

**PRE-DESIGN INVESTIGATION WORK PLAN
COAL TAR DELINEATION**

**Former 18th Street Gas Works
515 West 18th Street
New York, NY 10001
NYSDEC BCP No. C231093**

Submitted to:

New York State Department of Environmental Conservation
Division of Environmental Remediation
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Prepared for

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Affiliated with Integral Consulting Inc.

CONTENTS

Certification	1-1
1 INTRODUCTION	1-2
1.1 SITE DESCRIPTION	1-2
1.2 SITE HISTORY	1-3
1.3 PURPOSE.....	1-3
2 BACKGROUND	2-5
2.1 SUMMARY OF PREVIOUS INVESTIGATIONS AND ASSESSMENTS.....	2-5
2.1.1 Summary of Historic Sampling Results	2-5
2.1.2 Known sources of Contamination.....	2-6
2.2 PHYSICAL SETTING.....	2-6
2.2.1 Geologic Setting.....	2-6
2.2.2 Hydrogeologic Setting.....	2-6
2.2.3 Subsurface Features	2-7
3 REMEDIAL INVESTIGATION.....	3-8
3.1 PURPOSE AND OBJECTIVES.....	3-8
3.2 SOIL SAMPLING	3-8
3.3 IN-SITU STABILIZATION (ISS) TREATABILITY STUDY	3-9
3.4 HEALTH AND SAFETY PLAN (HASP).....	3-10
3.5 AIR MONITORING	3-10
3.6 INVESTIGATION DERIVED WASTE.....	3-10
3.7 REPORTING	3-11
5 REFERENCES.....	3-1

LIST OF APPENDICES

- Appendix A Previous Environmental Reports
Appendix B Health and Safety Plan with Community Air Monitoring Plan (HASP/CAMP)

LIST OF FIGURES

- Figure 1. Site Location Map
Figure 2. Site Plan
Figure 3. Previous Sample Location Map
Figure 4. North-South Cross Section of Lot 29
Figure 5. Proposed Coal Tar Delineation Boring Locations

CERTIFICATION

I, Kevin McCarty, P.G. certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Pre-Design Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Signature

Date

1 INTRODUCTION

Integral Engineering, P. C. (Integral) has prepared this Pre-Design Investigation Work Plan (Work Plan) on behalf of 18th Highline Associates, L.L.C. (18th Highline Associates or the Volunteer), for the property located at 515 West 18th Street (Block 690, Lots 20 & 29), New York, NY (Site). The Site is currently enrolled in the New York State Brownfield Cleanup Program (BCP) and identified as Site No. C231093.

Both Lots 20 and 29 were historically part of the West 18th Street Gas Works, a Manufactured Gas Plant (MGP) owned by the predecessors-in-interest of Consolidated Edison Company of New York, Inc. (Con Edison), from the mid-1800s to the early 1900s. The Site is included within a Voluntary Cleanup Agreement (VCA) between Con Edison and New York State Department of Environmental Conservation (NYSDEC) [VCA # D2-0003-02-08 effective August 15, 2002]. Numerous investigations including a Site Characterization Study (SCS) completed by TRC in 2006, and a Site Wide Remedial Investigation (RI) completed by ARCADIS in 2009, have been performed onsite under the VCA. These investigations identified petroleum impacts present in the subsurface of the Site, typically at intervals within the range of 1-15 feet below ground surface (bgs), and MGP impacts present in the eastern portion of the Site (Lot 29), typically at intervals within the range of 18-30 feet bgs.

In April 2015 NYSDEC determined that there was sufficient environmental data to deem the site fully characterized. Thus, the only investigatory actions to be conducted by the Volunteer are those associated with informing the remedial action and/or foundation design. For the purposes of this investigation (detailed in Section 1.3 of this plan), supplementary investigatory efforts are limited to Lot 29. However, a site description and a summary of site history are presented for both Lots 20 and 29.

This Work Plan includes a summary of Site history, a description of the regional geologic and hydrogeologic setting, a summary of previous environmental investigations, and a plan of action to fully delineate the extent of coal tar onsite.

1.1 SITE DESCRIPTION

The Site is located in a mixed use area of the West Chelsea section of the Borough of Manhattan. The Site is comprised of an approximately 46,000 square foot (SF) irregular parcel bounded to the north by West 19th Street, to the east by 10th Avenue, to the south by West 18th Street, and to the west by 11th Avenue. Adjacent properties include mixed use commercial, residential, and office space to the north, east, and west, and new development to the south. The Site is identified on New York City tax maps as Block 690, Lots 20 and 29. Lot 20 is currently improved with two 2-story buildings, with the first floor utilized as an active garage operated by Empire

City Subway, and the second floor functioning as an art gallery for Hauser & Wirth. Lot 29 abuts Lot 20 to the east. Lot 29 is currently not improved with any buildings and is used as a parking lot, also operated by Empire City Subway. High Line Park runs north to south over the western portion of Lot 29.

The Site is currently zoned C6-4 (Commercial and Mixed Use Residential).

A USGS Topographic Map is included as Figure 1. A Site plan showing the Site property boundaries is included as Figure 2.

1.2 SITE HISTORY

Lot 20 and 29 and their vicinity are believed to have been used for various industrial, commercial and residential uses in the early to mid-1800s.

The Manhattan Gas Light Company ("Manhattan") (a predecessor-in-interest to the Con Edison) purchased Lot 20 in 1870 and Lot 29 in 1848. Manhattan constructed a pair of large, open gas holders on Lot 29 and, it is believed, used Lot 20 for storage yard purposes, both in support of its West 18th Street Gas Works located on other parcels in the area.

Following Manhattan's sale of Lot 20 in 1919, a large garage was constructed on the 18th Street side that included buried gasoline tanks, and in 1947 a private garage was built on the 19th Street side. Both garage structures still stand today on Lot 20, with the first floor still used as an active garage and the second floor as an art gallery.

The two open gas holders on Lot 29 were razed in 1914 but their below-grade structures and foundations were left in place. Following Manhattan's sale of Lot 29 in 1917, it was used as a wagon yard, automobile parking lot, and commercial truck parking lot with a number of small structures and underground gasoline tanks for a filling station. Today, Lot 29 continues to serve as a parking lot.

1.3 PURPOSE

This Work Plan has been developed to achieve the following objectives:

- To identify the extent of coal tar contamination present within the subsurface on Lot 29;
- To identify the extent of significant non-MGP related petroleum impacts (if present) within the shallow subsurface above the groundwater table; and
- To collect data sufficient to inform the remedial action and foundation design.

This Work Plan was developed in general accordance with the NYSDEC's Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10), dated May 2010.

In addition, this Work Plan provides a summary of environmental conditions, including the following:

- Relevant information from existing environmental reports;
- Technical overview and findings from previous reports;
- Planned investigation activities as outlined in Section 3 of this Work Plan;
- Site base mapping, supporting figures presenting proposed sampling locations of planned investigational activities;
- A Site-Specific Health & Safety Plan (HASP); and
- A Community Air Monitoring Plan (CAMP).

References used in assessment of this Site and for development of this Work Plan are identified in the References section at the end of this document.

2 BACKGROUND

2.1 SUMMARY OF PREVIOUS INVESTIGATIONS AND ASSESSMENTS

In accordance with the DER-10, this Work Plan incorporates a summary of relevant Environmental Site Investigations, which provide the basis for identifying the areas in need of delineation on the Site.

Several investigation reports (Reports) have been prepared for the Former West 18th Street Gas Works Site, including the 2002 Site History Report by Parsons, the Site Characterization Study Report (SCS) completed by TRC in 2006, and the Draft Site Wide Remedial Investigation Report (RIR) completed by ARCADIS in 2009. The investigation and remediation activities were performed by either Con Edison or by property owners and/or developers.

Site specific information and data was extracted from the aforementioned Reports. Pertinent information from the Reports associated with data collected on Lot 29 is summarized below in order to present what is known with respect to the coal tar delineation area on the Site (Figure 2). Documents that were available are included as Appendix A.

2.1.1 Summary of Historic Sampling Results

Sample results from the investigations listed in Section 2.1 indicate the following Site-specific conditions present on Lot 29:

- Petroleum odors were detected in vadose zone and shallow saturated fill sporadically beneath Lot 29;
- Structures associated with the two former gas holders are present in the subsurface (holder bottoms at ~18 feet bgs) in proximity to the High Line Park foundations on the eastern-most portion of the Site;
- Evidence of MGP-residues (e.g., oil-like material [OLM], tar-like material [TLM], naphthalene odors, black staining) were detected as discrete narrow bands in six (6) soil borings within the subsurface interval measuring from 19 to 35 ft-bgs; OLM and TLM were observed above the Silty-Clay Unit outside Holder 5 (the southern holder) and in an approximate 6-inch lens of coarse fill 34.5 feet beneath the West 18th Street sidewalk. TLM was observed in coarse fill within Holder 4 (the northern holder) but above the Holder 4 bottom (18.5 feet bgs). No OLM or TLM were observed in the bottom of Holder 5;
- Brown LNAPL with a strong petroleum odor was observed in one boring from 8.4 to 8.8 ft-bgs located within Holder 5 in vicinity of a current or former UST;
- Volatile Organic Compounds (VOCs), Total VOCs, Semi-volatile Organic Compounds (SVOCs), Total SVOCs and metals were detected in subsurface soil at concentrations exceeding NYSDEC Recommended Soil Closure Objectives (RSCOs). No pesticides,

herbicides or PCBs were detected at concentrations in subsurface soil in excess of the NYSDEC RSCOs.

Figure 3 depicts previous sample locations.

2.1.2 Known sources of Contamination

Former gas holders 4 and 5 on Lot 29 were associated with the operations of the Former West 18th Street Gas Works. Previous investigations have identified the isolated presence of deep MGP-related oil and tar impacts in the vicinity of the gas holders and the High Line Park foundation elements.

2.2 PHYSICAL SETTING

The Site incorporates approximately 1.05 acres of fairly level land situated on the west side of Manhattan near the Hudson River. The Site is mapped on the Brooklyn, NY; Central Park NY-NJ; Jersey City, NY-NJ; and Weehawken, NY-NJ 7.5' Topographic Quadrangles, published by the United States Geological Survey (USGS). Review of the topographic map indicates that the Site is located approximately 8-11 feet above sea level (NAVD 1988).

2.2.1 Geologic Setting

The Site is located in the West Chelsea section of the Borough of Manhattan. The entire area is fully developed and is estimated to have been developed for the last century. All surface topography, exclusive of areas set aside (e.g., City Parks) has been impacted by development and may no longer reflect the original pre-development layout. A mix of historic fill material and native sands, silts and glacial till, is expected to underlay the Site and surrounding areas.

The Site is situated within the Manhattan Prong region of the Highlands Province, characterized by highly deformed Paleozoic to Proterozoic metasedimentary and metaigneous rocks. The bedrock under the Property is mapped as Cambrian-aged schist from the Hartland Formation (Merguerian 1983) which slopes from the northeast to the southwest. It is mapped as the structurally highest, upper schist unit (€-Oh) which is predominantly well layered, gray-weathered, fine- to coarse-grained, muscovite-quartz-biotiteplagioclase-kyanite-garnet schist, gneiss, and granofels with cm- and m-scale layers of greenish amphibolite-garnet. According to previous investigations, bedrock was encountered between 45 and 86 feet below grade (ARCADIS, 2009).

2.2.2 Hydrogeologic Setting

Groundwater is expected to be between 8 and 9 feet below ground surface. Regional groundwater flow is expected to be westerly towards the Hudson River; local groundwater

flow is assumed to be the same.

No wetlands or surface water bodies are present at the Site. The nearest surface water body is the Hudson River, located approximately 388 feet southwest of the Site.

2.2.3 Subsurface Features

Two 25,000 cubic feet sub-grade gas holders currently exist on Lot 29. The walls of the holders historically extended above grade, but were demolished in 1914, leaving their below grade walls and foundations in place. The walls of the holders extend from approximately 2-18 ft-bsg and range in thickness from approximately 2-7 feet. The holder foundations are present at approximately 18-20 ft-bsg. The gas holders are depicted in cross-section on Figure 4.

3 REMEDIAL INVESTIGATION

The activities described in this Work Plan will be conducted in accordance with 6 NYCRR Part 375 Brownfield Cleanup Regulations, and in general conformance with the NYSDEC DER-10. The delineation process will consist of sampling of soil/fill for visual/olfactory observation of coal tar in order to determine the limits of significantly impacted fill and native sediments. Boring locations may be modified during the field program based on observations made in the field, access, or subsurface obstruction.

3.1 PURPOSE AND OBJECTIVES

The purpose of this Pre-Design Investigation is to define the extent of coal tar impacts on the Lot 29 portion of the Site and to provide data of sufficient quantity to support development of a Remedial Action Work Plan. This Work Plan was developed to meet the following Site-specific objectives:

- Delineate the horizontal and vertical extent of coal tar in soil/fill beneath Lot 29;
- Delineate significant non-MGP related petroleum impacts (if present) within the shallow subsurface above the groundwater table on Lot 29; and
- Evaluate the appropriateness of different remedial alternatives that will effectively act as containment for MGP impacted soil/fill within the BCP Site boundary.

3.2 SOIL SAMPLING

In order to delineate coal tar beneath Lot 29, the following scope of work will be implemented:

- Advance approximately thirty-seven (37) soil borings across Lot 29 to evaluate the subsurface soil conditions to approximately 30 ft-bgs. Proposed Borings locations are within areas of Lot 29 not previously sampled and that represent data gaps in identifying the horizontal and vertical extent of MGP related impacts, and whose results will assist in the presentation of Alternative Analysis and remedy recommendations;
- Evaluate physical characteristics of the soil/fill column in each boring;
 - Borings will be continuously sampled starting at 10 ft-bgs. All borings will be advanced to a minimum of 30 ft-bgs. The information gathered from the upper fill/soil layer will also be used to inform various remedial alternative strategies.
 - Approximately 10 of 37 borings will be continuously sampled starting at 0 ft-bgs to 30 ft-bgs in order to delineate non-MGP related petroleum impacts identified previously by others and to evaluate the physical characteristics of the shallow subsurface.

- Samples for chemical analysis (VOCs and SVOCs) may be collected if significant non-MGP related petroleum impacts are observed in the form of Non Aqueous Phase Liquid [NAPL] or staining.

Prior to the advancement of soil borings, all locations will be hand cleared for utilities and subsurface infrastructure to a depth of approximately 5 ft-bsg.

The use of the real-time field-screening techniques will be applied in order to determine if additional delineation borings are necessary in areas where coal tar or petroleum impacts are observed from visual or olfactory cues. Additional delineation borings will be advanced radiating out from any proposed soil boring that shows signs of significant coal tar or non-MGP related petroleum impacts in order fully identify the limits of MGP impacts and/or petroleum impacts within the BCP Site boundary. This delineation process focuses the subsurface soil investigation on probable source areas, while obtaining a more complete data set and eliminating multiple mobilizations. Evaluation of impacted soil and source area delineation will support the alternative analysis and assist with the selection of the remedy

Impact will be determined in the field under the supervision of a Qualified Environmental Professional (QEP) via screening for VOCs using a PID and visual/olfactory indication.

Soil borings will be installed using a truck mounted hollow stem auger drill rig. Continuous soil samples will be collected using 2 foot steel spilt spoon samplers. Samplers and augers will be decontaminated onsite usingalconox and steam, respectively. The soil/fill retrieved from each sampler will be field screened with a PID for VOCs and described by Integral field personnel on boring logs. Evidence of significant impacts and contamination (e.g., coal tar; NAPL, sheens, odors, staining, elevated PID readings) will be documented by Integral field personnel.

All proposed soil boring locations are shown on Figure 5.

3.3 IN-SITU STABILIZATION (ISS) TREATABILITY STUDY

The goal of the bench-scale ISS treatability study is to identify at least one, and preferably more than one, solidification mix design that meets the performance criteria established for this site.

A solidification remedy was performed for the 17th Street project located adjacent to this site. We will test the same mix design that was used for that project to determine whether it may be successfully applied to this site. We will also evaluate several additional mix designs in parallel, to span a range of solidification additives.

Test cylinders will be evaluated first for permeability by ASTM D5084 by the falling head method using a flexible wall permeameter, and then for unconfined compressive strength by ASTM D1633. Permeability and strength tests will be performed sequentially on a single cylinder, in order to minimize the total number of test cylinders required. Strength and

permeability testing will be performed on one test cylinder from each mix design at or before 14 days of curing, and again after 28 days of curing. One or more of candidate mixes that perform well for strength and permeability will be tested by method 1315 for leaching of the 16 priority pollutant polycyclic aromatic hydrocarbons (PAHs).

The ISS treatability sample material will be a composited mixture of soil containing visible coal tar impacts collected during the coal tar delineation work, and spanning the anticipated depth range for the solidification remedy. Below is outline of the treatability study methodology:

- Mix designs: approximately 6-10
- Solidification reagents: Portland cement, slag cement, bentonite clay
- Test methods: ASTM D5084; ASTM D1633; EPA 1315
- Evaluated at: 14 days, 28 days

3.4 HEALTH AND SAFETY PLAN (HASP)

All work at the Site will be completed in accordance with the Health and Safety Plan (HASP) included in Appendix B.

3.5 AIR MONITORING

The NYSDOH Generic Community Air Monitoring Plan (CAMP), included as Appendix 1A of DER-10, will be implemented during all ground-intrusive sampling activities. Details of the CAMP are included in the HASP (Appendix B).

3.6 INVESTIGATION DERIVED WASTE

It is anticipated that soil cuttings will be generated during coal tar delineation activities. The cuttings or spoils from drilling operations will be placed on protective sheeting, screened with a PID, and either used to backfill the bore hole (if screening and visual inspection indicates no/minimal VOCs and no obvious MGP impacts) or placed into 55-gallon drums. Soil cuttings determined to be unacceptable for backfill and impacted decon water will be drummed, characterized and disposed of offsite in accordance with federal, state and local regulations. Borings with impacts will be backfilled with inert material and/or grouted at the surface to prevent odors from escaping and precipitation from percolating down the borehole.

Used personal protective equipment (PPE) and other non-hazardous materials that come into contact with coal tar will be drummed and disposed of offsite in accordance with federal, state and local regulations.

3.7 REPORTING

The results of the Pre-Design Investigation will be incorporated into the Remedial Action Work Plan.

4 SCHEDULE

Based upon current knowledge of the Site, the following Pre-Design schedule, subject to change, is proposed. A minimum of 5-day notice will be provided to NYSDEC in advance of field sampling.

Task	Task Duration	Total Duration
NYSDEC/NYSDOH Approval	0 Weeks	0 Weeks
Mobilization/Coordination with Owner and Tenant	1 Week	1 Week
Implement Delineation	1 Week	2 Weeks
Prepare RAWP	4 Weeks	6 Weeks

5 REFERENCES

NYSDEC 2010. New York State Department of Environmental Conservation, Division of Environmental Remediation. DER Technical Guidance for Site Investigation and Remediation (DER-10). 2010.

NYSDEC 2010. New York State Department of Environmental Conservation DEC Policy. Commissioner's Policy 51 – Soil Cleanup Guidance. October 21, 2010.

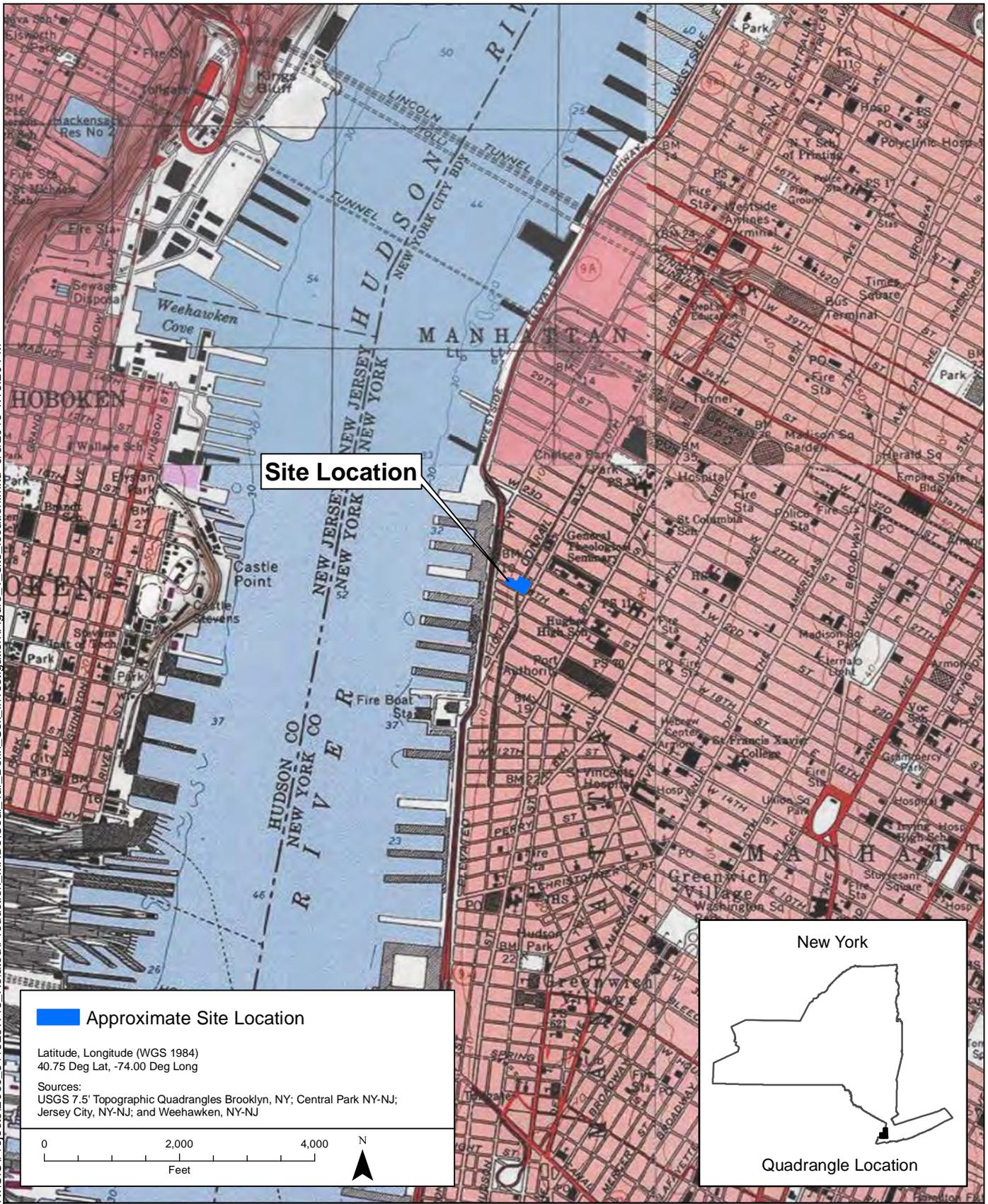
NYSDEC 2006. 6 NYCRR Part 375 Environmental Remediation Programs. Division of Environmental Remediation, December, 2006.

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TRC 2006. Site Characterization Study Report.

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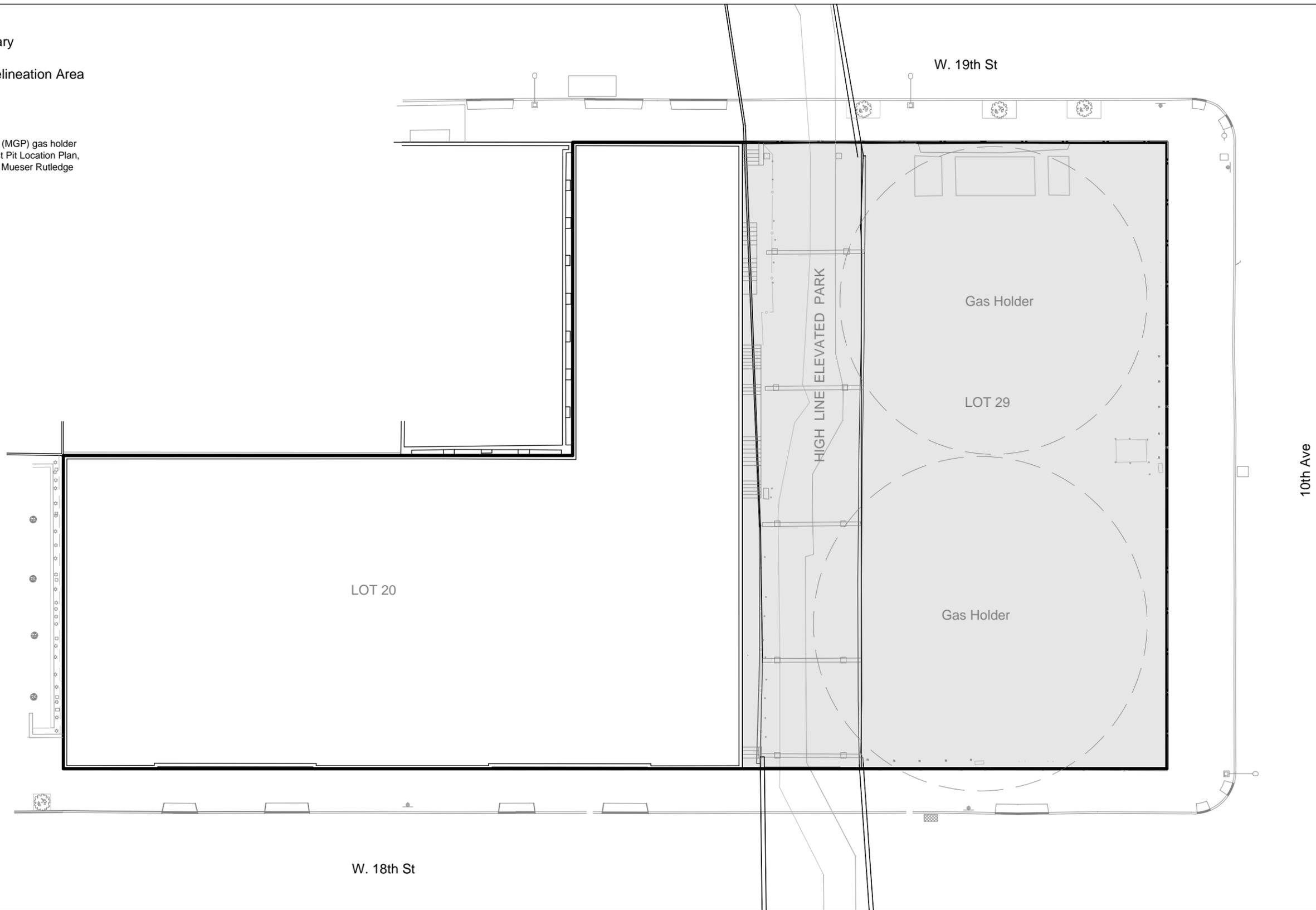


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Figure 1.
Site Location Map
Pre-Design Investigation Work Plan
515 West 18th Street
New York, New York 10011

 Site Boundary
 Coal Tar Delineation Area

Note:
 1. Former manufactured gas plant (MGP) gas holder structure locations are from Test Pit Location Plan, W18-W19 Street Development, Mueser Rutledge Consulting Engineers, 6-8-2016



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Figure 2.
 Site Plan
 Pre-Design Investigation Work Plan
 515 West 18th Street
 New York, New York 10011

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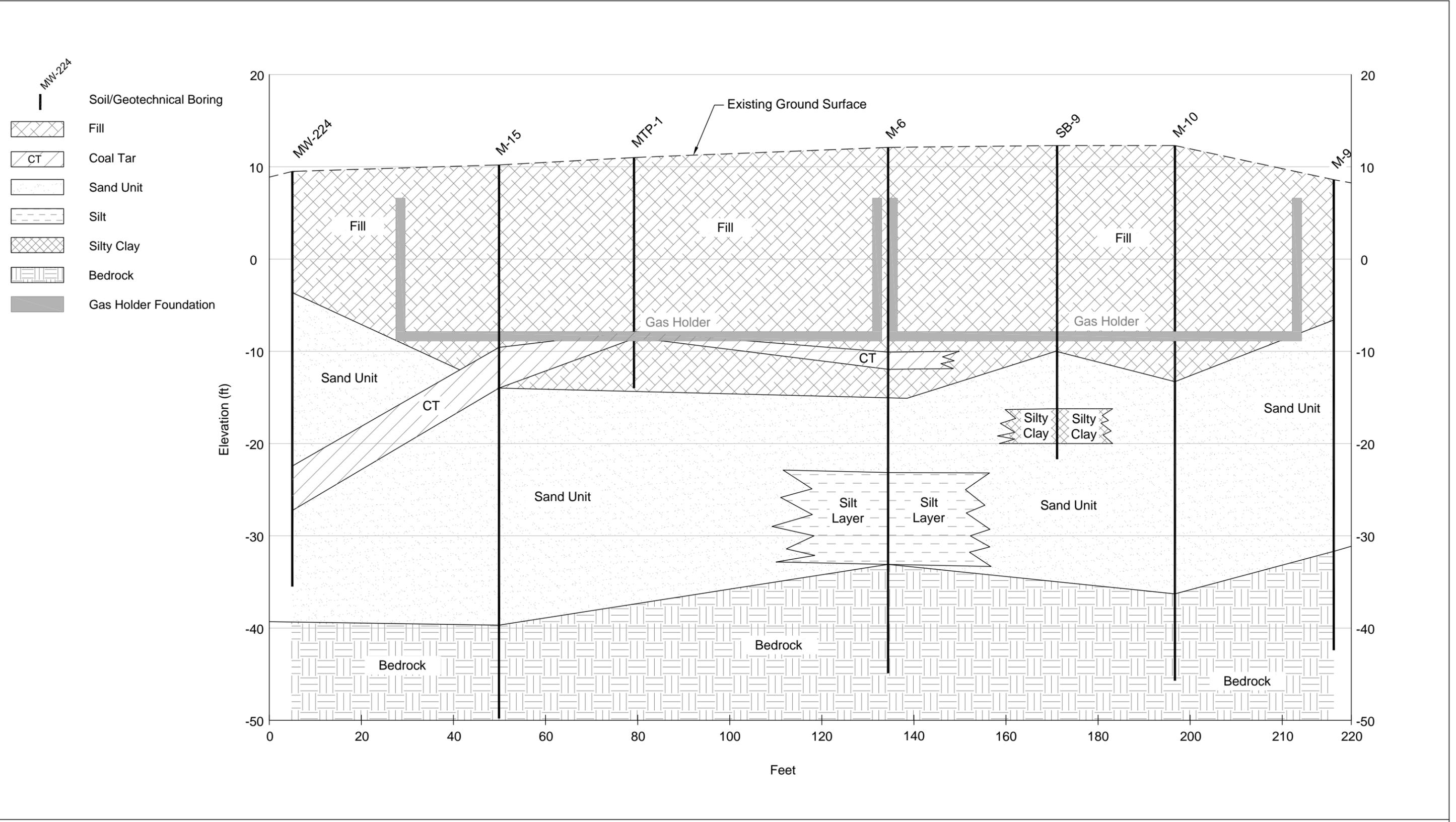
-  Site Boundary
-  Soil Boring (TRC 2005)
-  Soil Boring (Arcadis 2006-2007)
-  Geotechnical Boring with Visual Coal Tar Delineation (MRCE and Integral 2015)
-  Historical Offsite Soil Boring
-  Test Pit (TRC 2005)
-  Coal Tar Delineation Area
- A — A' Cross-Section Transect

Note:
 1. Former manufactured gas plant (MGP) gas holder structure locations are from Test Pit Location Plan, W18-W19 Street Development, Mueser Rutledge Consulting Engineers, 6-8-2016



Figure 3.
 Previous Sampling Locations
 Pre-Design Investigation Work Plan
 515 West 18th Street
 New York, New York 10011

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Note:
1. Coal Tar interval is estimated based upon historic environmental borings and physical observations from geotechnical borings advanced in 2015.

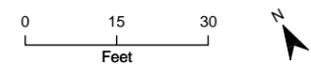
Figure 4.
North/South Subsurface Cross Section of Lot 29
Pre-Design Investigation Work Plan
515 West 18th Street
New York, New York 10011

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-  Site Boundary
-  Proposed Coal Tar Delineation Location
-  Historic Soil Sample Location, Installed by Others (2004 - 2007)
-  Geotechnical Boring with Visual Coal Tar Delineation (MRCE and Integral 2015)
-  Coal Tar Delineation Area



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Basemap Source: Architectural Survey,
Fehring Surveying, P.C., 511 West
18th Street, July 29, 2014.

Note:
1. Former manufactured gas plant (MGP) gas holder
structure locations are from Test Pit Location Plan,
W18-W19 Street Development, Mueser Rutledge
Consulting Engineers, 6-8-2016

Figure 5.
Proposed Coal Tar Delineation
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