RESULTS OF GEOARCHAEOLOGICAL SOIL BORINGS
Report #12

NEW JERSEY-NEW YORK EXPANSION PROJECT
STATEN ISLAND, NEW YORK

FERC Docket No. CP11-56-000
New York SHPO No. 09PR05949

Prepared for

SPECTRA ENERGY TRANSMISSION, LLC
150 WARREN STREET
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Prepared by

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October 24, 2012

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ATTACHMENTS

INTRODUCTION

Spectra Energy Corp (Spectra Energy) is proposing to expand its pipeline systems in the New Jersey-New York region to meet the immediate and future demand for natural gas in the largest United States metropolitan area. The New Jersey-New York Expansion Project (NJ-NY Project) will create a new transportation path for 800,000 decatherms per day (Dth/d) of natural gas from multiple receipt points on the Spectra Energy systems to new delivery points in New Jersey and New York. The Project consists of approximately 19.8 miles of multi-diameter pipeline, associated pipeline support facilities, and six new metering and regulating (M&R) stations. The proposed facilities are located in New Jersey, New York, and Connecticut (Figure 1).

Previous Investigations

The Public Archaeology Laboratory, Inc. (PAL) completed Phase IA archaeological overview surveys for the New York portion of the Project in August and December 2010 (Elquist et al. 2010a and b). Since that time additional Phase IA archaeological assessments have been conducted for pipeline route variations in the New York portion of the project (Elquist and Cherau 2011a, b, and c). The Phase IA archaeological assessment recommendations for the Project alignment and route variations include a program of geoarchaeological soil borings in sensitive areas where modern fill deposits associated with heavy industrialization and urbanization land uses have occurred. A total of 52 soil borings has been proposed to date for the archaeologically sensitive areas of the Staten Island portion of the Project pipeline route where subsurface soil conditions are unknown and/or considered too deep for conventional hand testing. Of these, two soil borings were completed in December 2010 (Cherau 2011a); 29 soil borings were completed from July to November 2011 (Cherau 2011b); 10 soil borings were completed along Route Variation 87 on property owned by 380 Development in February-March 2012 (Cherau 2012a); and nine soil borings were completed in April 2012 for Route Variation 76 and a portion of Route Variation 58 (Cherau 2012b). The final two soil borings for the New York portion of the Project were completed in September 2012 on NYC Economic Development Corporation (NYC EDC) Property – Arlington Yard on Staten Island, and are included in the current report (Figure 2).

The ongoing goal of the soil borings program is to determine the presence and depth of ground disturbances, fill and/or marsh deposits, and of any sediments or buried landscapes containing potentially significant archaeological resources below these deposits. The Project area is dominated by industrial and commercial facilities, but the possibility remains that intact archaeological resources may be preserved within and below historically deposited fill. Additionally, large areas along the Project area of potential effect (APE) consist of former or current tidal marsh that may have been previously available for human occupation prior to marine transgression.

The two new soil borings included in the current report were conducted along a section of the proposed pipeline route on NYC EDC) Property–Arlington Yard, off of Western Avenue just south of the raised Conrail Railroad tracks from Station Number (STA) 248+00 to STA 252+75 (Figure 3). This general area was previously assigned high archaeological sensitivity for both pre-contact and post-contact period resources (Elquist et al. 2010b: 78-82). The two geoarchaeological borings were spaced at a 62-meter (203 feet [ft]) interval, which is consistent with the New York project wide sampling interval of 61-m (200 ft). Both borings extended to a depth of 610 centimeters (20 ft), and encountered complex stratigraphic sequences of fill, possible pre-contact period surfaces, and underlying natural unconsolidated geological deposits. Four radiocarbon dates were also collected for locations having strong potential for recovering information on pre-contact period settlement and paleoenvironments as well as post-contact period settlement. The results of the geoarchaeological investigations for this portion of the Project were prepared by Geoarcheology Research Associates (GRA), under subcontract to PAL, the cultural resources consultants to Spectra Energy. The GRA report is provided as Attachment B.

This report also includes revised recommendations for previously investigated areas along Western Avenue and Richmond Terrace on Staten Island, included in the Soil Borings Review Report #3 for Staten Island (Cherau 2011b) (see Figure 2). One of these areas is located on NYSDEC Property along the pipeline route from STA 257+80 to STA 248+00, north of the Texas Eastern Transmission M&R 058 station and connecting utilities (Figures 4 and 5). The other area is located on NYCDOT Property in Richmond Terrace along the pipeline route from STA 280+00 to STA 291+00 (Figure 6).

PROJECT AREA OF POTENTIAL EFFECT (APE)

The Spectra Energy NJ-NY Project requires approvals and permits from federal, state, and local entities. One of The APE is the "geographic area or areas within which an undertaking may directly or indirectly cause changes in the character of or use of historical properties, if any such properties exist" (36 CFR 800.16[d]). The APE is defined based upon the *potential* for effect, which may differ for aboveground resources (historic structures and landscapes) and subsurface resources (archaeological sites). The APE includes all areas where ground disturbances are proposed, where land use (i.e., traffic patterns, drainages, etc.) may change, or any locations from which the undertaking may be visible.

For archaeological resources associated with the pipeline component of the Project, the APE consists of any areas of ground disturbance for the proposed pipeline trench and associated temporary workspace. In general, the horizontal APE for the proposed pipeline trench is anticipated to be a maximum of 4.5 m (15 ft) at the top and 3 m (10 ft) wide at the bottom; the vertical APE for the proposed pipeline trench is 2.2-2.4 m (7-8 ft) below surface, except in areas where existing utilities are present or the pipeline needs to be deeper for road and railroad crossings or other landowner concerns. The proposed Phase IB testing methodology presented in this report encompasses the horizontal and vertical APE for the pipeline trench.

SCOPE AND AUTHORITY

The Spectra Energy NJ-NY Project requires approvals and permits from federal, state, and local entities. One of the primary Project approval requirements at the federal level is a Certificate of Public Convenience and Necessity under Section 7(c) of the Natural Gas Act issued by the Federal Energy Regulatory Commission (FERC). Consequently, the Project is being reviewed under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. Prior to authorizing an undertaking (e.g., the issuance of a FERC approval or Certificate), Section 106 of the NHPA requires federal agencies, including the FERC, to take into account the effect of that undertaking on cultural resources listed or eligible for listing in the National Register of Historic Places (36 CFR §60). The agency must also afford the Advisory Council on Historic Preservation (ACHP) the opportunity to comment on the undertaking. The Section 106 process is coordinated at the state level by the State Historic Preservation Officer (SHPO), represented in New York by the New York State Office of Parks, Recreation, and Historic Preservation. The issuance of a federal agency certificate or approval depends, in part, on obtaining comments from the SHPO. In accordance with Section 106, FERC, as the lead federal agency for the Project, must consult with the New York SHPO regarding the effects of the Project on historic properties.

The primary goals of cultural resource investigations conducted as part of the Section 106 review process are to:

- locate, document, and evaluate buildings, structures, objects, landscapes, and archaeological sites that are listed, or eligible for listing, in the National Register of Historic Places (National Register);
- assess potential impacts of the Project on those resources; and
- provide recommendations for subsequent treatment, if necessary, to assist with compliance with Section 106.

In addition to Section 106, the additional cultural resources investigation will be conducted for this portion of the Project in accordance with FERC's Office of Energy Project's *Guidelines for Reporting on Cultural Resources Investigations* (2002); the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS, 48 Fed. Reg. 44716-42, Sept. 29, 1983); and the standards and guidelines set forth in the *Standards for Cultural Resource Investigations and the Curation of Archaeological Collections in New York State* (NYAC 1994) and *Landmarks Preservation Commission Guidelines for Archaeological Work in New York City* (NYC LPC 2002). Because of the sensitive nature of some of the material contained in this proposal, the covers and any applicable pages are labeled "CONTAINS PRIVILEGED INFORMATION – DO NOT RELEASE" in accordance with FERC guidelines and 36 CFR 800.11(c)(1).

RESULTS AND RECOMMENDATIONS

NYC EDC Property – Arlington Yard

Two geoarchaeological soil borings (RCH-3-ARC-1 and RCH-3-ARC-2) were excavated on the NYC EDC Property-Arlington Yard in Staten Island, a borough of New York City. This section of pipeline route was previously assigned high sensitivity for pre-contact and post-contact period resources as part of Route Variation 58 (Elquist and Cherau 2011c). The two soil borings were placed along a segment of the route variation that extends from STA 248+00 to STA 252+75 (note, the northern portion of Route Variation 58 on Port Authority Property from STA 252+75 to STA 255+50 was subjected to separate soil borings, the results of which are presented in Cherau 2011b). A bore pit measuring approximately 6 by 18 m (20 by 60 ft) and extending vertically to 369 cmbs (12.1 ft) will be required west of STA 251+00 to STA 251+29.7 in order to construct the pipeline below the railroad tracks. The presence of previously recorded pre-contact archaeological sites and artifact finds along Western Avenue indicated that Route Variation 58 had a high sensitivity for pre-contact cultural resources in intact sediments that may lie below expected deposits of marsh sediments, fill and/or disturbed soils in this area. Expected pre-contact resources could consist of campsite or village components dating to the Archaic through contact periods. The portion of the route south of the railroad crossing was considered to have moderate sensitivity for eighteenth- and nineteenth-century resources related to a documented Revolutionary War period skirmish and burials, and/or the Reverend Kinney property, and low sensitivity for later historic resources (Elquist and Cherau 2011c).

This section of pipeline route is located to the south of the elevated Conrail railroad and east of Western Avenue on a private road leading to Arlington Yard. The wetlands of Mariners Marsh are 457 meters (m) (1500 feet [ft]) east of Western Avenue. The pipeline route traverses an area previously characterized by

GRA as consisting of relatively deep and recent fills, resting on Pleistocene till and Pleistocene-to-Holocene shoreline deposits. A radiocarbon date of 16,940±30 years before present (B.P.) (Beta-309857) obtained from shore facies to the north of the current sampling location is consistent with the regional chrono-stratigraphy associated with the emergence of the Staten Island shoreline during the late Wisconsinan (GRA 2011).

RCH-3-ARC-1 and RCH-3-ARC-2 were placed on the artificial fill embankment just south of the Conrail railroad tracks and north of Bridge Creek. Both borings contained a similar fill sequence over marsh deposits. The fill soils in RCH-3-ARC-1 extended from just under pavement to 394.7 centimeters below surface (cmbs) (12.9 ft). The dark brown (10YR 3/3) loamy sand to dark olive brown (2.5Y 3/3) to black (10YR 2/1) sandy silt loam fill contained milled wood board, wood fragments, glass bottle fragments, ceramic sherds, slag, and rubber. The fill soils in RCH-3-ARC-2 extended from ground surface to 600.5 cmbs (19.7 ft). The similar colored and textured fill deposits contained flaky burned material; household debris including ceramic dish/cup fragments and bottle glass; construction debris (wood fragments, carbon rods, and window glass) as well as shell fragments and leather scraps. The diagnostic household items include a white milk glass cosmetic jar (1911+); a ceramic sherd (Hotel Astor, 1905-1907); a Chinese porcelain ceramic sherd (mid-eighteenth-century to present); and a window glass fragment (mid-nineteenth-century to present). The fill deposit containing these materials extended from 61 cmbs (2 ft) to between 399.3-576 cmbs (13.1-18.9 ft). This 515 cm (16.8 ft) thick fill deposit did not contain any discrete lens or strata (GRA 2012: 19, 34-39).

In both RCH-3-ARC-1 and RCH-3-ARC-2 the fill caps a sequence of peat. In RCH-3-ARC-2 the peat begins at 605 cmbs (19.8 ft) and continues to the limit of the soil boring at approximately 610 cmbs (20 ft). In RCH-3-ARC-1 the boring extends through the peat layer into underlying sands. The peat in RCH-3-ARC-1 is black (10YR 2/1) to very dark brown (10YR 2/2, matted and fibrous, and extends from 399-481.6 cmbs (13.1-15.8 ft). A sample from 472.4 (15.5 ft) yielded a radiocarbon date of 3020±30 B.P. (Beta-330954) for the peat and a date of 2600±30 B.P. (Beta-331344) for the organic sediment. The peat transitioned to a complex of sandy silt and silty sand to the bottom of the core at 610 cmbs (20 ft). The organic sediment at 512.1 cmbs (16.8 ft) yielded a radiocarbon date of 3360±30 B.P. (Beta-330955). The base of the stratum at 576 cmbs (18.9 ft) in a dark greenish grey (GLEY 4/10GY) produced a radiocarbon date of 8650±40 B.P. (Beta-330956). The sequence of radiocarbon dates indicates an intact sequence, with the slight disparity between the peat and sediment dates at 472 cmbs (15.5 ft) most likely resulting from root activity in the peat mat. The oldest material at 576 cmbs (18.9 ft) is well-sorted sand dating to the early Holocene Period (GRA 2012:20, 34-39).

The soil borings did not identify any sensitive pre-contact period strata within the vertical pipeline trench of 244-369 cmbs (8-12.1 ft), including the proposed bore pit for the Conrail Railroad crossing. While the fill deposits contained some household artifacts that can be provenienced to locations in Manhattan, it is more likely that the materials were disposed of as refuse by local Staten Island households. Since the materials are in a disturbed fill context used to construct the twentieth-century railroad embankment, they are not considered to have significant historical research value. No further archaeological investigations are recommended for the proposed pipeline trench from STA 248+00 to STA 252+75 on the NYC EDC Property-Arlington Yard.

Western Avenue – NYSDEC Property, Bridge Creek and Marsh Crossing

Four geoarchaeological soil borings (RCH-2-ARC-1, RCH-2-ARC-2, RCH-2-AC-3, and RCH-2-ARC-4) were completed on NYSDEC property along the pipeline route from STA 257+80 (reroute STA

241+48.8) to STA 248+00. The results of the borings and recommendations for Phase IB archaeological survey are presented in Soil Borings Report #3 (Cherau 2011b). Phase IB deep testing was recommended for the archaeologically sensitive strata identified through the soil boring analysis at this location. The sensitive strata begin at approximately 100 cmbs (3.3 ft) and extend below the vertical pipeline APE at approximately 214 cmbs (7 ft). The sensitive strata include A-horizon organic sediments as well as B and C subsoil horizons with mixed peats and silty-clay organic mats. Phase IB subsurface testing was recommended in the form of 11 machine-assisted trenches at 15 m (49 ft) intervals a distance of approximately 215 m (705 ft) (see Figures 4 and 5). The NY SHPO and the NYC LPC concurred with this recommendation in a letter dated January 5, 2012 and dated January 12, 2012, respectively (see Attachment A).

This section of pipeline route is located north of the National Register eligible Old Place Neck archaeological site (OPRHP No. A08501.002971), identified by PAL during testing for the nearby Project M&R 058 station in proposed pipeline route and work spaces (Elquist and Cherau 2011d). The pre-contact, contact, and early post-contact period components of the site have recently been subjected to Phase III data recovery investigations (Elquist and Cherau in prep). This area was previously assigned high archaeological sensitivity for both pre-contact and post-contact period resources. Pre-contact Native American archaeological resources are expected to be associated with the Old Place Neck Site dating from at least the Late Archaic through Contact periods. Post-contact period resources could include structural remains and artifact assemblages associated with documented seventeenth and eighteenth-century settlements and a nineteenth-century farmstead belonging to J. Carpenter (Elquist et al. 2010b:75-78). A post-contact period cultural component associated with the nineteenth-century Old Place Mill property was also identified within the Old Place Neck Site to the southwest.

This portion of pipeline route crosses Bridge Creek and marshes between approximately STA 241+00 and STA 247+00. Since the December 2011 recommendation for Phase IB subsurface testing, PAL discovered that the Bridge Creek wetlands were subjected to a large 18-acre restoration project completed in 2006 by the National Oceanic and Atmospheric Administration (NOAA) and its partners including EPA and the New York State Department of Environmental Conservation. The restoration project was in response to the January 1990 Exxon spill of approximately 567,000 gallons of fuel oil after a faulty pipeline ruptured beneath the Arthur Kill. The Bridge Creek restoration project restored tidal flow by removing unnecessary soil and improving channels within the marsh (NOAA 2006). The GRA 2011 soil borings were taken along the edge of the Western Avenue road shoulder where restoration activities may not have taken place. It is not known how extensive the soil removal and channel widening was in the project pipeline route; however, some level of rechannelization is likely to have taken place since the creek is obviously channeled across this area.

Also, since the December 2011 recommendation for Phase IB subsurface testing, Spectra Energy determined that the pipeline route through the Bridge Creek and marshes wetland area will be installed using a wet crossing construction methodology (i.e., water in the pipeline trench will be continuously pumped, but the trench will remain completely saturated due to its location within the wetland). Given the potential for some degree of disturbances related to NOAA’s 2005-2006 oil spill restoration project and that the area is a protected wetlands preserve where construction will be undertaken with minimal disturbances and a wet crossing of the wetland complex will be performed, PAL now recommends archaeological monitoring during the construction of the proposed pipeline trench from STA 257+80 (reroute STA 241+48.8) to STA 248+00. The archaeological monitoring will be designed to document and record any archaeological resources including evidence of pre-contact/early post-contact period occupations that may have occurred in this wetland marsh area along the margin of the Old Place Neck landform and may be associated with the Old Place Neck site occupation to the south.

Richmond Terrace Street Right-of-Way

In December 2011 as a result of geoarchaeological soil borings and analysis, PAL recommended Phase IB subsurface testing on NYCDOT Property in Richmond Terrace on Staten Island, New York (Cherau 2011). Eight geoarchaeological borings (RCH-5H-ARC-1 thru RCH-5H-ARC-8) were completed within the Richmond Terrace street right-of-way, which includes the section of Project pipeline trench between STA 280+00 to STA 291+00. The results of the soil borings indicated the potential for intact Holocene soils between fill and Pleistocene sediment complexes in two of the soil borings (RCH-5H-ARC-5 and RCH-5H-ARC-6) (GRA 2011:29, 39). The potentially sensitive strata began at a depth of 207 cmbs (6.8 ft) and extended below the vertical pipeline APE at 245 cmbs (8 ft). Phase IB subsurface testing was recommended in the form of five (5) machine-assisted trenches at 15 m (49 ft) intervals between STA 284+25 and STA 287+50 a distance of approximately 99 m (325 ft) m (see Figure 6). The NY SHPO concurred with this recommendation in a letter dated January 5, 2012, and the NYC LPC also concurred following a conference call with PAL on January 20, 2012 after commenting on the high sensitivity assessment for pre-contact period resources and need for Phase IB testing (see Attachment A).

Subsequent to the geoarchaeological soil borings analysis and NY SHPO and NYC LPC concurrences, Spectra obtained underground utilities information for the Richmond Terrace right-of-way where the Project pipeline route will traverse. PAL reviewed the utilities plan and cross section drawings, and determined that the street right-of-way contains several underground pipes, including a 6-inch water line, a 8-inch retired gas main, and a 20-inch water main (to be replaced). These three existing utilities are located within one and five feet horizontally and within one foot vertically (above) the proposed gas pipeline trench. It is likely that the construction of these utility easements previously disturbed the proposed pipeline trench. The geoarchaeological soil borings were taken on the north side of the street pavement where there are no extant utilities, so the potentially intact soil profiles interpreted below road bed fill are quite different from the south side of the street containing the utilities where the pipeline will actually be placed.

Given the presence of extant utilities and previous disturbances in close proximity to the proposed Project pipeline trench, no archaeological sensitivity is currently assigned to the Project APE between STA 284+25 and STA 287+50 in Richmond Terrace on Staten Island. No Phase IB testing will be conducted for this portion of the New Jersey-New York Expansion Project.

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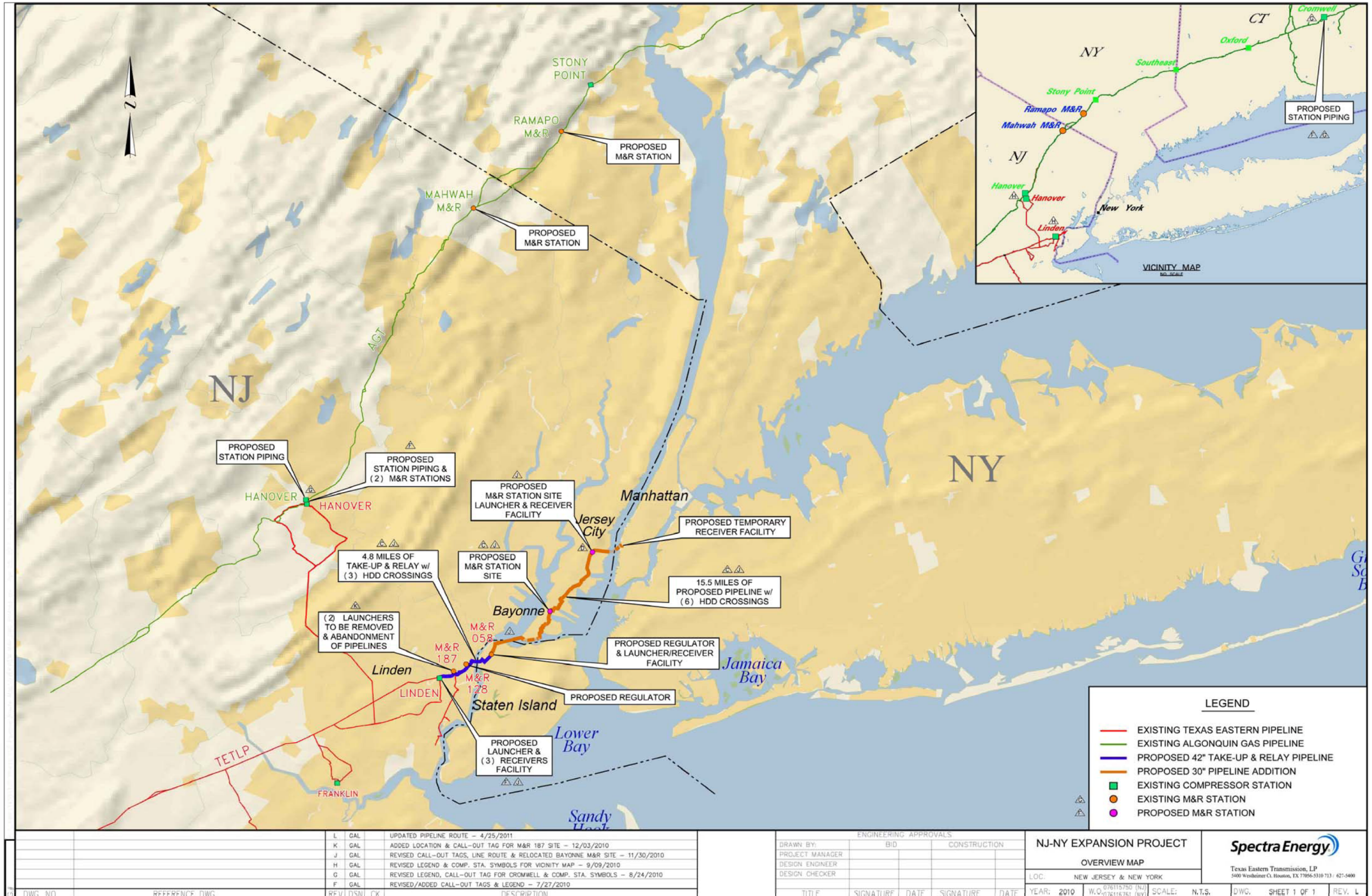

Figure 1. Overview map showing the various locations of the NJ-NY Project.

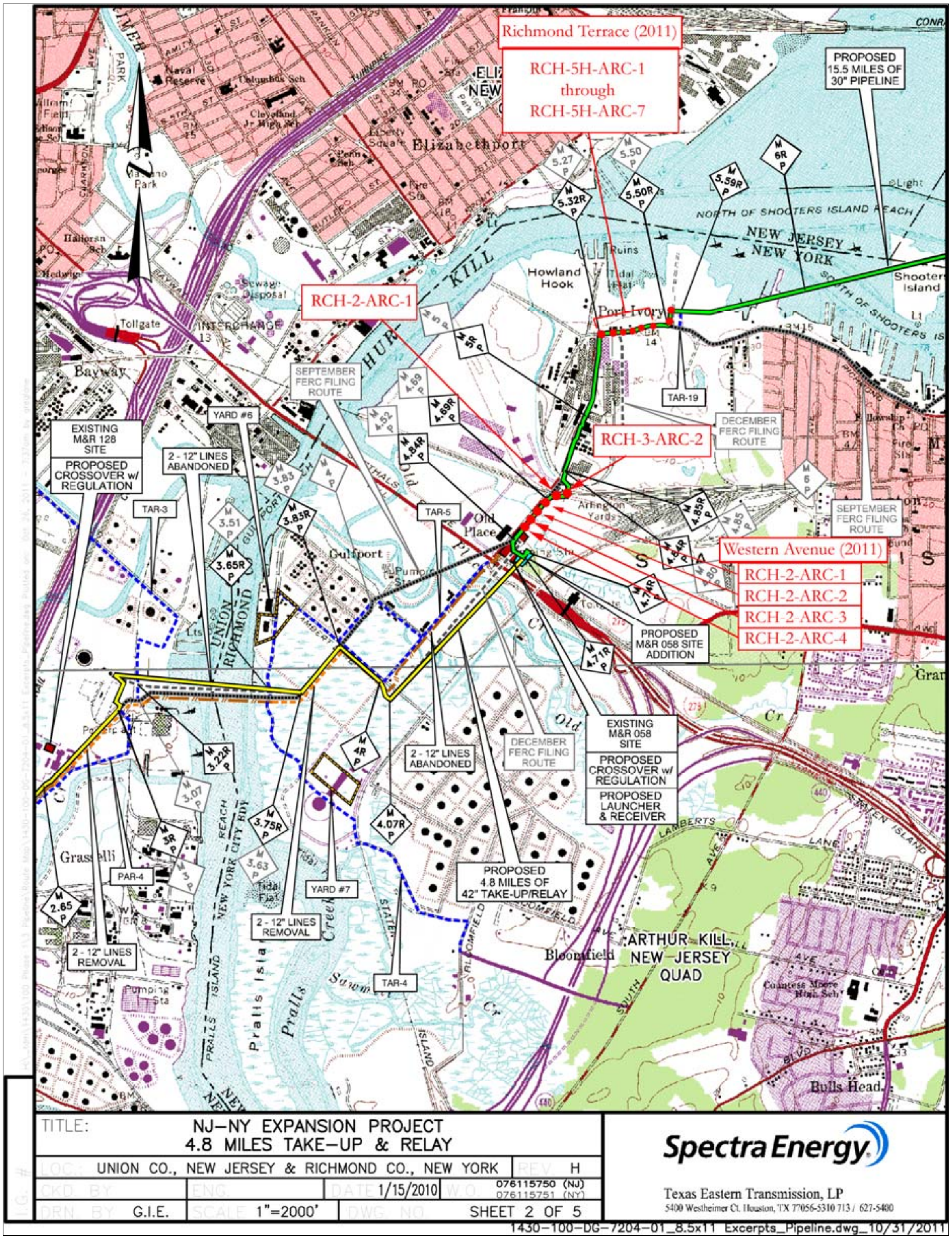

Figure 2. NJ-NY Project area, showing the location of geoarchaeological soil borings completed in Staten Island in 2011 and 2012, and discussed in the current report, on the Elizabeth and Arthur Kill, NJ, USGS topographic quadrangles, 7.5 minute series.

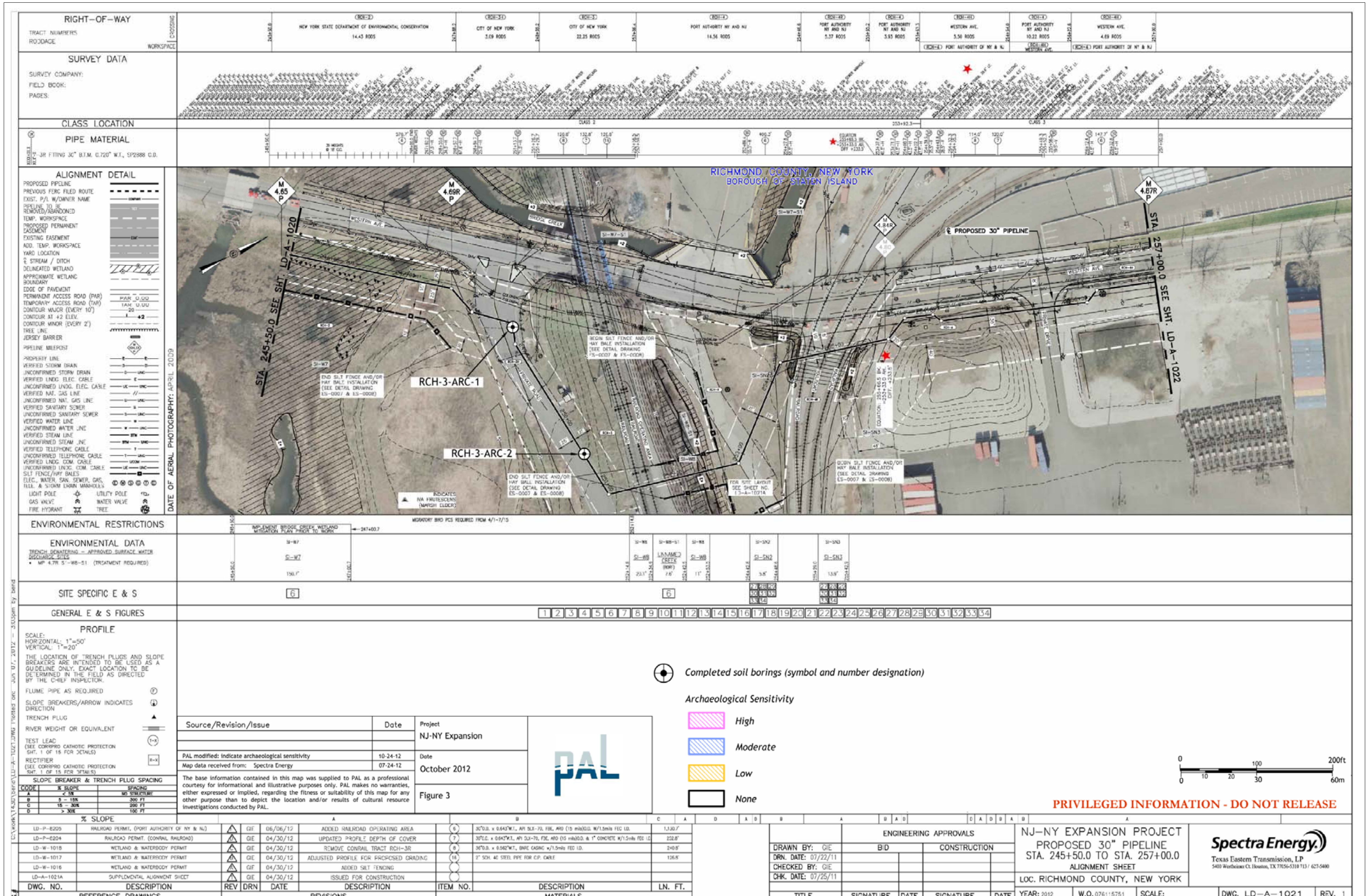

Figure 3. Revised archaeological sensitivity for pipeline route section, STA 248+00 to STA 252+75, NYC EDC Property – Arlington Yard, Staten Island, NY, NJ-NY Expansion Project.

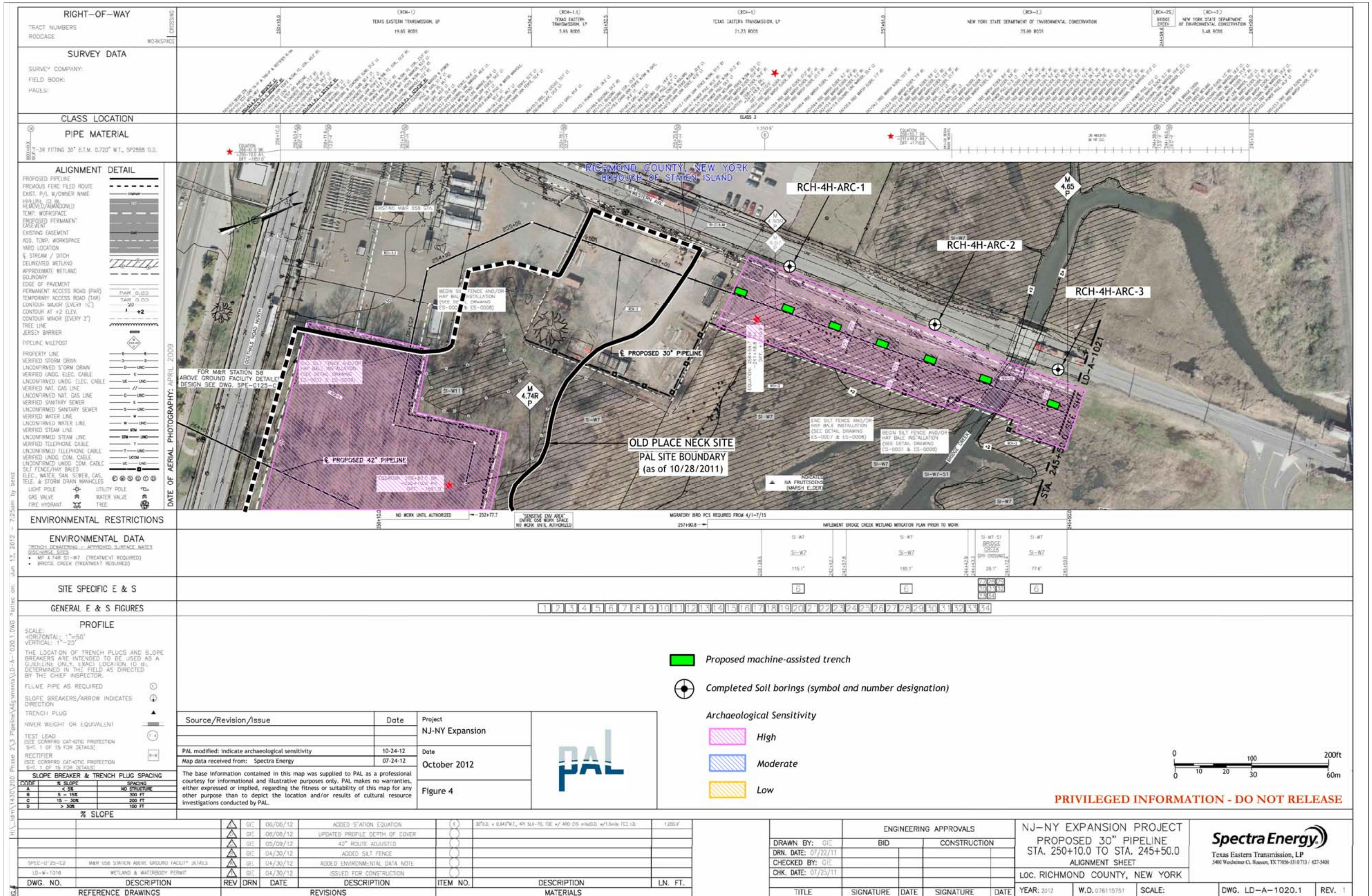

Figure 4. Archaeological sensitivity for pipeline route section, STA 257+80 (reroute STA 241+48.8) to STA 245+50, NYSDEC Property including Bridge Creek and Marsh Crossing, Staten Island, NY, NJ-NY Expansion Project.

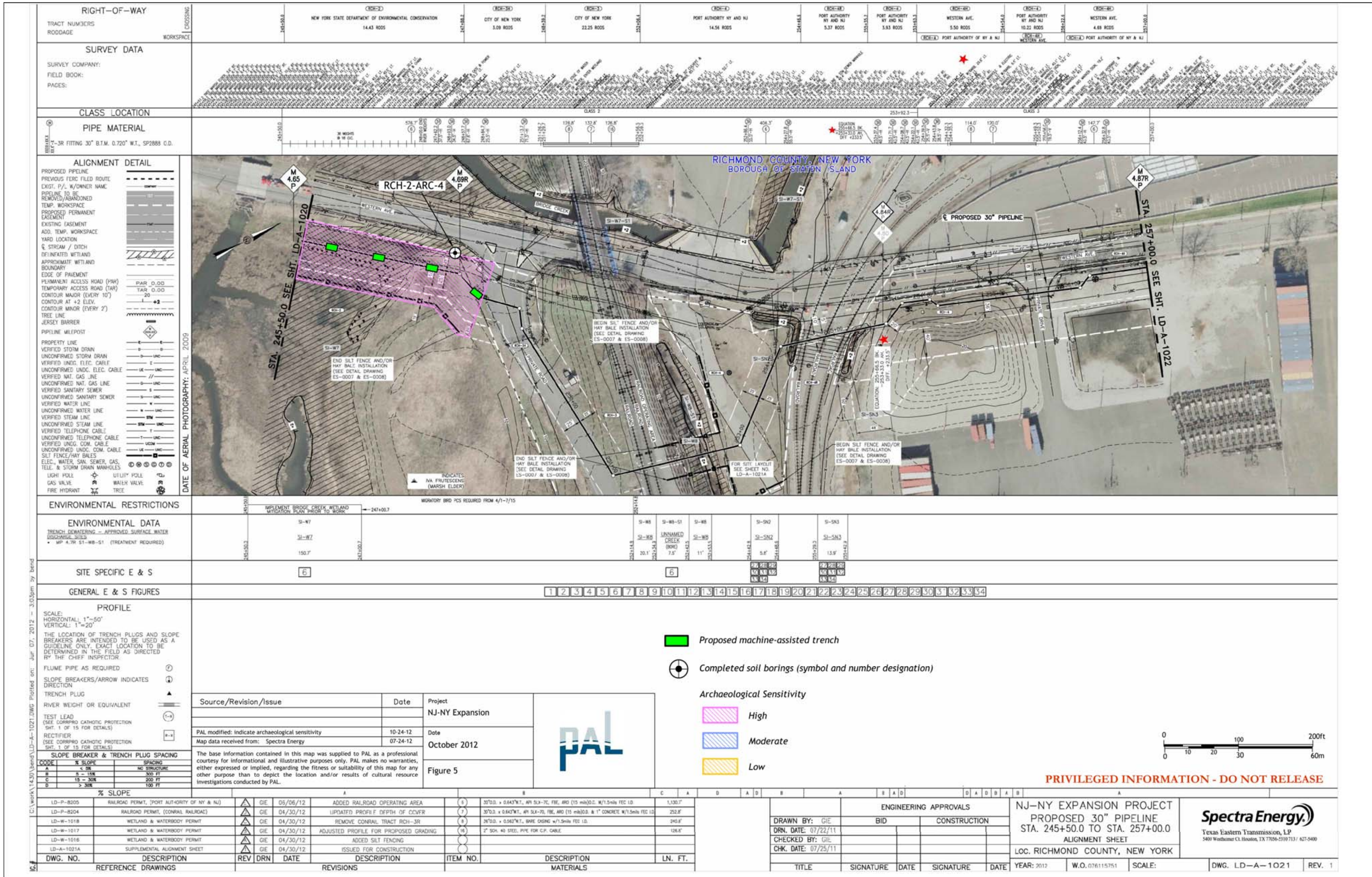

Figure 5. Archaeological sensitivity for pipeline route section, STA 245+50 to STA 248+00, NYSDEC Property including Bridge Creek and Marsh Crossing, Staten Island, NY, NJ-NY Expansion Project.

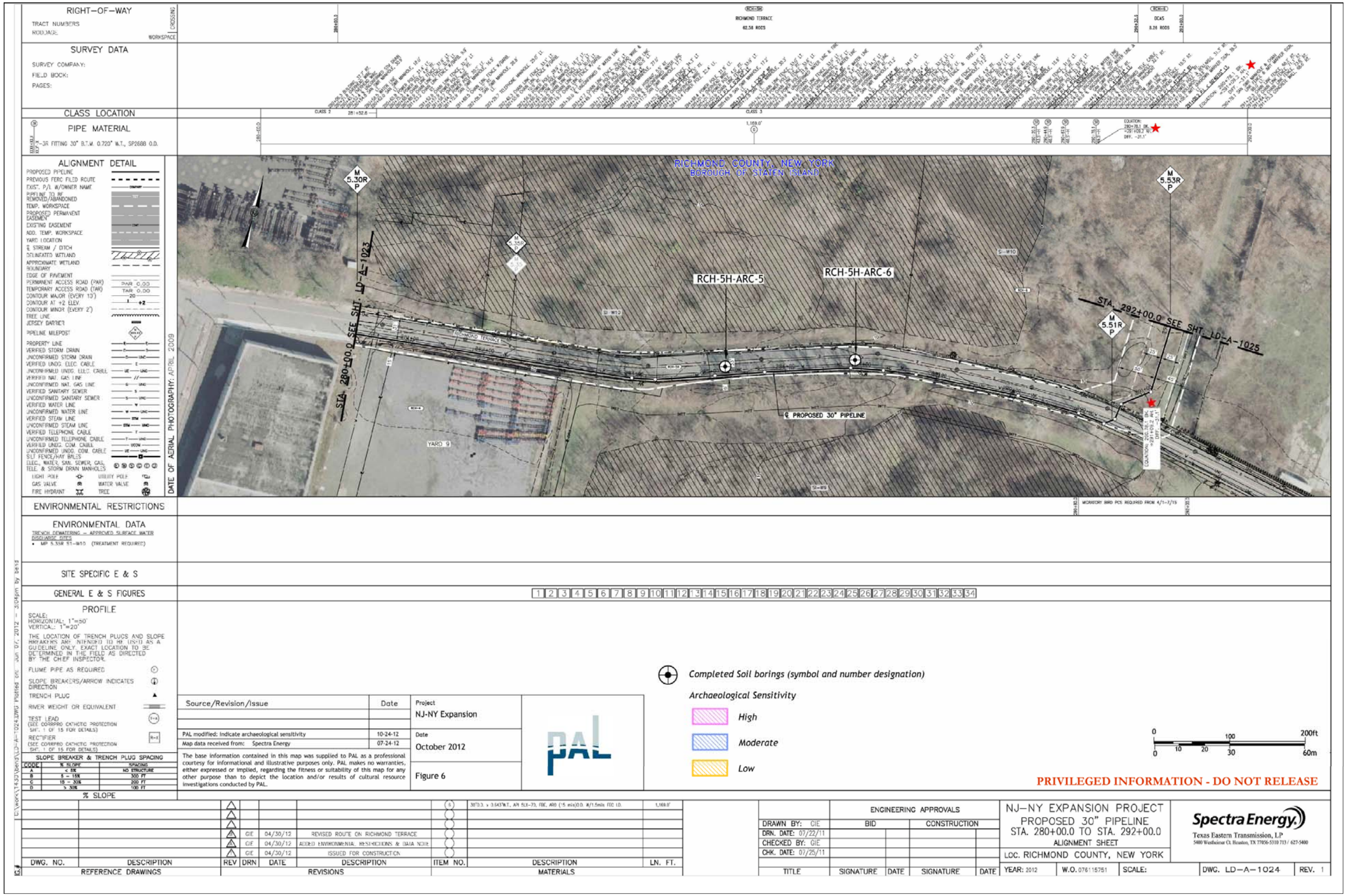

Figure 6. Revised archaeological sensitivity for pipeline route section, STA 284+25 to STA 287+50, Richmond Terrace Street Right-of-Way, Staten Island, NY, New Jersey, NJ-NY Expansion Project.

ATTACHMENT A

PROJECT CORRESPONDENCE

OFFICE OF PARKS · RECREATION · HISTORIC PRESERVATION
NEW YORK STATE

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189

518-237-8643

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Andrew M. Cuomo
Governor

Rose Harvey
Commissioner

January 5, 2012

Gregory Dubell
Public Archaeology Facility
210 Lonsdale Ave
Pawtucket, Rhode Isla 02860

Re: FERC
Response to Geoarchaeological Soil Borings - Report #3
Texas Eastern NJ-NY Expansion Project
Richmond and New York Counties, NY
09PR05949

Dear Mr. Dubell:

Thank your for requesting the comments of the New York State Historic Preservation Office (NY-SHPO) with regard to the potential for this project to affect significant historical/cultural resources. We have received and reviewed the documents: "*Results of Geoarchaeological Soil Borings and Proposed Phase IB Archaeological Surveys, Report #3, New Jersey-New York Expansion Project, Staten Island, New York,*", dated December 21, 2011. Based on our review of this document, NY-SHPO concurs with the Phase 1B testing recommendations presented in the report.

Please contact me at extension 3291, or by e-mail at douglas.mackey@parks.ny.gov, if you have any questions regarding these comments.

Sincerely

Douglas P. Mackey

Douglas P. Mackey
Historic Preservation Program Analyst
Archaeology

Cc: Amanda Sutphin, NYCLPC

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ARCHAEOLOGY

Project number: FEDERAL ENERGY REGULATORY COMM / 106-Y
Project: NJ/NY EXPANSION PROJECT GAS PIPELINE(SPECTRA)
Date received: 1/3/2012

Comments:

The LPC is in receipt of the, "Results of Geoarchaeological Soil Borings and Proposed Phase 1B Archaeological Surveys Report #3, New Jersey-New York Expansion Project," prepared by PAL and dated December 21, 2011. The LPC concurs with most of the recommendations for further work. We note though that a protocol detailing what to do if any human remains are found must be developed before testing proceeds in areas with such potential. We are unconvinced by the testing methodology and rationale for further work in the area called, "NYCDOT Property-Richmond Terrace (RCH-5H-ARC-1-ARC 8)." It is unclear to us how the proximity of the Richmond Hill Historic Site is relevant (page 39) and would appreciate more supporting information for this recommendation before we can make a determination.

In addition, the LPC now concurs that if the project cannot be redesigned to avoid impacting the Old Place Site, mitigation must occur as is recommended in the, "Phase 1B Archaeological Identification Survey M & R 058 Additional Temporary Workspace and Phase II Archaeological Evaluation Old Place Neck Site, Goethals Bridge HDD Workspace, Staten Island, New York," prepared by PAL and dated November 2011. We also concur with the recommendations made in the "Archaeological Overview Survey- Addendum #3 to Technical Report New Jersey-New York Expansion Project," prepared by PAL and dated November 9, 2011 which includes an assessment of the archaeological potential of the areas called "Route Variations: 80, 74, 58, 76, 64/79, 75, and MP 5.54 Workspace."

Cc: NYSHPO

Amanda Sutphin

1/12/2012

SIGNATURE DATE
Amanda Sutphin, Director of Archaeology

File Name: 26346_FSO_ALS_01112012.doc

	J.O./W.O. NO	
Spectra Energy	**CLIENT:** **SPECTRA ENERGY**	
	PROJECT: **NJ/NY EXPANSION PROJECT**	
	LOCATION: **NJ/NY**	

MINUTES OF MEETING

LOG NO.: MOM-0393

MEETING HELD AT: Conference Call		MEETING DATE: 01/20/12
REPORT BY: G. Dubell	REVIEWED BY: S. Cherau	DATE OF ISSUE: 02/06/12

PURPOSE OF MEETING: Conference call between PAL and NYC Landmarks Preservation Commission staff to follow-up on LPC's 1/12/2012 comment letter on archaeological reports and recommendations for Staten Island, NY.

ATTENDEES

Greg Dubell – PAL Suzanne Cherau – PAL	Amanda Sutphin – NYC LPC

DISTRIBUTION

Attendees and Team File

ITEM	REPORT
Meeting Summary	

Greg Dubell and Suzanne Cherau called Amanda Sutphin, Archaeologist for the New York City Landmarks Preservation Commission (NYC LPC) to follow-up on LPC's 1/12/2012 letter commenting on PAL's recent submittal of archaeological reports covering Staten Island, NY.

LPC's comment letter requested additional information regarding archaeological sensitivity along Richmond Terrace. Ms. Sutphin noted that two areas along Richmond Terrace were recommended as having archaeological sensitivity (Geoarchaeological Soil Boring Report #3, page 7):

- High sensitivity area associated with soil boring RCH-5H-ARC-2 measuring approximately 30.5 m (100 ft) – historic period sensitivity; and
- High sensitivity area associated with soil borings RCH-5H-ARC-5 and RCH-5H-ARC-6 measuring approximately 99 m (325 ft) – pre-contact sensitivity.

Ms. Sutphin communicated that the western sensitivity area associated with soil boring RCH-5H-ARC-2 should be re-assessed as having low sensitivity due to the expected non-significance of historic fill at that area. Ms. Cherau and Mr. Dubell agreed with Ms. Sutphin's re-evaluation recommendation.

Ms. Sutphin and PAL discussed PAL's reasoning for high sensitivity for pre-contact resources associated with soil borings RCH-5H-ARC-5 and RCH-5H-ARC-6 and Ms. Sutphin concurred that archaeological deep testing should be performed in that area to identify/evaluate potentially significant archaeological resources.

MINUTES OF MEETING

LOG NO.: MOM-0393

	PAL provided Ms. Sutphin an update on the status of landowner access to perform outstanding geoarchaeological soil borings on Staten Island. Mr. Dubell communicated that the Port Authority of NY and NJ has denied access for Spectra personnel to perform subsurface investigations on their property. Mr. Dubell further communicated that PAL will be advancing two additional soil borings on property owned by NYC Economic Development Corporation (EDC) off Western Avenue (RCH-3H-ARC-1 and RCH-3H-ARC-2) in February 2012. A right of entry License Agreement between Spectra and NYC EDC is currently being executed. PAL also provided Ms. Sutphin an update on upcoming archaeological deep testing activities on property owned by NYC EDC north of Richmond Terrace (RCH-6). PAL will be commencing deep testing fieldwork at 12 trench locations starting the week of February 20, 2012. PAL expects very shallow groundwater and unstable soil conditions. The Project team is preparing for groundwater to enter the open deep test pits at a rate of approximately 400 gallons per minute. PAL will make every effort to perform controlled excavations and adequately identify/evaluate any archaeological resources, however, environmental conditions (groundwater and slumping sidewalls) may make adequate evaluation not viable. Ms. Sutphin and PAL discussed various techniques to minimize and/or mitigate the adverse environmental conditions.
	Ms. Sutphin communicated that NYC LPC recently met with the NYC Department of Health regarding the treatment of human remains identified during archaeological fieldwork and/or as an unanticipated discovery during ongoing construction activities. Ms. Sutphin communicated that NYC LPC does not have regulation on the treatment of human remains. However, NYC health law forbids the movement of remains without a permit issued by the NYC Department of Health. The law also states that such a permit may only be issued to a funeral director. PAL recognized that local NYC laws governing the treatment of human remains will need to be incorporated into the NJ-NY Project's Unanticipated Discovery Plan (UDP), which is currently undergoing revisions to reflect comments received by the New Jersey State Historic Preservation Office (SHPO). The New York SHPO previously reviewed the draft UDP and PAL will re-submit the revised UDP to both the New York and New Jersey SHPOs, NYC LPC, and other relevant Native American groups and consulting parties.

ATTACHMENT B

GEOARCHEOLOGY RESEARCH ASSOCIATES – SOIL BORING REPORT #7

PRELIMINARY REPORT:
"PRE-ANALYSIS" RESULTS OF GEOARCHAEOLOGICAL INVESTIGATIONS, PHASE 1A, NJ-NY EXPANSION PROJECT
ROUND 12, SEPTEMBER 2012

RICHMOND COUNTY, STATEN ISLAND, NEW YORK

Prepared for:

Public Archaeology Lab
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Assembled by:

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and

Chelsea Richard, B.S.
Geoarcheological Technician

October 15, 2012

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1. INTRODUCTION

This report presents the preliminary results of field investigations conducted September 4-5, 2012 for the NJ-NY Expansion Project. Geoarcheology Research Associates (GRA) of Yonkers, New York was contracted by Public Archaeology Laboratory (PAL) of Pawtucket, Rhode Island to conduct a geoarchaeological study along a proposed pipeline corridor for Spectra Energy Transmission, LLC. This study presents a summary of a twelfth round of fieldwork and preliminary results for the project area. We have previously published analyses of 121 unique cores as part of the cultural resources survey for this project. These cores are discussed and interpreted in the following groupings: thirty-two (32) cores in Union and Hudson Counties, NJ and Richmond County, NY (GRA, 2011a); fourteen (14) cores in Hudson County; NJ (GRA, 2011b); thirty (30) cores in Richmond County, NY, including a re-publication of one (1) previously-reported core (GRA, 2011c); four (4) cores in Hudson County, NJ (GRA, 2012a); three (3) additional cores in Hudson County, NJ (GRA, 2012b); ten (10) cores in Richmond County, NY (GRA, 2012c); nine (9) additional cores in Richmond County, NY (GRA, 2012d); four (4) cores in Hudson and Union Counties, NJ (GRA, 2012e); seven (7) cores in Hudson County, NJ (GRA, 2012f); seven (7) additional cores in Hudson County, NJ (GRA, 2012g); and an additional two (2) cores in Hudson County, NJ (GRA, 2012h).

The present report documents two (2) new cores in Richmond County, NY. As in the case of earlier studies, the present document is a “pre-analysis” report that assembles the stratigraphy of subsurface deposits to the degree that technical field studies permit. The geoarchaeological study is being undertaken to develop a probability model for the Phase IB archaeological survey. By conducting a systematic survey involving deep testing, GRA is providing a working schema of subsurface stratigraphic relations in this project’s areas of potential effect (APE). The project impact area spans urban areas known for dense, complex, and deep archaeological and historical deposits.

The core locations are situated within Richmond County, NY (Figures 1 and 2). The pipeline route currently extends over 32.7 km (20.3 mi), and the present boring locations sample 0.06 km (0.04 mi), or 0.18%, of the proposed route. The locales sampled in this round of fieldwork lie on a road belonging to the NYC Economic Development Corporation, in Arlington Yard, off of Western Avenue just south of the raised Conrail railbed.

Preliminary hand augering typically preceded machine-based (Geoprobe™) drilling for the uppermost six feet (180 cm). Cores typically extended to a depth of 20 feet (610 cm), with isolated exceptions, and encountered complex stratigraphic sequences of fill, buried historical surfaces, possible prehistoric surfaces, and underlying natural, unconsolidated geological deposits. A critical objective of the overall project study was the identification of Late Quaternary environments associated with prehistoric and historic settings of potential and known sites along the length of line. To this end, we report on the results of four (4) radiocarbon dates for particularly critical locations with strong potential for recovering information on historic and prehistoric settlement and paleoenvironments. These are reported in Table 2 and Appendix B.

This preliminary report recounts baseline results of this initial investigation. A thorough overview of the geological setting of the region is presented, with a particular focus on landscape history along the project corridor (Chapter 2). A methods section follows which outlines both field and laboratory techniques (Chapter 3). Detailed descriptions of the test borings are provided in Chapter 4, and Chapter 5 presents a discussion of the results of geoarchaeological testing, as well as recommendations for further work.

Detailed sedimentological documentation for each core is presented in Appendix A along with photo mosaics of the drilled materials. Appendix B contains the ^{14}C testing reports from Beta Analytic. Appendix C features photos of diagnostic artifacts found during data collection.

Included in the recommendations is a protocol for specialized laboratory studies that should be undertaken in support of developing a paleolandscape model that underpins a robust model of archaeological sensitivity. It should be noted that no specialized analyses have been conducted to date for this specific segment of the pipeline. The study is still considered a preliminary report insofar as it is part of the greater cultural resource assessment addressing the entire project length of line.

Finally, it is noted that the recommendations presented in this study represent follow up work that would enhance the interpretive potential for reconstructing paleo-environment, site formation histories, and the development of a model of buried site preservation. The results of this report, together with previous results, suggest that a comprehensive follow-up analysis design should be based on a representative sampling of the entire pipeline corridor to maximize information yield and to develop a scientifically sound and cost-effective mitigation strategy.

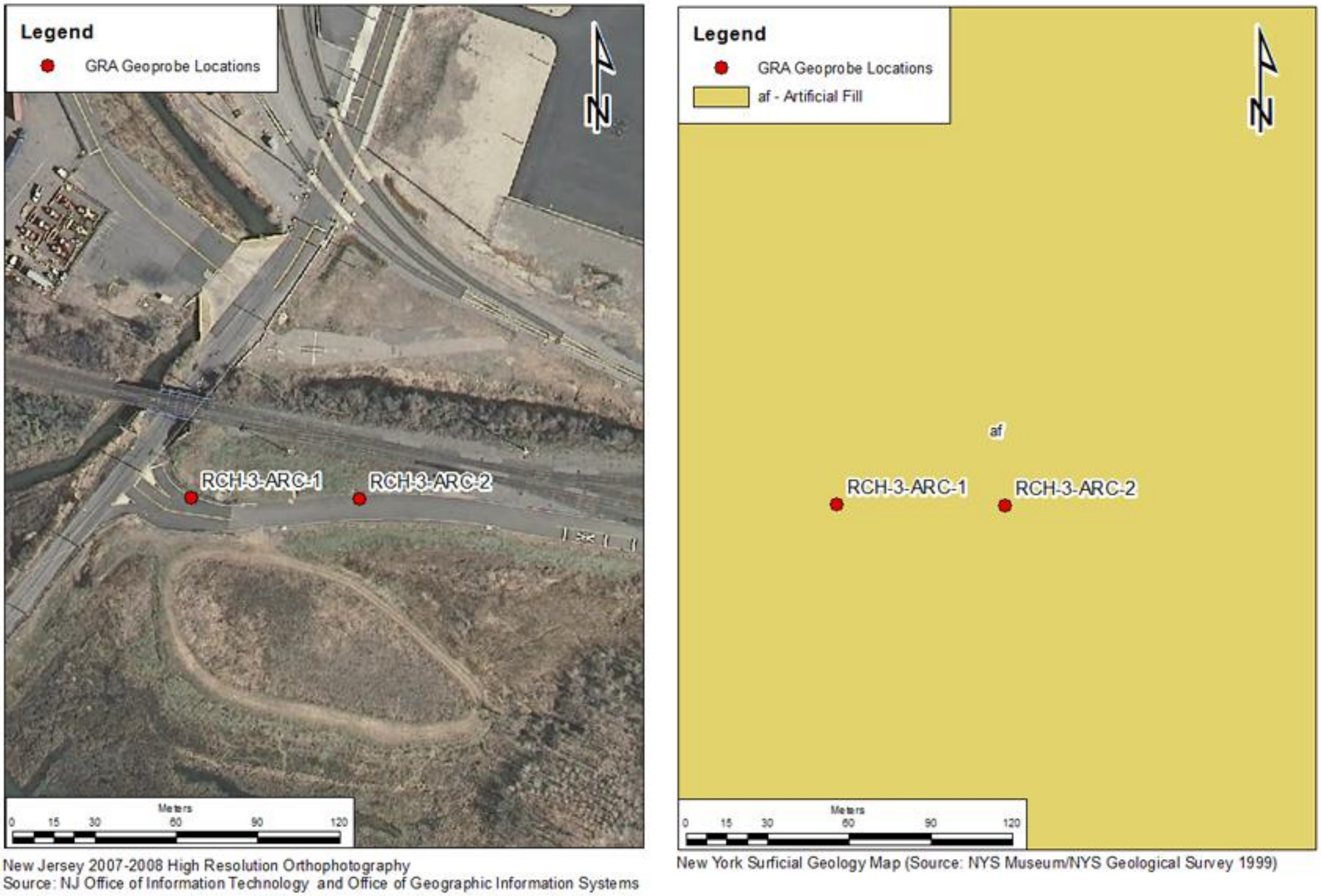
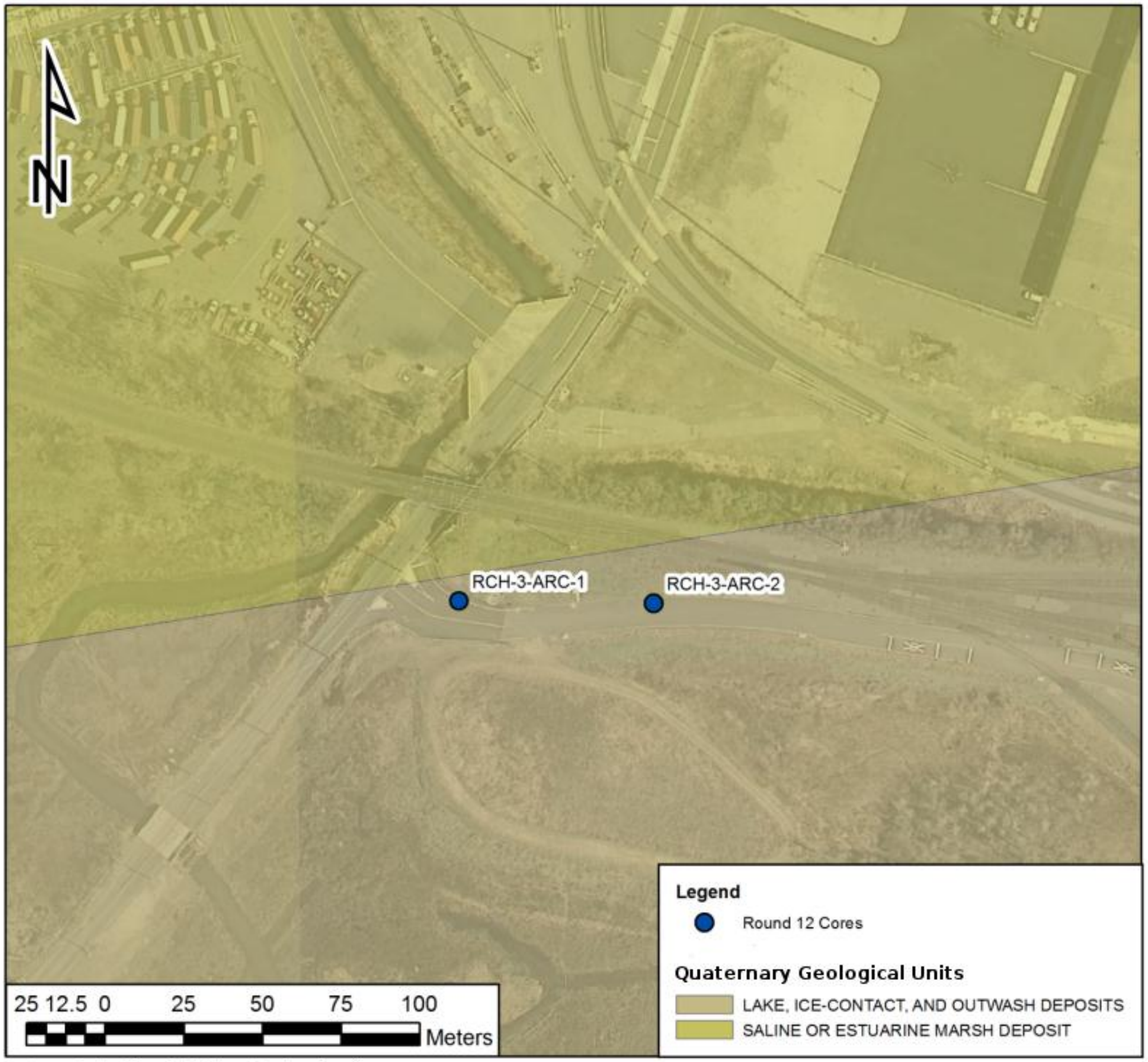


Figure 1: Aerial imagery alongside surficial geology map of project area with boring locations.



Quaternary Geologic Map of the Hudson River Quadrangle
(Source: United States Geological Survey 1992)

Figure 2: Quaternary geological units within the project area

2. PROJECT GEOMORPHIC BACKGROUND

The entire proposed pipeline corridor, as well as the segment under consideration, is located along urbanized segments of near-shore, tidal, and offshore settings in Upper New York Bay in New Jersey and New York. The Late Quaternary landform history of the New York Bay is a function of bedrock geology and events associated with regional glacial history. The end of the Pleistocene (after 18,000 B.P.) is almost exclusively registered in the surface and subsurface deposits of the coast and near-shore settings of metropolitan New York City and adjacent New Jersey and New York. Variable accumulations of sediment record the region's history of glaciation and deglaciation, and corresponding marine based submergence and emergence. Related terrestrial and marine histories reflect the dynamic balance along the glacial margins and shorelines over the course of the past million years.

Regional geological and palaeoenvironmental studies are extensive. Relevant research has focused on bedrock geology (Isachsen et al. 1991; Schuberth 1968); late Pleistocene and (to a lesser degree) Holocene surficial deposits (Antevs 1925; Averill et al. 1980; Lovegreen 1974; Merguerian & Sanders 1994; Rampino & Sanders 1981; Reeds 1925, 1926; Salisbury 1902; Salisbury & Kummel, 1893; Sirkin 1986; Stanford 1997; Stanford 2010, Stanford & Harper 1991; Widmer 1964), as well as postglacial vegetation change (Peteet et al. 1990; Rue & Traverse 1997; Thieme et al. 1996) and sea level rise (Newman et al. 1969; Weiss 1974). More recently, there have been detailed studies of archeological preservation potential for the Holocene surficial deposits (GRA 1996a, 1996b; Schuldenrein 1995a, 1995b, 2000; Schuldenrein et al., 2007; Thieme & Schuldenrein 1996, 1998; Larsen et al., 2010) and estuarine sediments (GRA 1999; LaPorta et al. 1999; Wagner & Siegel 1997).

Physiography and Bedrock Geology

The Upper New York Bay is an estuary formed within a valley deepened and widened by the advance and retreat of the Laurentide continental ice sheet of the last Ice Age. Mesozoic-age Newark Group rocks underlie most of the New York Harbor region in New Jersey and extend up the west side of the Hudson River. The Triassic-age Palisades Sill marks the western shore of the Hudson in the New York City area. The sill is an igneous intrusion into the Newark Group sedimentary rocks. These sedimentary rocks contrast with the Cambrian to Ordovician metamorphic rocks of the New York Group east of the Hudson River. Quaternary-age glacial deposits rest unconformably on the Newark Group sedimentary rocks as well as those of the New York Group.

Pleistocene Glaciation, Chronology, and Landform Development

The unique landscape configurations of the Upper New York Bay are attributable to large-scale geological processes of the last ice age. Until recently, generic landscape chronologies served as the only basis for geoarchaeologically-oriented cultural resources assessments (such as 3DI 1992). Currently, however, the combination of regional geologic mapping by the New Jersey Geological Survey (Stanford 1995, 2002 and Stone et al. 2002), as well as older regional mapping by the New York State Geological Survey (Cadwell 1989), palaeoenvironmental studies (e.g., Carbotte et al. 2004, Maenza-Gmelch, 1997), and geoarcheological investigations (e.g. Schuldenrein et al. 2007, Thieme 2003, Schuldenrein and Aiuvalasit 2011) provide a significantly more refined and chrono-stratigraphically accurate understanding of the late Quaternary geologic history and archeological potential of the Upper New York Bay.

Prior to the terminal Wisconsinan, glaciers advanced across the region at least twice during the Pleistocene (Stanford, 1997; Sirkin, 1986). Both Illinoisan, ca. 128,000-300,000 B.P. (radiocarbon years before present), and pre-Illinoisan (> 300,000 B.P.) terminal moraines are mapped in northern New Jersey, and these ice advances may be represented by still earlier tills on Long Island (Rampino and Sanders, 1981; Merguerian and Sanders, 1994). Older tills have a "dirty" appearance and can be distinguished from late Wisconsinan deposits by the presence of unweathered mudstone, sandstone, and igneous rock clasts in the late Wisconsinan deposits (Stanford, 1997).

The Hudson-Mohawk Lobe of the latest, or Wisconsinan, ice sheet advanced to its Harbor Hills terminal moraine by 20,000 B.P. (Sirkin, 1986; Sirkin and Stuckenrath, 1980). The extensive and arcuate shaped Harbor Hills landform marks the final position of the ice advance, links Long Island with Staten Island, and is dated by postglacial radiocarbon dates from northwestern New Jersey of 19,340±695 B.P. in a bog on Jenny Jump Mountain (Stanford, 1997) and 18,570±250 B.P. in Francis Lake (Cotter, et al., 1986). Thieme and Schuldenrein (1998) obtained a similar date of 19,400±60 B.P. from a loamy sediment overlying glacial till along Penhorn Creek in the Hackensack Meadowlands.

During the later phases of the Pleistocene, the hydrography at the glacial margin was dynamic and resulted in a glaciolacustrine landscape that involved cyclic retreats and transgressions of linear lakes that approximated the morphologies of structural valleys. Lakes Passaic, Hackensack, Hudson, and Flushing variously occupied the terrain between Long Island and east-central New Jersey as well as the Hudson valley. In Newark Bay and the lower reaches of the Hackensack and Passaic River valleys, subsurface stratigraphy revealed uniform lake bed sequences beginning with deep, classically-varved pro-glacial sediments (Antevs, 1925; Lovegreen, 1974; Reeds, 1925, 1926; Salisbury, 1902; Salisbury and Kummel, 1893; Stanford, 1997; Stanford and Harper, 1991; Widmer, 1964). Reddish brown muds derived from Mesozoic-age Newark Group rocks form thicker winter layers, while more sandy sediment layers were deposited as the ice melted during the summer. The top of the glaciolacustrine sediment sequence is typically an unconformable contact from 12-30 feet below the present land surface in the Hackensack Meadowlands (Lovegreen, 1974). These same varved silts and clays fill the deeper parts of the incised Hudson valley and are overlain by riverine sands and gravel, which are, in turn, capped by thick marine estuarine muds.

Deglaciation of the Mohawk River lowland between 13,000 and 12,000 B.P. is a key event in the geologic history of the New York Harbor area. Proglacial Lake Iroquois, which occupied the Lake Ontario basin, subsequently drained directly to the Hudson River valley via the Mohawk lowland and added to the volume of pro-glacial Lake Hudson. Researchers disagree on the mechanism, but an outlet through the Harbor Hills moraine at the Narrows was opened at about this same time, emptying Lake Hudson and forming the present Hudson River drainage pattern. Newman, et al. (1969) noted that marine and brackish water filled the -27 m (-89 ft)-deep channel of the Hudson River at 12,500 ± 600 B.P. (14,830 cal yrs B.P.) as evidenced by marine and brackish marine microfossils preserved at the base of organic silts beneath peat bogs at Iona Island. It is unclear as to whether the erosion of the outlet through the Harbor Hills moraine was gradual, or catastrophic as proposed by Uchupi et al. (2001) and Thieler et al. (2007). Nevertheless, evidence suggests that flow from the Hudson River eroded a channel and valley across the exposed continental shelf to drain and deposit a delta on the outer shelf at a lowered sea level stand.

Most challenging to our understanding of the Hudson River history is the lack of a clear explanation for a direct marine connection between contemporaneous sea level at the edge of the continental shelf and the upper Hudson River valley. More generally, we consider the shelf to have been sub-aerially exposed at this time. Differential isostatic adjustment of the earth's crust following deglaciation is the most reasonable explanation accounting for down-warping and depression of the crust beneath glacier ice in the north and commensurate uplift of the continental shelf, thereby raising sea level in line with the upper Hudson River channel. Evidence for differential uplift of the crust along the upper Hudson Valley (relative to the New York Harbor area) is based on historic tide gauge data by Fairbridge and Newman (1968), although the complete relationship remains unclear.

The present study relies on an accurate record of relative sea level rise developed for the New York Harbor area by Schuldenrein et al. (2007) for determining the submerged locations of probable prehistoric human habitation areas in the Hudson River channel. That study proposed a model for archaeological sensitivity that would help guide plans to minimize impacts on cultural resources by future marine construction. The attendant construct for sea level rise (Figure 3) is derived from radiocarbon analyses of nearby submerged environmental settings acquired during baseline New York Harbor and related GRA studies. Our new model differs markedly from that presented by Newman et al. (1969) and is proposed herein as a more accurate construct. GRA (Schuldenrein et al. 2007) presented a relative sea level history consistent with "far field" eustatic sea level studies (Fleming et al., 1998). We show a rapid rise in relative sea level at a rate of approximately 9 mm/yr (0.5 inches/yr) from at least 9000 cal yrs B.P. until about 8000 cal yrs B.P. when the rate of rise diminished to a consistent 1.5 – 1.6 mm/yr (0.06 inches/yr), from 7000 cal yrs B.P. until the present. This sea level model is consistent with studies by Bloom and Stuiver (1963) for the Connecticut shore; Redfield and Rubin (1964) for Barnstable, Massachusetts; Belknap and Kraft (1977); and Nikitina et al. (2000) for Delaware Bay as reexamined by Larsen and Clark (2006).

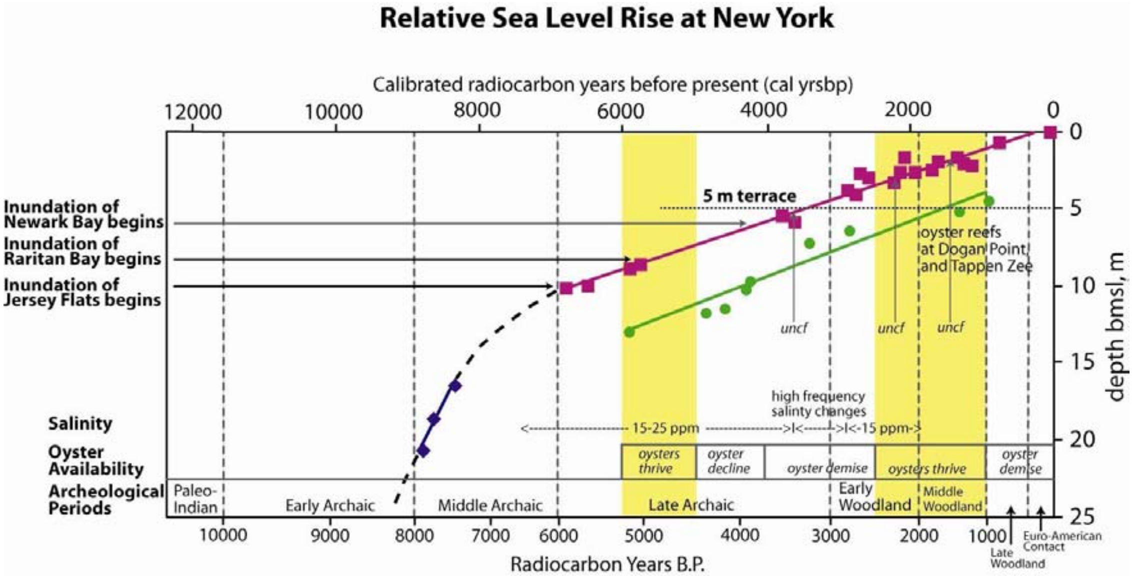


Figure 3. Sea level rise model for New York Harbor (from Schuldenrein et al. 2007).

In general terms, the new relative sea level model can be retrofitted to account for reflooding of the incised Hudson channel and Upper New York Bay as described by Thieler et al. (2007) for the Narrows at ca. 12,000 B.P. (13,875 cal yrs B.P.), as well as for the marine incursion of the upper Hudson Valley and consequent deposition of brackish estuarine sediments. It cannot, however, resolve the differential positions of the incised channel at the Narrows with the proposed delta at the edge of the continental shelf. We show progressive flooding of the main Hudson channel culminating in its present configuration. The area currently known as the New Jersey Flats was initially subject to inundation about 7,000 cal yrs B.P. Oyster reefs formed upriver at Tappan Zee at this time as well, and spread at successively shallower depths following the rising sea level (Carbotte et al., 2004). The latter record of oyster reef growth is consistent with sea level rise as demonstrated by the data points (in green) in Figure 3. The common depth range for the eastern oyster *Crassostrea virginica* is 8 to 24 feet (2.5-7.2 m). This explains the Tappan Zee oyster growth history which parallels but falls beneath our calculated and contemporaneous sea level curve. Marine water entered and progressively flooded Raritan Bay and Newark Bay about 6,000 cal yrs B.P. Marshes upstream from the present mouth of the Raritan River as well as the nearby Hackensack marshes became increasingly saline after 3,000 cal yrs B.P. and they subsequently evolved into salt marshes.

The estuaries and shorelines along the Upper Bay became the focus of historical Dutch settlement, and eventually blossomed into the sprawling metropolis of New York City. In general, the natural tidal zones and immediate near-shore settings through which the proposed pipeline corridor runs have been wholly reworked throughout the historic period and into the present day. The background literature review for this project conducted by PAL provides a thorough overview of the historical development of the project area with numerous archival maps that show the successive land use of the project area (Elquiest et al., 2010a and 2010b).

Expected Geological Sequence within the Project Area

For the initial reports on the NJ-NY Expansion project (ie. GRA 2011a), the assessment of the age and archaeological potential within the geological sequences drew extensively from the detailed surface geology maps of New Jersey (Stone et al., 2002). The present Staten Island segment is in New York State and that state's surface geology map is structured on different mapping units (NYGS 1989; see GRA 2011c). In general, however, the units and, more significantly, the ages of the attendant surface and upper sub-surface deposits are broadly correlative between the two states. For present purposes we draw directly from both the digitized New York State surface geology map (NYGS 1989) and the digitized Quaternary geology map produced by the USGS (Fullerton et al., 1992).

The area described in this Round 12 report is located to the south of the elevated Conrail railbed and east of Western Avenue on a private road leading to Arlington Yard. The wetlands of Mariners Marsh are 1500 feet (<0.5 km) east of Western Avenue. The Western Avenue street gradient is approximately level to the Mariners Marsh Park wetlands, indicating that the area may not contain deep or extensive fill deposits, and that the current roadway may represent part of an original landform (GRA 2011c; Elquiest et al. 2010: 78). Soils within this location are mapped as: Pavements and Buildings, wet substratum Laguardia-Ebbets Complex, 0-8 percent slopes and Pavement & buildings-Windsor-Verrazano complex, 0 to 8 percent slopes (NRCS 2005).

The project area traverses an area previously characterized by GRA (2011c) as consisting of relatively deep and recent fills, often resting unconformably on Pleistocene till and Pleistocene-to-Holocene shoreline deposits (Stone et al, 2002). As part of Round 3, ^{14}C dating organic sediment from shore facies revealed a date of 16,940±70 B.P. (Beta-309857). This date is consistent with the regional chrono-stratigraphy associated with the emergence of the Staten Island shoreline during the late Wisconsinan (GRA 2011c).

Studies by GRA (2011c) determined that moderately thin Holocene deposits beneath historic fills may not be indicative of deeply stratified prehistoric sites. However, the depth and discrete composition of these historic fills indicate that the likelihood of intact historic resources along this section of the proposed route is relatively high.

There is only one surficial deposit formally mapped within the project alignment corridor (Figure 1 and Appendix A). This is the *Artificial Fill* itself ("af" in Figure 1) and it is the most pervasive surface sediment actually registered in the impact zone, as detailed in our results section. Below this fill, two Quaternary deposits are mapped in the project area (Figure 2). These are *Lake, Ice-Contact, and Outwash Deposits* and *Saline or Estuarine Marsh Deposits*.

Lake, Ice-Contact, and Outwash Deposits formed as water and sediment flowed into pro-glacial Lake Bayonne during the retreat of the Wisconsinan glaciation. These matrices are permeable and thicknesses are highly variable (2-20 m). Exceptions to classic lake basin sedimentation proliferated, with deltas registering on the margins of the previously described pro-glacial lakes. While the lake basins infilled with fine-grained sediments, coarser deposits of sands and silts were laid down along the peripheries. Undifferentiated marine and lacustrine sand bodies have also been identified (NYGS 1999) as near-shore deposits at or below the highest marine levels, where they may include fossil shells. Finer grained sediments, silts and clays may also proliferate along the margins of the pro-glacial lakes; the fines are often calcareous. Delta sediment bodies have been recognized as coarse to fine gravel and sand depositional strata, stratified and well-sorted along the ancient lake shoreline, again with variable thicknesses (3-15 m).

These deposits comprise a complex of redeposited clay, silt, sand, and gravel characterized by well-sorted, stratified, reddish-yellow, light reddish-brown, or grey sands with some pebble gravel and minor cobble gravel. They can measure up to 30 m (100 ft.) thick in the Staten Island area (Fullerton et al. 1992; Stanford 1995).

Saline or Estuarine Marsh Deposits are found in near-shore settings, and are often buried by artificial fill. They consist of Holocene-age organic clay, silt, and fine sand, ranging in color from black to brown to greenish-gray, interbedded with peat. They are characteristically unoxidized, and in the project area overlie older *Lake, Ice-Contact, and Outwash Deposits* with thicknesses of 3.0-10.0 m (9.8-32.8 ft) (Fullerton, et al. 1992).

Both deposits underlie and interdigitate with anthropogenic fill along much of the alignment. It is stressed that these units must be considered as fundamental basal sediments that can be expected to underlie most core locations. They should not be used to infer either the age or composition of the sediments retrieved from individual cores. This is because of the pervasiveness of fill caps whose depth, composition, and lateral extent were not and could not have been mapped with requisite accuracy, despite the best efforts of the New York Geological Survey (NYGS, 1999).

3. METHODS

Designated sampling intervals for baseline core placements were agreed upon by the State Historic Preservation Officer (SHPO) of New York. For New York the sampling interval was set at one test boring every 300 ft (90 m). An underlying hypothesis is that for any comparative study this interval should accommodate comprehensive project-wide reconstructions.

On the ground, spacing intervals had to be modified because of logistical concerns. In some cases boring locations were judgmentally re-spaced to evaluate settings and substrate associated with particular features, known locations of critical archaeological sites, and palaeoenvironmental settings that were both rich and varied, despite their burial beneath significant accumulations of fill. The primary archaeological sites in the area are the Mariners Harbor Site and the Old Place Site. These sites are described in more detail in Section 4.

Additional considerations for the coring strategy included questions of representative sampling and in-field circumstances such as accessibility and presence of buried contaminants. In all cases of re-spacings, resolution was obtained through negotiations with Spectra Energy and PAL. The boring locations and precise placements were mapped by a team of surveyors contracted by Spectra Energy. Most in-field adjustments to boring proveniences resulted in locational modification of no more than 1.5-3 m (5-10 feet) from the originally designated placements. Remote sensing for buried utilities or obstructions was conducted at testing localities by Spectra Subsurface Imaging, LLC of Latham, NY. Their surveys augmented background subsurface map reviews by utility companies, property owners, and utility identifications by the One-Call Service. Remote sensing provided an additional control delimiting the presence and orientation of subsurface utilities and features.

Subsurface excavation for the GRA study was performed by a Geoprobe™ boring device, operated by LAWES, Inc. of Center Moriches, NY. The Geoprobe™ is a hydraulically driven, mechanical track-mounted device that extracts cores that can be collected in stratigraphically intact sections within plastic sleeves. For the present set of cores, these sections were described and sampled in the field.

For this project, cores of approximately 6 cm (2.5 in) diameter were collected in 145 cm (5 ft) sections to depths of up to 6.1 m (20 ft) below ground surface. During the investigations, the upper 0.3-1.8 m (1-6 ft) of each boring was extracted with the use of a hand auger and soil-sediment descriptions were made directly (Figure 4). Hand augering for upper deposits resulted in more precise recovery and more detailed observations. More precise inspections of the soil and sediment properties enabled the geoarchaeologists to preview the composition of the topmost historic sediments.

Sequential recovery of segmented cores resulted in preservation of the key litho- and pedo-stratigraphic units. All primary depositional facies and soil (weathered) horizons were registered in our observations at recorded depths that very closely approximated actual thicknesses and vertical contexts.

Safety gear included the use of protective eye-wear, hard-hats, steel-toed boots, nitrile gloves, and reflective safety vests. A trained environmental geologist employed by TRC, Inc. took sediment samples for characterization of contaminants, and ran a photoionization detection (PID) meter over the samples to test for volatile organic compounds. The in-field examinations of the borings were guided by health and safety procedures regarding the handling and collection of the cores. For several cores in the present series, accommodations were made at a separate facility that allowed for storage of soils and sediments that registered above normal PID and contamination levels.

Inspection of the samples was performed in the field, together with photographic documentation and initial soil and sediment characterizations. Sampling for special analysis was performed under field conditions, although key specimens for dating and related analyses were identified, recorded, sampled and taken to the laboratory for detailed inspection and preparation for shipping to appropriate outside laboratory facilities. The cores were described using standardized pedo- and litho-stratigraphic terminology (ISSC 1994; USDA 1994). Samples of historic artifacts as well as soil samples for possible age determinations by radiometric analysis were collected. Upon full documentation of the cores and sample collection, the discarded sediment and soil fractions were returned to the core hole. Upon completion of the project, stored specimens are sampled and characterized for contaminants; they are ultimately transported to a disposal facility.

As noted above, full recovery from each core segment was rarely achieved. This is typical, as highly variable conditions of the substrate can result in inadvertent sediment loss upon recovery. These conditions include the presence of an elevated water table, uniquely unconsolidated sediments, and dramatic changes in sediment texture. Based on GRA’s general experience working with this technique (Schuldenrein 2006, 2007), as well as regional conditions, the team has developed a method for extrapolating both the thicknesses and depths of deposits.

Figure 4: Hand-clearing the upper 6 ft of a boring

4. PRELIMINARY RESULTS

In this round of field investigations, the two (2) cores are distributed along a segment of line extending east-west over a distance of 62 m (203 ft) (Figures 1 and 2). Both cores are contained within a surficial deposit of Artificial Fill (Figure 1), and at the edge of older *Saline or Estuarine Marsh Deposits* that developed along the coast during the mid-to-late Holocene (Figure 2). These cap *Lake, Ice-Contact, and Outwash Deposits*, which were laid down by pro-glacial and post-glacial lake sedimentation during the Late Pleistocene (< 18,000 B.P.). It is stressed that late Holocene fill seals in (and possibly truncates) the depositional matrices in all settings.

The cores are presented as a single group. Discrete stratigraphic transitions for an intact peat sequence (with significant organic matter content) were sampled for RCH-3-ARC-1 (n=4) and sent to Beta Analytic for ^{14}C analysis. RCH-3-ARC-2 did not contain materials suitable for dating. Documentation for these dates is presented in Appendix B. Lithostratigraphic descriptions of the cores with accompanying photographic documentation are presented in Appendix A.

Table 2 structures the dates by depth and source materials. As documented in previous reports, both individual peat mats and enveloping or underlying organic sediment matrices provided legitimate contexts for cross-dating specimens. Thus it was possible to determine the integrity and depositional processes associated with specific stratigraphic contexts and to develop accurate measures of chronology and landscape transformation.

New York City Economic Development Corp. (NYCEDC), Arlington Yard (RCH-3-ARC-1, RCH-3-ARC-2)

Cores RCH-3-ARC-1 and RCH-3-ARC-2 are located on an embankment, just south of the Conrail train tracks and north of Bridge Creek. The unpaved surface next to the road is scattered with large quantities of visible ceramic and glass sherds, as well as assorted construction debris. The area directly to the south is not considered sensitive, because culturally-sensitive surfaces are deeply buried beneath historic fills. However, these two cores are located on the northern edge of this excavated and filled area, where fills may not be as deep. The natural sediments below the artificial fill exhibit characteristics which make this area sensitive to pre- and post-contact resources (Elquiest et al. 2010:76-79). For example, previous fieldwork by GRA 100 m (330 ft) to the north encountered peat sequences spanning the entire duration of the Holocene, beneath the artificial fill cap (GRA 2012d).

The region is rich in pre- and post-contact archaeological sites. The cores lie 0.5 km (0.31 mi) to the east of the Middle-Late Archaic Old Place Site (HAA 1995; Louis Berger Group 2007: 83; Elquiest et al. 2010), and are less than 1 km (0.6 mi) to the southwest of the Archaic-Woodland period site of Mariners Harbor (Elquiest et al. 2010) (Figure 5). This area was also the site of significant post-contact activity. The present-day Coca Cola factory property (0.4 km/0.25 mi south of the project area) was the site of a series of Revolutionary War period skirmishes in 1777, and a British fortification or picket line (Elquiest et al. 2010). Although this part of Staten Island is considered to have high sensitivity for prehistoric resources and moderate sensitivity for historic resources, borings RCH-3-ARC-1 and RCH-3-ARC-2 are located on an artificial railroad embankment constructed from fill.

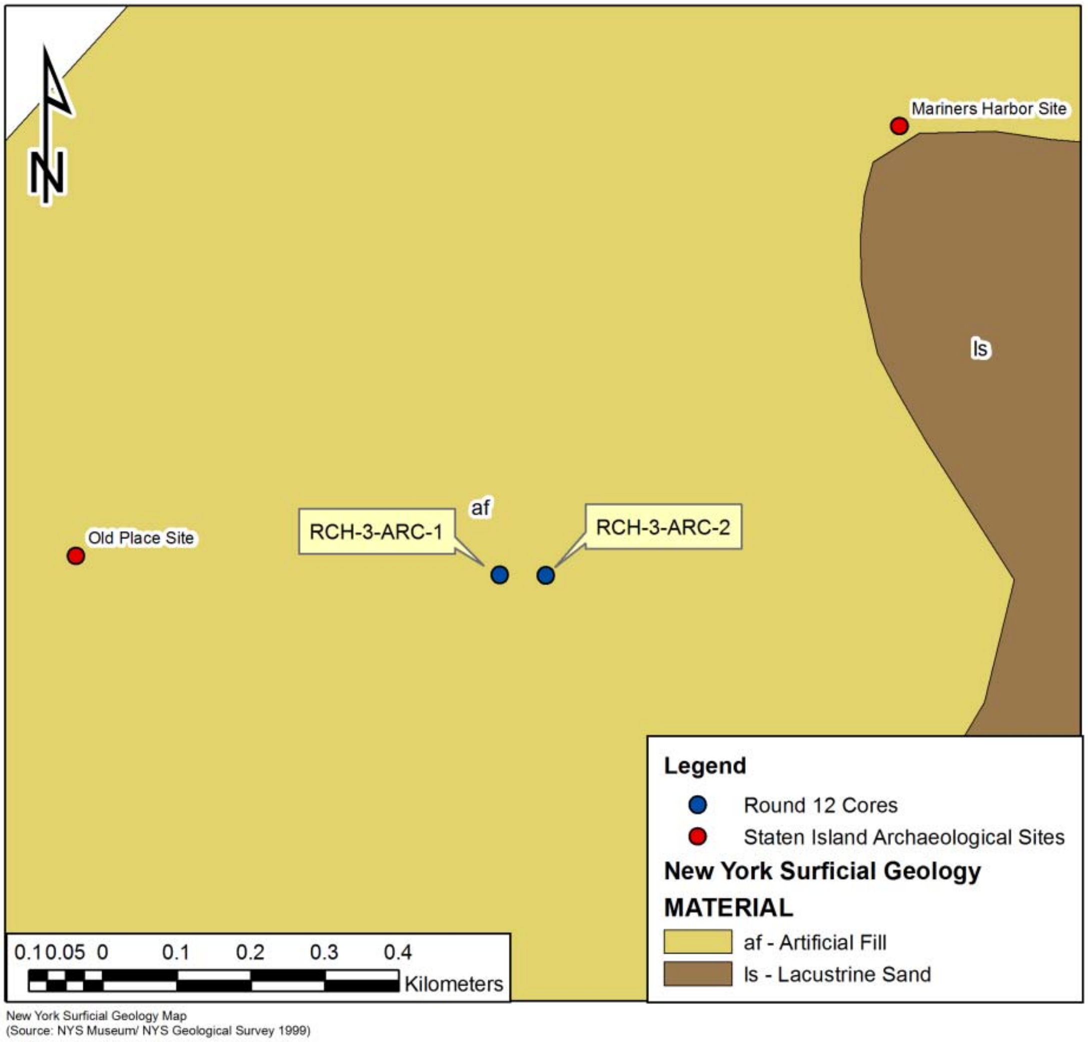


Figure 5: GRA Geoprobe locations in relation to locations of known archaeological sites.

Both RCH-3-ARC-1 and RCH-3-ARC-2 display a similar fill sequence over marsh deposits. Under an asphalt cap is 30.5-61 cm (1-2 ft) of dark brown (10YR 3/3) loose to very friable loamy sand with numerous 0.5-2 in pebbles (30-50% by volume) and a few brick and wood fragments. The fill changes character below this point, becoming a dark olive brown (2.5Y 3/3) to black (10YR 2/1), granular, loose-to-friable sandy silt loam with flaky burned material and common household debris (ceramic dish and cup fragments, and bottle glass) and construction debris (wood fragments, carbon rods, and window glass), as well as shell fragments and leather scraps. Some of the household items have diagnostic traits suggesting an early 20th century origin (Table 1 and Appendix C). This fill deposit begins at 61 cm (2 ft) bgs and continues to between 399.3-576.1 cm (13.1-18.9 ft) bgs. Despite the substantial size of this historic deposit, which measures up to 515 cm (16.8 ft) thick, there are no discrete strata.

In both cores, the fill caps peat. In RCH-3-ARC-2, this peat begins at 605 cm (19.8 ft) bgs and extends to the end of the core at 609.6 cm (20 ft) bgs. In RCH-3-ARC-1, the boring extends through the peat layer into underlying sands. In both cores, just above the peat and below the fill are a distinct 5 cm (2 in) of brown (10YR 4/3) very well-sorted, fine-grained, friable, weakly subangular blocky silty sand, becoming black (10YR 2/1) at the interface with the peat.

The peat in RCH-3-ARC-1 is black (10YR 2/1) to very dark brown (10YR 2/2), matted and fibrous, and extends from 399-481.6 cm (13.1-15.8 ft) bgs. A sample from 472.4 cm (15.5 ft) bgs returned ^{14}C dates of 3020 ± 30 BP (Beta-330954) for peat and 2600 ± 30 BP (Beta-331344) for organic sediment. Below the peat is a complex of sandy silt and silty sand to the end of the core. There is a clear transition from peat to 6 cm (2.4 in) of dark gray (2.5Y 4/1), friable, subangular blocky sandy silt at 481.6 cm (15.8 ft). At 487.7 cm (16 ft), this stratum, in turn, has a clear transition to 32 cm (1 ft) of black (10YR 2.5/1) friable, single-grain, very well-sorted, medium-grain sand with an organic silt component. This organic sediment returned a ^{14}C date of 3360 ± 30 BP (Beta-330955) at 512.1 cm (16.8 ft) bgs. At the base of this stratum, 1.5 cm (0.6 in) of very dark grayish brown (2.5Y 3/2) friable, single-grain, silty sand marks the transition to gleyed sediments. Between 521.2-576.1 cm (17.1-18.9 ft) bgs, there is a layer of dark greenish grey (GLEY 4/10GY), very well-sorted, medium, single grain silty sand. A sample spanning the transition from this layer to the basal stratum in the core (576-585 cm/18.9-19.2 ft bgs) returned a ^{14}C date of 8650 ± 40 BP (Beta-330956). This basal matrix consists of 33.5 cm (1.1 ft) of dark greenish grey (GLEY 4/10Y), well-sorted, friable, single grain blocky sand with no visible silt or inclusions.

The sequence of dates presented in Table 2 indicates an intact sequence. The slight disparity between the peat and sediment dates at 472 cm (15.5 ft) is not unusual, as root action within the peat mat redistributes material within the profile. The oldest material, at 576 cm (18.9 ft), is a well-sorted sand dating to the early Holocene.

Sample No.	Depth	Description	Notes	Estimated Age
RCH-3-ENV-2W (2)	4-5ft	white milk glass cosmetic jar	bottom embossed "[A]UBRY SISTERS AUG 22 1911"	1911+
RCH-3-ARC-2 (3)	surface	ceramic fragment	Hotel Astor transfer print	1905-1967
RCH-3-ARC-2 (5)	3-4ft	fragmented Chinese porcelain	green and red transfer print	Mid-18th century - present
RCH-3-ARC-2 (6)	3-4ft	window glass	starburst embossed pattern	Mid-19th century - present

Table 1: Diagnostic artifacts from NYCEDC property

	RCH-3-ARC-2	
depth	**peat**	**sediment**
472.4 cm	3020±30 BP (Beta-330954)	2600±30 BP (Beta-331344)
512.1 cm		3360±30 BP (Beta-330955)
576 cm		8650±40 BP (Beta-330956)

Table 2: Conventional radiocarbon dates for RCH-3-ARC-2

5. GEOARCHAEOLOGICAL INTERPRETATIONS AND RECOMMENDATIONS

RCH-3-ARC-1 and RCH-3-ARC-2 reflect the full range of expected geological units for the area. Both cores contain a substantial cap of *Artificial Fill* (Figure 1). A cosmetic jar from this mantle of fill securely dates some of the debris to 1911 or shortly thereafter (Appendix C: Figures 6 and 7). The fill caps late Holocene *Saline or Estuarine Marsh Deposits* (Figure 2). Calibrated radiocarbon dates indicate that these wetlands came into existence between Cal ^{14}C BP 3340 – 2720 BP (Appendix B). The peat formed on top of older *Lake, Ice-Contact, and Outwash Deposits* (Figure 2). A sample of this sediment indicates that the upper layers of this deposit formed in the early Holocene (Cal ^{14}C BP 9690 to 9540), after the glacial retreat (Appendix B). A thin band of well-sorted sand on top of the peat appears to be a nearshore deposit, and reflects inundation of the peat marsh by rising sea levels prior to land-filling. GRA has noted similar late Holocene wetland inundation events in nearby Hudson County, NJ (GRA 2012h).

The historic fill in both cores is relatively homogeneous, with debris-rich ashy material beneath a surface cap of gravel fill. No discrete fill events are visible in the borings, apart from these two broad categories. However, the provenience of the historic debris is of primary importance when assessing the sensitivity of this segment of pipeline corridor. Certain diagnostic items suggest a Manhattan origin for much of the waste: the Aubry Sisters cosmetic jar (West 2nd Street in Manhattan) and the Hotel Astor plate (on Times Square in Manhattan). It appears that the railroad embankment was built from early 20th century urban Manhattan waste that was re-purposed as construction fill. Staten Island has long served as a dump for waste from the New York metropolitan area, but additional archival research may rule out the possibility that the waste came from local Staten Island households with strong ties to urban Manhattan.

Beneath the fill, ^{14}C dates reflect an intact sequence of early-mid Holocene post-glacial sedimentation and late Holocene wetland formation. GRA identified a similar depositional sequence 100 m (328 ft) to the north, on the north side of the Conrail embankment (GRA 2012d). Although the wetlands post-date the Archaic occupation in the area, they would have been present during the Woodland period occupation at Mariners Harbor. However, no elevated non-fill surfaces are present along this particular segment of line, so it is unlikely that prehistoric archaeological sites will be impacted by pipeline construction on this property.

> *RCH-3-ARC-1 preserves an intact sequence of post-glacial shore facies and fluvial deposits and late-Holocene salt marsh deposits spanning the years Cal ^{14}C BP 9690-2720, at a depth of 394.7 cm (12.9 ft) bgs (Table 2). Adjacent elevated ground would be a likely location for Woodland period prehistoric cultural resources. If naturally-elevated ground (underlain by an intact glacial or deltaic landform) is present along the pipeline footprint in this area, deep testing of the elevated area is recommended. It is critical to establish the presence and age of intact surfaces or buried soils that may have supported human occupation near the wetland.*

A suite of palaeoenvironmental tests should be performed together with radiometric dating. Palaeoenvironmental reconstructions should focus on sedimentology, micromorphology, pollen studies, and palaeobotanical identification of plant remains.

RCH-3-ARC-2 consists of relatively homogeneous fill that nevertheless contains diagnostic items dating to the early 20th century (Table 1 and Appendix C). This material may be re-deposited from a Staten Island-based dump used by Manhattan residents. However, it is also possible that the fill was excavated from a dump used by local Staten Island settlements, and would reveal information about local household activities. In either case, the original context of the material appears to have been disturbed. This area warrants additional testing in order to establish the nature of the historic deposits. Prehistoric deposits are unlikely to be impacted, as the peat in this core is deeply buried (605 cm/19.8 ft bgs).

Table 3: Summary of archaeological recommendations: NYCEDC property

Property	Core No.	Sensitivity Assessment	Preliminary Analysis Information			Comments
			Contamination (No Further Work)	Modern Fill = 15 ft BS (No Futher Work)	Modern Fill/ Historic Strata = 15 ft BS (Further Work)	
NYCEDC	RCH-3-ARC-1	Moderate for prehistoric resources; low for historic resources				0-399.288 cm: fill of SSi with gravel, wood frags, ceramic, glass; 399.288-481.584 cm: peat marsh deposit of SiO matted, fibrous, well preserved peat; 481.584-487.69 cm: estuarine deposit SSi to SiS, med v. well sorted quartz sand; 487.68-609.6 cm: shoreline deposit, SiS med, v. well sorted quartz sand
NYCEDC	RCH-3-ARC-2	Low for prehistoric resources; moderate for historic resources			Present	0-600.456 cm: fill of SiO, flaky cinders, coal, terra cotta, leather, shell, brick; 600.456-605.028 cm: shoreline deposit, SiS, v. fine, v. well sorted sand transitioning downward to med., sorted sand; 605.028-609.6 cm: peat marsh deposit, SiO, matted, fibrous, well preserved peat

Table 4: Assessments of Archaeological Significance and Follow-up Testing

	RELATIVE AGE YOUNGEST → OLDEST									
	POTENTIALLY ARCHEOLOGICALLY SENSITIVE									
		HOLOCENE								
Core	Deep/ Mixed Fill	Discrete Fill	Buried Soil	Marsh/ Peat	Shore facies	Till	Proximity to known Arc sites*	RC Dates	SIGNIFICANT (x/-)	COMMENTS
RCH-3-ARC-1[1]	NO	NO	NO	YES	YES	NO	YES	YES	x	Fill with wood, rubber, glass, over peat from 399-488 cm, over shore facies to 610 cm
RCH-3-ARC-2	YES	NO	NO	YES	NO	NO	YES	NO	x	Fill with early 20th c household debris over peat at 605 cm

[1]sampled for radiocarbon date

*within ~1.0 km

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Appendix A: Core Photographs and Descriptions

RCH-3-ARC-1

6’ - 10’
(1.82m - 3.04m)
10’ - 15’
(3.04m - 4.57m)
15’ - 20’
(4.57m - 6.09m)
.25
.5
.75
1
Meters
0
1.25
2.5
3.75
5 Feet

RCH-3-ARC-1

Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
FILL	0-30.5	30.48	Ap1	10YR 2/1	asphalt	abk	vfi	c	asphalt
	30.5-60.9	30.48	Ap2	10YR 5/3	SG	gr	l	c	milled wood board, poorly sorted, subangular fine to coarse sand; gravel is subrounded and 50-70%
	60.9-91.4	30.48	Ap3	10YR 3/2	SSiL	gr	fri	g	10% subangular gravel, wood fragments, moist
	91.4-121.9	30.48	Ap3	2.5Y 4/3	SSiL	gr	fri	g	sticky, some clay, wood fragments, bottle mouth, ceramic, glass, very wet
	121.9-152.4	30.48	Ap3	2.5Y 3/3	SSiL	gr	fri	g	wet, oozy, rubber (10cm, white)
	152.4-182.9	30.48	Ap3	2.5Y 3/3	SiSO	gr	fri	g	wood fragments, glass, ceramic fragments, very wet
MISSING	182.9-280.4	97.536	n/a						
FILL	280.4-304.8	24.384	Ap4	10YR 2/1	SSiL	sbk	fri	n/a	slag, wood fragments
MISSING	304.8-391.7	86.868	n/a						

Continued on next page

Texture: Si=silt; L=loam; C=clay; S=sand; G=gravel; O=organic

Structure: 1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
sg=single grain; gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky;
pr=prismatic; pl=platy; dist=disturbed/no structure

Consistence: fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky

Boundary Distinctness: a=abrupt; c=clear; d=diffuse; g=gradual; s=sharp

Boundary Topography: w=wavy; s=smooth; a=abrupt

RCH-3-ARC-1, continued

Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
FILL	391.7-394.7	3.048	Ap4	10YR 2/1	SiSL	gr	fri	a	petrol smell, wood fragments, very wet, some gravel (up to 1in),
SHORE FACIES	394.7-396.2	1.524	1C1	10YR 3/2	SSi	sbk	p	a	
	396.2-399.3	3.048	1C2	10YR 2/1	SSi	sbk	fri	c	
PEAT MARSH	399.3-457.2	57.912	O1	10YR 2/1	SiO	sbk	fri	c	peat, matted and fibrous, well preserved
	457.2-481.6	24.384	O2	10YR 2/2	SiO	sbk	fi	c	matted and fibrous peat, nearly platy; **3020 ± 30 BP (Beta-330954) for peat and 2600 ± 30 BP (Beta-331344) for organic sediment at 472 cm**
ESTUARINE DEPOSIT	481.6-487.7	6.096	2C1	2.5Y 4/1	SSi	sbk	fri	c	plastic
SHORE FACIES	487.7-519.7	32.004	2C2	2.5Y 2.5/1	SiS	sg	fri	c	med, v. well sorted, subangular, quartz sand; **3360 ± 30 BP (Beta-330955) at 512 cm**
	519.7-521.2	1.524	2C3	2.5Y 3/2	SiS	sg	fri	c	
	521.2-576.1	54.864	2C4	GLEY 4/10GY	SiS	sg	fri	c	med, v. well sorted quartz sand, little silt, wet (<18.9ft), moist (>18.9ft)
	576.1-609.6	33.528	2C5	GLEY 4/10Y	S	sg	fri	n/a	med, well sorted sand, no silt, moist, firm but friable; **8650 ± 40 BP (Beta-330956) at 576 cm**

Texture: Si=silt; L=loam; C=clay; S=sand; G=gravel; O=organic
Structure: 1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
sg=single grain; gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky;
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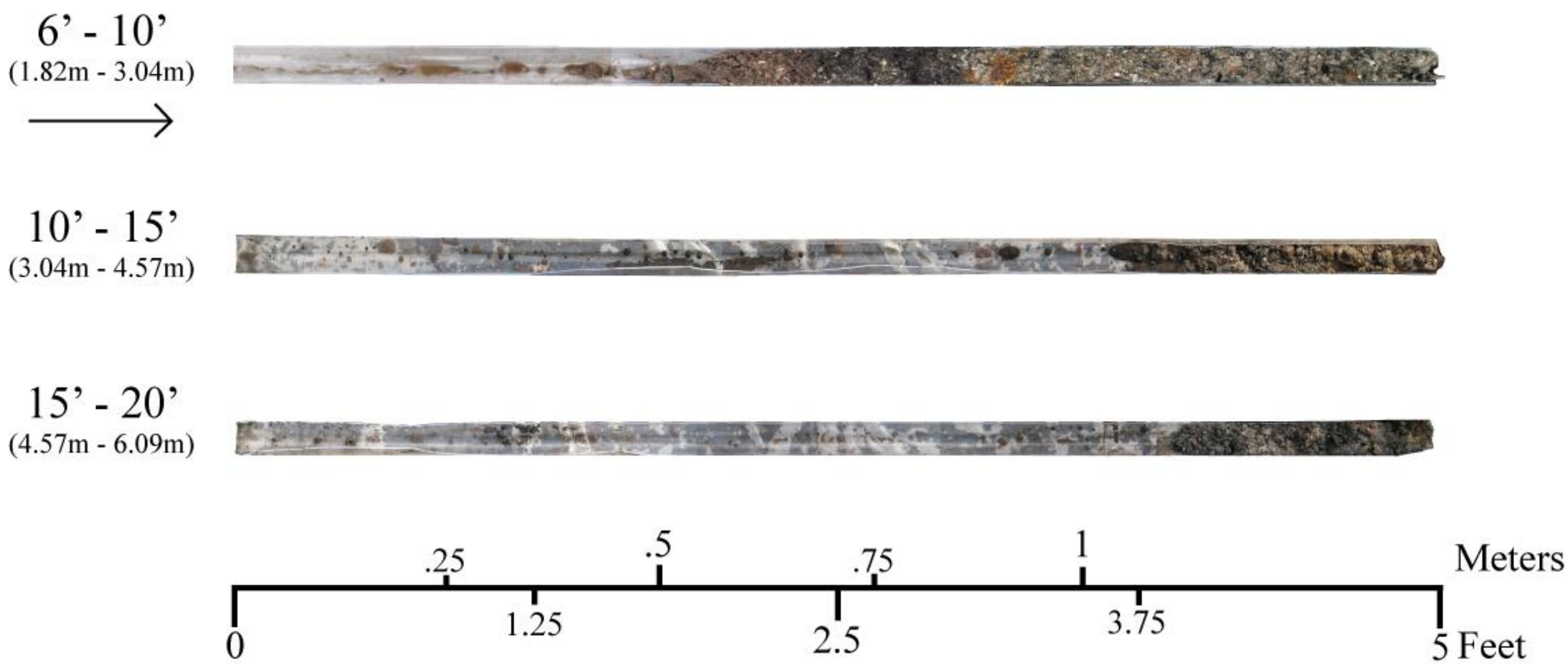
Consistence: fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness: a=abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography: w=wavy; s=smooth; a=abrupt

RCH-3-ARC-2



6’ - 10’
(1.82m - 3.04m)
10’ - 15’
(3.04m - 4.57m)
15’ - 20’
(4.57m - 6.09m)
.25
.5
.75
1
Meters
0
1.25
2.5
3.75
5 Feet

RCH-3-ARC-2

Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
FILL	0-30.5	30.48	Ap1	10YR 3/3	LS	gr	l	g	4cm gravel about 30%, brick fragments
	30.5-60.9	30.48	Ap1	10YR 3/3	LS	gr	v. fri	g	sorted, rounded sand, carbon rod, glass
	60.9-91.4	30.48	Ap2	10YR 3/2	SiLO	gr	l	g	flaky burned material, burnt shell, slag, brick, leather
	91.4-182.9	91.44	Ap2	10YR 3/2	SiLO	gr	l	g	flaky burned material, ash, some gravel (10%), terra cotta, painted ceramic (porcelain), pressed glass, glass, shell, brick, teacup handle, reddish oxidized material
MISSING	182.9-251.5	68.58	n/a						
FILL	251.5-256	4.572	Ap2	10YR 3/2	SiO	gr	l	c	flaky burned material, coal fragments, terra cotta, burnt shells
	256-268.2	12.192	Ap2	10YR 2/1	SiO	gr	v. fri	a	silty ash, flaky
	268.2-304.8	36.576	Ap2	10YR 4/2	SiO	gr	v. fri	n/a	nodule of oxidized material (7.5YR 3/4) from 8.9-9.0 ft
MISSING	304.8-419.1	114.3	n/a						

Continued on next page

Texture: Si=silt; L=loam; C=clay; S=sand; G=gravel; O=organic
Structure: 1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
sg=single grain; gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky;
pr=prismatic; pl=platy; dist=disturbed/no structure
Consistence: fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness: a=abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography: w=wavy; s=smooth; a=abrupt

RCH-3-ARC-2, continued

Unit	Depth (cm)	Thickness (cm)	Soil Horizon	Munsell Color	Texture	Structure	Consistence	Boundary	Comments
FILL	419.1-457.2	38.1	Ap2	10YR 4/2	SiO	gr	v. fri	n/a	more wet than above, otherwise the same, slag, shell, metal
MISSING	457.2-576.1	118.872	n/a						
FILL	576.1-600.5	24.384	Ap2	10YR 3/1	SiO	gr	v. fri	c	very wet, glass fragment
SHORE FACIES	600.5-602	1.524	1C1	10YR 4/3	SiS	sg	fri	a	very fine grained, v. well sorted, well rounded, plastic, 1sbk
	602-605	3.048	1C2	10YR 2/1	SiS	sbk	v. fri	a	medium, sorted, silty sand, wet
PEAT MARSH	605-609.6	4.572	O1	2.5Y 3/2	SiO	gr	fri	n/a	matted and fibrous peat, well preserved

Texture: Si=silt; L=loam; C=clay; S=sand; G=gravel; O=organic
Structure: 1=weak; 2= moderate; 3=strong; f=fine; m=medium; c=coarse
sg=single grain; gr=granular; mass=massive; strat=stratified; sbk=subangular blocky; ab=angular blocky;
pr=prismatic; pl=platy; dist=disturbed/no structure
Consistence: fri=friable; sl=slightly; v=very; l=loose; fi=firm; h=hard; st=sticky; ss=strongly sticky
Boundary Distinctness: a=abrupt; c=clear; d=diffuse; g=gradual; s=sharp
Boundary Topography: w=wavy; s=smooth; a=abrupt

Appendix B: Radiocarbon Results

Sample No. RCH-3-ARC-1 (3) organic sediment

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-27.1:lab. mult=1)

Laboratory number: **Beta-331344**

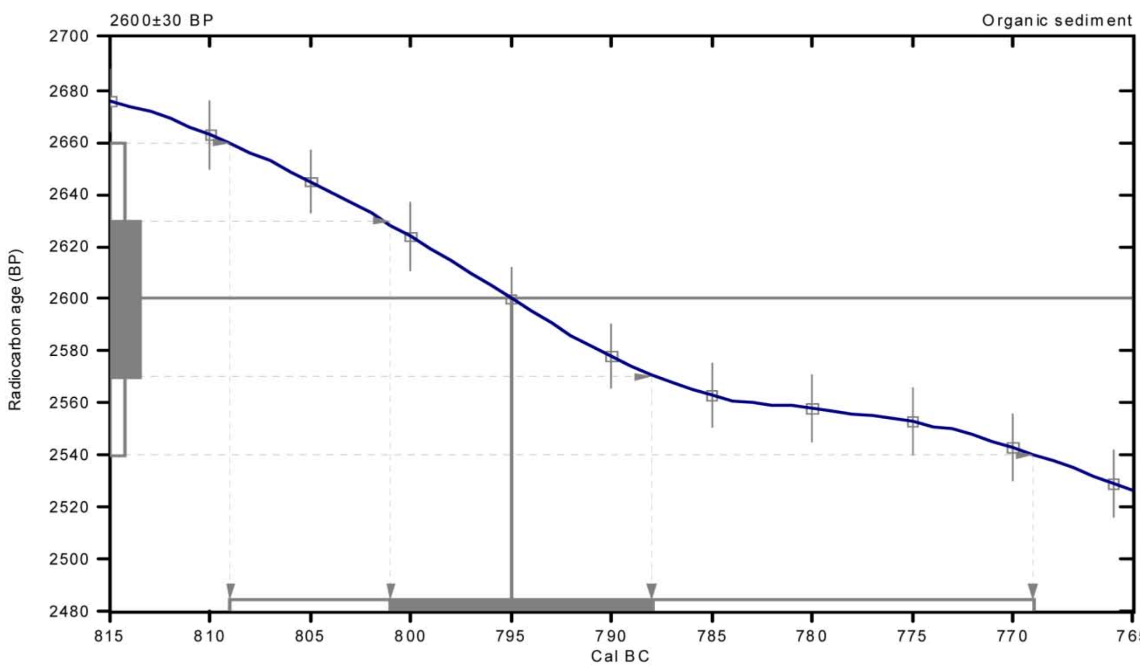
Conventional radiocarbon age: **2600±30 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 810 to 770 (Cal BP 2760 to 2720)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 800 (Cal BP 2740)

1 Sigma calibrated result: (68% probability) Cal BC 800 to 790 (Cal BP 2750 to 2740)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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Sample No. RCH-3-ARC-1 (3) peat

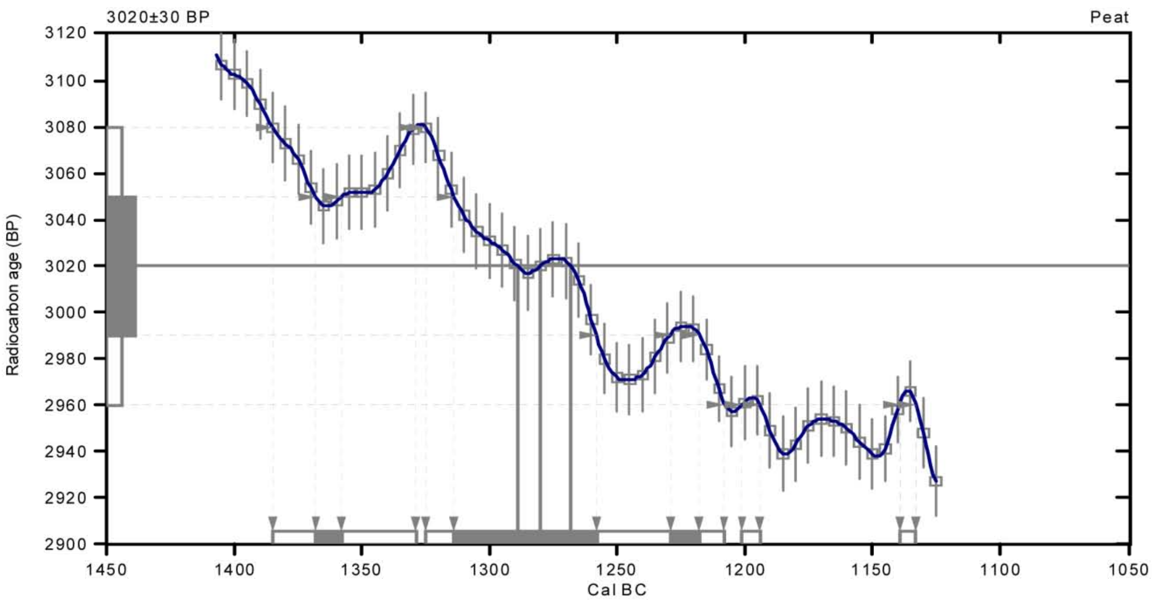
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-27.3:lab. mult=1)

Laboratory number:	**Beta-330954**
Conventional radiocarbon age:	**3020±30 BP**
2 Sigma calibrated results: (95% probability)	**Cal BC 1380 to 1330 (Cal BP 3340 to 3280) and Cal BC 1320 to 1210 (Cal BP 3280 to 3160) and Cal BC 1200 to 1190 (Cal BP 3150 to 3140) and Cal BC 1140 to 1130 (Cal BP 3090 to 3080)**

Intercept data

Intercepts of radiocarbon age with calibration curve:	Cal BC 1290 (Cal BP 3240) and Cal BC 1280 (Cal BP 3230) and Cal BC 1270 (Cal BP 3220)
1 Sigma calibrated results: (68% probability)	Cal BC 1370 to 1360 (Cal BP 3320 to 3310) and Cal BC 1310 to 1260 (Cal BP 3260 to 3210) and Cal BC 1230 to 1220 (Cal BP 3180 to 3170)



References:

Database used
INTCAL09

References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario
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Sample No. RCH-3-ARC-1 (5) organic sediment

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-26.9:lab. mult=1)

Laboratory number: **Beta-330955**

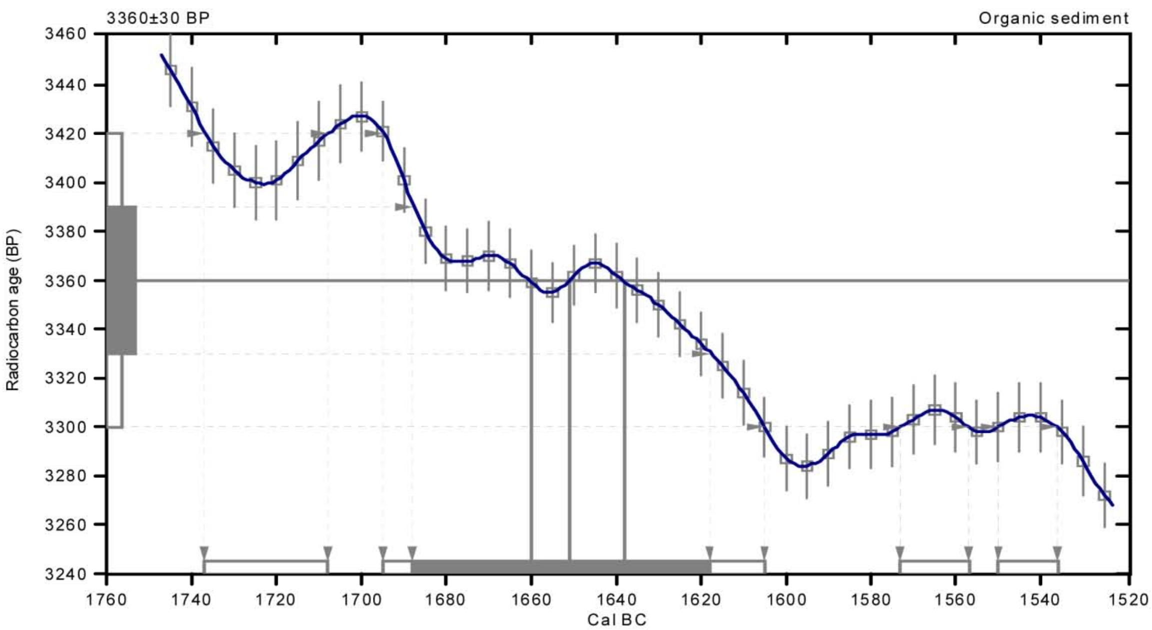
Conventional radiocarbon age: **3360±30 BP**

2 Sigma calibrated results: (95% probability) **Cal BC 1740 to 1710 (Cal BP 3690 to 3660) and Cal BC 1700 to 1600 (Cal BP 3640 to 3560) and Cal BC 1570 to 1560 (Cal BP 3520 to 3510) and Cal BC 1550 to 1540 (Cal BP 3500 to 3490)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal BC 1660 (Cal BP 3610) and Cal BC 1650 (Cal BP 3600) and Cal BC 1640 (Cal BP 3590)

1 Sigma calibrated result: (68% probability) Cal BC 1690 to 1620 (Cal BP 3640 to 3570)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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Sample No. RCH-3-ARC-1 (7) organic sediment

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-26.8:lab. mult=1)

Laboratory number: **Beta-330956**

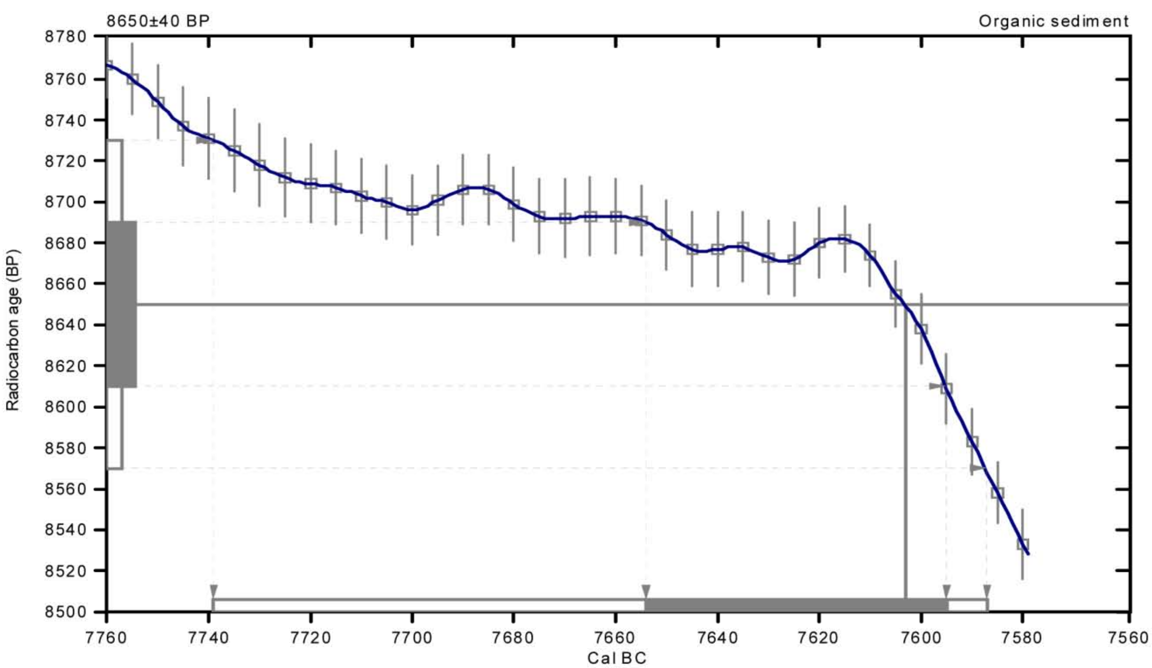
Conventional radiocarbon age: **8650±40 BP**

2 Sigma calibrated result: **Cal BC 7740 to 7590 (Cal BP 9690 to 9540)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 7600 (Cal BP 9550)

1 Sigma calibrated result: Cal BC 7650 to 7600 (Cal BP 9600 to 9540)
(68% probability)



References:

Database used
INTCAL09

References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario
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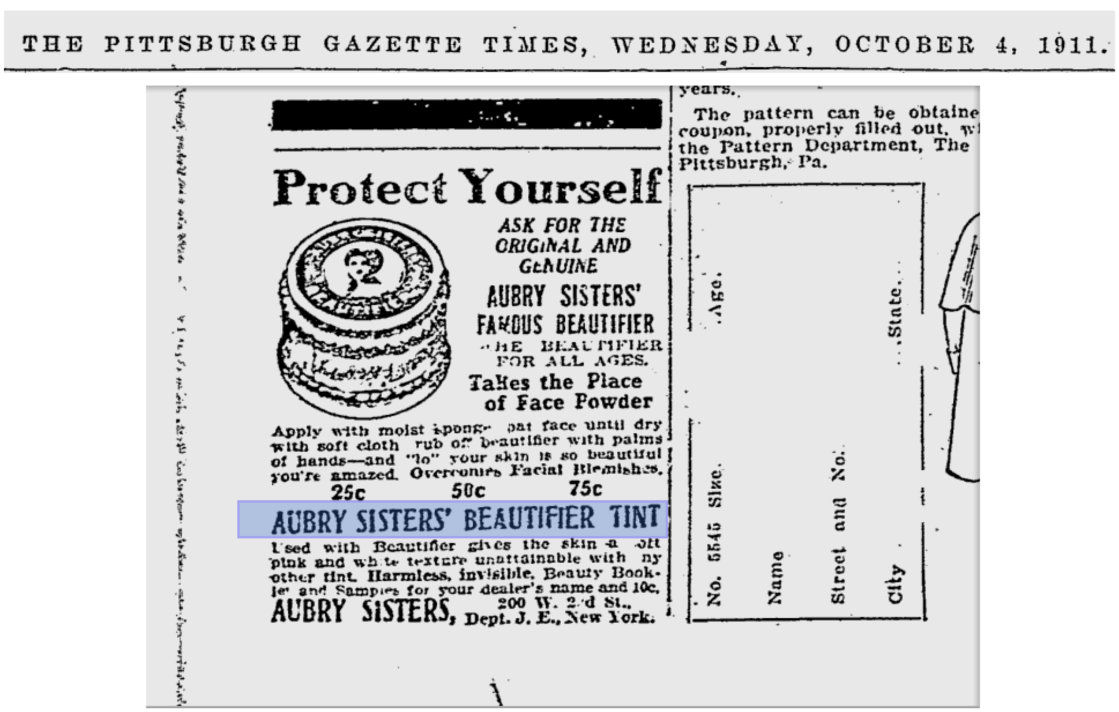
Appendix C: Artifact Photographs

Figure 6: Artifact No. RCH-3-ENV-2W (2)

Figure 7: Detail of Artifact No. RCH-3-ENV-2W (2)



THE PITTSBURGH GAZETTE TIMES, WEDNESDAY, OCTOBER 4, 1911.

Protect Yourself

ASK FOR THE ORIGINAL AND GENUINE

AUBRY SISTERS' FAMOUS BEAUTIFIER

THE BEAUTIFIER FOR ALL AGES.

Takes the Place of Face Powder

Apply with moist sponge pat face until dry with soft cloth rub off beautifier with palms of hands—and "lo" your skin is so beautiful you're amazed. Overcomes Facial Blemishes.

25c 50c 75c

AUBRY SISTERS' BEAUTIFIER TINT

Used with Beautifier gives the skin a soft pink and white texture unattainable with any other tint. Harmless, invisible. Beauty Booklet and Samples for your dealer's name and 10c.

AUBRY SISTERS, 200 W. 2'd St., Dept. J. E., New York.

years.

The pattern can be obtaine coupon, properly filled out, w the Pattern Department, The Pittsburgh, Pa.

No. 5545 Size. ....Age.

Name

Street and No.

City .... State....

Figure 8: Aubry Sisters advertisement from the Pittsburgh Gazette Times, 10/4/1911 (source: Google News Archive)

Figure 9: Artifact No. RCH-3-ARC-2 (3)

Figure 10: Detail of Artifact No. RCH-3-ARC-2 (3)

Figure 11: Hotel Astor plate (1905), housed at Minneapolis Institute of Arts (source: http://www.artsconnected.org/resource/50513/plate-from-the-hotel-astor-new-york-city). Note that design on Arlington Yard sherd is slightly different, and may represent a later variation.

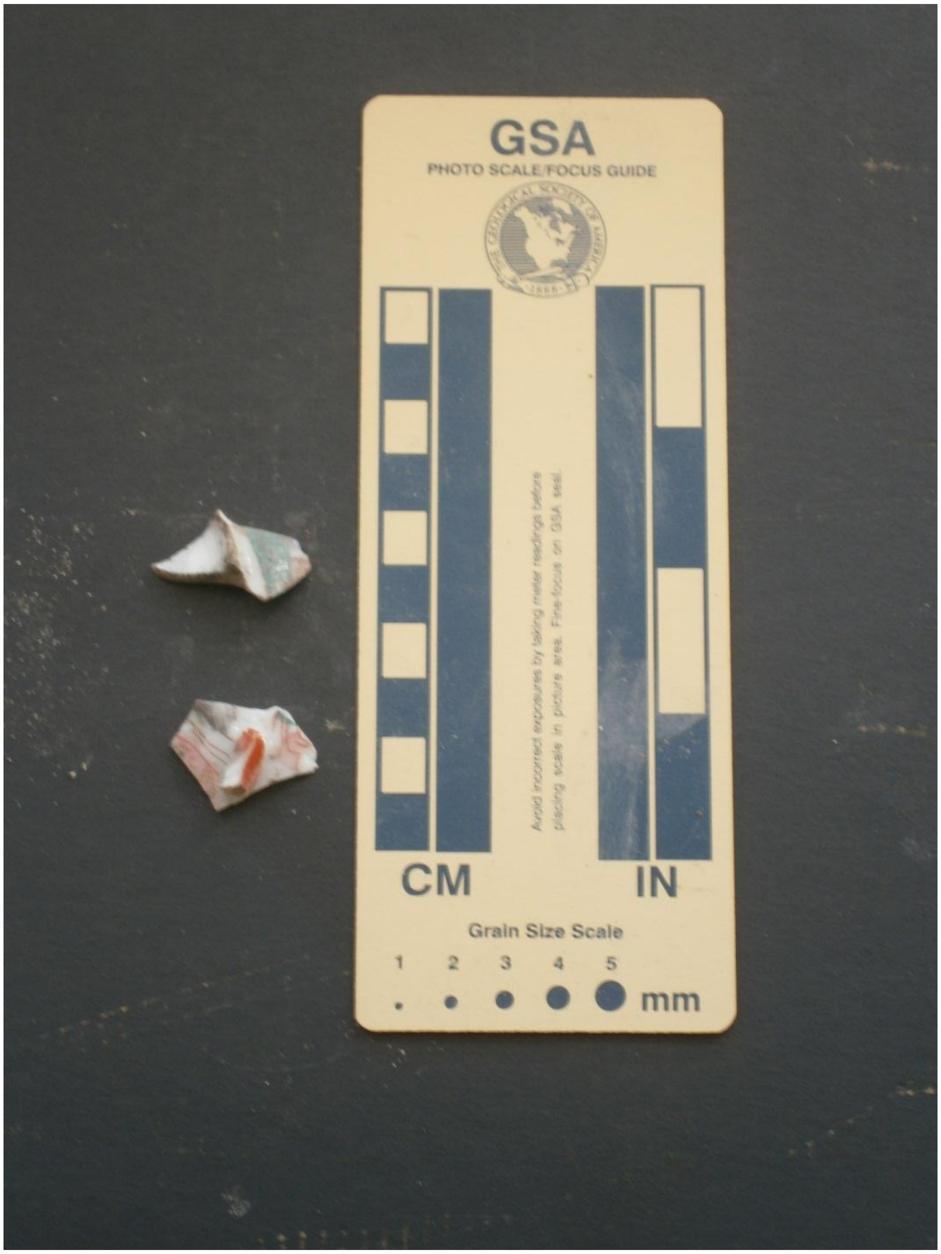


Figure 12: Artifact No. RCH-3-ARC-2 (5)

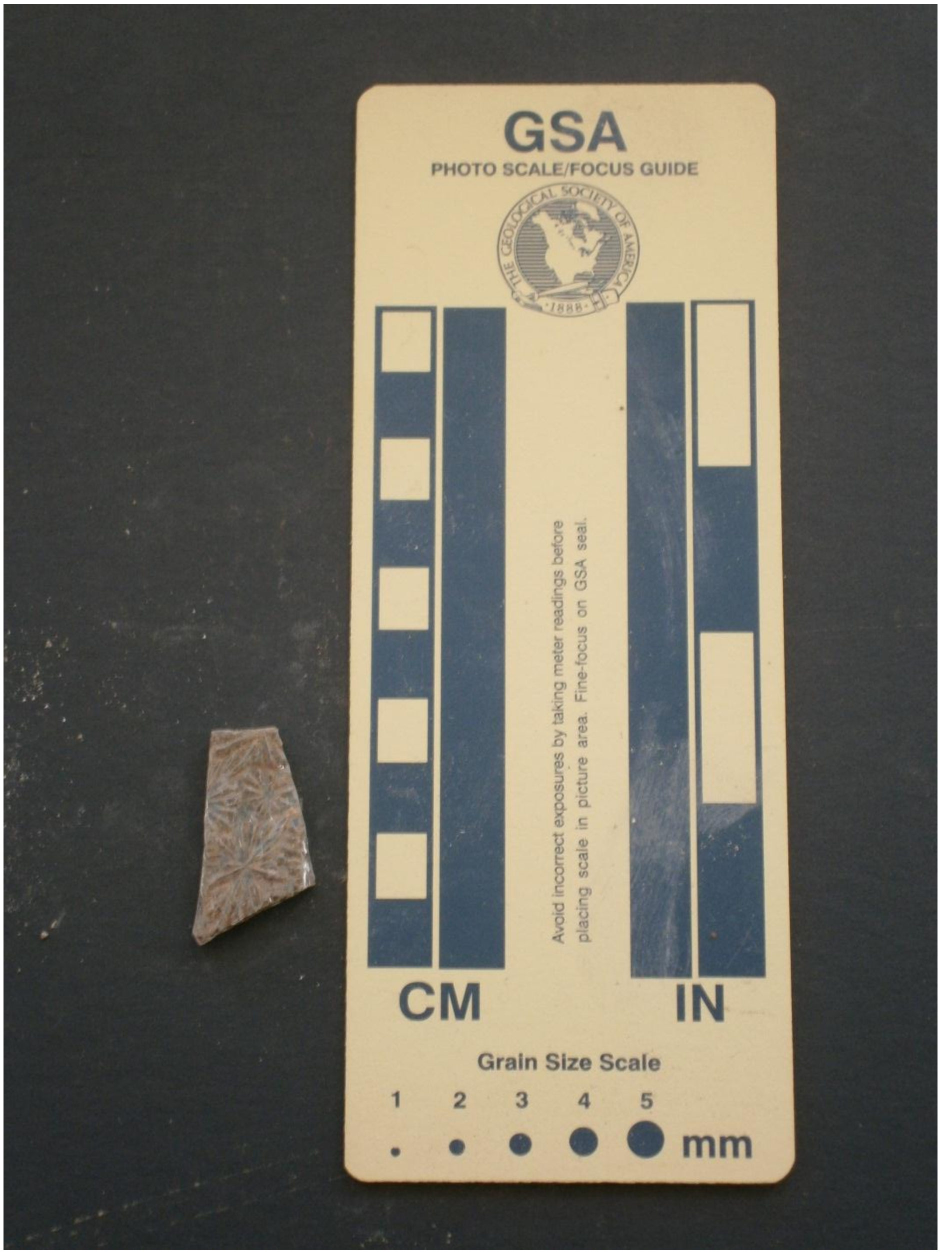


Figure 13: Artifact No. RCH-3-ARC-2 (6)