HISTORICAL PERSPECTIVES INC.

Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

DDC # SANDRESM1
NYSOPRHP # 15PR02961
LPC # DDC / SANDRESM1
CEQR # 15DPR013M

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Prepared For:

NYC DDC Department of Design and Construction

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February 2016

MANAGEMENT SUMMARY

SHPO Project Review Number (if available): **15PR02961**

Involved State and Federal Agencies: **United States Department of Housing and Urban Development, Community Development Block Grant Disaster Recovery**

Phase of Survey: **Phase IA Archaeological Documentary Study**

Location Information

Location: **East 23rd Street to East 25th Street at between Asser Levy Place and FDR Drive**
Minor Civil Division: **06101**
County: **New York**

Survey Area

Length: **Varies**
Width: **Varies**
Number of Acres Surveyed: **ca. 3.5**

USGS 7.5 Minute Quadrangle Map: **Brooklyn**

Archaeological Survey Overview

Number & Interval of Shovel Tests: **N/A**
Number & Size of Units: **N/A**
Width of Plowed Strips: **N/A**
Surface Survey Transect Interval: **N/A, urban area**

Results of Archaeological Survey

Number & name of precontact sites identified: **None**
Number & name of historic sites identified: **None**
Number & name of sites recommended for Phase II/Avoidance: **None**

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Date of Report: **February 2016**

EXECUTIVE SUMMARY

The proposed East Side Coastal Resiliency (ESCR) project is designed to reduce the risks to Manhattan's East Side from extreme weather and climate change, as well as improve quality of life. This project focuses on neighborhoods along the East River waterfront between Montgomery and East 23rd Streets (and, in one alternative up to East 25th Street). The proposed project will require ground disturbance within two defined locations, the Project Area One and Project Area Two corridors (the project site). Project Area One includes the southern section of the project site, from Montgomery Street north to East 13th Street, including portions adjacent to Pier 42 and all of East River Park. Project Area Two includes the northern section of the project site, from East 13th Street north to East 23rd Street (and, in one alternative up to East 25th Street), including Captain Patrick J. Brown Walk and Stuyvesant Cove Park. The FDR Drive runs through both of these two Project Areas, with pedestrian bridges over the FDR Drive connecting to locations west of the FDR Drive.

The New York City Office of Management and Budget and the New York City Department of Parks & Recreation consulted with the New York City Landmarks Preservation Commission (LPC) and the State Historic Preservation Office (SHPO) (also known as the New York State Office of Parks, Recreation, and Historic Preservation or NYSOPRHP) and received correspondence indicating that the project site requires an Archaeological Documentary Study (LPC 6/10/15). Similarly, SHPO has determined that the project area is archaeologically sensitive and a Phase IA archaeological study is required.

The first task in response to LPC and SHPO comments was to narrow the project site to establish the Area of Potential Effect (APE), defined as those locations that have potential archaeological sensitivity and that will experience either direct or indirect impacts. The established APE would then be subjected to the more comprehensive Phase IA Archaeological Documentary Study. The scope for establishing the APE was developed in consultation with LPC and SHPO (Sutphin 7/9/15, 8/10/15; Perazio 7/20/15).

In October 2015, Historical Perspectives, Inc. (HPI) completed the requested report, *Refinement of Archaeological Area of Potential Effect, East Side Coastal Resiliency Project, Montgomery Street to East 25th Street, Manhattan, New York County, New York*. The APE refinement report indicated that two portions of the overall ESCR project site should be subjected to Phase IA Archaeological Documentary Studies: the section from Montgomery Street to Rivington Street in Project Area One, and the section from East 23rd Street to East 25th Street in Project Area Two. These recommended studies would focus on historic period archaeological resources; no precontact period sensitivity was identified for any areas. The APE refinement report was submitted to, and accepted by, both the LPC and the SHPO (Sutphin 10/30/15; Perazio 12/10/15).

The present report constitutes the required Phase IA Archaeological Documentary Study for the section of the ESCR project from East 23rd Street to East 25th Street in Project Area Two (Figures 1, 2, and 3).[1] The companion study for the section from Montgomery Street to Rivington Street in Project Area One will be addressed in a separate report. This report satisfies the requirements of SEQRA/CEQR, and complies with the standards of the NYSOPRHP and the LPC (New York Archaeological Council 1994; NYSOPRHP 2005; LPC 2002; CEQR 2014).

This Phase IA Archaeological Documentary Study has shown that the entire APE was once under the water of the East River, and was landfilled at various times between the 1830s and the 1940s, with city streets created to separate and define newly formed blocks. Both East 23rd Street and East 24th Street began as piers and were later filled in to create streets. It is possible that remains of these piers, and possibly the former ferry house at the intersection of East 23rd Street and Avenue A, may still exist beneath the present streetbeds and sidewalks of these two streets. There is little likelihood that any potential resources from the 1830s-1850s House of Refuge complex could be located within the APE, as they were situated on the block immediately west of Avenue A/Asser Levy Place. The section of East 23rd Street between Avenue A and First Avenue originally was included within the APE, but has since been eliminated.

[1] At the time that the APE refinement report was completed, the section of East 23rd Street extended as far west as First Avenue. Since that time, the APE has been reduced and the section of East 23rd Street now extends only to the west side of the former Asser Levy Place (the roadway was discontinued in 2013). This report therefore addresses the section of East 23rd Street from the FDR Drive west to Asser Levy Place only.

There are a number of project Alternatives proposed for the East Side Coastal Resiliency project site. The Preferred Alternative has not yet been selected, and plans for each Alternative may still be changed. However, there are certain elements that apply to all the Alternatives. Namely, all of the Alternatives contain a combination of components including Engineered Berms, Floodwalls, and Deployable Systems. For each of these components, proposed excavation would extend ca. 2-4 feet below the existing grade for construction of the component base and pile caps, with sheet piles driven mechanically to ca. 40 feet below grade. It is expected that archaeological testing or monitoring would only be possible for the upper 2-4 feet of component installation. The sheet pile driving would not allow any visibility of subsurface conditions. The only two project locations that may provide more wide scale excavation windows would be the locations slated for utility work.

There have been several previous archaeological studies within and adjacent to the APE that have identified broad categories of potential historic period archaeological resources. These include those for the East River Waterfront Esplanade and Piers by HPI (2007a, 2007b) and recently for the reconstruction of Pier 42 AKRF (2015), which encompassed areas from Montgomery Street to east of Jackson Street south of the FDR Drive. The above studies have been submitted to, and accepted by, regulatory agencies. Therefore, to retain parity, the same broad resource categories are addressed below. Prior disturbance and archaeological sensitivity are addressed within each resource category.

River bottom remains

River bottom remains are those items discarded onto the river floor prior to or during landfilling. It is possible that archaeologically sensitive deposits are present on the river bottom within the APE. However, there are no construction activities within the APE that could affect potential river bottom remains.

Landfill retaining structures and landfill deposits (including sunken vessels)

Landfill retaining structures can include repurposed historic piers, wharves, and docks, as well as timber structures built specifically for retaining fill, sometimes also referred to as bulkheads. At times, derelict maritime vessels also were used both as landfill retaining structures or part of the landfill. Landfill by nature contains soil, but also may include concentrations of artifacts or other refuse material, such as ash, sometimes referred to as "cinders" in early soil boring logs.

Because the entire APE was once under water, there is potential for the presence of archaeologically sensitive historic landfill retaining structures from the first half of the nineteenth century along East 23rd Street and East 25th Street, as shown on Figure 15. The remainder of the APE was landfilled after this period.

Current plans indicate that the majority of project related impacts would only extend ca. 2-4 feet below the existing ground surface. It is possible that landfill retaining structures could be found within this upper reach of the soil column, as was the case at Burling Slip, where resources were found beginning at two feet below the current grade. However, previous archaeological investigations at other locations along the East River suggest that most of these resources are located deeper in the ground. Although the sheet pile driving will extend through areas more likely to contain these resources, it will not be possible to observe these areas due to the means of installation.

Historic streetbed resources (utilities, transportation elements, artifact deposits)

The APE contains portions of East 23rd, East 24th, and East 25th Streets. The street segments began as piers: East 23rd and East 25th Streets in the late 1830s and East 24th Street in the 1870s. The streets were landfilled in stages during the course of the second half of the nineteenth century.

Each of the city streets has subsurface utilities under them. While it is unlikely that any of the iconic wooden water mains from the pre-1842 Croton water era could be located under any of these streets (those mains were installed further south in Lower Manhattan), it is possible that water and sewer lines from the second half of the nineteenth century could still exist under city streets, if not removed during subsequent utility work.

East 23rd Street had streetcar tracks by the 1870s (e.g. Bromley 1879, Robinson 1885). While subsequent disturbance to the streetbeds from utility replacement may have disturbed or eliminated these resources, it is still

possible that segments could survive beneath the street. It is also possible that former street pavements, such as cobblestones or paving blocks, may be found beneath some areas.

Finally, archaeological monitoring of utility work in streetbeds of Lower Manhattan has shown that often concentrations or pockets of discarded artifacts can be found beneath historic streets. It is not possible to predict where such dumping grounds may be located, although archaeologists have had some subsequent success tracing the provenance of certain artifact caches to neighboring businesses (e.g. Urbanus 2015).

East 23rd Street may be sensitive for these varied types of resources if later disturbance has not affected them. Within the upper 2-4 feet of the soil column, where the majority of project impacts will occur, there is less likelihood of encountering buried utilities, although it is possible that streetcar tracks, earlier street paving, and possible artifact dumps may be present. These resources are more likely to be found in the present streetbed than within the sidewalks, however.

Former city block resources (foundation remains, historic shaft features)

The only portion of the APE that includes the interior portion of a city block is the portion of Asser Levy Park between the former line of East 24th Street and East 25th Street. This area was not landfilled until the 1890s, when it became a cement and concrete mixing facility. It became part of the public park in the late 1930s. HPI concludes that there is no archaeological sensitivity within this portion of the block.

The conclusions, above, have indicated historic period archaeological sensitivity for the East 23rd and East 25th Street portions of the APE, as shown on Figure 15. The different types of potential archaeological resources within the sensitive areas may be found below the existing and former street and sidewalk pavement layers and bedding, which generally extend at least one foot below the present grade. Therefore, potential resources may be located beginning at one foot below grade. At this time, most project impacts are slated to consist of excavation to depths of 2-4 feet below the current grade, for the installation of the upper components of walls and gates, and for pile caps. Impacts below these depths will be by sheet piles, which will be mechanically driven into the ground and will not afford visibility of any underlying soils. Areas where deeper and wider impacts may occur are where existing utilities could be encased or relocated. There may also be additional subsurface impacts outlined as the project moves forward.

Based on these results, HPI recommends that as the project moves forward and impacts are finalized, a scope for additional archaeology may be needed for the archaeologically sensitive areas of East 23rd and East 25th Streets, if these locations are chosen for project impacts as part of the selected Alternative.

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1. East 23rd Street intersection with the FDR Drive overpass. View looking northwest.

2. East 23rd Street intersection with the FDR Drive overpass. View looking east.

3. East 23rd Street intersection with the FDR Drive and Avenue C. Asser Levy Recreation Center (brick building) is in right background. View looking northwest.

4. East 23rd Street sidewalk at former line of Asser Levy Place. View looking west.

5. Asser Levy Playground with FDR Drive service road in foreground and East 25th Street on right. View looking northwest.

6. Asser Levy Playground with FDR Drive service road on left and East 25th Street in foreground. View looking southwest.

7. East 25th Street at former line of Asser Levy Place. View looking southeast.

I. INTRODUCTION

The proposed East Side Coastal Resiliency (ESCR) project is designed to reduce the risks to Manhattan's East Side from extreme weather and climate change, as well as improve quality of life. This project focuses on neighborhoods along the East River waterfront between Montgomery and East 23rd Streets (and, in one alternative up to East 25th Street). The proposed project will require ground disturbance within two defined locations, the Project Area One and Project Area Two corridors (the project site). Project Area One includes the southern section of the project site, from Montgomery Street north to East 13th Street, including portions adjacent to Pier 42 and all of East River Park. Project Area Two includes the northern section of the project site, from East 13th Street north to East 23rd Street (and, in one alternative up to East 25th Street), including Captain Patrick J. Brown Walk and Stuyvesant Cove Park. The FDR Drive runs through both of these two Project Areas, with pedestrian bridges over the FDR Drive connecting to locations west of the FDR Drive.

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II. PROJECT ALTERNATIVES AND COMPONENTS

A. Alternatives Descriptions

Within the total Project Area four Alternatives are proposed:

[2] At the time that the APE refinement report was completed, the section of East 23rd Street extended as far west as First Avenue. Since that time, the APE has been reduced and the section of East 23rd Street now extends only to the west side of the former Asser Levy Place (the roadway was discontinued in 2013). This report therefore addresses the section of East 23rd Street from the FDR Drive west to Asser Levy Place only.

- **Alternative 1**: No-Action Alternative
- **Alternative 2**: Baseline Flood Protection System
- **Alternative 3**: Flood Protection System with Park and Neighborhood Connection Improvements
- **Alternative 4**: Flood Protection System with Integrated Park Facility Resiliency Measures

The following text summarizes the overall components of the Alternatives, excerpted and adapted from the Preliminary Draft EIS for the project (January 22, 2016). Additionally, the project is divided into a series of "Reaches." The present APE includes Reach P and Reach Q.

- **Alternative 2 – Baseline Flood Protection System**

Alternative 2, the Baseline Flood Protection System Alternative, meets the project objectives by providing the required flood protection using a combination of berms and floodwalls with a reconstructed shared use path (bikeway/walkway) along the west side of East River Park. Under this alternative, the park and street improvements currently proposed as separate capital projects by DPR and NYCDOT, including the improvements proposed at Pier 42 and the Houston Street overpass, are also assumed to be completed. In Project Area Two, portions of Stuyvesant Cove Park would be raised as a landscaped engineered berm. Outside of Stuyvesant Cove Park, the Alternative 2 flood protection features would primarily be: 1) floodwalls along the FDR Drive, potentially along Murphy's Brother's Playground at Avenue C; and 2) deployable systems along East 23rd Street (with an alternative alignment along East 25th Street) and also at crossings under the FDR Drive. Also assumed in Alternative 2 are connections to the planned flood protection systems at the Con Edison East River Generating Facility and the VA Medical Center on East 23rd Street that will be constructed independently of the ESCR project.

- **Alternative 3 – Flood Protection System with Park and Neighborhood Connection Improvements**

The Flood Protection System with Park and Neighborhood Connection Improvements Alternative would similarly achieve the flood protection objectives of the Proposed Action, but would provide enhanced neighborhood connections and targeted park upgrades, including a meandering bikeway and walkway, redesign of several pedestrian bridges to provide both enhanced access and flood protection, and more extensive landscaped features in East River Park. A key feature of this alternative that distinguishes it from Alternative 2 is the proposed enhancement and potential realignment of the existing pedestrian bridges at Delancey, East 6th, and East 10th Streets. Under Alternative 3 in Project Area Two, portions of Stuyvesant Cove Park would be raised as a landscaped engineered berm. Outside of Stuyvesant Cove Park, the flood protection features under Alternative 3 would primarily be: 1) floodwalls along the FDR Drive, along Murphy's Brother's Playground at Avenue C; and 2) deployable systems along either East 23rd or East 25th Streets and also at crossings under the FDR Drive. Also assumed are connections to the planned flood protection systems at the Con Edison East River Generating Facility and the VA Medical Center on either East 23rd Street or East 25th Street that will be constructed independently of the ESCR project.

- **Alternative 4 – Flood Protection System with Integrated Park Facility Resiliency Measures**

This alternative would examine a design concept that provides flood protection for the inland neighborhood comparable to the systems provided in Alternative 3, while integrating treatments to enhance and increase the resiliency and usability of park and recreation features within East River Park.

Project plans, depicting these Alternatives on existing conditions maps for the APE, are included in this report as Appendices A and B. Currently, Alternatives 3 and 4 are considered the "Preliminary Preferred Alternative." Detailed surveys of the Preliminary Preferred Alternative are presented in Appendix B.

B. Project Components

The following text, excerpted from the Draft Scoping document (October 30, 2015) describes the different possible components of the proposed project. Appendix C illustrates typical cross sections of these components.

- **Engineered and landscape berm (also referred to as a "bridging berm").** Engineered berms elevate the existing topography to form a line of coastal flood protection and, therefore, require a relatively wide space to be installed. They are typically constructed of a core of compacted fill material, capped by stiff clay to withstand storm waves, with a stabilizing landscaped cover. To avoid seepage, the coastal flood protection berm has an interior cutoff wall that is constructed of either a stiff clay or slurry. These coastal protection berms can be integrated into a park setting and are also considered adaptable to provide increased protection or accommodate sea level rise to meet future design needs. Floodwalls (see below) are also used in conjunction with a berm at locations where there are horizontal space limitations. In certain reaches of Project Area One, these berms would be integrated with the pedestrian bridges that cross the FDR Drive and touch down in the park; these landings in the park (i.e., the "bridging berms") may then provide the dual benefit of improved access and flood protection. Engineered berms may be used for coastal flood protection within East River Park in Project Area One and within Stuyvesant Cove Park in Project Area Two. Floodwalls (see the description below) can also be used in conjunction with a landscaped berm in design reaches where there are horizontal space limitations. (In this combination, the floodwall provides the coastal protection and the berm is an associated landscape feature.)[3]

- **Floodwalls.** Floodwalls are narrow vertical flood protection structures with below-grade foundations that are designed to withstand both tidal storm surges and waves. They are typically constructed of steel, reinforced concrete, or a combination of materials, with a reinforced concrete cap. Floodwalls can be used where there are horizontal space limitations and where there is a design objective to protect existing recreational facilities by narrowing the footprint of the flood protection system. Typical floodwall designs include I-walls, L-walls, and T-walls, each providing differing degrees of structural protection to withstand tidal surge and wave forces. Floodwalls may be used (in combination with landscape berms) along the interior limits of East River Park in Project Area One (adjacent to the FDR Drive).

- **Deployable Systems.** In many flood protection systems it is necessary to provide an opening to accommodate day-to-day vehicular or pedestrian circulation along a street or sidewalk, for example. In these instances, deployable systems are used. There are several types of deployable systems that may be used in both Project Areas One and Two, each of which is made of steel and structurally reinforced. These deployable systems include the following.
  − **Swing Floodgates.** These gates operate like a hinged door and are deployed to the closed position prior to the anticipated arrival of the surge event. The width limit for these systems is generally about 40 feet.
  − **Roller Floodgates.** A roller floodgate is a deployable system that can be used in openings up to and exceeding 40 feet wide. It is stabilized with a single or double line of

[3] Although Engineered Berms are proposed for various locations within the overall ESCR project site, there are no Engineered Berms proposed to be located in the present APE between East 23rd Street and East 25th Street.

wheels and slides into its protection position prior to the anticipated arrival of the storm event.
− **Crest Floodgates.** Crest floodgates are a deployable flood protection system composed of a series of steel panels that are used along longer openings such as roads, sidewalks, or esplanades. A crest gate is more commonly built to meet site specific requirements (i.e., custom built) and they typically lie flat in a solid foundation that is either flush with the road surface or stored below grade in a recess covered by grating or steel plates. In preparation for a flood event, the gates are deployed and reinforced by retention arms or braces.
− **Demountable Floodgates.** Demountable floodgates consist of a frame structure with stacked panels that are typically stored off-site. When a flood event is projected, the frame and panels are transported to the site in modular sections and are manually installed.

- The Proposed Action would also require water main, sewer, and utility relocations, an operations and maintenance plan, utility and lighting plans, connections to other flood protection structures (e.g., the protection systems at the Con Edison East River Generating Facility and the VA Medical Center on East 23rd Street), and the repair and replacement of parkland and streets affected by construction. Construction activities may also require improvements of waterfront structures, temporary mooring facilities, and limited dredging along the East River to provide barge access during construction. Components designed to provide additional sewer capacity could include installation of parallel conveyance conduits, installation of a new in-line pump station, and/or construction of underground storage tanks and above-grade head house within East River Park.

C. Proposed components within the APE

The following text, excerpted and adapted from the Preliminary Draft EIS for the project (January 22, 2016) provides detailed measures proposed for Alternatives 2 and 3 within each segment of the APE. Alternative 4 is similar to Alternative 3, but with increased resiliency features, generally consisting of above-grade modifications to existing components, and landscaping.

1. Alternative 2, Baseline Flood Protection System

East 23rd Street Tie-back (Reach P). A segment of floodwall with swing gates is proposed at the northern end of Reach O just south of East 23rd Street to provide access for pedestrians and vehicles to the existing FDR ramps and driveways. The floodwall would continue northward before heading inland (west) under the elevated FDR Drive viaduct. The wall would continue west along East 23rd Street to Asser Levy Place. To ensure that traffic and pedestrian circulation is protected, a floodwall and system of deployable swing gates would be used in Reach P at the East 23rd Street intersection with the ramps and service roads under the elevated FDR Drive. The proposed flood protection system would then extend west on East 23rd Street and tie into the VA Medical Center flood protection system at the corner of East 23rd Street and Asser Levy Place. A floodwall would be used along a portion of the Asser Levy Park frontage, and deployable systems (demountable and crest gate systems) would be used to allow visual and pedestrian access to the Asser Levy Recreation Center.

2. Alternative 3: Flood Protection System with Park and Neighborhood Connection Improvements

East 23rd Street Tie-back (Reaches P and Q). A segment of floodwall with swing gates is proposed at the northern end of Reach O just south of East 23rd Street to provide access for pedestrians and vehicles to the existing FDR ramps and driveways. The floodwall would continue northward before heading inland (west) across the FDR Drive service road/Avenue C under the elevated FDR Drive viaduct. The wall would continue west along East 23rd Street to Asser Levy

Place. To ensure traffic and pedestrian circulation is protected, a floodwall and system of deployable swing gates would be used at the East 23rd Street intersection with the ramps and service roads under the elevated FDR Drive. The flood protection system would extend up the corner of East 23rd Street and Asser Levy Place, where a deployable (demountable and crest gate) system would be used to span the large opening. A short segment of floodwall would tie into the VA Medical Center flood protection system at the corner of East 23rd Street and Asser Levy Place. In another option considered under this alternative, the floodwall would continue north past East 23rd Street along the Asser Levy Recreation Center property line, and then would turn west to continue along East 25th Street. The flood protection would extend up East 25th Street to the corner of East 25th Street and Asser Levy Place, where a deployable (demountable and crest gate) system would be used to span the large opening. Similar to the East 23rd Street alignment, a short segment of floodwall would tie into the VA Medical Center flood protection system at the corner of East 25th Street and Asser Levy Place.

For the purposes of this report, the APE consists of all areas for the different Alternatives that would experience ground disturbance. Figures in this report illustrate the APE as a combination of the different Alternative footprints.

D. Project subsurface impacts

The archaeological APE for each of the project Alternatives includes all of the locations where subsurface impacts or associated earthmoving is proposed. At this time, only those general locations that would experience direct subsurface impacts from Engineered Berms, Floodwalls and Deployable Systems are known. Additionally, a staging area is proposed within the APE at the northeast corner of Block 981, the site of the present recreational courts of Asser Levy Park. However, any areas associated with additional tasks, such as utility relocations, street and parkland reconstruction, and dredging activities have not yet been identified.

Currently, plans indicate that the different project components, including the walls, engineered berms, and deployable systems, would include both an upper portion and a sheet pile driven lower portion. The upper portion includes the above-grade component, such as the floodwall or gate, and a base upon which it would be installed. The base of the upper portion would extend several feet below grade, depending on the component. For example, installation of floodwalls may require trenching excavation to ca. 2-4 feet below grade for construction of the wall base and pile caps. The lower portion, the sheet pile component, would be driven to ca. 40 feet below grade using equipment that would drive the sheet piling into the soil without any additional trenching. Similarly, deployable gates would rest on a base installed several feet below grade and would include sheet piles driven to ca. 40 feet below grade. The width of trenching for the installation of the different components would depend on the footprint; floodwall trenches may be only several feet wide to accommodate narrow spaces, whereas engineered berms may have wider trenches, depending on location. An exception to the relatively shallow upper installation project components are areas where existing utilities may need to be encased in protective barriers or relocated, which may entail deeper excavations.

III. METHODOLOGY

The present study entailed a review of various resources.

- Primary and secondary sources concerning history of the area and specific events associated with the project site and vicinity were reviewed using materials from the New York Public Library, the New York City Municipal Archives, the New York City Register, the library of HPI, and online resources.
- Historic maps and photographs were reviewed using materials from the New York Public Library, the New York City Municipal Archives, the Manhattan Borough President's Topographical Bureau, the library of HPI, and various online websites. These maps and photographs provided an overview of the topography and a chronology of land usage for the project site. A selection of these maps has been reproduced for this report.

- Land conveyances indices and selected tax assessment records were reviewed.
- Information about previously recorded archaeological sites and surveys in the area was compiled from data available at the NYSOPRHP, the LPC, and the library of HPI. Particular attention was paid to landfill-related and shoreline archaeological resources.
- Soil borings from 1962 were reviewed, which were located within the APE (see Appendix D). No subsequent soil borings, such as those undertaken for other portions of the ESCR overall project were located within the APE.
- Existing subsurface utility maps for sewer, gas, and steam were reviewed, as well as summaries of overall utilities from project reports.
- Project plans showing existing conditions and proposed alternative components created for DDC were examined. A selection of these plans is included as Appendix A and Appendix B.
- Last, Julie Abell Horn and Cece Saunders of HPI conducted a site visit on August 19, 2015 to assess any obvious or unrecorded subsurface disturbance; additional photographs were provided by AKRF (Photographs 1-7; Figure 2).

IV. CURRENT CONDITIONS AND ENVIRONMENTAL SETTING

A. Current Conditions

The APE between East 23rd Street and East 25th Street consists primarily of portions of the streetbed and sidewalks of the northern side of East 23rd Street, the southern side of East 25th Street, and the western edge of the FDR access road that runs along Block 891 (bounded by East 23rd Street, East 25th Street, the FDR access road, and the former line of Asser Levy Place, which was discontinued in 2013). Additional areas include locations under the elevated FDR Drive at East 23rd Street, and along the East River waterfront east of FDR Drive. A portion of the Asser Levy playground on Block 891 is included in the APE as well, and will be improved and/or repaired through landscaping, repaving, and fence/gate work as part of the Preliminary Preferred Alternative (Appendix B). Figure 2 and Photographs 1-7 illustrate the APE location and basic current conditions.

Sewers run down the center of East 23rd Street, the former line of East 24th Street, Asser Levy Place, and along the north side of the FDR Drive. Steam lines run under the sidewalks on both sides of East 23rd Street from Asser Levy Place to First Avenue. Electric and water lines run under the streets as well.

Proposed project components for all Alternatives in this segment include a combination of floodwalls and deployable gates. The components would cross the FDR Drive just north of East 23rd Street and then contain floodwalls and deployable gates along the sidewalks on the north side of East 23rd Street, the west side of FDR Drive, and the south side sidewalks of East 25th Street, depending on the Alternative. The proposed components would tie in to the VA Hospital floodwall system west of Asser Levy Place.

B. Topography and Hydrology

In its natural state, the entire APE was once under the waters of the East River (Randel 1818-1820, Figure 5). As will be described in more detail below, through the first half of the nineteenth century, Asser Levy Place (or Avenue A) marked the edge of the East River waterfront, with the majority of the APE still under water. The lines of East 23rd Street and East 25th Street began as piers and were landfilled in stages during the second half of the nineteenth century and the early twentieth century. The creation of East River Drive in the 1930s and 1940s concluded the landfilling of the easternmost side of the APE.

The APE consists of landfill and the topography is artificially level with elevations ranging from approximately 6-8 feet (NAVD88 datum) throughout most of the area.

C. Soils

According to the soil survey for New York City (Figure 4), the APE falls within soil mapping unit 101, known as "Pavement & buildings, wet substratum-Laguardia-Ebbets complex, 0 to 8 percent slopes:" and is described as:

> Nearly level to gently sloping urbanized areas filled with a mixture of natural soil materials and construction debris over swamp, tidal marsh, or water; a mixture of anthropogenic soils which vary in coarse fragment content, with up to 80 percent impervious pavement and buildings covering the surface (USDA 2005:12).

The soil mapping unit confirms that the entire APE was formerly under the waters of the East River, and all soils above the natural river bottom deposits are expected to consist of introduced fill.

Two soil borings undertaken in 1962 were located within the present APE (Appendix D). Boring D-22-5 was situated under the elevated FDR, 225 feet south of East 25th Street and 34 feet east of Block 981. Boring D-22-4 was situated in the sidewalk on the south side of East 25th Street, 55 feet east of the eastern boundary of Asser Levy Place.

The boring logs recorded thick fill strata extending from the surface topsoil/paving down to well below mean high water (mhw—considered elevation "0")[4], as would be expected in a filled, once-inundated location. Boring D-22-5 had a surface elevation of 7.0 feet and contained 15 feet of fill, followed by natural soils that were penetrated by fill, to a total depth of -24 feet, or 30 feet below grade. Natural soils were recorded beneath the fill layers. Boring D-22-4 had a surface elevation of 5.6 feet and contained 18 feet of fill, followed by natural soils that were penetrated by fill, to a total depth of -23 feet, or 29 feet below grade. Natural soils were recorded beneath the fill layers.

Although boring D-22-5 did record some wood within the fill, neither of the borings recorded any particular concentration of wood or "timbers," which may represent former landfilling devices, piers, or wharves, and fill materials that might indicate the presence of former structures or associated features.

As part of this project, it is expected that geotechnical soil borings will be completed in locations of planned impacts, particularly for sheet pilings. These geotechnical borings, which will have comprehensive and specific subsurface data, are planned for February or March of 2016. It is likely that study of these future borings will present further details of subsurface conditions within the APE.

V. BACKGROUND RESEARCH/HISTORICAL OVERVIEW

A. Previously Recorded Archaeological Sites and Surveys

Research conducted using data from the SHPO, the LPC, and the library of HPI revealed a number of archaeological sites that have been documented within a one-mile radius of the APE.

One of the closest documented sites is the Lower East Side Girls Club site, located on Avenue D between East 7th and 8th streets (HPI 2009). Like many of the historical archaeological sites on the Lower East Side, this site yielded remains from domestic water/waste management features, e.g., privies and cisterns. Most notable among the recorded sites is the late nineteenth century cistern complex on Block 378 (Grossman 1995), which yielded over 24,000 artifacts, mostly from the late 1860s. Those sites within a one mile radius (in Manhattan) are listed in Table 1, below.

[4] The soil borings reference the Manhattan Highway Datum, which is 2.750 feet above mean sea level at Sandy Hook, as established by the U.S. Coast and Geodetic Survey.

Table 1: Archaeological Sites within One Mile of the Project Site

NYSM or NYSOPRHP Site Number	Site Name/Description	Location	Site Type/Time Period
A06101.017934	Lower East Side Girls Club	E 7th & Ave D Block 377 Lot 42	Foundation and privy/Historical
A06101.017933	Lower East Side Girls Club	E 7th & Ave D Block 377 Lot 47	Privy/1830s–1850s
A06101.015723	Historical features	321 E 21st St., E of 2nd Ave	Brick cesspools, bldg. remains/nineteenth cent.
A06101.009530	Bernard Baruch College B	E 25th St., E of Lexington	Horse stables/ nineteenth cent.
A06101.018336	PSA4 Pre-Civil War Cistern	Avenue C between E. 8th and E. 9th Sts.	Historic cistern deposits
	Block 405, Lot 1	Avenue A, E 10th–11th Sts.	Privy/drainage system/late nineteenth cent.
	Congregation Moshcisker Chevrah Gur Arye Mikvah	308 E 3rd St., Aves C to D	Mikvah/early twentieth cent.
	Block 378 Lots 58 & 59	E 8th St, Aves C to D	Cistern Complex/mid- to late nineteenth cent.

There have been numerous archaeological studies completed for Manhattan's Lower East Side and East Village. Most of the archaeological sites in the above table were discovered as part of specific investigations. The current APE has not been subjected to archaeological study, other than being part of the early and general study of the East River Reach/Removal of Drift project for the East River between Battery Street and 90th Street (Historic Sites Research 1977).

B. Historic Period Summary

As noted above, the APE was originally under the East River. The shoreline of the river crossed East 23rd Street and East 25th Street along an irregular course between what is now First Avenue and Asser Levy Place/Avenue A (Viele 1865). The area inland of the APE was part of the colonial era Bellevue Estate, the riverfront retreat of Quaker merchant Lindley Murray. Beginning in 1793, the estate was leased by the City of New York as a quarantine hospital for Yellow Fever patients. The "fever hospital" was followed by additional city facilities for the sick and indigent. In 1816, Bellevue was formally dedicated, and at that time contained a "pest house" for fever victims, a public school, a penitentiary, a bakery, a morgue, a wash house, a soap factory, a greenhouse, an icehouse and a workshop (Digital Almshouse Project 2013). The Randel farm map of 1818-1820 (Figure 5) shows that these buildings all were located north of what would become East 24th Street. The APE at this time was still completely under the water of the East River.

In the mid-1820s, the Bellevue complex extended further south, to now include the block between East 23rd Street, East 24th Street, First Avenue and Avenue A. A new fever hospital was constructed near the First Avenue side of the block in 1824. In 1831, the building was located at the East River waterfront (Smith 1831), but the block soon was landfilled to the line of Avenue A. The 1836 Colton map (Figure 6) clearly shows this building as part of the Bellevue campus. The APE was still predominantly under water at this time, with only the intersection of East 23rd Street and Avenue A on firm ground, just at the water's edge.

Just after publication of the 1836 Colton map, in 1838-1839, the City's "House of Refuge" moved from its prior location at Fifth Avenue near East 23rd Street to the block between East 23rd Street, East 24th Street, First Avenue and Avenue A. A new building was constructed for girls, measuring 150 feet by 42 feet and three stories high, and the former fever hospital on the block was altered for use by boys (Peirce 1869:156; Stokes 1926, Vol. V:1750). Workshops were constructed on other parts of the block (Perris 1852). The 1852 Dripps map (Figure 7) shows the layout of the House of Refuge buildings, as well as a pier at the foot of East 23rd Street and a ferry landing in the location of the present Asser Levy Recreation Center, noted as

the ferry to Calvary Cemetery. The 1852 Perris map indicates that the ferry house may have extended into the present streetbed of East 23rd Street. Another pier is shown at the foot of East 25th Street. The House of Refuge moved to Randall's Island in 1854 (*New York Times* 1860), after which time the facilities on the block were replaced with other residential, commercial and industrial buildings (Perris 1859).

The APE remained largely similar through the end of the nineteenth century (Harrison 1867, Figure 8; Bromley 1891, Figure 9). The current East 23rd and East 25th Street corridors began as piers. The ferry to Greenpoint was located at the foot of East 23rd Street well into the early twentieth century. The first ferry "house" was shown as a small frame structure at the northeast corner of East 23rd Street and Avenue A, and partially extending into the streetbed of East 23rd Street (Dripps 1852, Figure 7; Perris 1852, 1859; Buckhout 1860; Bromley 1879). By the 1880s, a larger ferry building had been constructed in the approximate location of the present Asser Levy Recreation Center, on the east side of Avenue A between East 23rd and East 24th Streets. It stood through the turn of the twentieth century (Robinson 1885; Sanborn 1890; Bromley 1891 (Figure 9), 1897, 1899).

By the end of the 1860s, the block south of East 23rd Street and east of Avenue A had been landfilled, and East 23rd Street was shown on historic maps as a street rather than a pier, although the area to the north was still open water (Harrison 1867, Figure 8; Bromley 1879). A street railway ran down East 23rd Street to the edge of the river and, by the end of the 1870s, a pier extending into the East River at the foot of the street was attributed to the N.Y. and Manhattan Beach Railroad. Piers also were located at the foot of East 24th Street and East 25th Street within the APE (Bromley 1891; Figure 9).

Changes came to the APE just prior to the turn of the twentieth century. In the early 1890s, the block east of Avenue A between East 24th Street, East 25th Street was landfilled for municipal use. An 1893 survey of the block depicts a cement and concrete mixing facility with an office and an engine house as present (Thompson 1893). The facility was attributed to the Department of Public Works on the 1899 Bromley map and the Department of Docks and Ferries on the 1910 Sanborn map (Figure 10).

In the early 1900s, the Greenpoint Ferry complex at the foot of East 23rd Street was demolished and the Asser Levy Public Baths (now the Asser Levy Recreation Center building and a New York City Landmark) was constructed in its place, landfilling the block to its present extent and creating a wharf and bulkhead along the approximate line of the present FDR Drive. The Greenpoint Ferry was moved to an existing ferry complex south of East 23rd Street and off the APE. The Asser Levy Public Baths formally opened in 1908. They are shown on the 1910 Sanborn map (Figure 10). The APE retained a similar configuration through the 1930s. A 1924 aerial photograph (Figure 11), the 1929 Sanborn map and the 1930 Bromley map illustrate conditions during this period.

The early 1940s brought the greatest change to the APE, with the creation of East River Drive. In 1939, Block 981 had been formally made into a city park, including the Asser Levy Public Baths (Figure 12). The cement plant that was once located between East 24th and East 25th Streets was removed at this time. A damage map from 1942 (Figure 13) shows the degree to which the APE was affected by these projects. Portions of the western side of Block 981 were taken for the East River Drive, which also overlapped the early twentieth century wharf and bulkhead at the foot of East 23rd, East 24th, and East 25th Streets. Parcels taken for the new roadway included existing land, streetbeds, piers, and land under water. North of East 23rd Street, portions of still under water were landfilled using rubble from bombed out buildings in Bristol, England that had been loaded onto returning American supply ships for ballast during World War II (Pollak 2009). In 1944, a small strip of land was added to the park on Block 981 (Figure 14). The section of the East River Drive within the APE was elevated to its current height in the early 1950s (Sanborn 1951).

VI. HISTORIC LANDFILL CONTEXT

Due to the fact that the entire APE was once under the East River, and subsequently was landfilled, the most ubiquitous types of potential subsurface resources in the APE should consist of landfill, landfill retaining devices, and piers and wharves. Additional areas of the APE had late nineteenth-century development after landfilling. A brief discussion of these resources along the East River follows.

A. Landfill Retaining Structures, Wharves and Piers Review

Historical cribbing and bulkheads—devices for retaining fill—have been a subject of archaeological investigation for many decades (see e.g., Historic Sites Research 1978) and docks and wharves, some of which eventually functioned as landfill retainers, may have existed in some parts of the project site. All utilized similar construction techniques, which evolved from a vernacular tradition in the seventeenth and eighteenth centuries, to be replaced by the documented, standardized construction practices of the late nineteenth century.

In her research on pre-1850s landfill retaining devices and other waterfront features, McDonald (2011) has argued that previous discussions of these features, and attempts to create the neat typologies beloved by archaeologists, have led to a certain amount of confusion. McDonald states that archaeologists should instead describe basic attributes of the features, making clear distinctions between the various aspects of construction: structural material, fill material, form, structure type, and construction method. In New York City, most pre-1850s waterfront features employed log-construction techniques that, McDonald contends, were likely derived from a Germanic/Scandinavian vernacular architectural tradition—these methods and materials are not used in either the UK or the Netherlands, and, in New York City, were rarely, if ever, employed in aboveground structures beyond wharves and bulkheads. With technological advances facilitating efficient, deep pile driving, the log-construction tradition was phased out after mid-nineteenth century, in favor of standardized, pile-supported piers and bulkheading.

1. The "Vernacular" Tradition—the Eighteenth to Mid-nineteenth Centuries

- **Sheet Piling**

Prior to the late eighteenth century, the chief method of land extension and wharf construction in the New York City area was by the creation of sheet-pile seawalls. Debarked logs of American white oak, sharpened to a point at one end and shaped at the head to accommodate a pile cap, would be driven side by side into the mud of the river floor with a log or stone drop hammer. They would then be anchored together with heavy horizontal wood planking secured to the outboard face of the piles. The planking would retain the fill, which would be deposited on the landward side. Sheet piling was also employed to surround riprap embankments; and combinations of piles, planks, stone embankments, and sheet piling were the dominant construction methods to the time of the American Revolution and are mentioned as late as 1840 (Small 1941). This method was also employed in the construction of docks and wharves (Bone 1997:92–96).

- **Cribworks and Cobb-type Log Construction**

By the late eighteenth century, log cribworks—wood-frame, "boxlike receptacles" with solid bottoms and open sides, filled with loose stone and sunk to river bottom—provided larger, sturdier supports for retaining walls and wharves, where pile-supported structures could not be built or proved unstable in the face of strong river currents and ice. The river floor would be dredged, clearing mud and loose debris down to the bedrock or hardpan substratum. The crib bottom was fitted to the river floor's contours, and the cribwork was carefully filled with stone, mud, sand, and sometimes concrete, and pinned to the bottom. If the crib facing was constructed so tightly that earth alone could be used as the fill, it was called a "solid-filled crib" (Bone 1997:96–99; Joseph et al. 2004:178–179).

A cruder construction form, using notched, unhewn logs, and larger fill cells, was known as a cobb wharf, and the fill supposedly consisted entirely of stone (Joseph et al. 2004:179). Often the fill included other materials, such as ballast rock and coral, brush, and tree stumps (Louis Berger 1990:V-3). Cobb construction, with its less accurate joints, was less durable and stable than cribwork (Bone 1997:96–99). The 1690s cobb structure excavated at the Barclays Bank Site (75 Wall Street, corner of Wall and Water Streets) was built with rough logs joined to form a series of 5-foot-square compartments. The structure was secured in place by pilings, and filled with rock and coral (Louis Berger 1983).

Data illuminating eighteenth- and nineteenth-century wharf construction practices in Lower Manhattan has been accumulating since the 1960s, as examples of cobb-type construction have been uncovered at a

number of archaeological sites, including Cruger's Wharf, at present Old Slip and Water Street, ca. 1740 (Huey 1984); the Telco Block (site bounded by Water, Fulton, Front and John Streets), a mid-eighteenth-century cobb wharf complex (Soil Systems 1982:60, 64–68, Figures 3.10, 3.12); the Assay Office site (on the block between Front and South Streets, and Wall Street and Gouverneur Lane) plank bulkheads, as well as a cobb wharf complex dating to the 1790s (Greenhouse 1984: 2, 3, 4, 10, 13–14; Louis Berger 1990:Fig. 4.2, IV 3, 14–17; 1991; Cantwell and Wall 2001:230–233).

- **Grillage/Raft Type**

A grillage/raft type wharf employed construction techniques similar to that of a cobb wharf. As the name implies, it was a solid raft-like structure built of timbers laid as headers and stretchers, incorporating layers of stone. Additional "rafts" were built and stacked until the required height was reached. It would then be floated out to the intended location, filled with stones, and sunk (Joseph et al. 2004:179). The 175 Water Street site (on the block surrounded by John, Fletcher, Water, and Front Streets) uncovered wharf construction of this type, dating to ca. 1750 (Geismar 1983:117, 203; Louis Berger 1990).

2. Post-1850s—Modern Construction Techniques

It is no coincidence that McDonald (2011) closes her discussion of the "vernacular" period of pier and bulkhead construction by the 1850s. As archaeologist Michael Raber contends, this was the period in which the vernacular log-building styles were replaced with "modern" construction techniques of a "common type" (Raber et al. 1985:55), i.e., supported on deep piles (AKRF 2007:V-2). This change was initiated by two inventions of the Scottish engineer James Nasmyth: the steam hammer in 1838/39, and his development of the steam pile driver in 1845. Nasmyth's inventions permitted the driving of a pile in an astounding 4 minutes, when before it would have taken 12 hours (Bensel 1905:7; Tames 2005:84–85).

Although cobb construction did survive, even in New York City, due to its low-cost and simplicity of construction (Greene 1917:52–53, fig. 10), it was eschewed for the rehabilitation/reconstruction of the Manhattan waterfront. A comparison of nineteenth-century historic maps shows a rapid escalation of pier construction along the East River after 1845 and the invention of the steam pile driver (Colton 1836 [Figure 6], Dripps 1852 [Figure 7]).

By the 1870s, with the establishment of the New York City Department of Docks (1870) and the advent of Manhattan's upgraded bulkhead and pier system, East River bulkheads and piers/wharves were constructed with deep vertical pilings, following standardized methods and designs, well documented by engineer Carleton Greene and others (Goodrich 1905:21, figs. 4–6; Greene 1917:figs. 44, 47–49). Also supporting Raber's (1985:55) contention that this late-nineteenth-century pier and bulkhead construction was of a "common form," built from "a generally well-understood, common set of designs," is the 1904 statement of J. A. Bensel, engineer-in-chief of New York's Department of Docks and Ferries. Bensel observed that "the manner of building has varied little during the time in which the Port of New York has been in existence," and "nearly all piers along the East River" are pile platforms (Bensel 1905:7). The 1891 Bromley map (Figure 9) shows the continued standardization of piers in the project site by the end of the nineteenth century.

On the new waterfront, crib/cobb structures were no longer employed. Substantial preparatory dredging was involved, and piles, in various combinations, were driven down to bedrock (except where depth of bedrock made this impossible), with the spaces between the piles filled with rip rap or cobbles and stones to provide stability to the piles supporting the masonry bulkhead. For piers, decks of wood or concrete were built and paved atop the wooden piles (Greene 1917:28–33). The 1924 aerial photograph of the project site (Figure 11) shows that by this time, the APE contained several piers along the East River waterfront.

- **Bulkhead Construction**

Because of the general depth of mud—in some places up to 170 feet deep—along the entire East River shoreline, the bulkhead had to rest on piles, even though the piles could not extend to the hard bottom in all cases. According to engineer Carleton Greene, the river mud was dredged "for a width of about 85 feet to a

depth of 30 feet, more or less, depending on the consistency." As seen in Greene's schematic drawings (Greene 1917:fig. 44, 47–49), this width of dredging extended an equal distance on each side of the proposed bulkhead, therefore, approximately 42.5 ft. both inland and outboard, and to a depth of 35 to 40 feet below mhw.[5] According to Department of Docks annual reports, it was standard practice to remove the timbers of earlier construction ("Removal of old work") when they were encountered in this dredged area (e.g., Docks 1906:177–179). Into that dredged surface the piles were driven, and the open spaces filled in with cobbles and riprap to serve as a base and support for the concrete and masonry bulkhead. The new street area would have been further filled with "earth, ashes, &c." as Greene notes in his 1876 bulkhead drawing (Greene 1917:88–94, fig. 44).

- **Dredging**

Dredging was and is a normal part of harbor and pier slip maintenance that would have been carried out in the slips between piers within the project site. Accurate records of dredging, or even maps of pier slip depths prior to 1857 are not available to document routine dredging impact in now-filled sections within the project site. However, as the nineteenth century progressed, slips needed to accommodate larger and larger ships, and regular dredging deepened the slips, removing earlier river mud and any potential embedded cultural deposits.

B. Landfill resources in New York City archaeological contexts

There have been a number of archaeological testing programs undertaken in areas of New York City (generally Manhattan and Brooklyn) that were once under water and were landfilled in the eighteenth and nineteenth centuries. Some of the projects are referenced in the above discussion and additional details are presented below. Information about many of the sites has been previously summarized in the South Ferry Terminal Project final report and is excerpted here (AKRF, URS, and Stone 2012: 4-98 to 4-103).

1. Lower Manhattan projects

- **Site 1 of the Washington Street Urban Renewal Area**

Located on the Hudson River, this site was bounded by West Street, Greenwich Street, North Moore Street and Hubert Street and contained sections of Washington and Beach Streets. It was filled during the first two decades of the nineteenth century. Initial testing did not located any landfill retaining structures, but monitoring for foundation work on the north side of Beach Street did reveal segments of a timber wharf running east-west through the project site blocks. The feature was found under a concrete basement floor and despite its fragmentary condition from the basement construction was identified as part of cobb crib wharf (LBA 1987a).

- **The Telco Block**

Archaeologists from Soil Systems Inc. encountered portions of two mid-eighteenth century cobb wharves within the Telco Block, bounded by Fulton, Front, and Water Streets, and Burling Slip (John Street) along the East River waterfront (Soil Systems 1983). The wharves were known as the Van Cortlandt/Berrien Wharf and the Bowne/Byvanck Wharf. Several bulkheads also were found, thought to mark the edges of a filled-in water lot.

- **The Assay Site**

At the Assay Site, bounded by Front Street, South Street, and Old Slip on the East River, archaeologists located the cobb-constructed Bache's Wharf, two sections of another unnamed cobb wharf, and four bulkheads. The structures dated to the late eighteenth century (LBA 1990).

[5]Greene's calculations were based on a mean low water of 4.85 feet below mean high water (mhw).

- **175 Water Street**

Extensive landfill features were found at the 175 Water Street site, on the block bounded by Front Street, Water Street, Fletcher Street, and Burling Slip (John Street) along the East River. Recovered resources included a wharf/grillage system and remains of a mid-eighteenth century merchant ship, initially called the *Ronson* after the project developer, but now known as the *Princess Carolina.* The ship was found at ca. 8-9 feet below the modern ground surface (Soil Systems 1983; Riess and Smith 2015).

- **Schermerhorn Row Block**

On the block bounded by Burling Slip (John Street), Fulton Street, South Street and Front Street trenching by archaeologists found timber crib structures two feet below cellar floors, likely dating to the late eighteenth or early nineteenth century (Historic Sites Research 1991). The continued presence of features under later cellars attests to the ability for preservation despite subsequent disturbance.

- **Burling Slip**

Additional archaeological testing more recently was undertaken in the street and parking lot comprising historic Burling Slip (John Street) between Front and South Street (AKRF 2011). This area once contained a wharf constructed in ca. 1790, with the slip itself landfilled in ca. 1830. No landfill retaining structures were found in the slip, but under an Unanticipated Discoveries protocol, the south side of the ca. 1790 wharf was found on the north side of the slip. A length of the wharf or bulkhead measuring about 200 feet in length and between 2-9 feet below grade subsequently was exposed, extending to about two feet below the water table. The composition of the wharf was described as wall with tie-backs rather than a cribbing block with cross-ties.

- **John Street/Burling Slip**

Also within John Street, archaeological monitoring occurred for sewer replacement in the streetbed. Over this ca. 220-foot length, no landfilling devices were found and landfill dated to the nineteenth and twentieth centuries. All artifacts were in secondary deposition (Chrysalis 2011).

- **Rutgers Slip**

Closest to the current project site, at the intersection of Rutgers Slip and South Street contractors uncovered timbers believed by archaeologists to be portions of intact cribbing used for landfill retaining structures. The timbers were found at depths of ca. 6-8 feet below grade (AKRF 2012). The features could not be dated definitively, but were thought to date after 1835.

- **World Trade Center area**

At the site of the World Trade Center complex, on the former Hudson River shoreline, there have been two ships found. The first was a wooden ship dating to the Dutch period of occupation, and thought to be remains of the *Tyjger*, a vessel that burned and was abandoned along the shoreline in 1613. It was found during excavation for the I.R.T. subway line along Greenwich Street (at Dey Street) in 1916, and documented by amateur historian James Kelly, who was a supervisor on the subway project. The ship, which consisted of a burned keelson and three rib frames, was found beneath about 9 feet of fill and 11 feet of river silt. Archaeologists Ralph Solecki and Bert Salwen returned to the area in 1967, when the World Trade Center was being built, and attempted to find the rest of the ship, which was thought to lie west of the I.R.T. line. Unfortunately, their efforts were unsuccessful, and the remains of the *Tyjger* were never found (Solecki 1974).

The second ship was found at the southern site of the World Trade Center redevelopment project, on both sides of Washington Street between Liberty and Cedar Street. The ship, which consisted of the bottom

portion of a hull and a single deck, was found at a depth of between 11.5 and 20 feet below mean sea level, or between about 20 to 30 feet below the modern street grade (AKRF 2013).

Additionally, the New York State Museum documented a portion of the Hudson River bulkhead, which dated to ca. 1903, in the southern end of West Thames Park, near West Thames Street (NYSM 2011).

- **South Ferry Terminal Site**

Extensive archaeological investigations were undertaken at the South Ferry Terminal site, which included land formerly on firm ground as well as land once under water and now covered by landfill (AKRF, URS, and Stone 2012). In the landfilled area, archaeologists encountered both remains of Whitehall Slip timber cribbing and extensive landfill deposits. The timber cribbing was found at ca. 8-10 feet below the ground surface. In total, archaeologists documented resources in Whitehall Slip measuring over 200 feet in length and up to 60 feet in width.

- **East River Esplanade Monitoring**

As part of the East River Esplanade project, which extended along the east side of the FDR Drive, several test trenches were monitored by archaeologists to determine depths and extent of existing column footings for the FDR Drive. Monitoring of these trenches did not encounter any landfill retaining structures or other intact archaeological resources (HPI 2008).

- **Wall Street Triangle Site**

At the Wall Street Triangle site, located on the north side of Wall Street between Front and South Streets, contractors discovered large timbers at ca. 4 feet below grade (Geismar 2005). Inspection by an archaeologist revealed that these were likely former landfill retaining structures that had been broken up and redeposited in the landfill. This area was once known as the Wall Street or Coffee House Slip, and was landfilled in the 1820s and 1830s. While it is possible that the timbers were from former piers or wharves lining the slip, it could not be confirmed.

2. Brooklyn projects

- **Archaeological Monitoring at Joralemon and Furman Streets**

An early archaeological monitoring program by Ralph Solecki (1981) for the Red Hook Water Pollution Control project on the East River in Brooklyn revealed timber retaining structures from ca. 5-12 feet below grade near the intersection of Joralemon and Furman Streets. The structures consisted of timber cribworks filled with various sized stones, as well as an associated bulkhead.

- **Brooklyn Bridge Park project**

Archaeological testing for the Brooklyn Bridge Park project included areas on between Furman Street and the East River from Atlantic Avenue to Old Fulton Street (URS 2008, 2009). This area was once under water and was landfilled in the nineteenth century. Despite sensitivity for landfill retaining structures here, none were found. However, remains of foundations associated with the mid to late nineteenth-century Deforrest Storage Warehouses (later the Martin Stores) and the Jewell Brothers Flour Mill complex were found at relatively shallow depths below grade (the upper reaches were 1-2 feet below the current ground surface). Phase II Archaeological Evaluation determined that the flour mill complex was eligible for the National Register of Historic Places (URS 2012).

- **Dock Street Rezoning project**

Phase IB archaeological testing was completed for the parcel at the western end of the block bounded by Water Street, Dock Street, Front Street, and Main Street (HPI 2013). Although the block straddled the

original shoreline and was landfilled to bring it up to a level grade, no intact landfilling structures were found on the site. A number of features and foundations from nineteenth-century industrial buildings were located within the landfilled areas, however.

- **Archaeological Monitoring for Combined Sewer, Water Street, Old Fulton Street and Washington Street**

During rehabilitation of city streets along the East River in Brooklyn, archaeologists monitored installation of a new combined sewer under Water Street between Old Fulton Street and Adams Street, Old Fulton Street between Front Street and Furman Street and Washington Street between York Street and Plymouth Street (Chrysalis 2012). Much of these areas was once under water and was landfilled during the nineteenth century. The results of the monitoring revealed evidence of mid to late nineteenth century landfilling and evidence of mid to late nineteenth century and early twentieth century utilities. However, monitoring did not reveal remains of intact landfill retaining devices or waterfront features such as docks, despite the location of these streets along the natural East River shoreline. All wood found during monitoring was disarticulated and likely redeposited.

C. Discussion summary

The data from the archaeological testing programs on landfilled sites from the eighteenth and nineteenth centuries present a varied picture of resource locations and survival. For landfill retaining structures, most sites that had features were found at least several feet below the modern ground surface. The top of the shallowest buried feature was two feet below grade, but most sites recorded the upper reaches of features at least 4-5 feet below grade, and often much deeper. Given that these retaining devices would have been installed both above and below the natural water line of the river and that additional landfill may have been placed above these features to raise the area to a modern grade, this is not surprising. Within APE, it is likely that any landfill retaining devices or possible buried ship remains, should they exist, would be located at least several feet below the modern grade.

The archaeological testing programs also underscore the difficulty in predicting where landfill retaining structures still may exist within the modern landscape. The above discussion focuses only on field testing projects, but most of these programs were preceded by Phase IA Documentary Studies that identified areas of sensitivity for these resources that guided the field work. In many cases, archaeologists identified probable locations of resources where field work showed did not exist, whether because they were never located in those spots, or because they were destroyed by subsequent disturbance. In other cases, resources were found during an Unanticipated Discovery Program, often in locations archaeologists had not predicted during the research phase.

These factors considered, there are several patterns worth noting. At least on the East River shoreline of Manhattan, several sites have shown less likelihood of recovering landfill retaining devices in former slips, or the open water between wharves or piers where vessels could dock. Rather, resources have been found more consistently along or within former wharves and bulkheads. Additionally, streetbeds or former streetbeds with multiple or deeply installed utilities appear less likely to contain intact resources, based on later disturbance. Last, the types of project impacts greatly affect the research value of the potential resources. In areas where there is only limited visibility through trenching or narrow monitoring corridors, resources often cannot be properly evaluated. Those sites that have produced the most valuable research avenues are those where large areas have been excavated, such as for new building basements or large infrastructure projects.

VII. CONCLUSIONS

This Phase IA Archaeological Documentary Study has shown that the entire APE was once under the water of the East River, and was landfilled at various times between the 1830s and the 1940s, with city streets created to separate and define newly formed blocks. Both East 23rd Street and East 24th Street began as piers and were later filled in to create streets. It is possible that remains of these piers, and possibly the former ferry house at the intersection of East 23rd Street and Avenue A, may still exist beneath the present

streetbeds and sidewalks of these two streets. There is little likelihood that any potential resources from the 1830s-1850s House of Refuge complex could be located within the APE, as they were situated on the block immediately west of Avenue A/Asser Levy Place. The section of East 23rd Street between Avenue A and First Avenue originally was included within the APE, but has since been eliminated.

There are a number of project Alternatives proposed for the East Side Coastal Resiliency project site. The Preferred Alternative has not yet been selected, and plans for each Alternative may still be changed. However, there are certain elements that apply to all the Alternatives. Namely, all of the Alternatives contain a combination of components including Engineered Berms, Floodwalls, and Deployable Systems. For each of these components, proposed excavation would extend ca. 2-4 feet below the existing grade for construction of the component base and pile caps, with sheet piles driven mechanically to ca. 40 feet below grade. It is expected that archaeological testing or monitoring would only be possible for the upper 2-4 feet of component installation. The sheet pile driving would not allow any visibility of subsurface conditions. The only two project locations that may provide more wide scale excavation windows would be the locations slated for utility work.

There have been several previous archaeological studies within and adjacent to the APE that have identified broad categories of potential historic period archaeological resources. These include those for the East River Waterfront Esplanade and Piers by HPI (2007a, 2007b) and recently for the reconstruction of Pier 42 AKRF (2015), which encompassed areas from Montgomery Street to east of Jackson Street south of the FDR Drive. The above studies have been submitted to, and accepted by, regulatory agencies. Therefore, to retain parity, the same broad resource categories are addressed below. Prior disturbance and archaeological sensitivity are addressed within each resource category.

A. River bottom remains

River bottom remains are those items discarded onto the river floor prior to or during landfilling. It is possible that archaeologically sensitive deposits are present on the river bottom within the APE. However, there are no construction activities within the APE that could affect potential river bottom remains.

B. Landfill retaining structures and landfill deposits (including sunken vessels)

Landfill retaining structures can include repurposed historic piers, wharves, and docks, as well as timber structures built specifically for retaining fill, sometimes also referred to as bulkheads. At times, derelict maritime vessels also were used both as landfill retaining structures or part of the landfill. Landfill by nature contains soil, but also may include concentrations of artifacts or other refuse material, such as ash, sometimes referred to as "cinders" in early soil boring logs.

Because the entire APE was once under water, there is potential for the presence of archaeologically sensitive historic landfill retaining structures from the first half of the nineteenth century along East 23rd Street and East 25th Street, as shown on Figure 15. The remainder of the APE was landfilled after this period.

Current plans indicate that the majority of project related impacts would only extend ca. 2-4 feet below the existing ground surface. It is possible that landfill retaining structures could be found within this upper reach of the soil column, as was the case at Burling Slip, where resources were found beginning at two feet below the current grade. However, previous archaeological investigations at other locations along the East River suggest that most of these resources are located deeper in the ground. Although the sheet pile driving will extend through areas more likely to contain these resources, it will not be possible to observe these areas due to the means of installation.

C. Historic streetbed resources (utilities, transportation elements, artifact deposits)

The APE contains portions of East 23rd, East 24th, and East 25th Streets. The street segments began as piers: East 23rd and East 25th Streets in the late 1830s and East 24th Street in the 1870s. The streets were landfilled in stages during the course of the second half of the nineteenth century.

Each of the city streets has subsurface utilities under them. While it is unlikely that any of the iconic wooden water mains from the pre-1842 Croton water era could be located under any of these streets (those mains were installed further south in Lower Manhattan), it is possible that water and sewer lines from the second half of the nineteenth century could still exist under city streets, if not removed during subsequent utility work.

East 23rd Street had streetcar tracks by the 1870s (e.g. Bromley 1879, Robinson 1885). While subsequent disturbance to the streetbeds from utility replacement may have disturbed or eliminated these resources, it is still possible that segments could survive beneath the street. It is also possible that former street pavements, such as cobblestones or paving blocks, may be found beneath some areas.

Finally, archaeological monitoring of utility work in streetbeds of Lower Manhattan has shown that often concentrations or pockets of discarded artifacts can be found beneath historic streets. It is not possible to predict where such dumping grounds may be located, although archaeologists have had some subsequent success tracing the provenance of certain artifact caches to neighboring businesses (e.g. Urbanus 2015).

East 23rd Street may be sensitive for these varied types of resources if later disturbance has not affected them. Within the upper 2-4 feet of the soil column, where the majority of project impacts will occur, there is less likelihood of encountering buried utilities, although it is possible that streetcar tracks, earlier street paving, and possible artifact dumps may be present. These resources are more likely to be found in the present streetbed than within the sidewalks, however.

D. Former city block resources (foundation remains, historic shaft features)

The only portion of the APE that includes the interior portion of a city block is the portion of Asser Levy Park between the former line of East 24th Street and East 25th Street. This area was not landfilled until the 1890s, when it became a cement and concrete mixing facility. It became part of the public park in the late 1930s. HPI concludes that there is no archaeological sensitivity within this portion of the block.

VIII. RECOMMENDATIONS

The conclusions, above, have indicated historic period archaeological sensitivity for the East 23rd and East 25th Street portions of the APE, as shown on Figure 15. The different types of potential archaeological resources within the sensitive areas may be found below the existing and former street and sidewalk pavement layers and bedding, which generally extend at least one foot below the present grade. Therefore, potential resources may be located beginning at one foot below grade. At this time, most project impacts are slated to consist of excavation to depths of 2-4 feet below the current grade, for the installation of the upper components of walls and gates, and for pile caps. Impacts below these depths will be by sheet piles, which will be mechanically driven into the ground and will not afford visibility of any underlying soils. Areas where deeper and wider impacts may occur are where existing utilities could be encased or relocated. There may also be additional subsurface impacts outlined as the project moves forward.

Based on these results, HPI recommends that as the project moves forward and impacts are finalized, a scope for additional archaeology may be needed for the archaeologically sensitive areas of East 23rd and East 25th Streets, if these locations are chosen for project impacts as part of the selected Alternative.

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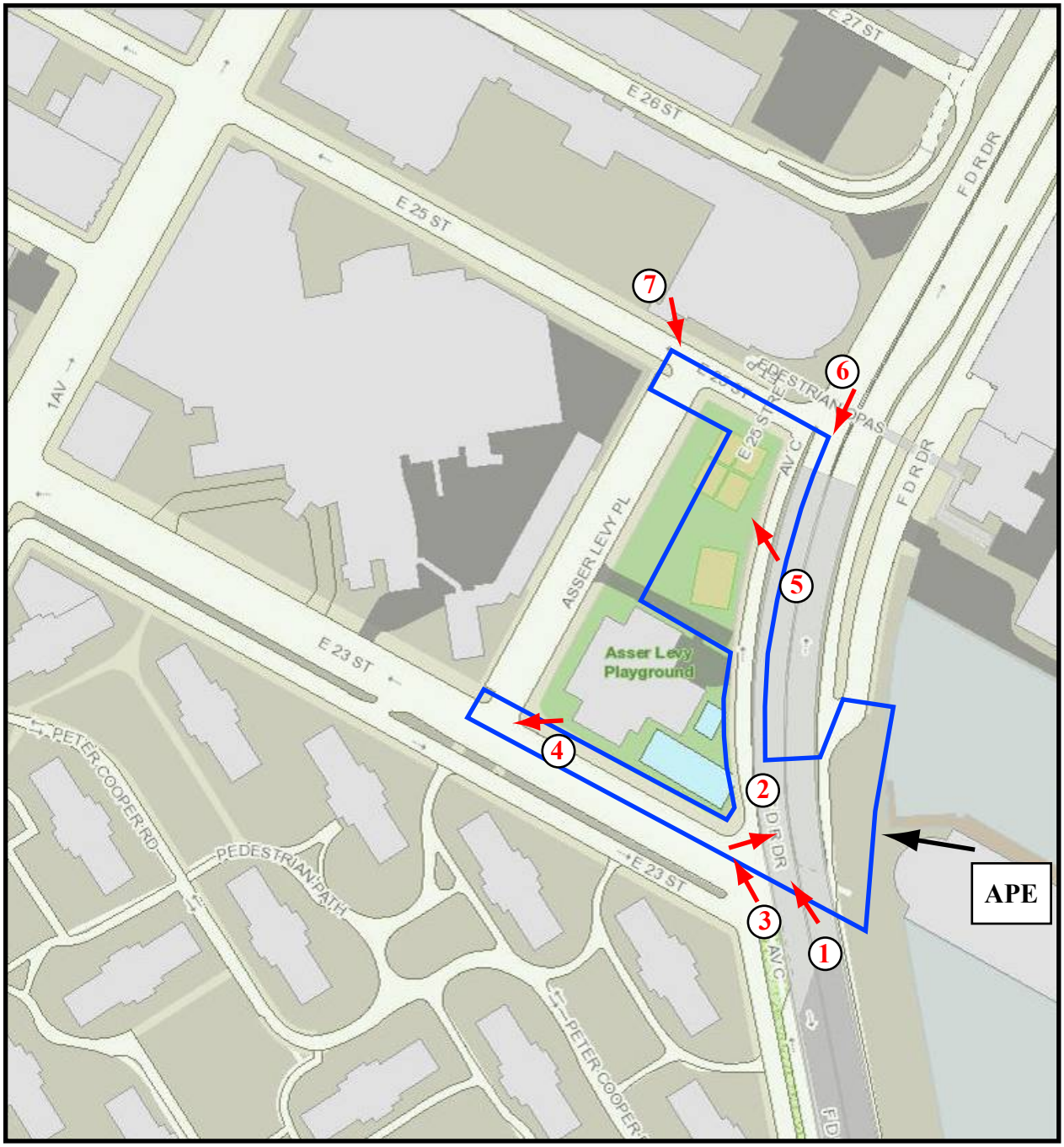
FIGURES

Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

Figure 1: APE on *Brooklyn, N.Y-N.J.* topographic quadrangle (U.S.G.S. 2013).



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

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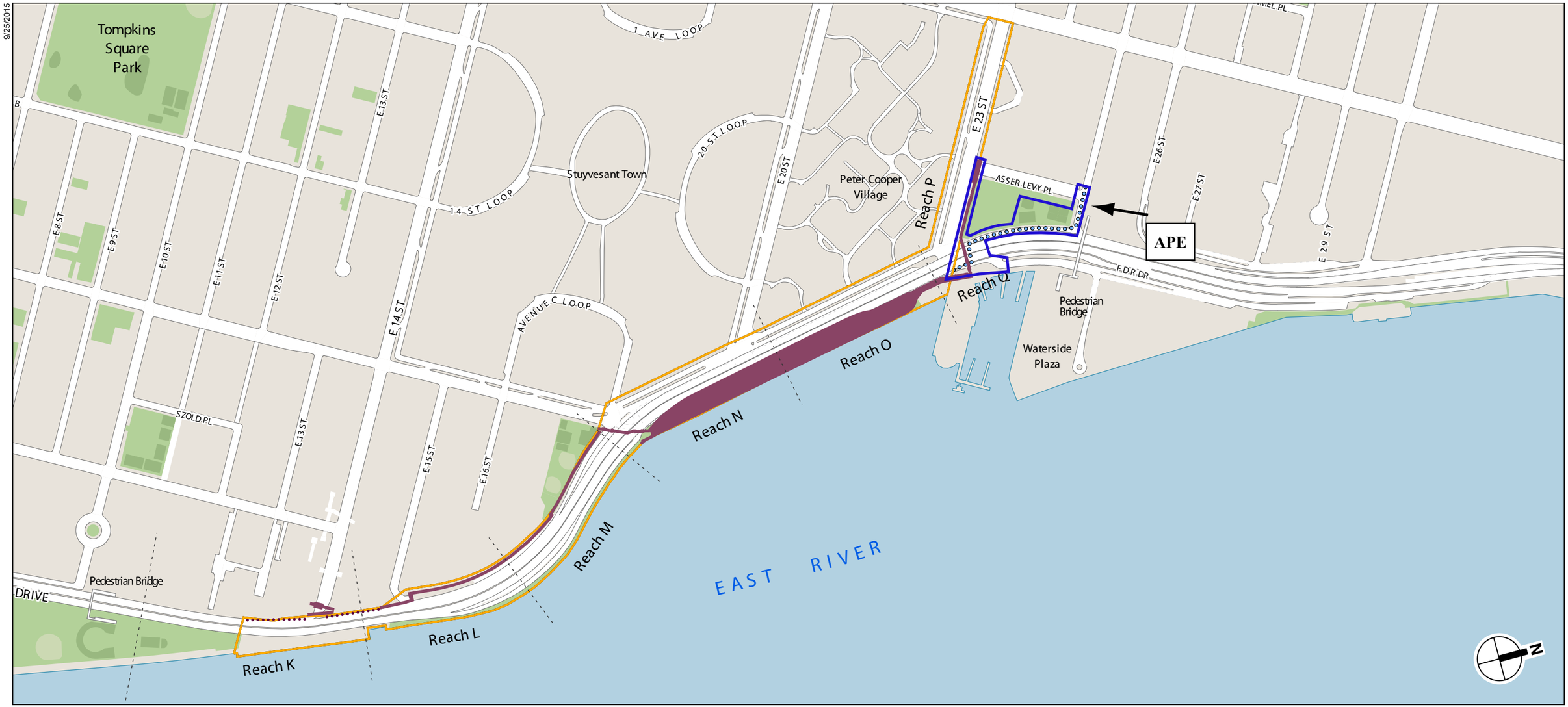
Figure 2: APE and photograph locations on modern street map (DoItt 2015).

0 100 200 300 400 500 FEET

9/25/2015



Project Area Two

Alternative Flood Protection System Alignment

Proposed Project Design Reaches

Approximate Limits of Alternative 2 Flood Protection System

Existing Con Ed Floodwalls

NOTE: Based on Preliminary Design Concepts

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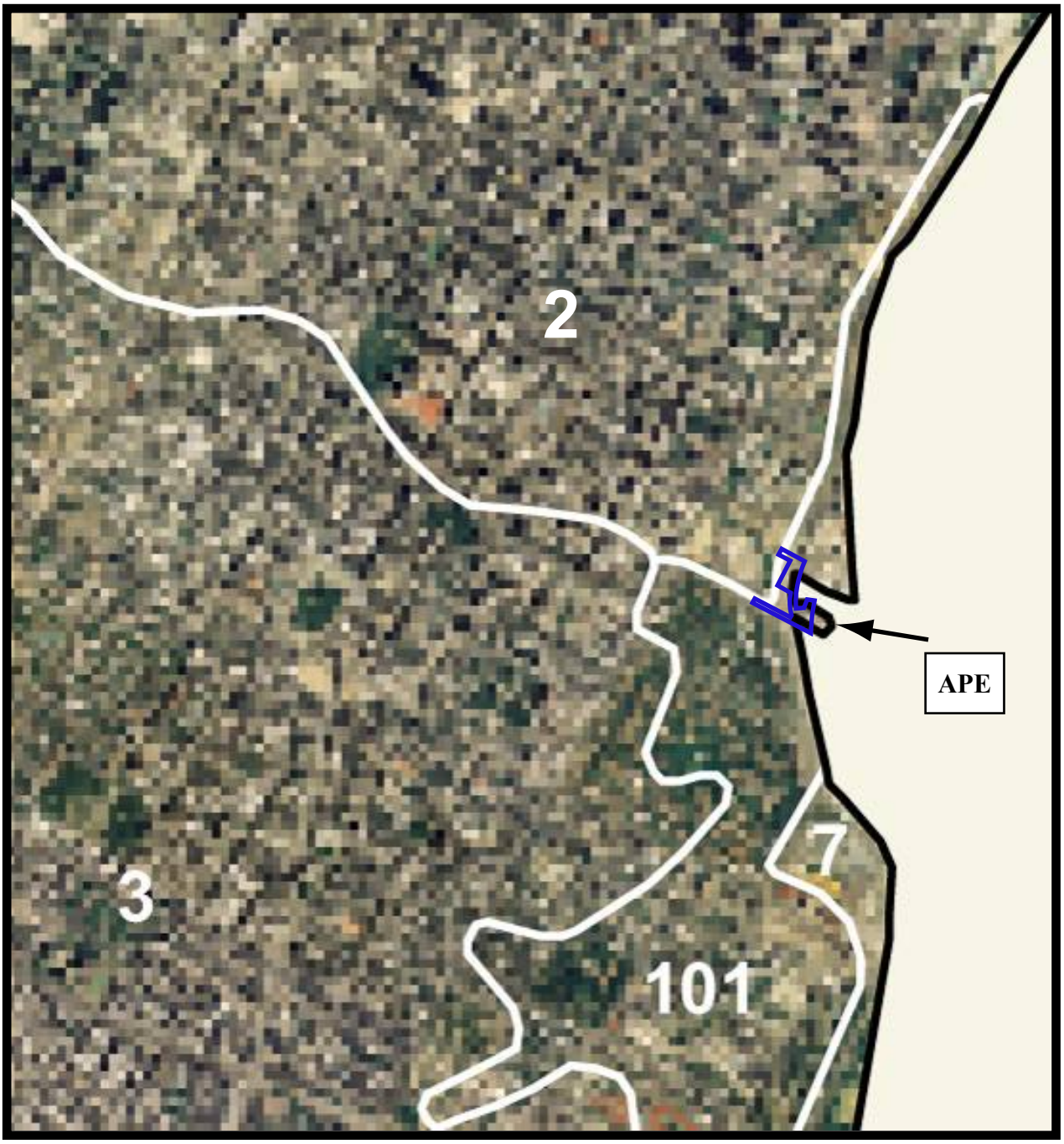
Capital Project SANDRESM1

EAST SIDE COASTAL RESILIENCY PROJECT

Alignment of Alternative 2 (Project Area Two)

Figure 3



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

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Figure 4: APE on *New York City Reconnaissance Soil Survey* (U.S.D.A. 2005).

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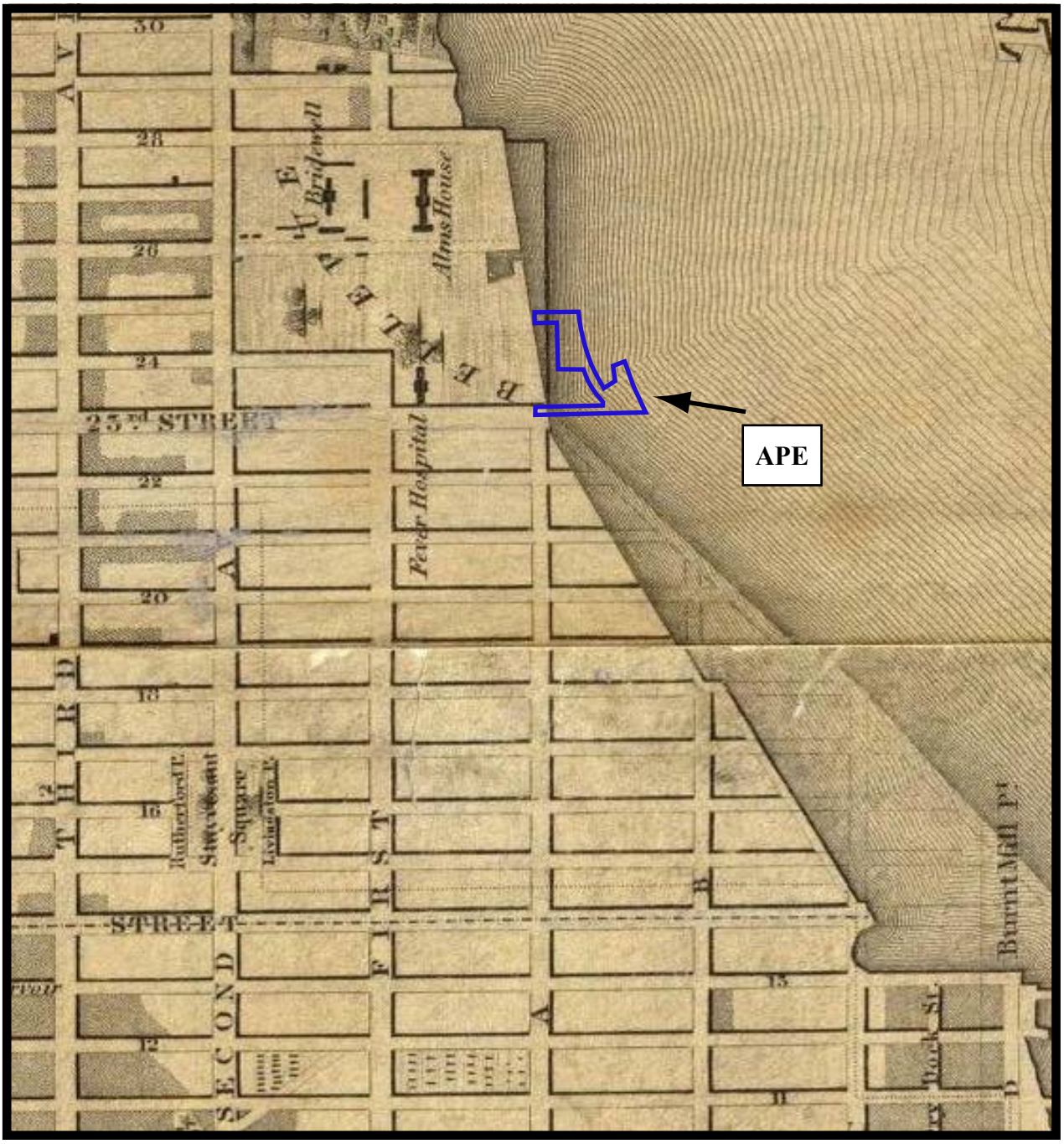
Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

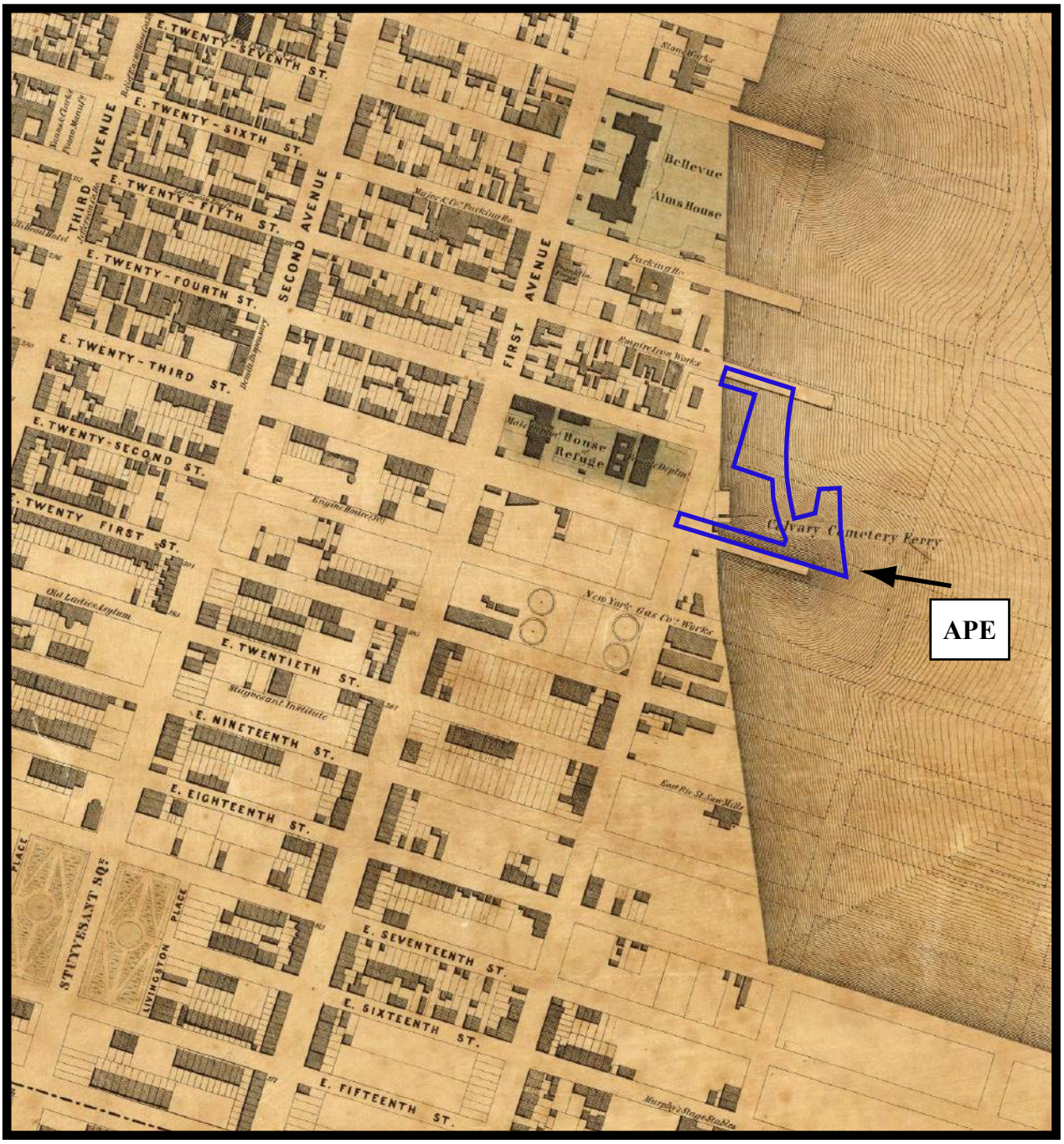
Figure 5: APE on Randel Farm Map Sheet 15 (Randel 1818-1820).



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

Figure 6: APE on *Topographical Map of the City and County of New-York and the Adjacent Country* (Colton 1836).

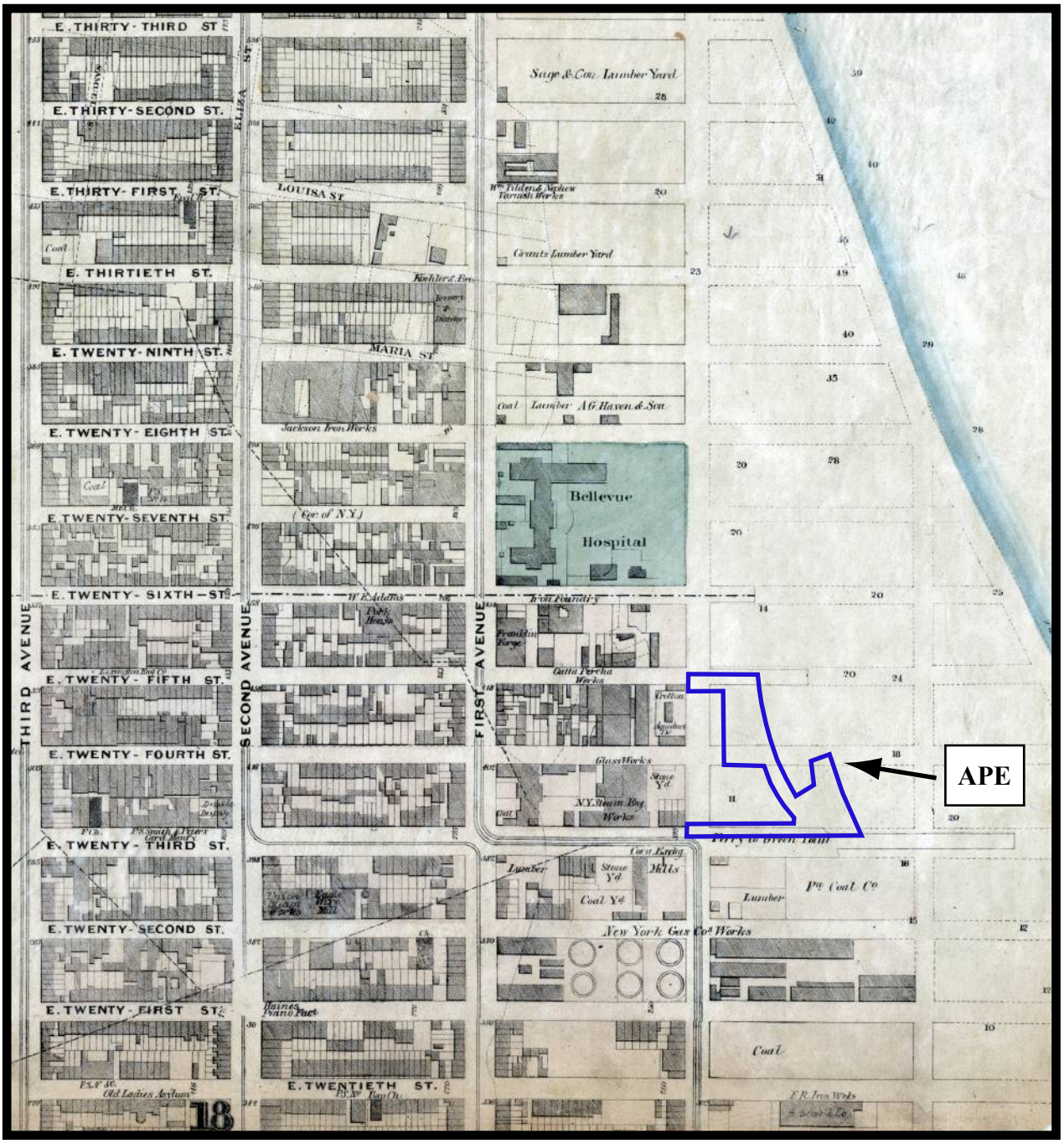
0 500 1000 1500 2000 2500 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

Figure 7: APE on *Map of the City of New York Extending Northward to Fiftieth Street* (Dripps 1852).

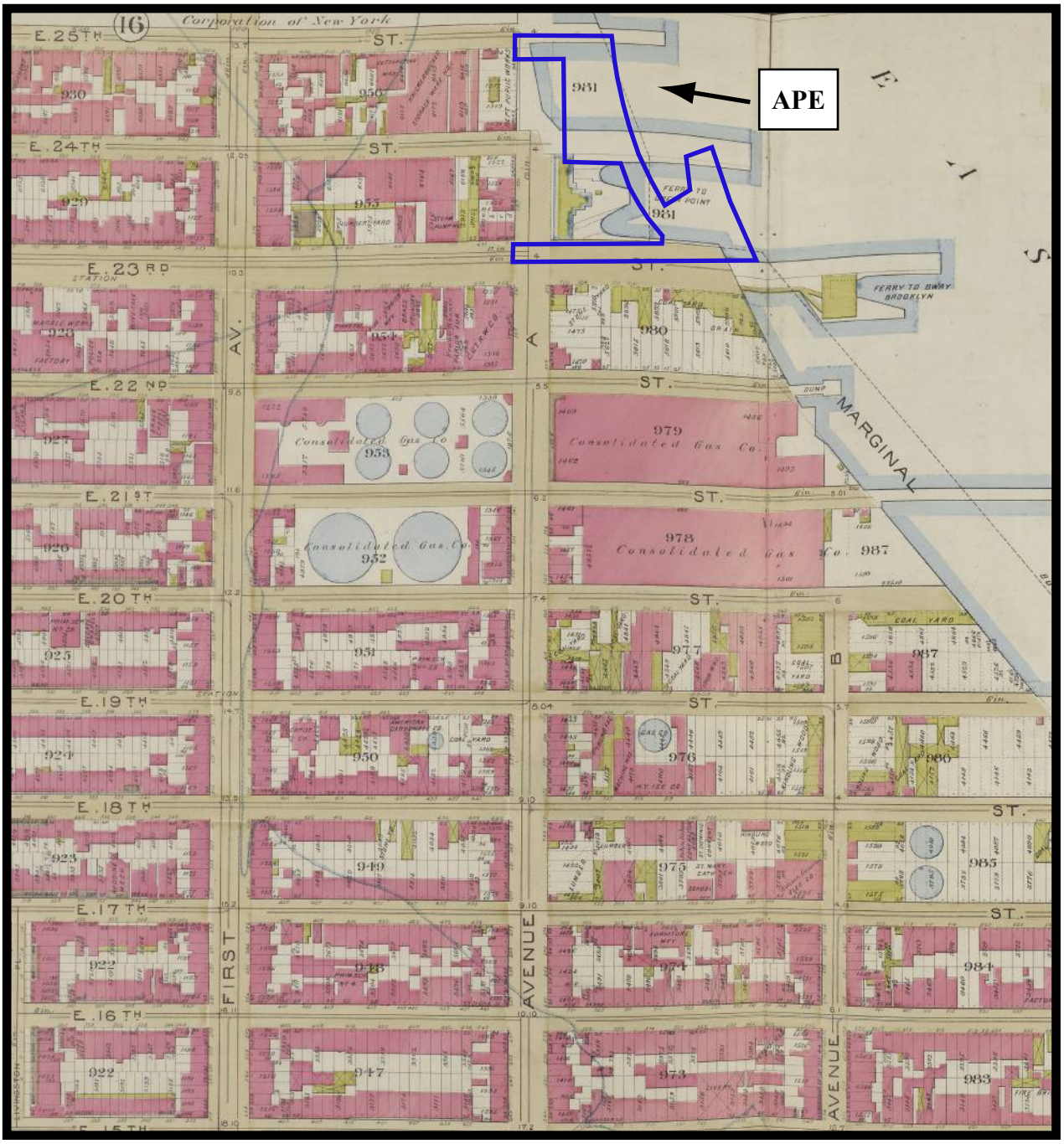
0 250 500 750 1000 1250 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

Figure 8: APE on *Plan of New York City from the Battery to Spuyten Duyvil Creek* (Harrison 1867).

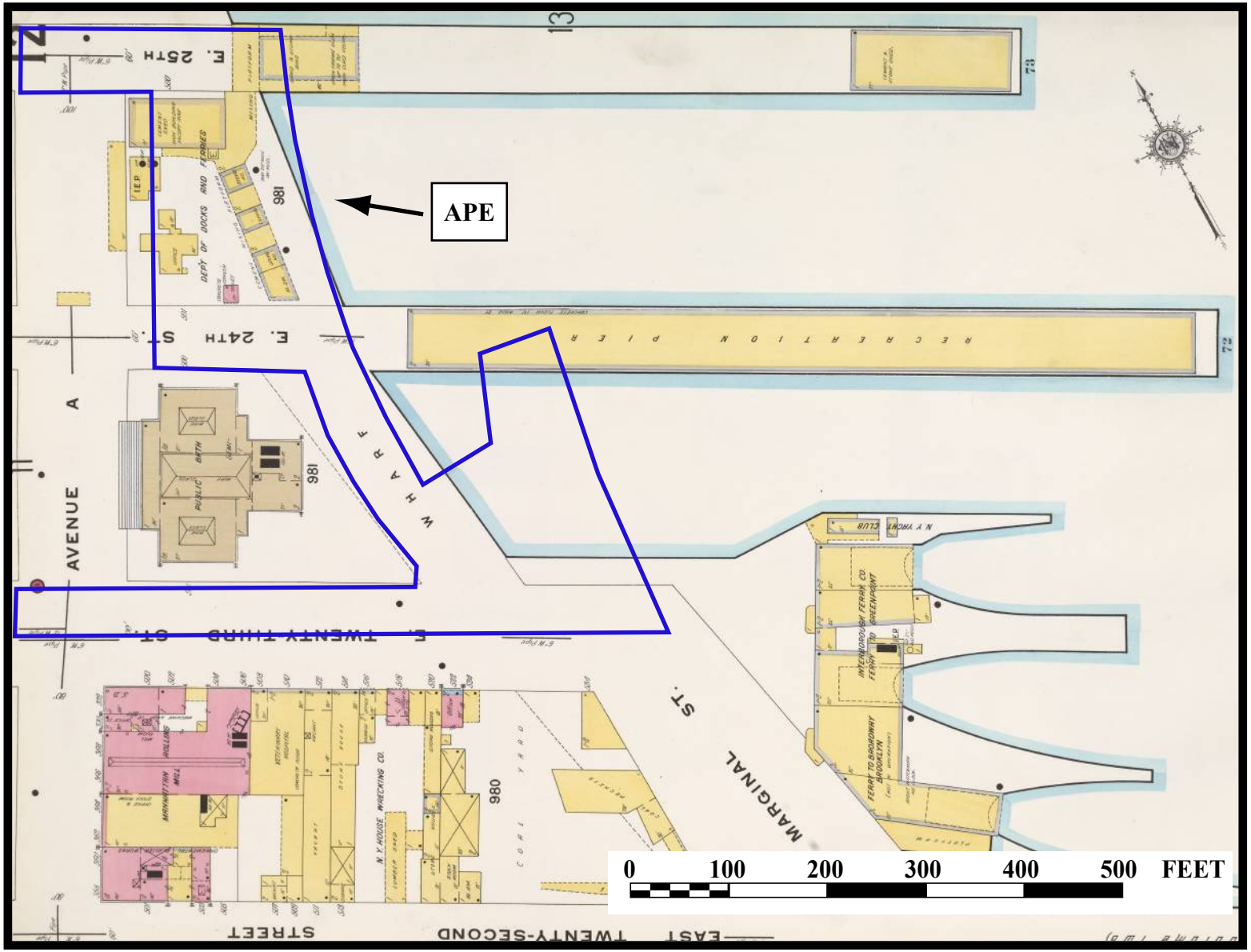
0 250 500 750 1000 1250 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

Figure 9: APE on *Atlas of the City of New York, Manhattan Island* (Bromley 1891).

0 250 500 750 1000 1250 FEET



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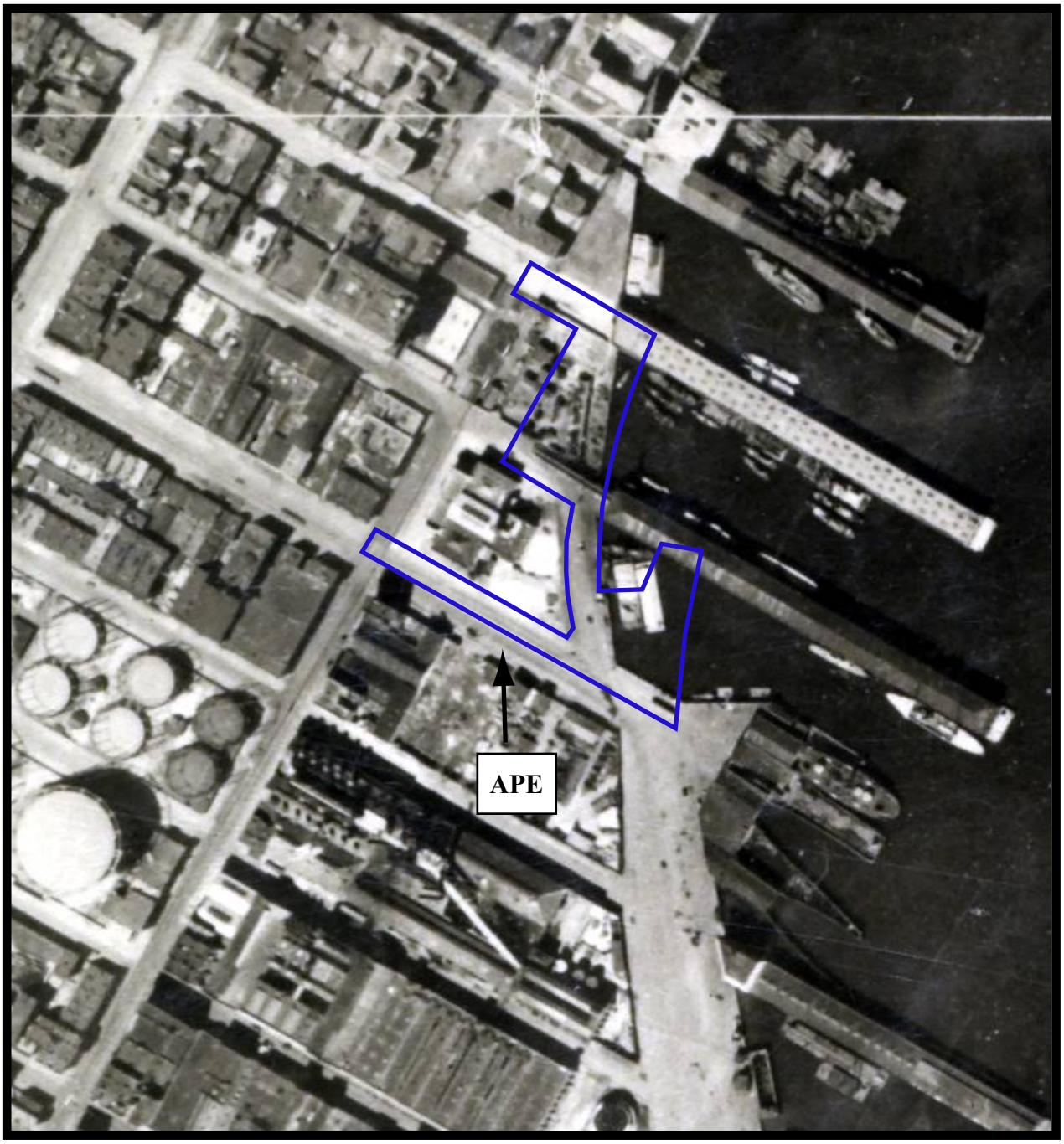
East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

Figure 10: APE on *Insurance Maps of the Borough of Manhattan* (Sanborn 1910).



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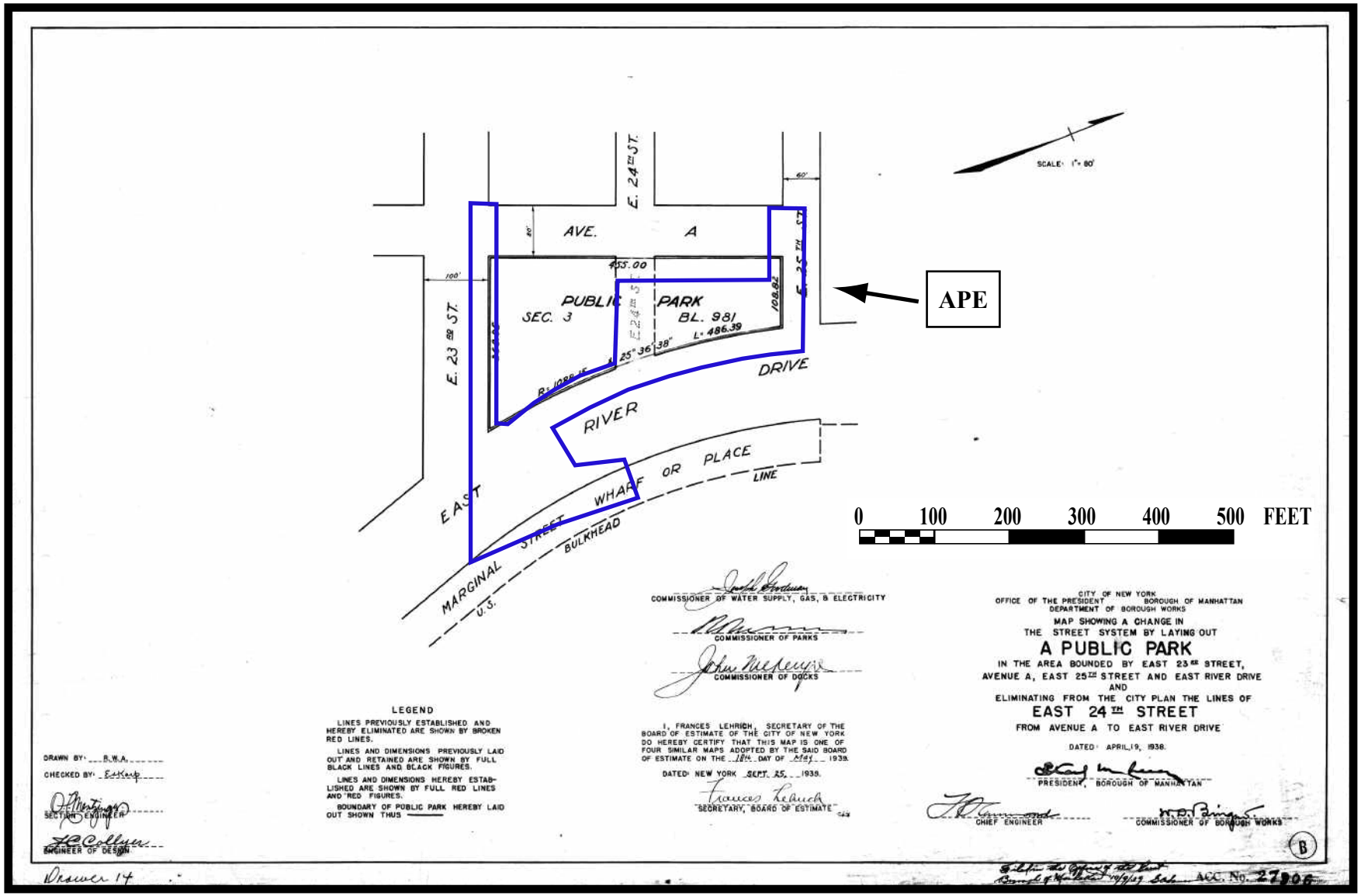
N

Figure 11: APE on *Sectional Aerial Maps of the City of New York* (Bureau of Engineering 1924).

0 200 400 600 800 1000 FEET



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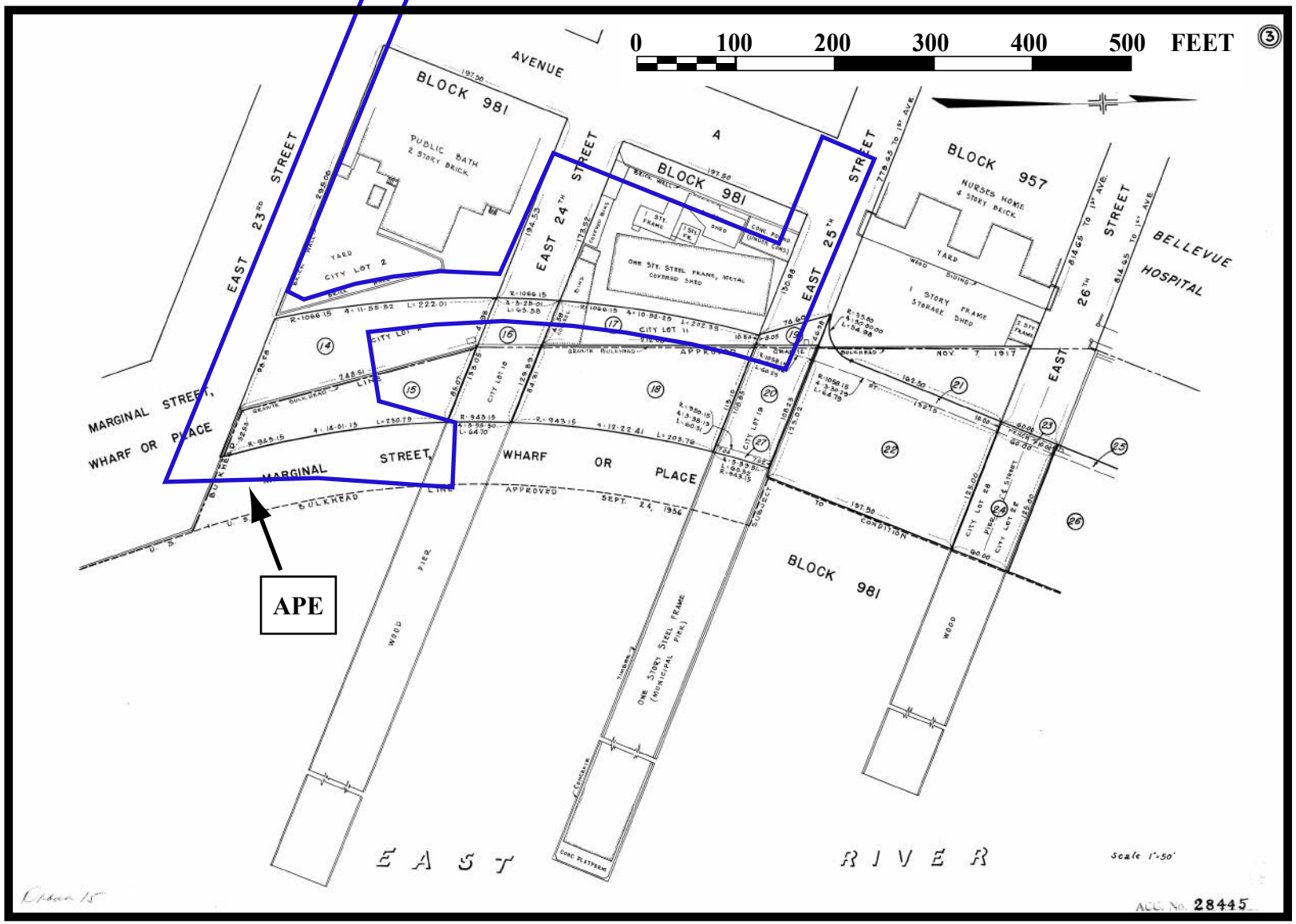
Manhattan, New York County, New York

Figure 12: APE on *Map Showing a Change in the Street System by Laying Out a Public Park...* (Borough Works 1939).



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Manhattan, New York County, New York

Figure 13: APE on *Draft Damage Map in the Matter of Acquiring Title to a Street Designated as East River Drive...* (Borough Works 1942).

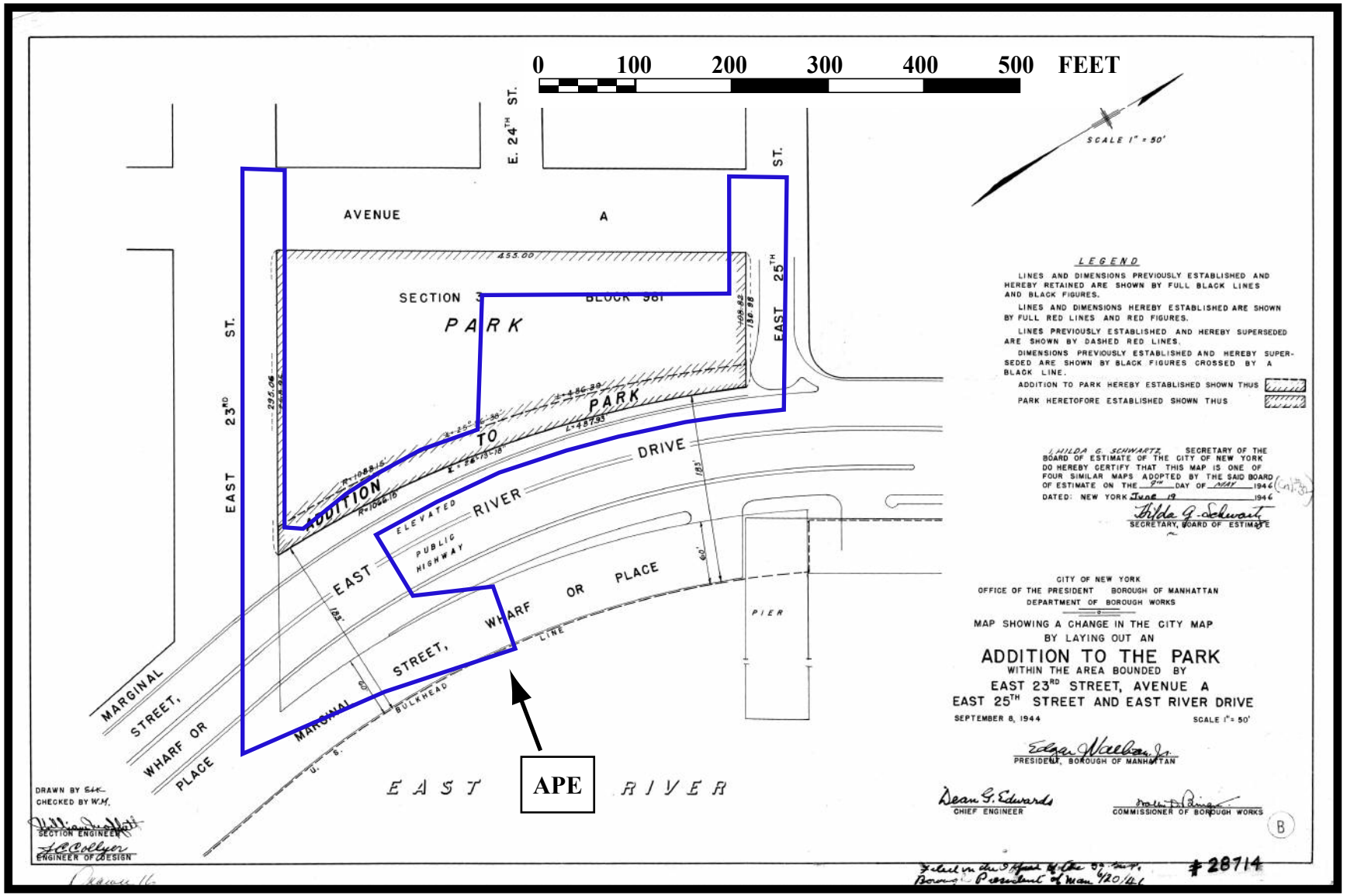

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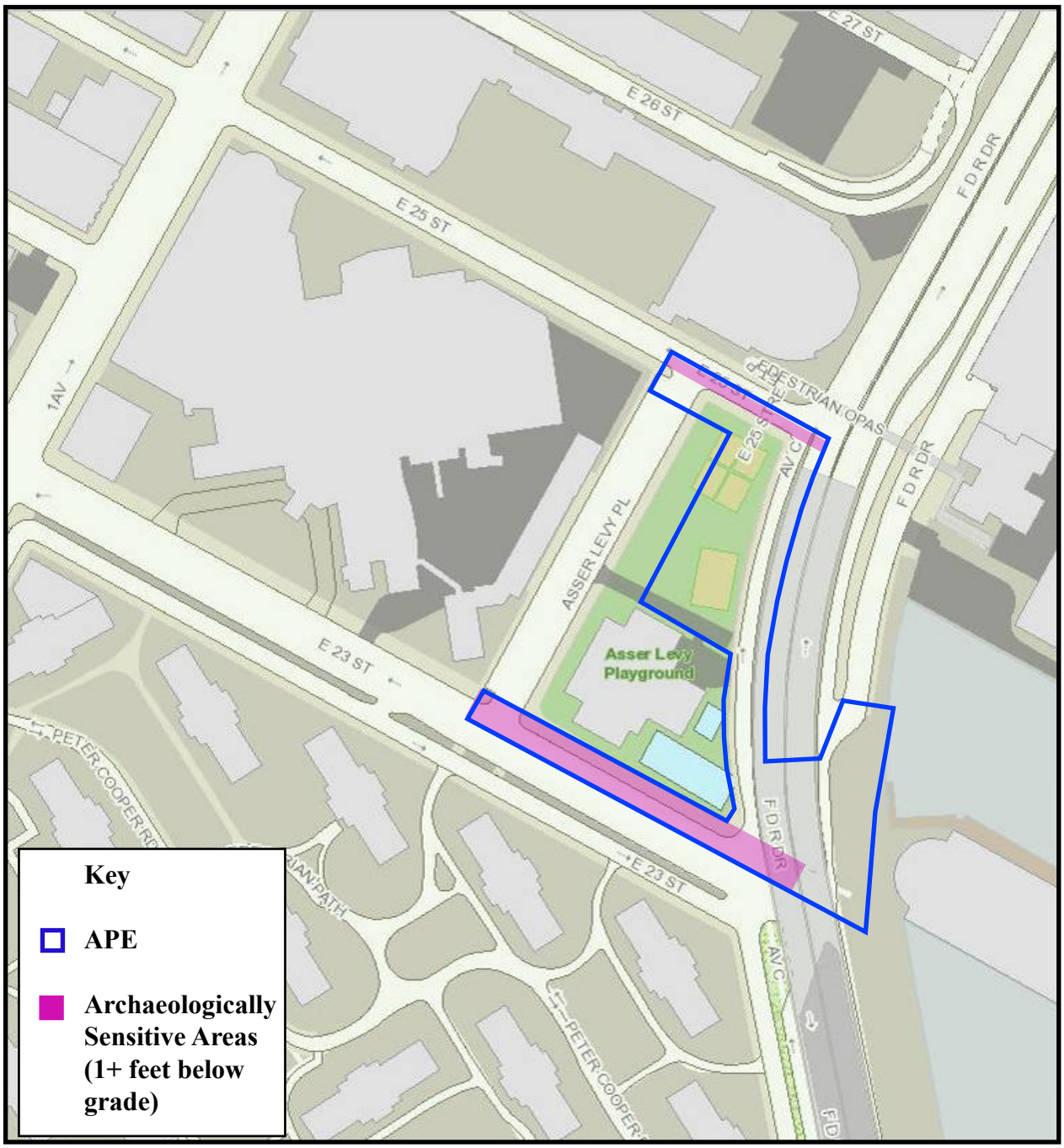
Figure 14: APE on *Map Showing a Change in the City Map by Laying out an Addition to the Park...* (Borough Works 1944).



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East Side Coastal Resiliency Project
East 23rd Street to East 25th Street
Manhattan, New York County, New York

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Figure 15: APE showing areas of archaeological sensitivity on modern street map (HPI 2016 and DoItt 2015).

0 100 200 300 400 500 FEET

PHOTOGRAPHS

Photograph 1: East 23rd Street intersection with the FDR Drive overpass. View looking northwest.

Photograph 2: East 23rd Street intersection with the FDR Drive overpass. View looking east.

Photograph 3: East 23rd Street intersection with the FDR Drive and Avenue C. Asser Levy Recreation Center (brick building) is in right background. View looking northwest.

Photograph 4: East 23rd Street sidewalk at former line of Asser Levy Place. View looking west.

Photograph 5: Asser Levy Playground with FDR Drive service road in foreground and East 25th Street on right. View looking northwest.

Photograph 6 Asser Levy Playground with FDR Drive service road on left and East 25th Street in foreground. View looking southwest.

Photograph 7: East 25th Street at former line of Asser Levy Place. View looking southeast.

APPENDIX A: PROJECT AREA TWO ALTERNATIVE 1, DESIGN PLANS, CIVIL PLANS, AND TYPICAL SECTIONS FOR THE APE

(Note: in this report, Alternative 1 is the “no build” alternative; here it is equivalent to Alternative 2)

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Department of Design and Construction

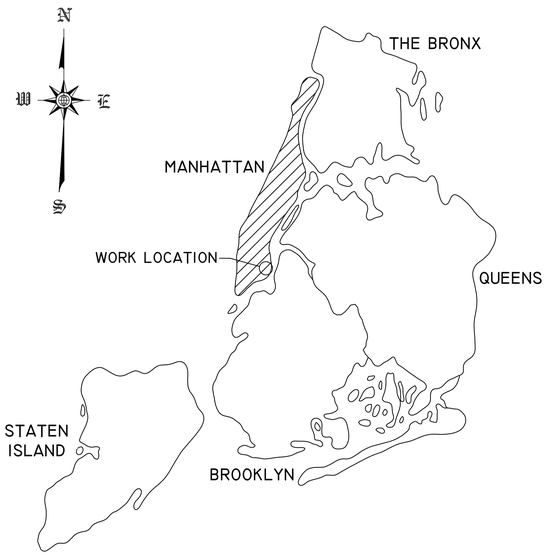
DIVISION OF INFRASTRUCTURE
BUREAU OF DESIGN

PROJECT ID: SANDRESMI

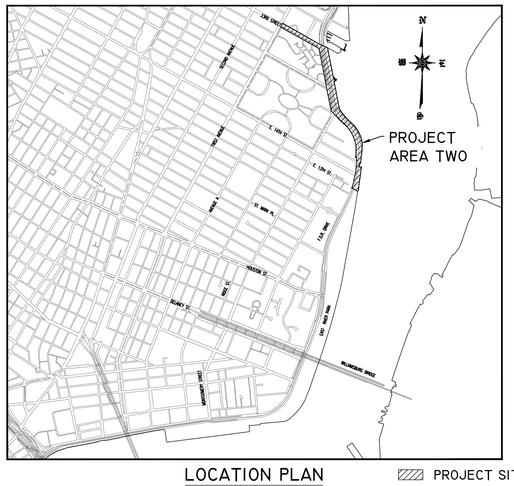
FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY

PROJECT AREA TWO - ALTERNATIVE 1

FROM EAST 13TH STREET TO EAST 23RD STREET



BOROUGH OF MANHATTAN
CITY OF NEW YORK



LOCATION PLAN
N.T.S.

PROJECT SITE

COMMUNITY BOARD NO. 3 AND NO. 6

ERIC MACFARLANE, P.E.
DEPUTY COMMISSIONER

YUN POY (DINO) NG, P.E.
ASSOCIATE COMMISSIONER

MOHSEN ZARGARELAHI, P.E.
ASSISTANT COMMISSIONER

ALI MALLICK, P.E.
DEPUTY ASSISTANT COMMISSIONER

REVIEWED AND APPROVED BY:

HOW SHEEN PAU, P.E.
DIRECTOR

NAME
ENGINEER-IN-CHARGE

SUBMITTED BY:

AKRF | KSE
The AKRF-KSE JV

PREPARED BY:

MATHEWS NIELSEN | ARCADIS | CH2MHILL. | Hardesty & Hanover engineering first moves you

0 1 2 3 4
ORIGINAL SIZE IN INCHES

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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PROJECT ID SANDRESMI

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ABBREVIATIONS

ABANDONED	ABDN.
APARTMENT	APT.
ASPHALT	ASPH.
BASEMENT	BSMT.
BITUMINOUS	BIT.
BLOCK	BLK.
BLUESTONE	B.S.
BLUESTONE CURB	B.S.C.
BLUESTONE WALK	B.S.W.
BOTTOM OF CURB	B.C.
BRICK	BRK.
BUILDING	BLDG.
BUILT	BLT.
CAST IRON	C.I.
CENTER LINE	C.L.
CHAIN LINK FENCE	C.L.F.
CHAMBER	CH.
CLASS NUMBER	CL. #
COMBINED	COMB.
COMMERCIAL	COML.
CONCRETE	CONC.
CONCRETE CURB	C.C.
CONCRETE WALK	C.W.
DIAMETER	DIA.
DOUBLE BARREL	D.B.
DOWN	DN.
DRAWING	DWG.
DUCTILE IRON PIPE	D.I.P.
EXISTING	EXIST.
EXTRA STRENGTH VITRIFIED PIPE	E.S.V.P.
FIRE ALARM	F.A.
FIRE DEPARTMENT	F.D.
FLAT TOP REINFORCED CONCRETE	F.T.R.C.
FRAME	FR.
GRANITE	GRAN.
GRANITE CURB	GRAN. C.
INTERCEPTOR	INT.
INVERT ELEVATION	INV. EL.
IRREGULAR	IRR.
MANHOLE	MH
NOT IN CONTRACT	N.I.C.
NOT TO SCALE	N.T.S.
PAVEMENT	PVMT.
POINT OF CURVATURE	P.C.
POINT OF INTERSECTION	P.I.
POINT OF TANGENCY	P.T.
PRECAST REINFORCED CONCRETE	P.R.C.
RADIUS	R
REINFORCED CONCRETE PIPE	R.C.P.
ROADWAY	RDWY.
SANITARY	SAN.
SEWER	SWR.
SIDEWALK	SWK.
STANDARD	STD.
STEAM	SM.
STEEL	STL.
STEEL FACED	ST.F.
STEEL FACED CONCRETE CURB	ST.F.C.C.
STONE	STN.
STORM	STM.
STORY	STY.
TOP OF CURB	T.C.
TRAFFIC SIGN	T.S.
VACANT	VAC.
WORKING POINT	W.P.

LEGEND

	EXISTING	PROPOSED
MANHOLES		
ELECTRIC	E	E
CABLE TV	C	
TELEPHONE	T	
TRAFFIC	Tf	
NYC MH	NYC	
GAS	G	
WATER	W	
FIRE DEPT.	F	
SUBWAY	Su	
COAL CHUTE	CC	
STORM SEWER	STM	STM
STORM CHAMBER	STM	STM
COMBINED SEWER		STM
SANITARY SEWER	SAN	SAN
INTERCEPTOR SEWER	INT	INT
UNIDENTIFIED MANHOLE (NO RECORD AVAILABLE)	Mh	
BUILT MANHOLE REPLACED BY NEW MANHOLE		
RECORD MANHOLE	S	
HARDWARE RIM EL. & INV. EL. (SEWER, ETC.)	61.23 / INV.47.89	
BASINS		
CATCH BASIN WITH CURB PIECE - TYPE 1	1	1
CATCH BASIN WITHOUT CURB PIECE - TYPE 2	2	2
CATCH BASIN WITHOUT CURB PIECE - TYPE 3	3	3
EXISTING CATCH BASIN TO BE REMOVED		
TO BE ABANDONED		A
TO BE MODIFIED		M
TO BE ADJUSTED		A
CATCH BASIN - NON-STANDARD		N
NEW CATCH BASIN TO BE CONSTRUCTED IN SAME LOCATION AS OLD BASIN		
INLET		
SEEPAGE BASIN	SB	SB
HYDRANTS		
LOW PRESSURE HYDRANT		
LOW PRESSURE HYDRANT TO BE REMOVED		
HIGH PRESSURE HYDRANT		
LOW PRESSURE HYDRANT TO BE RELOCATED		R
HIGH PRESSURE HYDRANT TO BE RELOCATED		R
LOW PRESSURE HYDRANT TO BE ADJUSTED (VERTICALLY)		A
HIGH PRESSURE HYDRANT TO BE ADJUSTED (VERTICALLY)		A
SIAMESE CONNECTION		
STREET LIGHTING AND TRAFFIC SIGNALS		
WOOD UTILITY POLE		
WOOD UTILITY POLE TO BE REMOVED		
WOOD UTILITY POLE WITH STREET LIGHT		
WOOD UTILITY POLE WITH STREET LIGHT TO BE REMOVED		
WOOD UTILITY POLE WITH TRAFFIC SIGNAL		
WOOD UTILITY POLE WITH STREET LIGHT AND FIRE ALARM BOX		F
WOOD UTILITY POLE WITH STREET LIGHT AND FIRE ALARM BOX TO BE REMOVED		F
WOOD UTILITY POLE WITH FIRE ALARM BOX		F
WOOD UTILITY POLE WITH PEDESTRIAN SIGNAL		PS
WOOD UTILITY POLE WITH TRAFFIC AND PEDESTRIAN SIGNAL		PS
WOOD UTILITY POLE WITH STREET LIGHT AND TRAFFIC AND PEDESTRIAN SIGNAL		PS
STREET LIGHT (METAL POLE)		
TRAFFIC SIGNAL CONTROL BOX		
TRAFFIC SIGNAL POST W/PEDESTRIAN SIGNAL	TPS	TPS

LEGEND

	EXISTING	PROPOSED
VALVE BOXES		
GAS	G	
WATER	W	
STEAM	St	
TREES		
EXISTING TREE (SIZE AS LABELED)		
EXISTING TREE TO BE REMOVED		
NEW TREE TO BE PLANTED		
SHRUB		
HEDGE (HEIGHT AS LABELED)		
MISCELLANEOUS		
VAULT (SIDEWALK)	V	
CELLAR WINDOW GRATING		
CELLAR DOOR	CD	
SUBWAY GRATING		
SURFACE WATER FLOW		
TRAFFIC DIRECTION		
PARKING METER		
OIL FILL CAP OR OIL VENT	O OR FILL	
FIRE ALARM BOX	F	
POLICE CALL BOX	P	
MAIL BOX, PUBLIC PHONE	MB TEL.	
COLUMN - FOUNDATION (OF ELEVATED STRUCTURES)	OR	
HEADER		
AREA OF ADJUSTMENT		
LIMIT OF NEW PAVEMENT		
BUS PAD		
SIGN (GROUND MOUNTED, SINGLE SIGN)		
SIGN (GROUND MOUNTED, MULTIPLE SIGNS)		
SIGN (GROUND MOUNTED, MULTIPLE SIGNS)		
SIGN (OVERHEAD)		
TRAIN STATION ENTRANCE	DOWN	
SHAFT TO BUILDING BASEMENT	SH	
PEDESTRIAN RAMP		
CURB (CONCRETE UNLESS OTHERWISE INDICATED)		
CURB WITH DROP CURB (DRIVEWAY)	D C	D C
EDGE OF PAVEMENT WITHOUT CURB		
PROPOSED CONSTRUCTION (TOP OF CURB) ELEVATION AND STATION		T.C. 13.8 / STA. 26+33
ROCK OUTCROP		
NORTH ARROW		
BARRIERS		
BEAM TYPE MALL BARRIER		
PORTABLE PRECAST CONCRETE BARRIER		
CAST IN PLACE CONCRETE BARRIER		
RETAINING WALL (W/TYPE)	RW (STN.)	
RAILROAD/TROLLEY TRACK		
FENCE (WITH HEIGHT AND TYPE)		
CHAIN LINK FENCE	6'	
IRON PICKET FENCE	5'	
WIRE FENCE	5'	
IRON ON CONCRETE COPING		
WOOD PICKET FENCE	4'	
GUARD POST	GP	
BUILDINGS		
HOUSE INFORMATION — HOUSE NUMBER, BLDG TYPE, FIRST FLOOR ELEV., (CE) CELLAR ENTR., (GE) GARAGE ENTR.	95-02 2-STY.FR. ▼ 25.3 G.E.17.5	
STAIRS OR STOOPS		
CANOPY	CANOPY	

LEGEND

	EXISTING	PROPOSED
CONDUITS		
6" WATER MAIN		
8" WATER MAIN		
12" WATER MAIN		
16" WATER MAIN		
20" WATER MAIN		
24" WATER MAIN		
30" WATER MAIN		
36" WATER MAIN		
42" WATER MAIN		
48" WATER MAIN		
54" WATER MAIN		
60" WATER MAIN		
66" WATER MAIN		
72" WATER MAIN		
84" WATER MAIN		
96" WATER MAIN		
STORM SEWER (WITH SIZE - LESS THAN 24")	15"STM	15"STM
STORM SEWER (WITH SIZE - 24" AND GREATER)*	24"STM	24"STM
SANITARY SEWER (WITH SIZE - LESS THAN 24")	15"SAN	15"SAN
SANITARY SEWER (WITH SIZE - 24" AND GREATER)*	24"SAN	24"SAN
COMBINED SEWER (WITH SIZE - LESS THAN 24")	15"COMB	15"COMB
COMBINED (WITH SIZE - 24" AND GREATER)*	24"COMB	24"COMB
INTERCEPTOR SEWER (WITH SIZE - LESS THAN 24")	15"INT	15"INT
INTERCEPTOR SEWER (WITH SIZE - 24" AND GREATER)*	24"INT	24"INT
CATCH BASIN CONNECTION		
GAS LINE (WITH SIZE)	4" G	
STEAM (WITH SIZE)	16" ST	
ELECTRIC		
TELEPHONE		
FIRE ALARM		
OVERHEAD (AERIAL) UTILITY LINE	A/E,T,F	
TA SUBWAY CONDUIT	Su	
LEGAL DATA		
LOT & BLOCK NUMBER	39 BLOCK 2109	
ESTABLISHED/LEGAL GRADE	12.3	
ANGLE	86°-30'-48"	
BLOCK LENGTH	167.01' (65.75 m)	
INTERPOLATED/CALCULATED ANGLE OR LENGTH	[86°-30'-48"] [167.01'(65.75 m)]	
PROPERTY POSSESSION LINE		
MAPPED PROPERTY LINE (RIGHT-OF-WAY LINE)		
LOT LINE		
SURVEY MONUMENT (CITY) - IDENTIFY BY TOPO NUMBER	BM#	
BENCH MARK (LABEL)	BM#	
SURVEY CONTROLS		
CONTROL SURVEY TRAVERSE		
CENTER LINE BASE LINE	T 100+00 T101+00	

* LINE SPACING IN SYMBOL TO BE SCALED TO CONDUIT SIZE

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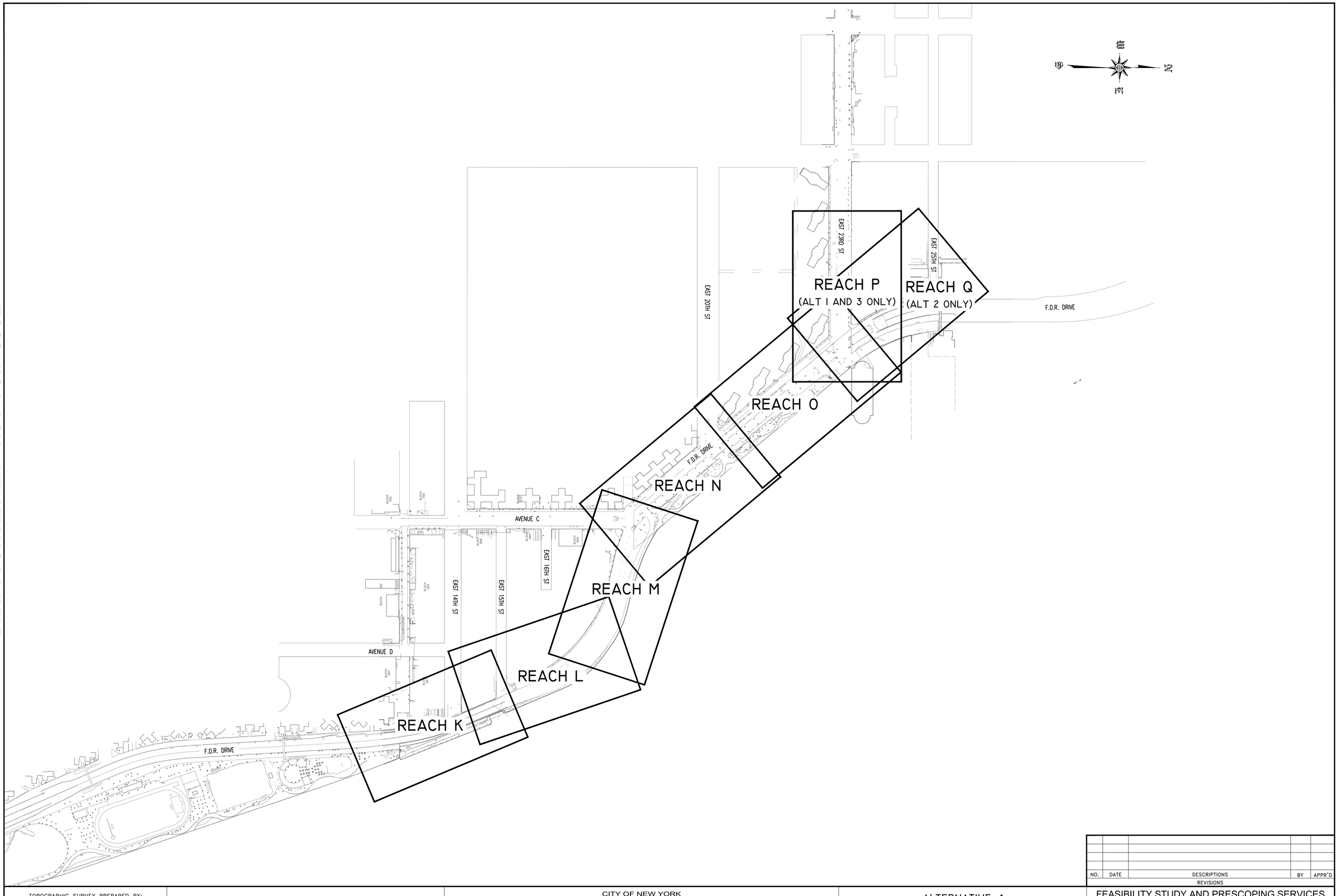

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FOR EAST SIDE COASTAL RESILIENCY
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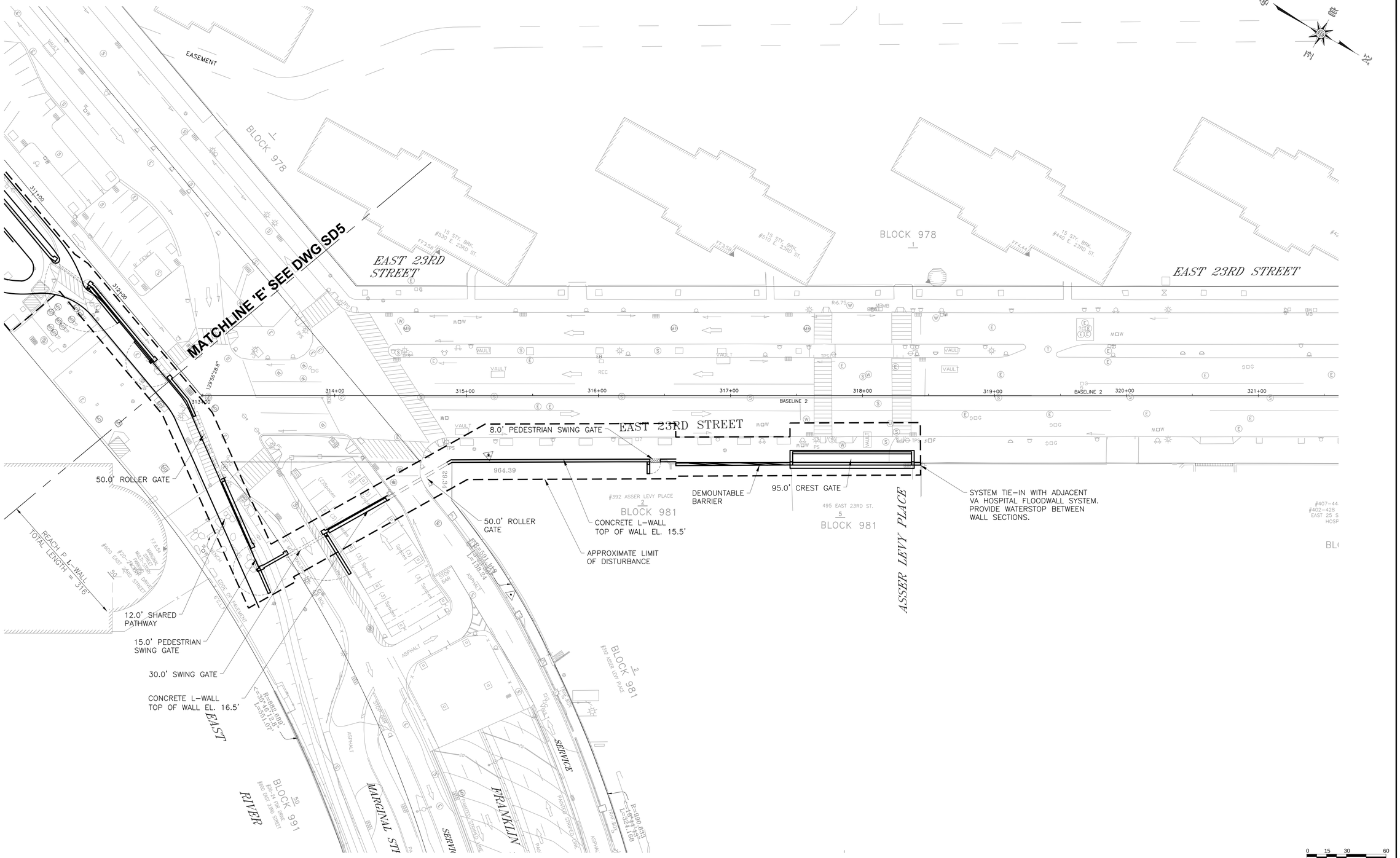

0 15 30 60
SCALE: 1" = 30'

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ALTERNATIVE 1
SCHEMATIC DESIGN PLAN – REACH P
STA. 312+75 – 318+44

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FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY

BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 08/28/2015

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SD6
SD5

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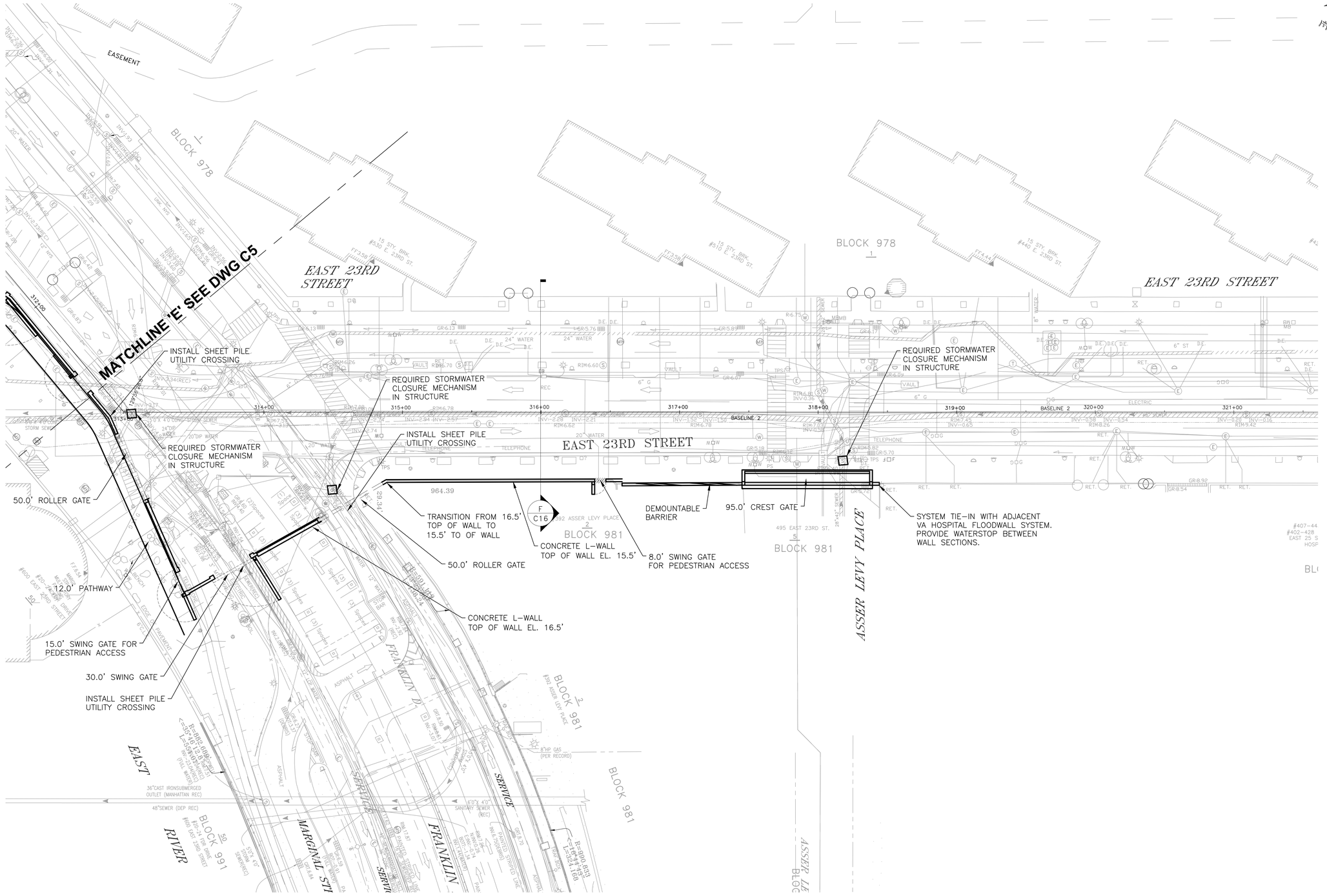

0 15 30 60
SCALE: 1" = 30'

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STA. 312+75 – 318+44

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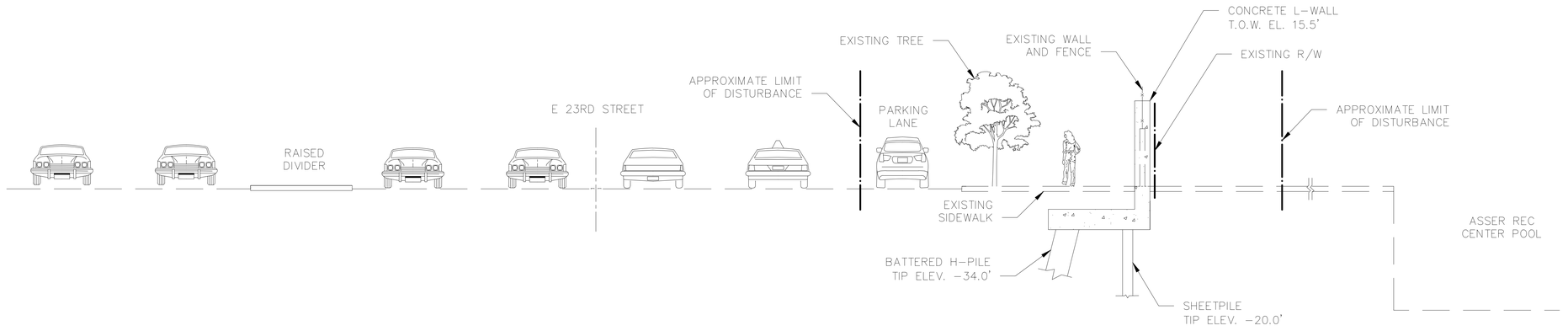

F
C6 TYPICAL SECTION – EAST 23RD STREET

STA. 316+00

0 15 30 60
SCALE: 1" = 30'

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C20

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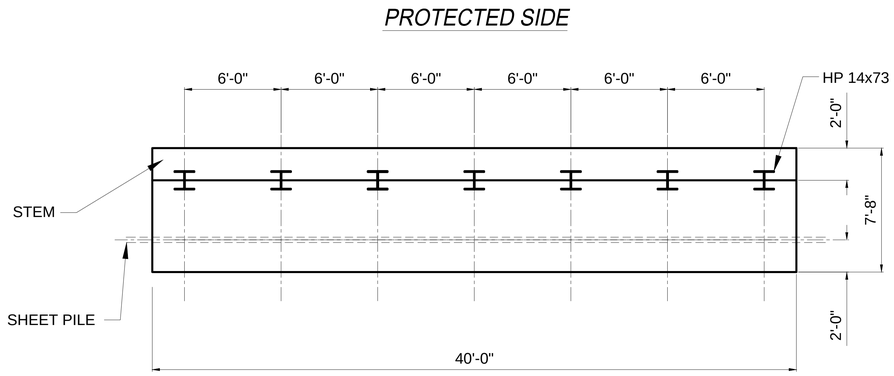
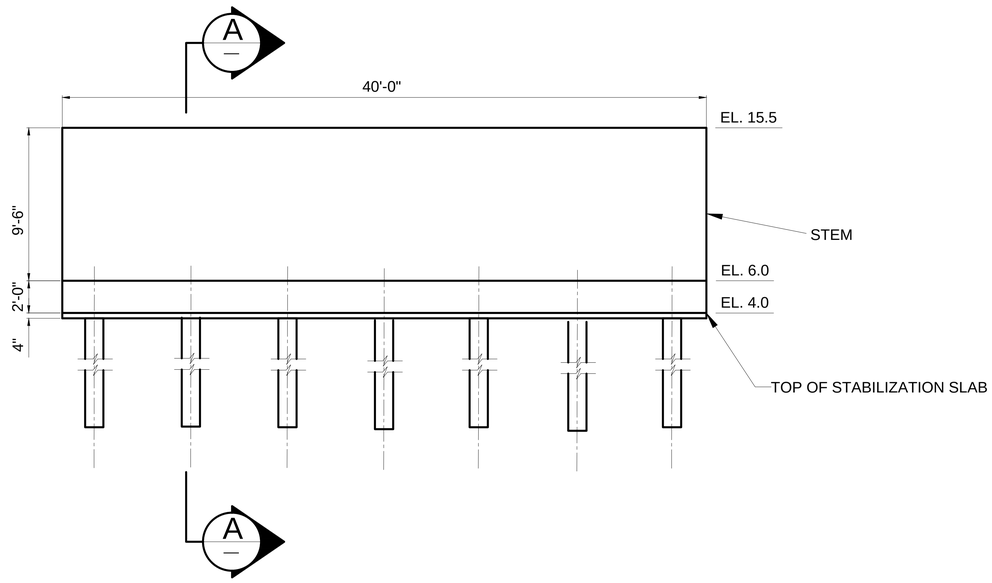
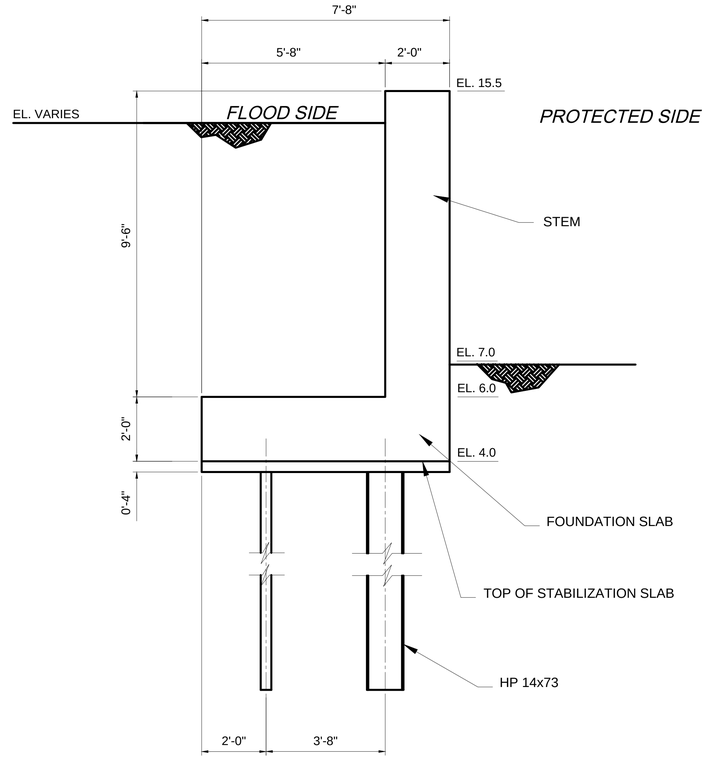


L-WALL PLAN



L-WALL ELEVATION



L-WALL SECTION A

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(11 OF 14)

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FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 08/26/2015

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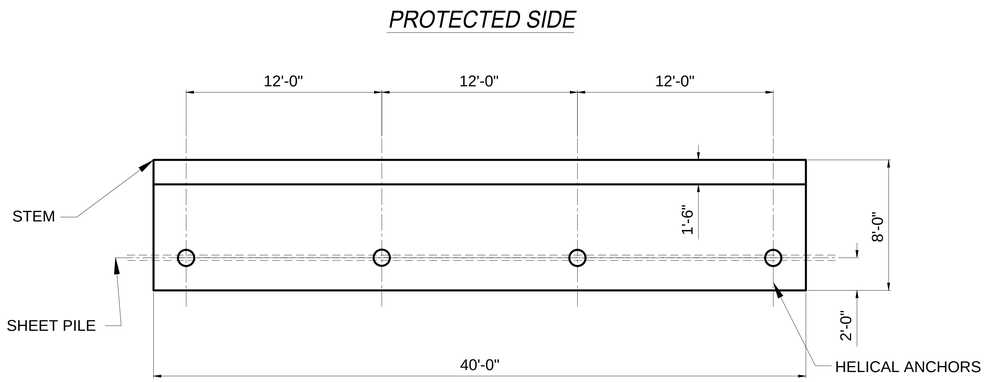
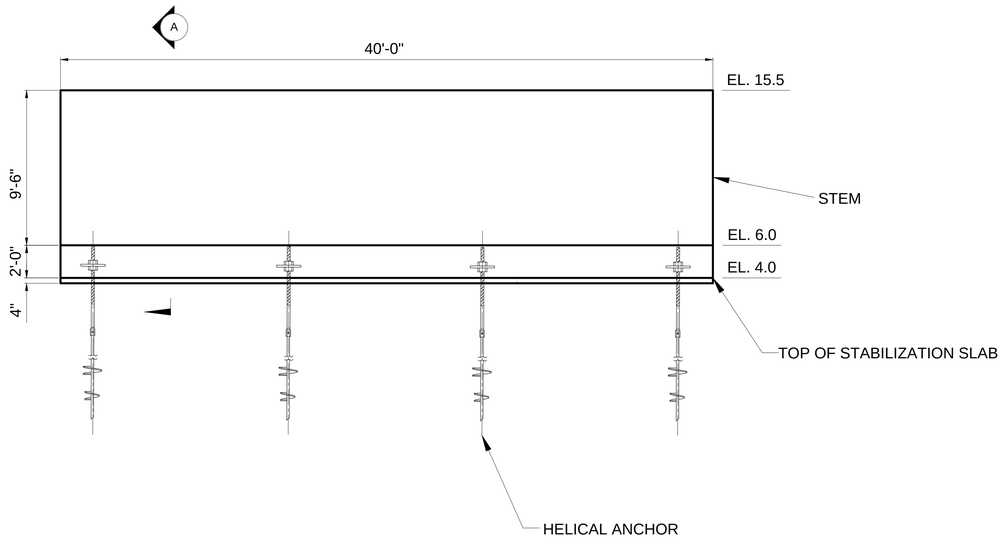
C20

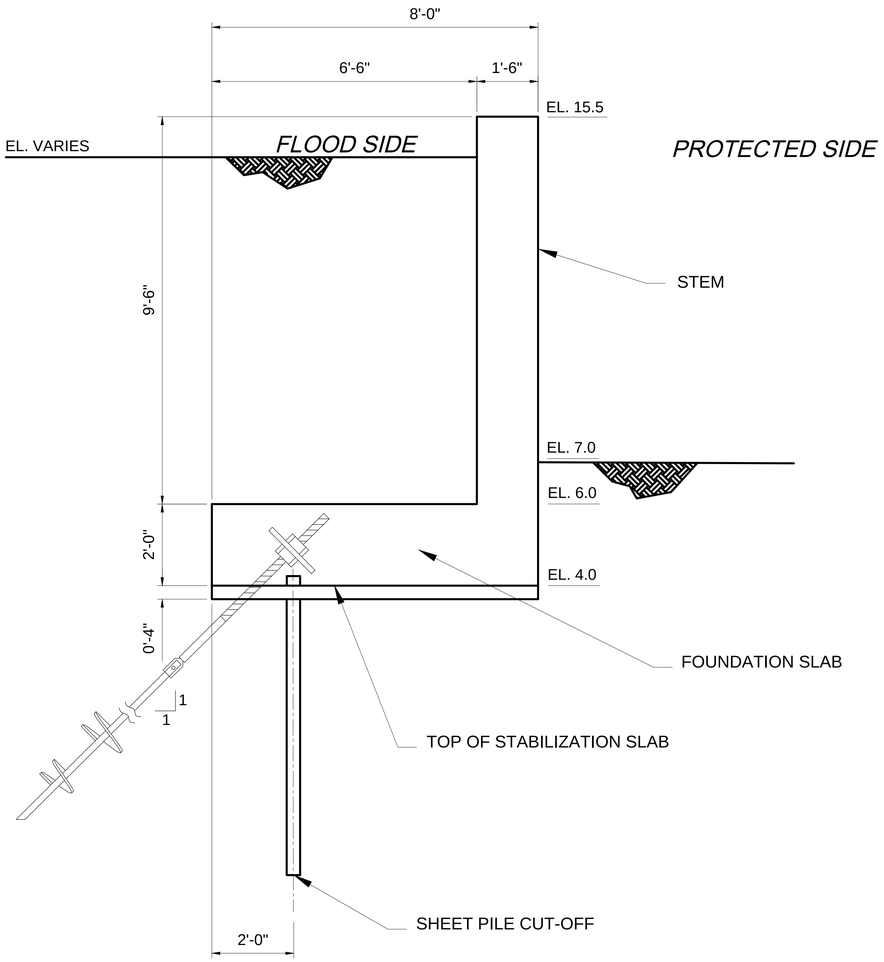
CONSULTANT DESIGN



L-WALL PLAN



L-WALL ELEVATION



SECTION A

SCALE: NTS

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

TOPOGRAPHIC SURVEY PREPARED BY:
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ONE PENN PLAZA SUITE 610
NEW YORK, NEW YORK 10119
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CITY OF NEW YORK
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DIVISION OF INFRASTRUCTURE
BUREAU OF DESIGN

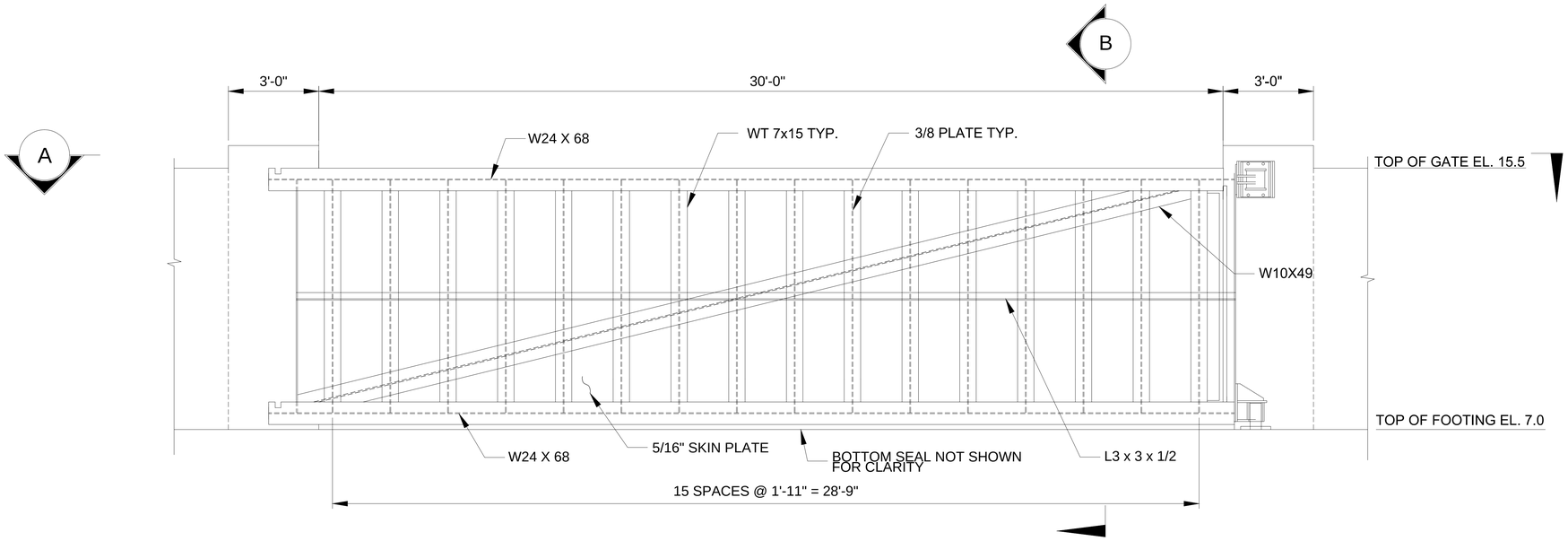
ALTERNATIVE 1
TYPICAL SECTIONS
(12 OF 14)

ARCADIS DRAWN BY
SANDRESM2-C311-P2 CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

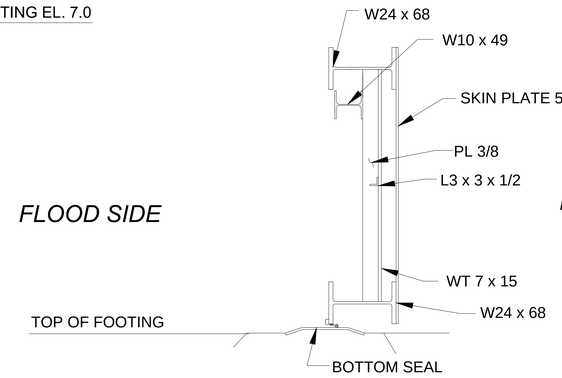
CAPITAL PROJECT NO. SANDRESM1 08/26/2015 | SHEET 28 OF 37 | C18/C20

CONSULTANT DESIGN



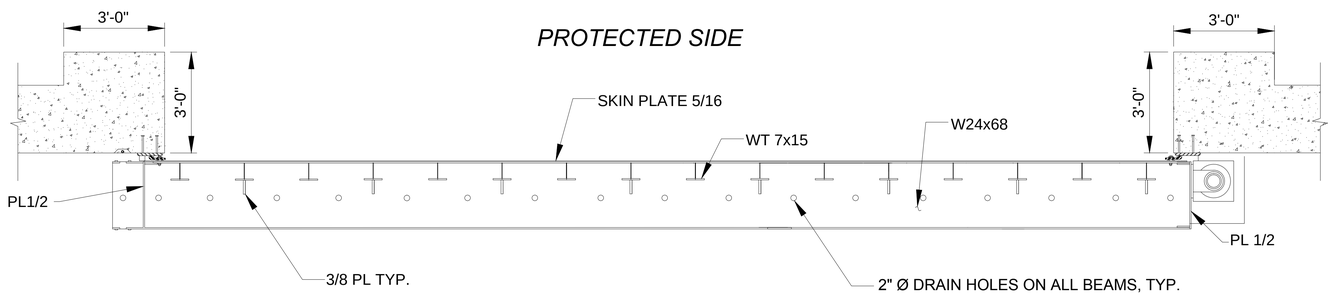
STEEL SWING GATE FLOOD SIDE ELEVATION

SCALE: NTS



SECTION B

SCALE: NTS



SECTION A

SCALE: NTS

NO.	DATE	DESCRIPTIONS	BY	APPR'D
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TYPICAL SECTIONS
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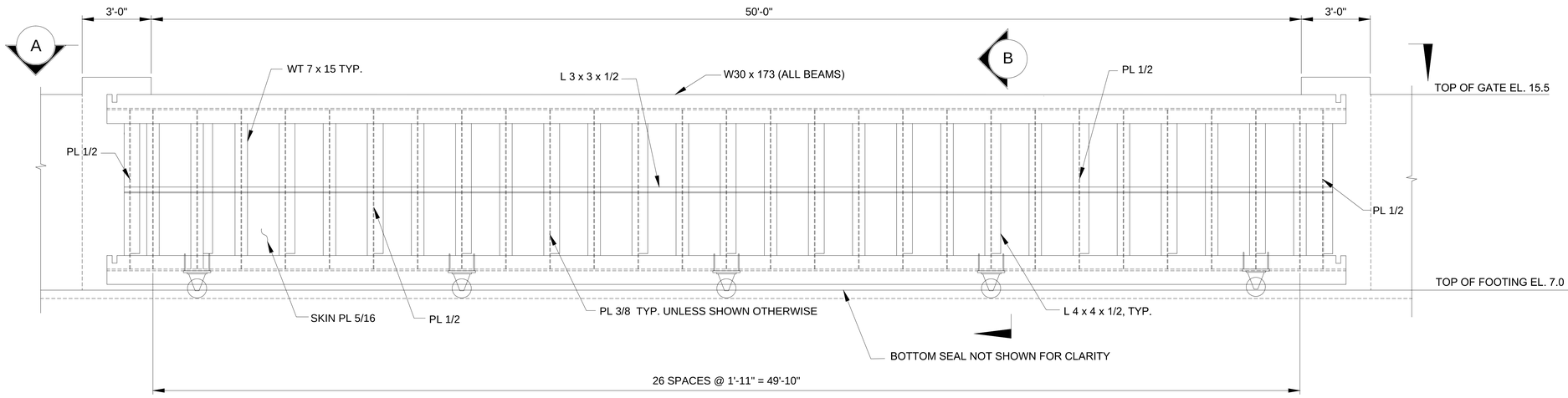
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 08/26/2015

SHEET 29 OF 37

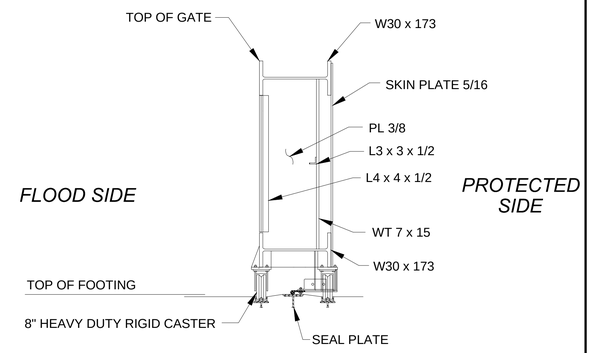
C19/C20

CONSULTANT DESIGN



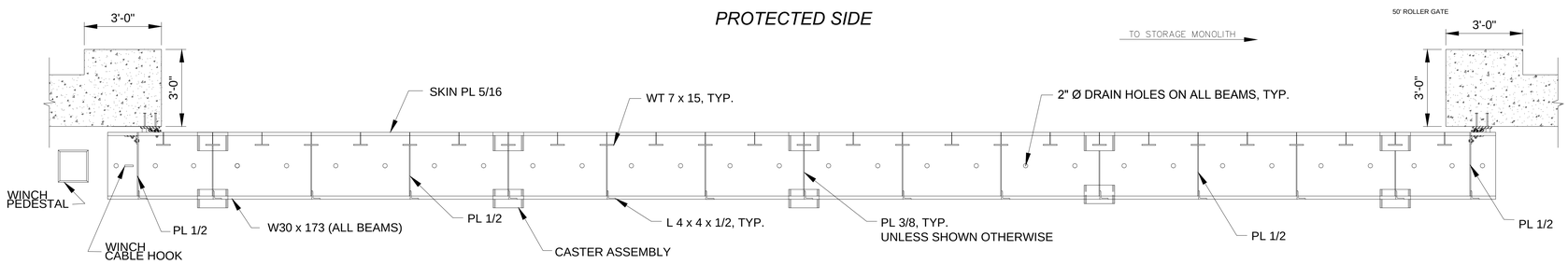
STEEL GATE FLOOD SIDE ELEVATION

SCALE: NTS



SECTION B

SCALE: NTS



SECTION A

SCALE: NTS

FLOOD SIDE

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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ALTERNATIVE 1
TYPICAL SECTIONS
(14 OF 14)

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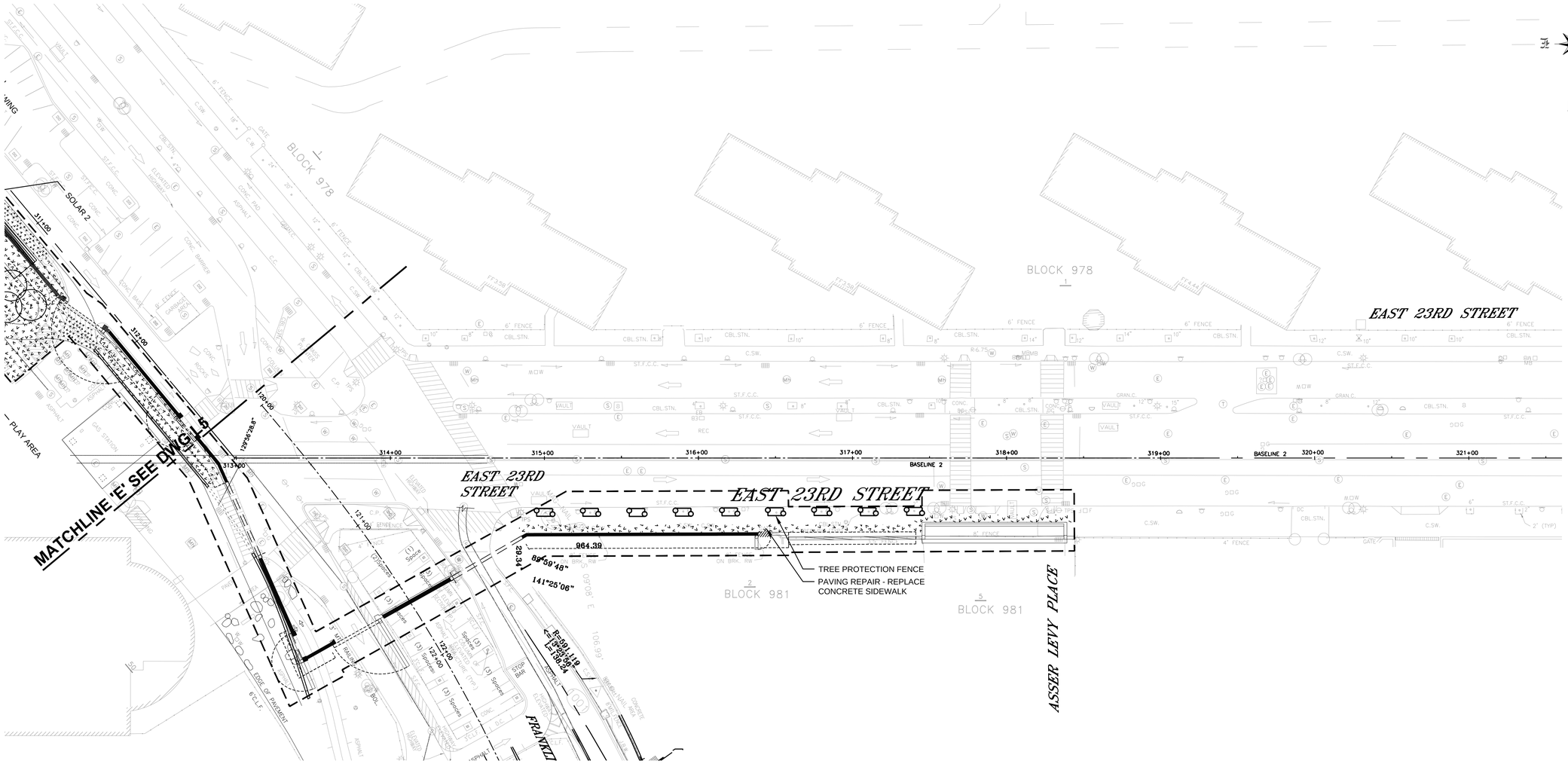
CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 08/26/2015 | SHEET 30 OF 37 | C20 / C20

CONSULTANT DESIGN

DRAFT FOR REVIEW - NOT FOR ISSUE



LANDSCAPE LEGEND

- PLANTING TYPE 1 (TREE/SHRUB/GRASS AND 36" SOIL)
- PLANTING TYPE 2 (SHRUB/GRASS AND 24" SOIL)
- PLANTING TYPE 3 (LAWN/GRASSES AND 15" SOIL)
- PLANTING REPAIR TYPE 1 (SEEDED LAWN, DECOMPACT SOILS, TOP DRESS)
- PLANTING REPAIR TYPE 2 (SHRUB/GROUNDCOVER, DECOMPACT SOILS, TOP DRESS)
- PAVING TYPE 1 (ASPHALT)
- PAVING TYPE 2 (PRECAST PAVERS)
- PAVING TYPE 3 (STONE PAVERS)
- IMPROVEMENT / REPAIR AREA
- FENCE TYPE 1
- FENCE TYPE 2 - TREE PROTECTION
- REMOVE EXISTING TREE
- PROPOSED TREE
- APPROXIMATE LIMIT OF DISTURBANCE

0 15 30 60
SCALE: 1" = 30'

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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ALTERNATIVE 1
LANDSCAPE PLAN – REACH P
STA. 312+75 – 318+44

MNLA DRAWN BY
SANDRESM1-L006-P2 CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 08/28/2015 | SHEET 36 OF 37 | L6 / L7

CONSULTANT DESIGN

APPENDIX B: PROJECT AREA TWO, PRELIMINARY PREFERRED ALTERNATIVE, DESIGN PLANS, CIVIL PLANS, AND TYPICAL SECTIONS FOR THE APE

CONCEPTUAL DESIGN - NOT FOR ISSUE

Department of Design and Construction

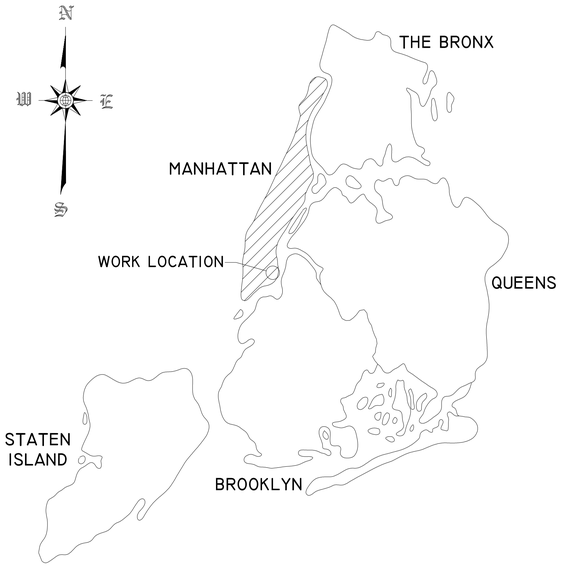
DIVISION OF INFRASTRUCTURE
BUREAU OF DESIGN

PROJECT ID: SANDRESMI

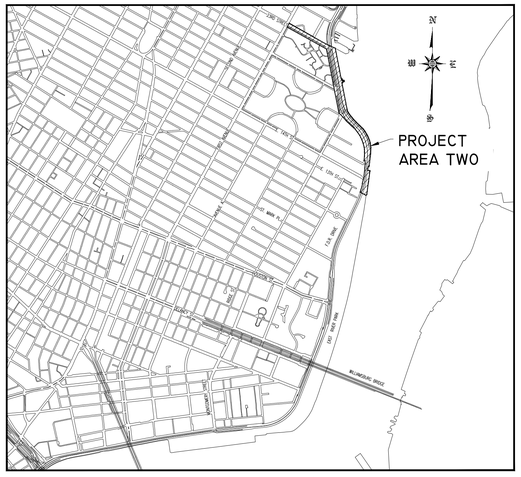
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY

PROJECT AREA TWO - PRELIMINARY PREFERRED ALTERNATIVE

FROM EAST 13TH STREET TO EAST 23RD STREET



BOROUGH OF MANHATTAN
CITY OF NEW YORK



LOCATION PLAN
N.T.S.

PROJECT SITE

COMMUNITY BOARD NO. 3 AND NO. 6

ERIC MACFARLANE, P.E.
DEPUTY COMMISSIONER

YUN POY (DINO) NG, P.E.
ASSOCIATE COMMISSIONER

MOHSEN ZARGARELAHI, P.E.
ASSISTANT COMMISSIONER

ALI MALLICK, P.E.
DEPUTY ASSISTANT COMMISSIONER

REVIEWED AND APPROVED BY:

HOW SHEEN PAU, P.E.
DIRECTOR

NAME
ENGINEER-IN-CHARGE

SUBMITTED BY:

AKRF KSE
The AKRF-KSE JV

PREPARED BY:

ARCADIS ch2m: Hardesty & Hanover engineering that moves you MATHEWS NIELSEN

0 1 2 3 4
ORIGINAL SIZE IN INCHES

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

PROJECT ID: SANDRESM1 | DATE: 11-24-15 | SHEET 1 OF 42 | G1 / G4

PROJECT ID SANDRESMI

CONSULTANT DESIGN

CONCEPTUAL DESIGN - NOT FOR ISSUE

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G3	SANDRESM1–PPA–G001–PA2	LEGEND AND ABBREVIATIONS
G4	SANDRESM1–PPA–G001–PA2	KEY MAP
SD1	SANDRESM1–PPA–SD001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – SCHEMATIC DESIGN PLAN – REACH K – STA. 275+45 TO STA. 282+00
SD2	SANDRESM1–PPA–SD001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – SCHEMATIC DESIGN PLAN – REACH L – STA. 282+00 TO STA. 289+40
SD3	SANDRESM1–PPA–SD001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – SCHEMATIC DESIGN PLAN – REACH M – STA. 289+40 TO STA. 296+77
SD4	SANDRESM1–PPA–SD001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – SCHEMATIC DESIGN PLAN – REACH N – STA. 296+77 TO STA. 305+00
SD5	SANDRESM1–PPA–SD001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – SCHEMATIC DESIGN PLAN – REACH O – STA. 305+00 TO STA. 312+75
SD6	SANDRESM1–PPA–SD001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – SCHEMATIC DESIGN PLAN – REACH Q – STA. 312+75 TO STA. 318+44
C1	SANDRESM1–PPA–C001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – CIVIL PLAN – REACH K – STA. 275+45 TO STA. 282+00
C2	SANDRESM1–PPA–C001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – CIVIL PLAN – REACH L – STA. 282+00 TO STA. 289+40
C3	SANDRESM1–PPA–C001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – CIVIL PLAN – REACH M – STA. 289+40 TO STA. 296+77
C4	SANDRESM1–PPA–C001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – CIVIL PLAN – REACH N – STA. 296+77 TO STA. 305+00
C5	SANDRESM1–PPA–C001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – CIVIL PLAN – REACH O – STA. 305+00 TO STA. 312+75
C6	SANDRESM1–PPA–C001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – CIVIL PLAN – REACH Q – STA. 312+75 TO STA. 318+44
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C9	SANDRESM1–PPA–C302–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (3 OF 19)
C10	SANDRESM1–PPA–C303–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (4 OF 19)
C11	SANDRESM1–PPA–C304–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (5 OF 19)
C12	SANDRESM1–PPA–C305–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (6 OF 19)
C13	SANDRESM1–PPA–C306–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (7 OF 19)
C14	SANDRESM1–PPA–C307–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (8 OF 19)
C15	SANDRESM1–PPA–C308–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (9 OF 19)
C16	SANDRESM1–PPA–C309–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (10 OF 19)
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C18	SANDRESM1–PPA–C311–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (12 OF 19)
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C21	SANDRESM1–PPA–C314–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (15 OF 19)
C22	SANDRESM1–PPA–C314–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (16 OF 19)
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C25	SANDRESM1–PPA–C314–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TYPICAL SECTIONS – (19 OF 19)
L1	SANDRESM1–PPA–L001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – LANDSCAPE PLAN – REACH K – STA. 275+45 TO STA. 282+00
L2	SANDRESM1–PPA–L001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – LANDSCAPE PLAN – REACH L – STA. 282+00 TO STA. 289+40
L3	SANDRESM1–PPA–L001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – LANDSCAPE PLAN – REACH M – STA. 289+40 TO STA. 296+77
L4	SANDRESM1–PPA–L001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – LANDSCAPE PLAN – REACH N – STA. 296+77 TO STA. 305+00
L5	SANDRESM1–PPA–L001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – LANDSCAPE PLAN – REACH O – STA. 305+00 TO STA. 312+75
L6	SANDRESM1–PPA–L001–PA2	PRELIMINARY PREFERRED ALTERNATIVE – LANDSCAPE PLAN – REACH Q – STA. 312+75 TO STA. 318+44
L7	SANDRESM1–PPA–L300–PA2	PRELIMINARY PREFERRED ALTERNATIVE – TREE MITIGATION SCHEDULE

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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PRELIMINARY PREFERRED ALTERNATIVE
INDEX OF DRAWINGS

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FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 2 OF 42 | G2 / G4

CONSULTANT DESIGN

CONCEPTUAL DESIGN - NOT FOR ISSUE

ABBREVIATIONS

ABANDONED	ABDN.
APARTMENT	APT.
ASPHALT	ASPH.
BASEMENT	BSMT.
BITUMINOUS	BIT.
BLOCK	BLK.
BLUESTONE	B.S.
BLUESTONE CURB	B.S.C.
BLUESTONE WALK	B.S.W.
BOTTOM OF CURB	B.C.
BRICK	BRK.
BUILDING	BLDG.
BUILT	BLT.
BOTTOM OF WALL	BW
CAST IRON	C.I.
CENTER LINE	C.L.
CHAIN LINK FENCE	C.L.F.
CHAMBER	CH.
CLASS NUMBER	CL. #
COMBINED	COMB.
COMMERCIAL	COML.
CONCRETE	CONC.
CONCRETE CURB	C.C.
CONCRETE WALK	C.W.
DIAMETER	DIA.
DOUBLE BARREL	D.B.
DOWN	DN.
DRAWING	DWG.
DUCTILE IRON PIPE	D.I.P.
EXISTING	EXIST.
EXTRA STRENGTH VITRIFIED PIPE	E.S.V.P.
FIRE ALARM	F.A.
FIRE DEPARTMENT	F.D.
FLAT TOP REINFORCED CONCRETE	F.T.R.C.
FRAME	FR.
GRANITE	GRAN.
GRANITE CURB	GRAN. C.
INTERCEPTOR	INT.
INVERT ELEVATION	INV. EL.
IRREGULAR	IRR.
MANHOLE	MH
NOT IN CONTRACT	N.I.C.
NOT TO SCALE	N.T.S.
PAVEMENT	PVMT.
POINT OF CURVATURE	P.C.
POINT OF INTERSECTION	P.I.
POINT OF TANGENCY	P.T.
PRECAST REINFORCED CONCRETE	P.R.C.
RADIUS	R
REINFORCED CONCRETE PIPE	R.C.P.
ROADWAY	RDWY.
SANITARY	SAN.
SEWER	SWR.
SIDEWALK	SWK.
STANDARD	STD.
STEAM	SM.
STEEL	STL.
STEEL FACED	ST.F.
STEEL FACED CONCRETE CURB	ST.F.C.C.
STONE	STN.
STORM	STM.
STORY	STY.
TOP OF CURB	T.C.
TRAFFIC SIGN	T.S.
TOP OF WALL	TW
VACANT	VAC.
WORKING POINT	W.P.

LEGEND

	EXISTING	PROPOSED
MANHOLES		
ELECTRIC	E	E
CABLE TV	C	
TELEPHONE	T	
TRAFFIC	Tf	
NYC MH	NYC	
GAS	G	
WATER	W	
FIRE DEPT.	F	
SUBWAY	Su	
COAL CHUTE	CC	
STORM SEWER	STM	STM
STORM CHAMBER	STM	STM
COMBINED SEWER		STM
SANITARY SEWER	SAN	SAN
INTERCEPTOR SEWER	INT	INT
UNIDENTIFIED MANHOLE (NO RECORD AVAILABLE)	MH	
BUILT MANHOLE REPLACED BY NEW MANHOLE		
RECORD MANHOLE	S	
HARDWARE RIM EL. & INV. EL. (SEWER, ETC.)	S 61.23 INV.47.89	
BASINS		
CATCH BASIN WITH CURB PIECE - TYPE 1	1	1
CATCH BASIN WITHOUT CURB PIECE - TYPE 2	2	2
CATCH BASIN WITHOUT CURB PIECE - TYPE 3	3	3
EXISTING CATCH BASIN TO BE REMOVED		
TO BE ABANDONED		A
TO BE MODIFIED		M
TO BE ADJUSTED		A
CATCH BASIN - NON-STANDARD		N
NEW CATCH BASIN TO BE CONSTRUCTED IN SAME LOCATION AS OLD BASIN		
INLET		
SEEPAGE BASIN	SB	SB
HYDRANTS		
LOW PRESSURE HYDRANT		
LOW PRESSURE HYDRANT TO BE REMOVED		
HIGH PRESSURE HYDRANT		
LOW PRESSURE HYDRANT TO BE RELOCATED		R
HIGH PRESSURE HYDRANT TO BE RELOCATED		R
LOW PRESSURE HYDRANT TO BE ADJUSTED (VERTICALLY)		A
HIGH PRESSURE HYDRANT TO BE ADJUSTED (VERTICALLY)		A
SIAMESE CONNECTION		
STREET LIGHTING AND TRAFFIC SIGNALS		
WOOD UTILITY POLE		
WOOD UTILITY POLE TO BE REMOVED		
WOOD UTILITY POLE WITH STREET LIGHT		
WOOD UTILITY POLE WITH STREET LIGHT TO BE REMOVED		
WOOD UTILITY POLE WITH TRAFFIC SIGNAL	T	
WOOD UTILITY POLE WITH STREET LIGHT AND FIRE ALARM BOX	F	F
WOOD UTILITY POLE WITH STREET LIGHT AND FIRE ALARM BOX TO BE REMOVED		F
WOOD UTILITY POLE WITH FIRE ALARM BOX	F	
WOOD UTILITY POLE WITH PEDESTRIAN SIGNAL	PS	
WOOD UTILITY POLE WITH TRAFFIC AND PEDESTRIAN SIGNAL	TPS	
WOOD UTILITY POLE WITH STREET LIGHT AND TRAFFIC AND PEDESTRIAN SIGNAL	TPS	
STREET LIGHT (METAL POLE)		
TRAFFIC SIGNAL CONTROL BOX		
TRAFFIC SIGNAL POST W/PEDESTRIAN SIGNAL	TPS	TPS

LEGEND

	EXISTING	PROPOSED
VALVE BOXES		
GAS	G	
WATER	W	
STEAM	St	
TREES		
EXISTING TREE (SIZE AS LABELED)	7"	
EXISTING TREE TO BE REMOVED		7"
NEW TREE TO BE PLANTED		
SHRUB		
HEDGE (HEIGHT AS LABELED)		
MISCELLANEOUS		
VAULT (SIDEWALK)	V	
CELLAR WINDOW GRATING		
CELLAR DOOR	CD	
SUBWAY GRATING		
SURFACE WATER FLOW		
TRAFFIC DIRECTION		
PARKING METER		
OIL FILL CAP OR OIL VENT	O OR FILL	
FIRE ALARM BOX	F	
POLICE CALL BOX	P	
MAIL BOX, PUBLIC PHONE	MB TEL.	
COLUMN - FOUNDATION (OF ELEVATED STRUCTURES)	OR	
HEADER		
AREA OF ADJUSTMENT		
LIMIT OF NEW PAVEMENT		
BUS PAD		
SIGN (GROUND MOUNTED, SINGLE SIGN)		
SIGN (GROUND MOUNTED, MULTIPLE SIGNS)		
SIGN (GROUND MOUNTED, MULTIPLE SIGNS)		
SIGN (OVERHEAD)		
TRAIN STATION ENTRANCE	DOWN	
SHAFT TO BUILDING BASEMENT	SH	
PEDESTRIAN RAMP		
CURB (CONCRETE UNLESS OTHERWISE INDICATED)		
CURB WITH DROP CURB (DRIVEWAY)	D C	D C
EDGE OF PAVEMENT WITHOUT CURB		
PROPOSED CONSTRUCTION (TOP OF CURB) ELEVATION AND STATION		T.C. 13.8 STA. 26+33
ROCK OUTCROP		
NORTH ARROW		
BARRIERS		
BEAM TYPE MALL BARRIER		
PORTABLE PRECAST CONCRETE BARRIER		
CAST IN PLACE CONCRETE BARRIER		
RETAINING WALL (W/TYPE)		RW (STN.)
RAILROAD/TROLLEY TRACK		
CONCRETE FLOOD WALL		
FENCE (WITH HEIGHT AND TYPE)		
CHAIN LINK FENCE	6'	
IRON PICKET FENCE	5'	
WIRE FENCE	5'	
IRON ON CONCRETE COPING		
WOOD PICKET FENCE	4'	
GUARD POST	GP	
BUILDINGS		
HOUSE INFORMATION — HOUSE NUMBER, BLDG TYPE, FIRST FLOOR ELEV., (CE) CELLAR ENTR., (GE) GARAGE ENTR.	95-02 2-STY.FR. ▼25.3 G.E.17.5	
STAIRS OR STOOPS		
CANOPY	CANOPY	

LEGEND

	EXISTING	PROPOSED
CONDUITS		
6" WATER MAIN		
8" WATER MAIN		
12" WATER MAIN		
16" WATER MAIN		
20" WATER MAIN		
24" WATER MAIN		
30" WATER MAIN		
36" WATER MAIN		
42" WATER MAIN		
48" WATER MAIN		
54" WATER MAIN		
60" WATER MAIN		
66" WATER MAIN		
72" WATER MAIN		
84" WATER MAIN		
96" WATER MAIN		
STORM SEWER (WITH SIZE - LESS THAN 24")	15"STM	15"STM
STORM SEWER (WITH SIZE - 24" AND GREATER)*	24"STM	24"STM
SANITARY SEWER (WITH SIZE - LESS THAN 24")	15"SAN	15"SAN
SANITARY SEWER (WITH SIZE - 24" AND GREATER)*	24"SAN	24"SAN
COMBINED SEWER (WITH SIZE - LESS THAN 24")	15"COMB	15"COMB
COMBINED (WITH SIZE - 24" AND GREATER)*	24"COMB	24"COMB
INTERCEPTOR SEWER (WITH SIZE - LESS THAN 24")	15"INT	15"INT
INTERCEPTOR SEWER (WITH SIZE - 24" AND GREATER)*	24"INT	24"INT
CATCH BASIN CONNECTION		
GAS LINE (WITH SIZE)	4" G	
STEAM (WITH SIZE)	16" ST	
ELECTRIC		
TELEPHONE		
FIRE ALARM		
OVERHEAD (AERIAL) UTILITY LINE	A/T,T,F	
TA SUBWAY CONDUIT	Su	
LEGAL DATA		
LOT & BLOCK NUMBER	39 BLOCK 2109	
ESTABLISHED/LEGAL GRADE	12.3	
ANGLE	86°-30'-48"	
BLOCK LENGTH	167.01' (65.75 m)	
INTERPOLATED/CALCULATED ANGLE OR LENGTH	[86°-30'-48"] [167.01'(65.75 m)]	
PROPERTY POSSESSION LINE		
MAPPED PROPERTY LINE (RIGHT-OF-WAY LINE)		
LOT LINE		
SURVEY MONUMENT (CITY) - IDENTIFY BY TOPO NUMBER	⊕M#	
BENCH MARK (LABEL)	BM#	
SURVEY CONTROLS		
CONTROL SURVEY TRAVERSE		
CENTER LINE BASE LINE	T 100+00 T101+00	

* LINE SPACING IN SYMBOL TO BE SCALED TO CONDUIT SIZE

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

TOPOGRAPHIC SURVEY PREPARED BY:
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PRELIMINARY PREFERRED ALTERNATIVE
LEGEND AND ABBREVIATIONS

AKRF — DRAWN BY
SANDRESM1-PPA-G001-PA2 — CADD FILE

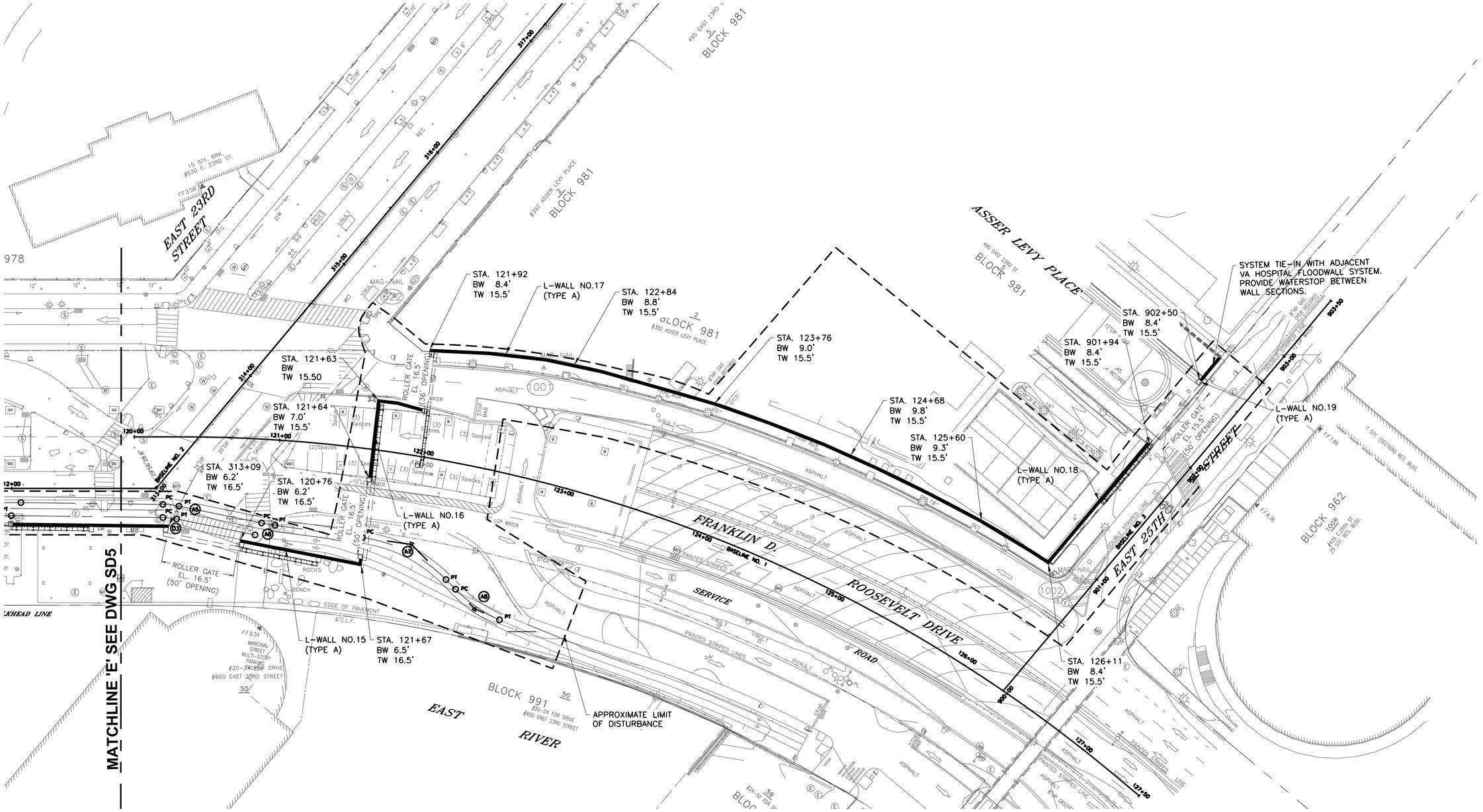
FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY

BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 3 OF 42 | G3 G4

CONSULTANT DESIGN

CONCEPTUAL DESIGN - NOT FOR ISSUE



NOTE:
WALLS NO. 15–17 STATIONS
REFERENCE BASELINE NO. 1

NOTE:
WALL NO. 18&19 STATIONS
REFERENCE BASELINE NO. 3

WALKWAY CENTERLINE
CURVE NO. D3
RADIUS: 50.0'
DELTA: 10°50'00" RIGHT
PC: STA. 120+20
PT: STA. 120+29
LENGTH: 10.0'

BIKEWAY CENTERLINE
CURVE NO. A5
RADIUS: 59.0'
DELTA: 10°50'00" RIGHT
PC: STA. 120+20
PT: STA. 120+31
LENGTH: 11.0'

BIKEWAY CENTERLINE
CURVE NO. A6
RADIUS: 150.0'
DELTA: 3°35'00" LEFT
PC: STA. 120+91
PT: STA. 121+01
LENGTH: 9.0'

BIKEWAY CENTERLINE
CURVE NO. A7
RADIUS: 100.0'
DELTA: 37°30'00" RIGHT
PC: STA. 121+65
PT: STA. 122+31
LENGTH: 66.0'

BIKEWAY CENTERLINE
CURVE NO. A8
RADIUS: 100.0'
DELTA: 21°10'00" LEFT
PC: STA. 122+40
PT: STA. 122+77
LENGTH: 37.0'

0 15 30 60
SCALE: 1" = 30'

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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PRELIMINARY PREFERRED ALTERNATIVE
SCHEMATIC DESIGN – REACH Q
STA. 312+75 – 318+19

ARCADIS — DRAWN BY
SANDRESM1-PPA-SD001-PA2 — CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 | 11/24/2015 | SHEET 10 OF 42 | SD6 / SD6

CONSULTANT DESIGN

CONCEPTUAL DESIGN - NOT FOR ISSUE

TRANSITION FROM 16.5' TOP OF WALL TO 15.5' TOP OF WALL

INSTALL SHEETPILE UTILITY CROSSING

PROPOSED MANHOLE WITH STORMWATER CLOSURE MECHANISM

SYSTEM TIE-IN WITH ADJACENT VA HOSPITAL FLOODWALL SYSTEM. PROVIDE WATERSTOP BETWEEN WALL SECTIONS.

INSTALL SHEETPILE UTILITY CROSSING

STORMWATER CLOSURE MECHANISM IN STRUCTURE

REQUIRED STORMWATER CLOSURE MECHANISM IN STRUCTURE

INSTALL SHEET PILE UTILITY CROSSING

INSTALL SHEET PILE UTILITY CROSSING

INSTALL SHEET PILE UTILITY CROSSING

INSTALL SHEETPILE UTILITY CROSSING

24" WATER LINE CATION

MATCHLINE 'E' SEE DWG C5

EAST 23RD STREET

ASSER LEVY PLACE

FRANKLIN D. ROOSEVELT DRIVE SERVICE ROAD

MARGINAL STREET, WHARF OR PLACE

U.S. BULKHEAD LINE

BLOCK 981

BLOCK 991

BLOCK 962

EAST RIVER

SCALE: 1" = 30'

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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PRELIMINARY PREFERRED ALTERNATIVE
CIVIL PLAN – REACH Q
STA. 312+75 – 318+44

ARCADIS — DRAWN BY
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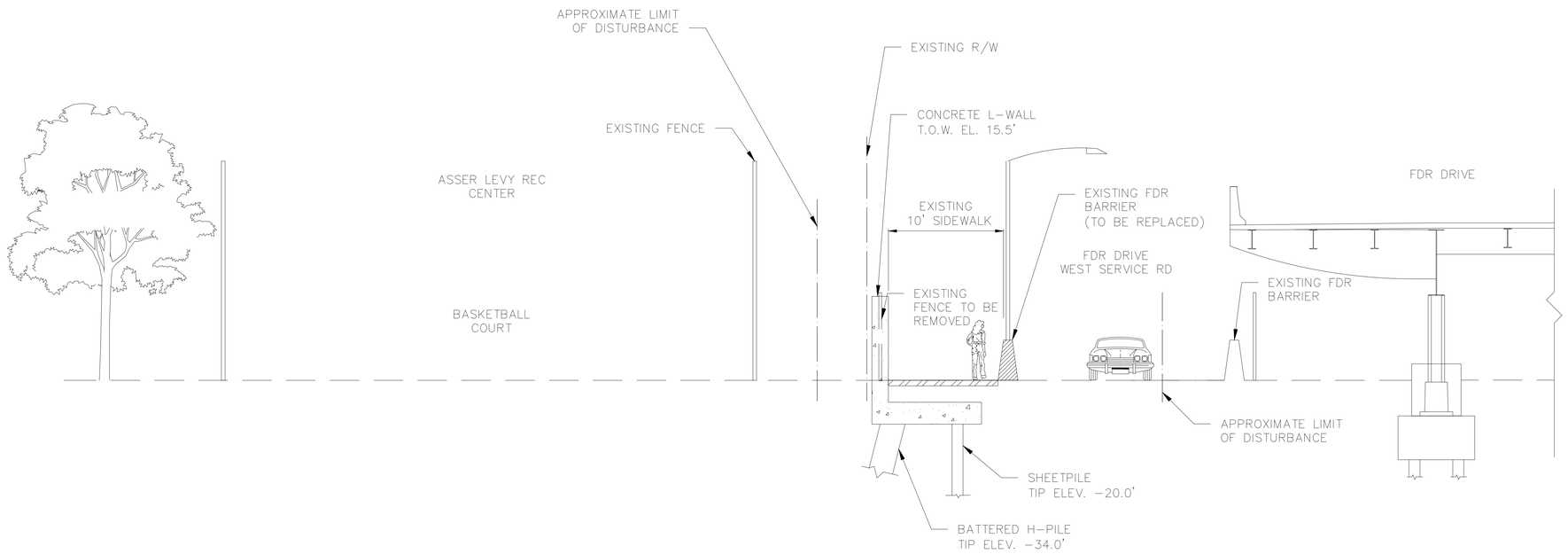
FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 SHEET 16 OF 42 C6 / C21

CONSULTANT DESIGN



F / C6 TYPICAL SECTION – ASSER LEVY REC CENTER

STA. 124+00

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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TYPICAL SECTIONS
(9 OF 19)

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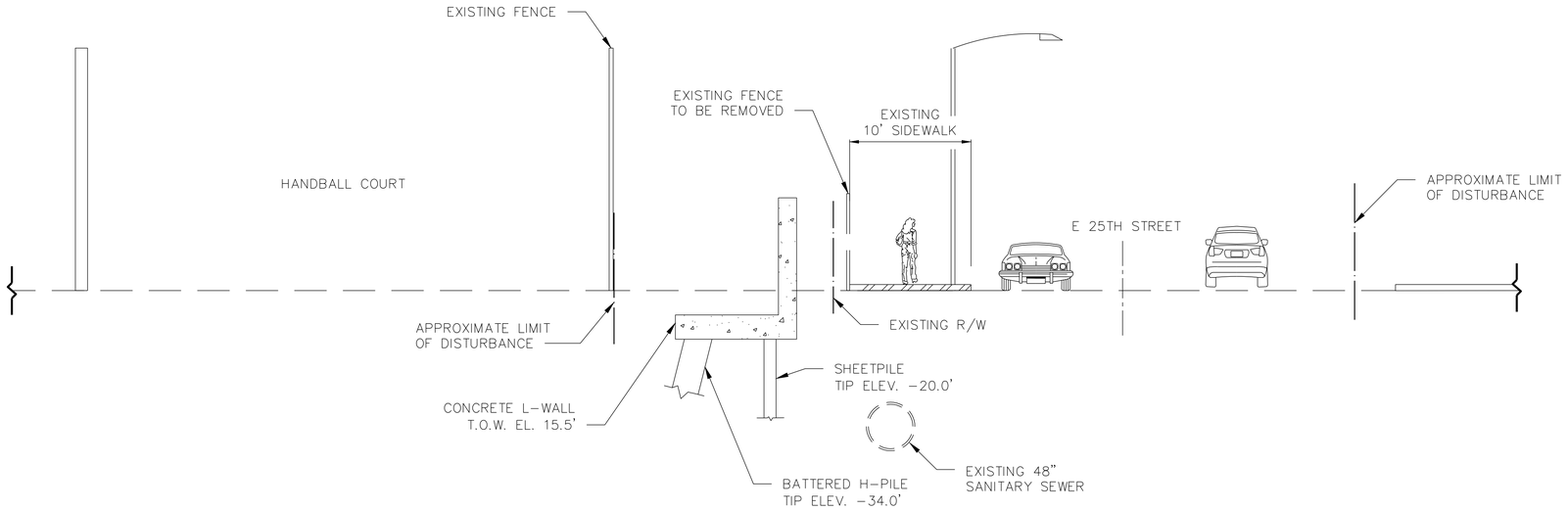
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 25 OF 42 | C15/C25

CONCEPTUAL DESIGN - NOT FOR ISSUE



G / C6 TYPICAL SECTION – EAST 25TH STREET

STA. 901+50

0 15 30 60
SCALE: 1" = 30'

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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BUREAU OF DESIGN

PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS
(10 OF 19)

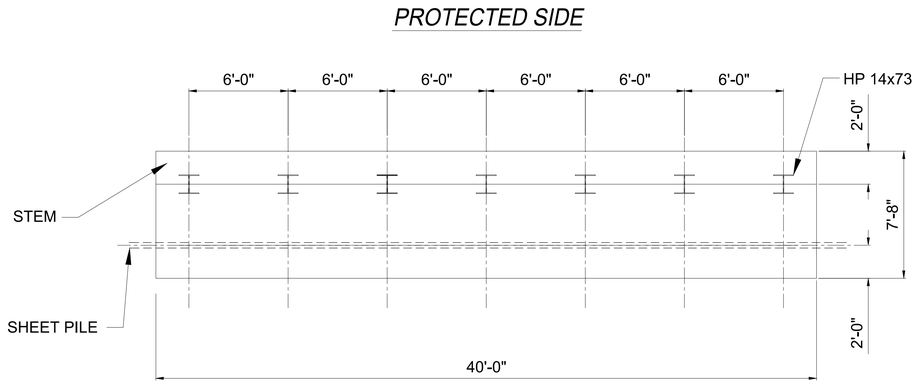
ARCADIS
DRAWN BY

SANDRESM1-PPA-C309-PA2
CADD FILE

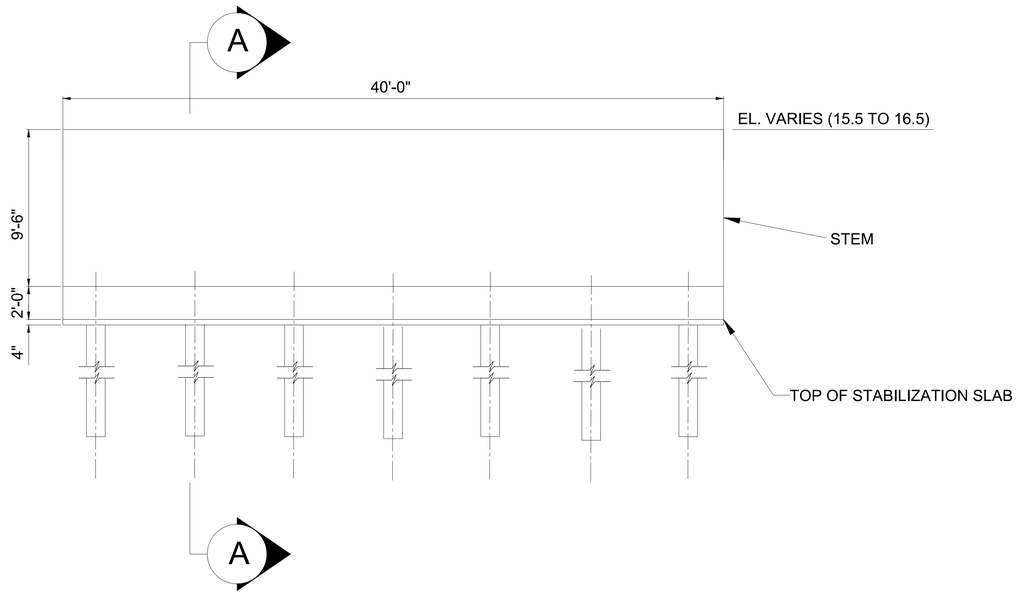
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 26 OF 42 | C16/C25

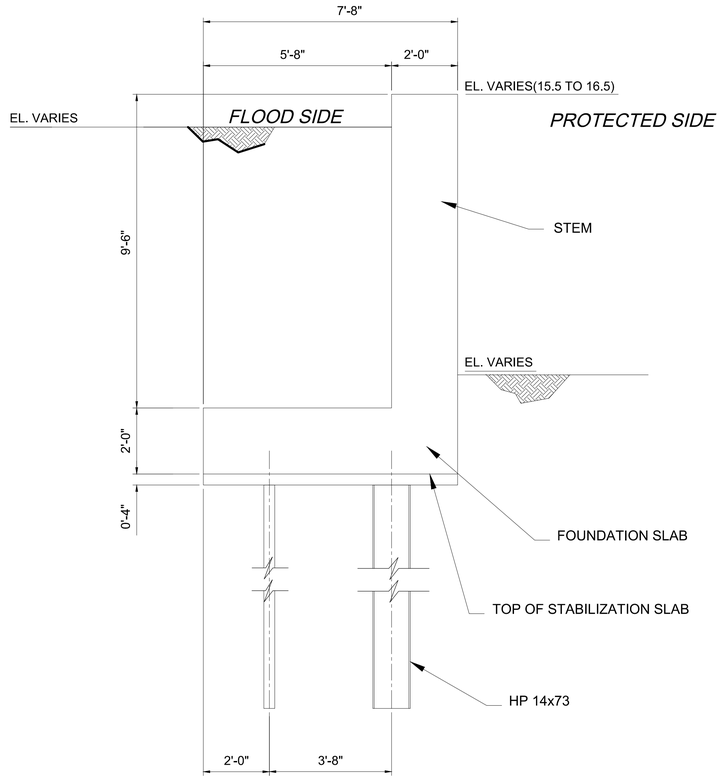
CONSULTANT DESIGN



L-WALL PLAN



L-WALL ELEVATION



L-WALL SECTION A

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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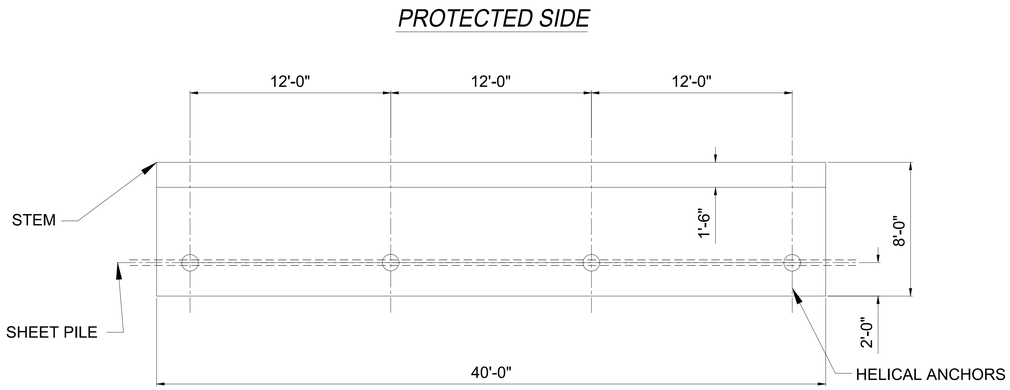
PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS
(11 OF 19)

DRAWN BY: ARCADIS
CADD FILE: SANDRESM1-C310-PA2

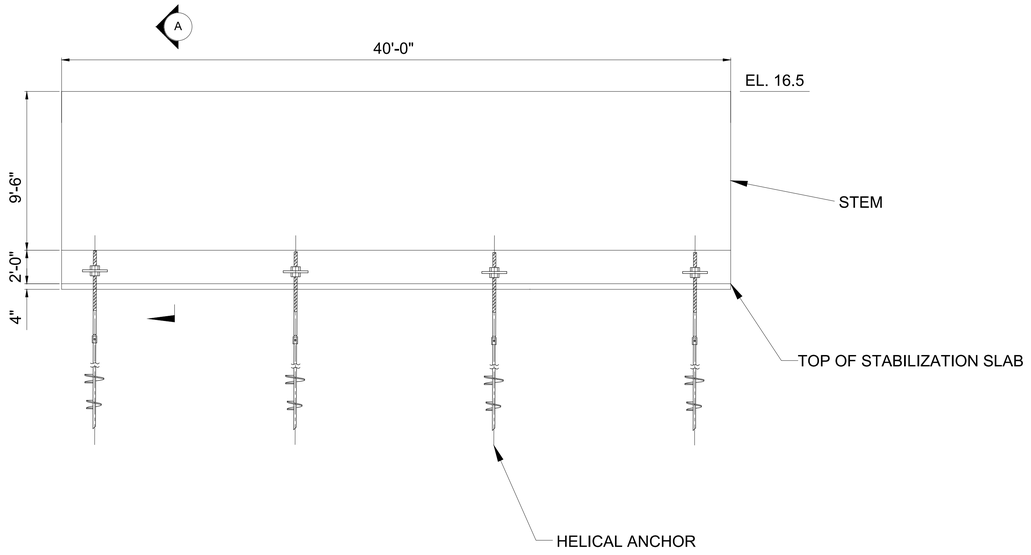
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 27 OF 42 | C17/C25

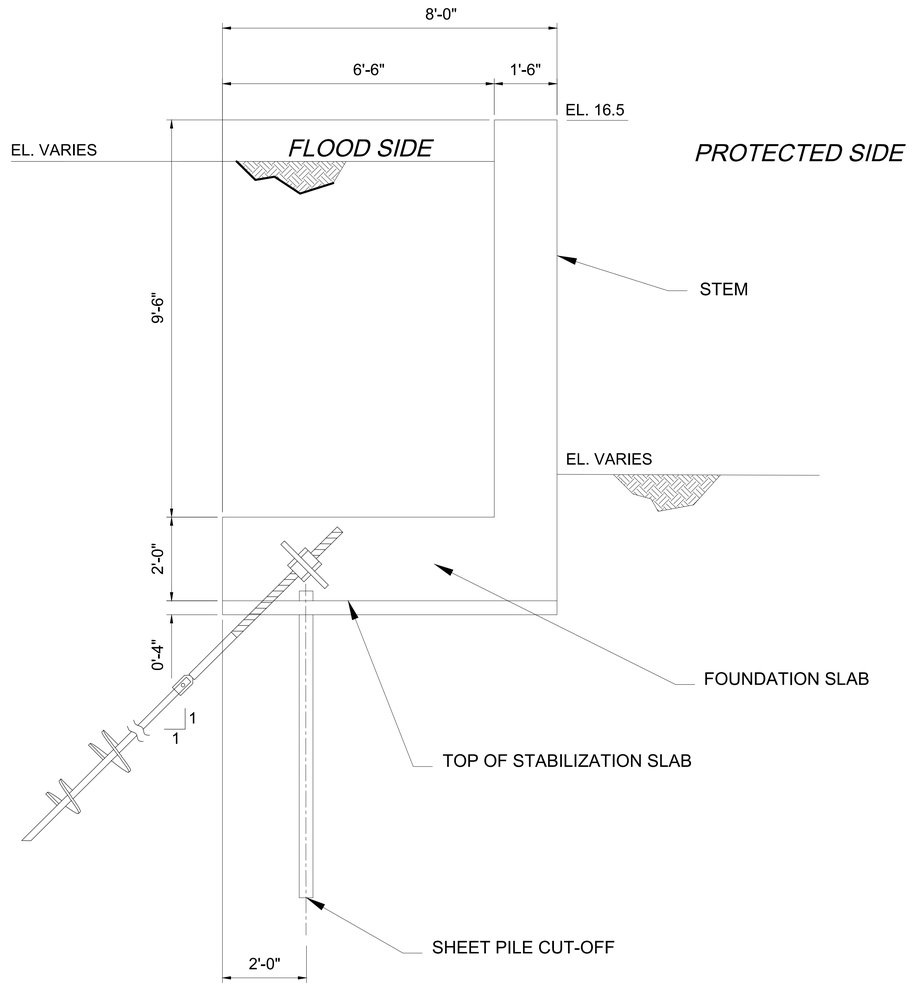
CONSULTANT DESIGN



L-WALL PLAN



L-WALL ELEVATION



SECTION A

SCALE: NTS

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

TOPOGRAPHIC SURVEY PREPARED BY:
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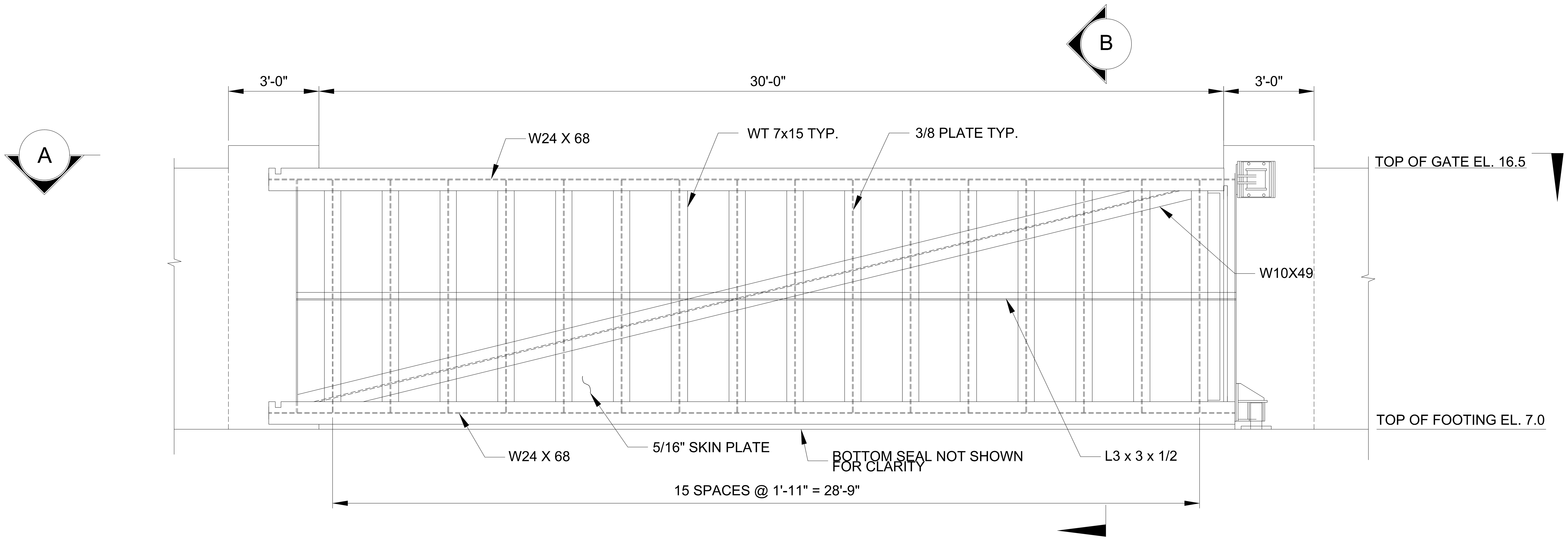
PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS
(12 OF 19)

ARCADIS DRAWN BY
SANDRESM1-C311-PA2 CADD FILE

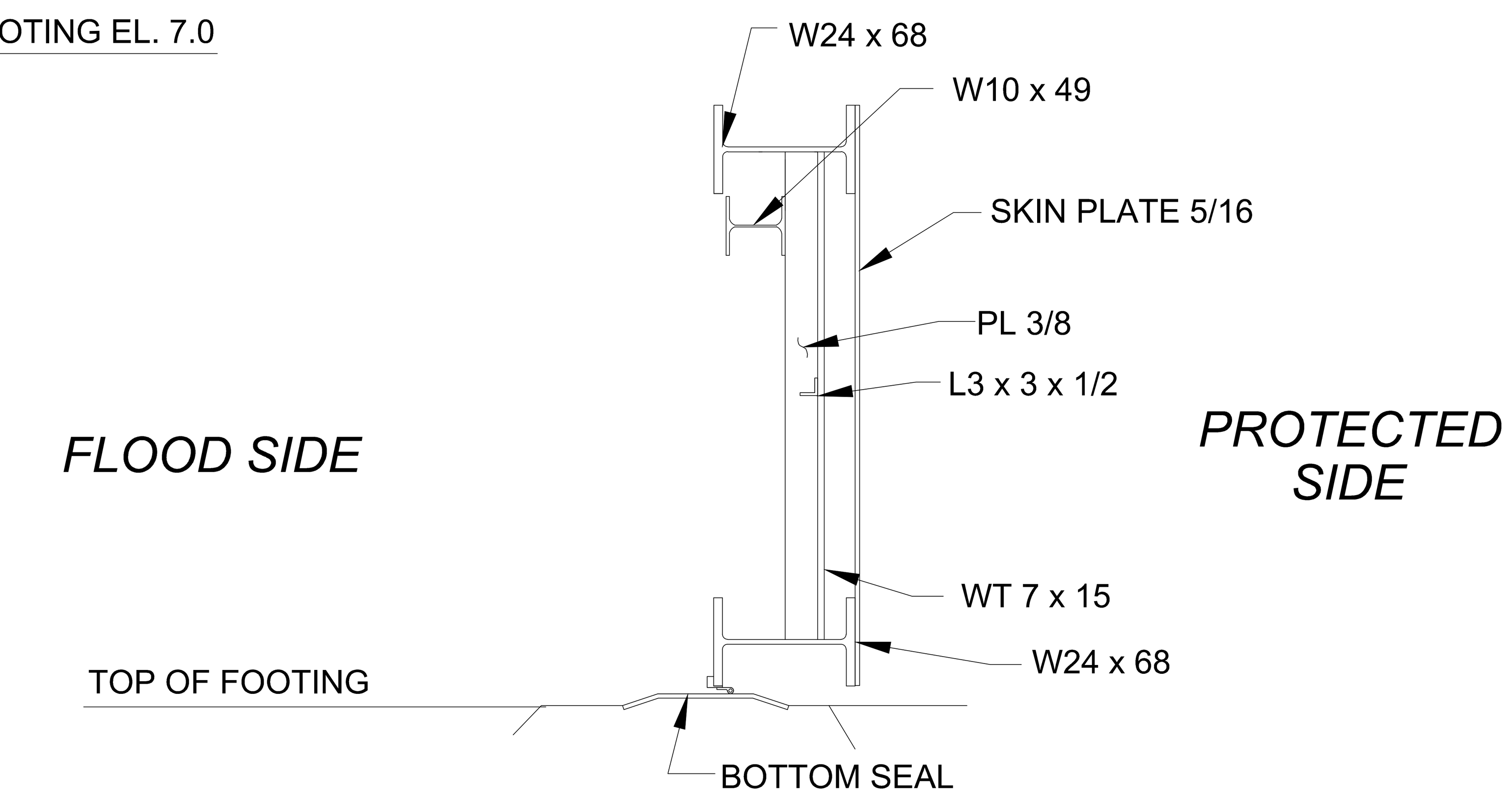
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 SHEET 28 OF 42 C18/C25



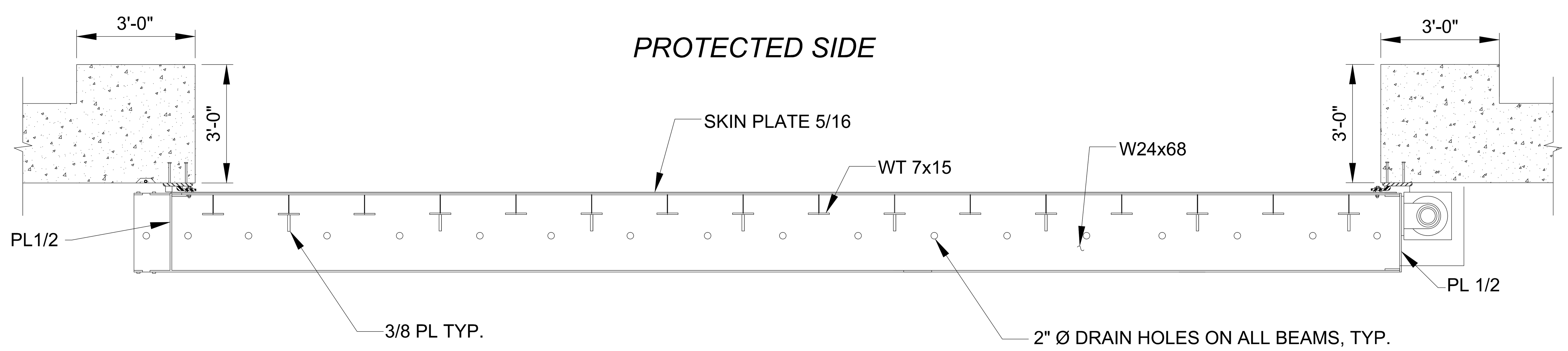
STEEL SWING GATE FLOOD SIDE ELEVATION

SCALE: NTS



SECTION B

SCALE: NTS



SECTION A

SCALE: NTS

NO.	DATE	DESCRIPTIONS	BY	APPR'D

REVISIONS

TOPOGRAPHIC SURVEY PREPARED BY:

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PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS
(13 OF 19)

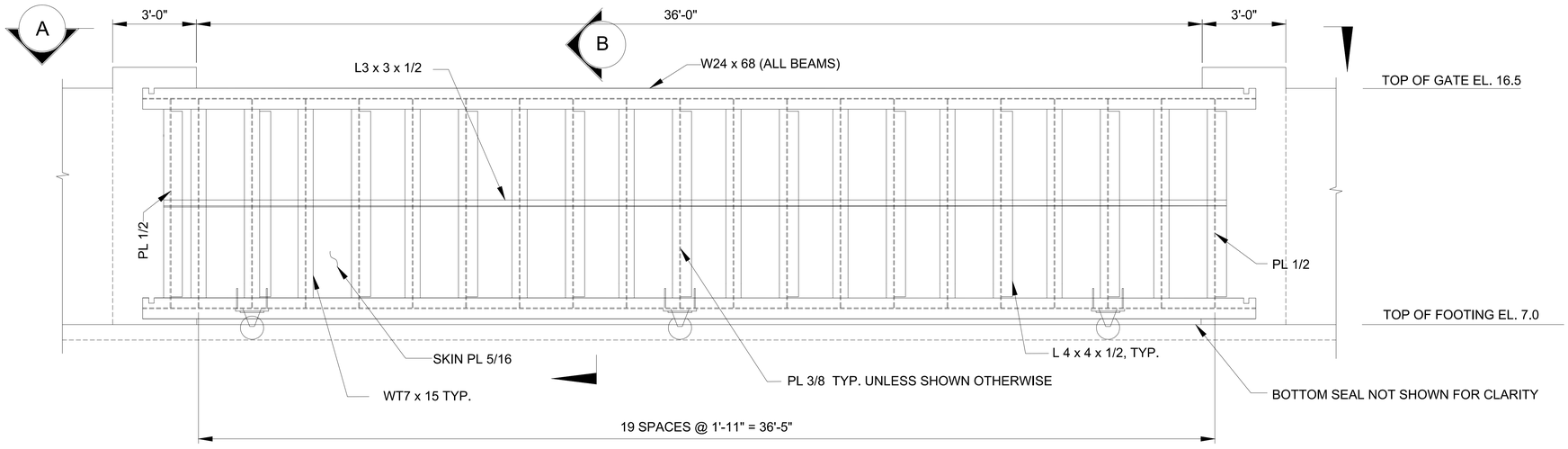
ARCADIS
DRAWN BY

SANDRESM1-PPA-C312-PA2
CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

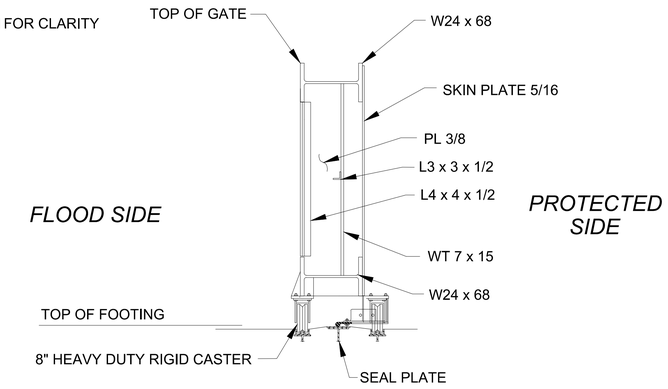
CAPITAL PROJECT NO. SANDRESM1 11/24/2015 SHEET 29 OF 42 C19 C25

CONSULTANT DESIGN



STEEL GATE FLOOD SIDE ELEVATION

SCALE: NTS



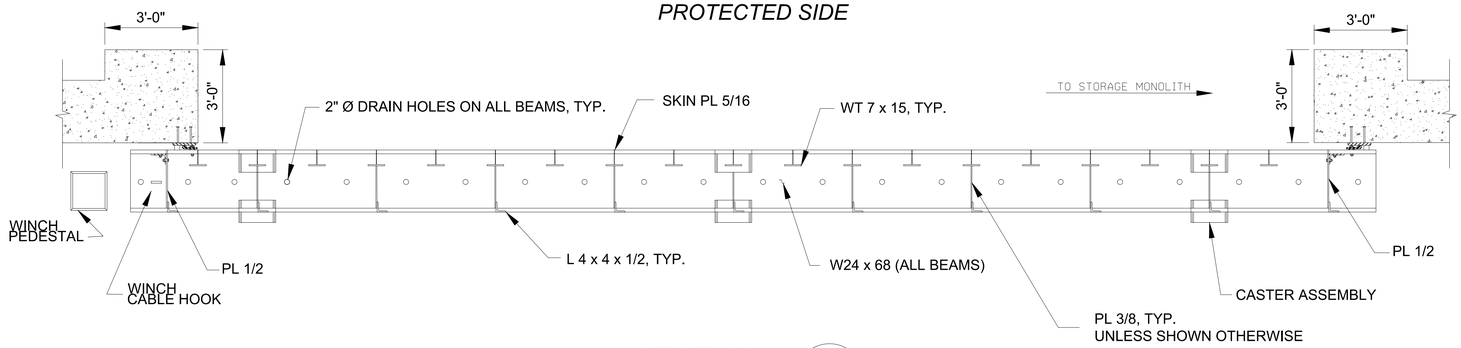
FLOOD SIDE

PROTECTED SIDE

SECTION B

SCALE: NTS

PROTECTED SIDE



SECTION A

SCALE: NTS

FLOOD SIDE

CONCEPTUAL DESIGN - NOT FOR ISSUE

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS
(14 OF 19)

ARCADIS
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CADD FILE

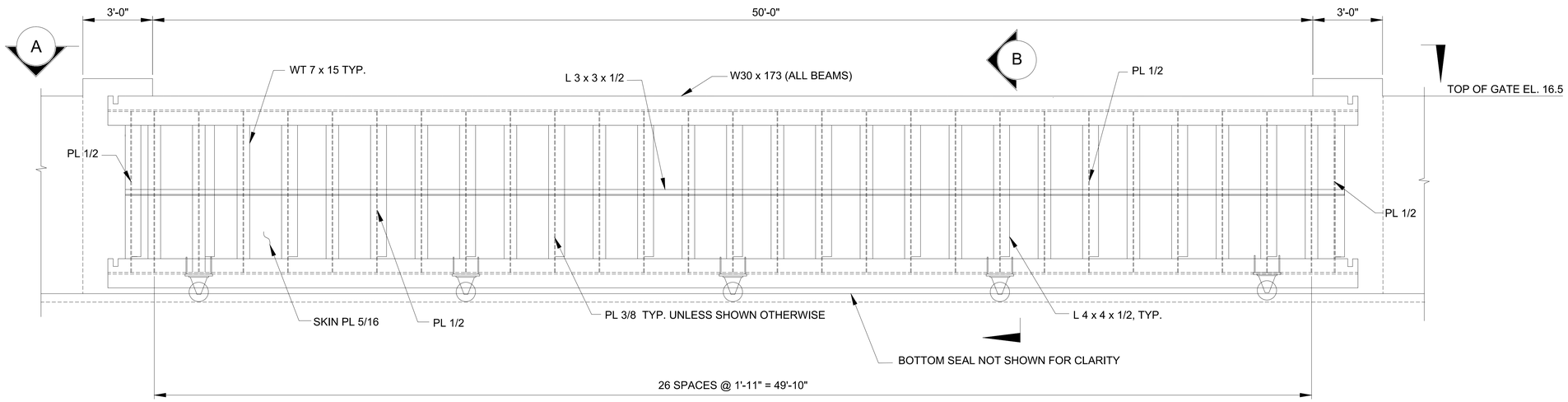
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015

SHEET 30 OF 42

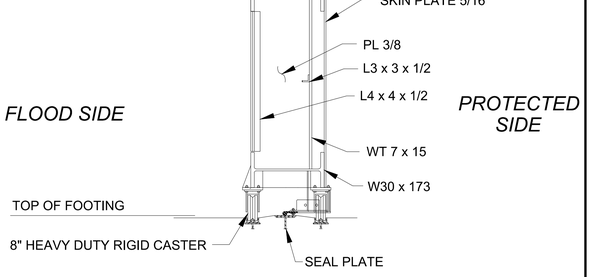
C20
C25

CONSULTANT DESIGN



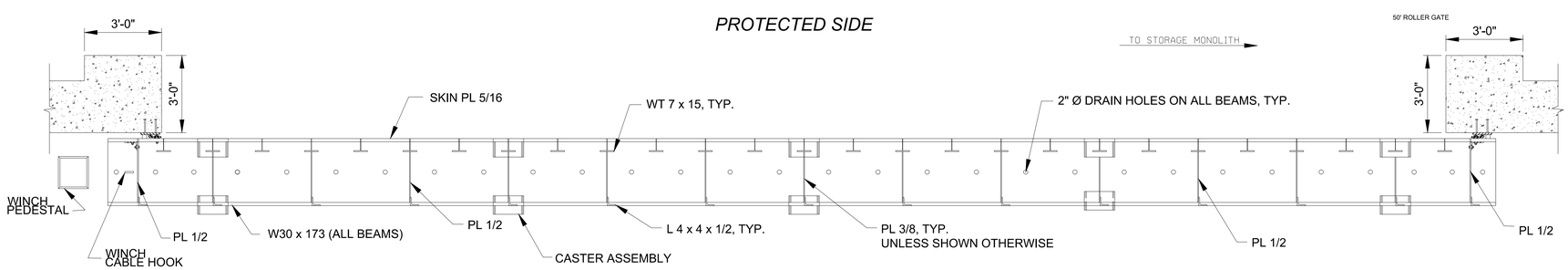
STEEL GATE FLOOD SIDE ELEVATION

SCALE: NTS



SECTION B

SCALE: NTS



SECTION A

SCALE: NTS

FLOOD SIDE

CONCEPTUAL DESIGN - NOT FOR ISSUE

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS
(15 OF 19)

ARCADIS
DRAWN BY

SANDRESM1-PPA0-C314-PA2
CADD FILE

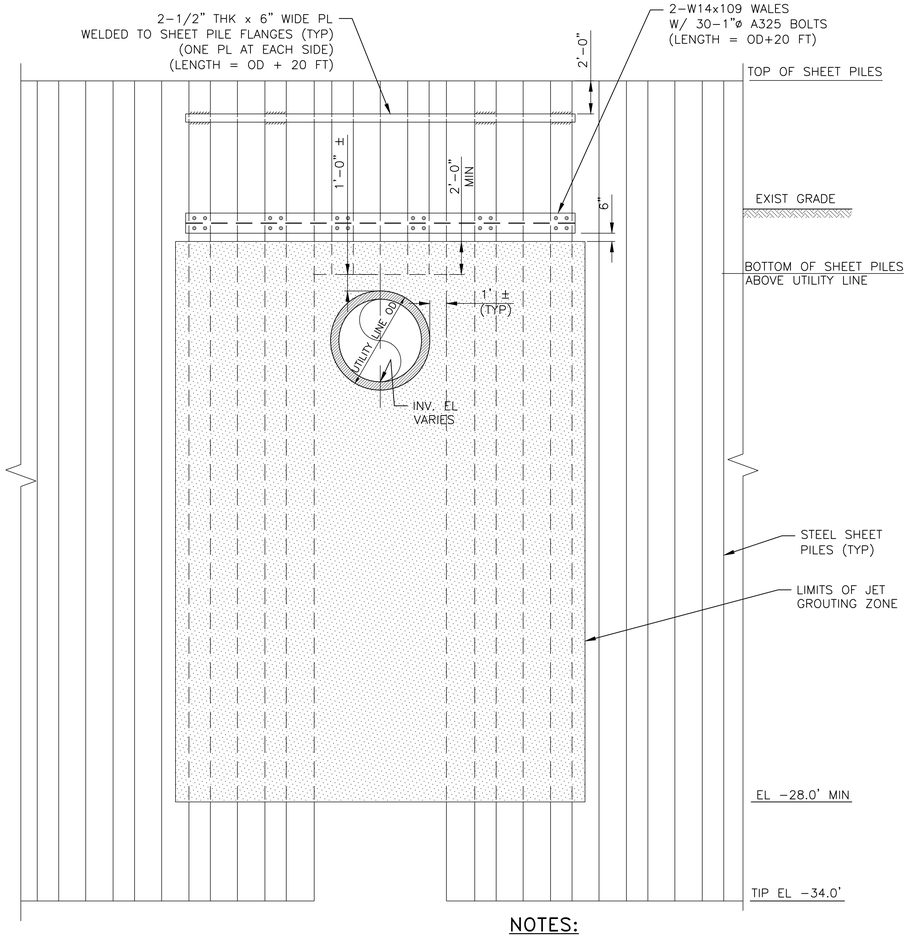
FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015

SHEET 31 OF 42

C21
C25

CONSULTANT DESIGN

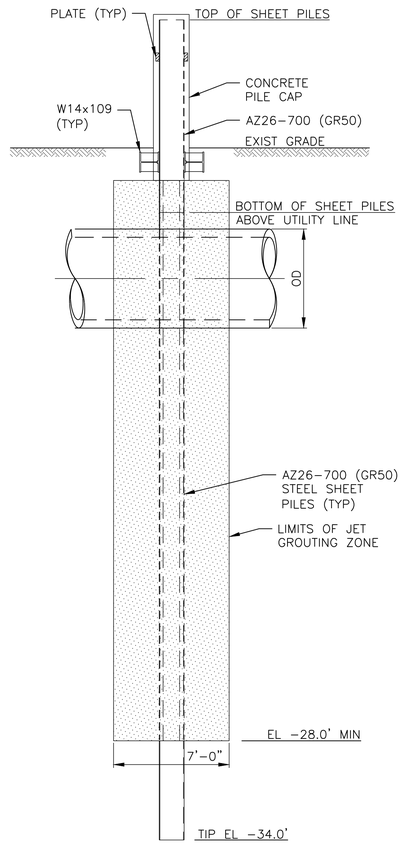


NOTES:

CONCRETE PILE CAP A TOP OF SHEET PILE NOT SHOWN FOR CLARITY.

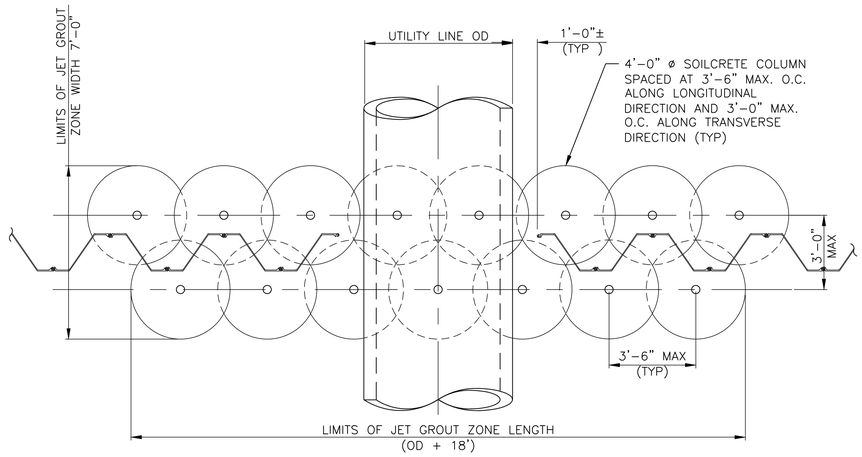
UTILITY CROSSING – TYPE A ELEVATION

NOT TO SCALE



UTILITY CROSSING – TYPE A SECTION

NOT TO SCALE



NOTES:

WALES, PLATES AND SHEET PILES ABOVE UTILITY LINE NOT SHOWN FOR CLARITY

UTILITY CROSSING – TYPE A SECTION

NOT TO SCALE

NOTES:

1. JET GROUTING SHALL BE PERFORMED WITH THE TRIPLE FLUID SYSTEM.
2. THE MINIMUM UNCONFINED COMPRESSIVE DESIGN STRENGTH OF THE SOILCRETE SHALL BE 500 PSI AT 3 DAYS AND 750 PSI AT 28 DAYS.
3. THE DESIGN PERMEABILITY OF THE SOILCRETE SHALL BE LESS THAN 1.0×10^{-6} CM/SEC.
4. USE VERTICAL AND ANGLED SLEEVE PIPES AS REQUIRED TO PERFORM JET GROUTING AROUND / BELOW THE UTILITY LINE.
5. PRIOR TO PERFORMING JET GROUTING AND DRIVING SHEET PILES AT/NEAR EACH UTILITY LINE CROSSING LOCATION, PRE-TRENCH EXCAVATION TO LOCATE/EXPOSE THE UTILITY LINE (THEN BACKFILLING) IS REQUIRED.

NO.	DATE	DESCRIPTIONS	BY	APPR'D

REVISIONS

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PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS – (16 OF 19)

CH2M
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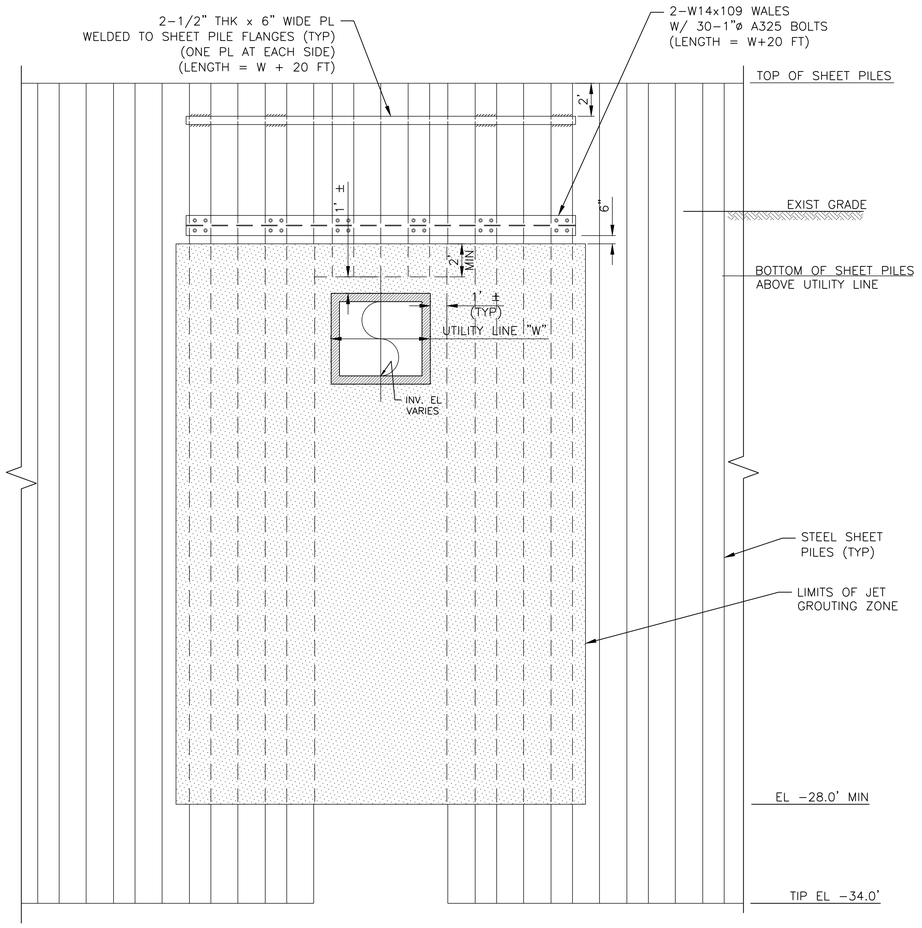
CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015

SHEET 32 OF 42

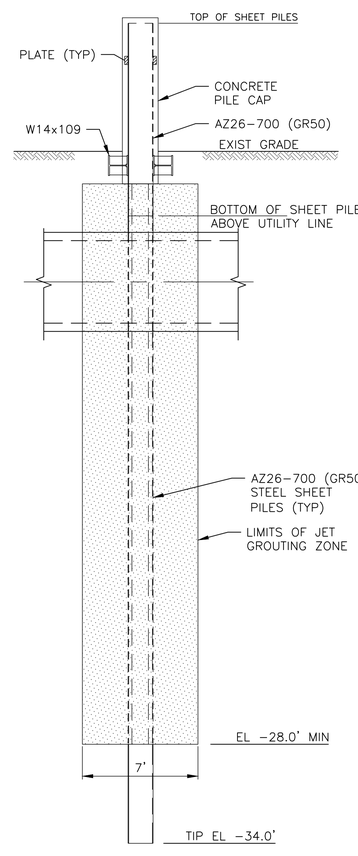
C22 / C25



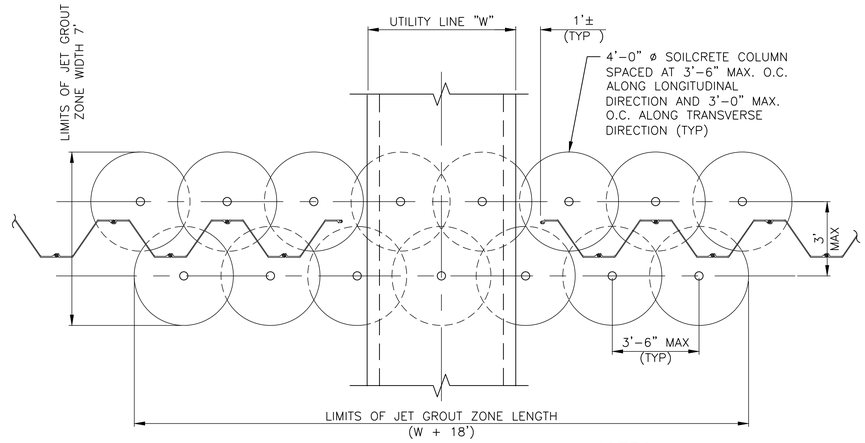
NOTES:

CONCRETE PILE CAP A TOP OF SHEET PILE NOT SHOWN FOR CLARITY.

UTILITY CROSSING – TYPE B
ELEVATION
NOT TO SCALE



UTILITY CROSSING – TYPE B
SECTION
NOT TO SCALE



NOTES:

WALES, PLATES AND SHEET PILES ABOVE UTILITY LINE NOT SHOWN FOR CLARITY

UTILITY CROSSING – TYPE B
PARTIAL PLAN
NOT TO SCALE

NOTES:

1. JET GROUTING SHALL BE PERFORMED WITH THE TRIPLE FLUID SYSTEM.
2. THE MINIMUM UNCONFINED COMPRESSIVE DESIGN STRENGTH OF THE SOILCRETE SHALL BE 500 PSI AT 3 DAYS AND 750 PSI AT 28 DAYS.
3. THE DESIGN PERMEABILITY OF THE SOILCRETE SHALL BE LESS THAN 1.0×10^{-6} CM/SEC.
4. USE VERTICAL AND ANGLED SLEEVE PIPES AS REQUIRED TO PERFORM JET GROUTING AROUND / BELOW THE UTILITY LINE.
5. PRIOR TO PERFORMING JET GROUTING AND DRIVING SHEET PILES AT/NEAR EACH UTILITY LINE CROSSING LOCATION, PRE-TRENCH EXCAVATION TO LOCATE/EXPOSE THE UTILITY LINE (THEN BACKFILLING) IS REQUIRED.

CONCEPTUAL DESIGN - NOT FOR ISSUE

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

TOPOGRAPHIC SURVEY PREPARED BY:
URS CORPORATION NY
ONE PENN PLAZA SUITE 610
NEW YORK, NEW YORK 10119
LICENSED LAND SURVEYOR

AKRF | KSE
The AKRF-KSE JV

CITY OF NEW YORK
DEPARTMENT OF DESIGN + CONSTRUCTION
DIVISION OF INFRASTRUCTURE
BUREAU OF DESIGN

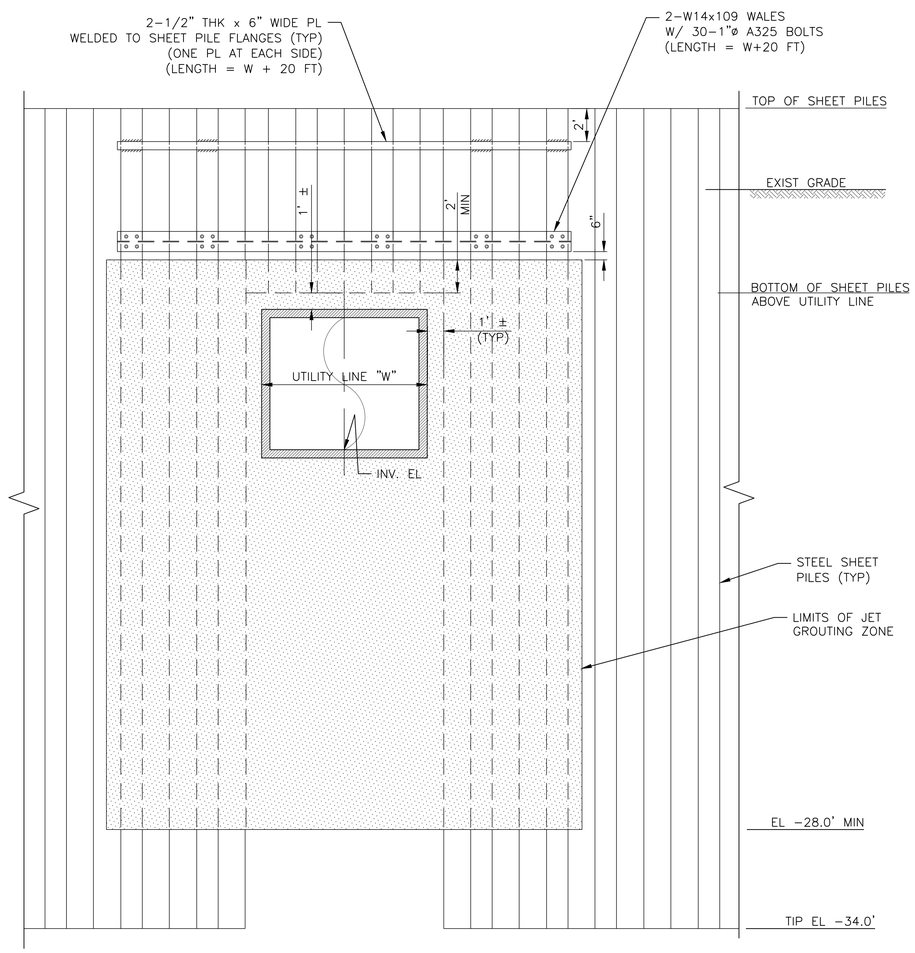
PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS – (17 OF 19)

CH2M — DRAWN BY
SANDRESM1-PPA-C316-PA2 — CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 33 OF 42 | C23/C25

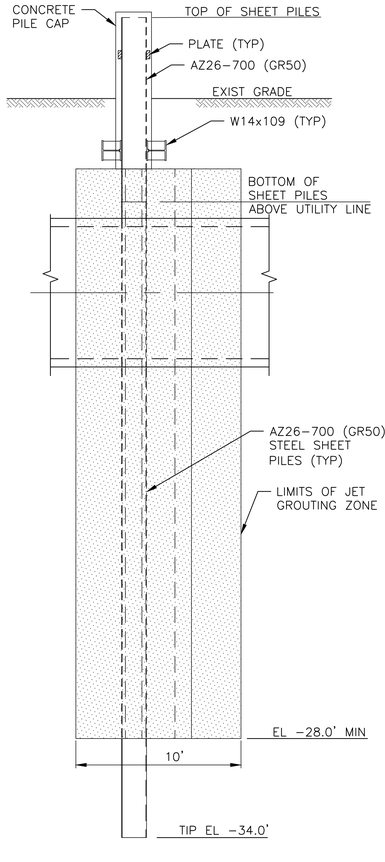
CONSULTANT DESIGN



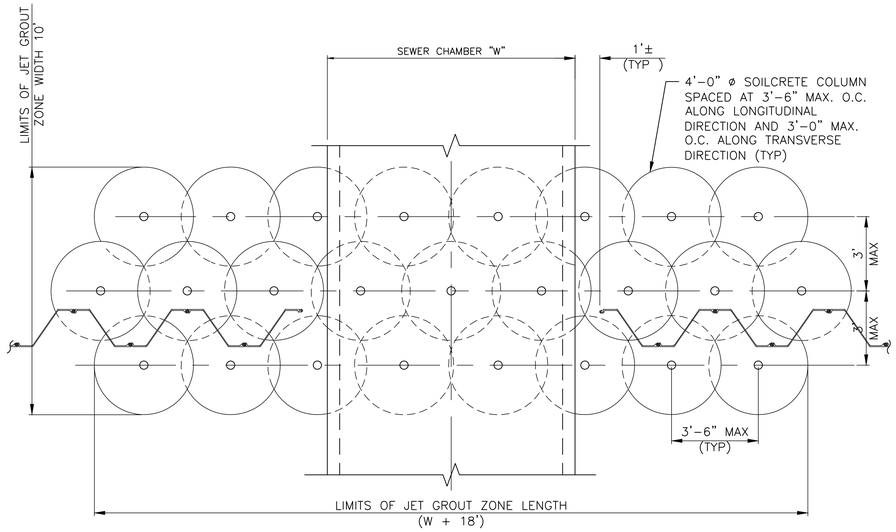
NOTES:

CONCRETE PILE CAP A TOP OF SHEET PILE NOT SHOWN FOR CLARITY.

UTILITY CROSSING – TYPE C
ELEVATION
NOT TO SCALE



UTILITY CROSSING – TYPE C
SECTION
NOT TO SCALE



NOTES:

WALES, PLATES AND SHEET PILES ABOVE UTILITY LINE NOT SHOWN FOR CLARITY

UTILITY CROSSING – TYPE C
PARTIAL PLAN
NOT TO SCALE

NOTES:

1. JET GROUTING SHALL BE PERFORMED WITH THE TRIPLE FLUID SYSTEM.
2. THE MINIMUM UNCONFINED COMPRESSIVE DESIGN STRENGTH OF THE SOILCRETE SHALL BE 500 PSI AT 3 DAYS AND 750 PSI AT 28 DAYS.
3. THE DESIGN PERMEABILITY OF THE SOILCRETE SHALL BE LESS THAN 1.0 X 10^{-6} CM/SEC.
4. USE VERTICAL AND ANGLED SLEEVE PIPES AS REQUIRED TO PERFORM JET GROUTING AROUND / BELOW THE UTILITY LINE.
5. PRIOR TO PERFORMING JET GROUTING AND DRIVING SHEET PILES AT/NEAR EACH UTILITY LINE CROSSING LOCATION, PRE-TRENCH EXCAVATION TO LOCATE/EXPOSE THE UTILITY LINE (THEN BACKFILLING) IS REQUIRED.
6. ASSUME CHAMBER WIDTH OF 15 FT FOR COST ESTIMATE PURPOSES.

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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BUREAU OF DESIGN

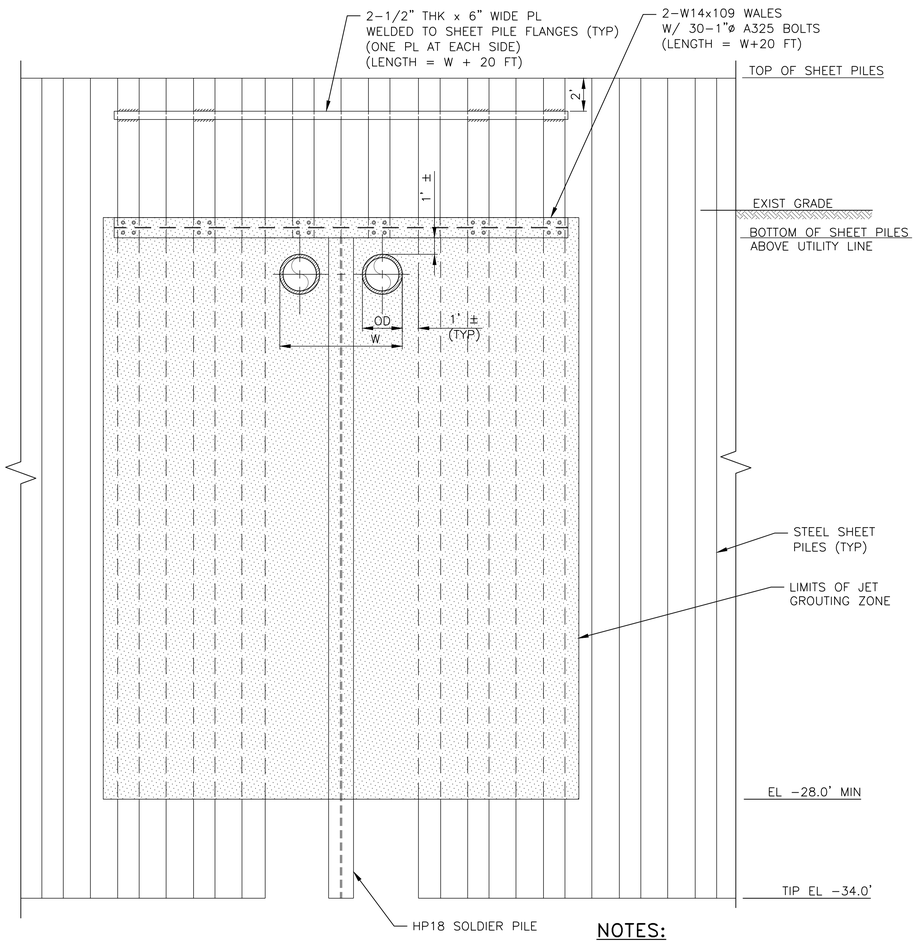
PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS – (18 OF 19)

CH2M
DRAWN BY

SANDRESM1-PPA-C317-PA2
CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 34 OF 42 | C24 / C25

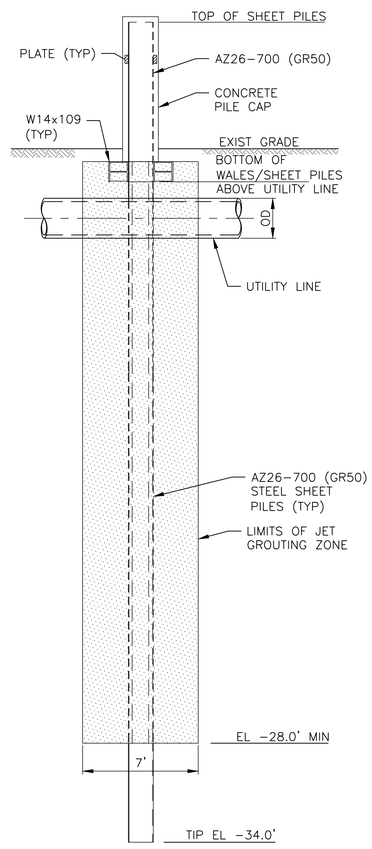


NOTES:

CONCRETE PILE CAP A TOP OF SHEET PILE NOT SHOWN FOR CLARITY.

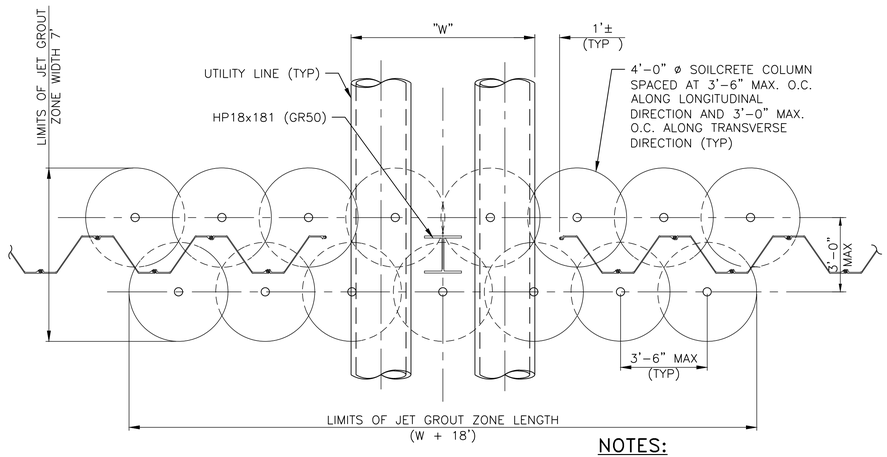
UTILITY CROSSING – TYPE D ELEVATION

NOT TO SCALE



UTILITY CROSSING – TYPE D SECTION

NOT TO SCALE



NOTES:

WALES, PLATES AND SHEET PILES ABOVE UTILITY LINE NOT SHOWN FOR CLARITY

UTILITY CROSSING – TYPE D PARTIAL PLAN

NOT TO SCALE

NOTES:

1. JET GROUTING SHALL BE PERFORMED WITH THE TRIPLE FLUID SYSTEM.
2. THE MINIMUM UNCONFINED COMPRESSIVE DESIGN STRENGTH OF THE SOILCRETE SHALL BE 500 PSI AT 3 DAYS AND 750 PSI AT 28 DAYS.
3. THE DESIGN PERMEABILITY OF THE SOILCRETE SHALL BE LESS THAN 1.0×10^{-6} CM/SEC.
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NO.	DATE	DESCRIPTIONS	BY	APPR'D

REVISIONS

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NEW YORK, NEW YORK 10119
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BUREAU OF DESIGN

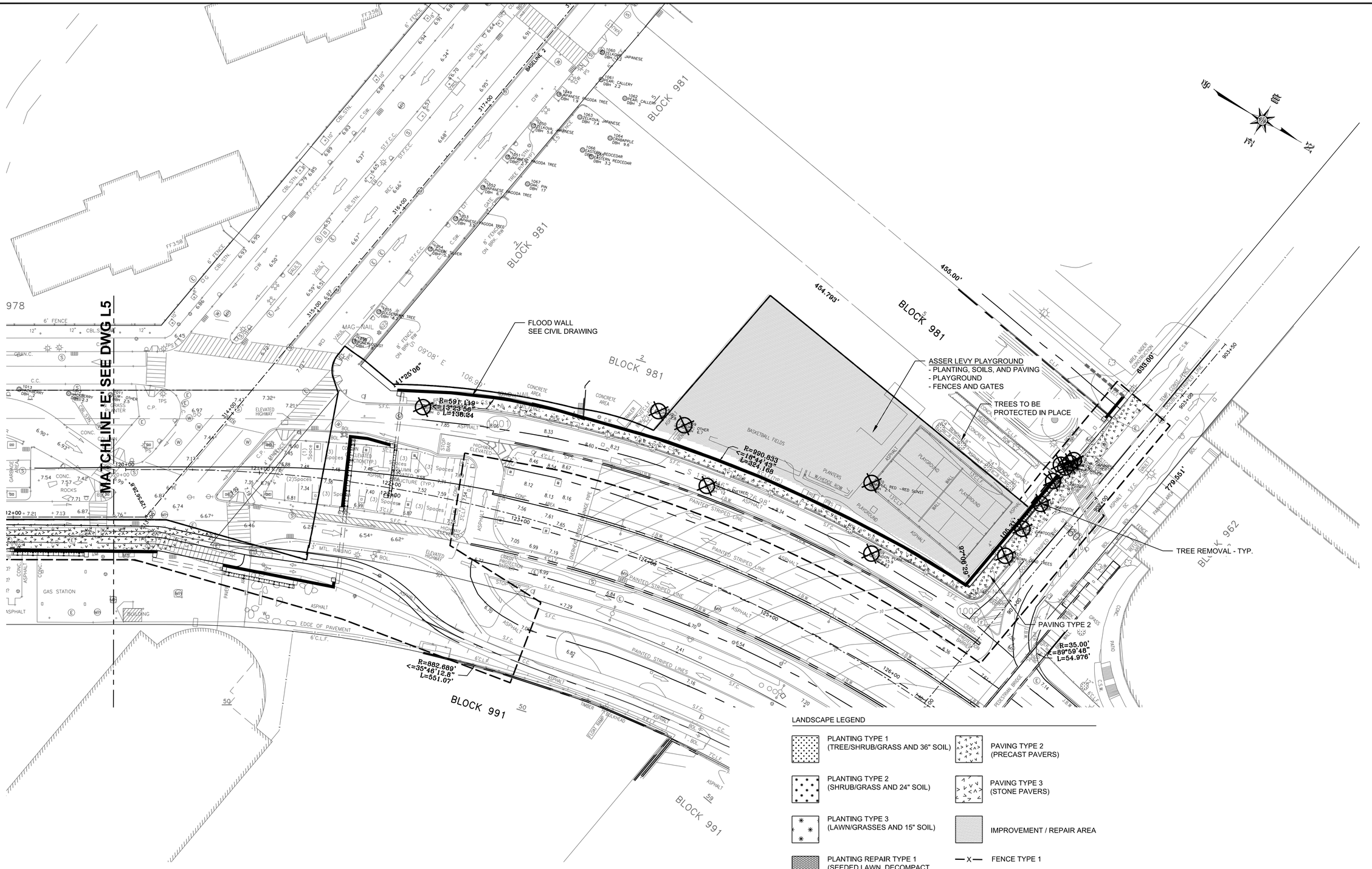
PRELIMINARY PREFERRED ALTERNATIVE
TYPICAL SECTIONS – (19 OF 19)

CH2M — DRAWN BY
SANDRESM1–PPA–C318–PA2 — CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 35 OF 42 | C25/C25

CONCEPTUAL DESIGN - NOT FOR ISSUE



0 15 30 60
SCALE: 1" = 30'

NO.	DATE	DESCRIPTIONS	BY	APPR'D
		REVISIONS		

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NEW YORK, NEW YORK 10119
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DEPARTMENT OF DESIGN + CONSTRUCTION
DIVISION OF INFRASTRUCTURE
BUREAU OF DESIGN

PRELIMINARY PREFFERED ALTERNATIVE
LANDSCAPE PLAN – REACH Q
STA. 312+75 – 318+44

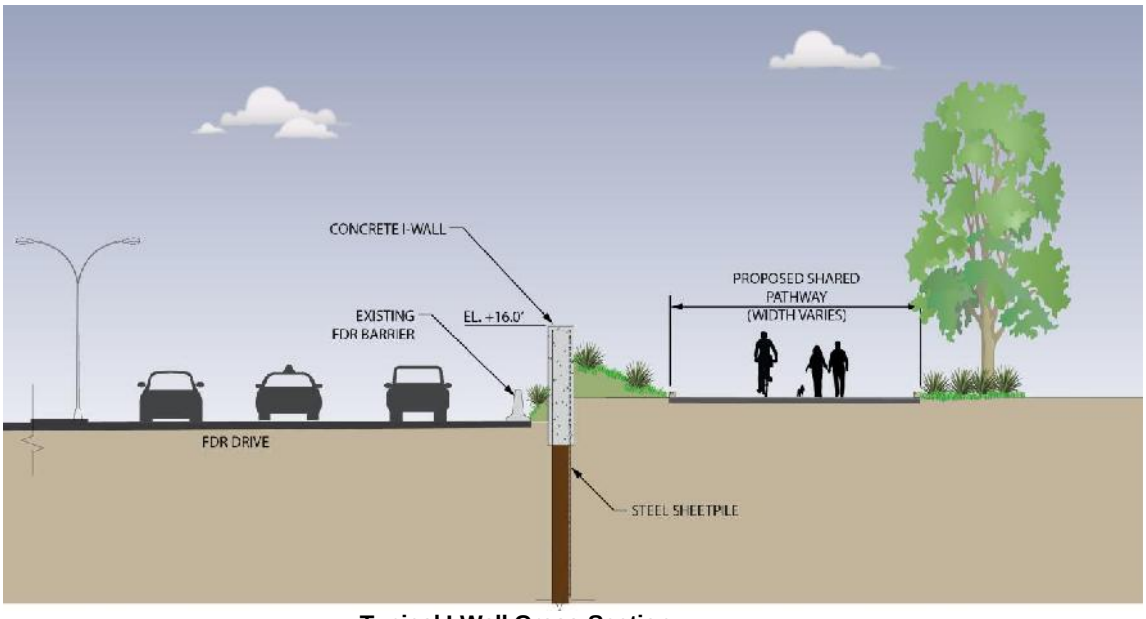
MNLA DRAWN BY
SANDRESM1-PPA-L006-PA2 CADD FILE

FEASIBILITY STUDY AND PRESCOPING SERVICES
FOR EAST SIDE COASTAL RESILIENCY
BOROUGH OF MANHATTAN

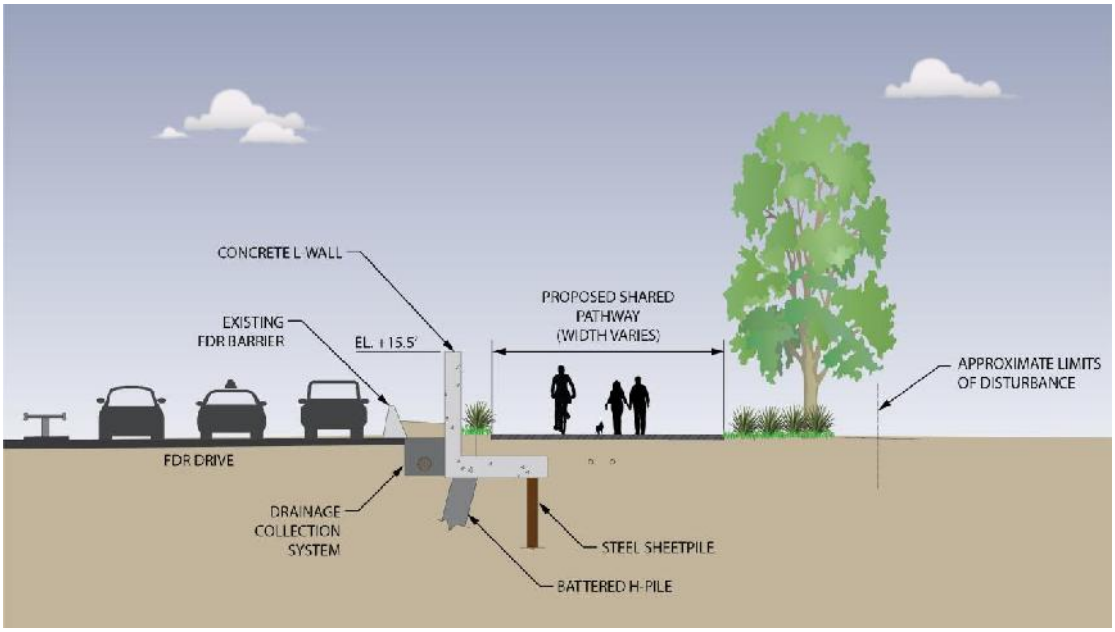
CAPITAL PROJECT NO. SANDRESM1 11/24/2015 SHEET 41 OF 42 L6 / L7

CONSULTANT DESIGN

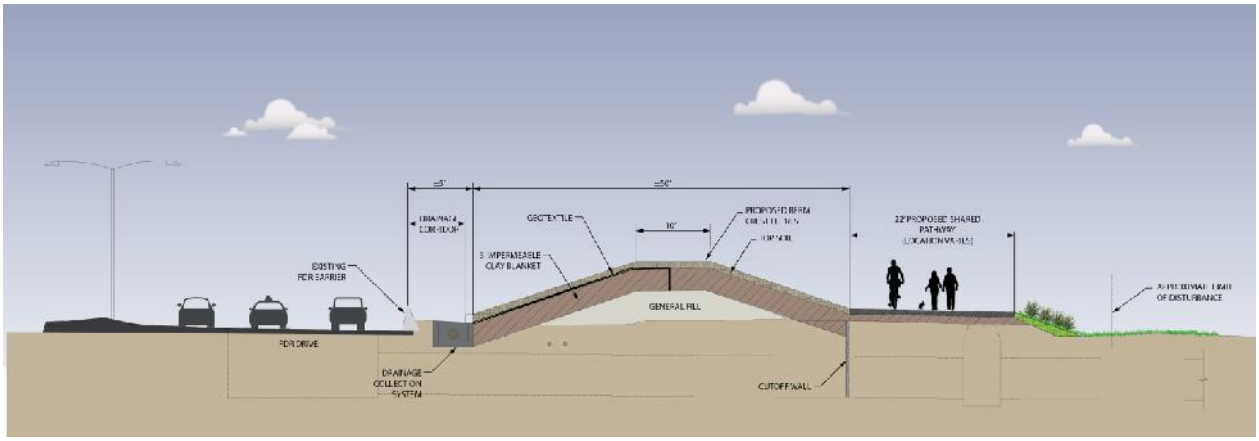
APPENDIX C: GENERALIZED TYPICAL IMPACTS DRAWINGS



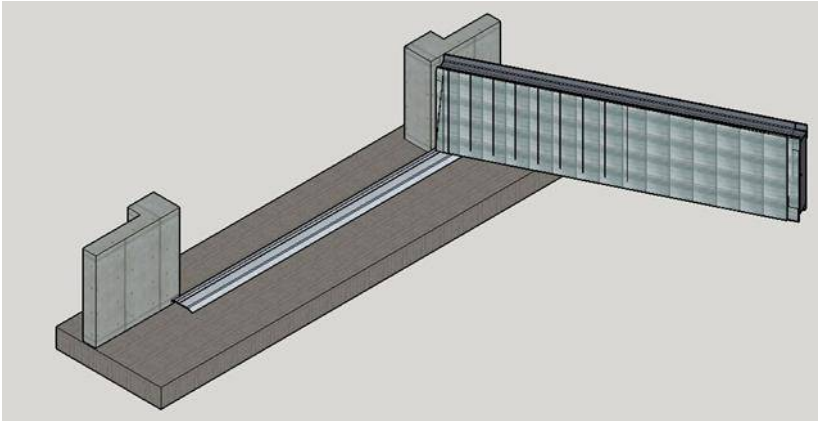
Typical I-Wall Cross-Section



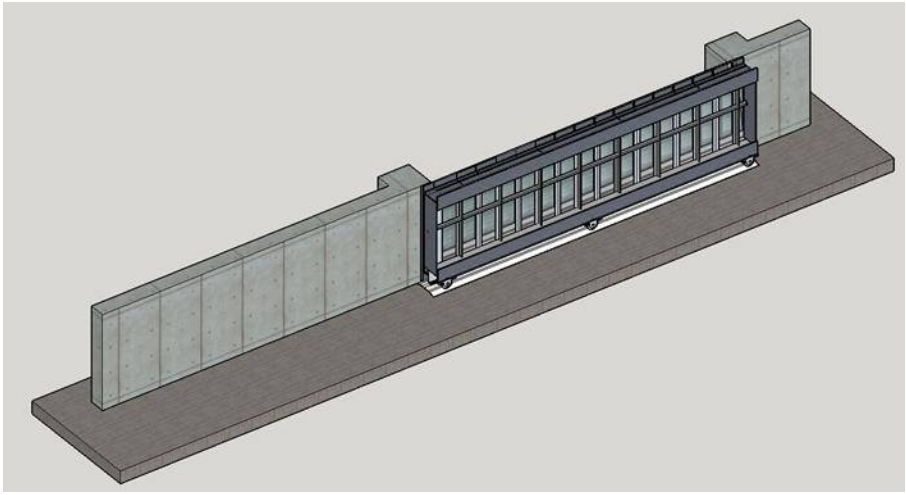
Typical L-Wall Cross-Section



Typical Engineered Levee (Reinforced Berm) Cross-Section



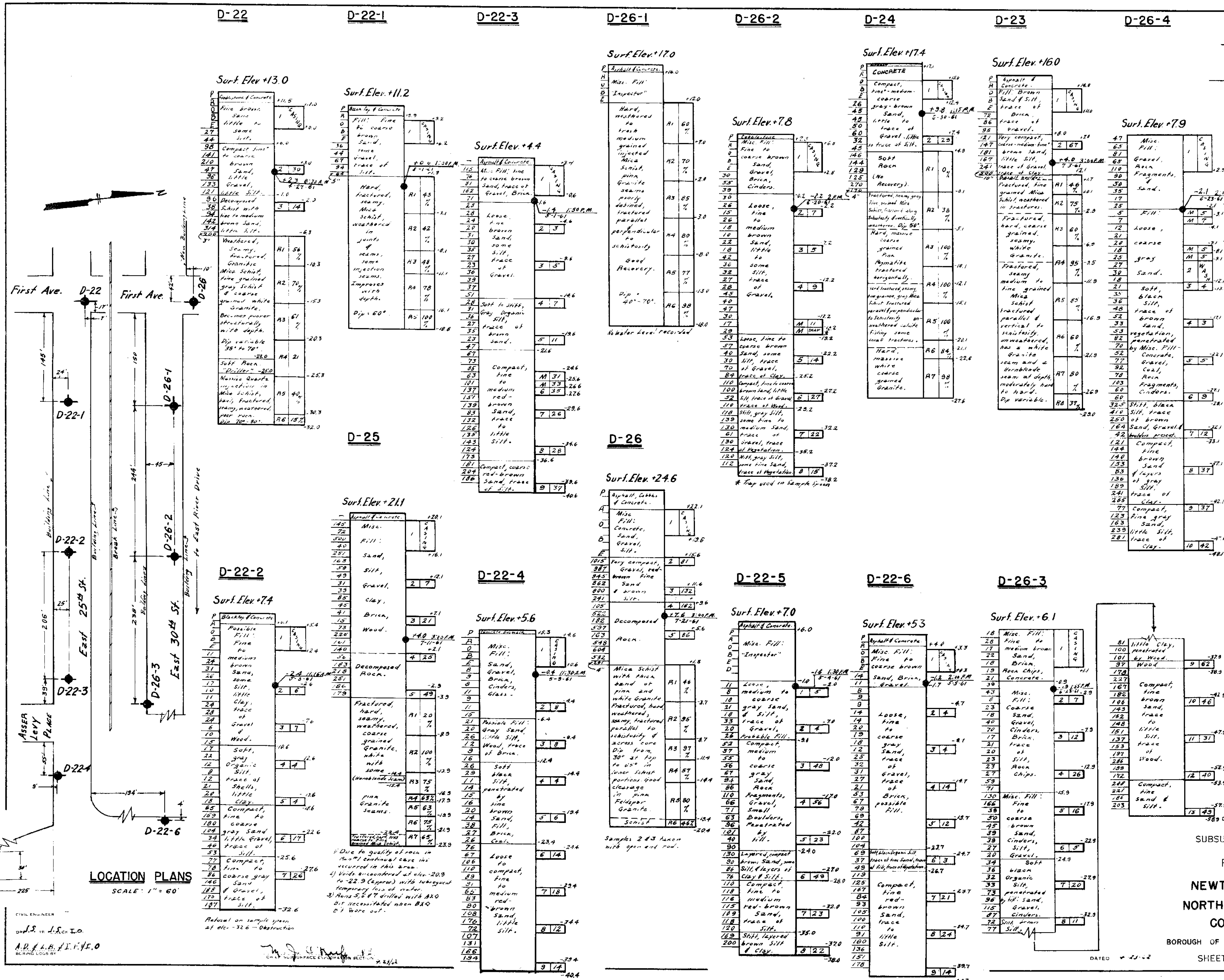
Typical Swing Gate with Concrete Monolith



Typical Steel Roller Gate with Concrete Monolith

APPENDIX D: SOIL BORING PLANS AND LOGS

Newtown Creek P.C.P. North Branch Interceptor Borings (1962)



LOCATION PLANS
SCALE: 1" = 60'

CITY OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING SERVICES

SUBSURFACE EXPLORATION SECTION

RECORD OF BORINGS

NEWTOWN CREEK P.C.P.
NORTH BRANCH INTERCEPTOR
CONTRACT NO. 3

BOROUGH OF MANHATTAN

SHEET 5 OF 12

174A-3