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Remedial Action Report

Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil

Final

Site 133 East NJDEP Program Interest Number: 025695
Site 135 NJDEP Program Interest Number: 246332

**PPG Garfield Avenue Group
Hudson County Chromate Sites
Jersey City, New Jersey**

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List of Acronyms and Abbreviations

AAC	Acceptable Ambient Concentration
ACM	asbestos-containing material
ACO	Administrative Consent Order
AMP	Air Monitoring Plan
AOC	Area of Concern
bgs	below ground surface
BOL	bill of lading
CCPW	Chromate Chemical Production Waste
CID	Case Inventory Document
CMAA	Construction Manager as Agent
COC	chain-of-custody
Cr ⁺⁶	hexavalent chromium
CrSCC	Chromium Soil Cleanup Criteria
DCP	Dust Control Plan
DGA	dense-graded aggregate
DIGWSSL	Default Impact to Groundwater Soil Screening Level
EDD	electronic data deliverable
EI.	elevation
ENTACT	ENTACT Environmental Services of Latrobe, Pennsylvania
EQ	Environmental Quality Company
ERFS	Environmental Remediation and Financial Services, LLC
FSP-QAPP	Field Sampling Plan – Quality Assurance Project Plan
ft	foot or feet
GA Group	Garfield Avenue Group
GPS	Global Positioning System
HASP	Health and Safety Plan
HCC	Hudson County Chromate
IGWSRS-GAG	Impact to Groundwater Soil Remediation Standard - Garfield Avenue Group
JCMUA	Jersey City Municipal Utilities Authority
JCO	Judicial Consent Order
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LSRP	Licensed Site Remediation Professional
MDL	Method Detection Limit
mg/kg	milligrams per kilogram
MGP	manufactured gas plant
MS	matrix spike
MSD	matrix spike duplicate
NAVD88	North American Vertical Datum of 1988
NJ	New Jersey
N.J.A.C.	New Jersey Administrative Code

NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJGIN	New Jersey Geographic Information Network
OSHA	Occupational Safety and Health Administration or Act
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PDI	pre-design investigation
PI	Program Interest
PPE	personal protective equipment
PSEG	Public Service Electric and Gas Company
PVSC	Passaic Valley Sewerage Commission
QA	quality assurance
QC	quality control
RA	remedial action
RAP	Remedial Action Permit
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan
RDCSRS	Residential Direct Contact Soil Remediation Standard
RE	receptor evaluation
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RPD	relative percent difference
SESCP	Soil Erosion and Sediment Control Plan
SOP	standard operating procedure
SRP	Site Remediation Program
SRS	Soil Remediation Standard
SSRIR	Supplemental Soil Remedial Investigation Report
SVOC	semi-volatile organic compound
SW	Southwestern
TEE	Terminal Excavation Elevation
TEP	Technical Execution Plan
TOC	total organic carbon
TRSR	Technical Requirements for Site Remediation
TSDF	treatment, storage, and disposal facility
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	volatile organic compound
Weston	Weston Solutions, Inc.

Regulatory Cross Reference Table

**Regulatory Cross Reference Table
Remedial Action Report
Site 133 East and Site 135, Garfield Avenue Group
PPG, Jersey City, New Jersey**

N.J.A.C. 7:26C and 7:26E (last amended August 6, 2018) regulations are the primary source of Remedial Action Report (RAR) requirements. This document is not to be used as a replacement for the Technical Regulations.

Regulation	Description	Document Location	
N.J.A.C. 7:26E-5.7	Remedial Action Report Requirements	Report	Location
5.7(a)	The person responsible for conducting the remediation shall implement the remedial action and submit to the Department a remedial action report, along with a form found on the Department's website at www.nj.gov/dep/srp/srra/forms , pursuant to (b) below, and according to the applicable regulatory timeframe in N.J.A.C. 7:26E-5.8.	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	throughout
5.7(b)	The person responsible for conducting the remediation shall present and discuss in the remedial action report all of the information identified or collected pursuant to N.J.A.C. 7:26E-5.1 through 5.6, along with all of the following:	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	throughout
5.7(b) 1	The general reporting requirements in N.J.A.C. 7:26E-1.6;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	see below
1.6(a) 1	Submit all documents, forms, spreadsheets and worksheets required in this chapter;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	The Cover/Certification Form is included with the Site Remediation Program Forms. The paper Remedial Action Report form is no longer accepted and is intended for work conducted under the Licensed Site Remediation Professional Program. As this work is being conducted under direct oversight and not being submitted online, no Remedial Action Report form is included.
1.6(a) 2	Certify and have the licensed site remediation professional certify, pursuant to N.J.A.C. 7:26C-1.5, all forms and documents prepared to pursuant to this chapter;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Regulatory Forms
1.6(a) 3	Submit a completed case inventory document (CID) worksheet available on the Department's website at www.nj.gov/dep/srp/srra/forms at the front of each remedial phase workplan and report required by this chapter, except for a preliminary assessment report where no areas of concern were identified;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Regulatory Forms
1.6(a) 4	Submit a quality assurance project plan (QAPP) prepared pursuant to N.J.A.C. 7:26E-2.2 with each remedial phase workplan and report required by this chapter, except for a preliminary assessment report and remedial action report;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Not Applicable for this Remedial Action Report
1.6(a) 5	Except where a final remediation document for unrestricted use is filed with the Department within one year after the earliest applicable trigger to remediate listed in N.J.A.C. 7:26C-2.2, submit all sampling data electronically in a summary table using the format outlined in the Site Remediation Program's "Electronic Data Interchange Manual," available at www.nj.gov/dep/srp/hazsite/docs/ , in effect as of the date the document is submitted and include items described in subsections 1.6(a) 5.i-iii of Tech Reg.	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Electronic data deliverable provided to NJDEP for data used to document compliance with remedial action goals; receipts of submittal included in Appendix E
1.6(a) 6	Submit a geographic information system (GIS) compatible site plan that includes the site boundaries and the location of all areas of concern as polygons.	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Figure 1-2 - Site Plan
1.6(b) 1	The physical setting of the site that includes a general description of soils, geology, hydrology, hydrogeology, and topography of the site and surroundings;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 2.2 - Physical Setting of the Site

**Regulatory Cross Reference Table
Remedial Action Report
Site 133 East and Site 135, Garfield Avenue Group
PPG, Jersey City, New Jersey**

N.J.A.C. 7:26C and 7:26E (last amended August 6, 2018) regulations are the primary source of Remedial Action Report (RAR) requirements. This document is not to be used as a replacement for the Technical Regulations.

Regulation	Description	Document Location	
		Report	Location
N.J.A.C. 7:26E-5.7	Remedial Action Report Requirements		
1.6(b) 2	A description of any significant events or seasonal variations that may have influenced sampling procedures or analytical results;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	No significant events or seasonal variations influenced sampling procedures or analytical results. Soil sampling results are discussed in: Section 2.1 - Summary of Soil Remedial Investigation Findings Section 4.2.1 - Proposed Terminal Excavation Elevations and Pre-Design Investigation Section 5.3 - Post-Excavation Soil Sampling
1.6(b) 3	A description of the results and implications of field measurements or area-specific changes in sampling protocol due to field conditions;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Not Applicable for these Sites
1.6(b) 4	A list of: i. All variances from the requirements of this chapter submitted pursuant to N.J.A.C. 7:26E-1.7; and ii. All rationales submitted for deviations from any technical guidance pursuant to N.J.A.C. 7:26C-1.2(a)3;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Not Applicable for these Sites
1.6(b) 5	The applicable regulatory timeframe, including: i. Regulatory citation of the regulatory timeframe; and ii. Calendar date of the regulatory timeframe;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Master Schedule, referenced in Section 1.0
1.6(b) 6	A summary table(s), organized by area of concern, of all sampling results, including sample location, medium, sample depth, field and laboratory identification numbers, analytical results, and comparison to remediation standards, and the following: i. Identification of each contaminant concentration exceeding a remediation standard; ii. Identification of each sample with a method detection limit or a practical quantitation level that exceeds a remediation standard, along with an explanation in the table key; and iii. A report of all soils and solids sample results in milligrams per kilogram on a dry weight basis, aqueous sample results in micrograms per liter, and air results in micrograms per cubic meter;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Site 133 East: Appendix D-4 - Tables 5-1 through 5-5 - Analytical Results for In-Place Soil Site 135 North: Appendix D-5 - Tables 5-1 through 5-2 - Analytical Results for In-Place Soil Site 135 South: Appendix D-6 - Tables 5-1 through 5-3 - Analytical Results for In-Place Soil
1.6(b) 7	For soil borings, test pits and monitoring wells: i. Stratigraphic logs, which include soil/rock physical descriptions and field instrument readings detected during drilling for each soil boring, test pit and monitoring well; ii. State permit numbers and as-built specifications, if applicable; and iii. Monitoring well certification forms A (the well construction as built certification) and B (the well location certification) available on the Department's website at www.nj.gov/dep/srp/regs/guidance.htm ;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	i. Appendix I - Boring Logs ii and iii. Not Applicable
1.6(b) 8	Maps and figures, with map scale and orientation, including: i. Site location, land use, receptor evaluation, and area of concern maps; ii. Sample location map(s), that include the following: (1) Field identification numbers for all samples; (2) Sample locations, sample depths and contaminant concentrations plotted on the map; and (3) If data for more than 25 samples are presented for an area of concern, soil, ground water and sediment contaminant isopleth maps and cross section diagram(s), including the horizontal and vertical distribution of contaminants in each media, with sample point location numbers and contaminant concentrations; and iii. Ground water elevation contour maps showing the location of all monitoring wells, piezometers, or other ground water sampling points, for each set of static ground water level measurements for each aquifer;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	i. Site Location: Figure 1-1 - USGS Site Location Map; Land Use: Regulatory Forms - Receptor Evaluation (located immediately behind the report cover page); Areas of Concern: Figure 1-2 - Site Plan ii. Sample Location Maps: Site 133 East: Appendix D-1 - Figures 5-1 through 5-5 Site 135 North: Appendix D-2 - Figures 5-1 through 5-2 Site 135 South: Appendix D-3 - Figures 5-1 through 5-3 iii. Groundwater Maps - Not Applicable

**Regulatory Cross Reference Table
Remedial Action Report
Site 133 East and Site 135, Garfield Avenue Group
PPG, Jersey City, New Jersey**

N.J.A.C. 7:26C and 7:26E (last amended August 6, 2018) regulations are the primary source of Remedial Action Report (RAR) requirements. This document is not to be used as a replacement for the Technical Regulations.

Regulation	Description	Document Location	
		Report	Location
N.J.A.C. 7:26E-5.7	Remedial Action Report Requirements		
1.6(b) 9	A discussion of the usability of laboratory analytical data;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 6.0 - Reliability of Data: Data Validation and Usability
1.6(b) 10	A description of the significance of information generated in the library search of tentatively identified compounds and unknown compounds.	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Not Applicable for these Sites
5.7(b) 2	A presentation and discussion of all of the information identified or collected, pursuant to N.J.A.C. 7:26E-1.10 through 1.16 and an updated receptor evaluation on a form found on the Department's website at www.nj.gov/dep/srp/srra/forms ;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Regulatory Forms - Receptor Evaluation (located immediately behind the report cover page) and Section 8.0 - Receptor Evaluation Update
5.7(b) 3	A summary of the findings and recommendations for each area of concern from the remedial investigation report prepared pursuant to N.J.A.C. 7:26E-4.9;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 2.3 - Recommended Remedial Action
5.7(b) 4	A description, by area of concern, of each remedial action implemented;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 5.0 - Description of Remedial Action
5.7(b) 5	A list, by remedial action, of the remediation standards that apply to each remedial action;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 3.0 - Identification of Applicable Remedial Standards/Criteria and Table 3-1 - Soil Remediation Standards/Criteria
5.7(b) 6	Documentation, by area of concern, that each remedial action is effective in protecting the public health and safety and the environment by: i. Providing an overview of the data to establish the remedial action is operating as designed; or ii. Demonstrating compliance with the applicable remediation standards;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 7.0 - Documentation of the Protectiveness of the Remedial Action
5.7(b) 7	A remedial action permit application prepared pursuant to N.J.A.C. 7:26C-7, if applicable;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	The remedial action permit will be filed and submitted following approval of the Remedial Action Report and filing of the deed notice.
5.7(b) 8	"As-built" diagrams for any permanent structures associated with the remedial action including, without limitation, caps or other structures associated with the remedial action and engineering controls, if applicable;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 7.0 - Documentation of the Protectiveness of the Remedial Action Appendix G - As-Built Diagrams
5.7(b) 9	A detailed description of site restoration activities, if applicable;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 7.2 - Description of Restoration Activities
5.7(b) 10	The total remediation costs through the implementation of the remedial action;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 7.3 - Total Remedial Action Cost
5.7(b) 11	Documentation of all types and quantities of waste generated by the remedial action, including copies of fully executed manifests or bill(s) of lading documenting any off-site transport of waste;	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 7.4 - Documentation of Waste Generation and Disposal Appendix K - Hazardous Waste Disposal Documentation Appendix L - Non-Hazardous Waste Disposal Documentation
5.7(b) 12	Documentation of the source, type, quantities, and location of each alternative fill and clean fill used as part of the remedial action at the site; and	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 7.5 - Documentation of Source, Type, Quantities, and Location of Fill Appendix M - Clean Fill Documentation
5.7(b) 13	A description of each permit required and obtained to implement the remedial action.	Remedial Action Report - Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) Soil	Section 7.6 - Identification of Required Permits and Authorizations Appendix B - Permits and Approvals

Executive Summary

This Remedial Action Report (RAR) has been prepared by AECOM on behalf of PPG to document the remedial action (RA) for:

- Chromate Chemical Production Waste (CCPW) and CCPW-impacted soils at Site 133 East Grid Rows S through CC excluding Grids S43A and S44A (Area of Concern [AOC] 133E-1A);
- Soils impacted by manufactured gas plant (MGP)-related constituents associated with the former Halladay Street Gas Works MGP at Site 133 East Grid Rows S through CC excluding Grids S43A and S44A (AOC 133E-2A);
- CCPW and CCPW-impacted soils at Site 135 (AOC 135-1).

Site 133 East and Site 135 (the Site) are part of the Garfield Avenue Group (GA Group) Sites, which include Sites 114, 132, 133, 135, 137, 143, and 186, and adjacent roadways and properties (**Figure 1-1**). Site 114 is the former location of a chromite ore processing facility previously owned by PPG, and the former Halladay Street Gas Works MGP previously owned by Public Service Electric and Gas Company (PSEG). Site 133 East is tracked under the New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program (SRP) Program Interest (PI) number 025695, Activity Number RPC900001. Site 135 is tracked under the NJDEP SRP PI number 246332, Activity Number RPC000001.

Site 133 East is located at 22 Halladay Street in Jersey City, New Jersey (NJ) (**Figure 1-2**). Site 133 East is identified as Block 21509, Lot 1, in the Jersey City Parcel Data from the New Jersey Geographic Information Network (NJGIN), last updated October 6, 2015 (available at: https://njgin.state.nj.us/OGIS_IV, last accessed in November 2018). This RAR addresses RA on a portion of the Site 133 East property only. Documentation of RA on the remainder of Site 133 East will be addressed in a separate submittal. Site 133 East is bordered to the west by Halladay Street, to the south by Caven Point Avenue, to the east by the Al Smith Moving Property (Al Smith Moving) at 33 Pacific Avenue (Block 21509, Lot 3) and Site 135 at 51-99 Pacific Avenue (Block 21509, Lot 2), and to the north by Carteret Avenue. Site 114 is located to the north across Carteret Avenue. The total area encompassed by Site 133 East is approximately 2.0 acres.

Site 135 is located at 51-99 Pacific Avenue in Jersey City, NJ (**Figure 1-2**). Site 135 is identified as Block 21510, Lot 2 in NJGIN (available at the web link provided above). Site 135 is bordered to the west by Site 133 East at 22 Halladay Street (Block 21509, Lot 1), to the south by Al Smith Moving at 33 Pacific Avenue (Block 21509, Lot 3), to the east by Pacific Avenue, and to the north by Carteret Avenue. Site 114 is located to the northwest across Carteret Avenue. The total area encompassed by Site 135 is approximately 1.4 acres.

This RAR addresses only the soil impacts for which PPG is responsible under the *Administrative Consent Order* (ACO) (NJDEP, 1990) and the *Partial Consent Judgment Concerning the PPG Sites* (Judicial Consent Order [JCO]) (Superior Court of New Jersey Law Division – Hudson County, 2009). PPG is responsible for CCPW and CCPW-related impacts.

PPG and PSEG are jointly responsible for remediation of MGP parameters including those emanating from Site 114. PSEG is taking the lead on closing out MGP-related impacts in accordance with the

Licensed Site Remediation Professional (LSRP) Program under PI number G000005480, activity number LSR120001, per the July 2019 agreement between PPG and PSEG (PPG and PSEG, 2019). MGP-related information has been included in this RAR for informational purposes only. For example, MGP-related information is provided in Sample Maps and Analytical Results Tables in Appendices D-1 and D-4, the Site 133 East Draft Deed Notice in Appendix H-1, and the Site 133 East As-Built Diagrams in Appendix G. The MGP AOC identified herein is superseded by MGP AOCs established by PSEG and is no longer relevant. Information required to document remediation of MGP-related impacts will be presented by PSEG in their forthcoming RAR.

At Site 133 East, constituents covered by this RAR include:

- CCPW and hexavalent chromium (Cr^{+6});
- CCPW metals (antimony, total chromium, nickel, thallium, and vanadium); and
- MGP-related naphthalene.

At Site 135, constituents covered by this RAR include:

- CCPW and Cr^{+6} ; and
- CCPW metals.

Under the ACO and JCO, PPG is not responsible for other constituents exceeding the NJDEP Soil Remediation Standards (SRS) or Default Impact to Groundwater Soil Screening Levels (DIGWSSLs) that may be present at Site 133 East and Site 135. However, as the property owner of Site 133 East and Site 135, PPG is responsible for other constituents under the LSRP program. This RAR addresses only the soil impacts for which PPG is responsible under the ACO and JCO.

The Case Inventory Document (CID) for Site 133 East summarizes the presence of three AOCs for soil. This RAR presents a summary of the implemented RA for AOC 133E-1A (CCPW-impacted soils in Site 133 East Grid Rows S through CC excluding Grids S43A and S44A) and for AOC 133E-2A (MGP-impacted soils in Site 133 East Grid Rows S through CC excluding Grids S43A and S44A). Documentation of the RA for AOC 133E-1B (CCPW-impacted soils in Site 133 East Grid Rows P through R plus Grids S43A and S44A) at Site 133 East will be provided in a separate document. The CID for Site 135 summarizes the presence of one AOC for soil, AOC 135-1 (CCPW-impacted soils in Site 135). Groundwater impacted by CCPW and/or MGP material throughout the GA Group Sites is being tracked under the Site 114 PI number G000005480, and is not included on the CIDs for Site 133 East or Site 135; documentation of the RA for groundwater for the GA Group Sites will be provided in a separate document.

Based on the findings of the Remedial Investigation (RI), the recommended RA for soils at Site 133 East and Site 135 included the excavation and removal of visible CCPW and soils with concentrations of Cr^{+6} greater than the Chromium Soil Cleanup Criteria (CrSCC).

The overall objectives for Cr^{+6} and CCPW-impacted soil, as stated in the Remedial Action Work Plan (RAWP) (see **Section 4.1** for the RAWP submittal history), were:

- Elimination of potential exposure to Cr^{+6} in CCPW and CCPW-impacted soil (Cr^{+6} at concentrations greater than 20 milligrams per kilogram [mg/kg]) due to direct contact or windborne dust;
- Removal of accessible impacted soil at depths less than 20 feet (ft) below ground surface (bgs) and above the meadow mat;

- Removal of CCPW and certain impacted soil to depths greater than 20 ft bgs but to a maximum of 35 ft bgs where: a) the meadow mat is not present, and b) removal is technically prudent and beneficial to the future groundwater remediation; and
- Establishment of site conditions suitable for future uses of the Site.

For the purposes of planning and implementing the RA, Site 133 East, the northern portion of Site 135 (Site 135 North), and the alleyway located between Site 133 East and Site 135 were identified as part of GA Group Phase 3C, which also included Halladay Street South (**Figure 1-2**). The southern portion of Site 135 (Site 135 South) was identified as part of GA Group Phase 5 (also known as GA Group Off-Site Properties). Excavation of Site 133 East was conducted concurrently with excavation in Halladay Street South. Excavation in the southeast portion of Site 133 East and the southern portion of Site 135 was conducted concurrently with excavation in Al Smith Moving. Documentation of the RA for soil at Halladay Street South and Al Smith Moving will be provided in separate documents.

In Site 133 East and Site 135, remedial excavation was conducted between April 21, 2015 and January 8, 2018 in four mobilizations. Restoration activities were completed on February 15, 2018.

In accordance with the RAWP, following excavation, CCPW metals associated with re-used fill materials and MGP-related constituents remaining at concentrations greater than the CrSCC or SRS are addressed through the placement of an engineering control (capping), institutional controls (deed notice), and a corresponding Remedial Action Permit (RAP).

For Site 133 East, confirmation sampling results presented on figures and tables in this report indicate remedial objectives for AOC 133E-1A and 133E-2A have been achieved as follows:

- Excavation of soil containing Cr⁺⁶ met the requirements specified in the NJDEP Memorandum entitled *Chromium Moratorium*, February 8, 2007 (the Chromium Policy) (NJDEP, 2007) in accordance with the *Updated Method to Determine Compliance with the Department's Chromium Policy, Garfield Avenue – Sites 114, 132, 133, 135, 137, and 143, Jersey City, NJ* (Method to Determine Compliance) (NJDEP, 2013).
- Soil concentrations for CCPW metals are in compliance with the CrSCC or SRS.
- Soil concentrations for CCPW metals in the unsaturated zone are in compliance with the DIGWSSLs and/or the site-specific Impact to Groundwater Soil Remediation Standards for the Garfield Avenue Group (IGWSRS-GAGs).
- Naphthalene remains in place at concentrations greater than the SRS and is addressed by an engineering control (Clean Fill Soil Cap) and institutional control (deed notice).
- Soil concentrations for naphthalene in the unsaturated zone are in compliance with the DIGWSSLs.

For Site 135, confirmation sampling results presented on figures and tables in this report indicate remedial objectives for AOC 135-1 have been achieved as follows:

- Excavation of soil containing Cr⁺⁶ met the requirements specified in the Chromium Policy (NJDEP, 2007) in accordance with the Method to Determine Compliance (NJDEP, 2013).
- Antimony associated with re-used fill materials remains at concentrations greater than the SRS and is addressed by an engineering control (Clean Fill Soil Cap) and institutional controls (deed notice).

- Soil concentrations of the other CCPW metals are in compliance with the CrSCC or SRS.
- Soil concentrations for CCPW metals in the unsaturated zone are in compliance with the DIGWSSLs and/or the IGWSRS-GAGs.

The soil RA for Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1) is effective in protecting public health and safety and the environment, and no further soil remediation is warranted for these AOCs. This RAR demonstrates compliance with the applicable remediation requirements for the soils on Site 133 East AOC 133E-1A and AOC 133E-2A, and Site 135 AOC 135-1 and no further action with regard to AOCs 133E-1A, 133E-2A, and 135-1 soils is needed (other than filing the deed notices and implementing the RAPs). PPG requests the closure of AOCs 133E-1A, 133E-2A, and 135-1 by the NJDEP through the issuance of a Consent Judgment Compliance Letter.

1.0 Introduction

This Remedial Action Report (RAR) has been prepared by AECOM on behalf of PPG to document the remedial action (RA) for:

- Chromate Chemical Production Waste (CCPW) and CCPW-impacted soils at Site 133 East Grid Rows S through CC excluding Grids S43A and S44A (Area of Concern [AOC] 133E-1A);
- Soils impacted by manufactured gas plant (MGP)-related constituents associated with the former Halladay Street Gas Works MGP at Site 133 East Grid Rows S through CC excluding Grids S43A and S44A (AOC 133E-2A); and
- CCPW and CCPW-impacted soils at Site 135 (AOC 135-1).

Site 133 East and Site 135 (the Site) are part of the Garfield Avenue Group (GA Group) Sites, which include Sites 114, 132, 133, 135, 137, 143, and 186, and adjacent roadways and properties (**Figure 1-1**). Site 114 is the former location of a chromite ore processing facility previously owned by PPG, and the former Halladay Street Gas Works MGP previously owned by Public Service Electric and Gas Company (PSEG). Site 133 East is tracked under the New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program (SRP) Program Interest (PI) number 025695, Activity Number RPC900001. Site 135 is tracked under the NJDEP SRP PI number 246332, Activity Number RPC000001.

Site 133 East is located at 22 Halladay Street in Jersey City, New Jersey (NJ) (**Figure 1-2**). Site 133 East is identified as Block 21509, Lot 1, in the Jersey City Parcel Data from the New Jersey Geographic Information Network (NJGIN), last updated October 6, 2015 (available at: https://njgin.state.nj.us/OGIS_IV, last accessed in November 2018). This RAR addresses RA on a portion of the Site 133 East property. Documentation of RA on the remainder of Site 133 East will be addressed in a separate submittal. Site 133 East is bordered to the west by Halladay Street, to the south by Caven Point Avenue, to the east by the Al Smith Moving Property at 33 Pacific Avenue (Block 21509, Lot 3) and Site 135 at 51-99 Pacific Avenue (Block 21509, Lot 2), and to the north by Carteret Avenue. Site 114 is located to the north across Carteret Avenue. The total area encompassed by Site 133 East is approximately 2.0 acres.

Site 135 is located at 51-99 Pacific Avenue in Jersey City, NJ (**Figure 1-2**). Site 135 is identified as Block 21510, Lot 2 in NJGIN (available at the web link provided above). Site 135 is bordered to the west by Site 133 East at 22 Halladay Street (Block 21509, Lot 1), to the south by Al Smith Moving at 33 Pacific Avenue (Block 21509, Lot 3), to the east by Pacific Avenue, and to the north by Carteret Avenue. Site 114 is located to the northwest across Carteret Avenue. For the purposes of planning and implementing the RA, Site 135 was represented as two areas - Site 135 North and Site 135 South. The total area encompassed by Site 135 is approximately 1.4 acres.

In 1990, PPG and the NJDEP entered into an *Administrative Consent Order* (ACO) (NJDEP, 1990) to investigate and remediate locations where CCPW or CCPW-impacted materials related to former PPG operations may be present. On June 26, 2009, NJDEP, PPG, and the City of Jersey City entered into a *Partial Consent Judgment Concerning the PPG Sites*, also referred to as the Judicial Consent Order (JCO) (Superior Court of New Jersey Law Division – Hudson County, 2009), with the purpose of remediating soils and sources of contamination at these Hudson County Chromate (HCC) sites.

Priority for the remedial activities was given to residential locations where the CCPW and CCPW-impacted materials were present. The provisions of the original ACO remain in effect with the JCO taking precedence where there are conflicts between the two documents.

As part of the JCO, a judicially enforceable master schedule was created, establishing RA milestone dates for the NJ Chrome Remediation Sites, including Site 133 East and Site 135. Since its establishment in 2009, the master schedule has been revised several times. The most recent revision to the Master Schedule was finalized on July 31, 2019 (Ricchio, 2019).

PPG and PSEG are jointly responsible for remediation of MGP parameters related to the former Halladay Street Gas Works MGP. PSEG, as the former Halladay Street Gas Works MGP operator, is the lead party for addressing these impacts.

PSEG is taking the lead on closing out MGP-related impacts in accordance with the Licensed Site Remediation Professional (LSRP) Program under PI number G000005480, activity number LSR120001, per the July 2019 agreement between PPG and PSEG (PPG and PSEG, 2019). MGP-related information has been included in this RAR for informational purposes only. For example, MGP-related information is provided in Sample Maps and Analytical Results Tables in Appendices D-1 and D-4, the Site 133 East Draft Deed Notice in Appendix H-1, and the Site 133 East As-Built Diagrams in Appendix G. The MGP AOC identified herein is superseded by MGP AOCs established by PSEG and is no longer relevant. Information required to document remediation of MGP-related impacts will be presented by PSEG in their forthcoming RAR.

Site 133 East is currently vacant land owned by PPG. Site 133 East was undeveloped until about 1911. Site 133 East was used for industrial purposes, with seven interconnected warehouse buildings built over time. Previous site uses included varnish and paint manufacturing. PPG purchased the property in February 2014. Concurrent with PPG's purchase of Site 133 East, the property was vacated in order to conduct remedial activities (AECOM, 2016b). During the period spanning September through October 2014, the contiguous warehouse buildings were demolished. The building slab was removed as part of RA activities.

Site 135 is currently vacant land owned by PPG. Site 135 was undeveloped until about 1928. Site 135 was used for industrial purposes, with seven interconnected warehouse buildings built over time. Previous site uses included general grocery warehousing, bleach manufacturing, and other manufacturing activities. PPG purchased the property in August 2015. Concurrent with PPG's purchase of Site 135, the property was vacated in order to conduct remedial activities (AECOM, 2017c). Six of the seven buildings were demolished to the building slab between December 2015 and February 2016; the southernmost building (Building No. 51, located at 51 Pacific Avenue) was demolished between October and November 2016. The building slabs were removed as part of RA activities.

The Case Inventory Document (CID) for Site 133 East (SRP PI number 025695, Activity Number RPC900001) summarizes the presence of three soil AOCs, as presented on **Table 1-1**. As part of the Supplemental Soil Remedial Investigation Report (SSRIR) for the GA Group Sites, contaminated soil within Site 133 East was considered a single AOC (Site 133 East - Soil) (AECOM, 2018b). As part of this RAR, the single AOC for soil has been divided into three separate AOCs based on contaminants of concern and RA status. The survey limits of each AOC are shown on **Figure 1-2**. This RAR presents a summary of the implemented RA for AOC 133E-1A (CCPW-impacted soils in Site 133 East Grid Rows S through CC excluding Grids S43A and S44A) and for AOC 133E-2A (MGP-impacted soils in Site 133 East Grid Rows S through CC excluding Grids S43A and S44A).

The CID for Site 135 (SRP PI number 246332, Activity Number RPC000001), summarizes the presence of one AOC for soil, as presented on **Table 1-1**. As part of the SSRIR for the GA Group Sites, contaminated soils within Site 135 were considered a single AOC (Site 135 - Soil) (AECOM, 2018b). As part of this RAR, the soil AOC has been renamed AOC 135-1. The limits of AOC 135-1 are shown on **Figure 1-2**. This RAR presents a summary of the implemented RA for Site 135 soils (AOC 135-1).

Documentation of the RA for additional AOCs will be provided in separate documents. Due to access concerns, the southwestern portion of Site 133 East (Grid Rows P through R plus Grids S43A and S44A) could not be excavated at the time of the remediation of AOC 133E-1A as depicted on **Figure 1-2**. These grids are assigned to a separate AOC (AOC 133E-1B). Groundwater impacted by CCPW and/or MGP material throughout the GA Group Sites is being tracked under PI number G000005480 for Site 114 (the location of the former Chromate Chemical Production Facility and MGP). Remediation of non-CCPW-related constituents and constituents not associated with operation of the former Halladay Street Gas Works MGP is also being conducted at these sites under LSRP oversight under the same PI numbers but different Activity Numbers. The CIDs included herein only reflect the remediated soil AOCs that PPG is responsible for associated with the ACO/JCO.

This RAR was prepared in accordance with the requirements set forth in the *Technical Requirements for Site Remediation* (TRSR), New Jersey Administrative Code (N.J.A.C.), Title 7, Chapter 26E, Subchapter 5.5 (N.J.A.C. 7:26E-5.5) (NJDEP, 1993b), Appendix A of the 1990 ACO (NJDEP, 1990), and the June 26, 2009 JCO (Superior Court of New Jersey Law Division – Hudson County, 2009).

The remainder of this RAR is organized as follows:

- **Section 2** provides the summary of soil remedial investigation (RI) findings and recommendations;
- **Section 3** identifies the applicable remedial standards/criteria;
- **Section 4** presents the summary of pre-remedial action design activities;
- **Section 5** provides the description of the RA implemented;
- **Section 6** discusses the reliability of the data including data validation and usability;
- **Section 7** includes documentation of the protectiveness of the remedy;
- **Section 8** provides the updated receptor evaluation information;
- **Section 9** presents the conclusions and recommendations; and
- **Section 10** lists the references cited in the report.

Supporting information is presented in the appendices.

2.0 Summary of Soil Remedial Investigation Findings and Recommendations

2.1 Summary of Soil Remedial Investigation Findings

RI activities performed at the GA Group Sites were detailed in the following reports, including Remedial Investigation Work Plans (RIWPs) and Remedial Investigation Reports (RIRs), previously submitted to the NJDEP:

- April 2003 *Remedial Investigation Work Plan – Site 114* (ENSR, 2003).
- March 2006 *Remedial Investigation Report – Site 114* (Site 114 RIR) (ENSR, 2006a).
- March 2006 *Remedial Investigation Work Plan – Site 114 (Off Site)* (ENSR, 2006b).
- September 2006 *Remedial Investigation Work Plan – Sites 132, 133, 135, 137 and 143* (ENSR, 2006c).
- December 2007 *Remedial Investigation Report Former Halladay Street Gas Works, Jersey City, New Jersey* (Halladay Street Gas Works RIR) (CMX, 2007).
- July 2008 *Remedial Investigation Report Addendum, Supplemental Offsite Soil Sampling, Former Halladay Street Gas Works, Jersey City, New Jersey* (RIR Addendum) (CMX, 2008).
- December 2009 *Remedial Investigation Report – Non-Residential Chromate Chemical Production Waste Sites, Sites 114, 132, 133, 135, 137, and 143* (AECOM, 2009).
- March 2011 *Soil Remedial Investigation Work Plan – Sites 114, 132, 133, 135, 137, 143 and Site 186* (AECOM, 2011a).
- November 2011 *Draft Remedial Investigation Report – Soil Garfield Avenue Group Non-Residential CCPW Sites 114, 132, 133, 135, 137, 143 and 186* (AECOM, 2011b).
- February 2012 *Remedial Investigation Report – Soil Garfield Avenue Group Non-Residential CCPW Sites 114, 132, 133, 135, 137, 143 and 186* (2012 RIR) (AECOM, 2012a).
- May 2014 *Remedial Investigation Report Former Halladay Street Gas Works Jersey City, New Jersey* (AMEC, 2014).
- August 2018 *Supplemental Soil Remedial Investigation Report, Final Revision 1, PPG Garfield Avenue Group, Hudson County Chromium Sites, Jersey City, New Jersey* (August 2018 SSRIR) (AECOM, 2018b), as approved by NJDEP on October 22, 2018 (NJDEP, 2018a).

The 2012 RIR provides a detailed summary of the previous RI investigations throughout the GA Group Sites. Additional data specific to Site 133 East was collected as part of the August 2018 SSRIR; however, no additional data specific to Site 135 was collected. In addition, Impact to Groundwater Soil Remediation Standards for the Garfield Avenue Group (IGWSRS-GAGs) for antimony and nickel, applicable to the GA Group Sites (including Site 133 East and Site 135), were developed and presented in the August 2018 SSRIR (AECOM, 2018b). The following is a summary of the information provided in the 2012 RIR and the 2018 SSRIR with respect to Site 133 East and Site 135.

RI activities were conducted at Site 133 East and Site 135 as part of investigation activities at Site 114 and the southern GA Group Sites (Sites 132, 133, 135, 137, and 143) between 2005 and 2008. The results of these activities were included in the Site 114 RIR (ENSR, 2006a), and the Halladay Street Gas Works RIR (CMX, 2007) and RIR Addendum (CMX, 2008).

Site 133 East and Site 135 were initially targeted for RI activities by PPG because of their proximity to former waste stockpile areas located on Site 137 and to the former chromite ore processing facility on Site 114. RI activities were also conducted by PSEG for impacts related to the former Halladay Street Gas Works MGP located in the northeastern portion of Site 114. PPG and PSEG conducted several RI phases throughout the GA Group Sites. The 2012 RIR incorporated the results of RI work conducted by both PPG and PSEG through 2011. The RI work was designed to delineate the compounds on or potentially emanating from Site 114 related to former chromite ore processing operations and related to PPG's former ownership of Site 114. The compounds present on Site 114 included volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, and hexavalent chromium (Cr⁺⁶), as well as CCPW.

The RI activities identified the following with respect to CCPW at Site 133 East and Site 135:

- At Site 133 East, Cr⁺⁶ was present at concentrations greater than the Chromium Soil Cleanup Criteria (CrSCC) in soils. The exceedances were limited to the northern two thirds of the Site, in proximity to Site 114.
- At Site 135, Cr⁺⁶ was present at concentrations greater than the CrSCC in the northern portion of the Site. Exceedances of Cr⁺⁶ were not recorded during the RI in the southern portion of Site 135.
- Most of the Cr⁺⁶ detected at concentrations greater than the CrSCC was found within the fill material that was placed on top of the meadow mat or on top of native materials. Concentrations of Cr⁺⁶ greater than the CrSCC within Site 133 East and Site 135 were limited to depths shallower than 20 feet (ft) below ground surface (bgs).
- The RI activities identified the presence of CCPW metals in soil at Site 133 East and Site 135 at concentrations greater than the most stringent NJDEP Soil Remediation Standards (SRS) and the NJDEP Default Impact to Groundwater Soil Screening Levels (DIGWSSLs). In general, CCPW metals exceedances, particularly antimony and vanadium, were coincident with Cr⁺⁶. Thallium exceedances were few and were co-located within the CCPW-impacted areas. Since the completion of the 2012 RIR, the NJDEP has eliminated the SRS for thallium. None of the RI data had nickel concentrations that exceeded the NJDEP SRS.

The PSEG RI activities identified visible MGP-related materials in the central portion of Site 133 East. An emanating from Site 114 onto Site 133 East and Site 135 North evaluation was conducted in March 2015; it was determined that MGP-related naphthalene was likely present on Site 133 East and no constituents were emanating from Site 114 onto Site 135 North (AECOM, 2015d; AECOM, 2017g). In accordance with the memorandum entitled *Response to NJDEP/Weston's Comments on PPG's ACO/JCO Parameters List (Revision 0)* (AECOM, 2017g), no MGP-related constituents were identified on Site 135.

2.2 Physical Setting of the Site

The GA Group Sites, including Site 133 East and Site 135, are located in an urban area in Jersey City, Hudson County, NJ, between Garfield Avenue, Caven Point Avenue, Pacific Avenue, and the NJ Transit Light Rail. The GA Group Sites consist of former industrial and commercial properties and

businesses. The GA Group Sites, including Site 133 East and Site 135, are located within the Canal Crossing Redevelopment Area, which encompasses 111 acres of planned redevelopment space in the southeastern section of Jersey City, NJ (City of Jersey City, 2009).

There is little topographic relief within and surrounding the GA Group Sites, where the topography ranges from elevation (El.) 9 ft to 16 ft relative to the North American Vertical Datum of 1988 (NAVD88). However, west of Garfield Avenue, the land surface slopes upward and reaches approximately El. 100 ft NAVD88 about one-half mile to the west. The topography east of the GA Group Sites is fairly flat, extending to the Hudson River and Upper New York Bay. Due to highly compacted surface soils and other impervious features, storm water runoff within the GA Group Sites is primarily channeled into the municipal storm sewer system (ENSR, 2006a).

The GA Group Sites are located in a section of Jersey City that experienced significant industrial development in the early 1900s. To create more available land, developers filled the surrounding marshlands and estuarine areas. Research indicates that the fill included construction spoils consisting of silts and sands, garbage from New York City, ship ballast, coal ash, and incinerator ash. It is unknown what specific fill material was used in which locations. The meadow mat associated with wetland areas was covered with fill materials and/or removed for building foundations or other improvement projects (ENSR, 2006a).

2.2.1 Topography

The United States Geological Survey (USGS) Jersey City, NJ topographic quadrangle map (**Figure 1-1**) presents the regional topography for the GA Group Sites and surrounding area. Site 133 East and Site 135 have little topographic relief, with ground surface ranging from El. 9 to 11 ft NAVD88 outside of the building slabs. In general, the former building foundations at Site 133 East and Site 135 were approximately 1 to 3 ft above the surrounding ground surface. However, just to the west of Garfield Avenue, the topography rises approximately 30 to 40 ft in elevation within several hundred yards of the GA Group Sites, and to about El. 100 ft NAVD88 about a half-mile west of the GA Group Sites. As of May 2018, the surface elevation of the Site following soil remediation and restoration ranges from El. 10 to 13 ft NAVD88.

2.2.2 Regional Geology

The regional geology includes unconsolidated sediments of Recent and Pleistocene age. According to the New Jersey Geologic Survey, these sediments include alluvial, estuarine, eolian (windblown), and glacial lacustrine deposits, as well as glacial till of late Wisconsin age. The Triassic age bedrock of the Newark Group (Lockatong and Stockton formations) throughout the region is comprised of non-marine sedimentary rocks, consisting mainly of sandstone, mudstone, and conglomerate. A diabase sill (i.e., the Palisades Sill) intruded into the Lockatong formation west of Garfield Avenue approximately 200 million years ago.

2.2.3 Site 133 East and Site 135 Geology

Site 133 East and Site 135 are located on miscellaneous fill material that was used to reclaim the salt marsh for the construction of this portion of Jersey City. The estuarine native soils beneath the fill material include an organic meadow mat layer and a thick sequence of unconsolidated natural material. The major geologic units in the area of Site 133 East and Site 135 from top to bottom include:

- A non-native fill layer (the shallow zone);

- Native soils consisting of sand, silty sand, and clays (the intermediate zone) generally separated from the fill by organic sediments or meadow mat;
- Till directly above the bedrock underlying sand with occasional gravel lenses generally separated from the intermediate zone by a layer of lower hydraulic conductivity silts and clayey silts (the deep zone); and
- Bedrock of the Lockatong and Stockton Formations (bedrock zone).

The bedrock surface is relatively shallow west of Garfield Avenue, but fairly deep beneath Site 114. Bedrock was observed at depths less than 10 ft bgs west of the Site along Garfield Avenue, at depths exceeding 100 ft bgs below the center of Site 114, and at an approximate depth of 80 ft bgs at Halladay Street to the west of Site 133 East and Site 135 (AECOM, 2012a).

East of the GA Group Sites, the bedrock surface rises to a large bedrock plateau that extends to the shoreline of New York Bay. The bedrock slopes downward again east of Ellis Island (Stanford, 1995).

Estuarine organic-rich deposits (i.e., meadow mat) were identified at a number of boring locations. Observations have indicated that the meadow mat is not continuous. Depths of the meadow mat range from approximately 10 to 21 ft bgs (AECOM, 2012a). Shallow soils (predominantly fill) extend from the ground surface to the top of the meadow mat, where the meadow mat is present, or to a similar depth where meadow mat is not present.

Below the meadow mat, soils are unconsolidated and are characterized by fine to medium sand and silt with clay and some gravel, typical of the current understanding of the geologic depositional history of the area. The native, unconsolidated soils range in thickness from approximately 56 to 77 ft, based on borings that extended to bedrock.

Excavation of the impacted miscellaneous fill at Site 133 East and Site 135 took place between April 2015 and January 2018. A summary of the restoration activities, including backfilling, is provided in **Section 7.2** of this RAR.

2.2.4 Hydrogeology

This RAR only addresses the RA of soil at Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1). Groundwater impacted by CCPW and/or MGP material throughout the GA Group Sites is being tracked under PI number G00005480 for Site 114 (the location of the former Chromate Chemical Production Facility and MGP). The status of the groundwater investigation throughout the GA Group Sites is documented in the *Groundwater Remedial Investigation Report, Draft* submitted to the NJDEP on October 1, 2018 (AECOM, 2018d). A separate RAR will be prepared and submitted to document the groundwater RA at the GA Group Sites. This description of hydrogeology is provided herein solely to meet the regulatory requirements of N.J.A.C. 7:26E-5.7(b)1 as specified by N.J.A.C. 7:26E-1.6(b)1.

2.2.4.1 Regional Groundwater Flow

Groundwater occurs regionally in the following hydrogeologic zones: the fill; the meadow mat and the unconsolidated overburden soils; and the bedrock. A summary of the groundwater flow in these formations is included below:

- **Fill (Shallow Water-Bearing Zone):** Groundwater in the fill is typically encountered within 10 ft bgs. In general, shallow groundwater flow patterns represent a subdued version of the land

surface topography. Variations from this can be attributed to heterogeneities in the fill. For instance, tightly compacted dredged sediments would be expected to restrict water flow much more than construction debris. Subsurface infrastructure (e.g., basements, drains, sheet pile, utility corridors, etc.) would also affect groundwater flow patterns. Groundwater elevations in the shallow fill can also be influenced by recharge events.

- **Overburden (Intermediate and Deep Water-Bearing Zones) and Meadow Mat:** Groundwater flow in the overburden is controlled by hydraulic conductivity or flow through the connected porous spaces in the soil matrix. Groundwater flows horizontally in these soils but may be influenced by local recharge and discharge zones (i.e., surface water bodies and drainage divides). Meadow mat is a dense matrix of organic material and fine-grained soils; the hydraulic conductivity of the meadow mat is expected to be three or more orders-of-magnitude less than the underlying overburden.
- **Bedrock (Bedrock Water-Bearing Zone):** Well yields from bedrock have been reported to range from several gallons to several hundred gallons per minute, with yields generally decreasing with depth. Groundwater in the bedrock formations occurs under both unconfined and confined conditions, primarily within secondary porosity due to fractures and joints. The Palisades Sill is understood to be a no flow boundary and has low permeability. In general, groundwater flow in bedrock is a very small fraction of the total groundwater flux through the area.

2.2.4.2 GA Group Sites Groundwater Flow

Like the regional hydrogeology, groundwater at the GA Group Sites occurs in several hydrogeologic zones:

- The shallow fill zone (shallow water-bearing zone);
- The intermediate sand and silty sand zone including the meadow mat (intermediate water-bearing zone);
- The deep sand, gravel lenses, silts, clays, and glacial till (deep water-bearing zone); and
- Bedrock of the Stockton Formation and Lockatong Formation (bedrock water-bearing zone).

Shallow groundwater flow is complex and is affected by various on- and off-site activities and features, including excavations, placement of clean and/or amended fill, sheet pile, implementation of interim groundwater remedial measures, other subsurface infrastructure, and localized variability in recharge. The principal direction of groundwater flow in the intermediate, and deep water-bearing zones is from northwest to southeast. This flow direction is consistent with the geologic setting where the GA Group area is recharged from groundwater coming off the topographic high to the west. Recharge to the intermediate water-bearing zone is also occurring due to downward gradients in the fill and upward gradients in the deep water-bearing zone.

During a May/June 2018 groundwater sampling round, groundwater elevations throughout the GA Group Sites in the shallow, intermediate, and deep overburden, and bedrock groundwater zones ranged from El. 3.25 to 12.78 ft NAVD88 (shallow), El. 6.16 to 9.67 ft NAVD88 (intermediate), El. 6.44 to 8.03 ft NAVD88 (deep), and El. 7.55 to 10.48 ft NAVD88 (bedrock).

The 50th percentile groundwater elevation for Site 133 East and Site 135 was estimated to be El. 6.2 ft NAVD88 based on 13 monitoring wells located on or adjacent to Site 133 East and Site 135 gauged

between February 2007 and December 2016. The monitoring well locations and data are included in **Appendix A**.

2.3 Recommended Remedial Action

Based on the findings of the RI, the recommended RA for soils at Site 133 East and Site 135 included the excavation and removal of visible CCPW and soils with concentrations of Cr⁺⁶ greater than the CrSCC. It was anticipated that the presence of CCPW metals (antimony, total chromium, nickel, thallium, and vanadium) at concentrations greater than the CrSCC, SRS, DIGWSSLs, or the site-specific IGWSRS-GAGs would be resolved as a result of the excavation being driven by the presence of Cr⁺⁶ and visible CCPW impacts.

At Site 133 East, PPG was also responsible for remediation of naphthalene associated with the former Halladay Street Gas Works MGP operations on Site 114 at concentrations greater than the SRS or DIGWSSLs. The excavation extent was not driven by the presence of naphthalene; it was anticipated that the presence of naphthalene would be resolved as a result of the excavation being driven by the presence of Cr⁺⁶ and visible CCPW.

Following excavation, CCPW metals associated with re-used fill materials and MGP-related constituents remaining at concentrations greater than the CrSCC or SRS were addressed through the placement of an engineering control (capping), institutional controls (a deed notice), and a corresponding Remedial Action Permit (RAP).

3.0 Identification of Applicable Remedial Standards/Criteria

3.1 Regulatory Requirements, Guidance and Alternative/Site-Specific Determinations

The RAs described in the Remedial Action Work Plan (RAWP) (see **Section 4.1** for the RAWP submittal history) were performed in accordance with the following regulatory requirements, NJDEP Guidance, and Site-specific determinations:

- N.J.A.C. 7:9D – *Well Construction and Maintenance; Sealing of Abandoned Wells*, last amended January 2, 2018 (NJDEP, 2001).
- N.J.A.C. 7:26C – *Administrative Requirements for the Remediation of Contaminated Sites*, last amended August 6, 2018 (NJDEP, 1993a).
- N.J.A.C. 7:26D – *Soil Remediation Standards*, last amended September 18, 2017 (NJDEP, 2008a).
- N.J.A.C. 7:26E – *Technical Requirements for Site Remediation*, last amended August 6, 2018 (NJDEP, 1993b).
- NJDEP *Field Sampling Procedures Manual*, dated August 2005, last updated April 2011 (NJDEP, 2005).
- NJDEP *Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria*, dated September 2012 (NJDEP, 2012c).
- NJDEP Memorandum from Lisa P. Jackson to Irene Kropp, Subject: *Chromium Moratorium*, February 8, 2007 (the Chromium Policy) (NJDEP, 2007).
- NJDEP *Chromium Soil Cleanup Criteria*, September 2008, revised April 2010 (NJDEP, 2008b).
- NJDEP *Administrative Consent Order*, dated July 19, 1990 (NJDEP, 1990).
- *Partial Consent Judgment Concerning the PPG Sites (JCO)* between NJDEP, PPG, and the City of Jersey City, June 26, 2009 (Superior Court of New Jersey Law Division - Hudson County, 2009).
- Letter from Mr. Thomas Cozzi to W. Michael McCabe, Subject: *Updated Method to Determine Compliance with the Department's Chromium Policy*, Garfield Avenue – Sites 114, 132, 133, 135, 137, and 143, Jersey City, NJ. August 13, 2013 (Method to Determine Compliance) (NJDEP, 2013).
- NJDEP Memorandum from Diane Groth to David Doyle, Subject: *PPG Garfield Avenue Group Sites, Adjacent Streets and Nearby Properties, Jersey City, NJ: Alternative Remediation Standard for Vanadium*, December 28, 2016 (NJDEP, 2016).
- August 2018 *Supplemental Soil Remedial Investigation Report, Final Revision 1, PPG Garfield Avenue Group, Hudson County Chromium Sites, Jersey City, New Jersey* (August 2018 SSRIR) (AECOM, 2018b), which presented the IGWSRS-GAG for antimony and nickel. The August 2018 SSRIR was approved by NJDEP on October 22, 2018 (NJDEP, 2018a).

3.2 Soil Remediation Standards/Criteria

For soil at Site 133 East, under the ACO and JCO, PPG is responsible for CCPW, CCPW-related impacts, and MGP-related impacts associated with the former Halladay Street Gas Works MGP only. For soil at Site 135, under the ACO and JCO, PPG is responsible for CCPW and CCPW-related impacts only; no MGP-related constituents were identified on Site 135. Under the ACO and JCO, PPG is not responsible for any other constituents at concentrations exceeding NJDEP SRS, CrSCC, DIGWSSL, or IGWSRS-GAG that may be present at Site 133 East or Site 135. However, as the property owner of Site 133 East and Site 135, PPG is responsible for other constituents under the LSRP program. This RAR addresses only the soil impacts for which PPG is responsible under the ACO and JCO.

The NJDEP SRS and other criteria relevant to the remediation at Site 133 East and Site 135 are presented in **Table 3-1**.

4.0 Summary of Pre-Remedial Action Design Activities

Based on the findings of the RI (as summarized in **Section 2.0**), the recommended RA for soil at Site 133 East and Site 135 included the excavation and removal of visible CCPW and soils with concentrations of Cr⁺⁶ greater than the CrSCC.

For the purposes of planning and implementing the RA, Site 133 East, the northern portion of Site 135 (Site 135 North), and the alleyway located between Site 133 East and Site 135 were identified as part of GA Group Phase 3C, which also included Halladay Street South (**Figure 1-2**). On Site 135, based on the RI results (**Section 2.1**), it was originally anticipated that only the northern portion of the property (Site 135 North) would require excavation. However, based on additional sampling conducted as part of the preliminary design investigation, remediation was proposed on the southern portion of the site (Site 135 South), as well. Site 135 South was identified as part of GA Group Phase 5. As a result, for the purposes of planning and implementing the RA, Site 135 was represented as two areas - Site 135 North and Site 135 South.

Excavation in Site 133 East was conducted concurrently with excavation in Halladay Street South. Excavation in the southeastern portion of Site 133 East and the southern portion of Site 135 was conducted concurrently with excavation in Al Smith Moving. Documentation of the RA for soil at Halladay Street South and Al Smith Moving is being provided in separate documents.

4.1 Summary of the Remedial Action Work Plan (Soil)

Following the preparation and submittal of the RIR (AECOM, 2012a), AECOM (on behalf of PPG) prepared a RAWP. A summary of the RAWP submittal/approval history is as follows:

- On April 17, 2012, PPG/AECOM issued the *Draft Remedial Action Work Plan (Soil), Rev. 2, Garfield Avenue Group – Sites 114, 132, 133, 135, 137 and 143, Jersey City, New Jersey* (2012 RAWP) (AECOM, 2012d).
- On May 11, 2012, NJDEP found the 2012 RAWP to be administratively complete and issued a Conditional Approval in a letter from Thomas J. Cozzi to M. Michael McCabe, Subject: *Remedial Action Work Plan (Soil), Rev. 2, Garfield Avenue Group – Sites 114, 132, 133, 135, 137 and 143, Jersey City, New Jersey* (NJDEP, 2012b).
- On December 5, 2014, PPG/AECOM issued the *Draft Remedial Action Work Plan (Soil) Rev. 3, Garfield Avenue Group – Sites 114, 132, 133, 135, 137 and 143, Jersey City, New Jersey* (Draft 2014 RAWP) (AECOM, 2014i), documenting compliance with the conditions of NJDEP's Conditional Approval.
- On February 28, 2018, Weston Solutions, Inc. (Weston), on behalf of NJDEP, issued an email that requested minor editorial changes to the Draft 2014 RAWP (Weston, 2018a).
- On May 15, 2018, PPG/AECOM issued the *Final Remedial Action Work Plan (Soil) Rev. 3, Garfield Avenue Group Sites, Jersey City, New Jersey* (Final RAWP Rev. 3) (AECOM, 2018a).
- On July 12, 2018, Weston, on behalf of NJDEP, issued an email that requested one additional minor editorial change to the Final RAWP Rev. 3 (Weston, 2018b).

- On August 21, 2018, on behalf of the City of Jersey City, Environmental Remediation and Financial Services, LLC (ERFS) provided comments on the Final RAWP Rev. 3 (ERFS, 2018a), which were distributed by the Site Administrator by email on August 21, 2018.
- On September 27, 2018, PPG/AECOM issued the *Final Remedial Action Work Plan (Soil) Rev. 4, Garfield Avenue Group Sites, Jersey City, New Jersey* (Final RAWP Rev. 4) (AECOM, 2018c).
- On October 10, 2018, on behalf of the City of Jersey City, ERFS provided concurrence on the Final RAWP Rev. 4 (ERFS, 2018b).
- On November 9, 2018, NJDEP approved the Final RAWP Rev. 4 (NJDEP, 2018b).

The overall objectives for Cr⁺⁶ and CCPW-impacted soil, as stated in the RAWP were:

- Elimination of potential exposure to Cr⁺⁶ in CCPW and CCPW-impacted soil (Cr⁺⁶ at concentrations greater than 20 milligrams per kilogram [mg/kg]) due to direct contact or windborne dust;
- Removal of accessible impacted soil at depths less than 20 ft bgs and above the meadow mat;
- Removal of CCPW and certain impacted soil to depths greater than 20 ft bgs but to a maximum of 35 ft bgs where: a) the meadow mat is not present, and b) removal is technically prudent and beneficial to the future groundwater remediation; and
- Establishment of site conditions suitable for future uses of the Site.

The selected RA for Cr⁺⁶ and CCPW-impacted soil at Site 133 East (AOC 133E-1A) and Site 135 (AOC 135-1) was excavation (in areas where the impacted soil was present and accessible) to depths no deeper than 35 ft bgs, and off-site disposal. Excavation and treatment of soil containing Cr⁺⁶ was to meet the Chromium Policy (NJDEP, 2007) by following the Method to Determine Compliance (NJDEP, 2013). Meadow mat, where present, was to be protected to the extent practical since it provides a natural barrier to chromium migration and can reduce Cr⁺⁶ to trivalent chromium.

At Site 133 East, under the ACO and JCO, PPG was also responsible for remediation of naphthalene, associated with the former Halladay Street Gas Works MGP, at concentrations greater than SRS and DIGWSSLs (AOC 133E-2A). However, the excavation extent was not driven by the presence of naphthalene; it was anticipated that the presence of naphthalene would be resolved as a result of the excavation being driven by the presence of Cr⁺⁶ and visible CCPW.

Following excavation, CCPW metals and MGP-related constituents remaining at concentrations greater than the CrSCC or SRS were to be addressed through the placement of an engineering control (capping), institutional controls (a deed notice), and a corresponding RAP.

Excavation areas were to be backfilled with soil suitable for residential, commercial, or other possible purposes. In areas where deemed necessary, a capillary break was to be installed between groundwater and the ground surface to eliminate the possibility of chromate crystallization from impacted groundwater wicking to the surface. As described in the *Capillary Break Design Final Report (Revision 2)* (AECOM, 2017i), it was determined that a capillary break was not required within Site 133 East AOC 133E-1A or Site 135 AOC 135-1.

To improve the design of the RAWP, several pre-design activities were planned. These activities were to include actions such as soil borings, test pits, utility surveys, geotechnical assessments and sampling, and obtaining permits where required. The goals of these events were: to define the limits of excavation and the locations of underground utilities under adjacent road ways; to obtain geotechnical data for design of excavation support; and to determine the depth of excavation in specific grids.

Sampling in soil borings prior to excavation (i.e., pre-excavation sampling) would be used to define the proposed terminal excavation elevation (TEE) for specific grids, subject to review and concurrence by NJDEP. Technical Execution Plans (TEPs) were to be prepared and submitted to NJDEP to define the sample collection and excavation methods to be used.

The excavation was to be implemented on a 30-ft by 30-ft grid pattern. To determine compliance with the remediation objectives, post-excavation sampling of pit bottoms and sidewalls or sampling in soil borings prior to excavation (i.e., pre-excavation sampling) was to be conducted in excavation areas, with analysis for Cr⁺⁶. At the Site, where the TEE in adjacent grids varied by more than two feet, sidewall samples were to be collected every 30 linear ft and at two-ft depth intervals. Where excavation grids were enclosed by shoring or where the TEEs in adjacent grids varied by less than two feet, sidewall sampling was not required.

The final phase of remedial activities to be conducted at Site 133 East and Site 135 was to include site restoration activities before demobilization from the area.

4.2 Summary of the Technical Execution Plan and Related Activities

4.2.1 Proposed Terminal Excavation Elevations and Pre-Design Investigation

Proposed TEEs for the Site 133 East and Site 135 excavation were provided in a series of memoranda from PPG/AECOM to NJDEP/Weston and responses to comments from PPG/AECOM. The memoranda typically included detailed information demonstrating how the final excavation depth in each grid would comply with the Cr⁺⁶ decision trees in the Method to Determine Compliance (NJDEP, 2013).

As part of the pre-RA activities, and in an effort to better define the TEEs and planned excavation, preliminary design investigation (PDI) activities were implemented.

The proposed TEEs for Site 133 East and Site 135 North were primarily included in the Phase 3C TEE submittals. Grids along the western boundary of Site 133 East were split between Halladay Street South and Phase 3C. Due to the split nature of the grids, the proposed TEEs for some grids in 133 East were included with the Halladay Street South TEE submittals. Grids in Site 135 South were primarily included in the Site 135 South TEE submittals. Grids that straddled the Site 133 East/Site 135 boundary were included in either the Phase 3C submittal or the Site 135 South submittal.

Note that excavation for remediation of non-CCPW constituents being addressed under the LSRP program by PPG was conducted concurrently with the excavation for remediation of Cr⁺⁶ at concentrations greater than the CrSCC and visible CCPW at the Site. The proposed TEE documents listed below were based on remediation of Cr⁺⁶ and visible CCPW only.

4.2.1.1 Phase 3C

The following is a listing of the deliverables and correspondence that detailed the proposed TEEs and PDI investigation activities in Phase 3C (which includes primarily Site 133 East and Site 135 North grids).

Submittal 1

- On August 19, 2013, PPG/AECOM submitted the technical memorandum entitled *PPG Target Excavation Depths in Phase 3B & 3C* (AECOM, 2013).
- On September 4, 2013, Weston, on behalf of NJDEP, provided comments on AECOM's August 19, 2013 memorandum (Weston, 2013).
- On January 22, 2014, PPG/AECOM submitted the technical memorandum entitled *Response to Weston's 9/4/13 Comments on "PPG Target Excavation Depths in Phase 3B & 3C"* (AECOM, 2014b).
- On February 12, 2014, Weston, on behalf of NJDEP, provided comments on AECOM's January 22, 2014 memorandum (Weston, 2014a).

Submittal 2

- On January 22, 2014, PPG/AECOM submitted the technical memorandum entitled *PPG Supplemental Terminal Excavation Elevations in Phase 3B & 3C* (AECOM, 2014c).
- On February 12, 2014, Weston, on behalf of NJDEP, provided comments on AECOM's January 22, 2014 memorandum (Weston, 2014a).
- On April 10, 2014, PPG/AECOM submitted the technical memorandum entitled *Response to Weston's 9/4/13 comments on "PPG Target Excavation Depths in Phase 3B & 3C,"* which provided responses to NJDEP's February 12, 2014 comments on Submittal 1 and Submittal 2.
- On April 28, 2014, Weston, on behalf of NJDEP, provided a final round of comments wherein all of the responses were deemed adequate (Weston, 2014c).

Submittal 3

- On August 1, 2014 (distributed by AECOM on August 4, 2014), PPG/AECOM submitted the technical memorandum entitled *Phase 3C Terminal Excavation Elevation Supplemental Submittal* (AECOM, 2014e).
- On August 15, 2014, PPG/AECOM submitted the technical memorandum entitled *Phase 3C Terminal Excavation Elevation Supplemental Submittal (Revision 1)* (AECOM, 2014g), with minor corrections issued on August 28, 2014 (AECOM, 2014h).
- On August 19, 2014, Weston, on behalf of NJDEP, provided high-level comments on AECOM's August 15, 2014 memorandum (Weston, 2014e).
- On October 10, 2014, Weston, on behalf of NJDEP, Weston provided comments on AECOM's August 15, 2014 memorandum (Weston, 2014f).
- On January 23, 2015, PPG/AECOM submitted the technical memorandum entitled *Phase 3C Terminal Excavation Elevation – Submittal 3 (Revision 2)* (AECOM, 2015a).
- On March 6, 2015, Weston, on behalf of NJDEP, provided comments on AECOM's January 23, 2015 memorandum (Weston, 2015b).

- On April 13, 2015, PPG/AECOM memorandum, submitted the technical memorandum entitled *Phase 3C Terminal Excavation Elevation – Submittal 3 (Revision 3)* (AECOM, 2015g).
- On April 28, 2015, Weston, on behalf of NJDEP, provided comments on AECOM's April 13, 2015 memorandum (Weston, 2015g).
- On August 10, 2015, PPG/AECOM submitted the technical memorandum entitled *Phase 3C Terminal Excavation Elevation – Submittal 3 (Revision 4)* (AECOM, 2015i).
- On August 25, 2015, Weston, on behalf of NJDEP, provided comments on AECOM's August 10, 2015 memorandum (Weston, 2015i).
- On October 19, 2015, PPG/AECOM submitted the technical memorandum entitled *Phase 3C Terminal Excavation Elevation – Submittal 3 (Revision 5)* (AECOM, 2015l).
- On November 11, 2015, Weston, on behalf of PPG, provided conditional concurrence on AECOM's October 19, 2015 memorandum (Weston, 2015k).

4.2.1.2 Site 135 South

The following is a listing of the deliverables and correspondence that detailed the proposed TEEs and PDI investigation activities in Site 135 South (includes primarily Site 135 South grids):

Submittal 1

- On January 7, 2016, PPG/AECOM submitted the technical memorandum entitled *Site 135 South Terminal Excavation Elevation Submittal* (AECOM, 2016a).
- On January 28, 2016 (Weston, 2016a) and February 4, 2016 (Weston, 2016b), Weston, on behalf of NJDEP, provided preliminary comments on AECOM's January 7, 2016 memorandum.
- On February 18, 2016, Weston, on behalf of NJDEP, provided additional comments on AECOM's January 7, 2016 memorandum (Weston, 2016c).
- On March 17, 2016, PPG/AECOM submitted the technical memorandum entitled *Site 135 South Terminal Excavation Elevation Submittal (Revision 1)* (AECOM, 2016c).
- On March 30, 2016, Weston, on behalf of NJDEP, provided comments on AECOM's March 17, 2016 memorandum (Weston, 2016d).
- On April 8, 2016, PPG/AECOM provided an email response to Weston's March 30, 2016 email (AECOM, 2016e).
- On April 19, 2016, Weston, on behalf of PPG, provided a final round of comments wherein all of the responses were deemed adequate (Weston, 2016e).

Submittal 2

- On April 12, 2016, PPG/AECOM submitted the technical memorandum entitled *Site 135 South Terminal Excavation Elevation - Submittal 2* (AECOM, 2016h).
- On April 19, 2016, Weston, on behalf of NJDEP, provided comments on AECOM's April 12, 2016 memorandum wherein all of the responses were deemed adequate (Weston, 2016f).

Submittal 3

- On May 10, 2016, PPG/AECOM submitted the technical memorandum entitled *Site 135 South Terminal Excavation Elevation - Submittal 3* (AECOM, 2016j).
- On May 19, 2016, Weston, on behalf of NJDEP, provided comments on AECOM's May 10, 2016 memorandum wherein the document was deemed adequate (Weston, 2016j).
- On May 23, 2016, Weston, on behalf of NJDEP, provided a revised email correcting a typographical error on the May 19, 2016 comment email (Weston, 2016k).

4.2.1.3 Halladay Street South

The following is a listing of the deliverables and correspondence that detailed the proposed TEEs and PDI investigation activities in Halladay Street South (which includes some partial Site 133 East grids):

- On December 15, 2014, PPG/AECOM submitted the technical memorandum entitled *Phase 4 Halladay Street South Terminal Excavation Elevation Submittal (Revision 0)* (AECOM, 2014j).
- On December 18, 2014, PPG/AECOM submitted the technical memorandum entitled *Phase 4 Halladay Street South Terminal Excavation Elevation Submittal (Revision 1)* (AECOM, 2014k).
- On February 23, 2015 Weston, on behalf of NJDEP, provided comments on AECOM's December 15, 2014 and December 18, 2014 memoranda (Weston, 2015a).
- On March 10, 2015, PPG/AECOM submitted the technical memorandum entitled *Phase 4 Halladay Street South Terminal Excavation Elevation Submittal (Revision 2)* (AECOM, 2015c).
- On March 26, 2015, Weston, on behalf of NJDEP, provided comments on AECOM's March 10, 2015 memorandum (Weston, 2015d).
- On April 13, 2015 (distributed by AECOM on April 14, 2015), PPG/AECOM submitted the technical memorandum entitled *Phase 4 Halladay Street South Terminal Excavation Elevation Submittal (Revision 3)* (AECOM, 2015f).
- On April 28, 2015, Weston, on behalf of NJDEP, provided comments on AECOM's April 13, 2015 memorandum (Weston, 2015f).
- On July 31, 2015, PPG/AECOM submitted the technical memorandum entitled *Phase 4 Halladay Street South Terminal Excavation Elevation Submittal (Revision 4)* (AECOM, 2015h).
- On August 13, 2015, Weston, on behalf of NJDEP, provided comments on AECOM's July 31, 2015 memorandum (Weston, 2015h).
- On August 19, 2015, PPG/AECOM provided an email of responses to Weston's August 13, 2015 comments (AECOM, 2015j).
- On September 4, 2015, Weston, on behalf of NJDEP, provided conditional concurrence on AECOM's August 19, 2015 email (Weston, 2015j).
- On October 19, 2015, PPG/AECOM provided an email response to Weston's September 4, 2015 conditional concurrence (AECOM, 2015n).
- On November 12, 2015, Weston provided concurrence on AECOM's August 19, 2015 email (Weston, 2015l).

4.2.2 Technical Execution Plan

The TEPs for Site 133 East and Site 135 provided more detailed information on the planned RA including descriptions of the remediation activities and goals as well as depictions of the anticipated horizontal extent of excavation and shoring and the post-excavation sampling approach. The TEP submittal history for Site 133 East and Site 135 is provided below.

4.2.2.1 Southwestern (SW) Area TEP

- On March 9, 2012, PPG/AECOM issued the *Technical Execution Plan, Southwestern Area Soil Excavation; PPG Site 114 – Garfield Avenue, Jersey City, New Jersey* (SW Area TEP) (AECOM, 2012b) and the Response to Comments reference table.
- On March 27, 2012, the NJDEP conditionally approved the SW Area TEP (NJDEP, 2012a).
- On April 23, 2012, PPG/AECOM submitted the *Final Technical Execution Plan, Southwestern Area Soil Excavation, PPG Site 114 – Garfield Avenue, Jersey City, New Jersey* (AECOM, 2012e).

4.2.2.2 Phase 3C TEP

The Phase 3C TEP includes Site 133 East and Site 135 North.

- On January 3, 2014, PPG/AECOM issued the *Technical Execution Plan, Southwest TEP Addendum (Phase 3C Area Soil Excavation), PPG Sites 133 and 135 - Garfield Avenue, Jersey City, New Jersey* (P3C TEP) (AECOM, 2014a).
- On July 3, 2014, Weston, on behalf of NJDEP, provided comments on the P3C TEP (Weston, 2014d).
- On August 6, 2014, PPG/AECOM submitted the *Technical Execution Plan (Revision 1), Southwest TEP Addendum (Phase 3C Area Soil Excavation), PPG Sites 133E and 135 - Garfield Avenue, Jersey City, New Jersey* (P3C TEP – Revision 1) (AECOM, 2014f).
- On October 10, 2014, Weston, on behalf of NJDEP, provided comments on the P3C TEP – Revision 1 (Weston, 2014g).
- On January 23, 2015, PPG/AECOM submitted the *Technical Execution Plan (Revision 2), Southwest TEP Addendum (Phase 3C Area Soil Excavation), PPG Sites 133-East and 135 - Garfield Avenue, Jersey City, New Jersey* (P3C TEP – Revision 2) (AECOM, 2015b).
- On March 10, 2015, Weston, on behalf of NJDEP, provided comments on the P3C TEP - Revision 2 (Weston, 2015c).
- On March 27, 2015, PPG/AECOM submitted the *Technical Execution Plan (Revision 3), Southwest TEP Addendum (Phase 3C Area Soil Excavation), PPG Sites 133-East and 135 - Garfield Avenue, Jersey City, New Jersey* (P3C TEP – Revision 3) (AECOM, 2015e).
- On April 10, 2015, Weston, on behalf of NJDEP, provided comments on the P3C TEP - Revision 3 (Weston, 2015e).
- On August 21, 2015, PPG/AECOM submitted the *Technical Execution Plan (Revision 4), Southwest TEP Addendum (Phase 3C Area Soil Excavation), PPG Sites 133 East and 135 North - Garfield Avenue, Jersey City, New Jersey* (P3C TEP – Revision 4) (AECOM, 2015k).
- On September 4, 2015, Weston, on behalf of NJDEP, provided comments on the P3C TEP - Revision 4 (Weston, 2015n).

- On October 19, 2015, PPG/AECOM submitted the technical memorandum entitled *Response to Comments on the Phase 3C Technical Execution Plan (Revisions 1, 2, 3, and 4)* (AECOM, 2015m).
- On November 12, 2015, Weston, on behalf of NJDEP, provided concurrence on AECOM's October 19, 2015 responses (Weston, 2015m).
- On April 8, 2016, PPG/AECOM submitted the *Technical Execution Plan (Revision 5), Southwest TEP Addendum (Phase 3C Area Soil Excavation), PPG Sites 133 East and 135 North - Jersey City, New Jersey* (P3C TEP – Revision 5) (AECOM, 2016f).
- On April 26, 2016, Weston, on behalf of NJDEP, provided concurrence on the backfill reuse plan proposed in Section 5.4.2 of the P3C TEP – Revision 5 (Weston, 2016g).
- On May 13, 2016, Weston, on behalf of NJDEP, provided comments on the P3C TEP - Revision 5 (Weston, 2016i).
- On June 8, 2016, PPG/AECOM submitted the technical memorandum entitled *Response to Comments on the Phase 3C Technical Execution Plan (Revision 5)* (AECOM, 2016l).
- On June 24, 2016, Weston, on behalf of NJDEP, provided concurrence on AECOM's June 8, 2016 responses (Weston, 2016l).

4.2.2.3 Site 135 South TEP

- On April 8, 2016, PPG/AECOM issued the *Technical Execution Plan, Southwest TEP Addendum (Site 135 South Soil Excavation), PPG Site 135 South, Jersey City, New Jersey* (135S TEP) (AECOM, 2016g).
- On April 26, 2016, Weston, on behalf of NJDEP, provided concurrence on the backfill reuse plan proposed in Section 5.4.1 of the 135S TEP (Weston, 2016g).
- On May 6, 2016, Weston, on behalf of NJDEP, provided comments on the 135S TEP (Weston, 2016h).
- On June 8, 2016, PPG/AECOM issued the *Technical Execution Plan (Revision 1), Southwest TEP Addendum (Site 135 South Soil Excavation), PPG Site 135 South, Jersey City, New Jersey* (135S TEP - Revision 1) (AECOM, 2016k).
- On June 24, 2016, Weston, on behalf of NJDEP, provided comments on the 135S TEP - Revision 1 (Weston, 2016m).
- On September 6, 2016, PPG/AECOM provided an email response (AECOM, 2016m) to the Weston comments from June 24, 2016. A revised TEP was not issued.

4.2.2.4 AI Smith Moving TEP

The AI Smith Moving TEP includes portions of Site 133 East and Site 135 South that were excavated concurrently with AI Smith Moving.

- On March 2, 2017, PPG/AECOM issued the *Technical Execution Plan, AI Smith Moving Property - Soil Excavation, Jersey City, New Jersey* (ASM TEP), dated March 1, 2017 (AECOM, 2017b).
- On March 31, 2017, Weston, on behalf of NJDEP, provided comments on the ASM TEP (Weston, 2017a).

- On May 12, 2017, PPG/AECOM issued the *Technical Execution Plan (Revision 1), AI Smith Moving Property - Soil Excavation, Jersey City, New Jersey* (ASM TEP - Revision 1) (AECOM, 2017d).
- On May 25, 2017 Weston, on behalf of NJDEP, provided comments on the ASM TEP - Revision 1 (Weston, 2017b).
- On June 2, 2017, PPG/AECOM provided an email documenting concurrence with NJDEP/Weston's May 25, 2017 comments (AECOM, 2017e). A revised TEP was not issued.

5.0 Description of the Remedial Action

The RA at AOC 133E-1A (CCPW-impacted soil at Site 133 East Grid Rows S through CC excluding Grids S43A and S44A) included the excavation of CCPW and visible CCPW-impacted soil, off-site transport and disposal of affected soil, backfilling of the excavations, and restoration of the affected areas. It was anticipated that the presence of CCPW metals (antimony, total chromium, nickel, thallium, and vanadium) at concentrations greater than the CrSCC, SRS, DIGWSSLs, or IGWSRS-GAGs would be resolved as a result of the excavation being driven by the presence of Cr⁺⁶ and visible CCPW.

The RA at AOC 133E-2A (MGP-impacted soil at Site 133 East Grid Rows S through CC excluding Grids S43A and S44A) included two parts. The first portion consisted of the excavation of CCPW and CCPW-impacted soil, which also resulted in removal of some MGP-impacted soil. Naphthalene concentrations were evaluated to determine if this compound was remaining in place at concentrations greater than the NJDEP SRS or DIGWSSLs. The second portion of the RA consisted of the placement of an engineering control, a deed notice, and a corresponding RAP to mitigate exposure to naphthalene remaining in place at concentrations greater than the SRS.

The RA at AOC 135-1 (CCPW-impacted soil at Site 135) included two parts. The first portion consisted of the excavation of CCPW and CCPW-impacted soil and off-site transport and disposal of affected soil. The second portion of the RA consisted of the placement of an engineering control, a deed notice, and a corresponding RAP to mitigate exposure to antimony associated with re-used fill materials remaining at concentrations greater than the SRS.

The RA was performed in accordance with the NJDEP-conditionally-approved RAWP (AECOM, 2012d) as described in **Section 4.1**, and TEPs and TEE submittals, as described in **Section 4.2**.

Preparatory activities for the remediation of the GA Group Sites, overall, began in 2010 with obtaining regulatory permits and/or approvals to facilitate implementation of the RA. Mobilization and preparation for the RA of the GA Group Sites began in June 2010.

AECOM served as the remediation engineer. Mueser Rutledge Consulting Engineers served as the geotechnical/structural engineer.

AECOM served as Construction Manager as Agent (CMAA) to manage and coordinate the work of multiple contractors hired by PPG to perform the required remedial construction and support work until January 2017, at which time ENTACT Environmental Services of Latrobe, Pennsylvania (ENTACT) assumed the role of CMAA.

AECOM performed the air monitoring at the Site during demolition and excavation activities, in accordance with the December 2010 *Revision of the Air Monitoring Workplan for Ground Intrusive Activities at the Garfield Avenue Site in Jersey City, New Jersey (AMP)* and applicable AMP Amendments (15, 24, 30, and 31) (AECOM, 2010b).

ENTACT performed the remedial construction activities at the Site. These services consisted of coordination and disconnection of utilities, excavation and backfilling, decontamination, demolition, dewatering, and Site restoration.

WTS Transportation Services, LLC coordinated transportation and disposal of the waste streams generated from the RA activities until April 2017, at which time ENTACT and AECOM took over the coordination and tracking of waste streams.

The following sections summarize the RA activities as implemented.

5.1 Pre-Construction Activities

The following activities were conducted prior to starting excavation of CCPW and CCPW-impacted soils:

- Approval of permit applications and plans submitted to the state and local agencies.
- Implementation of a Soil Erosion and Sediment Control Plan (SESCP).
- Implementation of the AMP.
- Development of a site-specific Health and Safety Plan (HASP).
- Site utility clearance activities.
- Abandonment of monitoring wells located within the extent of excavation.
- Mobilization of equipment and set up of temporary facilities.
- Establishment of work zones.
- Demolition of existing structures.
- Installation of excavation shoring.

The necessary permits were obtained from and approved by the state, local, and county agencies prior to initiation of activities covered by the permits as detailed in **Section 7.6**. Necessary permits and approvals are documented in **Appendix B**.

Pre-construction activities including mobilization and placement of jersey barriers and temporary fencing, implementation of the SESCO, establishment of work zones, and utility clearance were performed from June 2014 through March 2015. The erosion and sediment controls consisted primarily of the placement of hay bales to contain soil that was potentially displaced during remedial activities. Hay bales were placed in areas where contractors were actively working at each Site and were relocated throughout the remediation activities, as needed, in accordance with the SESCO. Hay bales were installed along the downgradient perimeter of each Site.

The AMP was developed to provide specific procedures for measuring, documenting, and responding to potential airborne impacts during remedial activities at the Sites. The AMP was approved by NJDEP prior to the initiation of work.

A HASP was developed for the RA at the GA Group Sites (including Site 133 East and Site 135) in accordance with the Occupational Safety and Health Act (OSHA) 1910.120. The HASP documents policies and procedures to be followed to protect workers and the public from potential hazards posed at the GA Group Sites. The HASP includes training program protocols, a medical surveillance program, equipment maintenance programs, personal hygiene practices, a project air monitoring plan, a dust control plan, and other information.

In addition to contacting the New Jersey One-Call system, a utility survey was conducted prior to undertaking intrusive Site activities. A private utility locator, Enviroscan, Inc. of Lancaster,

Pennsylvania, performed a geophysical survey to mark underground utilities (gas, sewer, water, phone, cable, electrical, etc.) that existed within the proposed excavation area. As part of pre-demolition activities related to the buildings on Site 133 East and Site 135, building utilities were disconnected and capped at the street. Electric and natural gas utilities were disconnected by PSEG and sewer and potable water service was cut and capped under the supervision of the Jersey City Municipal Utilities Authority (JCMUA).

On Site 133 East, monitoring wells 133-MW2A (permit number 2600082196) and 133-MW2B (permit number 2600082197) were properly decommissioned by NJ-licensed well drillers in accordance with the NJDEP's *Well Construction and Maintenance; Sealing of Abandoned Wells* (N.J.A.C. 7:9D) (NJDEP, 2001). Well decommissioning documentation is included in **Appendix C**. Monitoring wells 135-MW3A and 135-MW3B, located in Pacific Avenue just beyond the Site 135 boundary, were not formally decommissioned. Based on field observations, these wells are believed to have been removed or destroyed during soil remediation activities (i.e., excavation). In accordance with NJDEP's *Well Construction and Maintenance; Sealing of Abandoned Wells* Subchapter 3 (N.J.A.C. 7:9D) (NJDEP, 2001), the required information for the removed wells was provided in writing to the Bureau of Water Allocation and Well Permitting (and is included in **Appendix C**).

Equipment was delivered during the initial mobilization phase for the RA activities at the GA Group Sites and on an as-needed basis as work progressed. Temporary facilities including field office trailers, sanitary facilities, and Conex/intermodal boxes for equipment storage were mobilized onto Site 114 and set up for use during the RAs. As remediation progressed, some support trailers were relocated to Site 132 to improve logistics.

Work zones were established to exclude unauthorized personnel from entering the Sites and to prevent contamination from being tracked off Site or into clean work zones. The following work zones were established:

- A Secure Zone was established to exclude unauthorized personnel from entering the Site. The Secure Zone consisted of a steel chain link fence and locking gates. Warning signs were placed on the fence to prevent unauthorized entry into work areas.
- A Support Zone was established to stage office trailers, sanitary facilities, and Conex/intermodal storage boxes, and provide for vehicle parking.
- An Exclusion Zone encompassed areas associated with impacted material and/or heavy equipment hazards. Temporary fencing was installed to isolate the exclusion zones and modified Level D personal protective equipment (PPE), including Tyvek, was required when working in the exclusion zone.
- A Contamination Reduction Zone and a truck decontamination pad were constructed for transition from the Exclusion Zone. The Contamination Reduction Zone prevented the track-out of sediment onto off-Site streets other paved areas, and onto sidewalks from vehicles and personnel exiting the Site.

Demolition of the on-Site buildings was conducted as follows:

- The seven contiguous warehouses on Site 133 East were demolished in September and October 2014. The building slabs were left in place to be removed as part of excavation activities.

- The six northern buildings on Site 135 were demolished between December 2015 and February 2016. The building slabs were left in place to be removed as part of excavation activities.
- The southernmost building on Site 135 (Building 51 at 51 Pacific Avenue) was demolished in October and November 2016. The building slab was removed as part of excavation activities.
- Note that the excavation of grids on Site 133 East and Site 135 abutting Al Smith Moving were conducted following the demolition of the building and slab on Al Smith Moving in July and August 2017. The details of the Al Smith Moving RA will be presented in a separate RAR submittal.

Prior to the demolition of the buildings, pre-demolition activities including utility cutoffs and asbestos abatement were required prior to issuance of a demolition permit. An abatement contractor was acquired to remove universal waste materials and asbestos-containing material (ACM). Following the asbestos abatement, a NJ-Certified industrial hygienist certified the post-abatement air quality. The contractor demolished the structure down to the concrete slabs, segregated waste streams, and disposed of the waste in accordance with local, state (including New Jersey Department of Transportation [NJDOT]) and federal regulations.

Excavation shoring was installed in August 2015 at the northern limits of the Site 133 East excavation and in February 2016 at the northern limit of Site 135 North to protect infrastructure in Carteret Avenue. Shoring consisted of steel sheet piling.

5.2 Excavation

In accordance with the Phase 3C TEP, the Site 135 South TEP, and the Al Smith Moving TEP, the soil at Site 133 East and Site 135 was excavated in 30-foot by 30-foot-grid cells. The Site consists of the following grids:

- Site 133 East includes Rows P through CC (extending west to east) and Columns 21A through 48A (extending from north to south).
 - The remediated portion of Site 133 East (AOC 133E-1A and AOC 133E-2A) consists of Site 133 East Grid Rows S through CC excluding Grids S43A and S44A.
 - The remainder of Site 133 East (AOC 133E-1B) will be addressed in a future submission. During the RA, it was determined that, due to access issues related to adjacent properties, the grids in Rows P, Q, and R and Grids S43A and S44A would be excavated at a later date in conjunction with the Phase 3B South remediation. Portions of Grids R42A, R43A, R44A, R45A, S43A, and S44A were excavated as part of the Phase 3C excavation. However, additional excavation or sampling is required and could not be conducted due to access issues. The additional excavation and sampling in these grids and will be conducted at a later date in conjunction with the Phase 3B South remediation.
- Site 135 North includes Grid Row BB through FF (extending west to east) and Grid Column 22A through 26A (extending from north to south).
- Site 135 South includes Grid Row V through EE (extending west to east) and Grid Column 25A through 42A (extending from north to south).

Each grid was excavated to a target depth. Soil analytical results from the RI soil boring program and the PDI soil boring program were used to determine the planned depths of the excavation. See

Section 2.0 for further information regarding the RI and **Section 4.0** for further information regarding the PDI activities, planned TEEs, and TEPs.

Excavation for remediation of non-CCPW-related constituents being addressed under the LSRP program by PPG was conducted concurrently with the excavation for remediation of Cr⁺⁶ and CCPW. In some cases, excavation was conducted to depths deeper than the proposed Cr⁺⁶ TEEs for remediation of non-CCPW-related constituents. The results of the LSRP program remediation by PPG will be reported in a separate document.

Remedial excavation was conducted in four stages between April 21, 2015 and January 8, 2018, as described below. To facilitate constructability, the limits of each excavation stage overlapped with other stages.

- Excavation of the majority of Site 133 East occurred concurrently with grids in Halladay Street South, between April 21, 2015 and October 22, 2015. During this mobilization, excavation in the southern portion of Site 133 East was not conducted due to the proximity to the Al Smith Moving building (located to the southeast of Site 133 East) and to allow continued access to the Ten West Apparel driveway (located to the southwest of Site 133 East). Excavation along the eastern edge of Site 133 East was limited by the presence of the building located on Site 135. To maintain safe conditions, excavation of the grids located in the alleyway shared between Site 133 East and Site 135 was incomplete as the grade was sloped away from the Site 135 building along the length of Site 133 East.
- Excavation of Site 135 North, the majority of Site 135 South (approximately Columns 21A through 37A), and a portion of the alleyway between Site 133 East and Site 135 (approximately Columns 21A through 37A) occurred between February 23, 2016 and August 23, 2016. This mobilization did not include the southernmost Site 135 grids within the Building 51 footprint. Note that excavation to remediate non-CCPW constituents, under the LSRP program by PPG, continued between August 23, 2016 and November 7, 2016. During this time period, additional Cr⁺⁶ confirmation samples were collected and waste was loaded out as part of the non-CCPW remediation.
- Excavation of the Site 135 grids within the Building 51 footprint and the alleyway between Site 133 East and Site 135 adjacent to Building 51 occurred between November 22, 2016 and February 17, 2017. During this mobilization, excavation along the southern boundary of Site 135 was not conducted due to the proximity to Al Smith Moving.
- Excavation of grids on Site 133 East and Site 135 adjacent to Al Smith Moving occurred in conjunction with excavation of Al Smith Moving between August 16, 2017 and January 8, 2018.

Excavation was performed by ENTACT utilizing an excavator. As the removal of CCPW-impacted material from within the excavation proceeded, an excavator with a hammer attachment was used to break up existing slabs, concrete, or other concrete obstacles, such as building foundations, within the limits of the excavation to allow access to underlying soils.

AECOM implemented dust control measures at Site 133 East and Site 135, in accordance with the March 2011 Revision of the Dust Control Plan (DCP) and applicable DCP Amendments, during excavation, stockpiling, transportation, backfilling, and associated activities during the RA. Results of the air monitoring and sampling during the Site 133 East and Site 135 activities were documented as part of the activities associated with the larger scale GA Group Sites, available on the Chromium Cleanup Website (<http://www.chromiumcleanup.com>, last accessed in November 2018) in the form of Monthly Reports and Event Documentation Reports. The concentrations and the short-duration

metrics demonstrate that the dust control measures were effective at maintaining Cr⁺⁶ in dust at concentrations less than the Acceptable Ambient Concentration (AAC).

ENTACT verified vertical excavation extents using global positioning system (GPS) survey equipment to document that proposed excavation depths were achieved. Once the excavation limits were met to the targeted depths within each grid cell, a representative from Weston and/or an AECOM geologist inspected the completed excavation for visible CCPW. If visible CCPW was noted, excavation would continue in half-foot increments until inspection revealed that there was no CCPW present. Post-excavation samples were collected if required to document compliance in accordance with the Method to Determine Compliance (NJDEP, 2013). Figures 5-1A through 5-5D in **Appendix D-1** depict the grid layout of Site 133 East and the final as-built TEEs. Figures 5-1 through 5-2 in **Appendix D-2** depict the grid layout of Site 135 North and the final as-built TEEs. Figures 5-1A through 5-3C in **Appendix D-3** depict the grid layout of Site 135 South and the final as-built TEEs.

Excavated materials were live-loaded into lined dump trucks where possible. Soil stockpiles were not used during this excavation. Concrete was stockpiled to be sized prior to load out in accordance with the Soil and Stockpile Management Plan for the GA Group Sites included in the 2012 RAWP (AECOM, 2012d). The stockpiles were located on un-remediated portions of the Site. Since the stockpile locations were to undergo excavation as part of a subsequent phase of work, post-removal soil samples were not collected from below the stockpiles. During times when excavation was progressing, but trucks were not on site, day piles were created in areas that had not yet been remediated, adjacent to or within the excavation. The ground surface was pitched so that liquid that may have drained out of the soils returned into the excavation prior to its transport for off-site disposal (see **Section 7.4** on waste generation and disposal).

Surface water runoff, storm water, groundwater entering the excavation, and decontamination wastewater were transferred by pump to the GA Group Sites groundwater treatment plant located on Site 114.

5.3 Post-Excavation Soil Sampling

During the course of RA activities, post-excavation pit bottom samples were collected, if required, to document compliance with the Chromium Policy (NJDEP, 2007) in accordance with the Method to Determine Compliance (NJDEP, 2013). Where the TEE in adjacent grids varied by more than two feet, sidewall samples were collected every 30 linear ft and at two-ft depth intervals. Where excavation grids were enclosed by shoring or where the TEE in adjacent grids varied by less than two feet, sidewall sampling was not conducted. In some cases, excavation was designed so that PDI or historical boring locations served as sidewall samples. In some cases, excavation was conducted to depths deeper than required for CCPW remediation in order to remediate non-CCPW constituents under the LSRP program by PPG, removing the Cr⁺⁶ confirmation samples. The Specific Notes on Tables 5-1 in **Appendices D-4, D-5** and **D-6** explain how the Chromium Policy was met in these specific instances.

In the event that the excavation was expanded to remove visible CCPW beyond the original proposed excavation extents, either post-excavation pit bottom and sidewall samples or samples from soil borings prior to excavation (i.e., pre-excavation sampling) were used as confirmation samples. In addition, the areas were visually inspected by the Site Administrator's independent technical consultant, Weston, and/or an AECOM geologist to confirm that the excavation bottom and sidewalls were free of visible CCPW.

The post-excavation/confirmation samples were analyzed for:

- Cr⁺⁶ using United States Environmental Protection Agency (USEPA) SW-846 Method 3060A digestion and USEPA SW-846 Method 7196A, as modified by NJDEP;
- pH using USEPA SW-846 Method 9045C, D;
- Redox Potential using method ASTM International Method D1498-76M; and
- Total chromium, antimony, nickel, thallium, and vanadium using USEPA SW-846 Method 6010C (in 10% of selected samples only per the RAWP [see Section 4.1 for the RAWP submittal history] and Field Change Notification SWTEP 1 discussed in Section 5.5).
- On Site 133 East, under the ACO and JCO, the other constituent for which PPG was responsible (naphthalene associated with the former Halladay Street Gas Works MGP) was analyzed for in the post-excavation/confirmation samples using USEPA SW-846 Method SW8270 (in 10% of selected samples only per the RAWP).

Additional excavation (re-dig) was completed where post-excavation soil samples exceeded the CrSCC (see **Section 3.0**). Typically, the full 30-ft by 30-ft grid was excavated to remove the CrSCC exceedance(s). In the event that a sidewall sample exceeded the CrSCC, the sidewall was further excavated to remove the CrSCC exceedance.

Figures 5-1A through 5-5D in **Appendix D-1** present data for locations within the Site 133 East boundary that have samples remaining in place. Figures 5-1 through 5-2 in **Appendix D-2** present data for locations within the Site 135 North boundary that have samples remaining in place. Figures 5-1A through 5-3C in **Appendix D-3** present data for locations within the Site 135 South boundary that have samples remaining in place. In addition, locations from outside the respective site boundary and/or removed samples may be shown to demonstrate compliance with the RA objectives. Laboratory analytical reports and data validation reports for the data presented in these tables are included in **Appendices E** and **F**, respectively. Since some grids span multiple site boundaries, some sample locations are included in more than one sample set. The laboratory electronic data deliverables (EDDs) passed submission and have been logged into the NJDEP database, as documented in **Appendix E**.

5.3.1 LSRP Program Sampling

On Site 133 East, excavation and soil sampling for non-CCPW-related constituents and constituents not associated with the operation of the former Halladay Street Gas Works MGP were conducted by PPG under the LSRP program concurrently with the CCPW-impacts RA. In some cases, contaminants of concern (i.e., naphthalene) associated with impacts emanating from Site 114 are the same as contaminants associated with site operations that are being evaluated under the LSRP program by PPG. The naphthalene results associated with samples collected under the LSRP program (typically designated by "SI" or "RI" in the Location ID) on Site 133 East are included in this submittal for completeness. Reporting on the Site 133 East soil samples collected during the LSRP program by PPG will be submitted separately, and this data has not been included in the EDD submission to the NJDEP database for this RAR.

5.4 Institutional and Engineering Controls

5.4.1 Site 133 East

As shown on Figures 5-4B, 5-4C, and 5-4D in **Appendix D-1** and Table 5-4 in **Appendix D-4**, naphthalene remains in place at concentrations greater than the SRS on Site 133 East in Grids X26A, X28A, Y27A, Z30A, and W36A. It is unclear whether the naphthalene present in these grids is related solely to the former Halladay Street Gas Works MGP located on Site 114 or if it is also a remnant of

site-specific operations that historically occurred on Site 133 East. As PPG is responsible for both categories of impacts (under the ACO/JCO and the LSRP program), the naphthalene remaining in place at concentrations greater than the unrestricted use standards is being addressed by the engineering and institutional controls described here, irrespective of the source. The remedy for naphthalene remaining in place at concentrations greater than the SRS consists of an engineering control (Clean Fill Soil Cap), a deed notice, and a corresponding RAP for a restricted area shown on the as-built diagram in **Appendix G**.

Following remediation of soils, dense-graded aggregate (DGA) backfill material was placed at the bottom of the excavation up to El. 9.0 ft NAVD88 and compacted to final backfill subgrades. A demarcation liner was placed throughout Site 133 East at El. 9.0 ft NAVD88. A minimum thickness of two feet of additional DGA backfill material was placed on top of the demarcation liner from El. 9.0 to 11.0 ft NAVD88 which serves as the Clean Fill Soil Cap Engineering Control to restrict access to soils with naphthalene at concentrations greater than the unrestricted use standards. In some areas, additional DGA is present on top of the cap.

The horizontal extent of the Clean Fill Soil Cap Engineering Control to address naphthalene remaining in place is depicted on the as-built diagram included in **Appendix G**. The western, eastern, and northern extent of the restricted area is the property boundary. The southern extent of the restricted area is based on the delineation of naphthalene to the south at the elevation of the naphthalene remaining in place on-site (shown on Figure 5-4B in **Appendix D-1**). An as-built diagram depicting a typical section of the Clean Fill Soil Cap is included in **Appendix G**. Additional information on site restoration and documentation of clean fill is included in **Sections 7.2 and 7.5**.

The draft deed notice is provided in **Appendix H**. Once the NJDEP approves the RAR, the final deed notice will be filed with the County Clerk. Once the deed notice is filed, a RAP application will be submitted for the remaining soil impacts, along with the final RAR, to NJDEP for approval.

5.4.2 Site 135

As described in **Section 7.5.3**, in some cases, historic fill from grids that were excavated for purposes other than removing impacted materials (i.e., to facilitate the placement of the Clean Fill Soil Cap Engineering Control or the removal of subsurface concrete) was used to backfill adjacent grids. In accordance with the historic fill reuse process described in **Section 7.5.3**, fill with antimony at concentrations greater than the unrestricted use standard was moved from Grids BB30A, BB31A, and CC31A into Grids AA32A and BB32A. The antimony associated with the re-used fill materials is more likely attributed to historic fill than to CCPW, based on the following lines of evidence:

- Visible CCPW was not identified in the re-used material;
- The concentrations of Cr⁺⁶ were less than the CrSCC and concentrations of other CCPW-metals were less than the RDCSRS or site-specific Alternative Remediation Standards (ARS) in the reused material represented by samples 135-BB32A-WC-1 and 135-BB32A-WC-2. Analytical results associated with samples 135-BB32A-WC-1 and 135-BB32A-WC-2 are included in **Appendices M-7 and M-8**;
- Historic fill was visually identified at this location;
- Other constituents typical of historic fill (such as arsenic and lead) were identified at concentrations greater than standards in sample 135-BB32A-WC-1 and 135-BB32A-WC-2 (**Appendices M-7 and M-8**); and
- As presented in the August 2018 SSRIR (AECOM, 2018b), sporadic detections of antimony have been observed in the eastern portion of Site 135 and were determined to be unrelated to the Project Area and have not emanated from Site 114.

However, since there is not definitive evidence that the antimony associated with the re-used fill materials is attributed to historic fill and not to CCPW, the antimony exceedance is conservatively addressed via an engineering control (Clean Fill Soil Cap) and institutional controls (deed notice) under the JCO program.

The remedy for antimony associated with re-used fill materials remaining at concentrations greater than the SRS consists of a Clean Fill Soil Cap Engineering Control, a deed notice, and a corresponding RAP for a restricted area shown on the as-built diagram in **Appendix G**.

Following remediation of soils, removal of concrete, and regrading of historic fill within the excavation footprint, DGA backfill material was placed at the bottom of the excavation up to El. 9.0 ft NAVD88 and compacted to final backfill subgrades. A demarcation liner was placed throughout Site 135 at approximately El. 9.0 ft NAVD88. In the northeast corner of Site 135, the demarcation liner was sloped down to elevation 6.7 ft NAVD88 in order to allow the restoration grade to meet the existing roadway grade. A minimum thickness of 28 inches of additional DGA backfill material was placed on top of the demarcation liner which serves as the Clean Fill Soil Cap Engineering Control to restrict access to soils with antimony at concentrations greater than the unrestricted use standards.

PPG is also responsible for other impacts remaining under the LSRP program (i.e., historic fill and polychlorinated biphenyls). Under the LSRP program, Site 135 will have a Clean Fill Soil Cap Engineering Control and deed notice. The horizontal extent of the Clean Fill Soil Cap Engineering Control covers the entire Site 135 (to address historic fill), and has a thickness of 28 inches (to address polychlorinated biphenyls remaining in place at concentrations greater than the RDCSRS), as depicted on the as-built diagram included in **Appendix G**. Since the Clean Fill Soil Cap Engineering Control will ultimately address both CCPW and LSRP parameters, the horizontal extent and thickness of the cap have been conservatively designed for antimony (i.e., the cap has a wider footprint and greater thickness than required) in order to address the LSRP parameters. Additional information on site restoration and documentation of clean fill is included in **Sections 7.2** and **7.5**.

PPG has prepared a deed notice which encompasses Site 135 since the entire property will be deed noticed under the LSRP program. The draft deed notice included in **Appendix H** includes the remaining antimony associated with re-used fill materials that is to be addressed under the ACO/JCO. The final deed notice may also include additional parameters to be addressed under the LSRP program. Once the NJDEP approves the RAR, the final deed notice will be filed with the County Clerk. Once the deed notice is filed, the RAP application for the remaining soil impacts will be submitted, along with the final RAR, to NJDEP for approval.

5.5 Field Change Notifications

Field changes made during implementation of the TEPs were documented in Field Change Notification forms. Field Change Notifications, relevant to the RA activities at Site 133 East and Site 135, are listed in **Table 5-1**.

Additionally, during the RA, some excavation was conducted in Columns 42A, 43A, and 44A; however, due to access issues, it was determined that Grid Rows P through R, plus Grids S43A and S44A, would be excavated at a later date in conjunction with the Phase 3B South remediation. This area is defined as AOC 133E-1B and will be addressed in a future submission.

6.0 Reliability of Data: Data Validation and Usability

6.1 Data Validation

Data validation was performed by AECOM to evaluate whether the analytical data collected to demonstrate compliance with the RA objectives were scientifically defensible, properly documented, of known quality, and met RA objectives. Data validation included the review of analytical procedures, quality control (QC) results, calibration procedures, data reduction, and completeness of the laboratory data packages as specified in the soil RIWP (AECOM, 2011a) and Field Sampling Plan – Quality Assurance Project Plan (FSP-QAPP) (AECOM, 2010a). Deficiencies noted were communicated to the laboratory and resolutions were documented in the data validation reports. If appropriate, data were qualified for use as described later in this section.

The laboratory analytical data packages (**Appendix E**) were reviewed in accordance with the FSP-QAPP (AECOM, 2010a), the NJDEP validation Standard Operating Procedures (SOPs) for Cr⁺⁶ and inorganic data, and USEPA Region 2 metals and SVOC validation guidelines. The following NJDEP validation guidelines served as the basis for the actions taken during validation:

- NJDEP Office of Data Quality *SOP 5.A.10, Rev 3 (September 2009), SOP for Analytical Data Validation of Hexavalent Chromium – for USEPA SW-846 Method 3060A, USEPA SW-846 Method 7196A and USEPA SW-846 Method 7199* (NJDEP, 2009); and
- NJDEP Office of Data Quality *SOP 5.A.16, Rev 1 (May 2002), Quality Assurance Data Validation of Analytical Deliverables for Inorganics (based on USEPA SW-846 Methods)* (NJDEP, 2002).

Where USEPA Region 2 inorganic and organic validation guidelines were also used in assessing metals, the most current guidance in effect at the time of validation was used; the specific revision used is listed in each data validation memorandum provided in **Appendix F**. The link to USEPA Region 2 validation guidance on the USEPA website is shown below:

- <https://www.epa.gov/quality/region-2-quality-assurance-guidance-and-standard-operating-procedures> (last accessed in November 2018)

The level of validation ranged from a comprehensive validation according to the NJDEP guidelines to a limited validation based on QC summary information or completeness reviews, depending on the analyte and matrix. The validation procedures for the Cr⁺⁶ data included full validation, which involved a comprehensive review of both summary forms and raw data, whereas the metals data received limited validation. Limited validation for metals data was based on information provided by the laboratory on its QC summary forms and did not include raw data review. At a minimum, limited validation included validation of the following data elements:

- Agreement of analyses conducted with chain-of-custody (COC) requests;
- Holding times and sample preservation;
- Method blanks/field equipment blanks/trip blanks;
- Surrogate spike recoveries;

- Laboratory Control Samples (LCS) or equivalent results;
- Matrix Spike (MS)/Matrix Spike Duplicate (MSD) results;
- Laboratory duplicate results;
- Field duplicate results; and
- Quantitation limits and sample results (limited to evaluating dilutions and re-analyses).

Full validation was conducted on the Cr⁺⁶ data. Full validation included each of the data elements listed for limited validation along with review of calibration data and raw data, and spot checks for verification of calculations.

Validation reports were prepared for each data package that was validated. The validation reports are provided in **Appendix F**. The reports summarize the samples reviewed, parameters reviewed, nonconformance with the established criteria, and validation actions (including application of data qualifiers) presented in accordance with the NJDEP "hit list" format. Validation data qualifiers were based on the USEPA Region 2 validation guidelines for organic data and the NJDEP validation SOPs for the Cr⁺⁶ and inorganic data. The following qualifiers are used in data validation:

- J Indicates the result was an estimated value; the associated numerical value was an approximate concentration of the analyte in the sample. J+ or J- is used when the direction of bias can be determined.
- U Indicates the analyte was not detected in the sample above the sample reporting limit.
- UJ Indicates the analyte was not detected above the reporting limit and the reporting limit was approximate.
- UB The analyte concentration is less than or equal to three (3) times the concentration in the associated method/preparation blank. The presence of the analyte in the sample is negated due to laboratory blank contamination.
- JB The analyte concentration is greater than three (3) times, but less than or equal to ten (10) times the concentration in the associated method/preparation blank. The presence of that analyte in the sample is considered "real" but the concentration is quantitatively qualified due to method blank contamination.
- R The sample result was rejected due to serious deficiencies; the presence or absence of the analyte could not be confirmed.
- RA The sample result was rejected due to NJ-specific data validation QC requirements; however, the result is usable for project objectives. Refer to the Data Quality and Usability section of the data validation report for further information.

6.2 Data Usability Assessment

Soil samples collected to demonstrate compliance with the RA objectives were sent to Test America Laboratories (formerly Severn-Trent Laboratories) in Edison, NJ (NJ certification 12028) or SGS-Accutest Laboratories in Dayton, NJ (NJ Certification 12129). The analyses were performed in accordance with USEPA- and NJDEP-approved analytical protocols in place at the time the analyses were performed. Quality assurance analytical measures were implemented in accordance with the

NJDEP TRSR (N.J.A.C. 7:26E) (NJDEP, 1993b) and complied with the requirements for a NJDEP-certified laboratory specified in *Regulations Governing the Certification of Laboratories and Environmental Measurements* (NJDEP, 1981). Specific quality control issues identified during validation are documented in the individual data validation reports provided in **Appendix F**. Results of the data validation indicated that, in general, the analytical data were of adequate quality to meet the project objectives. However, there were some quality assurance (QA)/QC issues identified during data validation that resulted in rejection of data or qualification of data as estimated.

Data usability was evaluated using the data quality indicators of precision, accuracy, representativeness, comparability, completeness, and sensitivity. Data that were not rejected during validation are regarded as usable.

Certain Cr⁺⁶ results that were rejected due to failure of the matrix spikes to meet the NJDEP-specified control limits of 50-150% were qualified "RA" to indicate the result may have value for information purposes. This qualifier is typically used for Cr⁺⁶ where the spiked sample matrix appears to be reducing and would not be expected to support the presence of Cr⁺⁶. The presence of other indicators of a reducing environment such as total organic carbon (TOC), sulfide, or ferrous iron is a factor in the decision to utilize the "RA" qualifier. In this data set the "RA" qualifier was also applied to certain metals, which were run outside of holding time at the request of AECOM. These samples were collected in November 2014 for Cr⁺⁶ analysis but analysis for metals was requested in late May 2015, which was beyond the 6-month holding time for the CCPW metals. Since the analysis had been requested in spite of the holding time exceedance, professional judgment was used during validation to qualify positive results "RA" and to use the R qualifier only for non-detect results in this portion of the Site 133 East dataset.

6.2.1 Precision

Precision is the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions and includes both field and analytical components. The information used to evaluate precision included results for field duplicates, matrix duplicates, and laboratory duplicates. For the RAR data set (the data used to demonstrate compliance with the RA objectives), relative percent difference (RPD) non-conformances were observed for field and/or laboratory duplicates associated with Cr⁺⁶ and CCPW metals and field duplicates associated with naphthalene.

Field precision was assessed through the collection and analysis of field duplicates and expressed as the RPD of the sample and field duplicate pair results. For the Site 133 East data set, field duplicate precision resulted in qualification of 15.7% of the Cr⁺⁶ data, 3.4% of the naphthalene data, and 6.2% of the CCPW metals data. For the Site 135 North data set, 14.2% of the Cr⁺⁶ data and 8.7% of the CCPW metals data were qualified based on field duplicate precision. The Site 135 South data set had 16.5% of the Cr⁺⁶ data qualified on the basis of field duplicate precision; none of the CCPW metals results were qualified based on field precision.

Laboratory precision was assessed through the RPD results for MS/MSDs, LCS/laboratory control sample duplicate (LCSD) pairs, and duplicate sample analyses. MS/MSDs and duplicate sample analyses do not reflect laboratory precision as purely as LCS/LCSDs since sample homogeneity, which can be a significant issue for soil samples, can impact the precision of sample and matrix spike duplicates. However, no differentiation of the applied reason code is made between LCS/LCSDs and MS/MSDs or sample duplicates. Laboratory precision resulted in qualification of 17.6% of the Cr⁺⁶ data and 1.7% of the CCPW metals; none of the naphthalene results were qualified on the basis of laboratory precision in the Site 133 East data set. For the Site 135 North data set, 23.4% of the Cr⁺⁶

results were qualified based on laboratory duplicate precision; 22.9% of the Site 135 South Cr⁺⁶ results were qualified based on laboratory precision. None of the CCPW metals results for Site 135 North or 135 South were qualified based on laboratory precision.

Four Cr⁺⁶ results associated with Site 133 East were qualified for failure to meet the 20% RPD criteria between duplicate injection results associated with the ion chromatography analysis used in Method 7199.

6.2.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. The results of LCS data, surrogate recoveries, method blanks, and MS/MSDs were used as the primary indicators of accuracy; information such as sample container type, preservation, and holding time was also considered as impacting to analytical accuracy. Some of this information was assessed by the laboratory at the time of receipt (container type and preservation); other parameters were evaluated during the validation process.

Two Cr⁺⁶ results (0.21%) in the Site 133 East data set were rejected (R) based on spike recoveries below the control limit of 50% with the Eh/pH plot indicating the sample used for matrix spiking was oxidizing and, therefore, should support the presence of Cr⁺⁶. An additional 23.3% of the Site 133 East Cr⁺⁶ results were qualified "RA" to indicate the results were rejected since both initial and reanalysis spike recoveries fell outside control limits of 50-150%, but the sample matrix appeared to be reducing and, therefore, unable to support the presence of Cr⁺⁶. The Site 133 East CCPW metals included non-detect results for six antimony and 10 thallium analyses (1.9% of the total CCPW data reported) that were rejected due to exceedance of the 6-month holding time. In addition, positive results for an additional 7.0% of the CCPW data run beyond the 6-month holding time were qualified as "RA". There were no rejected data points associated with the Site 133 East naphthalene data. Site 135 data also included Cr⁺⁶ data qualified "RA" due to low matrix spike recoveries but data indicative of a reducing matrix; 36.2% of the Site 135 North Cr⁺⁶ data and 36.4% of the Site 135 South Cr⁺⁶ data were qualified "RA". None of the CCPW metals data associated with Sites 135 North or 135 South was qualified as rejected (R) or "RA". The Cr⁺⁶ and CCPW metals results qualified "RA" may provide further information for project decisions but should be used with an understanding of the QC issues identified.

Qualification of data as estimated (J/UJ) for accuracy was related to issues such as field or laboratory blank contamination, LCS results, MS results, and percent solids. A summary of the validation findings are presented by QC parameter type below.

The presence of negative blanks, or target analytes in laboratory blanks and/or blanks related to field activities (i.e., field blanks) was cited as a reason for qualification of 3.9% of the Cr⁺⁶ results, 0.86% of the naphthalene results, and 2.7% of the CCPW metals results associated with Site 133 East. Blank data resulted in qualification of one Cr⁺⁶ result (<1%) and five CCPW metals results (1%) associated with the Site 135 South data set. None of the Site 135 North data was qualified on the basis of blank results. For those blanks in which contaminants were detected, action levels were established in accordance with the NJDEP or USEPA Region 2 validation guidance documents. Associated sample results were qualified accordingly.

In the Site 133 East data set, 82.7% of the Cr⁺⁶ data, 2.6% of the naphthalene data, and 14.2% of the CCPW metals results were qualified on the basis of MS or MSD recoveries. For the Site 135 North data, 76.6% of the Cr⁺⁶ results and 23.2% of the CCPW metals results were qualified on the basis of MS and/or MSD recovery. Site 135 South data included qualification of 94.2% of the Cr⁺⁶ results and

5.5% of the CCPW metals results based on MS and/or MSD recoveries. Cr⁺⁶ results were flagged as estimated based on the results of soluble and/or insoluble spike recoveries outside the range of 75-125% but within the limits of 50-150%. Data points impacted by MS and/or MSD recoveries within this range were flagged as J or UJ; individual data validation memoranda address the potential for high or low bias to sample results based on matrix interferences.

The Site 133 East data set included nine Cr⁺⁶ results that were qualified as estimated due to receipt outside the temperature range of 4±2°C, one naphthalene result qualified on the basis of internal standard recovery, and four naphthalene results qualified based on surrogate recoveries; in addition, nine CCPW metals results were qualified on the basis of serial dilution results. One Cr⁺⁶ result in Site 135 South was qualified due to receipt outside the temperature range of 4±2°C and two Cr⁺⁶ results were qualified based on calibration blank results that were reported between the Method Detection Limit (MDL) and reporting limit.

Moisture content greater than 50% resulted in selected data points being qualified as estimated (J or UJ). Approximately 10.6% of the Site 133 East results, 14.3% of the Site 135 North results, and 9.9% of the Site 135 South results were qualified on the basis of low percent solids.

6.2.3 Representativeness

The representativeness of any field program is a function of the planning and procedures used to collect the samples and the locations and density of samples collected. Sampling and preservation methods were based on established methods and SOPs outlined in the soil RIWP (AECOM, 2011a) and FSP-QAPP (AECOM, 2010a), which are known to minimize error associated with the disturbance of environmental samples from their natural setting.

Factors to be considered in evaluating representativeness are the use of standard analytical procedures, sample preservation, and the use of the appropriate sample container. The analytical methods, preservation procedures, and containers used in this program were as specified in the FSP-QAPP.

The moisture content of samples is also a factor in the representativeness of the data. In accordance with USEPA Region 2 validation guidance, samples containing more than 50% moisture were qualified as estimated. As noted previously, this requirement resulted in the qualification of 10.6% of the Site 133 East data, 14.3% of the Site 135 North data, and 9.9% of the Site 135 South data.

6.2.4 Comparability

Comparability of the data in the RAR data set was maximized by using standard methods for sampling, analysis, and data validation.

6.2.5 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system; valid data are defined as those data judged to be usable (i.e., not rejected as a result of the validation process). For the Site 133 East data set, 1, 923 individual data points were generated; 0.94% (two Cr⁺⁶ and 16 metals results) were qualified as rejected and are considered unusable for project decisions. An additional 14.8% of the data (225 Cr⁺⁶ and 16 metals results) were qualified "RA" to indicate that, although QC exceedances were identified, the results may still have value for understanding site conditions. Overall, 99.1% of the reported Site 133 East values generated for Cr⁺⁶, naphthalene, and CCPW metals are considered usable for project decisions with an understanding of the data quality issues identified during validation.

The Site 135 North data set contained 210 individual results for Cr⁺⁶ and CCPW metals; none of the data was qualified as rejected (R) and unusable. However, 51 Cr⁺⁶ data points (24.3% of the Site 135 North data) were qualified as “RA” due to spike recoveries below 50% but there were indications that the sample matrix was reducing and not amenable to supporting the presence of Cr⁺⁶. Since none of the Site 135 North data was qualified as R, 100% of the results are considered usable for site decisions with an understanding of the quality issues identified during validation.

The Site 135 South data set contained 1,217 individual results for Cr⁺⁶ and CCPW metals; none of the data was qualified as R and unusable; however, 272 Cr⁺⁶ results (22.4% of the total Site 135 South data) were qualified as “RA”. Since none of the Site 135 South data were qualified as R, 100% of the results are considered usable for site decisions with an understanding of the data quality issues identified during validation.

The Cr⁺⁶ values qualified as “RA” do not meet the required 50-150% soluble and insoluble matrix spike recovery limits due to sample matrices that do not appear to be capable of supporting Cr⁺⁶. In the Site 133 East data set, the “RA” qualifier was also applied to CCPW metals that were analyzed at the request of AECOM project staff after the expiration of the 6-month holding time. It was the judgment of the validator that positive results analyzed beyond 6 months should not be rejected; only non-detect results generated beyond the holding time were rejected and are considered unusable. Results qualified as “RA” can be used for information purposes with a full understanding of the limitations as described in the data validation report.

6.2.6 Sensitivity

Analytical dilutions were necessary for certain samples due to the sample matrix or elevated concentrations of target or non-target analytes. The detection limits reported by the laboratory were adjusted to reflect dilution factors. Limitations in analytical methodologies and/or low percent solids content for some soil samples can result in detection limits that exceed either the Residential Direct Contact Soil Remediation Standard (RDCSRS) or DIGWSSL; however none of the data associated with the Site 133 East, Site 135 North, or Site 135 South data sets were reported as non-detect values at concentrations greater than the regulatory limits.

6.2.7 Data Quality/Data Usability Conclusions

The findings of this Data Quality Assessment and Data Usability Evaluation indicate that the data used to demonstrate compliance with the RA objectives are sufficiently representative of actual conditions and may be used to support decisions with the exceptions identified below:

- Cr⁺⁶ results qualified “RA” due to matrix spike recoveries outside the range of 50-150% but having evidence of a reducing matrix and positive results for CCPW metals data generated beyond the 6-month holding time may provide useful information for site decisions, but should be used with an understanding of the data limitations.
- Results for Cr⁺⁶ and CCPW metals qualified R are considered to have serious quality deficiencies and should not be used for site decisions.

Data qualifiers and reason codes were applied by the data validator to identify data limitations found in the validation process. Specific details regarding analytes and samples can be found in the individual data validation reports in **Appendix F**.

7.0 Documentation of the Protectiveness of the Remedial Action

Soil analytical results from the RI and PDI soil boring programs were used to pre-determine the depths of the excavation. These sampling results, in combination with the post-excavation sampling results, were used to document the effectiveness and completeness of the soil remediation.

Once the excavation limits met the final as-built TEEs, the Site Administrator's independent technical consultant, Weston, and/or an AECOM geologist inspected the completed excavation to confirm the absence of visible CCPW.

As summarized in **Section 5.3**, the locations of samples used to demonstrate compliance with the remediation goals for Site 133 East (AOC 133E-1A and AOC 133E-2A) are depicted on Figures 5-1A through 5-5D in **Appendix D-1**, and Tables 5-1 through 5-5 in **Appendix D-4** present the analytical results for samples used to demonstrate compliance with the remediation goals. For Site 135 North, the locations of samples used to demonstrate compliance with the remediation goals are depicted on Figures 5-1 through 5-2 in **Appendix D-2**, and Tables 5-1 through 5-2 in **Appendix D-5** present the analytical results for samples used to demonstrate compliance with the remediation goals. Note that, because the excavation at Site 135 North was extended to below the average groundwater table as shown in **Appendix D-7**, tables and figures for Site 135 North were not generated showing analytical results compared to the DIGWSSLs. For Site 135 South, the locations of samples used to demonstrate compliance with the remediation goals are depicted on Figures 5-1A through 5-3C in **Appendix D-3**, and Tables 5-1 through 5-3 in **Appendix D-6** present the analytical results for samples used to demonstrate compliance with the remediation goals. Laboratory analytical reports and data validation reports for the data presented in these tables are included in **Appendices E** and **F**, respectively. As discussed in **Section 6**, the laboratory analytical data for the collected samples was found to be usable for the purposes of defining the extents of the remedial excavation. **Appendix I** presents the available boring logs from the locations of samples that were used to demonstrate compliance with the remediation goals.

Excavation in Site 133 East and Site 135 was not designed to remove all soil from the unsaturated zone, as detailed in the TEPs and TEE submittals (see **Section 4.2**). Therefore, the elevations of samples remaining in place were compared to the groundwater elevation, above which is the unsaturated zone. The groundwater elevation was estimated as the 50th percentile groundwater elevation from 13 monitoring wells located on or adjacent to Site 133 East and Site 135 gauged between February 2007 and December 2016. The monitoring well locations and data are included in **Appendix A**. The estimated groundwater elevation which defines the unsaturated zone for this Site is El. 6.2 ft NAVD88.

For Site 133 East (AOC 133E-1A), compliance averaging was used to attain compliance for antimony remaining in soil in Grid W38A compared to the SRS and thallium remaining in unsaturated soil in Grid Z28A compared to the DIGWSSL. For Site 135 (AOC 135-1), compliance averaging was used to attain compliance for antimony remaining in soil in Grids Y37A and Z38A compared to the SRS. Compliance averaging results are presented in **Appendix J**.

At Site 133 East, AOC 133E-1A and AOC 133E-2A have been remediated as follows:

- AOC 133E-1A
 - Excavation of soil containing Cr⁺⁶ met the requirements specified in the Chromium Policy (NJDEP, 2007) in accordance with the Method to Determine Compliance (NJDEP, 2013).
 - Soil concentrations for CCPW metals are in compliance with the CrSCC or SRS.
 - Soil concentrations for CCPW metals in the unsaturated zone are in compliance with the DIGWSSLs and/or the site-specific IGWSRS-GAGs.
- AOC 133E-2A
 - Naphthalene remains in place at concentrations greater than the SRS and is addressed by an engineering control (Clean Fill Soil Cap) and institutional controls (deed notice).
 - Soil concentrations for naphthalene in the unsaturated zone are in compliance with the DIGWSSL.

At Site 135, AOC 135-1 has been remediated as follows:

- Excavation of soil containing Cr⁺⁶ met the requirements specified in the Chromium Policy (NJDEP, 2007) in accordance with the Method to Determine Compliance (NJDEP, 2013).
- Antimony associated with re-used fill materials remains at concentrations greater than the SRS and is addressed by an engineering control (Clean Fill Soil Cap) and institutional controls (deed notice).
- Soil concentrations of the other CCPW metals are in compliance with the CrSCC or SRS.
- Soil concentrations for CCPW metals in the unsaturated zone are in compliance with the DIGWSSLs and/or the site-specific IGWSRS-GAGs.

Waste manifests for soil and other materials that were loaded for off-site disposal are presented in **Appendix K** and **Appendix L**.

Clean fill documentation is provided in **Appendix M**.

7.1 As-Built Diagrams

The following as-built diagrams are included in **Appendix G**:

- An as-built diagram depicting the final extents of the excavation for Site 133 East and Site 135, as well as Halladay Street South and Al Smith Moving;
- As-built diagrams depicting the horizontal extent and typical section of the Clean Fill Soil Cap Engineering Control to address naphthalene remaining in place in Site 133 East;
- As-built diagrams depicting the horizontal extent and typical section of the Clean Fill Soil Cap Engineering Control to address antimony associated with re-used fill materials remaining in Site 135; and
- An as-built diagram of the final Site grades following restoration for Site 133 East and Site 135, as well as Halladay Street South and Al Smith Moving.

7.2 Description of Site Restoration Activities

After completion of the excavation activities at each grid cell, the backfill was amended with FerroBlack®-H by ENTACT in accordance with the plans and specifications. The placement of FerroBlack®-H serves as a phase of groundwater remediation as documented in the *Progress Report for Groundwater Pilot Study and FerroBlack®-H Amended Backfill Permits-By-Rule - 2016 Fourth Quarter (October to December)* (AECOM, 2017a). Backfilling of Site 133 East and Site 135 was completed in stages, keeping pace with the excavation. Restoration activities were completed across the GA Group Sites, including Site 133 East and Site 135, between July 10, 2017 and February 15, 2018. In accordance with the Master Schedule milestones, the majority of Site 133 East and Site 135 were restored by January 31, 2018; the portions of these sites adjacent to Al Smith Moving were restored by February 15, 2018.

Clean fill for site restoration consisted of ¾-inch stone and DGA backfill material supplied by Tilcon. Information regarding the source and quality of the backfill material is provided in **Section 7.5**. Based on the compaction goal of 90% standard proctor, specified in the Phase 3C, Site 135, and ASM TEPs, ENTACT satisfactorily completed compaction of the backfill placed within the limits of Site 133 East and Site 135. Final compaction results ranged from 95.1% to 100.2%, exceeding the 90% compaction goal.

Site 133 East and Site 135 were backfilled and restored in accordance with the *Restoration Technical Execution Plan, Garfield Avenue Group (Revision 1)* (Restoration TEP), dated August 2017 (AECOM, 2017f) and the PPG/AECOM memorandum entitled *Response to NJDEP/Weston's 08/31/17 Comments and the City of Jersey City/ERFS's 09/12/17 Comments on the Restoration Technical Execution Plan, Garfield Avenue Group (Revision 1)*, dated October 16, 2017 (AECOM, 2017h).

7.3 Total Remedial Action Cost

PPG's total remediation cost for implementation of the RA at Site 133 East AOC 133E-1A and AOC 133E-2A and Site 135 AOC 135-1 was estimated at approximately \$40 million. This includes costs for: RI, engineering, demolition, shoring installation, excavation and backfilling, air monitoring, construction management, groundwater management and treatment, waste transportation and disposal, and overall project management and reporting.

7.4 Documentation of Waste Generation and Disposal

The approximate in-place volume of soil excavated from Site 133 East AOC 133-1A and Site 135 AOC 135-1 and disposed of off site is estimated at 59,000 cubic yards (approximately 88,500 tons assuming a soil density of 1.5 tons per cubic yard), based on the limits of excavation.

Waste manifests and bills of lading (BOLs) for the Site 133 East and Site 135 excavation are included in **Appendix K** (Hazardous Waste Disposal Documentation) and **Appendix L** (Non-Hazardous Waste Disposal Documentation).

The excavation of these sites occurred concurrently with the excavation of other GA Group Sites documented in separate submittals. The excavation for CCPW was also conducted concurrently with the excavation for non-CCPW parameters under the LSRP program. The quantities, manifests, and BOLs included herein include all waste generated during the date ranges of building demolition and soil excavation as follows:

- September 2, 2014 through October 10, 2014 - Demolition of Site 133 East buildings. Post-demolition wastes were disposed of between November 20, 2014 and December 11, 2014.

- April 21, 2015 through October 22, 2015 - Excavation of the majority of Site 133 East concurrently with grids in Halladay Street South. Due to the concurrent excavation, manifests from Site 133 East and Halladay Street South could not be separated and are included in both RAR submittals.
- December 31, 2015 through February 26, 2016 - Demolition of the northern Site 135 buildings.
- February 23, 2016 through August 23, 2016 - Excavation of Site 135 North, the majority of Site 135 South and a portion of the alleyway between 133 East and 135 South. Note that excavation for remediation of non-CCPW constituents, under the LSRP program, continued between August 23, 2016 and November 7, 2016. For completeness, waste manifests from this time period are also included in **Appendices K and L**.
- October 17, 2016 through November 11, 2016 - Demolition of Building 51 on Site 135.
- November 22, 2016 through February 17, 2017 - Excavation within the Building 51 footprint on Site 135.
- July 10, 2017 through August 18, 2017 - Demolition of Al Smith Moving. Portions of the Building 51 foundation on Site 135 were loaded out concurrently with demolition.
- August 16, 2017 through January 8, 2018 - Excavation of Al Smith Moving in conjunction with adjacent grids on Site 133 East and Site 135. During this mobilization, weight tickets and BOLs were tracked by site and sets of one to four grids. Weight tickets/BOLs for grids or sets of grids that fall within or straddle Site 133 East or Site 135 are included in **Appendices K and L**. Some weight tickets are included in both this submittal and the Al Smith Moving RAR as they represent material from a grid or set of grids that straddles the Site boundary.

Other materials generated as a result of the RA activities at Site 133 East and Site 135 included contaminated debris, demolition debris, and groundwater treatment plant sludge.

The following facilities were used for the off-site disposal of waste materials generated during RA activities at Site 133 East and Site 135:

Hazardous Waste Materials

- Stablex, Canada Inc., Blainville, Québec, Canada;
- Environmental Quality Company (EQ) Detroit Inc., Detroit, Michigan;
- EQ - Michigan Disposal Waste Treatment Plant, Belleville, Michigan;
- EQ Envirite of Pennsylvania, Inc., York, Pennsylvania; and/or
- Clean Earth of North Jersey (CENJ) treatment, storage, and disposal facility (TSDF), Kearny, NJ.

Non-Hazardous Solid Waste Materials

- Cumberland County Improvements Authority Landfill, Deerfield Township, NJ; and/or
- CENJ TSDF, Kearny, NJ.

Non-Hazardous Liquid Waste (Water)

- Groundwater was pre-treated through the on-site treatment plant and discharged to the public sewer system (conveyed via the JCMUA system) to the Passaic Valley Sewerage Commission (PVSC) Wastewater Treatment Plant, Newark, NJ for final treatment and

discharge. Prior to November 7, 2017, the groundwater treatment plant was located on Site 114 and operated under the PVSC Sewer Use Permit #31630010 (included in **Appendix B**). After November 9, 2017, the on-site treatment plant was relocated to Site 137 under the PVSC Sewer Use Permit # 31630035 (**Appendix B**). Between November 8 and 10, 2017, some liquid waste was transported directly to PVSC for treatment and disposal because the on-site treatment system was not yet operating at full capacity following the relocation of the plant from Site 114 to Site 137. A total of 27 loads (containing approximately 6,000 to 7,000 gallons each) were transported to PVSC during this timeframe. The liquid waste BOLs for this time period are included in **Appendix L**.

Copies of fully executed manifests, BOLs, and certificates of disposal documenting the off-site transport of waste material are presented in the following appendices:

- **Appendix K** – Hazardous Waste Disposal Documentation. This appendix includes fully executed manifests and certificates of disposal (if provided) documenting the off-site transport of hazardous soil, sludge, concrete, and other debris, such as scrap metal.
- **Appendix L** – Non-Hazardous Waste Disposal Documentation. This appendix includes BOLs documenting the off-site transport of non-hazardous soil, concrete, and demolition debris. Demolition debris that was classified as general refuse was not tracked and is not included.

7.5 Documentation of Source, Type, Quantities, and Location of Fill

Licensed quarry material was utilized for backfill and restoration and consisted of ¾-inch open grade stone and DGA supplied by Tilcon (from their licensed mine facilities at 625 Mt. Hope Road, Wharton, NJ and Broad Street, Pompton Lakes, NJ), a licensed quarry facility permitted to operate as a commercial quarry by NJDEP.

To meet the minimum requirements of the NJDEP TRSR (NJDEP, 1993b) at the time of the Site 133 East and Site 135 activities, the sources of imported fill were certified by the supplier as clean from a virgin source, based on their knowledge of the place of origin and history. In accordance with Field Change Notification #16A dated July 24, 2015, each quarry, on an annual basis, was required to provide its License (Mining Certificate) and Annual Certification that the material was from a clean, virgin source with analytical results provided by the quarry/mine in accordance with NJDEP's *Fill Material Guidance for SRP Sites Version 3.0* (NJDEP, 2015).

The concentrations of the analytes in samples collected from the quarry material were less than the NJDEP RDCSRS and the quarry material did not pose a potential impact to groundwater (per NJDEP's *Fill Material Guidance for SRP Sites Version 3.0* [NJDEP, 2015]), indicating that the material was acceptable for on-site use.

In addition, AECOM implemented a stringent visual inspection process, by on-site AECOM personnel, to verify the quality of the backfill. Visual inspection criteria included the size of the individual stones, the presence of foreign debris, the ratio of fines in the material, and significant differences in color.

A list of the quarry material load reports is provided in **Appendix M-1** and the analytical reports, mine certificates, and annual certifications are provided in **Appendix M-2**.

In limited situations, DGA backfill was placed in one area, re-excavated and reused in another area (as described in **Sections 7.5.1** and **7.5.2**), or historic fill from grids that were excavated for purposes other than removing impacted materials (i.e., to facilitate the placement of the Clean Fill Soil Cap

Engineering Control or removal of subsurface concrete) was reused to backfill adjacent grids (as described in **Section 7.5.3**).

7.5.1 Site 114 Backfill Use

In September 2015, amended DGA that had been placed in Site 114, Phase 2B-4 was excavated from above the water table to facilitate the construction of the Capillary Rise Test Plots (AECOM, 2016i). This unsaturated material was combined with additional DGA and FerroBlack®-H amendment, and used as clean backfill on Site 133 East. The original location, volume and final location of the material are provided in **Appendix M-3**.

The laboratory data, in accordance with *Fill Material Guidance for SRP Sites Version 3.0*, April 2015 (NJDEP, 2015), for the original material placed on Site 114 is provided in **Appendix M-4**. It was determined that additional sampling was not required since the original sampling data met the clean fill sampling requirements and reflected the nature of the material placed on Site 133 East as the material removed from Site 114 was from the unsaturated zone and site conditions did not change between placement on Site 114 and use on Site 133 East (e.g. no new releases or changes in site activities).

7.5.2 Site 133 East Backfill Use

During the 2015 mobilization, excavation of grids along the eastern edge of Site 133 East was limited by the presence of the building located on Site 135. To maintain safe conditions, the Site 133 East excavation was sloped away from the building along the alleyway shared between Site 133 East and Site 135. Following excavation, the unremediated slope was covered with a plastic liner and Site 133 East was temporarily backfilled with DGA to a minimum El. 9.0 ft NAVD88. During the 2016 mobilization, the remaining grids in the alleyway shared by Site 133 East and Site 135 were excavated along with Site 135. To complete the Site 135 excavation, the previously placed DGA along the alleyway was removed to allow access to impacted soils beneath the DGA and plastic liner.

In accordance with the Site 135 TEP and the March 4, 2016, *Site 133 East – Backfill Use Plan* (AECOM, 2016d), conditionally approved by NJDEP/Weston on March 11, 2016, and the October 26, 2016 *Site 133 East - Backfill Use Plan (Addendum 1)* (AECOM, 2016n), the DGA placed above the plastic liner was removed, stockpiled, sampled, reused, and tracked within Site 133 East and Site 135. The backfill was confirmed visually clean. Location tracking is provided in **Appendix M-5**. Analytical sampling results are provided in **Appendix M-6**.

7.5.3 Historic Fill Reuse

In accordance with the Site 135S TEP - Rev 1 (AECOM, 2016k) and the procedures presented in the NJDEP's *Fill Material Guidance for SRP Sites Version 3.0* (NJDEP, 2015), historic fill from grids that were excavated for purposes other than removing impacted materials (i.e., to facilitate the placement of the Clean Fill Soil Cap Engineering Control or removal of subsurface concrete), was reused to backfill adjacent grids. The historic fill that was reused was confirmed visually clean. Location tracking is provided in **Appendix M-7**. Analytical sampling results are included in **Appendix M-8**.

In accordance with the Site 135S TEP - Rev 1 (AECOM, 2016k) and the procedures presented in the NJDEP's *Fill Material Guidance for SRP Sites Version 3.0* (NJDEP, 2015), antimony at concentrations greater than the unrestricted use scenario was moved to Grids AA32A and BB32A. The remedy for antimony remaining in place at concentrations greater than the SRS consists of an engineering control (Clean Fill Soil Cap), a deed notice, and a corresponding RAP as described in **Section 5.4**. Additionally, exceedances of other metals and select polycyclic aromatic hydrocarbons (PAHs)

determined to be associated with historic fill remain in the historic fill reuse areas. These exceedances will be addressed by a deed notice to be established under the LSRP program and are not further discussed herein.

7.6 Identification of Required Permits and Authorizations

The permits and approvals needed for the RA at Site 133 East and Site 135 are listed below:

- SESCO approvals from Hudson-Essex-Passaic County Soil Conservation District.
- Notice of Non-Applicability, Discharge to Surface Water General Permit for Construction Activity - Stormwater (5G3), NJDEP, Division of Water Quality.
- Flood Hazard Area Individual Permit for GA Group, NJDEP, Division of Land Use Regulation.
- Fire Safety Permit, Jersey City Fire Department, Fire Prevention Division.
- Water Use Registration, NJDEP, Division of Water Supply.
- Permit-By-Rule Discharge Authorization for Site-wide FerroBlack®-H Backfill Amendment, NJDEP, Site Remediation Program.
- Community Right-to-Know Survey for 2017, NJDEP.
- PVSC Sewer Use Permit #31630010 (Site 114 groundwater treatment plant).
- PVSC Sewer Use Permit # 31630035 (Site 137 groundwater treatment plant).

The necessary permits were obtained from and approved by the state, local, and county agencies prior to initiation of the activities covered by the permits. Necessary permits and approvals are documented in **Appendix B**.

Local permits that are not included in **Appendix B** include local road closure and street opening permits (which were renewed approximately every 6 months) and demolition permits (Site 133 East Permit No. 2014-2811 and Site 135 Permit No. 2015-4625).

8.0 Receptor Evaluation Update

The purpose of a receptor evaluation (RE) is to document the existence of human or ecological receptors, and the actions taken to protect those receptors, at contaminated sites. Pursuant to N.J.A.C. 7:25E-1.12, REs must include general site information, an evaluation of surrounding land use, a description of contamination, a discussion of groundwater use in the area, an evaluation of vapor intrusion potential, and an ecological evaluation.

The Receptor Evaluation Report, Rev. 3, Non-Residential Chromate Chemical Production Waste Sites 114, 132, 133, 135, 137, 143 and 186 Jersey City, New Jersey, dated March 20, 2012, was submitted to the NJDEP on March 23, 2012 (AECOM, 2012c). The Final Garfield Avenue Group RE/Ground Water RE/Baseline Ecological Evaluation Reports were submitted to the NJDEP on July 22, 2013. The updated RE form and required attachments are provided with this RAR.

9.0 Conclusions and Recommendations

9.1 Soil

For Site 133 East, this RAR documents that the soil RA for AOC 133E-1A and AOC 133E-2A is effective in protecting public health and safety and the environment and remedial objectives have been achieved as follows:

- AOC 133E-1A
 - Excavation of soil containing Cr⁺⁶ met the requirements specified in the Chromium Policy (NJDEP, 2007) in accordance with the Method to Determine Compliance (NJDEP, 2013).
 - Soil concentrations for CCPW metals are in compliance with the CrSCC or SRS.
 - Soil concentrations for CCPW metals in the unsaturated zone are in compliance with the DIGWSSLs and the site-specific IGWSRS-GAGs.
- AOC 133 E-2A
 - Naphthalene remains in place at concentrations greater than the SRS and is addressed by an engineering control (Clean Fill Soil Cap) and institutional control (deed notice).
 - Soil concentrations for naphthalene in the unsaturated zone are in compliance with the DIGWSSL.

On this basis, PPG, the responsible party, has demonstrated compliance with the applicable remediation requirements for the soils on Site 133 East AOC 133E-1A and AOC 133E-2A, and no further action with regard to AOC 133E-1A and AOC 133E-2A is needed (other than filing the deed notice and implementing the RAP). PPG requests the closure of AOC 133E-1A and AOC 133E-2A by the NJDEP through the issuance of a Consent Judgment Compliance Letter.

For Site 135, this RAR documents that the soil RA for AOC 135-1 is effective in protecting public health and safety and the environment and remedial objectives have been achieved as follows:

- Excavation of soil containing Cr⁺⁶ met the requirements specified in the Chromium Policy (NJDEP, 2007) in accordance with the Method to Determine Compliance (NJDEP, 2013).
- Antimony associated with re-used fill material remains at concentrations greater than the SRS and is addressed by an engineering control (Clean Fill Soil Cap) and institutional controls (deed notice).
- Soil concentrations of other CCPW metals are in compliance with the SRS.
- Soil concentrations for CCPW metals in the unsaturated zone are in compliance with the DIGWSSLs and/or the IGWSRS-GAGs.

On this basis, PPG, the responsible party, has demonstrated compliance with the applicable remediation requirements for the soils on Site 135 AOC 135-1, and no further action with regard to

AOC 135-1 is needed (other than filing the deed notice and implementing the RAP). PPG requests the closure of AOC 135-1 by the NJDEP through the issuance of a Consent Judgment Compliance Letter.

9.2 Groundwater

This RAR only addresses the RA of soil at Site 133 East (AOC 133E-1A and AOC 133E-2A) and Site 135 (AOC 135-1). CCPW and MGP-impacted groundwater within the GA Group Sites is being tracked under the Site 114 PI number G000005480. The status of the GA Group Sites groundwater contamination and plans for groundwater RA are documented in the *Groundwater Remedial Investigation Report, Draft*, submitted on October 1, 2018 (AECOM, 2018d). A separate RAR will be prepared and submitted to document the groundwater RA at the GA Group Sites.

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