Hudson South Study Area

Geophysical Survey Interpretive Report

Final Report | Report Number 21-10 | April 2021

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Hudson South Study Area

Geophysical Survey Interpretative Report

Report (Final)

Prepared for:

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Report		Report Number	Volume
Field Report – Geophysical Operations	[*Available on Request*]	11506.1	1
Operations Report – Geophysical Operations	[*Available on Request*]	11506.2	2
Hudson South Study Area Geophysical Survey Interpretive Report		11506.3	3
Hudson North Study Area (Subarea A) Geophysical Survey Interpretive Report		11506.4	4
Hudson North Study Area (Subarea B) Geophysical Survey Interpretive Report		11506.5	5
Protected Species Observer Report	[*Available on Request*]	11506.6	6
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This report is the Geophysical Survey Interpretive Report for the Hudson South Study Area data.

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Abstract

Gardline Limited carried out a reconnaissance level Geophysical Site Investigation of the seabed and subsurface geology in the Hudson South Study Area. The goal of the investigation was to obtain high-quality data sufficient for reducing lease holder uncertainty at the time of offtake and helping to advance the design and installation requirements for offshore wind farm facilities in the study area. The survey collected multibeam echosounder, side scan sonar, and gradiometer data to assess the seabed, and sub-bottom profiler and multi-channel ultra-high resolution seismic data to assess subsurface conditions. In total, the survey consisted of 54 lines over a total of 1,928-line kilometers.

Areas of ripples and megaripples are seen at seabed across the study area. Possible bioherm features are interpreted to the western and southwestern portions of the study area. A charted UXO hazard, three wrecks and 15 known telecommunication cables are located within the study area. Numerous sonar contacts at the seabed were interpreted as debris and/or possible boulders.

The subsurface geology is complex. The uppermost formation is a layer of Holocene sediments consisting predominantly of sand and gravelly sand. These sediments are underlain by the Pleistocene Sediment Wedge that is expected to consist of predominantly clay-rich sediments but also contains complex

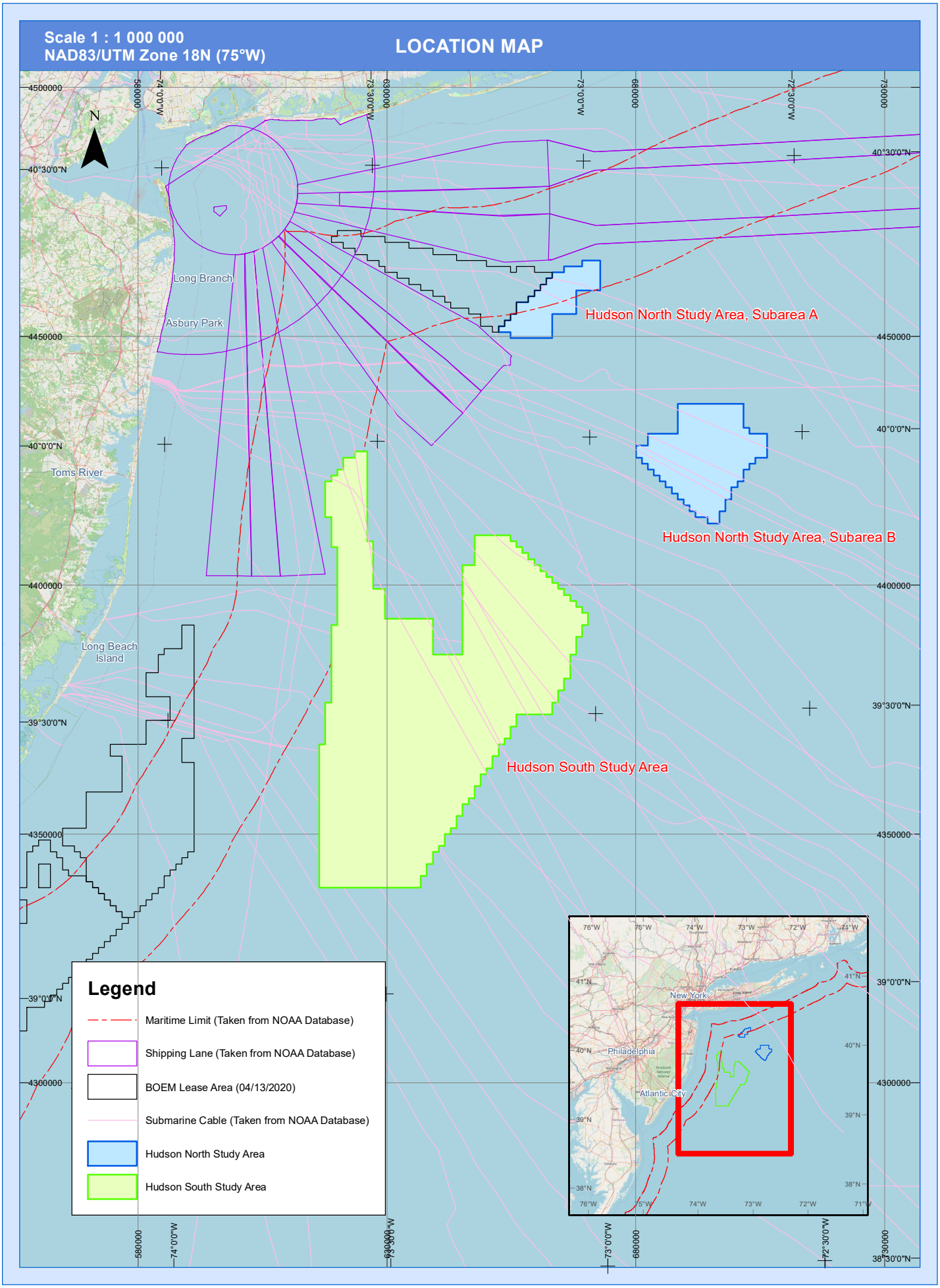
channel systems. The underlying Pleistocene Succession is characterized by numerous dipping reflectors comprising predominantly sand and clay. The Paleo Hudson Channel is interpreted beneath the Pleistocene Sediment Wedge, incising through the Pleistocene Succession into the underlying Coastal Plain Deposits. The Coastal Plain Deposits are expected to consist of nearly lithified, predominantly coarse-to-medium sand with occasional gravel, and possible organic matter.

Further geological site characterizations should include geotechnical testing, considering the presence of Pleistocene channel deposits that are expected to be highly variable in spatial extent, thickness, and grain size composition.

Key words

New York State, middle continental shelf, geophysical survey, seabed, sediment, subsurface geology.

Location Map



Job No. 11506

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The following charts have been provided to accompany this report and are provided under a separate cover. Within each series the Hudson South Study Area is covered by 57 charts.

All plan view charts are presented at a scale of 1:10,000. Profile charts provided in Series Q have been scaled on a line-by-line basis to best display the data.

A single overview chart has been provided 11506.3_Drwg_Overview at a scale of 1:40,000.

A	A_11506.3_Drwg*A_Ref_Trk	Reference point track
B	A_11506.3_Drwg*B_MBES_Trk	Multibeam echosounder track
C	A_11506.3_Drwg*C_SSS_Trk	Side scan sonar track
D	A_11506.3_Drwg*D_Grad_Trk	Gradiometer track
E	A_11506.3_Drwg*E_SBP_Trk	Sub-bottom profiler track
F	A_11506.3_Drwg*F_UHRS_Trk	Shot point track (UHRS) – (First CMP position)
G	A_11506.3_Drwg*G_Bathymetry	Bathymetry
H	A_11506.3_Drwg*H_Backscatter	Backscatter
I	A_11506.3_Drwg*I_Gradient	Seabed gradient
J	A_11506.3_Drwg*J_Features	Seabed features
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L	A_11506.3_Drwg*L_Residual	Magnetometer residual grid
M	A_11506.3_Drwg*M_Sediments1	H05 base Holocene Sediments
N	A_11506.3_Drwg*N_Sediments2	H23 base Paleo Hudson Channel
O	A_11506.3_Drwg*O_Sediments3	H50 top Coastal Plain Deposits
P	A_11506.3_Drwg*P_SubFeatures	Subsurface features
Q	A_11506.3_Drwg*Q_Profile	Interpreted geological profiles

Acronyms and Abbreviations

2DRMS	Twice Distance Root Mean Square
2D UHRS	Two-Dimensional Ultra-High Resolution Seismic
AS	Analytical Signal
ASCII	American Standard Code for Information Interchange
ASV	Assumed Seismic Velocity
AVG	Angle Varying Gain
BASE	Bathymetry Associated with Statistical Error
BOEM	Bureau of Ocean Energy Management
BSB	Below Seabed
C	Celsius(°)
Cm	Centimeter(s)
CMP	Common Mid-Point

CoG	Center of Gravity
dB	Decibel(s)
deg	Degree(s)
DTM	Digital Terrain Model
DTU	Danish Technical University
EdAnN	Editing and Analysis
EPSG	European Petroleum Survey Group
FD	Finite Difference
FK	Frequency and Wave Number Domain
GIS	Geographic Information System
(D)GNSS	(Differential) Global Navigation Satellite System
GRS80	Geodetic Reference System 1980
h	Hours (times expressed hh:mmh e.g. 12:45h)
H	Height
HPQC	High Performance Quality Control
HSE	Health, Safety and Environment
IHO	International Hydrography Organization
ITRF	International Terrestrial Reference Frame
(k)J	(Kilo)Joule(s)
(k)Hz	(Kilo)Hertz
km	Kilometer(s)
kts	Knots
m	Meter(s)
MBES	Multibeam Echosounder
MLLW	Mean Lower Low Water
MRU	Motion Reference Unit
ms	Millisecond(s)
m/s	Meters per Second
MUHRS	Multi-Channel Ultra-High Resolution Seismic
M.V.	Motor Vessel
MVP	Moving Vessel Profiler
NAD83	North American Datum 1983
NAVD88	North American Vertical Datum 1988
N,E,S,W	North, East, South, West
NMO	Normal Moveout
NOAA	National Oceanic and Atmospheric Administration
nT	Nano Tesla
NYSERDA	New York State Energy Research and Development Authority
PAMS	Passive Acoustic Monitoring System

PDF	Portable Document Format
ppm	Pixels per meter
PPP	Precise Point Position
PSO	Protective Species Observer
QA	Quality Assurance
QC	Quality Control
r	Rotation
RTK	Real Time Kinematic
Rx	Receive
S	Second(s)
SBES	Single Beam Echosounder
SEGY	Society of Exploration Geophysicists File Format
SRME	2D – Surface Related Multiple Elimination
SRWEMA	2D – Surface Related Wave Equation Multiple Attenuation
SoW	Scope of Work
SSS	Side Scan Sonar
SVP	Sound Velocity Profiler
THU	Total Horizontal Uncertainty
TPU	Total Propagated Uncertainty
TVG	Time Variant Gain
TVU	Total Vertical Uncertainty
TWT	Two-Way Travel Time
Tx	Transmit
UHRS	Ultra-High Resolution Seismic
USBL	Ultra-Short Base Line
UTC	Coordinated Universal Time
(U)TM	(Universal) Transverse Mercator
UXO	Unexploded Ordnance
UW	Underwater
V	Velocity
WEA	Wind Energy Areas
WGS84	World Geodetic System 1984
WTG	Wind Turbine Generator

Executive Summary

Gardline Limited carried out a Geophysical Site Investigation for the New York State Energy Research and Development Authority ("NYSERDA"). The aims of the survey were to investigate the Hudson South Study Area to obtain and make public high-quality seabed and shallow subsurface data sufficient for reducing lease holder uncertainty at the time of offtake and helping to advance the design and installation requirements for offshore wind farms in eventual final Wind Energy Areas (WEAs) within the study area including, but not limited to, foundations and cables.

The scope of work called for:

- An accurate bathymetric chart for the reconnaissance survey footprint.
- Information on the presence within the reconnaissance survey footprint of all seabed features of significance to the construction of wind farm facilities.
- A reconnaissance unconstrained geological model of the site.
- The current position of existing (in-service and out-of-service) cables and pipelines (subject to burial depth and limitations of proposed equipment).
- Input into the specifications and scope for a geotechnical sampling and testing program following the completion of the geophysical survey.
- A comprehensive interpretive report on the survey results obtained to assist design of the offshore foundations/structures and cable burial.

The survey consisted of 54 lines, 31 primary survey lines were oriented 0°/180° and 23 secondary survey lines (crosslines) were oriented 90°/270°. The survey was conducted as a reconnaissance level investigation with a primary line spacing of 1,800m (meters) and secondary or tieline spacing of 4,500m.

Multibeam echosounder (MBES), side scan sonar (SSS), and gradiometer data were collected to provide information on the seabed conditions. Sub-bottom profiler (SBP) and multi-channel ultra-high resolution seismic (MUHRS) data were collected to aid the interpretation of the subsurface conditions. Most of the data were generally of average to good quality; however, data quality was occasionally compromised due to environmental conditions at the time of data collection.

Ripples and megaripples were found locally at the seabed across the study area, implying the presence of mobile sediments. Possible bioherm features are interpreted to the western and southwestern portions of the study area. A charted UXO hazard is located within the study area, but was not identified in the data collected. Three wrecks are located within the study area, none of which were confidently interpreted.

Three items of debris and a gradiometer anomaly have tentatively been linked to the wreck of a sunken barge named the Huron. Within the study area, 15 known telecommunication cables are expected, three of which were identified with gradiometer data alone. Numerous sonar contacts were identified at the seabed, 75 of which are interpreted as debris. The remainder are interpreted as point contacts on the SSS data and thought to represent possible boulders (Chart Series J).

The subsurface conditions are complex (Chart Series Q). A layer of Holocene sand and gravelly sand (Chart Series M) overlies the Pleistocene Sediment Wedge. Channel systems are present within the Pleistocene Sediment Wedge (Chart Series P). These sediments are likely to be highly variable in terms of grain size and spatial distribution. Raised amplitudes at the basal horizons are thought to represent coarse sediment lag deposits, but the presence of shallow gas cannot be ruled out. The Pleistocene Sediment Wedge is expected to consist of predominantly clay-rich sediments. The “R” Horizon separates the Pleistocene Sediment Wedge from the underlying Pleistocene Succession. The Pleistocene Succession is characterized by numerous dipping reflectors comprising predominantly sand and clay. Underlying this the Coastal Plain Deposits (Chart Series O) are expected to consist of nearly lithified, predominantly coarse-to-medium sand with occasional gravel, and possible organic matter. The Paleo Hudson Channel crosses the study area from northwest to southeast underlying the “R” Horizon. The base of the Paleo Hudson Channel incises through the Pleistocene Succession into the upper surface of the Coastal Plain Deposits.

The reconnaissance survey grid provided sufficient seabed and subsurface coverage to support site characterization. Interpretations of the geophysical data were completed along the grid with extrapolation of channels and horizons between the existing data corridors where appropriate, with a reduced level of confidence of interpolated, mapped features with distance away from the actual survey data. The existing data coverage can be used to aid in designing future geophysical surveys with the intent of developing a tighter data spacing in the future to support more detailed engineering and permitting needs.

Geotechnical testing is recommended to better delineate and characterize the subsurface geological conditions for wind turbine generator (WTG) foundations analysis. The Upper Pleistocene channeled units are interpreted to be highly variable, so extensive sampling (borings) and testing (CPTs) are prudent, both laterally and vertically.

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