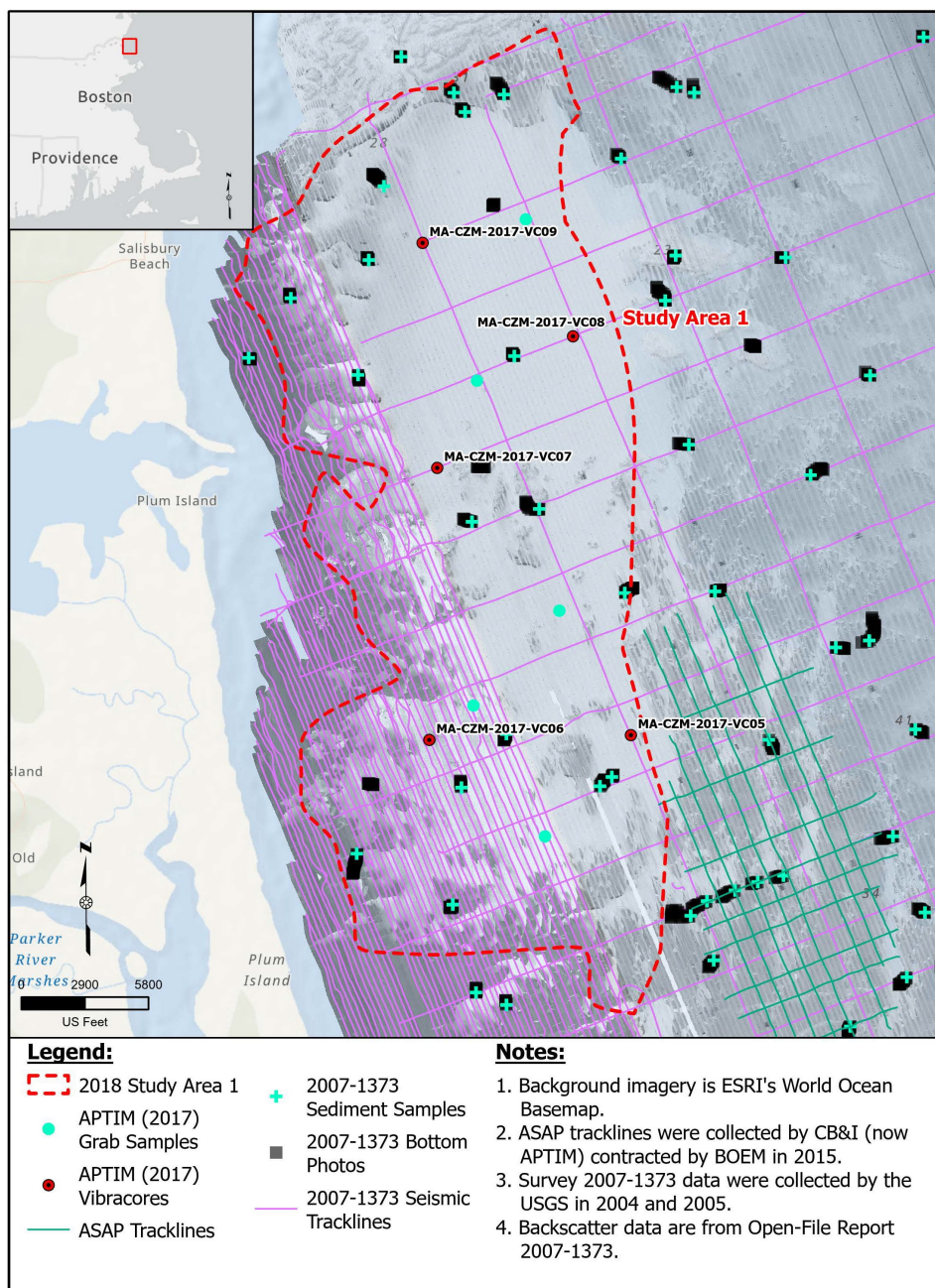
Overall, this 2025 borrow site characterization represents a significant advancement in refining Massachusetts' understanding of offshore sand resources. By integrating extensive historical datasets with newly acquired geophysical and geotechnical data, APTIM and CZM were able to validate previous reconnaissance-level estimates while narrowing the most prospective areas for future borrow area development. Across all study areas, the reconnaissance-level investigations identified a cumulative preliminary volume of ~356,383,000 m³ (466,131,000 cy) of potential sand resources. Following refinement through 2025 geotechnical data and focus-level delineations, this estimate was revised to ~126,467,000 m³ (165,412,000 cy), reflecting the exclusion of lower-quality or finer-grained sediments. The delineation of Focus Areas across multiple study regions demonstrates the importance of targeted investigations that prioritize sediment quality, continuity, and suitability for coastal restoration. While the reconnaissance and focus level results provide a valuable planning framework, the progression to final borrow area designation will require additional site-specific investigations and engineering analysis to



ensure these resources can be utilized effectively to support long-term coastal resilience in the Commonwealth.

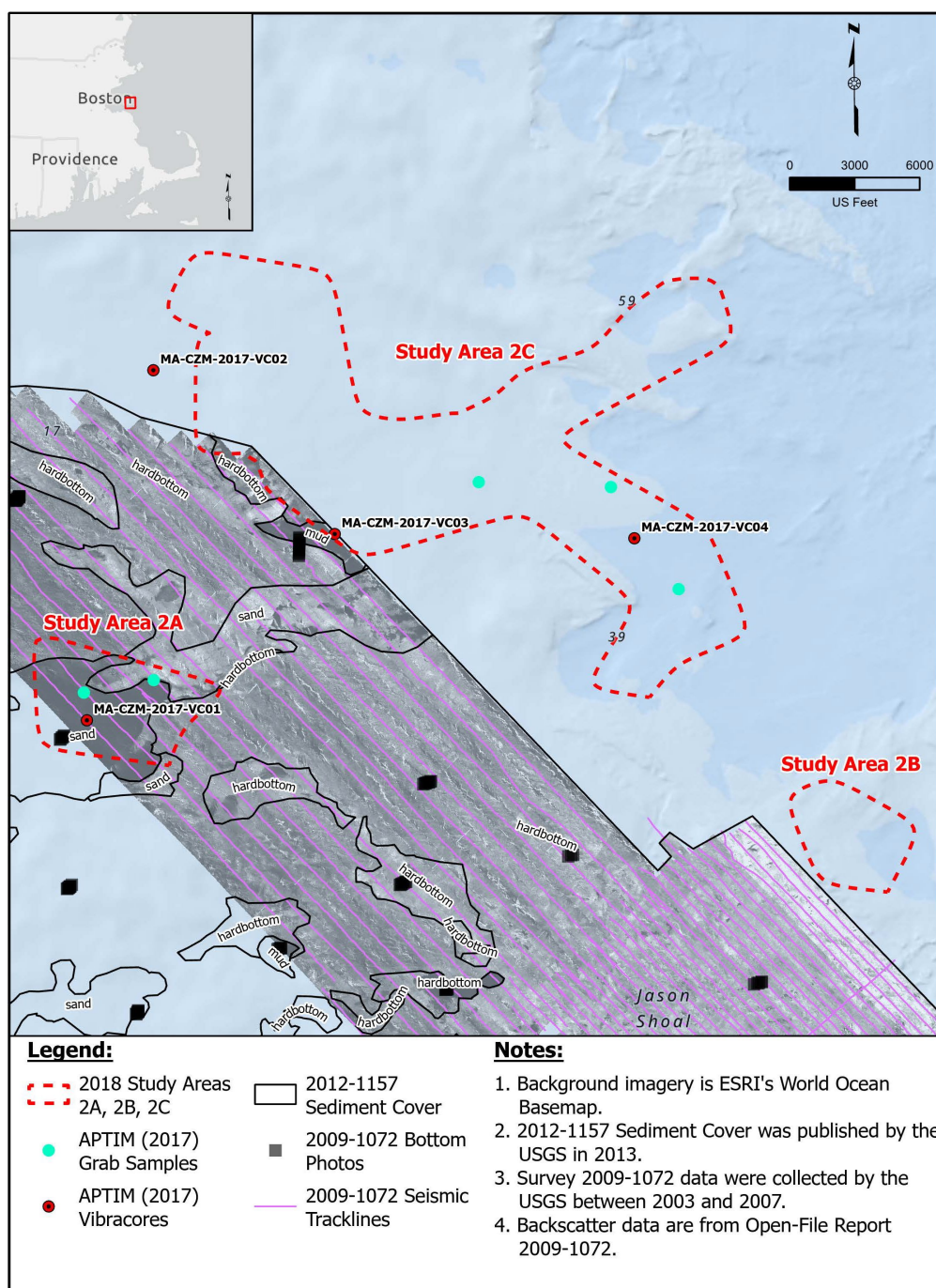


11.0 MAPS



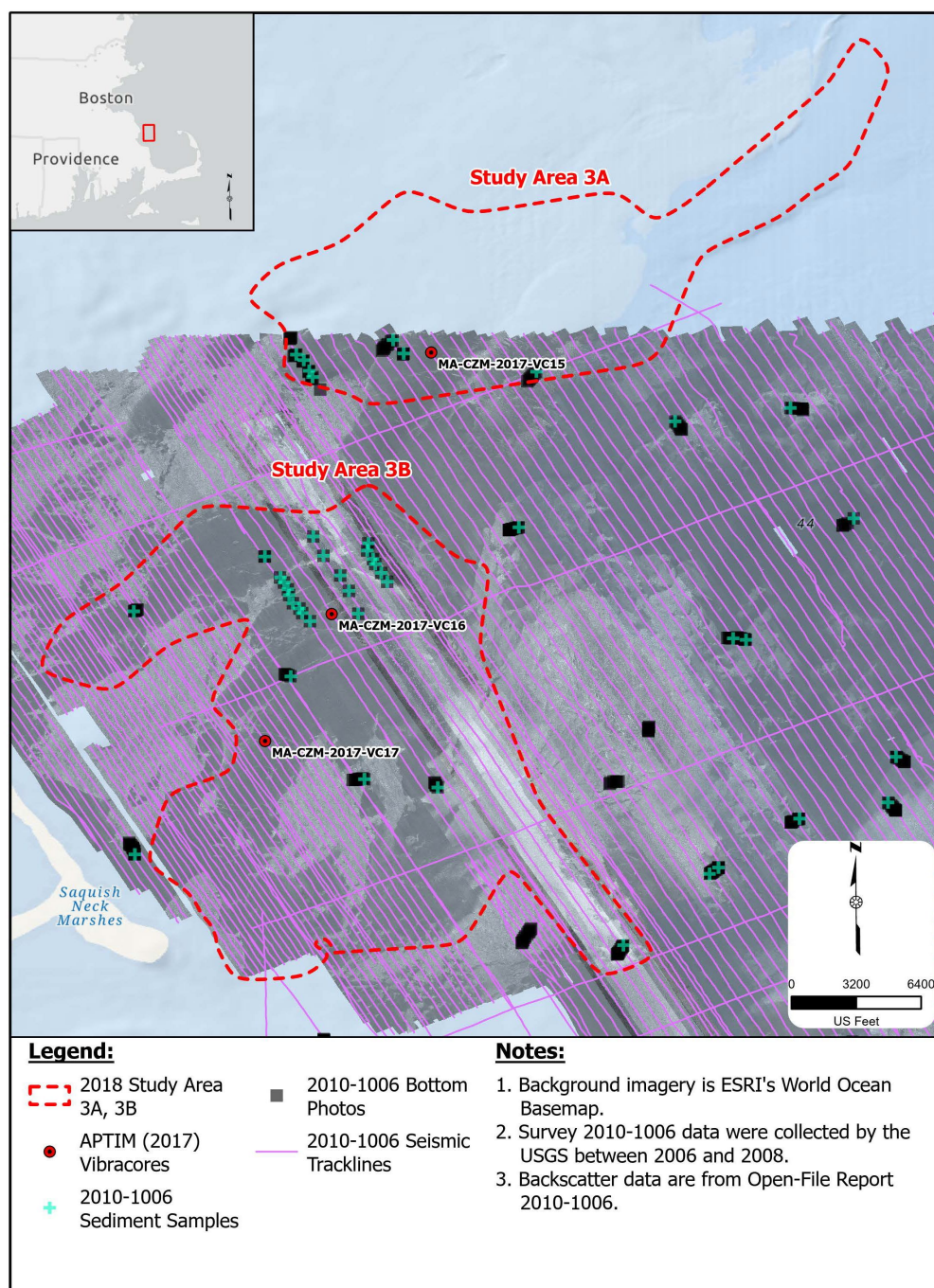
Map 1. Study Area 1—Merrimack, Historic Data





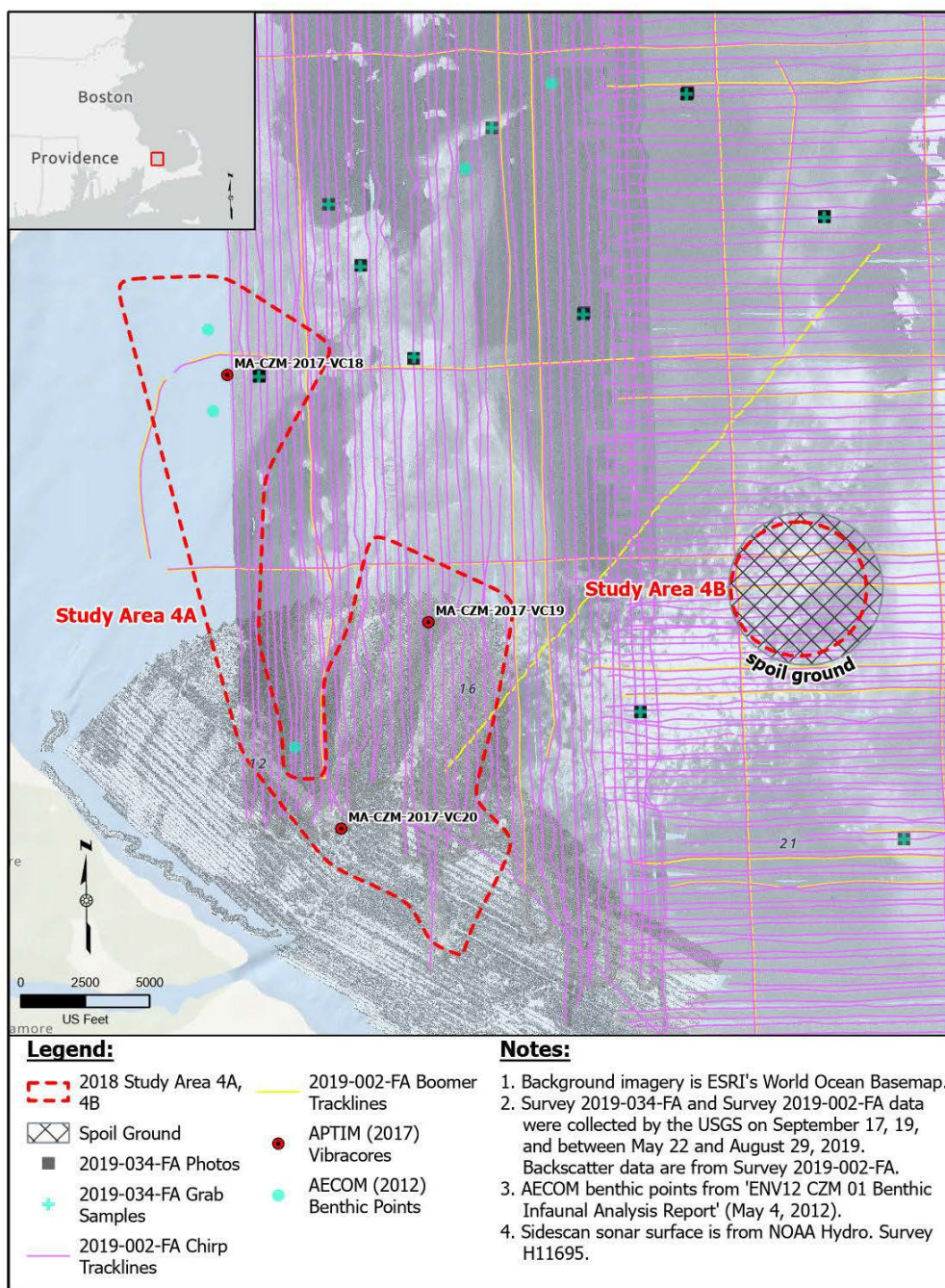
Map 2. Study Area 2—Nantasket Historic Data





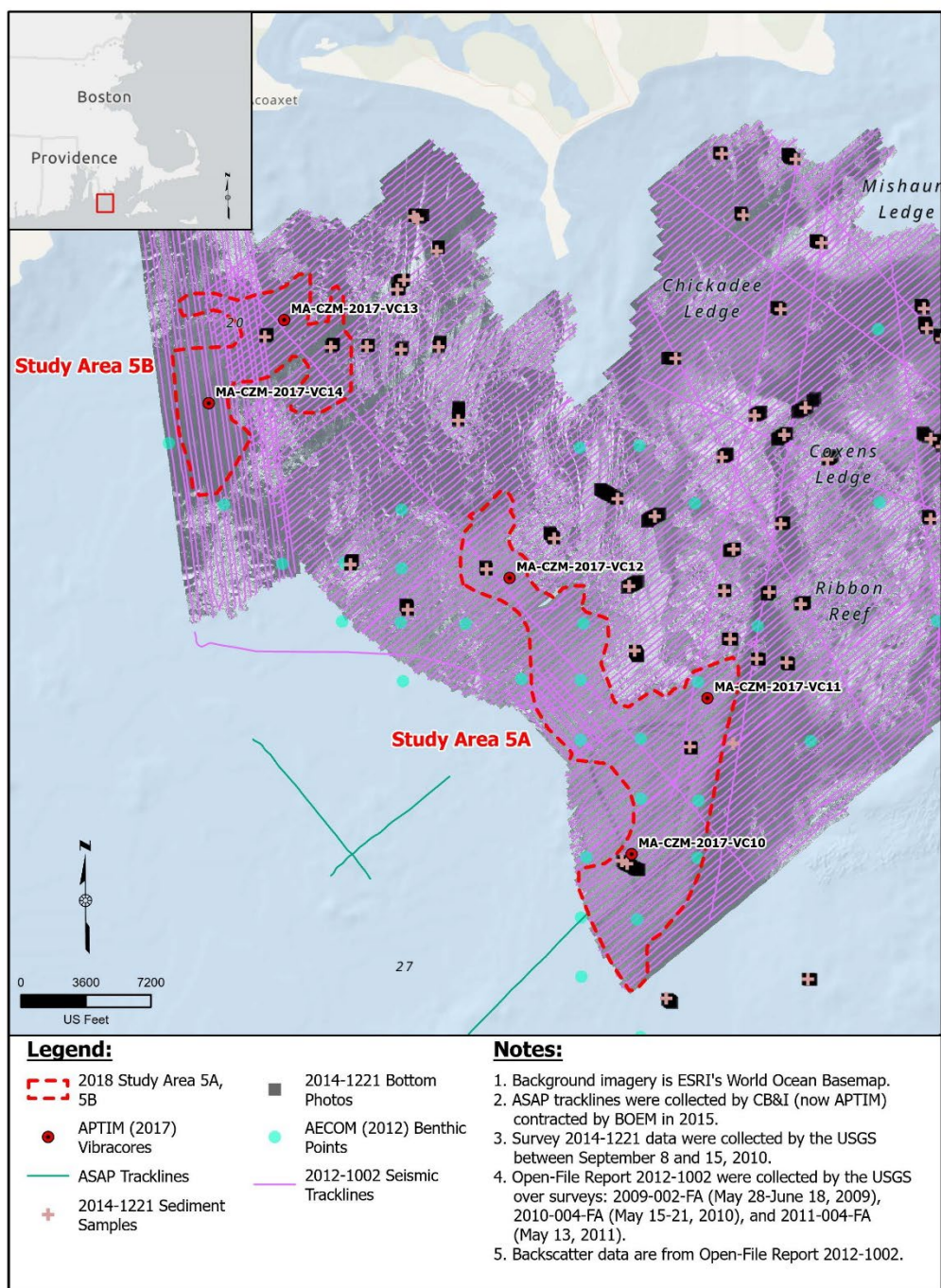
Map 3. Study Area 3—Duxbury Beach, Historic Data





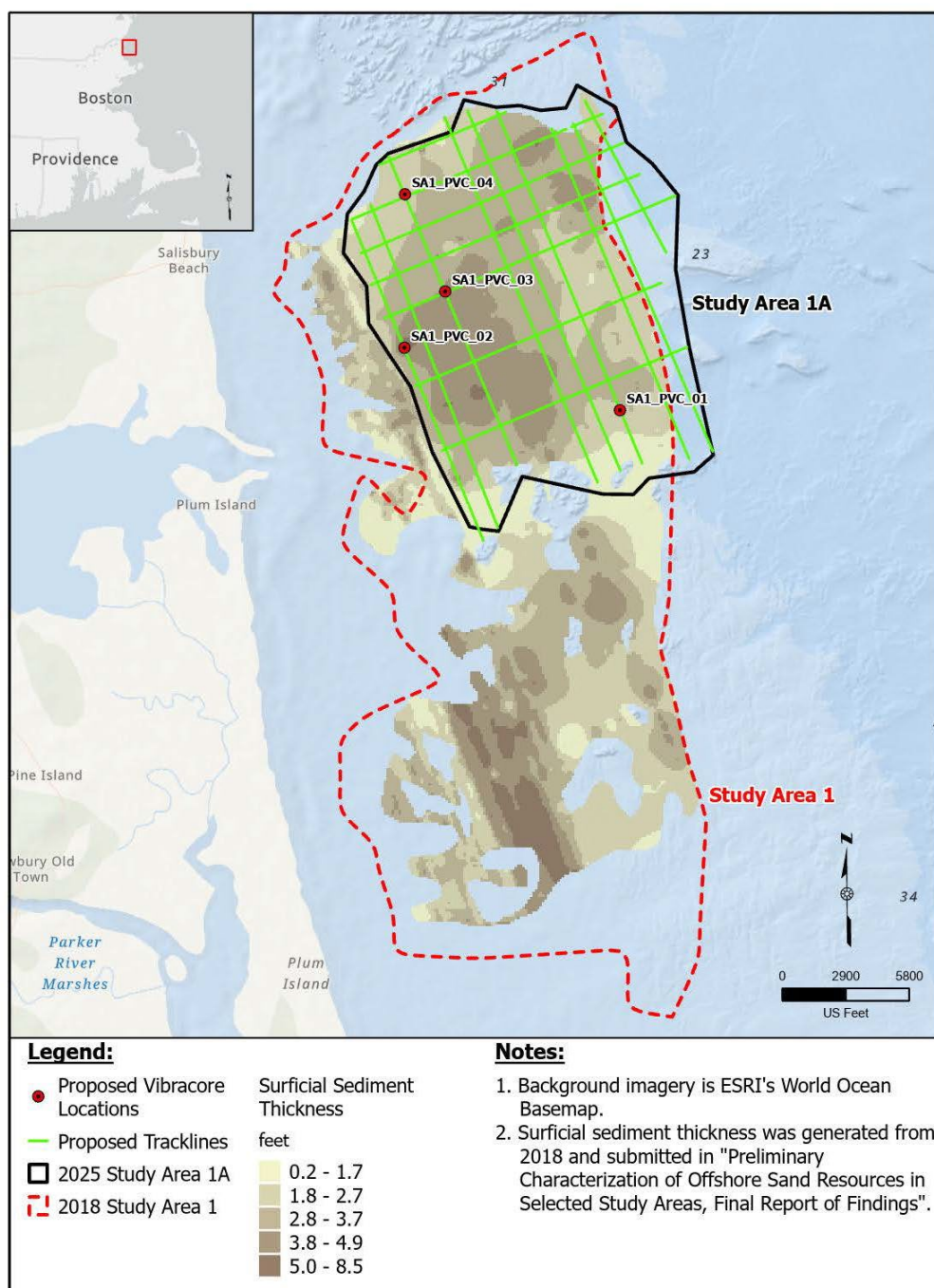
Map 4. Study Area 4—Sandwich, Historic Data





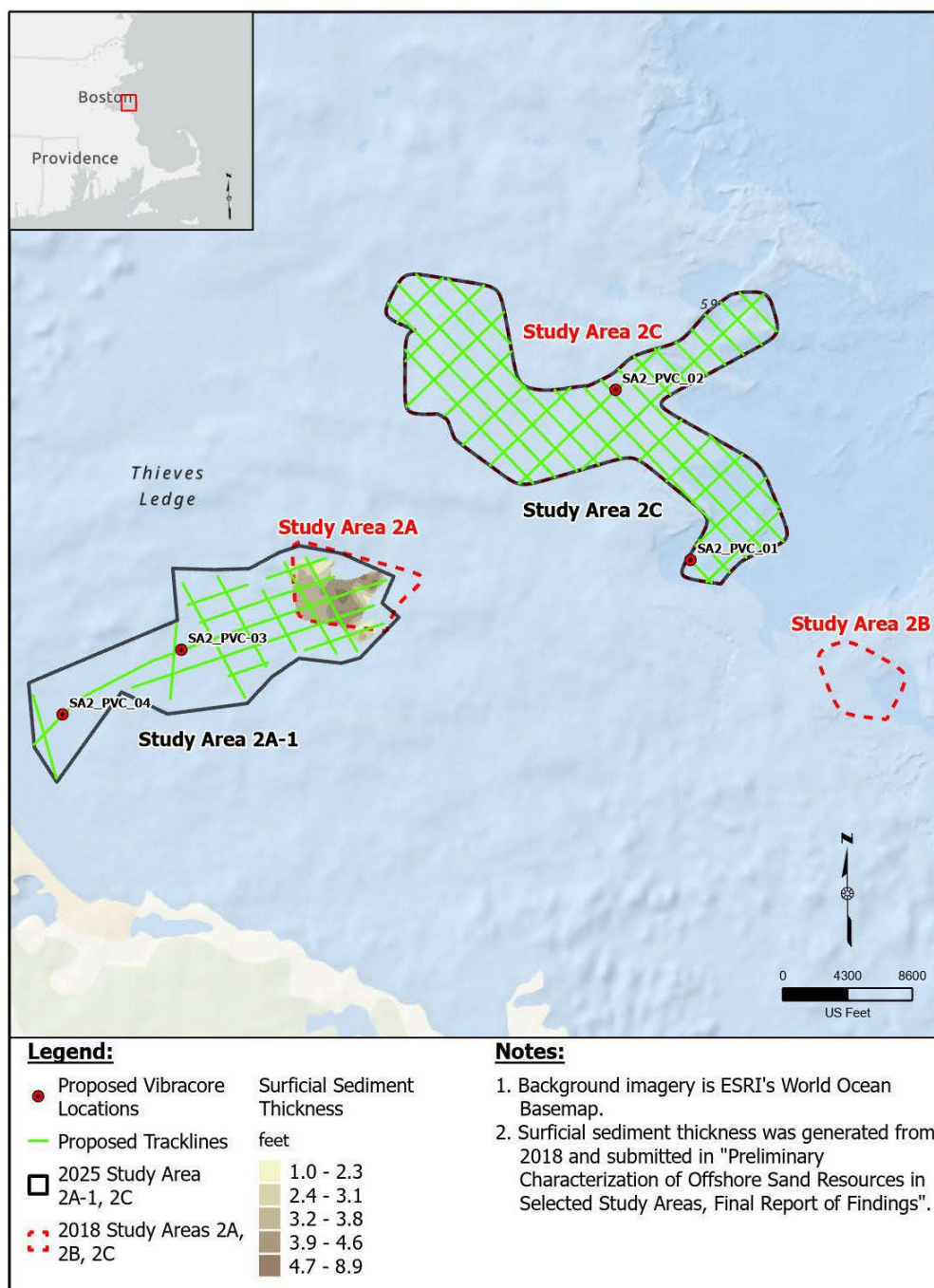
Map 5. Study Area 5—Cuttyhunk, Historic Data





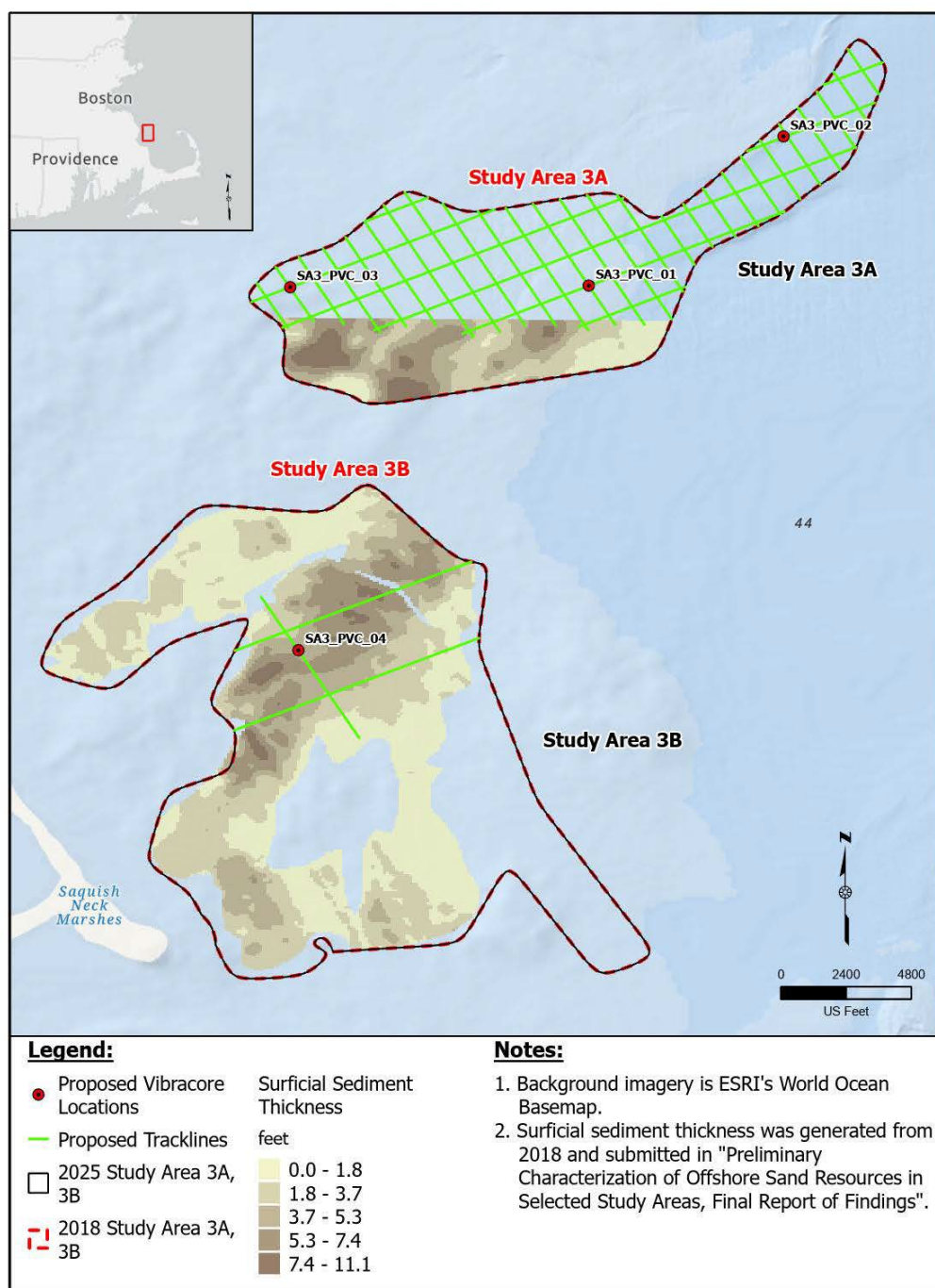
Map 6. Study Area 1—Merrimack, Proposed Data





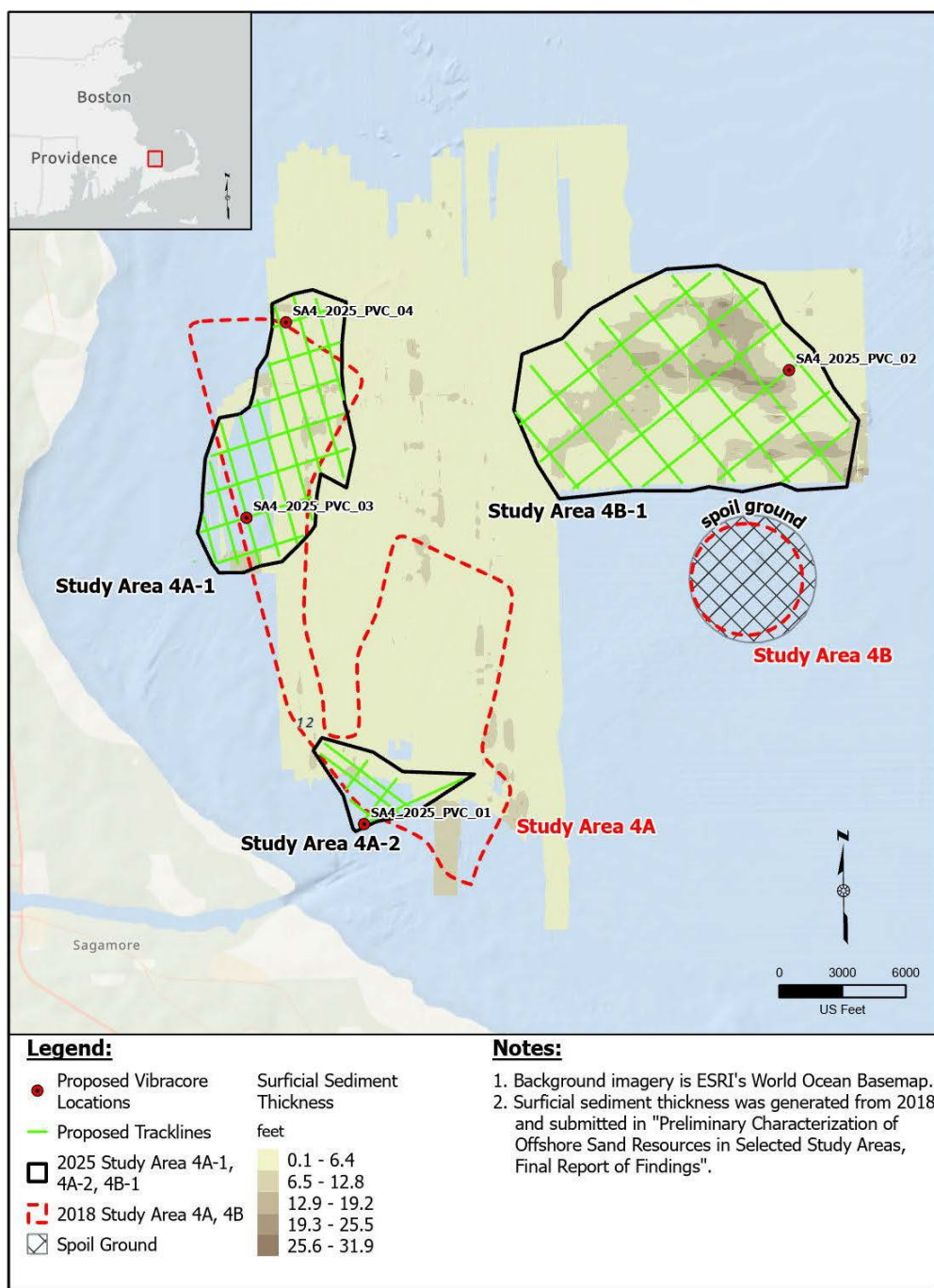
Map 7. Study Area 2—Nantasket, Proposed Data





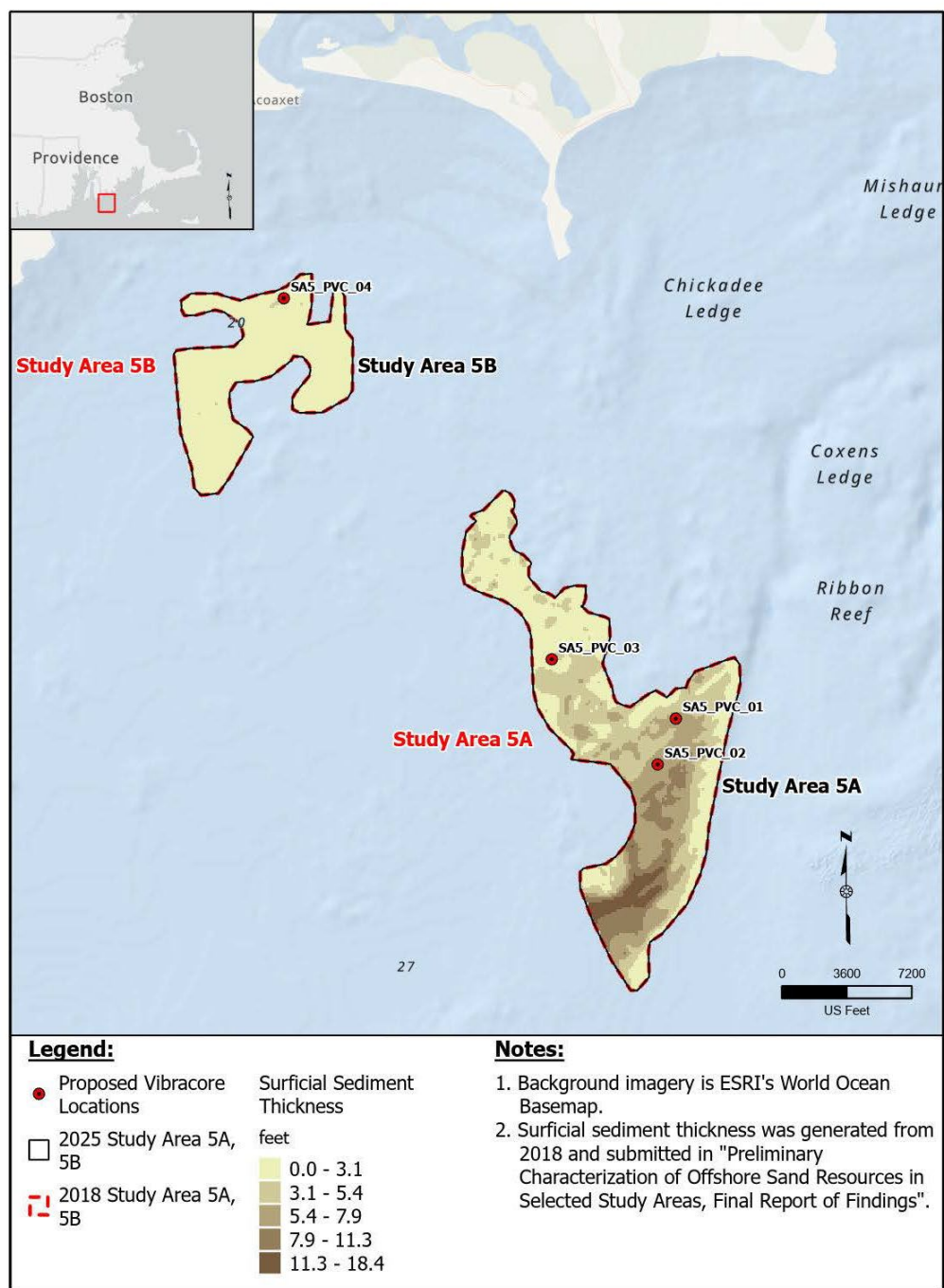
Map 8. Study Area 3—Duxbury Beach, Proposed Data





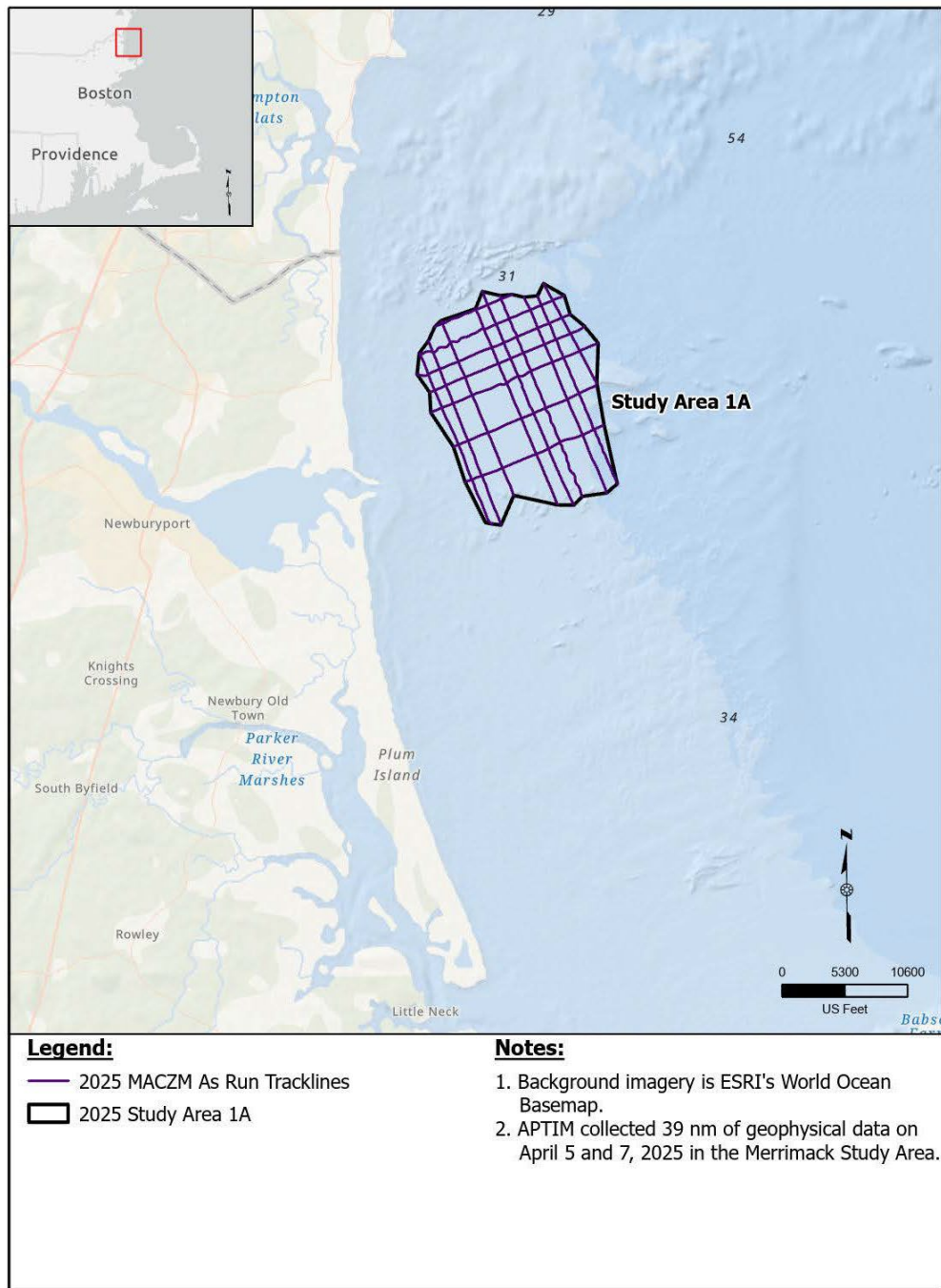
Map 9. Study Area 4—Sandwich, Proposed Data





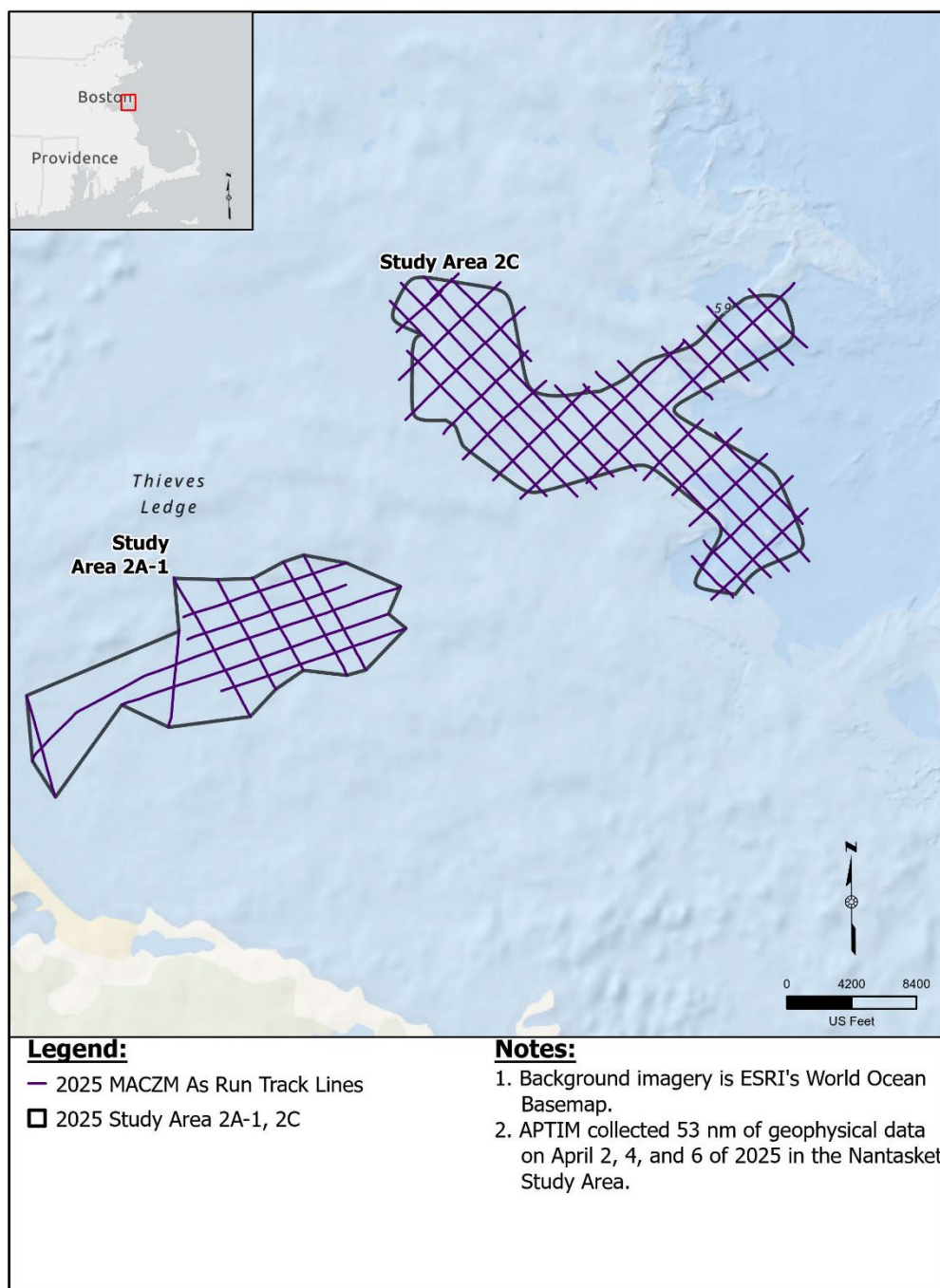
Map 10. Study Area 5—Cuttyhunk, Proposed Data





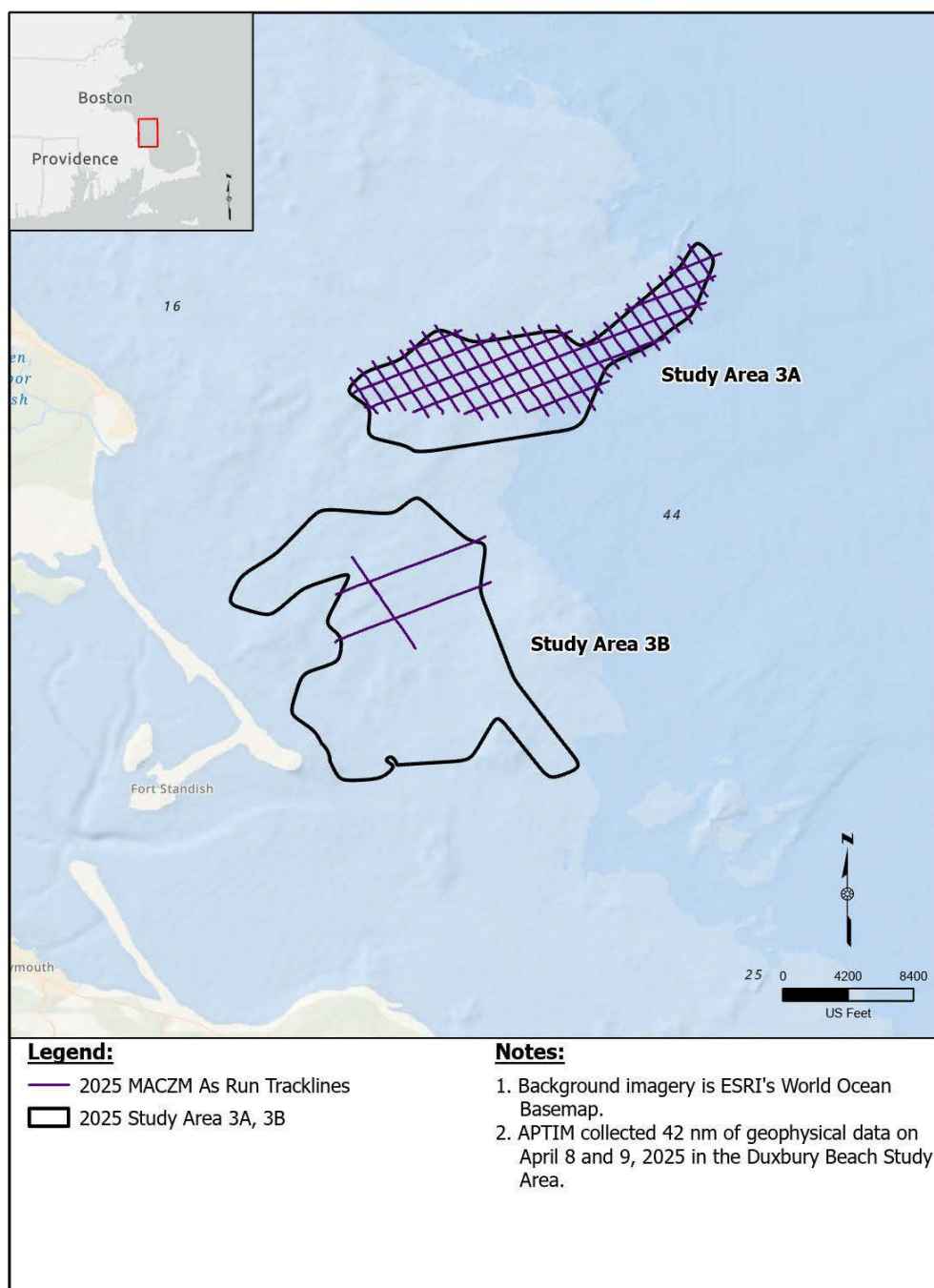
Map 11. Study Area 1—Merrimack, As Run Geophysical Tracklines





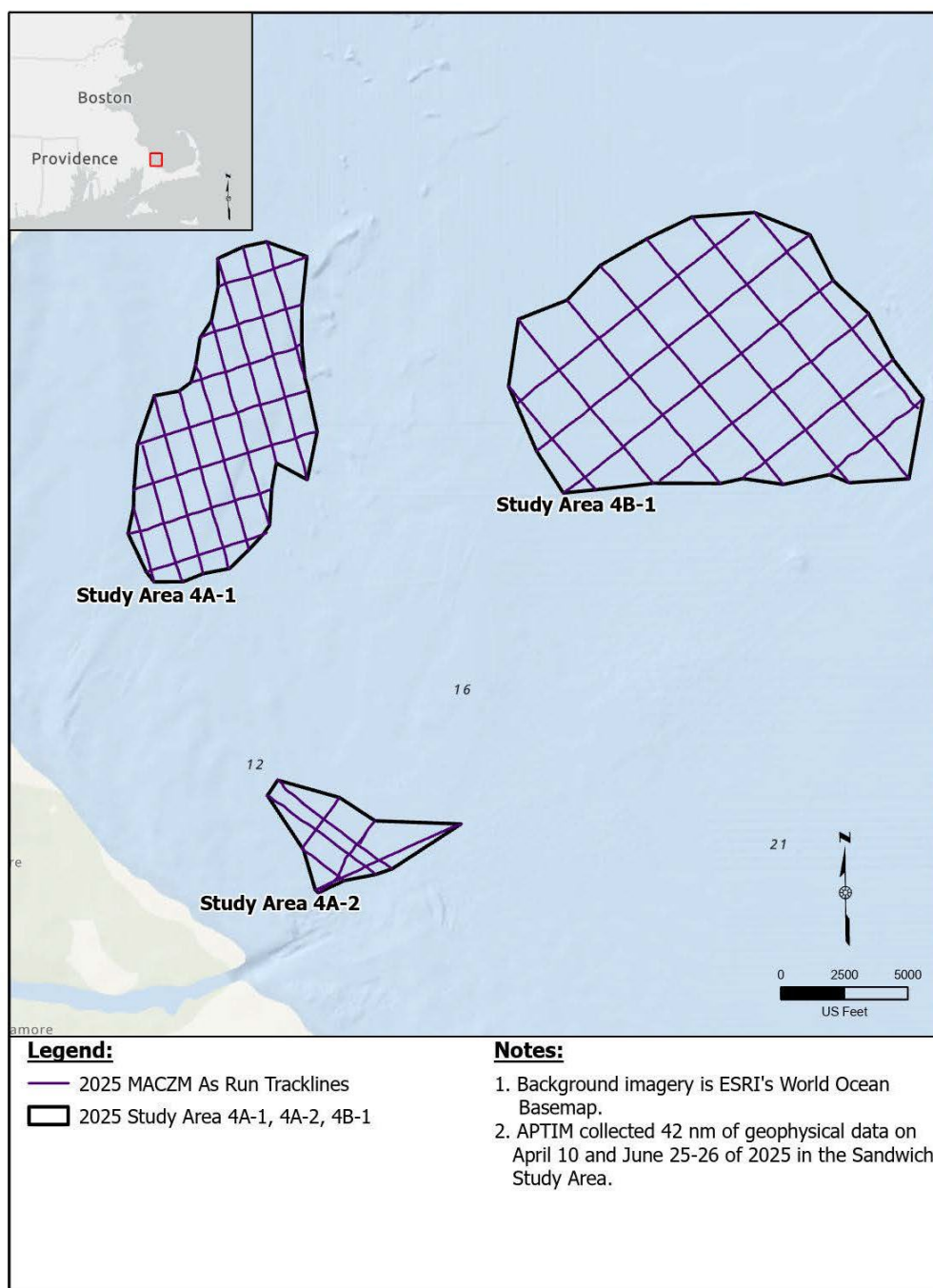
Map 12. Study Area 2—Nantasket, As Run Geophysical Tracklines

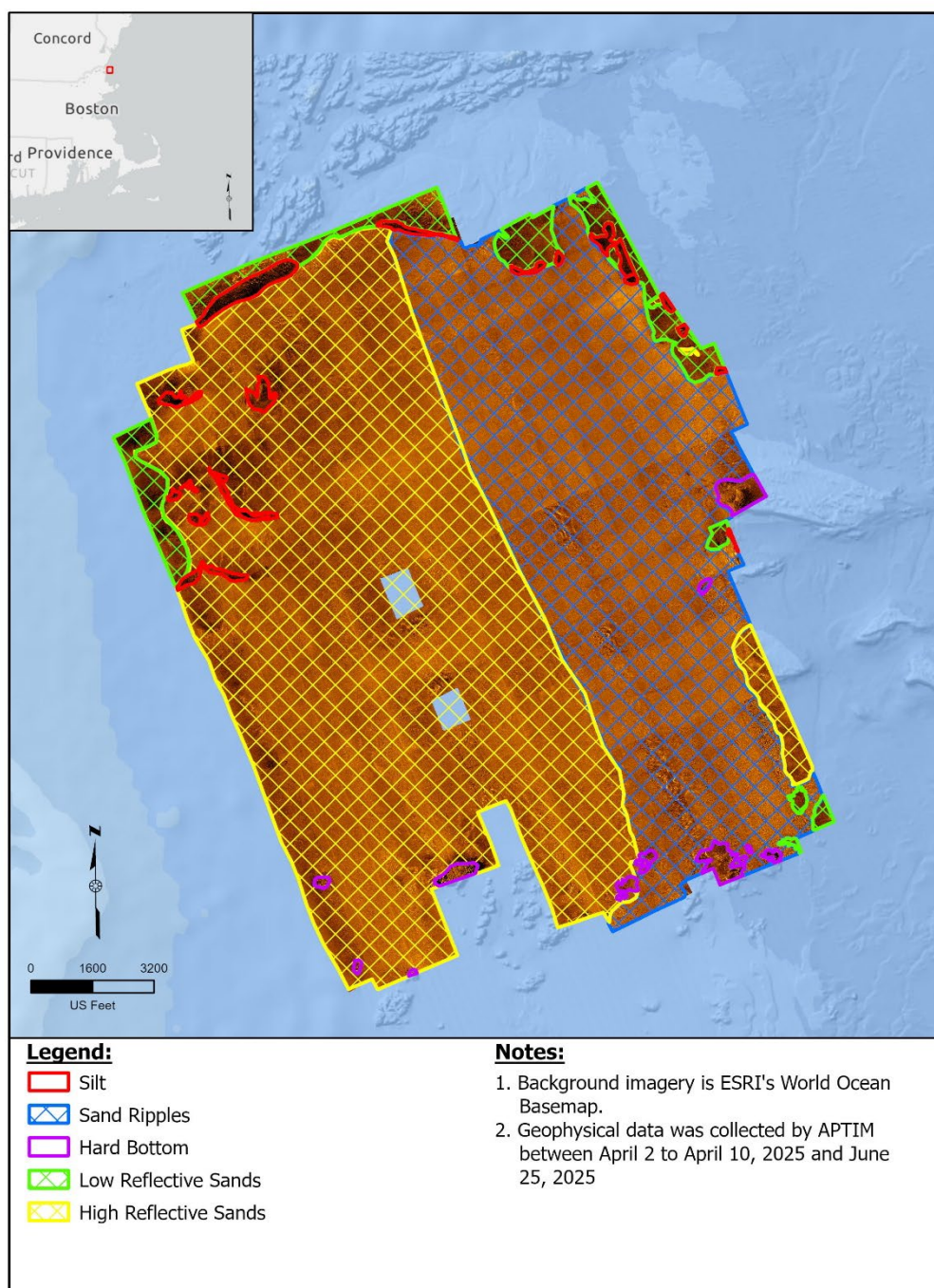




Map 13. Study Area 3—Duxbury Beach, As Run Geophysical Tracklines

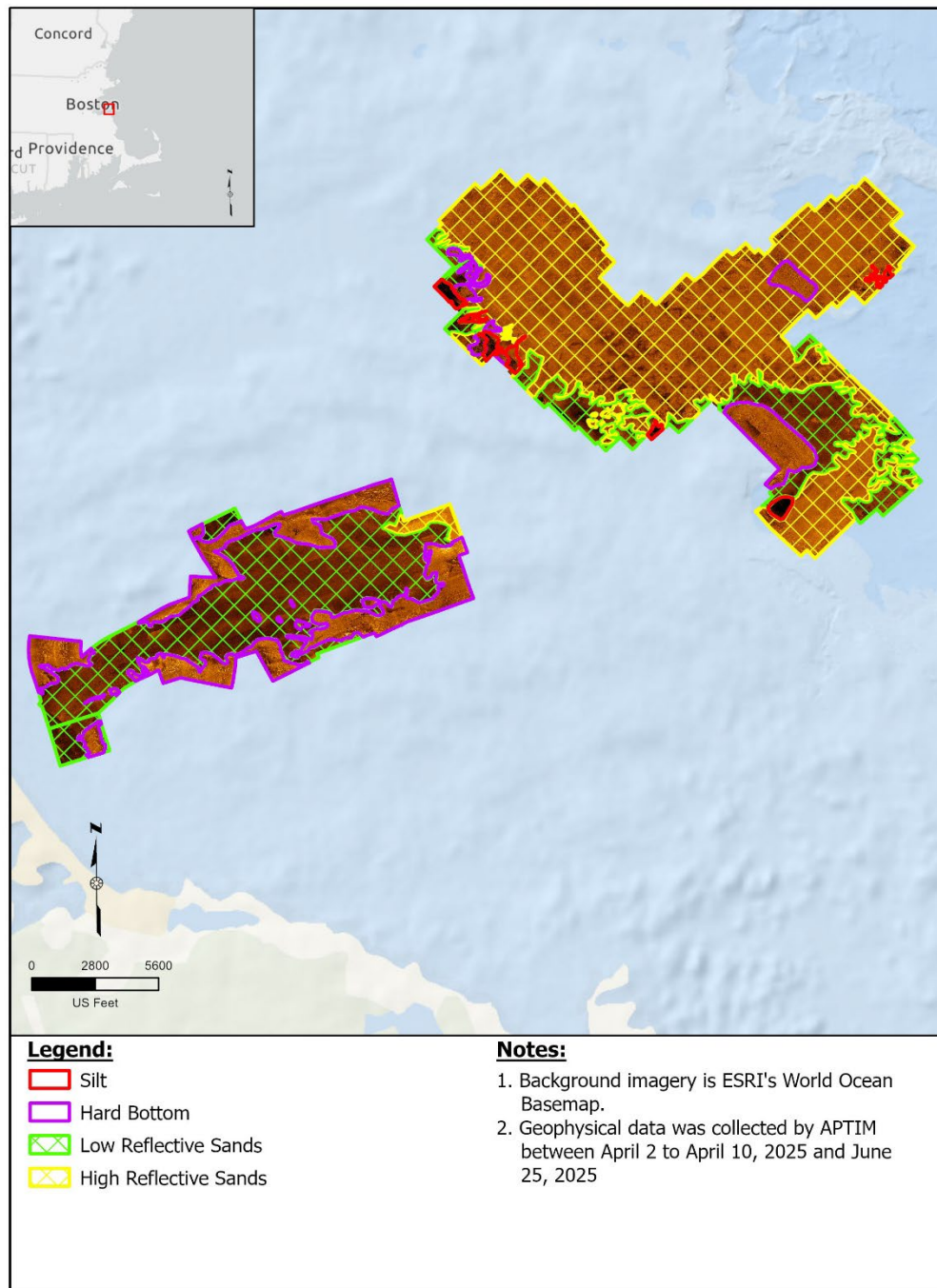






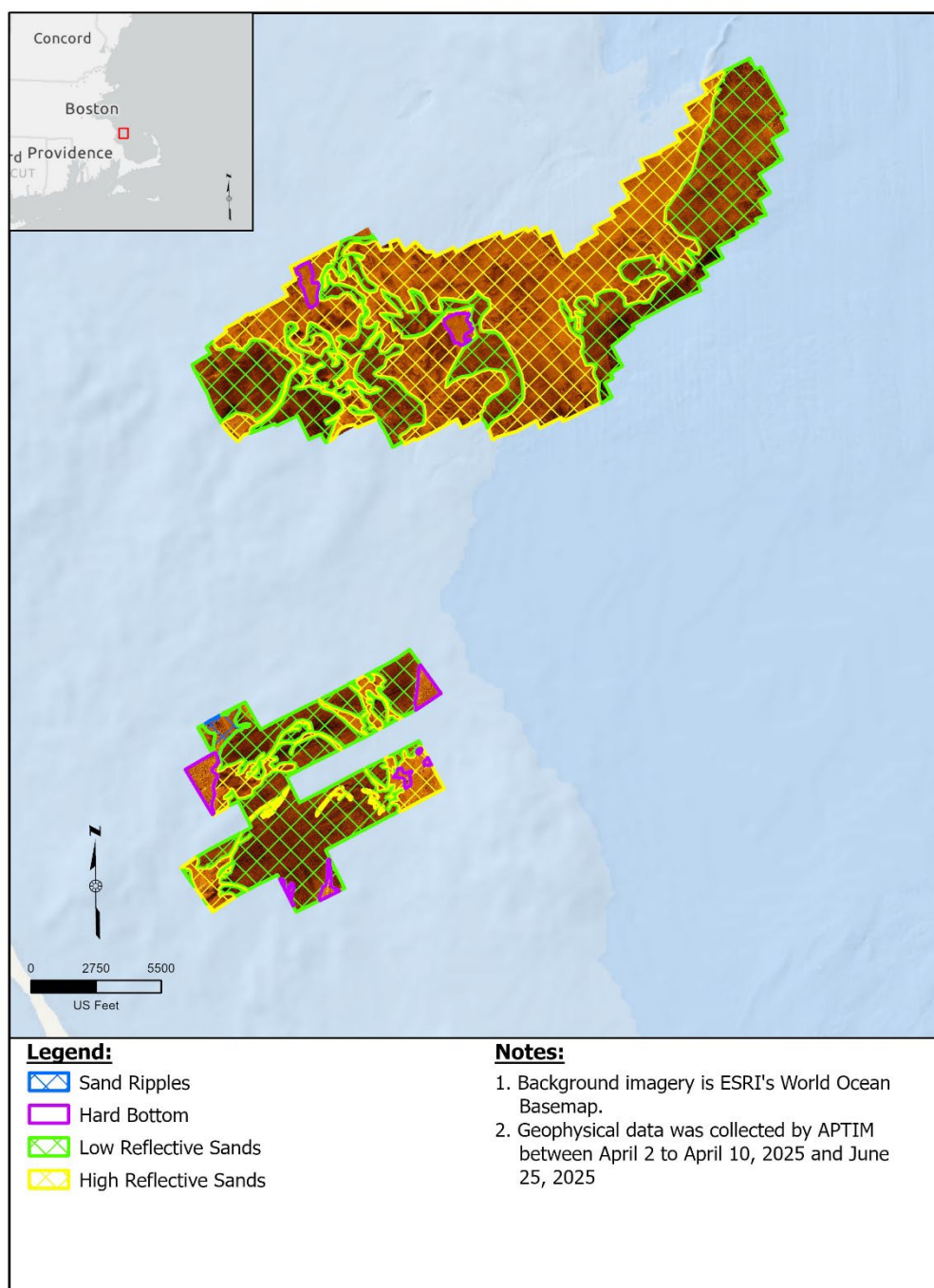
Map 15. Study Area 1—Merrimack, Sidescan Sonar Features and Geotiffs





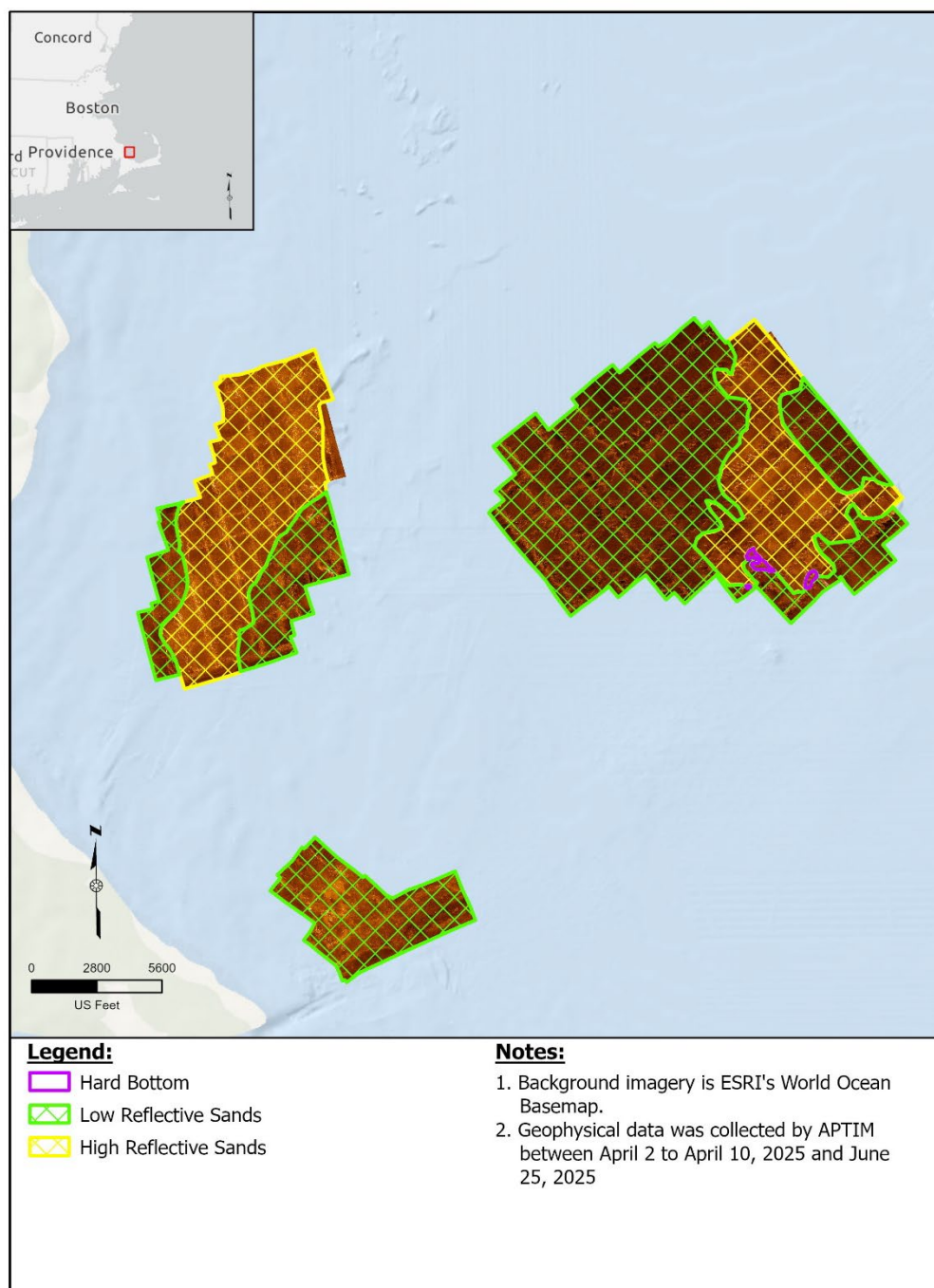
Map 16. Study Area 2—Nantasket Beach, Sidescan Sonar Features and Geotiffs





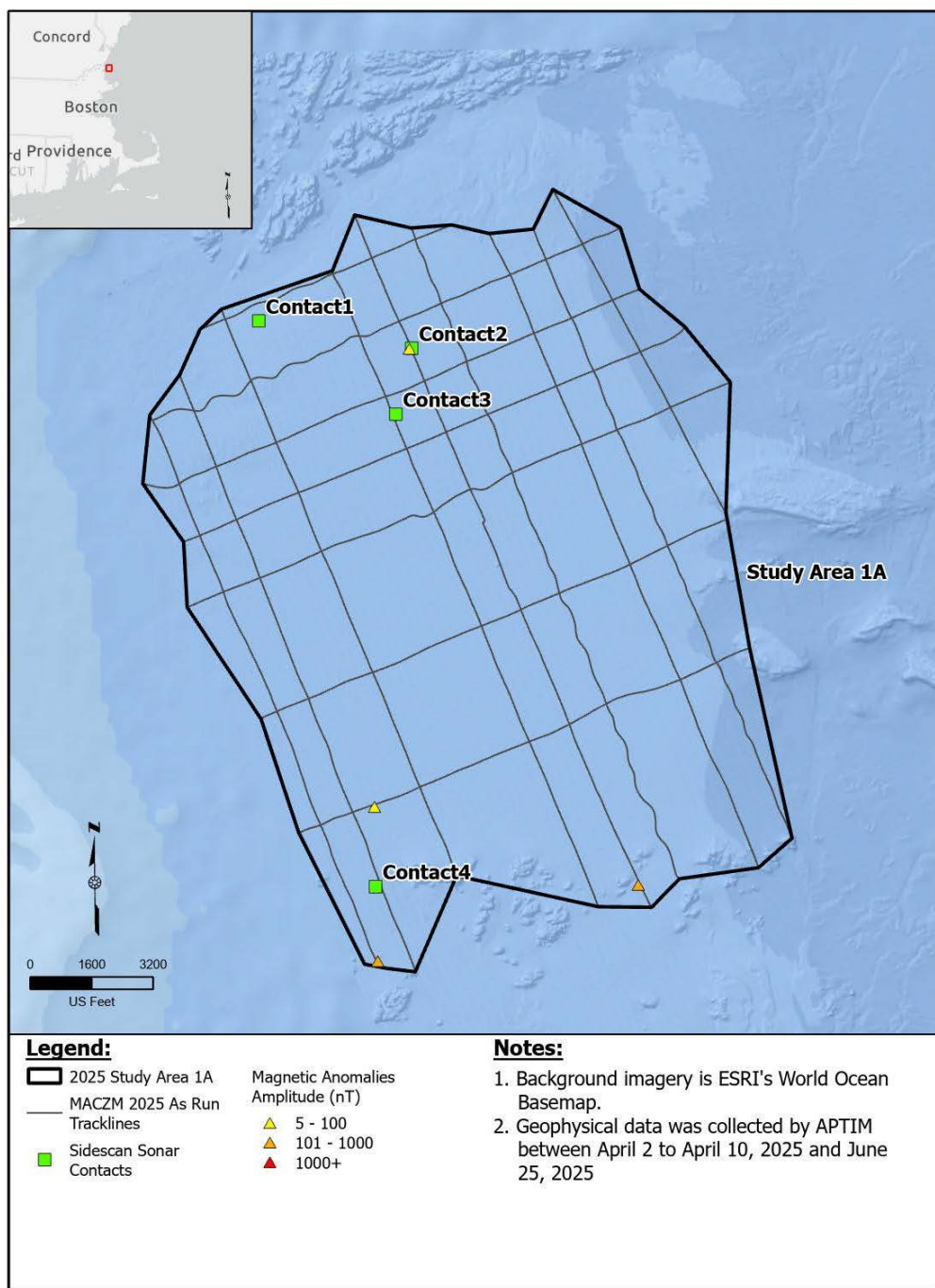
Map 17. Study Area 3—Duxbury Beach, Sidescan Sonar Features and Geotiffs





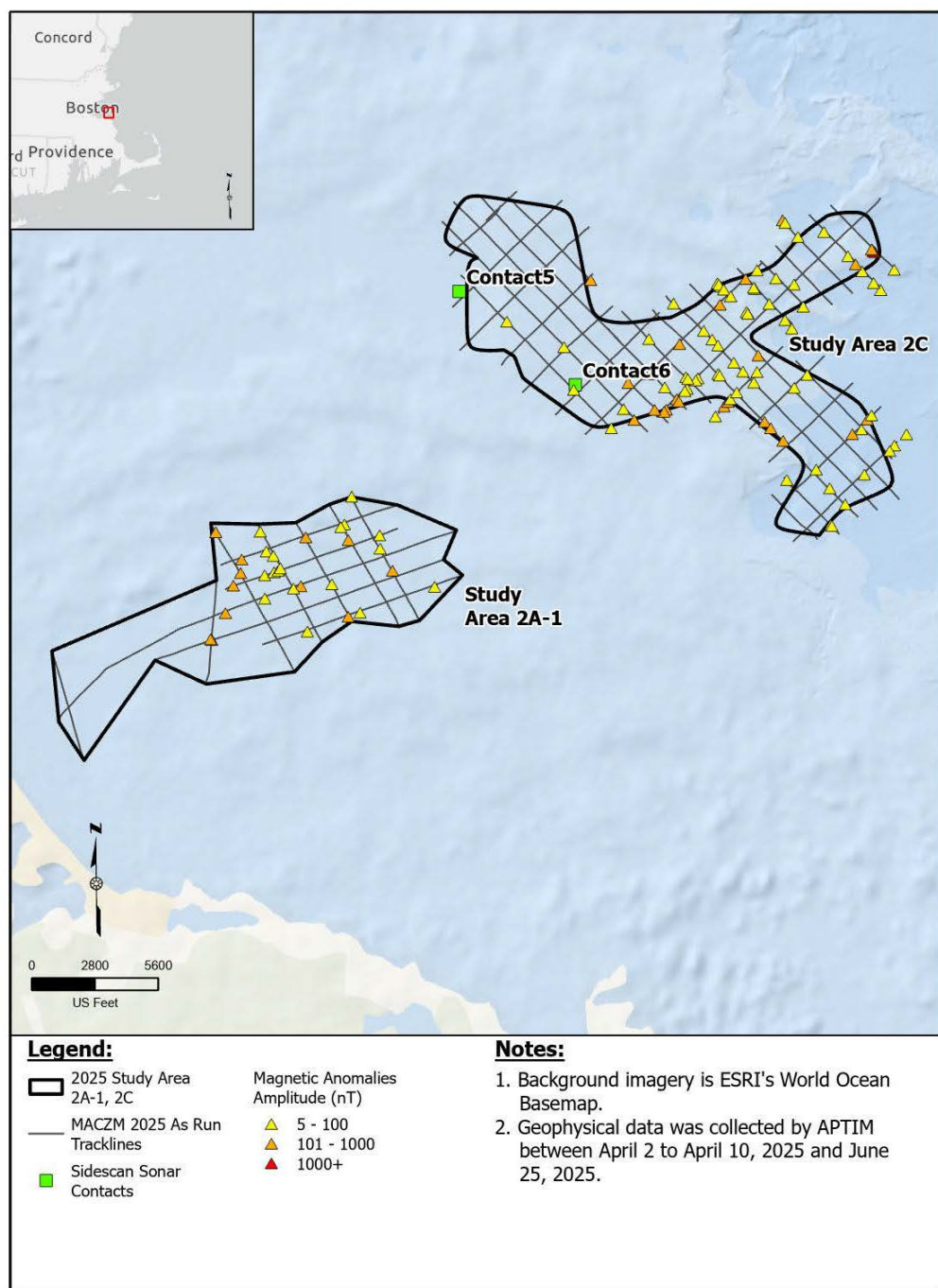
Map 18. Study Area 4—Sandwich, Sidescan Sonar Features and Geotiffs





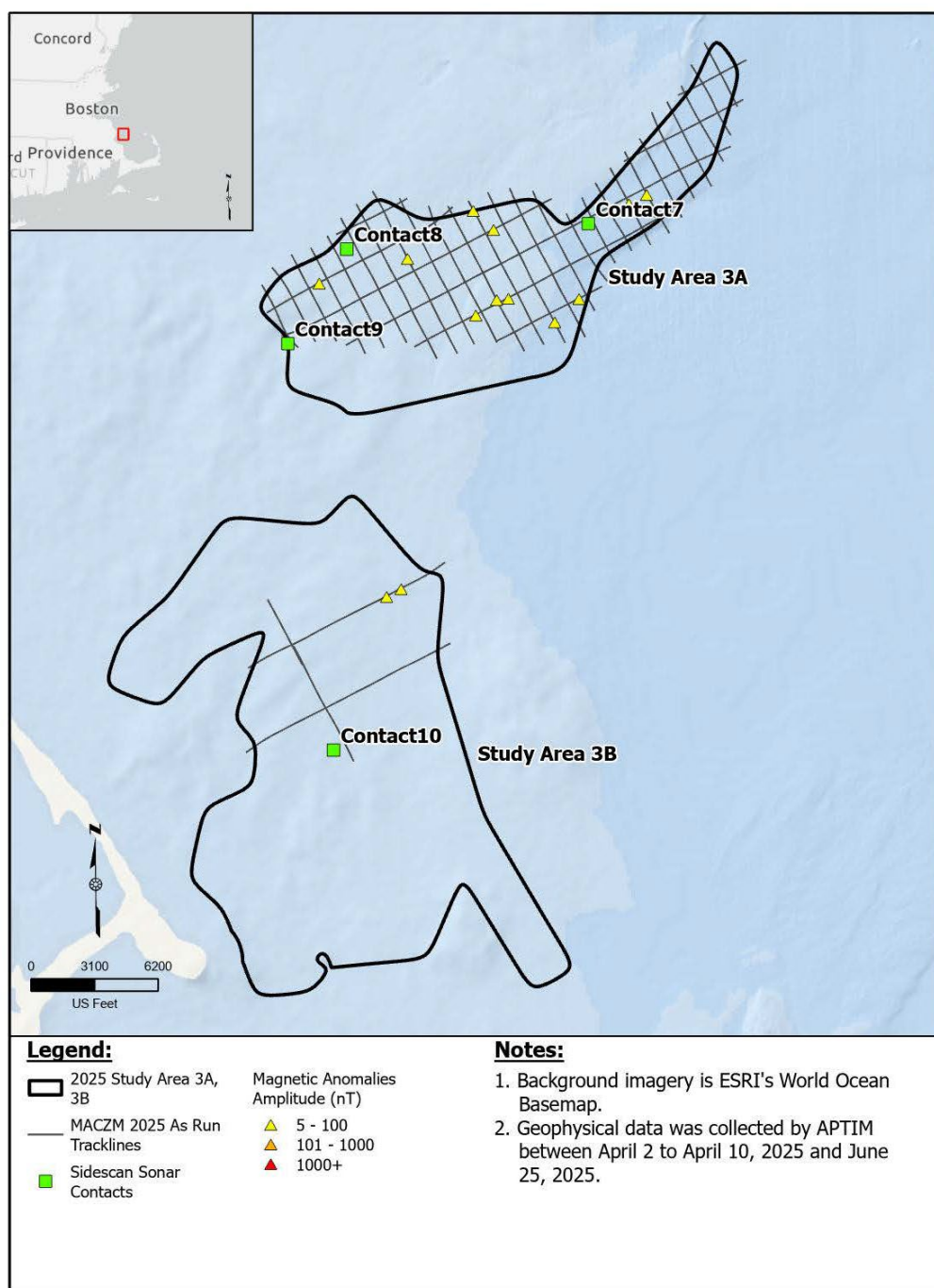
Map 19. Study Area 1—Merrimack, Sidescan Sonar Contacts and Magnetometer Anomalies





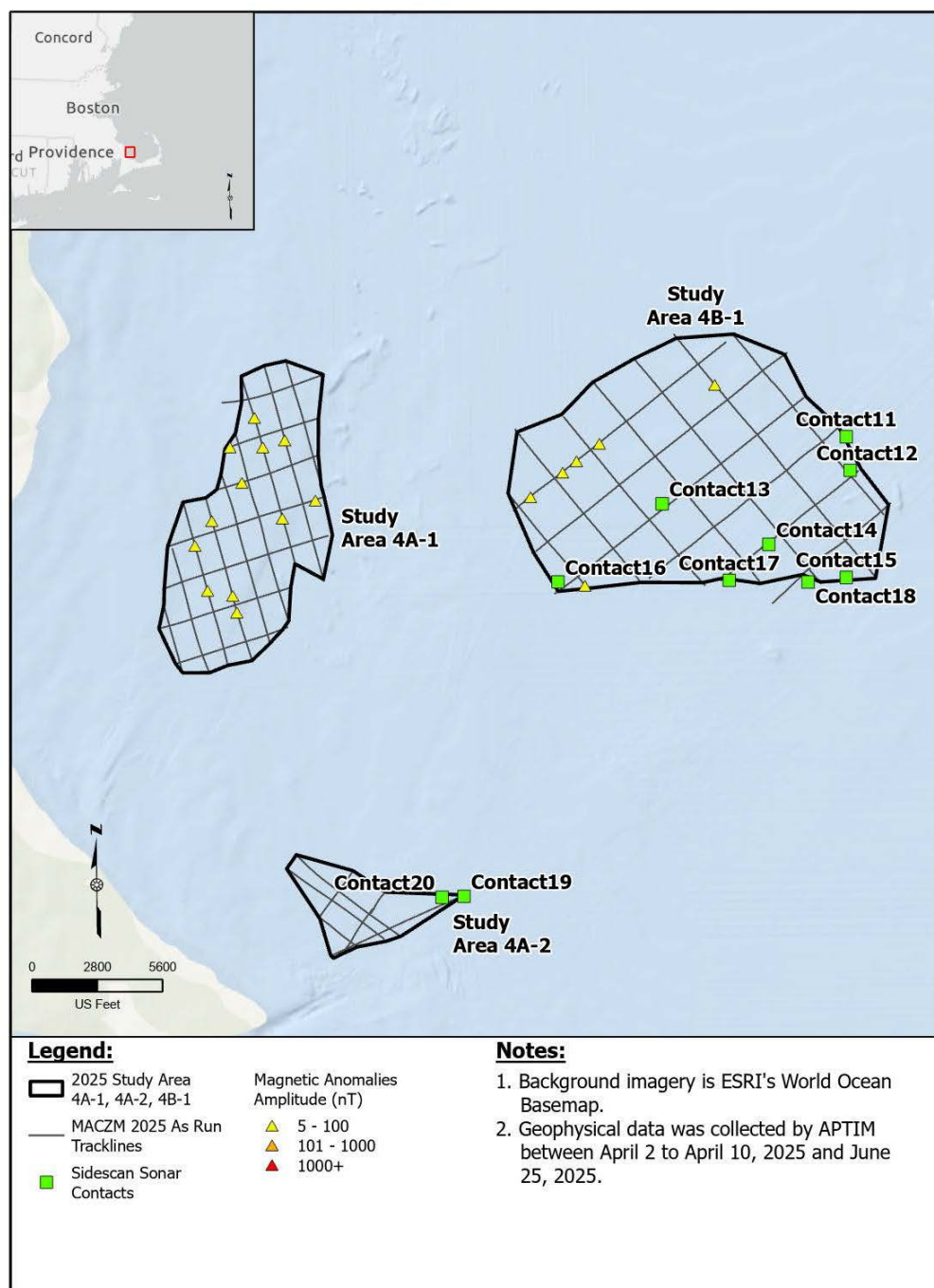
Map 20. Study Area 2—Nantasket Beach, Sidescan Sonar Contacts and Magnetometer Anomalies





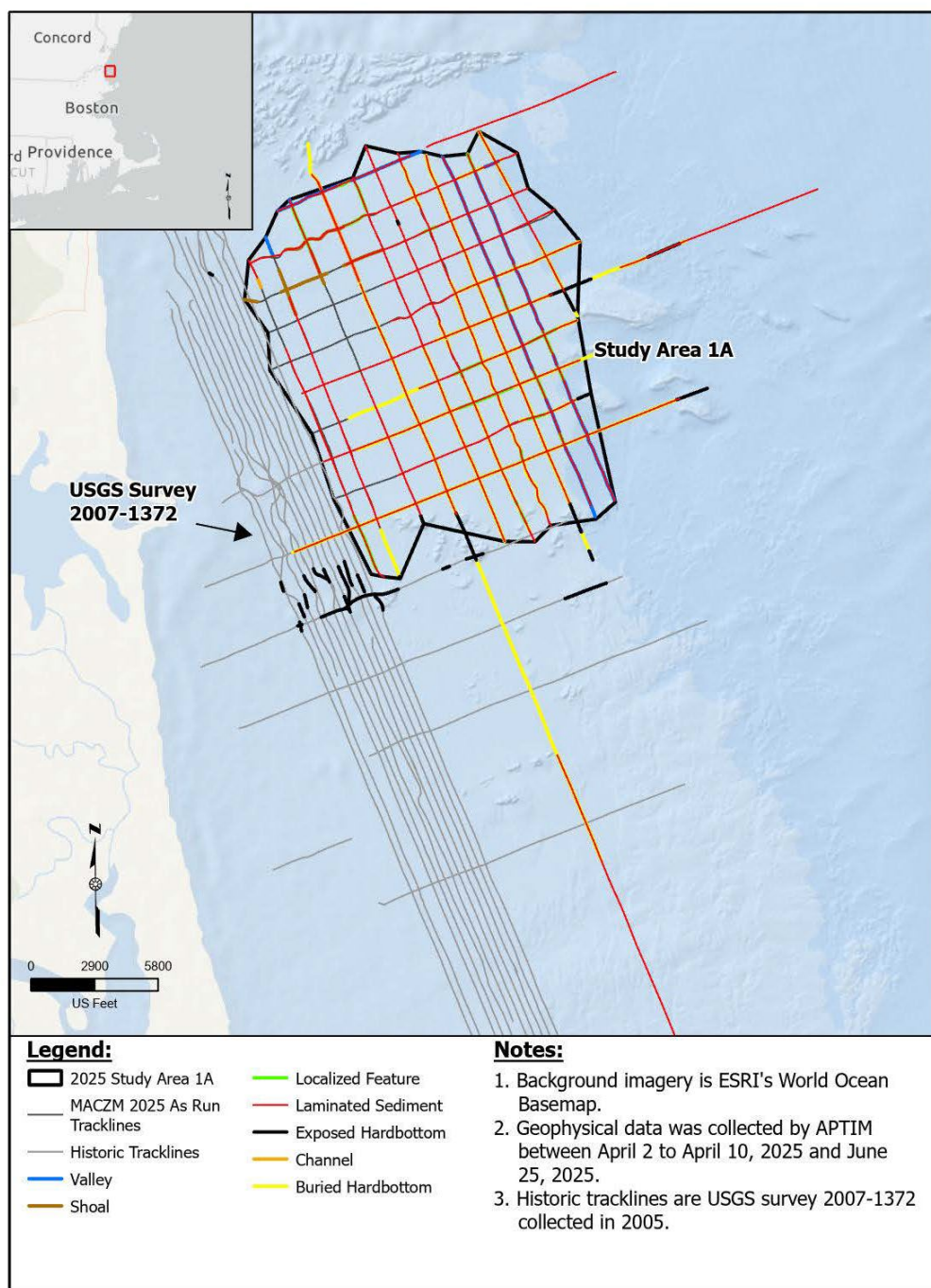
Map 21. Study Area 3—Duxbury Beach, Sidescan Sonar Contacts and Magnetometer Anomalies





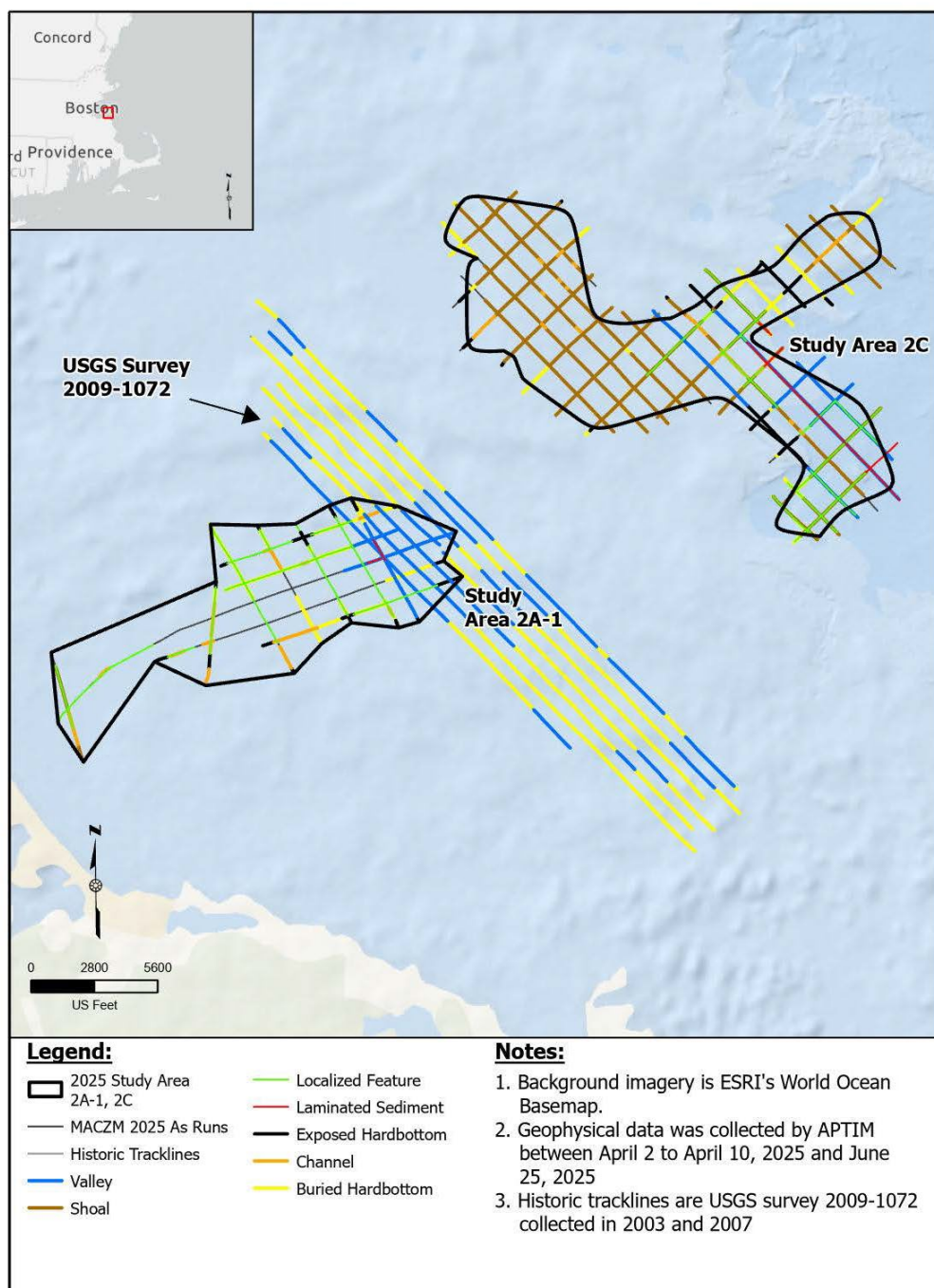
Map 22. Study Area 4—Sandwich, Sidescan Sonar Contacts and Magnetometer Anomalies





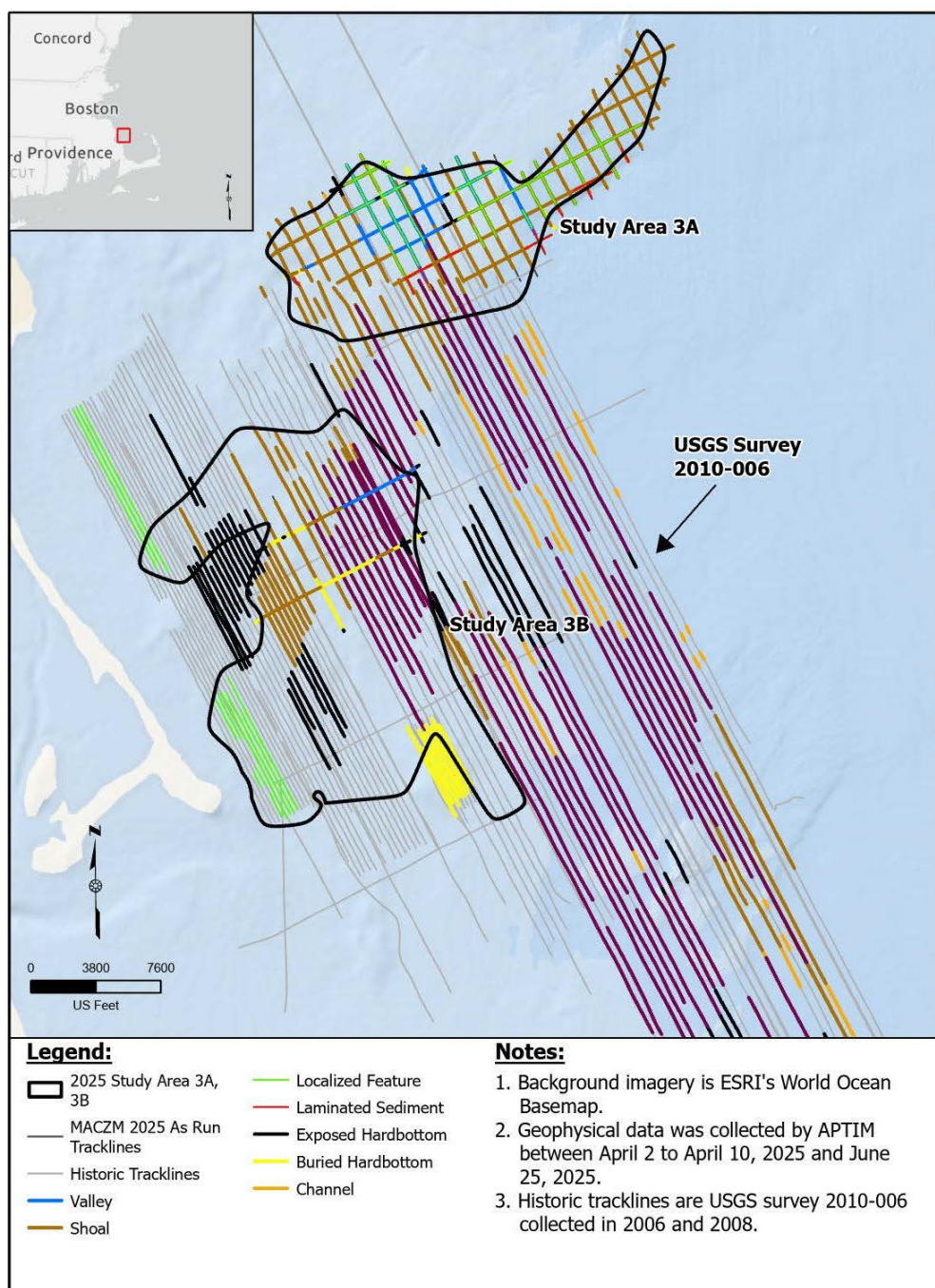
Map 23. Study Area 1—Merrimack, Chirp Features





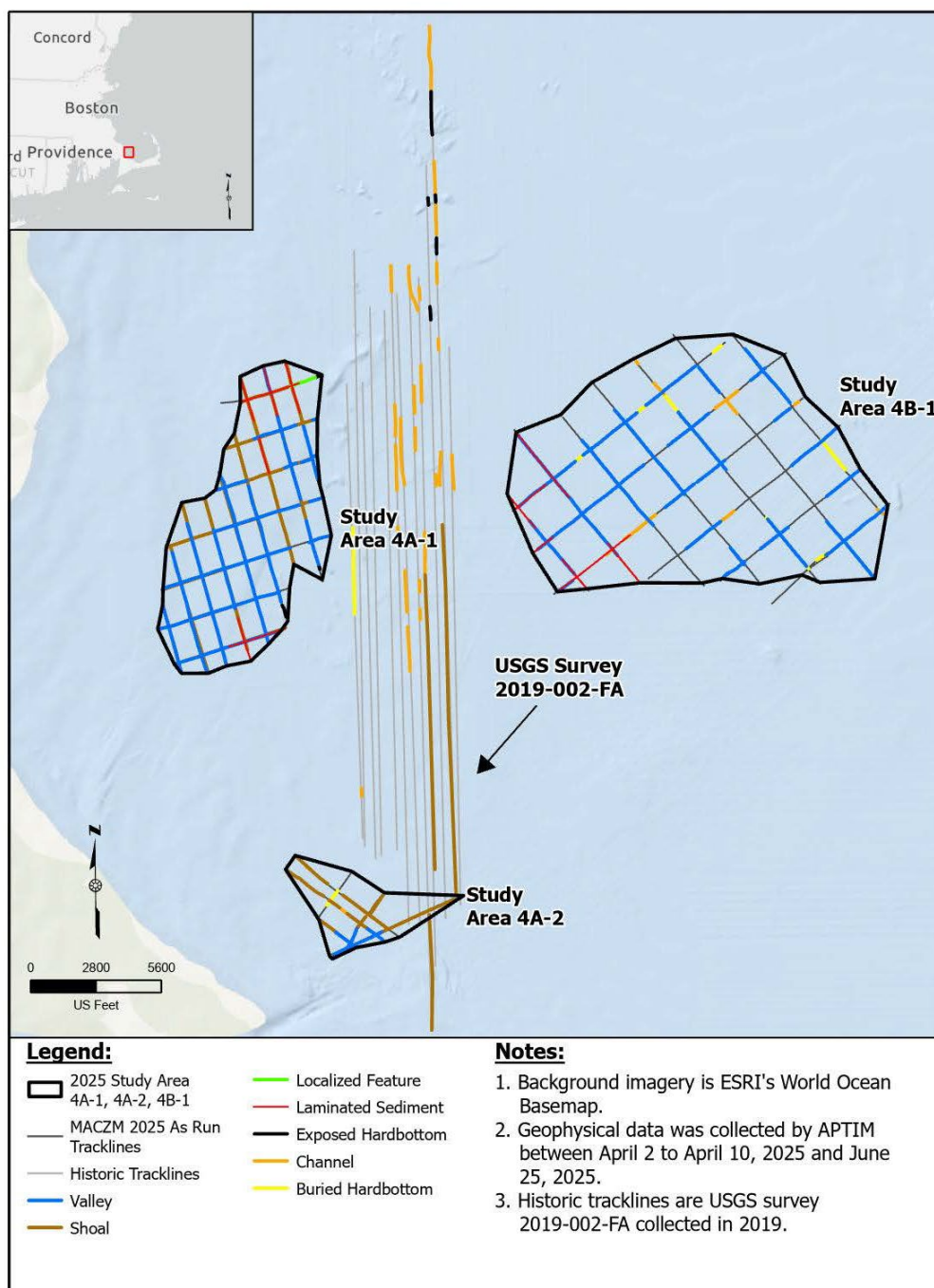
Map 24. Study Area 2—Nantasket Beach, Chirp Features





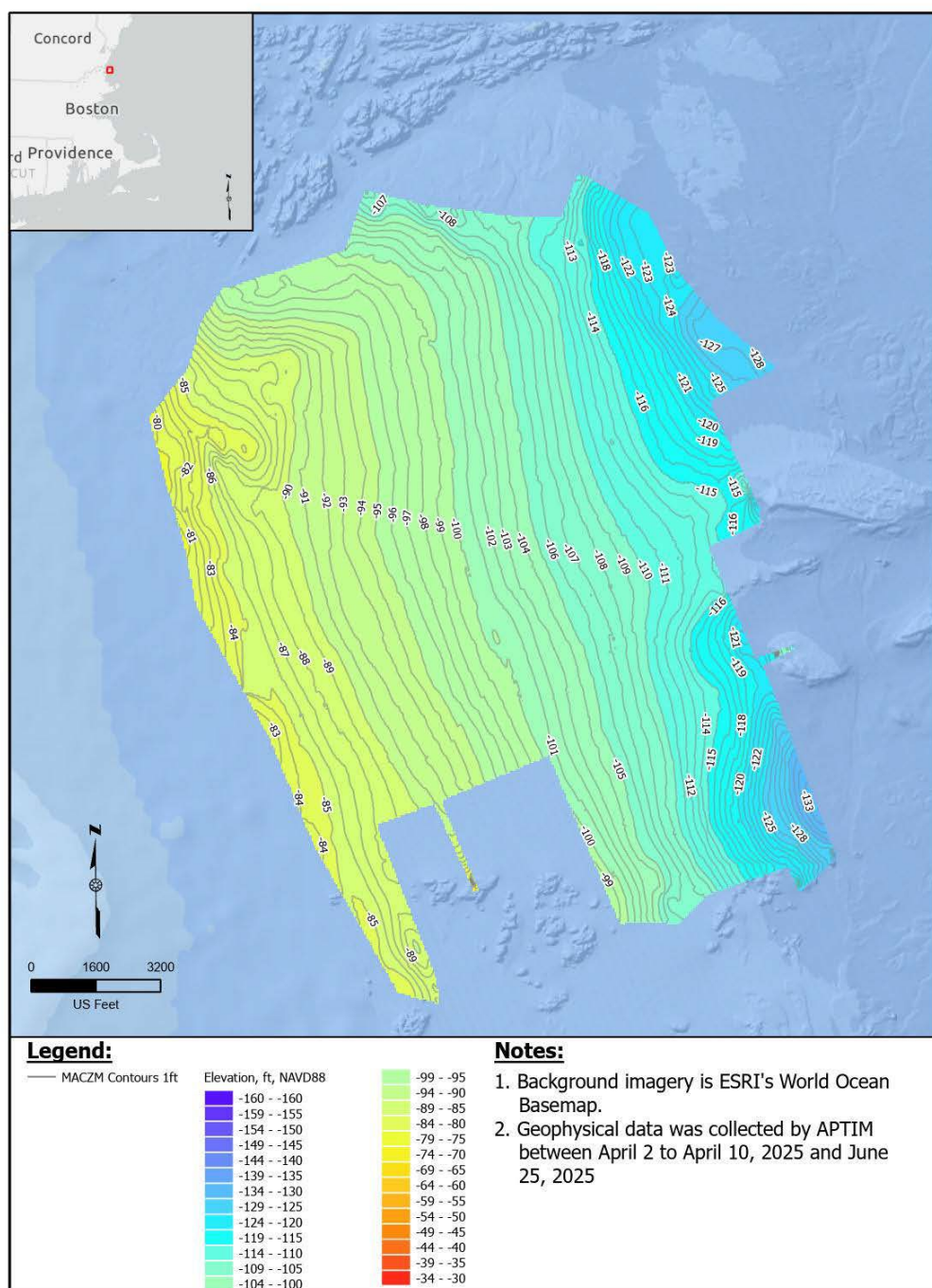
Map 25. Study Area 3—Duxbury Beach, Chirp Features





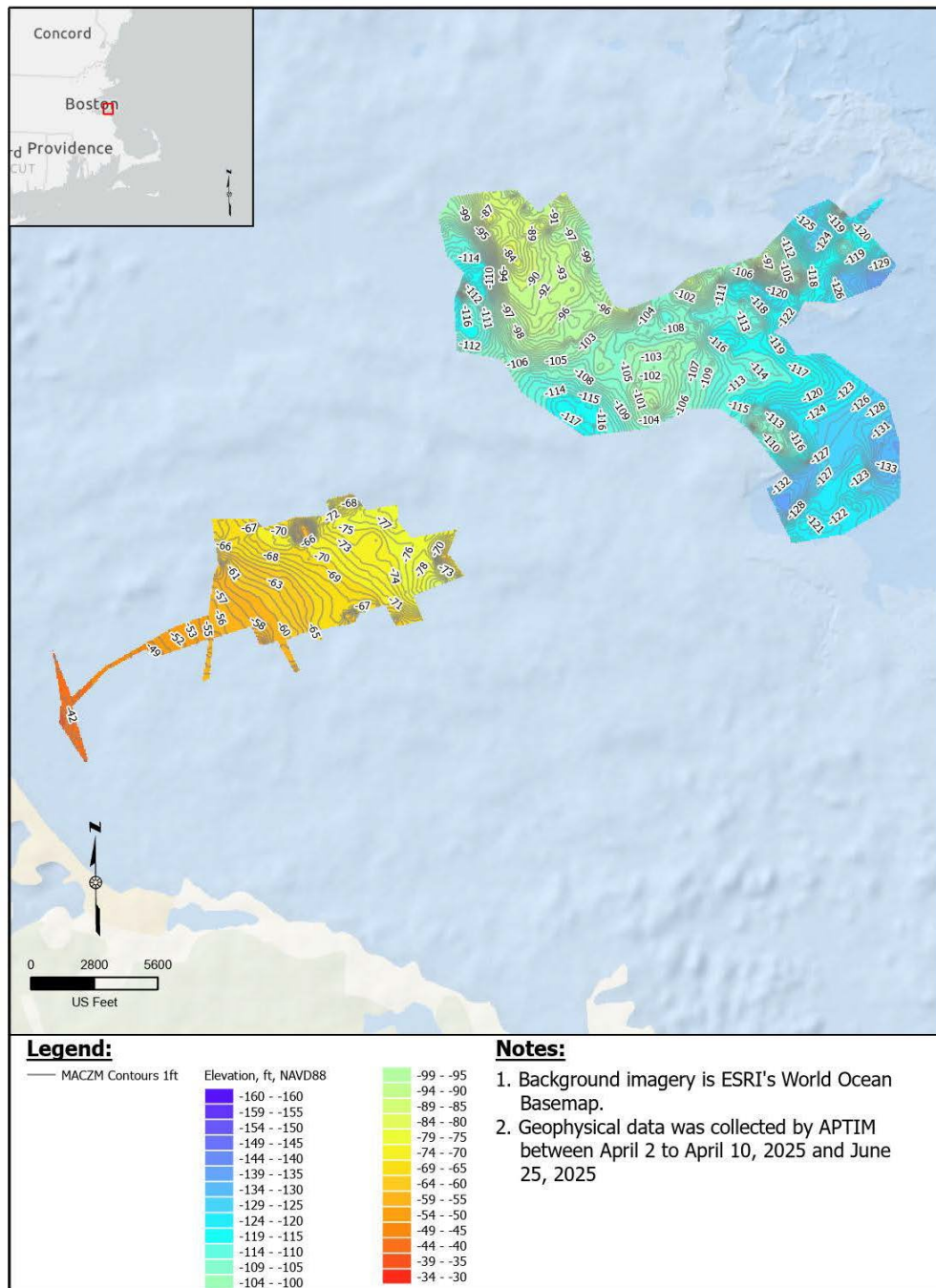
Map 26. Study Area 4—Sandwich, Chrip Features





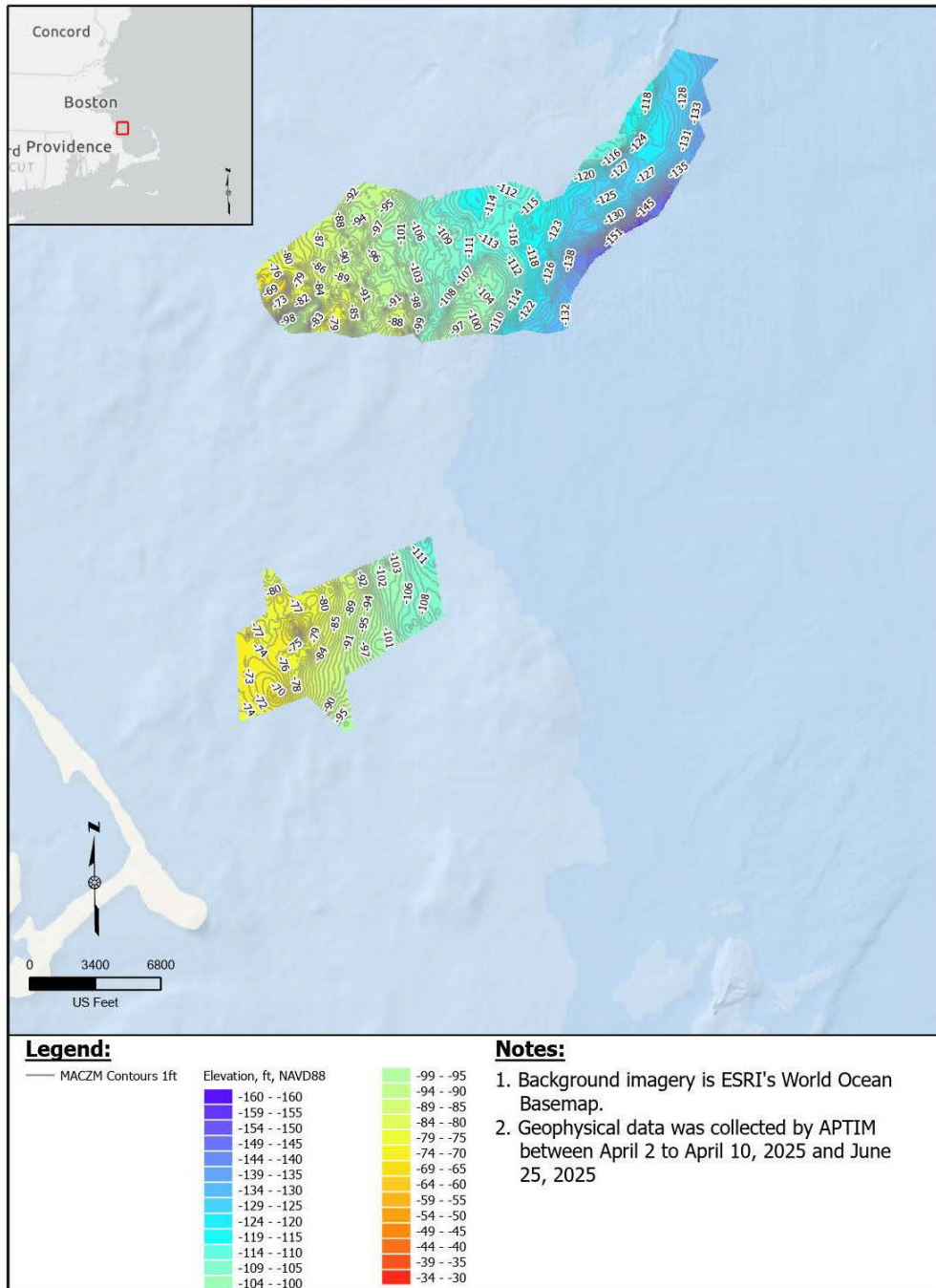
Map 27. Study Area 1—Merrimack, Bathymetric Surface





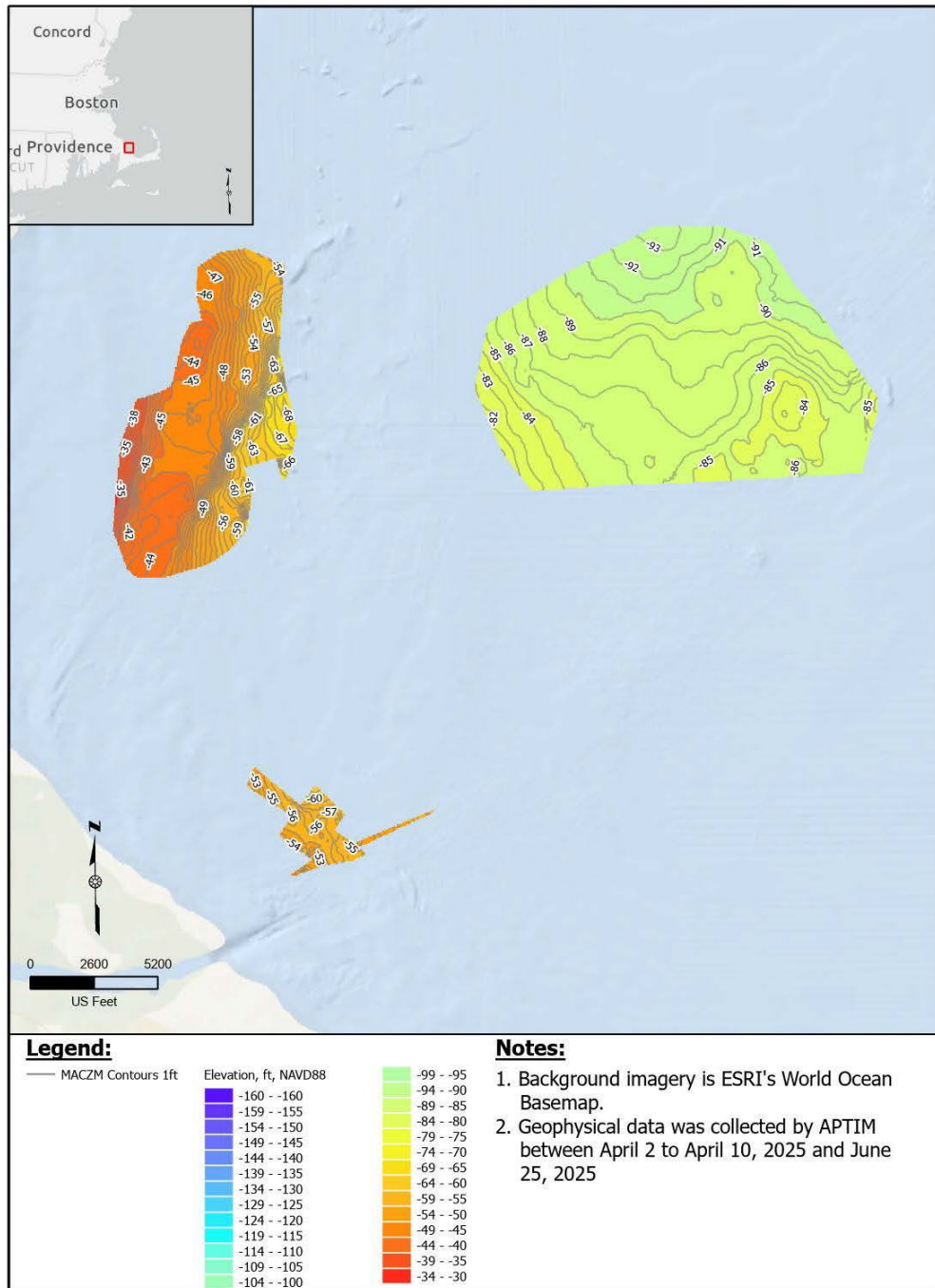
Map 28. Study Area 2—Nantasket Beach, Bathymetric Surface





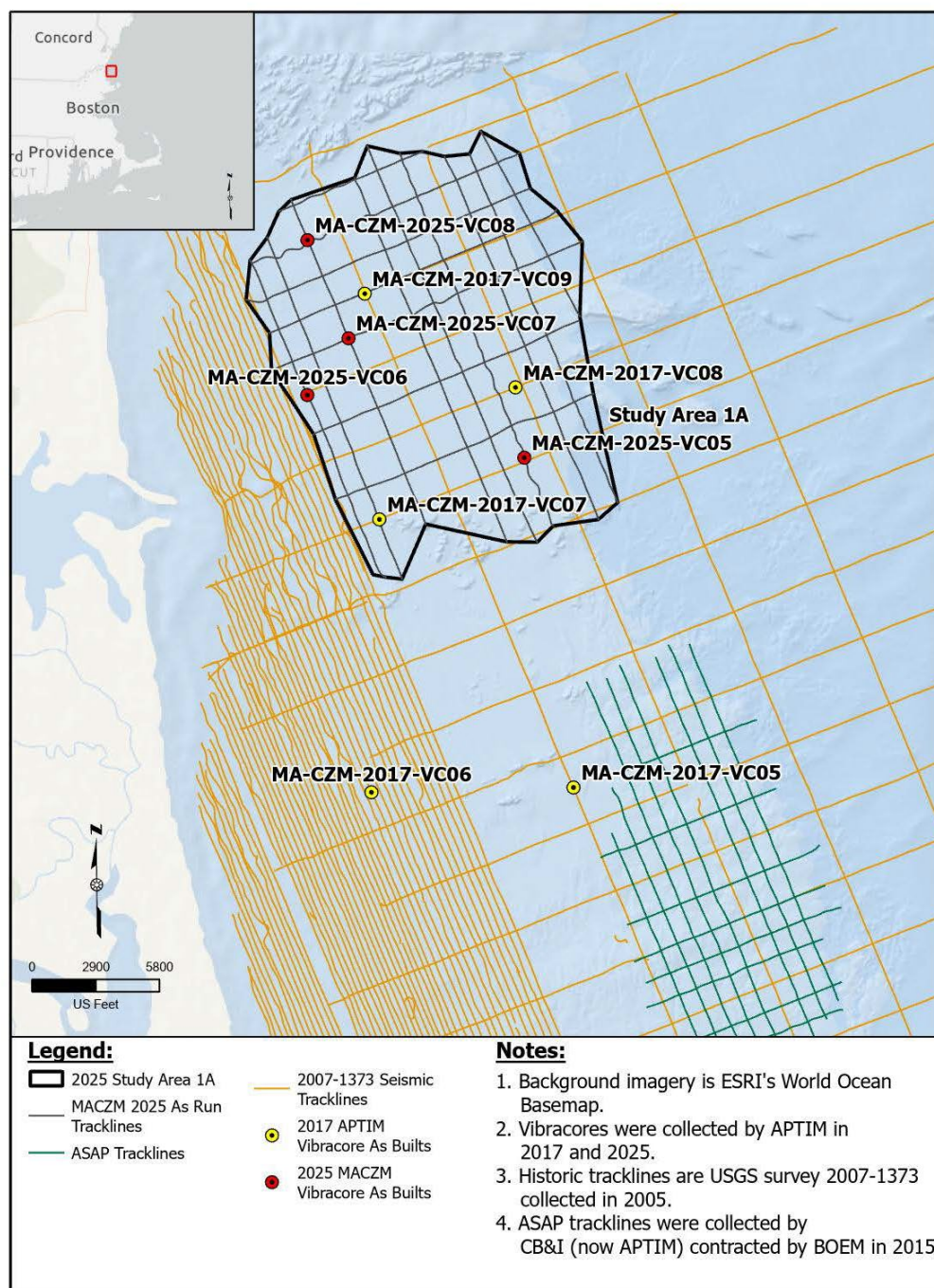
Map 29. Study Area 3—Duxbury Beach, Bathymetric Surface





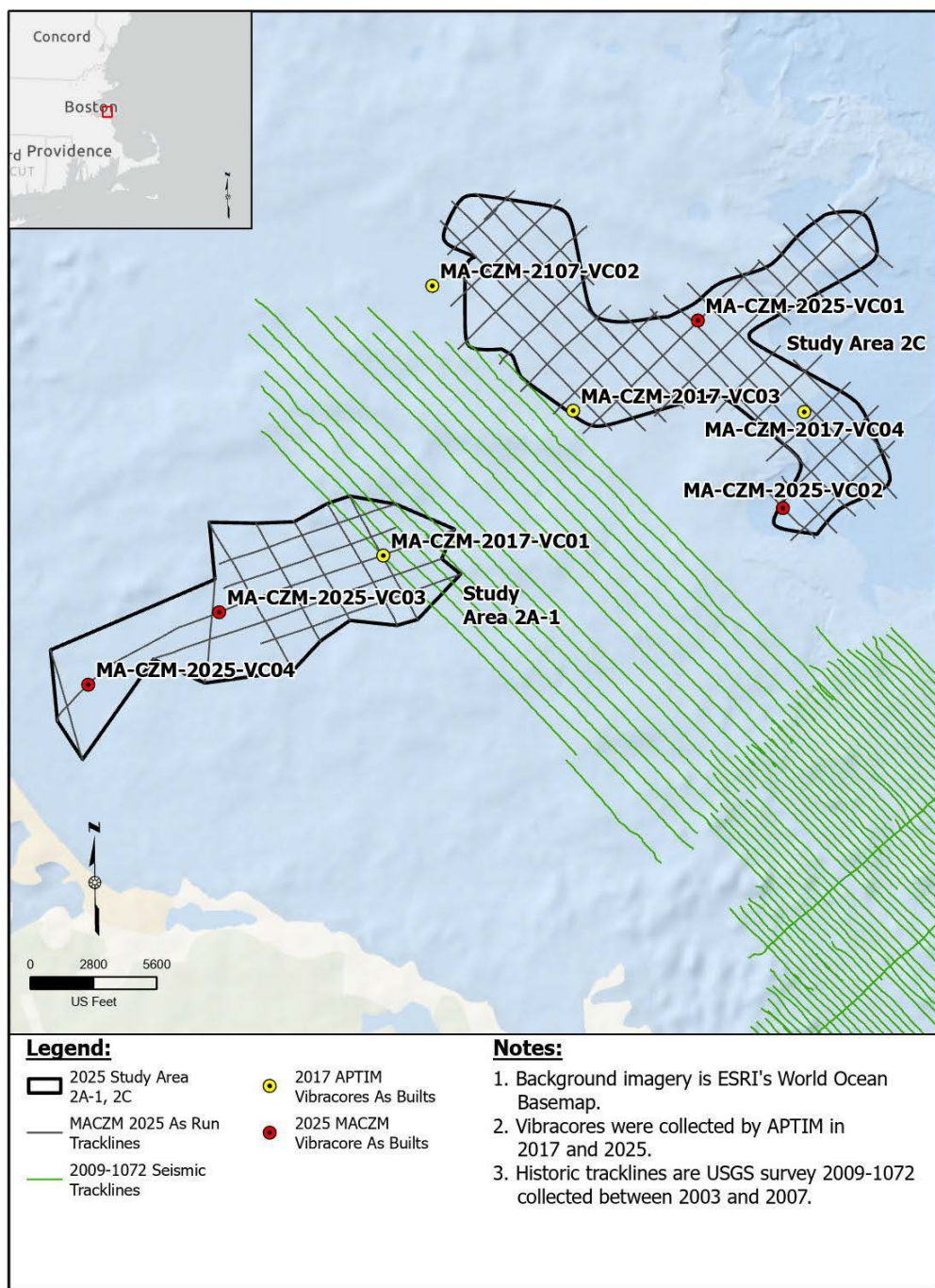
Map 30. Study Area 4—Sandwich, Bathymetric Surface





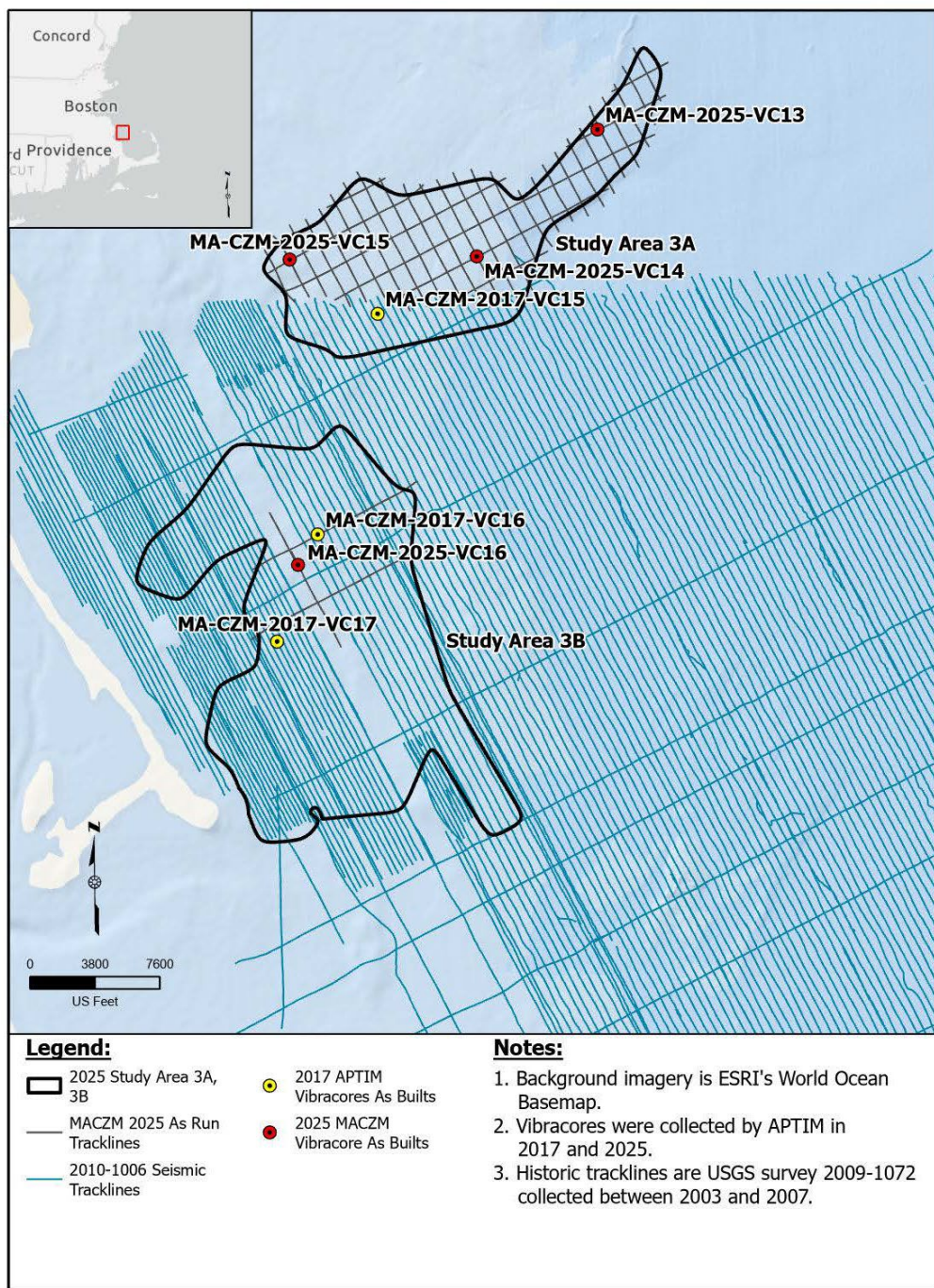
Map 31. Study Area 1—Merrimack, Vibracore As-Builts





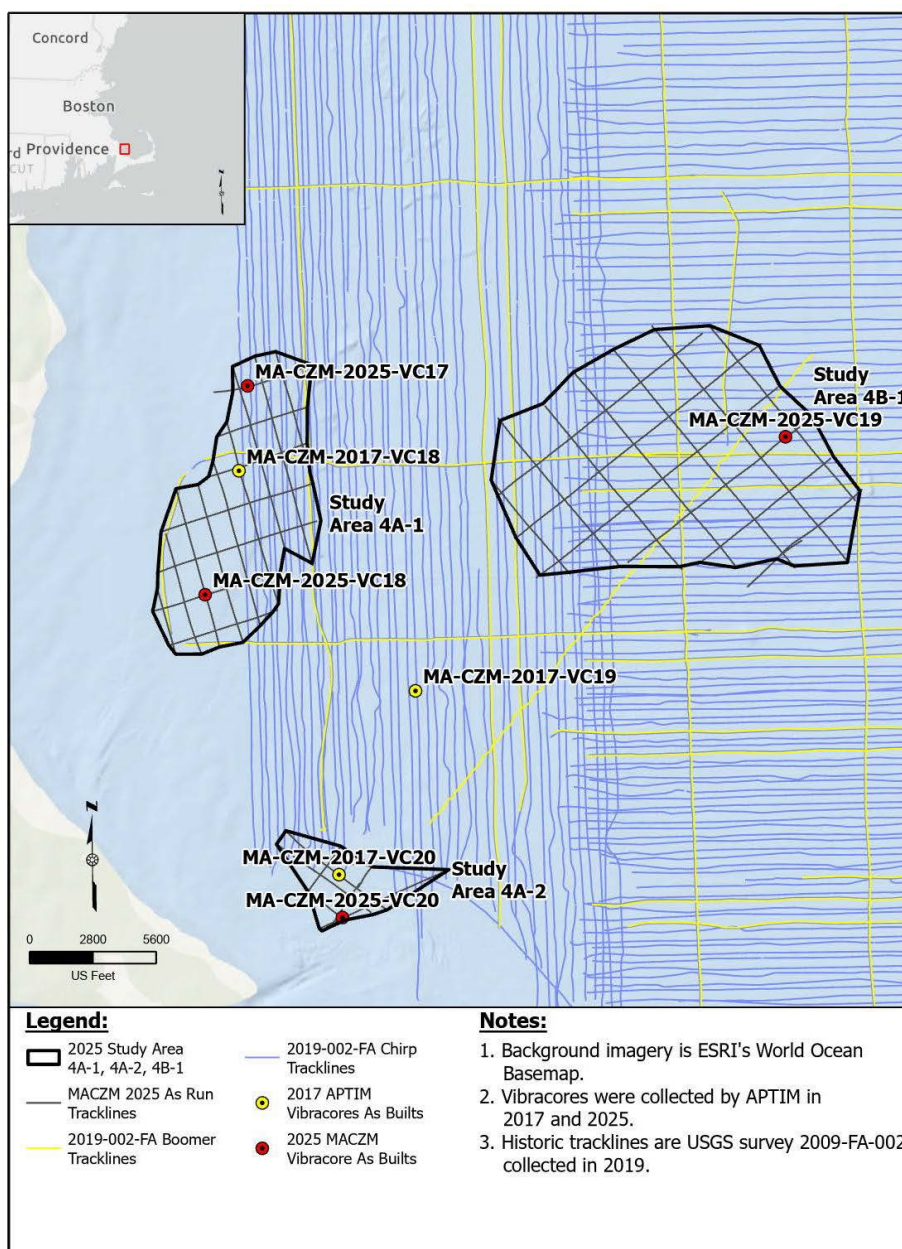
Map 32. Study Area 2—Nantasket Beach, Vibracore As Built





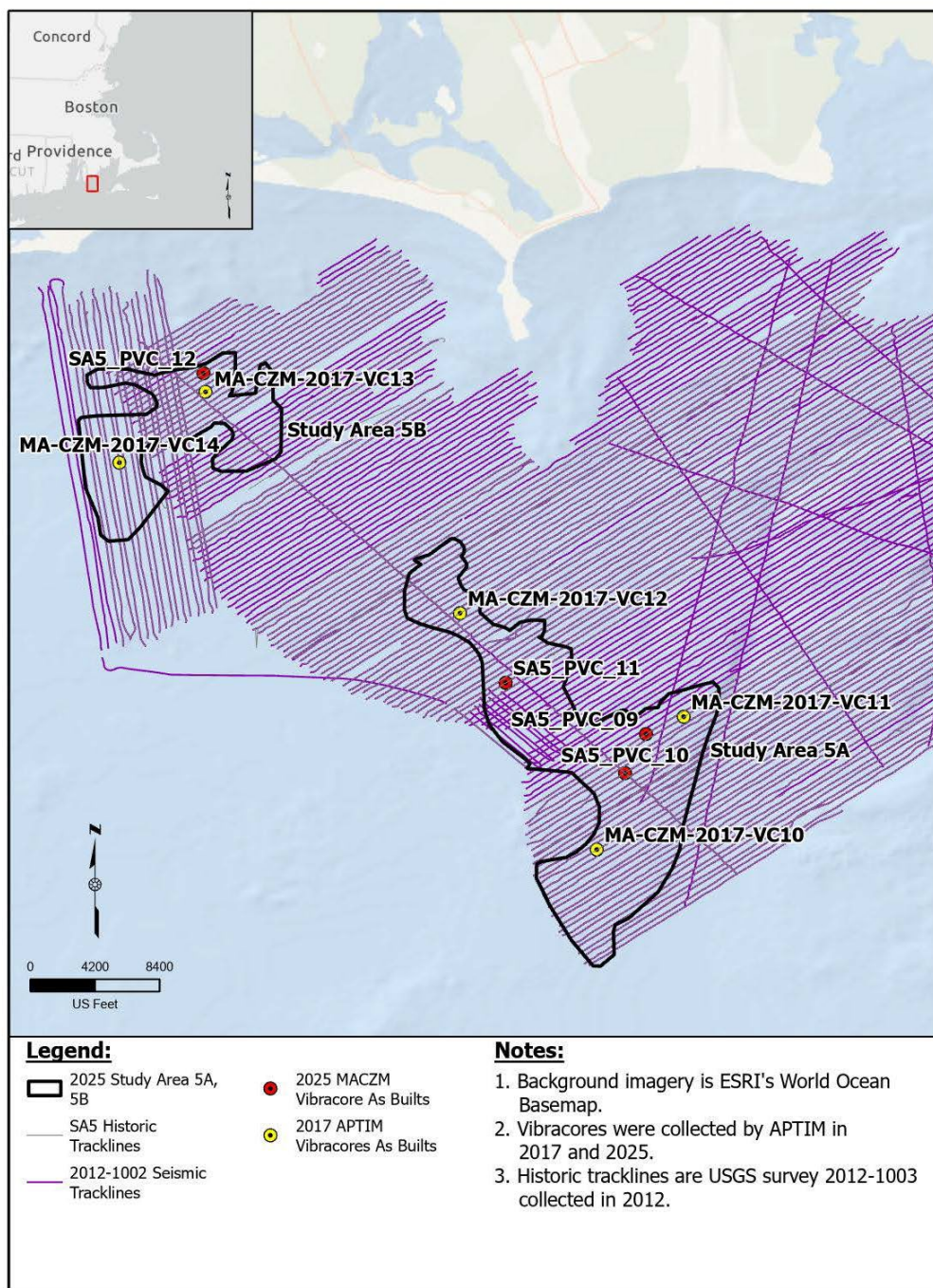
Map 33. Study Area 3—Duxbury Beach, Vibracore As-Builts





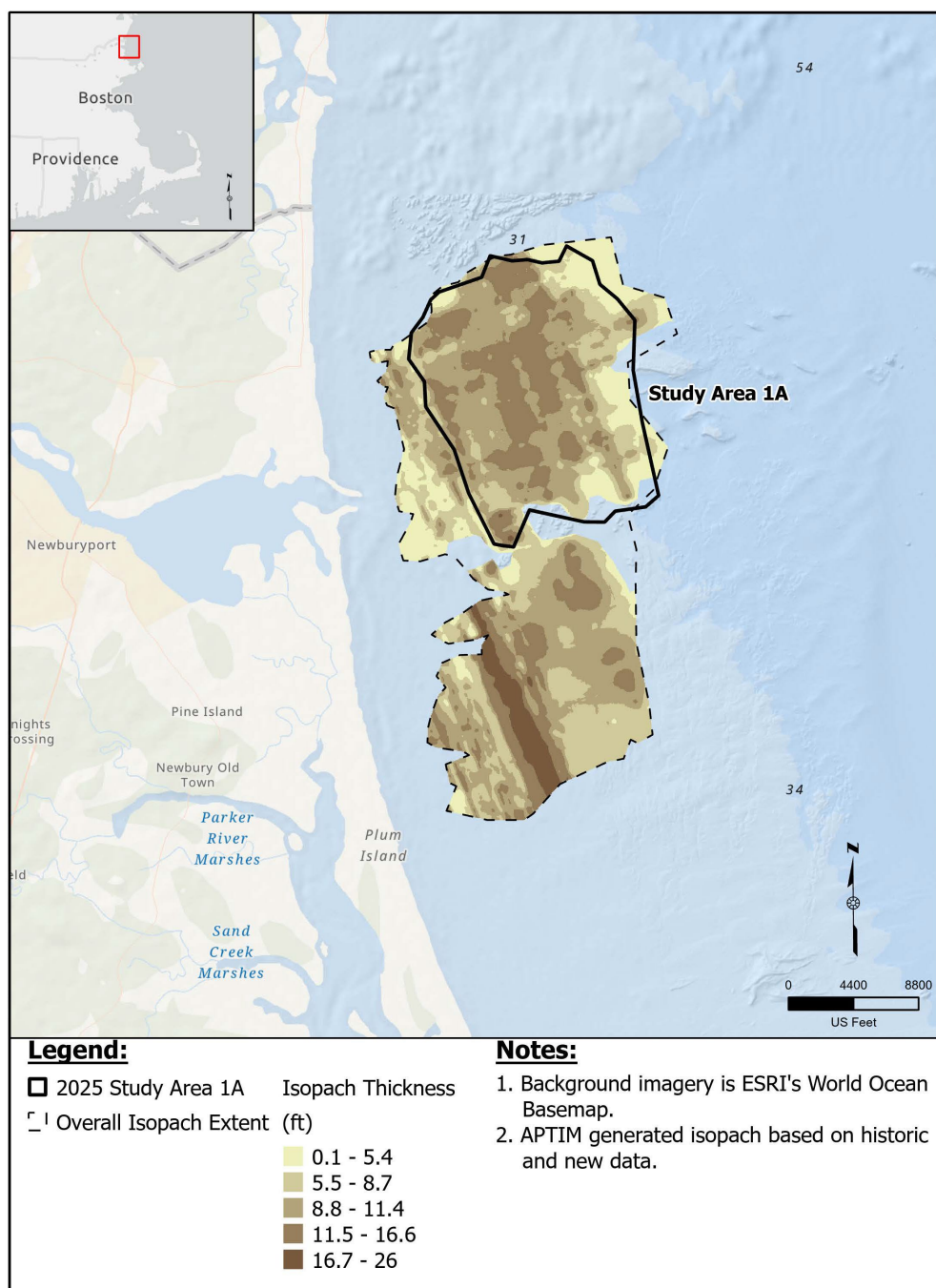
Map 34. Study Area 4—Sandwich, Vibracore As-Built





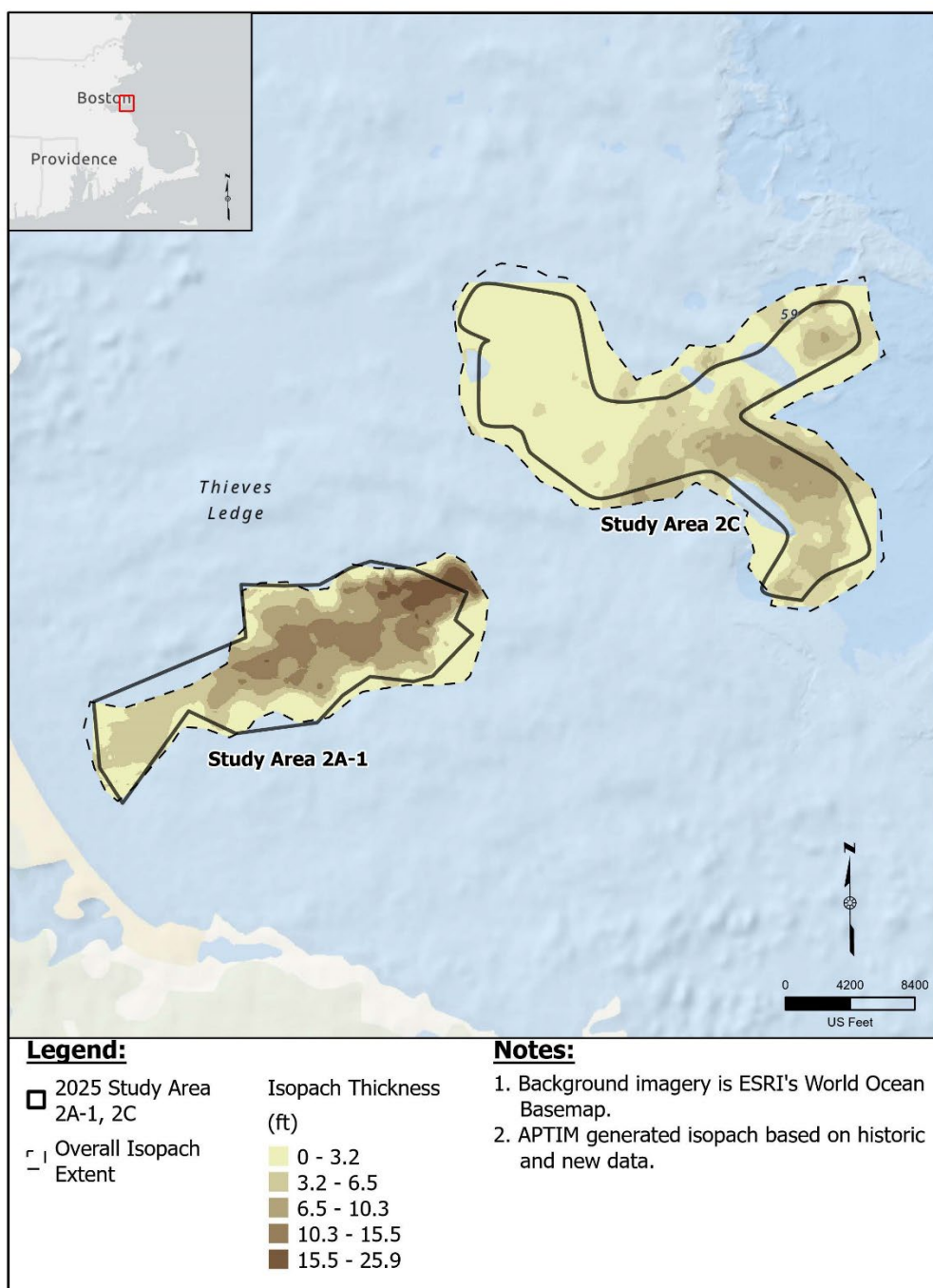
Map 35. Study Area 5—Cuttyhunk, Vibracore As-Built





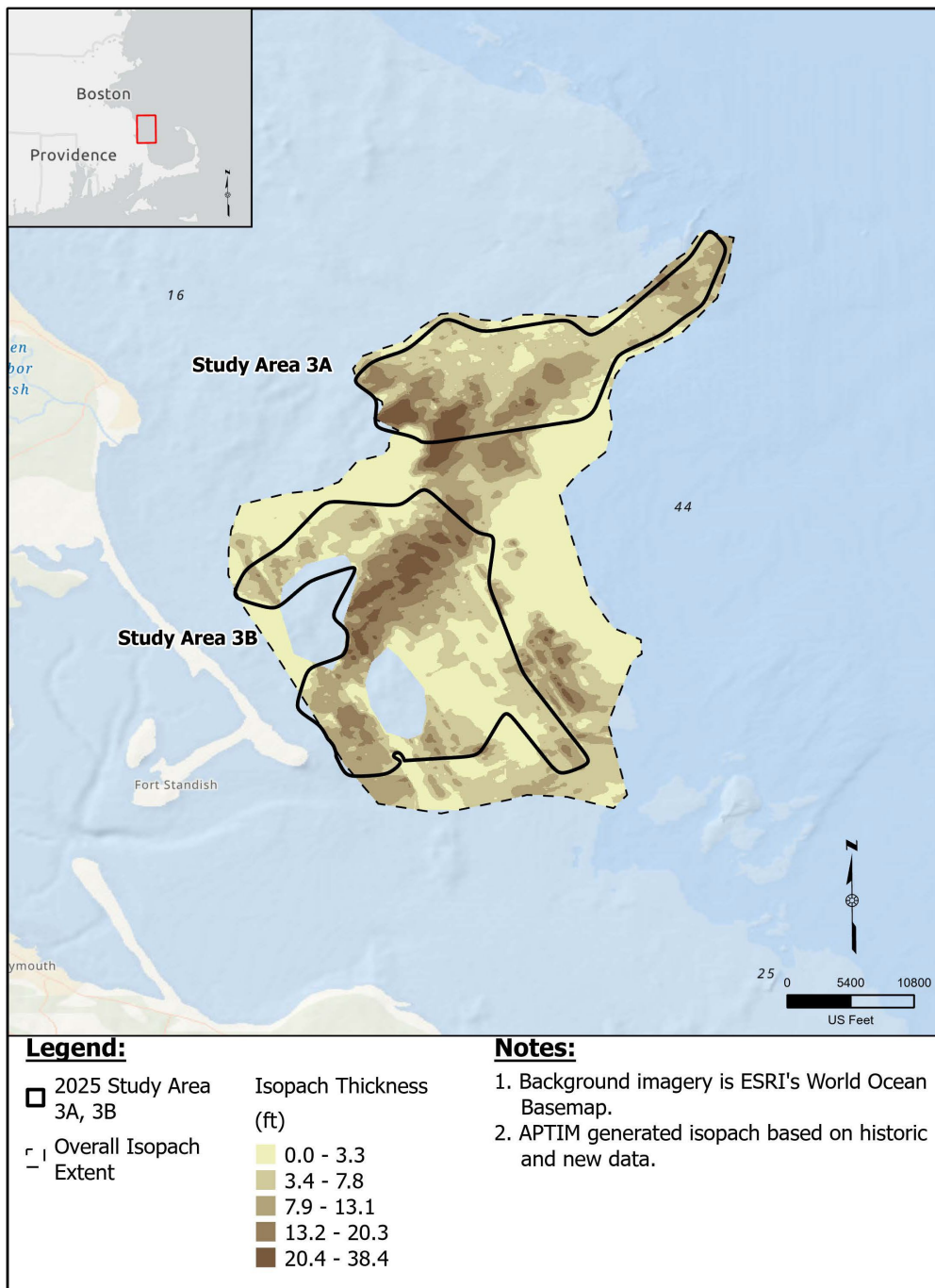
Map 36. Study Area 1—Merrimack, Overall Isopach Map





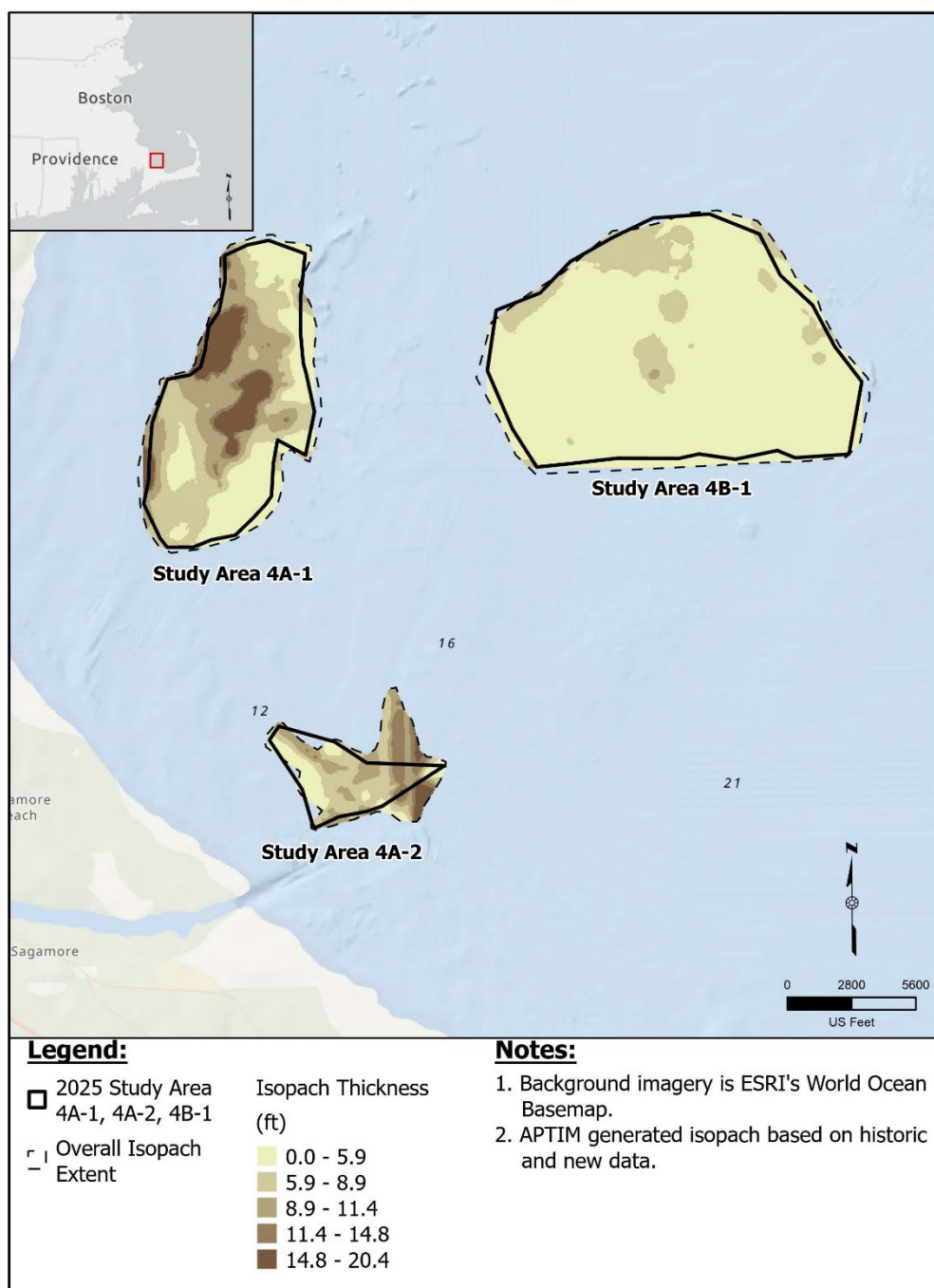
Map 37. Study Area 2—Nantasket, Overall Isopach Map





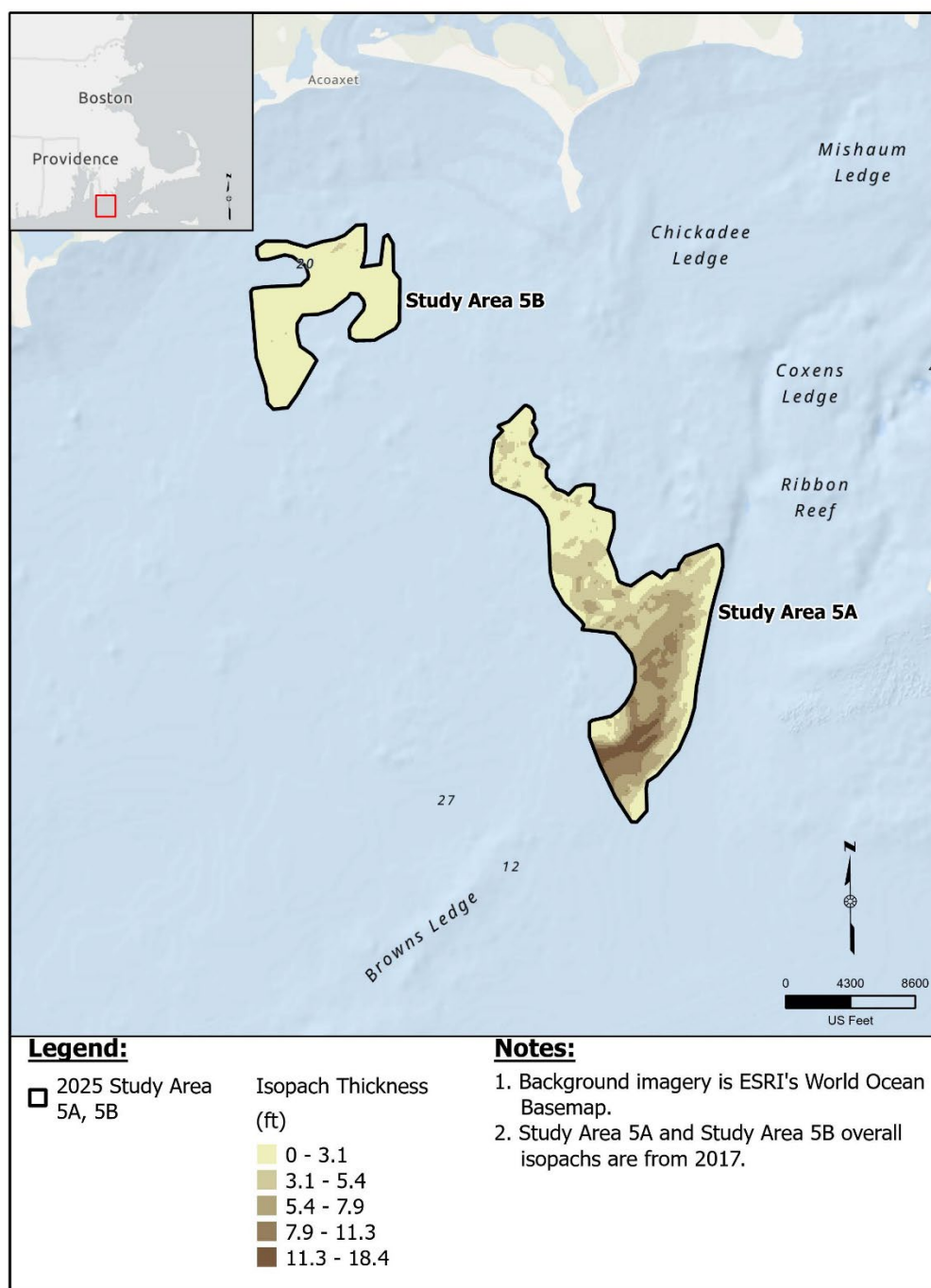
Map 38. Study Area 3—Duxbury Beach, Overall Isopach Map





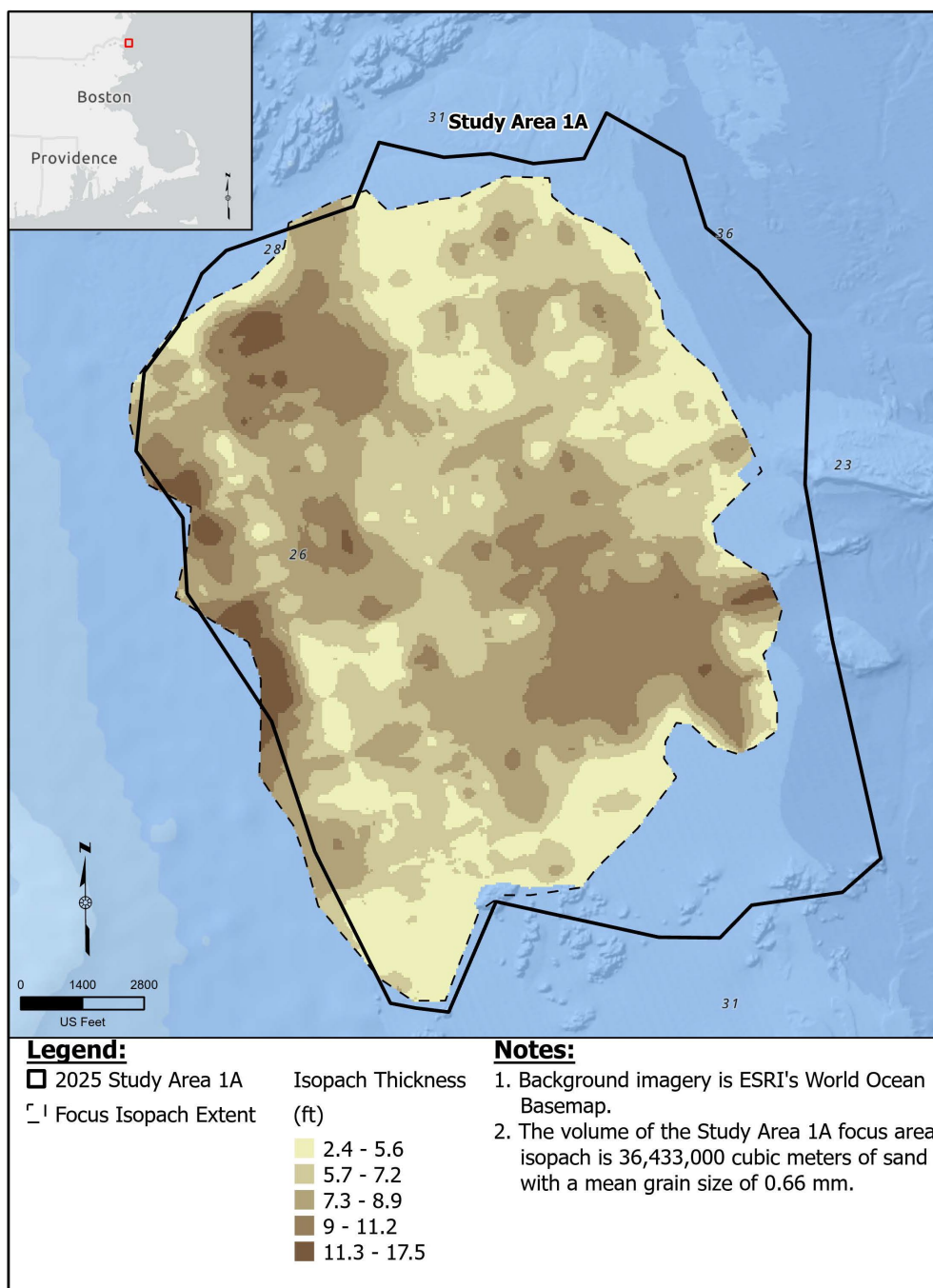
Map 39. Study Area 4—Sandwich, Overall Isopach Map





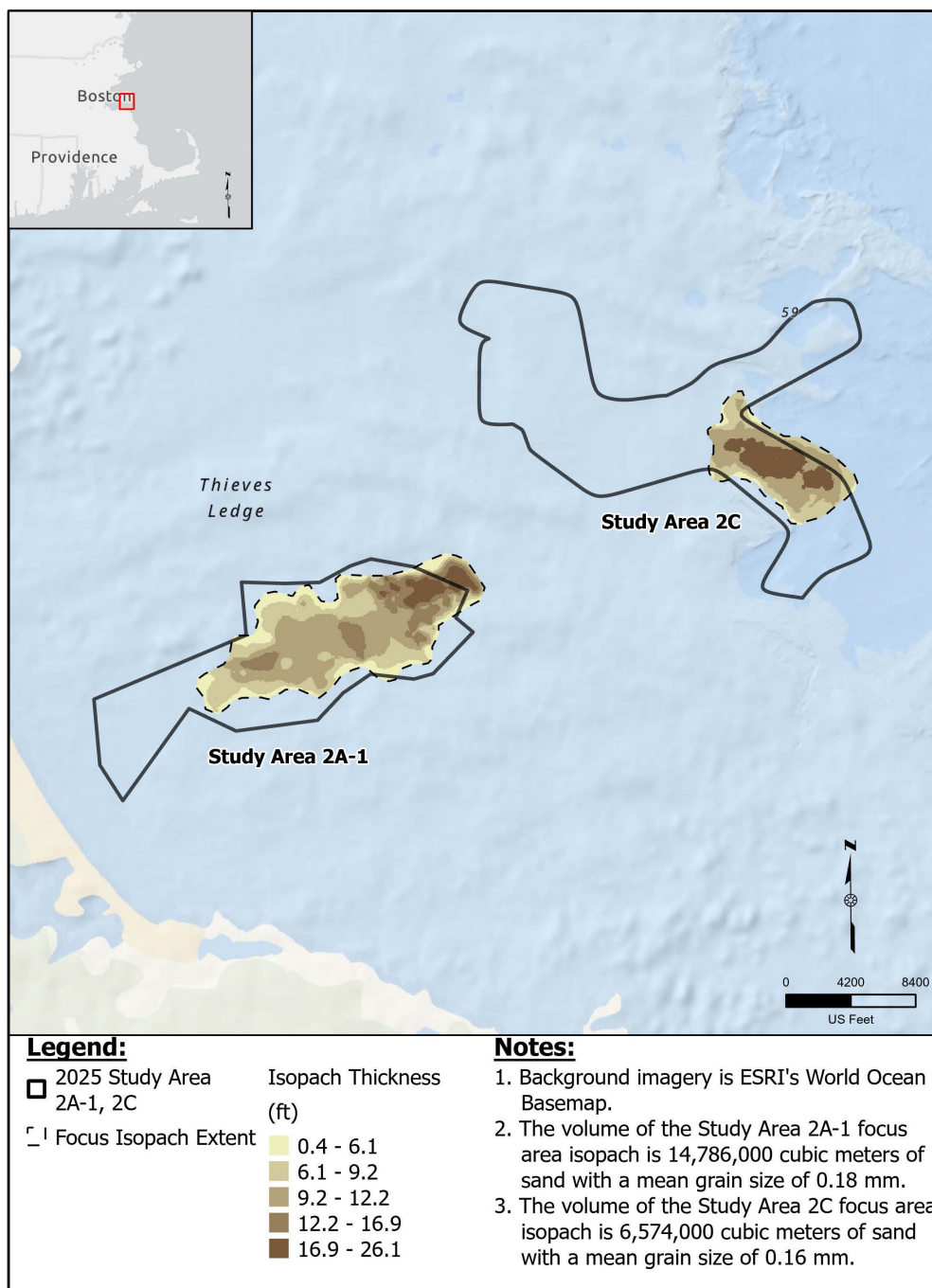
Map 40. Study Area 5—Cuttyhunk, Overall Isopach Map





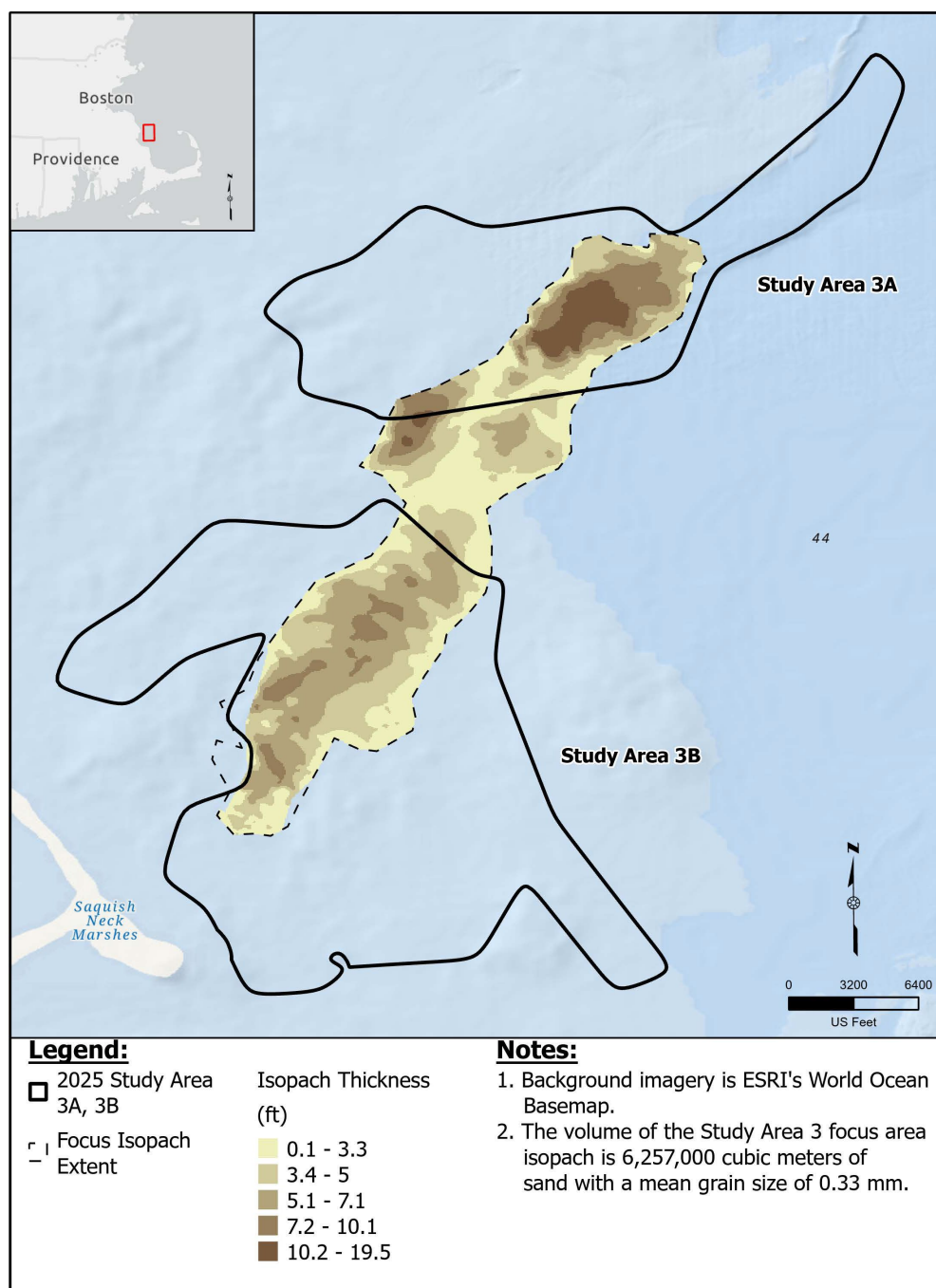
Map 41. Study Area 1—Merrimack, Focus Area Isopach Map





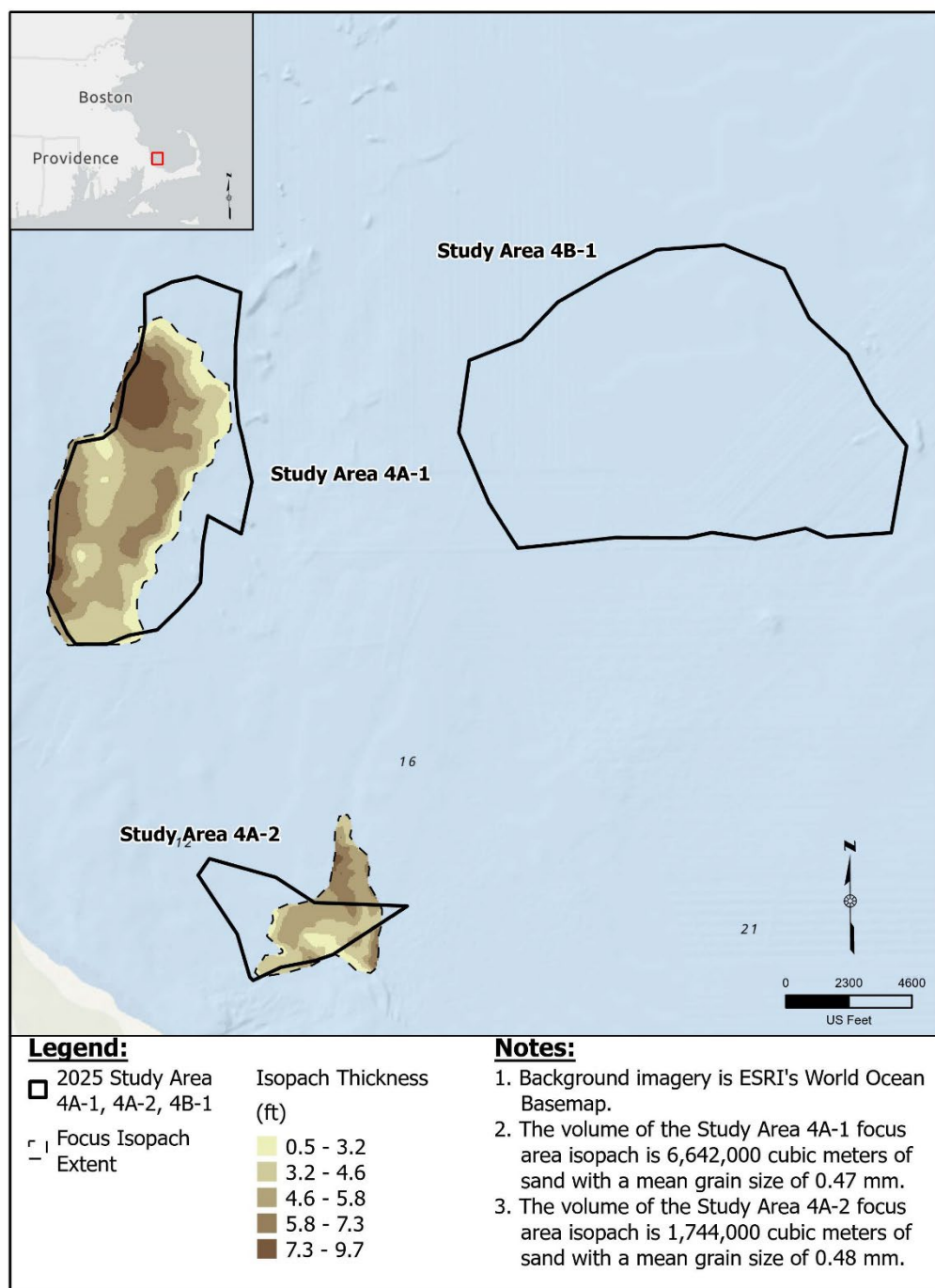
Map 42. Study Area 2—Nantasket, Focus Area Isopach Map





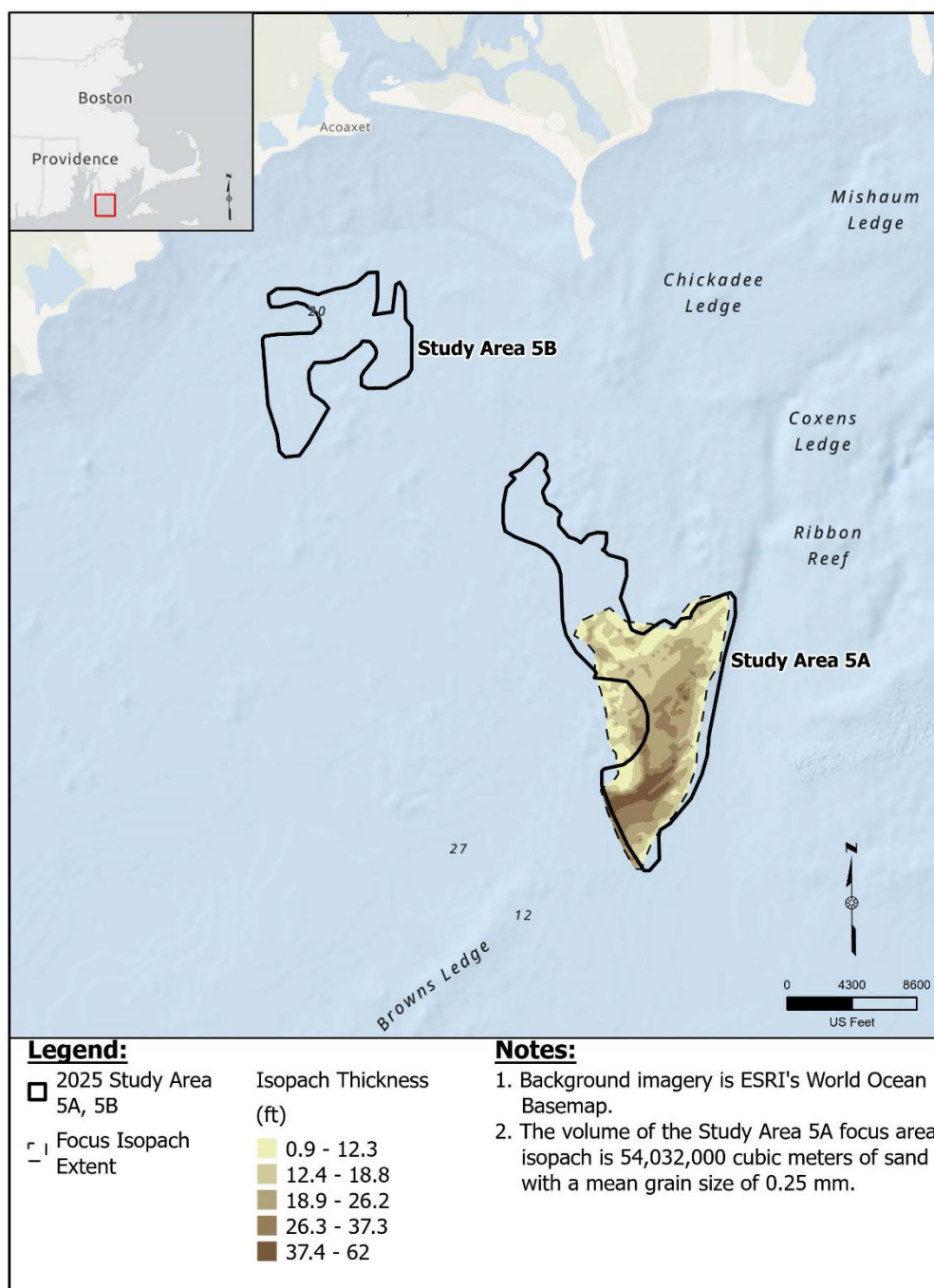
Map 43. Study Area 3—Duxbury Beach, Focus Area Isopach Map





Map 44. Study Area 4—Sandwich, Focus Area Isopach Map





Map 45. Study Area 5—Cuttyhunk, Focus Area Isopach Map



12.0 REFERENCES

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13.0 APPENDICES

These appendices contain the geotechnical data collected during the Preliminary Characterization of Offshore Sand Resources for the Commonwealth of Massachusetts Office of Coastal Zone Management. In 2025 a total of twenty (20) vibracores were taken within the investigation areas. The vibracore data are provided in the form of vibracore logs, vibracore photographs, granulometric reports, grain size distribution curves/histograms, carbonate analysis results and mini vane shear test results.

- Appendix A: Bathymetric XYZ (Digital Only)—This appendix contains the .xyz files for the bathymetric data.
- Appendix B: Sidescan Contact Report—This appendix contains the sidescan sonar contact report.
- Appendix C: Magnetometer Anomaly Table—This appendix contains the magnetometer anomaly table.
- Appendix D: Seismic Web Project (Digital Only)—This appendix contains the files for the seismic web project.
- Appendix E: 2025 APTIM Vibracore Logs—This appendix contains twenty (20) vibracore logs. Laboratory and descriptive information for each vibracore is presented on the log sheets. Unified Soils Classification System terminology is used in the core layer descriptions and key grain size information (mean grain size, fines content and sorting) for each vibracore sample is presented under the Remarks column. Multiple layer intervals are sometimes represented by a single sample. The Box or Sample column is used to identify the specific sample that represents a specific layer.
- Appendix F: 2025 APTIM Vibracore Photographs—This appendix contains photographs of the twenty (20) vibracores.
- Appendix G: 2025 APTIM Individual Vibracore Granulometric Reports—This appendix contains individual granulometric reports for the vibracore samples collected.
- Appendix H: 2025 APTIM Individual Vibracore Grain Size Distribution Curves/Histogram—This appendix contains individual grain size distribution for the vibracore samples collected.
- Appendix I: 2025 APTIM Carbonate Analysis Report—This appendix contains a carbonate analysis report for the selected vibracore samples tested.
- Appendix J: 2025 APTIM Vibracore Mini Vane Shear Test Results—This appendix contains a mini vane shear test report for the associated vibracore.
- Appendix K: 2025 APTIM Overall Study Area Composite Tables—This appendix contains the composite tables for the overall study area.



- Appendix L: 2025 APTIM Focus Area Composite Tables—This appendix contains the composite tables for each focus area.
- Appendix M: Cumulative Composite Curves—This appendix contains the composite curves for all areas.



Appendix A Bathymetric XYZ (digital only)



Appendix B

Sidescan Contact Reports



Massachusetts Coastal Zone Management

2025 Massachusetts Coastal Zone Management Contact Report

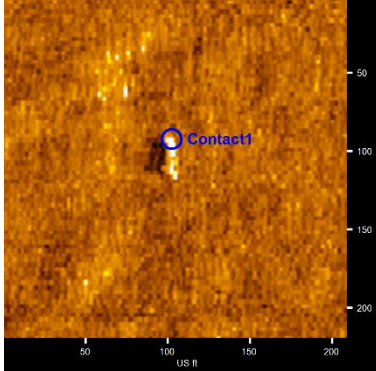
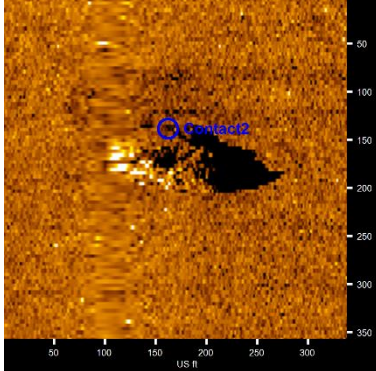
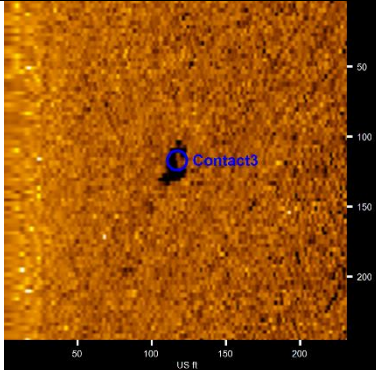
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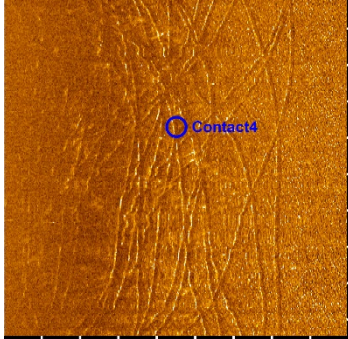
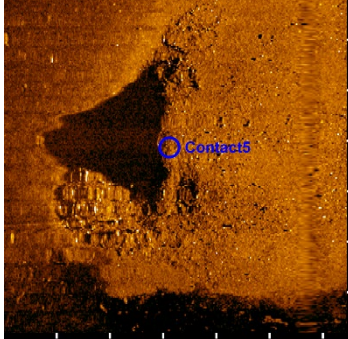
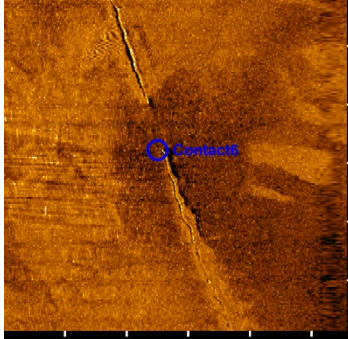
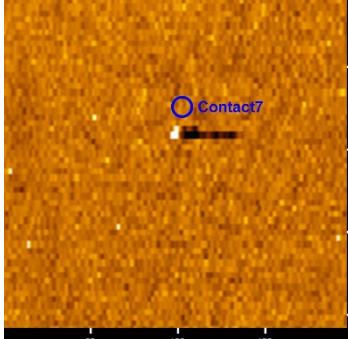


Massachusetts Coastal Zone Management

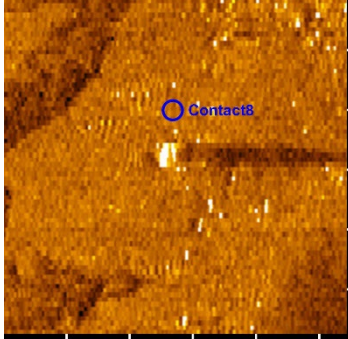
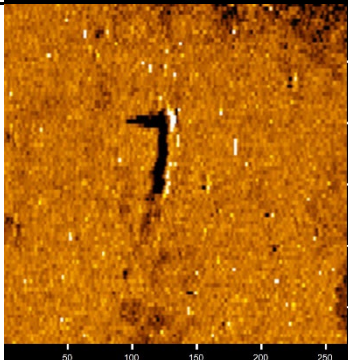
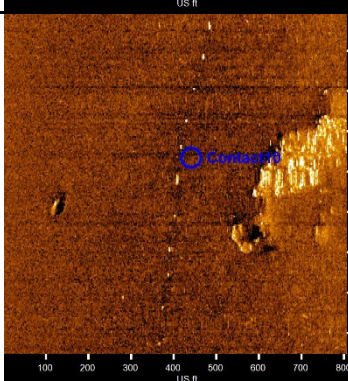
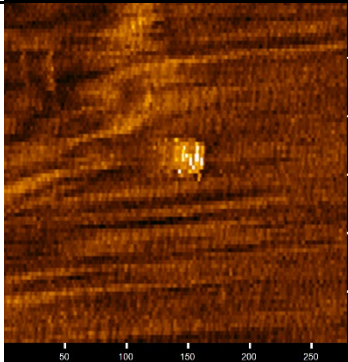
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Target Image	Target Info	User Entered Info
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	Contact2 • Sonar Time at Target: 4/5/2025 9:20:37 AM • Click Position (X) 853262.89 (Y) 3136815.02 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_07.jsf • Ping Number: 18205 • Heading: 356.920 Degrees • Line Name: MACZM_2025_SSS_Line_07 • Target depth: 110.64 US ft	Dimensions and attributes • Target Width: 62.02 US ft • Target Height: 41.85 US ft • Target Length: 63.49 US ft • Target Shadow: 120.87 US ft • Mag Anomaly: Mag 107 • Classification1: Unknown Feature • Area: Study Area 1 • Description: High intensity object with shadow
	Contact3 • Sonar Time at Target: 4/7/2025 12:12:54 PM • Click Position (X) 852848.67 (Y) 3135093.97 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_08.jsf • Ping Number: 66816 • Heading: 354.000 Degrees • Line Name: MACZM_2025_SSS_Line_08 • Target depth: 106.86 US ft	Dimensions and attributes • Target Width: 21.83 US ft • Target Height: 1.57 US ft • Target Length: 33.83 US ft • Target Shadow: 4.67 US ft • Classification1: Unknown Feature • Area: Study Area 1 • Description: Small low intensity feature

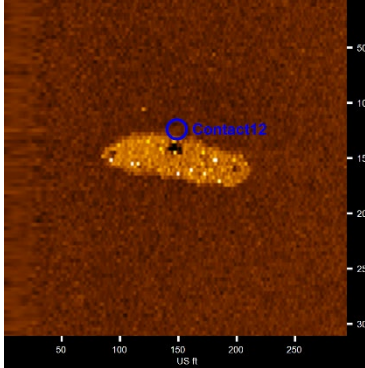
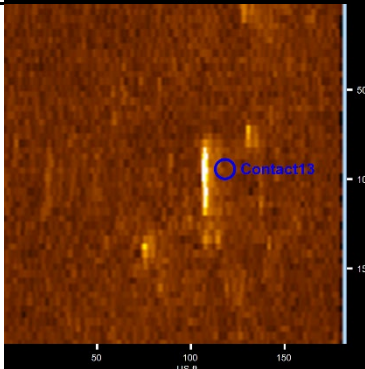
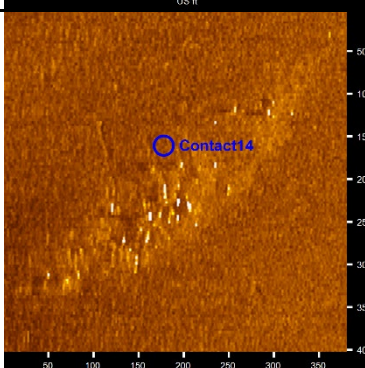
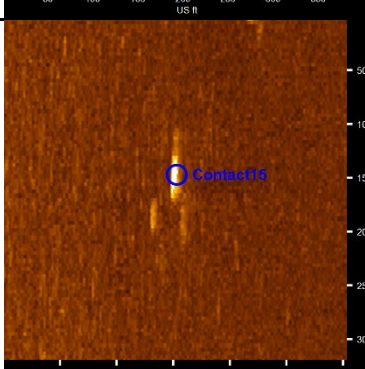
Massachusetts Coastal Zone Management

 A side-scan sonar image showing a dark, circular feature labeled 'Contact4' at approximately 350 US ft depth. The image has a vertical depth scale on the right from 100 to 900 US ft and a horizontal range scale at the bottom from 100 to 800 US ft.	Contact4 • Sonar Time at Target: 4/7/2025 1:18:29 PM • Click Position (X) 852320.29 (Y) 3122781.78 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_09.jsf • Ping Number: 75056 • Heading: 172.230 Degrees • Line Name: MACZM_2025_SSS_Line_09 • Target depth: 92.61 US ft	Dimensions and attributes • Classification1: Anchor Scour • Area: Study Area 1 • Description: Multiple anchor scours
 A side-scan sonar image showing a dark, irregular feature labeled 'Contact5' at approximately 300 US ft depth. The image has a vertical depth scale on the right from 100 to 600 US ft and a horizontal range scale at the bottom from 100 to 600 US ft.	Contact5 • Sonar Time at Target: 4/6/2025 2:10:49 PM • Click Position (X) 847009.28 (Y) 2950024.96 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_47.jsf • Ping Number: 16241 • Heading: 73.610 Degrees • Line Name: MACZM_2025_SSS_Line_47 • Target depth: 106.94 US ft	Dimensions and attributes • Target Width: 76.02 US ft • Target Height: 20.86 US ft • Target Length: 290.57 US ft • Target Shadow: 229.34 US ft • Classification1: Rock • Area: Study Area 2 • Description: Large rock
 A side-scan sonar image showing a dark, linear feature labeled 'Contact6' at approximately 250 US ft depth. The image has a vertical depth scale on the right from 100 to 500 US ft and a horizontal range scale at the bottom from 100 to 500 US ft.	Contact6 • Sonar Time at Target: 4/6/2025 12:16:18 PM • Click Position (X) 852150.03 (Y) 2945885.14 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_39.jsf • Ping Number: 185T • Heading: 134.140 Degrees • Line Name: MACZM_2025_SSS_Line_39 • Target depth: 117.99 US ft	Dimensions and attributes • Target Width: 9.26 US ft • Target Height: 4.99 US ft • Target Length: 644.46 US ft • Target Shadow: 31.92 US ft • Mag Anomaly: Mag 109 • Classification1: Unknown Feature • Area: Study Area 2 • Description: Large high intensity linear feature
 A side-scan sonar image showing a small, dark, rectangular feature labeled 'Contact7' at approximately 100 US ft depth. The image has a vertical depth scale on the right from 50 to 200 US ft and a horizontal range scale at the bottom from 50 to 150 US ft.	Contact7 • Sonar Time at Target: 4/8/2025 7:13:23 PM • Click Position (X) 919801.78 (Y) 2864030.08 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_77.jsf • Ping Number: 35331 • Heading: 169.600 Degrees • Line Name: MACZM_2025_SSS_Line_77 • Target depth: 139.53 US ft	Dimensions and attributes • Target Width: 22.96 US ft • Target Height: 6.04 US ft • Target Length: 7.75 US ft • Target Shadow: 37.19 US ft • Classification1: Unknown Feature • Area: Study Area 3 • Description: Small unknown high intensity feature

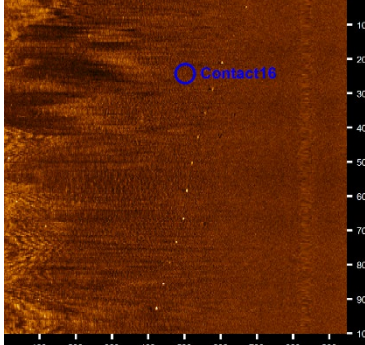
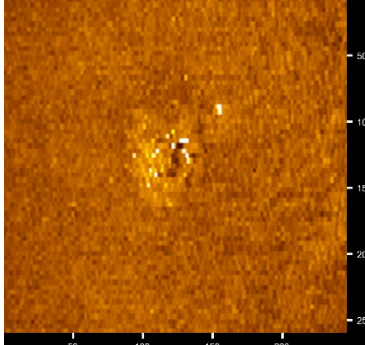
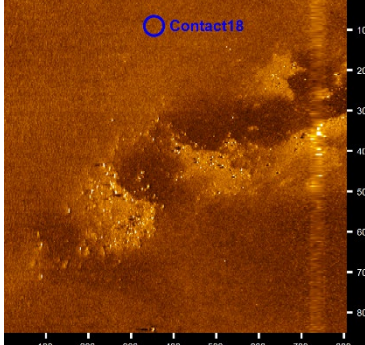
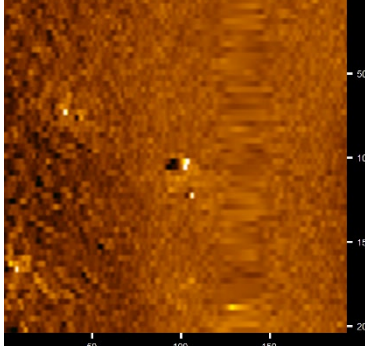
Massachusetts Coastal Zone Management

	Contact8 • Sonar Time at Target: 4/9/2025 3:15:26 PM • Click Position (X) 908002.60 (Y) 2862787.66 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_65.jsf • Ping Number: 26807 • Heading: 351.920 Degrees • Line Name: MACZM_2025_SSS_Line_65 • Target depth: 94.32 US ft	Dimensions and attributes • Target Width: 20.19 US ft • Target Height: 14.27 US ft • Target Length: 29.10 US ft • Target Shadow: 151.86 US ft • Classification1: Unknown Feature • Area: Study Area 3 • Description: Small unknown high intensity feature
	Contact9 • Sonar Time at Target: 4/9/2025 3:51:15 PM • Click Position (X) 905120.72 (Y) 2858168.75 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_87.jsf • Ping Number: 31307 • Heading: 334.720 Degrees • Line Name: MACZM_2025_SSS_Line_87 • Target depth: 108.56 US ft	Dimensions and attributes • Target Width: 11.68 US ft • Target Height: 6.88 US ft • Target Length: 73.35 US ft • Target Shadow: 27.17 US ft • Classification1: Unknown Feature • Area: Study Area 3 • Description: Linear high intensity unknown feature
	Contact10 • Sonar Time at Target: 4/9/2025 9:02:17 PM • Click Position (X) 907358.09 (Y) 2838304.45 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_96.001.jsf • Ping Number: 70390 • Heading: 168.630 Degrees • Line Name: MACZM_2025_SSS_Line_96.001 • Target depth: 112.26 US ft	Dimensions and attributes • Target Width: 17.17 US ft • Target Length: 1101.70 US ft • Classification1: Unknown Feature • Area: Study Area 3 • Description: Several small high intensity features in a linear pattern
	Contact11 • Sonar Time at Target: 6/25/2025 9:50:35 PM • Click Position (X) 954949.82 (Y) 2770540.85 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_124.jsf • Ping Number: 28184 • Heading: 243.590 Degrees • Line Name: MACZM_2025_SSS_Line_124 • Target depth: 99.93 US ft	Dimensions and attributes • Target Width: 36.58 US ft • Target Length: 19.24 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Small high intensity feature

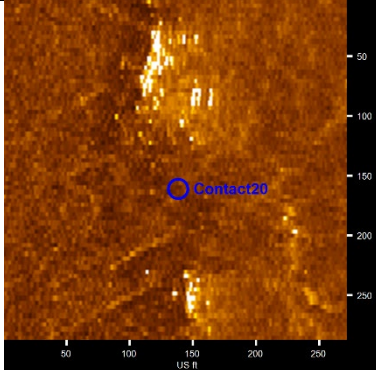
Massachusetts Coastal Zone Management

	Contact12 • Sonar Time at Target: 4/10/2025 7:19:11 AM • Click Position (X) 955118.93 (Y) 2769098.21 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_134.jsf • Ping Number: 3106 • Heading: 341.180 Degrees • Line Name: MACZM_2025_SSS_Line_134 • Target depth: 102.95 US ft	Dimensions and attributes • Target Width: 49.25 US ft • Target Length: 120.12 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Round high intensity object
	Contact13 • Sonar Time at Target: 4/10/2025 9:23:17 AM • Click Position (X) 947044.21 (Y) 2767661.06 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_108.jsf • Ping Number: 18700 • Heading: 158.830 Degrees • Line Name: MACZM_2025_SSS_Line_108 • Target depth: 103.04 US ft	Dimensions and attributes • Target Width: 38.12 US ft • Target Length: 8.59 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Long linear unknown feature
	Contact14 • Sonar Time at Target: 4/10/2025 8:37:25 AM • Click Position (X) 951626.26 (Y) 2765918.32 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_130.jsf • Ping Number: 12937 • Heading: 342.230 Degrees • Line Name: MACZM_2025_SSS_Line_130 • Target depth: 100.71 US ft	Dimensions and attributes • Target Width: 291.2 US ft • Target Length: 170.7 US ft • Classification1: Rubble Field • Area: Study Area 4 • Description: rubble field
	Contact15 • Sonar Time at Target: 4/10/2025 8:18:45 AM • Click Position (X) 954953.92 (Y) 2764499.93 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_132.jsf • Ping Number: 10590 • Heading: 159.750 Degrees • Line Name: MACZM_2025_SSS_Line_132 • Target depth: 101.83 US ft	Dimensions and attributes • Target Width: 12.88 US ft • Target Length: 69.53 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Linear high intensity object

Massachusetts Coastal Zone Management

	Contact16 • Sonar Time at Target: 6/25/2025 9:10:30 PM • Click Position (X) 942575.66 (Y) 2764311.49 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_107.jsf • Ping Number: 23149 • Heading: 73.870 Degrees • Line Name: MACZM_2025_SSS_Line_107 • Target depth: 88.66 US ft	Dimensions and attributes • Target Width: 27.36 US ft • Target Length: 1122.49 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Small high intensity dots and a linear pattern
	Contact17 • Sonar Time at Target: 6/25/2025 10:26:56 PM • Click Position (X) 949925.50 (Y) 2764375.16 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_126.jsf • Ping Number: 32753 • Heading: 61.430 Degrees • Line Name: MACZM_2025_SSS_Line_126 • Target depth: 95.48 US ft	Dimensions and attributes • Target Width: 70.02 US ft • Target Length: 44.91 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Multiple small high intensity features
	Contact18 • Sonar Time at Target: 4/10/2025 8:31:47 AM • Click Position (X) 953312.29 (Y) 2764306.82 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_130.jsf • Ping Number: 12228 • Heading: 342.110 Degrees • Line Name: MACZM_2025_SSS_Line_130 • Target depth: 102.46 US ft	Dimensions and attributes • Target Width: 445.25 US ft • Target Length: 734.29 US ft • Classification1: Rubble Field • Area: Study Area 4 • Description: rubble field
	Contact19 • Sonar Time at Target: 6/25/2025 8:32:19 AM • Click Position (X) 938542.45 (Y) 2750810.36 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_106.jsf • Ping Number: 2913 • Heading: 263.110 Degrees • Line Name: MACZM_2025_SSS_Line_106 • Target depth: 63.52 US ft	Dimensions and attributes • Target Width: 8.07 US ft • Target Height: 7.86 US ft • Target Length: 7.53 US ft • Target Shadow: 12.52 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Small high intensity feature with shadow

Massachusetts Coastal Zone Management

	Contact20 • Sonar Time at Target: 6/25/2025 8:34:27 AM • Click Position (X) 937604.36 (Y) 2750767.37 (Projected) • Map Projection: EPSG:6492 • Acoustic Source File: MACZM_2025_SSS_Line_106.jsf • Ping Number: 318T • Heading: 263.940 Degrees • Line Name: MACZM_2025_SSS_Line_106 • Target depth: 60.60 US ft	Dimensions and attributes • Target Width: 88.45 US ft • Target Length: 63.75 US ft • Classification1: Unknown Feature • Area: Study Area 4 • Description: Multiple small high intensity features
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Appendix C

Magnetometer Anomaly Table



Anomaly ID	Line	Event	X ¹	Y ¹	Amplitude (nT)	Duration (ft)	Signature	Description/Associations
Mag_001	27	1	859799	2949066	65.6	26.06	Dipolar	Unknown/Modern Debris
Mag_002	27	1	859725	2949139	19.22	47.38	Monopolar	Unknown/Modern Debris
Mag_003	25	23	858471	2946399	52.97	88.02	Multiple Component	Unknown/Modern Debris
Mag_004	25	24	858541	2946329	55.2	68.2	Monopolar	Unknown/Modern Debris
Mag_005	25	39	860529	2944284	424.38	35.05	Monopolar	Unknown/Modern Debris
Mag_006	25	41	860802	2944000	292.99	61.45	Dipolar	Unknown/Modern Debris
Mag_007	25	45	861347	2943444	274.61	60.22	Monopolar	Unknown/Modern Debris
Mag_008	25	67	864103	2940624	9.41	36.24	Dipolar	Unknown/Modern Debris
Mag_009	28	82	864818	2943950	55.47	100.22	Monopolar	Unknown/Modern Debris
Mag_010	27	118	858441	2950417	38	31.24	Dipolar	Unknown/Modern Debris
Mag_011	27	117	858591	2950270	52.35	77.75	Dipolar	Unknown/Modern Debris
Mag_012	27	117	858504	2950355	19.91	22.55	Monopolar	Unknown/Modern Debris
Mag_013	27	116	858720	2950141	50.48	68.38	Monopolar	Unknown/Modern Debris
Mag_014	27	108	859787	2949067	54.19	87.48	Dipolar	Unknown/Modern Debris
Mag_015	27	114	859029	2949838	43.2	165.62	Multiple Component	Unknown/Modern Debris
Mag_016	17	124	856499	2949523	35.87	77.81	Monopolar	Unknown/Modern Debris
Mag_017	17	133	857833	2948314	40.13	90.19	Dipolar	Unknown/Modern Debris
Mag_018	17	136	858208	2947928	27.01	140.77	Monopolar	Unknown/Modern Debris
Mag_019	17	138	858461	2947660	25.61	99.99	Dipolar	Unknown/Modern Debris
Mag_020	17	143	859166	2946907	48.2	123.26	Monopolar	Unknown/Modern Debris
Mag_021	17	146	859570	2946506	32.32	48.3	Monopolar	Unknown/Modern Debris
Mag_022	17	150	860055	2946022	25.94	71.07	Monopolar	Unknown/Modern Debris
Mag_023	26	237	860246	2947220	193.21	94.58	Monopolar	Unknown/Modern Debris
Mag_024	24	260	861514	2941706	17.27	105.46	Dipolar	Unknown/Modern Debris
Mag_025	24	260	863463	2939720	81.37	49.92	Monopolar	Unknown/Modern Debris
Mag_026	24	260	863512	2939668	32.18	61.16	Dipolar	Unknown/Modern Debris
Mag_027	46	303	866812	2943726	21.93	89.1	Dipolar	Unknown/Modern Debris
Mag_028	46	307	866280	2943230	15.7	48.48	Monopolar	Unknown/Modern Debris
Mag_029	46	313	866073	2942993	19.52	46.54	Monopolar	Unknown/Modern Debris
Mag_030	46	321	864947	2941944	16.82	28.44	Dipolar	Unknown/Modern Debris
Mag_031	44	356	862813	2942165	17.75	44.89	Monopolar	Unknown/Modern Debris
Mag_032	44	366	864415	2943733	107.09	61.93	Dipolar	Unknown/Modern Debris
Mag_033	44	371	865082	2944385	176.08	80.99	Monopolar	Unknown/Modern Debris
Mag_034	44	372	865268	2944569	25.84	61.61	Monopolar	Unknown/Modern Debris
Mag_035	40	382	862415	2946361	25.93	60.4	Monopolar	Unknown/Modern Debris
Mag_036	40	386	861842	2945797	10.3	51.92	Monopolar	Unknown/Modern Debris
Mag_037	33	402	865671	2950120	26.44	73.95	Dipolar	Unknown/Modern Debris
Mag_038	33	404	865360	2950429	17.12	60.44	Monopolar	Unknown/Modern Debris
Mag_039	33	408	864851	2950948	22.47	45.65	Dipolar	Unknown/Modern Debris
Mag_040	33	410	864558	2951257	275.36	57.07	Dipolar	Unknown/Modern Debris
Mag_041	33	413	864219	2951616	25.79	18.15	Monopolar	Unknown/Modern Debris
Mag_042	33	421	863157	2952691	45	57.61	Monopolar	Unknown/Modern Debris
Mag_043	30	444	862241	2949386	28.03	57.25	Dipolar	Unknown/Modern Debris
Mag_044	30	454	861032	2950634	26.44	27.11	Dipolar	Unknown/Modern Debris
Mag_045	32	459	861326	2953209	153.22	160.72	Dipolar	Unknown/Modern Debris
Mag_046	32	460	861437	2953089	16.72	45.58	Monopolar	Unknown/Modern Debris
Mag_047	32	463	862006	2952471	21.34	74.52	Monopolar	Unknown/Modern Debris
Mag_048	34	480	866272	2951016	48.91	54.5	Dipolar	Unknown/Modern Debris
Mag_049	34	486	865400	2951800	638.83	56.01	Dipolar	Unknown/Modern Debris
Mag_050	34	486	865350	2951850	1256.18	46.9	Dipolar	Unknown/Modern Debris
Mag_051	34	487	865273	2951925	110.23	43.05	Monopolar	Unknown/Modern Debris
Mag_052	36	526	861837	2950368	80.91	82.11	Monopolar	Unknown/Modern Debris

Mag_053	36	554	857575	2946210	84.46	85.35	Multiple Component	Unknown/Modern Debris
Mag_054	36	555	857478	2946114	94.72	98.42	Multiple Component	Unknown/Modern Debris
Mag_055	36	557	857100	2945744	59.52	134.75	Multiple Component	Unknown/Modern Debris
Mag_056	36	558	857000	2945645	50.5	51.84	Monopolar	Unknown/Modern Debris
Mag_057	36	560	856638	2945286	127.74	176.55	Multiple Component	Unknown/Modern Debris
Mag_058	36	563	856179	2944822	268.5	86.58	Dipolar	Unknown/Modern Debris
Mag_059	36	564	856084	2944725	141.67	133.64	Monopolar	Unknown/Modern Debris
Mag_060	38	566	858352	2944520	44.86	85.19	Dipolar	Unknown/Modern Debris
Mag_061	38	569	858734	2944961	140.97	67.59	Multiple Component	Unknown/Modern Debris
Mag_062	38	571	858909	2945162	295.97	70.47	Monopolar	Unknown/Modern Debris
Mag_063	38	571	859012	2945280	82.21	65.43	Dipolar	Unknown/Modern Debris
Mag_064	38	573	859293	2945581	57.69	62.04	Dipolar	Unknown/Modern Debris
Mag_065	38	580	860195	2946488	24.73	43.45	Monopolar	Unknown/Modern Debris
Mag_066	29	589	861737	2948411	21.48	35.63	Multiple Component	Unknown/Modern Debris
Mag_067	29	592	861435	2948791	42.64	25.92	Dipolar	Unknown/Modern Debris
Mag_068	29	597	860733	2949505	28.7	65.91	Monopolar	Unknown/Modern Debris
Mag_069	29	602	860105	2950167	56.45	59.91	Monopolar	Unknown/Modern Debris
Mag_070	29	603	860052	2950222	57.86	62.14	Monopolar	Unknown/Modern Debris
Mag_071	29	605	859688	2950606	226.75	129.78	Multiple Component	Unknown/Modern Debris
Mag_072	37	627	860201	2951000	96.14	44.81	Monopolar	Unknown/Modern Debris
Mag_073	37	637	858556	2949468	146.68	70.57	Monopolar	Unknown/Modern Debris
Mag_074	37	648	856768	2947724	716.91	108.36	Monopolar	Unknown/Modern Debris
Mag_075	37	656	855418	2946387	107.01	135.41	Dipolar	Unknown/Modern Debris
Mag_076	52	686	841923	2939736	67.74	104.61	Monopolar	Unknown/Modern Debris
Mag_077	52	694	840213	2939165	142.92	348.48	Monopolar	Unknown/Modern Debris
Mag_078	52	702	838465	2938539	47.39	63.98	Monopolar	Unknown/Modern Debris
Mag_079	52	707	837374	2938185	627.55	513.2	Monopolar	Unknown/Modern Debris
Mag_080	59	714	837006	2937025	440.66	709.42	Monopolar	Unknown/Modern Debris
Mag_081	59	722	838392	2937478	24.53	77.4	Monopolar	Unknown/Modern Debris
Mag_082	59	724	838809	2937618	14.11	70.6	Monopolar	Unknown/Modern Debris
Mag_083	59	725	838987	2937681	17.86	75.76	Monopolar	Unknown/Modern Debris
Mag_084	59	750	843483	2939255	53.87	92.81	Monopolar	Unknown/Modern Debris
Mag_085	50	788	839993	2937004	141.13	579.73	Multiple Component	Unknown/Modern Debris
Mag_086	50	789	839666	2936894	79.42	132.94	Monopolar	Unknown/Modern Debris
Mag_087	50	795	838400	2936455	34.16	118.05	Monopolar	Unknown/Modern Debris
Mag_088	50	803	836655	2935807	409.58	1374.93	Monopolar	Unknown/Modern Debris
Mag_089	58	893	836053	2934622	861.75	225.51	Monopolar	Unknown/Modern Debris
Mag_090	51	957	845914	2936974	65.86	66.65	Multiple Component	Unknown/Modern Debris
Mag_091	51	973	842617	2935827	59.62	110.03	Monopolar	Unknown/Modern Debris
Mag_092	51	976	842094	2935649	113.57	61.43	Monopolar	Unknown/Modern Debris
Mag_093	51	984	840286	2934991	46.73	563.99	Monopolar	Unknown/Modern Debris
Mag_094	61	1005	835999	2934651	315.97	90.68	Monopolar	Unknown/Modern Debris
Mag_095	53	1021	836227	2939393	135.39	86.59	Monopolar	Unknown/Modern Debris
Mag_096	53	1031	837329	2937582	551.35	531.53	Monopolar	Unknown/Modern Debris
Mag_097	56	1075	839086	2937795	13.6	78.37	Monopolar	Unknown/Modern Debris
Mag_098	56	1078	838778	2938340	30.73	73.95	Monopolar	Unknown/Modern Debris

Mag_099	56	1083	838197	2939413	35.13	60.22	Monopolar	Unknown/Modern Debris
Mag_100	54	1102	841370	2937085	88.35	115.31	Dipolar	Unknown/Modern Debris
Mag_101	57	1133	842096	2939044	275.2	125.05	Monopolar	Unknown/Modern Debris
Mag_102	57	1136	841760	2939612	42.76	111.86	Dipolar	Unknown/Modern Debris
Mag_103	55	1142	842244	2940966	57.58	82.19	Monopolar	Unknown/Modern Debris
Mag_104	55	1155	843506	2938663	52.23	69.18	Dipolar	Unknown/Modern Debris
Mag_105	55	1160	844053	2937686	324.71	133.59	Dipolar	Unknown/Modern Debris
Mag_106	7	1319	859163	3122847	338.62	609.81	Multiple Component	SSS Contact 2
Mag_107	7	1385	853200	3136818	60.31	114.13	Monopolar	Unknown/Modern Debris
Mag_108	35	2229	849116	2948720	29.38	55.25	Dipolar	SSS Contact 6
Mag_109	35	2248	852077	2945698	35	81.4	Monopolar	Unknown/Modern Debris
Mag_110	35	2259	853739	2944000	31.84	63.13	Monopolar	Unknown/Modern Debris
Mag_111	19	2264	855662	2944813	194.77	114.42	Monopolar	Unknown/Modern Debris
Mag_112	19	2271	854490	2946002	495.54	237.09	Monopolar	Unknown/Modern Debris
Mag_113	22	2340	852830	2950558	221.48	91.31	Monopolar	Unknown/Modern Debris
Mag_114	23	2350	855406	2947948	28.07	51.48	Monopolar	Unknown/Modern Debris
Mag_115	23	2360	857044	2946260	61.48	89.3	Dipolar	Unknown/Modern Debris
Mag_116	23	2360	857132	2946178	50.05	89.47	Multiple Component	Unknown/Modern Debris
Mag_117	18	2371	854755	2944367	159.3	157.3	Multiple Component	Unknown/Modern Debris
Mag_118	18	2374	854284	2944845	46.49	153.53	Monopolar	Unknown/Modern Debris
Mag_119	18	2390	851642	2947587	61.23	268.07	Monopolar	Unknown/Modern Debris
Mag_120	20	2482	856728	2945180	129	81.25	Monopolar	Unknown/Modern Debris
Mag_121	20	2478	856111	2945807	36.53	31.98	Dipolar	Unknown/Modern Debris
Mag_122	25	2487	863415	2941334	35.5	42.61	Monopolar	Unknown/Modern Debris
Mag_123	14	2708	852291	3124879	18.06	63.7	Dipolar	Unknown/Modern Debris
Mag_124	9	3333	852378	3120859	234.34	306.57	Monopolar	Unknown/Modern Debris
Mag_125	80	3454	923097	2864669	15.32	76.24	Monopolar	Unknown/Modern Debris
Mag_126	80	3459	922643	2865472	11.38	47.52	Monopolar	Unknown/Modern Debris
Mag_127	72	3594	914176	2864694	8.89	54.12	Monopolar	Unknown/Modern Debris
Mag_128	68	3655	910967	2862347	18.27	70.69	Monopolar	Unknown/Modern Debris
Mag_129	71	3790	915321	2860339	15.6	62.29	Monopolar	Unknown/Modern Debris
Mag_130	73	3846	918155	2859240	15.28	56.45	Monopolar	Unknown/Modern Debris
Mag_131	79	3912	921779	2865018	5.26	45.96	Monopolar	Unknown/Modern Debris
Mag_132	89	4236	906652	2861143	29.43	25.99	Monopolar	Unknown/Modern Debris
Mag_133	92	4305	915168	2863764	21.17	61.04	Monopolar	Unknown/Modern Debris
Mag_134	94	4363	915891	2860402	25.56	115.59	Monopolar	Unknown/Modern Debris
Mag_135	94	4371	914303	2859581	8.47	100.2	Monopolar	Unknown/Modern Debris
Mag_136	95	4408	919341	2860383	25.65	54.62	Monopolar	Unknown/Modern Debris
Mag_137	97	4425	910653	2846205	6.77	43.12	Monopolar	Unknown/Modern Debris
Mag_138	97	4428	909946	2845827	9.63	59.95	Monopolar	Unknown/Modern Debris
Mag_139	132	4617	949304	2772797	15.95	131.64	Dipolar	Unknown/Modern Debris
Mag_140	116	5524	927720	2766954	36.36	39.09	Monopolar	Unknown/Modern Debris
Mag_141	116	5510	928615	2763740	10.31	30.56	Monopolar	Unknown/Modern Debris
Mag_142	116	5507	928791	2763024	6.86	48.49	Monopolar	Unknown/Modern Debris
Mag_143	117	5538	926992	2765887	16.48	52.91	Monopolar	Unknown/Modern Debris
Mag_144	117	5546	927537	2763958	5.15	70.71	Dipolar	Unknown/Modern Debris
Mag_145	103	5614	932161	2767831	24.12	124.34	Dipolar	Unknown/Modern Debris
Mag_146	118	5632	929009	2768590	69.52	58.83	Monopolar	Unknown/Modern Debris
Mag_147	120	5640	928496	2770113	37.78	31.7	Dipolar	Unknown/Modern Debris
Mag_148	112	5711	929545	2771380	9.6	62.11	Dipolar	Unknown/Modern Debris
Mag_149	112	5716	929905	2770117	18.14	64.38	Dipolar	Unknown/Modern Debris
Mag_150	112	5729	930746	2767064	14.66	94.14	Monopolar	Unknown/Modern Debris

Mag_151	109	5764	930847	2770416	10	41.51	Dipolar	Unknown/Modern Debris
Mag_152	127	5807	941397	2767978	43.94	95.52	Monopolar	Unknown/Modern Debris
Mag_153	127	5814	942775	2769029	28.61	88.08	Dipolar	Unknown/Modern Debris
Mag_154	127	5818	943369	2769515	14.28	39.24	Monopolar	Unknown/Modern Debris
Mag_155	127	5823	944352	2770272	10.51	74.12	Monopolar	Unknown/Modern Debris
Mag_156	133	6174	943731	2764174	20.74	45.26	Monopolar	Unknown/Modern Debris

¹Projected coordinates are referenced to NAD83, Massachusetts Mainland State Plane, US Foot.

Appendix D Seismic Web Project (digital only)



Appendix E

2025 APTIM Vibracore Logs



DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC01			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 4	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 04-14-25 04-14-25	
8. TOTAL DEPTH OF BORING 18.0 Ft.			16. ELEVATION TOP OF BORING -112.3 Ft.	
			17. TOTAL RECOVERY FOR BORING 16 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-112.3	0.0					
-113.3	1.0		Sandy FAT CLAY, soft, trace organics, trace shell hash, trace silt, sand component is fine grained, quartz, sand typically distributed throughout layer and in laminae, silt distributed in sand, (2.5" x 3.0") sandy pocket @ top of core, dark greenish gray (10Y-4/1), (CH).			
-116.4	4.1		SAND, very fine to fine grained, quartz, some silt, trace clay, trace rock fragments, trace shell hash, clay increases with depth in layer, rock fragments are typically distributed throughout layer, rock fragments are typically up to 1.5", (1.75" x 2.5") rock fragment @ 1.5", (1.0" x 1.5") pocket of rock fragments @ 3.2', dark greenish gray (10Y-4/1), (SM).		1	Sample #1, Depth = 2.2' Mean (mm): 0.13, Phi Sorting: 0.74 Fines (230): 24.27% Fines (200): 28.47% (SM)
-120.3	8.0		FAT CLAY, very soft, trace rock fragments, trace sand, very fine to fine grained, quartz, trace shell hash, trace silt, sand increases with depth in layer, silt distributed in sand, rock fragments typically up to 1.5", (1.5" x 2.5") rock fragment @ 4.5', dark greenish gray (10Y-4/1), (CH).		T1	Sample #T1, Depth = 7.0' Shear Strength (kPa): 9.81
-122.8	10.5		FAT CLAY, very soft, trace sand, very fine to fine grained, quartz, trace shell hash, trace silt, sand typically distributed throughout layer, silt distributed in sand, (1.5" x 3.0") sandy pocket @ 8.1', shell hash increases between 8.3' & 9.1', dark greenish gray (10Y-4/1), (CH).		T2	Sample #T2, Depth = 9.6' Shear Strength (kPa): 9.81
-126.6	14.3		FAT CLAY, very soft, trace organics, trace rock fragments, trace shell hash, trace wood fragments, wood fragments distributed in laminae, (0.75" x 1.25") pocket of rock fragments up to 1.0" @ 14.1', dark greenish gray (10Y-4/1), (CH).		T3	Sample #T3, Depth = 12.0' Shear Strength (kPa): 14.71
-128.3	16.0		FAT CLAY, stiff, trace rock fragments, (0.25" x 0.75") rock fragment @ 15.8', dark greenish gray (10Y-4/1), (CH).		T4	Sample #T4, Depth = 15.2' Shear Strength (kPa): 85.81
-130.3	18.0		No recovery.			
			End of Boring			

MA CZM VIBRACORES 2025 G.P. 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC02			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 0 3	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 04-14-25 04-14-25	
8. TOTAL DEPTH OF BORING 17.9 Ft.			16. ELEVATION TOP OF BORING -135.6 Ft.	
			17. TOTAL RECOVERY FOR BORING 12.5 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve	
-135.6	0.0						0
-136.4	0.8		LEAN CLAY, very soft, some organics, trace rock fragments, trace sand, fine grained, quartz, trace silt, silt distributed in sand, rock fragments typically up to 1.0", (1.0" x 2.0") rock fragment @ 0.6', color is mottled black (2.5Y-2.5/1) and dark gray (5Y-4/1), (CL).		T1	Sample #T1, Depth = 2.0' Shear Strength (kPa): 4.90	
-138.9	3.3		FAT CLAY, very soft, trace rock fragments, rock fragments up to 2.5", dark gray (N-4/0), (CH).		T2	Sample #T2, Depth = 6.0' Shear Strength (kPa): 4.90	5
			FAT CLAY, very soft, some organics, trace shell hash, shell hash increases between 10.8' & 11.3', bit sample from 12.2' to 12.5', color is mottled black (N-2.5/0) and dark gray (5Y-4/1), (CH).		T3	Sample #T3, Depth = 9.5' Shear Strength (kPa): 4.90	10
-148.1	12.5						15
			No recovery.				
-153.5	17.9						20
			End of Boring				25

MA_CZM_VIBRACORES_2025_GPJ_7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC03			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER ☐ MANUAL HAMMER APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 4 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 04-14-25 04-14-25	
8. TOTAL DEPTH OF BORING 16.4 Ft.			16. ELEVATION TOP OF BORING -56.2 Ft.	
			17. TOTAL RECOVERY FOR BORING 17.9 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-56.2	0.0					
			SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments are bivalve and echinoid (sand dollar) fragments up to 1.25", dark gray (N-4/0), (SP).		1	Sample #1, Depth = 2.4' Mean (mm): 0.22, Phi Sorting: 0.42 Fines (230): 1.58% Fines (200): 1.61% (SP)
					2	Sample #2, Depth = 6.0' Mean (mm): 0.23, Phi Sorting: 0.54 Fines (230): 2.38% Fines (200): 2.42% (SP)
-65.0	8.8				3	Sample #3, Depth = 10.9' Mean (mm): 0.19, Phi Sorting: 0.43 Fines (230): 3.69% Fines (200): 3.75% (SP)
			SAND, fine grained, quartz, trace organics, trace shell hash, trace silt, trace wood fragments, wood fragments distributed in laminae, dark gray (N-4/0), (SP).		4	Sample #4, Depth = 14.0' Mean (mm): 0.17, Phi Sorting: 0.45 Fines (230): 3.98% Fines (200): 4.12% (SP)
-72.0	15.8					
-74.1	17.9		Sandy LEAN CLAY, soft, trace rock fragments, trace shell hash, trace silt, sand component is fine grained, quartz, rock fragments up to 1.25", expansion from 16.4' to 17.9', dark greenish gray (10Y-4/1), (CL).			
			End of Boring			

MA CZM VIBRACORES 2025 G.P.J. 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC04			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES 5	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES 0	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING 04-14-25	
8. TOTAL DEPTH OF BORING 17.3 Ft.			16. ELEVATION TOP OF BORING -45.0 Ft.	
			17. TOTAL RECOVERY FOR BORING 17.2 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR SM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-45.0	0.0					
-48.4	3.4		SAND, very fine to fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, clay distributed in pockets up to 1.0" and laminae, oxidation throughout layer, shell fragments are bivalve fragments typically up to 1.5", 1.75" bivalve fragment @ 0.2', dark greenish gray (10Y-4/1), (SP).		1	Sample #1, Depth = 1.6' Mean (mm): 0.15, Phi Sorting: 0.49 Fines (230): 3.58% Fines (200): 3.82% (SP)
-51.2	6.2		SAND, very fine to fine grained, quartz, trace clay, trace shell hash, trace silt, clay distributed throughout layer and in laminae, dark greenish gray (10Y-4/1), (SM).		2	Sample #2, Depth = 5.0' Mean (mm): 0.14, Phi Sorting: 0.45 Fines (230): 11.58% Fines (200): 12.42% (SM)
-57.5	12.5		SAND, very fine to fine grained, quartz, some silt, little clay, trace shell hash, clay increases with depth in layer, clay distributed throughout layer, in pockets typically up to 1.5" and in laminae, (2.5" x 3.0") clay pocket @ 12.2', dark greenish gray (10Y-4/1), (SM-SC).		3	Sample #3, Depth = 8.0' Mean (mm): 0.13, Phi Sorting: 0.44 Fines (230): 33.99% Fines (200): 34.58% (SM-SC)
-57.9	12.9				4	Sample #4, Depth = 11.0' Mean (mm): 0.12, Phi Sorting: 0.57 Fines (230): 30.47% Fines (200): 31.54% (SM-SC)
-59.8	14.8		SAND, fine to medium grained, quartz, some shell hash, little gravel, subangular to subrounded, trace rock fragments, trace shell fragments, trace silt, shell fragments are bivalve and gastropod fragments up to 0.5", (0.75" x 1.5") rock fragment @ 12.6', 1" rock fragment @ 12.6', very dark greenish gray (10Y-3/1), (SW).			
-62.2	17.2		Clayey SAND, fine grained, quartz, little shell hash, trace gravel, subangular to subrounded, trace rock fragments, trace shell fragments, trace silt, rock fragments typically up to 1.25", shell fragments are bivalve and gastropod fragments up to 1.0", (1.5" x 2.0") rock fragment @ 13.5', (2.5" x 3.75") rock fragment @ 14.2', dark gray (5Y-4/1), (SC).		5	Sample #5, Depth = 15.6' Mean (mm): 0.46, Phi Sorting: 1.21 Fines (230): 4.24% Fines (200): 4.26% (SW)
-62.3	17.3		SAND, fine grained, quartz, trace clay, trace gravel, angular to subrounded, trace rock fragments, trace shell fragments, trace shell hash, trace silt, clay distributed in pockets up to 0.5", rock fragments typically up to 1.25", shell fragments are bivalve fragments up to 0.75", (1.25" x 1.5") rock fragment @ 16.4', dark greenish gray (10Y-4/1), (SW). No recovery.			
			End of Boring			

MA CZM VIBRACORES 2025 GPL 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC05			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES 2	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES 2	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING 04-15-25	
8. TOTAL DEPTH OF BORING 14.8 Ft.			16. ELEVATION TOP OF BORING -108.1 Ft.	
			17. TOTAL RECOVERY FOR BORING 13.9 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR SM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-108.1	0.0					
-108.7	0.6		Clayey SAND, fine to medium grained, quartz, trace gravel, subangular to subrounded, trace rock fragments, trace silt, rock fragments typically up to 0.75", (1.0" x 1.5") rock fragment @ 0.5', dark gray (2.5Y-4/1), (SC).		T1	Sample #T1, Depth = 1.6' Shear Strength (kPa): 34.32
-110.2	2.1		FAT CLAY, soft, little organics, trace sand, fine grained, quartz, trace silt, sand decreases with depth in layer, organics typically distributed throughout layer and in laminae, sand distributed in pockets up to 0.75", silt distributed in sand, (2.5" x 3.0") organic clay pocket @ 1.8', color is mottled black (N-2.5/0) and gray (N-5/0), (CH).		1	Sample #1, Depth = 2.7' Mean (mm): 0.10, Phi Sorting: 0.58 Fines (230): 36.89% Fines (200): 42.95% (SM)
-112.1	4.0		Silty SAND, very fine grained, quartz, trace clay, trace organics, clay distributed in pockets up to 1.75" and laminae, organics distributed in clay, gray (5Y-5/1), (SM).			
-116.0	7.9		Sandy LEAN CLAY, firm, trace organics, trace silt, sand component is very fine grained, quartz, sand typically distributed throughout layer, organics distributed throughout layer and in laminae, silt distributed in sand, (1.0" x 1.5") silty sand pocket @ 5.6', color is mottled dark gray (N-4/0) and dark greenish gray (10Y-4/1), (CL).			
-119.3	11.2		SAND, very fine to fine grained, quartz, little silt, trace clay, trace organics, clay distributed in clayey pockets up to 1.0", organics distributed in laminae, color is mottled dark greenish gray (10Y-4/1) and greenish gray (10Y-5/1), (SM).		2	Sample #2, Depth = 10.0' Mean (mm): 0.13, Phi Sorting: 0.46 Fines (230): 18.49% Fines (200): 20.57% (SM)
-121.1	13.0		FAT CLAY, soft, trace sand, fine grained, quartz, trace silt, sand typically distributed in laminae, silt distributed in sand, (1.5" x 2.0") sand pocket @ 12.8', dark gray (N-4/0), (CH).		T2	Sample #T2, Depth = 12.1' Shear Strength (kPa): 39.23
-122.0	13.9		Silty SAND, very fine to fine grained, quartz, trace clay, clay distributed in laminae, bit sample from 13.6' to 13.9', dark greenish gray (10Y-4/1), (SM).			
-122.9	14.8		No recovery.			
			End of Boring			

MA CZM VIBRACORES 2025 GPJ 7/22/25

DRILLING LOG		DIVISION		INSTALLATION		SHEET 1	
						OF 1 SHEETS	
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts							
2. BORING DESIGNATION MA-CZM-2025-VC06				LOCATION COORDINATES (ft) X = 849,044 Y = 3,128,942		9. SIZE AND TYPE OF BIT 3.0 In.	
3. DRILLING AGENCY APTIM				CONTRACTOR FILE NO.		10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
4. NAME OF DRILLER APTIM						HORIZONTAL NAD 1983	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG. FROM VERTICAL		VERTICAL NAVD88	
6. THICKNESS OF OVERBURDEN 0.0 Ft.						11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.						12. TOTAL SAMPLES 2	
8. TOTAL DEPTH OF BORING 19.1 Ft.						DISTURBED 2	
						UNDISTURBED (UD) 0	
						13. TOTAL NUMBER CORE BOXES	
						14. ELEVATION GROUND WATER	
						15. DATE BORING 04-15-25	
						STARTED 04-15-25	
						COMPLETED 04-15-25	
						16. ELEVATION TOP OF BORING -85.5 Ft.	
						17. TOTAL RECOVERY FOR BORING 15.2 Ft.	
						18. SIGNATURE AND TITLE OF INSPECTOR SM	
ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve	
-85.5	0.0						
			SAND, medium to coarse grained, quartz, little gravel, subrounded to rounded, trace rock fragments, trace shell fragments, trace silt, sand grain size decreases with depth in layer, rock fragments up to 1.0", (1.5" x 1.75") bivalve fragment @ 5.6', very dark gray (2.5Y-3/1), (SW).		1	Sample #1, Depth = 4.0' Mean (mm): 0.88, Phi Sorting: 1.57 Fines (230): 1.54% Fines (200): 1.56% (SW)	
-94.1	8.6						
			SAND, medium grained, quartz, trace gravel, subrounded to rounded, trace rock fragments, trace silt, rock fragments up to 1.25", dark grayish brown (2.5Y-4/2), (SW).		2	Sample #2, Depth = 12.0' Mean (mm): 0.67, Phi Sorting: 1.26 Fines (230): 1.81% Fines (200): 1.86% (SW)	
-100.7	15.2						
			No recovery.				
-104.6	19.1						
			End of Boring				

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC07			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES 2 DISTURBED 0 UNDISTURBED (UD) 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING 04-15-25 STARTED 04-15-25 COMPLETED 04-15-25	
8. TOTAL DEPTH OF BORING 18.6 Ft.			16. ELEVATION TOP OF BORING -92.1 Ft.	
			17. TOTAL RECOVERY FOR BORING 11.6 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-92.1	0.0					
			SAND, fine to medium grained, quartz, little gravel, subangular to subrounded, trace clay, trace rock fragments, trace shell fragments, trace shell hash, trace silt, oxidation throughout layer, shell fragments are bivalve fragments up to 1.0", (1.0" x 2.75") rock fragment @ 6.9', clayey lamina @ 8.7', color is mottled dark gray (2.5Y-4/1) and dark gray (5Y-4/1), (SW).		1	Sample #1, Depth = 5.8' Mean (mm): 0.56, Phi Sorting: 1.09 Fines (230): 1.15% Fines (200): 1.16% (SW)
-102.3	10.2		SAND, fine to medium grained, quartz, some gravel, subangular to rounded, little rock fragments, trace silt, oxidation throughout layer, rock fragments increase with depth in layer, rock fragments up to 2.75", color is mottled dark gray (2.5Y-4/1) and dark gray (5Y-4/1), (SW).		2	Sample #2, Depth = 10.8' Mean (mm): 0.72, Phi Sorting: 1.21 Fines (230): 1.14% Fines (200): 1.15% (SW)
-103.7	11.6					
			No recovery.			
-110.7	18.6					
			End of Boring			

MA_CZM_VIBRACORES_2025_GPL_7/22/25

DRILLING LOG		DIVISION		INSTALLATION		SHEET 1 OF 1 SHEETS	
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts				9. SIZE AND TYPE OF BIT 3.0 In.			
2. BORING DESIGNATION MA-CZM-2025-VC08				10. COORDINATE SYSTEM/DATUM MA State Plane Mainland		HORIZONTAL NAD 1983	
3. DRILLING AGENCY APTIM				11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		VERTICAL NAVD88	
4. NAME OF DRILLER APTIM				12. TOTAL SAMPLES 3		DISTURBED 1	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				13. TOTAL NUMBER CORE BOXES		☐ AUTO HAMMER ☐ MANUAL HAMMER	
6. THICKNESS OF OVERBURDEN 0.0 Ft.				14. ELEVATION GROUND WATER		15. DATE BORING 04-15-25	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.				16. ELEVATION TOP OF BORING -89.1 Ft.		COMPLETED 04-15-25	
8. TOTAL DEPTH OF BORING 17.0 Ft.				17. TOTAL RECOVERY FOR BORING 16.9 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR SM	
ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve	
-89.1	0.0						
-91.2	2.1		SAND, fine grained, quartz, trace gravel, subangular to subrounded, trace shell fragments, trace shell hash, trace silt, shell fragments are echinoid (sand dollar) fragments up to 0.5", dark gray (2.5Y-4/1), (SP).		1	Sample #1, Depth = 1.0' Mean (mm): 0.33, Phi Sorting: 0.76 Fines (230): 3.27% Fines (200): 3.31% (SP)	
-92.3	3.2		LEAN CLAY, very soft, some sand, fine grained, quartz, trace organics, trace shell hash, trace silt, sand distributed in pockets up to 1.0" and laminae, organics distributed in laminae, shell hash and silt distributed in sand, dark greenish gray (10Y-4/1), (CL).		T1	Sample #T1, Depth = 2.9' Shear Strength (kPa): 9.81	
-103.9	14.8		SAND, medium to coarse grained, quartz, little gravel, subrounded to rounded, trace clay, trace silt, (0.75" x 2.0") clay pocket @ 4.0', dark gray (2.5Y-4/1), (SW).		2	Sample #2, Depth = 9.0' Mean (mm): 0.61, Phi Sorting: 0.98 Fines (230): 1.24% Fines (200): 1.25% (SW)	
-106.0	16.9		SAND, fine to medium grained, quartz, little silt, (2.25" x 3.0") silty pocket @ 16.7', color is mottled gray (2.5Y-5/1) and dark grayish brown (2.5Y-4/2), (SW).		3	Sample #3, Depth = 16.2' Mean (mm): 0.38, Phi Sorting: 0.94 Fines (230): 1.34% Fines (200): 1.38% (SW)	
-106.1	17.0		No recovery.				
			End of Boring				

MA_CZM_VIBRACORES_2025_GPL_7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC09			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER ☐ MANUAL HAMMER APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 3 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 04-17-25 04-17-25	
8. TOTAL DEPTH OF BORING 17.6 Ft.			16. ELEVATION TOP OF BORING -63.8 Ft.	
			17. TOTAL RECOVERY FOR BORING 17.7 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-63.8	0.0					
-70.1	6.3		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, oxidation throughout layer, shell fragments are bivalve and echinoid (sand dollar) fragments up to 1.25", dark gray (5Y-4/1), (SP).		1	Sample #1, Depth = 4.2' Mean (mm): 0.25, Phi Sorting: 0.61 Fines (230): 2.70% Fines (200): 2.75% (SP)
-76.9	13.1		SAND, fine grained, quartz, trace gravel, subangular to subrounded, trace rock fragments, trace shell fragments, trace shell hash, trace silt, oxidation throughout layer, shell fragments are bivalve fragments up to 0.5", (0.5" x 1.0") rock fragment @ 7.1', (1.25" x 1.5") rock fragment @ 9.4', (1.25" x 1.75") rock fragment @ 10.9', dark gray (5Y-4/1), (SP).		2	Sample #2, Depth = 10.1' Mean (mm): 0.21, Phi Sorting: 0.41 Fines (230): 1.38% Fines (200): 1.40% (SP)
-81.5	17.7		SAND, very fine to fine grained, quartz, trace clay, trace shell hash, trace silt, silt increases with depth in layer, clay distributed in laminae, expansion from 17.6' to 17.7', dark gray (5Y-4/1), (SP).		3	Sample #3, Depth = 15.7' Mean (mm): 0.18, Phi Sorting: 0.40 Fines (230): 3.76% Fines (200): 3.83% (SP)
			End of Boring			

MA CZM VIBRACORES 2025 GPJ 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC10			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES 2 DISTURBED 0 UNDISTURBED (UD) 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING 04-17-25 STARTED 04-17-25 COMPLETED 04-17-25	
8. TOTAL DEPTH OF BORING 18.3 Ft.			16. ELEVATION TOP OF BORING -66.2 Ft.	
			17. TOTAL RECOVERY FOR BORING 17.6 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-66.2	0.0					
			SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shells, shell fragments are bivalve and gastropod fragments up to 1.0", (0.5" x 0.75") whole bivalve @ 4.2', dark gray (5Y-4/1), (SP).		1	Sample #1, Depth = 5.0' Mean (mm): 0.23, Phi Sorting: 0.46 Fines (230): 1.69% Fines (200): 1.71% (SP)
-75.9	9.7					
			SAND, fine grained, quartz, trace organics, trace rock fragments, trace shell fragments, trace shell hash, trace silt, trace whole shells, shell hash increases with depth in layer, (0.5" x 0.75") rock fragment @ 10.6', 0.5" whole bivalve @ 11.4', (0.75" x 1.0") bivalve fragment @ 12.3', organic lamina @ 16.9', color grades from dark gray (5Y-4/1) to dark greenish gray (10Y-4/1), (SP).		2	Sample #2, Depth = 14.1' Mean (mm): 0.22, Phi Sorting: 0.45 Fines (230): 2.60% Fines (200): 2.74% (SP)
-83.8	17.6					
-84.5	18.3		No recovery.			
			End of Boring			

MA_CZM_VIBRACORES_2025_GPJ_7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC11			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING	
8. TOTAL DEPTH OF BORING 19.2 Ft.			16. ELEVATION TOP OF BORING -62.2 Ft.	
			17. TOTAL RECOVERY FOR BORING 19.2 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR SM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-62.2	0.0					
-64.0	1.8		SAND, fine grained, quartz, trace clay, trace gravel, subangular to subrounded, trace rock fragments, trace shell fragments, trace shell hash, trace silt, trace whole shells, oxidation throughout layer, rock fragments typically up to 1.25", shell fragments are bivalve fragments up to 0.5", 0.75" whole bivalve @ 1.3', (2.0" x 4.0") rock fragment @ 1.4', clay pockets up to 0.5" between 1.6' & 1.8', gray (2.5Y-5/1), (SW).		1	Sample #1, Depth = 0.9' Mean (mm): 0.26, Phi Sorting: 1.02 Fines (230): 1.47% Fines (200): 1.48% (SW)
-65.1	2.9		Sandy LEAN CLAY, very soft, trace organics, trace shell hash, trace silt, sand component is fine grained, quartz, sand distributed throughout layer and in pockets typically up to 1.75", shell hash and silt distributed in sand, 3.0" sand pocket @ 2.3', organic laminae between 2.6' & 2.9', very dark greenish gray (10Y-3/1), (CL).		T1	Sample #T1, Depth = 2.2' Shear Strength (kPa): 17.16
-68.1	5.9		LEAN CLAY, soft, trace sand, fine grained, quartz, trace shell fragments, trace silt, trace wood fragments, wood fragments distributed in laminae, 0.75" bivalve fragment @ 5.1', very dark greenish gray (10Y-3/1), (CL).		T2	Sample #T2, Depth = 4.6' Shear Strength (kPa): 29.42
-69.6	7.4		LEAN CLAY, firm, some sand, fine grained, quartz, trace silt, trace wood fragments, sand typically distributed throughout layer and in laminae, silt distributed in sand, (1.0" x 1.5") sand pocket @ 6.7', wood fragment lamina @ 7.4', very dark greenish gray (10Y-3/1), (CL).		T3	Sample #T3, Depth = 11.4' Shear Strength (kPa): 24.52
-79.9	17.7		LEAN CLAY, soft, trace sand, fine grained, quartz, trace shell fragments, trace silt, trace whole shells, trace wood fragments, whole shells increase with depth in layer, wood fragments distributed in laminae, whole shells are whole gastropods up to 0.75", 0.5" gastropod fragment @ 8.6', very dark greenish gray (10Y-3/1), (CL).		T4	Sample #T4, Depth = 16.0' Shear Strength (kPa): 36.77
-81.4	19.2		Organic LEAN CLAY, firm, organics increase with depth in layer, bit sample from 18.6' to 19.2', black (10YR-2/1), (OL).			
			End of Boring			

MA CZM VIBRACORES 2025 GPJ 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC12			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 04-17-25 04-17-25	
8. TOTAL DEPTH OF BORING 20.0 Ft.			16. ELEVATION TOP OF BORING -56.8 Ft.	
			17. TOTAL RECOVERY FOR BORING 11.4 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR SM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-56.8	0.0					
-58.9	2.1		SAND, very fine to fine grained, quartz, little clay, trace shell hash, trace silt, clay distributed in clayey pockets up to 1.0" and laminae, dark greenish gray (10Y-4/1), (SC).		1	Sample #1, Depth = 1.0' Mean (mm): 0.15, Phi Sorting: 1.13 Fines (230): 18.69% Fines (200): 19.17% (SC)
-63.3	6.5		Clayey SAND, fine grained, quartz, trace rock fragments, trace shell fragments, trace shell hash, trace silt, trace whole shells, clay increases with depth in layer, shell fragments are bivalve and gastropod fragments up to 1.0", 0.5" whole gastropod @ 5.8', 0.5" rock fragment @ 5.9', color grades from dark gray (5Y-4/1) to very dark greenish gray (10Y-3/1), (SC).			
-68.2	11.4		LEAN CLAY, very soft, some sand, fine grained, quartz, trace shell hash, trace silt, trace whole shells, sand decreases with depth in layer, (0.5" x 0.75") whole bivalve @ 9.4', bit sample from 11.3' to 11.4', very dark greenish gray (10Y-3/1), (CL).		T1	Sample #T1, Depth = 10.0' Shear Strength (kPa): 14.71
-76.8	20.0		No recovery.			
			End of Boring			

MA CZM VIBRACORES 2025 G.P.J. 7/22/25

DRILLING LOG		DIVISION		INSTALLATION		SHEET 1 OF 1 SHEETS	
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts				9. SIZE AND TYPE OF BIT 3.0 In.			
2. BORING DESIGNATION MA-CZM-2025-VC13				10. COORDINATE SYSTEM/DATUM MA State Plane Mainland		HORIZONTAL NAD 1983	
3. DRILLING AGENCY APTIM				11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		VERTICAL NAVD88	
4. NAME OF DRILLER APTIM				12. TOTAL SAMPLES 5			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				13. TOTAL NUMBER CORE BOXES			
6. THICKNESS OF OVERBURDEN 0.0 Ft.				14. ELEVATION GROUND WATER			
7. DEPTH DRILLED INTO ROCK 0.0 Ft.				15. DATE BORING 06-28-25			
8. TOTAL DEPTH OF BORING 18.8 Ft.				16. ELEVATION TOP OF BORING -121.7 Ft.			
				17. TOTAL RECOVERY FOR BORING 18.7 Ft.			
				18. SIGNATURE AND TITLE OF INSPECTOR MS			
ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve	
-121.7	0.0						
-125.5	3.8		SAND, fine grained, quartz, trace clay, trace gravel, subangular to subrounded, trace shell fragments, trace shell hash, trace silt, clay distributed in laminae, shell fragments are bivalve fragments up to 0.75", color is mottled dark greenish gray (10Y-4/1) and dark gray (5Y-4/1), (SW).		1	Sample #1, Depth = 2.4' Mean (mm): 0.21, Phi Sorting: 0.89 Fines (230): 5.55% Fines (200): 6.34% (SW-SM)	
-126.2	4.5		SAND, fine grained, quartz, some gravel, subrounded, trace rock fragments, trace shell hash, trace silt, rock fragments typically up to 2.25", (2.0" x 3.25") rock fragment @ 4.2", color is mottled dark greenish gray (10Y-4/1) and dark gray (5Y-4/1), (GW).		2	Sample #2, Depth = 4.1' Mean (mm): 2.71, Phi Sorting: 3.04 Fines (230): 2.46% Fines (200): 2.61% (GW)	
					3	Sample #3, Depth = 8.0' Mean (mm): 0.16, Phi Sorting: 0.55 Fines (230): 5.64% Fines (200): 6.63% (SP-SM)	
			SAND, fine grained, quartz, trace gravel, subrounded, trace organics, trace rock fragments, trace silt, silt decreases with depth in layer, organics distributed in laminae, (1.5" x 2.5") rock fragment @ 9.9", color grades from dark gray (5Y-4/1) to dark greenish gray (10Y-4/1), (SP-SM).		4	Sample #4, Depth = 12.8' Mean (mm): 0.15, Phi Sorting: 0.43 Fines (230): 4.42% Fines (200): 4.58% (SP)	
-137.2	15.5						
-139.4	17.7		SAND, fine grained, quartz, little clay, little silt, trace gravel, subrounded, trace organics, trace rock fragments, trace shell hash, organics distributed in laminae, rock fragments up to 1.0", color is mottled dark gray (5Y-4/1) and dark greenish gray (10Y-4/1), (SM-SC).		5	Sample #5, Depth = 16.0' Mean (mm): 0.18, Phi Sorting: 1.99 Fines (230): 21.58% Fines (200): 22.79% (SM-SC)	
-140.4	18.7		FAT CLAY, soft, trace sand, fine grained, quartz, trace shell hash, trace silt, bit sample from 18.5' to 18.7', dark greenish gray (10Y-4/1), (CH).				
-140.5	18.8		No recovery.				
			End of Boring				

MA_CZM_VIBRACORES_2025_GPL_7/22/25

DRILLING LOG		DIVISION		INSTALLATION		SHEET 1 OF 1 SHEETS	
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts				9. SIZE AND TYPE OF BIT 3.0 In.			
2. BORING DESIGNATION MA-CZM-2025-VC14				10. COORDINATE SYSTEM/DATUM MA State Plane Mainland		HORIZONTAL NAD 1983	
3. DRILLING AGENCY APTIM				11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		VERTICAL NAVD88	
4. NAME OF DRILLER APTIM				12. TOTAL SAMPLES			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				13. TOTAL NUMBER CORE BOXES		DISTURBED 4	
6. THICKNESS OF OVERBURDEN 0.0 Ft.				14. ELEVATION GROUND WATER		UNDISTURBED (UD) 0	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.				15. DATE BORING		STARTED 06-28-25	
8. TOTAL DEPTH OF BORING 17.9 Ft.				16. ELEVATION TOP OF BORING -105.3 Ft.		COMPLETED 06-28-25	
				17. TOTAL RECOVERY FOR BORING 18.8 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR MS	
ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve	
-105.3	0.0						
-107.1	1.8		SAND, fine to medium grained, quartz, trace gravel, subangular to subrounded, trace shell fragments, trace shell hash, trace silt, trace whole shells, shell fragments are bivalve fragments up to 1.0", whole shells are whole bivalves up to 1.0", color is mottled very dark gray (5Y-3/1) and dark gray (2.5Y-4/1), (SW)		1	Sample #1, Depth = 1.1' Mean (mm): 0.48, Phi Sorting: 1.09 Fines (230): 1.30% Fines (200): 1.32% (SW)	
					2	Sample #2, Depth = 6.6' Mean (mm): 0.55, Phi Sorting: 1.15 Fines (230): 1.14% Fines (200): 1.15% (SW)	
-116.9	11.6		SAND, fine to medium grained, quartz, trace clay, trace gravel, subangular to subrounded, trace shell fragments, trace shell hash, trace silt, trace whole shells, clay distributed in laminae, shell fragments are bivalve fragments up to 1.5", whole shells are whole bivalves typically up to 0.75", (2.0" x 2.5") whole bivalve @ 6.2', color is mottled dark gray (5Y-4/1) and very dark gray (N-3/0), (SW).		3	Sample #3, Depth = 13.2' Mean (mm): 0.33, Phi Sorting: 0.74 Fines (230): 1.76% Fines (200): 1.78% (SP)	
-121.0	15.7		SAND, fine grained, quartz, trace gravel, subangular to subrounded, trace shell fragments, trace shell hash, trace silt, shell fragments are bivalve fragments typically up to 1.0", (2.5" x 3.5") bivalve fragment @ 14.5', (1.25" x 2.5") bivalve fragment @ 14.6', (2.0" x 2.5") bivalve fragment @ 14.6', color grades from very dark gray (5Y-3/1) to dark gray (5Y-4/1), (SP).		4	Sample #4, Depth = 17.5' Mean (mm): 0.22, Phi Sorting: 1.08 Fines (230): 19.76% Fines (200): 20.11% (SC)	
-124.1	18.8		SAND, fine grained, quartz, little clay, trace shell fragments, trace shell hash, trace silt, shell fragments are bivalve fragments up to 1.5", bit sample from 18.6' to 18.8', expansion from 17.9' to 18.8', dark greenish gray (10Y-4/1), (SC).				
			End of Boring				

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC15			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 4 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 06-28-25 06-28-25	
8. TOTAL DEPTH OF BORING 17.1 Ft.			16. ELEVATION TOP OF BORING -71.4 Ft.	
			17. TOTAL RECOVERY FOR BORING 17.9 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-71.4	0.0					
-74.5	3.1		SAND, fine grained, quartz, trace shell hash, trace silt, color is mottled olive gray (5Y-4/2) and dark greenish gray (10Y-4/1), (SP).		1	Sample #1, Depth = 1.4' Mean (mm): 0.19, Phi Sorting: 0.54 Fines (230): 1.70% Fines (200): 1.72% (SP)
-80.9	9.5		SAND, fine grained, quartz, trace clay, trace gravel, subangular to subrounded, trace shell fragments, trace shell hash, trace silt, shell fragments and shell hash typically distributed throughout layer, shell fragments are bivalve fragments and echinoid (sand dollar) fragments typically up to 0.75", (1.5" x 3.0") shelly pockets @ 4.0' and 9.2', shell component is shell fragments and shell hash, (2.25" x 2.5") bivalve fragment @ 4.1', (0.5" x 3.0") clayey pocket @ 8.7', (1.25" x 2.0") bivalve fragment @ 9.2', color is mottled olive gray (5Y-4/2) and dark greenish gray (10Y-4/1), (SW).		2	Sample #2, Depth = 6.4' Mean (mm): 0.26, Phi Sorting: 1.27 Fines (230): 1.67% Fines (200): 1.76% (SW)
-89.3	17.9		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, silt increases with depth in layer, clay distributed in laminae, shell fragments are bivalve and echinoid (sand dollar) fragments up to 2.0", expansion from 17.1' to 17.9', color is mottled dark gray (5Y-4/1) and dark greenish gray (10Y-4/1), (SP).		3	Sample #3, Depth = 12.6' Mean (mm): 0.19, Phi Sorting: 0.58 Fines (230): 3.63% Fines (200): 3.75% (SP)
					4	Sample #4, Depth = 15.5' Mean (mm): 0.19, Phi Sorting: 0.64 Fines (230): 4.34% Fines (200): 4.54% (SP)
			End of Boring			

MA_CZM_VIBRACORES_2025_GPJ_7/22/25

DRILLING LOG		DIVISION		INSTALLATION		SHEET 1 OF 1 SHEETS	
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts				9. SIZE AND TYPE OF BIT 3.0 In.			
2. BORING DESIGNATION MA-CZM-2025-VC16				10. COORDINATE SYSTEM/DATUM MA State Plane Mainland		HORIZONTAL NAD 1983	
3. DRILLING AGENCY APTIM				11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		VERTICAL NAVD88	
4. NAME OF DRILLER APTIM				12. TOTAL SAMPLES 3			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				13. TOTAL NUMBER CORE BOXES			
6. THICKNESS OF OVERBURDEN 0.0 Ft.				14. ELEVATION GROUND WATER			
7. DEPTH DRILLED INTO ROCK 0.0 Ft.				15. DATE BORING 06-28-25			
8. TOTAL DEPTH OF BORING 17.2 Ft.				16. ELEVATION TOP OF BORING -65.9 Ft.			
				17. TOTAL RECOVERY FOR BORING 17.7 Ft.			
				18. SIGNATURE AND TITLE OF INSPECTOR MS			
ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve	
-65.9	0.0						
-68.9	3.0		SAND, fine grained, quartz, trace shell hash, trace silt, color is mottled dark gray (5Y-4/1) and dark greenish gray (10Y-4/1), (SP).		1	Sample #1, Depth = 1.4' Mean (mm): 0.20, Phi Sorting: 0.66 Fines (230): 1.95% Fines (200): 2.01% (SP)	
-76.1	10.2		SAND, fine grained, quartz, trace gravel, subrounded, trace shell fragments, trace shell hash, trace silt, shell fragments are bivalve fragments up to 0.75", color is mottled dark gray (5Y-4/1) and dark greenish gray (10Y-4/1), (SP).		2	Sample #2, Depth = 6.0' Mean (mm): 0.25, Phi Sorting: 0.77 Fines (230): 1.39% Fines (200): 1.42% (SP)	
-82.6	16.7		SAND, fine grained, quartz, trace clay, trace gravel, subrounded, trace shell fragments, trace shell hash, trace silt, clay distributed in laminae, shell fragments are bivalve fragments up to 0.75", color is mottled dark gray (5Y-4/1) and dark greenish gray (10Y-4/1), (SP).		3	Sample #3, Depth = 13.4' Mean (mm): 0.20, Phi Sorting: 0.76 Fines (230): 3.48% Fines (200): 3.57% (SP)	
-83.6	17.7		SAND, fine grained, quartz, little silt, trace clay, trace shell fragments, trace shell hash, shell fragments are bivalve fragments typically up to 0.5", (1.0" x 1.25") bivalve fragment @ 16.7", (1.0" x 1.5") bivalve fragment @ 16.7", (1.75" x 2.0") bivalve fragment @ 16.8", (1.5" x 1.75") bivalve fragment @ 16.8, bit sample from 17.4' to 17.7', expansion from 17.2' to 17.7', very dark greenish gray (10Y-3/1), (SM).				
			End of Boring				

MA CZM VIBRACORES 2025 GPJ 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC17			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER ☐ MANUAL HAMMER APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 2 2	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 06-28-25 06-28-25	
8. TOTAL DEPTH OF BORING 19.3 Ft.			16. ELEVATION TOP OF BORING -46.2 Ft.	
			17. TOTAL RECOVERY FOR BORING 19.3 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-46.2	0.0					
			SAND, fine to medium grained, quartz, trace clay, trace gravel, subrounded, trace shell fragments, trace shell hash, trace silt, shell fragments and shell hash typically distributed throughout layer, shell fragments are bivalve, gastropod, and echinoid (sand dollar) fragments up to 1.25", 3.0" shelly pocket @ 2.3', shell component is shell hash and shell fragments, clay lamina @ 5.1', gravel distributed between 7.0' & 7.6', dark greenish gray (10Y-4/1), (SP).		1	Sample #1, Depth = 3.5' Mean (mm): 0.28, Phi Sorting: 0.57 Fines (230): 2.77% Fines (200): 2.78% (SP)
-53.8	7.6					
-54.4	8.2		SAND, medium to coarse grained, quartz, some gravel, subangular to subrounded, trace clay, trace rock fragments, trace shell fragments, trace silt, trace whole shells, rock fragments up to 1.0", shell fragments are bivalve fragments typically up to 0.75", whole shells are whole gastropods up to 0.5", (2.0" x 3.0") bivalve fragment @ 8.0', dark greenish gray (10Y-4/1), (SW).		2	Sample #2, Depth = 7.9' Mean (mm): 1.30, Phi Sorting: 1.71 Fines (230): 1.85% Fines (200): 1.88% (SW)
			FAT CLAY, firm, trace sand, fine grained, quartz, trace silt, sand distributed in sandy pockets up to 2.0", silt distributed in sand, color is mottled dark gray (5Y-4/1) and dark grayish brown (2.5Y-4/2), (CH).		T1	Sample #T1, Depth = 10.5' Shear Strength (kPa): 44.13
-58.9	12.7					
			FAT CLAY, stiff, trace rock fragments, 0.5" rock fragment @ 18.2', bit sample from 19.0' to 19.3', color is mottled dark grayish brown (2.5Y-4/2) and dark gray (5Y-4/1), (CH).		T2	Sample #T2, Depth = 16.4' Shear Strength (kPa): 134.84
-65.5	19.3					
			End of Boring			

MA CZM VIBRACORES 2025 GPJ 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC18			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER APTIM SEAS VC-700 Vibracore ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES 5 DISTURBED 0 UNDISTURBED (UD) 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING 06-28-25 STARTED 06-28-25 COMPLETED 06-28-25	
8. TOTAL DEPTH OF BORING 19.5 Ft.			16. ELEVATION TOP OF BORING -43.2 Ft.	
			17. TOTAL RECOVERY FOR BORING 18.2 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR MS	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-43.2	0.0					
-48.4	5.2		SAND, fine to medium grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments are bivalve and echinoid (sand dollar) fragments up to 2.75", dark gray (5Y-4/1), (SP).		1	Sample #1, Depth = 2.8' Mean (mm): 0.47, Phi Sorting: 0.83 Fines (230): 1.09% Fines (200): 1.10% (SP)
-52.3	9.1		SAND, fine grained, quartz, trace clay, trace organics, trace shell fragments, trace shell hash, trace silt, organics distributed in laminae, shell fragments are bivalve and echinoid (sand dollar) fragments typically up to 0.75", (2.75" x 3.0") bivalve fragment @ 5.8', color grades from dark gray (5Y-4/1) to dark greenish gray (10Y-4/1), (SP-SM).		2	Sample #2, Depth = 7.0' Mean (mm): 0.18, Phi Sorting: 0.84 Fines (230): 8.72% Fines (200): 9.52% (SP-SM)
-55.8	12.6		SAND, fine grained, quartz, little clay, trace organics, trace shell fragments, trace shell hash, trace silt, clay distributed throughout layer and in laminae, organics distributed in laminae, shell fragments are bivalve fragments up to 1.0", (0.75" x 1.0") pocket of medium grained sand @ 11.3', dark greenish gray (10Y-4/1), (SC).		3	Sample #3, Depth = 11.0' Mean (mm): 0.15, Phi Sorting: 1.37 Fines (230): 22.33% Fines (200): 23.98% (SC)
-56.7	13.5		SAND, fine to medium grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, shell fragments are bivalve and echinoid (sand dollar) fragments up to 0.5", dark gray (5Y-4/1), (SW).		4	Sample #4, Depth = 13.0' Mean (mm): 0.32, Phi Sorting: 1.15 Fines (230): 8.23% Fines (200): 8.73% (SW-SM)
-59.9	16.7		SAND, fine grained, quartz, little clay, little silt, trace organics, trace shell fragments, trace shell hash, clay increases with depth in layer, organics distributed in laminae, shell fragments are bivalve fragments up to 0.75", dark greenish gray (10Y-4/1), (SM-SC).		5	Sample #5, Depth = 14.5' Mean (mm): 0.16, Phi Sorting: 1.01 Fines (230): 35.92% Fines (200): 38.68% (SM-SC)
-61.4	18.2		LEAN CLAY, firm, little sand, fine grained, quartz, trace shell hash, trace silt, dark greenish gray (10Y-4/1), (CL).			
-62.7	19.5		No recovery.			
			End of Boring			

MA CZM VIBRACORES 2025 GPJ 7/22/25

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts			9. SIZE AND TYPE OF BIT 3.0 In.	
2. BORING DESIGNATION MA-CZM-2025-VC19			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL ☐ AUTO HAMMER ☐ MANUAL HAMMER APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER APTIM			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 0 5	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN 0.0 Ft.			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.			15. DATE BORING STARTED COMPLETED 06-29-25 06-29-25	
8. TOTAL DEPTH OF BORING 17.7 Ft.			16. ELEVATION TOP OF BORING -89.1 Ft.	
			17. TOTAL RECOVERY FOR BORING 17.5 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR SF	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-89.1	0.0					
-93.0	3.9		Clayey SAND, fine grained, quartz, trace gravel, subangular to subrounded, trace rock fragments, trace shell fragments, trace silt, rock fragments up to 1.0", shell fragments are bivalve fragments typically up to 1.0", (1.75" x 2.0") bivalve fragment @ 2.6', (1.25" x 2.0") bivalve fragment @ 2.6', dark greenish gray (10Y-4/1), (SC).			
-99.6	10.5		FAT CLAY, soft, little sand, fine to medium grained, quartz, trace gravel, angular to subangular, trace organics, trace rock fragments, trace shell hash, trace silt, sand decreases with depth in layer, sand distributed in pockets up to 3.0", silt distributed in sand, rock fragments up to 0.75", dark gray (N-4/0), (CH).		T1	Sample #T1, Depth = 6.2' Shear Strength (kPa): 24.52
-104.9	15.8		FAT CLAY, soft, trace organics, trace shell fragments, trace shell hash, trace silt, silt distributed in laminae, shell fragments are bivalve fragments typically up to 0.5", shell hash and shell fragments distributed between 13.2' & 13.6', 2.0" bivalve fragment @ 13.3', color is mottled dark gray (N-4/0) and dark greenish gray (10Y-4/1), (CH).		T2	Sample #T2, Depth = 9.9' Shear Strength (kPa): 34.32
-106.6	17.5		FAT CLAY, firm, little organics, bit sample from 17.3' to 17.5', color grades from dark gray (5Y-4/1) to dark gray (N-4/0), (CH).		T3	Sample #T3, Depth = 10.9' Shear Strength (kPa): 24.52
-106.8	17.7		No recovery.		T4	Sample #T4, Depth = 15.3' Shear Strength (kPa): 29.42
			End of Boring		T5	Sample #T5, Depth = 16.5' Shear Strength (kPa): 49.03

MA CZM VIBRACORES 2025 G.P. 7/22/25

DRILLING LOG		DIVISION		INSTALLATION		SHEET 1	
1. PROJECT Preliminary Characterization of Offshore Sand Resources, Massachusetts				9. SIZE AND TYPE OF BIT 3.0 In.			
2. BORING DESIGNATION MA-CZM-2025-VC20				10. COORDINATE SYSTEM/DATUM MA State Plane Mainland		HORIZONTAL NAD 1983	VERTICAL NAVD88
3. DRILLING AGENCY APTIM				11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		☐ AUTO HAMMER ☐ MANUAL HAMMER	
4. NAME OF DRILLER APTIM				12. TOTAL SAMPLES 3		UNDISTURBED (UD) 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER	
6. THICKNESS OF OVERBURDEN 0.0 Ft.				15. DATE BORING 06-29-25		COMPLETED 06-29-25	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.				16. ELEVATION TOP OF BORING -52.1 Ft.		17. TOTAL RECOVERY FOR BORING 15.5 Ft.	
8. TOTAL DEPTH OF BORING 18.2 Ft.				18. SIGNATURE AND TITLE OF INSPECTOR MS			

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS USCS classification system defines silt as the percent passing the No.200 (0.075 mm) sieve
-52.1	0.0					
-55.0	2.9		SAND, fine grained, quartz, trace clay, trace gravel, subrounded, trace rock fragments, trace shell fragments, trace shell hash, trace silt, clay distributed throughout layer and in laminae, rock fragments up to 1.25", shell fragments are bivalve fragments up to 0.5", dark gray (5Y-4/1), (SW).		1	Sample #1, Depth = 1.8' Mean (mm): 0.31, Phi Sorting: 1.40 Fines (230): 9.74% Fines (200): 10.01% (SW-SM)
-55.8	3.7		SAND, fine to medium grained, quartz, some gravel, subrounded, little rock fragments, trace silt, rock fragments up to 3.25", color is mottled dark gray (5Y-4/1) and gray (N-5/0), (GW).		2	Sample #2, Depth = 3.3' Mean (mm): 2.89, Phi Sorting: 2.50 Fines (230): 3.72% Fines (200): 3.75% (GW)
-62.4	10.3		SAND, fine grained, quartz, trace clay, trace gravel, subrounded, trace shell fragments, trace shell hash, trace silt, clay distributed in laminae, shell fragments are bivalve fragments typically up to 1.25", (1.75" x 2.0") bivalve fragment @ 5.0', gray (N-5/0), (SP).		3	Sample #3, Depth = 7.5' Mean (mm): 0.24, Phi Sorting: 0.57 Fines (230): 1.80% Fines (200): 1.83% (SP)
-67.6	15.5		Clayey SAND, fine grained, quartz, trace gravel, subangular to subrounded, trace shell hash, trace silt, clay distributed throughout layer, in pockets up to 3.0", and in laminae, bit sample from 15.4' to 15.5', dark greenish gray (10Y-4/1), (SC).			
-70.3	18.2		No recovery.			
			End of Boring			

Appendix F

2025 APTIM Vibracore Photographs



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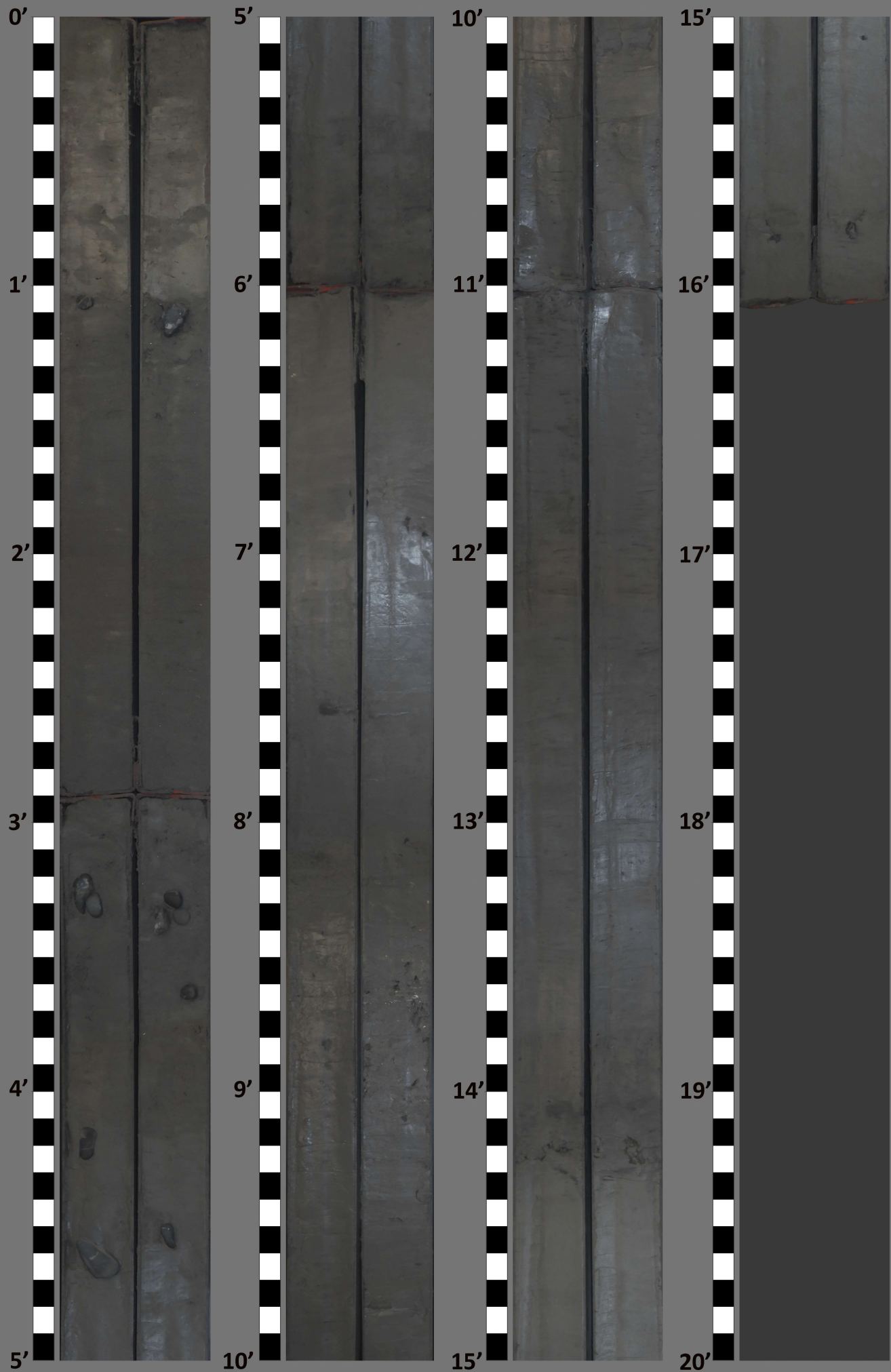
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC01

Date Collected: 04/14/2025
Top Elev. (ft NAVD88): -112.3
Bottom Elev. (ft NAVD88): -128.3
Core Length (ft): 16.0



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MA-CZM-2025-VC02

Date Collected: 04/14/2025
Top Elev. (ft NAVD88): -135.6
Bottom Elev. (ft NAVD88): -148.1
Core Length (ft): 12.5



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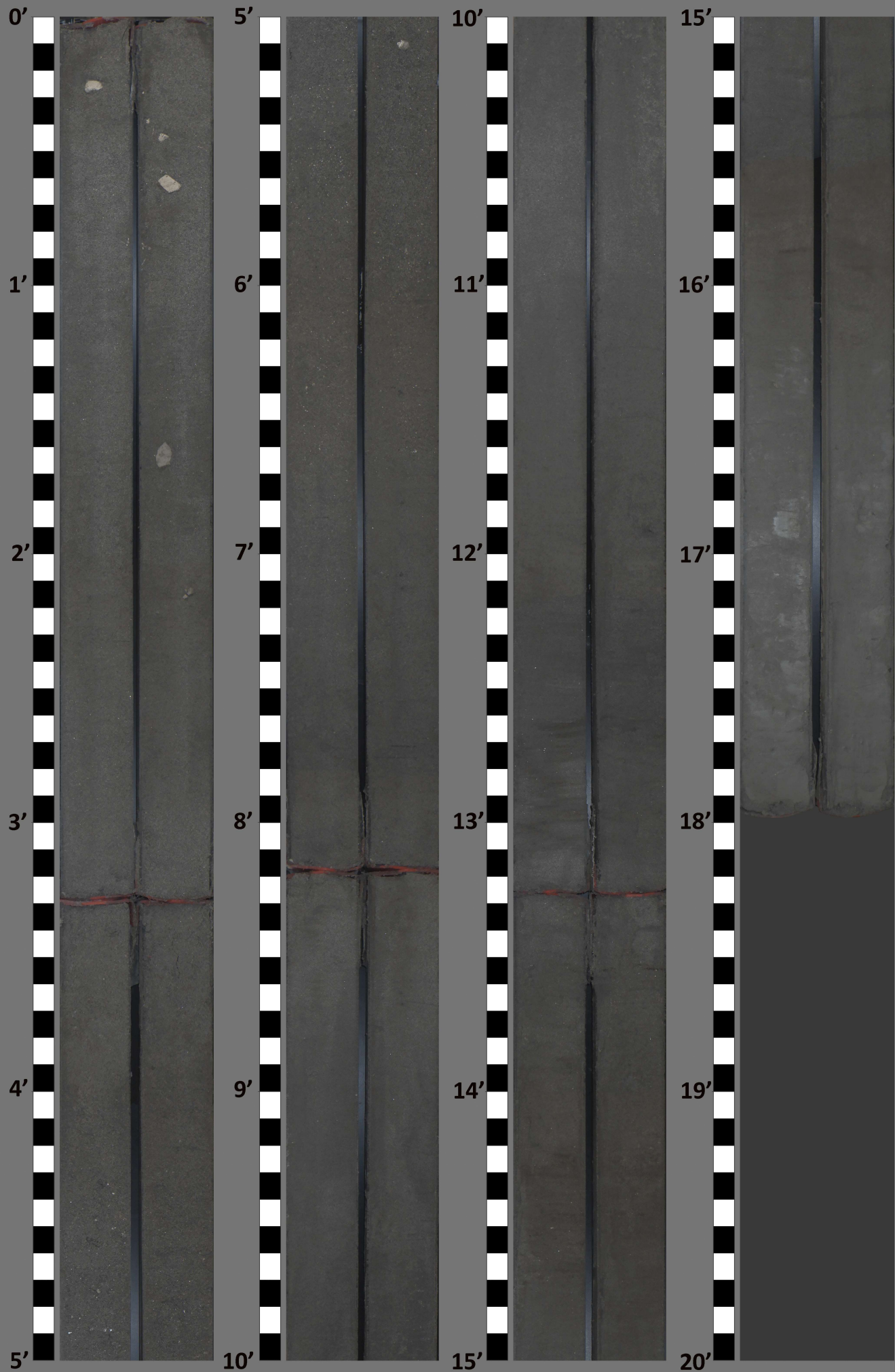
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC03

Date Collected: 04/14/2025
Top Elev. (ft NAVD88): -56.2
Bottom Elev. (ft NAVD88): -74.1
Core Length (ft): 17.9



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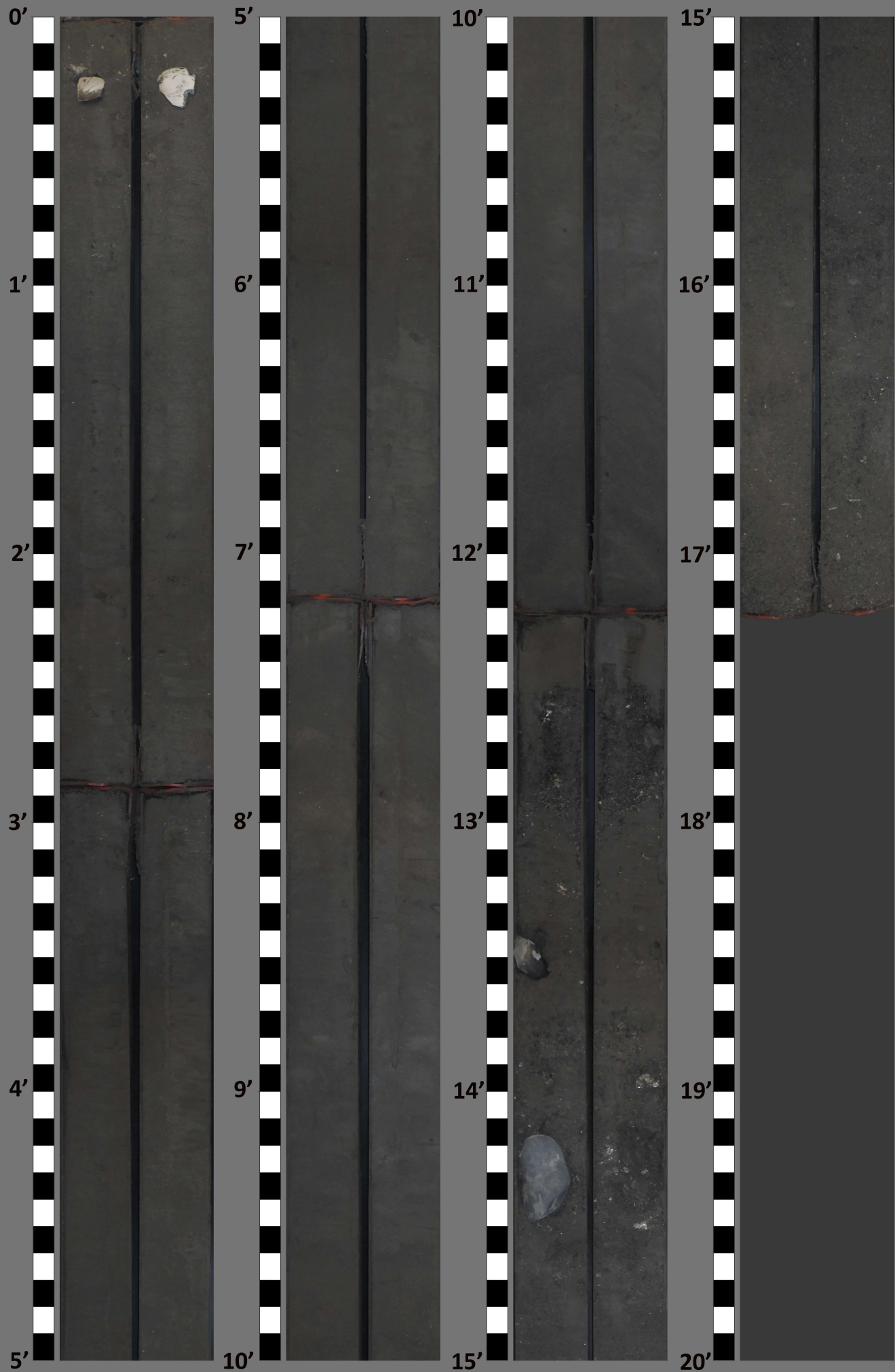
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC04

Date Collected: 04/14/2025
Top Elev. (ft NAVD88): -45.0
Bottom Elev. (ft NAVD88): -62.2
Core Length (ft): 17.2



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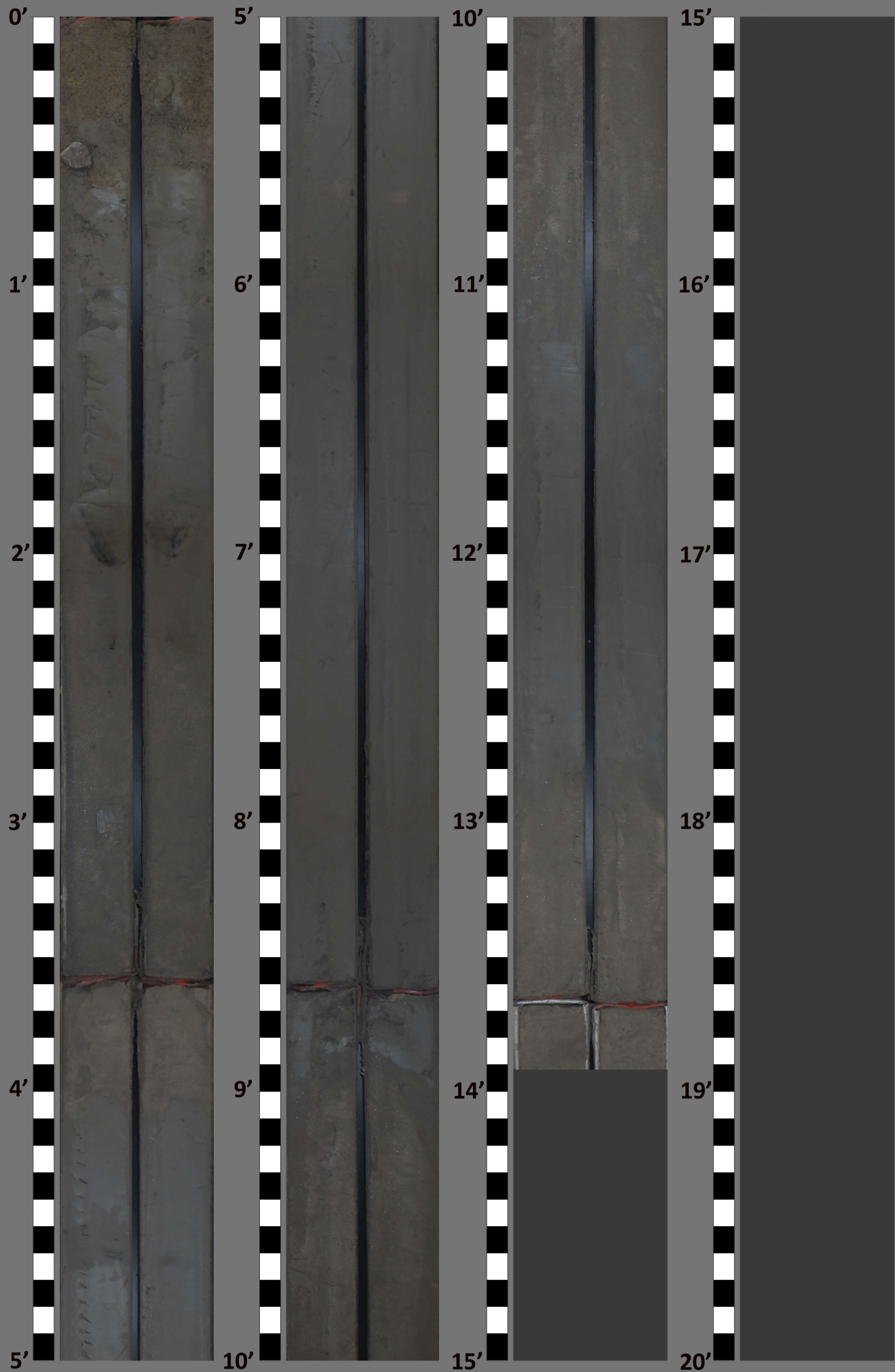
Preliminary
Characterization
of Offshore
Sand Resources

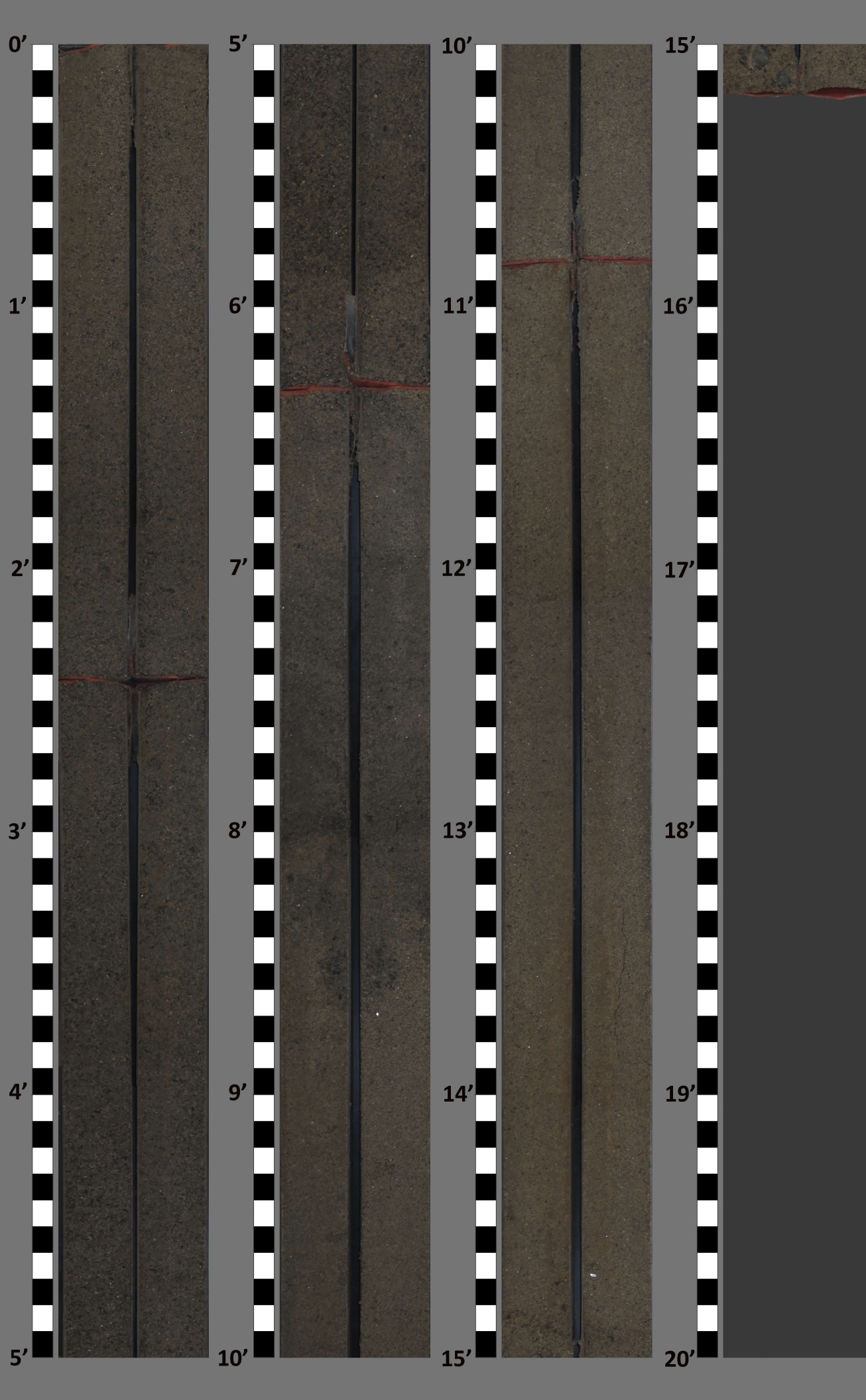
MA-CZM-2025-VC05

Date Collected: 04/15/2025
Top Elev. (ft NAVD88): -108.1
Bottom Elev. (ft NAVD88): -122.0
Core Length (ft): 13.9



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MA-CZM-2025-VC06

Date Collected: 04/15/2025
Top Elev. (ft NAVD88): -85.5
Bottom Elev. (ft NAVD88): -100.7
Core Length (ft): 15.2



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Date Collected: 04/15/2025
Top Elev. (ft NAVD88): -92.1
Bottom Elev. (ft NAVD88): -103.7
Core Length (ft): 11.6



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MA-CZM-2025-VC08

Date Collected: 04/15/2025
Top Elev. (ft NAVD88): -89.1
Bottom Elev. (ft NAVD88): -106.0
Core Length (ft): 16.9



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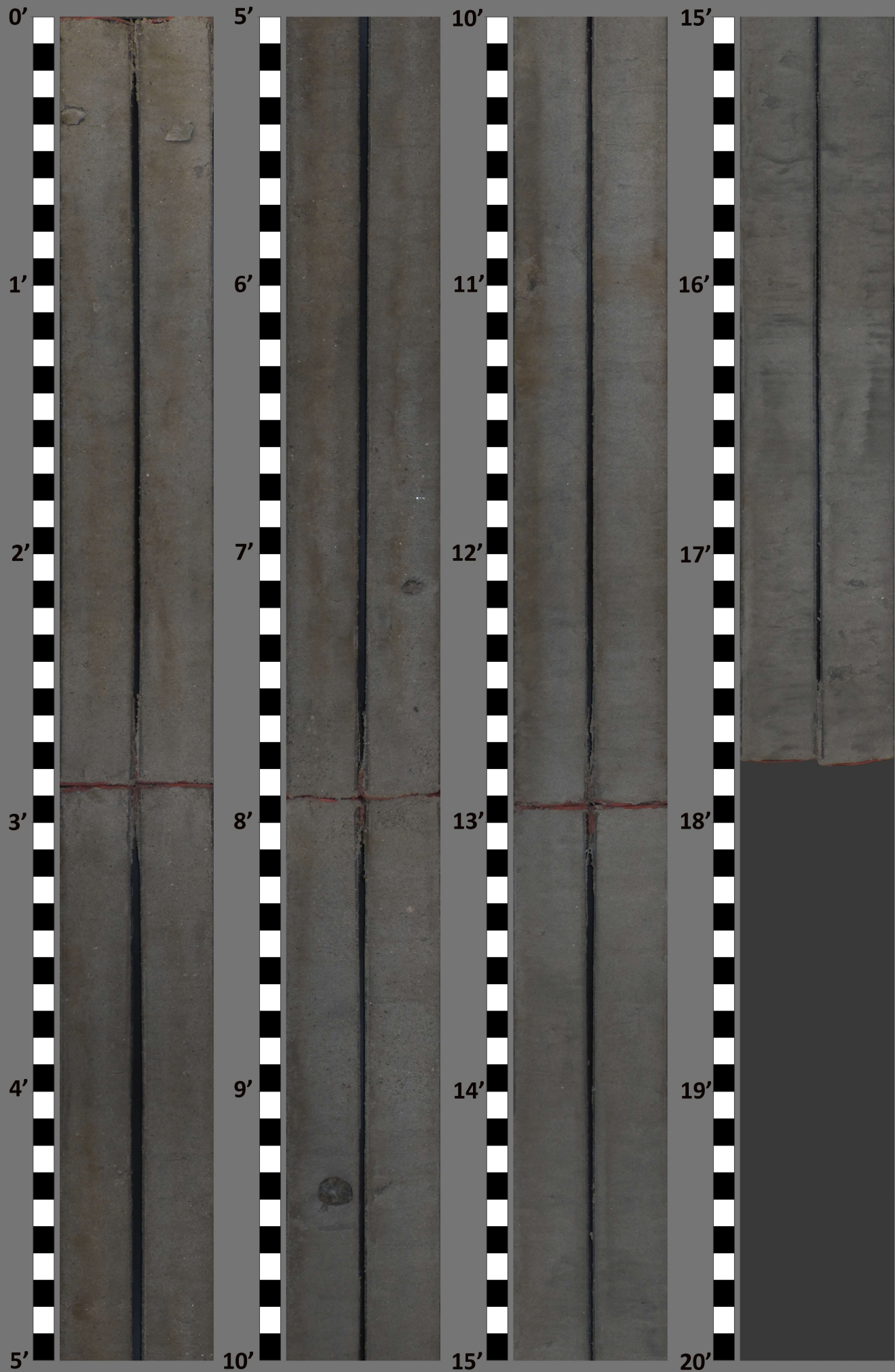
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC09

Date Collected: 04/17/2025
Top Elev. (ft NAVD88): -63.8
Bottom Elev. (ft NAVD88): -81.5
Core Length (ft): 17.7



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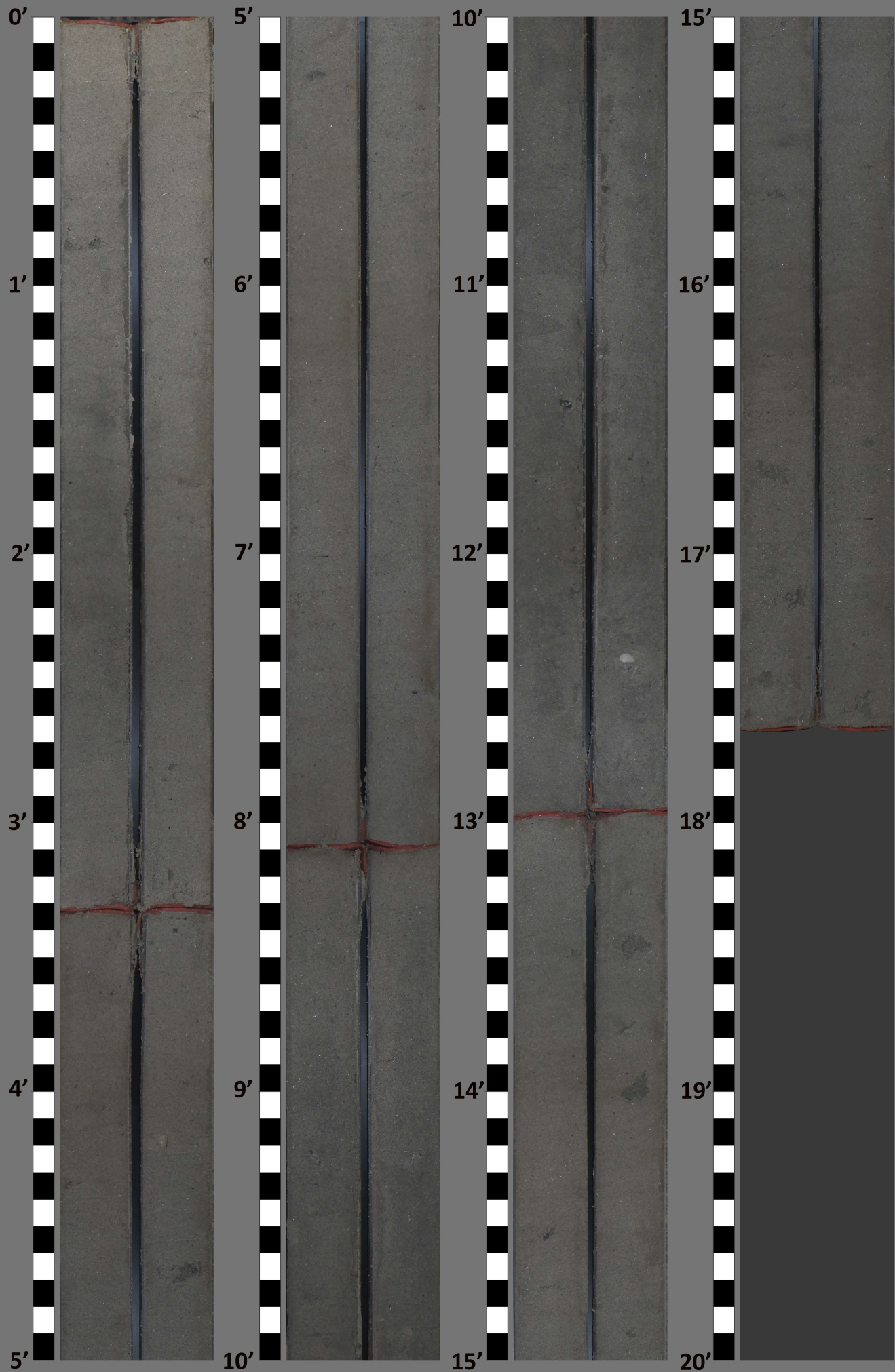
Preliminary
Characterization
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Sand Resources

MA-CZM-2025-VC10

Date Collected: 04/17/2025
Top Elev. (ft NAVD88): -66.2
Bottom Elev. (ft NAVD88): -83.8
Core Length (ft): 17.6



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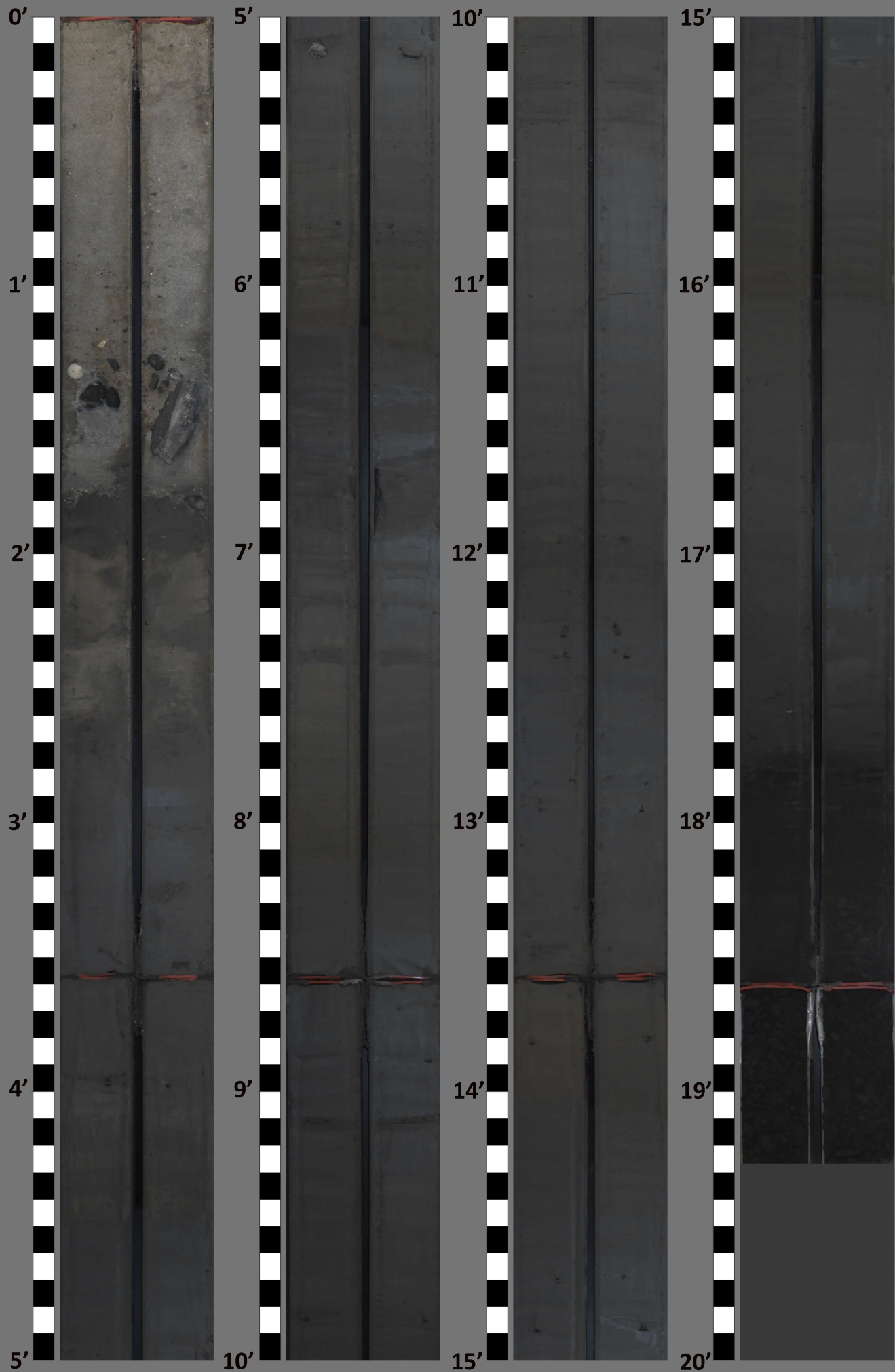
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC11

Date Collected: 04/17/2025
Top Elev. (ft NAVD88): -62.2
Bottom Elev. (ft NAVD88): -81.4
Core Length (ft): 19.2



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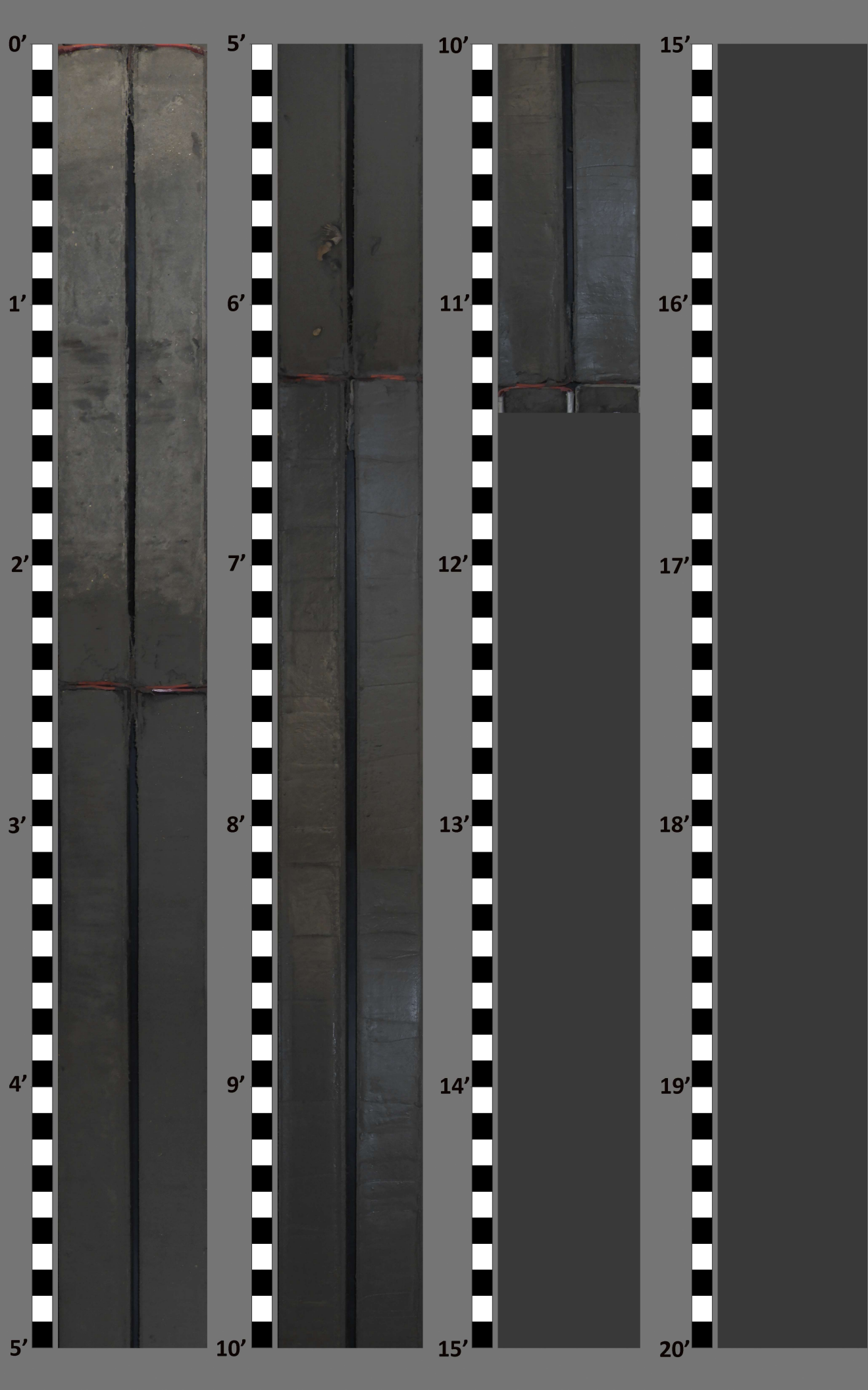
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC12

Date Collected: 04/17/2025
Top Elev. (ft NAVD88): -56.8
Bottom Elev. (ft NAVD88): -68.2
Core Length (ft): 11.4



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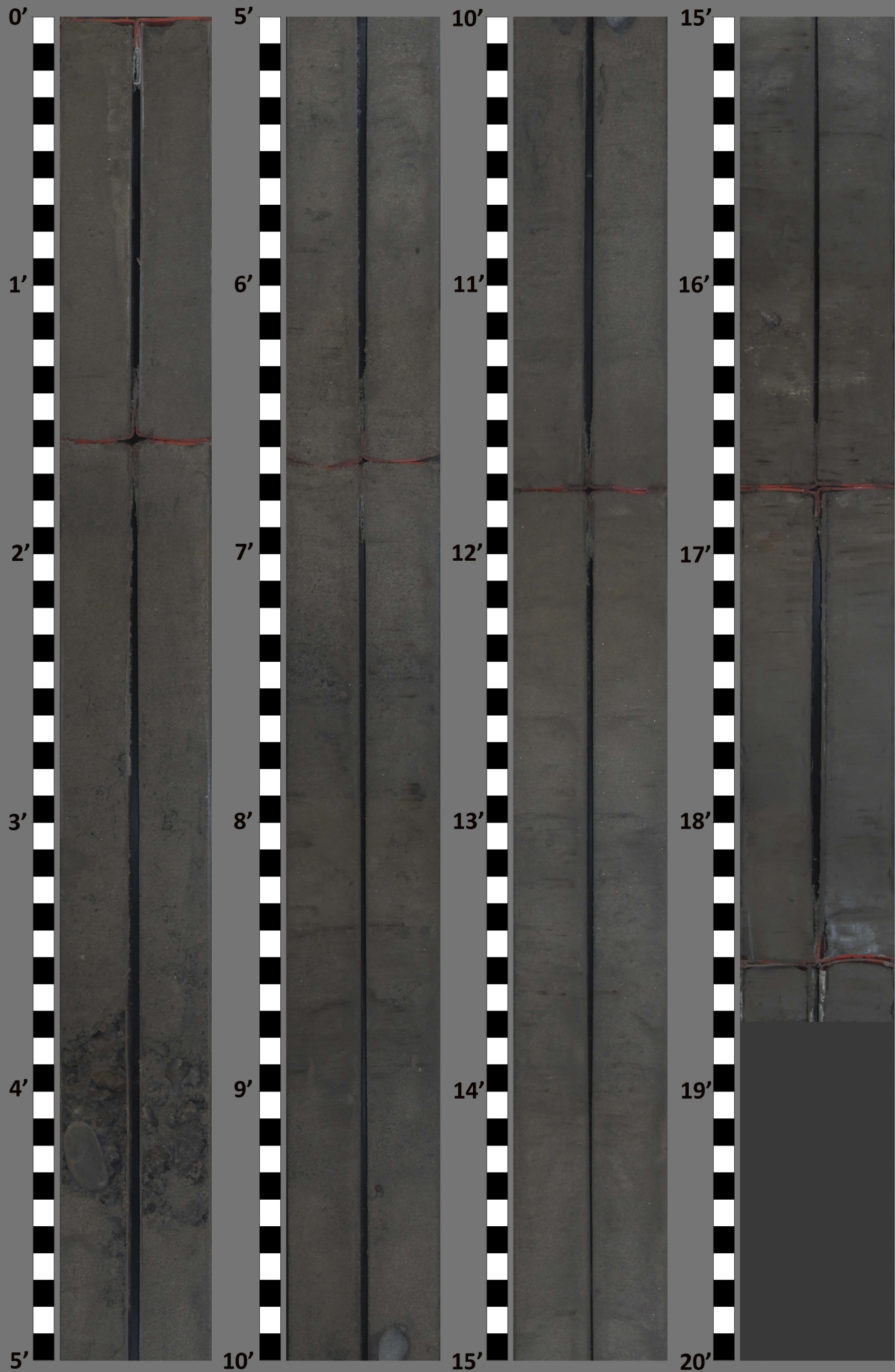
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC13

Date Collected: 06/28/2025
Top Elev. (ft NAVD88): -121.7
Bottom Elev. (ft NAVD88): -140.4
Core Length (ft): 18.7



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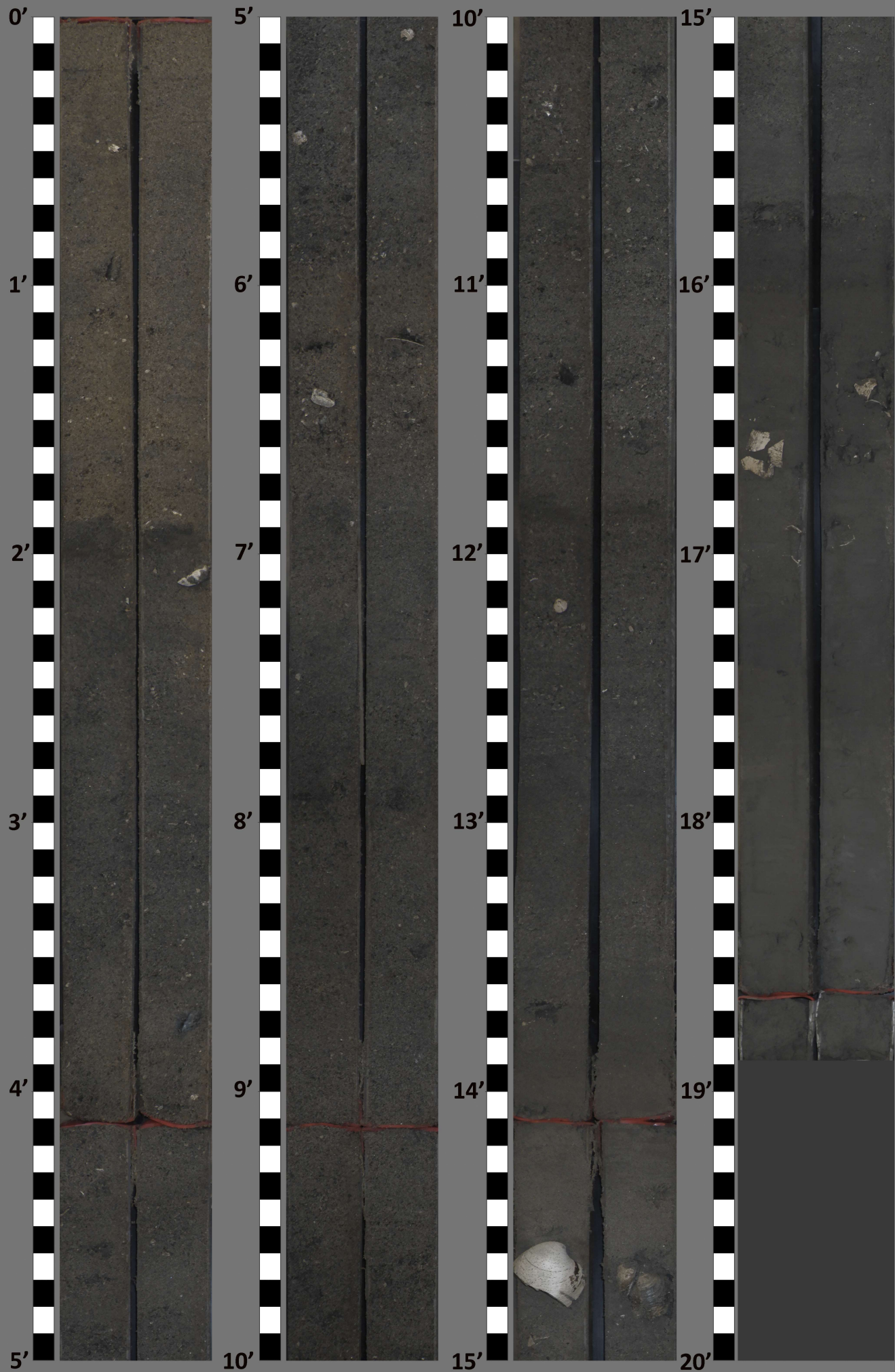
Preliminary
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Sand Resources

MA-CZM-2025-VC14

Date Collected: 06/28/2025
Top Elev. (ft NAVD88): -105.3
Bottom Elev. (ft NAVD88): -124.1
Core Length (ft): 18.8



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MA-CZM-2025-VC15

Date Collected: 06/28/2025
Top Elev. (ft NAVD88): -71.4
Bottom Elev. (ft NAVD88): -89.3
Core Length (ft): 17.9



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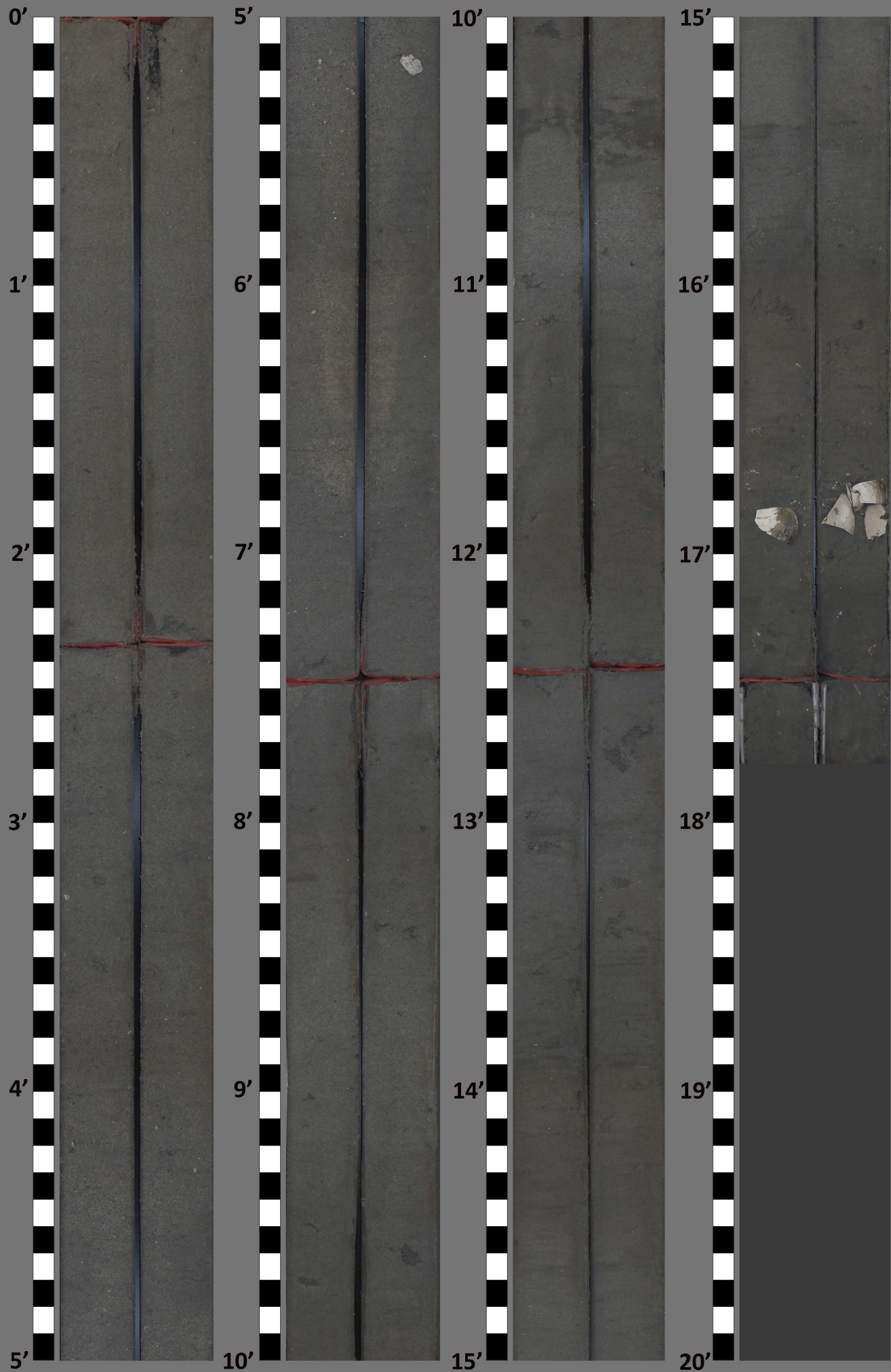
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC16

Date Collected: 06/28/2025
Top Elev. (ft NAVD88): -65.9
Bottom Elev. (ft NAVD88): -83.6
Core Length (ft): 17.7



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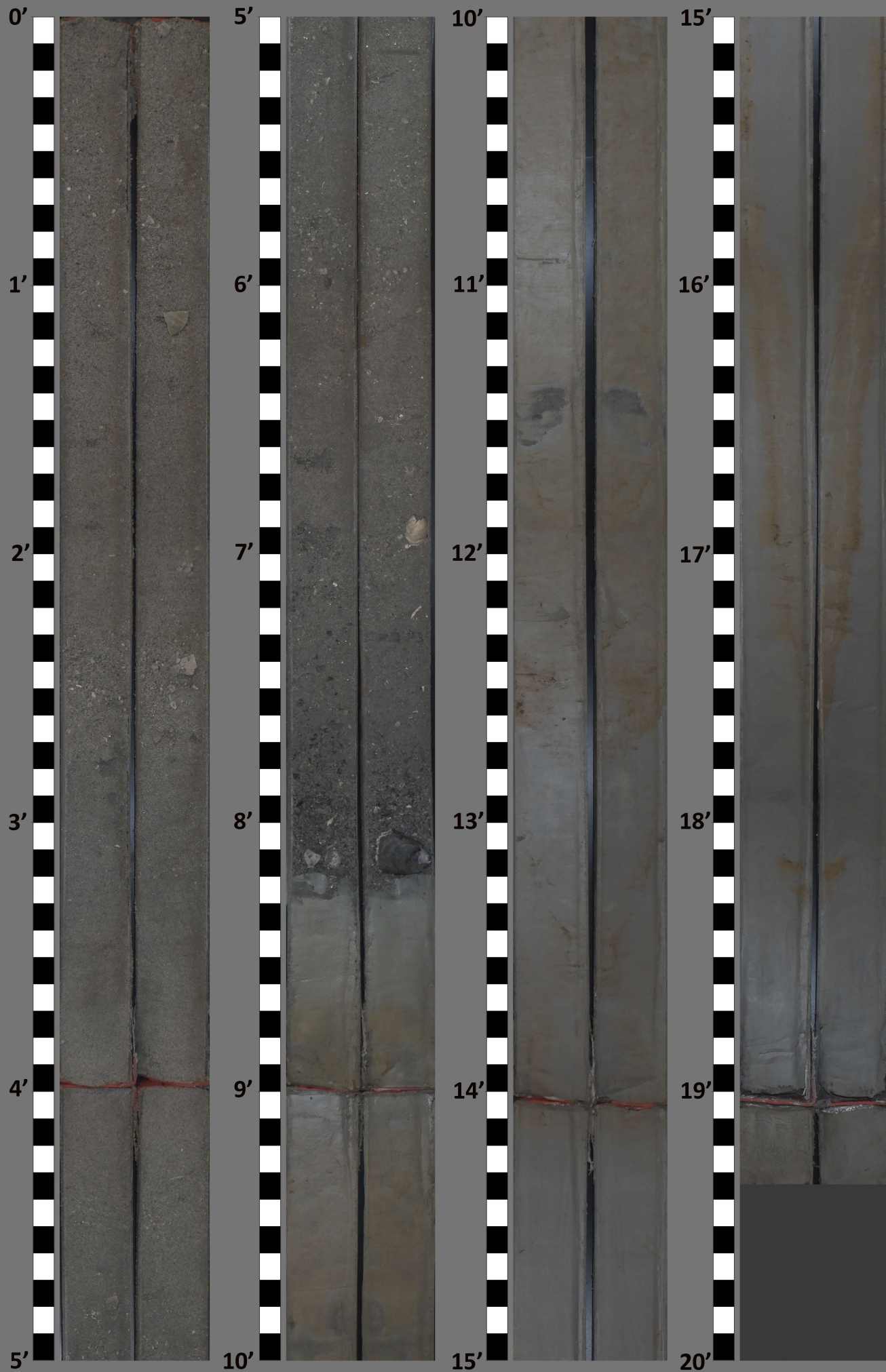
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC17

Date Collected: 06/28/2025
Top Elev. (ft NAVD88): -46.2
Bottom Elev. (ft NAVD88): -65.5
Core Length (ft): 19.3



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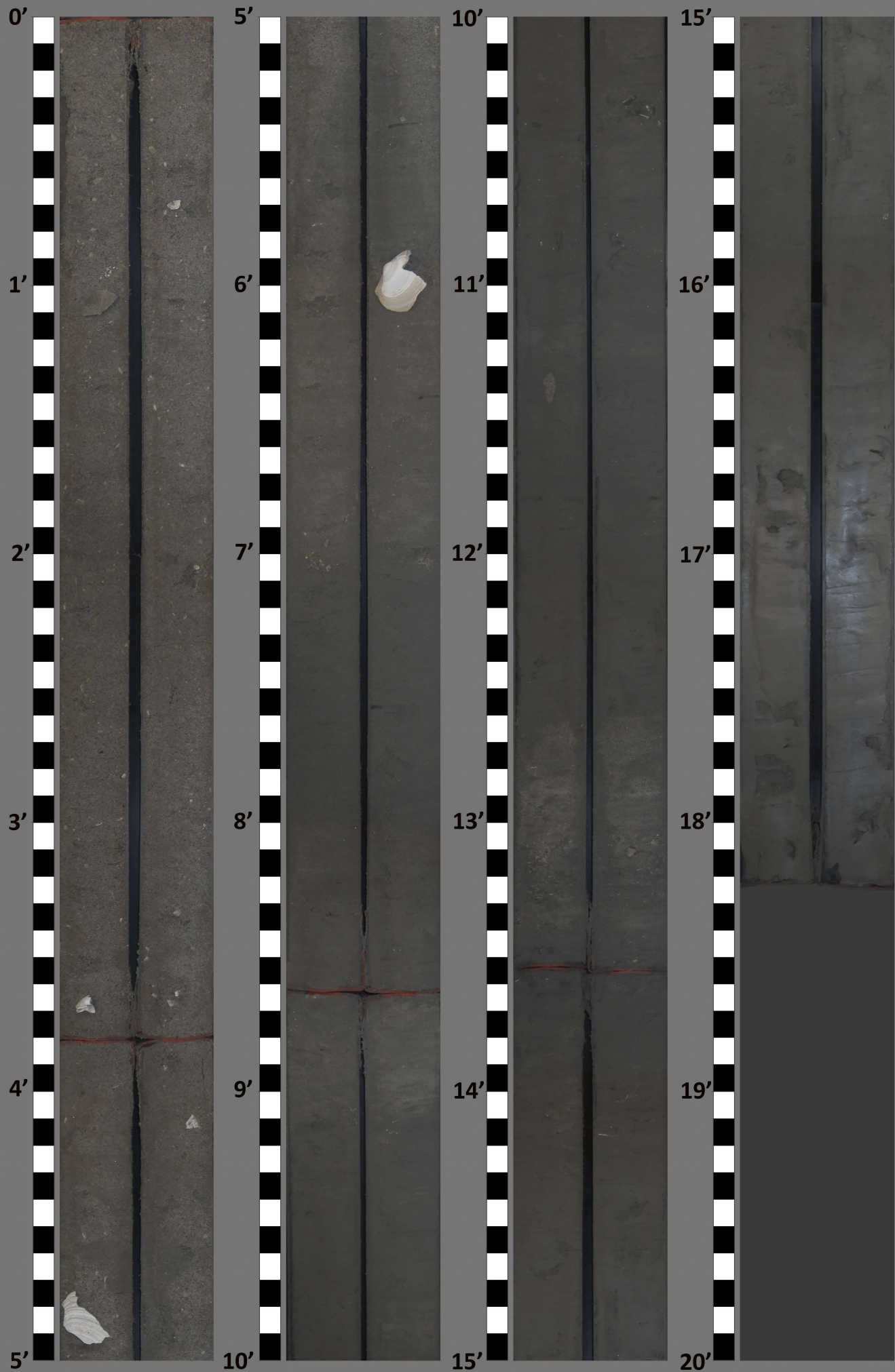
Preliminary
Characterization
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Sand Resources

MA-CZM-2025-VC18

Date Collected: 06/28/2025
Top Elev. (ft NAVD88): -43.2
Bottom Elev. (ft NAVD88): -61.4
Core Length (ft): 18.2



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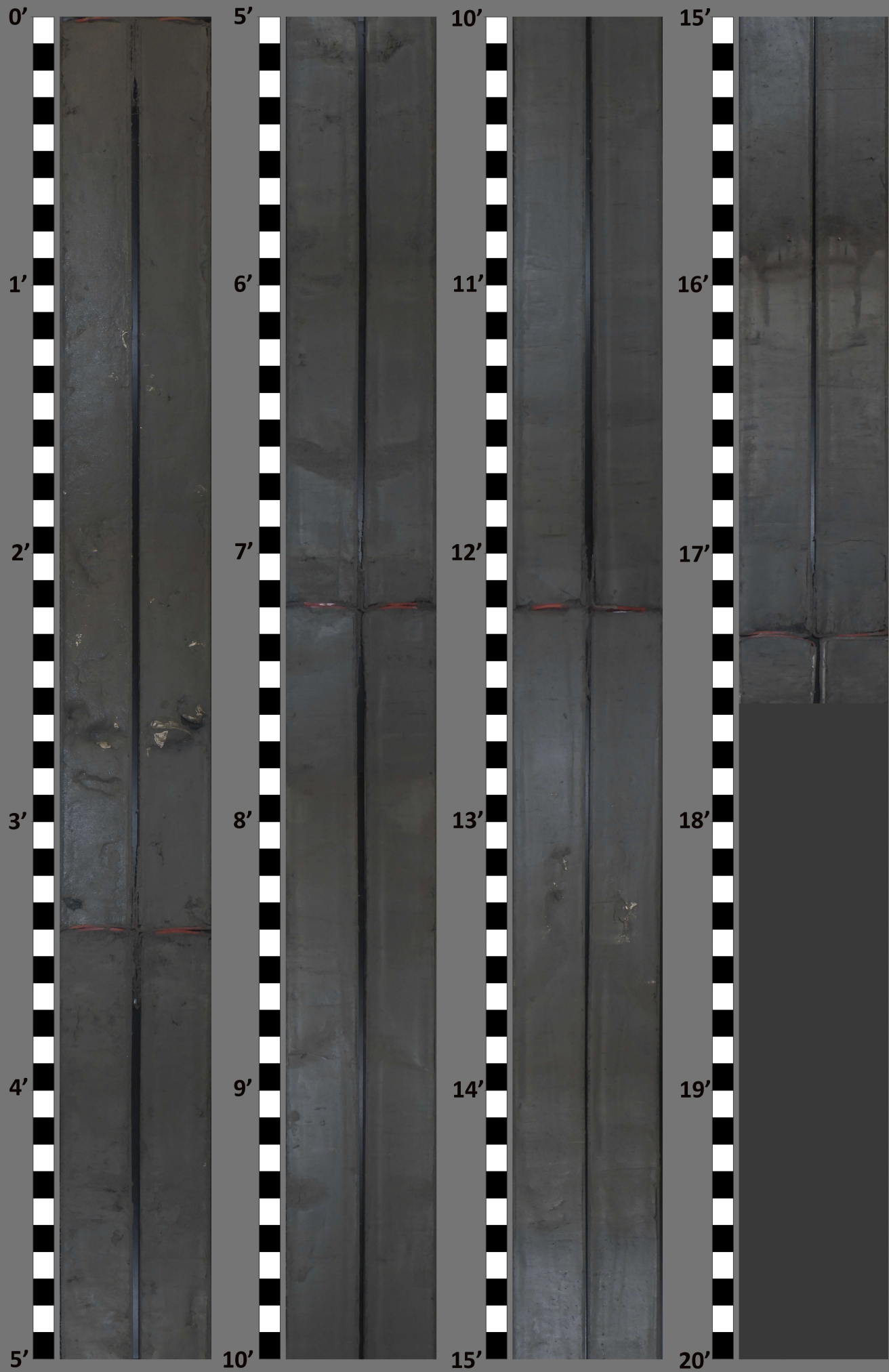
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC19

Date Collected: 06/29/2025
Top Elev. (ft NAVD88): -89.1
Bottom Elev. (ft NAVD88): -106.6
Core Length (ft): 17.5



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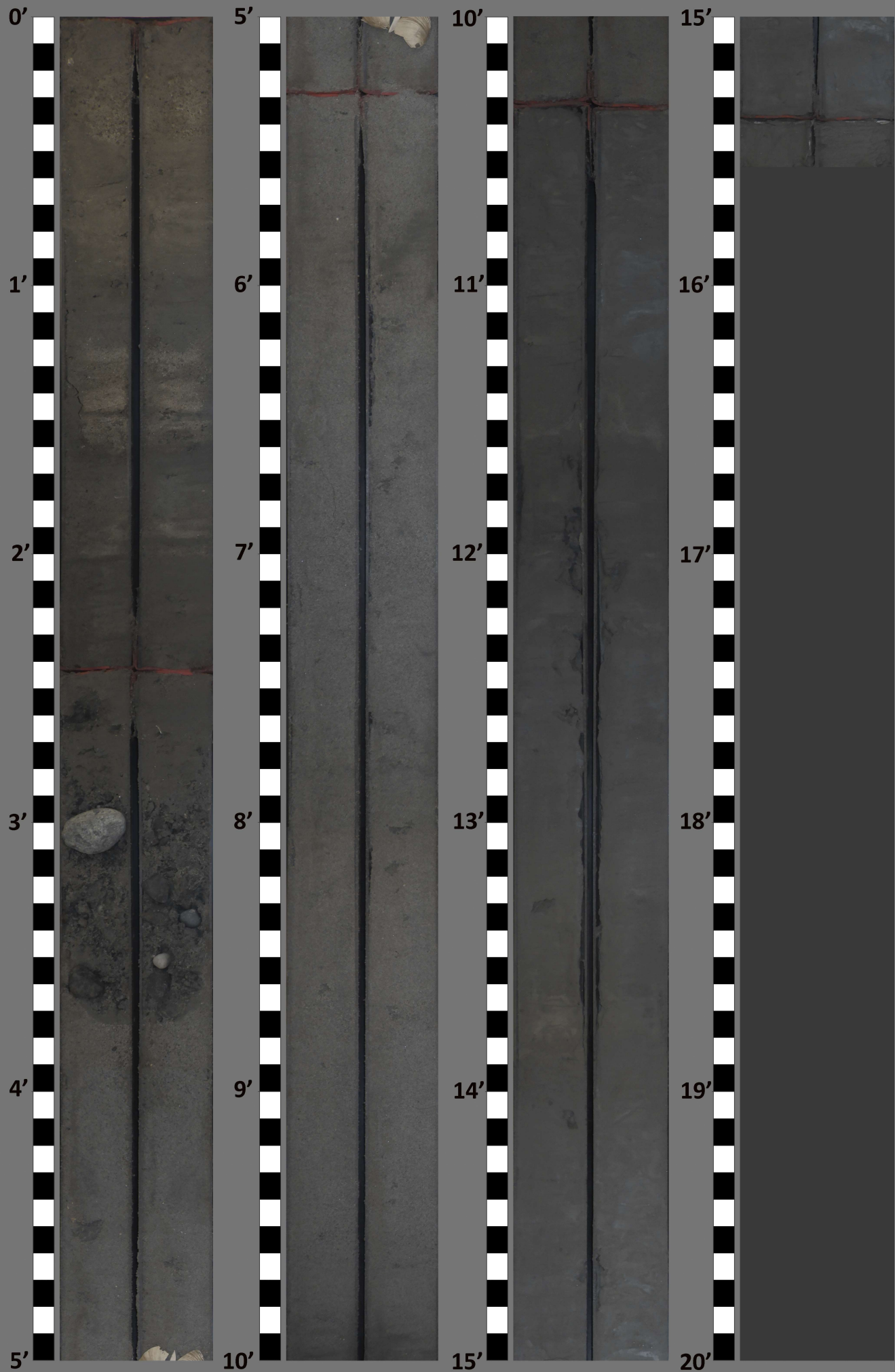
Preliminary
Characterization
of Offshore
Sand Resources

MA-CZM-2025-VC20

Date Collected: 06/29/2025
Top Elev. (ft NAVD88): -52.1
Bottom Elev. (ft NAVD88): -67.6
Core Length (ft): 15.5



6401 Congress Avenue, Suite 140
Boca Raton, FL 33487
www.aptim.com
(561)391-8102



Appendix G

2025 APTIM Individual Vibracore Granularmetric Report



MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC01 #1								
Analysis Date: 04-29-25								
Analyzed By: TJ								
Easting (ft): 857,676		Northing (ft): 2,948,696		Coordinate System: MA State Plane Mainland		Elevation (ft): -114.5 NAVD88		
USCS: SM		Munsell: Wet - 10Y-4/1 Dry - 5Y-5/1 Washed - 5Y-6/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 89.20	Wash Weight (g): 68.89	Pan Retained (g): 1.24	Sieve Loss (%): 0.11	Fines (%): #200 - 28.47 #230 - 24.27	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.22	0.25	0.22	0.25		
7	-1.50	2.83	0.03	0.03	0.25	0.28		
10	-1.00	2.00	0.21	0.24	0.46	0.52		
14	-0.50	1.41	0.22	0.25	0.68	0.77		
18	0.00	1.00	0.22	0.25	0.90	1.02		
25	0.50	0.71	0.28	0.31	1.18	1.33		
35	1.00	0.50	0.63	0.71	1.81	2.04		
45	1.50	0.35	0.80	0.90	2.61	2.94		
60	2.00	0.25	1.82	2.04	4.43	4.98		
80	2.50	0.18	3.42	3.83	7.85	8.81		
120	3.00	0.13	19.72	22.11	27.57	30.92		
170	3.50	0.09	29.69	33.28	57.26	64.20		
200	3.75	0.07	6.54	7.33	63.80	71.53		
230	4.00	0.06	3.75	4.20	67.55	75.73		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
		3.96	3.29	2.87	2.66	2.00		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.97	0.13	0.74	-3.06	17.16			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC03 #1								
Analysis Date: 04-30-25								
Analyzed By: TJ								
Easting (ft): 836,453		Northing (ft): 2,935,772		Coordinate System: MA State Plane Mainland		Elevation (ft): -58.6 NAVD88		
USCS: SP		Munsell: Wet - N-4/0 Dry - N-6/0 Washed - N-6/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 96.69	Wash Weight (g): 95.26	Pan Retained (g): 0.00	Sieve Loss (%): 0.09	Fines (%): #200 - 1.61 #230 - 1.58	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 2
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.01	0.01	0.01	0.01		
5	-2.00	4.00	0.03	0.03	0.04	0.04		
7	-1.50	2.83	0.01	0.01	0.05	0.05		
10	-1.00	2.00	0.01	0.01	0.06	0.06		
14	-0.50	1.41	0.02	0.02	0.08	0.08		
18	0.00	1.00	0.02	0.02	0.10	0.10		
25	0.50	0.71	0.08	0.08	0.18	0.18		
35	1.00	0.50	0.20	0.21	0.38	0.39		
45	1.50	0.35	2.56	2.65	2.94	3.04		
60	2.00	0.25	26.53	27.44	29.47	30.48		
80	2.50	0.18	48.86	50.53	78.33	81.01		
120	3.00	0.13	15.14	15.66	93.47	96.67		
170	3.50	0.09	1.57	1.62	95.04	98.29		
200	3.75	0.07	0.10	0.10	95.14	98.39		
230	4.00	0.06	0.03	0.03	95.17	98.42		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.95	2.60	2.44	2.19	1.90	1.74	1.54		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.17	0.22	0.42	-0.73	10.45			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC03 #2								
Analysis Date: 04-28-25								
Analyzed By: TJ								
Easting (ft): 836,453		Northing (ft): 2,935,772		Coordinate System: MA State Plane Mainland		Elevation (ft): -62.2 NAVD88		
USCS: SP		Munsell: Wet - N-4/0 Dry - N-5/0 Washed - N-6/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 97.81	Wash Weight (g): 95.58	Pan Retained (g): 0.02	Sieve Loss (%): 0.07	Fines (%): #200 - 2.42 #230 - 2.38	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.09	0.09	0.09	0.09		
5	-2.00	4.00	0.00	0.00	0.09	0.09		
7	-1.50	2.83	0.10	0.10	0.19	0.19		
10	-1.00	2.00	0.10	0.10	0.29	0.29		
14	-0.50	1.41	0.13	0.13	0.42	0.42		
18	0.00	1.00	0.14	0.14	0.56	0.56		
25	0.50	0.71	0.37	0.38	0.93	0.94		
35	1.00	0.50	0.96	0.98	1.89	1.92		
45	1.50	0.35	6.37	6.51	8.26	8.43		
60	2.00	0.25	26.26	26.85	34.52	35.28		
80	2.50	0.18	44.71	45.71	79.23	80.99		
120	3.00	0.13	13.67	13.98	92.90	94.97		
170	3.50	0.09	2.32	2.37	95.22	97.34		
200	3.75	0.07	0.23	0.24	95.45	97.58		
230	4.00	0.06	0.04	0.04	95.49	97.62		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.01	2.61	2.43	2.16	1.81	1.64	1.24		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.1	0.23	0.54	-1.61	12.95			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC03 #3								
Analysis Date: 04-28-25								
Analyzed By: TJ								
Easting (ft): 836,453		Northing (ft): 2,935,772		Coordinate System: MA State Plane Mainland			Elevation (ft): -67.1 NAVD88	
USCS: SP		Munsell: Wet - N-4/0 Dry - N-6/0 Washed - N-6/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 97.71	Wash Weight (g): 94.15	Pan Retained (g): 0.01	Sieve Loss (%): 0.03	Fines (%): #200 - 3.75 #230 - 3.69	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.05	0.05	0.05	0.05		
7	-1.50	2.83	0.00	0.00	0.05	0.05		
10	-1.00	2.00	0.01	0.01	0.06	0.06		
14	-0.50	1.41	0.01	0.01	0.07	0.07		
18	0.00	1.00	0.01	0.01	0.08	0.08		
25	0.50	0.71	0.02	0.02	0.10	0.10		
35	1.00	0.50	0.07	0.07	0.17	0.17		
45	1.50	0.35	0.83	0.85	1.00	1.02		
60	2.00	0.25	10.86	11.11	11.86	12.13		
80	2.50	0.18	45.53	46.60	57.39	58.73		
120	3.00	0.13	29.38	30.07	86.77	88.80		
170	3.50	0.09	6.65	6.81	93.42	95.61		
200	3.75	0.07	0.63	0.64	94.05	96.25		
230	4.00	0.06	0.06	0.06	94.11	96.31		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.46	2.92	2.77	2.41	2.14	2.04	1.68		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.42	0.19	0.43	-0.6	10.26			

MA_CZM_VIBRACORES_2025.GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC03 #4								
Analysis Date: 04-28-25								
Analyzed By: TJ								
Easting (ft): 836,453		Northing (ft): 2,935,772		Coordinate System: MA State Plane Mainland		Elevation (ft): -70.2 NAVD88		
USCS: SP		Munsell: Wet - N-4/0 Dry - N-6/0 Washed - N-7/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 93.16	Wash Weight (g): 89.57	Pan Retained (g): 0.04	Sieve Loss (%): 0.09	Fines (%): #200 - 4.12 #230 - 3.98	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.08	0.09	0.08	0.09		
7	-1.50	2.83	0.14	0.15	0.22	0.24		
10	-1.00	2.00	0.10	0.11	0.32	0.35		
14	-0.50	1.41	0.08	0.09	0.40	0.44		
18	0.00	1.00	0.04	0.04	0.44	0.48		
25	0.50	0.71	0.04	0.04	0.48	0.52		
35	1.00	0.50	0.10	0.11	0.58	0.63		
45	1.50	0.35	0.14	0.15	0.72	0.78		
60	2.00	0.25	2.41	2.59	3.13	3.37		
80	2.50	0.18	37.25	39.98	40.38	43.35		
120	3.00	0.13	42.50	45.62	82.88	88.97		
170	3.50	0.09	6.11	6.56	88.99	95.53		
200	3.75	0.07	0.33	0.35	89.32	95.88		
230	4.00	0.06	0.13	0.14	89.45	96.02		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.46	2.95	2.85	2.57	2.27	2.16	2.02		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.53	0.17	0.45	-3.48	34.25			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC04 #1								
Analysis Date: 04-29-25								
Analyzed By: CC								
Easting (ft): 830,647		Northing (ft): 2,932,560		Coordinate System: MA State Plane Mainland		Elevation (ft): -46.6 NAVD88		
USCS: SP		Munsell: Wet - 10Y-4/1 Dry - 10Y-5/1 Washed - N-6/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 96.82	Wash Weight (g): 93.48	Pan Retained (g): 0.08	Sieve Loss (%): 0.04	Fines (%): #200 - 3.82 #230 - 3.58	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.10	0.10	0.10	0.10		
7	-1.50	2.83	0.10	0.10	0.20	0.20		
10	-1.00	2.00	0.04	0.04	0.24	0.24		
14	-0.50	1.41	0.06	0.06	0.30	0.30		
18	0.00	1.00	0.04	0.04	0.34	0.34		
25	0.50	0.71	0.06	0.06	0.40	0.40		
35	1.00	0.50	0.06	0.06	0.46	0.46		
45	1.50	0.35	0.26	0.27	0.72	0.73		
60	2.00	0.25	2.93	3.03	3.65	3.76		
80	2.50	0.18	19.53	20.17	23.18	23.93		
120	3.00	0.13	43.73	45.17	66.91	69.10		
170	3.50	0.09	24.55	25.36	91.46	94.46		
200	3.75	0.07	1.67	1.72	93.13	96.18		
230	4.00	0.06	0.23	0.24	93.36	96.42		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.58	3.29	3.12	2.79	2.51	2.30	2.03		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.74	0.15	0.49	-2.61	23.36			

MA_CZM_VIBRACORES_2025.GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC04 #2								
Analysis Date: 04-29-25								
Analyzed By: CC								
Easting (ft): 830,647		Northing (ft): 2,932,560		Coordinate System: MA State Plane Mainland		Elevation (ft): -50.0 NAVD88		
USCS: SM		Munsell: Wet - 10Y-4/1 Dry - 10Y-6/1 Washed - N-6/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 92.74	Wash Weight (g): 82.32	Pan Retained (g): 0.27	Sieve Loss (%): 0.04	Fines (%): #200 - 12.42 #230 - 11.58	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number		Sieve Size (Phi)		Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"		-4.25		19.03	0.00	0.00	0.00	0.00
5/8"		-4.00		16.00	0.00	0.00	0.00	0.00
7/16"		-3.50		11.31	0.00	0.00	0.00	0.00
5/16"		-3.00		8.00	0.00	0.00	0.00	0.00
3.5		-2.50		5.66	0.09	0.10	0.09	0.10
4		-2.25		4.76	0.00	0.00	0.09	0.10
5		-2.00		4.00	0.05	0.05	0.14	0.15
7		-1.50		2.83	0.02	0.02	0.16	0.17
10		-1.00		2.00	0.00	0.00	0.16	0.17
14		-0.50		1.41	0.07	0.08	0.23	0.25
18		0.00		1.00	0.03	0.03	0.26	0.28
25		0.50		0.71	0.06	0.06	0.32	0.34
35		1.00		0.50	0.08	0.09	0.40	0.43
45		1.50		0.35	0.13	0.14	0.53	0.57
60		2.00		0.25	0.57	0.61	1.10	1.18
80		2.50		0.18	6.85	7.39	7.95	8.57
120		3.00		0.13	46.79	50.45	54.74	59.02
170		3.50		0.09	23.42	25.25	78.16	84.27
200		3.75		0.07	3.07	3.31	81.23	87.58
230		4.00		0.06	0.78	0.84	82.01	88.42
Phi 5		Phi 16		Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.49		3.32	2.91	2.66	2.57	2.26
Moment		Mean Phi		Mean mm	Sorting	Skewness		Kurtosis
Statistics		2.87		0.14	0.45	-3.92		44.88

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC04 #3								
Analysis Date: 04-29-25								
Analyzed By: CC								
Easting (ft): 830,647		Northing (ft): 2,932,560		Coordinate System: MA State Plane Mainland		Elevation (ft): -53.0 NAVD88		
USCS: SM-SC		Munsell: Wet - 10Y-4/1 Dry - 10Y-5/1 Washed - N-6/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 84.72	Wash Weight (g): 56.00	Pan Retained (g): 0.07	Sieve Loss (%): 0.00	Fines (%): #200 - 34.58 #230 - 33.99	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.02	0.02	0.02	0.02		
10	-1.00	2.00	0.01	0.01	0.03	0.03		
14	-0.50	1.41	0.02	0.02	0.05	0.05		
18	0.00	1.00	0.06	0.07	0.11	0.12		
25	0.50	0.71	0.09	0.11	0.20	0.23		
35	1.00	0.50	0.14	0.17	0.34	0.40		
45	1.50	0.35	0.22	0.26	0.56	0.66		
60	2.00	0.25	0.65	0.77	1.21	1.43		
80	2.50	0.18	2.92	3.45	4.13	4.88		
120	3.00	0.13	22.53	26.59	26.66	31.47		
170	3.50	0.09	25.86	30.52	52.52	61.99		
200	3.75	0.07	2.91	3.43	55.43	65.42		
230	4.00	0.06	0.50	0.59	55.93	66.01		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
			3.30	2.88	2.71	2.50		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.98	0.13	0.44	-2.4	17.93			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts									
Sample Name: MA-CZM-2025-VC04 #4									
Analysis Date: 05-02-25									
Analyzed By: CC									
Easting (ft): 830,647		Northing (ft): 2,932,560		Coordinate System: MA State Plane Mainland		Elevation (ft): -56.0 NAVD88			
USCS: SM-SC		Munsell: Wet - 10Y-4/1 Dry - 5Y-5/1 Washed - 5Y-6/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).					
Dry Weight (g): 89.57	Wash Weight (g): 62.40	Pan Retained (g): 0.10	Sieve Loss (%): 0.00	Fines (%): #200 - 31.54 #230 - 30.47	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):	
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained			
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00			
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00			
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00			
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00			
3.5	-2.50	5.66	0.00	0.00	0.00	0.00			
4	-2.25	4.76	0.30	0.33	0.30	0.33			
5	-2.00	4.00	0.00	0.00	0.30	0.33			
7	-1.50	2.83	0.02	0.02	0.32	0.35			
10	-1.00	2.00	0.02	0.02	0.34	0.37			
14	-0.50	1.41	0.04	0.04	0.38	0.41			
18	0.00	1.00	0.03	0.03	0.41	0.44			
25	0.50	0.71	0.04	0.04	0.45	0.48			
35	1.00	0.50	0.08	0.09	0.53	0.57			
45	1.50	0.35	0.14	0.16	0.67	0.73			
60	2.00	0.25	0.69	0.77	1.36	1.50			
80	2.50	0.18	2.85	3.18	4.21	4.68			
120	3.00	0.13	19.45	21.71	23.66	26.39			
170	3.50	0.09	30.99	34.60	54.65	60.99			
200	3.75	0.07	6.69	7.47	61.34	68.46			
230	4.00	0.06	0.96	1.07	62.30	69.53			
Phi 5		Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
				3.34	2.97	2.76	2.51		
Moment	Mean Phi		Mean mm		Sorting		Skewness		Kurtosis
Statistics	3.04		0.12		0.57		-4.93		43.63

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC04 #5								
Analysis Date: 04-29-25								
Analyzed By: TJ								
Easting (ft): 830,647		Northing (ft): 2,932,560		Coordinate System: MA State Plane Mainland		Elevation (ft): -60.6 NAVD88		
USCS: SW		Munsell: Wet - 5-4/1 Dry - 5Y-5/1 Washed - 5Y-5/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 100.53	Wash Weight (g): 96.33	Pan Retained (g): 0.02	Sieve Loss (%): 0.05	Fines (%): #200 - 4.26 #230 - 4.24	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	2.21	2.20	2.21	2.20		
4	-2.25	4.76	1.06	1.05	3.27	3.25		
5	-2.00	4.00	0.55	0.55	3.82	3.80		
7	-1.50	2.83	1.98	1.97	5.80	5.77		
10	-1.00	2.00	1.78	1.77	7.58	7.54		
14	-0.50	1.41	2.32	2.31	9.90	9.85		
18	0.00	1.00	2.70	2.69	12.60	12.54		
25	0.50	0.71	5.36	5.33	17.96	17.87		
35	1.00	0.50	11.98	11.92	29.94	29.79		
45	1.50	0.35	23.52	23.40	53.46	53.19		
60	2.00	0.25	26.55	26.41	80.01	79.60		
80	2.50	0.18	10.82	10.76	90.83	90.36		
120	3.00	0.13	3.79	3.77	94.62	94.13		
170	3.50	0.09	1.35	1.34	95.97	95.47		
200	3.75	0.07	0.27	0.27	96.24	95.74		
230	4.00	0.06	0.02	0.02	96.26	95.76		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.32	2.20	1.91	1.43	0.80	0.32	-1.70		
Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
	1.13	0.46	1.21	-1.4	5.13			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC05 #1								
Analysis Date: 04-28-25								
Analyzed By: TJ								
Easting (ft): 858,920		Northing (ft): 3,126,090		Coordinate System: MA State Plane Mainland		Elevation (ft): -110.8 NAVD88		
USCS: SM		Munsell: Wet - 5Y-5/1 Dry - 2.5Y-6/1 Washed - 2.5Y-8/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 96.06	Wash Weight (g): 63.79	Pan Retained (g): 3.15	Sieve Loss (%): 0.02	Fines (%): #200 - 42.95 #230 - 36.89	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.00	0.00	0.00	0.00		
10	-1.00	2.00	0.04	0.04	0.04	0.04		
14	-0.50	1.41	0.24	0.25	0.28	0.29		
18	0.00	1.00	0.25	0.26	0.53	0.55		
25	0.50	0.71	0.30	0.31	0.83	0.86		
35	1.00	0.50	0.23	0.24	1.06	1.10		
45	1.50	0.35	0.17	0.18	1.23	1.28		
60	2.00	0.25	0.24	0.25	1.47	1.53		
80	2.50	0.18	1.22	1.27	2.69	2.80		
120	3.00	0.13	5.50	5.73	8.19	8.53		
170	3.50	0.09	29.82	31.04	38.01	39.57		
200	3.75	0.07	16.79	17.48	54.80	57.05		
230	4.00	0.06	5.82	6.06	60.62	63.11		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
			3.65	3.27	3.12	2.69		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	3.28	0.10	0.58	-3.84	23.74			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC05 #2								
Analysis Date: 04-29-25								
Analyzed By: TJ								
Easting (ft): 858,920		Northing (ft): 3,126,090		Coordinate System: MA State Plane Mainland		Elevation (ft): -118.1 NAVD88		
USCS: SM		Munsell: Wet - 10Y-5/1 Dry - 10Y-7/1 Washed - N-7/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 100.62	Wash Weight (g): 83.51	Pan Retained (g): 1.50	Sieve Loss (%): 0.00	Fines (%): #200 - 20.57 #230 - 18.49	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.00	0.00	0.00	0.00		
10	-1.00	2.00	0.01	0.01	0.01	0.01		
14	-0.50	1.41	0.00	0.00	0.01	0.01		
18	0.00	1.00	0.01	0.01	0.02	0.02		
25	0.50	0.71	0.01	0.01	0.03	0.03		
35	1.00	0.50	0.03	0.03	0.06	0.06		
45	1.50	0.35	0.21	0.21	0.27	0.27		
60	2.00	0.25	1.71	1.70	1.98	1.97		
80	2.50	0.18	9.77	9.71	11.75	11.68		
120	3.00	0.13	25.15	25.00	36.90	36.68		
170	3.50	0.09	35.65	35.43	72.55	72.11		
200	3.75	0.07	7.37	7.32	79.92	79.43		
230	4.00	0.06	2.09	2.08	82.01	81.51		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
		3.60	3.19	2.77	2.59	2.16		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.99	0.13	0.46	-0.77	4.57			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC06 #1								
Analysis Date: 04-30-25								
Analyzed By: TJ								
Easting (ft): 849,044		Northing (ft): 3,128,942		Coordinate System: MA State Plane Mainland		Elevation (ft): -89.5 NAVD88		
USCS: SW		Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-5/1 Washed - 2.5Y-6/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 105.09	Wash Weight (g): 103.52	Pan Retained (g): 0.01	Sieve Loss (%): 0.04	Fines (%): #200 - 1.56 #230 - 1.54	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	3.87	3.68	3.87	3.68		
3.5	-2.50	5.66	4.13	3.93	8.00	7.61		
4	-2.25	4.76	2.11	2.01	10.11	9.62		
5	-2.00	4.00	2.08	1.98	12.19	11.60		
7	-1.50	2.83	4.41	4.20	16.60	15.80		
10	-1.00	2.00	6.52	6.20	23.12	22.00		
14	-0.50	1.41	9.05	8.61	32.17	30.61		
18	0.00	1.00	8.68	8.26	40.85	38.87		
25	0.50	0.71	12.69	12.08	53.54	50.95		
35	1.00	0.50	13.90	13.23	67.44	64.18		
45	1.50	0.35	12.40	11.80	79.84	75.98		
60	2.00	0.25	13.37	12.72	93.21	88.70		
80	2.50	0.18	6.28	5.98	99.49	94.68		
120	3.00	0.13	2.81	2.67	102.30	97.35		
170	3.50	0.09	0.95	0.90	103.25	98.25		
200	3.75	0.07	0.20	0.19	103.45	98.44		
230	4.00	0.06	0.02	0.02	103.47	98.46		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.56	1.82	1.46	0.46	-0.83	-1.48	-2.83		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	0.19	0.88	1.57	-0.45	2.49			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC06 #2								
Analysis Date: 04-30-25								
Analyzed By: TJ								
Easting (ft): 849,044		Northing (ft): 3,128,942		Coordinate System: MA State Plane Mainland		Elevation (ft): -97.5 NAVD88		
USCS: SW		Munsell: Wet - 2.5Y-4/2 Dry - 2.5Y-6/2 Washed - 2.5Y-6/2		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 105.93	Wash Weight (g): 104.11	Pan Retained (g): 0.01	Sieve Loss (%): 0.08	Fines (%): #200 - 1.86 #230 - 1.81	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	2.31	2.18	2.31	2.18		
4	-2.25	4.76	0.42	0.40	2.73	2.58		
5	-2.00	4.00	1.88	1.77	4.61	4.35		
7	-1.50	2.83	1.93	1.82	6.54	6.17		
10	-1.00	2.00	4.96	4.68	11.50	10.85		
14	-0.50	1.41	9.00	8.50	20.50	19.35		
18	0.00	1.00	10.92	10.31	31.42	29.66		
25	0.50	0.71	13.71	12.94	45.13	42.60		
35	1.00	0.50	16.17	15.26	61.30	57.86		
45	1.50	0.35	13.66	12.90	74.96	70.76		
60	2.00	0.25	18.96	17.90	93.92	88.66		
80	2.50	0.18	6.70	6.32	100.62	94.98		
120	3.00	0.13	2.38	2.25	103.00	97.23		
170	3.50	0.09	0.81	0.76	103.81	97.99		
200	3.75	0.07	0.16	0.15	103.97	98.14		
230	4.00	0.06	0.05	0.05	104.02	98.19		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.50	1.87	1.62	0.74	-0.23	-0.70	-1.82		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	0.58	0.67	1.26	-0.5	2.92			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values					 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts									
Sample Name: MA-CZM-2025-VC07 #1									
Analysis Date: 05-01-25									
Analyzed By: CC									
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):			
850,918		3,131,527		MA State Plane Mainland		-97.9 NAVD88			
USCS:		Munsell:		Comments:					
SW		Wet - 5Y-4/1 Dry - 2.5Y-6/1 Washed - 2.5Y-7/1		<i>Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).</i>					
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):	
105.88	104.69	0.01	0.01	#200 - 1.16 #230 - 1.15			1	1	
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained			
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00			
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00			
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00			
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00			
3.5	-2.50	5.66	0.00	0.00	0.00	0.00			
4	-2.25	4.76	0.00	0.00	0.00	0.00			
5	-2.00	4.00	1.19	1.12	1.19	1.12			
7	-1.50	2.83	2.61	2.47	3.80	3.59			
10	-1.00	2.00	4.82	4.55	8.62	8.14			
14	-0.50	1.41	5.73	5.41	14.35	13.55			
18	0.00	1.00	5.33	5.03	19.68	18.58			
25	0.50	0.71	12.18	11.50	31.86	30.08			
35	1.00	0.50	18.55	17.52	50.41	47.60			
45	1.50	0.35	25.29	23.89	75.70	71.49			
60	2.00	0.25	17.69	16.71	93.39	88.20			
80	2.50	0.18	7.89	7.45	101.28	95.65			
120	3.00	0.13	2.57	2.43	103.85	98.08			
170	3.50	0.09	0.69	0.65	104.54	98.73			
200	3.75	0.07	0.12	0.11	104.66	98.84			
230	4.00	0.06	0.01	0.01	104.67	98.85			
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95			
2.46	1.87	1.61	1.05	0.28	-0.26	-1.35			
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis				
Statistics	0.84	0.56	1.09	-0.65	3.16				

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC07 #2								
Analysis Date: 05-01-25								
Analyzed By: CC								
Easting (ft): 850,918		Northing (ft): 3,131,527		Coordinate System: MA State Plane Mainland		Elevation (ft): -102.9 NAVD88		
USCS: SW		Munsell: Wet - 5Y-4/1 Dry - 2.5Y-6/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 106.04	Wash Weight (g): 104.84	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 1.15 #230 - 1.14	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.99	0.93	0.99	0.93		
3.5	-2.50	5.66	1.58	1.49	2.57	2.42		
4	-2.25	4.76	1.47	1.39	4.04	3.81		
5	-2.00	4.00	1.76	1.66	5.80	5.47		
7	-1.50	2.83	2.41	2.27	8.21	7.74		
10	-1.00	2.00	3.41	3.22	11.62	10.96		
14	-0.50	1.41	7.02	6.62	18.64	17.58		
18	0.00	1.00	10.95	10.33	29.59	27.91		
25	0.50	0.71	17.52	16.52	47.11	44.43		
35	1.00	0.50	20.64	19.46	67.75	63.89		
45	1.50	0.35	17.95	16.93	85.70	80.82		
60	2.00	0.25	12.30	11.60	98.00	92.42		
80	2.50	0.18	4.68	4.41	102.68	96.83		
120	3.00	0.13	1.49	1.41	104.17	98.24		
170	3.50	0.09	0.55	0.52	104.72	98.76		
200	3.75	0.07	0.10	0.09	104.82	98.85		
230	4.00	0.06	0.01	0.01	104.83	98.86		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.29	1.64	1.33	0.64	-0.14	-0.62	-2.07		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	0.47	0.72	1.21	-0.73	3.63			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC08 #1								
Analysis Date: 04-30-25								
Analyzed By: TJ								
Easting (ft): 849,049		Northing (ft): 3,135,994		Coordinate System: MA State Plane Mainland		Elevation (ft): -90.1 NAVD88		
USCS: SP		Munsell: Wet - 2.5Y-4/1 Dry - 2.5Y-6/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 101.03	Wash Weight (g): 97.81	Pan Retained (g): 0.01	Sieve Loss (%): 0.07	Fines (%): #200 - 3.31 #230 - 3.27	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.03	0.03	0.03	0.03		
10	-1.00	2.00	0.07	0.07	0.10	0.10		
14	-0.50	1.41	0.23	0.23	0.33	0.33		
18	0.00	1.00	0.67	0.66	1.00	0.99		
25	0.50	0.71	4.21	4.17	5.21	5.16		
35	1.00	0.50	14.38	14.23	19.59	19.39		
45	1.50	0.35	25.52	25.26	45.11	44.65		
60	2.00	0.25	23.36	23.12	68.47	67.77		
80	2.50	0.18	17.56	17.38	86.03	85.15		
120	3.00	0.13	7.35	7.28	93.38	92.43		
170	3.50	0.09	3.66	3.62	97.04	96.05		
200	3.75	0.07	0.65	0.64	97.69	96.69		
230	4.00	0.06	0.04	0.04	97.73	96.73		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.35	2.47	2.21	1.62	1.11	0.88	0.48		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.62	0.33	0.76	0.11	3.1			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC08 #2								
Analysis Date: 04-30-25								
Analyzed By: TJ								
Easting (ft): 849,049		Northing (ft): 3,135,994		Coordinate System: MA State Plane Mainland		Elevation (ft): -98.1 NAVD88		
USCS: SW		Munsell: Wet - 2.5Y-4/1 Dry - 2.5Y-6/1 Washed - 2.5Y-7/1		Comments: <i>Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).</i>				
Dry Weight (g): 102.94	Wash Weight (g): 101.72	Pan Retained (g): 0.01	Sieve Loss (%): 0.05	Fines (%): #200 - 1.25 #230 - 1.24	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.41	0.40	0.41	0.40		
5	-2.00	4.00	0.65	0.63	1.06	1.03		
7	-1.50	2.83	2.37	2.30	3.43	3.33		
10	-1.00	2.00	3.90	3.79	7.33	7.12		
14	-0.50	1.41	4.79	4.65	12.12	11.77		
18	0.00	1.00	6.84	6.64	18.96	18.41		
25	0.50	0.71	13.39	13.01	32.35	31.42		
35	1.00	0.50	25.65	24.92	58.00	56.34		
45	1.50	0.35	25.70	24.97	83.70	81.31		
60	2.00	0.25	11.60	11.27	95.30	92.58		
80	2.50	0.18	4.68	4.55	99.98	97.13		
120	3.00	0.13	1.30	1.26	101.28	98.39		
170	3.50	0.09	0.31	0.30	101.59	98.69		
200	3.75	0.07	0.06	0.06	101.65	98.75		
230	4.00	0.06	0.01	0.01	101.66	98.76		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.27	1.62	1.37	0.87	0.25	-0.18	-1.28		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	0.72	0.61	0.98	-0.7	3.66			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC08 #3								
Analysis Date: 04-30-25								
Analyzed By: TJ								
Easting (ft): 849,049		Northing (ft): 3,135,994		Coordinate System: MA State Plane Mainland		Elevation (ft): -105.3 NAVD88		
USCS: SW		Munsell: Wet - 2.5Y-4/2 Dry - 2.5Y-6/2 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 101.84	Wash Weight (g): 100.51	Pan Retained (g): 0.00	Sieve Loss (%): 0.04	Fines (%): #200 - 1.38 #230 - 1.34	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.53	0.52	0.53	0.52		
10	-1.00	2.00	1.17	1.15	1.70	1.67		
14	-0.50	1.41	2.64	2.59	4.34	4.26		
18	0.00	1.00	4.24	4.16	8.58	8.42		
25	0.50	0.71	6.60	6.48	15.18	14.90		
35	1.00	0.50	12.70	12.47	27.88	27.37		
45	1.50	0.35	19.48	19.13	47.36	46.50		
60	2.00	0.25	26.05	25.58	73.41	72.08		
80	2.50	0.18	18.17	17.84	91.58	89.92		
120	3.00	0.13	6.89	6.77	98.47	96.69		
170	3.50	0.09	1.77	1.74	100.24	98.43		
200	3.75	0.07	0.19	0.19	100.43	98.62		
230	4.00	0.06	0.04	0.04	100.47	98.66		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.88	2.33	2.08	1.57	0.90	0.54	-0.41		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.41	0.38	0.94	-0.7	3.57			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC09 #1								
Analysis Date: 05-02-25								
Analyzed By: CC								
Easting (ft): 789,434		Northing (ft): 2,610,816		Coordinate System: MA State Plane Mainland		Elevation (ft): -68.0 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-6/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 100.50	Wash Weight (g): 97.79	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 2.75 #230 - 2.70	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.08	0.08	0.08	0.08		
5	-2.00	4.00	0.03	0.03	0.11	0.11		
7	-1.50	2.83	0.10	0.10	0.21	0.21		
10	-1.00	2.00	0.25	0.25	0.46	0.46		
14	-0.50	1.41	0.33	0.33	0.79	0.79		
18	0.00	1.00	0.42	0.42	1.21	1.21		
25	0.50	0.71	0.66	0.66	1.87	1.87		
35	1.00	0.50	2.36	2.35	4.23	4.22		
45	1.50	0.35	8.38	8.34	12.61	12.56		
60	2.00	0.25	30.34	30.19	42.95	42.75		
80	2.50	0.18	39.31	39.11	82.26	81.86		
120	3.00	0.13	13.57	13.50	95.83	95.36		
170	3.50	0.09	1.72	1.71	97.55	97.07		
200	3.75	0.07	0.18	0.18	97.73	97.25		
230	4.00	0.06	0.05	0.05	97.78	97.30		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.99	2.58	2.41	2.09	1.71	1.56	1.05		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.01	0.25	0.61	-1.66	10.46			

MA_CZM_VIBRACORES_2025.GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC09 #2								
Analysis Date: 05-01-25								
Analyzed By: CC								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
789,434		2,610,816		MA State Plane Mainland		-73.9 NAVD88		
USCS:		Munsell:		Comments:				
SP		Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-8/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
100.44	99.10	0.03	0.02	#200 - 1.40 #230 - 1.38				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.08	0.08	0.08	0.08		
10	-1.00	2.00	0.00	0.00	0.08	0.08		
14	-0.50	1.41	0.02	0.02	0.10	0.10		
18	0.00	1.00	0.03	0.03	0.13	0.13		
25	0.50	0.71	0.03	0.03	0.16	0.16		
35	1.00	0.50	0.18	0.18	0.34	0.34		
45	1.50	0.35	1.68	1.67	2.02	2.01		
60	2.00	0.25	23.40	23.30	25.42	25.31		
80	2.50	0.18	53.25	53.02	78.67	78.33		
120	3.00	0.13	18.38	18.30	97.05	96.63		
170	3.50	0.09	1.79	1.78	98.84	98.41		
200	3.75	0.07	0.19	0.19	99.03	98.60		
230	4.00	0.06	0.02	0.02	99.05	98.62		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.96	2.65	2.47	2.23	1.99	1.80	1.56		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.22	0.21	0.41	-0.82	11.34			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC09 #3								
Analysis Date: 05-01-25								
Analyzed By: CC								
Easting (ft): 789,434		Northing (ft): 2,610,816		Coordinate System: MA State Plane Mainland		Elevation (ft): -79.5 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-8/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 99.93	Wash Weight (g): 96.32	Pan Retained (g): 0.09	Sieve Loss (%): 0.04	Fines (%): #200 - 3.83 #230 - 3.76	Rock Fragments (%):	Organics (%):	Carbonate (%): 0	Shell Hash (%): 1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.00	0.00	0.00	0.00		
10	-1.00	2.00	0.05	0.05	0.05	0.05		
14	-0.50	1.41	0.01	0.01	0.06	0.06		
18	0.00	1.00	0.03	0.03	0.09	0.09		
25	0.50	0.71	0.02	0.02	0.11	0.11		
35	1.00	0.50	0.04	0.04	0.15	0.15		
45	1.50	0.35	0.30	0.30	0.45	0.45		
60	2.00	0.25	5.91	5.91	6.36	6.36		
80	2.50	0.18	48.48	48.51	54.84	54.87		
120	3.00	0.13	33.73	33.75	88.57	88.62		
170	3.50	0.09	6.64	6.64	95.21	95.26		
200	3.75	0.07	0.91	0.91	96.12	96.17		
230	4.00	0.06	0.07	0.07	96.19	96.24		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.48	2.93	2.80	2.45	2.19	2.10	1.88		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.47	0.18	0.4	-0.29	8.43			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC10 #1								
Analysis Date: 05-01-25								
Analyzed By: CC								
Easting (ft): 788,426		Northing (ft): 2,608,275		Coordinate System: MA State Plane Mainland		Elevation (ft): -71.2 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 99.93	Wash Weight (g): 98.26	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 1.71 #230 - 1.69	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.00	0.00	0.00	0.00		
10	-1.00	2.00	0.04	0.04	0.04	0.04		
14	-0.50	1.41	0.04	0.04	0.08	0.08		
18	0.00	1.00	0.06	0.06	0.14	0.14		
25	0.50	0.71	0.10	0.10	0.24	0.24		
35	1.00	0.50	0.77	0.77	1.01	1.01		
45	1.50	0.35	4.56	4.56	5.57	5.57		
60	2.00	0.25	33.46	33.48	39.03	39.05		
80	2.50	0.18	43.23	43.26	82.26	82.31		
120	3.00	0.13	13.58	13.59	95.84	95.90		
170	3.50	0.09	2.16	2.16	98.00	98.06		
200	3.75	0.07	0.23	0.23	98.23	98.29		
230	4.00	0.06	0.02	0.02	98.25	98.31		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.97	2.56	2.42	2.13	1.79	1.66	1.44		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.11	0.23	0.46	-0.27	5.64			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC10 #2								
Analysis Date: 05-01-25								
Analyzed By: CC								
Easting (ft): 788,426		Northing (ft): 2,608,275		Coordinate System: MA State Plane Mainland		Elevation (ft): -80.3 NAVD88		
USCS: SP		Munsell: Wet - 10Y-4/1 Dry - 5Y-6/1 Washed - 5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 100.40	Wash Weight (g): 97.82	Pan Retained (g): 0.02	Sieve Loss (%): 0.02	Fines (%): #200 - 2.74 #230 - 2.60	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.00	0.00	0.00	0.00		
10	-1.00	2.00	0.01	0.01	0.01	0.01		
14	-0.50	1.41	0.05	0.05	0.06	0.06		
18	0.00	1.00	0.04	0.04	0.10	0.10		
25	0.50	0.71	0.09	0.09	0.19	0.19		
35	1.00	0.50	0.61	0.61	0.80	0.80		
45	1.50	0.35	2.50	2.49	3.30	3.29		
60	2.00	0.25	26.80	26.69	30.10	29.98		
80	2.50	0.18	48.18	47.99	78.28	77.97		
120	3.00	0.13	15.54	15.48	93.82	93.45		
170	3.50	0.09	3.39	3.38	97.21	96.83		
200	3.75	0.07	0.43	0.43	97.64	97.26		
230	4.00	0.06	0.14	0.14	97.78	97.40		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.23	2.69	2.47	2.21	1.91	1.74	1.53		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.2	0.22	0.45	-0.08	5.46			

MA_CZM_VIBRACORES_2025_GPJ_7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC11 #1								
Analysis Date: 04-30-25								
Analyzed By: TJ								
Easting (ft): 782,562		Northing (ft): 2,614,101		Coordinate System: MA State Plane Mainland		Elevation (ft): -63.1 NAVD88		
USCS: SW		Munsell: Wet - 2.5Y-5/1 Dry - 2.5Y-7/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 102.00	Wash Weight (g): 100.58	Pan Retained (g): 0.00	Sieve Loss (%): 0.08	Fines (%): #200 - 1.48 #230 - 1.47	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	1.98	1.94	1.98	1.94		
3.5	-2.50	5.66	0.70	0.69	2.68	2.63		
4	-2.25	4.76	0.00	0.00	2.68	2.63		
5	-2.00	4.00	0.10	0.10	2.78	2.73		
7	-1.50	2.83	0.26	0.25	3.04	2.98		
10	-1.00	2.00	0.34	0.33	3.38	3.31		
14	-0.50	1.41	0.24	0.24	3.62	3.55		
18	0.00	1.00	0.18	0.18	3.80	3.73		
25	0.50	0.71	0.41	0.40	4.21	4.13		
35	1.00	0.50	0.87	0.85	5.08	4.98		
45	1.50	0.35	4.02	3.94	9.10	8.92		
60	2.00	0.25	28.33	27.77	37.43	36.69		
80	2.50	0.18	46.47	45.56	83.90	82.25		
120	3.00	0.13	13.30	13.04	97.20	95.29		
170	3.50	0.09	3.05	2.99	100.25	98.28		
200	3.75	0.07	0.24	0.24	100.49	98.52		
230	4.00	0.06	0.01	0.01	100.50	98.53		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.99	2.57	2.42	2.15	1.79	1.63	1.00		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.97	0.26	1.02	-3.6	18.13			

MA_CZM_VIBRACORES_2025.GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC12 #1								
Analysis Date: 05-02-25								
Analyzed By: CC								
Easting (ft): 767,716		Northing (ft): 2,634,096		Coordinate System: MA State Plane Mainland		Elevation (ft): -57.8 NAVD88		
USCS: SC		Munsell: Wet - 10Y-4/1 Dry - 5Y-6/1 Washed - 5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 98.42	Wash Weight (g): 80.09	Pan Retained (g): 0.03	Sieve Loss (%): 0.03	Fines (%): #200 - 19.17 #230 - 18.69	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	2.11	2.14	2.11	2.14		
3.5	-2.50	5.66	0.00	0.00	2.11	2.14		
4	-2.25	4.76	0.00	0.00	2.11	2.14		
5	-2.00	4.00	0.00	0.00	2.11	2.14		
7	-1.50	2.83	0.21	0.21	2.32	2.35		
10	-1.00	2.00	0.07	0.07	2.39	2.42		
14	-0.50	1.41	0.16	0.16	2.55	2.58		
18	0.00	1.00	0.10	0.10	2.65	2.68		
25	0.50	0.71	0.12	0.12	2.77	2.80		
35	1.00	0.50	0.21	0.21	2.98	3.01		
45	1.50	0.35	0.54	0.55	3.52	3.56		
60	2.00	0.25	2.25	2.29	5.77	5.85		
80	2.50	0.18	6.02	6.12	11.79	11.97		
120	3.00	0.13	33.58	34.12	45.37	46.09		
170	3.50	0.09	29.26	29.73	74.63	75.82		
200	3.75	0.07	4.93	5.01	79.56	80.83		
230	4.00	0.06	0.47	0.48	80.03	81.31		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
		3.49	3.07	2.69	2.56	1.81		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.72	0.15	1.13	-4.16	21.68			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC13 #1								
Analysis Date: 07-16-25								
Analyzed By: SF								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
923,366		2,868,090		MA State Plane Mainland		-124.1 NAVD88		
USCS:		Munsell:		Comments:				
SW-SM		Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-6/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
101.90	96.37	0.06	0.07	#200 - 6.34 #230 - 5.55				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.07	0.07	0.07	0.07		
4	-2.25	4.76	0.00	0.00	0.07	0.07		
5	-2.00	4.00	0.07	0.07	0.14	0.14		
7	-1.50	2.83	0.53	0.52	0.67	0.66		
10	-1.00	2.00	0.29	0.28	0.96	0.94		
14	-0.50	1.41	0.68	0.67	1.64	1.61		
18	0.00	1.00	0.78	0.77	2.42	2.38		
25	0.50	0.71	1.33	1.31	3.75	3.69		
35	1.00	0.50	2.94	2.89	6.69	6.58		
45	1.50	0.35	7.30	7.16	13.99	13.74		
60	2.00	0.25	15.95	15.65	29.94	29.39		
80	2.50	0.18	22.12	21.71	52.06	51.10		
120	3.00	0.13	27.12	26.61	79.18	77.71		
170	3.50	0.09	13.99	13.73	93.17	91.44		
200	3.75	0.07	2.26	2.22	95.43	93.66		
230	4.00	0.06	0.81	0.79	96.24	94.45		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
	3.23	2.95	2.47	1.86	1.57	0.73		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.27	0.21	0.89	-1.45	6.83			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC13 #2								
Analysis Date: 07-16-25								
Analyzed By: SF								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
923,366		2,868,090		MA State Plane Mainland		-125.8 NAVD88		
USCS:		Munsell:		Comments:				
GW		Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - N-6/0		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
118.40	115.52	0.02	0.00	#200 - 2.61 #230 - 2.46				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
1.0"	-4.75	26.91	0.00	0.00	0.00	0.00		
3/4"	-4.25	19.03	33.18	28.02	33.18	28.02		
5/8"	-4.00	16.00	0.00	0.00	33.18	28.02		
7/16"	-3.50	11.31	12.76	10.78	45.94	38.80		
5/16"	-3.00	8.00	14.72	12.43	60.66	51.23		
3.5	-2.50	5.66	4.58	3.87	65.24	55.10		
4	-2.25	4.76	1.63	1.38	66.87	56.48		
5	-2.00	4.00	0.72	0.61	67.59	57.09		
7	-1.50	2.83	1.04	0.88	68.63	57.97		
10	-1.00	2.00	0.89	0.75	69.52	58.72		
14	-0.50	1.41	0.65	0.55	70.17	59.27		
18	0.00	1.00	0.57	0.48	70.74	59.75		
25	0.50	0.71	0.74	0.63	71.48	60.37		
35	1.00	0.50	1.59	1.34	73.07	61.71		
45	1.50	0.35	4.74	4.00	77.81	65.71		
60	2.00	0.25	9.24	7.80	87.05	73.51		
80	2.50	0.18	10.71	9.05	97.76	82.56		
120	3.00	0.13	10.87	9.18	108.63	91.74		
170	3.50	0.09	5.72	4.83	114.35	96.57		
200	3.75	0.07	0.97	0.82	115.32	97.39		
230	4.00	0.06	0.18	0.15	115.50	97.54		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.34	2.58	2.08	-3.05	-4.08	-4.32	-4.62		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	-1.44	2.71	3.04	0.4	1.37			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102							
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts											
Sample Name: MA-CZM-2025-VC13 #3											
Analysis Date: 07-16-25											
Analyzed By: SF											
Easting (ft): 923,366		Northing (ft): 2,868,090		Coordinate System: MA State Plane Mainland		Elevation (ft): -129.7 NAVD88					
USCS: SP-SM		Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).							
Dry Weight (g): 98.20	Wash Weight (g): 92.75	Pan Retained (g): 0.09	Sieve Loss (%): 0.01	Fines (%): #200 - 6.63 #230 - 5.64	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):			
Sieve Number		Sieve Size (Phi)		Sieve Size (Millimeters)		Grams Retained		% Weight Retained	Cum. Grams Retained	C. % Weight Retained	
3/4"		-4.25		19.03		0.00		0.00	0.00	0.00	
5/8"		-4.00		16.00		0.00		0.00	0.00	0.00	
7/16"		-3.50		11.31		0.00		0.00	0.00	0.00	
5/16"		-3.00		8.00		0.00		0.00	0.00	0.00	
3.5		-2.50		5.66		0.00		0.00	0.00	0.00	
4		-2.25		4.76		0.00		0.00	0.00	0.00	
5		-2.00		4.00		0.10		0.10	0.10	0.10	
7		-1.50		2.83		0.06		0.06	0.16	0.16	
10		-1.00		2.00		0.03		0.03	0.19	0.19	
14		-0.50		1.41		0.01		0.01	0.20	0.20	
18		0.00		1.00		0.03		0.03	0.23	0.23	
25		0.50		0.71		0.04		0.04	0.27	0.27	
35		1.00		0.50		0.19		0.19	0.46	0.46	
45		1.50		0.35		0.48		0.49	0.94	0.95	
60		2.00		0.25		6.84		6.97	7.78	7.92	
80		2.50		0.18		27.06		27.56	34.84	35.48	
120		3.00		0.13		33.18		33.79	68.02	69.27	
170		3.50		0.09		20.49		20.87	88.51	90.14	
200		3.75		0.07		3.17		3.23	91.68	93.37	
230		4.00		0.06		0.97		0.99	92.65	94.36	
Phi 5		Phi 16		Phi 25		Phi 50		Phi 75		Phi 84	Phi 95
		3.35		3.14		2.71		2.31		2.15	1.79
Moment		Mean Phi		Mean mm		Sorting		Skewness		Kurtosis	
Statistics		2.66		0.16		0.55		-1.31		12.16	

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC13 #4								
Analysis Date: 07-16-25								
Analyzed By: SF								
Easting (ft): 923,366		Northing (ft): 2,868,090		Coordinate System: MA State Plane Mainland		Elevation (ft): -134.5 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 98.33	Wash Weight (g): 94.01	Pan Retained (g): 0.02	Sieve Loss (%): 0.00	Fines (%): #200 - 4.58 #230 - 4.42	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.09	0.09	0.09	0.09		
10	-1.00	2.00	0.02	0.02	0.11	0.11		
14	-0.50	1.41	0.02	0.02	0.13	0.13		
18	0.00	1.00	0.03	0.03	0.16	0.16		
25	0.50	0.71	0.09	0.09	0.25	0.25		
35	1.00	0.50	0.15	0.15	0.40	0.40		
45	1.50	0.35	0.30	0.31	0.70	0.71		
60	2.00	0.25	1.79	1.82	2.49	2.53		
80	2.50	0.18	21.91	22.28	24.40	24.81		
120	3.00	0.13	49.16	49.99	73.56	74.80		
170	3.50	0.09	18.73	19.05	92.29	93.85		
200	3.75	0.07	1.54	1.57	93.83	95.42		
230	4.00	0.06	0.16	0.16	93.99	95.58		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.68	3.24	3.01	2.75	2.50	2.30	2.06		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.71	0.15	0.43	-1.79	17.47			

MA_CZM_VIBRACORES_2025.GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC13 #5								
Analysis Date: 07-17-25								
Analyzed By: MS								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
923,366		2,868,090		MA State Plane Mainland		-137.7 NAVD88		
USCS:		Munsell:		Comments:				
SM-SC		Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 2.5Y-7/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
100.13	78.79	0.27	0.00	#200 - 22.79 #230 - 21.58				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	6.31	6.30	6.31	6.30		
7/16"	-3.50	11.31	0.00	0.00	6.31	6.30		
5/16"	-3.00	8.00	0.00	0.00	6.31	6.30		
3.5	-2.50	5.66	0.00	0.00	6.31	6.30		
4	-2.25	4.76	0.00	0.00	6.31	6.30		
5	-2.00	4.00	0.00	0.00	6.31	6.30		
7	-1.50	2.83	0.00	0.00	6.31	6.30		
10	-1.00	2.00	0.02	0.02	6.33	6.32		
14	-0.50	1.41	0.04	0.04	6.37	6.36		
18	0.00	1.00	0.02	0.02	6.39	6.38		
25	0.50	0.71	0.10	0.10	6.49	6.48		
35	1.00	0.50	0.17	0.17	6.66	6.65		
45	1.50	0.35	0.31	0.31	6.97	6.96		
60	2.00	0.25	0.61	0.61	7.58	7.57		
80	2.50	0.18	6.38	6.37	13.96	13.94		
120	3.00	0.13	23.17	23.14	37.13	37.08		
170	3.50	0.09	32.40	32.36	69.53	69.44		
200	3.75	0.07	7.78	7.77	77.31	77.21		
230	4.00	0.06	1.21	1.21	78.52	78.42		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
		3.68	3.20	2.74	2.54	-2.07		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.44	0.18	1.99	-2.83	9.53			

MA_CZM_VIBRACORES_2025_GPJ_7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC14 #1								
Analysis Date: 07-15-25								
Analyzed By: MS								
Easting (ft): 916,291		Northing (ft): 2,860,654		Coordinate System: MA State Plane Mainland		Elevation (ft): -106.4 NAVD88		
USCS: SW		Munsell: Wet - 2.5Y-4/1 Dry - 2.5Y-5/2 Washed - 2.5Y-6/2		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 99.77	Wash Weight (g): 98.51	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 1.32 #230 - 1.30	Rock Fragments (%):	Organics (%):	Carbonate (%): 2	Shell Hash (%): 3
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	1.06	1.06	1.06	1.06		
3.5	-2.50	5.66	1.32	1.32	2.38	2.38		
4	-2.25	4.76	0.49	0.49	2.87	2.87		
5	-2.00	4.00	0.49	0.49	3.36	3.36		
7	-1.50	2.83	1.15	1.15	4.51	4.51		
10	-1.00	2.00	1.36	1.36	5.87	5.87		
14	-0.50	1.41	1.76	1.76	7.63	7.63		
18	0.00	1.00	2.84	2.85	10.47	10.48		
25	0.50	0.71	7.11	7.13	17.58	17.61		
35	1.00	0.50	17.42	17.46	35.00	35.07		
45	1.50	0.35	28.10	28.16	63.10	63.23		
60	2.00	0.25	23.56	23.61	86.66	86.84		
80	2.50	0.18	9.55	9.57	96.21	96.41		
120	3.00	0.13	1.91	1.91	98.12	98.32		
170	3.50	0.09	0.30	0.30	98.42	98.62		
200	3.75	0.07	0.06	0.06	98.48	98.68		
230	4.00	0.06	0.02	0.02	98.50	98.70		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.43	1.94	1.75	1.27	0.71	0.39	-1.32		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.06	0.48	1.09	-1.73	6.96			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC14 #2								
Analysis Date: 07-15-25								
Analyzed By: MS								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
916,291		2,860,654		MA State Plane Mainland		-111.9 NAVD88		
USCS:		Munsell:		Comments:				
SW		Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-7/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
98.79	97.71	0.01	0.05	#200 - 1.15 #230 - 1.14				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	1.82	1.84	1.82	1.84		
4	-2.25	4.76	1.28	1.30	3.10	3.14		
5	-2.00	4.00	0.71	0.72	3.81	3.86		
7	-1.50	2.83	3.01	3.05	6.82	6.91		
10	-1.00	2.00	2.44	2.47	9.26	9.38		
14	-0.50	1.41	2.98	3.02	12.24	12.40		
18	0.00	1.00	3.51	3.55	15.75	15.95		
25	0.50	0.71	8.02	8.12	23.77	24.07		
35	1.00	0.50	18.38	18.61	42.15	42.68		
45	1.50	0.35	27.57	27.91	69.72	70.59		
60	2.00	0.25	19.40	19.64	89.12	90.23		
80	2.50	0.18	7.10	7.19	96.22	97.42		
120	3.00	0.13	1.16	1.17	97.38	98.59		
170	3.50	0.09	0.22	0.22	97.60	98.81		
200	3.75	0.07	0.04	0.04	97.64	98.85		
230	4.00	0.06	0.01	0.01	97.65	98.86		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.33	1.84	1.61	1.13	0.52	0.00	-1.81		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	0.85	0.55	1.15	-1.31	4.56			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC14 #3								
Analysis Date: 07-14-25								
Analyzed By: MS								
Easting (ft): 916,291		Northing (ft): 2,860,654		Coordinate System: MA State Plane Mainland			Elevation (ft): -118.5 NAVD88	
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 99.10	Wash Weight (g): 97.36	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 1.78 #230 - 1.76	Rock Fragments (%):	Organics (%):	Carbonate (%): 2	Shell Hash (%): 1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.21	0.21	0.21	0.21		
7	-1.50	2.83	0.33	0.33	0.54	0.54		
10	-1.00	2.00	0.36	0.36	0.90	0.90		
14	-0.50	1.41	0.79	0.80	1.69	1.70		
18	0.00	1.00	1.09	1.10	2.78	2.80		
25	0.50	0.71	3.64	3.67	6.42	6.47		
35	1.00	0.50	9.61	9.70	16.03	16.17		
45	1.50	0.35	21.75	21.95	37.78	38.12		
60	2.00	0.25	30.65	30.93	68.43	69.05		
80	2.50	0.18	22.80	23.01	91.23	92.06		
120	3.00	0.13	5.18	5.23	96.41	97.29		
170	3.50	0.09	0.84	0.85	97.25	98.14		
200	3.75	0.07	0.08	0.08	97.33	98.22		
230	4.00	0.06	0.02	0.02	97.35	98.24		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.78	2.32	2.13	1.69	1.20	0.99	0.30		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.59	0.33	0.74	-1.12	6.07			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC14 #4								
Analysis Date: 07-14-25								
Analyzed By: MS								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
916,291		2,860,654		MA State Plane Mainland		-122.8 NAVD88		
USCS:		Munsell:		Comments:				
SC		Wet - 10Y-4/1 Dry - 5Y-5/1 Washed - 5Y-6/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
98.79	79.32	0.03	0.02	#200 - 20.11 #230 - 19.76				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.31	0.31	0.31	0.31		
4	-2.25	4.76	0.00	0.00	0.31	0.31		
5	-2.00	4.00	0.35	0.35	0.66	0.66		
7	-1.50	2.83	0.55	0.56	1.21	1.22		
10	-1.00	2.00	0.48	0.49	1.69	1.71		
14	-0.50	1.41	0.48	0.49	2.17	2.20		
18	0.00	1.00	0.60	0.61	2.77	2.81		
25	0.50	0.71	1.50	1.52	4.27	4.33		
35	1.00	0.50	4.18	4.23	8.45	8.56		
45	1.50	0.35	8.92	9.03	17.37	17.59		
60	2.00	0.25	11.69	11.83	29.06	29.42		
80	2.50	0.18	13.05	13.21	42.11	42.63		
120	3.00	0.13	17.30	17.51	59.41	60.14		
170	3.50	0.09	15.81	16.00	75.22	76.14		
200	3.75	0.07	3.70	3.75	78.92	79.89		
230	4.00	0.06	0.35	0.35	79.27	80.24		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
		3.46	2.71	1.81	1.41	0.58		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.2	0.22	1.08	-1.41	6.1			

MA_CZM_VIBRACORES_2025_GPJ_7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC15 #1								
Analysis Date: 07-16-25								
Analyzed By: MS								
Easting (ft): 905,329		Northing (ft): 2,860,471		Coordinate System: MA State Plane Mainland		Elevation (ft): -72.8 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/2 Dry - 2.5Y-6/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 99.39	Wash Weight (g): 97.74	Pan Retained (g): 0.01	Sieve Loss (%): 0.03	Fines (%): #200 - 1.72 #230 - 1.70	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.05	0.05	0.05	0.05		
5	-2.00	4.00	0.00	0.00	0.05	0.05		
7	-1.50	2.83	0.04	0.04	0.09	0.09		
10	-1.00	2.00	0.12	0.12	0.21	0.21		
14	-0.50	1.41	0.19	0.19	0.40	0.40		
18	0.00	1.00	0.27	0.27	0.67	0.67		
25	0.50	0.71	0.72	0.72	1.39	1.39		
35	1.00	0.50	1.20	1.21	2.59	2.60		
45	1.50	0.35	2.53	2.55	5.12	5.15		
60	2.00	0.25	6.98	7.02	12.10	12.17		
80	2.50	0.18	45.56	45.84	57.66	58.01		
120	3.00	0.13	35.64	35.86	93.30	93.87		
170	3.50	0.09	4.13	4.16	97.43	98.03		
200	3.75	0.07	0.25	0.25	97.68	98.28		
230	4.00	0.06	0.02	0.02	97.70	98.30		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.14	2.86	2.74	2.41	2.14	2.04	1.47		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.36	0.19	0.54	-2.29	14.05			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC15 #2								
Analysis Date: 07-16-25								
Analyzed By: SF								
Easting (ft): 905,329		Northing (ft): 2,860,471		Coordinate System: MA State Plane Mainland		Elevation (ft): -77.8 NAVD88		
USCS: SW		Munsell: Wet - 5Y-4/2 Dry - 2.5Y-6/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 100.52	Wash Weight (g): 98.85	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 1.76 #230 - 1.67	Rock Fragments (%):	Organics (%):	Carbonate (%): 3	Shell Hash (%): 5
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	1.40	1.39	1.40	1.39		
5/16"	-3.00	8.00	0.86	0.86	2.26	2.25		
3.5	-2.50	5.66	0.54	0.54	2.80	2.79		
4	-2.25	4.76	0.00	0.00	2.80	2.79		
5	-2.00	4.00	0.25	0.25	3.05	3.04		
7	-1.50	2.83	0.30	0.30	3.35	3.34		
10	-1.00	2.00	0.63	0.63	3.98	3.97		
14	-0.50	1.41	1.40	1.39	5.38	5.36		
18	0.00	1.00	1.83	1.82	7.21	7.18		
25	0.50	0.71	3.02	3.00	10.23	10.18		
35	1.00	0.50	3.21	3.19	13.44	13.37		
45	1.50	0.35	3.31	3.29	16.75	16.66		
60	2.00	0.25	9.11	9.06	25.86	25.72		
80	2.50	0.18	38.82	38.62	64.68	64.34		
120	3.00	0.13	29.57	29.42	94.25	93.76		
170	3.50	0.09	4.25	4.23	98.50	97.99		
200	3.75	0.07	0.25	0.25	98.75	98.24		
230	4.00	0.06	0.09	0.09	98.84	98.33		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.15	2.83	2.68	2.31	1.96	1.40	-0.63		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.96	0.26	1.27	-2.63	10.64			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC15 #3								
Analysis Date: 07-17-25								
Analyzed By: MS								
Easting (ft):		Northing (ft):		Coordinate System:			Elevation (ft):	
905,329		2,860,471		MA State Plane Mainland			-84.0 NAVD88	
USCS:		Munsell:		Comments:				
SP		Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-7/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
100.43	96.80	0.01	0.02	#200 - 3.75 #230 - 3.63			1	1
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.05	0.05	0.05	0.05		
7	-1.50	2.83	0.06	0.06	0.11	0.11		
10	-1.00	2.00	0.15	0.15	0.26	0.26		
14	-0.50	1.41	0.27	0.27	0.53	0.53		
18	0.00	1.00	0.13	0.13	0.66	0.66		
25	0.50	0.71	0.62	0.62	1.28	1.28		
35	1.00	0.50	1.36	1.35	2.64	2.63		
45	1.50	0.35	2.62	2.61	5.26	5.24		
60	2.00	0.25	8.16	8.13	13.42	13.37		
80	2.50	0.18	35.48	35.33	48.90	48.70		
120	3.00	0.13	39.99	39.82	88.89	88.52		
170	3.50	0.09	7.24	7.21	96.13	95.73		
200	3.75	0.07	0.52	0.52	96.65	96.25		
230	4.00	0.06	0.12	0.12	96.77	96.37		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.45	2.94	2.83	2.52	2.16	2.04	1.45		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.42	0.19	0.58	-2.06	12.06			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC15 #4								
Analysis Date: 07-16-25								
Analyzed By: SF								
Easting (ft): 905,329		Northing (ft): 2,860,471		Coordinate System: MA State Plane Mainland		Elevation (ft): -86.9 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 103.11	Wash Weight (g): 98.80	Pan Retained (g): 0.04	Sieve Loss (%): 0.09	Fines (%): #200 - 4.54 #230 - 4.34	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.18	0.17	0.18	0.17		
7	-1.50	2.83	0.24	0.23	0.42	0.40		
10	-1.00	2.00	0.16	0.16	0.58	0.56		
14	-0.50	1.41	0.26	0.25	0.84	0.81		
18	0.00	1.00	0.29	0.28	1.13	1.09		
25	0.50	0.71	0.51	0.49	1.64	1.58		
35	1.00	0.50	1.23	1.19	2.87	2.77		
45	1.50	0.35	2.56	2.48	5.43	5.25		
60	2.00	0.25	8.16	7.91	13.59	13.16		
80	2.50	0.18	32.41	31.43	46.00	44.59		
120	3.00	0.13	43.01	41.71	89.01	86.30		
170	3.50	0.09	8.83	8.56	97.84	94.86		
200	3.75	0.07	0.62	0.60	98.46	95.46		
230	4.00	0.06	0.21	0.20	98.67	95.66		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.56	2.97	2.86	2.56	2.19	2.05	1.45		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.43	0.19	0.64	-2.56	15.3			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC16 #1								
Analysis Date: 07-15-25								
Analyzed By: SF								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
905,819		2,842,575		MA State Plane Mainland		-67.3 NAVD88		
USCS:		Munsell:		Comments:				
SP		Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 2.5Y-7/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
99.40	97.48	0.01	0.00	#200 - 2.01 #230 - 1.95				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.00	0.00	0.00	0.00		
7	-1.50	2.83	0.17	0.17	0.17	0.17		
10	-1.00	2.00	0.23	0.23	0.40	0.40		
14	-0.50	1.41	0.13	0.13	0.53	0.53		
18	0.00	1.00	0.16	0.16	0.69	0.69		
25	0.50	0.71	0.32	0.32	1.01	1.01		
35	1.00	0.50	2.06	2.07	3.07	3.08		
45	1.50	0.35	6.88	6.92	9.95	10.00		
60	2.00	0.25	15.98	16.08	25.93	26.08		
80	2.50	0.18	26.03	26.19	51.96	52.27		
120	3.00	0.13	36.77	36.99	88.73	89.26		
170	3.50	0.09	8.08	8.13	96.81	97.39		
200	3.75	0.07	0.60	0.60	97.41	97.99		
230	4.00	0.06	0.06	0.06	97.47	98.05		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.35	2.93	2.81	2.46	1.97	1.69	1.14		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.32	0.20	0.66	-1.39	7.54			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC16 #2								
Analysis Date: 07-15-25								
Analyzed By: MS								
Easting (ft): 905,819		Northing (ft): 2,842,575		Coordinate System: MA State Plane Mainland		Elevation (ft): -71.9 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 2.5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 95.50	Wash Weight (g): 94.20	Pan Retained (g): 0.00	Sieve Loss (%): 0.03	Fines (%): #200 - 1.42 #230 - 1.39	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 2
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.32	0.34	0.32	0.34		
4	-2.25	4.76	0.00	0.00	0.32	0.34		
5	-2.00	4.00	0.11	0.12	0.43	0.46		
7	-1.50	2.83	0.12	0.13	0.55	0.59		
10	-1.00	2.00	0.12	0.13	0.67	0.72		
14	-0.50	1.41	0.26	0.27	0.93	0.99		
18	0.00	1.00	0.27	0.28	1.20	1.27		
25	0.50	0.71	0.80	0.84	2.00	2.11		
35	1.00	0.50	4.41	4.62	6.41	6.73		
45	1.50	0.35	14.25	14.92	20.66	21.65		
60	2.00	0.25	24.47	25.62	45.13	47.27		
80	2.50	0.18	22.63	23.70	67.76	70.97		
120	3.00	0.13	21.74	22.76	89.50	93.73		
170	3.50	0.09	4.33	4.53	93.83	98.26		
200	3.75	0.07	0.31	0.32	94.14	98.58		
230	4.00	0.06	0.03	0.03	94.17	98.61		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.14	2.79	2.59	2.06	1.57	1.31	0.81		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2	0.25	0.77	-1.42	9.04			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC16 #3								
Analysis Date: 07-15-25								
Analyzed By: SF								
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):		
905,819		2,842,575		MA State Plane Mainland		-79.3 NAVD88		
USCS:		Munsell:		Comments:				
SP		Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 2.5Y-7/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
97.13	93.77	0.02	0.00	#200 - 3.57 #230 - 3.48				
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.00	0.00	0.00	0.00		
5	-2.00	4.00	0.03	0.03	0.03	0.03		
7	-1.50	2.83	0.32	0.33	0.35	0.36		
10	-1.00	2.00	0.35	0.36	0.70	0.72		
14	-0.50	1.41	0.35	0.36	1.05	1.08		
18	0.00	1.00	0.32	0.33	1.37	1.41		
25	0.50	0.71	0.68	0.70	2.05	2.11		
35	1.00	0.50	3.23	3.33	5.28	5.44		
45	1.50	0.35	6.28	6.47	11.56	11.91		
60	2.00	0.25	10.94	11.26	22.50	23.17		
80	2.50	0.18	24.38	25.10	46.88	48.27		
120	3.00	0.13	37.01	38.10	83.89	86.37		
170	3.50	0.09	9.12	9.39	93.01	95.76		
200	3.75	0.07	0.65	0.67	93.66	96.43		
230	4.00	0.06	0.09	0.09	93.75	96.52		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.46	2.97	2.85	2.52	2.04	1.68	0.93		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.32	0.20	0.76	-1.76	8.25			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC17 #1								
Analysis Date: 07-14-25								
Analyzed By: MS								
Easting (ft): 929,652		Northing (ft): 2,772,280		Coordinate System: MA State Plane Mainland		Elevation (ft): -49.7 NAVD88		
USCS: SP		Munsell: Wet - 10Y-4/1 Dry - 10Y-6/1 Washed - 5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 97.13	Wash Weight (g): 94.45	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 2.78 #230 - 2.77	Rock Fragments (%):	Organics (%):	Carbonate (%): 1	Shell Hash (%): 2
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.37	0.38	0.37	0.38		
3.5	-2.50	5.66	0.00	0.00	0.37	0.38		
4	-2.25	4.76	0.08	0.08	0.45	0.46		
5	-2.00	4.00	0.09	0.09	0.54	0.55		
7	-1.50	2.83	0.06	0.06	0.60	0.61		
10	-1.00	2.00	0.04	0.04	0.64	0.65		
14	-0.50	1.41	0.03	0.03	0.67	0.68		
18	0.00	1.00	0.05	0.05	0.72	0.73		
25	0.50	0.71	0.22	0.23	0.94	0.96		
35	1.00	0.50	1.55	1.60	2.49	2.56		
45	1.50	0.35	13.01	13.39	15.50	15.95		
60	2.00	0.25	45.71	47.06	61.21	63.01		
80	2.50	0.18	28.99	29.85	90.20	92.86		
120	3.00	0.13	3.32	3.42	93.52	96.28		
170	3.50	0.09	0.59	0.61	94.11	96.89		
200	3.75	0.07	0.32	0.33	94.43	97.22		
230	4.00	0.06	0.01	0.01	94.44	97.23		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.81	2.35	2.20	1.86	1.60	1.50	1.09		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.83	0.28	0.57	-3.48	31.56			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC17 #2								
Analysis Date: 07-14-25								
Analyzed By: MS								
Easting (ft): 929,652		Northing (ft): 2,772,280		Coordinate System: MA State Plane Mainland		Elevation (ft): -54.1 NAVD88		
USCS: SW		Munsell: Wet - 10Y-4/1 Dry - 10Y-7/1 Washed - N-7/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 107.78	Wash Weight (g): 105.92	Pan Retained (g): 0.02	Sieve Loss (%): 0.08	Fines (%): #200 - 1.88 #230 - 1.85	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.10	0.09	0.10	0.09		
5/16"	-3.00	8.00	6.41	5.95	6.51	6.04		
3.5	-2.50	5.66	7.84	7.27	14.35	13.31		
4	-2.25	4.76	3.41	3.16	17.76	16.47		
5	-2.00	4.00	4.73	4.39	22.49	20.86		
7	-1.50	2.83	8.53	7.91	31.02	28.77		
10	-1.00	2.00	9.25	8.58	40.27	37.35		
14	-0.50	1.41	10.91	10.12	51.18	47.47		
18	0.00	1.00	10.71	9.94	61.89	57.41		
25	0.50	0.71	10.79	10.01	72.68	67.42		
35	1.00	0.50	6.98	6.48	79.66	73.90		
45	1.50	0.35	4.27	3.96	83.93	77.86		
60	2.00	0.25	11.32	10.50	95.25	88.36		
80	2.50	0.18	8.06	7.48	103.31	95.84		
120	3.00	0.13	2.02	1.87	105.33	97.71		
170	3.50	0.09	0.36	0.33	105.69	98.04		
200	3.75	0.07	0.09	0.08	105.78	98.12		
230	4.00	0.06	0.03	0.03	105.81	98.15		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.44	1.79	1.14	-0.37	-1.74	-2.29	-3.09		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	-0.38	1.30	1.71	0.06	1.97			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC18 #1								
Analysis Date: 07-16-25								
Analyzed By: MS								
Easting (ft): 927,771		Northing (ft): 2,763,035		Coordinate System: MA State Plane Mainland		Elevation (ft): -46.0 NAVD88		
USCS: SP		Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-6/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 104.34	Wash Weight (g): 103.20	Pan Retained (g): 0.01	Sieve Loss (%): 0.01	Fines (%): #200 - 1.10 #230 - 1.09	Rock Fragments (%):	Organics (%):	Carbonate (%): 2	Shell Hash (%): 4
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	1.08	1.04	1.08	1.04		
5/16"	-3.00	8.00	0.00	0.00	1.08	1.04		
3.5	-2.50	5.66	0.22	0.21	1.30	1.25		
4	-2.25	4.76	0.11	0.11	1.41	1.36		
5	-2.00	4.00	0.18	0.17	1.59	1.53		
7	-1.50	2.83	0.21	0.20	1.80	1.73		
10	-1.00	2.00	0.38	0.36	2.18	2.09		
14	-0.50	1.41	0.59	0.57	2.77	2.66		
18	0.00	1.00	1.81	1.73	4.58	4.39		
25	0.50	0.71	8.22	7.88	12.80	12.27		
35	1.00	0.50	26.04	24.96	38.84	37.23		
45	1.50	0.35	40.42	38.74	79.26	75.97		
60	2.00	0.25	16.67	15.98	95.93	91.95		
80	2.50	0.18	5.29	5.07	101.22	97.02		
120	3.00	0.13	1.32	1.27	102.54	98.29		
170	3.50	0.09	0.52	0.50	103.06	98.79		
200	3.75	0.07	0.11	0.11	103.17	98.90		
230	4.00	0.06	0.01	0.01	103.18	98.91		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
2.30	1.75	1.49	1.16	0.76	0.57	0.04		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.08	0.47	0.83	-2.36	15.08			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values					 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts									
Sample Name: MA-CZM-2025-VC18 #2									
Analysis Date: 07-16-25									
Analyzed By: MS									
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):			
927,771		2,763,035		MA State Plane Mainland		-50.2 NAVD88			
USCS:		Munsell:		Comments:					
SP-SM		Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-7/1		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).					
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):	
100.04	91.36	0.02	0.03	#200 - 9.52 #230 - 8.72					
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained			
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00			
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00			
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00			
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00			
3.5	-2.50	5.66	0.00	0.00	0.00	0.00			
4	-2.25	4.76	0.10	0.10	0.10	0.10			
5	-2.00	4.00	0.17	0.17	0.27	0.27			
7	-1.50	2.83	0.27	0.27	0.54	0.54			
10	-1.00	2.00	0.26	0.26	0.80	0.80			
14	-0.50	1.41	0.12	0.12	0.92	0.92			
18	0.00	1.00	0.13	0.13	1.05	1.05			
25	0.50	0.71	0.39	0.39	1.44	1.44			
35	1.00	0.50	2.34	2.34	3.78	3.78			
45	1.50	0.35	6.65	6.65	10.43	10.43			
60	2.00	0.25	9.79	9.79	20.22	20.22			
80	2.50	0.18	17.15	17.14	37.37	37.36			
120	3.00	0.13	26.35	26.34	63.72	63.70			
170	3.50	0.09	22.95	22.94	86.67	86.64			
200	3.75	0.07	3.84	3.84	90.51	90.48			
230	4.00	0.06	0.80	0.80	91.31	91.28			
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95			
	3.44	3.25	2.74	2.14	1.78	1.09			
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis				
Statistics	2.5	0.18	0.84	-1.62	8.13				

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC18 #3								
Analysis Date: 07-17-25								
Analyzed By: SF								
Easting (ft): 927,771		Northing (ft): 2,763,035		Coordinate System: MA State Plane Mainland		Elevation (ft): -54.2 NAVD88		
USCS: SC		Munsell: Wet - 10Y-4/1 Dry - 10Y-5/1 Washed - 10Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 93.46	Wash Weight (g): 72.66	Pan Retained (g): 0.06	Sieve Loss (%): 0.01	Fines (%): #200 - 23.98 #230 - 22.33	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	1.33	1.42	1.33	1.42		
5/16"	-3.00	8.00	0.80	0.86	2.13	2.28		
3.5	-2.50	5.66	0.31	0.33	2.44	2.61		
4	-2.25	4.76	0.00	0.00	2.44	2.61		
5	-2.00	4.00	0.05	0.05	2.49	2.66		
7	-1.50	2.83	0.08	0.09	2.57	2.75		
10	-1.00	2.00	0.05	0.05	2.62	2.80		
14	-0.50	1.41	0.09	0.10	2.71	2.90		
18	0.00	1.00	0.18	0.19	2.89	3.09		
25	0.50	0.71	0.50	0.53	3.39	3.62		
35	1.00	0.50	1.33	1.42	4.72	5.04		
45	1.50	0.35	2.71	2.90	7.43	7.94		
60	2.00	0.25	3.95	4.23	11.38	12.17		
80	2.50	0.18	2.71	2.90	14.09	15.07		
120	3.00	0.13	13.69	14.65	27.78	29.72		
170	3.50	0.09	36.12	38.65	63.90	68.37		
200	3.75	0.07	7.15	7.65	71.05	76.02		
230	4.00	0.06	1.54	1.65	72.59	77.67		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
		3.72	3.26	2.84	2.53	0.99		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.69	0.15	1.37	-3.29	14.6			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC18 #4								
Analysis Date: 07-16-25								
Analyzed By: SF								
Easting (ft): 927,771		Northing (ft): 2,763,035		Coordinate System: MA State Plane Mainland		Elevation (ft): -56.2 NAVD88		
USCS: SW-SM		Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-7/1		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 104.08	Wash Weight (g): 95.74	Pan Retained (g): 0.07	Sieve Loss (%): 0.14	Fines (%): #200 - 8.73 #230 - 8.23	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.94	0.90	0.94	0.90		
4	-2.25	4.76	0.62	0.60	1.56	1.50		
5	-2.00	4.00	0.67	0.64	2.23	2.14		
7	-1.50	2.83	2.11	2.03	4.34	4.17		
10	-1.00	2.00	1.07	1.03	5.41	5.20		
14	-0.50	1.41	0.65	0.62	6.06	5.82		
18	0.00	1.00	0.43	0.41	6.49	6.23		
25	0.50	0.71	1.09	1.05	7.58	7.28		
35	1.00	0.50	4.31	4.14	11.89	11.42		
45	1.50	0.35	15.61	15.00	27.50	26.42		
60	2.00	0.25	41.11	39.50	68.61	65.92		
80	2.50	0.18	10.97	10.54	79.58	76.46		
120	3.00	0.13	5.74	5.51	85.32	81.97		
170	3.50	0.09	7.39	7.10	92.71	89.07		
200	3.75	0.07	2.29	2.20	95.00	91.27		
230	4.00	0.06	0.52	0.50	95.52	91.77		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
	3.14	2.43	1.80	1.45	1.15	-1.10		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.66	0.32	1.15	-1.55	6.94			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts									
Sample Name: MA-CZM-2025-VC18 #5									
Analysis Date: 07-16-25									
Analyzed By: SF									
Easting (ft):		Northing (ft):		Coordinate System:		Elevation (ft):			
927,771		2,763,035		MA State Plane Mainland		-57.7 NAVD88			
USCS:		Munsell:		Comments:					
SM-SC		Wet - 10Y-4/1 Dry - 10Y-5/1 Washed - N-7/0		Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).					
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):	
98.59	63.40	0.16	0.04	#200 - 38.68 #230 - 35.92					
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained			
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00			
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00			
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00			
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00			
3.5	-2.50	5.66	0.00	0.00	0.00	0.00			
4	-2.25	4.76	0.00	0.00	0.00	0.00			
5	-2.00	4.00	0.07	0.07	0.07	0.07			
7	-1.50	2.83	0.12	0.12	0.19	0.19			
10	-1.00	2.00	0.09	0.09	0.28	0.28			
14	-0.50	1.41	0.27	0.27	0.55	0.55			
18	0.00	1.00	0.60	0.61	1.15	1.16			
25	0.50	0.71	1.60	1.62	2.75	2.78			
35	1.00	0.50	2.79	2.83	5.54	5.61			
45	1.50	0.35	2.98	3.02	8.52	8.63			
60	2.00	0.25	5.73	5.81	14.25	14.44			
80	2.50	0.18	4.44	4.50	18.69	18.94			
120	3.00	0.13	10.70	10.85	29.39	29.79			
170	3.50	0.09	22.63	22.95	52.02	52.74			
200	3.75	0.07	8.46	8.58	60.48	61.32			
230	4.00	0.06	2.72	2.76	63.20	64.08			
Phi 5		Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
				3.44	2.78	2.17	0.89		
Moment	Mean Phi		Mean mm		Sorting		Skewness		Kurtosis
Statistics	2.68		0.16		1.01		-1.41		4.81

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC20 #1								
Analysis Date: 07-16-25								
Analyzed By: MS				Easting (ft): 933,849 Northing (ft): 2,748,751 Coordinate System: MA State Plane Mainland Elevation (ft): -53.9 NAVD88				
USCS: SW-SM		Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 2.5Y-7/1						Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).
Dry Weight (g): 103.04	Wash Weight (g): 93.16	Pan Retained (g): 0.03	Sieve Loss (%): 0.13	Fines (%): #200 - 10.01 #230 - 9.74	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.84	0.82	0.84	0.82		
4	-2.25	4.76	0.24	0.23	1.08	1.05		
5	-2.00	4.00	1.26	1.22	2.34	2.27		
7	-1.50	2.83	1.52	1.48	3.86	3.75		
10	-1.00	2.00	1.75	1.70	5.61	5.45		
14	-0.50	1.41	2.25	2.18	7.86	7.63		
18	0.00	1.00	2.53	2.46	10.39	10.09		
25	0.50	0.71	5.13	4.98	15.52	15.07		
35	1.00	0.50	8.62	8.37	24.14	23.44		
45	1.50	0.35	10.76	10.44	34.90	33.88		
60	2.00	0.25	12.89	12.51	47.79	46.39		
80	2.50	0.18	16.64	16.15	64.43	62.54		
120	3.00	0.13	10.43	10.12	74.86	72.66		
170	3.50	0.09	13.61	13.21	88.47	85.87		
200	3.75	0.07	4.25	4.12	92.72	89.99		
230	4.00	0.06	0.28	0.27	93.00	90.26		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
	3.43	3.09	2.11	1.07	0.56	-1.13		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	1.7	0.31	1.4	-0.95	3.67			

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

Granularmetric Report Depths and elevations based on measured values					 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts									
Sample Name: MA-CZM-2025-VC20 #2									
Analysis Date: 07-16-25									
Analyzed By: MS									
Easting (ft): 933,849		Northing (ft): 2,748,751		Coordinate System: MA State Plane Mainland			Elevation (ft): -55.4 NAVD88		
USCS: GW		Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - N-6/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).					
Dry Weight (g): 119.34	Wash Weight (g): 114.93	Pan Retained (g): 0.01	Sieve Loss (%): 0.02	Fines (%): #200 - 3.75 #230 - 3.72	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):	
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained			
1.25"	-5.00	32.00	0.00	0.00	0.00	0.00			
1.0"	-4.75	26.91	12.66	10.61	12.66	10.61			
3/4"	-4.25	19.03	0.00	0.00	12.66	10.61			
5/8"	-4.00	16.00	6.48	5.43	19.14	16.04			
7/16"	-3.50	11.31	5.42	4.54	24.56	20.58			
5/16"	-3.00	8.00	18.37	15.39	42.93	35.97			
3.5	-2.50	5.66	15.87	13.30	58.80	49.27			
4	-2.25	4.76	2.34	1.96	61.14	51.23			
5	-2.00	4.00	3.05	2.56	64.19	53.79			
7	-1.50	2.83	4.66	3.90	68.85	57.69			
10	-1.00	2.00	2.96	2.48	71.81	60.17			
14	-0.50	1.41	2.47	2.07	74.28	62.24			
18	0.00	1.00	2.52	2.11	76.80	64.35			
25	0.50	0.71	5.67	4.75	82.47	69.10			
35	1.00	0.50	7.21	6.04	89.68	75.14			
45	1.50	0.35	4.66	3.90	94.34	79.04			
60	2.00	0.25	9.61	8.05	103.95	87.09			
80	2.50	0.18	2.49	2.09	106.44	89.18			
120	3.00	0.13	1.80	1.51	108.24	90.69			
170	3.50	0.09	5.21	4.37	113.45	95.06			
200	3.75	0.07	1.42	1.19	114.87	96.25			
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95			
3.49	1.81	0.99	-2.41	-3.36	-4.01	-4.65			
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis				
Statistics	-1.53	2.89	2.5	0.47	1.94				

MA_CZM_VIBRACORES_2025 GPJ 7/23/25

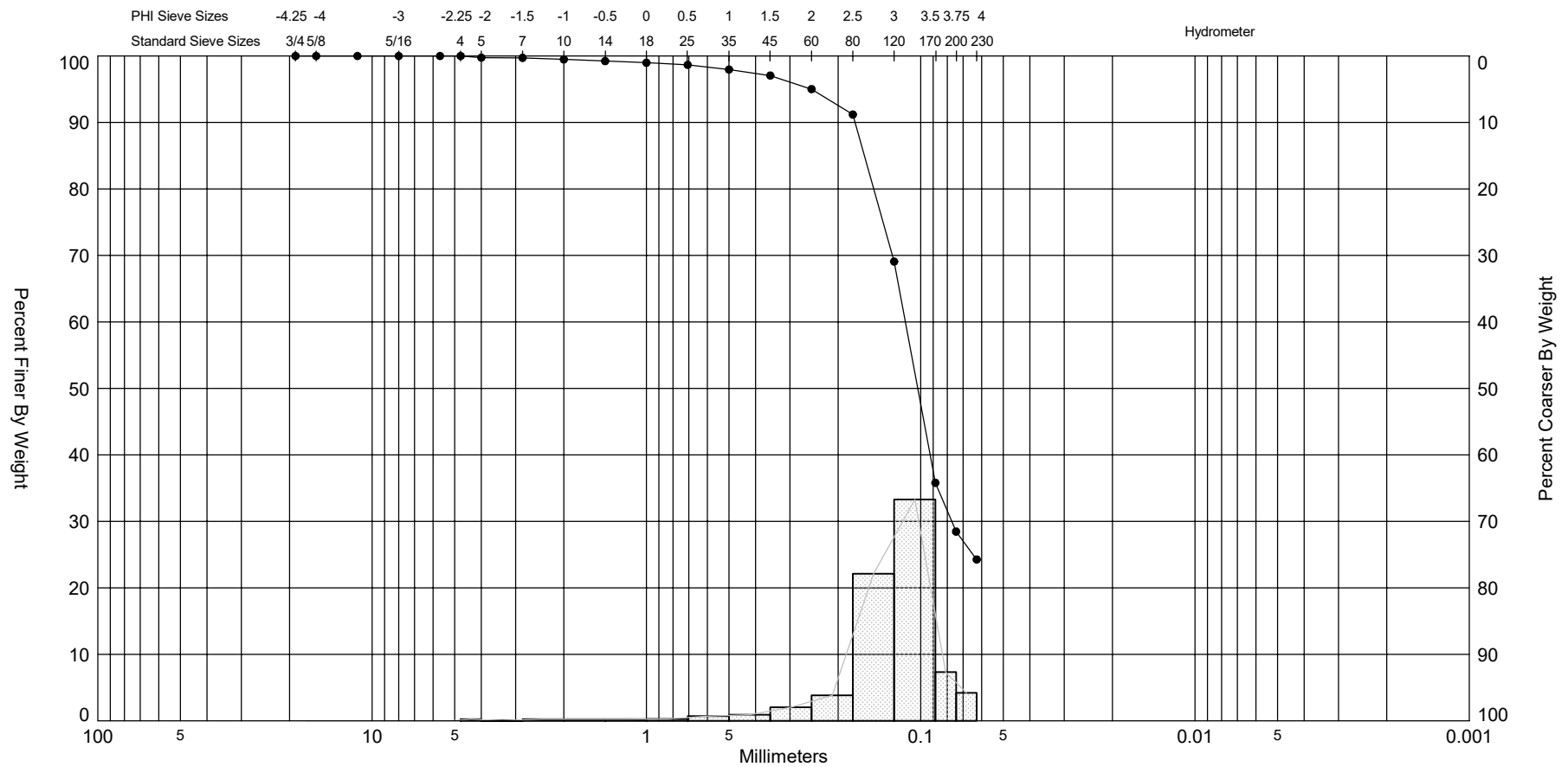
Granularmetric Report Depths and elevations based on measured values				 APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102				
Project Name: Preliminary Characterization of Offshore Sand Resources, Massachusetts								
Sample Name: MA-CZM-2025-VC20 #3								
Analysis Date: 07-16-25								
Analyzed By: MS								
Easting (ft): 933,849		Northing (ft): 2,748,751		Coordinate System: MA State Plane Mainland		Elevation (ft): -59.6 NAVD88		
USCS: SP		Munsell: Wet - N-5/0 Dry - N-6/0 Washed - N-7/0		Comments: Rock fragment, organic and shell hash percentages are based on visual estimates. Carbonate percentage is based on the acid leaching methodology described in Twenhofel and Tyler (1941).				
Dry Weight (g): 101.53	Wash Weight (g): 99.72	Pan Retained (g): 0.00	Sieve Loss (%): 0.01	Fines (%): #200 - 1.83 #230 - 1.80	Rock Fragments (%):	Organics (%):	Carbonate (%):	Shell Hash (%):
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained		
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00		
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00		
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00		
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00		
3.5	-2.50	5.66	0.00	0.00	0.00	0.00		
4	-2.25	4.76	0.05	0.05	0.05	0.05		
5	-2.00	4.00	0.00	0.00	0.05	0.05		
7	-1.50	2.83	0.00	0.00	0.05	0.05		
10	-1.00	2.00	0.00	0.00	0.05	0.05		
14	-0.50	1.41	0.02	0.02	0.07	0.07		
18	0.00	1.00	0.06	0.06	0.13	0.13		
25	0.50	0.71	0.45	0.44	0.58	0.57		
35	1.00	0.50	3.05	3.00	3.63	3.57		
45	1.50	0.35	9.87	9.72	13.50	13.29		
60	2.00	0.25	27.14	26.73	40.64	40.02		
80	2.50	0.18	39.86	39.26	80.50	79.28		
120	3.00	0.13	14.84	14.62	95.34	93.90		
170	3.50	0.09	3.81	3.75	99.15	97.65		
200	3.75	0.07	0.53	0.52	99.68	98.17		
230	4.00	0.06	0.03	0.03	99.71	98.20		
Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95		
3.15	2.66	2.45	2.13	1.72	1.55	1.07		
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis			
Statistics	2.08	0.24	0.57	-0.48	5.25			

Appendix H

2025 APTIM Individual Grain Size Distribution



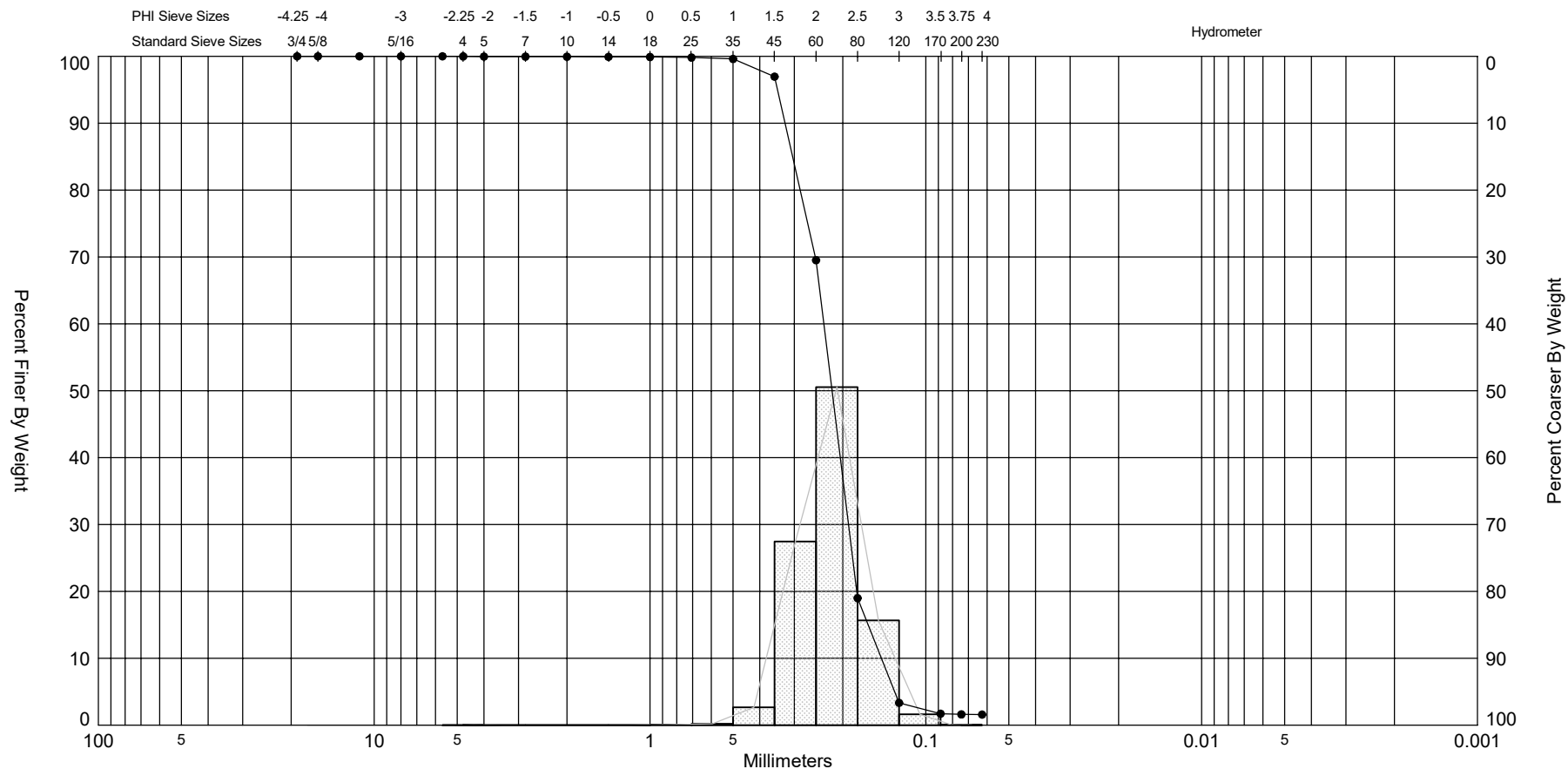
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC01 #1	—●—	-114.5	SM	#200 - 28.47 #230 - 24.27			3.29	2.97	-3.06	17.16	0.74	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-29-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	857,676
												Northing (Y, ft):	2,948,696
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

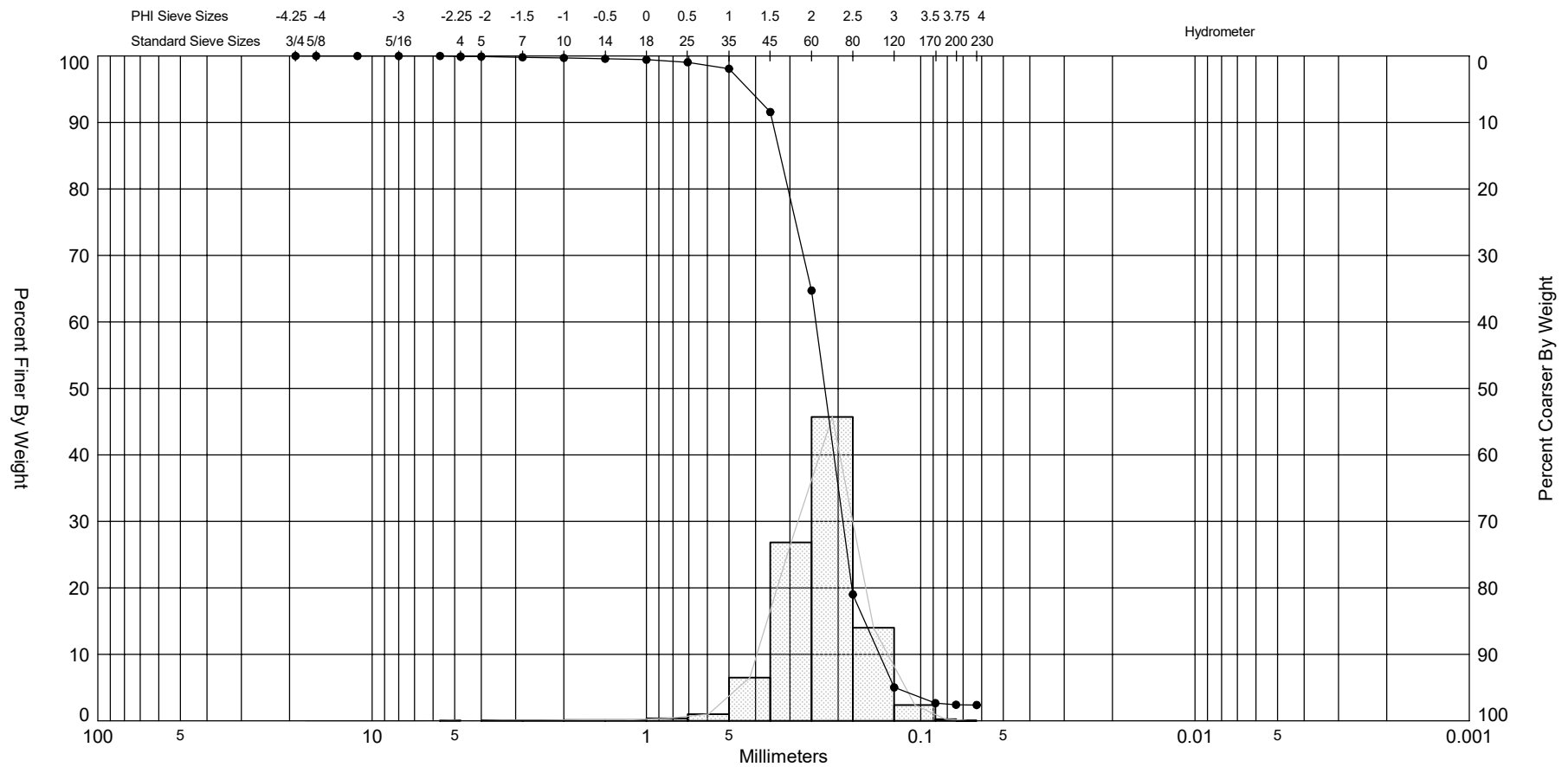
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC03 #1	—●—	-58.6	SP	#200 - 1.61 #230 - 1.58		1	2.19	2.17	-0.73	10.45	0.42	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-30-25
Depths and elevations based on measured values												Analyzed By:	TJ
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	836,453
												Northing (Y, ft):	2,935,772
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

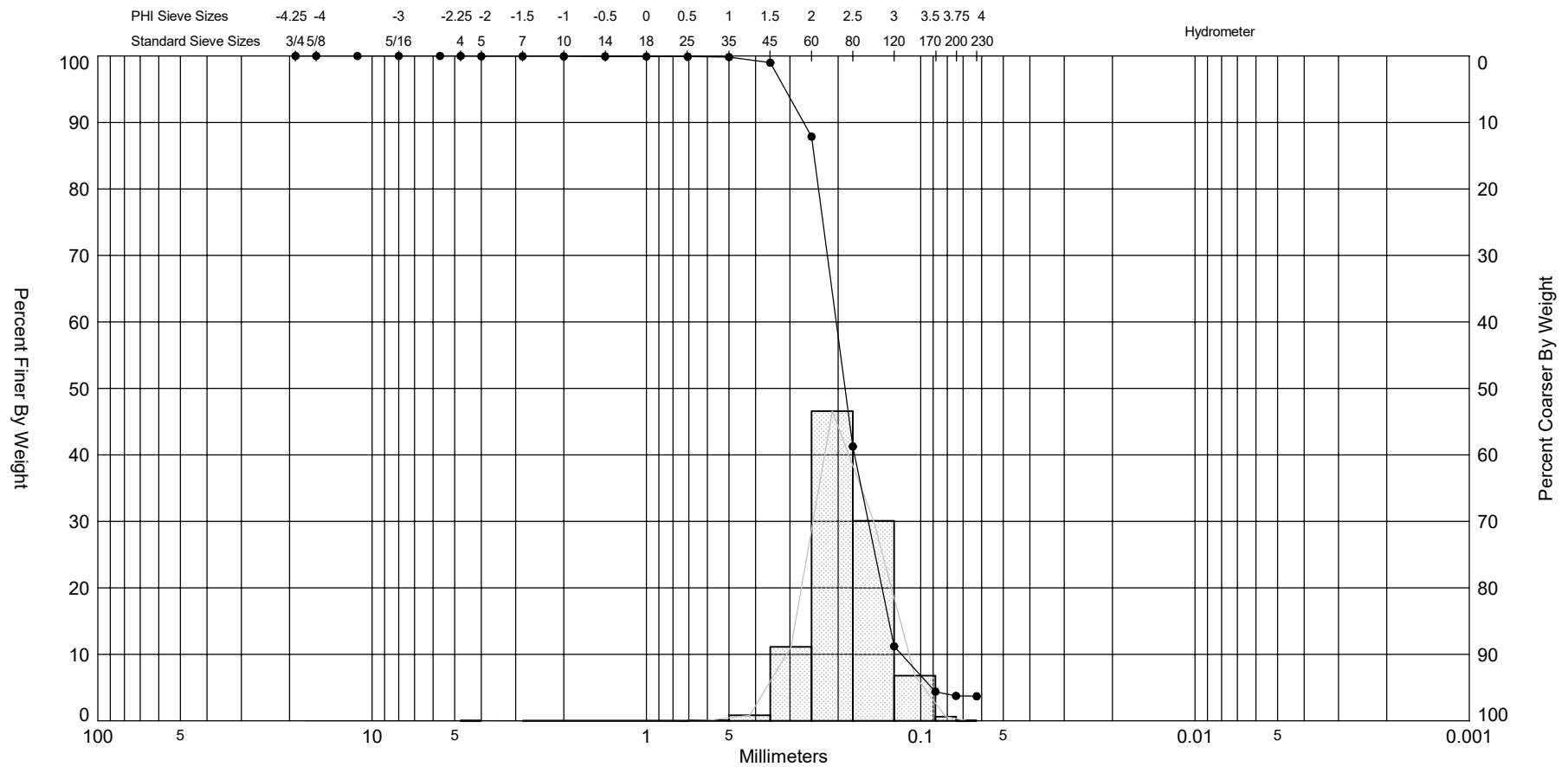
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

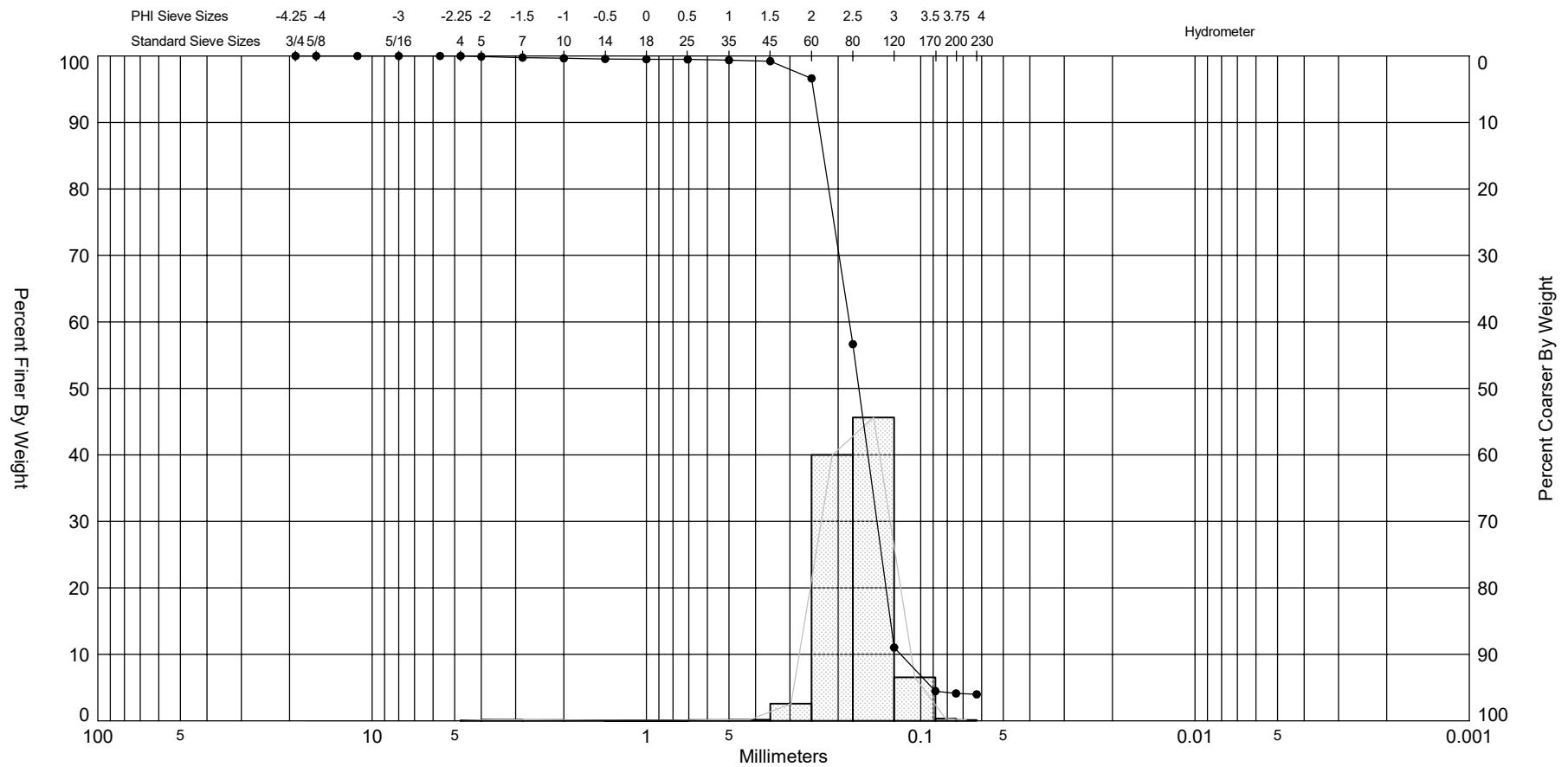
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC03 #2	—●—	-62.2	SP	#200 - 2.42 #230 - 2.38			2.16	2.1	-1.61	12.95	0.54	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-28-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	836,453
												Northing (Y, ft):	2,935,772
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC03 #3	—●—	-67.1	SP	#200 - 3.75 #230 - 3.69		1	2.41	2.42	-0.6	10.26	0.43	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-28-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	836,453
												Northing (Y, ft):	2,935,772
												Horizontal Datum:	NAD 1983
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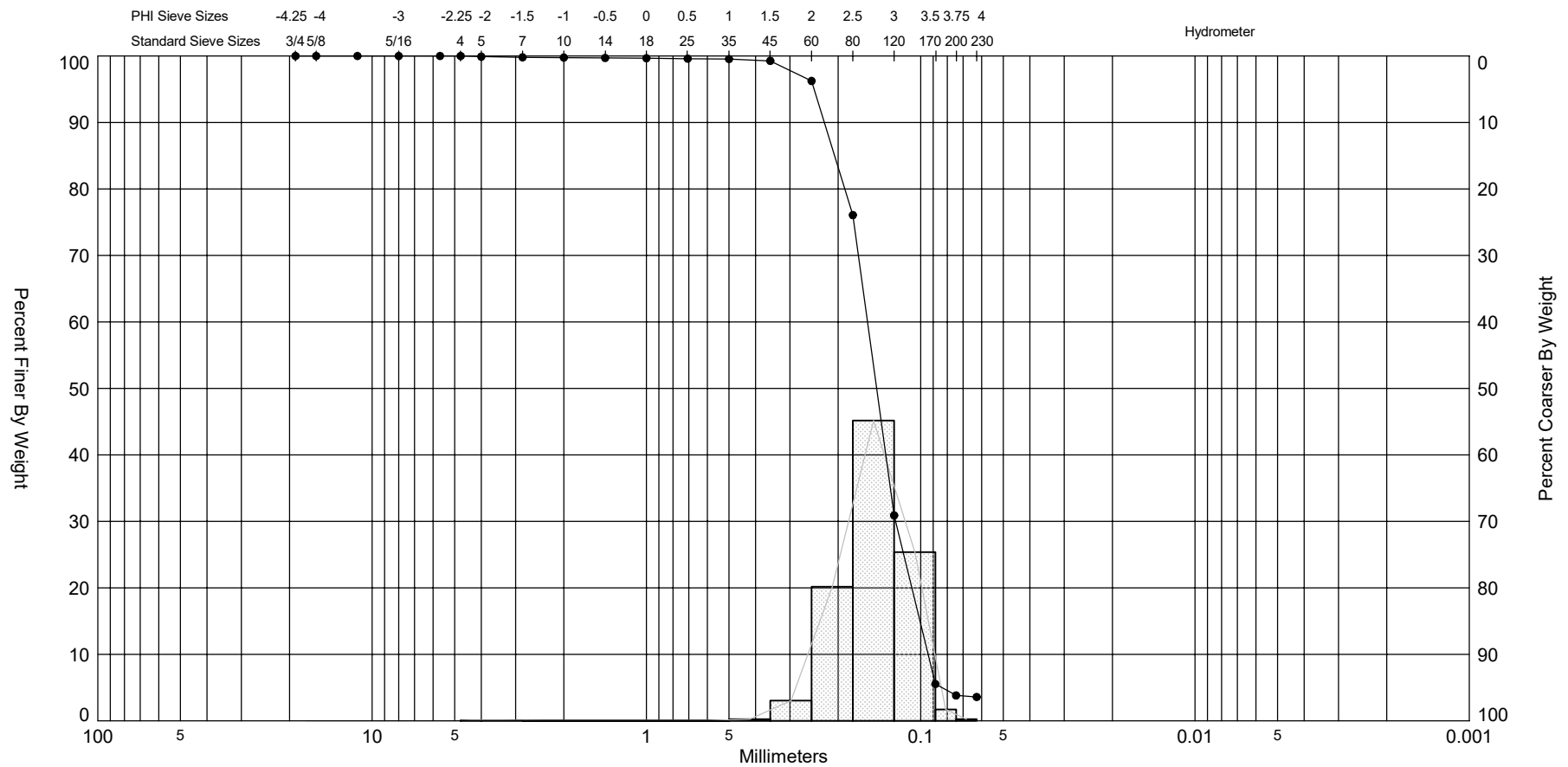
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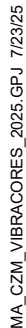
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC03 #4	—●—	-70.2	SP	#200 - 4.12 #230 - 3.98			2.57	2.53	-3.48	34.25	0.45	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-28-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	836,453
												Northing (Y, ft):	2,935,772
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25

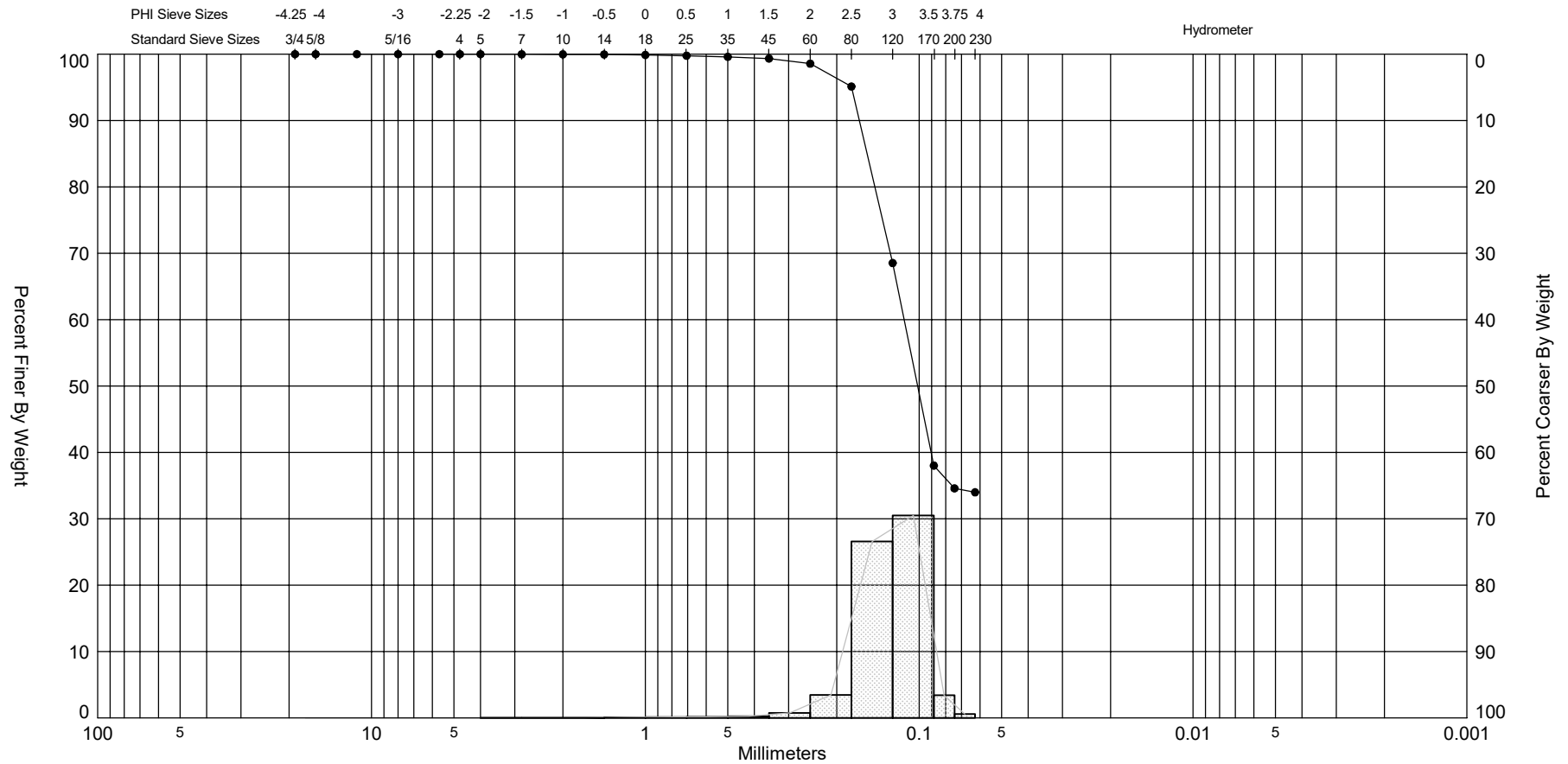


Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC04 #1		-46.6	SP	#200 - 3.82 #230 - 3.58			2.79	2.74	-2.61	23.36	0.49	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-29-25
Depths and elevations based on measured values												Analyzed By:	CC
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	830,647
												Northing (Y, ft):	2,932,560
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88



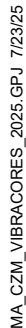
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC04 #2		-50.0	SM	#200 - 12.42 #230 - 11.58			2.91	2.87	-3.92	44.88	0.45	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-29-25
Depths and elevations based on measured values												Analyzed By:	CC
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	830,647
												Northing (Y, ft):	2,932,560
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



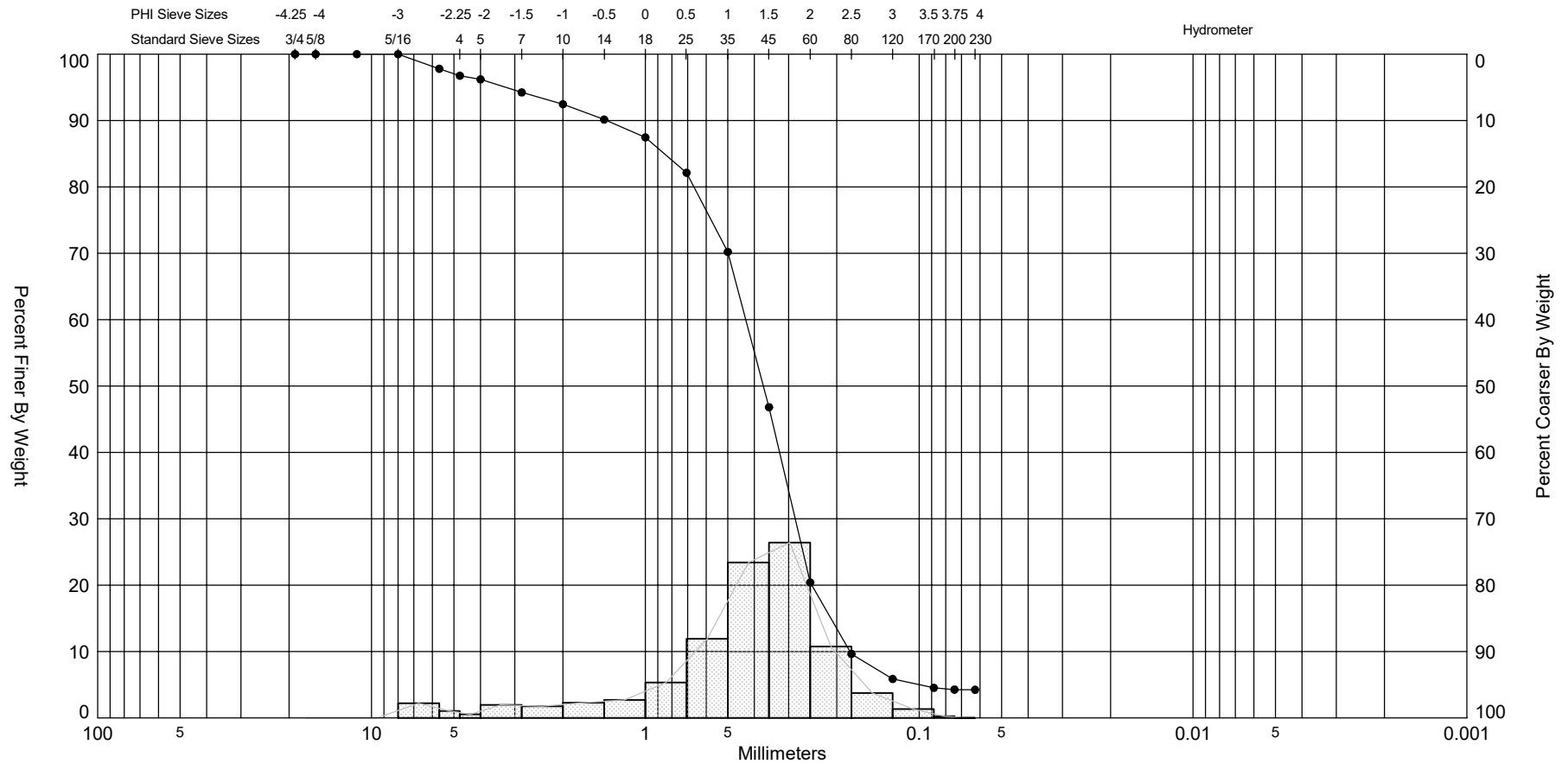
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC04 #3	—●—	-53.0	SM-SC	#200 - 34.58 #230 - 33.99			3.3	2.98	-2.4	17.93	0.44	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-29-25
Depths and elevations based on measured values												Analyzed By:	CC
							APTIM						
							6401 Congress Avenue, Suite 140						
							Boca Raton, FL 33487						
							ph (561) 391-8102						
												Easting (X, ft):	830,647
												Northing (Y, ft):	2,932,560
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC04 #4		-56.0	SM-SC	#200 - 31.54 #230 - 30.47			3.34	3.04	-4.93	43.63	0.57	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-02-25
Depths and elevations based on measured values												Analyzed By:	CC
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	830,647
												Northing (Y, ft):	2,932,560
												Horizontal Datum:	NAD 1983
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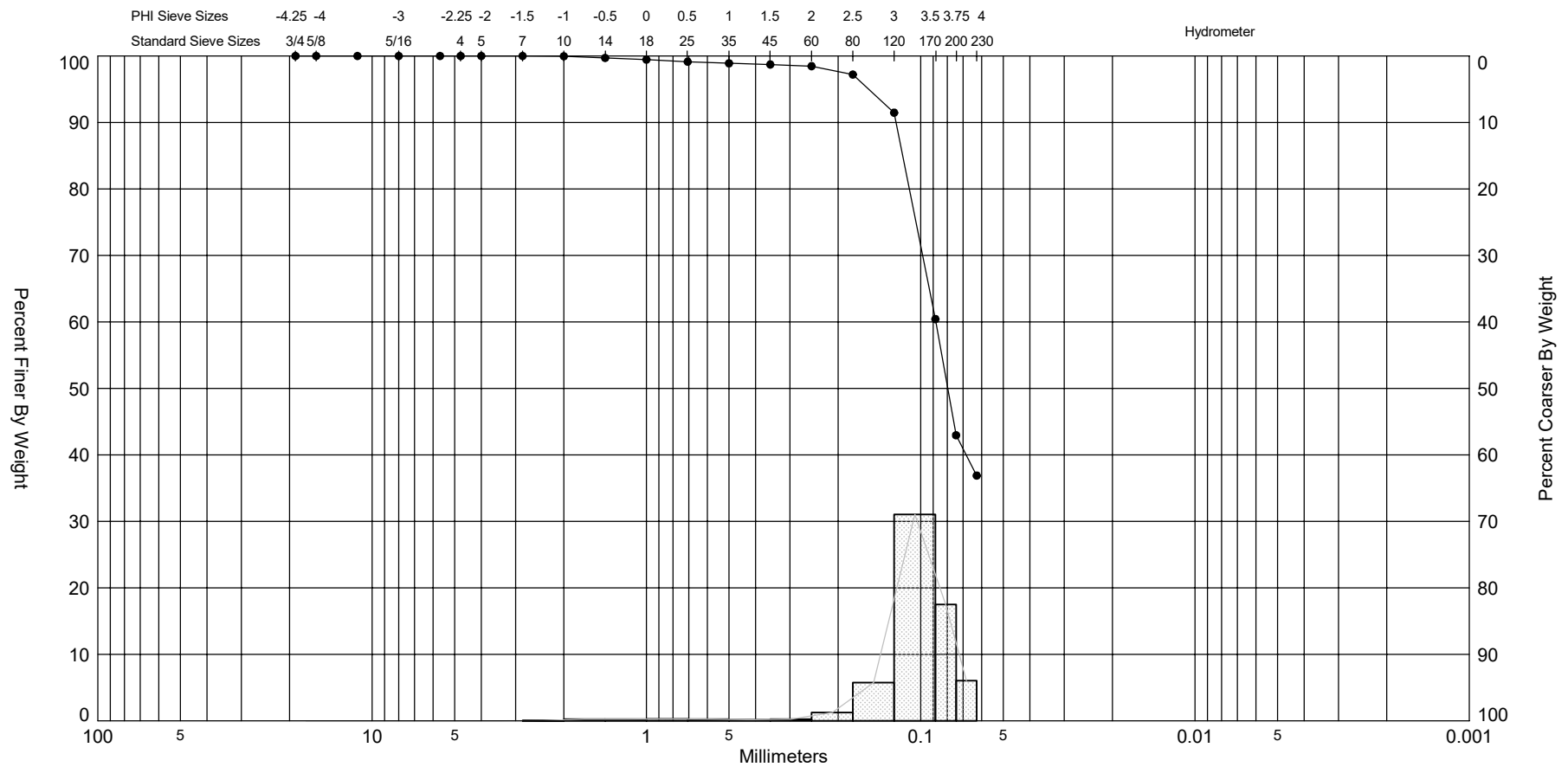
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC04 #5	—●—	-60.6	SW	#200 - 4.26 #230 - 4.24			1.43	1.13	-1.4	5.13	1.21	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-29-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	830,647
												Northing (Y, ft):	2,932,560
												Horizontal Datum:	NAD 1983
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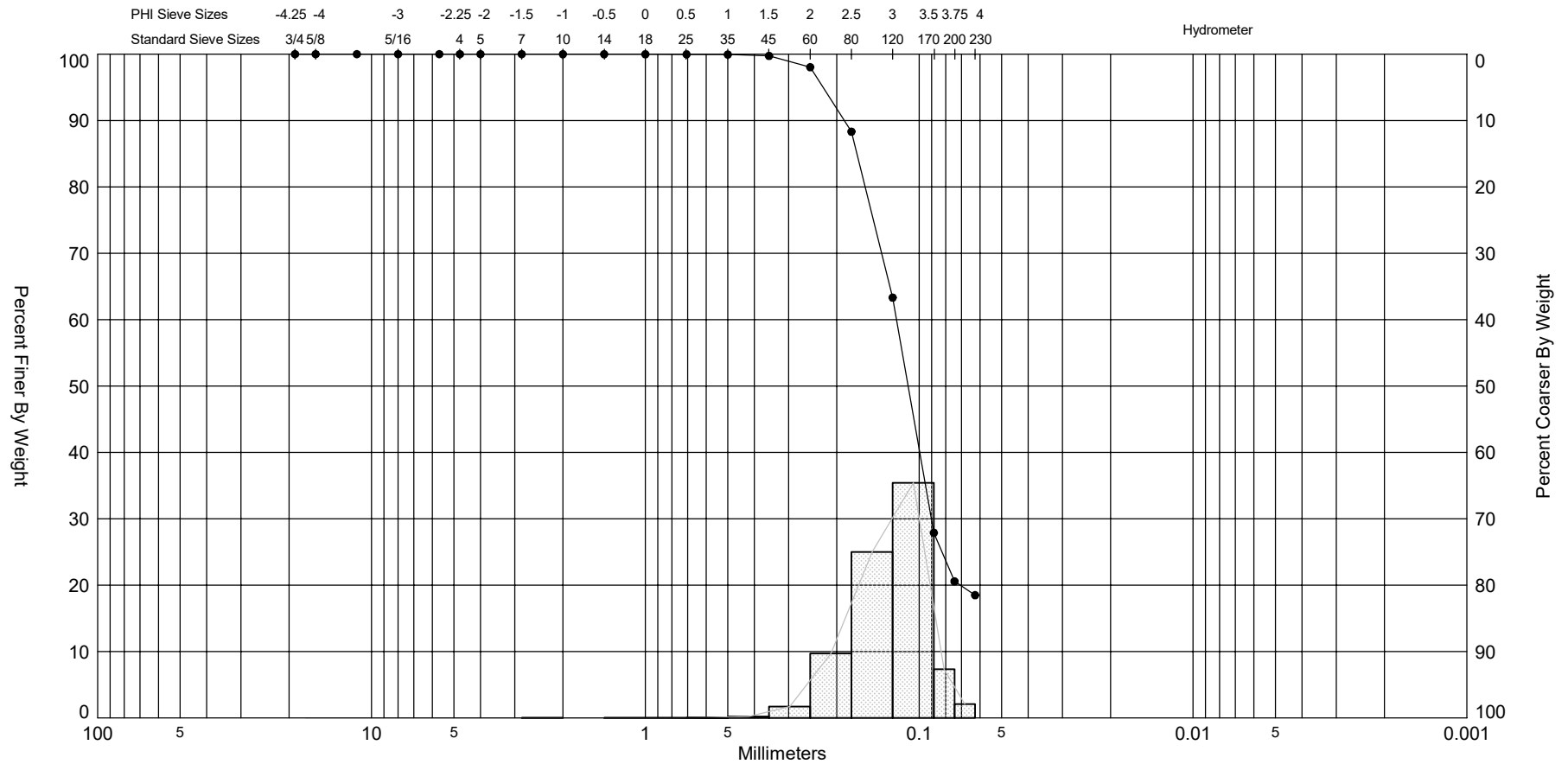
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC05 #1	—●—	-110.8	SM	#200 - 42.95 #230 - 36.89			3.65	3.28	-3.84	23.74	0.58	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-28-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	858,920
												Northing (Y, ft):	3,126,090
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

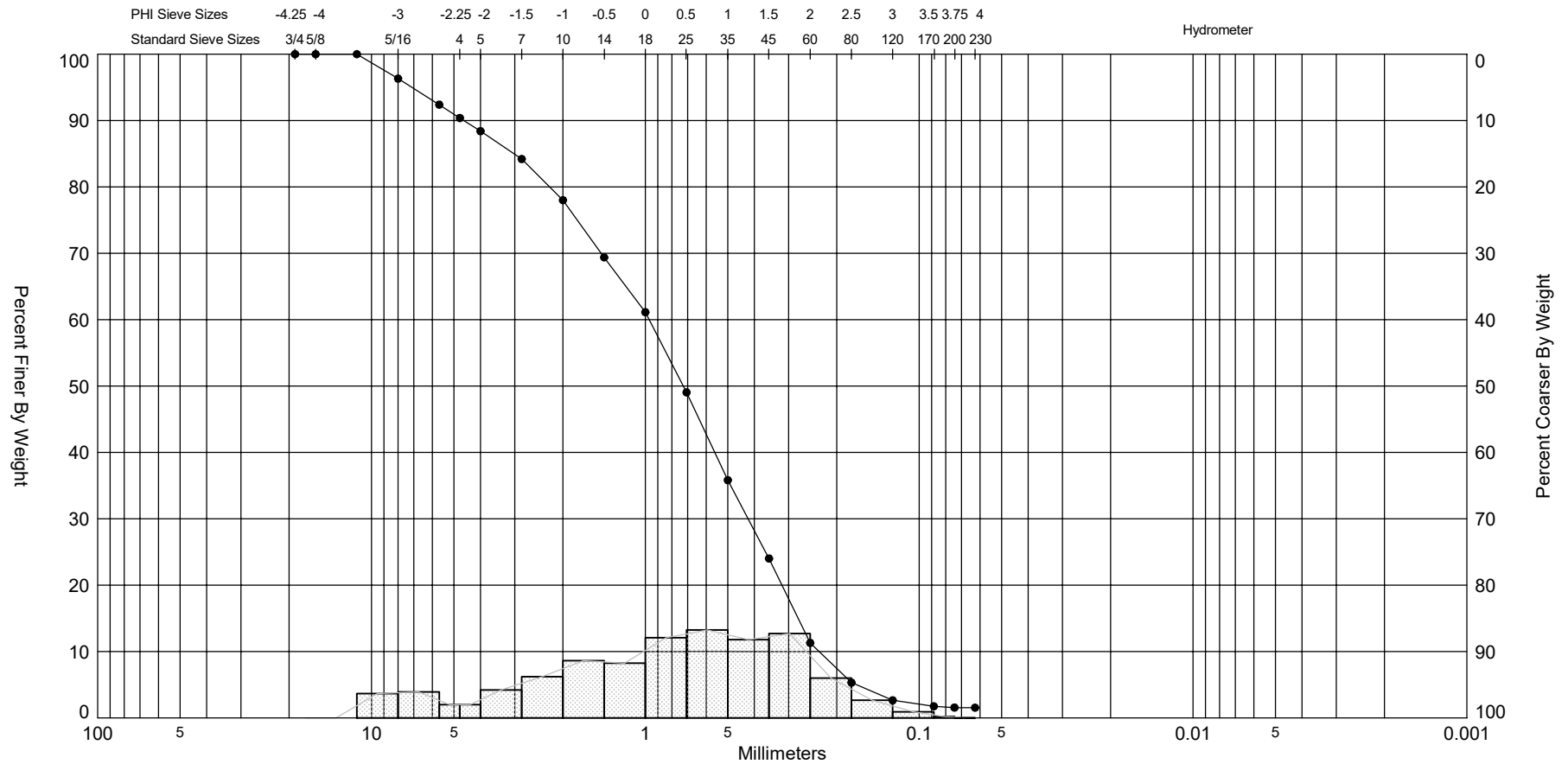
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay	
Coarse	Fine	Coarse	Medium	Fine		

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC05 #2	—●—	-118.1	SM	#200 - 20.57 #230 - 18.49			3.19	2.99	-0.77	4.57	0.46	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-29-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	858,920
												Northing (Y, ft):	3,126,090
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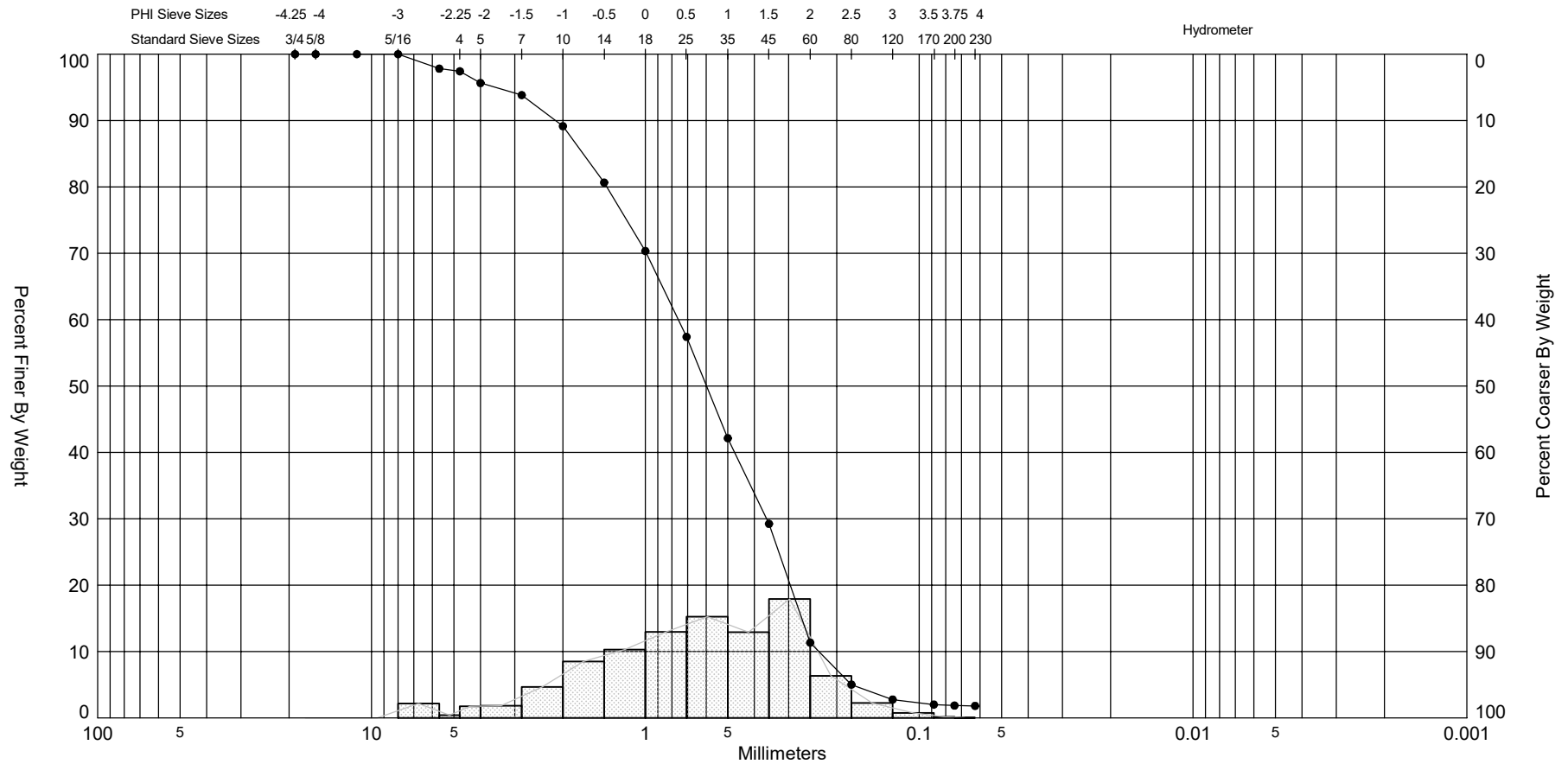
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC06 #1	—●—	-89.5	SW	#200 - 1.56 #230 - 1.54		1	0.46	0.19	-0.45	2.49	1.57	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-30-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	849,044
												Northing (Y, ft):	3,128,942
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

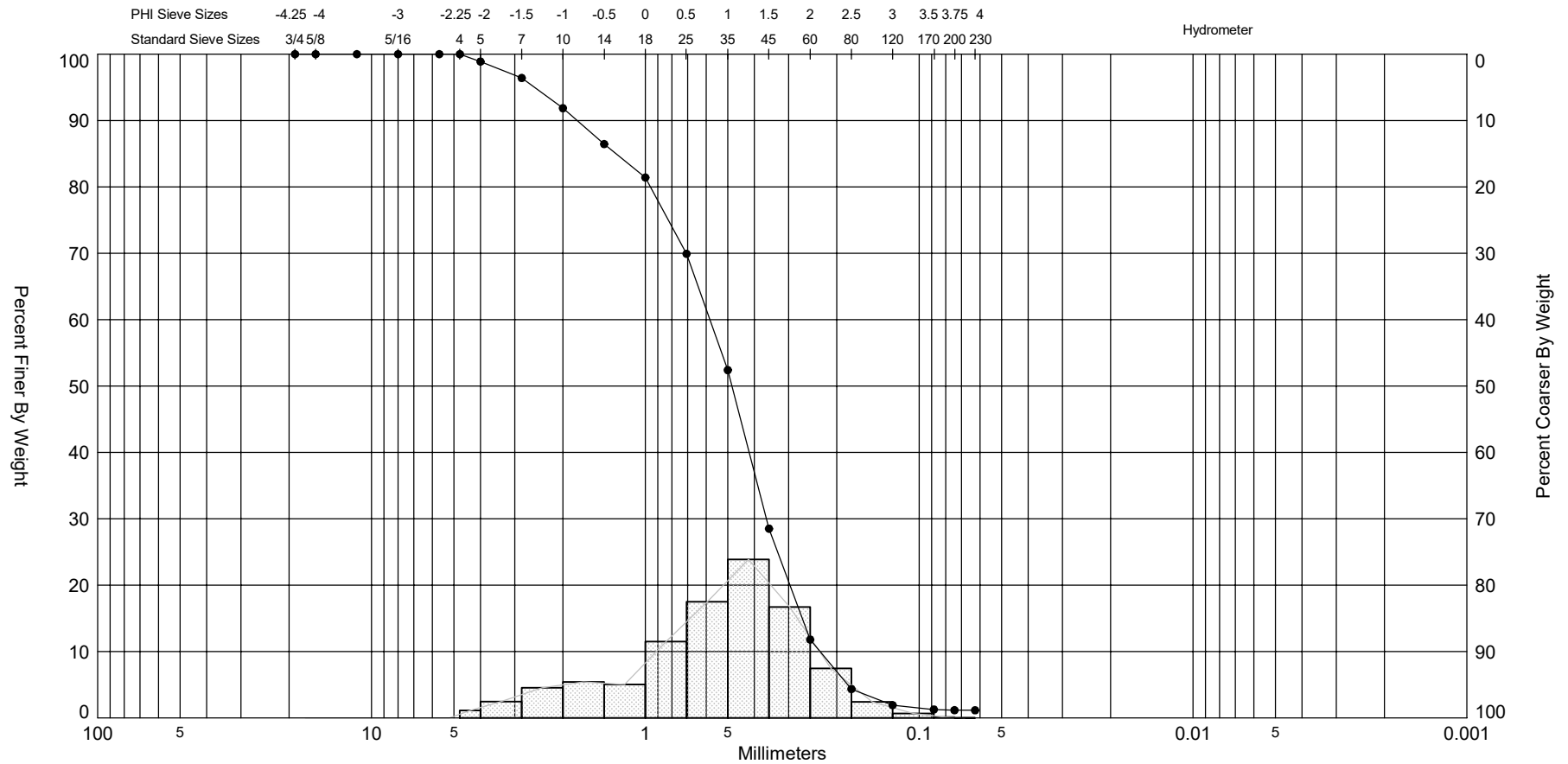
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC06 #2	—●—	-97.5	SW	#200 - 1.86 #230 - 1.81			0.74	0.58	-0.5	2.92	1.26	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-30-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM					Easting (X, ft):	849,044
							6401 Congress Avenue, Suite 140					Northing (Y, ft):	3,128,942
							Boca Raton, FL 33487					Horizontal Datum:	NAD 1983
							ph (561) 391-8102					Vertical Datum:	NAVD88

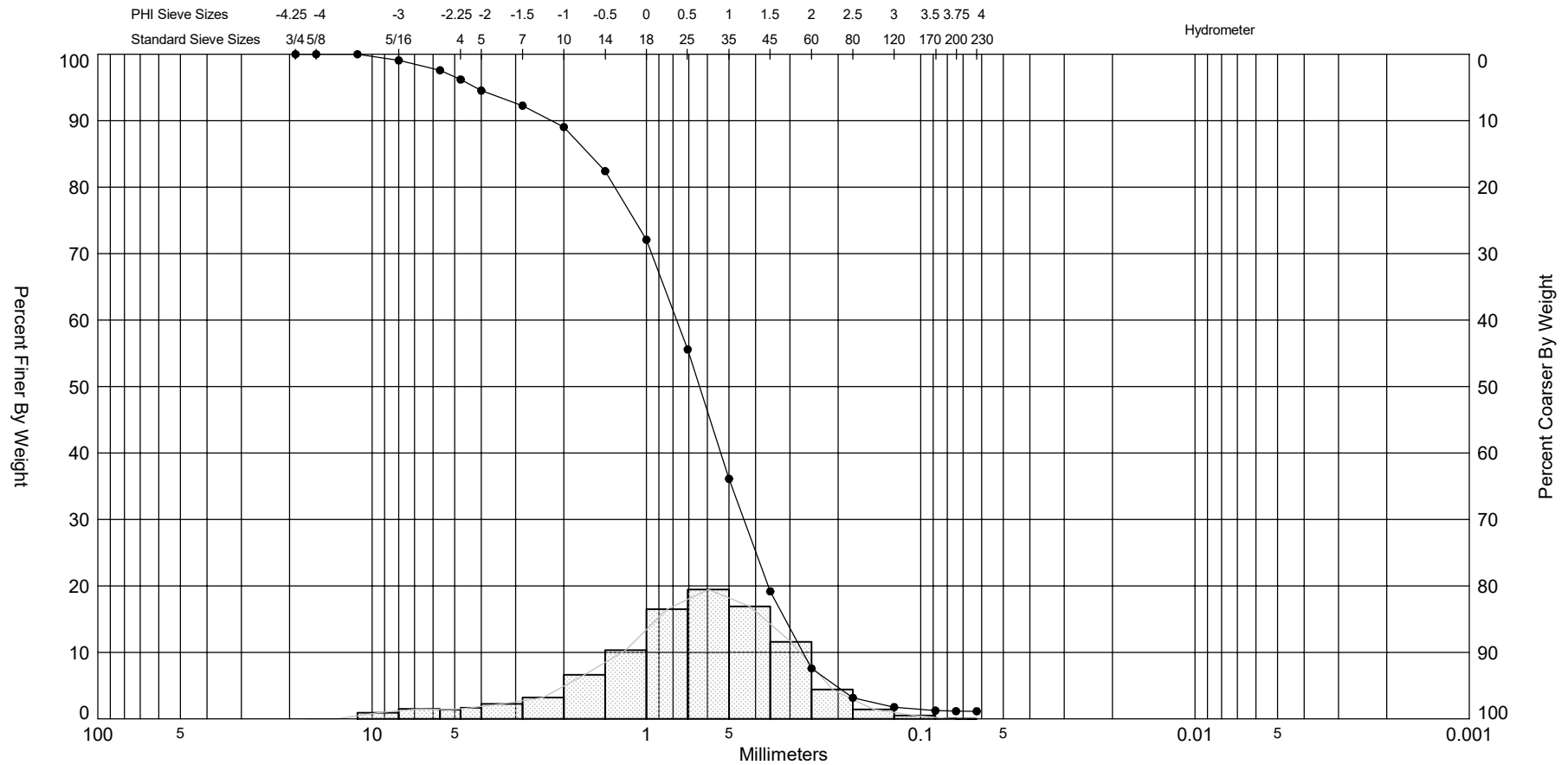
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

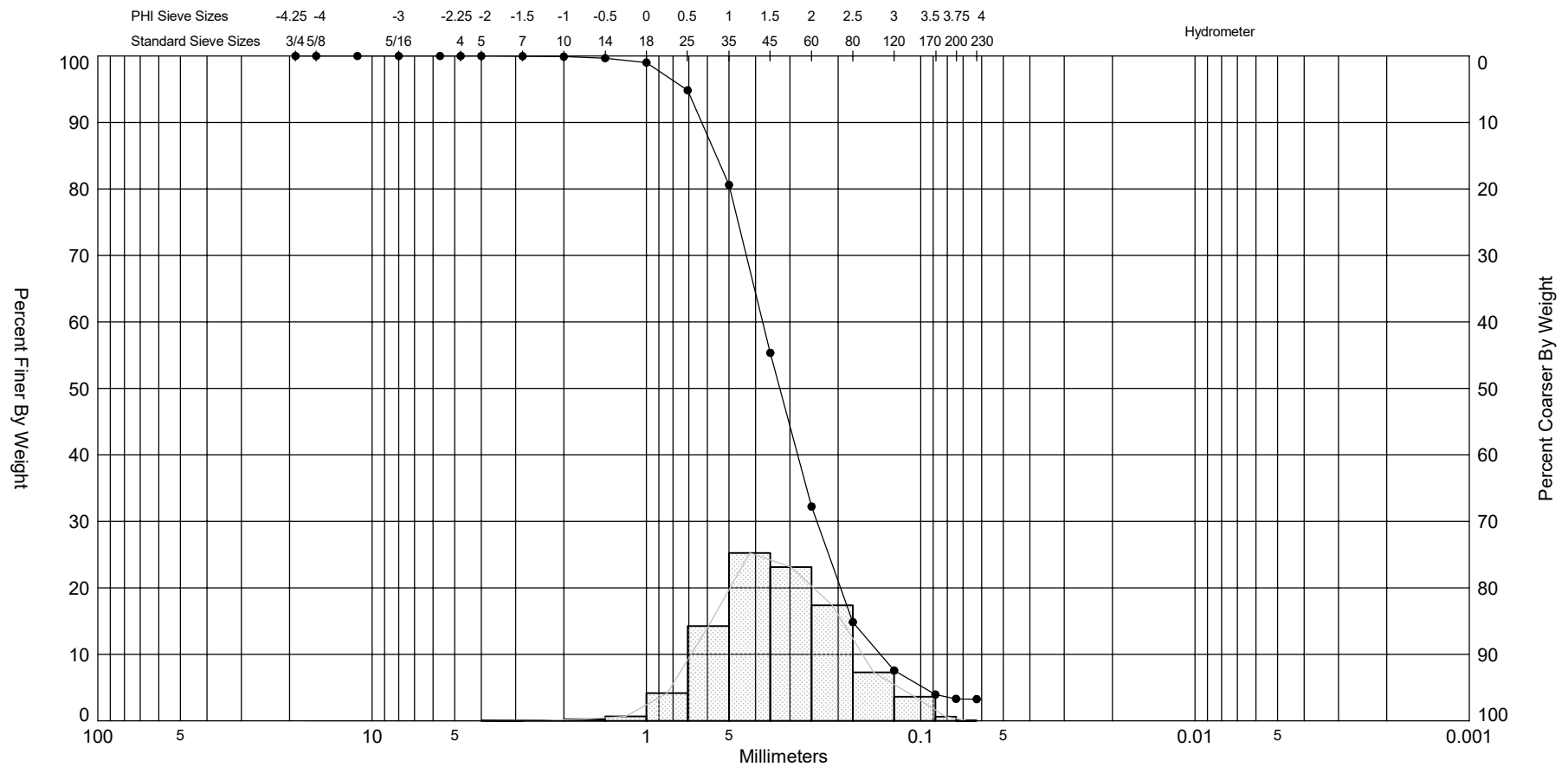
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC07 #1	—●—	-97.9	SW	#200 - 1.16 #230 - 1.15		1	1.05	0.84	-0.65	3.16	1.09	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-01-25
Depths and elevations based on measured values												Analyzed By:	CC
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	850,918
												Northing (Y, ft):	3,131,527
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25

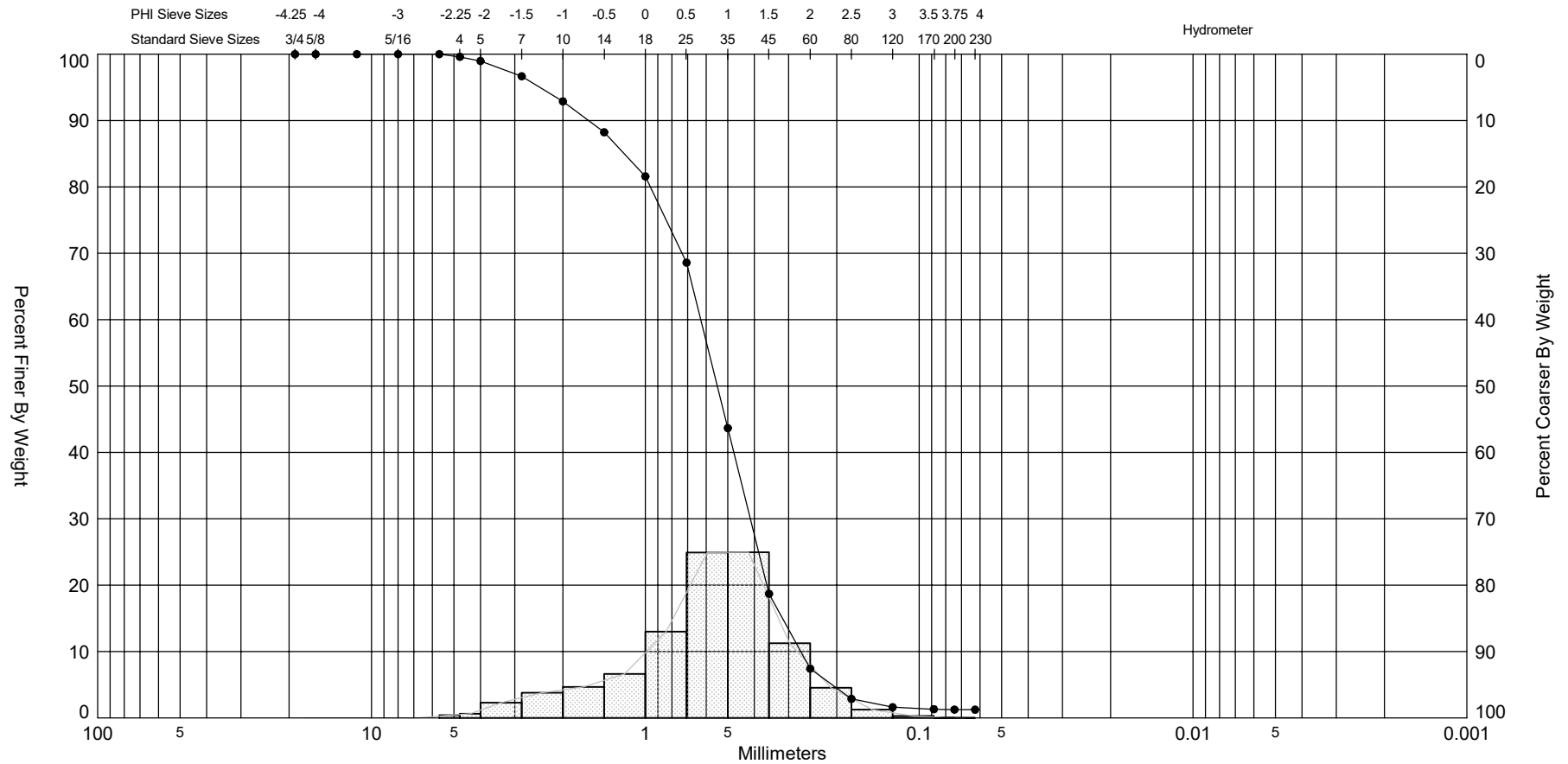


Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC07 #2	—●—	-102.9	SW	#200 - 1.15 #230 - 1.14			0.64	0.47	-0.73	3.63	1.21	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-01-25
Depths and elevations based on measured values												Analyzed By:	CC
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	850,918
												Northing (Y, ft):	3,131,527
												Horizontal Datum:	NAD 1983
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MA_CZM_VIBRACORES_2025.GPJ 7/23/25

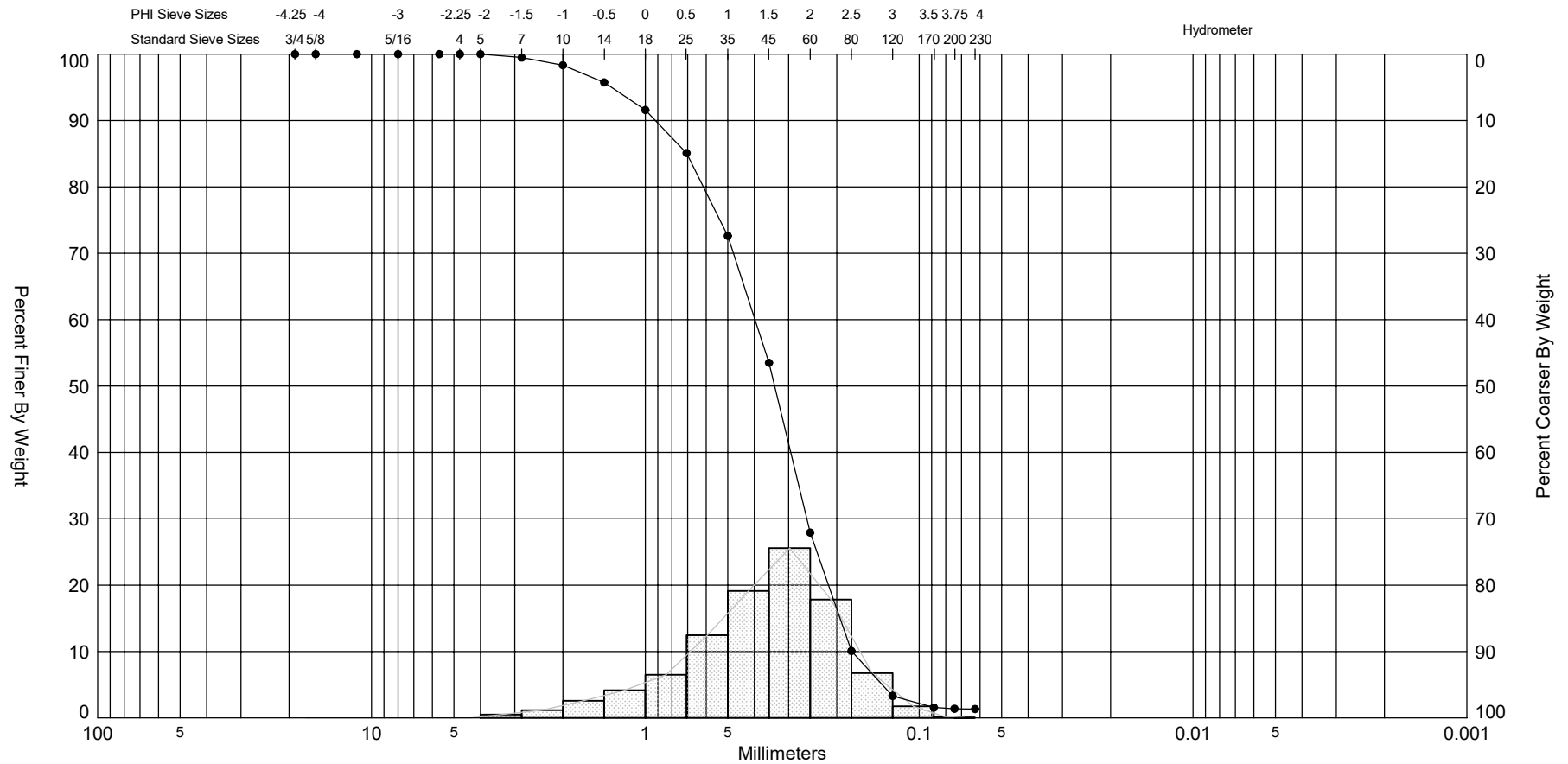


MA_CZM_VIBRACORES_2025.GPJ 7/23/25

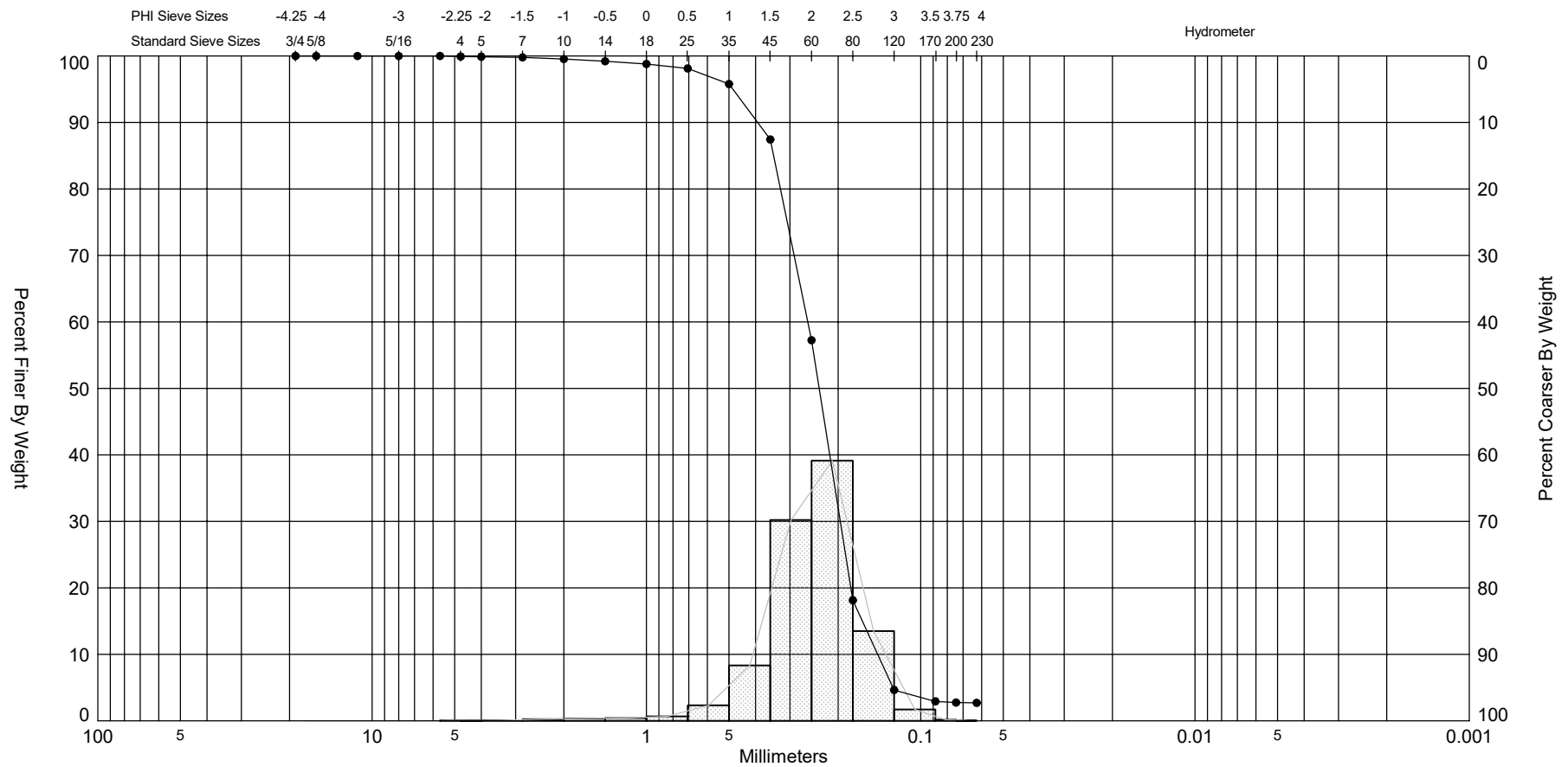


Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC08 #2		-98.1	SW	#200 - 1.25 #230 - 1.24			0.87	0.72	-0.7	3.66	0.98	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-30-25
Depths and elevations based on measured values												Analyzed By:	TJ
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	849,049
												Northing (Y, ft):	3,135,994
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



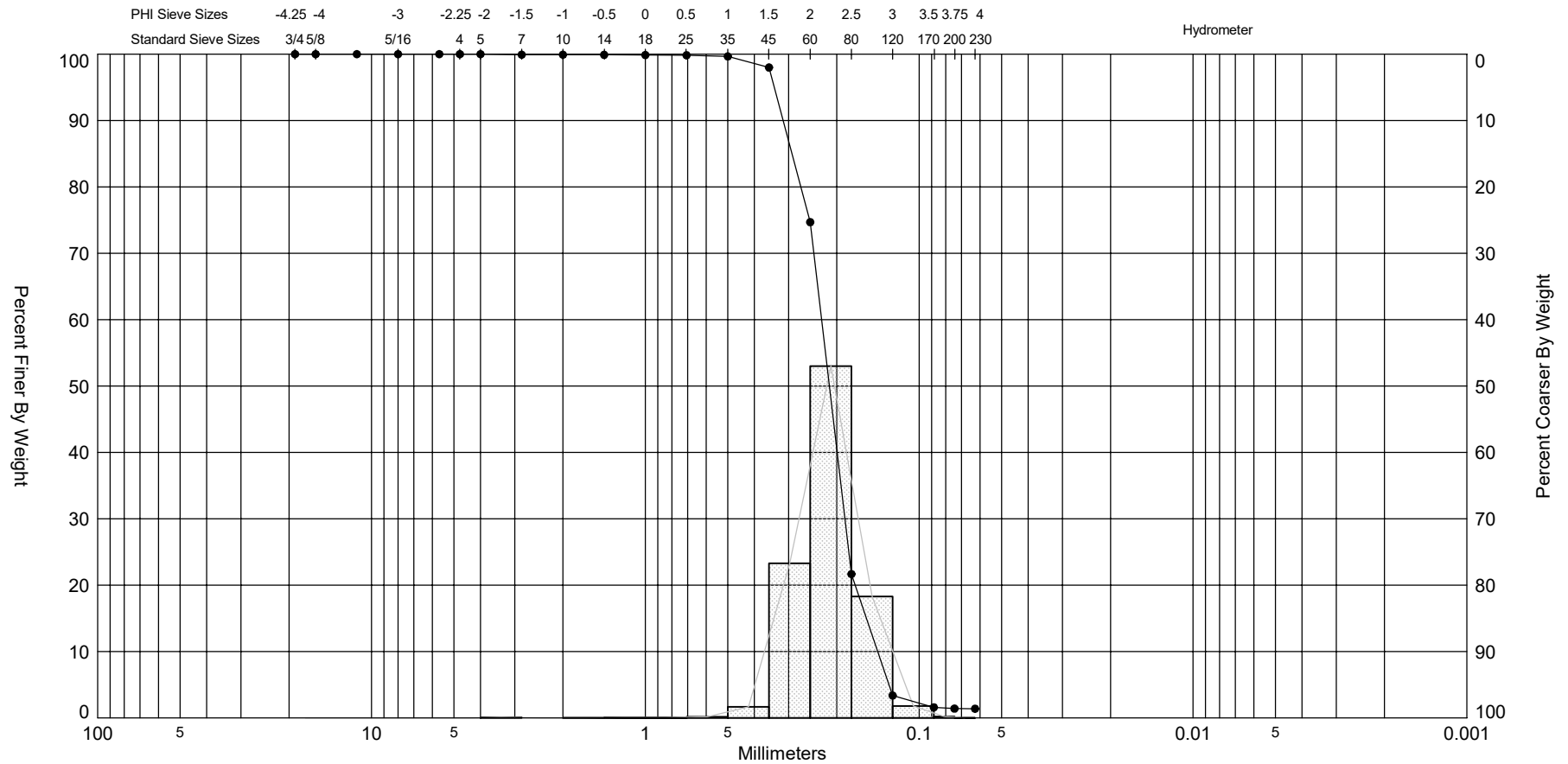
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

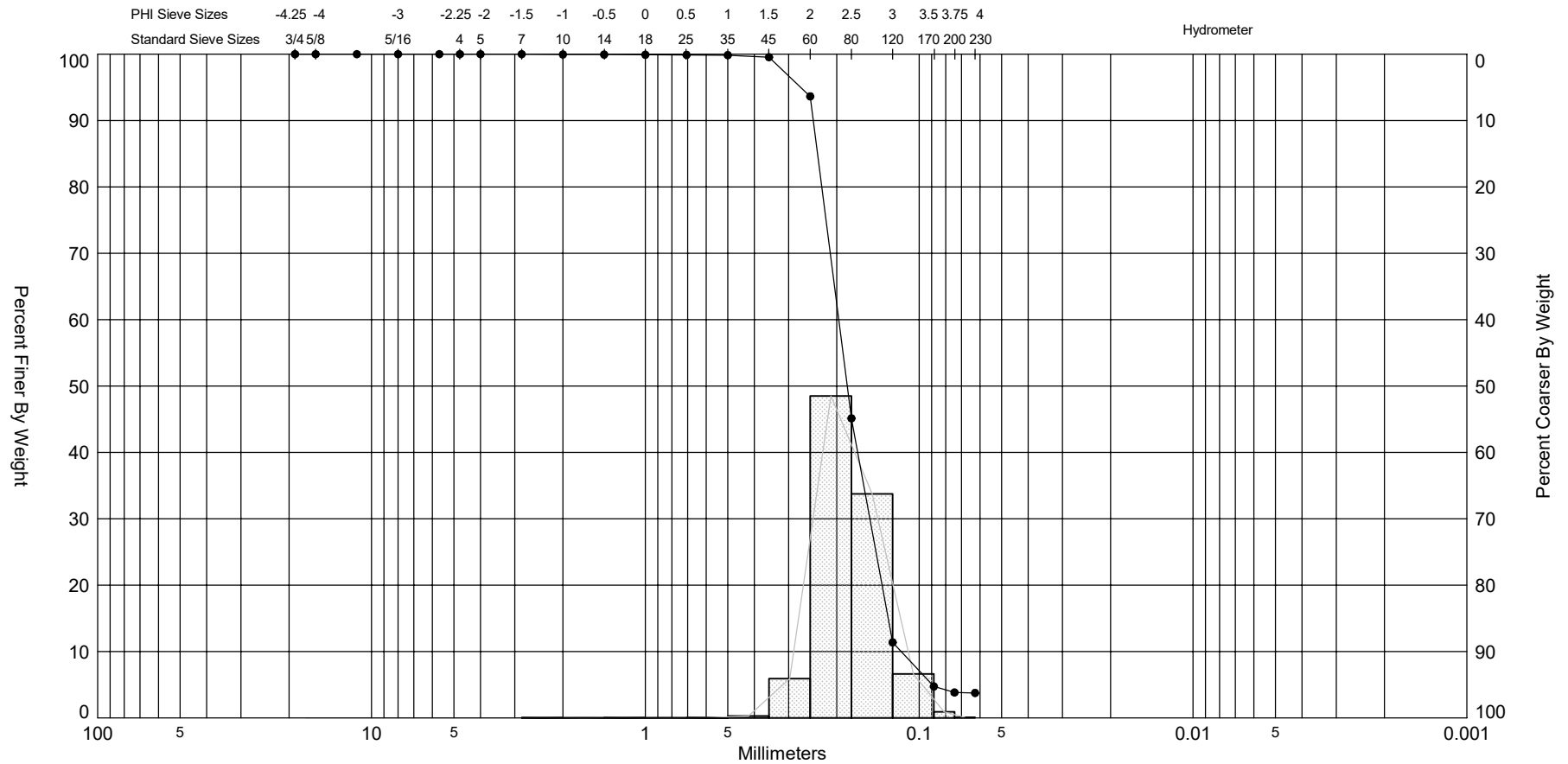
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MA-CZM-2025-VC09 #1	—●—	-68.0	SP	#200 - 2.75 #230 - 2.70			2.09	2.01	-1.66	10.46	0.61	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-02-25
Depths and elevations based on measured values												Analyzed By:	CC
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	789,434
												Northing (Y, ft):	2,610,816
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC09 #2	—●—	-73.9	SP	#200 - 1.40 #230 - 1.38			2.23	2.22	-0.82	11.34	0.41	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-01-25
Depths and elevations based on measured values												Analyzed By:	CC
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	789,434
												Northing (Y, ft):	2,610,816
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

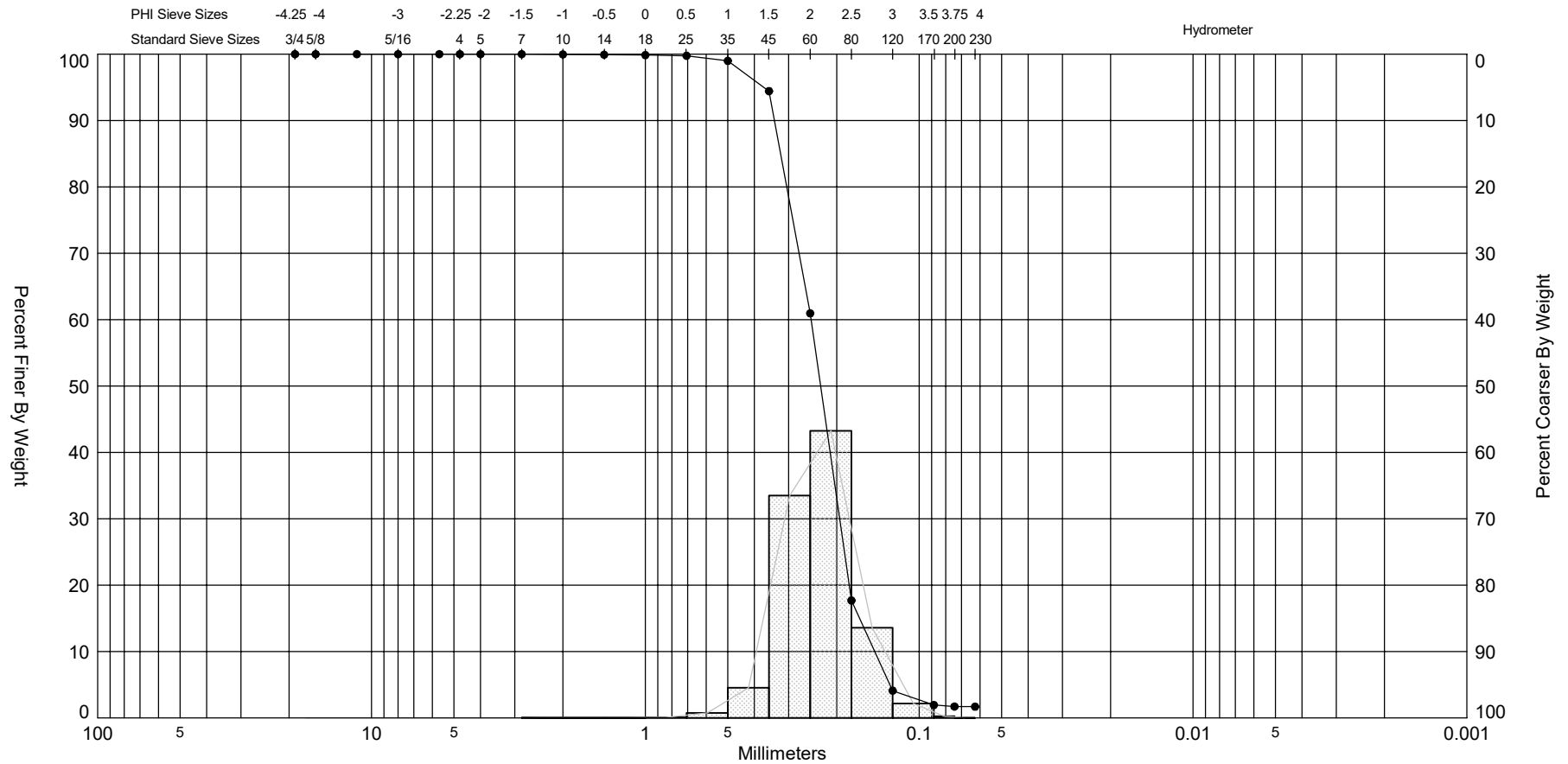
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

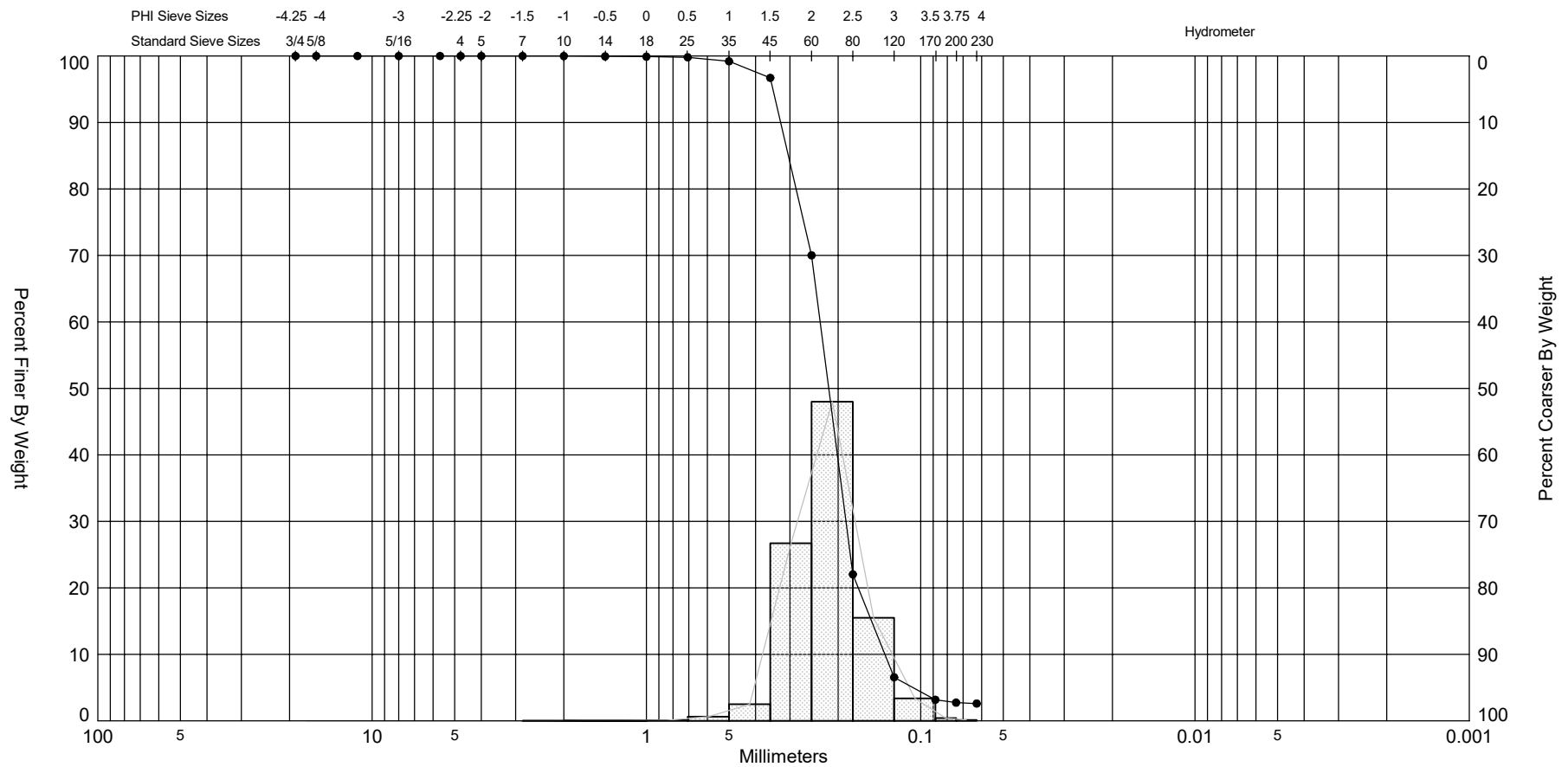
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC09 #3	—●—	-79.5	SP	#200 - 3.83 #230 - 3.76		0	2.45	2.47	-0.29	8.43	0.4	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-01-25
Depths and elevations based on measured values												Analyzed By:	CC
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	789,434
												Northing (Y, ft):	2,610,816
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MA_CZM_VIBRACORES_2025.GPJ 7/23/25



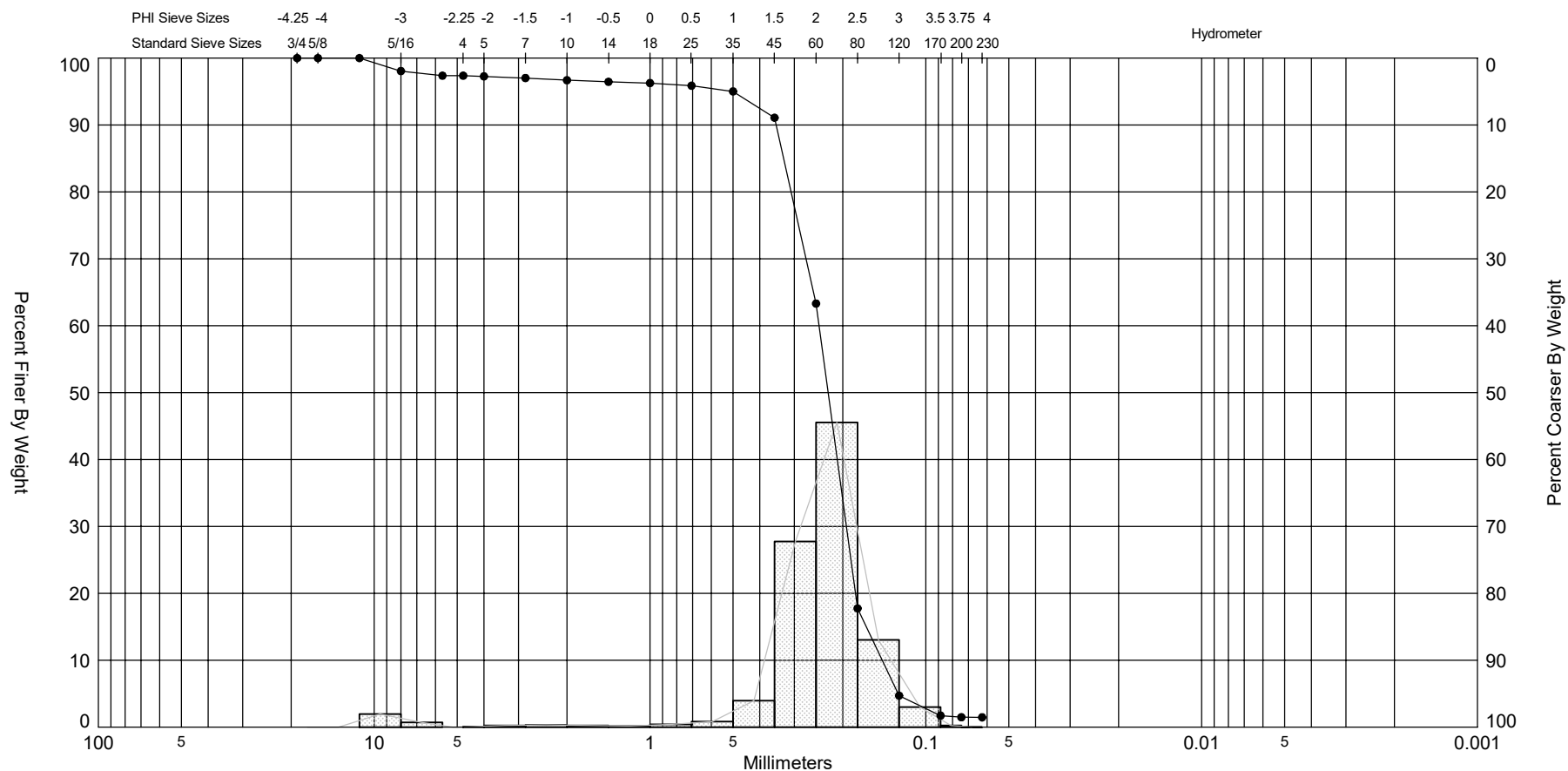
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC10 #1	—●—	-71.2	SP	#200 - 1.71 #230 - 1.69		1	2.13	2.11	-0.27	5.64	0.46	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-01-25
Depths and elevations based on measured values												Analyzed By:	CC
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	788,426
												Northing (Y, ft):	2,608,275
												Horizontal Datum:	NAD 1983
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MA_CZM_VIBRACORES_2025.GPJ 7/23/25



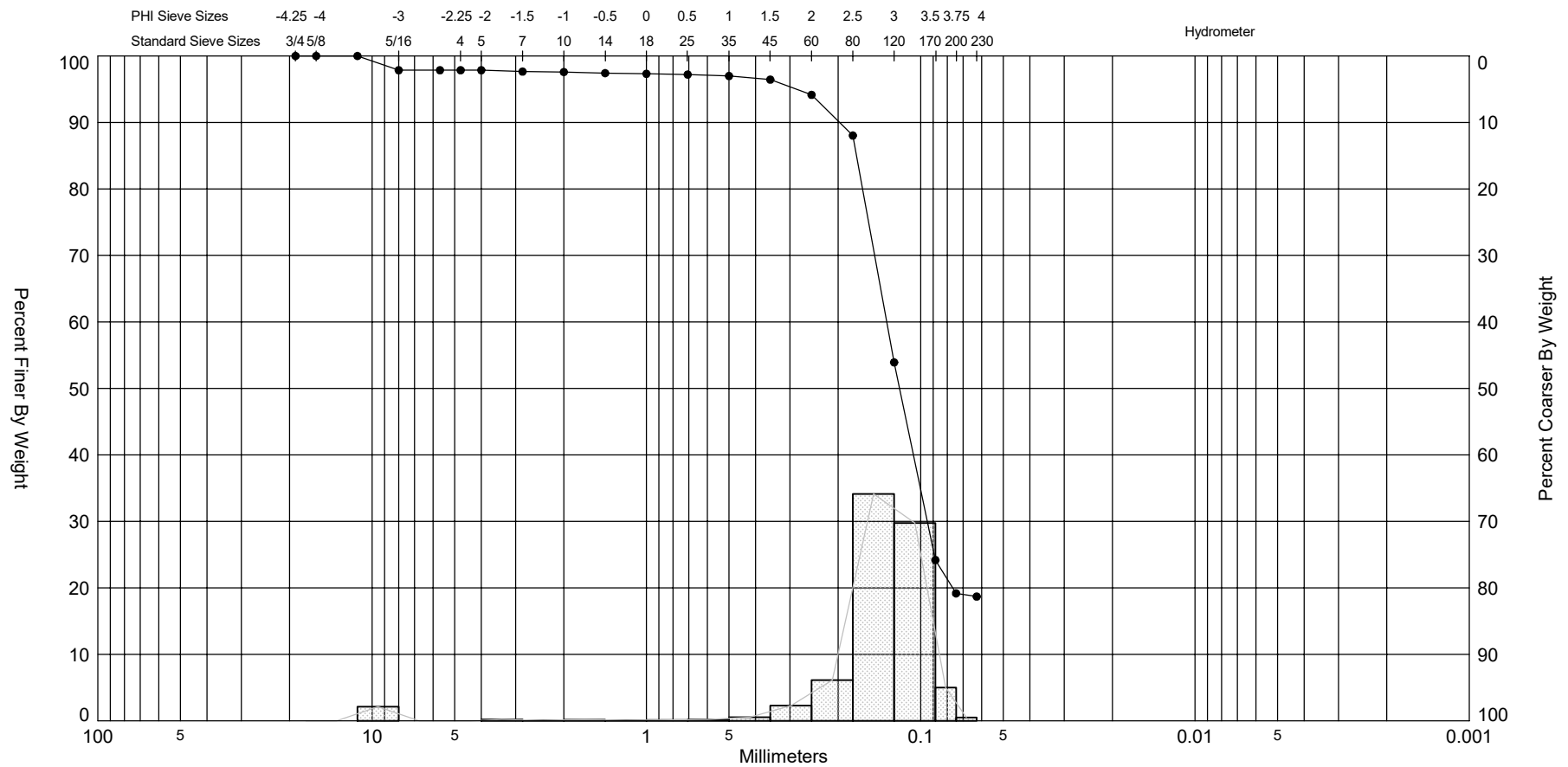
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC10 #2	—●—	-80.3	SP	#200 - 2.74 #230 - 2.60			2.21	2.2	-0.08	5.46	0.45	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-01-25
Depths and elevations based on measured values												Analyzed By:	CC
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	788,426
												Northing (Y, ft):	2,608,275
												Horizontal Datum:	NAD 1983
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MA_CZM_VIBRACORES_2025.GPJ 7/23/25



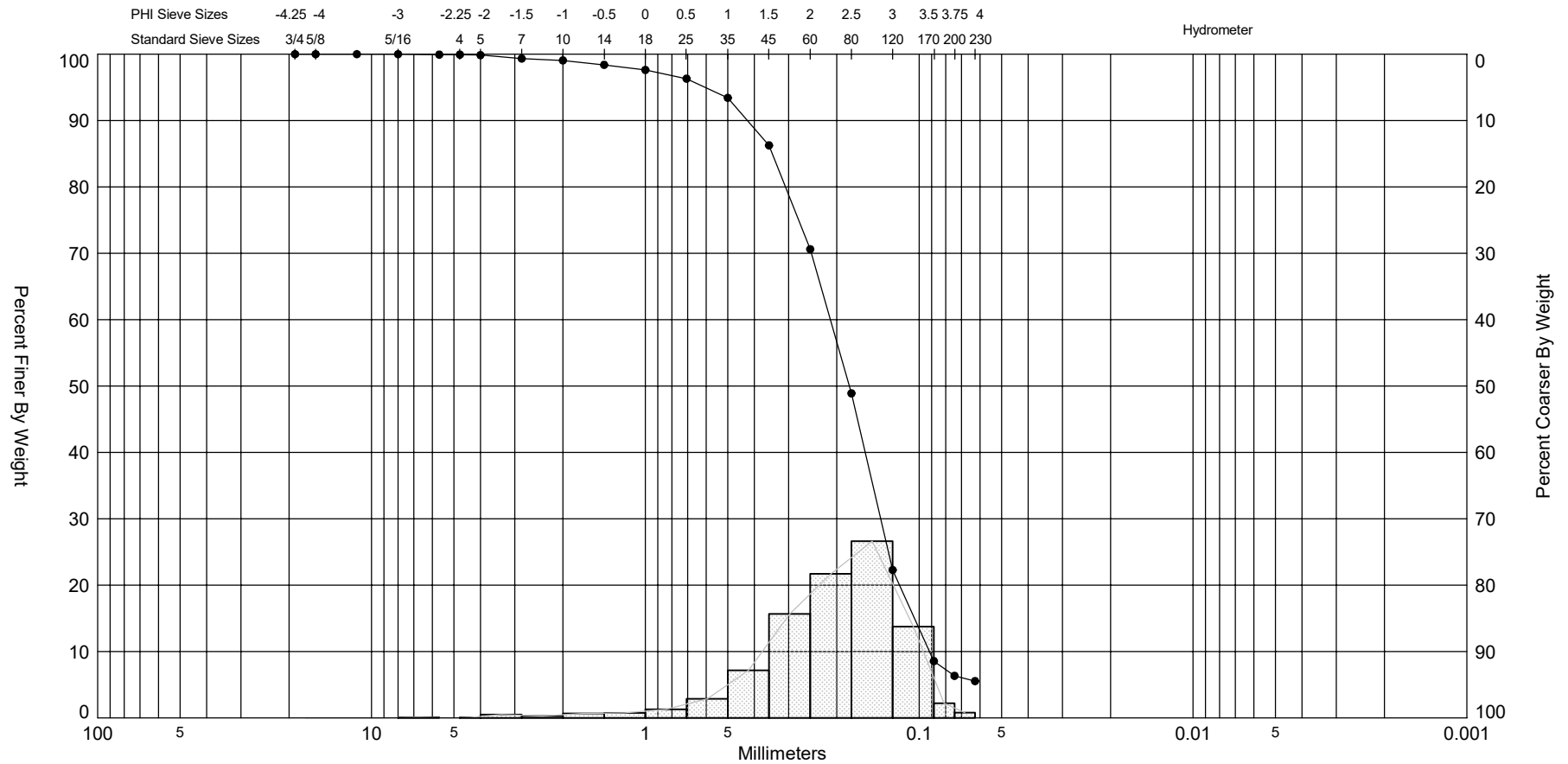
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC11 #1	—●—	-63.1	SW	#200 - 1.48 #230 - 1.47			2.15	1.97	-3.6	18.13	1.02	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	04-30-25
Depths and elevations based on measured values												Analyzed By:	TJ
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	782,562
												Northing (Y, ft):	2,614,101
												Horizontal Datum:	NAD 1983
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MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC12 #1	—●—	-57.8	SC	#200 - 19.17 #230 - 18.69			3.07	2.72	-4.16	21.68	1.13	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	05-02-25
Depths and elevations based on measured values												Analyzed By:	CC
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	767,716
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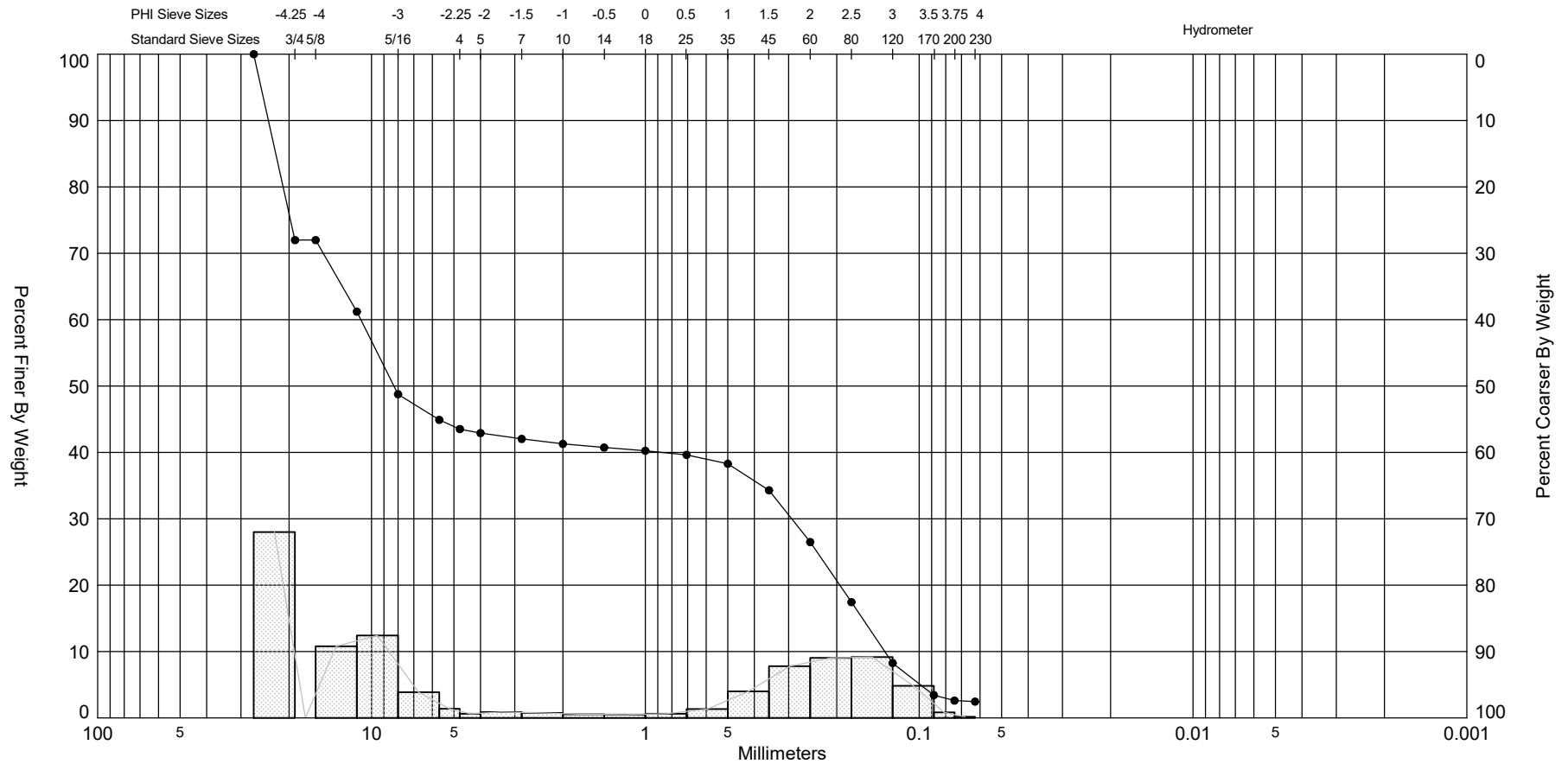
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC13 #1		-124.1	SW-SM	#200 - 6.34 #230 - 5.55			2.47	2.27	-1.45	6.83	0.89	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	923,366
												Northing (Y, ft):	2,868,090
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

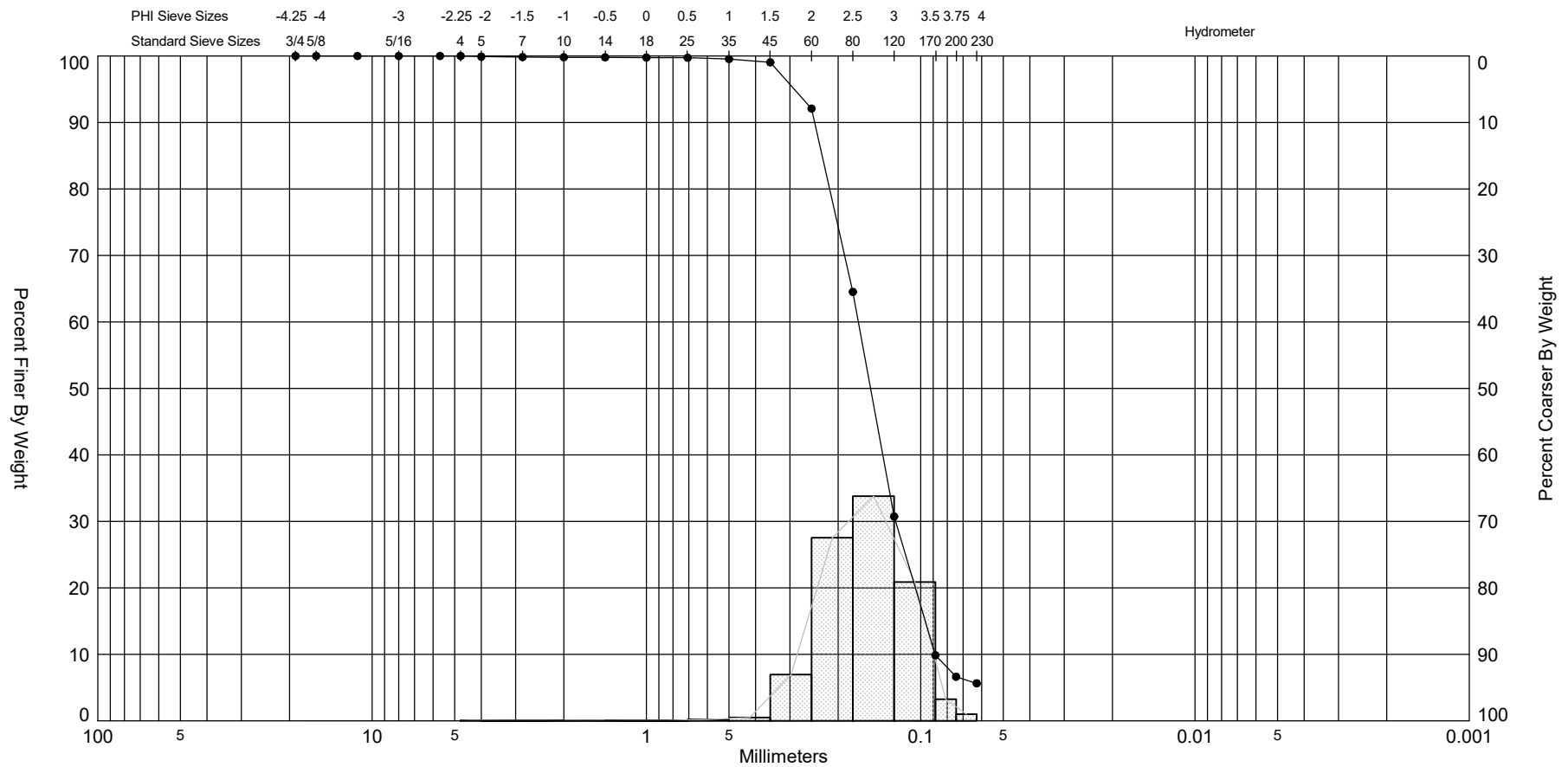
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

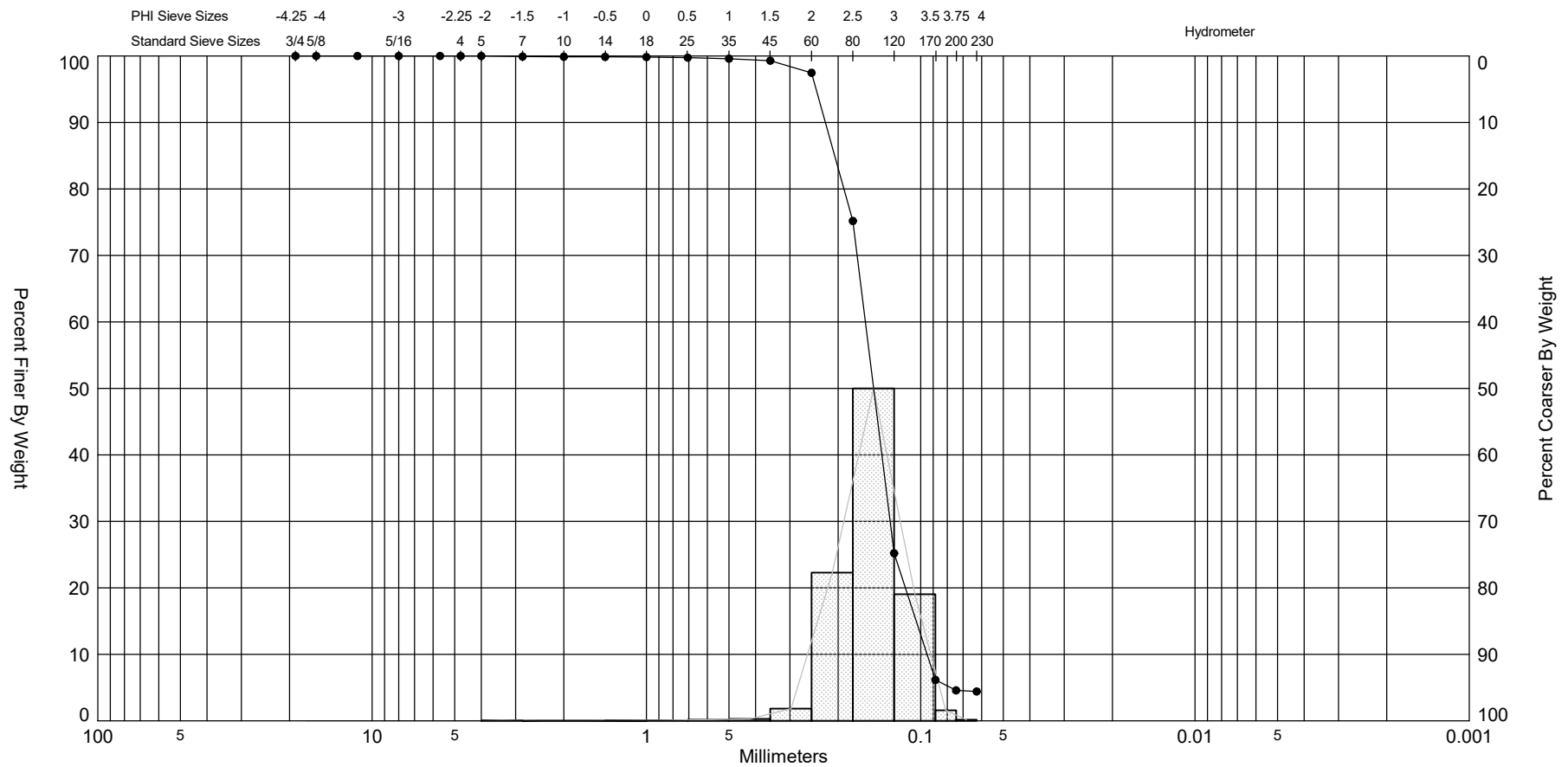
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC13 #2	—●—	-125.8	GW	#200 - 2.61 #230 - 2.46			-3.05	-1.44	0.4	1.37	3.04	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	923,366
												Northing (Y, ft):	2,868,090
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MA_CZM_VIBRACORES_2025.GPJ 7/23/25



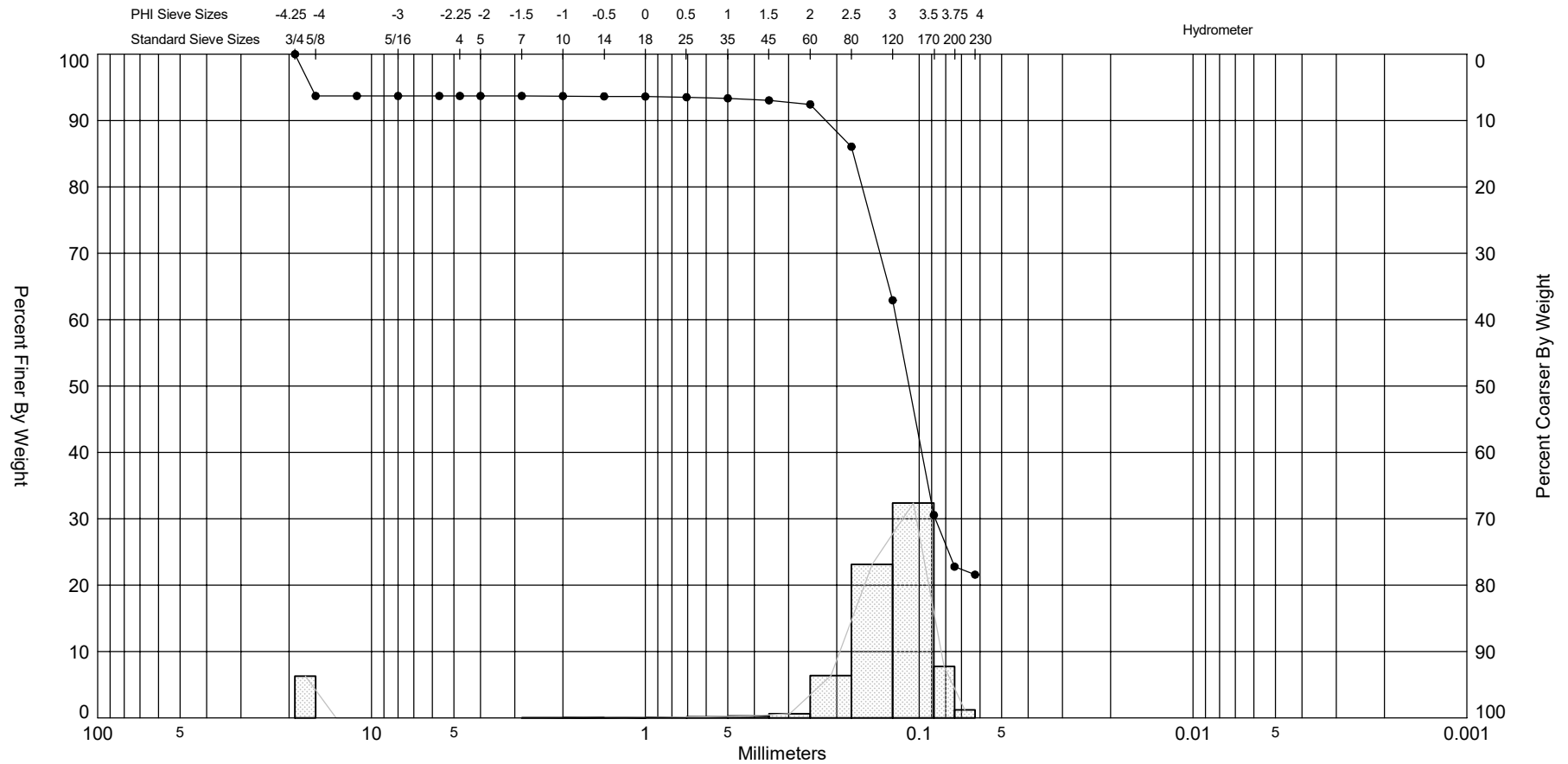
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC13 #3	—●—	-129.7	SP-SM	#200 - 6.63 #230 - 5.64			2.71	2.66	-1.31	12.16	0.55	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	923,366
												Northing (Y, ft):	2,868,090
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC13 #4		-134.5	SP	#200 - 4.58 #230 - 4.42			2.75	2.71	-1.79	17.47	0.43	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	923,366
												Northing (Y, ft):	2,868,090
												Horizontal Datum:	NAD 1983
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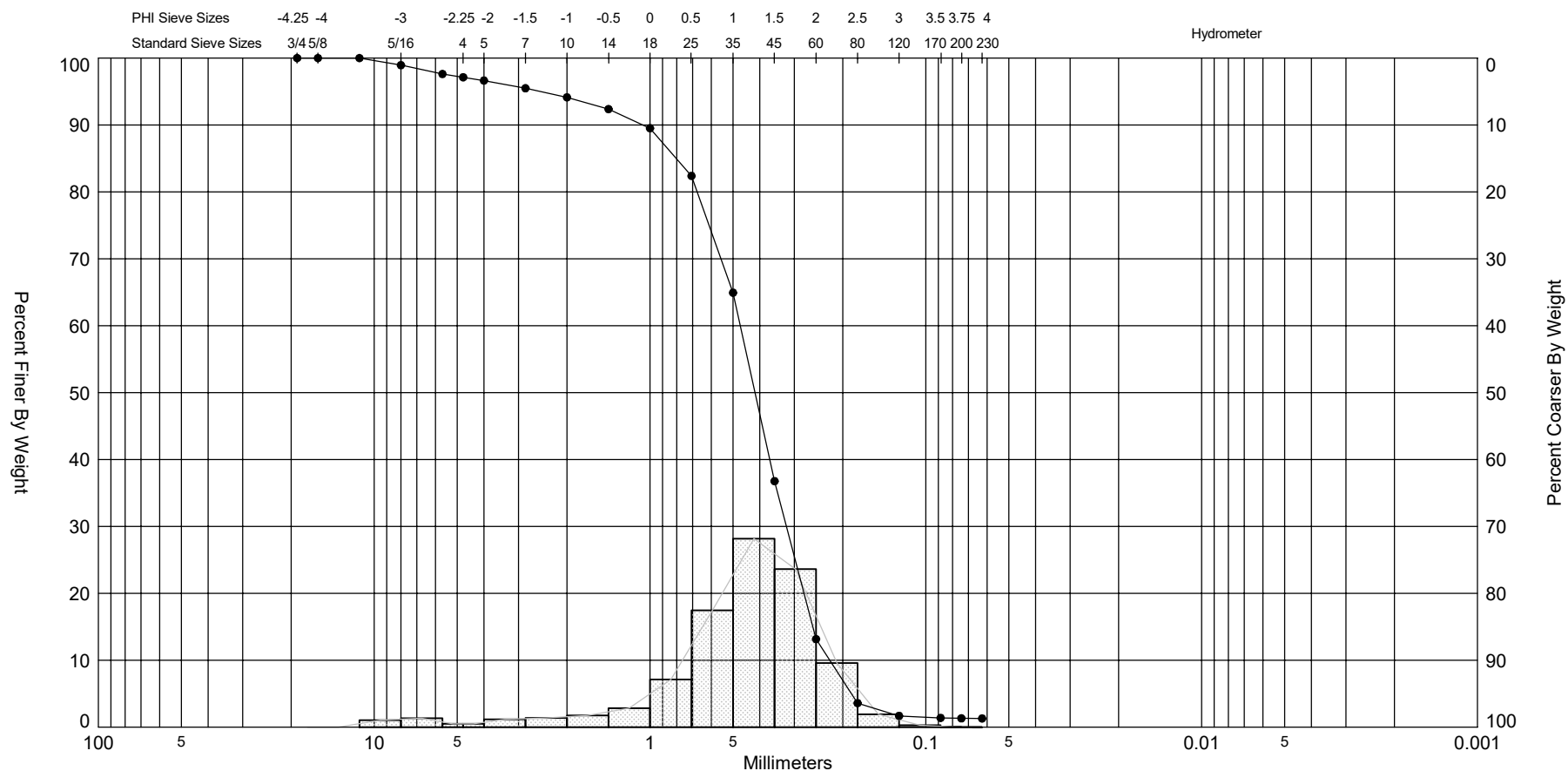
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

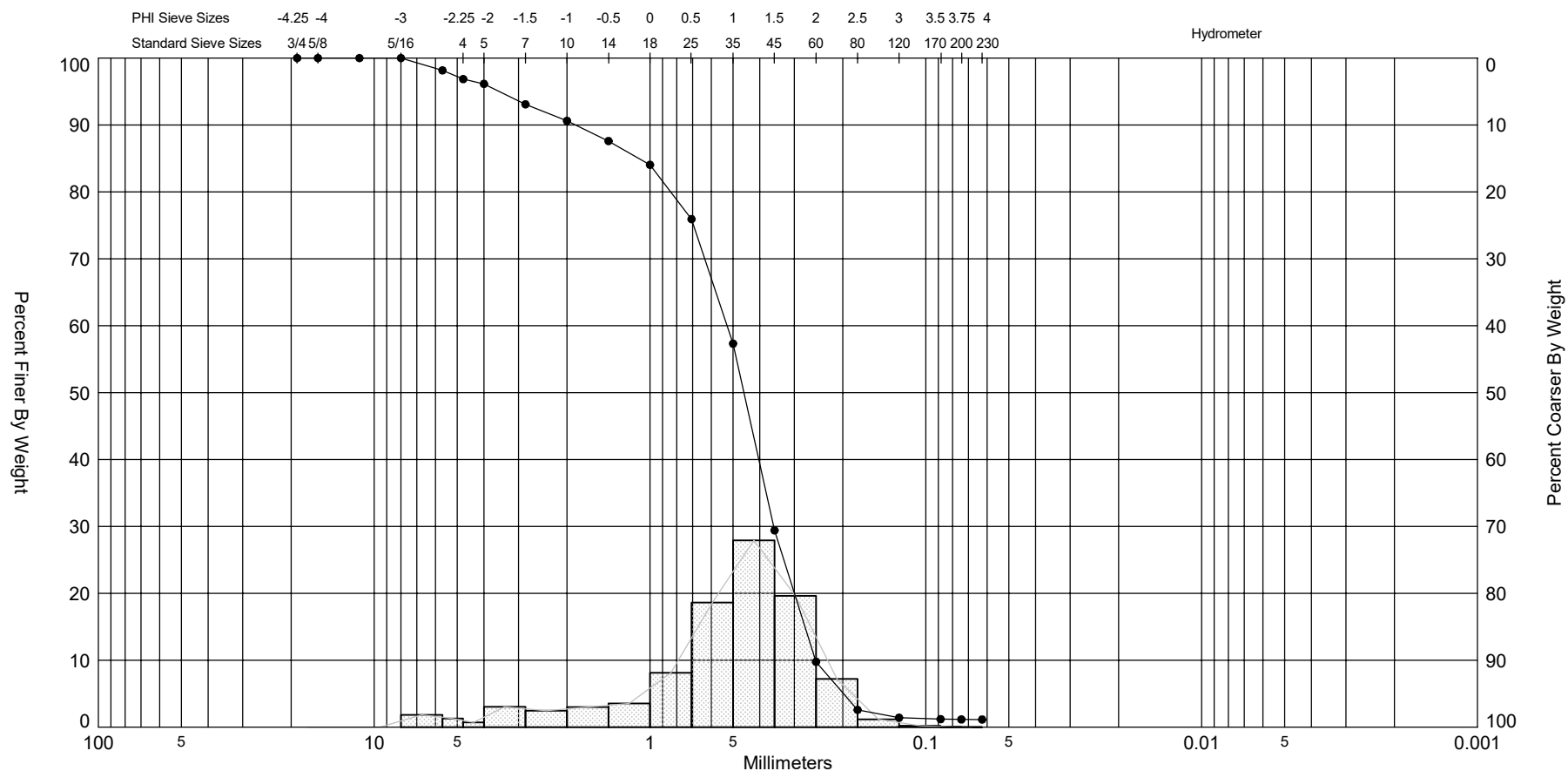
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MA-CZM-2025-VC13 #5	—●—	-137.7	SM-SC	#200 - 22.79 #230 - 21.58			3.2	2.44	-2.83	9.53	1.99	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-17-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	923,366
												Northing (Y, ft):	2,868,090
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC14 #1	—●—	-106.4	SW	#200 - 1.32 #230 - 1.30		2	1.27	1.06	-1.73	6.96	1.09	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-15-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	916,291
												Northing (Y, ft):	2,860,654
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

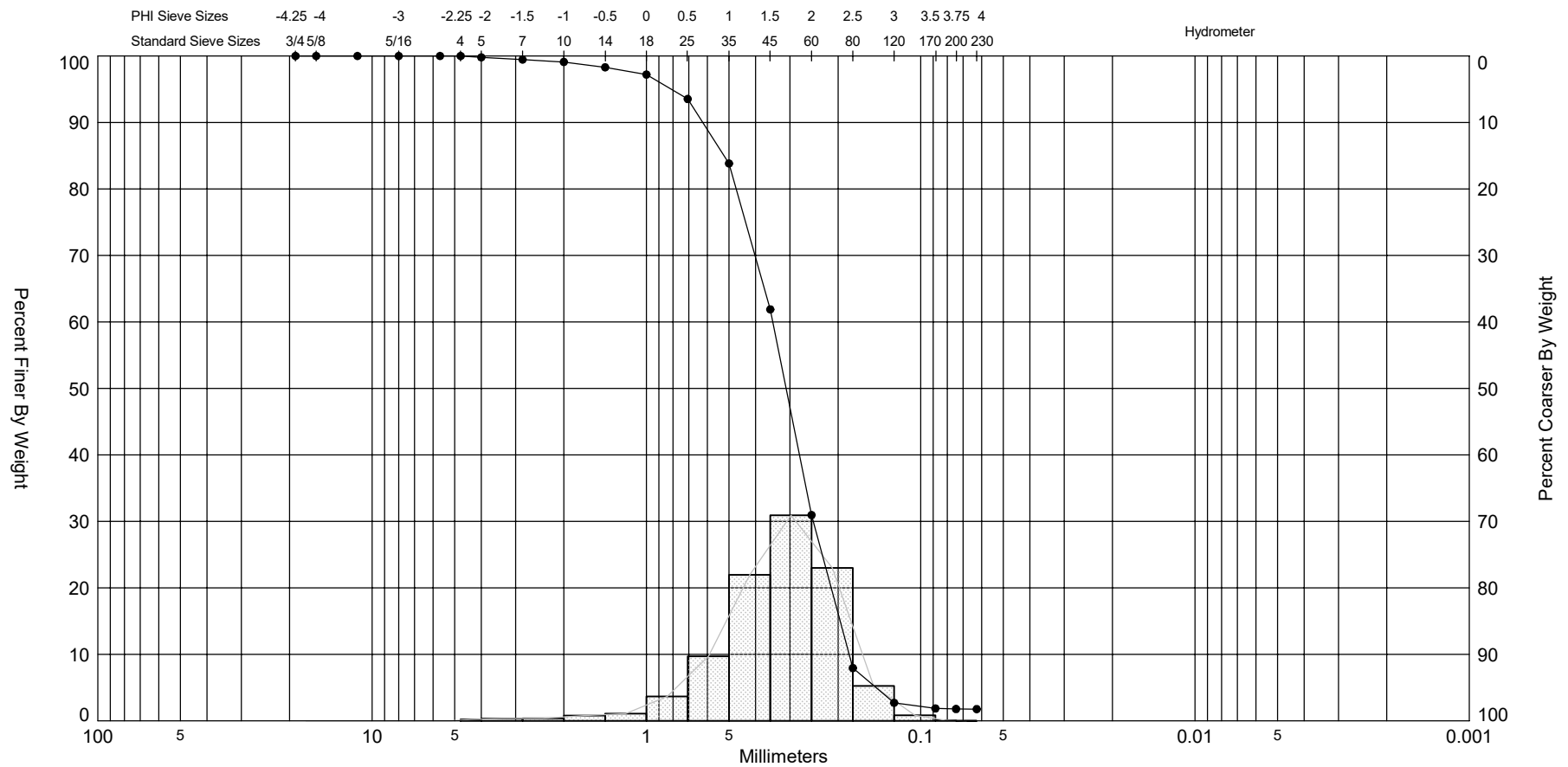
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

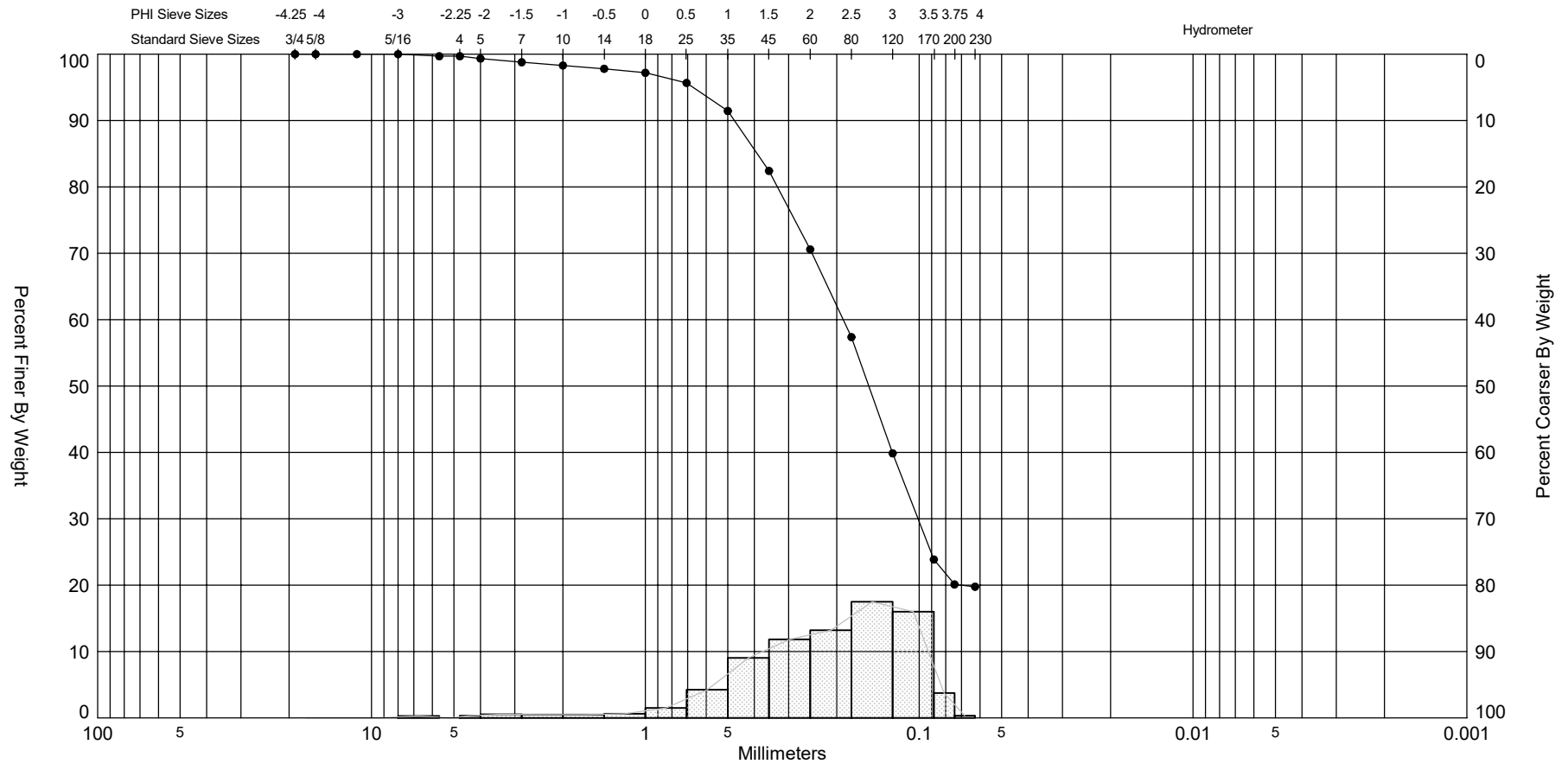
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC14 #2	—●—	-111.9	SW	#200 - 1.15 #230 - 1.14			1.13	0.85	-1.31	4.56	1.15	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-15-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	916,291
												Northing (Y, ft):	2,860,654
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC14 #3	—●—	-118.5	SP	#200 - 1.78 #230 - 1.76		2	1.69	1.59	-1.12	6.07	0.74	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-14-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	916,291
												Northing (Y, ft):	2,860,654
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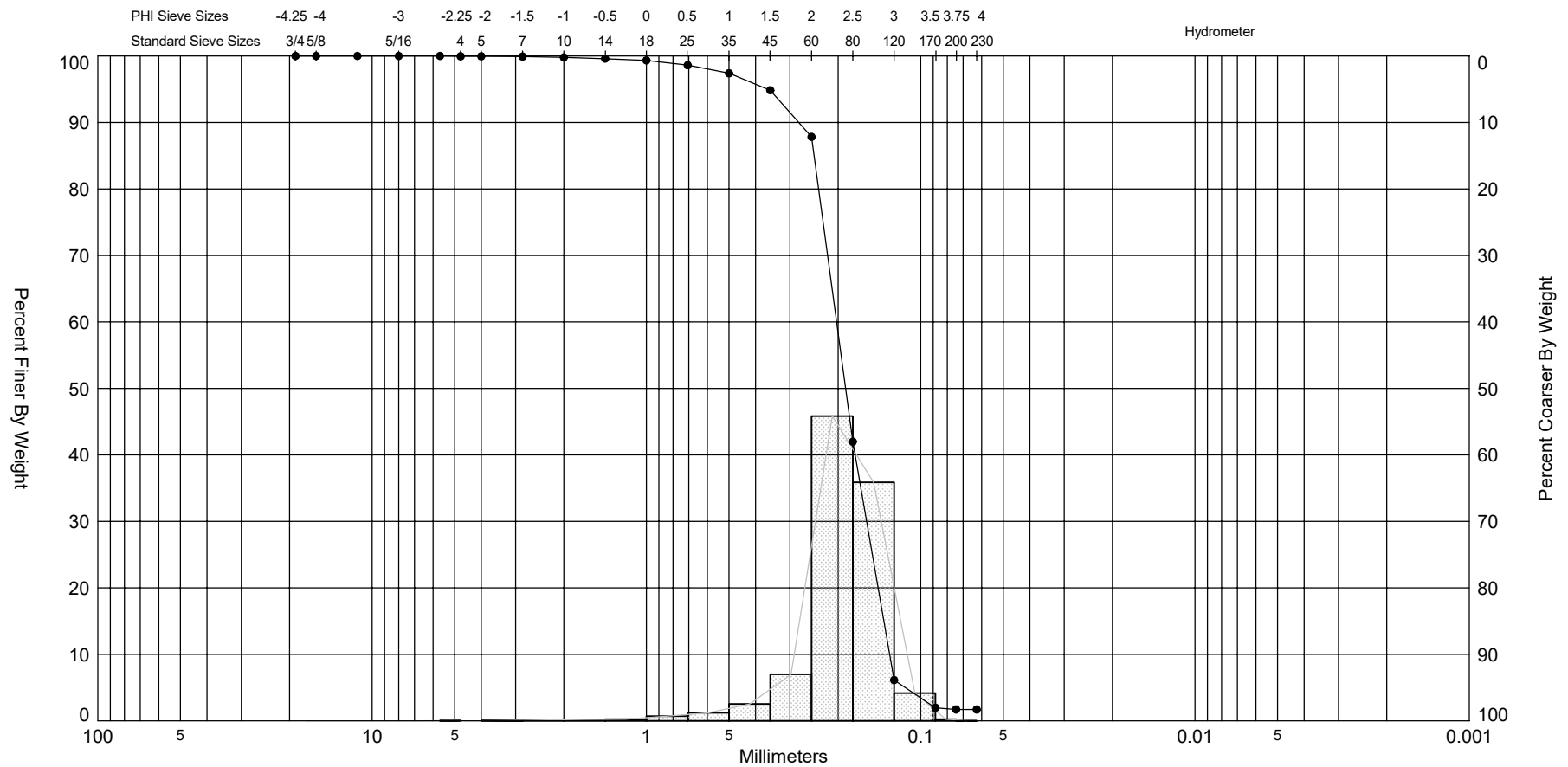
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC14 #4	—●—	-122.8	SC	#200 - 20.11 #230 - 19.76			2.71	2.2	-1.41	6.1	1.08	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-14-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	916,291
												Northing (Y, ft):	2,860,654
												Horizontal Datum:	NAD 1983
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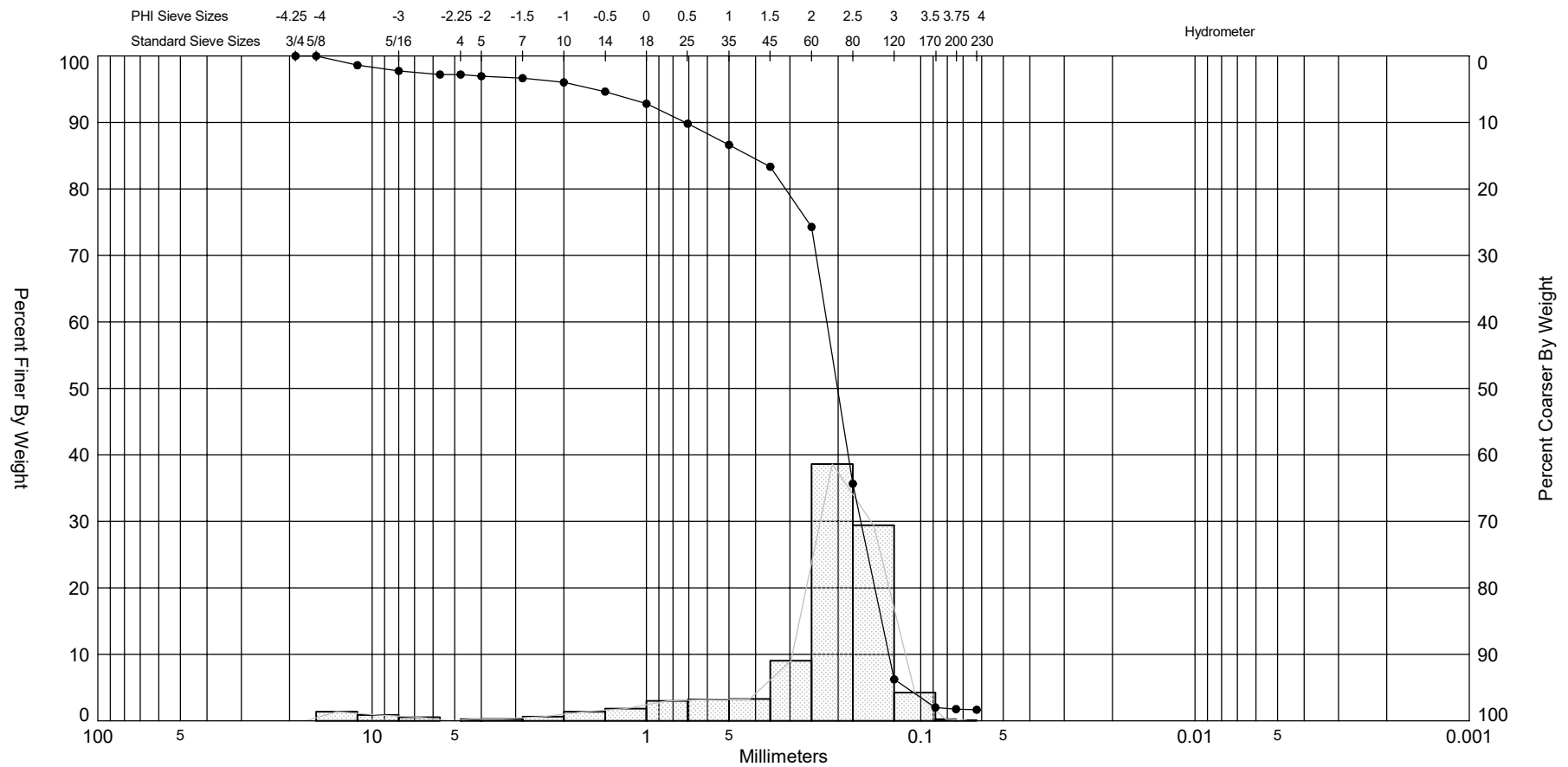
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC15 #1	—●—	-72.8	SP	#200 - 1.72 #230 - 1.70		1	2.41	2.36	-2.29	14.05	0.54	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	905,329
												Northing (Y, ft):	2,860,471
												Horizontal Datum:	NAD 1983
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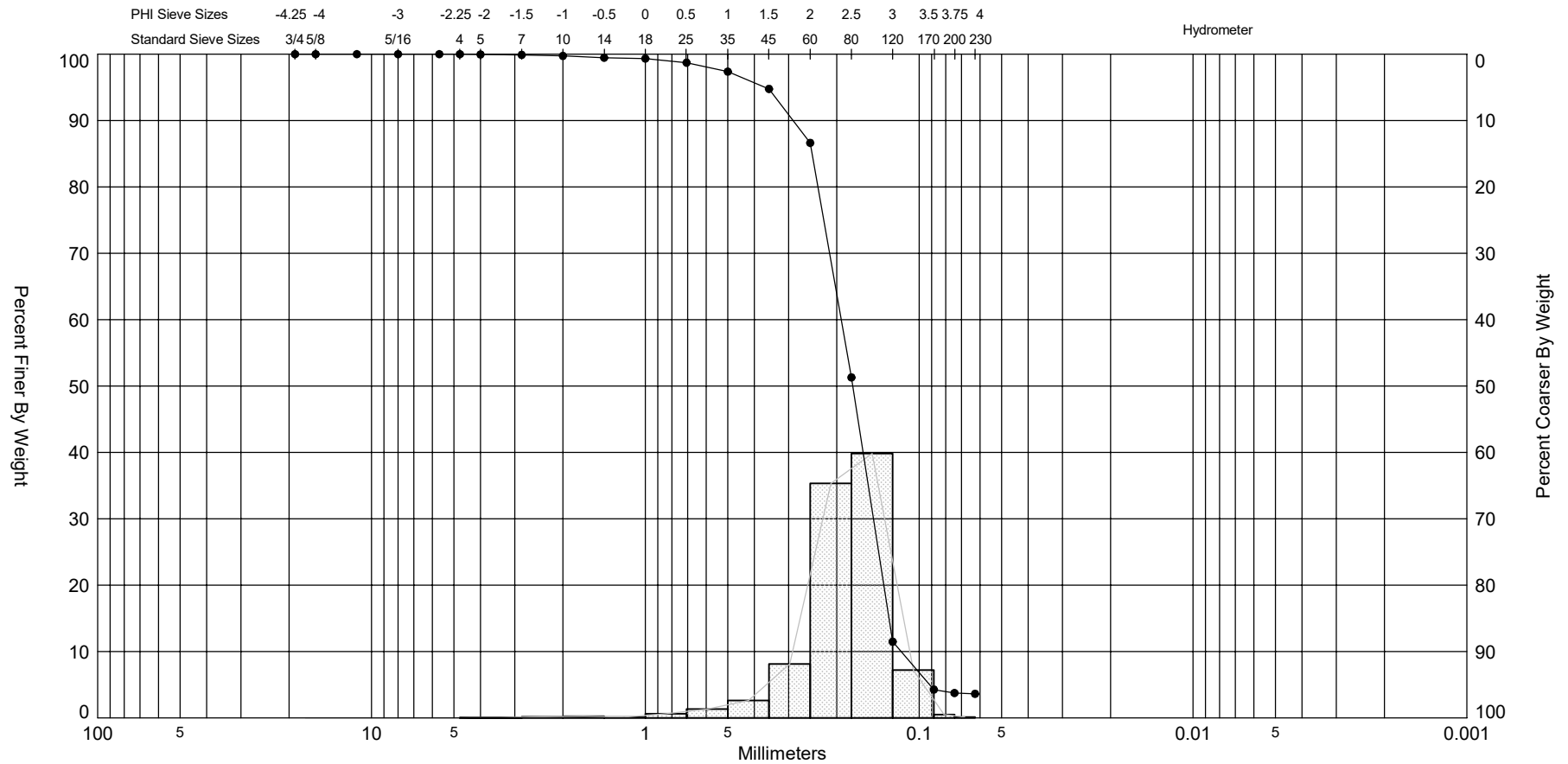
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

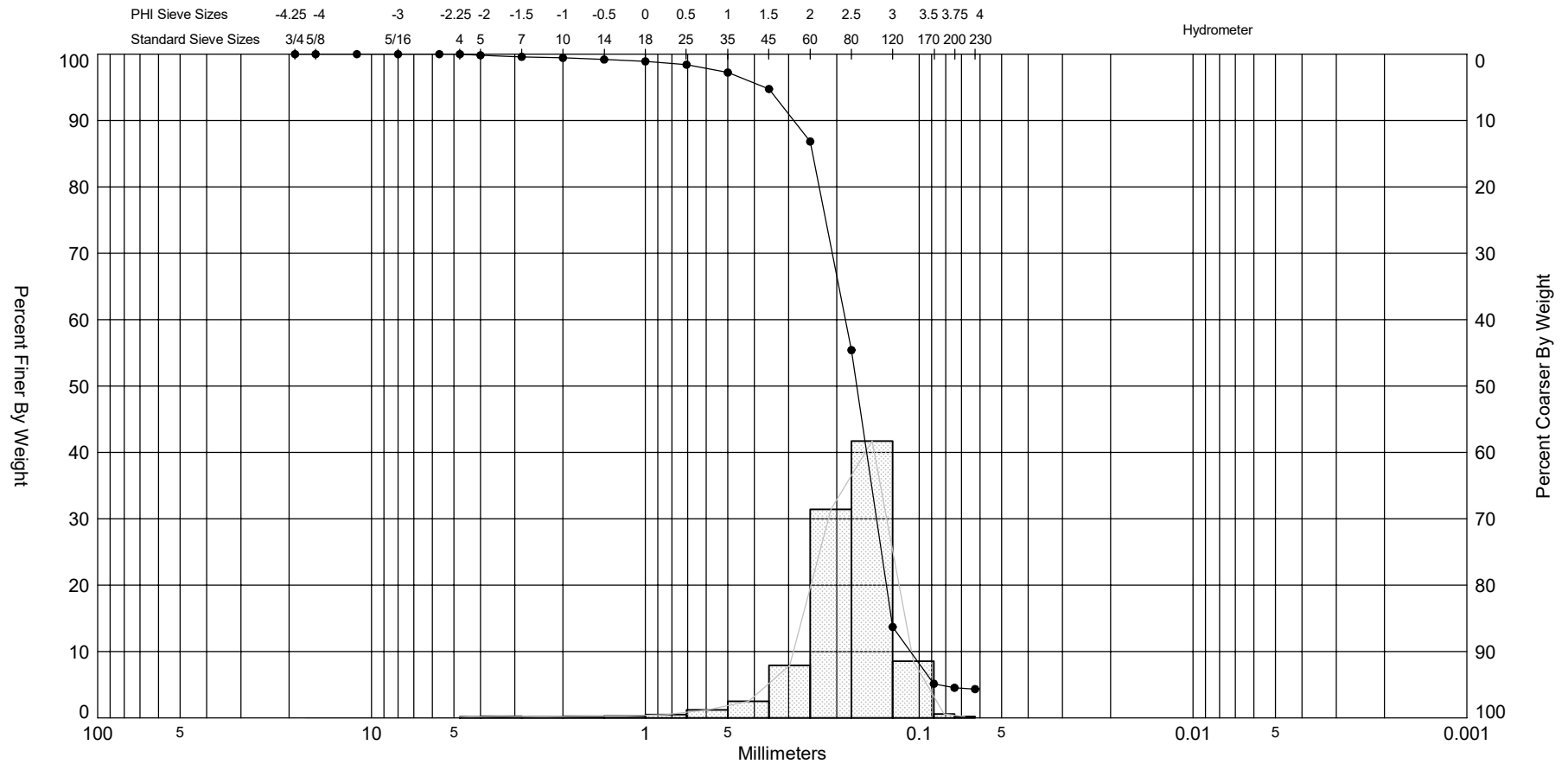
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MA-CZM-2025-VC15 #2	—●—	-77.8	SW	#200 - 1.76 #230 - 1.67		3	2.31	1.96	-2.63	10.64	1.27	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	905,329
												Northing (Y, ft):	2,860,471
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MA_CZM_VIBRACORES_2025.GPJ 7/23/25



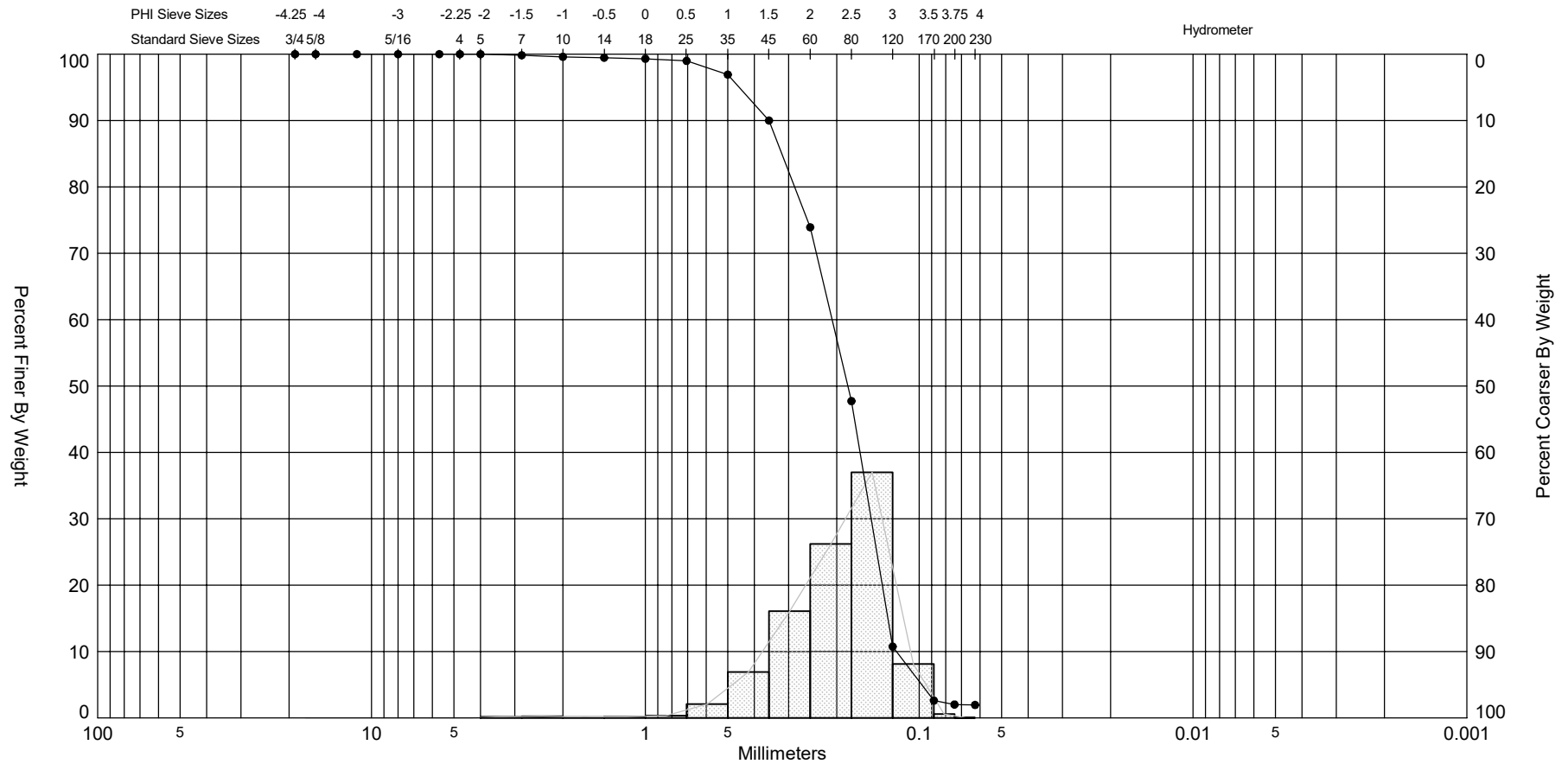
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC15 #3		-84.0	SP	#200 - 3.75 #230 - 3.63		1	2.52	2.42	-2.06	12.06	0.58	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-17-25
Depths and elevations based on measured values												Analyzed By:	MS
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	905,329
												Northing (Y, ft):	2,860,471
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



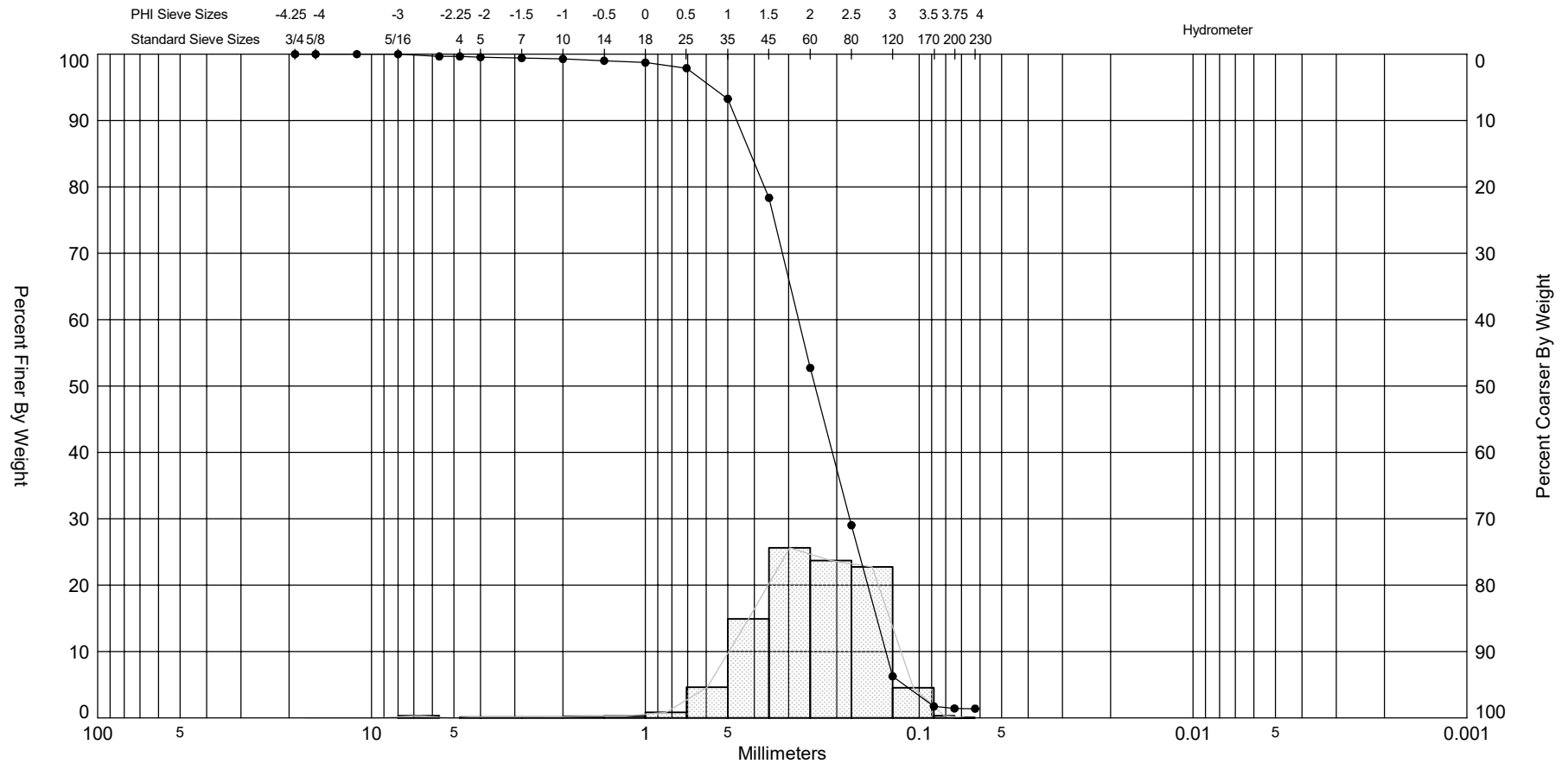
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC15 #4		-86.9	SP	#200 - 4.54 #230 - 4.34			2.56	2.43	-2.56	15.3	0.64	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	905,329
												Northing (Y, ft):	2,860,471
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC16 #1		-67.3	SP	#200 - 2.01 #230 - 1.95			2.46	2.32	-1.39	7.54	0.66	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-15-25
Depths and elevations based on measured values												Analyzed By:	SF
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	905,819
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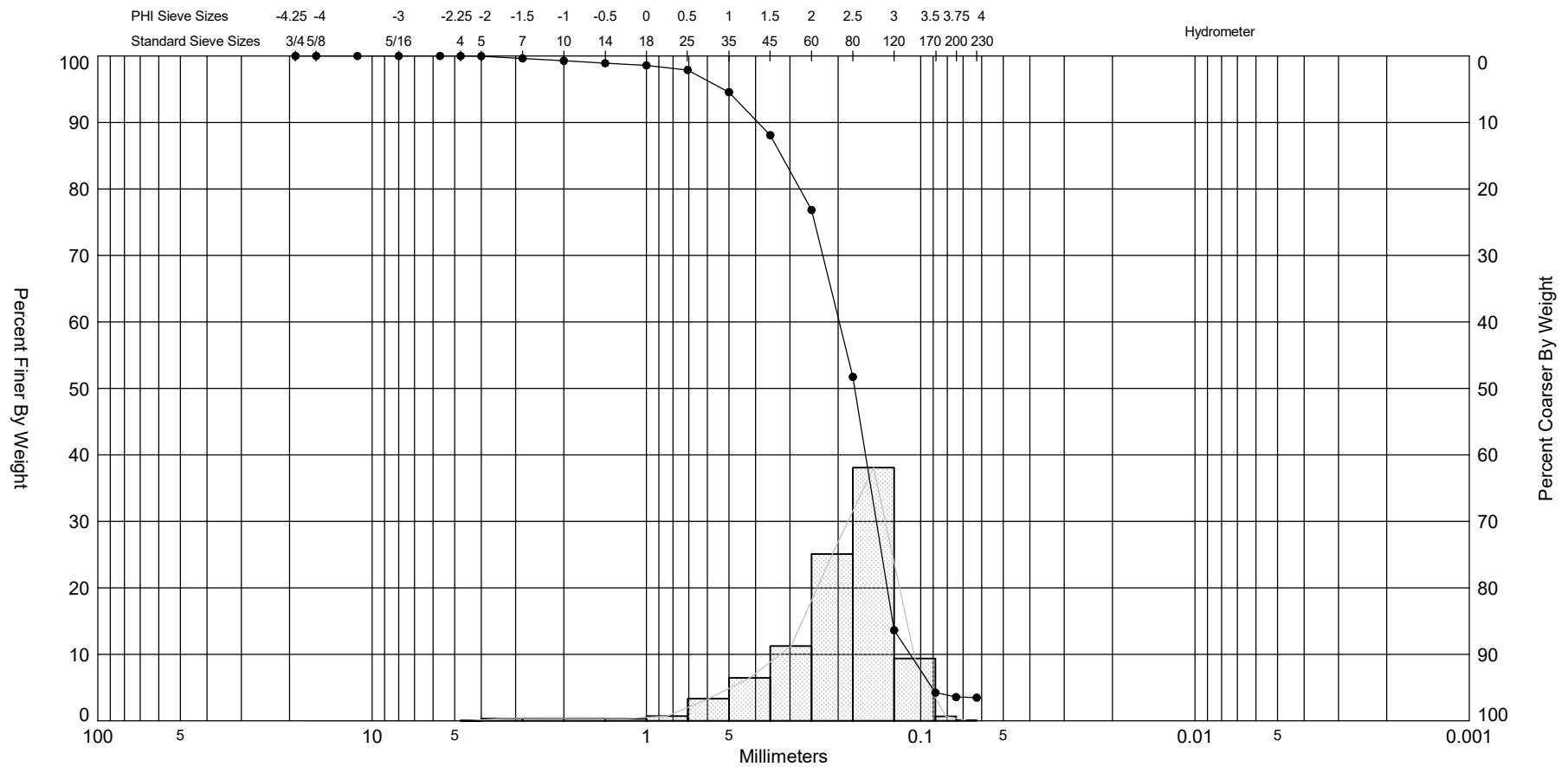
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC16 #2	—●—	-71.9	SP	#200 - 1.42 #230 - 1.39		1	2.06	2	-1.42	9.04	0.77	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-15-25
Depths and elevations based on measured values												Analyzed By:	MS
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	905,819
												Northing (Y, ft):	2,842,575
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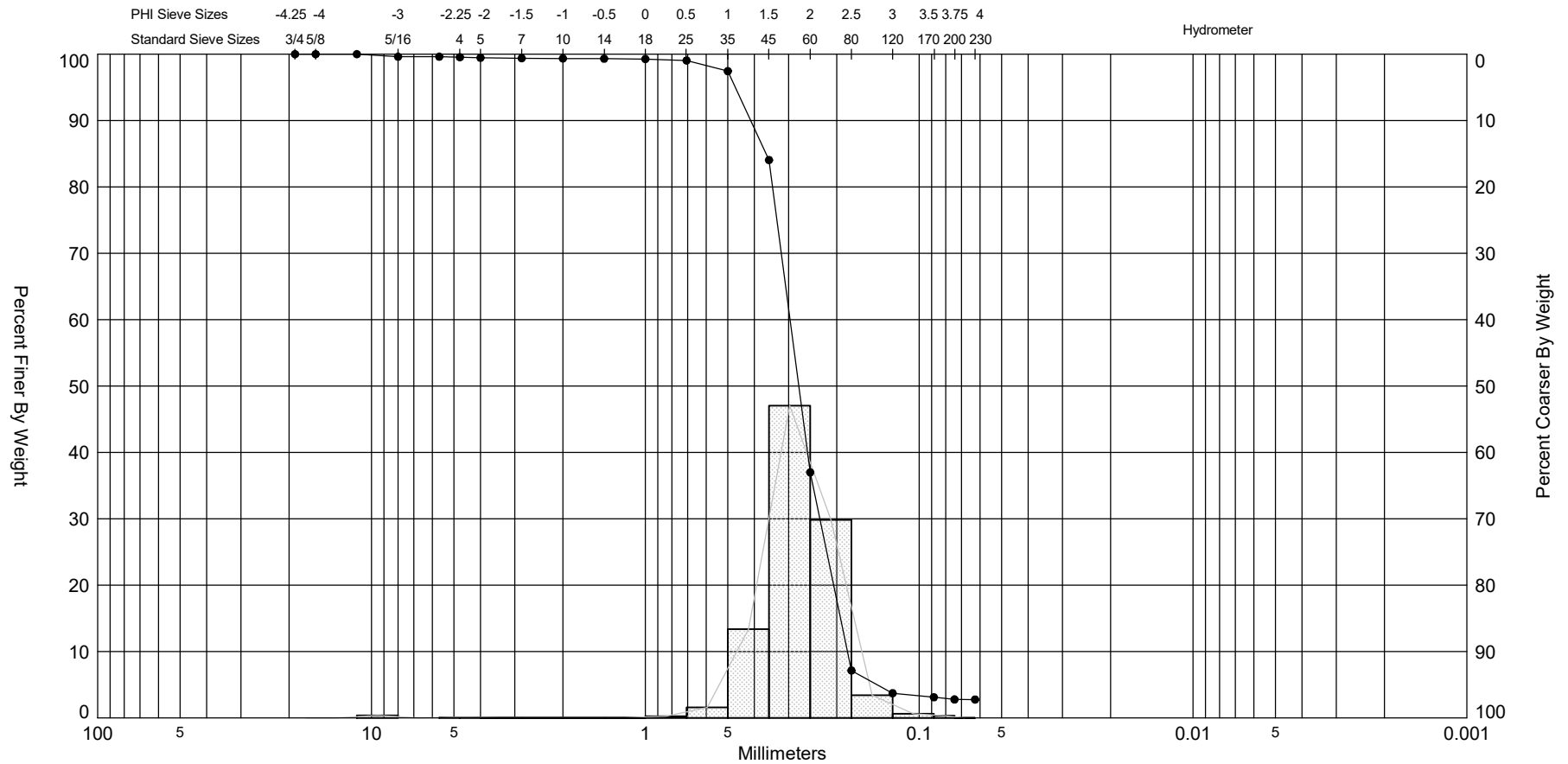
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay	
Coarse	Fine	Coarse	Medium	Fine		

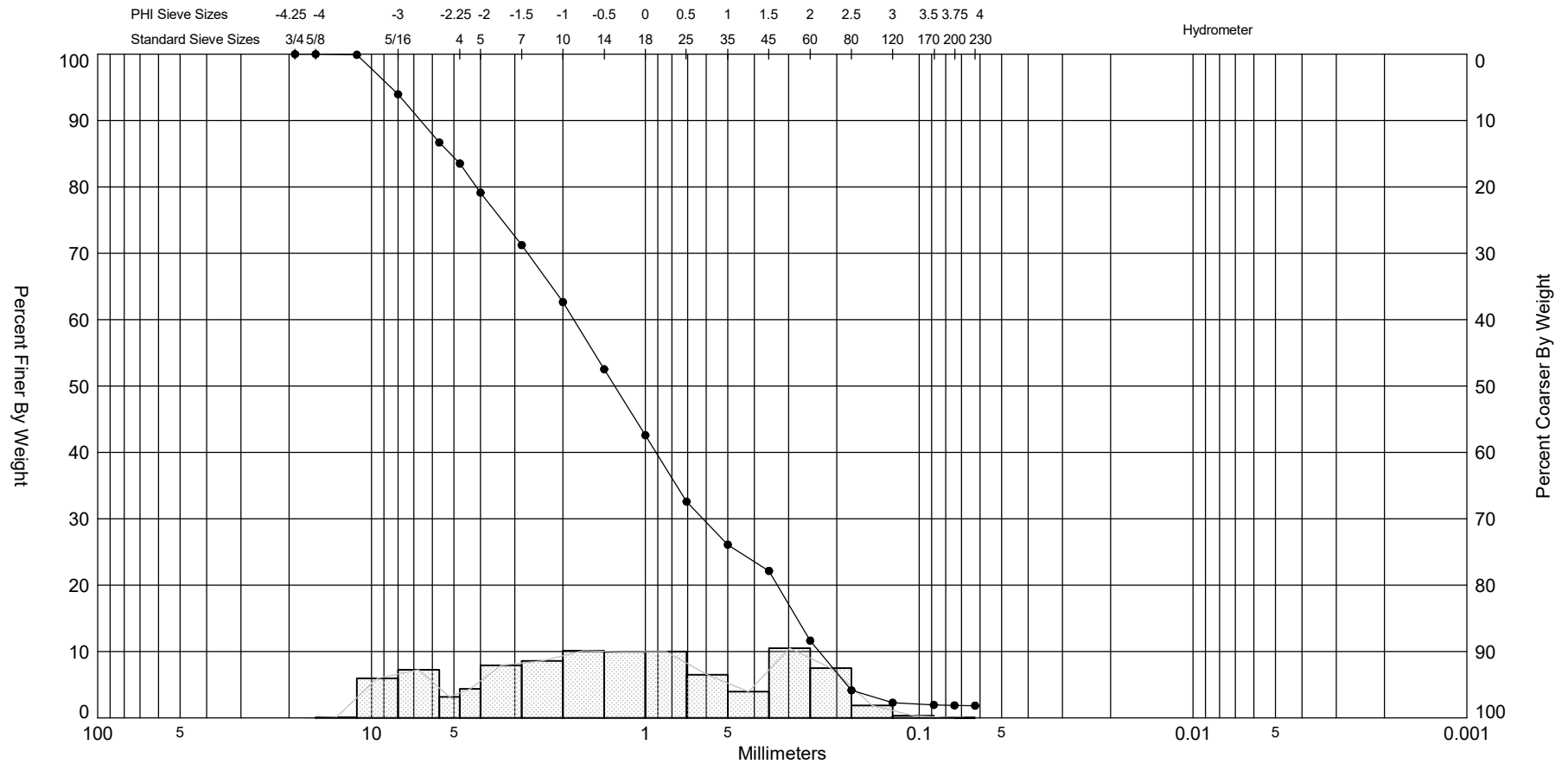
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC16 #3	—●—	-79.3	SP	#200 - 3.57 #230 - 3.48			2.52	2.32	-1.76	8.25	0.76	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-15-25
Depths and elevations based on measured values												Analyzed By:	SF
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	905,819
												Northing (Y, ft):	2,842,575
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC17 #1		-49.7	SP	#200 - 2.78 #230 - 2.77		1	1.86	1.83	-3.48	31.56	0.57	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-14-25
Depths and elevations based on measured values												Analyzed By:	MS
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	929,652
												Northing (Y, ft):	2,772,280
												Horizontal Datum:	NAD 1983
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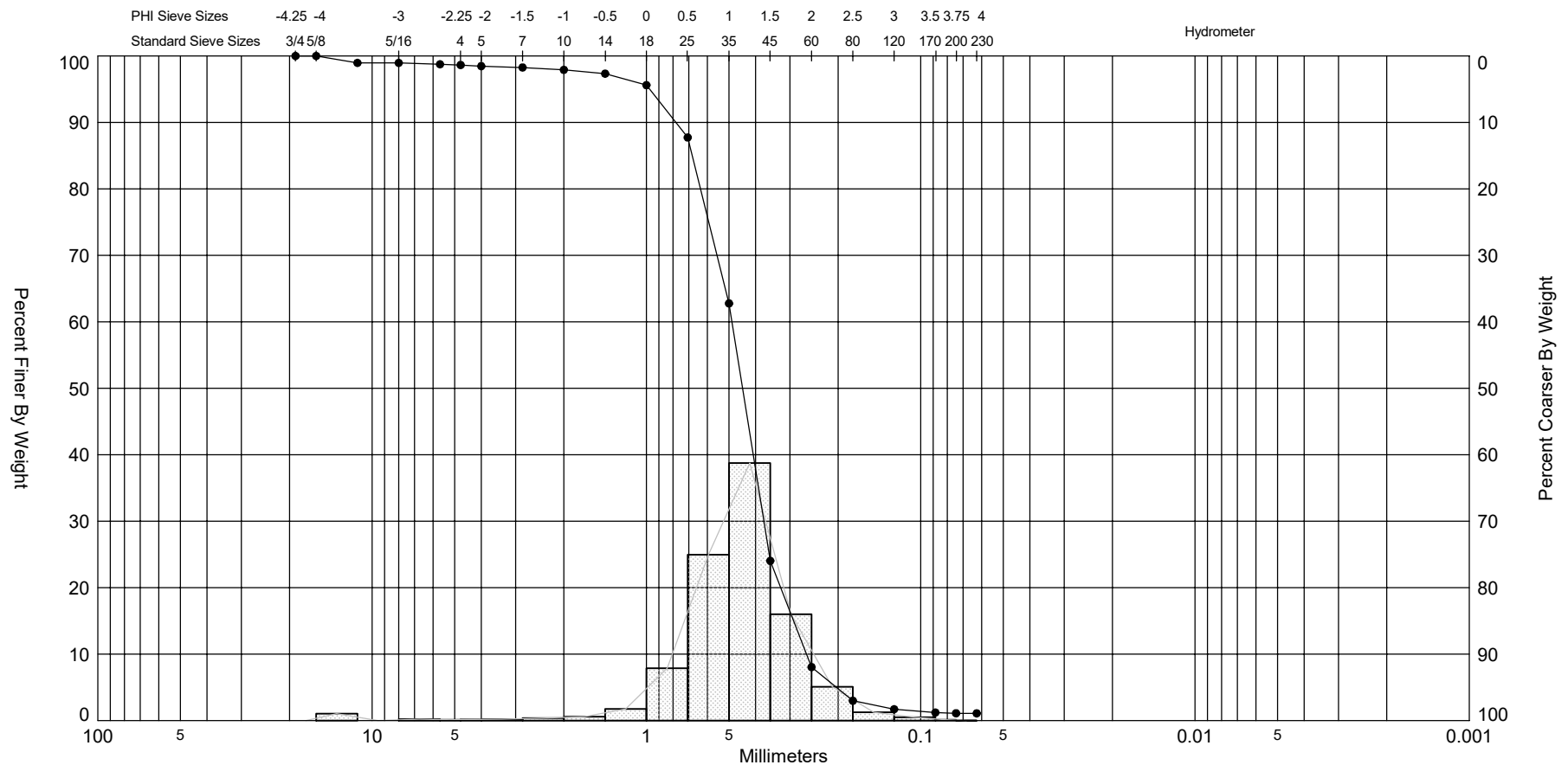
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

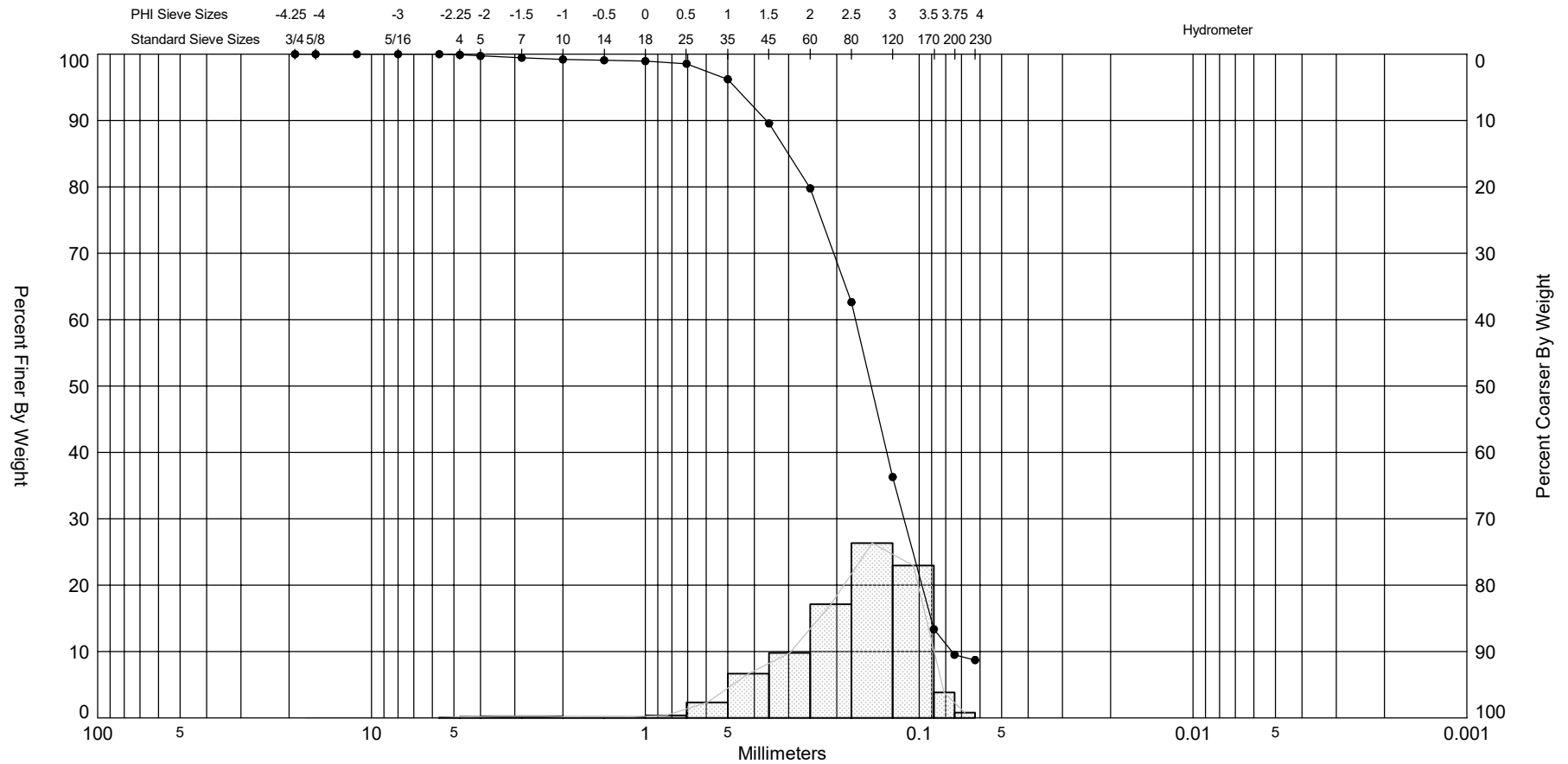
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC17 #2	—●—	-54.1	SW	#200 - 1.88 #230 - 1.85			-0.37	-0.38	0.06	1.97	1.71	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-14-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	929,652
												Northing (Y, ft):	2,772,280
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC18 #1		-46.0	SP	#200 - 1.10 #230 - 1.09		2	1.16	1.08	-2.36	15.08	0.83	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	MS
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	927,771
												Northing (Y, ft):	2,763,035
												Horizontal Datum:	NAD 1983
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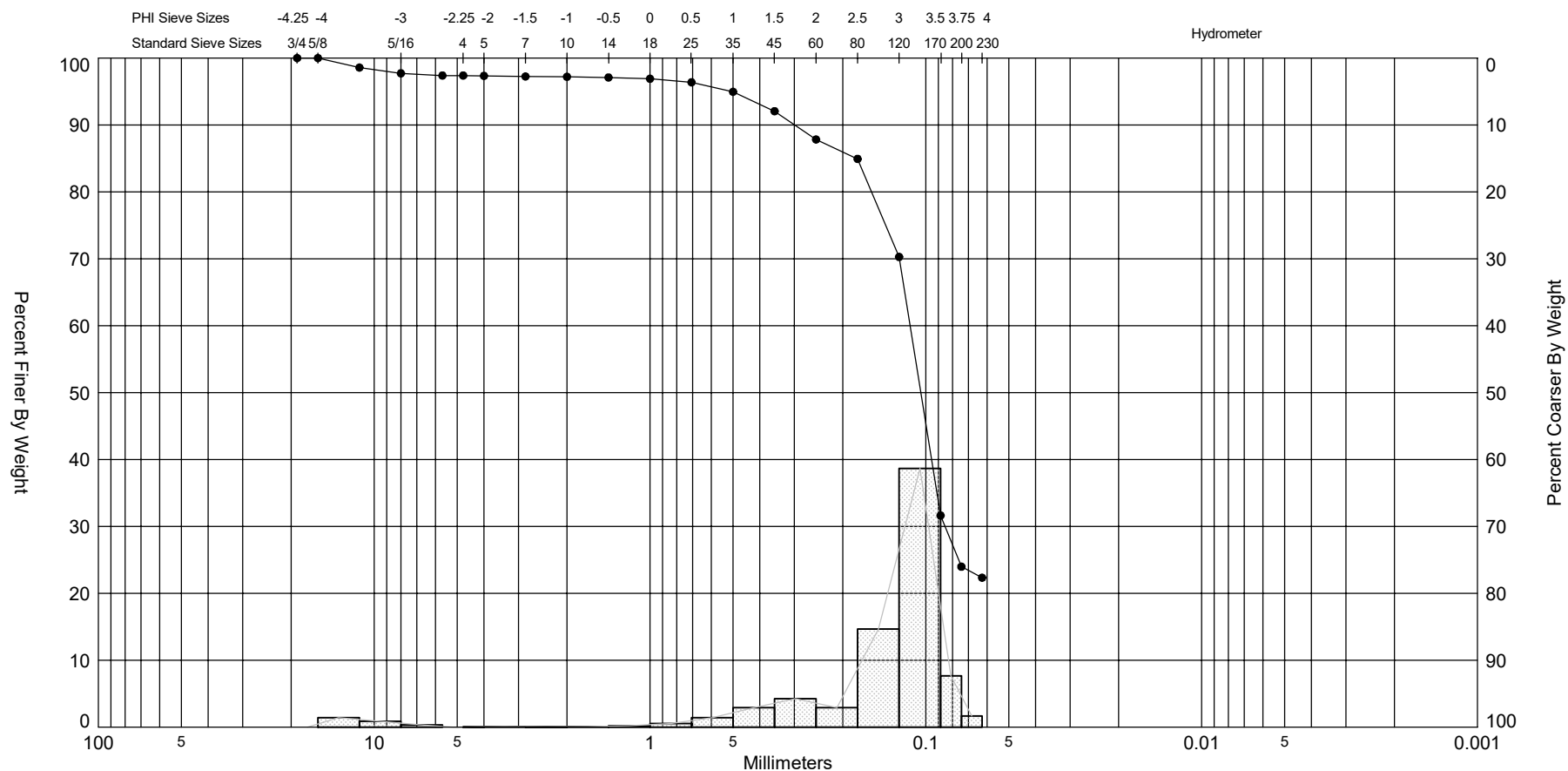
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay	
Coarse	Fine	Coarse	Medium	Fine		

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC18 #2	—●—	-50.2	SP-SM	#200 - 9.52 #230 - 8.72			2.74	2.5	-1.62	8.13	0.84	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	MS
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	927,771
												Northing (Y, ft):	2,763,035
												Horizontal Datum:	NAD 1983
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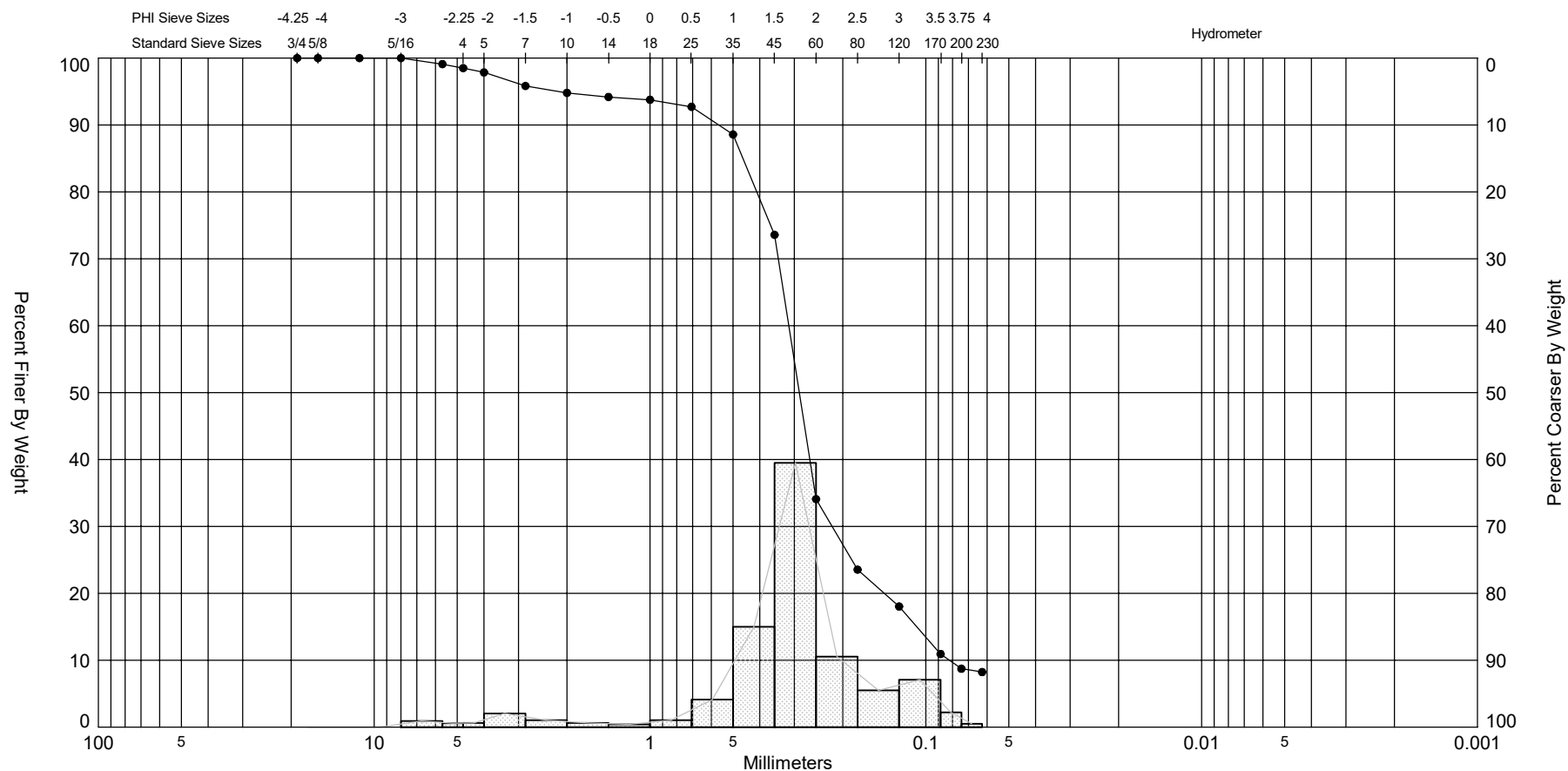
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

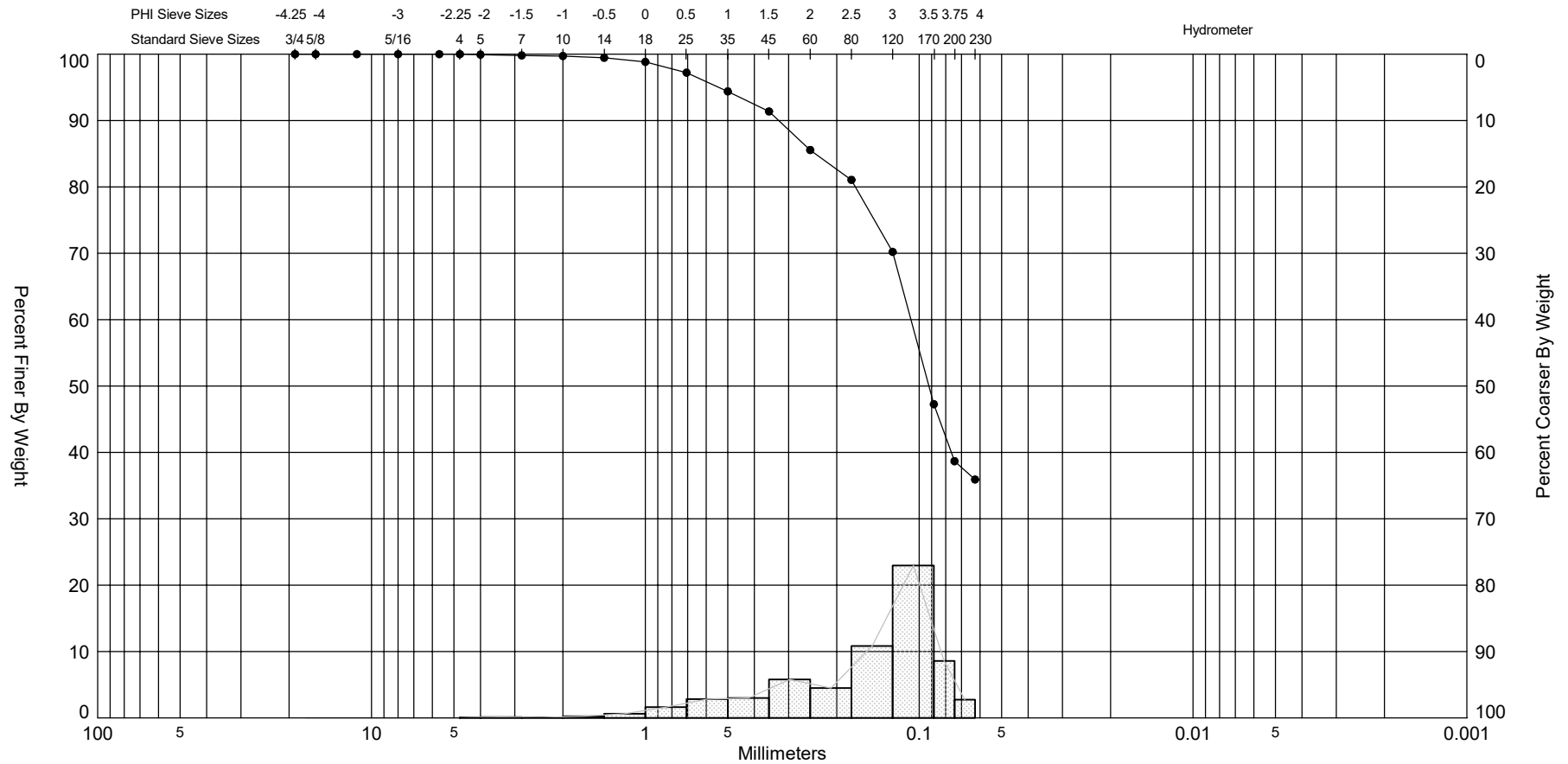
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC18 #3	—●—	-54.2	SC	#200 - 23.98 #230 - 22.33			3.26	2.69	-3.29	14.6	1.37	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-17-25
Depths and elevations based on measured values												Analyzed By:	SF
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	927,771
												Northing (Y, ft):	2,763,035
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC18 #4	—●—	-56.2	SW-SM	#200 - 8.73 #230 - 8.23			1.8	1.66	-1.55	6.94	1.15	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	927,771
												Northing (Y, ft):	2,763,035
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

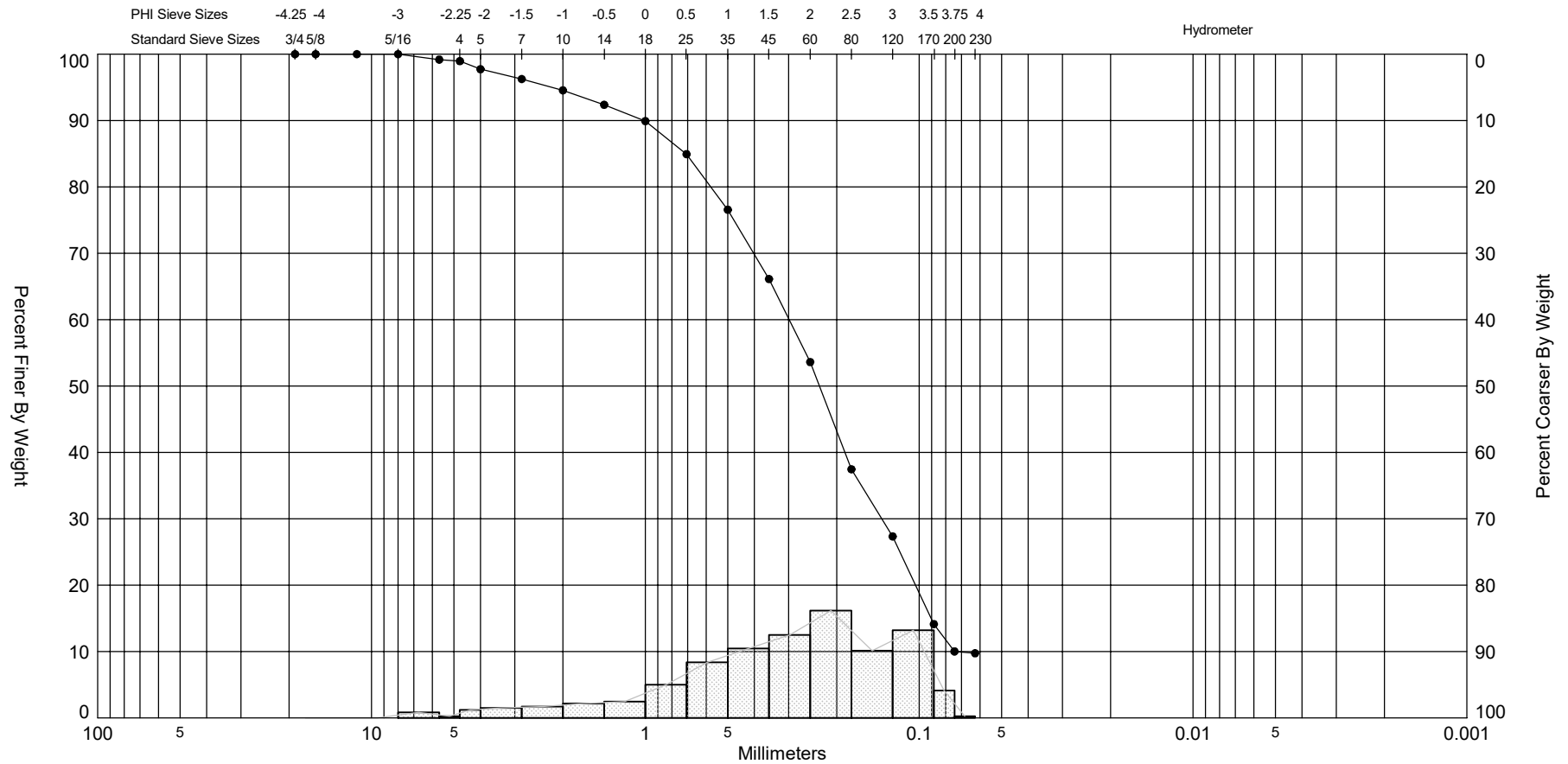
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC18 #5	—●—	-57.7	SM-SC	#200 - 38.68 #230 - 35.92			3.44	2.68	-1.41	4.81	1.01	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	SF
							APTIM					Easting (X, ft):	927,771
							6401 Congress Avenue, Suite 140					Northing (Y, ft):	2,763,035
							Boca Raton, FL 33487					Horizontal Datum:	NAD 1983
							ph (561) 391-8102					Vertical Datum:	NAVD88

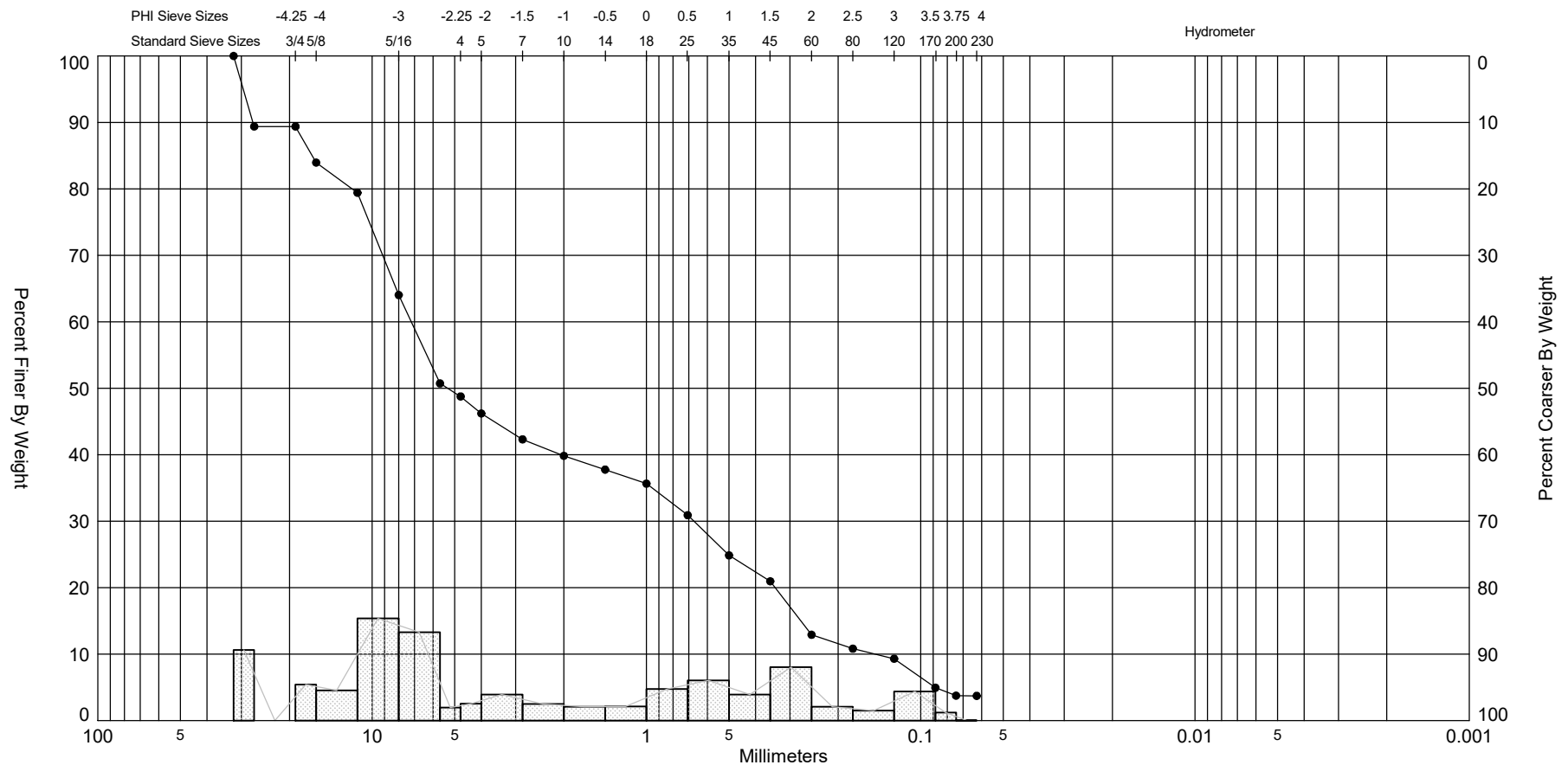
MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

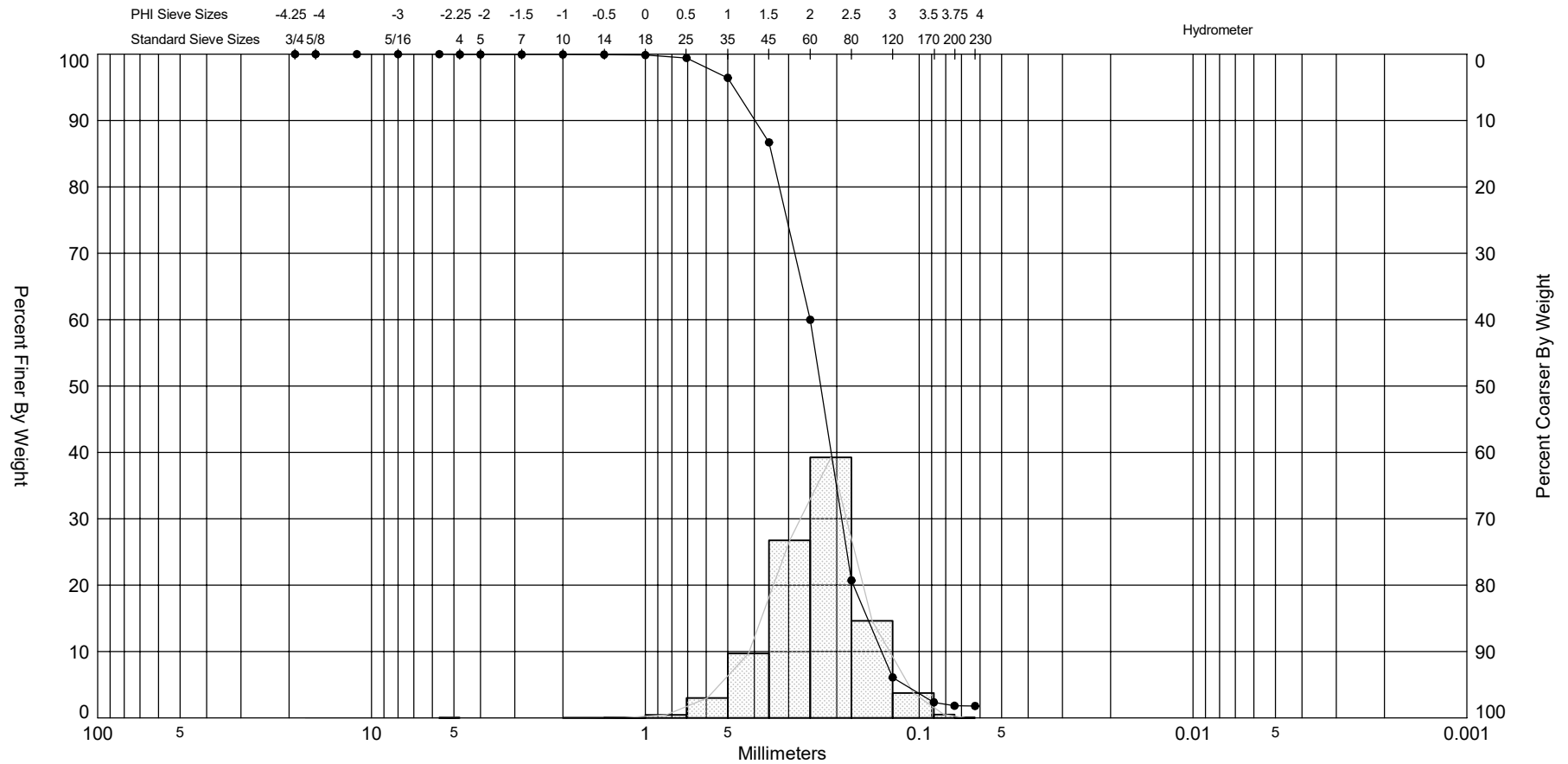
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC20 #1	—●—	-53.9	SW-SM	#200 - 10.01 #230 - 9.74			2.11	1.7	-0.95	3.67	1.4	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	MS
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	933,849
												Northing (Y, ft):	2,748,751
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC20 #2	—●—	-55.4	GW	#200 - 3.75 #230 - 3.72			-2.41	-1.53	0.47	1.94	2.5	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102					Easting (X, ft):	933,849
												Northing (Y, ft):	2,748,751
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_VIBRACORES_2025.GPJ 7/23/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC20 #3	—●—	-59.6	SP	#200 - 1.83 #230 - 1.80			2.13	2.08	-0.48	5.25	0.57	Project Name:	Preliminary Characterization of Offshore Sand Resources, Massachusetts
Comments:												Analysis Date:	07-16-25
Depths and elevations based on measured values												Analyzed By:	MS
							APTIM						
							6401 Congress Avenue, Suite 140						
							Boca Raton, FL 33487						
							ph (561) 391-8102						
												Easting (X, ft):	933,849
												Northing (Y, ft):	2,748,751
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

Appendix I

2025 APTIM Carbonate Analysis Report





Preliminary Characterization of Offshore Sand Resources, Massachusetts
Carbonate Report (Vibracore Samples)

Sample ID	Dish Weight	Dish + Dry	Dish + End	Dry Weight	Post Reaction Weight	% Terrigenous	% Carbonate
MA-CZM-2025-VC03 S#1	152.88	247.94	246.79	95.06	93.91	99%	1%
MA-CZM-2025-VC03 S#3	154.17	248.25	247.38	94.08	93.21	99%	1%
MA-CZM-2025-VC06 S#1	154.04	257.47	256.94	103.43	102.90	99%	1%
MA-CZM-2025-VC07 S#1	166.19	270.78	270.14	104.59	103.95	99%	1%
MA-CZM-2025-VC08 S#1	152.47	250.13	249.38	97.66	96.91	99%	1%
MA-CZM-2025-VC09 S#3	153.29	249.46	249.18	96.17	95.89	100%	0%
MA-CZM-2025-VC10 S#1	157.03	255.21	254.35	98.18	97.32	99%	1%
MA-CZM-2025-VC14 S#1	158.68	257.17	254.83	98.49	96.15	98%	2%
MA-CZM-2025-VC14 S#3	172.41	269.71	267.79	97.30	95.38	98%	2%
MA-CZM-2025-VC15 S#1	160.76	258.42	257.69	97.66	96.93	99%	1%
MA-CZM-2025-VC15 S#2	154.05	252.84	249.68	98.79	95.63	97%	3%
MA-CZM-2025-VC15 S#3	151.37	248.06	247.19	96.69	95.82	99%	1%
MA-CZM-2025-VC16 S#2	153.84	247.98	246.86	94.14	93.02	99%	1%
MA-CZM-2025-VC17 S#1	153.08	247.49	246.50	94.41	93.42	99%	1%
MA-CZM-2025-VC18 S#1	157.87	261.03	258.60	103.16	100.73	98%	2%

Appendix J

2025 APTIM Vibracore Mini Vane Shear Test Results





Mini Vane Shear Test Results

CORE ID	SAMPLE DEPTH (ft)	Vane Type	MAX. VANE READING (kg/cm ²)	CALCULATED SHEAR STRENGTH		DESCRIPTION ¹
				(kg/cm ²)	(kPa)	
MA-CZM-2025-VC01	7.0	Midsized	1.0	0.10	9.81	Very Soft
	9.6	Midsized	1.0	0.10	9.81	Very Soft
	12.0	Midsized	1.5	0.15	14.71	Very Soft
	15.2	Small	3.5	0.88	85.81	Stiff
MA-CZM-2025-VC02	2.0	Midsized	0.5	0.05	4.90	Very Soft
	6.0	Midsized	0.5	0.05	4.90	Very Soft
	9.5	Midsized	0.5	0.05	4.90	Very Soft
MA-CZM-2025-VC03	No Torvane Conducted					
MA-CZM-2025-VC04	No Torvane Conducted					
MA-CZM-2025-VC05	1.6	Midsized	3.5	0.35	34.32	Soft
	12.1	Midsized	4.0	0.40	39.23	Soft
MA-CZM-2025-VC06	No Torvane Conducted					
MA-CZM-2025-VC07	No Torvane Conducted					
MA-CZM-2025-VC08	2.9	Midsized	1.0	0.10	9.81	Very Soft
MA-CZM-2025-VC09	No Torvane Conducted					
MA-CZM-2025-VC10	No Torvane Conducted					
MA-CZM-2025-VC11	2.2	Midsized	1.8	0.18	17.16	Very Soft
	4.6	Midsized	3.0	0.30	29.42	Soft
	11.4	Midsized	2.5	0.25	24.52	Soft
	16.0	Midsized	3.8	0.38	36.77	Soft
MA-CZM-2025-VC12	10.0	Midsized	1.5	0.15	14.71	Very Soft
MA-CZM-2025-VC13	No Torvane Conducted					
MA-CZM-2025-VC14	No Torvane Conducted					
MA-CZM-2025-VC15	No Torvane Conducted					
MA-CZM-2025-VC16	No Torvane Conducted					
MA-CZM-2025-VC17	10.5	Midsized	4.5	0.45	44.13	Firm
	16.4	Small	5.5	1.38	134.84	Stiff
MA-CZM-2025-VC18	No Torvane Conducted					
MA-CZM-2025-VC19	6.2	Midsized	2.5	0.25	24.52	Soft
	9.9	Midsized	3.5	0.35	34.32	Soft
	10.9	Midsized	2.5	0.25	24.52	Soft
	15.3	Midsized	3.0	0.30	29.42	Soft
	16.5	Midsized	5.0	0.50	49.03	Firm
MA-CZM-2025-VC20	No Torvane Conducted					

¹ Based on Table 1.6 from Engineering Properties of Soils and Rocks, Fourth Edition by Fred G. Bell

Appendix K

2025 APTIM Overall Study Area Composite Tables



CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS OF OVERALL STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS																																								
SAMPLE I. D.	ELEVATION (NAVD 88 FT)	DEPTH (FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	mm MEDIAN	PHI MEAN	mm MEAN	PHI SORTING	mm SORTING	% SILT *	WET Munsell Value	DRY Munsell Value	-5.0	-4.75	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	-0.5	PHI SIZES					0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.0	PAN
MA-CZM-2025-VC03 S#1	-58.6	2.4	4.2	2.19	0.22	2.17	0.22	0.42	0.75	1.58	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.05	0.06	0.08	0.10	0.18	0.39	3.04	30.48	81.01	96.67	98.29	98.39	98.42	99.91					
MA-CZM-2025-VC03 S#2	-62.2	6.0	4.6	2.16	0.22	2.10	0.22	0.54	0.69	2.38	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.19	0.29	0.42	0.56	0.94	1.92	8.43	35.28	80.99	94.97	97.34	97.58	97.62	99.93					
MA-CZM-2025-VC03 S#3	-67.1	10.9	3.6	2.41	0.19	2.42	0.19	0.43	0.74	3.69	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.06	0.07	0.08	0.10	0.17	1.02	12.13	58.73	88.80	95.61	96.25	96.31	99.97					
MA-CZM-2025-VC03 S#4	-70.2	14.0	3.4	2.57	0.17	2.53	0.17	0.45	0.73	3.98	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.24	0.35	0.44	0.48	0.52	0.63	0.78	3.37	43.35	88.97	95.53	95.88	96.02	99.91					
Cut to -72.0ft NAVD																																								
MA-CZM-2025-VC03 Composite			15.8	2.31	0.20	2.28	0.21	0.5	0.71	2.74	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.13	0.19	0.25	0.31	0.46	0.84	3.66	21.86	67.82	92.72	96.81	97.13	97.19	99.93					
MA-CZM-2025-VC04 S#1	-46.6	1.6	3.4	2.79	0.14	2.74	0.15	0.49	0.71	3.58	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.24	0.30	0.34	0.40	0.46	0.73	3.76	23.93	69.10	94.46	96.18	96.42	99.96						
MA-CZM-2025-VC04 S#2	-50.0	5.0	2.8	2.91	0.13	2.87	0.14	0.45	0.73	11.58	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.15	0.17	0.25	0.28	0.34	0.43	0.57	1.18	8.57	59.02	84.27	87.58	88.42	99.96						
MA-CZM-2025-VC04 S#3	-53.0	8.0	3.3	3.30	0.10	2.98	0.13	0.44	0.74	33.99	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.05	0.12	0.23	0.40	0.66	1.43	4.88	31.47	61.99	65.42	66.01	100.00						
MA-CZM-2025-VC04 S#4	-56.0	11.0	3.0	3.34	0.10	3.04	0.12	0.57	0.67	30.47	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.35	0.37	0.41	0.44	0.48	0.57	0.73	1.50	4.68	26.39	60.99	68.46	69.53	100.00					
MA-CZM-2025-VC04 S#5	-60.6	15.6	2.4	1.43	0.37	1.13	0.46	1.21	0.43	4.24	4	5	0.00	0.00	0.00	0.00	0.00	0.00	2.20	3.25	3.80	5.77	7.54	9.85	12.54	17.87	29.79	53.19	79.60	90.36	94.13	95.47	95.74	95.76	99.95					
MA-CZM-2025-VC04 Composite**			14.9	2.93	0.13	2.56	0.17	0.97	0.51	17.32	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.61	0.73	1.08	1.38	1.80	2.27	3.18	5.19	9.13	14.52	23.65	54.30	78.78	82.10	82.66	99.98					
**Vibracore includes 2.3ft of unsampled material between -57.5 & -59.8. Composite results do not reflect incorporation of unsampled material.																																								
MA-CZM-2025-VC06 S#1	-89.5	4.0	8.6	0.46	0.73	0.19	0.88	1.57	0.34	1.54	3	5	0.00	0.00	0.00	0.00	0.00	3.68	7.61	9.62	11.60	15.80	22.00	30.61	38.87	50.95	64.18	75.98	88.70	94.68	97.35	98.25	98.44	98.46	99.96					
MA-CZM-2025-VC06 S#2	-97.5	12.0	6.6	0.74	0.60	0.58	0.67	1.26	0.42	1.81	4	6	0.00	0.00	0.00	0.00	0.00	0.00	2.18	2.58	4.35	6.17	10.85	19.35	29.66	42.60	57.86	70.76	88.66	94.98	97.23	97.99	98.14	98.19	99.92					
MA-CZM-2025-VC06 Composite			15.2	0.59	0.66	0.36	0.78	1.45	0.37	1.60	3	5	0.00	0.00	0.00	0.00	0.00	2.08	5.25	6.56	8.45	11.62	17.16	25.72	34.87	47.32	61.44	73.71	88.68	94.81	97.30	98.14	98.31	98.34	99.94					
MA-CZM-2025-VC07 S#1	-97.9	5.8	10.2	1.05	0.48	0.84	0.56	1.09	0.47	1.15	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	3.59	8.14	13.55	18.58	30.08	47.60	71.49	88.20	95.65	98.08	98.73	98.84	98.85	99.99					
MA-CZM-2025-VC07 S#2	-102.9	10.8	1.4	0.64	0.64	0.47	0.72	1.21	0.43	1.14	4	6	0.00	0.00	0.00	0.00	0.00	0.93	2.42	3.81	5.47	7.74	10.96	17.58	27.91	44.43	63.89	80.82	92.42	96.83	98.24	98.76	98.85	98.86	100.00					
MA-CZM-2025-VC07 Composite			11.6	1.01	0.50	0.80	0.57	1.11	0.46	1.13	4	6	0.00	0.00	0.00	0.00	0.00	0.11	0.29	0.46	1.65	4.09	8.48	14.04	19.71	31.81	49.57	72.62	88.71	95.79	98.10	98.73	98.84	98.85	99.99					
MA-CZM-2025-VC08 S#1	-90.1	1.0	2.1	1.62	0.33	1.62	0.33	0.76	0.59	3.27	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.10	0.33	0.99	5.16	19.39	44.65	67.77	85.15	92.43	96.05	96.69	96.73	99.93						
MA-CZM-2025-VC08 S#2	-98.1	9.0	11.6	0.87	0.55	0.72	0.61	0.98	0.51	1.24	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	1.03	3.33	7.12	11.77	18.41	31.42	56.34	81.31	92.58	97.13	98.39	98.69	98.75	98.76	99.95					
MA-CZM-2025-VC08 S#3	-105.3	16.2	2.1	1.57	0.34	1.41	0.38	0.94	0.52	1.34	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	1.67	4.26	8.42	14.90	27.37	46.50	72.08	89.92	96.69	98.43	98.62	98.66	99.96						
MA-CZM-2025-VC08 Composite**			15.8	1.05	0.48	0.93	0.52	1.01	0.50	1.49	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.76	2.52	5.46	9.25	14.77	25.73	47.58	71.81	86.56	94.58	97.37	98.30	98.46	98.48	99.95					
**Vibracore includes 1.1ft of unsampled material between -91.2 & -92.3. Composite results do not reflect incorporation of unsampled material.																																								
MA-CZM-2025-VC09 S#1	-68.0	4.2	6.3	2.09	0.23	2.01	0.25	0.61	0.66	2.70	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.11	0.21	0.46	0.79	1.21	1.87	4.22	12.56	42.75	81.86	95.36	97.07	97.25	97.30	100.00					
MA-CZM-2025-VC09 S#2	-73.9	10.1	6.8	2.23	0.21	2.22	0.21	0.41	0.75	1.38	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.10	0.13	0.16	0.34	2.01	25.31	78.33	96.63	98								

CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS OF OVERALL STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS																																								
SAMPLE I. D.	ELEVATION (NAVD 88 FT)	DEPTH (FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	mm MEDIAN	PHI MEAN	mm MEAN	PHI SORTING	mm SORTING	% SILT *	WET Munsell Value	DRY Munsell Value	-5.0	-4.75	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	-0.5	PHI SIZES					0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.0	PAN
MA-CZM-2025-VC18 S#1	-46.0	2.8	5.2	1.16	0.45	1.08	0.47	0.83	0.56	1.09	4	5	0.00	0.00	0.00	0.00	1.04	1.04	1.25	1.36	1.53	1.73	2.09	2.66	4.39	12.27	37.23	75.97	91.95	97.02	98.29	98.79	98.90	98.91	99.99					
MA-CZM-2025-VC18 S#2	-50.2	7.0	3.9	2.74	0.15	2.50	0.18	0.84	0.56	8.72	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.27	0.54	0.80	0.92	1.05	1.44	3.78	10.43	20.22	37.36	63.70	86.64	90.48	91.28	99.97					
MA-CZM-2025-VC18 S#3	-54.2	11.0	3.5	3.26	0.10	2.69	0.15	1.37	0.39	22.33	4	5	0.00	0.00	0.00	0.00	1.42	2.28	2.61	2.61	2.66	2.75	2.80	2.90	3.09	3.62	5.04	7.94	12.17	15.07	29.72	68.37	76.02	77.67	99.99					
MA-CZM-2025-VC18 S#4	-56.2	13.0	0.9	1.80	0.29	1.66	0.32	1.15	0.45	8.23	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.90	1.50	2.14	4.17	5.20	5.82	6.23	7.28	11.42	26.42	65.92	76.46	81.97	89.07	91.27	91.77	99.86					
MA-CZM-2025-VC18 S#5	-57.7	14.5	3.2	3.44	0.09	2.68	0.16	1.01	0.50	35.92	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.19	0.28	0.55	1.16	2.78	5.61	8.63	14.44	18.94	29.79	52.74	61.32	64.08	99.96					
Cut to -59.9ft NAVD																																								
MA-CZM-2025-VC18 Composite			16.7	2.51	0.18	2.01	0.25	1.24	0.42	14.36	4	5	0.00	0.00	0.00	0.00	0.62	0.80	0.98	1.07	1.23	1.50	1.76	2.07	2.82	5.84	15.22	30.83	42.22	49.84	61.84	80.23	84.53	85.62	99.97					
MA-CZM-2025-VC20 S#1	-53.9	1.8	2.9	2.11	0.23	1.70	0.31	1.40	0.38	9.74	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.82	1.05	2.27	3.75	5.45	7.63	10.09	15.07	23.44	33.88	46.39	62.54	72.66	85.87	89.99	90.26	99.87					
MA-CZM-2025-VC20 S#2	-55.4	3.3	0.8	-2.41	5.31	-1.53	2.89	2.50	0.18	3.72	4	5	0.00	10.61	10.61	16.04	20.58	35.97	49.27	51.23	53.79	57.69	60.17	62.24	64.35	69.1	75.14	79.04	87.09	89.18	90.69	95.06	96.25	96.28	99.98					
MA-CZM-2025-VC20 S#3	-59.6	7.5	6.6	2.13	0.23	2.08	0.24	0.57	0.67	1.80	5	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.07	0.13	0.57	3.57	13.29	40.02	79.28	93.90	97.65	98.17	98.20	99.99					
Cut to -62.4ft NAVD																																								
MA-CZM-2025-VC20 Composite			10.3	2.08	0.24	1.69	0.31	1.46	0.36	4.16	5	6	0.00	0.82	0.82	1.25	1.60	2.79	4.06	4.31	4.85	5.57	6.24	7.03	7.92	9.98	14.72	24.19	45.47	75.34	87.67	94.13	95.72	95.82	99.96					
MA-CZM-2017-VC01 S#1	-78.6	2.5	5.1	2.93	0.13	2.85	0.14	0.63	0.65	9.16	3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.38	0.38	0.49	0.62	0.71	0.80	0.96	1.17	1.57	3.07	12.69	56.00	85.40	88.26	90.84	100.00					
MA-CZM-2017-VC01 S#2	-83.5	7.4	4.8	2.79	0.14	2.61	0.16	0.83	0.56	8.84	3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.53	0.64	0.70	0.74	0.97	1.28	1.98	3.89	6.33	12.23	29.27	64.57	85.35	88.24	91.16	99.96					
MA-CZM-2017-VC01 S#3	-87.1	11.0	2.1	2.93	0.13	2.36	0.19	1.62	0.33	19.71	2.5	5	0.00	0.00	0.00	0.00	0.00	0.00	4.74	5.48	5.48	5.48	5.63	5.75	5.90	6.00	6.26	6.75	7.57	10.57	24.87	54.20	74.43	76.94	80.29	99.93				
MA-CZM-2017-VC01 Composite			12.0	2.88	0.14	2.67	0.16	0.95	0.52	10.87	3	5	0.00	0.00	0.00	0.00	0.00	0.83	1.33	1.33	1.38	1.47	1.57	1.72	1.90	2.30	3.23	4.52	8.05	21.45	59.11	83.46	86.27	89.12	99.97					
MA-CZM-2017-VC04 S#1	-124.7	1.0	2.1	2.72	0.15	2.57	0.17	0.68	0.62	7.62	2.5	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.33	0.77	1.12	1.35	1.63	2.23	3.94	9.49	30.84	75.09	90.03	91.62	92.38	99.79					
MA-CZM-2017-VC04 S#2	-128.0	4.3	4.4	2.87	0.14	2.74	0.15	0.61	0.66	11.50	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.23	0.39	0.52	0.64	0.85	1.23	2.53	6.69	20.06	60.44	84.54	87.33	88.50	99.99					
MA-CZM-2017-VC04 S#3	-131.3	7.6	2.2	2.82	0.14	2.67	0.16	0.61	0.66	13.63	3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.15	0.27	0.38	0.54	0.81	1.56	3.19	7.97	22.80	65.62	82.18	84.77	86.37	99.88					
Cut to -132.4ft NAVD																																								
MA-CZM-2017-VC04 Composite			8.7	2.82	0.14	2.68	0.16	0.63	0.65	11.02	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.23	0.45	0.63	0.79	1.03	1.55	3.04	7.69	23.35	65.29	85.27	87.72	88.90	99.91					
MA-CZM-2017-VC05 S#1	-104.4	0.4	0.8	1.48	0.36	1.38	0.38	0.95	0.52	1.35	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	1.38	4.93	8.82	15.60	29.66	50.81	72.11	88.77	96.43	98.28	98.48	98.65	99.96					
MA-CZM-2017-VC05 S#2	-105.5	1.5	1.3	1.27	0.41	0.99	0.50	1.32	0.40	1.17	3	6	0.00	0.00	0.00	0.00	0.00	0.96	0.96	1.40	1.93	4.88	9.60	16.50	21.74	28.09	40.29	58.42	75.83	90.31	96.82	98.51	98.68	98.83	99.98					
MA-CZM-2017-VC05 S#3	-108.1	4.1	4.1	1.30	0.41	1.17	0.44	1.09	0.47	1.25	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	1.61	3.95	9.22	15.03	23.24	37.97	58.13	76.06	90.12	96.67	98.39	98.58	98.75	99.98					
MA-CZM-2017-VC05 S#4	-111.3	7.3	2.5	0.78	0.58	0.52	0.70	1.48	0.36	0.77	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.58	1.59	4.84	11.90	20.39	29.40	36.64	44.02	54.57	68.83	81.56	92.71	97.49	98.95	99.16	99.23	99.98					
MA-CZM-2017-VC05 Composite			8.7	1.21	0.43	0.97	0.51	1.28	0.41	1.09	3	6	0.00	0.00	0.00	0.00	0.00	0.14	0.31	0.67	1.76	4.92	9.28	15.71	21.67	29.23	42.32	60.57	77.24	90.77	96.91	98.56	98.75	98.89	99.98					
MA-CZM-2017-VC06 S#1	-81.0	1.3	2.6	2.26	0.21	1.90	0.27	1.37	0.39	2.36	5	7																												

CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS OF OVERALL STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS																																								
SAMPLE I. D.	ELEVATION (NAVD 88 FT)	DEPTH (FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	mm MEDIAN	PHI MEAN	mm MEAN	PHI SORTING	mm SORTING	% SILT *	WET Munsell Value	DRY Munsell Value	-5.0	-4.75	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	-0.5	PHI SIZES					0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.0	PAN
MA-CZM-2017-VC11 VS#1			0.4	2.02	0.25	1.61	0.33	1.33	0.40	2.80	3	6	0.00	0.00	0.00	0.00	0.00	0.00	2.79	4.34	4.99	6.34	7.39	8.63	9.62	10.72	15.67	32.24	48.60	79.25	93.84	96.56	96.89	97.20	99.97					
MA-CZM-2017-VC13 S#1	-58.4	1.6	2.5	2.10	0.23	2.05	0.24	0.78	0.58	3.65	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.38	0.43	0.59	0.78	1.06	1.41	2.06	5.07	16.98	44.69	71.58	87.43	94.68	95.60	96.35	99.96					
MA-CZM-2017-VC13 S#2	-60.8	4.0	2.2	2.63	0.16	2.18	0.22	1.38	0.38	7.80	4	6	0.00	0.00	0.00	0.00	0.00	2.49	2.58	2.64	3.13	3.79	4.52	5.65	6.76	8.22	11.03	15.48	23.32	41.90	72.44	88.88	90.72	92.20	99.95					
MA-CZM-2017-VC13 S#3	-62.2	5.4	0.7	2.34	0.20	1.87	0.27	1.27	0.41	8.19	3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.68	0.84	1.85	2.65	4.18	6.47	10.62	21.94	37.15	44.90	52.40	72.12	88.76	90.51	91.81	99.96					
Cut to -62.6ft NAVD																																								
MA-CZM-2017-VC13 Composite			5.8	2.30	0.20	2.05	0.24	1.14	0.45	5.68	4	6	0.00	0.00	0.00	0.00	0.00	0.94	1.37	1.55	1.82	2.35	2.88	3.70	4.62	6.03	10.10	19.90	36.88	58.54	80.34	91.90	93.22	94.29	99.96					
MA-CZM-2017-VC14 S#1	-62.9	0.6	1.3	2.23	0.21	2.06	0.24	0.86	0.55	5.25	2.5	5	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.49	0.63	1.01	1.39	1.92	2.69	4.77	7.48	14.45	34.20	68.60	88.44	93.65	94.43	94.75	99.96					
MA-CZM-2017-VC14 S#2	-64.6	2.3	2.0	2.29	0.20	2.11	0.23	0.95	0.52	5.82	4	6	0.00	0.00	0.00	0.00	0.35	0.64	0.64	0.93	1.20	1.67	2.40	3.03	3.51	3.96	5.01	10.19	29.20	65.62	87.50	92.85	93.75	94.18	99.94					
Cut to -65.6ft NAVD																																								
MA-CZM-2017-VC14 Composite			3.3	2.26	0.21	2.09	0.23	0.91	0.53	5.56	3	6	0.00	0.00	0.00	0.00	0.21	0.39	0.49	0.76	0.98	1.41	2.00	2.59	3.19	4.28	5.98	11.87	31.17	66.79	87.87	93.17	94.02	94.40	99.95					
MA-CZM-2017-VC15 S#1	-80.7	0.6	1.2	1.11	0.46	1.01	0.50	0.99	0.50	0.81	5	7	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.76	2.14	3.89	7.38	14.30	26.72	45.36	66.26	83.78	95.82	98.83	99.15	99.18	99.19	99.99						
MA-CZM-2017-VC15 S#2	-86.1	6.0	9.5	2.26	0.21	2.20	0.22	0.57	0.67	1.63	5	6	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.16	0.33	0.39	0.43	0.49	0.63	0.86	1.87	7.07	26.71	72.37	95.12	98.03	98.21	98.37	99.97					
MA-CZM-2017-VC15 Composite			10.7	2.20	0.22	2.07	0.24	0.74	0.60	1.53	5	6	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.17	0.38	0.59	0.82	1.26	2.16	3.76	6.75	13.71	33.11	75.00	95.54	98.16	98.32	98.46	99.97					
MA-CZM-2017-VC16 S#1	-79.1	0.7	1.4	1.76	0.30	1.73	0.30	0.76	0.59	1.23	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.51	0.88	1.24	1.47	1.79	5.01	8.86	33.50	65.22	86.27	96.22	98.53	98.66	98.77	99.97					
MA-CZM-2017-VC16 S#2	-80.6	2.2	1.6	2.13	0.23	2.06	0.24	0.61	0.66	1.72	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.09	0.22	0.39	1.01	3.92	16.61	41.05	76.06	94.22	97.83	98.07	98.28	99.97						
MA-CZM-2017-VC16 S#3	-82.0	3.6	1.3	1.10	0.47	0.76	0.59	1.57	0.34	1.22	4	6	0.00	0.00	0.00	0.00	5.04	6.91	7.08	7.26	7.94	9.93	11.81	14.02	17.73	27.41	45.97	65.37	82.20	92.83	97.88	98.67	98.75	98.78	99.92					
MA-CZM-2017-VC16 S#4	-86.2	7.8	6.9	2.82	0.14	2.68	0.16	0.63	0.65	14.68	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.43	0.54	0.63	0.95	1.73	3.24	5.86	23.45	64.70	80.32	83.80	85.32	99.99					
MA-CZM-2017-VC16 Composite			11.2	2.55	0.17	2.21	0.22	1.05	0.48	9.57	4	6	0.00	0.00	0.00	0.00	0.59	0.80	0.84	0.86	0.99	1.36	1.80	2.18	2.73	4.54	8.07	16.14	27.17	46.87	76.71	87.23	89.43	90.42	99.98					
MA-CZM-2017-VC16 VS#2			1.3	2.13	0.23	2.06	0.24	0.61	0.66	1.72	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.09	0.22	0.39	1.01	3.92	16.61	41.05	76.06	94.22	97.83	98.07	98.28	99.97						
MA-CZM-2017-VC17 S#1	-73.5	2.0	1.4	1.41	0.38	1.43	0.37	0.90	0.54	0.79	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.78	1.09	1.92	4.08	12.09	33.44	53.63	68.31	87.16	97.91	99.06	99.15	99.21	99.99					
MA-CZM-2017-VC17 S#2	-74.4	2.9	0.5	-0.82	1.77	-0.54	1.45	1.67	0.31	0.67	3	6	0.00	0.00	0.00	0.00	1.37	2.99	9.62	13.63	20.44	35.02	46.25	56.54	64.67	72.69	80.66	85.11	87.73	92.75	98.29	99.21	99.28	99.33	99.95					
MA-CZM-2017-VC17 S#3	-78.6	7.1	7.8	3.06	0.12	2.96	0.13	0.56	0.68	17.25	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.18	0.32	0.42	0.67	1.02	1.49	2.13	6.10	47.35	71.02	77.36	82.75	99.94					
MA-CZM-2017-VC17 Composite			11.0	2.82	0.14	2.44	0.18	1.15	0.45	12.53	3	6	0.00	0.00	0.00	0.00	0.06	0.14	0.44	0.62	0.95	1.77	2.38	3.07	3.80	5.44	9.11	13.71	19.04	28.62	61.64	79.04	83.58	87.43	99.95					
MA-CZM-2017-VC18 S#1	-45.3	2.0	4.1	1.07	0.48	0.99	0.50	0.66	0.63	0.91	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.41	0.95	1.43	2.65	5.67	16.31	44.53	83.32	95.53	98.53	98.92	99.04	99.07	99.09	99.98					
MA-CZM-2017-VC18 S#2	-48.7	5.4	2.6	1.25	0.42	1.19	0.44	0.79	0.58	0.97	4	6	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.46	0.55	1.51	2.23	2.93	4.85	11.80	31.87	67.55	88.74	97.35	98.52	98.88	98.99	99.03	99.97					
MA-CZM-2017-VC18 S#3	-50.3	7.0	0.6	1.35	0.39	1.14	0.45	1.05	0.48	1.59	4	6	0.00	0.00	0.00	0.00	0.00	0.00	1.13	1.73	2.83	5.85	7.07	7.84	8.85	12.69	27.46	59.43	87.90	96.72	97.49	97.80	98.10	98.41	99.94					
MA-CZM-2017-VC18 S#4	-52.0	8.7	2.7	1.61	0.33	1.56	0.34	0.48	0.72	1.13	4	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.20	0.23	0.35	1.50	9.72	40.28	86.20	97.82	98.56	98.72	98.76	98.87	99.97					
MA-CZM-2017-VC18 Composite			10.0	1.27	0.41	1.20	0.44	0.72	0.61	0.99	4	6	0.00	0.00	0.00	0.00	0.09	0.09	0.15	0.26	0.48	1.17	1.64	2.38	4.21	10.92	30.82	66.17	90.79	97.92	98.63	98.84	98.91	98.97	99.97					
MA-CZM-2017-VC20 S#1	-55.7	0.6	1.3	1.02	0.49	0.95	0.52	1.19	0.44	1.69	3	6	0.00	0.00	0.00	0.00	0.00	2.42	2.42	2.74	2.84	3.82	5.26	8.20	13.16	25.01	48.96	72.32	83.11	89.71	95.17	97.61	98.01	98.31	99.99					
MA-CZM-2017-VC20 S#2	-57.2	2.1	1.7	2.11	0.23	1.31	0.40	1.98	0.25	2.83	4	6	0.00	0.00	0.00	0.00	6.19	9.11	11.58	12.21	12.21	12.90	13.84	15.14	16.44	18.73	22.89	28.04	41.04	81.87	88.39	96.51	96.88	97.17	99.95					
MA-CZM-2017-VC20 S#3	-60.9	5.8	5.5	2.21	0.22	2.21	0.22	0.45	0.73	1.38	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00																			

NOTES:
 * % Silt is based on the #230 sieve

COMPOSITE DATA TABLE OF OVERALL STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS																																		
VIBRACORE I. D.	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	PHI MEAN	MEAN (mm)	PHI SORTING	SORTING (mm)	% SILT *	WET Munsell Value	DRY Munsell Value	-5.0	-4.75	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	PHI SIZES		0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.0	PAN
																						-0.5												
MA-CZM-2025-VC03 Composite	15.8	2.31	0.20	2.28	0.21	0.50	0.71	2.74	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.13	0.19	0.25	0.31	0.46	0.84	3.66	21.86	67.82	92.72	96.81	97.13	97.19	99.93	
MA-CZM-2025-VC04 Composite**	14.9	2.93	0.13	2.56	0.17	0.97	0.51	17.32	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.61	0.73	1.08	1.38	1.80	2.27	3.18	5.19	9.13	14.52	23.65	54.30	78.78	82.10	82.66	99.98	
MA-CZM-2017-VC01 Composite	12.0	2.88	0.14	2.67	0.16	0.95	0.52	10.87	3	5	0.00	0.00	0.00	0.00	0.00	0.83	1.33	1.33	1.38	1.47	1.57	1.72	1.90	2.30	3.23	4.52	8.05	21.45	59.11	83.46	86.27	89.12	99.97	
MA-CZM-2025-VC06 Composite	15.2	0.59	0.66	0.36	0.78	1.45	0.37	1.60	3	5	0.00	0.00	0.00	0.00	0.00	2.08	5.25	6.56	8.45	11.62	17.16	25.72	34.87	47.32	61.44	73.71	88.68	94.81	97.30	98.14	98.31	98.34	99.94	
MA-CZM-2025-VC07 Composite	11.6	1.01	0.50	0.80	0.57	1.11	0.46	1.13	4	6	0.00	0.00	0.00	0.00	0.00	0.11	0.29	0.46	1.65	4.09	8.48	14.04	19.71	31.81	49.57	72.62	88.71	95.79	98.10	98.73	98.84	98.85	99.99	
MA-CZM-2025-VC08 Composite**	15.8	1.05	0.48	0.93	0.52	1.01	0.50	1.49	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.76	2.52	5.46	9.25	14.77	25.73	47.58	71.81	86.56	94.58	97.37	98.30	98.46	98.48	99.95	
MA-CZM-2017-VC05 Composite	8.7	1.21	0.43	0.97	0.51	1.28	0.41	1.09	3	6	0.00	0.00	0.00	0.00	0.00	0.14	0.31	0.67	1.76	4.92	9.28	15.71	21.67	29.23	42.32	60.57	77.24	90.77	96.91	98.56	98.75	98.89	99.98	
MA-CZM-2017-VC06 Composite	12.2	2.45	0.18	2.32	0.20	0.90	0.54	2.11	5	7	0.00	0.00	0.00	0.00	0.00	0.20	0.49	0.62	0.71	1.07	1.46	2.07	2.88	4.14	6.11	8.97	19.60	53.39	83.63	95.24	96.69	97.86	99.96	
MA-CZM-2017-VC07 Composite	10.8	1.26	0.42	1.11	0.46	1.01	0.50	3.36	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.31	0.50	1.44	3.14	6.55	12.41	22.78	38.53	60.32	82.93	91.23	93.79	95.53	96.12	96.55	99.91	
MA-CZM-2017-VC08 Composite	10.6	0.56	0.68	0.44	0.74	1.09	0.47	0.92	4	6	0.00	0.00	0.00	0.00	0.00	1.92	1.92	2.26	2.65	4.50	8.31	16.02	29.25	47.48	67.88	84.80	94.84	97.72	98.65	98.95	98.99	99.04	99.97	
MA-CZM-2017-VC09 Composite	12.0	1.72	0.30	1.24	0.42	1.59	0.33	3.07	4	6	0.00	0.00	0.00	0.00	0.14	0.64	2.11	2.89	3.94	7.21	10.54	15.41	21.52	28.69	37.41	46.30	54.66	73.89	89.01	94.29	95.69	96.92	99.98	
MA-CZM-2025-VC09 Composite	17.7	2.25	0.21	2.21	0.22	0.52	0.70	2.44	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.11	0.21	0.34	0.50	0.76	1.67	5.36	26.59	73.49	94.10	97.11	97.49	97.53	99.98	
MA-CZM-2025-VC10 Composite	17.6	2.17	0.22	2.15	0.23	0.46	0.73	2.08	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.12	0.22	0.92	4.55	34.98	80.36	94.80	97.51	97.83	97.90	99.99	
MA-CZM-2025-VC11 Composite	1.8	2.15	0.23	1.97	0.26	1.02	0.49	1.47	5	7	0.00	0.00	0.00	0.00	0.00	1.94	2.63	2.63	2.73	2.98	3.31	3.55	3.73	4.13	4.98	8.92	36.69	82.25	95.29	98.28	98.52	98.53	99.92	
MA-CZM-2017-VC10 Composite	6.8	2.30	0.20	2.21	0.22	0.64	0.64	1.83	5	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.15	0.31	0.56	1.44	4.36	12.05	27.48	65.01	92.53	97.49	97.87	98.17	99.99	
MA-CZM-2017-VC11 Composite	9.9	1.49	0.36	1.31	0.40	1.02	0.49	1.08	6	7	0.00	0.00	0.00	0.00	0.25	0.55	1.66	2.24	2.81	4.01	5.35	6.72	7.97	9.46	16.85	50.69	83.88	95.98	98.36	98.78	98.84	98.90	99.98	
MA-CZM-2017-VC12 Composite	8.4	2.52	0.17	2.37	0.19	0.63	0.65	3.45	4	6	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.05	0.06	0.12	0.17	0.24	0.37	0.80	2.66	8.66	21.21	48.76	87.50	95.48	96.10	96.52	99.97	
MA-CZM-2025-VC12 Composite	2.1	3.07	0.12	2.72	0.15	1.13	0.46	18.69	4	6	0.00	0.00	0.00	0.00	0.00	2.14	2.14	2.14	2.14	2.35	2.42	2.58	2.68	2.80	3.01	3.56	5.85	11.97	46.09	75.82	80.83	81.31	99.97	
MA-CZM-2017-VC13 Composite	5.8	2.30	0.20	2.05	0.24	1.14	0.45	5.68	4	6	0.00	0.00	0.00	0.00	0.00	0.94	1.37	1.55	1.82	2.35	2.88	3.70	4.62	6.03	10.10	19.90	36.88	58.54	80.34	91.90	93.22	94.29	99.96	
MA-CZM-2017-VC14 Composite	3.3	2.26	0.21	2.09	0.23	0.91	0.53	5.56	3	6	0.00	0.00	0.00	0.00	0.21	0.39	0.49	0.76	0.98	1.41	2.00	2.59	3.19	4.28	5.98	11.87	31.17	66.79	87.87	93.17	94.02	94.40	99.95	
MA-CZM-2025-VC13 Composite	17.7	2.72	0.15	2.42	0.19	1.29	0.41	7.13	4	5	0.00	0.00	0.00	1.89	1.89	2.32	2.82	2.98	3.08	3.26	3.37	3.56	3.77	4.12	4.90	6.78	13.22	34.59	69.20	88.98	92.14	92.87	99.98	
MA-CZM-2025-VC14 Composite	18.8	1.41	0.38	1.23	0.43	1.16	0.45	4.34	4	5	0.00	0.00	0.00	0.00	0.00	0.10	1.24	1.96	2.49	4.35	5.93	7.93	10.39	16.36	30.54	54.06	75.26	87.12	91.94	94.91	95.57	95.64	99.97	
MA-CZM-2025-VC15 Composite	17.9	2.43	0.19	2.25	0.21	0.93	0.52	2.72	4	6	0.00	0.00	0.00	0.00	0.50	0.80	1.00	1.01	1.15	1.32	1.64	2.30	3.09	4.55	6.50	9.31	17.53	55.01	90.84	96.75	97.14	97.25	99.97	
MA-CZM-2025-VC16 Composite	16.7	2.32	0.20	2.18	0.22	0.76	0.59	2.29	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.21	0.43	0.66	0.94	1.22	1.91	5.57	15.77	34.08	58.78	90.06	97.13	97.64	97.		

COMPOSITE SUMMARY TABLE OF OVERALL STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS

VIBRACORE I. D.	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	PHI MEAN	MEAN (mm)	PHI SORTING	SORTING (mm)	% SILT *	WET Munsell Value	DRY Munsell Value
Study Area 1 Overall	96.9	1.18	0.44	1.01	0.50	1.33	0.40	1.84	4	6
Study Area 2A-1 Overall	42.7	2.67	0.16	2.18	0.22	0.83	0.56	10.11	4	5
Study Area 2C Overall	8.7	2.82	0.14	2.68	0.16	0.63	0.65	11.02	3	6
Study Area 3 Overall	104.0	2.37	0.19	2.07	0.24	1.12	0.46	5.33	4	6
Study Area 4A-1 Overall	34.9	1.75	0.30	1.68	0.31	1.08	0.47	7.81	4	6
Study Area 4A-2 Overall	21.1	2.15	0.23	1.83	0.28	1.29	0.41	3.09	4	6
Study Area 5A Overall	62.2	2.16	0.22	2.06	0.24	0.74	0.60	2.16	4	6
Study Area 5B Overall	11.2	2.45	0.18	2.17	0.22	1.10	0.47	8.08	4	6

NOTES:

* % Silt is based on the #230 sieve

Appendix L

2025 APTIM Focus Area Composite Tables



CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS OF FOCUSED STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS																																						
SAMPLE I.D.	ELEVATION (NAVD 88 FT)	DEPTH (FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	mm MEDIAN	PHI MEAN	mm MEAN	PHI SORTING	mm SORTING	% SILT *	WET Munsell Value	DRY Munsell Value	-5.0	-4.75	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	PHI SIZES					0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.0	PAN
MA-CZM-2025-VC03 S#1	-58.6	2.4	4.2	2.19	0.22	2.17	0.22	0.42	0.75	1.58	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.05	0.06	0.08	0.10	0.18	0.39	3.04	30.48	81.01	96.67	98.29	98.39	98.42	99.91			
MA-CZM-2025-VC03 S#2	-62.2	6.0	4.6	2.16	0.20	2.10	0.23	0.54	0.69	2.38	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.19	0.29	0.42	0.56	0.94	1.92	8.43	35.28	80.99	94.97	97.34	97.58	97.62	99.93			
MA-CZM-2025-VC03 S#3	-67.1	10.9	3.6	2.41	0.19	2.42	0.19	0.43	0.74	3.69	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.06	0.07	0.08	0.10	0.17	1.02	12.13	58.73	88.80	95.61	96.25	96.31	99.97				
MA-CZM-2025-VC03 S#4	-70.2	14.0	3.4	2.57	0.17	2.53	0.17	0.45	0.73	3.98	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.24	0.35	0.44	0.48	0.52	0.63	0.78	3.37	43.35	88.97	95.53	95.88	96.02	99.91				
Cut to -72.0ft NAVD																																						
MA-CZM-2025-VC03 Composite			15.8	2.31	0.20	2.28	0.21	0.50	0.71	2.74	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.13	0.19	0.25	0.31	0.46	0.84	3.66	21.86	67.82	92.72	96.81	97.13	97.19	99.93			
MA-CZM-2025-VC06 S#1	-89.5	4.0	8.6	0.46	0.73	0.19	0.88	1.57	0.34	1.54	3	5	0.00	0.00	0.00	0.00	0.00	3.68	7.61	9.62	11.60	15.80	22.00	30.61	38.87	50.95	64.18	75.98	88.70	94.68	97.35	98.25	98.44	98.46	99.96			
MA-CZM-2025-VC06 S#2	-97.5	12.0	6.6	0.74	0.60	0.58	0.67	1.26	0.42	1.81	4	6	0.00	0.00	0.00	0.00	0.00	0.00	2.18	2.58	4.35	6.17	10.85	19.35	29.66	42.60	57.86	70.76	88.66	94.98	97.23	97.99	98.14	98.19	99.92			
MA-CZM-2025-VC06 Composite			15.2	0.59	0.66	0.36	0.78	1.45	0.37	1.60	3	5	0.00	0.00	0.00	0.00	0.00	2.08	5.25	6.56	8.45	11.62	17.16	25.72	34.87	47.32	61.44	73.71	88.68	94.81	97.30	98.14	98.31	98.34	99.94			
MA-CZM-2025-VC07 S#1	-97.9	5.8	10.2	1.05	0.48	0.84	0.56	1.09	0.47	1.15	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	3.59	8.14	13.55	18.58	30.08	47.60	71.49	88.20	95.65	98.08	98.73	98.84	98.85	99.99			
MA-CZM-2025-VC07 S#2	-102.9	10.8	1.4	0.64	0.64	0.47	0.72	1.21	0.43	1.14	4	6	0.00	0.00	0.00	0.00	0.00	0.93	2.42	3.81	5.47	7.74	10.96	17.58	27.91	44.43	63.89	80.82	92.42	96.83	98.24	98.76	98.85	98.86	100.00			
MA-CZM-2025-VC07 Composite			11.6	1.01	0.50	0.80	0.57	1.11	0.46	1.13	4	6	0.00	0.00	0.00	0.00	0.00	0.11	0.29	0.46	1.65	4.09	8.48	14.04	19.71	31.81	49.57	72.62	88.71	95.79	98.10	98.73	98.84	98.85	99.99			
MA-CZM-2025-VC08 S#1	-90.1	1.0	2.1	1.62	0.33	1.62	0.33	0.76	0.59	3.27	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.10	0.33	0.99	5.16	19.39	44.65	67.77	85.15	92.43	96.05	96.69	96.73	99.93				
MA-CZM-2025-VC08 S#2	-98.1	9.0	11.6	0.87	0.55	0.72	0.61	0.98	0.51	1.24	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	1.03	3.33	7.12	11.77	18.41	31.42	56.34	81.31	92.58	97.13	98.39	98.69	98.75	98.76	99.95			
MA-CZM-2025-VC08 S#3	-105.3	16.2	0.0	1.57	0.34	1.41	0.38	0.94	0.52	1.34	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	1.67	4.26	8.42	14.90	27.37	46.50	72.08	89.92	96.69	98.43	98.62	98.66	99.96				
Cut to -103.9ft NAVD																																						
MA-CZM-2025-VC08 Composite**			13.7	0.99	0.50	0.86	0.55	1.00	0.50	1.52	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.87	2.82	6.04	10.02	15.74	27.39	50.68	75.69	88.78	95.29	97.48	98.29	98.43	98.45	99.95			
**Vibracore includes 1.1ft of unsampled material between -91.2 & -92.3. Composite results do not reflect incorporation of unsampled material.																																						
MA-CZM-2025-VC09 S#1	-68.0	4.2	6.3	2.09	0.23	2.01	0.25	0.61	0.66	2.70	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.11	0.21	0.46	0.79	1.21	1.87	4.22	12.56	42.75	81.86	95.36	97.07	97.25	97.30	100.00			
MA-CZM-2025-VC09 S#2	-73.9	10.1	6.8	2.23	0.21	2.22	0.21	0.41	0.75	1.38	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.10	0.13	0.16	0.34	2.01	25.31	78.33	96.63	98.41	98.60	98.62	99.98			
MA-CZM-2025-VC09 S#3	-79.5	15.7	4.6	2.45	0.18	2.47	0.18	0.40	0.76	3.76	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.06	0.09	0.11	0.15	0.45	6.36	54.87	88.62	95.26	96.17	96.24	99.96			
MA-CZM-2025-VC09 Composite			17.7	2.25	0.21	2.21	0.22	0.52	0.70	2.44	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.11	0.21	0.34	0.50	0.76	1.67	5.36	26.59	73.49	94.10	97.11	97.49	97.53	99.98			
MA-CZM-2025-VC10 S#1	-71.2	5.0	9.7	2.13	0.23	2.11	0.23	0.46	0.73	1.69	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.14	0.24	1.01	5.57	39.05	82.31	95.90	98.06	98.29	98.31	100.00				
MA-CZM-2025-VC10 S#2	-80.3	14.1	7.9	2.21	0.22	2.20	0.22	0.45	0.73	2.60	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.10	0.19	0.8												

CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS OF FOCUSED STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS																																				
SAMPLE I. D.	ELEVATION (NAVD 88 FT)	DEPTH (FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	mm MEDIAN	PHI MEAN	mm MEAN	PHI SORTING	mm SORTING	% SILT *	WET Munsell Value	DRY Munsell Value	-5.0	-4.75	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	PHI SIZES										PAN		
																								-0.5	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75		4.0	
MA-CZM-2017-VC09 S#1	-94.6	2.1	4.2	0.50	0.71	0.30	0.81	1.53	0.35	0.33	4	6	0.00	0.00	0.00	0.00	0.00	1.07	5.16	7.03	9.01	15.88	21.97	29.57	38.54	50.05	63.21	75.50	86.53	94.01	98.47	99.46	99.60	99.67	100.00	
MA-CZM-2017-VC09 S#2	-97.2	4.7	0.9	0.98	0.51	0.90	0.54	1.38	0.38	0.74	2.5	5	0.00	0.00	0.00	0.00	1.83	3.57	4.00	5.00	5.20	5.71	7.45	10.67	16.08	28.53	50.79	68.66	77.71	89.10	97.60	99.02	99.17	99.26	99.93	
MA-CZM-2017-VC09 S#3	-99.5	7.0	0.0	2.03	0.24	1.43	0.37	1.45	0.37	3.03	5	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	1.27	3.85	7.17	13.12	20.60	26.44	32.80	40.57	48.54	72.42	88.96	94.80	96.15	96.97	99.98	
MA-CZM-2017-VC09 S#4	-102.9	10.4	0.0	2.59	0.17	2.47	0.18	0.80	0.57	7.41	4	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.32	0.82	1.79	3.31	5.13	8.30	13.43	44.92	74.24	85.60	89.04	92.59	99.96	
Cut to -97.6ft NAVD																																				
MA-CZM-2017-VC09 Composite			5.1	0.63	0.65	0.40	0.76	1.53	0.35	0.39	4	6	0.00	0.00	0.00	0.00	0.32	1.51	4.96	6.67	8.34	14.09	19.41	26.23	34.58	46.25	61.02	74.29	84.97	93.14	98.32	99.38	99.52	99.60	99.99	
MA-CZM-2017-VC10 S#1	-74.5	2.6	5.2	2.38	0.19	2.34	0.20	0.53	0.69	2.07	5	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07	0.10	0.36	1.70	6.85	19.01	60.07	91.32	97.11	97.57	97.93	100.00		
MA-CZM-2017-VC10 S#2	-77.9	6.0	1.6	1.90	0.27	1.82	0.28	0.78	0.58	1.06	5	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.36	0.58	1.07	2.05	4.97	13.01	28.93	55.00	81.05	96.46	98.72	98.84	98.94	99.96	
MA-CZM-2017-VC10 Composite			6.8	2.30	0.20	2.21	0.22	0.64	0.64	1.83	5	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.15	0.31	0.56	1.44	4.36	12.05	27.48	65.01	92.53	97.49	97.87	98.17	99.99	
MA-CZM-2017-VC11 S#1	-66.9	0.3	0.6	2.02	0.25	1.61	0.33	1.33	0.40	2.80	3	6	0.00	0.00	0.00	0.00	0.00	0.00	2.79	4.34	4.99	6.34	7.39	8.63	9.62	10.72	15.67	32.24	48.60	79.25	93.84	96.56	96.89	97.20	99.97	
MA-CZM-2017-VC11 S#2	-67.4	0.8	0.4	1.10	0.47	-0.06	1.04	2.07	0.24	0.63	5	7	0.00	0.00	0.00	0.00	6.14	9.48	20.27	25.83	30.53	34.63	36.78	38.03	38.75	39.55	45.27	69.85	91.69	97.60	99.06	99.33	99.35	99.37	99.97	
MA-CZM-2017-VC11 S#3	-70.7	4.1	6.3	1.56	0.34	1.47	0.36	0.72	0.61	1.11	6	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	1.01	2.28	3.44	4.43	5.71	11.69	45.35	83.77	96.54	98.44	98.77	98.83	98.89	99.98	
MA-CZM-2017-VC11 S#4	-74.5	7.9	1.3	1.50	0.35	1.46	0.36	0.62	0.65	0.94	5	7	0.00	0.00	0.00	0.00	0.00	0.53	0.64	0.64	0.82	1.27	1.60	1.94	2.86	11.04	50.39	86.74	97.54	98.83	99.01	99.05	99.06	99.99		
MA-CZM-2017-VC11 S#5	-75.8	9.2	1.3	1.13	0.46	0.67	0.63	1.31	0.40	0.57	5	7	0.00	0.00	0.00	0.00	0.00	1.29	4.61	6.49	7.74	11.21	13.68	17.23	20.92	24.39	39.45	79.46	95.43	98.95	99.37	99.43	99.43	99.98		
MA-CZM-2017-VC11 Composite			9.9	1.49	0.36	1.31	0.40	1.02	0.49	1.08	6	7	0.00	0.00	0.00	0.00	0.25	0.55	1.66	2.24	2.81	4.01	5.35	6.72	7.97	9.46	16.85	50.69	83.88	95.98	98.36	98.78	98.84	98.90	99.98	
MA-CZM-2017-VC16 S#1	-79.1	0.7	1.4	1.76	0.30	1.73	0.30	0.76	0.59	1.23	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.51	0.88	1.24	1.47	1.79	5.01	8.86	33.50	65.22	86.27	96.22	98.53	98.66	98.77	99.97	
MA-CZM-2017-VC16 S#2	-80.6	2.2	1.6	2.13	0.23	2.06	0.24	0.61	0.66	1.72	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.09	0.22	0.39	1.01	3.92	16.61	41.05	76.06	94.22	97.83	98.07	98.28	99.97	
MA-CZM-2017-VC16 S#3	-82.0	3.6	1.3	1.10	0.47	0.76	0.59	1.57	0.34	1.22	4	6	0.00	0.00	0.00	0.00	5.04	6.91	7.08	7.26	7.94	9.93	11.81	14.02	17.73	27.41	45.97	65.37	82.20	92.83	97.88	98.67	98.75	98.78	99.92	
MA-CZM-2017-VC16 S#4	-86.2	7.8	0.0	2.82	0.14	2.68	0.16	0.63	0.65	14.68	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.43	0.54	0.63	0.95	1.73	3.24	5.86	23.45	64.70	80.32	83.80	85.32	99.99	
Cut to -82.7ft NAVD																																				
MA-CZM-2017-VC16 Composite			4.3	1.77	0.29	1.56	0.34	1.17	0.44	1.36	4	6	0.00	0.00	0.00	0.00	1.52	2.09	2.19	2.24	2.57	3.31	4.01	4.80	6.09	10.29	18.24	36.85	61.36	84.45	95.98	98.31	98.47	98.59	99.95	
MA-CZM-2017-VC16 VS#2			1.3	2.13	0.23	2.06	0.24	0.61	0.66	1.72	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.09	0.22	0.39	1.01	3.92	16.61	41.05	76.06	94.22	97.83	98.07	98.28	99.97	
MA-CZM-2017-VC17 S#1	-73.5	2.0	1.4	1.41	0.38	1.43	0.37	0.90	0.54	0.79	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.78	1.09	1.92	4.08	12.09	33.44	53.63	68.31	87.16	97.91	99.06	99.15	99.21	99.99
MA-CZM-2017-VC17 S#2	-74.4	2.9	0.5	-0.82	1.77	-0.54	1.45	1.67	0.31	0.67	3	6	0.00	0.00	0.00	0.00	1.37	2.99	9.62	13.63	20.44	35.02	46.25	56.54	64.67	72.69	80.66	85.11	87.73	92.75	98.29	99.21	99.28	99.33	99.95	
MA-CZM-2017-VC17 S#3	-78.6	7.1	0.0	3.06	0.12	2.96	0.13	0.56	0.68	17.25	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.18	0.32	0.42	0.67	1.02	1.49	2.13	6.10	47.35	71.02	77.36	82.75	99.94	
Cut to -74.7ft NAVD																																				
MA-CZM-2017-VC17 Composite			3.2	1.69	0.31	1.38	0.38	1.31	0.40	1.14	4	6	0.00	0.00	0.00	0.00	0.21	0.47	1.50	2.13	3.26	5.84	7.74	9.76	12.05	17.06	28.83	43.51	60.27	83.52	96.47	98.58	98.73	98.85	99.98	
MA-CZM-2017-VC18 S#1	-45.3	2.0	4.1	1.07	0.48	0.99	0.50	0.66	0.63	0.91	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.41	0.95	1.43	2.65	5.67	16.31	44.53	83.32	95.53	98.53	98.92	99.04	99.07	99.09	99.98	
MA-CZM-2017-VC18 S#2	-48.7	5.4	2.6	1.																																

COMPOSITE DATA TABLE OF FOCUSED STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS																																				
VIBRACORE I. D.	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	PHI MEAN	MEAN (mm)	PHI SORTING	SORTING (mm)	% SILT *	WET Munsell Value	DRY Munsell Value	-5.0	-4.75	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	PHI SIZES				0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.0	PAN
																						-0.5														
MA-CZM-2025-VC03 Composite	15.8	2.31	0.20	2.28	0.21	0.50	0.71	2.74	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.13	0.19	0.25	0.31	0.46	0.84	3.66	21.86	67.82	92.72	96.81	97.13	97.19	99.93			
MA-CZM-2017-VC01 Composite	12.0	2.88	0.14	2.67	0.16	0.95	0.52	10.87	3	5	0.00	0.00	0.00	0.00	0.00	0.83	1.33	1.33	1.38	1.47	1.57	1.72	1.90	2.30	3.23	4.52	8.05	21.45	59.11	83.46	86.27	89.12	99.97			
MA-CZM-2025-VC06 Composite	15.2	0.59	0.66	0.36	0.78	1.45	0.37	1.60	3	5	0.00	0.00	0.00	0.00	0.00	2.08	5.25	6.56	8.45	11.62	17.16	25.72	34.87	47.32	61.44	73.71	88.68	94.81	97.30	98.14	98.31	98.34	99.94			
MA-CZM-2025-VC07 Composite	11.6	1.01	0.50	0.80	0.57	1.11	0.46	1.13	4	6	0.00	0.00	0.00	0.00	0.00	0.11	0.29	0.46	1.65	4.09	8.48	14.04	19.71	31.81	49.57	72.62	88.71	95.79	98.10	98.73	98.84	98.85	99.99			
MA-CZM-2025-VC08 Composite**	13.7	0.99	0.50	0.86	0.55	1.00	0.50	1.52	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.87	2.82	6.04	10.02	15.74	27.39	50.68	75.69	88.78	95.29	97.48	98.29	98.43	98.45	99.95			
MA-CZM-2017-VC07 Composite	4.0	0.89	0.54	0.79	0.58	0.93	0.52	1.85	3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.15	0.26	1.36	3.81	9.17	17.94	32.74	55.08	77.90	91.48	95.81	97.25	97.82	97.93	98.08	99.92			
MA-CZM-2017-VC08 Composite	10.6	0.56	0.68	0.44	0.74	1.09	0.47	0.92	4	6	0.00	0.00	0.00	0.00	0.00	1.92	1.92	2.26	2.65	4.50	8.31	16.02	29.25	47.48	67.88	84.80	94.84	97.72	98.65	98.95	98.99	99.04	99.97			
MA-CZM-2017-VC09 Composite	5.1	0.63	0.65	0.40	0.76	1.53	0.35	0.39	4	6	0.00	0.00	0.00	0.00	0.32	1.51	4.96	6.67	8.34	14.09	19.41	26.23	34.58	46.25	61.02	74.29	84.97	93.14	98.32	99.38	99.52	99.60	99.99			
MA-CZM-2025-VC09 Composite	17.7	2.25	0.21	2.21	0.22	0.52	0.70	2.44	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.11	0.21	0.34	0.50	0.76	1.67	5.36	26.59	73.49	94.10	97.11	97.49	97.53	99.98			
MA-CZM-2025-VC10 Composite	17.6	2.17	0.22	2.15	0.23	0.46	0.73	2.08	4	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.12	0.22	0.92	4.55	34.98	80.36	94.80	97.51	97.83	97.90	99.99			
MA-CZM-2017-VC10 Composite	6.8	2.30	0.20	2.21	0.22	0.64	0.64	1.83	5	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.15	0.31	0.56	1.44	4.36	12.05	27.48	65.01	92.53	97.49	97.87	98.17	99.99			
MA-CZM-2017-VC11 Composite	9.9	1.49	0.36	1.31	0.40	1.02	0.49	1.08	6	7	0.00	0.00	0.00	0.00	0.25	0.55	1.66	2.24	2.81	4.01	5.35	6.72	7.97	9.46	16.85	50.69	83.88	95.98	98.36	98.78	98.84	98.90	99.98			
MA-CZM-2025-VC14 Composite	11.6	1.15	0.45	0.88	0.54	1.14	0.45	1.14	4	5	0.00	0.00	0.00	0.00	0.00	0.16	1.92	3.10	3.78	6.54	8.84	11.66	15.10	23.07	41.50	69.45	89.70	97.26	98.55	98.78	98.82	98.84	99.96			
MA-CZM-2025-VC16 Composite	16.7	2.32	0.20	2.18	0.22	0.76	0.59	2.29	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.21	0.43	0.66	0.94	1.22	1.91	5.57	15.77	34.08	58.78	90.06	97.13	97.64	97.70	99.99			
MA-CZM-2017-VC16 Composite	4.3	1.77	0.29	1.56	0.34	1.17	0.44	1.36	4	6	0.00	0.00	0.00	0.00	1.52	2.09	2.19	2.24	2.57	3.31	4.01	4.80	6.09	10.29	18.24	36.85	61.36	84.45	95.98	98.31	98.47	98.59	99.95			
MA-CZM-2017-VC17 Composite	3.2	1.69	0.31	1.38	0.38	1.31	0.40	1.14	4	6	0.00	0.00	0.00	0.00	0.21	0.47	1.50	2.13	3.26	5.84	7.74	9.76	12.05	17.06	28.83	43.51	60.27	83.52	96.47	98.58	98.73	98.85	99.98			
MA-CZM-2025-VC18 Composite	5.2	1.16	0.45	1.08	0.47	0.84	0.56	1.09	4	5	0.00	0.00	0.00	0.00	1.04	1.04	1.25	1.36	1.53	1.73	2.09	2.66	4.39	12.27	37.23	75.97	91.95	97.02	98.29	98.79	98.90	98.91	99.99			
MA-CZM-2017-VC18 Composite	7.3	1.15	0.45	1.07	0.48	0.75	0.59	0.96	3	6	0.00	0.00	0.00	0.00	0.12	0.12	0.21	0.36	0.66	1.55	2.18	3.18	5.64	14.41	38.62	75.74	92.48	97.96	98.66	98.88	98.96	99.01	99.97			
MA-CZM-2025-VC20 Composite	3.7	1.77	0.29	0.96	0.51	2.19	0.22	8.33	4	6	0.00	2.29	2.29	3.47	4.45	7.78	11.30	11.90	13.41	15.41	17.28	19.44	21.82	26.75	34.62	43.64	55.19	68.30	76.56	87.86	91.34	91.56	99.89			
MA-CZM-2017-VC20 Composite	3.0	1.61	0.33	1.15	0.45	1.69	0.31	2.32	4	6	0.00	0.00	0.00	0.00	3.51	6.21	7.61	8.11	8.15	8.97	10.12	12.13	15.02	21.45	34.19	47.23	59.27	85.27	91.33	96.99	97.37	97.66	99.97			
MA-CZM-2017-VC04 Composite	8.7	2.82	0.14	2.68	0.16	0.63	0.65	11.02	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.23	0.45	0.63	0.79	1.03	1.55	3.04	7.69	23.35	65.29	85.27	87.72	88.90	99.91			
Study Area 1 Focus Area	60.2	0.80	0.57	0.61	0.66	1.23	0.43	1.29	4	6	0.00	0.00	0.00	0.00	0.03	1.01	2.15	2.80	3.84	6.44	10.70	17.13	25.46	38.77	57.38	76.23	89.66	95.55	97.81	98.51	98.64	98.68	99.96			
Study Area 2A-1 Focus Area	27.8	2.54	0.17	2.44	0.18	0.74	0.60	6.26	4	5	0.00	0.00	0.00	0.00	0.00	0.36	0.58	0.59	0.63	0.71	0.78	0.89	1.00	1.25	1.87	4.03	15.90	47.81	78.22	91.05	92.44	93.71	99.95			
Study Area 2C Focus Area	8.7	2.82	0.14	2.68	0.16	0.63	0.65	11.02	3	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.23	0.45	0.63	0.79	1.03	1.55	3.04	7.69	23.35	65.29	85.27	87.72	88.90	99.91			
Study Area 3 Focus Area	35.8	1.80	0.29	1.61	0.33	1.16	0.45	1.71	4	5	0.00	0.00	0.00	0.00	0.20	0.35	1.09	1.53	1.92	3.24	4.35	5.67	7.27	11.13	20.81	38.17	57.72	76.54	94.10	97.94	98.22	98.28	99.97			
Study Area 4A-1 Focus Area	12.5	1.16	0.45	1.08	0.47	0.79	0.58	1.00	4	6	0.00	0.00	0.00	0.00	0.50	0.50	0.64	0.77	1.02	1.63	2.14	2.96	5.12	13.52	38.04	75.84	92.26	97.57	98.51	98.84	98.94	98.97	99.98			
Study Area 4A-2 Focus Area	6.7	1.70	0.31	1.05	0.48	1.97	0.26	5.65	4	6	0.00	1.27	1.27	1.92	4.03	7.08	9.65	10.20	11.05	12.53	14.08	16.17	18.78	24.38	34.43	45.25	57.02	75.90	83.17	91.94	94.04	94.29	99.93			
Study Area 5A Focus Area	52.0	2.12	0.23	2.02	0.25	0.73	0.60	1.98	4	6	0.00	0.00	0.00	0.00	0.05	0.11	0.32	0.44	0.55	0.81	1.12	1.46	1.80	2.32	4.66	14.59	40.45	78.99	94.94	97.61	97.91	98.00	99.99			

NOTES:
* % Silt is based on the #230 sieve
**Vibracore includes unsampled. Composite results do not reflect incorporation of unsampled material. See Cumulative Percents and Computed Distributions Table for more info.

COMPOSITE SUMMARY TABLE OF FOCUSED STUDY AREAS PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES, MASSACHUSETTS

VIBRACORE I. D.	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	PHI MEAN	MEAN (mm)	PHI SORTING	SORTING (mm)	% SILT *	WET Munsell Value	DRY Munsell Value
Study Area 1 Focus Area	60.2	0.80	0.57	0.61	0.66	1.23	0.43	1.29	4	6
Study Area 2A-1 Focus Area	27.8	2.54	0.17	2.44	0.18	0.74	0.60	6.26	4	5
Study Area 2C Focus Area	8.7	2.82	0.14	2.68	0.16	0.63	0.65	11.02	3	6
Study Area 3 Focus Area	35.8	1.80	0.29	1.61	0.33	1.16	0.45	1.71	4	5
Study Area 4A-1 Focus Area	12.5	1.16	0.45	1.08	0.47	0.79	0.58	1.00	4	6
Study Area 4A-2 Focus Area	6.7	1.70	0.31	1.05	0.48	1.97	0.26	5.65	4	6
Study Area 5A Focus Area	52.0	2.12	0.23	2.02	0.25	0.73	0.60	1.98	4	6

NOTES:

* % Silt is based on the #230 sieve

Appendix M

Cumulative Composite Curves





Silt and Clay



APTIM
6401 Congress Avenue, Suite 140
Boca Raton, FL 33487
ph (561) 391-8102

Sample Information

	Preliminary Characterization of Offshore Sand Resources - Composites
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Comments:

Depths and elevations based on measured values

Analysis Date:

Analyzed By:

Easting (X, ft):

Northing (Y, ft):

Horizontal Datum:

Vertical Datum:



Silt and Clay



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6401 Congress Avenue, Suite 140
Boca Raton, FL 33487
ph (561) 391-8102

Sample Information

Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
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Analysis Date:	
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Analyzed By:	
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Easting (X, ft):	
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Northing (Y, ft):	
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Horizontal Datum:	
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Vertical Datum:	
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MACZM_2025_COMPOSITES.GPJ 8/15/25



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC07 Composite			SW	#200 - 1.99 #230 - 1.85			0.89	0.79	-0.32	3.48	0.93	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Focused Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
												Northing (Y, ft):	
												Horizontal Datum:	
												Vertical Datum:	



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC08 Composite			SW	#200 - 0.97 #230 - 0.92			0.56	0.44	-0.76	4.42	1.09	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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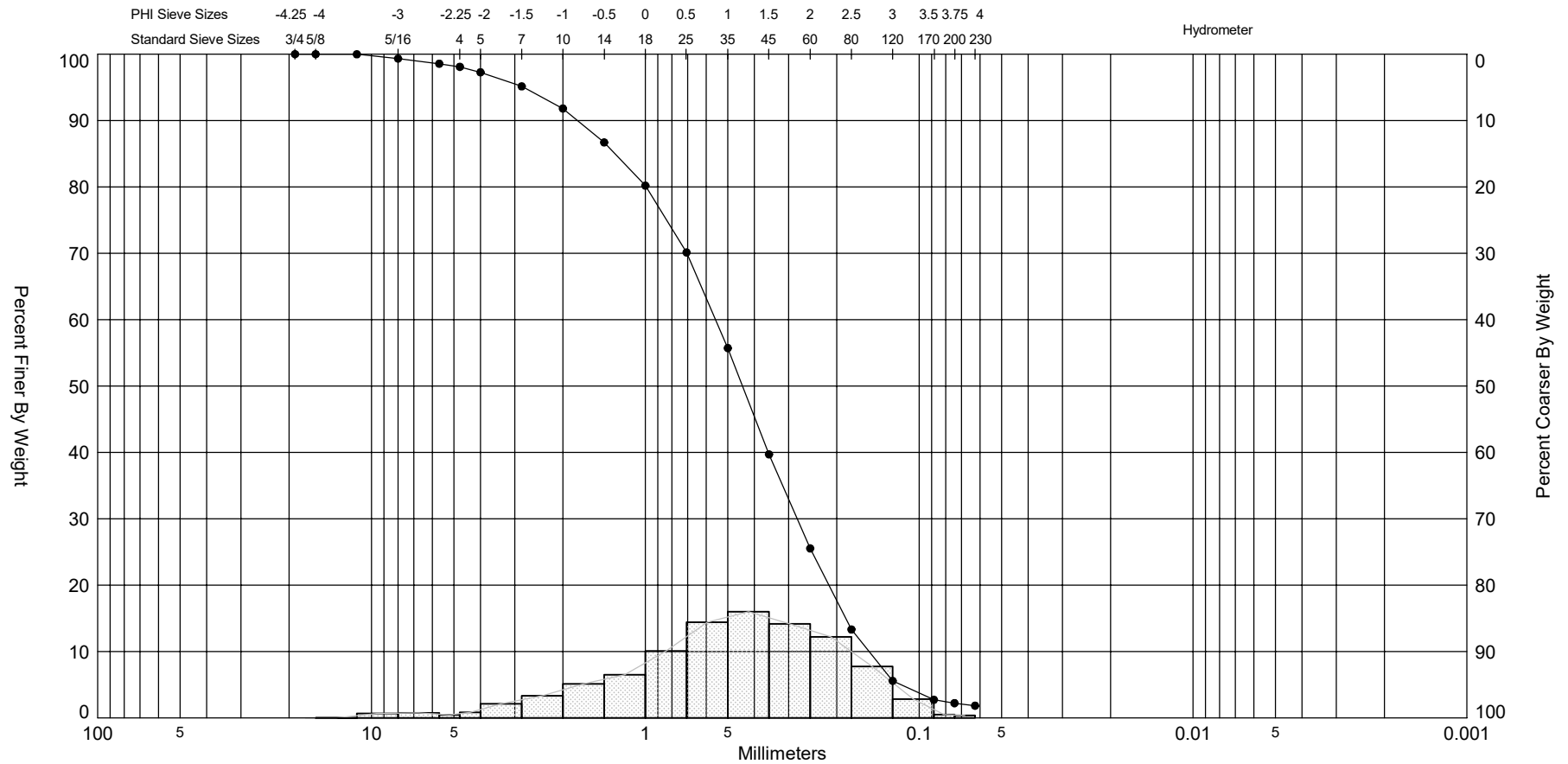


Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC09 Composite			SW	#200 - 0.46 #230 - 0.39			0.63	0.4	-0.46	2.57	1.53	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Focused Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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												Horizontal Datum:	
												Vertical Datum:	



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC06 Composite			SW	#200 - 1.63 #230 - 1.60			0.59	0.36	-0.54	2.77	1.45	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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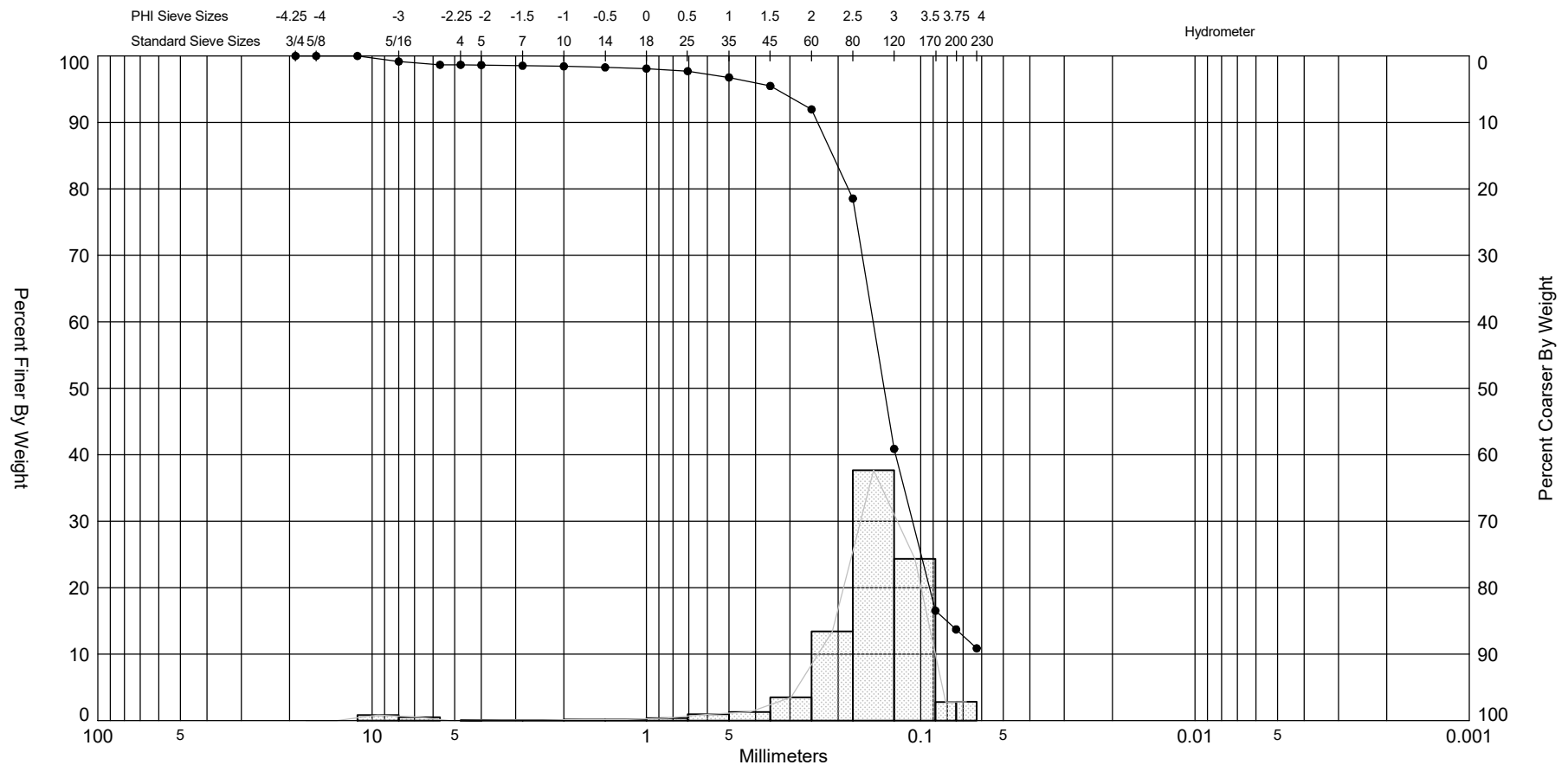
MACZM_2025_COMPOSITES.GPJ 8/15/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
Study Area 1 Overall	—●—		SW	#200 - 2.22 #230 - 1.84			1.18	1.01	-0.62	3.29	1.33	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
							APTIM					Easting (X, ft):	
							6401 Congress Avenue, Suite 140					Northing (Y, ft):	
							Boca Raton, FL 33487					Horizontal Datum:	
							ph (561) 391-8102					Vertical Datum:	

MACZM_2025_COMPOSITES.GPJ 8/15/25





Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC04 Composite			SM	#200 - 12.20 #230 - 11.02			2.82	2.68	-2.46	15.54	0.63	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
												Northing (Y, ft):	
												Horizontal Datum:	
												Vertical Datum:	



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC03 Composite			SP	#200 - 2.80 #230 - 2.74			2.31	2.28	-1.43	13.27	0.5	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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												Horizontal Datum:	
												Vertical Datum:	



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC04 Composite			SM	#200 - 17.88 #230 - 17.32			2.93	2.56	-2.47	11.22	0.97	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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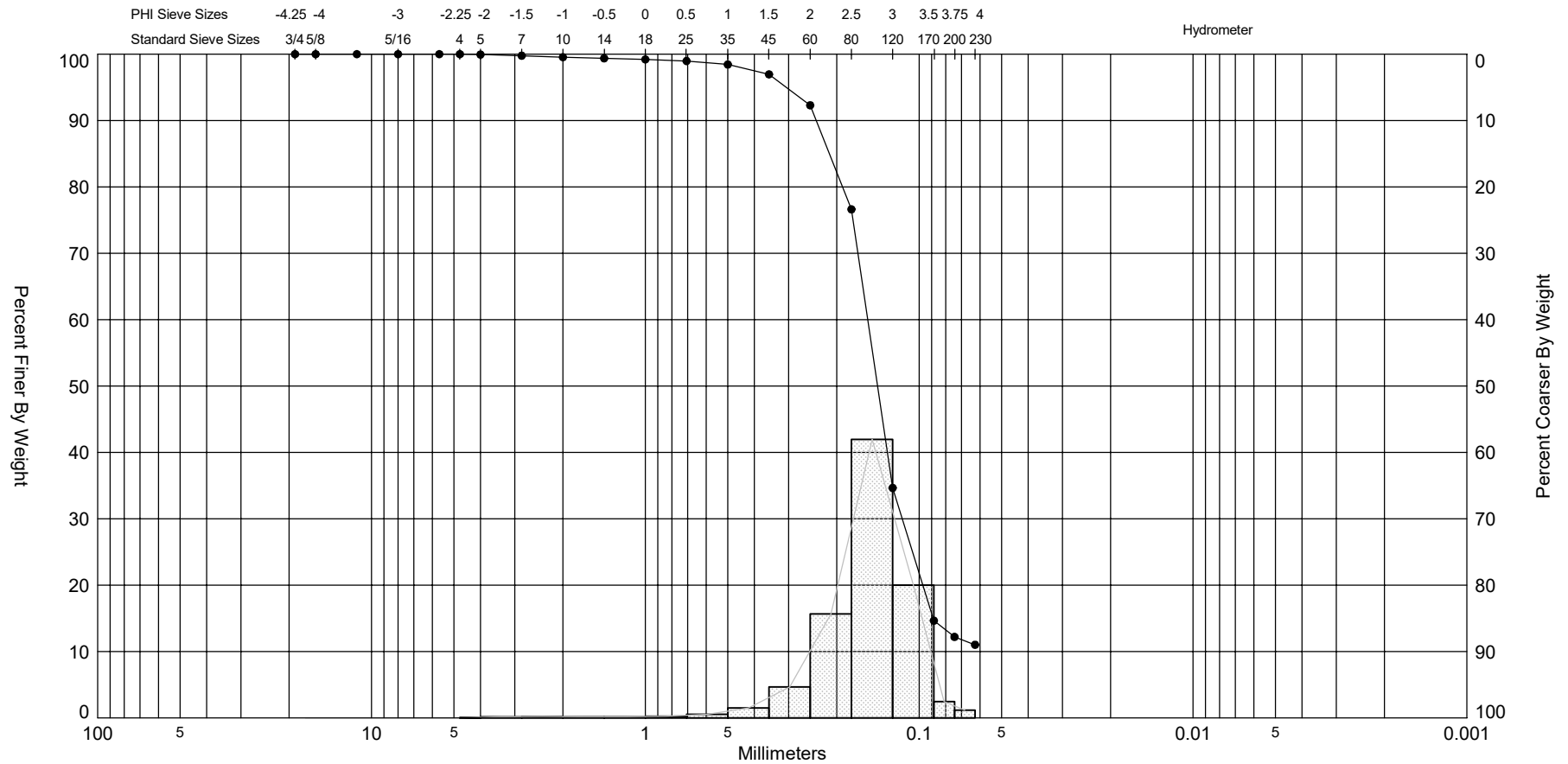


Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
Study Area 2A-1 Overall			SP-SM	#200 - 11.13 #230 - 10.11			2.67	2.48	-2.75	16.87	0.83	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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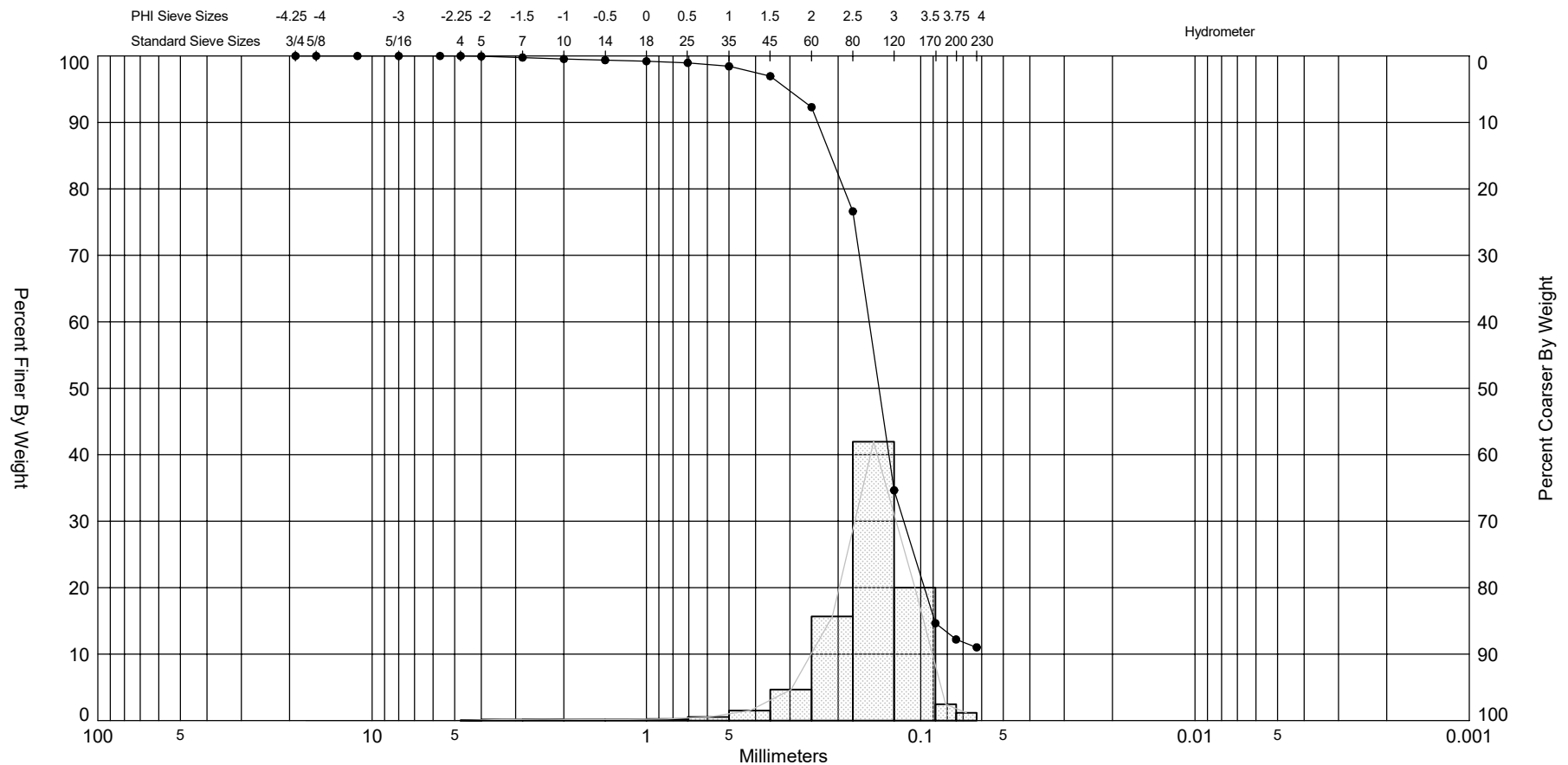


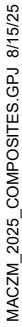
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Study Area 2A-1 Focus Area			SP-SM	#200 - 7.53 #230 - 6.26			2.54	2.44	-3.05	22.71	0.74	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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												Horizontal Datum:	
												Vertical Datum:	

MACZM_2025_COMPOSITES.GPJ 8/15/25



MACZM_2025_COMPOSITES.GPJ 8/15/25





Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC15 Composite			SP	#200 - 1.67 #230 - 1.53			2.2	2.07	-2.08	10.8	0.74	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
												Northing (Y, ft):	
												Horizontal Datum:	
												Vertical Datum:	



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC16 Composite			SW-SM	#200 - 10.55 #230 - 9.57			2.55	2.21	-2.29	11.64	1.05	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Overall Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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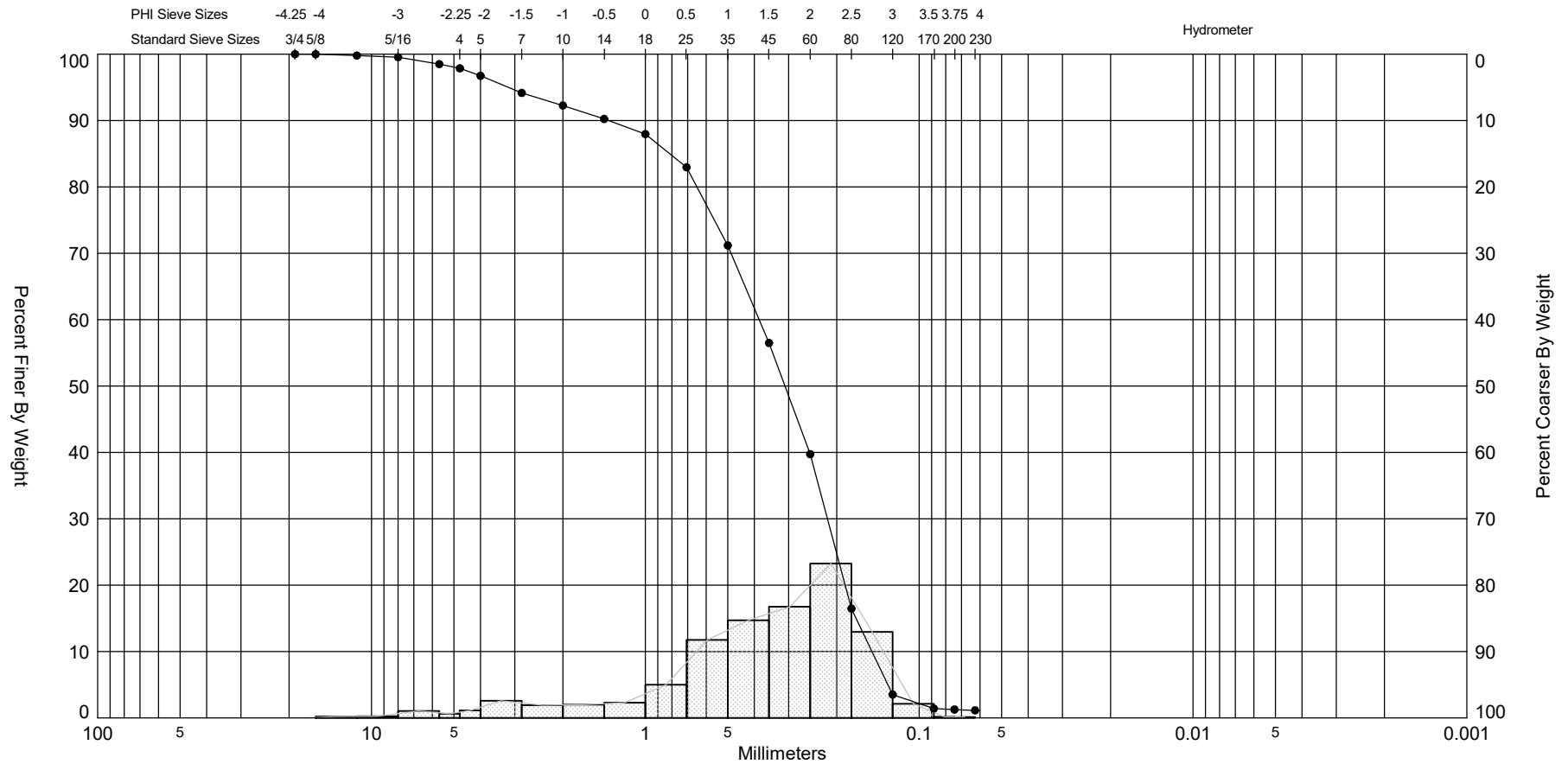


Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC16 Composite			SW	#200 - 1.48 #230 - 1.36			1.77	1.56	-2.21	9.96	1.17	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Focused Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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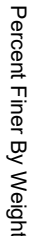
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MA-CZM-2017-VC17 Composite			SM	#200 - 16.39 #230 - 12.53			2.82	2.44	-1.99	7.93	1.15	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Overall Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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MACZM_2025_COMPOSITES.GPJ 8/15/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC17 Composite	—●—		SW	#200 - 1.26 #230 - 1.14			1.69	1.38	-1.33	4.67	1.31	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Focused Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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Silt and Clay

Comments:

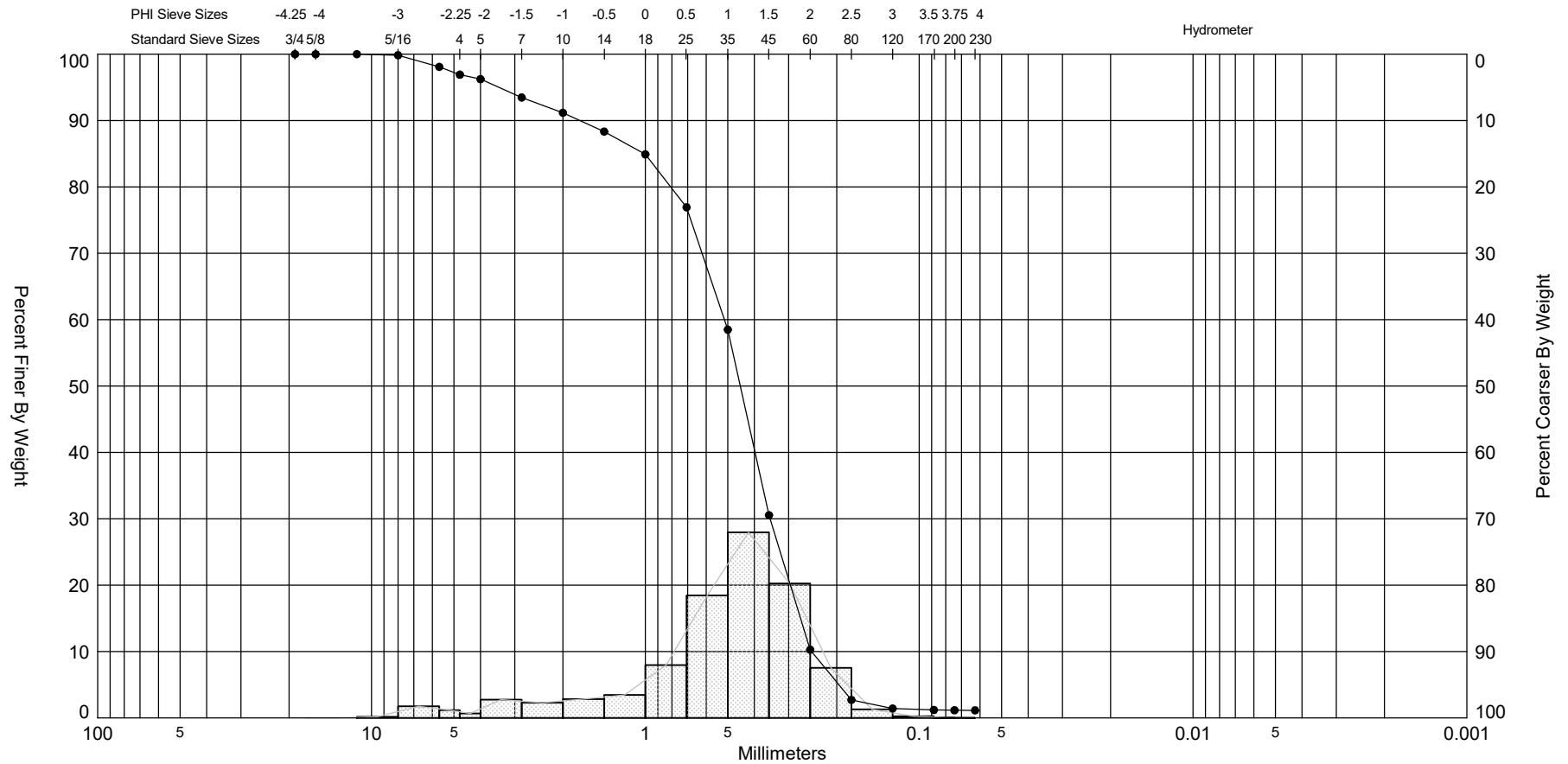
Depths and elevations based on measured values



APTIM
6401 Congress Avenue, Suite 140
Boca Raton, FL 33487
ph (561) 391-8102

Sample Information	
Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Analysis Date:	
Analyzed By:	
Easting (X, ft):	
Northing (Y, ft):	
Horizontal Datum:	
Vertical Datum:	

MACZM_2025_COMPOSITES.GPJ 8/15/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC14 Composite	—●—		SW	#200 - 1.15 #230 - 1.14			1.15	0.88	-1.36	4.84	1.14	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Focused Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
												Northing (Y, ft):	
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Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC15 Composite			SW	#200 - 2.83 #230 - 2.72			2.43	2.25	-3.36	18.47	0.93	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC16 Composite			SP	#200 - 2.35 #230 - 2.29			2.32	2.18	-1.51	8.21	0.76	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
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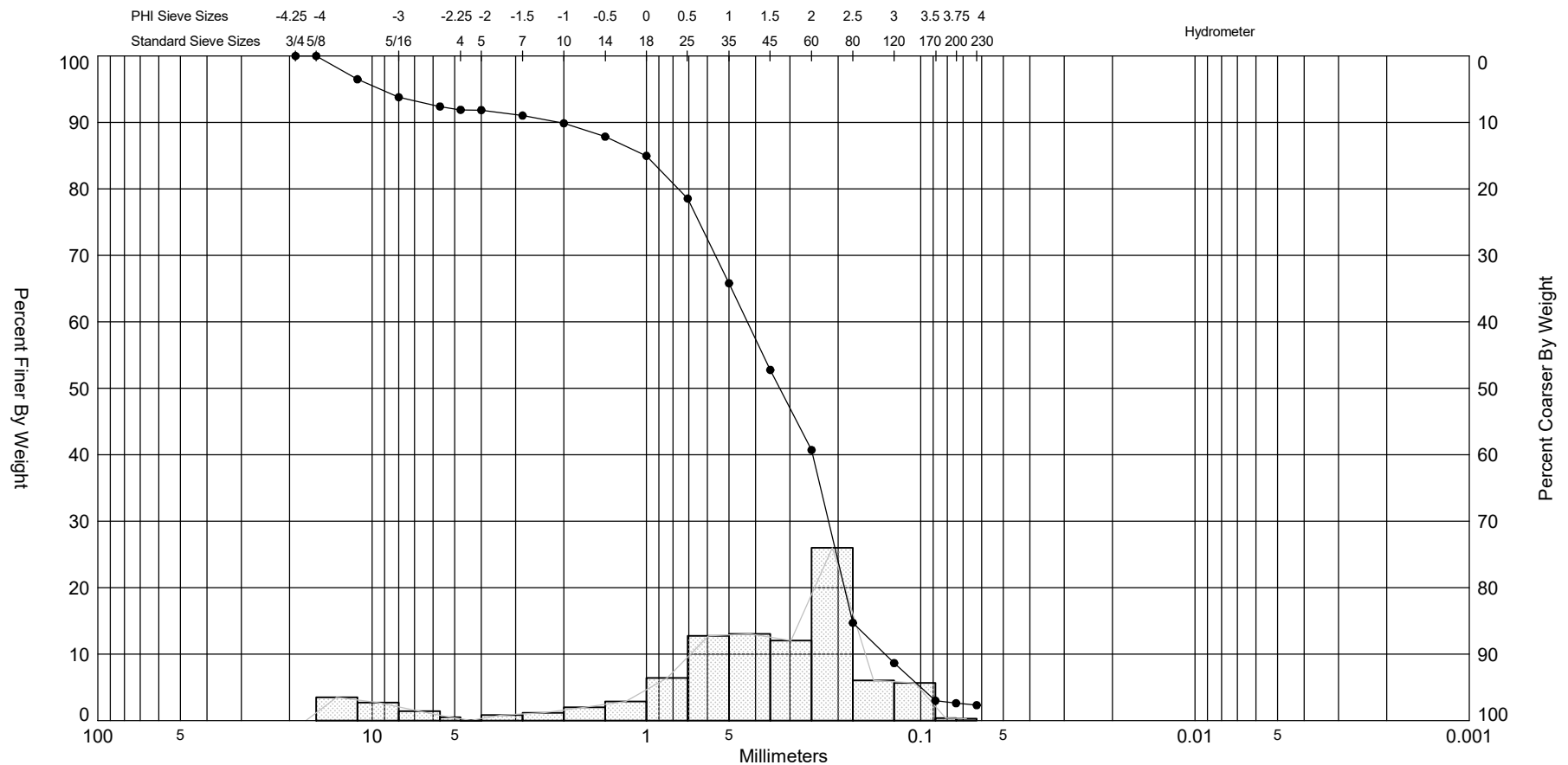
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MA-CZM-2017-VC18 Composite			SP	#200 - 1.01 #230 - 0.96			1.15	1.07	-1.36	8.38	0.75	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Focused Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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Silt and Clay

MACZM 2025 COMPOSITES.GPJ 8/15/25

MACZM_2025_COMPOSITES.GPJ 8/15/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

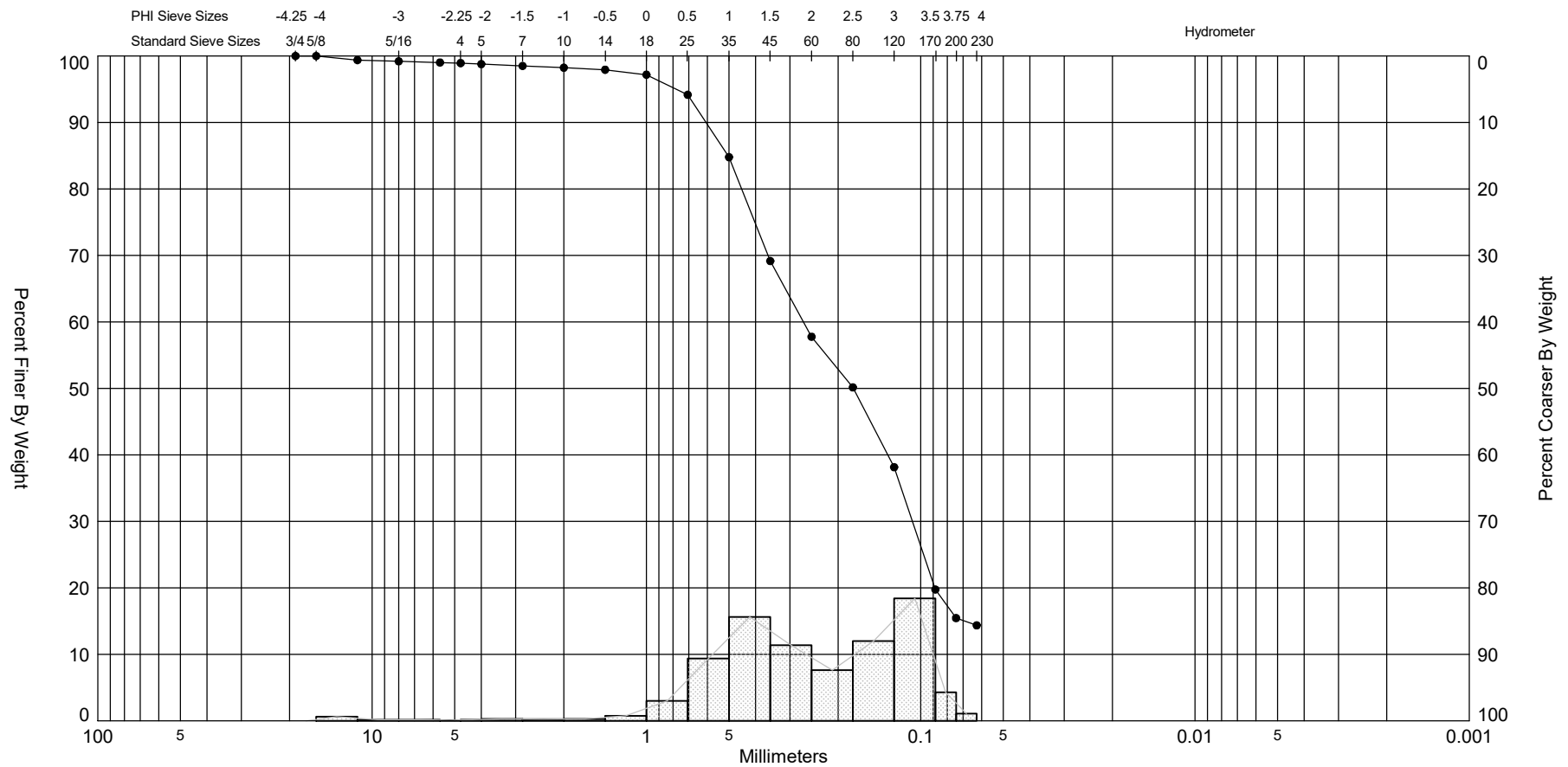
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MA-CZM-2017-VC20 Composite	—●—		SW	#200 - 2.61 #230 - 2.32			1.61	1.15	-1.46	4.77	1.69	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
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Silt and Clay

MACZM 2025 COMPOSITES.GPJ 8/15/25

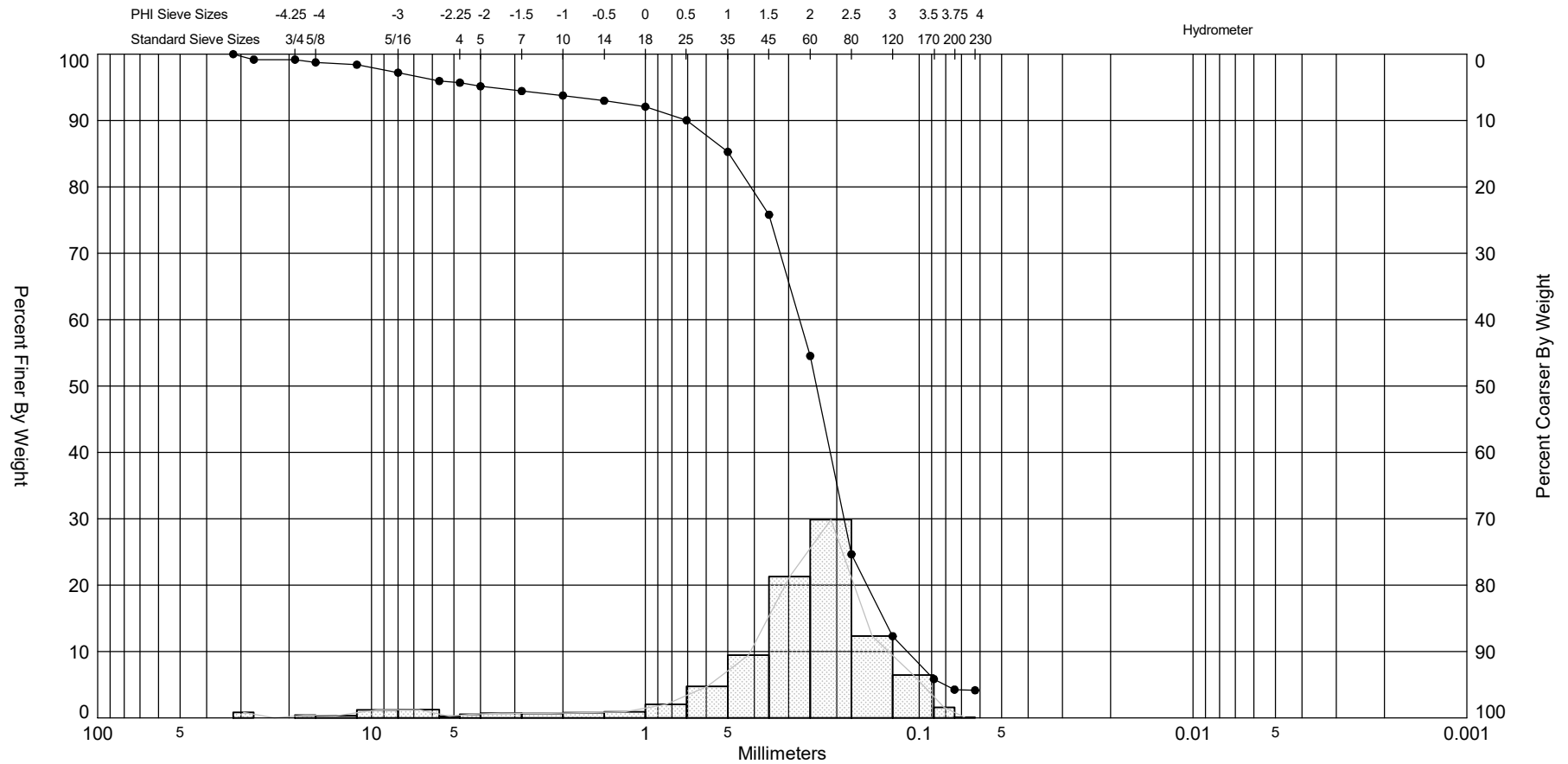
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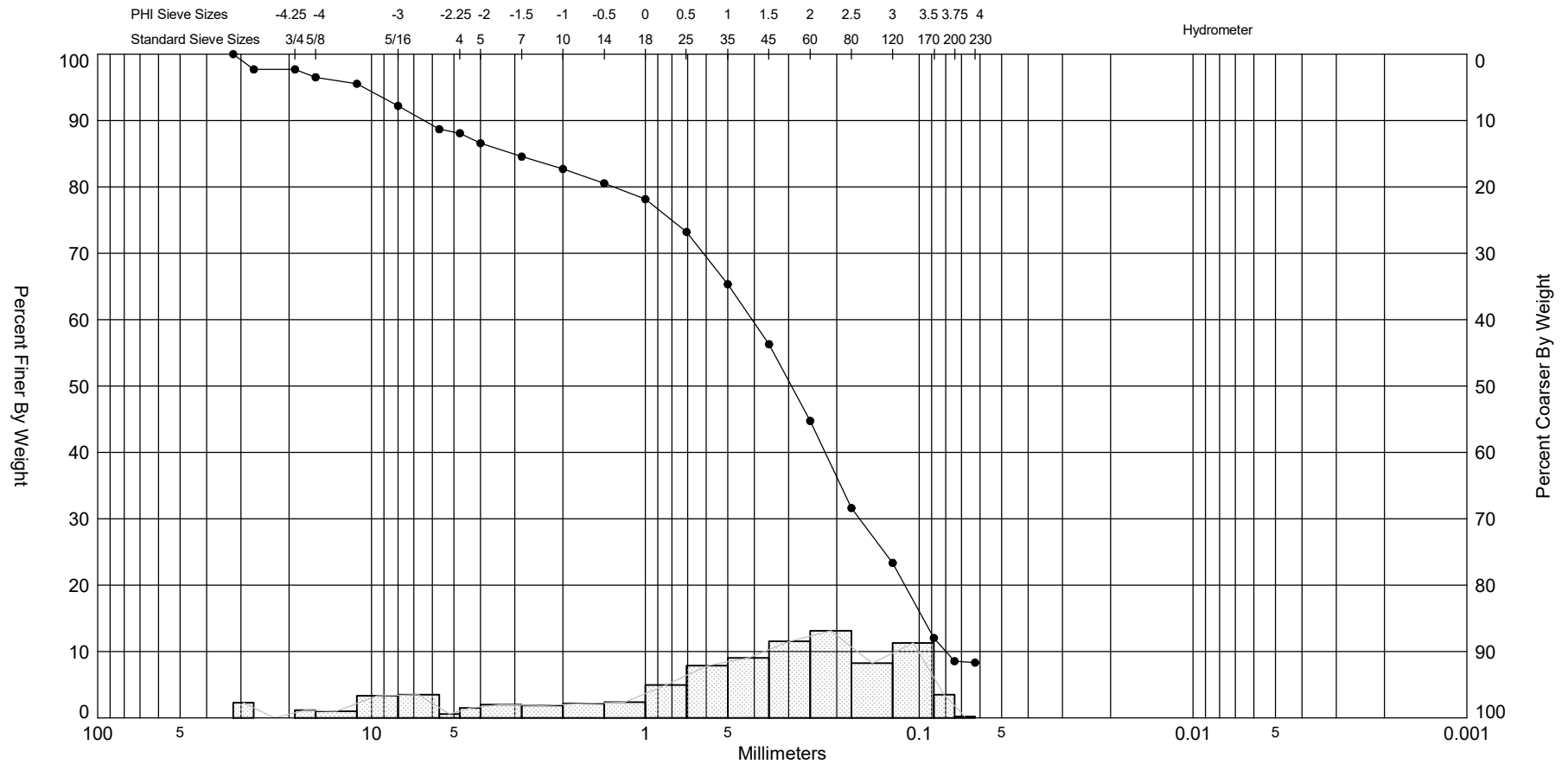


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MA-CZM-2025-VC18 Composite			SP	#200 - 1.10 #230 - 1.09			1.16	1.08	-2.36	15.08	0.84	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
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Depths and elevations based on measured values												Analyzed By:	
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MACZM_2025_COMPOSITES.GPJ 8/15/25



MACZM_2025_COMPOSITES.GPJ 8/15/25



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC20 Composite	—●—		SW-SM	#200 - 8.55 #230 - 8.33			1.77	0.96	-1.05	3.19	2.19	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments: Focused Study Area Composite												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC10 Composite			SP	#200 - 2.13 #230 - 1.83			2.3	2.21	-1.11	6.07	0.64	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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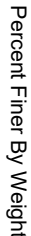
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MA-CZM-2017-VC11 Composite			SW	#200 - 1.14 #230 - 1.08			1.49	1.31	-2.27	9.41	1.02	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC12 Composite			SP	#200 - 3.87 #230 - 3.45			2.52	2.37	-1.32	7.79	0.63	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
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Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC13 Composite			SW-SM	#200 - 6.74 #230 - 5.68			2.3	2.05	-1.99	8.93	1.14	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
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												Vertical Datum:	



Silt and Clay



APTIM
6401 Congress Avenue, Suite 140
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ph (561) 391-8102

Sample Information

Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
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Analysis Date:

Analyzed By:

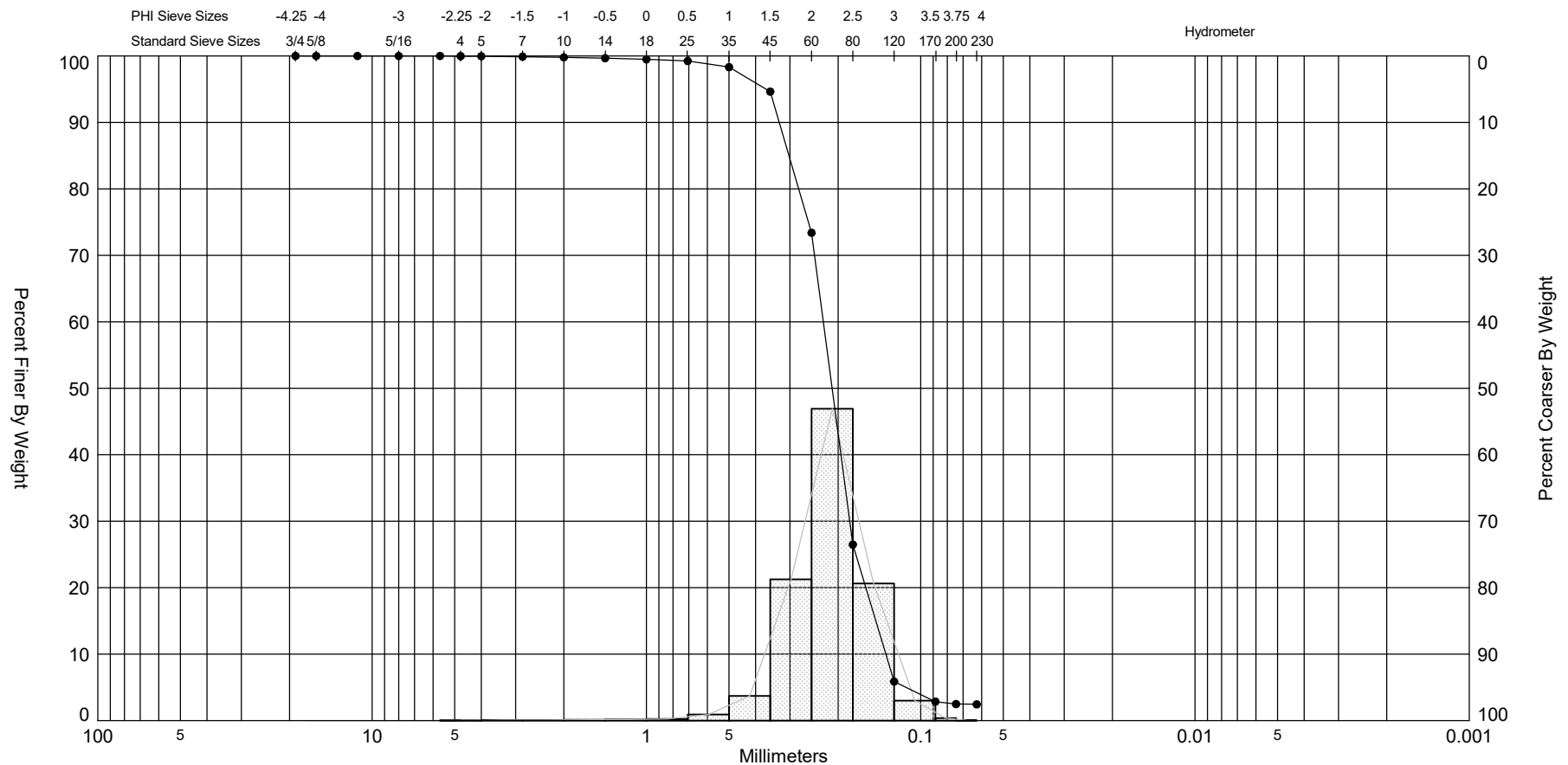
Easting (X, ft):

Northing (Y, ft):

Horizontal Datum:

Vertical Datum:

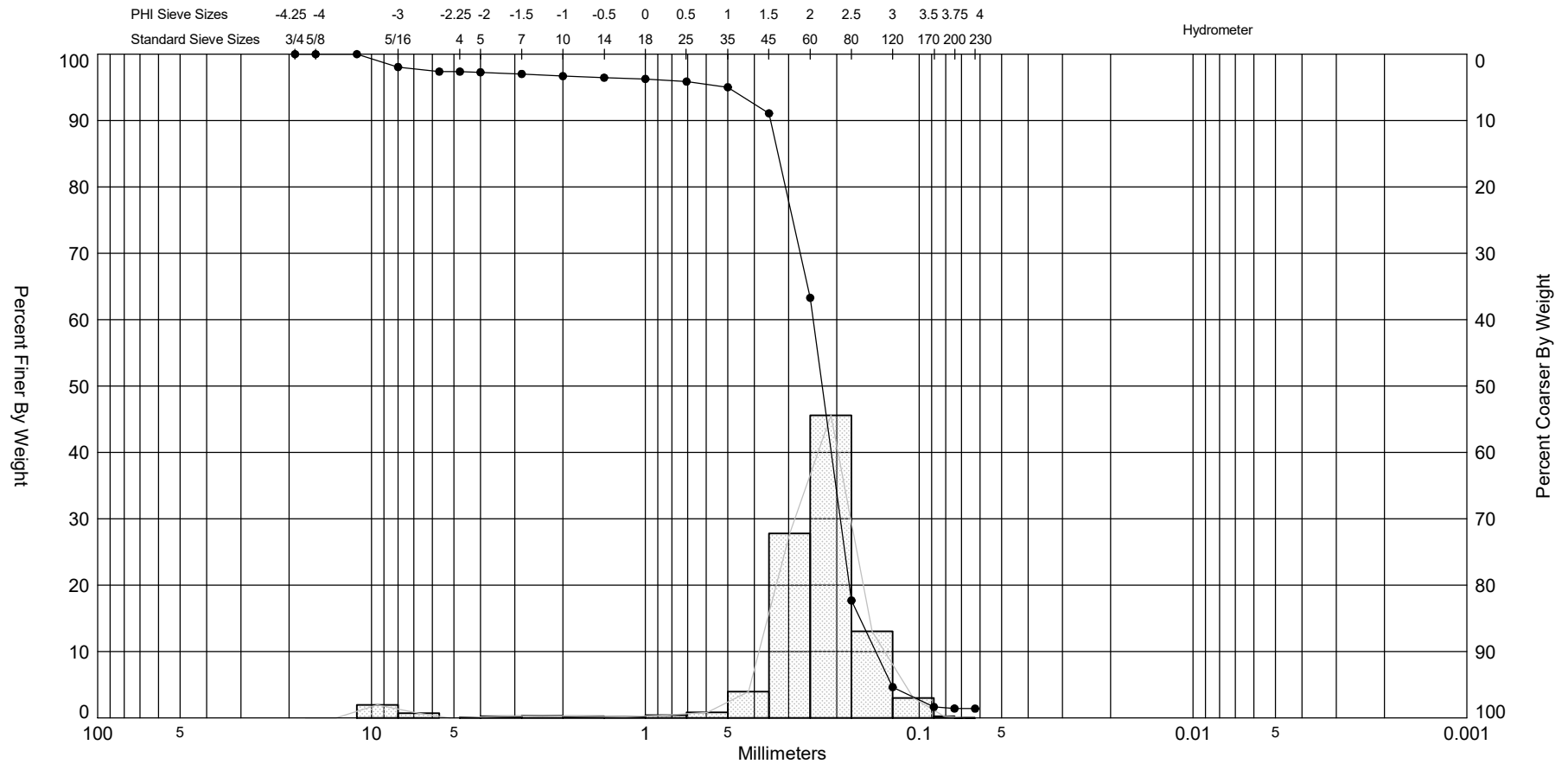
MACZM_2025_COMPOSITES.GPJ 8/15/25





Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC10 Composite			SP	#200 - 2.15 #230 - 2.08			2.17	2.15	-0.19	5.55	0.46	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
												Northing (Y, ft):	
												Horizontal Datum:	
												Vertical Datum:	

MACZM_2025_COMPOSITES.GPJ 8/19/25





Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2025-VC12 Composite			SM	#200 - 19.15 #230 - 18.67			3.07	2.73	-4.17	21.75	1.13	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
												Northing (Y, ft):	
												Horizontal Datum:	
												Vertical Datum:	



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
Study Area 5A Overall			SP	#200 - 2.29 #230 - 2.16			2.16	2.06	-2.41	15.34	0.74	Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
Comments:												Analysis Date:	
Depths and elevations based on measured values												Analyzed By:	
						APTIM 6401 Congress Avenue, Suite 140 Boca Raton, FL 33487 ph (561) 391-8102						Easting (X, ft):	
												Northing (Y, ft):	
												Horizontal Datum:	
												Vertical Datum:	



Silt and Clay



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Boca Raton, FL 33487
ph (561) 391-8102

Sample Information

Project Name:	Preliminary Characterization of Offshore Sand Resources - Composites
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Analysis Date:	
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Analyzed By:	
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Easting (X, ft):	
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Northing (Y, ft):	
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Horizontal Datum:	
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Vertical Datum:	
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