FEASIBILITY STUDY REPORT

WORK ASSIGNMENT D007622-34

FORMER KLINK COSMO CLEANERS SITE
GREENPOINT/EAST WILLIAMSBURG
INDUSTRIAL AREA

SITE NO. 224130
KINGS (C) NY

Prepared for:
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 Broadway, Albany, New York

Basil Seggos, Commissioner

DIVISION OF ENVIRONMENTAL REMEDIATION
Remedial Bureau B

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Final
September 2018

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BROOKLYN, KINGS COUNTY, NEW YORK

PREPARED FOR:

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REMEDIAL BUREAU B

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PREPARED BY:

URS CORPORATION – NEW YORK

257 WEST GENESEE STREET, SUITE 400

BUFFALO, NEW YORK 14202

SEPTEMBER 2018

Engineering Certification

I, Mark E. Lang, certify that I am currently a New York State registered professional engineer as defined in 6NYCRR Part 375 and that this Feasibility Study Report for the Former Klink Cosmo Cleaners Site (Site #224130) was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

Respectfully submitted,

URS Corporation – New York

9/11/18

Mark E. Lang, PE
New York State Licensed Professional Engineer
License No. 074013

Date

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LIST OF ACRONYMS AND ABBREVIATIONS

3rd Rock	3rd Rock LLC
AARCO	AARCO Environmental Services, Corporation
ACME	ACME Architectural Products, Inc.
ADT	Aquifer Drilling and Testing, Inc.
Aka	also known as
amsl	above mean sea level
AS	Air Sparge
ASP	Analytical Services Protocol
Associated	Associated Environmental Services, Ltd.
AST	above ground storage tank
ASTM	American Society for Testing and Materials
AWL	AWL Industries, Inc.
bgs	below ground surface
BP	British Petroleum
BQE	Brooklyn-Queens Expressway
B. Thayer	B. Thayer Associates
BTEX	benzene, toluene, ethylbenzene, xylenes
cis-1,2-DCE	cis-1,2-dichloroethene, aka cis-1,2-dichloroethylene
C&D	construction and demolition
CD	compact disc
cm/sec	centimeters per second
COC	chain-of-custody
Con Edison	Consolidated Edison Company of New York
CPCs	chemicals of potential concern
CRA	Conestoga-Rovers & Associates
Crown	Crown Enterprises, Inc.
CSIA	compound-specific stable isotope analysis
CVOC	chlorinated volatile organic compound
4,4-DDD	dichlorodiphenyldichloroethane
4,4-DDE	dichlorodiphenyldichloroethylene
4,4-DDT	dichlorodiphenyltrichloroethane
DCA	dichloroethane
DCE	dichloroethene, aka dichloroethylene
1,2-DCE	1,2-dichloroethene
DEP	Department of Environmental Protection
DER	Division of Environmental Remediation
DIs	drop inlets
DNAPL	dense non-aqueous phase liquid
DOB	Department of Buildings
DOT	Department of Transportation
DNSY	City of New York Department of Sanitation
DUSR	Data Usability Summary Report
EE	Environmental Easement
ELAP	Environmental Laboratory Approval Program
EM	electromagnetic
EPM	Environmental Planning and Management, Inc.

ERH	electrical resistivity heating
ESA	environmental site assessment
EOA	Expanded Outreach Area
ExxonMobil	ExxonMobil Brooklyn Terminal
FAP	Field Activities Plan
FS	Feasibility Study
ft./ft.	foot per foot
ft^3	cubic feet
FWRIA	Fish and Wildlife Resources Impact Analysis
Glacier	Glacier Drilling, LLC
gpm	gallons per minute
GPR	ground penetrating radar
HHEA	Human Health Exposure Assessment
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HSA	hollow stem augers
ICs	Institutional Controls
ID	inside diameter
IDW	investigation derived wastes
Impact	Impact Environmental Consulting, Inc.
ISCO	in-situ chemical oxidation
ISCR	in-situ chemical reduction
K	hydraulic conductivity
k_i	intrinsic permeability
L	liter
L/min	liters per minute
LNAPL	light non-aqueous phase liquid
MEK	methyl ethyl ketone
META	META Environmental, Inc.
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MGP	Manufactured Gas Plant
MTBE	methyl tert-butyl ether
MW	monitoring well
NAD83	North American Datum of 1983
NAPL	non-aqueous phase liquid
NAVD	North American Vertical Datum
NOD	natural oxidant demand
NYC	New York City
NYCDEP	New York City Department of Environmental Protection
NYCDOT	New York City Department of Transportation
NYCRR	New York Code Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OD	outside diameter

Off-Site System	Off-Site Free Product Recovery System
OM&M	operation, maintenance and monitoring
ORP	Oxidation/Reduction Potential
Pace	Pace Analytical Service
PCBs	polychlorinated biphenyls
PCE	perchloroethene, aka tetrachloroethene or tetrachloroethylene or perchloroethylene
PID	photoionization detector
POET	Point of Entry Treatment
ppbv	parts per billion by volume
ppm	parts per million
PRB	permeable reactive barrier
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RAGS	Risk Assessment Guidance for Superfund
RAOs	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
Roux	Roux Associates, Inc.
RQD	rock quality designation
RSI	Radar Solutions International
SAP	Sampling and Analysis Plan
SC	Site Characterization
SCGs	Standards, Criteria, and Guidance
SCO	soil cleanup objectives
SPDES	Spill Discharge Elimination System
sf	square feet
Site	Former Klink Cosmo Cleaners Site
SMP	Site Management Plan
SSD	subslab depressurization
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TAGM	Technical and Administrative Guidance Memorandums
TAL	Target Analyte List
TCE	trichloroethene
TCL	Target Compound List
TMV	toxicity, mobility or volume
TOGS	Technical and Operational Guidance Series
trans-1,2-DCE	trans-1,2-dichloroethene, aka trans-1,2-dichloroethylene
µg/kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)
$\mu g/m^3$	microgram per cubic meter
UIC	Underground Injection Control
USCG	United States Coast Guard
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey

URS	URS Corporation – New York
UST	underground storage tank
VC	vinyl chloride
VOCs	volatile organic compounds
WA	Work Assignment
Zebra	Zebra Environmental Corporation
ZVI	zero valent iron

EXECUTIVE SUMMARY

On behalf of the New York State Department of Environmental Conservation (NYSDEC), this Feasibility Study (FS) report was prepared by URS Corporation – New York (URS) for the Former Klink Cosmo Cleaners Site (Site - NYSDEC ID # 224130), located in the Greenpoint/East Williamsburg Industrial Area section of Brooklyn, Kings County, New York. The Former Klink Cosmo Cleaners Site is shown on Sanborn Maps to be a clothing warehouse from the mid 1950's until sometime after 1995. Klink Cosmo Cleaners is listed in the Environmental Data Resources (EDR) Report as a generator of F002 waste (spent halogenated solvents) for this facility and several manifests are listed in the EDR Report. The current property owner, AWL Industries, Inc., acquired the property in 1997.

Based on data gathered during investigations at the Meeker Avenue Plume Trackdown Site (NYSDEC ID # 224121) conducted between May 2007 and July 2009, and a groundwater sampling event conducted in November 2009, a source of groundwater contamination was identified originating near the buildings housing the Former Klink Cosmo Cleaners, which was located at 364-392 Richardson Street (Tax District of Brooklyn, Block 02860, Lot 0001). In January 2009, the above mentioned source of groundwater contamination was listed as a NYSDEC Class 2 Inactive Hazardous Waste Disposal Site (Site Number 224130). Results of the Remedial Investigation (RI) Phases prepared by URS (June 2015) and previous investigations indicated the presence of perchloroethene (PCE) and related degradation products in soil, soil vapor, and groundwater at the Site. The horizontal and vertical extent of PCE and other chlorinated volatile organic compounds (CVOCs) in soil, soil vapor, and groundwater has been delineated, although other sources of CVOC contamination north of the Former Klink Cosmo Cleaners Site are contributing to the overall horizontal and vertical extent of dissolved phase groundwater contamination in the site area. The other sources are being managed separately under various NYSDEC programs.

Based on investigations performed to date, PCE and its degradation products were detected in numerous groundwater monitoring wells in both the shallow and deep overburden groundwater as well as in downgradient top of clay monitoring wells. High concentrations of PCE were detected on-site, in soil, soil vapor, and groundwater samples collected directly beneath and within the contaminated soil source area located beneath the AWL Industries, Inc. building, and in groundwater samples collected from shallow and deep overburden groundwater monitoring wells located adjacent to and downgradient of the on-site soil source area. The horizontal extent of the dissolved phase PCE and TCE groundwater plume extends to the northeast into the ACME Steel Metal Works Site and ACME Steel Brass Foundry Site

Area (NYSDEC Site ID #s 224131 and 224132) which are situated near the intersection of Lombardy Street and Porter Avenue). Based upon the observed concentrations of CVOCs from groundwater sampling events, a dissolved phase chlorinated solvent plume originates at the Former Klink Cosmo Cleaners Site. The horizontal extent of dissolved phase CVOC contamination associated with the Klink Cosmo Site chlorinated solvents has been delineated, although other sources are contributing to the overall distribution of CVOCs. The chlorinated solvent plumes in the shallow and deep overburden have higher concentrations of PCE immediately north and east of the Former Klink Cosmo Cleaners Site. The extent of PCE has a larger footprint in the shallow groundwater compared to the deep groundwater and is migrating to the northeast and comingles with the dissolved chlorinated solvent plume originating from other sources and within the ACME Steel source area.

The vertical extent of PCE and TCE impacted groundwater was determined to extend down to the top of the Raritan Formation (i.e., approximately 110 feet below ground surface). The vertical extent of PCE and TCE impacted groundwater is not expected to migrate below the top of the Raritan Formation due to its vast areal extent and low permeability. Based upon the data collected to assess the potential for degradation of PCE in the groundwater system as presented above, there is evidence that little reductive dechlorination is occurring in the vicinity of the site. Rates of degradation are very difficult to determine due to the unknown quantity of source material present beneath the Former Klink Cosmo Cleaners Site. Based upon the geochemical conditions in the groundwater system, the aquifer is only slightly conducive for naturally occurring reductive dechlorination. VOC contamination has exceeded applicable standards, criteria, and guidance (SCGs) in soil, soil vapor, and groundwater.

The remedial action goal for the Former Klink Cosmo Cleaners Site is to eliminate or mitigate all significant threats to human health and/or the environment, to the extent practicable, caused by contaminants present due to the release of PCE from the former dry cleaners onsite. In order to meet this goal, remedial action objectives (RAOs) have been established to protect human health and the environment. These RAOs provide the basis for selecting appropriate technologies and developing remedial alternatives. RAOs were established on the basis of contaminated media, SCGs for the site (especially Part 375 soil cleanup objectives), the results of Klink Cosmo Cleaners Site Remedial Investigation Phases, and the qualitative human health exposure assessment. The RAOs for the Site are as follows:

Soil

Public Health Protection

- Prevent ingestion/direct contact with contaminated soil
- Prevent inhalation exposure to contaminants volatilizing from soil.

Environmental Protection

- Prevent migration of contaminants that would result in groundwater, surface water, or sediment contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Groundwater

Public Health Protection

- Prevent ingestion of groundwater contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

Environmental Protection

- Restore groundwater aquifer to pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water and sediments.
- Remove the source of groundwater contamination.

Soil Vapor

Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings.

In order to meet the remedial goal and remedial action objectives for the Site, the following remedial alternatives were developed:

- **Alternative 1** – No Action, Institutional Controls with Site Management
- **Alternative 2** – IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management

- **Alternative 3** – IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management
- **Alternative 4** – IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management
- **Alternative 5** – IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management

These alternatives were evaluated against the New York State Department of Environmental Conservation (NYSDEC) criteria: Overall Protection of Public Health and the Environment; Compliance with Standards; Criteria and Guidance; Long-term Effectiveness and Permanence; Reduction of Toxicity, Mobility and Volume with Treatment; Short-term Effectiveness (including green remediation and sustainability); Implementability; Land Use; and Cost. Alternative 3 is the recommended alternative for the Site because it is comparable to Alternatives 4 and 5 for most evaluation criteria and is superior to Alternative 5 in terms of implementability and cost and superior to Alternative 4 in terms of implementability.

Components of Remediation

A conceptual layout for Alternative 3 is shown on Figure 5-2. SVE/AS (Source Area Remediation): Five air sparge wells will be constructed. These wells along with three existing wells would be used to introduce compressed air into groundwater below the Former Klink Cosmo building to remove VOCs. Four soil vapor extraction wells will be constructed. These wells along with two existing wells would be used to capture VOCs volatilized by air sparging into the groundwater beneath the Former Klink Cosmo building. The existing concrete slab will be maintained as part of the Soil Cover element. A Sub-slab Depressurization System will mitigate impacts to indoor air.

In-Situ Groundwater Remediation: Approximately 30 injection wells will be installed to inject sodium permanganate into contaminated groundwater. Conceptually, 29,000 gallons of a 5% solution will be injected into the groundwater during 4 separate injection events. Injection well quantities and locations as well as the amount of sodium permanganate injected will be further evaluated and finalized during the remedial design phase of the project.

1 INTRODUCTION

1.1 Contract Authority

URS Corporation – New York (URS) prepared this Feasibility Study (FS) report for the Former Klink Cosmo Cleaners Site (ID # 224130) [Site] located in the Greenpoint/East Williamsburg Industrial Area section of Brooklyn, Kings County, New York. The report was prepared for the New York State Department of Environmental Conservation (NYSDEC) as Work Assignment D007622-34.

1.2 Scope of Feasibility Study

This FS report evaluates the remedial action for the contaminants found to be present at and in the vicinity of the Site. This FS was developed to meet the requirements set forth in the New York State Code Rules and Regulations (NYCRR) 6 NYCRR 375, and NYSDEC Department of Environmental Remediation (DER) DER-10 Technical Guidance for Site Investigation and Remediation. This FS specifies the remedial goal and remedial action objectives, identifies potential remedial technologies feasible for use at this site, and develops remedial alternatives that meet the remedial action objectives. Remedial alternatives are evaluated in sufficient detail such that the NYSDEC can prepare a Proposed Remedial Action Plan and issue a Record of Decision.

1.3 Report Organization

This document has been organized consistent with NYSDEC DER-10 and includes the following sections:

- Executive Summary
- Introduction
- Site Description and History
- Remedial Goal and Remedial Action Objectives
- Identification and Screening of Remedial Technologies
- Development and Description of Alternatives
- Detailed Analysis of Alternatives.

2 SITE DESCRIPTION AND HISTORY

This section presents a site description, summary of previous investigations, summary of contamination, and a summary of a human health exposure assessment.

2.1 Site Background and Description

The Site is located in the Greenpoint/East Williamsburg Industrial Area section of the Borough of Brooklyn, New York and is located within the Meeker Avenue Plume Trackdown Site (NYSDEC Site Number 224121) investigation area. A site location map is shown in Figure 2-1.

Based on the results of several investigations conducted in the greater Meeker Avenue Plume Trackdown area, chlorinated solvents including tetrachloroethene (PCE) and trichloroethene (TCE) were found in soil vapor, soil, and groundwater in areas outside the historic petroleum ExxonMobil spill. As these chemicals are not related to petroleum, the NYSDEC initiated the Meeker Avenue Plume Trackdown Site investigation in order to determine the source(s) of this contamination. Information was gathered relevant to the Former Klink Cosmo Cleaners Site and other nearby potential contamination sources as part of these previous investigations.

In September 1978, the United States Coast Guard (USCG) noted oil entering Newtown Creek from the northeastern end of Meeker Avenue. A subsequent investigation concluded that the area of the spill under the Greenpoint/East Williamsburg Industrial Area was in excess of 52 acres and the total spill volume, as estimated in 1979, was approximately 17 million gallons of petroleum products (Roux Associates, Inc. [Roux] October 14, 2005). The current BP property was determined to be the source of a petroleum free-product plume located generally north of the Brooklyn-Queens Expressway (BQE). Investigation activities were conducted by Roux, on behalf of ExxonMobil, from 1990 to the present to further define the extent of the plume. The “Off-Site Plume” area consists of the area underlain by the petroleum free-product plume that is not on the BP Terminal or the Peerless, Inc. properties. Currently, the extent of the Off-Site Plume area is less than what it was in 1990 due to the operation of the Off-Site Free-Product Recovery System (Off-Site System). The Off-Site System has recovered over 6.8 million gallons of free-product since it became operational in 1995 (Roux, May, 2016). Based upon water level information, some hydraulic influence associated with the operation of the product recovery system has been noted in the Former Klink Cosmo Cleaners Site area.

The Former Klink Cosmo Cleaners property is currently owned by AWL Industries, Inc., (AWL). AWL also owns adjacent parcels to the west to Morgan Avenue and they are currently being used for

sheet metal fabrication. The entire site property and the majority of the nearby surrounding area are covered by one-story buildings and/or pavement/concrete. The contaminated and impacted area associated with the Former Klink Cosmo Cleaners Site consists of an On-Site source area (i.e., 364-392 Richardson Street [Tax District of Brooklyn, Block 02860, Lot 0001]), and the Off-Site impacted area which is bounded by Lombardy Street to the north, Porter Avenue to the east, Withers Street to the south, and Morgan Avenue to the west. Residential areas are found along Beadel Street between Morgan Avenue and Porter Avenue, interspersed along Morgan Avenue between Lombardy Street and Beadel Street, and along Vandervoort Avenue between Lombardy Street and Division Place. A public recreational area (baseball diamonds) is located across Vandervoort Avenue from the Site.

The topography of the site investigation area slopes gently downward to the south. The elevation near the Klink Cosmo area ranges from approximately at 39 feet (NAVD 88 – North America Vertical Datum of 1988) near the corner of Morgan Avenue and Richardson Street to 35 feet near the corner of Vandervoort Avenue and Richardson Street to 28 feet farther south at the corner of Frost Street and Vandervoort Avenue.

The area east of the Former Klink Cosmo Cleaners Site, across Vandervoort Avenue, includes two former manufactured gas plant (MGP) gas holders which were part of a Brooklyn Union Gas Company Former MGP site. The 400-foot tall gas holders were constructed in 1927 and 1948, and used until the 1990's by the Brooklyn Union Gas Company, a predecessor to KeySpan, currently National Grid. The gas holders, used to help maintain consistent gas pressure to customers, were removed via a controlled implosion in July 2001. The outlines of the Former gas holders are clearly visible east of the residences and baseball diamonds shown in Plate 1 and Figure 2-2.

Limited green space is present in the area and is generally situated in the vicinity of residential properties. Surface soil is present in landscape boxes adjacent to area sidewalks; however, given the nature of the urban environment the soil should not be construed as representative of clean surface soil. Recreation areas in the vicinity are baseball fields directly east of the Site, across Vandervoort Avenue, and Monsignor McGolrick Park which is a 9.13 acre park 2,000 feet northwest of the Site bounded by Monitor and Russell Streets and Nassau and Driggs Avenues.

2.1.1 Demography and Land Use

The population of Brooklyn (Kings County) is 2,504,700 according to the 2010 Census. The Former Klink Cosmo Cleaners Site is located south of a region of historic petroleum refining and storage operations that occupied a significant portion of the Greenpoint area. By 1870, over 50 refineries were

located along the banks of Newtown Creek located north and east of the Meeker Plume Trackdown Site (NYSDEC Site ID # 224121). Currently, bulk oil storage terminals north of the Site include the British Petroleum (BP) Terminal and the ExxonMobil Brooklyn Terminal (ExxonMobil). The Former Paragon Oil facility was located along Newtown Creek, north of Bridgewater Street, between Meeker Avenue and Apollo Street.

The area in the vicinity of the Former Klink Cosmo Cleaners Site is a mixture of residences and manufacturing facilities, including both commercial and industrial facilities. A recreational area is situated directly east of the Site across Vandervoort Avenue.

Land use in New York City is regulated by the City's Zoning Resolution, which has two parts: zoning text and zoning maps. The text establishes zoning districts and sets forth regulations governing their land use and development. The maps show the locations and boundaries of the zoning districts. The City is divided into three basic zoning districts: residential (R), commercial (C), and manufacturing (M). The three basic districts are further divided into a range of lower-, medium-, and higher-density residential, commercial, and manufacturing districts. A copy of the most current land use map is included in Appendix A.

The project area falls within three zoning districts identified by the New York City Department of City Planning (http://www.nyc.gov/html/dcp/html/zone/zh_zmaptable.shtml). These zoning districts are: R6B, M1-1, and M3-1. The current (2011) zoning and land use of individual properties was determined through the NYCityMap (http://gis.nyc.gov/doitt/nycitymap).

R6 and R6B Residential Districts (medium density). Primary permitted uses in the R6 district include medium density residential. A mixture of building types are allowed and range from small apartment buildings set back on small lots to row houses to large-scale apartment towers. The "B" suffix indicates a contextual district, where supplemental regulations require a new development to maintain the scale and form of the existing neighborhood context. Residential buildings are zoned as R6B north of Division Place and south of Lombardy Street between Morgan and Porter Avenues.

M1-1 Manufacturing District (light industrial). Permitted uses in the M1 districts include typical light industrial, office and retail uses. M1 districts are often a buffer between M2 or M3 manufacturing districts and adjacent residential or commercial districts. Residences are generally not included within M1 districts unless as part of a Special Mixed Use District. The majority of properties south of Meeker Avenue east of Morgan Avenue and west of Porter Avenue are located in the M1-1 district.

M3-1 Manufacturing District (heavy industrial). Permitted uses in the M-3 industrial district include heavy industry that generate potential nuisance effects such as noise, traffic or pollutants and include power plants and fuel supply depots. The "1" suffix refers to supplemental parking requirements. Properties south of Meeker and east of Porter Avenue are zoned M3-1.

2.2 Site History

The Former Klink Cosmo Cleaners Site is shown on Sanborn Maps to be a clothing warehouse from the mid 1950's until sometime after 1995. Klink Cosmo Cleaners is listed in the Environmental Data Resources (EDR) Report as a generator of F002 waste (spent halogenated solvents) for this facility and several manifests are listed in the EDR report. The current property owner, AWL, acquired the property in 1997.

Based on data gathered during investigations at the Meeker Avenue Plume Trackdown Site conducted between May 2007 and July 2009, and a groundwater sampling event conducted in November 2009, a source of groundwater contamination was identified originating near the buildings housing the Former Klink Cosmo Cleaners, which was located at 364-392 Richardson Street (Tax District of Brooklyn, Block 02860, Lot 0001). Monitoring wells DEC-031 and DEC-031D are located on the southwest corner of Vandervoort Avenue and Richardson Street (northeast building corner). Groundwater samples from these wells indicated significant PCE and TCE contamination that decrease with depth. The PCE contamination is in the shallow groundwater zone, indicating the contamination is near its source. Although PCE, TCE and their associated degradation products have been found in groundwater samples from surrounding upgradient, downgradient and sidegradient wells, the concentrations are one to two orders of magnitude lower than in DEC-031/031D. Soil-gas samples also indicated the presence of elevated levels of PCE and TCE in the vicinity of this building. The highest concentration was at soil-gas point SG-049, located adjacent to monitoring wells DEC-031/031D on the corner of Richardson Street and Vandervoort Avenue. In January 2009, the above mentioned source of groundwater contamination was listed as a NYSDEC Class 2 Inactive Hazardous Waste Disposal Site (Site Number 224130).

2.3 Previous Investigations at Nearby Facilities

Several investigations were performed prior to the RI and are summarized below.

2.3.1 Investigations by Impact Environmental Consulting, Inc.

In March 1998, Impact Environmental Consulting, Inc. (Impact Environmental) conducted a Phase I Environmental Site Assessment (ESA) for a nearby facility located across Vandervoort Avenue at 46-60 Anthony Street/ 95 Lombardy Street for ACME Architectural Products Inc., of Brooklyn, New York (ACME) (Impact Environmental, March 30, 1998a). The property historically had been utilized for iron working, metal shearing and finishing operations. At the time of the ESA, operations at the property included office space and operational space. The operational space was utilized for the machining, finishing, and storage of materials and products used in the manufacture of doors and knock down frames. The ESA identified a number of potential contamination sources that existed on the property due to current and/or past site activities. Numerous floor drains were identified throughout the building and their outfall locations were unknown. It was suspected that some drains may have discharged directly to on-site soils. Several underground storage tanks (USTs) and above ground storage tanks (ASTs) were identified and had been used for fuel oil storage and storage of degreasing products, respectively. It was noted that at the time of the ESA the facility was using a phosphate wash and rinse as a degreaser. During a personal interview, it was revealed that any regulated waste (i.e., waste paint, waste oil, waste degreaser and waste water precipitate) generated at the property was stored in the yard at 72 Anthony Street prior to disposal.

In March 1998, Impact Environmental conducted a Phase I ESA at 72 Anthony Street for ACME (Impact Environmental, March 30, 1998b). The property historically had been utilized as a brass foundry and civilian observation patrol. Operations on the property at the time of the ESA included office space and operational space. The operational space was utilized for the grinding, sanding and finishing of steel doors. The investigation identified a number of potential contamination sources that existed on the property due to current and/or past site activities. Numerous floor drains were identified throughout the building and their outfall locations were unknown. It is suspected that some drains may have discharged directly to on-site soils. One UST and one AST dip tank existed and were used for fuel oil storage and storage of degreasing products, respectively. It was noted that at the time of the ESA, the facility was using a phosphate wash and rinse as a degreaser. It was also noted that the floor of the room containing the AST dip tank was impacted by the release of degreasers from the dip tank. In addition, significant storage of portable chemical containers was observed in the building. A paint room was identified in the center of the building, as was an associated paint storage room. The floor of the paint room was significantly stained by painting operations. Floor drains were observed in the paint storage room. A chemical storage area existed outside and to the east of the building and a bermed, concrete storage pad

was also observed. Numerous chemical containers were noted outside the building and consisted of 55-gallon drums and smaller containers of primers, cutting oils, hydraulic oils, waste water, xylene, waste paints, adhesives, waste degreasers, steam cleaners and waste oil contaminated absorbents. However, most of the drums were located outside the bermed, concrete storage pad and were uncovered or missing screw caps. Two dry wells were identified along the south side of the building. In addition, during a personal interview it was revealed that the property previously maintained two dip tanks for degreasing. It was noted that a Phase I ESA was previously performed on the property in June 1995 by Conestoga-Rovers & Associates (CRA). The CRA Phase I revealed that 1,1,1-trichloroethane (1,1,1-TCA) was formerly utilized in the dip tanks and that a floor drain was observed under one of the dip tanks.

In June 1998, Impact Environmental conducted a Phase II ESA at 46-60 Anthony Street/ 95 Lombardy Street for ACME (Impact Environmental, June 1998). The scope of the Phase II ESA was based on the recommendations of the Phase I ESA and included a remote survey [i.e., ground penetrating radar (GPR)] of a floor drain located in the northeast portion of the building and the collection of a sample from 0-2 feet bgs below the floor drain. The remote survey conducted confirmed that the floor drain directly discharged to the subsurface soils. A soil sample collected from the 0-2 foot interval below the floor drain contained the volatile organic compounds (VOCs) PCE and TCE, at 1,190 and 99.2 micrograms per kilogram (µg/kg), respectively. In addition, the semi-volatile organic compounds (SVOCs) di-n-butylphthalate, pyrene and bis (2-ethylhexyl) phthalate were detected at 4,460, 539 and 1,690 µg/kg, respectively. Metals which included arsenic (4.93 milligrams per kilogram [mg/kg]), barium (114 mg/kg), cadmium (6.53 mg/kg), chromium (123 mg/kg), lead (906 mg/kg) and mercury (0.045 mg/kg) were also detected. Cadmium, chromium and lead exceeded their respective criteria found in the Technical and Administrative Guidance Memorandum (TAGM) #4046, Determination of Soil Cleanup Objectives and Cleanup Levels (NYSDEC, January 24, 1994). The Phase II ESA concluded that on-site operations had impacted the environmental quality beneath the property and recommended that corrective actions were required to mitigate the contaminated soil associated with the floor drain.

2.3.2 Investigations by Environmental Planning and Management, Inc.

In September 2005, Environmental Planning and Management, Inc. (EPM) completed an investigation for the New York State Department of Transportation (NYSDOT) in connection with the Kosciuszko Bridge Project (EPM, January 2006). The investigation included the collection and analysis of soil and groundwater samples. PCE was also detected at a concentration of 89.9 micrograms per liter (µg/L) in ExxonMobil monitoring well MW-018 (east side of Vandervoort Avenue between Anthony and Cherry Streets).

2.3.3 Investigations by Roux Associates

In September 2005, Roux Associates on behalf of ExxonMobil sampled soil vapor at 23 temporary locations in and around the perimeter of the Off-Site Plume area (Roux, October 14, 2005). The soil vapor samples collected in September 2005 indicated the presence of PCE at a concentration of 10,200 micrograms per cubic meter ($\mu g/m^3$) at a monitoring point located on the southwest corner of the Vandervoort Avenue and Anthony Street intersection. It was determined that the chlorinated solvents detected (i.e., PCE and TCE) were from a different source than the petroleum free-product plume.

2.3.4 Investigations by URS

To date, URS has completed nine phases of site investigation fieldwork and a tenth phase is in progress at the Meeker Avenue SC Plume Trackdown Site (NYSDEC Site Number 224121) within which the Former Klink Cosmo Cleaners Site is located. The SC Phase IV activities were focused in an area to the northeast of the Former Klink Cosmo Cleaners Site. The SC Phase V activities were focused in an area to the northwest of Klink Cosmo. SC Phases VIII through X activities were focused in the area to the west of Morgan Avenue, west of the Former Klink Cosmo Cleaners Site and north of the BQE in the Expanded Outreach Area (EOA). Only data gathered during the SC Phases I, II, III, V, VI, and VII field activities are relevant to the Former Klink Cosmo Cleaners Site. In addition, the September 2009 Groundwater Split Sampling event, and the November 2009 Groundwater Sampling Event field activities, Klink Cosmo Phases I and II RI field work, both on-site and off-site Phase III RI field work and reports, and the Soil Vapor Extraction (SVE)/Air Sparge (AS) Pilot Test and report have been performed. The various reports from which information is summarized in this FS Report are listed below.

DEC Site ID: 224130 – Former Klink Cosmo Cleaners Site

Remedial Investigation Phase I Investigation Report (URS, December 2011):

- Fieldwork: 5/2/2011 - 7/15/2011
- Installed/sampled 10 soil vapor points & 17 groundwater monitoring wells
- Advanced 17 soil borings

Remedial Investigation Phase II Investigation Report (URS, November 2012):

- Fieldwork: 2/27/2012 - 4/20/2012
- Installed/sampled 12 soil vapor points & 12 groundwater monitoring wells

- Advanced 12 soil borings

Off-Site Phase III Remedial Investigation Letter Report (URS, September 2014):

- Fieldwork: 12/9/2013 - 3/7/2014
- Installed/sampled 5 soil vapor points & 3 groundwater monitoring wells
- Advanced 3 soil borings

On-Site Phase III Remedial Investigation Report (URS, March 2016):

- Fieldwork: 4/13/2015 - 8/27/2015
- Installed 3 observation wells, 2 air sparge wells, 1 combined observation/air sparge well, & 2 soil vapor extraction wells
- Sampled 6 sub-slab soil vapor implants
- Installed/sampled 7 groundwater monitoring wells
- Advanced 7 soil borings

SVE/AS Pilot Study Report (URS, March 2016):

- Fieldwork: 11/16/2015 - 11/19/2015
- Conducted to determine the effectiveness of the air sparge wells and soil vapor extraction wells installed during the On-Site Phase III Remedial Investigation
- Determined radius of influence

DEC Site ID: 224121 - Meeker Avenue Plume Trackdown

Site Characterization Phase I Summary Report, September 2007 (URS, September 2007):

- Fieldwork: 5/7/2007 - 9/11/2007
- Installed/sampled 23 soil vapor points, 22 soil borings & 22 groundwater monitoring wells

Site Characterization Phase II Summary Report, April 2008 (URS, April 2008):

- Fieldwork: 11/5/2007 - 12/27/2007
- Installed/sampled 28 soil vapor points, 25 soil borings, 15 direct-push groundwater sampling locations, & 14 groundwater monitoring wells

Site Characterization Phase III Summary Report, October 2008 (URS, October 2008):

- Fieldwork: 5/5/2008 - 7/24/2008
- Installed/sampled 14 soil vapor points, 24 soil borings, 20 direct-push groundwater sampling locations, & 24 groundwater monitoring wells

Site Characterization Phase IV Summary Report, May 2009 (URS, May 2009):

- Fieldwork: 11/3/2008 - 12/8/2008
- Advanced 4 Membrane Interface Probe borings
- Installed/sampled 8 groundwater monitoring wells
- Advanced 8 soil borings

Site Characterization Phase V Summary Report, October 2009 (URS, October 2009):

- Fieldwork: 6/15/2009 - 7/13/2009
- Installed/sampled 10 groundwater monitoring wells
- Advanced 8 soil borings

Groundwater Split Sampling Event Letter Report, January 2010 (URS, January 2010):

- Fieldwork: 9/24/2009
- Sampled 8 groundwater monitoring wells for Compound Specific Isotope Analysis (CSIA)

Site Characterization Phase VI Summary Report, April 2012 (URS, April 2012):

- Fieldwork: 8/2/2011 - 1/13/2012
- Installed/sampled 10 soil vapor points & 35 groundwater monitoring wells
- Advanced 58 soil borings

Site Characterization Phase VII Summary Report, November 2013 (URS, November 2013):

- Fieldwork: 6/11/2012 - 3/27/2013
- Installed/sampled 10 soil vapor points & 24 groundwater monitoring wells
- Advanced 24 soil borings

Relevant information pertaining to the Site area from the above-referenced reports is summarized in the following Sections below.

2.4 Geology

2.4.1 Regional Geology

The Klink Cosmo Site is located within the Atlantic Coastal Plain physiographic province of New York State (Broughton, et al. 1966). The Atlantic Coastal Plain is characterized by low relief with elevations ranging from sea level to almost 400 feet (NAVD 88). The lithology of Brooklyn and Queens consists of Cretaceous and Pleistocene age unconsolidated deposits underlain by Precambrian crystalline bedrock. The unconsolidated deposits pinch out in northwestern Queens where bedrock outcrops, but reach a thickness of more than 1,000 feet in southeastern Queens. The unconsolidated deposits form six distinct hydrogeologic units consisting of four aquifers and two confining layers that generally dip to the south-southeast. The units in ascending order are the Lloyd aquifer (0-300 feet thick), the Raritan confining unit (0-200 feet thick), the Magothy aquifer (0-500 feet thick), the Jameco aquifer (0-200 feet thick), the Gardiners clay (0-150 feet thick), and the upper glacial aquifer (0-300 feet thick) (USGS, 1999a and b). The units pinch out to the north-northeast and may not all be found at any one location.

Based on deep borings performed near the site for unrelated work, the site is underlain from the surface down by upper glacial aquifer, the Raritan Formation, and crystalline bedrock. The upper glacial aquifer is of Wisconsin age and consists of a terminal moraine, a ground moraine, and glacial outwash deposits whose area is characterized as an unsorted and unstratified mixture of clay, sand, gravel and boulders. The Raritan Formation is recognized as a regional confining unit which has been described as light to dark gray, brown-red, pink, red and gray-white clay, silty clay and clayey to silty fine sand. Disseminated lignite and pyrite are common and calcareous concretions may be found. Prior to the SC Phase VI fieldwork, the Raritan Formation had previously been encountered in three borings performed near the site by the United States Geological Survey (USGS): one boring near Morgan Avenue and Meeker Avenue (-47 feet); one boring under the BQE near the west bank of Newtown Creek (-48 feet); and one boring near Meeker Avenue between Stewart Avenue and Gardner Avenue (-71 feet). The boring near Morgan Avenue and Meeker Avenue penetrated the Raritan Formation into the underlying crystalline bedrock at an elevation of -163 feet.

As of May 2017, the Raritan Formation was positively encountered in twelve top of clay monitoring well locations within the greater Meeker Avenue Plume Trackdown area at depths between approximately 108.5 and 138.0 feet bgs (elevations of approximately -57 to -121.2 feet) and was

described as gray with white banding, brown, brownish gray, greenish gray, dark gray to greenish brown, fine sand and silt, clays with carbonized plant fragments, clays with varying amounts of sand to silts with varying amounts of sand and clay. In the vicinity of the Klink Cosmo Site, these locations include DEC-006TC, DEC-028TC, DEC-029TC, and DEC-031TC (Figure 2-2). The Raritan Formation is recognized as a laterally extensive and regional aquitard in the greater NYC metropolitan area.

2.4.2 Site Geology

Figure 2-2 presents the locations of the monitoring wells and cross sections developed as part of the RIs. Cross sections A-A', B-B', C-C', D-D' and E-E' are shown on Figures 2-3 through 2-7, respectively. The following textural units have been found in the upper glacial aquifer in most borings, from the surface downward: a fill unit; a sand unit or a discontinuous glacial till unit; a sand unit if the discontinuous glacial till unit was encountered at the surface; a discontinuous clayey silt unit within the sand unit; sand and gravel unit; and the Raritan Formation. Due to the heterogeneous nature of the geology, some, but not all, of the units may or may not be present at each boring. The thickness of the upper glacial aquifer adjacent to the Site is approximately 108.5 feet thick (DEC-031TC). An isopleth of the top of Raritan Formation is shown on Figure 2-8.

The fill unit, varying in thickness from approximately 0 to 11 feet, consists of a heterogeneous mixture of sand, silt, clay and varying amounts of construction and demolition debris (i.e., bricks, concrete, coal, slag, etc.). Potentially former MGP related fill material (i.e., cinder and/or trace slag) was found to be present across Vandervoort Avenue in the vicinity of a Former MGP facility in DEC-014D (5-7 feet below ground surface [bgs]), DEC-043 (1-11 feet bgs), SG-079 (1-2 feet bgs), and SG-086 (at 1 foot bgs) [Plate 2]. The fill layer was also identified between 2.5 and 7 feet bgs in borings AWL-1 through AWL-6 advanced inside the AWL Industries, Inc. building.

The glacial till unit was noted at the surface in some borings and consists of a heterogeneous mixture of sand, silt, and clay and varying amounts of gravel, cobbles and boulders. The sand unit is present at all the boring locations and is represented by stratified sands of varying textures containing some to no fines. The lacustrine clayey silt/silt unit has been observed as an inclusive unit within the sand unit. The thickness of the clayey silt/silt unit, where present, varies from 0.5 to over 10 feet thick.

The sand and gravel unit has been found to overlie the Raritan Formation at DEC-029TC and DEC-031TC. The Raritan Formation consisted of gray or dark gray, silt with some clay and fine sand stringers; clay with some sand; clay and silt; or fine sand and silt.

2.5 Geotechnical Test Results

Geotechnical samples were collected from the Klink Cosmo area during both phases of the RI field activities and from the SC Phase VI field activities. Soil samples from grab samples and Shelby tubes were analyzed by 3rd Rock for grain size distribution (ASTM D422), Atterberg Limits (ASTM D4318), and falling head permeability (ASTM D5084). Results are discussed below.

2.5.1 Geotechnical Samples from Upper Glacial Aquifer

Upper glacial aquifer samples were collected from DEC-011D, DEC-028D, DEC-029D, and DEC-044D with depths between 50 and 84.5 feet bgs. The soils were identified as poorly graded sand, well graded sand with silt and gravel, silt, clay, and clay with sand with USCS classifications of SP, SW-SM, ML, CL and CH. Soils were identified as either non-plastic or of low plasticity. Three samples were analyzed by ASTM D5084 Method C for permeability. The measured permeability values were 2.0×10^{-3} cm/sec for the silty sand.

2.5.2 Geotechnical Samples from Top of Raritan Formation

Samples were collected from the top of the Raritan Formation, and included samples from the silty sand material from above the clay, DEC-029TC (108-113 feet bgs) and DEC-031TC (105-106 feet bgs), and from the clay DEC-029TC (115-117 feet bgs) and DEC-031TC (115-116.5 feet bgs). USCS classifications in the Raritan Formation ranged from SM, ML, and CL. Soils were identified as either non-plastic or of low plasticity. The measured permeability values varied between 1.7×10^{-6} to 9.9×10^{-6} cm/sec for the clay.

2.6 Groundwater Levels and Hydrogeology

The primary hydrogeologic unit identified within the investigation area is the upper glacial aquifer. Groundwater in the area is generally present in unconfined conditions; however, localized semi-confined or confined conditions are possible due to the presence of interbeds of sand, clay, and silt. The water table surface may be found between approximately 25 and 50 feet bgs depending on the well location.

During RI Phase II field activities, an additional synoptic round of groundwater levels was obtained on March 28 and 29, 2012 from monitoring wells in the Klink Cosmo area. Potentiometric surface maps based on the water level measurements obtained on March 28 and 29, 2012 are provided in

Figure 2-9 for the shallow overburden wells (i.e., up to 60 feet bgs) and in Figure 2-10 for the deep overburden wells (i.e., between approximately 60 and 110 feet bgs). During the SC Phase VI field activities the flow direction of groundwater above the top of Raritan clay (i.e., approximately 110 feet bgs) was determined to be to the northeast/northwest. In the immediate vicinity of the Former Klink Cosmo Cleaners Site area, the shallow and deep groundwater flow is east/northeast. The horizontal hydraulic gradient of the shallow groundwater flow during the RI Phases was less than approximately 0.001 to 0.004 foot per foot (ft/ft). In the immediate vicinity of the Former Klink Cosmo Cleaners Site area, groundwater measurements in the top of Raritan Formation monitoring wells were similar (2 feet in DEC-031TC and 2.18 feet in DEC-029TC).

Vertical hydraulic gradients in well pairs DEC-043/043D, DEC-064/064D, DEC-065/065D, and DEC-066/066D are positive or downwards (0.004, 0.002, 0.012, 0.006 ft/ft, respectively). Vertical hydraulic gradients in the majority of well pairs downgradient of the site, DEC-014R/014D, DEC-015/015D, DEC-029/029D, DEC-031/031D, and DEC-045/045D, were slightly negative, or upwards (-0.002 to -0.007 ft/ft) based upon the water level information. Vertical hydraulic gradients in well pairs DEC-006D/006DD, DEC-007/007D, DEC-013/013D, DEC-030/030D, and DEC-044/044D were also upwards but were greater in magnitude (-0.012 to -0.017 ft/ft).

The vertical hydraulic gradients in top of Raritan Formation well triplets were similar in direction and magnitude during RI Phase II field activities. Vertical hydraulic gradients between the shallow and top of Raritan Formation wells at DEC-029/029TC and DEC-031/031TC were slightly negative or upwards (-0.002 to -0.006 ft/ft, respectively). Vertical hydraulic gradients between the deep and top of Raritan Formation wells at DEC-029D/029TC and DEC-031D/031TC were slightly positive or downwards (0.004 to 0.003 ft/ft, respectively).

2.6.1 Slug Test Results

Horizontal hydraulic conductivity values calculated based upon rising and falling head slug tests for the shallow overburden (i.e., upper Glacial Aquifer) ranged from 2.69×10^{-5} cm/sec to 4.77×10^{-3} cm/sec, and for the deep overburden ranged from 9.74×10^{-3} cm/sec to 2.48×10^{-2} cm/sec.

2.7 Surface Water and Hydrology

The site area slopes slightly to the east and south and is bounded by streets on the north, west and east. The surface of the site is mostly covered by buildings and/or pavement/sidewalks. There is a storm water drop inlet (DI) along Richardson Street near Vandervoort Avenue.

The nearest surface water body is Newtown Creek located approximately 2,500 feet northeast of the site. Newtown Creek is classified as a Class SD (marine waters) surface water body by the NYSDEC. The best usage of Class SD waters is fishing. These waters are suitable for fish, shellfish, and wildlife survival. The classification may be given to those waters that, because of natural or man-made conditions, cannot meet the requirements of primary and secondary contact recreation and fish propagation. While Newtown Creek may not be suitable for swimming and other recreational activities that involve human contact with surface water, individuals use Newtown Creek for fishing and boating. Water is not withdrawn from Newtown Creek for potable use. Numerous storm water drains from surrounding roadways and permitted Spill Discharge Elimination System (SPDES) outfalls discharge into Newtown Creek, including those discharging groundwater collected and treated on the nearby ExxonMobil remediation site.

Surface water levels within Newtown Creek vary depending on the tide. High tide in Newtown Creek is generally at an elevation of 4 to 5 feet above mean sea level (amsl); low tide is generally at an elevation of 0 to -1 feet amsl (www.saltwatertides.com).

2.8 Utilities

Utilities on and near the site include underground water, electric, natural gas, sanitary and storm sewer. There is a storm water drop inlet (DI) along Richardson Street near Vandervoort Avenue. Overhead electric and communication lines run north-south adjacent to the site within the eastern sidewalk along Morgan Avenue, north-south within the western sidewalk along Vandervoort Avenue, and east-west within the north sidewalk along Withers Street. Fire hydrants are located on Richardson Street, Morgan Avenue, Withers Street, and Vandervoort Avenue. A series of interconnected floor drains were identified inside the AWL Industries, Inc., building and these are depicted on Figure 2-11 (i.e., AWL-FD-1 through AWL-FD-4).

2.9 Nature and Extent of Contamination

The overall nature and extent of contamination associated with the Former Klink Cosmo Cleaners Site is based upon the information obtained as part of the investigation phases. The findings of the investigations were summarized in the various reports noted above and the key aspects of the nature and extent of contamination in affected media is presented in this section and provides the estimated areas, volumes, and quantities appropriate for remediation. Based upon the findings of the investigations conducted to date, this summary is divided into two separate areas that were affected by operations at the Former Klink Cosmo Cleaners Site: 1) On-Site Source Area; and 2) Off-Site Areas of affected media.

2.9.1 Standards, Criteria, and Guidance

For each medium, detected concentrations of individual contaminants were compared to applicable standards, criteria and guidance values (SCGs). The SCGs determined during the RI, SC, and Pilot Study phases for the individual media are identified below.

Three sources of soil SCGs are considered appropriate for this site: site-specific background soil results, NYSDEC Part 375, and NYSDEC CP-51. CP-51 supplements Part 375 by providing criteria for contaminants previously included under TAGM 4046 where values were not included in Part 375. Hereafter, mention of Part 375 includes incorporation of CP-51 criteria values. Part 375 Unrestricted Use Criteria are considered to assist in the development of a remedial alternative capable of achieving unrestricted future use as required by DER-10 Section 4.4 (b) 3 ii. In addition, Commercial use soil criteria and Protection of Groundwater criteria for the AWL Industries, Inc. property. The SCGs for groundwater are the Class GA standards and guidance values presented in TOGS 1.1.1. There are no criteria for soil vapor analytical data. There are no criteria for soil vapor analytical data beneath public sidewalks. However, NYSDOH promulgates sub-slab soil vapor/indoor air concentrations for TCE, cis-1,2-DCE, 1,1-DCE, carbon tetrachloride (Matrix A); PCE, 1,1,1-TCA, and methylene chloride (Matrix B); and vinyl chloride (Matrix C) at locations occupied by structures/residences, and these are considered applicable SCGs.

2.9.2 Soil

On August 3, 2011, eight soil samples were obtained from the 0 to 2-foot depth interval from eight locations in Monsignor McGolrick Park, located northwest of the site, as part of the SC Phase VI field activities. These samples were analyzed for target compound list/target analyte list (TCL/TAL) contaminants. Detected concentrations will be considered to be representative of site-specific background for the Klink Cosmo Site. These soil background concentrations will be included as soil SCGs on the soil analytical tables presented below. Since the detected concentrations of di-n-butylphthalate, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin, arsenic, copper, iron, lead, mercury, and zinc exceeded Part 375 Unrestricted Use criteria in the background soil samples, these contaminants are considered to be present as background for the site.

As part of the field investigations, soil samples were obtained from soil borings on properties zoned residential and/or manufacturing by the NYC Department of City Planning. The zoning classification for the property of location of the soil boring is a consideration in the determination of the appropriate soil SCGs. The majority of properties within the investigation area are zoned manufacturing.

As discussed in Section 2.1.1, properties located in the manufacturing districts in NYC may be either industrial or commercial use. However, land uses allowed within manufacturing districts include residential use either within special mixed use districts or by special permit. Residences may be present on properties throughout the entire investigation area. The nearest residences are located along the west side of Vandervoort Avenue just north of Division Place. The AWL Industries, Inc. property is used for commercial purposes, therefore the commercial Part 375 commercial use soil cleanup criteria applies. Residential use soil cleanup objectives were also used for comparison purposes given the special mixed use zoning.

2.9.2.1 On-Site Source Area

A statistical summary of the detected analytical results in on-site soil samples as compared to Unrestricted Use, Protection of Groundwater, Commercial, and Site Background SCGs is presented in Table 2-1A through 2-1D for the locations within the AWL Industries, Inc. building. Thirty-seven soil samples were collected and analyzed for VOCs, and seven soil samples were collected for SVOCs, pesticides, PCBs, and metals as part of site investigations. Not all locations were sampled for all parameters during the sampling events.

Detected VOCs exceeding criteria included chlorinated VOCs (CVOCs) and acetone. SVOCs exceeding criteria included di-n-butylphthalate and PAHs [i.e., benzo(a)anthracene, benzo(a)pyrene, benzo(f)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene]. Pesticides and metals exceeding criteria included 4,4'-DDD and aldrin, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, mercury, nickel, and zinc (Figures 2-12 and 2-12A). However, detected compounds exceeding Commercial Use criteria included tetrachloroethene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, barium, copper, and lead. Detected concentrations of SVOCs, metals, and pesticides are typical for urban fill materials and shallow soil and are not considered to be associated with past operations at the AWL Industries, Inc. property. The primary contaminants originating from the Site are CVOCs, in particular, PCE and TCE. The other detected compounds and metals are not likely attributable to former dry cleaning operations at the Site. This following discussion focuses on the CVOCs.

Isoconcentration contours and/or detected maximum PCE and TCE concentrations in soil for each sampling location (i.e., on-site and off-site locations) are shown on Figures 2-13 and 2-14 (see inset for on-site locations), respectively. The highest concentration of PCE was found in samples collected from borings advanced inside the AWL Industries, Inc. building and, with the exception of AWL-06, all

on-site soil results exceeded Unrestricted and Protection of Groundwater criteria. Concentrations of PCE exceeded the Commercial Use criterion at four samples and were detected at the highest concentration at AWL-02 (273 mg/kg). The highest concentration of TCE was also found in soil beneath the AWL Industries, Inc. building. Locations AWL-02 and AWL-03 had concentrations that exceeded only Unrestricted Use and Protection of Groundwater criteria. No other locations exceeded any criteria. Based upon the soil sample results, the source of PCE and TCE contamination is located beneath the concrete floor slab in the eastern portion of the AWL Industries, Inc. building at depths ranging from immediately below the concrete slab to 35 feet bgs, which is the depth to the water table surface.

2.9.2.2 Floor Drain Sediment Analytical Results

The floor drain sediment samples collected during the On-Site RI were compared to Part 375 criteria identified for the soil samples discussed in Section 2.9. Soil sample SCGs were used because these are samples from floor drains and not sediment samples from a water body.

A summary of the detected analytical results in floor drain sediment samples were compared to Unrestricted Use, Protection of Groundwater, Commercial, and Soil Background SCGs and are presented in Tables 2-2A through 2-2D.

Compounds exceeding Unrestricted Use criteria include: PCE; the SVOC di-n-butlyphthalate; the pesticides 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin, endrin, and heptachlor epoxide; and the metals antimony, arsenic, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, vanadium and zinc. The highest concentration of PCE was at location AWL-FD-1 at 15 mg/kg followed by AWL-FD-3 with 1.7 mg/kg. The majority of non-VOC exceedances and highest concentrations were at location AWL-FD-1.

The following compounds exceeded Protection of Groundwater criteria in one or more locations: PCE, dieldrin, heptachlor epoxide, arsenic, cadmium, copper, lead, manganese, mercury, nickel and zinc. Almost all the Protection of Groundwater exceedances were at location AWL-FD-1. PCE, heptachlor epoxide, copper and nickel at location AWL-FD-3 were the only other exceedances.

The following compounds exceeded Commercial Use criteria in one or more locations: arsenic, cadmium, chromium, copper, lead, and nickel.

Compounds exceeding Site Background criteria in On-Site RI floor drain sediment samples include di-n-butlyphthalate, 4,4'-DDD, dieldrin, aluminum, arsenic, copper, iron, lead, mercury and zinc. The majority of exceedances were at location AWL-FD-1.

2.9.2.3 Off-Site Area

A statistical summary of the detected analytical results in off-site soil samples as compared to Unrestricted Use, Protection of Groundwater, Residential, and Site Background SCGs is presented in Tables 2-3A through 2-3D for the off-site locations. One hundred seventeen soil samples were collected and analyzed for VOCs, and eight soil samples were collected for SVOCs. Seven samples were collected for pesticides, PCBs, and metals. Not all locations were sampled for all parameters during the sampling events.

Detected VOCs exceeding criteria included PCE, acetone, xylenes, and methylene chloride. SVOCs exceeding criteria included di-n-butylphthalate and 2-methyl naphthalene. Metals exceeding criteria included aluminum, chromium, cobalt, iron, lead, mercury, nickel, and vanadium. The primary contaminant originating from the Site is PCE. The other detected compounds and metals are not likely attributable to former dry cleaning operations at the Site. This following discussion focuses on PCE.

In the adjacent off-site area, only Unrestricted Use, Residential Use, and Protection of Groundwater criteria were exceeded for PCE, at locations AS-01 and SVE-01, which were advanced in the sidewalk area adjacent to the AWL Industries, Inc. building. No other off-site locations had concentrations of PCE that exceeded criteria. TCE did not exceed any criteria in any off-site sample locations.

2.10 Groundwater

2.10.1 On-Site Area

Groundwater samples were collected from five temporary well locations within the building (AWL-01, AWL-02, AWL-03, AWL-04 and AWL-05). Figure 2-15 depicts groundwater results exceeding criteria for sampling locations in the on-site area and adjacent off-site area. Table 2-4 provides a statistical summary of the detected parameters for the On-Site groundwater samples (including quality assurance/quality control samples) as follows: the number of detections; the minimum, maximum and average values; and the location of the maximum value. Groundwater samples from these locations are representative of the shallow groundwater. PCE was detected above Class GA groundwater standards in four of five sample locations within the building footprint with concentrations ranging from a high of 2,800 µg/L (AWL-05) to a low of 870 µg/L (AWL-01). TCE was detected in four of five sample locations within the building footprint near the northeast corner, ranging from a high of 12 µg/L (AWL-03) to a low of 1.8 µg/L (AWL-01) with AWL-03, AWL-04 and AWL-05 exceeding groundwater criteria

(Figure 2-15). The presence of PCE and TCE degradation products have also been detected in the groundwater samples at concentrations exceeding groundwater criteria. Cis-1,2-DCE was detected above groundwater criteria in 3 of 5 groundwater sample locations from within the AWL building footprint. The range of cis-1,2-DCE varied from 11 µg/L to 1.8 µg/L, with the highest concentration detected at AWL-05. No other breakdown products were detected within the building footprint.

Benzene and toluene were detected above criteria only in samples AWL-03 (1.3 µg/L) and AWL-01 (7.8 µg/L), respectively.

Metals detected above criteria in the groundwater samples include arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, magnesium, manganese, nickel, sodium and thallium. The AWL exceedances, especially metals, may be high biased since they are from temporary monitoring wells. Because temporary monitoring wells are not constructed with sandpacks and are not developed or purged, they tend to have high turbidity levels. For example, iron concentrations in the AWL well samples ranged from 61,800 µg/L to 332,000 µg/L. In contrast iron concentrations in groundwater from the surrounding off-site monitoring well results ranged from 1,200 µg/L to 17,800 µg/L.

2.10.2 Off-Site Area Shallow Groundwater Zone

Three-hundred and three groundwater samples were collected and analyzed for VOCs, seven groundwater samples were collected for SVOCs and metals, and six groundwater samples were collected for pesticides and PCBs as part of site investigations. Total and dissolved iron were analyzed in 100 and 94 groundwater samples, respectively, and several groundwater samples were collected and analyzed for miscellaneous water quality parameters, natural attenuation parameters, and CSIA parameters. Not all locations were sampled for all parameters during the multiple sampling events. A summary of the detected TCL VOCs, SVOCs, total and dissolved metals, miscellaneous water quality and natural attenuation parameters from groundwater samples collected during investigations to date is presented in Table 2-5. This table also provides a statistical summary of the detected parameters for the groundwater samples. Results exceeding TOGS No. 1.1.1 Class GA groundwater criteria are indicated with a circle.

Detected VOCs exceeding Class GA groundwater criteria included CVOCs, BTEX compounds, chlorinated benzene isomers, chloroform, acetone, MTBE, and other aromatic hydrocarbons. Detected SVOCs included di-n-butylphthalate and phenol. Concentrations of dieldrin and gamma-BHC exceeded SCGs in one groundwater sample. Concentrations of total iron, manganese, and sodium exceeded SCGs in at least 1 location and as many as 77 locations in the case for iron. The primary contaminants originating from the Site are CVOCs, in particular, PCE, TCE, and to a lesser extent - cis- and trans-1,2-

DCE, and VC. Other notable CVOC detections but at generally low concentrations include 1,1,1-trichloroethane, 1,1-dichloroethane, and 1,2-dichloroethane. BTEX compounds, aromatic benzene compounds, acetone, chlorinated benzenes, and metals are not attributable to former dry cleaning operations at the Site, and are likely attributable to miscellaneous spills or other sources. This following discussion focuses on the CVOCs.

Isoconcentration contours and/or detected maximum PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and VC concentrations recorded from all sampling events for each groundwater sampling location designated within the on-site and off-site areas in the shallow groundwater overburden zone are shown on Figures 2-16, 2-17, 2-18, 2-19 and 2-20, respectively.

PCE was detected in 260 of the 303 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 1.2 µg/L to 46,000 µg/L (Figure 2-16). Two hundred thirty six samples had concentrations exceeding the groundwater criterion. The highest concentration of PCE in the shallow groundwater was detected at DEC-014R (46,000 µg/L). The extent of the PCE contamination plume in the shallow zone is several blocks wide extending beyond Lombardy Street to the northeast. The direction of the plume flow is toward the north/northeast.

TCE (Figure 2-17) was generally detected at much lower concentrations compared to the PCE concentrations, suggesting that little reductive dechlorination of PCE and TCE is occurring. TCE was detected in 236 of the 303 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 0.52 µg/L to 2,100 µg/L. One hundred seventy one samples had concentrations exceeding the groundwater criterion. The highest concentrations of TCE in the shallow groundwater was detected at DEC-156 (2,100 µg/L) and DEC-071 (1,000 µg/L) which are located on Morgan Avenue a few blocks northwest of the Site. TCE contamination in this area appears to be attributable to another source(s). At and near the Klink Cosmo Site, the extent of the TCE contamination plume in the shallow zone is much less concentrated than the PCE contamination plume suggesting that little reductive dechlorination of PCE is occurring.

Cis-1,2-DCE and trans-1,2-DCE were generally detected at much lower concentrations and less frequently than PCE and TCE (Figures 2-18 and 2-19, respectively). Cis-1,2-DCE was detected in 174 of the 303 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 0.90 µg/L to 230 µg/L. Trans-1,2-DCE was detected in 26 of the 303 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 0.69 µg/L to 48 µg/L. VC was detected in 21 of the 303 samples collected from monitoring

well locations as part of investigations to date at concentrations ranging from 1.0 µg/L to 48 µg/L (Figure 2-20). It appears that DCE and VC is attributable to the source(s) of TCE near DEC-156 and DEC-071).

2.10.3 Off-Site Deep Overburden Groundwater Zone

One-hundred and sixty seven groundwater samples were collected and analyzed for VOCs, three groundwater samples were collected for SVOCs and pesticides and PCBs, and two samples were collected for metals as part of site investigations. Total and dissolved iron were analyzed in 78 and 76 groundwater samples, respectively, and several groundwater samples were collected and analyzed for miscellaneous water quality parameters, natural attenuation parameters, and CSIA parameters. Not all locations were sampled for all parameters during the multiple sampling events. A summary of the detected TCL VOCs, SVOCs, total and dissolved metals, miscellaneous water quality and natural attenuation parameters from groundwater samples collected during investigations to date is presented in Table 2-6. This table also provides a statistical summary of the detected parameters for the groundwater samples. Results exceeding TOGS No. 1.1.1 Class GA groundwater criteria are indicated with a circle.

Detected VOCs exceeding Class GA groundwater criteria included CVOCs, and chloroform. There were no SVOCs exceeding SCGs. No pesticides or PCBs were detected. Concentrations of total iron, magnesium, manganese, and sodium exceeded SCGs in at least 1 location and as many as 44 locations in the case for iron. The primary contaminants originating from the Site are CVOCs, in particular, PCE, TCE, and to a lesser extent cis- and trans-1,2-DCE, and VC. Other notable CVOC detections but at generally low concentrations include 1,1,1-trichloroethane, 1,1-dichloroethane, and 1,2-dichloroethane. The following discussion focuses on PCE and TCE.

Isoconcentration contours and/or detected maximum PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and VC concentrations recorded from all sampling events for each groundwater sampling location designated within the off-site area in the deep groundwater overburden zone are shown on Figures 2-21, 2-22, 2-23, 2-24 and 2-25, respectively.

PCE was detected in 130 of the 167 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 0.44 µg/L to 7,000 µg/L (Figure 2-21). One hundred five samples had concentrations exceeding the groundwater criterion. The highest concentration of PCE in the deep groundwater was detected at DEC-029D (7,000 µg/L). TCE (Figure 2-22) was generally detected at much lower concentrations compared to the PCE concentrations, suggesting that little reductive dechlorination of PCE and TCE is occurring. TCE was detected in 120 of the 167 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from

0.46 µg/L to 1,300 µg/L. Seventy-nine samples had concentrations exceeding the groundwater criterion. The highest concentrations of TCE in the deep groundwater was detected at DEC-005D (70,000 µg/L) and DEC-039D (1,300 µg/L) which are located on Vandervoort Avenue and Lombardy Street a few blocks northwest of the Site adjacent to the ACME Steel/Metal Works Site (Site No. 224131). TCE contamination at these locations appears to be attributable to the ACME Steel Site. The extent of the TCE contamination plume in the shallow zone is much less concentrated than the PCE contamination plume suggesting that little reductive dechlorination of PCE is occurring at and near the Klink Cosmo Site.

Cis-1,2-DCE and trans-1,2-DCE were generally detected at much lower concentrations and less frequently than PCE and TCE (Figures 2-23 and 2-24, respectively). Cis-1,2-DCE was detected in 86 of the 167 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 0.61 µg/L to 290 µg/L. Trans-1,2-DCE was detected in 14 of the 167 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 1.1 µg/L to 67 µg/L. VC was detected in 7 of the 167 samples collected from monitoring well locations as part of investigations to date at concentrations ranging from 1.1 µg/L to 41 µg/L (Figure 2-25).

2.10.4 Summary of Groundwater Analytical Results in the Klink Cosmo Area

PCE and its degradation products were detected in numerous groundwater monitoring wells in both the shallow and deep overburden groundwater as well as in downgradient top of clay monitoring wells. High concentrations of PCE were detected at the site, in groundwater samples collected directly beneath and within the contaminated soil source area located beneath the AWL Industries, Inc. building, and in groundwater samples collected from shallow and deep overburden groundwater monitoring wells located adjacent to and downgradient of the onsite soil source area.

The horizontal extent of the dissolved phase PCE and TCE groundwater plume extends to the northeast into the ACME Steel Area (near the intersection of Lombardy Street and Porter Avenue). Based upon the observed concentrations of CVOCs from groundwater sampling events, a dissolved phase chlorinated solvent plume originates at the Former Klink Cosmo Cleaners Site. The horizontal extent of dissolved phase CVOC contamination associated with the Klink Cosmo Site chlorinated solvents has been delineated, although other sources are contributing to the overall distribution of CVOCs. The chlorinated solvent plumes in the shallow and deep overburden have higher concentrations of PCE immediately north and east of the Former Klink Cosmo Cleaners Site. The extent of PCE has a larger

footprint in the shallow groundwater compared to the deep groundwater and is migrating to the northeast and comingles with the dissolved chlorinated solvent plume originating from other sources and within the ACME Steel source area.

The vertical extent of PCE and TCE impacted groundwater was determined to extend down to the top of the Raritan Formation. The vertical extent of PCE and TCE impacted groundwater is not expected to migrate below the top of the Raritan Formation due to its vast areal extent and low permeability.

Based upon the data collected to assess the potential for degradation of PCE in the groundwater system as presented above, there is evidence that some reductive dechlorination is occurring in the vicinity of the site. Rates of degradation are very difficult to determine due to the unknown quantity of source material present beneath the Former Klink Cosmo Cleaners Site. Based upon the geochemical conditions in the groundwater system, the aquifer is only slightly conducive for naturally occurring reductive dechlorination. It is possible that the geochemical conditions could be enhanced via in-situ bioremediation technologies to further promote higher rates of reductive dechlorination.

2.11 Non-Aqueous Phase Liquids

During the RI Phase I field activities, petroleum related light non-aqueous phase liquid (LNAPL) found in upgradient monitoring well DEC-048 was analyzed for VOCs, SVOCs, and fuel fingerprint (SW-846 Method 8015), and specific gravity. Fuel oil was detected at a concentration of 950,000 mg/kg (95%). NYSDEC Spill No. 1103190 was assigned on June 21, 2011 to the LNAPL found in this area. Organics detected, at concentrations ranging from 130 ppm to 3,500 ppm, include: 1,2,4-trimethylbenzene, 2-methylnaphthalene, acenaphthene, fluorene, naphthalene, phenanthrene, and pyrene. These detected compounds are consistent with fuel oil(s). Two additional compounds, 1,1-biphenyl and bis (2-ethylhexyl) phthalate were also detected within the same range of concentrations. The specific gravity of the sample at 60 degrees F was determined to be 0.8608, which is consistent with a No. 2 fuel. A comparison of the DEC-048 sample chromatogram to a general diesel/Fuel Oil No. 2 chromatogram indicates a similarity, although degradation of the product found in DEC-048 is evident. The spill is being managed under the NYSDEC Spills Program and will not be addressed as part of the FS.

2.12 Soil Vapor Results

Soil vapor in the Klink Cosmo area has been adversely impacted by the presence of PCE, TCE and their daughter products. The elevated soil vapor concentrations were generally present to the west, north and the eastern perimeter of the Former Klink Cosmo Cleaners building (Figure 2-26) and

immediately down gradient (SG-060, SG-082, SG-083, SG-084, SG-086, SG-087, SG-116, SG-117, SG-118, and SG-119) [Figures 2-27 and 2-28]. A second area of elevated soil vapor concentration was found north/ northwest of the site (i.e., SG-048 and SG-056).

2.12.1 On-Site RI Soil Vapor Results

The six subslab sampling locations where VOCs were detected in soil vapor during the On-Site Phase III RI, including PCE and its breakdown products, are shown on Figure 2-26. A summary of detected VOCs in the soil vapor and ambient air samples collected during the On-Site Phase III RI is presented in Table 2-7. Table 2-7 provides a statistical summary of the detected parameters for the On-Site Phase III RI soil vapor samples as follows: the number of detections; the minimum, maximum and average values; and the location of the maximum value.

One outdoor air sample was collected during the On-Site Phase III RI sampling to represent background air conditions. VOCs detected in the outdoor air sample include 1,2,4-trimethylbenzene, acetone, benzene, chloromethane, dichlorofluoromethane, ethylbenzene, methyl ethyl ketone, methylene chloride, PCE, toluene, trichlorofluoromethane and xylene. Concentrations of VOCs in the outdoor air samples ranged from 0.056 to 16.3 $\mu g/m^3$. PCE was the highest concentration VOC detected in the outdoor air.

PCE was detected in all six subslab soil vapor sampling locations, at concentrations ranging from 27,300 $\mu g/m^3$ (AWL-SV-5) to 2,090,000 $\mu g/m^3$ at location AWL-SV-4. Reported PCE concentrations at all subslab locations were above the soil vapor intrusion SCG criterion of 1,000 $\mu g/m^3$, indicating mitigation is required. The average PCE concentration was 1,040,000 $\mu g/m^3$. All of these subslab soil vapor sampling locations are located within the footprint of the AWL Industries, Inc. building and soil vapor contamination correlates with the subsurface soil contamination.

Concentrations of TCE, detected in all sample locations, were significantly lower than PCE concentrations, ranging from 140 $\mu g/m^3$ (AWL-SV-5) to 7,380 $\mu g/m^3$ at AWL-SV-2. The average concentration was 4,193 $\mu g/m^3$. Reported TCE concentrations at all subslab locations were above the soil vapor intrusion SCG criterion of 60 $\mu g/m^3$, indicating mitigation is required. Cis-1,2-dichloroethene was the only other breakdown product, detected in five of seven locations (5.95 $\mu g/m^3$ to 3,570 $\mu g/m^3$ with an average of 1,093 $\mu g/m^3$). Detected concentrations of cis-1,2-dichloroethene exceeded the soil vapor intrusion criterion of 60 $\mu g/m^3$, indicating mitigation is required. It should be noted that because of the high PCE concentrations, the reporting limits for the non-detect compounds are elevated due to sample

dilution. Therefore, additional daughter products may be present but were at concentrations below the reporting limits.

In addition to the VOCs listed above, detections in the sampled locations include: 1,1,1-trichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, acetone, chloroform, ethylbenzene, methyl ethyl ketone, methylene chloride, toluene and xylene. 1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, toluene and xylene contaminants suggest a possible petroleum source.

2.12.2 Off-Site Soil Vapor Results

Using the maximum detected results from the sampling events at each soil vapor location in the Klink Cosmo area, isoconcentration contours were developed for PCE and TCE and presented in Figures 2-27 and 2-28, respectively. A summary of detected VOCs in the soil vapor and ambient air samples collected during the Off-Site investigations is presented in Table 2-8. The highest soil vapor concentrations were beneath the AWL Industries, Inc. building and to the north, east and south of the building. A second area of elevated PCE soil vapor concentration was found north/northwest of the site (i.e., SG-112, SG-048 and SG-056). Other areas with high PCE concentration were further northwest (SG-0043 and SG-040) and west (SG-086). These high concentration pockets of PCE may be attributable to other sources in the area. VOCs (in addition to PCE and TCE) detected in approximately half (or more) of the sampled locations include: 1,1,1-trichloroethane, 1,2,4-trimethylbenzene, cis-1,2-dichloroethene, benzene, chloroform, ethanol, MEK, methylene chloride, hexane, toluene, and xylene. These contaminants suggest a possible petroleum or fuel source. The majority of soil vapor samples along Vandervoort Avenue and Division Place all had significant concentrations of petroleum related compounds. SG-113 (along Vandervoort Avenue) and SG-114 (along Division Place) had the highest total VOCs concentrations compared to other locations in the area. Fewer contaminants were present along Morgan Avenue and Richardson Street. The highest levels of TCE were found on the eastern side of the AWL Industries, Inc. building along Vandervoort Avenue (SG-049, SG-116).

2.13 Qualitative Human Health Exposure Assessment

Based upon the analytical data obtained and presented in this Section, the contaminants of potential concern (CPCs) were selected based on the frequency of detection, range of concentrations, and potential for migration, as well as whether the detected analytes exceeded applicable standards, criteria, or guidance values for the media. A “medium of potential concern” is identified as a physical medium (soil, groundwater, soil vapor) in which one or more contaminants were detected at concentrations exceeding their SCGs.

Soil analytical results were compared to soil background concentrations (surface soil samples from McGolrick Park), and Part 375 Unrestricted Use criteria as presented on Tables presented in Section 2. VOCS, SVOCs, pesticides, and metals exceeded background concentrations or Part 375 Unrestricted Use criteria and are considered CPCs for soil.

Several VOCs, SVOCs, pesticides, and metals were detected in groundwater. For groundwater, the SCGs are the NYSDEC Class GA (groundwater) standards and guidance values presented in TOGS 1.1.1, April 2000 (including subsequent revisions). All contaminants detected in groundwater that exceeded SCGs are considered CPCs. Table 2-9 presents a summary of CPCs for soil, groundwater, and soil vapor at on-site and off-site sampling locations.

Soil vapor was also sampled during the investigation and found to be contaminated with VOCs. There are no criteria for soil vapor analytical data; however, the NYSDOH Soil Vapor Guidance Decision Matrices A, B, and C (NYSDOH 2006, with updates) were utilized to evaluate the potential for soil vapor intrusion by reviewing sub-slab vapor concentrations for the VOCs relevant to the Decision Matrices: Matrix A - 60 $\mu g/m^3$ for TCE, carbon tetrachloride, cis-1,2-dichloroethene, and 1,1-dichloroethene; Matrix B - 1,000 $\mu g/m^3$ for PCE, 1,1,1-trichloroethane, and methylene chloride; and Matrix C - 60 $\mu g/m^3$ for VC. Detected analytical results were sufficiently high for either PCE and/or TCE and methylene chloride at many locations to indicate the highest level of action recommended: mitigate. These compounds are therefore considered CPCs for soil vapor as indicated on Table 2-9.

Tables 2-10 and 2-11 present a summary of the potential routes of exposure, the potential receptors, and the potential completed pathways. There are completed exposure pathways from soil under the current and future use conditions during construction activities. There are potential exposure pathways from soil vapor and outdoor air through the inhalation of VOCs to construction workers, On-Site employees, and the pubic under both the current and future use scenarios. Exposure pathways are not complete for any receptors for groundwater. Figure 2-29 depicts the Conceptual Site Model.

2.13.1 Fish and Wildlife Resources Impact Analysis

Results of the Fish and Wildlife Resources Impact Analysis indicate that the site is located in an old, highly developed, urbanized area. Plant communities in the off-site project area include mowed lawn and trees, mowed lawn, and vegetated areas on disturbed sites. These communities are associated with residential, recreational, commercial and industrial areas in the project area. No plant communities were identified in the on-site area. The results of the FWRIA Step I analysis indicate that there is limited potential for wildlife at the site. Because of its location in an urbanized area and the presence of the

building and sidewalks which cover most of the surface of the site, the site provides very little if any suitable habitat for wildlife other than Norway rat, house mouse and perching birds. The site does not provide any current or potential value to humans as a nature recreation area.

2.14 Summary of Soil Vapor Extraction/Air Sparge Pilot Test

URS conducted a combination soil vapor extraction/air sparge (SVE/AS) pilot test at the Former Klink Cosmo Cleaners Site in mid-November 2015 to verify that SVE would be effective at this Site and to determine values for design of a full-scale remediation system. Based on the vacuum gauge pressure measurements during the SVE/AS Pilot Test with both SVE wells operating, the ROI developed was at least 40 feet. Average radius of influence (ROI) based upon data collected as part of the SVE/AS Pilot Study indicated the ROIs in SVE-1 and SVE-2 ranged from approximately 40 to 75 ft. The intrinsic permeability is the measurement for the ability of fluids (groundwater and air) to pass through soils, and is typically used as an indicator to determine the effectiveness of SVE. Intrinsic permeability is a function of soil properties only, whereas hydraulic conductivity is a function of both soil and fluid properties. Using the hydraulic conductivity values provided in the Remedial Investigation Phase II Report, the intrinsic permeability (k_i) was calculated to be 5.55×10^{-8} cm^2. This corresponds to the permeability expected for fill, sand, gravel, and a sandy silt layer observed in the formation above the water table and corresponds to an environment that would be conducive to SVE remediation. Based upon the results of the SVE/AS Pilot Test, the NYSDEC determined that this technology would be used to remediate the on-site source area as an Interim Remedial Measure (IRM). Because the on-site source area is not accessible due to the AWL Industries, Inc. operations, the NYSDEC determined that the IRM would need to be designed to operate from the adjacent perimeter sidewalk area as discussed below.

2.14.1 Conceptual Design Layout for Source Perimeter Treatment

Figure 2-30 provides a conceptual design layout of SVE and AS wells for treating the contaminant source along the perimeter of the warehouse building. The following paragraphs and details in the Pilot Test Report (URS, 2016) provide the basis, assumptions, calculations and references used to develop the conceptual design.

2.14.1.1 Recommended Locations and Depths of Soil Vapor Extraction Wells

Based on an ROI of 40 feet, four additional SVE wells will be installed on the sidewalk adjacent to the Former Klink Cosmo building to remediate the source area. One of the additional extraction wells will be installed near the intersection of Richardson Street and Vandervoort Avenue, two additional

extraction wells will be installed south of the intersection approximately 40 feet away from each other, and the remaining additional extraction well will be installed on Richardson Street between SVE-1 and SVE-2, drilled on an approximately 15-degree angle to extend beneath the warehouse building (extending approximately 20 feet from the building perimeter). Figure 2-30 provides the locations of the existing and proposed extraction wells.

As summarized in the SVE/AS Pilot Test Report, the screened interval of the new extraction wells will be 15 feet.

2.14.1.2 Soil Vapor Extraction Well Flow Rates

The total treatment area encompassed by the six SVE wells will total approximately 19,175 ft^2. Groundwater exists approximately 32 feet below grade. As such the treatment volume is 613,600 cubic feet (ft^3). At a soil porosity of 0.24 and extracting at least two pore volumes per day the vacuum extraction rate is 213 ft^3/ minute.

Assuming that the subsurface conditions are relatively homogenous, each SVE well will be designed to have an extraction flow rate of approximately 35 scfm. At 35 scfm per well, the total extraction rate would be 210 scfm.

2.14.1.3 Determination of Soil Vapor Extraction Well Vacuum

The intrinsic permeability of $5.55x10^{-8}$ cm^2 was used to determine the vacuum pressure at the SVE wells. As summarized in the SVE/AS Pilot Test Report, the vacuum in the extraction wells should be approximately 50.2 inches H_2O to achieve the required radius of influence.

2.14.1.4 Air Sparge Flow Rate

As summarized in the SVE/AS Pilot Test Report, the AS system should consist of eight 2-inch diameter wells spaced between 15 to 20 feet. A 3 foot screen length should be used for design of the additional sparge wells since subsurface conditions are relatively uniform in the treatment zone.

Assuming a one pore exchange rate and an SVE extraction rate equal to two times the sparging injection rate, the air sparging flow rate is 100 ft^3/ minute.

Operation of the air sparge system can vary from having all eight wells online or pulsing the system with a few wells online at one time. With all eight wells online, the air sparging rate per well would be 12.5 ft^3/ minute

2.14.1.5 Sparging Air Pressure

The majority of on-site contamination in the unsaturated zone extends up to approximately 35 feet bgs. On-site dissolved phase contamination in the saturated zone was detected from approximately 35 to 80 bgs. The shallow groundwater zone within the upper glacial aquifer is considered to be 35 to 60 feet bgs, and the deep groundwater zone within the upper glacial aquifer is considered to be 60 to 80 feet bgs. The air sparging pressure should be maintained between the minimum pressure necessary to induce flow and the pressure at which fracturing occurs. Because contaminants exist in both the shallow and deep groundwater zones beneath the site, air should be injected in two different zones.

As summarized in the SVE/AS Pilot Test Report, an acceptable pressure range for the shallow aquifer is 5.4 to 32.8 psig. Injection pressures in the deep aquifer range between 22.6 and 62.0 psig. This exceeds the acceptable pressure range provided in the reference documents.

If the well screen is placed at 75 feet bgs, at the midpoint of DEC-031D, minimum air pressure (P_{min}) would be 18.3 psig and $P_{fracture}$ would be 54.8 psig. The range of P_{min} for treating the shallow and deep aquifer is 5.4 to 18.3 psi (top of screen for deep aquifer set at 75 feet bgs). This is in the range of acceptable values for air sparge pressure. Actual operation of the air sparge system would warrant treatment of the shallow and deep aquifer to be conducted separately due to the fracture pressure when treating the shallow aquifer.

3 REMEDIAL GOAL AND REMEDIAL ACTION OBJECTIVES

3.1 Remedial Goal

In accordance with DER-10, the remedial goal for site remediation is as follows:

- The remedy will eliminate or mitigate all significant threats to human health and/or the environment, to the extent practicable, caused by contaminants present due to the release of PCE from the former dry cleaners onsite.

3.2 Remedial Action Objectives

In order to meet the remedial goal, remedial action objectives (RAOs) were developed to protect public health and the environment and provide the basis for selecting technologies and developing alternatives. The results of the RI have shown that soil is contaminated with contaminants of concern and that there is a significant risk to human health or the environment from soil. Consequently, RAOs were established for soil. RAOs were established for all contaminated media (soil, groundwater, and soil vapor) are presented below.

Soil

Public Health Protection

- Prevent ingestion/direct contact with contaminated soil
- Prevent inhalation exposure to contaminants volatilizing from soil.

Environmental Protection

- Prevent migration of contaminants that would result in groundwater, surface water, or sediment contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Groundwater

Public Health Protection

- Prevent ingestion of groundwater contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

Environmental Protection

- Restore groundwater aquifer to pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water and sediments.
- Remove the source of groundwater contamination.

Soil Vapor

Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings.

3.3 Remediation Areas and Volumes

The extent of soil, groundwater, and soil vapor contamination is discussed below. Areas and volumes of contamination have been developed based on the characterization information provided in the RI reports and will serve as the basis for development and evaluation of alternatives in this FS.

3.3.1 Soil

Contaminants detected above the soil cleanup criteria in soil include CVOCs, SVOCs, and metals. However, the SVOCs and metals are typical for urban fill materials and will not be addressed by this FS. Active remediation will address only the CVOC contaminants. CVOC soil contamination is limited to the source area underneath the Klink Cosmo building at 368 Richardson Street. The estimated area of soil contamination is 6,000 square feet as shown on Figure 3-1. The estimated average depth of soil contamination is 34 feet which results in an estimated volume of 204,000 cubic feet (approximately 7,600 cubic yards).

3.3.2 Groundwater

The FS will address remediation of contaminated groundwater within the 1,000 ppb contours for dissolved phase PCE in the shallow groundwater zone (at a depth between approximately 35 feet and 60 feet bgs) as shown on Figures 3-2 and 3-3. The FS will also address remediation of contaminated groundwater within the 1,000 ppb contours for dissolved phase PCE in the deep groundwater zone (at a depth between approximately 60 feet and 110 feet bgs) as shown on Figures 3-4 and 3-5.

3.3.3 Soil Vapor

The horizontal extent of PCE contamination in soil vapor is shown on Figure 3-6 and the horizontal extent of TCE contamination in soil vapor is shown on Figure 3-7.

3.4 General Response Actions

General response actions are broad response categories capable of satisfying the remedial action objectives for the Site.

No Action: A no action response provides a baseline for comparison with other alternatives.

Institutional Controls: Institutional controls (ICs), such as Environmental Easements (EEs) and Site Management Plans (SMPs), are measures to provide protection to human health and the environment by identifying contamination and reducing exposure.

Exposure Point Mitigation: Remedial measures may be implemented at the point of exposure to mitigate exposure to contaminated material and provide adequate protection to human health and the environment.

Containment: Containment measures are those remedial actions whose purpose is to contain and/or isolate contaminants. These measures prevent migration from, or direct human exposure to, contaminated media without treating, disturbing or removing the contamination.

Removal: Removal measures remove contamination from the subsurface for subsequent treatment and/or disposal.

Treatment: Treatment and disposal measures include technologies whose purpose is to reduce the toxicity, mobility, or volume of contaminants by directly altering, isolating, or destroying those contaminants.

4 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

This section identifies specific remedial technologies for soil, groundwater and soil vapor and evaluates their effectiveness with respect to their technical feasibility in meeting the RAOs for this site. Appropriate technologies will be carried forward into the development of alternatives. Table 4-1 provides a summary of the remedial technologies and screening process for soil, groundwater, and soil vapor. General response actions that will be considered for the Former Klink Cosmo site include the following:

- Soil
  - Institutional Controls/Engineering Controls (ICs/ECs) with an SMP
  - Barriers/Soil Covers
  - Removal

- Groundwater
  - ICs/ECs with an SMP
  - Exposure Point Mitigation
  - Containment
  - Removal
  - In-Situ Treatment

- Soil Vapor
  - Exposure Point Mitigation
  - Removal

4.1 Identification of Technologies for Soil

This section identifies and provides a screening of remedial technologies for subsurface soil. There is no exposed surface soil at the site. All soil is covered by buildings or sidewalks.

4.1.1 Institutional Controls

Institutional controls would provide no action towards remediating soil contamination, but would include an environmental easement and a Site Management Plan (SMP) which may be used in conjunction with, or in the absence of, remedial measures. Institutional controls would:

- Require compliance with the approved SMP.

- Include requirements to complete and submit reports to the NYSDEC with certification of compliance with institutional controls/engineering controls. Specify procedures to manage potential exposure to residual contaminated soil, including procedures for soil

characterization, soil excavation and handling, and the health and safety of workers and the community.

- Restrict the use of the property.
- Include requirements to sample, analyze and evaluate soil vapor in future on-site buildings or existing buildings that have been modified, and institute soil vapor intrusion mitigation, only if necessary, in accordance with NYSDOH guidance.
- Restrict groundwater use.

Effectiveness: Institutional controls such as an SMP and an environmental easement would not be effective by themselves in meeting the RAOs for protection of human health, nor for meeting the RAO for preventing migration of contaminants in soil into groundwater and other RAOs for the site. Institutional controls can be combined with other technologies in order to meet the RAOs.

Implementability: Institutional controls would not be difficult to implement.

Cost: The cost for institutional controls would be relatively low.

Conclusion: Institutional controls are retained for the development of alternatives for the Site.

4.1.2 Barriers

A low permeability cap and vertical subsurface barriers are potential technologies for the site.

4.1.2.1 Barriers/Soil Covers

A soil cover is a material cover such as a soil cover with demarcation layer or concrete slab that serves to provide a barrier against direct contact with contaminated soil. The existing concrete slab at the AWL Industries, Inc. property is a type of barrier.

Effectiveness: A soil cover would be effective in preventing direct contact with contaminated soil and would meet the RAOs for protection of human health. A soil cover would also reduce migration and provide some environmental protection.

Implementability: This technology is readily implementable.

Cost: The cost of soil covers is low since much of the existing site area structures are serving as a soil cover.

Conclusion: Soil cover is retained as a technology to prevent direct contact exposure.

4.1.3 Removal

4.1.3.1 Excavation and Disposal Off-Site

Soil would be removed from under the Former Klink Cosmo Cleaners building at 368 Richardson Street.

Effectiveness: Soil excavation is effective at removing contaminated source material.

Implementability: Soil excavation is not considered to be feasible at this site. It would require building demolition and extensive excavation protection measures to excavate to a depth of 34 feet in this urban area.

Cost: The costs of soil excavation and disposal would be high.

Conclusion: Soil excavation and disposal will not be retained for the development of alternatives for the Site.

4.1.3.2 Soil Vapor Extraction and Air Sparging

URS conducted a soil vapor extraction/ air sparge (SVE/AS) pilot test at the Klink Cosmo Cleaners site in November 2015. The results of the pilot test were published in the SVE/AS Pilot Study Report submitted by URS to the NYSDEC in March 2016. The results of the pilot study demonstrate that SVE is feasible and NYSDEC determined that it would be the best method for remediating contaminated soil and dissolved phase contaminated groundwater (AS) beneath the Former Klink Cosmo Cleaners building and will be completed as an IRM under a presumptive remedial approach. This technology is therefore retained and is included in all of the Alternatives evaluated in Section 5.0. The pilot study report provided design parameters for the SVE/AS system that are presented in Section 2.14.

Effectiveness: The effectiveness of this technology has been demonstrated in the pilot study. During the pilot test approximately 5 pounds of VOCs were removed in one day of system operation.

Implementability: The SVE/AS system is implementable at the under the Former Klink Cosmo building at 368 Richardson Street as demonstrated by the pilot test. A conceptual design, which includes well locations and construction details, has been provided in the pilot study report.

Cost: The cost for air sparging with soil vapor extraction would be moderate.

Conclusion: Treatment via SVE and air sparging will be retained for the development of alternatives for the Site. Because of the success of the pilot study at the Site, other treatment technologies (e.g. thermal treatment technologies such as electrical resistance heating [ERH]) will not be considered for the development of alternatives.

4.2 Identification of Technologies for Groundwater

This section identifies and provides a screening of remedial technologies for groundwater.

4.2.1 Institutional Controls

Institutional controls for groundwater would include the controls discussed in Section 4.1.1 and long-term monitoring. In the absence of active remedial measures, monitoring would be used to assess the degree to which natural processes were reducing contaminant concentrations in groundwater.

Natural processes which would be expected to occur include physical processes such as hydrodynamic dispersion and dilution by infiltration, and microbial degradation, which transforms the contaminants into typically less toxic daughter products and, ultimately, to carbon dioxide and water. Given sufficient time, a plume will stabilize after reaching a size where all of the mass delivered by the source is either diluted to a very low concentration or destroyed. Further, if the source is removed or isolated from the aquifer through remediation, natural processes will cause the remaining plume to collapse with time, as the contaminant mass residing within the plume is diluted and destroyed, assuming no new mass is introduced.

Groundwater on-site and in the vicinity of the site is not utilized for potable or other known purposes. ICs which maintain use restrictions regarding groundwater and a monitoring plan to assess future groundwater conditions would be in line with current practices and be protective of human health. Monitoring would consist of periodic sampling of select existing monitoring wells, and analysis for VOCs and natural attenuation indicator parameters (i.e., such as dissolved oxygen and oxidation reduction potential).

Effectiveness: Institutional controls such as an SMP and an environmental easement would be effective in meeting the RAOs to protect public health by preventing ingestion of groundwater with contaminant levels exceeding drinking water standards, and preventing contact with groundwater contaminated with VOCs during work-related activities for construction workers, employees, and residents, but would not be effective in meeting the RAOs to protect the environment by restoring the aquifer to pre-disposal/pre-release conditions or removing the source of groundwater contamination. Institutional controls alone would not prevent the migration of groundwater contamination.

Implementability: Institutional controls would not be difficult to implement considering that potable water is provided by the City of New York.

Cost: The cost for institutional controls would be relatively low.

Conclusion: Institutional Controls are retained for the development of alternatives for the Site.

4.2.2 Exposure Point Mitigation

Point of Entry Treatment (POET) systems are used in homes when residents use groundwater for their water supply. All residents in the remediation area are supplied with water from the municipality; therefore, these systems are unnecessary at the site. Exposure point mitigation is not retained for use in the development of alternatives for the Site.

4.2.3 Containment

4.2.3.1 Hydraulic Containment/Control

Groundwater containment technologies limit the migration of contaminated groundwater. Containment can be accomplished through physical isolation or hydraulic control. Primary physical containment technologies are the installation of sheet piling or slurry walls. These technologies are particularly effective on small source areas that have not migrated significantly. Hydraulic control utilizes pumping wells to reverse natural hydraulic gradients to prevent plume migration. Extracted groundwater would require treatment prior to discharge.

Effectiveness: Because the groundwater plume has migrated across several adjacent properties and because the plume is located in a highly populated urban area that would limit the locations and depths of barriers, physical containment would not be effective at this Site. Hydraulic control would be effective for preventing groundwater from migrating away from the source area.

Implementability: Physical containment of the groundwater plume would not be implementable at this Site because of the limitations imposed by structures and utilities in the area. Hydraulic control via groundwater extraction and subsequent treatment would be feasible to implement at this Site.

Cost: The cost of hydraulic control would be high because of the cost of long term pumping, maintenance, and monitoring required for the groundwater treatment system.

Conclusion: Hydraulic control via pumping wells is retained for the development of alternatives.

4.2.4 Removal

Groundwater contamination can removed by extracting groundwater or by volatilizing contamination in the groundwater and then capturing contaminated vapors. Some technologies may be suitable for treating groundwater near the source area but not the dissolve-phase plume as discussed below.

4.2.4.1 Groundwater Extraction

Extraction via pumping wells is the typical method for groundwater removal as a liquid. Collection trenches are also used for groundwater extraction, but are not feasible in this densely populated urban area. Collected groundwater would require treatment prior to discharge.

Effectiveness: Groundwater extraction would be effective at the Site because the soil is relatively permeable.

Implementability: Groundwater extraction through wells is technically implementable.

Cost: The cost of groundwater removal would be high because of the cost of long term pumping from multiple wells, maintenance, and monitoring required for the groundwater treatment system.

Conclusion: Groundwater extraction via pumping wells is retained for the development of alternatives.

4.2.4.2 Soil Vapor Extraction and Air Sparging

Soil vapor extraction and air sparging was discussed in Section 2.14. The pilot study conducted adjacent to the Former Klink Cosmo building demonstrated that it is a feasible and preferred method of remediating soil and groundwater under the building in the source area. However, soil vapor extraction and air sparging are not considered feasible for the off-site groundwater plume. This technology would

not be practical in removing contamination in the dissolved phase plume due to the expanse of the plume and extreme difficulty in constructing and operating this technology in a densely populated urban area with numerous buildings and utilities. Therefore soil vapor extraction and air sparging is not retained for the development alternatives with respect to the groundwater plume.

4.2.4.3 Electrical Resistance Heating

ERH is a treatment method which uses the flow of electricity to heat soil and groundwater to vaporize contaminants. Electric current is passed through the soil between subsurface electrodes. The resistance to the electrical flow in the soil causes an increase in temperature until the boiling point of water is reached. The groundwater then forms steam, and the contaminants are volatilized. These volatilized contaminants are then captured and removed by a soil vapor extraction system.

Effectiveness: ERH would be effective in limited areas of source contamination, but not in the dissolved phase plume.

Implementability: ERH produces heat that could impact subsurface utilities or other infrastructure. It would be difficult to implement in a heavily populated urban area.

Cost: The cost of ERH is high.

Conclusion: ERH is not retained for the development of alternatives

4.2.5 Treatment

Treatment technologies destroy or alter contaminants, converting them to less toxic or non-toxic end products. Organic contaminants at the Site can be converted through oxidation or reduction processes.

4.2.5.1 Permanganate Injection

Permanganate is a reagent used for in-situ chemical oxidation (ISCO), which uses oxidants delivered into the saturated zone to oxidize the contaminants to non-toxic compounds such as water, carbon dioxide, and chloride ions. Permanganate is available in two forms, i.e. potassium permanganate or sodium permanganate.

Effectiveness: Permanganate injection is dependent upon aqueous phase contact between the delivered oxidant materials and the contaminant. Therefore, the ability to achieve adequate subsurface distribution closely determines the effectiveness of the approach.

Permanganate is preferred to the other ISCO reagents because it can be used over a wide range of pH values, does not require a catalyst, and is a long-lasting oxidant. It has the potential to remain active in the subsurface for months, allowing it to diffuse and otherwise travel into the lower permeability zones more effectively. It is especially applicable at inaccessible areas, such as for groundwater contamination present beneath buildings.

Permanganate effectiveness is greatly impacted by the presence of oxidizable materials present in the subsurface that are not contaminants. These materials exert what is termed a natural oxidant demand (NOD). The NOD reacts with and consumes permanganate that can slow the rate of remediation. The NOD has been measured in soil samples collected at the site, and the results show that the NOD is relatively low. This is a favorable condition for remediation using permanganate.

Implementability: The location of wells will be limited because the remediation area is located in an urban area. Potassium permanganate is delivered to the site as a solid and must be mixed at the site prior to injection. In addition, the quantity of potassium present on the site is limited by Homeland Security regulations making it more difficult to coordinate and implement potassium permanganate injections. Sodium permanganate is delivered in liquid form which can be directly injected into groundwater and is not restricted by Homeland Security regulations. The injection of sodium permanganate would be easier to implement than potassium permanganate.

Cost: The costs for permanganate injection are moderate to high depending on the number of injections required to achieve acceptable results.

Conclusion: Sodium permanganate injection is retained for the development of alternatives.

4.2.5.2 EHC Injection

EHC® is a reagent used for in-situ chemical reduction (ISCR). In-situ chemical reduction (ISCR) works by supplying an excess of hydrogen atoms to substitute for each chlorine atom on the contaminant molecules, thus sequentially dechlorinating the molecules. The chlorinated compounds are converted through a series of daughter products until they are finally converted to ethene and ethane.

EHC is composed of controlled release carbon and zero valent iron (ZVI). Consequently, EHC stimulates both biotic reductive dechlorination via the carbon source and abiotic reductive dechlorination via ZVI.

Effectiveness: Under reducing conditions, PCE breaks down into its daughter products, TCE, DCE and vinyl chloride. These daughter products have been detected infrequently in groundwater indicating that little reductive dechlorination is occurring at the site. EHC injection would promote reductive dechlorination and should be effective for groundwater remediation.

Implementability: The location of injection points will be limited because the remediation area is located in a densely populated urban area.

Cost: The costs of EHC injections are expected to be moderate to high depending on the number of injections required for remediation.

Conclusion: EHC injections are retained for the development of alternatives.

4.2.5.3 Ozone and Hydrogen Peroxide Injection

Hydrogen peroxide can be circulated through the contaminated groundwater zone to increase oxygen levels. Though hydrogen peroxide has the potential of providing some of the highest levels of available oxygen to contaminated groundwater, it is toxic to microbes at high concentrations. Hydrogen peroxide also decomposes quickly to oxygen, which limits the extent to which it can be distributed in the subsurface.

Ozone can be injected into the subsurface in a dissolved or gaseous phase. Ozone is a strong oxidant, with an oxidation potential greater than that of hydrogen peroxide. Because of its oxidizing potential, ozone can be toxic to microbes and can actually suppress subsurface biological activity. However, this is generally temporary, and a sufficient number of bacteria can survive and resume biodegradation after ozone has been applied.

Effectiveness: Hydrogen peroxide and ozone injections are dependent upon aqueous phase contact between the delivered oxidant materials and the contaminant. Therefore, the ability to achieve adequate subsurface distribution closely determines the effectiveness of the approach. Due to the quick decomposition of these reagents, and the relatively low permeability of the soil, hydrogen peroxide and ozone would not be expected to be effective at the Site.

Implementability: The location of injection points will be limited because the remediation area is located in an urban area. Hydrogen peroxide and ozone are very strong oxidants and would require heightened safety precautions during implementation.

Cost: The costs of hydrogen peroxide and ozone injections are expected to moderate to high depending on the number of injections required.

Conclusion: Treatment via ozone and hydrogen peroxide injection is not retained for the development of alternatives.

4.2.5.4 Permeable Reactive Barrier

Permeable reactive barriers (PRBs) are barriers constructed in the subsurface used to intercept and treat contaminated groundwater. The most common PRB construction used ZVI to promote reductive dechlorination of chlorinated contaminants.

Effectiveness: The PRB can effectively treat and destroy chlorinated contaminants in groundwater.

Implementability: The construction of a PRB in a densely populated urban area is not feasible.

Cost: The cost of a PRB would be high.

Conclusion: The PRB will not be retained for the development of alternatives.

4.3 Identification of Technologies for Soil Vapor

4.3.1 Institutional Controls

The institutional controls for soil vapor area would be as described in Section 4.1.1. The effectiveness, implementability and cost would be similar to that described in Section 4.2.1. The SMP would include measures to sample, analyze and evaluate soil vapor in future on-site buildings or existing buildings that have been modified, and institute soil vapor intrusion mitigation, only if necessary, in accordance with NYSDOH guidance. Institutional controls alone would not be protective of human health for soil vapor, but are retained for the development of alternatives for the Site.

4.3.2 Exposure Point Mitigation

4.3.2.1 SSD Systems

Sub-slab depressurization systems (SSD systems) consist of the installation of a fan and pipes to collect air from beneath a building floor. The fan creates a vacuum beneath the slab, which prevents volatilized contaminants in soil from penetrating up into the building itself. The air collected by the fan is vented outdoors.

Effectiveness: SSD systems are very effective at preventing soil vapor intrusion into buildings.

Implementability: Temporary access to buildings is required to install SSD systems. However, access would only be needed for a relatively short time (e.g., a matter of days). Therefore, there should be little interruption of business activities or inconvenience for residents and businesses.

Cost: The cost of SSD systems would be low to moderate.

Conclusion: SSD systems are retained for the development of alternatives for the Site.

4.3.3 Removal

4.3.3.1 SVE/AS

Soil vapor extraction and air sparging was discussed in Sections 4.1.2.2 and 4.2.4.2. The pilot study conducted at the Former Klink Cosmo building demonstrated that it is a feasible and preferred method of remediating soil and groundwater in the source area and would prevent soil vapors from entering the Former Klink Cosmo building. However, soil vapor extraction and air sparging are not considered feasible throughout the rest of the groundwater plume where contamination is at significantly lower levels. These systems would be extremely difficult to construct and operate in this densely populated urban area with numerous building and utilities. Therefore soil vapor extraction and air sparging is not retained for the development alternatives with respect to soil vapor.

4.4 Summary of Remedial Technologies

Remedial technologies retained for use in the development of alternatives include the following:

Soil (under Former Klink Cosmo building)

- Institutional Controls and Monitoring with an SMP

- Barrier/Soil Cover
- Soil Vapor Extraction and Air Sparging

Groundwater

- Institutional Controls and Monitoring with an SMP
- Hydraulic Containment
- Hydraulic Extraction
- Permanganate Injection
- EHC Injection

Soil Vapor

- Institutional Controls with SMP
- SSD Systems

5 DEVELOPMENT AND DESCRIPTION OF ALTERNATIVES

This section combines the remedial technologies considered feasible for each media into a list of remedial alternatives that best meet the remedial goal and RAOs for the site as a whole. The alternatives are described in this section with regards to: size and configuration, time for remediation, spatial requirements, options for disposal, permitting requirements, limitations, and ecological impacts in accordance with DER-10.

5.1 Development of Alternatives

Alternatives have been developed to address the general response actions identified for the site including: no action, institutional controls, exposure point mitigation, containment, removal and treatment. The No Action alternative serves as a baseline of comparison. Remedial alternatives other than No Action include combinations of remedial technologies for soil, groundwater and soil vapor.

An Environmental Easement (EE) with an SMP are basic requirements for all alternatives. A soil cover, installation of SSD systems as needed, and an SVE/AS system in the source area under the Former Klink Cosmo building are considered basic components of all alternatives except No Action.

There are four feasible technologies for remediation of groundwater, i.e. hydraulic containment, permanganate injection, hydraulic extraction, and EHC injection. Each of these technologies was used to develop an alternative for site remediation.

A summary of the remedial alternatives including their components is presented in Table 5-1.

Based on the technologies considered feasible for remediation listed in Section 4.4 and the discussion above, five alternatives have been developed for the Site as follows:

Alternative 1 – No Action, Institutional Controls with Site Management

Alternative 2 – IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management

Alternative 3 – IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management

Alternative 4 – IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management

Alternative 5 – IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management

5.2 Description of Alternatives

Alternatives are described in accordance with DER-10, with regard to: size and configuration, time for remediation, spatial requirements, options for disposal, permitting requirements, limitations, and ecological impacts.

5.2.1 Alternative 1 – No Action, Institutional Controls with Site Management

Under this alternative, contaminants present in soil, groundwater and soil vapor would attenuate over time by natural processes; however, given the relatively high levels of PCE, TCE, and their degradation products, the RAOs for soil, groundwater and soil vapor would not be met for an extensive period of time.

Size and Configuration

- No active remedial construction would take place. ICs in the form of an EE and companion SMP would be components of the remedial alternative. An SMP would be developed to include institutional controls to manage residual contaminated media and potential worker or community exposures to contaminated media; evaluate potential vapor intrusion as required per NYSDOH guidance; and maintain use restrictions regarding site development and groundwater use.

Time for Remediation

- No active remedial measures are included.

Spatial Requirements

- There are no spatial requirements.

Options for Disposal

- There are no materials requiring disposal other than those associated with the SMP. Because an SMP is required in each alternative, the costs associated with the monitoring sampling, etc. will be the same and not have any effect on the cost comparative analysis.

Permit Requirements

- No permits would be required for this alternative.

Limitations

- This alternative does not meet SCGs for soil, groundwater or soil vapor or provide protection to potentially exposed receptors.

Ecological Impacts

- This alternative is not anticipated to have any negative impacts on fish and wildlife resources.

5.2.2 Alternative 2 - IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management

Alternative 2 would include an SMP specifying required institutional controls for the Site, SSD systems installed at any locations determined not to be compliant with NYSDOH guidelines based on air sampling, and installation of an SVE/AS system to remediate the source area underneath the Former Klink Cosmo building, and maintain the existing concrete slab which serves as a soil cover. A conceptual layout of this alternative is presented on Figure 5-1.

Size and Configuration

- An SMP would be developed to include institutional and engineering controls to manage residual contaminated media and potential worker or community exposures to contaminated media; evaluate potential vapor intrusion as required per NYSDOH guidance; and maintain use restrictions regarding site development and groundwater use.

- SSD systems would be installed wherever sampling showed air quality was not in compliance with NYSDOH guidelines.

- Five additional air sparge wells would be constructed. These wells along with three existing wells would be used to introduce compressed air into groundwater below the Former Klink Cosmo building to remove VOCs.

- Four additional soil vapor extraction wells will be constructed. These wells along with two existing wells would be used to capture VOCs volatilized by air sparging into the groundwater beneath the Former Klink Cosmo building.

- The existing concrete slab will be maintained and serve as the soil cover to prevent direct contact with contaminated soil.

- Annual sampling and analysis for VOCs, as well as routine water quality indicator parameters, would be performed in approximately 40 selected existing groundwater monitoring wells.

- An annual report and Five-Year review would evaluate site conditions, OM&M activities and recommend any changes necessary to the OM&M program.

Time for Remediation

- For the purposes of this report, a 30-year period is assumed for monitoring and a 5-year period for source removal by the SVE/AS system.

- Construction would require less than one year.

Spatial Requirements

- Space is very limited in this densely populated urban area.
- Based on the conceptual design presented in the pilot study report there is adequate space to construct air sparge and SVE wells. It will be more difficult to find space for the air sparging and SVE equipment. The equipment will have to be located outside of the building.

Options for Disposal

- Well drill cuttings will have to be disposed of off-site.

Permit Requirements

- An air permit will not be required for the SVE/AS system. However, the system discharge to the atmosphere will be required to meet the substantive requirements of NYSDEC air emissions regulations, including air emissions control equipment, if necessary.

Limitations

- This alternative does not address immediately address the contamination in the off-site groundwater plume.

Ecological Impacts

- This alternative is not anticipated to have any negative impacts on fish and wildlife resources.

5.2.3 Alternative 3 – IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management

Alternative 3 would include an SMP specifying required institutional controls for the Site, SSD systems installed at any locations determined not to be compliant with NYSDOH guidelines based on air sampling, installation of an SVE/AS system to remediate the source area underneath the Former Klink Cosmo building and permanganate injection to address dissolved phase groundwater contamination, and maintain the existing concrete slab which serves as a soil cover. A conceptual layout of this alternative is presented on Figure 5-2.

Size and Configuration

- An SMP would be developed to include institutional and engineering controls to manage residual contaminated media and potential on-site worker or community exposures to contaminated media; evaluate potential vapor intrusion as required per NYSDOH guidance; and maintain use restrictions regarding site development and groundwater use.

- SSD systems would be installed wherever sampling showed air quality was not in compliance with NYSDOH guidelines.

- Five additional air sparge wells would be constructed. These wells along with three existing wells would be used to introduce compressed air into groundwater below the Former Klink Cosmo building to remove VOCs.

- Four additional soil vapor extraction wells will be constructed. These wells along with two existing wells would be used to capture VOCs volatilized by air sparging into the groundwater beneath the Former Klink Cosmo building.

- Conceptually, ten sodium permanganate injection well pairs (one shallow and one deep well at each location – five pairs in 'source perimeter' area), and 16 shallow sodium permanganate injection wells and four deep sodium permanganate injection wells would be installed as shown on Figure 5-2 ('Division east' area). These wells were established in two linear arrays including: 1) 'source perimeter' which are situated along the north side of Richardson Street and west side of Vandervoort Avenue opposite the Former Klink Cosmo Site building source area; 2) 'Division east' which are situated along the east side of Vandervoort Avenue south of Division Street and along the south side of Division Street east of Vandervoort Avenue. The

injection well arrays are positioned to treat the dissolved phase contaminated zones downgradient of the former Klink Cosmo source area. The groundwater injection treatment areas are positioned upgradient of the nearest residential and commercial properties.

- An estimated 115,000 gallons of a 5% sodium permanganate solution would be injected into groundwater (Appendix B). It is assumed that the 115,000 gallons of sodium permanganate solution would be injected quarterly in four separate events of approximately 29,000 gallons per event.

- The existing concrete slab will be maintained and serve as the soil cover to prevent direct contact with contaminated soil.

- Quarterly sampling and analysis for VOCs for 2 years and annually thereafter as well as routine water quality indicator parameters, would be performed in approximately 40 selected existing groundwater monitoring wells.

- An annual report and Five-Year review would evaluate site conditions, OM&M activities and provide recommendations for any changes necessary to the OM&M program.

Time for Remediation

- For the purposes of this report, a 30-year period is assumed for monitoring and a 5-year period for source removal by the SVE/AS system.

- It is estimated that construction (including permanganate injections) would require a period of 1 to 2 years.

Spatial Requirements

- Space is very limited in this densely populated urban area.

- Based on the conceptual design presented in the pilot study report there is adequate space to construct air sparge and SVE wells. It will be more difficult to find space for the air sparging and SVE equipment. The equipment will have to be located outside of the building.

Options for Disposal

- Well drill cuttings will have to be disposed of off-site.

Permit Requirements

- An air permit will not be required for the SVE/AS system. However, the system discharge to the atmosphere will be required to meet the substantive requirements of NYSDEC air emissions regulations, including air emissions control equipment, if necessary.

- Injection may require submission of an Inventory of Injection Wells Form 7520-16 as part of the Underground Injection Control (UIC) program operated by the United States Environmental Protection Agency (USEPA). Injection wells incidental to aquifer remediation and experimental technologies are distinguished from hazardous waste injection wells and are designated as Class V under the Underground Injection Control (UIC) program. Class V wells covered by the Federal UIC program are authorized by rule and do not require a separate UIC permit.

Limitations

- Injection wells can only be placed in accessible areas such as sidewalks within the plume; thereby, potentially limiting the effectiveness of the injection wells.

Ecological Impacts

- This alternative is not anticipated to have any negative impacts on fish and wildlife resources.

5.2.4 Alternative 4 – IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management

Alternative 4 is similar to Alternative 3 except off-site groundwater would be treated with EHC. Alternative 4 would include an SMP specifying required institutional controls for the Site, SSD systems installed at any locations determined not to be compliant with NYSDOH guidelines based on air sampling, installation of an SVE/AS system to remediate the source area underneath the Former Klink Cosmo building, soil cover, and EHC injection to address dissolved phase groundwater contamination. A conceptual layout of this alternative is presented on Figure 5-3.

Size and Configuration

- An SMP would be developed to include institutional and engineering controls to manage residual contaminated media and potential on-site worker or community exposures to

contaminated media; evaluate potential vapor intrusion as required per NYSDOH guidance; and maintain use restrictions regarding site development and groundwater use.

- SSD systems would be installed wherever sampling showed air quality was not in compliance with NYSDOH guidelines.

- Five additional air sparge wells would be constructed. These wells along with three existing wells would be used to introduce compressed air into groundwater below the Former Klink Cosmo building to remove VOCs.

- Four additional soil vapor extraction wells will be constructed. These wells along with two existing wells would be used to capture VOCs volatilized by air sparging into the groundwater beneath the Former Klink Cosmo building.

- Conceptually, ten injection well pairs (one shallow and one deep well at each location – five pairs each in 'source perimeter' area), and 16 shallow injection wells and four deep injection wells would be installed as shown on Figure 5-2 ('Division east' area). These wells were established in two linear arrays including: 1) 'source perimeter' which are situated along the north side of Richardson Street and west side of Vandervoort Avenue opposite the Former Klink Cosmo Site building source area; 2) 'Division east' which are situated along the east side of Vandervoort Avenue south of Division Street and along the south side of Division Street east of Vandervoort Avenue. The injection well arrays are positioned to treat the dissolved phase contaminated zones downgradient of the former Klink Cosmo source area. The groundwater injection treatment areas are positioned upgradient of the nearest residential and commercial properties.

- An estimated 150,000 gallons of 12.3% EHC solution would be injected into groundwater. It is assumed that the 150,000 gallons of EHC solution would be injected in four separate events of 37,500 gallons per event (Appendix C).

- The existing concrete slab will be maintained and serve as the soil cover to prevent direct contact with contaminated soil.

- Quarterly sampling and analysis for VOCs for 2 years and annually thereafter as well as routine water quality indicator parameters, would be performed in approximately 40 selected existing groundwater monitoring wells.

- An annual report and Five-Year review would evaluate site conditions, OM&M activities and provide recommendations for any changes necessary to the OM&M program.

Time for Remediation

- For the purposes of this report, a 30-year period is assumed for monitoring and a 5-year period for source removal by the SVE/AS system.

- It is estimated that construction (including EHC injections) would require a period of 1 to 2 years.

Spatial Requirements

- Space is very limited in this densely populated urban area.

- Based on the conceptual design presented in the pilot study report there is adequate space to construct air sparge and SVE wells. It will be more difficult to find space for the air sparging and SVE equipment. The equipment will have to be located outside of the building.

Permit Requirements

- An air permit will not be required for the SVE/AS system. However, the system discharge will be required to meet the substantive requirements of NYSDEC air emissions regulations, including air emissions control equipment, if necessary.

- Injection may require submission of an Inventory of Injection Wells Form 7520-16 as part of the Underground Injection Control (UIC) program operated by the United States Environmental Protection Agency (USEPA). Injection wells incidental to aquifer remediation and experimental technologies are distinguished from hazardous waste injection wells and are designated as Class V under the Underground Injection Control (UIC) program. Class V wells covered by the Federal UIC program are authorized by rule and do not require a separate UIC permit.

Limitations

- Injection wells can only be placed in accessible areas such as sidewalks within the plume; thereby, potentially limiting the effectiveness of the injection wells.

Ecological Impacts

- This alternative is not anticipated to have any negative impacts on fish and wildlife resources.

5.2.5 Alternative 5 – IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management

Alternative 5 would include an SMP specifying required institutional controls for the Site, SSD systems installed at any locations determined not to be compliant with NYSDOH guidelines based on air sampling, installation of an SVE/AS system to remediate the source area underneath the Former Klink Cosmo building, sodium permanganate injection to address off-site dissolved phase groundwater contamination, maintain the existing concrete slab which serves as a soil cover, and hydraulic containment to prevent further contaminant migration in groundwater. A conceptual layout of this alternative is presented on Figure 5-4.

Size and Configuration

- An SMP would be developed to include institutional and engineering controls to manage residual contaminated media and potential on-site worker or community exposures to contaminated media; evaluate potential vapor intrusion as required per NYSDOH guidance; and maintain use restrictions regarding site development and groundwater use.

- SSD systems would be installed wherever sampling showed air quality was not in compliance with NYSDOH guidelines.

- Five additional air sparge wells would be constructed. These wells along with three existing wells would be used to introduce compressed air into groundwater below the Former Klink Cosmo building to remove VOCs.

- Four additional soil vapor extraction wells will be constructed. These wells along with two existing wells would be used to capture VOCs volatilized by air sparging into the groundwater beneath the Former Klink Cosmo building.

- Conceptually, ten sodium permanganate injection well pairs (one shallow and one deep well at each location – five pairs in ‘source perimeter’ area), and 16 shallow sodium permanganate injection wells and four deep sodium permanganate injection wells would be installed as shown on Figure 5-2 (‘Division east’ area). These wells were established in two linear arrays

including: 1) 'source perimeter' which are situated along the north side of Richardson Street and west side of Vandervoort Avenue opposite the Former Klink Cosmo Site building source area; 2) 'Division east' which are situated along the east side of Vandervoort Avenue south of Division Street and along the south side of Division Street east of Vandervoort Avenue. The injection well arrays are positioned to treat the dissolved phase contaminated zones downgradient of the former Klink Cosmo source area. The groundwater injection treatment areas are positioned upgradient of the nearest residential and commercial properties.

- An estimated 115,000 gallons of a 5% sodium permanganate solution would be injected into groundwater (Appendix B). It is assumed that the 115,000 gallons of sodium permanganate solution would be injected quarterly in four separate events of approximately 29,000 gallons per event.

- The existing concrete slab will be maintained and serve as the soil cover to prevent direct contact with contaminated soil.

- Conceptually, three extraction wells would be installed at the locations shown on Figure 5-4. Hydraulic extraction wells would be situated along the south side of Richardson Street and west side of Vandervoort Avenue near the northeast corner of the Former Klink Cosmo building, and along the north side of Richardson Street opposite from the northeast corner of the Former Klink Cosmo building. It is assumed that the property located in the southeast corner of Vandervoort Avenue and Richardson Street would be acquired by NYSDEC to allow for construction of a structure for the pump and treatment of groundwater.

- An approximately 30 gallon per minute treatment system would be installed to treat groundwater before discharging to the sanitary sewer.

- Quarterly sampling and analysis for VOCs for 2 years and annually thereafter as well as routine water quality indicator parameters, would be performed in approximately 40 selected existing groundwater monitoring wells.

- An annual report and Five-Year review would evaluate site conditions, OM&M activities and provide recommendations for any changes necessary to the OM&M program.

Time for Remediation

- For the purposes of this report, a 30-year period is assumed for groundwater extraction and treatment and monitoring and a 5-year period for source removal by the SVE/AS system.
- It is estimated that construction (including permanganate injections) would require a period of 1 to 2 years.

Spatial Requirements

- Space is very limited in this densely populated urban area.
- Based on the conceptual design presented in the pilot study report there is adequate space to construct air sparge and SVE wells adjacent to the building. It will be more difficult to find space for the air sparging and SVE equipment. The equipment will have to be located outside of the building.
- It will difficult to find space for groundwater treatment equipment in this area. It is assumed that the property located at the southwest corner of the intersection of Vandervoort Avenue and Richardson Street would be acquired to house the treatment building.

Options for Disposal

- Well drill cuttings will have to be disposed of off-site.
- Filter socks from the water treatment system will need to be disposed of off-site.
- Spent carbon from the water treatment system will have to be disposed of off-site.

Permit Requirements

- An air permit will not be required for the SVE/AS system. However, the system discharge to the atmosphere will be required to meet the substantive requirements of NYSDEC air emissions regulations, including air emissions control equipment, if necessary.
- Injection may require submission of an Inventory of Injection Wells Form 7520-16 as part of the Underground Injection Control (UIC) program operated by the United States Environmental Protection Agency (USEPA). Injection wells incidental to aquifer

remediation and experimental technologies are distinguished from hazardous waste injection wells and are designated as Class V under the Underground Injection Control (UIC) program. Class V wells covered by the Federal UIC program are authorized by rule and do not require a separate UIC permit.

- A permit will be required for the groundwater treatment system discharge to the sanitary sewer.

Limitations

- Injection wells can only be placed in accessible areas such as sidewalks within the plume; thereby, potentially limiting the effectiveness of the injection wells**.**
- Extraction wells can only be placed in accessible areas such as sidewalks within the plume; thereby, potentially limiting the effectiveness of the extraction wells.
- Groundwater extraction and treatment will be required for a long period of time which will require extensive maintenance and repair activities that will increase over time.

Ecological Impacts

- This alternative is not anticipated to have any negative impacts on fish and wildlife resources.

6 DETAILED ANALYSIS OF ALTERNATIVES AND RECOMMENDED REMEDY

6.1 Description of Evaluation Criteria

Each of the alternatives is subjected to a detailed evaluation with respect to the criteria outlined in 6 NYCRR Part 375. A description of each of the evaluation criteria is provided below. This evaluation aids in the selection process for remedial actions in New York State.

Overall Protection of Public Health and the Environment

This criterion is an assessment of whether the alternative meets requirements that are protective of human health and the environment. The overall assessment is based on a composite of factors assessed under other evaluation criteria, particularly long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs. This evaluation focuses on how a specific alternative achieves protection over time and how site risks are reduced. The analysis includes how the source of contamination is to be eliminated, reduced, or controlled.

Compliance with Standards, Criteria, and Guidance

This criterion determines whether or not each alternative and the proposed remedial technologies comply with applicable environmental laws and SCGs pertaining to the chemicals detected in contaminated media and the location of the Site.

Long-term Effectiveness and Permanence

This criterion addresses the performance of a remedial action in terms of its permanence and the quantity/nature of waste or residuals remaining at the Site after implementation. An evaluation is made on the extent and effectiveness of controls required to manage residuals remaining at the Site and the operation and maintenance systems necessary for the remedy to remain effective. The factors that are evaluated include permanence of the remedial alternative, magnitude of the remaining risk, adequacy and reliability of controls used to manage residual contamination.

Reduction of Toxicity, Mobility or Volume with Treatment

This criterion assesses the remedial alternative's use of technologies that permanently and significantly reduce toxicity, mobility, or volume (TMV) of the contamination as their principal element. Preference is given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the contaminants at the Site.

Short-term Effectiveness

This criterion assesses the effects of the alternative during the construction and implementation phase with respect to the effect on human health and the environment. The factors that are assessed include protection of the workers and the community during remedial activities, environmental impacts that result from remediation, and the time required until the remedial action objectives are achieved. In addition, sustainability and green remediation concepts and techniques per DER-31 Green Remediation (NYSDEC, January 2011) are discussed.

Implementability

This criterion addresses the technical and administrative feasibility of implementing the alternative and the availability of various services and materials required during implementation. The evaluation includes the feasibility of construction and operation, the reliability of the technology, the ease of undertaking additional remedial action, monitoring considerations, activities needed to coordinate with regulatory agencies, availability of adequate equipment, services and materials, offsite treatment, and storage and disposal services.

Land Use

This criterion addresses the current, intended, and reasonably anticipated future land use of the Site and surroundings. The current and continued use of the Site is as an active laundromat, with storage in the basement. The second floor is apartments. Commercial properties, many with residences on the upper floors, are located along Astoria Blvd. Residential properties are located on the side streets.

Cost

Capital costs and operation, maintenance, and monitoring costs (OM&M) are estimated for each alternative and presented as present worth using a 5% discount rate for duration of future activities.

Community and State Acceptance

Concerns of the State and the Community will be addressed separately in accordance with the public participation program developed for this site.

6.2 Alternative 1 – No Action, Institutional Controls with Site Management

Under this alternative, contaminated soil and groundwater would remain onsite above SCGs. Soil vapor and the presence of indoor air contaminants would continue. No construction would be required.

6.2.1 Overall Protection of Public Health and the Environment

While there is some protection through the EE and SMP, this alternative is not protective of public health and the environment and does not meet the RAOs.

6.2.2 Compliance with SCGs

This alternative does not meet the soil, groundwater, or soil vapor intrusion SCGs.

6.2.3 Long-Term Effectiveness and Permanence

This alternative is not effective in the long term.

6.2.4 Reduction of Toxicity, Mobility and Volume with Treatment

Natural processes, which are currently active in groundwater, would continue to reduce contaminant levels. However, the existing natural processes would not destroy the majority of the contamination within the foreseeable future.

6.2.5 Short-Term Effectiveness

As there is no construction associated with this alternative, there would be no short-term impacts to workers or the community.

6.2.6 Implementability

This alternative would be difficult to implement due to administrative issues, especially State and local approvals. The RAOs would not be met and soil and groundwater contamination would remain above SCGs.

6.2.7 Land Use

This alternative would not be protective for continued Site use.

6.2.8 Cost

Estimated capital and OM&M costs for Alternative 1 are presented on Table 6-1. The capital cost is $40,600, present worth of OM&M costs is $488,846, and the total capital with annual present worth cost of Alternative 1 is $557,000.

6.3 Alternative 2 - IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management

6.3.1 Overall Protection of Public Health and the Environment

Active remedial measures and institutional controls included in this alternative would meet RAOs for soil and soil vapor, but not groundwater. SVE/AS will eliminate the source of contamination, but the groundwater plume would not be actively remediated and groundwater contamination would only be reduced slowly over time by natural attenuation. Potential human exposure or environmental impacts would be addressed by SSD systems and institutional controls.

6.3.2 Compliance with SCGs

SCGs for soil would be met for soil under the Former Klink Cosmo building. Groundwater quality would be greatly improved; however, groundwater SCGs would probably not be achieved in the dissolved phase groundwater plume for a number of years after remediation by natural attenuation. SCGs for soil vapor intrusion would be met through the operation of a SSDS to mitigate any potential soil vapor exposure.

6.3.3 Long-Term Effectiveness and Permanence

This alternative addresses the major source of contamination at the site, i.e. soil under the Former Klink Cosmo building, through SVE/AS. Institutional and engineering controls would adequately address the remaining residual contamination at the site. However, this alternative does not address RAOs with regard to environmental protection to restore the groundwater aquifer and prevent migration of contamination.

6.3.4 Reduction of Toxicity, Mobility and Volume with Treatment

SVE/AS would greatly reduce the volume of contamination at the site, mainly in the source area.

6.3.5 Short-Term Effectiveness

Short term risks to workers and the public are possible during well installation. These risks could be controlled by implementing proper health and safety measures, e.g. by performing air monitoring and using PPE as required. Construction would be completed in less than one year. This alternative complies

with DER-31Green Remediation in that it aggressively remediates the source to reduce long term OM&M associated with groundwater remediation.

6.3.6 Implementability

The proposed remedial technologies are commonly used for remediation and are readily available from many vendors. The conceptual layout for the SVE/AS system shows that well installation is feasible in the area of the building. Location of equipment is somewhat more problematic and will require coordination with building owners and the City.

6.3.7 Land Use

The site is expected to remain zoned as M3-1, a multi-unit residential and commercial area for the foreseeable future. Alternative 2 will restrict land use to commercial through deed restrictions. In addition, land use in the area of the SVE/AS wells would be temporarily limited.

6.3.8 Cost

Estimated capital and OM&M costs for Alternative 2 are presented on Table 6-1. The capital cost is $682,236, present worth of OM&M costs is $614,593, and the total capital with annual present worth cost of Alternative 2 is $2,063,000.

6.4 Alternative 3 - IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management

6.4.1 Overall Protection of Public Health and the Environment

Active remedial measures and institutional controls included in this alternative would meet most RAOs for the Site. SVE/AS will eliminate the source of contamination. Potential human exposure or environmental impacts would be addressed by SSD systems, in-situ groundwater treatment and institutional controls.

6.4.2 Compliance with SCGs

SCGs for soil would be met at the source, i.e. at 368 Richardson Street. Groundwater quality would be greatly improved; however, groundwater SCGs would probably not be achieved for a number of years after the completion of injections. Contaminant concentrations would continue to decrease after the

injections. SCGs for soil vapor intrusion would be met through the operation of a SSD system to mitigate any potential soil vapor exposure.

6.4.3 Long-Term Effectiveness and Permanence

This alternative addresses the major source of contamination at the site, i.e. the soil source area under the building at 368 Richardson Street. Permanganate injections would greatly reduce groundwater contamination. Deed restrictions and engineering controls would adequately address the remaining residual contamination at the site.

6.4.4 Reduction of Toxicity, Mobility and Volume with Treatment

Alternative 3 includes removal of soil and groundwater contamination under the building at 368 Richardson Street and in-situ treatment the dissolved phase plume. These remedial components combined would greatly reduce the volume of contamination at the Site.

6.4.5 Short-Term Effectiveness

Air emissions would be a concern during well installation for the SVE/AS system and for permanganate injection. Air monitoring would be required to protect workers and the public. It is estimated that construction (including permanganate injections) would require a period of 1 to 2 years.

6.4.6 Implementability

The technologies employed for remediation are conventional technologies for addressing the types of contamination at the site. Considerable coordination with the City for installation of injection points and with business owners and residents for installation of SVE/AS and SSD systems would be required.

6.4.7 Land Use

The site is expected to remain a multi-unit residential and commercial area for the foreseeable future. Alternative 3 will restrict land use to commercial through deed restrictions. In addition, land use in the area of the injection points would be temporarily limited.

6.4.8 Cost

Estimated capital and OM&M costs for Alternative 3 are presented on Table 6-1. The capital cost is $2,142,981, present worth of OM&M costs is $614,593, and the total capital with annual present worth cost of Alternative 3 is $4,512,000.

6.5 Alternative 4 - IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management

6.5.1 Overall Protection of Human Health and the Environment

Active remedial measures and institutional controls included in this alternative would meet most RAOs for the Site. SVE/AS will eliminate the source of contamination. Potential human exposure or environmental impacts would be addressed by SSD systems, in-situ groundwater treatment and institutional controls.

6.5.2 Compliance with SCGs

SCGs for soil would be met at the source, i.e. at 368 Richardson Street. Groundwater quality would be greatly improved; however, groundwater SCGs would probably not be achieved for a number of years after the completion of injections. Contaminant concentrations would continue to decrease after the injections. SCGs for soil vapor intrusion would be met through the operation of a SSD system to mitigate any potential soil vapor exposure.

6.5.3 Long-Term Effectiveness

This alternative addresses the major source of contamination at the site, i.e. the soil source area under the building at 368 Richardson Street. EHC injections would greatly reduce groundwater contamination in the dissolved phase plume. Deed restrictions and engineering controls would adequately address the remaining residual contamination at the site.

6.5.4 Reduction of Toxicity, Mobility and Volume with Treatment

Alternative 4 includes removal of soil and groundwater contamination under the building at 368 Richardson Street and in-situ treatment of the dissolved phase plume. These remedial components combined would greatly reduce the volume of contamination at the Site.

6.5.5 Short-Term Effectiveness

Air emissions would be a concern during well installation for the SVE/AS system and for EHC injection. Air monitoring would be required to protect workers and the public. It is estimated that construction (including EHC injections) would require a period of 1 to 2 years.

6.5.6 Implementability

The technologies employed for remediation are conventional technologies for addressing the types of contamination at the site. Considerable coordination with the City for installation of injection points and with business owners and residents for installation of SVE/AS and SSD systems would be required.

6.5.7 Land Use

The site is expected to remain zoned as M3-1, a multi-unit residential and commercial area for the foreseeable future. Alternative 4 will restrict land use to commercial through deed restrictions. In addition, land use in the area of the injection points would be temporarily limited.

6.5.8 Cost

Estimated capital and OM&M costs for Alternative 4 are presented on Table 6-1. The capital cost is $2,215,517, present worth of OM&M costs is $614,593, and the total capital with annual present worth cost of Alternative 4 is $4,634,000.

6.6 Alternative 5 - IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management

6.6.1 Overall Protection of Human Health and the Environment

Active remedial measures and institutional controls included in this alternative would meet RAOs for the Site. SVE/AS will eliminate the source of contamination. Potential human exposure or environmental impacts would be addressed by SSD systems, in-situ groundwater treatment and institutional controls. Groundwater would eventually be restored to pre-disposal conditions, however, this would take many years.

6.6.2 Compliance with SCGs

SCGs for soil would be met at the source, i.e. at 368 Richardson Street. Groundwater quality would be greatly improved; however, groundwater SCGs would probably not be achieved for a number of years after the completion of injections. Contaminant concentrations would continue to decrease after the injections and with continued groundwater extraction and treatment. SCGs for soil vapor intrusion would be met through the operation of a SSD system to mitigate any potential soil vapor exposure.

6.6.3 Long-Term Effectiveness

This alternative addresses the major source of contamination at the site, i.e. the soil source area under the building at 368 Richardson Street. Permanganate injections would greatly reduce groundwater contamination. Hydraulic containment would prevent migration of contamination while these measures were in place. Deed restrictions and engineering controls would adequately address the remaining residual contamination at the site.

6.6.4 Reduction of Toxicity, Mobility and Volume with Treatment

Alternative 5 includes removal of soil and groundwater contamination under the building at 368 Richardson Street and in-situ groundwater treatment that greatly reduces the volume of contamination at the Site. Hydraulic containment limits the mobility of groundwater contamination by preventing further migration of the contamination in groundwater.

6.6.5 Short-Term Effectiveness

Air emissions would be a concern during well installation for the SVE/AS system, operation of the pump and treat groundwater remediation system which would include an air stripper, and for permanganate injection. Air monitoring would be required to protect workers and the public. It is estimated that construction (including permanganate injections) would require a period of 1 to 2 years.

6.6.6 Implementability

The technologies employed for remediation are conventional technologies for addressing the types of contamination at the site. Considerable coordination with the City for installation of injection points and extraction wells and with business owners and residents for installation of SVE/AS, pump and treat and SSD systems would be required.

6.6.7 Land Use

The site is expected to remain zoned as M3-1, a multi-unit residential and commercial area for the foreseeable future. Alternative 5 will restrict land use to commercial through deed restrictions. In addition, land use in the area of the injection points and extraction wells would be temporarily limited.

6.6.8 Cost

Estimated capital and OM&M costs for Alternative 5 are presented on Table 6-1. The capital cost is $4,123,369, present worth of OM&M costs is $1,561,539, and the total capital with annual present worth cost of Alternative 5 is $8,781,000.

6.7 Comparative Analysis of Alternatives

The following section presents the comparative analysis of the five remedial alternatives for the Site based on the evaluation criteria used for remedial alternatives.

6.7.1 Overall Protection of Public Health and the Environment

Alternative 1 is not protective of public health and the environment. Alternative 2 is protective of human health, but does not meet the environmental RAO to restore the groundwater to pre-release conditions, to the extent practicable. All remaining alternatives would eventually meet the RAOs for the Site. All alternatives except No Action include removal of the source of contamination below the building at 368 Richardson Street. These four alternatives all also include SSD systems to mitigate potential soil vapor intrusion exposure, a soil cover to prevent direct contact with contaminated soil, institutional controls including deed restrictions limiting property use for commercial purposes, and (e.g. restrictions on groundwater use for drinking water. Alternatives 3, 4 and 5 are more protective of public health and the environment than alternative 2 because they will require less time to remediate groundwater. Alternative 5 is most protective but will take a long time.

6.7.2 Compliance with SCGs

Alternative 1 does not comply with soil, soil vapor, or groundwater SCGs. For all other alternatives, SCGs for soil would be met through SVE in the source area, pathway elimination via soil cover, and institutional controls. SCGs for soil vapor intrusion would be met through operation of a SSD system. Groundwater quality would be greatly improved; however, groundwater SCGs would not be achieved for a number of years following remediation. Alternatives 3, 4 and 5 that include in-situ

treatment would be expected to achieve groundwater SCGs most quickly. Alternative 2, which includes source removal, but no in-situ treatment of the groundwater plume, would take longer to achieve groundwater SCGs than all other alternatives except No Action.

6.7.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence is directly related to the quantity of residuals remaining on the site. Alternative 1 does not address the source of contamination and is the least effective and permanent. All other alternatives include source removal that minimizes soil residual contamination. Alternatives 3, 4 and 5 include remediation of the groundwater plume, and are consequently more effective and permanent than alternative 2 which only addresses the source of contamination.

For all alternatives, monitoring and deed restrictions implemented through an SMP would be an effective means of managing residual contamination.

6.7.4 Reduction of Toxicity, Mobility and Volume with Treatment

The greatest reduction in TMV would be achieved by Alternative 5 since it includes reduction of contamination by SVE/AS and in-situ groundwater treatment, and reduction of contaminant mobility by hydraulic containment. Alternatives 3 and 4 would reduce TMV somewhat less than Alternative 5 because they do not reduce contaminant mobility. Alternative 2 reduces contamination less than Alternatives 3, 4 and 5 because there is no active groundwater remediation. Alternative 1 does not reduce TMV.

6.7.5 Short-Term Effectiveness

Alternative 1 does not include any active remediation, and therefore, poses no risk to human health or the environment during construction. However, this alternative would not achieve the remedial action objectives for public health or the environment. Alternative 2 poses the least risk to human health and the environment other than Alternative 1. It will take less than a year to construct and has significantly less drilling than Alternatives 3, 4 and 5. Alternatives 3 and 4 pose a greater risk than Alternative 2, but are comparable to each other with respect to short term effectiveness. Alternative 5 includes the most drilling and consequently poses the most short-term risks. Alternative 5 includes continued operation and maintenance of a groundwater treatment system that would continue to pose a risk to local residents.

6.7.6 Implementability

Since there is no construction, there is no implementation issue associated with Alternative 1 however, there would be administrative issues. Alternatives 2, 3, 4 and 5 all include drilling which would require coordination with the City. However, Alternatives 3, 4 and 5 would require much more extensive drilling in public areas. Alternatives 3, 4 and 5 include in-situ groundwater remediation; however, permanganate injection included in Alternatives 3 and 5 has been used at more sites than EHC injection included in Alternative 4 and is a more proven technology. Alternative 5 includes a groundwater treatment system that would be difficult to find space for and would be difficult to operate and maintain in this densely populated urban area.

6.7.7 Land Use

The site is expected to remain zoned as M3-1, a multi-unit residential and commercial area for the foreseeable future. Deed restrictions would be required under all alternatives in the areas impacted by contamination.

6.7.8 Cost

Capital costs and operation, maintenance, and monitoring costs (OM&M) are provided for each alternative and presented as present worth using a 5% discount rate. Cost estimates for each alternative are presented in Appendix D and are summarized on Table 6-1.

7 RECOMMENDED ALTERNATIVE

Alternatives were developed, screened and evaluated for the remediation of the Former Klink Cosmo Cleaners site. The evaluation of alternatives focused on remedial action objectives that were designed to provide source reduction, eliminate exposure pathways and attain SCGs to the extent practicable. Remediation areas and volumes were calculated for contaminated media identified for the site. Costs were developed for each alternative. The overall approach used to select the recommended alternative considered protection of human health and the environment during construction and after completion of remediation, the potential difficulties associated with implementing the alternative and the cost-effectiveness of the alternative. The recommendation is presented below.

7.1 Basis for Recommendations

Alternative 1 is not protective of human health and the environment and is rejected as a viable alternative for remediation. Alternative 2 includes measures to remove the source of contamination. However, Alternative 2 does not address the contamination in the groundwater plume, and is not as protective as alternatives other than No Action. Therefore, Alternative 2 is not considered further in this evaluation. The three most feasible remedial alternatives, Alternatives 3, 4 and 5 are discussed below.

- Overall Protection of Public Health and the Environment: Alternatives 3, 4 and 5 include measures to reduce the major source of contamination. These alternatives all also include SSD systems to address soil vapor contamination and institutional controls (e.g. restrictions on groundwater use for drinking water) to protect the public. All three alternatives meet the RAOs for the site.
- Compliance with Standards, Criteria and Guidance: All three alternatives would meet the SCGs for soil, soil vapor intrusion, and improve groundwater quality although all alternatives rely on long-term attenuation to ultimately achieve SCGs for groundwater.
- Long-Term Effectiveness and Permanence: Long-term effectiveness and permanence is directly related to the quantity of residual contamination remaining on the site after remediation. All alternatives are comparable in this respect.
- Reduction of Toxicity, Mobility with Treatment: All alternatives are comparable with respect to reducing the volume of contamination. However, alternative 5 also includes hydraulic containment that will limit the mobility of contamination.
- Short-Term Effectiveness: The three alternatives are comparable with respect to short-term effectiveness since they all would include drilling a part of the remediation and

because they would require comparable times to complete construction of the remediation.

- Implementability: Alternative 5 includes a groundwater treatment system that would be difficult to install and to operate in an urban area. Although all alternatives employ in-situ groundwater treatment, Alternatives 3 and 5 are superior to Alternative 4 because there is much greater experience using the technology included these alternatives for remediation.
- Cost: Alternative 5 is the most costly alternative and includes long-term O&M, but provides limited additional improvement in meeting RAOs. The estimated costs of Alternatives 3 and 2 are $4,512,000 and $2,063,000, respectively.
- Land Use: The site is expected to remain a multi-unit residential commercial area for the foreseeable future. Remediation will not significantly impact the use of the site although deed restrictions will impact activities on the site. Alternative 3 is the recommended alternative for the Site because it is comparable to Alternatives 4 and 5 for most evaluation criteria and is superior to Alternative 5 in terms of implementability and cost and superior to alternative 4 in terms of implementability.

7.2 Components of Remediation

A conceptual layout for Alternative 3 is shown on Figure 5-2. The major components of the alternative are SVE/AS for source remediation and in-situ groundwater remediation which are described below.

SVE/AS (Source Area Remediation): Five air sparge wells will be constructed. These wells along with three existing wells would be used to introduce compressed air into groundwater below the Former Klink Cosmo building to remove VOCs. Four soil vapor extraction wells will be constructed. These wells along with two existing wells would be used to capture VOCs volatilized by air sparging into the groundwater beneath the Former Klink Cosmo building.

In-Situ Groundwater Remediation: Approximately 30 injection wells will be installed to inject sodium permanganate into contaminated groundwater. Conceptually, approximately 29,000 gallons of a 5% solution will be injected into the groundwater during 4 separate injection events. Injection well quantities and locations as well as the amount of sodium permanganate injected will be further evaluated and finalized during the remedial design phase of the project.

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TABLES

TABLE 2-1A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,2-Dichloroethene (cis)	MG/KG	0.25	37	5	0.0008	0.095	0.025	0	AWL-01	4-5
1,4-Dichlorobenzene	MG/KG	1.8	37	2	0.008	0.096	0.052	0	AWL-01	17-18
Acetone	MG/KG	0.05	37	1	0.079	0.079	0.079	1	AWL-03	39.5-40
Chloroform	MG/KG	0.37	37	3	0.002	0.009	0.006	0	AWL-06	0.5-1.5
Methylene chloride	MG/KG	0.05	37	17	0.002	0.007	0.005	0	AWL-02	21.5-22.5
Naphthalene	MG/KG	12	37	2	0.009	9.05	4.53	0	AWL-03	1.5-2.2
Tetrachloroethene	MG/KG	1.3	37	33	0.002	273.0	34.19	11	AWL-02	0.4-1.5
Trichloroethene	MG/KG	0.47	37	12	0.0009	1.14	0.233	2	AWL-03	1.5-2.2
Semivolatile Organic Compounds										
2-Methylnaphthalene	MG/KG	0.41 CP-51	7	1	0.390	0.390	0.390	0	AWL-04	0.5-1.5
Acenaphthene	MG/KG	20	7	1	1.20	1.20	1.20	0	AWL-04	0.5-1.5
Acenaphthylene	MG/KG	100	7	2	0.310	0.430	0.370	0	AWL-05	5-6
Anthracene	MG/KG	100	7	3	0.046	2.20	0.919	0	AWL-04	0.5-1.5
Benzo(a)anthracene	MG/KG	1	7	3	0.310	6.60	2.90	2	AWL-04	0.5-1.5
Benzo(a)pyrene	MG/KG	1	7	3	0.600	5.40	2.67	2	AWL-04	0.5-1.5
Benzo(b)fluoranthene	MG/KG	1	7	3	0.910	7.80	3.77	2	AWL-04	0.5-1.5
Benzo(g,h,i)perylene	MG/KG	100	7	3	0.770	3.70	1.99	0	AWL-04	0.5-1.5
Benzo(k)fluoranthene	MG/KG	0.8	7	3	0.260	2.50	1.19	1	AWL-04	0.5-1.5
Carbazole	MG/KG	-	7	2	0.190	1.60	0.895	0	AWL-04	0.5-1.5
Chrysene	MG/KG	1	7	3	0.440	6.40	2.98	2	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Dibenz(a,h)anthracene	MG/KG	0.33	7	3	0.380	0.960	0.577	3	AWL-04	0.5-1.5
Dibenzofuran	MG/KG	7	7	1	0.970	0.970	0.970	0	AWL-04	0.5-1.5
Di-n-butylphthalate	MG/KG	0.014 CP-51	7	2	0.027	1.50	0.764	2	AWL-04	0.5-1.5
Fluoranthene	MG/KG	100	6	2	0.370	3.30	1.84	0	AWL-05	5-6
Fluorene	MG/KG	30	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Indeno(1,2,3-cd)pyrene	MG/KG	0.5	7	3	0.600	3.70	1.97	3	AWL-04	0.5-1.5
Naphthalene	MG/KG	12	7	1	0.570	0.570	0.570	0	AWL-04	0.5-1.5
Phenanthrene	MG/KG	100	7	3	0.075	13.00	5.09	0	AWL-04	0.5-1.5
Pyrene	MG/KG	100	7	3	0.600	11.00	5.03	0	AWL-04	0.5-1.5
Pesticide Organic Compounds										
4,4'-DDD	MG/KG	0.0033	7	2	0.004	0.026	0.015	2	AWL-04	0.5-1.5
Aldrin	MG/KG	0.005	7	1	0.013	0.013	0.013	1	AWL-04	0.5-1.5
Endrin ketone	MG/KG	-	7	2	0.004	0.029	0.016	0	AWL-04	0.5-1.5
gamma-Chlordane	MG/KG	0.54 CP-51	7	2	0.002	0.013	0.007	0	AWL-04	0.5-1.5
Heptachlor epoxide	MG/KG	0.02 CP-51	7	1	0.005	0.005	0.005	0	AWL-04	0.5-1.5
Methoxychlor	MG/KG	1.2 CP-51	7	1	0.021	0.021	0.021	0	AWL-04	0.5-1.5
Metals										
Aluminum	MG/KG	10000 CP-51	7	7	1,890	9,400	4,139	0	AWL-01	4-5
Antimony	MG/KG	12 CP-51	7	3	0.490	6.60	3.90	0	AWL-04	0.5-1.5
Arsenic	MG/KG	13	7	7	0.880	38.70	9.35	1	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Barium	MG/KG	350	7	7	10.50	1,280	233.3	1	AWL-04	0.5-1.5
Beryllium	MG/KG	7.2	7	7	0.160	0.530	0.303	0	AWL-01	4-5
Cadmium	MG/KG	2.5	7	6	0.038	4.00	0.909	1	AWL-04	0.5-1.5
Calcium	MG/KG	10000 CP-51	7	7	438.0	8.45E+04	1.68E+04	2	AWL-01	17-18
Chromium	MG/KG	30	7	7	3.90	44.20	15.93	1	AWL-04	0.5-1.5
Cobalt	MG/KG	20 CP-51	7	5	2.90	7.90	5.28	0	AWL-01	4-5
Copper	MG/KG	50	7	7	6.40	290.0	81.94	3	AWL-04	0.5-1.5
Iron	MG/KG	2000 CP-51	7	7	4,930	2.48E+04	1.23E+04	7	AWL-01	4-5
Lead	MG/KG	63	7	7	2.10	2,680	532.8	3	AWL-04	0.5-1.5
Magnesium	MG/KG	-	7	7	925.0	3.38E+04	6,192	0	AWL-01	17-18
Manganese	MG/KG	1600	7	7	80.90	416.0	251.8	0	AWL-01	4-5
Mercury	MG/KG	0.18	7	4	0.005	1.90	1.01	3	AWL-04	0.5-1.5
Nickel	MG/KG	30	7	7	4.40	39.10	14.01	1	AWL-04	0.5-1.5
Potassium	MG/KG	-	7	7	256.0	840.0	558.4	0	AWL-01	17-18
Selenium	MG/KG	3.9	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Silver	MG/KG	2	7	1	1.70	1.70	1.70	0	AWL-04	0.5-1.5
Sodium	MG/KG	-	7	5	61.10	350.0	181.8	0	AWL-05	5-6
Thallium	MG/KG	5 CP-51	7	1	0.470	0.470	0.470	0	AWL-04	0.5-1.5
Vanadium	MG/KG	39 CP-51	7	7	6.00	25.70	12.80	0	AWL-01	4-5
Zinc	MG/KG	109	7	7	9.40	1,670	303.1	3	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,2-Dichloroethene (cis)	MG/KG	0.25	37	7	0.0008	0.095	0.019	0	AWL-01	4-5
1,4-Dichlorobenzene	MG/KG	1.8	37	2	0.008	0.096	0.052	0	AWL-01	17-18
Acetone	MG/KG	0.05	37	1	0.079	0.079	0.079	1	AWL-03	39.5-40
Chloroform	MG/KG	0.37	37	5	0.002	0.013	0.007	0	AWL-06	0.5-1.5
Methylene chloride	MG/KG	0.05	37	19	0.002	0.007	0.005	0	AWL-02	21.5-22.5
Naphthalene	MG/KG	12	37	2	0.009	9.05	4.53	0	AWL-03	1.5-2.2
Tetrachloroethene	MG/KG	1.3	37	36	0.002	273.0	33.69	11	AWL-02	0.4-1.5
Trichloroethene	MG/KG	0.47	37	14	0.0009	1.14	0.203	2	AWL-03	1.5-2.2
Semivolatile Organic Compounds										
2-Methylnaphthalene	MG/KG	36.4 CP-51	7	1	0.390	0.390	0.390	0	AWL-04	0.5-1.5
Acenaphthene	MG/KG	98	7	1	1.20	1.20	1.20	0	AWL-04	0.5-1.5
Acenaphthylene	MG/KG	107	7	2	0.310	0.430	0.370	0	AWL-05	5-6
Anthracene	MG/KG	1000	7	3	0.046	2.20	0.919	0	AWL-04	0.5-1.5
Benzo(a)anthracene	MG/KG	1	7	3	0.310	6.60	2.90	2	AWL-04	0.5-1.5
Benzo(a)pyrene	MG/KG	22	7	3	0.600	5.40	2.67	0	AWL-04	0.5-1.5
Benzo(b)fluoranthene	MG/KG	1.7	7	3	0.910	7.80	3.77	2	AWL-04	0.5-1.5
Benzo(g,h,i)perylene	MG/KG	1000	7	3	0.770	3.70	1.99	0	AWL-04	0.5-1.5
Benzo(k)fluoranthene	MG/KG	1.7	7	3	0.260	2.50	1.19	1	AWL-04	0.5-1.5
Carbazole	MG/KG	-	7	2	0.190	1.60	0.895	0	AWL-04	0.5-1.5
Chrysene	MG/KG	1	7	3	0.440	6.40	2.98	2	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Dibenz(a,h)anthracene	MG/KG	1000	7	3	0.380	0.960	0.577	0	AWL-04	0.5-1.5
Dibenzofuran	MG/KG	210	7	1	0.970	0.970	0.970	0	AWL-04	0.5-1.5
Di-n-butylphthalate	MG/KG	8.1 CP-51	7	2	0.027	1.50	0.764	0	AWL-04	0.5-1.5
Fluoranthene	MG/KG	1000	6	2	0.370	3.30	1.84	0	AWL-05	5-6
Fluorene	MG/KG	386	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Indeno(1,2,3-cd)pyrene	MG/KG	8.2	7	3	0.600	3.70	1.97	0	AWL-04	0.5-1.5
Naphthalene	MG/KG	12	7	1	0.570	0.570	0.570	0	AWL-04	0.5-1.5
Phenanthrene	MG/KG	1000	7	3	0.075	13.00	5.09	0	AWL-04	0.5-1.5
Pyrene	MG/KG	1000	7	3	0.600	11.00	5.03	0	AWL-04	0.5-1.5
Pesticide Organic Compounds										
4,4'-DDD	MG/KG	14	7	2	0.004	0.026	0.015	0	AWL-04	0.5-1.5
Aldrin	MG/KG	0.19	7	1	0.013	0.013	0.013	0	AWL-04	0.5-1.5
Endrin ketone	MG/KG	-	7	2	0.004	0.029	0.016	0	AWL-04	0.5-1.5
gamma-Chlordane	MG/KG	14 CP-51	7	2	0.002	0.013	0.007	0	AWL-04	0.5-1.5
Heptachlor epoxide	MG/KG	0.02 CP-51	7	1	0.005	0.005	0.005	0	AWL-04	0.5-1.5
Methoxychlor	MG/KG	900 CP-51	7	1	0.021	0.021	0.021	0	AWL-04	0.5-1.5
Metals										
Aluminum	MG/KG	-	7	7	1,890	9,400	4,139	0	AWL-01	4-5
Antimony	MG/KG	-	7	3	0.490	6.60	3.90	0	AWL-04	0.5-1.5
Arsenic	MG/KG	16	7	7	0.880	38.70	9.35	1	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Barium	MG/KG	820	7	7	10.50	1,280	233.3	1	AWL-04	0.5-1.5
Beryllium	MG/KG	47	7	7	0.160	0.530	0.303	0	AWL-01	4-5
Cadmium	MG/KG	7.5	7	6	0.038	4.00	0.909	0	AWL-04	0.5-1.5
Calcium	MG/KG	-	7	7	438.0	8.45E+04	1.68E+04	0	AWL-01	17-18
Chromium	MG/KG	NS	7	7	3.90	44.20	15.93	0	AWL-04	0.5-1.5
Cobalt	MG/KG	-	7	5	2.90	7.90	5.28	0	AWL-01	4-5
Copper	MG/KG	1720	7	7	6.40	290.0	81.94	0	AWL-04	0.5-1.5
Iron	MG/KG	-	7	7	4,930	2.48E+04	1.23E+04	0	AWL-01	4-5
Lead	MG/KG	450	7	7	2.10	2,680	532.8	2	AWL-04	0.5-1.5
Magnesium	MG/KG	-	7	7	925.0	3.38E+04	6,192	0	AWL-01	17-18
Manganese	MG/KG	2000	7	7	80.90	416.0	251.8	0	AWL-01	4-5
Mercury	MG/KG	0.73	7	4	0.005	1.90	1.01	2	AWL-04	0.5-1.5
Nickel	MG/KG	130	7	7	4.40	39.10	14.01	0	AWL-04	0.5-1.5
Potassium	MG/KG	-	7	7	256.0	840.0	558.4	0	AWL-01	17-18
Selenium	MG/KG	4	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Silver	MG/KG	8.3	7	1	1.70	1.70	1.70	0	AWL-04	0.5-1.5
Sodium	MG/KG	-	7	5	61.10	350.0	181.8	0	AWL-05	5-6
Thallium	MG/KG	-	7	1	0.470	0.470	0.470	0	AWL-04	0.5-1.5
Vanadium	MG/KG	-	7	7	6.00	25.70	12.80	0	AWL-01	4-5
Zinc	MG/KG	2480	7	7	9.40	1,670	303.1	0	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1C
STATISTICAL SUMMARY OF COMPOUNDS DETECTED IN ON-SITE SOIL SAMPLES
COMMERCIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,2-Dichloroethene (cis)	MG/KG	500	37	5	0.0008	0.095	0.025	0	AWL-01	4-5
1,4-Dichlorobenzene	MG/KG	130	37	2	0.008	0.096	0.052	0	AWL-01	17-18
Acetone	MG/KG	500	37	1	0.079	0.079	0.079	0	AWL-03	39.5-40
Chloroform	MG/KG	350	37	3	0.002	0.009	0.006	0	AWL-06	0.5-1.5
Methylene chloride	MG/KG	500	37	17	0.002	0.007	0.005	0	AWL-02	21.5-22.5
Naphthalene	MG/KG	500	37	2	0.009	9.05	4.53	0	AWL-03	1.5-2.2
Tetrachloroethene	MG/KG	150	37	33	0.002	273.0	34.19	4	AWL-02	0.4-1.5
Trichloroethene	MG/KG	200	37	12	0.0009	1.14	0.233	0	AWL-03	1.5-2.2
Semivolatile Organic Compounds										
2-Methylnaphthalene	MG/KG	-	7	1	0.390	0.390	0.390	0	AWL-04	0.5-1.5
Acenaphthene	MG/KG	500	7	1	1.20	1.20	1.20	0	AWL-04	0.5-1.5
Acenaphthylene	MG/KG	500	7	2	0.310	0.430	0.370	0	AWL-05	5-6
Anthracene	MG/KG	500	7	3	0.046	2.20	0.919	0	AWL-04	0.5-1.5
Benzo(a)anthracene	MG/KG	5.6	7	3	0.310	6.60	2.90	1	AWL-04	0.5-1.5
Benzo(a)pyrene	MG/KG	1	7	3	0.600	5.40	2.67	2	AWL-04	0.5-1.5
Benzo(b)fluoranthene	MG/KG	5.6	7	3	0.910	7.80	3.77	1	AWL-04	0.5-1.5
Benzo(g,h,i)perylene	MG/KG	500	7	3	0.770	3.70	1.99	0	AWL-04	0.5-1.5
Benzo(k)fluoranthene	MG/KG	56	7	3	0.260	2.50	1.19	0	AWL-04	0.5-1.5
Carbazole	MG/KG	-	7	2	0.190	1.60	0.895	0	AWL-04	0.5-1.5
Chrysene	MG/KG	56	7	3	0.440	6.40	2.98	0	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Commercial, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1C
STATISTICAL SUMMARY OF COMPOUNDS DETECTED IN ON-SITE SOIL SAMPLES
COMMERCIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Dibenz(a,h)anthracene	MG/KG	0.56	7	3	0.380	0.960	0.577	1	AWL-04	0.5-1.5
Dibenzofuran	MG/KG	350	7	1	0.970	0.970	0.970	0	AWL-04	0.5-1.5
Di-n-butylphthalate	MG/KG	-	7	2	0.027	1.50	0.764	0	AWL-04	0.5-1.5
Fluoranthene	MG/KG	500	6	2	0.370	3.30	1.84	0	AWL-05	5-6
Fluorene	MG/KG	500	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Indeno(1,2,3-cd)pyrene	MG/KG	5.6	7	3	0.600	3.70	1.97	0	AWL-04	0.5-1.5
Naphthalene	MG/KG	500	7	1	0.570	0.570	0.570	0	AWL-04	0.5-1.5
Phenanthrene	MG/KG	500	7	3	0.075	13.00	5.09	0	AWL-04	0.5-1.5
Pyrene	MG/KG	500	7	3	0.600	11.00	5.03	0	AWL-04	0.5-1.5
Pesticide Organic Compounds										
4,4'-DDD	MG/KG	92	7	2	0.004	0.026	0.015	0	AWL-04	0.5-1.5
Aldrin	MG/KG	0.68	7	1	0.013	0.013	0.013	0	AWL-04	0.5-1.5
Endrin ketone	MG/KG	-	7	2	0.004	0.029	0.016	0	AWL-04	0.5-1.5
gamma-Chlordane	MG/KG	-	7	2	0.002	0.013	0.007	0	AWL-04	0.5-1.5
Heptachlor epoxide	MG/KG	-	7	1	0.005	0.005	0.005	0	AWL-04	0.5-1.5
Methoxychlor	MG/KG	-	7	1	0.021	0.021	0.021	0	AWL-04	0.5-1.5
Metals										
Aluminum	MG/KG	-	7	7	1,890	9,400	4,139	0	AWL-01	4-5
Antimony	MG/KG	-	7	3	0.490	6.60	3.90	0	AWL-04	0.5-1.5
Arsenic	MG/KG	16	7	7	0.880	38.70	9.35	1	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Commercial, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1C
STATISTICAL SUMMARY OF COMPOUNDS DETECTED IN ON-SITE SOIL SAMPLES
COMMERCIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Barium	MG/KG	400	7	7	10.50	1,280	233.3	1	AWL-04	0.5-1.5
Beryllium	MG/KG	590	7	7	0.160	0.530	0.303	0	AWL-01	4-5
Cadmium	MG/KG	9.3	7	6	0.038	4.00	0.909	0	AWL-04	0.5-1.5
Calcium	MG/KG	-	7	7	438.0	8.45E+04	1.68E+04	0	AWL-01	17-18
Chromium	MG/KG	1500	7	7	3.90	44.20	15.93	0	AWL-04	0.5-1.5
Cobalt	MG/KG	-	7	5	2.90	7.90	5.28	0	AWL-01	4-5
Copper	MG/KG	270	7	7	6.40	290.0	81.94	1	AWL-04	0.5-1.5
Iron	MG/KG	-	7	7	4,930	2.48E+04	1.23E+04	0	AWL-01	4-5
Lead	MG/KG	1000	7	7	2.10	2,680	532.8	1	AWL-04	0.5-1.5
Magnesium	MG/KG	-	7	7	925.0	3.38E+04	6,192	0	AWL-01	17-18
Manganese	MG/KG	10000	7	7	80.90	416.0	251.8	0	AWL-01	4-5
Mercury	MG/KG	2.8	7	4	0.005	1.90	1.01	0	AWL-04	0.5-1.5
Nickel	MG/KG	310	7	7	4.40	39.10	14.01	0	AWL-04	0.5-1.5
Potassium	MG/KG	-	7	7	256.0	840.0	558.4	0	AWL-01	17-18
Selenium	MG/KG	1500	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Silver	MG/KG	1500	7	1	1.70	1.70	1.70	0	AWL-04	0.5-1.5
Sodium	MG/KG	-	7	5	61.10	350.0	181.8	0	AWL-05	5-6
Thallium	MG/KG	-	7	1	0.470	0.470	0.470	0	AWL-04	0.5-1.5
Vanadium	MG/KG	-	7	7	6.00	25.70	12.80	0	AWL-01	4-5
Zinc	MG/KG	10000	7	7	9.40	1,670	303.1	0	AWL-04	0.5-1.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Commercial, plus CP-51 Table 1 10/21/10.


Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,2-Dichloroethene (cis)	MG/KG	-	37	5	0.0008	0.095	0.025	0	AWL-01	4-5
1,4-Dichlorobenzene	MG/KG	-	37	2	0.008	0.096	0.052	0	AWL-01	17-18
Acetone	MG/KG	-	37	1	0.079	0.079	0.079	0	AWL-03	39.5-40
Chloroform	MG/KG	-	37	3	0.002	0.009	0.006	0	AWL-06	0.5-1.5
Methylene chloride	MG/KG	-	37	17	0.002	0.007	0.005	0	AWL-02	21.5-22.5
Naphthalene	MG/KG	-	37	2	0.009	9.05	4.53	0	AWL-03	1.5-2.2
Tetrachloroethene	MG/KG	-	37	33	0.002	273.0	34.19	0	AWL-02	0.4-1.5
Trichloroethene	MG/KG	-	37	12	0.0009	1.14	0.233	0	AWL-03	1.5-2.2
Semivolatile Organic Compounds										
2-Methylnaphthalene	MG/KG	-	7	1	0.390	0.390	0.390	0	AWL-04	0.5-1.5
Acenaphthene	MG/KG	-	7	1	1.20	1.20	1.20	0	AWL-04	0.5-1.5
Acenaphthylene	MG/KG	-	7	2	0.310	0.430	0.370	0	AWL-05	5-6
Anthracene	MG/KG	-	7	3	0.046	2.20	0.919	0	AWL-04	0.5-1.5
Benzo(a)anthracene	MG/KG	-	7	3	0.310	6.60	2.90	0	AWL-04	0.5-1.5
Benzo(a)pyrene	MG/KG	-	7	3	0.600	5.40	2.67	0	AWL-04	0.5-1.5
Benzo(b)fluoranthene	MG/KG	-	7	3	0.910	7.80	3.77	0	AWL-04	0.5-1.5
Benzo(g,h,i)perylene	MG/KG	-	7	3	0.770	3.70	1.99	0	AWL-04	0.5-1.5
Benzo(k)fluoranthene	MG/KG	-	7	3	0.260	2.50	1.19	0	AWL-04	0.5-1.5
Carbazole	MG/KG	-	7	2	0.190	1.60	0.895	0	AWL-04	0.5-1.5
Chrysene	MG/KG	-	7	3	0.440	6.40	2.98	0	AWL-04	0.5-1.5

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Dibenz(a,h)anthracene	MG/KG	-	7	3	0.380	0.960	0.577	0	AWL-04	0.5-1.5
Dibenzofuran	MG/KG	-	7	1	0.970	0.970	0.970	0	AWL-04	0.5-1.5
Di-n-butylphthalate	MG/KG	0.09	7	2	0.027	1.50	0.764	1	AWL-04	0.5-1.5
Fluoranthene	MG/KG	-	6	2	0.370	3.30	1.84	0	AWL-05	5-6
Fluorene	MG/KG	-	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Indeno(1,2,3-cd)pyrene	MG/KG	-	7	3	0.600	3.70	1.97	0	AWL-04	0.5-1.5
Naphthalene	MG/KG	-	7	1	0.570	0.570	0.570	0	AWL-04	0.5-1.5
Phenanthrene	MG/KG	-	7	3	0.075	13.00	5.09	0	AWL-04	0.5-1.5
Pyrene	MG/KG	-	7	3	0.600	11.00	5.03	0	AWL-04	0.5-1.5
Pesticide Organic Compounds										
4,4'-DDD	MG/KG	0.1	7	2	0.004	0.026	0.015	0	AWL-04	0.5-1.5
Aldrin	MG/KG	-	7	1	0.013	0.013	0.013	0	AWL-04	0.5-1.5
Endrin ketone	MG/KG	-	7	2	0.004	0.029	0.016	0	AWL-04	0.5-1.5
gamma-Chlordane	MG/KG	-	7	2	0.002	0.013	0.007	0	AWL-04	0.5-1.5
Heptachlor epoxide	MG/KG	-	7	1	0.005	0.005	0.005	0	AWL-04	0.5-1.5
Methoxychlor	MG/KG	-	7	1	0.021	0.021	0.021	0	AWL-04	0.5-1.5
Metals										
Aluminum	MG/KG	10600	7	7	1,890	9,400	4,139	0	AWL-01	4-5
Antimony	MG/KG	-	7	3	0.490	6.60	3.90	0	AWL-04	0.5-1.5
Arsenic	MG/KG	16.4	7	7	0.880	38.70	9.35	1	AWL-04	0.5-1.5

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-1D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Barium	MG/KG	-	7	7	10.50	1,280	233.3	0	AWL-04	0.5-1.5
Beryllium	MG/KG	-	7	7	0.160	0.530	0.303	0	AWL-01	4-5
Cadmium	MG/KG	-	7	6	0.038	4.00	0.909	0	AWL-04	0.5-1.5
Calcium	MG/KG	-	7	7	438.0	8.45E+04	1.68E+04	0	AWL-01	17-18
Chromium	MG/KG	-	7	7	3.90	44.20	15.93	0	AWL-04	0.5-1.5
Cobalt	MG/KG	-	7	5	2.90	7.90	5.28	0	AWL-01	4-5
Copper	MG/KG	161	7	7	6.40	290.0	81.94	2	AWL-04	0.5-1.5
Iron	MG/KG	19500	7	7	4,930	2.48E+04	1.23E+04	2	AWL-01	4-5
Lead	MG/KG	208	7	7	2.10	2,680	532.8	3	AWL-04	0.5-1.5
Magnesium	MG/KG	-	7	7	925.0	3.38E+04	6,192	0	AWL-01	17-18
Manganese	MG/KG	-	7	7	80.90	416.0	251.8	0	AWL-01	4-5
Mercury	MG/KG	1.4	7	4	0.005	1.90	1.01	2	AWL-04	0.5-1.5
Nickel	MG/KG	-	7	7	4.40	39.10	14.01	0	AWL-04	0.5-1.5
Potassium	MG/KG	-	7	7	256.0	840.0	558.4	0	AWL-01	17-18
Selenium	MG/KG	-	7	1	1.10	1.10	1.10	0	AWL-04	0.5-1.5
Silver	MG/KG	-	7	1	1.70	1.70	1.70	0	AWL-04	0.5-1.5
Sodium	MG/KG	-	7	5	61.10	350.0	181.8	0	AWL-05	5-6
Thallium	MG/KG	-	7	1	0.470	0.470	0.470	0	AWL-04	0.5-1.5
Vanadium	MG/KG	-	7	7	6.00	25.70	12.80	0	AWL-01	4-5
Zinc	MG/KG	120	7	7	9.40	1,670	303.1	2	AWL-04	0.5-1.5

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-2A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
Methylene chloride	MG/KG	0.05	5	1	0.011	0.011	0.011	0	AWL-FD-3
Tetrachloroethene	MG/KG	1.3	5	5	0.062	15.00	3.45	2	AWL-FD-1
Semivolatile Organic Compounds									
Acetophenone	MG/KG	-	3	1	0.330	0.330	0.330	0	AWL-FD-1
Benzaldehyde	MG/KG	-	3	1	0.490	0.490	0.490	0	AWL-FD-1
Benzo(g,h,i)perylene	MG/KG	100	3	1	0.230	0.230	0.230	0	AWL-FD-1
bis(2-Ethylhexyl)phthalate	MG/KG	50 CP-51	3	3	1.10	12.00	4.93	0	AWL-FD-1
Butylbenzylphthalate	MG/KG	100 CP-51	3	1	1.30	1.30	1.30	0	AWL-FD-1
Di-n-butylphthalate	MG/KG	0.014 CP-51	3	2	0.230	0.950	0.590	2	AWL-FD-1
Fluoranthene	MG/KG	100	3	1	0.230	0.230	0.230	0	AWL-FD-1
Pyrene	MG/KG	100	3	1	0.240	0.240	0.240	0	AWL-FD-1
Pesticide Organic Compounds									
4,4'-DDD	MG/KG	0.0033	3	1	0.110	0.110	0.110	1	AWL-FD-1
4,4'-DDE	MG/KG	0.0033	3	3	0.054	0.170	0.125	3	AWL-FD-1
4,4'-DDT	MG/KG	0.0033	3	3	0.140	1.00	0.460	3	AWL-FD-1
alpha-Chlordane	MG/KG	0.094	3	3	0.011	0.066	0.040	0	AWL-FD-3
Dieldrin	MG/KG	0.005	3	3	0.025	0.140	0.087	3	AWL-FD-1

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

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WHERE [MATRIX] = 'SE' AND [LOCID] LIKE 'AWL-*';

TABLE 2-2A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Pesticide Organic Compounds									
Endosulfan I	MG/KG	2.4	3	1	0.019	0.019	0.019	0	AWL-FD-3
Endosulfan II	MG/KG	2.4	3	1	0.022	0.022	0.022	0	AWL-FD-3
Endrin	MG/KG	0.014	3	1	0.030	0.030	0.030	1	AWL-FD-3
gamma-Chlordane	MG/KG	0.54 CP-51	3	2	0.032	0.045	0.039	0	AWL-FD-1
Heptachlor epoxide	MG/KG	0.02 CP-51	3	1	0.048	0.048	0.048	1	AWL-FD-3
Metals									
Aluminum	MG/KG	10000 CP-51	3	3	1,070	7,800	3,343	0	AWL-FD-1
Antimony	MG/KG	12 CP-51	3	1	35.60	35.60	35.60	1	AWL-FD-1
Arsenic	MG/KG	13	3	3	5.10	22.30	12.80	1	AWL-FD-1
Barium	MG/KG	350	3	3	52.00	215.0	107.0	0	AWL-FD-1
Beryllium	MG/KG	7.2	3	1	0.350	0.350	0.350	0	AWL-FD-1
Cadmium	MG/KG	2.5	3	3	3.40	25.40	11.67	3	AWL-FD-1
Calcium	MG/KG	10000 CP-51	3	3	9,860	3.08E+04	2.12E+04	2	AWL-FD-1
Chromium	MG/KG	30	3	3	177.0	1.92E+04	6,680	3	AWL-FD-1
Cobalt	MG/KG	20 CP-51	3	3	11.80	132.0	56.93	2	AWL-FD-1
Copper	MG/KG	50	3	3	306.0	2,010	914.3	3	AWL-FD-1
Iron	MG/KG	2000 CP-51	3	3	5.28E+04	2.25E+05	1.38E+05	3	AWL-FD-1

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

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WHERE [MATRIX] = 'SE' AND [LOCID] LIKE 'AWL-*';

TABLE 2-2A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Metals									
Lead	MG/KG	63	3	3	100.0	1,110	440.7	3	AWL-FD-1
Magnesium	MG/KG	-	3	3	1,450	3,180	2,273	0	AWL-FD-1
Manganese	MG/KG	1600	3	3	481.0	2,400	1,221	1	AWL-FD-1
Mercury	MG/KG	0.18	3	3	0.200	1.70	0.770	3	AWL-FD-1
Nickel	MG/KG	30	3	3	94.60	9,510	3,312	3	AWL-FD-1
Potassium	MG/KG	-	3	3	785.0	6,750	3,598	0	AWL-FD-3
Silver	MG/KG	2	3	2	0.110	0.500	0.305	0	AWL-FD-1
Sodium	MG/KG	-	3	3	1,200	2,830	2,100	0	AWL-FD-3
Thallium	MG/KG	5 CP-51	3	3	0.340	1.20	0.743	0	AWL-FD-3
Vanadium	MG/KG	39 CP-51	3	3	5.50	105.0	38.83	1	AWL-FD-1
Zinc	MG/KG	109	3	3	634.0	5,290	2,425	3	AWL-FD-1

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

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WHERE [MATRIX] = 'SE' AND [LOCID] LIKE 'AWL-*';

TABLE 2-2B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
Methylene chloride	MG/KG	0.05	5	1	0.011	0.011	0.011	0	AWL-FD-3
Tetrachloroethene	MG/KG	1.3	5	5	0.062	15.00	3.45	2	AWL-FD-1
Semivolatile Organic Compounds									
Acetophenone	MG/KG	-	3	1	0.330	0.330	0.330	0	AWL-FD-1
Benzaldehyde	MG/KG	-	3	1	0.490	0.490	0.490	0	AWL-FD-1
Benzo(g,h,i)perylene	MG/KG	1000	3	1	0.230	0.230	0.230	0	AWL-FD-1
bis(2-Ethylhexyl)phthalate	MG/KG	435 CP-51	3	3	1.10	12.00	4.93	0	AWL-FD-1
Butylbenzylphthalate	MG/KG	122 CP-51	3	1	1.30	1.30	1.30	0	AWL-FD-1
Di-n-butylphthalate	MG/KG	8.1 CP-51	3	2	0.230	0.950	0.590	0	AWL-FD-1
Fluoranthene	MG/KG	1000	3	1	0.230	0.230	0.230	0	AWL-FD-1
Pyrene	MG/KG	1000	3	1	0.240	0.240	0.240	0	AWL-FD-1
Pesticide Organic Compounds									
4,4'-DDD	MG/KG	14	3	1	0.110	0.110	0.110	0	AWL-FD-1
4,4'-DDE	MG/KG	17	3	3	0.054	0.170	0.125	0	AWL-FD-1
4,4'-DDT	MG/KG	136	3	3	0.140	1.00	0.460	0	AWL-FD-1
alpha-Chlordane	MG/KG	2.9	3	3	0.011	0.066	0.040	0	AWL-FD-3
Dieldrin	MG/KG	0.1	3	3	0.025	0.140	0.087	1	AWL-FD-1

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

TABLE 2-2B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Pesticide Organic Compounds									
Endosulfan I	MG/KG	102	3	1	0.019	0.019	0.019	0	AWL-FD-3
Endosulfan II	MG/KG	102	3	1	0.022	0.022	0.022	0	AWL-FD-3
Endrin	MG/KG	0.06	3	1	0.030	0.030	0.030	0	AWL-FD-3
gamma-Chlordane	MG/KG	14 CP-51	3	2	0.032	0.045	0.039	0	AWL-FD-1
Heptachlor epoxide	MG/KG	0.02 CP-51	3	1	0.048	0.048	0.048	1	AWL-FD-3
Metals									
Aluminum	MG/KG	-	3	3	1,070	7,800	3,343	0	AWL-FD-1
Antimony	MG/KG	-	3	1	35.60	35.60	35.60	0	AWL-FD-1
Arsenic	MG/KG	16	3	3	5.10	22.30	12.80	1	AWL-FD-1
Barium	MG/KG	820	3	3	52.00	215.0	107.0	0	AWL-FD-1
Beryllium	MG/KG	47	3	1	0.350	0.350	0.350	0	AWL-FD-1
Cadmium	MG/KG	7.5	3	3	3.40	25.40	11.67	1	AWL-FD-1
Calcium	MG/KG	-	3	3	9,860	3.08E+04	2.12E+04	0	AWL-FD-1
Chromium	MG/KG	NS	3	3	177.0	1.92E+04	6,680	0	AWL-FD-1
Cobalt	MG/KG	-	3	3	11.80	132.0	56.93	0	AWL-FD-1
Copper	MG/KG	1720	3	3	306.0	2,010	914.3	1	AWL-FD-1
Iron	MG/KG	-	3	3	5.28E+04	2.25E+05	1.38E+05	0	AWL-FD-1

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

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WHERE [MATRIX] = 'SE' AND [LOCID] LIKE 'AWL-*';

TABLE 2-2B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Metals									
Lead	MG/KG	450	3	3	100.0	1,110	440.7	1	AWL-FD-1
Magnesium	MG/KG	-	3	3	1,450	3,180	2,273	0	AWL-FD-1
Manganese	MG/KG	2000	3	3	481.0	2,400	1,221	1	AWL-FD-1
Mercury	MG/KG	0.73	3	3	0.200	1.70	0.770	1	AWL-FD-1
Nickel	MG/KG	130	3	3	94.60	9,510	3,312	2	AWL-FD-1
Potassium	MG/KG	-	3	3	785.0	6,750	3,598	0	AWL-FD-3
Silver	MG/KG	8.3	3	2	0.110	0.500	0.305	0	AWL-FD-1
Sodium	MG/KG	-	3	3	1,200	2,830	2,100	0	AWL-FD-3
Thallium	MG/KG	-	3	3	0.340	1.20	0.743	0	AWL-FD-3
Vanadium	MG/KG	-	3	3	5.50	105.0	38.83	0	AWL-FD-1
Zinc	MG/KG	2480	3	3	634.0	5,290	2,425	1	AWL-FD-1

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

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WHERE [MATRIX] = 'SE' AND [LOCID] LIKE 'AWL-*';

TABLE 2-2C
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
COMMERCIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
Methylene chloride	MG/KG	500	5	1	0.011	0.011	0.011	0	AWL-FD-3	0-0
Tetrachloroethene	MG/KG	150	5	5	0.062	15.00	3.45	0	AWL-FD-1	0-0
Semivolatile Organic Compounds										
Acetophenone	MG/KG	-	3	1	0.330	0.330	0.330	0	AWL-FD-1	0-0
Benzaldehyde	MG/KG	-	3	1	0.490	0.490	0.490	0	AWL-FD-1	0-0
Benzo(g,h,i)perylene	MG/KG	500	3	1	0.230	0.230	0.230	0	AWL-FD-1	0-0
bis(2-Ethylhexyl)phthalate	MG/KG	-	3	3	1.10	12.00	4.93	0	AWL-FD-1	0-0
Butylbenzylphthalate	MG/KG	-	3	1	1.30	1.30	1.30	0	AWL-FD-1	0-0
Di-n-butylphthalate	MG/KG	-	3	2	0.230	0.950	0.590	0	AWL-FD-1	0-0
Fluoranthene	MG/KG	500	3	1	0.230	0.230	0.230	0	AWL-FD-1	0-0
Pyrene	MG/KG	500	3	1	0.240	0.240	0.240	0	AWL-FD-1	0-0
Pesticide Organic Compounds										
4,4'-DDD	MG/KG	92	3	1	0.110	0.110	0.110	0	AWL-FD-1	0-0
4,4'-DDE	MG/KG	62	3	3	0.054	0.170	0.125	0	AWL-FD-1	0-0
4,4'-DDT	MG/KG	47	3	3	0.140	1.00	0.460	0	AWL-FD-1	0-0
alpha-Chlordane	MG/KG	24	3	3	0.011	0.066	0.040	0	AWL-FD-3	0-0
Dieldrin	MG/KG	1.4	3	3	0.025	0.140	0.087	0	AWL-FD-1	0-0

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Commercial, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-2C
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
COMMERCIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Pesticide Organic Compounds										
Endosulfan I	MG/KG	200	3	1	0.019	0.019	0.019	0	AWL-FD-3	0-0
Endosulfan II	MG/KG	200	3	1	0.022	0.022	0.022	0	AWL-FD-3	0-0
Endrin	MG/KG	89	3	1	0.030	0.030	0.030	0	AWL-FD-3	0-0
gamma-Chlordane	MG/KG	-	3	2	0.032	0.045	0.039	0	AWL-FD-1	0-0
Heptachlor epoxide	MG/KG	-	3	1	0.048	0.048	0.048	0	AWL-FD-3	0-0
Metals										
Aluminum	MG/KG	-	3	3	1,070	7,800	3,343	0	AWL-FD-1	0-0
Antimony	MG/KG	-	3	1	35.60	35.60	35.60	0	AWL-FD-1	0-0
Arsenic	MG/KG	16	3	3	5.10	22.30	12.80	1	AWL-FD-1	0-0
Barium	MG/KG	400	3	3	52.00	215.0	107.0	0	AWL-FD-1	0-0
Beryllium	MG/KG	590	3	1	0.350	0.350	0.350	0	AWL-FD-1	0-0
Cadmium	MG/KG	9.3	3	3	3.40	25.40	11.67	1	AWL-FD-1	0-0
Calcium	MG/KG	-	3	3	9,860	3.08E+04	2.12E+04	0	AWL-FD-1	0-0
Chromium	MG/KG	1500	3	3	177.0	1.92E+04	6,680	1	AWL-FD-1	0-0
Cobalt	MG/KG	-	3	3	11.80	132.0	56.93	0	AWL-FD-1	0-0
Copper	MG/KG	270	3	3	306.0	2,010	914.3	2	AWL-FD-1	0-0
Iron	MG/KG	-	3	3	5.28E+04	2.25E+05	1.38E+05	0	AWL-FD-1	0-0

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Commercial, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-2C
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
COMMERCIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Lead	MG/KG	1000	3	3	100.0	1,110	440.7	1	AWL-FD-1	0-0
Magnesium	MG/KG	-	3	3	1,450	3,180	2,273	0	AWL-FD-1	0-0
Manganese	MG/KG	10000	3	3	481.0	2,400	1,221	0	AWL-FD-1	0-0
Mercury	MG/KG	2.8	3	3	0.200	1.70	0.770	0	AWL-FD-1	0-0
Nickel	MG/KG	310	3	3	94.60	9,510	3,312	2	AWL-FD-1	0-0
Potassium	MG/KG	-	3	3	785.0	6,750	3,598	0	AWL-FD-3	0-0
Silver	MG/KG	1500	3	2	0.110	0.500	0.305	0	AWL-FD-1	0-0
Sodium	MG/KG	-	3	3	1,200	2,830	2,100	0	AWL-FD-3	0-0
Thallium	MG/KG	-	3	3	0.340	1.20	0.743	0	AWL-FD-3	0-0
Vanadium	MG/KG	-	3	3	5.50	105.0	38.83	0	AWL-FD-1	0-0
Zinc	MG/KG	10000	3	3	634.0	5,290	2,425	0	AWL-FD-1	0-0

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Commercial, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-2D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
Methylene chloride	MG/KG	-	5	1	0.011	0.011	0.011	0	AWL-FD-3
Tetrachloroethene	MG/KG	-	5	5	0.062	15.00	3.45	0	AWL-FD-1
Semivolatile Organic Compounds									
Acetophenone	MG/KG	-	3	1	0.330	0.330	0.330	0	AWL-FD-1
Benzaldehyde	MG/KG	-	3	1	0.490	0.490	0.490	0	AWL-FD-1
Benzo(g,h,i)perylene	MG/KG	-	3	1	0.230	0.230	0.230	0	AWL-FD-1
bis(2-Ethylhexyl)phthalate	MG/KG	-	3	3	1.10	12.00	4.93	0	AWL-FD-1
Butylbenzylphthalate	MG/KG	-	3	1	1.30	1.30	1.30	0	AWL-FD-1
Di-n-butylphthalate	MG/KG	0.09	3	2	0.230	0.950	0.590	2	AWL-FD-1
Fluoranthene	MG/KG	-	3	1	0.230	0.230	0.230	0	AWL-FD-1
Pyrene	MG/KG	-	3	1	0.240	0.240	0.240	0	AWL-FD-1
Pesticide Organic Compounds									
4,4'-DDD	MG/KG	0.1	3	1	0.110	0.110	0.110	1	AWL-FD-1
4,4'-DDE	MG/KG	0.95	3	3	0.054	0.170	0.125	0	AWL-FD-1
4,4'-DDT	MG/KG	1	3	3	0.140	1.00	0.460	1	AWL-FD-1
alpha-Chlordane	MG/KG	-	3	3	0.011	0.066	0.040	0	AWL-FD-3
Dieldrin	MG/KG	0.043	3	3	0.025	0.140	0.087	2	AWL-FD-1

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

TABLE 2-2D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Pesticide Organic Compounds									
Endosulfan I	MG/KG	-	3	1	0.019	0.019	0.019	0	AWL-FD-3
Endosulfan II	MG/KG	-	3	1	0.022	0.022	0.022	0	AWL-FD-3
Endrin	MG/KG	-	3	1	0.030	0.030	0.030	0	AWL-FD-3
gamma-Chlordane	MG/KG	-	3	2	0.032	0.045	0.039	0	AWL-FD-1
Heptachlor epoxide	MG/KG	-	3	1	0.048	0.048	0.048	0	AWL-FD-3
Metals									
Aluminum	MG/KG	10600	3	3	1,070	7,800	3,343	0	AWL-FD-1
Antimony	MG/KG	-	3	1	35.60	35.60	35.60	0	AWL-FD-1
Arsenic	MG/KG	16.4	3	3	5.10	22.30	12.80	1	AWL-FD-1
Barium	MG/KG	-	3	3	52.00	215.0	107.0	0	AWL-FD-1
Beryllium	MG/KG	-	3	1	0.350	0.350	0.350	0	AWL-FD-1
Cadmium	MG/KG	-	3	3	3.40	25.40	11.67	0	AWL-FD-1
Calcium	MG/KG	-	3	3	9,860	3.08E+04	2.12E+04	0	AWL-FD-1
Chromium	MG/KG	-	3	3	177.0	1.92E+04	6,680	0	AWL-FD-1
Cobalt	MG/KG	-	3	3	11.80	132.0	56.93	0	AWL-FD-1
Copper	MG/KG	161	3	3	306.0	2,010	914.3	3	AWL-FD-1
Iron	MG/KG	19500	3	3	5.28E+04	2.25E+05	1.38E+05	3	AWL-FD-1

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

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WHERE [MATRIX] = 'SE' AND [LOCID] LIKE 'AWL-*';

TABLE 2-2D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE FLOOR DRAIN SEDIMENT SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Metals									
Lead	MG/KG	208	3	3	100.0	1,110	440.7	1	AWL-FD-1
Magnesium	MG/KG	-	3	3	1,450	3,180	2,273	0	AWL-FD-1
Manganese	MG/KG	-	3	3	481.0	2,400	1,221	0	AWL-FD-1
Mercury	MG/KG	1.4	3	3	0.200	1.70	0.770	1	AWL-FD-1
Nickel	MG/KG	-	3	3	94.60	9,510	3,312	0	AWL-FD-1
Potassium	MG/KG	-	3	3	785.0	6,750	3,598	0	AWL-FD-3
Silver	MG/KG	-	3	2	0.110	0.500	0.305	0	AWL-FD-1
Sodium	MG/KG	-	3	3	1,200	2,830	2,100	0	AWL-FD-3
Thallium	MG/KG	-	3	3	0.340	1.20	0.743	0	AWL-FD-3
Vanadium	MG/KG	-	3	3	5.50	105.0	38.83	0	AWL-FD-1
Zinc	MG/KG	120	3	3	634.0	5,290	2,425	3	AWL-FD-1

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Does not include results of SEW-SD-1 located off-site.

Only Detected Results Reported.

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WHERE [MATRIX] = 'SE' AND [LOCID] LIKE 'AWL-*';

TABLE 2-3A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,1,1-Trichloroethane	MG/KG	0.68	117	1	0.036	0.036	0.036	0	SB-11	25-26
1,1-Dichloroethane	MG/KG	0.27	117	1	0.003	0.003	0.003	0	SB-11	25-26
1,2,4-Trimethylbenzene	MG/KG	3.6	58	1	0.020	0.020	0.020	0	AS-01	24-25
1,2-Dichloroethene (cis)	MG/KG	0.25	117	5	0.003	0.007	0.004	0	OW-01	8-9
1,4-Dichlorobenzene	MG/KG	1.8	117	1	0.002	0.002	0.002	0	SVE-01	23-24
Acetone	MG/KG	0.05	117	37	0.002	0.400	0.030	4	DEC-028TC	92-93
Carbon disulfide	MG/KG	2.7 CP-51	117	2	0.005	0.037	0.021	0	DEC-144D	65.5-66
Ethylbenzene	MG/KG	1	117	1	0.003	0.003	0.003	0	AS-01	24-25
Isopropylbenzene (Cumene)	MG/KG	2.3 CP-51	117	1	0.420	0.420	0.420	0	DEC-048	24.5-25.5
Methyl ethyl ketone (2-Butanone)	MG/KG	0.12	117	2	0.010	0.014	0.012	0	DEC-028TC	92-93
Methylcyclohexane	MG/KG	-	117	1	0.520	0.520	0.520	0	DEC-048	24.5-25.5
Methylene chloride	MG/KG	0.05	117	37	0.002	0.072	0.010	1	SB-11	25-26
Naphthalene	MG/KG	12	58	3	0.005	0.014	0.009	0	DEC-065D	34-35
Styrene	MG/KG	300 CP-51	117	1	0.007	0.007	0.007	0	DEC-030D	3.5-4.5
Tetrachloroethene	MG/KG	1.3	117	50	0.001	11.50	0.377	2	AS-01	24-25
Toluene	MG/KG	0.7	117	12	0.0006	0.200	0.019	0	DEC-048	24.5-25.5
Trichloroethene	MG/KG	0.47	117	10	0.002	0.058	0.012	0	DEC-156D	70-71
Xylene (total)	MG/KG	0.26	117	3	0.002	0.890	0.304	1	DEC-048	24.5-25.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
1,1-Biphenyl	MG/KG	60 CP-51	8	1	3.70	3.70	3.70	0	DEC-048	24.5-25.5
2-Methylnaphthalene	MG/KG	0.41 CP-51	8	1	16.00	16.00	16.00	1	DEC-048	24.5-25.5
Acenaphthene	MG/KG	20	8	2	0.061	2.30	1.18	0	DEC-048	24.5-25.5
Anthracene	MG/KG	100	8	1	0.590	0.590	0.590	0	DEC-048	24.5-25.5
Benzo(a)anthracene	MG/KG	1	8	1	0.073	0.073	0.073	0	DEC-030D	3.5-4.5
Benzo(a)pyrene	MG/KG	1	8	1	0.092	0.092	0.092	0	DEC-030D	3.5-4.5
Benzo(b)fluoranthene	MG/KG	1	8	1	0.096	0.096	0.096	0	DEC-030D	3.5-4.5
Benzo(g,h,i)perylene	MG/KG	100	8	1	0.072	0.072	0.072	0	DEC-030D	3.5-4.5
Benzo(k)fluoranthene	MG/KG	0.8	8	1	0.056	0.056	0.056	0	DEC-030D	3.5-4.5
bis(2-Ethylhexyl)phthalate	MG/KG	50 CP-51	8	4	0.073	0.260	0.125	0	DEC-065D	9-10
Chrysene	MG/KG	1	8	1	0.083	0.083	0.083	0	DEC-030D	3.5-4.5
Dibenz(a,h)anthracene	MG/KG	0.33	8	1	0.023	0.023	0.023	0	DEC-030D	3.5-4.5
Dibenzofuran	MG/KG	7	8	1	0.034	0.034	0.034	0	DEC-156D	40-41
Di-n-butylphthalate	MG/KG	0.014 CP-51	8	1	0.130	0.130	0.130	1	DEC-030D	3.5-4.5
Fluoranthene	MG/KG	100	8	2	0.079	0.110	0.095	0	DEC-030D	3.5-4.5
Fluorene	MG/KG	30	8	2	0.073	2.90	1.49	0	DEC-048	24.5-25.5
Indeno(1,2,3-cd)pyrene	MG/KG	0.5	8	1	0.058	0.058	0.058	0	DEC-030D	3.5-4.5
Naphthalene	MG/KG	12	8	2	0.029	3.00	1.51	0	DEC-048	24.5-25.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Phenanthrene	MG/KG	100	8	3	0.046	7.10	2.45	0	DEC-048	24.5-25.5
Pyrene	MG/KG	100	8	3	0.094	0.670	0.308	0	DEC-048	24.5-25.5
Pesticide Organic Compounds										
alpha-Chlordane	MG/KG	0.094	7	1	0.017	0.017	0.017	0	DEC-030D	3.5-4.5
Dieldrin	MG/KG	0.005	7	1	0.005	0.005	0.005	1	DEC-030D	3.5-4.5
gamma-Chlordane	MG/KG	0.54 CP-51	7	1	0.014	0.014	0.014	0	DEC-030D	3.5-4.5
Metals										
Aluminum	MG/KG	10000 CP-51	7	7	2,270	2.40E+04	8,730	2	DEC-156D	40-41
Arsenic	MG/KG	13	7	5	0.530	3.40	1.77	0	DEC-156D	40-41
Barium	MG/KG	350	7	7	19.30	113.0	54.76	0	DEC-065D	14-15
Beryllium	MG/KG	7.2	7	7	0.150	1.10	0.500	0	DEC-065D	14-15
Cadmium	MG/KG	2.5	7	2	0.048	0.490	0.269	0	DEC-030D	3.5-4.5
Calcium	MG/KG	10000 CP-51	7	6	566.0	6,070	2,303	0	DEC-065D	14-15
Chromium	MG/KG	30	7	7	4.70	120.0	33.59	2	DEC-156D	40-41
Cobalt	MG/KG	20 CP-51	7	7	2.90	26.00	9.74	1	DEC-156D	40-41
Copper	MG/KG	50	7	6	6.40	29.80	16.83	0	DEC-065D	14-15
Iron	MG/KG	2000 CP-51	7	7	4,730	9.90E+04	3.32E+04	7	DEC-156D	40-41

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3A
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
UNRESTRICTED USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Lead	MG/KG	63	7	7	1.40	74.20	17.41	1	DEC-030D	3.5-4.5
Magnesium	MG/KG	-	7	7	1,220	5,700	2,801	0	DEC-156D	40-41
Manganese	MG/KG	1600	7	7	120.0	1,290	441.0	0	DEC-065D	14-15
Mercury	MG/KG	0.18	7	5	0.003	0.320	0.103	1	DEC-030D	3.5-4.5
Nickel	MG/KG	30	7	7	5.60	39.00	15.91	1	DEC-156D	40-41
Potassium	MG/KG	-	7	7	43.60	1.60E+04	3,096	0	DEC-156D	40-41
Selenium	MG/KG	3.9	7	1	0.490	0.490	0.490	0	DEC-030D	3.5-4.5
Silver	MG/KG	2	7	1	0.450	0.450	0.450	0	DEC-156D	40-41
Sodium	MG/KG	-	7	5	9.00	360.0	120.5	0	DEC-065D	14-15
Thallium	MG/KG	5 CP-51	7	3	2.50	3.40	2.87	0	DEC-065D	14-15
Vanadium	MG/KG	39 CP-51	7	7	5.10	250.0	56.77	2	DEC-156D	40-41
Zinc	MG/KG	109	7	7	10.00	90.00	44.14	0	DEC-156D	40-41

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Unrestricted Use, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,1,1-Trichloroethane	MG/KG	0.68	117	1	0.036	0.036	0.036	0	SB-11	25-26
1,1-Dichloroethane	MG/KG	0.27	117	1	0.003	0.003	0.003	0	SB-11	25-26
1,2,4-Trimethylbenzene	MG/KG	3.6	58	1	0.020	0.020	0.020	0	AS-01	24-25
1,2-Dichloroethene (cis)	MG/KG	0.25	117	5	0.003	0.007	0.004	0	OW-01	8-9
1,4-Dichlorobenzene	MG/KG	1.8	117	1	0.002	0.002	0.002	0	SVE-01	23-24
Acetone	MG/KG	0.05	117	37	0.002	0.400	0.030	4	DEC-028TC	92-93
Carbon disulfide	MG/KG	2.7 CP-51	117	2	0.005	0.037	0.021	0	DEC-144D	65.5-66
Ethylbenzene	MG/KG	1	117	1	0.003	0.003	0.003	0	AS-01	24-25
Isopropylbenzene (Cumene)	MG/KG	2.3 CP-51	117	1	0.420	0.420	0.420	0	DEC-048	24.5-25.5
Methyl ethyl ketone (2-Butanone)	MG/KG	0.12	117	2	0.010	0.014	0.012	0	DEC-028TC	92-93
Methylcyclohexane	MG/KG	-	117	1	0.520	0.520	0.520	0	DEC-048	24.5-25.5
Methylene chloride	MG/KG	0.05	117	37	0.002	0.072	0.010	1	SB-11	25-26
Naphthalene	MG/KG	12	58	3	0.005	0.014	0.009	0	DEC-065D	34-35
Styrene	MG/KG	-	117	1	0.007	0.007	0.007	0	DEC-030D	3.5-4.5
Tetrachloroethene	MG/KG	1.3	117	50	0.001	11.50	0.377	2	AS-01	24-25
Toluene	MG/KG	0.7	117	12	0.0006	0.200	0.019	0	DEC-048	24.5-25.5
Trichloroethene	MG/KG	0.47	117	10	0.002	0.058	0.012	0	DEC-156D	70-71
Xylene (total)	MG/KG	1.6	117	3	0.002	0.890	0.304	0	DEC-048	24.5-25.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
1,1-Biphenyl	MG/KG	-	8	1	3.70	3.70	3.70	0	DEC-048	24.5-25.5
2-Methylnaphthalene	MG/KG	36.4 CP-51	8	1	16.00	16.00	16.00	0	DEC-048	24.5-25.5
Acenaphthene	MG/KG	98	8	2	0.061	2.30	1.18	0	DEC-048	24.5-25.5
Anthracene	MG/KG	1000	8	1	0.590	0.590	0.590	0	DEC-048	24.5-25.5
Benzo(a)anthracene	MG/KG	1	8	1	0.073	0.073	0.073	0	DEC-030D	3.5-4.5
Benzo(a)pyrene	MG/KG	22	8	1	0.092	0.092	0.092	0	DEC-030D	3.5-4.5
Benzo(b)fluoranthene	MG/KG	1.7	8	1	0.096	0.096	0.096	0	DEC-030D	3.5-4.5
Benzo(g,h,i)perylene	MG/KG	1000	8	1	0.072	0.072	0.072	0	DEC-030D	3.5-4.5
Benzo(k)fluoranthene	MG/KG	1.7	8	1	0.056	0.056	0.056	0	DEC-030D	3.5-4.5
bis(2-Ethylhexyl)phthalate	MG/KG	435 CP-51	8	4	0.073	0.260	0.125	0	DEC-065D	9-10
Chrysene	MG/KG	1	8	1	0.083	0.083	0.083	0	DEC-030D	3.5-4.5
Dibenz(a,h)anthracene	MG/KG	1000	8	1	0.023	0.023	0.023	0	DEC-030D	3.5-4.5
Dibenzofuran	MG/KG	210	8	1	0.034	0.034	0.034	0	DEC-156D	40-41
Di-n-butylphthalate	MG/KG	8.1 CP-51	8	1	0.130	0.130	0.130	0	DEC-030D	3.5-4.5
Fluoranthene	MG/KG	1000	8	2	0.079	0.110	0.095	0	DEC-030D	3.5-4.5
Fluorene	MG/KG	386	8	2	0.073	2.90	1.49	0	DEC-048	24.5-25.5
Indeno(1,2,3-cd)pyrene	MG/KG	8.2	8	1	0.058	0.058	0.058	0	DEC-030D	3.5-4.5
Naphthalene	MG/KG	12	8	2	0.029	3.00	1.51	0	DEC-048	24.5-25.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Phenanthrene	MG/KG	1000	8	3	0.046	7.10	2.45	0	DEC-048	24.5-25.5
Pyrene	MG/KG	1000	8	3	0.094	0.670	0.308	0	DEC-048	24.5-25.5
Pesticide Organic Compounds										
alpha-Chlordane	MG/KG	2.9	7	1	0.017	0.017	0.017	0	DEC-030D	3.5-4.5
Dieldrin	MG/KG	0.1	7	1	0.005	0.005	0.005	0	DEC-030D	3.5-4.5
gamma-Chlordane	MG/KG	14 CP-51	7	1	0.014	0.014	0.014	0	DEC-030D	3.5-4.5
Metals										
Aluminum	MG/KG	-	7	7	2,270	2.40E+04	8,730	0	DEC-156D	40-41
Arsenic	MG/KG	16	7	5	0.530	3.40	1.77	0	DEC-156D	40-41
Barium	MG/KG	820	7	7	19.30	113.0	54.76	0	DEC-065D	14-15
Beryllium	MG/KG	47	7	7	0.150	1.10	0.500	0	DEC-065D	14-15
Cadmium	MG/KG	7.5	7	2	0.048	0.490	0.269	0	DEC-030D	3.5-4.5
Calcium	MG/KG	-	7	6	566.0	6,070	2,303	0	DEC-065D	14-15
Chromium	MG/KG	NS	7	7	4.70	120.0	33.59	0	DEC-156D	40-41
Cobalt	MG/KG	-	7	7	2.90	26.00	9.74	0	DEC-156D	40-41
Copper	MG/KG	1720	7	6	6.40	29.80	16.83	0	DEC-065D	14-15
Iron	MG/KG	-	7	7	4,730	9.90E+04	3.32E+04	0	DEC-156D	40-41

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.


Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3B
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
PROTECTION OF GROUNDWATER CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Lead	MG/KG	450	7	7	1.40	74.20	17.41	0	DEC-030D	3.5-4.5
Magnesium	MG/KG	-	7	7	1,220	5,700	2,801	0	DEC-156D	40-41
Manganese	MG/KG	2000	7	7	120.0	1,290	441.0	0	DEC-065D	14-15
Mercury	MG/KG	0.73	7	5	0.003	0.320	0.103	0	DEC-030D	3.5-4.5
Nickel	MG/KG	130	7	7	5.60	39.00	15.91	0	DEC-156D	40-41
Potassium	MG/KG	-	7	7	43.60	1.60E+04	3,096	0	DEC-156D	40-41
Selenium	MG/KG	4	7	1	0.490	0.490	0.490	0	DEC-030D	3.5-4.5
Silver	MG/KG	8.3	7	1	0.450	0.450	0.450	0	DEC-156D	40-41
Sodium	MG/KG	-	7	5	9.00	360.0	120.5	0	DEC-065D	14-15
Thallium	MG/KG	-	7	3	2.50	3.40	2.87	0	DEC-065D	14-15
Vanadium	MG/KG	-	7	7	5.10	250.0	56.77	0	DEC-156D	40-41
Zinc	MG/KG	2480	7	7	10.00	90.00	44.14	0	DEC-156D	40-41

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Restricted Use. Protection of Groundwater, plus CP-51 Table 1 10/21/10.


Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3C
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
RESIDENTIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,1,1-Trichloroethane	MG/KG	100	117	1	0.036	0.036	0.036	0	SB-11	25-26
1,1-Dichloroethane	MG/KG	19	117	1	0.003	0.003	0.003	0	SB-11	25-26
1,2,4-Trimethylbenzene	MG/KG	47	58	1	0.020	0.020	0.020	0	AS-01	24-25
1,2-Dichloroethene (cis)	MG/KG	59	117	5	0.003	0.007	0.004	0	OW-01	8-9
1,4-Dichlorobenzene	MG/KG	9.8	117	1	0.002	0.002	0.002	0	SVE-01	23-24
Acetone	MG/KG	100	117	37	0.002	0.400	0.030	0	DEC-028TC	92-93
Carbon disulfide	MG/KG	100 CP-51	117	2	0.005	0.037	0.021	0	DEC-144D	65.5-66
Ethylbenzene	MG/KG	30	117	1	0.003	0.003	0.003	0	AS-01	24-25
Isopropylbenzene (Cumene)	MG/KG	100 CP-51	117	1	0.420	0.420	0.420	0	DEC-048	24.5-25.5
Methyl ethyl ketone (2-Butanone)	MG/KG	100	117	2	0.010	0.014	0.012	0	DEC-028TC	92-93
Methylcyclohexane	MG/KG	-	117	1	0.520	0.520	0.520	0	DEC-048	24.5-25.5
Methylene chloride	MG/KG	51	117	37	0.002	0.072	0.010	0	SB-11	25-26
Naphthalene	MG/KG	100	58	3	0.005	0.014	0.009	0	DEC-065D	34-35
Styrene	MG/KG	-	117	1	0.007	0.007	0.007	0	DEC-030D	3.5-4.5
Tetrachloroethene	MG/KG	5.5	117	50	0.001	11.50	0.377	2	AS-01	24-25
Toluene	MG/KG	100	117	12	0.0006	0.200	0.019	0	DEC-048	24.5-25.5
Trichloroethene	MG/KG	10	117	10	0.002	0.058	0.012	0	DEC-156D	70-71
Xylene (total)	MG/KG	100	117	3	0.002	0.890	0.304	0	DEC-048	24.5-25.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Residential, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3C
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
RESIDENTIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
1,1-Biphenyl	MG/KG	-	8	1	3.70	3.70	3.70	0	DEC-048	24.5-25.5
2-Methylnaphthalene	MG/KG	0.41 CP-51	8	1	16.00	16.00	16.00	1	DEC-048	24.5-25.5
Acenaphthene	MG/KG	100	8	2	0.061	2.30	1.18	0	DEC-048	24.5-25.5
Anthracene	MG/KG	100	8	1	0.590	0.590	0.590	0	DEC-048	24.5-25.5
Benzo(a)anthracene	MG/KG	1	8	1	0.073	0.073	0.073	0	DEC-030D	3.5-4.5
Benzo(a)pyrene	MG/KG	1	8	1	0.092	0.092	0.092	0	DEC-030D	3.5-4.5
Benzo(b)fluoranthene	MG/KG	1	8	1	0.096	0.096	0.096	0	DEC-030D	3.5-4.5
Benzo(g,h,i)perylene	MG/KG	100	8	1	0.072	0.072	0.072	0	DEC-030D	3.5-4.5
Benzo(k)fluoranthene	MG/KG	1	8	1	0.056	0.056	0.056	0	DEC-030D	3.5-4.5
bis(2-Ethylhexyl)phthalate	MG/KG	50 CP-51	8	4	0.073	0.260	0.125	0	DEC-065D	9-10
Chrysene	MG/KG	1	8	1	0.083	0.083	0.083	0	DEC-030D	3.5-4.5
Dibenz(a,h)anthracene	MG/KG	0.33	8	1	0.023	0.023	0.023	0	DEC-030D	3.5-4.5
Dibenzofuran	MG/KG	14	8	1	0.034	0.034	0.034	0	DEC-156D	40-41
Di-n-butylphthalate	MG/KG	100 CP-51	8	1	0.130	0.130	0.130	0	DEC-030D	3.5-4.5
Fluoranthene	MG/KG	100	8	2	0.079	0.110	0.095	0	DEC-030D	3.5-4.5
Fluorene	MG/KG	100	8	2	0.073	2.90	1.49	0	DEC-048	24.5-25.5
Indeno(1,2,3-cd)pyrene	MG/KG	0.5	8	1	0.058	0.058	0.058	0	DEC-030D	3.5-4.5
Naphthalene	MG/KG	100	8	2	0.029	3.00	1.51	0	DEC-048	24.5-25.5

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Residential, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3C
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
RESIDENTIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Phenanthrene	MG/KG	100	8	3	0.046	7.10	2.45	0	DEC-048	24.5-25.5
Pyrene	MG/KG	100	8	3	0.094	0.670	0.308	0	DEC-048	24.5-25.5
Pesticide Organic Compounds										
alpha-Chlordane	MG/KG	0.91	7	1	0.017	0.017	0.017	0	DEC-030D	3.5-4.5
Dieldrin	MG/KG	0.039	7	1	0.005	0.005	0.005	0	DEC-030D	3.5-4.5
gamma-Chlordane	MG/KG	0.54 CP-51	7	1	0.014	0.014	0.014	0	DEC-030D	3.5-4.5
Metals										
Aluminum	MG/KG	-	7	7	2,270	2.40E+04	8,730	0	DEC-156D	40-41
Arsenic	MG/KG	16	7	5	0.530	3.40	1.77	0	DEC-156D	40-41
Barium	MG/KG	350	7	7	19.30	113.0	54.76	0	DEC-065D	14-15
Beryllium	MG/KG	14	7	7	0.150	1.10	0.500	0	DEC-065D	14-15
Cadmium	MG/KG	2.5	7	2	0.048	0.490	0.269	0	DEC-030D	3.5-4.5
Calcium	MG/KG	-	7	6	566.0	6,070	2,303	0	DEC-065D	14-15
Chromium	MG/KG	36	7	7	4.70	120.0	33.59	1	DEC-156D	40-41
Cobalt	MG/KG	30 CP-51	7	7	2.90	26.00	9.74	0	DEC-156D	40-41
Copper	MG/KG	270	7	6	6.40	29.80	16.83	0	DEC-065D	14-15
Iron	MG/KG	2000 CP-51	7	7	4,730	9.90E+04	3.32E+04	7	DEC-156D	40-41

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Residential, plus CP-51 Table 1 10/21/10.


Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3C
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
RESIDENTIAL USE CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Lead	MG/KG	400	7	7	1.40	74.20	17.41	0	DEC-030D	3.5-4.5
Magnesium	MG/KG	-	7	7	1,220	5,700	2,801	0	DEC-156D	40-41
Manganese	MG/KG	2000	7	7	120.0	1,290	441.0	0	DEC-065D	14-15
Mercury	MG/KG	0.81	7	5	0.003	0.320	0.103	0	DEC-030D	3.5-4.5
Nickel	MG/KG	140	7	7	5.60	39.00	15.91	0	DEC-156D	40-41
Potassium	MG/KG	-	7	7	43.60	1.60E+04	3,096	0	DEC-156D	40-41
Selenium	MG/KG	36	7	1	0.490	0.490	0.490	0	DEC-030D	3.5-4.5
Silver	MG/KG	36	7	1	0.450	0.450	0.450	0	DEC-156D	40-41
Sodium	MG/KG	-	7	5	9.00	360.0	120.5	0	DEC-065D	14-15
Thallium	MG/KG	-	7	3	2.50	3.40	2.87	0	DEC-065D	14-15
Vanadium	MG/KG	100 CP-51	7	7	5.10	250.0	56.77	1	DEC-156D	40-41
Zinc	MG/KG	2200	7	7	10.00	90.00	44.14	0	DEC-156D	40-41

*Criteria- 6 NYCRR Part 375.6, Remedial Program Soil Cleanup Objectives, Effective 12/14/06. Protection of Public Health, Residential, plus CP-51 Table 1 10/21/10.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Volatile Organic Compounds										
1,1,1-Trichloroethane	MG/KG	-	117	1	0.036	0.036	0.036	0	SB-11	25-26
1,1-Dichloroethane	MG/KG	-	117	1	0.003	0.003	0.003	0	SB-11	25-26
1,2,4-Trimethylbenzene	MG/KG	-	58	1	0.020	0.020	0.020	0	AS-01	24-25
1,2-Dichloroethene (cis)	MG/KG	-	117	5	0.003	0.007	0.004	0	OW-01	8-9
1,4-Dichlorobenzene	MG/KG	-	117	1	0.002	0.002	0.002	0	SVE-01	23-24
Acetone	MG/KG	-	117	37	0.002	0.400	0.030	0	DEC-028TC	92-93
Carbon disulfide	MG/KG	-	117	2	0.005	0.037	0.021	0	DEC-144D	65.5-66
Ethylbenzene	MG/KG	-	117	1	0.003	0.003	0.003	0	AS-01	24-25
Isopropylbenzene (Cumene)	MG/KG	-	117	1	0.420	0.420	0.420	0	DEC-048	24.5-25.5
Methyl ethyl ketone (2-Butanone)	MG/KG	-	117	2	0.010	0.014	0.012	0	DEC-028TC	92-93
Methylcyclohexane	MG/KG	-	117	1	0.520	0.520	0.520	0	DEC-048	24.5-25.5
Methylene chloride	MG/KG	-	117	37	0.002	0.072	0.010	0	SB-11	25-26
Naphthalene	MG/KG	-	58	3	0.005	0.014	0.009	0	DEC-065D	34-35
Styrene	MG/KG	-	117	1	0.007	0.007	0.007	0	DEC-030D	3.5-4.5
Tetrachloroethene	MG/KG	-	117	50	0.001	11.50	0.377	0	AS-01	24-25
Toluene	MG/KG	-	117	12	0.0006	0.200	0.019	0	DEC-048	24.5-25.5
Trichloroethene	MG/KG	-	117	10	0.002	0.058	0.012	0	DEC-156D	70-71
Xylene (total)	MG/KG	-	117	3	0.002	0.890	0.304	0	DEC-048	24.5-25.5

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
1,1-Biphenyl	MG/KG	-	8	1	3.70	3.70	3.70	0	DEC-048	24.5-25.5
2-Methylnaphthalene	MG/KG	-	8	1	16.00	16.00	16.00	0	DEC-048	24.5-25.5
Acenaphthene	MG/KG	-	8	2	0.061	2.30	1.18	0	DEC-048	24.5-25.5
Anthracene	MG/KG	-	8	1	0.590	0.590	0.590	0	DEC-048	24.5-25.5
Benzo(a)anthracene	MG/KG	-	8	1	0.073	0.073	0.073	0	DEC-030D	3.5-4.5
Benzo(a)pyrene	MG/KG	-	8	1	0.092	0.092	0.092	0	DEC-030D	3.5-4.5
Benzo(b)fluoranthene	MG/KG	-	8	1	0.096	0.096	0.096	0	DEC-030D	3.5-4.5
Benzo(g,h,i)perylene	MG/KG	-	8	1	0.072	0.072	0.072	0	DEC-030D	3.5-4.5
Benzo(k)fluoranthene	MG/KG	-	8	1	0.056	0.056	0.056	0	DEC-030D	3.5-4.5
bis(2-Ethylhexyl)phthalate	MG/KG	-	8	4	0.073	0.260	0.125	0	DEC-065D	9-10
Chrysene	MG/KG	-	8	1	0.083	0.083	0.083	0	DEC-030D	3.5-4.5
Dibenz(a,h)anthracene	MG/KG	-	8	1	0.023	0.023	0.023	0	DEC-030D	3.5-4.5
Dibenzofuran	MG/KG	-	8	1	0.034	0.034	0.034	0	DEC-156D	40-41
Di-n-butylphthalate	MG/KG	0.09	8	1	0.130	0.130	0.130	1	DEC-030D	3.5-4.5
Fluoranthene	MG/KG	-	8	2	0.079	0.110	0.095	0	DEC-030D	3.5-4.5
Fluorene	MG/KG	-	8	2	0.073	2.90	1.49	0	DEC-048	24.5-25.5
Indeno(1,2,3-cd)pyrene	MG/KG	-	8	1	0.058	0.058	0.058	0	DEC-030D	3.5-4.5
Naphthalene	MG/KG	-	8	2	0.029	3.00	1.51	0	DEC-048	24.5-25.5

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Semivolatile Organic Compounds										
Phenanthrene	MG/KG	-	8	3	0.046	7.10	2.45	0	DEC-048	24.5-25.5
Pyrene	MG/KG	-	8	3	0.094	0.670	0.308	0	DEC-048	24.5-25.5
Pesticide Organic Compounds										
alpha-Chlordane	MG/KG	-	7	1	0.017	0.017	0.017	0	DEC-030D	3.5-4.5
Dieldrin	MG/KG	0.043	7	1	0.005	0.005	0.005	0	DEC-030D	3.5-4.5
gamma-Chlordane	MG/KG	-	7	1	0.014	0.014	0.014	0	DEC-030D	3.5-4.5
Metals										
Aluminum	MG/KG	10600	7	7	2,270	2.40E+04	8,730	1	DEC-156D	40-41
Arsenic	MG/KG	16.4	7	5	0.530	3.40	1.77	0	DEC-156D	40-41
Barium	MG/KG	-	7	7	19.30	113.0	54.76	0	DEC-065D	14-15
Beryllium	MG/KG	-	7	7	0.150	1.10	0.500	0	DEC-065D	14-15
Cadmium	MG/KG	-	7	2	0.048	0.490	0.269	0	DEC-030D	3.5-4.5
Calcium	MG/KG	-	7	6	566.0	6,070	2,303	0	DEC-065D	14-15
Chromium	MG/KG	-	7	7	4.70	120.0	33.59	0	DEC-156D	40-41
Cobalt	MG/KG	-	7	7	2.90	26.00	9.74	0	DEC-156D	40-41
Copper	MG/KG	161	7	6	6.40	29.80	16.83	0	DEC-065D	14-15
Iron	MG/KG	19500	7	7	4,730	9.90E+04	3.32E+04	4	DEC-156D	40-41

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-3D
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL SAMPLES
SITE BACKGROUND CRITERIA
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value	Depth Of Max
					Min	Max	Avg			
Metals										
Lead	MG/KG	208	7	7	1.40	74.20	17.41	0	DEC-030D	3.5-4.5
Magnesium	MG/KG	-	7	7	1,220	5,700	2,801	0	DEC-156D	40-41
Manganese	MG/KG	-	7	7	120.0	1,290	441.0	0	DEC-065D	14-15
Mercury	MG/KG	1.4	7	5	0.003	0.320	0.103	0	DEC-030D	3.5-4.5
Nickel	MG/KG	-	7	7	5.60	39.00	15.91	0	DEC-156D	40-41
Potassium	MG/KG	-	7	7	43.60	1.60E+04	3,096	0	DEC-156D	40-41
Selenium	MG/KG	-	7	1	0.490	0.490	0.490	0	DEC-030D	3.5-4.5
Silver	MG/KG	-	7	1	0.450	0.450	0.450	0	DEC-156D	40-41
Sodium	MG/KG	-	7	5	9.00	360.0	120.5	0	DEC-065D	14-15
Thallium	MG/KG	-	7	3	2.50	3.40	2.87	0	DEC-065D	14-15
Vanadium	MG/KG	-	7	7	5.10	250.0	56.77	0	DEC-156D	40-41
Zinc	MG/KG	120	7	7	10.00	90.00	44.14	0	DEC-156D	40-41

*Criteria- Background soil concentrations from Msgr. McGolrick Park collected August 3, 2011 exceeding 6 NYCRR Part 375.6 Unrestricted Use and CP-51 Table 1 limits.


Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-4
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
1,2-Dichloroethene (cis)	UG/L	5	5	4	1.80	11.00	7.13	3	AWL-05
Acetone	UG/L	50	5	2	14.00	22.00	18.00	0	AWL-04
Benzene	UG/L	1	5	1	1.30	1.30	1.30	1	AWL-03
Chloroform	UG/L	7	5	3	1.60	3.30	2.50	0	AWL-03
Tetrachloroethene	UG/L	5	5	4	870.0	2,800	1,768	4	AWL-05
Toluene	UG/L	5	5	2	1.20	7.80	4.50	1	AWL-01
Trichloroethene	UG/L	5	5	4	1.80	12.00	8.15	3	AWL-03
Semivolatile Organic Compounds									
Diethylphthalate	UG/L	50	4	1	1.40	1.40	1.40	0	AWL-03
Pesticide Organic Compounds									
Endosulfan I	UG/L	-	4	1	0.051	0.051	0.051	0	AWL-05
Metals									
Aluminum	UG/L	-	4	3	7.78E+04	1.85E+05	1.35E+05	0	AWL-03
Arsenic	UG/L	25	4	3	16.60	60.50	41.60	2	AWL-03
Barium	UG/L	1000	4	3	1,140	5,390	2,677	3	AWL-04
Beryllium	UG/L	3	4	3	8.10	27.40	16.73	3	AWL-04
Cadmium	UG/L	5	4	3	3.00	17.10	9.60	2	AWL-04

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-4
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Metals									
Calcium	UG/L	-	4	3	1.48E+05	2.61E+05	1.86E+05	0	AWL-04
Chromium	UG/L	50	4	3	201.0	744.0	482.3	3	AWL-04
Cobalt	UG/L	-	4	3	132.0	904.0	416.7	0	AWL-04
Copper	UG/L	200	4	3	301.0	1,480	816.7	3	AWL-04
Iron	UG/L	300	4	3	9.86E+04	3.32E+05	2.30E+05	3	AWL-03
Lead	UG/L	25	4	3	74.30	287.0	175.8	3	AWL-04
Magnesium	UG/L	35000	4	3	6.18E+04	9.37E+04	7.93E+04	3	AWL-03
Manganese	UG/L	300	4	3	1.46E+04	8.99E+04	4.09E+04	3	AWL-04
Mercury	UG/L	0.7	4	2	0.044	0.400	0.222	0	AWL-04
Nickel	UG/L	100	4	3	235.0	1,090	594.0	3	AWL-04
Potassium	UG/L	-	4	3	1.64E+04	3.37E+04	2.67E+04	0	AWL-04
Sodium	UG/L	20000	4	3	5.92E+04	9.86E+04	7.99E+04	3	AWL-05
Thallium	UG/L	0.5	4	2	45.60	47.10	46.35	2	AWL-04
Vanadium	UG/L	-	4	3	133.0	466.0	301.3	0	AWL-03
Zinc	UG/L	2000	4	3	336.0	1,580	858.7	0	AWL-04

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-5
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SHALLOW GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
1,1,1,2-Tetrachloroethane	UG/L	5	86	6	1.20	9.50	3.73	1	DEC-014R
1,1,1-Trichloroethane	UG/L	5	303	34	0.860	12.00	3.32	6	DEC-042
1,1,2-Trichloroethane	UG/L	1	303	1	0.480	0.480	0.480	0	DEC-015
1,1-Dichloroethane	UG/L	5	303	90	0.480	46.00	7.42	36	DEC-010
1,1-Dichloroethene	UG/L	5	303	61	0.880	49.00	7.92	18	DEC-010
1,2,3-Trichloropropane	UG/L	0.04	86	1	2.30	2.30	2.30	1	DEC-013
1,2,4-Trimethylbenzene	UG/L	5	86	2	0.950	1.50	1.23	0	DEC-048
1,2-Dichlorobenzene	UG/L	3	303	2	1.20	1.40	1.30	0	DEC-048
1,2-Dichloroethane	UG/L	0.6	303	22	0.270	43.00	3.27	16	DEC-140
1,2-Dichloroethene (cis)	UG/L	5	303	174	0.900	230.0	24.69	136	DEC-071
1,2-Dichloroethene (trans)	UG/L	5	303	26	0.690	48.00	5.28	4	DEC-071
1,4-Dichlorobenzene	UG/L	3	303	7	0.820	4.30	1.75	1	DEC-014R
Acetone	UG/L	50	303	8	3.10	180.0	55.39	3	DEC-032
Benzene	UG/L	1	303	4	0.560	50.00	13.25	2	DEC-008
Carbon disulfide	UG/L	60	303	1	1.70	1.70	1.70	0	DEC-009
Carbon tetrachloride	UG/L	5	303	1	1.00	1.00	1.00	0	DEC-014R
Chloroethane	UG/L	5	303	3	1.20	1.80	1.43	0	DEC-028
Chloroform	UG/L	7	303	83	0.400	12.00	2.63	3	DEC-065
Cyclohexane	UG/L	-	303	1	11.00	11.00	11.00	0	DEC-008

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-5
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SHALLOW GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
Ethylbenzene	UG/L	5	303	1	1.70	1.70	1.70	0	DEC-008
Isopropylbenzene (Cumene)	UG/L	5	303	3	1.00	2.70	1.70	0	DEC-048
Methyl ethyl ketone (2-Butanone)	UG/L	50	303	2	13.00	38.00	25.50	0	DEC-048
Methyl tert-butyl ether	UG/L	10	303	43	0.190	8.40	1.39	0	DEC-006D
Methylcyclohexane	UG/L	-	303	2	0.620	1.50	1.06	0	DEC-008
Methylene chloride	UG/L	5	303	2	2.10	2.20	2.15	0	DEC-011
Naphthalene	UG/L	10	86	3	1.00	5.70	2.97	0	DEC-046
sec-Butylbenzene	UG/L	5	86	4	0.970	3.40	2.32	0	DEC-028
Tetrachloroethene	UG/L	5	303	260	1.20	4.60E+04	2,038	236	DEC-014R
Toluene	UG/L	5	303	4	0.610	8.60	2.69	1	DEC-008
Trichloroethene	UG/L	5	303	236	0.520	2,100	76.48	171	DEC-156
Trichlorofluoromethane	UG/L	5	303	17	1.40	58.00	12.93	10	DEC-042
Vinyl chloride	UG/L	2	303	21	1.00	54.00	20.89	19	DEC-009
Xylene (total)	UG/L	5	303	5	0.680	17.00	4.30	1	DEC-008
Semivolatile Organic Compounds									
Di-n-butylphthalate	UG/L	50	7	1	0.560	0.560	0.560	0	DEC-031
Phenol	UG/L	1	7	1	0.860	0.860	0.860	0	DEC-141
Pesticide Organic Compounds									
Dieldrin	UG/L	0.004	6	1	0.050	0.050	0.050	1	DEC-167

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-5
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SHALLOW GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Pesticide Organic Compounds									
Endrin ketone	UG/L	5	6	1	0.027	0.027	0.027	0	DEC-167
gamma-BHC (Lindane)	UG/L	0.05	6	1	0.051	0.051	0.051	1	DEC-031
Metals									
Aluminum	UG/L	-	6	2	154.0	528.0	341.0	0	DEC-141
Barium	UG/L	1000	6	3	48.50	95.00	78.17	0	DEC-048
Calcium	UG/L	-	6	4	6.12E+04	8.98E+04	7.43E+04	0	DEC-141
Chromium	UG/L	50	6	2	0.790	3.70	2.25	0	DEC-141
Cobalt	UG/L	-	6	3	1.10	3.90	2.27	0	DEC-167
Copper	UG/L	200	7	1	3.50	3.50	3.50	0	DEC-031
Iron	UG/L	300	100	84	20.00	4.67E+04	2,764	77	DEC-033
Lead	UG/L	25	7	1	7.10	7.10	7.10	0	DEC-031
Magnesium	UG/L	35000	6	4	2.14E+04	3.10E+04	2.63E+04	0	DEC-167
Manganese	UG/L	300	6	4	229.0	5,000	1,554	2	DEC-167
Nickel	UG/L	100	7	3	6.60	16.00	11.13	0	DEC-031
Potassium	UG/L	-	6	3	2,350	3,490	2,910	0	DEC-141
Sodium	UG/L	20000	6	4	7.10E+04	1.00E+05	8.31E+04	4	DEC-167
Zinc	UG/L	2000	7	1	14.00	14.00	14.00	0	DEC-031
Dissolved Metals									
Iron	UG/L	300	94	51	20.00	2.77E+04	1,396	16	DEC-071

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-5
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SHALLOW GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Miscellaneous Parameters									
Alkalinity, Total (as CaCO3)	MG/L	-	130	121	52.00	557.0	185.2	0	DEC-004
Chloride	MG/L	250	130	121	40.00	928.0	218.6	32	DEC-033
Flash Point	DEG. F	-	1	1	176.0	176.0	176.0	0	DEC-031
Nitrate-Nitrogen	MG/L	10	73	66	0.021	13.80	4.93	5	DEC-027
Nitrite-Nitrogen	MG/L	1	73	20	0.021	0.200	0.070	0	DEC-004
Nitrate-Nitrite	MG/L	10	57	50	0.028	19.20	6.09	8	DEC-039
Phosphorous, Total (as P)	MG/L	-	36	34	0.067	0.500	0.175	0	DEC-033
Sulfate (as SO4)	MG/L	250	130	121	4.70	486.0	104.6	7	DEC-071
Sulfide	MG/L	0.05	36	2	0.030	0.062	0.046	1	DEC-015
Total Dissolved Solids	MG/L	500	1	1	569.0	569.0	569.0	1	DEC-031
Total Kjeldahl Nitrogen	MG/L	-	37	1	0.780	0.780	0.780	0	DEC-031
Total Organic Carbon (TOC)	MG/L	-	94	81	0.450	7.00	1.80	0	DEC-011
Total Suspended Solids	MG/L	-	1	1	4.00	4.00	4.00	0	DEC-031
Dissolved Gases									
Ethane	UG/L	-	94	12	0.490	25.00	5.61	0	DEC-097
Ethene	UG/L	-	94	6	1.30	8.10	3.65	0	DEC-071
Methane	UG/L	-	94	29	0.580	290.0	42.92	0	DEC-097

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-6
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE DEEP GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
1,1,1-Trichloroethane	UG/L	5	167	31	0.850	22.00	5.29	10	DEC-065D
1,1-Dichloroethane	UG/L	5	167	56	0.450	22.00	3.10	11	DEC-111D
1,1-Dichloroethene	UG/L	5	167	67	0.450	120.0	15.47	36	DEC-065D
1,2,3-Trichlorobenzene	UG/L	5	89	1	2.10	2.10	2.10	0	DEC-064D
1,2,3-Trichloropropane	UG/L	0.04	57	1	2.70	2.70	2.70	1	DEC-015D
1,2,4-Trichlorobenzene	UG/L	5	167	1	5.50	5.50	5.50	1	DEC-064D
1,2-Dichloroethane	UG/L	0.6	167	75	0.400	3,700	255.8	74	DEC-029TC
1,2-Dichloroethene (cis)	UG/L	5	167	86	0.610	290.0	16.39	44	DEC-071D
1,2-Dichloroethene (trans)	UG/L	5	167	14	1.10	67.00	12.24	8	DEC-156D
1,2-Dichloropropane	UG/L	1	167	2	2.00	2.20	2.10	2	DEC-029TC
Acetone	UG/L	50	167	2	2.70	3.70	3.20	0	DEC-009D
Benzene	UG/L	1	167	2	0.930	0.980	0.955	0	DEC-029D
Carbon disulfide	UG/L	60	167	1	4.60	4.60	4.60	0	DEC-031D
Chloroethane	UG/L	5	167	1	2.40	2.40	2.40	0	DEC-097D
Chloroform	UG/L	7	167	21	0.460	7.40	2.37	1	DEC-031TC
Chloromethane	UG/L	5	167	1	1.10	1.10	1.10	0	DEC-046D
Methyl ethyl ketone (2-Butanone)	UG/L	50	167	1	1.80	1.80	1.80	0	DEC-009D
Methyl tert-butyl ether	UG/L	10	167	61	0.260	3.80	1.20	0	DEC-014D
Methylene chloride	UG/L	5	167	2	0.900	1.10	1.00	0	DEC-031TC
Tetrachloroethene	UG/L	5	167	130	0.440	7,000	290.2	105	DEC-029D

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-6
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE DEEP GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Volatile Organic Compounds									
Trichloroethene	UG/L	5	167	120	0.460	1,300	104.8	79	DEC-039D
Trichlorofluoromethane	UG/L	5	167	2	1.30	1.60	1.45	0	DEC-144D
Vinyl chloride	UG/L	2	167	7	1.10	41.00	16.63	7	DEC-097D
Semivolatile Organic Compounds									
Di-n-butylphthalate	UG/L	50	3	1	0.720	0.720	0.720	0	DEC-031D
Metals									
Aluminum	UG/L	-	2	2	116.0	464.0	290.0	0	DEC-031D
Barium	UG/L	1000	2	1	36.80	36.80	36.80	0	DEC-031D
Calcium	UG/L	-	2	2	1.11E+05	1.24E+05	1.18E+05	0	DEC-141D
Chromium	UG/L	50	2	2	2.00	2.10	2.05	0	DEC-141D
Cobalt	UG/L	-	2	1	6.10	6.10	6.10	0	DEC-031D
Iron	UG/L	300	78	66	27.00	2.96E+04	4,425	44	DEC-088D
Magnesium	UG/L	35000	2	2	5.84E+04	5.86E+04	5.85E+04	2	DEC-141D
Manganese	UG/L	300	2	2	783.0	2,300	1,542	2	DEC-031D
Nickel	UG/L	100	3	2	3.70	4.20	3.95	0	DEC-031D
Potassium	UG/L	-	2	2	5,720	7,020	6,370	0	DEC-031D
Sodium	UG/L	20000	2	2	1.02E+05	1.24E+05	1.13E+05	2	DEC-141D
Vanadium	UG/L	-	2	1	2.20	2.20	2.20	0	DEC-031D
Zinc	UG/L	2000	3	1	11.00	11.00	11.00	0	DEC-031D

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-6
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE DEEP GROUNDWATER SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	Criteria*	No. of Samples	No. of Detections	Range of Detections			No. Exceed	Location of Max Value
					Min	Max	Avg		
Dissolved Metals									
Iron	UG/L	300	76	52	20.00	2.66E+04	3,808	24	DEC-029TC
Miscellaneous Parameters									
Alkalinity, Total (as CaCO3)	MG/L	-	103	88	78.90	310.0	156.0	0	DEC-029TC
Chloride	MG/L	250	103	88	20.20	2,640	317.3	24	DEC-029TC
Flash Point	DEG. F	-	1	1	176.0	176.0	176.0	0	DEC-031D
Nitrate-Nitrogen	MG/L	10	63	46	0.029	10.20	5.21	1	DEC-015D
Nitrite-Nitrogen	MG/L	1	63	21	0.021	0.140	0.050	0	DEC-044D
Nitrate-Nitrite	MG/L	10	40	30	1.02	10.10	5.30	1	DEC-064D
Phosphorous, Total (as P)	MG/L	-	27	23	0.044	0.520	0.193	0	DEC-088D
Sulfate (as SO4)	MG/L	250	103	88	2.60	792.0	192.4	13	DEC-029TC
Sulfide	MG/L	0.05	27	2	0.038	0.100	0.069	1	DEC-011D
Total Dissolved Solids	MG/L	500	1	1	1,090	1,090	1,090	1	DEC-031D
Total Organic Carbon (TOC)	MG/L	-	76	63	0.540	22.50	1.61	0	DEC-028TC
Total Suspended Solids	MG/L	-	1	1	4.00	4.00	4.00	0	DEC-031D
Dissolved Gases									
Ethane	UG/L	-	76	3	1.20	4.40	2.43	0	DEC-029TC
Ethene	UG/L	-	76	4	0.520	9.70	2.88	0	DEC-029TC
Methane	UG/L	-	76	36	0.490	2,500	127.5	0	DEC-011D

*Criteria- NYSDEC TOGS (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. June 1998, including April 2000 and June 2004 Addenda, Class GA.

Concentration Exceeds Criteria

Only Detected Results Reported.

TABLE 2-7
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN ON-SITE SOIL VAPOR SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	No. of Samples	No. of Detections	Range of Detections			Location of Max Value
				Min	Max	Avg	
Volatile Organic Compounds							
1,1,1-Trichloroethane	UG/M3	7	1	10.60	10.60	10.60	AWL-SV-5
1,2,4-Trimethylbenzene	UG/M3	7	2	27.30	206.0	116.7	AWL-SV-1
1,2-Dichloroethene (cis)	UG/M3	7	5	5.95	3,570	1,093	AWL-SV-1
1,3,5-Trimethylbenzene (Mesitylene)	UG/M3	7	1	8.85	8.85	8.85	AWL-SV-5
Acetone	UG/M3	7	6	128.0	4,390	1,305	AWL-SV-6
Chloroform	UG/M3	7	5	93.80	2,400	949.8	AWL-SV-4
Ethylbenzene	UG/M3	7	3	108.0	208.0	168.0	AWL-SV-1
Methyl ethyl ketone (2-Butanone)	UG/M3	7	2	18.60	88.50	53.55	AWL-SV-1
Methylene chloride	UG/M3	7	1	867.0	867.0	867.0	AWL-SV-5
Tetrachloroethene	UG/M3	7	6	2.73E+04	2.09E+06	1.04E+06	AWL-SV-4
Toluene	UG/M3	7	2	113.0	235.0	174.0	AWL-SV-5
Trichloroethene	UG/M3	7	6	140.0	7,380	4,193	AWL-SV-2
Xylene (total)	UG/M3	7	5	547.0	2,190	1,298	AWL-SV-6

Only Detected Results Reported.

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WHERE [UNITS] = 'UG/M3' AND [LOCID] LIKE 'AWL*';

TABLE 2-8
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL VAPOR SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	No. of Samples	No. of Detections	Range of Detections			Location of Max Value
				Min	Max	Avg	
Volatile Organic Compounds							
1,1,1-Trichloroethane	UG/M3	183	115	1.00	4.20E+04	1,355	SG-040
1,1,2,2-Tetrachloroethane	UG/M3	183	1	3.10	3.10	3.10	SG-018
1,1,2-Trichloro-1,2,2-trifluoroethane	UG/M3	183	62	0.780	1,520	77.56	SG-049
1,1,2-Trichloroethane	UG/M3	108	6	0.440	41.00	20.13	SG-040
1,1-Dichloroethane	UG/M3	183	67	0.240	3,400	163.1	SG-040
1,1-Dichloroethene	UG/M3	183	46	0.400	1,290	127.2	SG-086
1,2,4-Trimethylbenzene	UG/M3	91	43	0.880	180.0	26.00	SG-079
1,2-Dichlorobenzene	UG/M3	183	2	1.10	5.00	3.05	SG-063
1,2-Dichloroethane	UG/M3	183	15	0.470	455.0	39.74	SG-115
1,2-Dichloroethene (cis)	UG/M3	183	78	0.360	4.37E+05	9,143	SG-049
1,2-Dichloroethene (trans)	UG/M3	183	48	0.440	1,420	91.65	SG-049
1,2-Dichloropropane	UG/M3	183	8	0.750	169.0	31.99	SG-087
1,3,5-Trimethylbenzene (Mesitylene)	UG/M3	91	12	1.60	47.40	14.68	SG-079
1,3-Dichlorobenzene	UG/M3	183	64	0.300	25.70	6.24	SG-115
1,4-Dichlorobenzene	UG/M3	183	30	0.300	7.30	2.16	SG-079
2,2,4-Trimethylpentane	UG/M3	85	26	0.910	400.0	54.31	SG-021
2-Hexanone	UG/M3	108	25	0.450	11.00	2.02	SG-021
4-Methyl-2-pentanone	UG/M3	183	39	0.420	24.90	2.95	SG-055

Only Detected Results Reported.

TABLE 2-8
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL VAPOR SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	No. of Samples	No. of Detections	Range of Detections			Location of Max Value
				Min	Max	Avg	
Volatile Organic Compounds							
Acetone	UG/M3	108	64	4.10	400.0	76.38	SG-062
Benzene	UG/M3	183	110	0.420	600.0	27.94	SG-021
Bromodichloromethane	UG/M3	183	17	0.600	61.00	5.85	SG-040
Bromoform	UG/M3	183	4	1.70	1,830	476.7	SG-045
Bromomethane	UG/M3	183	2	0.430	0.900	0.665	SG-063
Carbon disulfide	UG/M3	108	43	0.440	140.0	14.15	SG-060
Carbon tetrachloride	UG/M3	183	54	0.420	2,430	126.2	SG-049
Chlorobenzene	UG/M3	183	3	0.470	0.510	0.490	SG-019
Chlorodifluoromethane	UG/M3	10	3	23.00	490.0	193.3	SG-127
Chloroethane	UG/M3	183	22	0.320	93.00	13.12	SG-040
Chloroform	UG/M3	183	100	0.610	1.42E+04	262.5	SG-060
Chloromethane	UG/M3	183	26	0.280	3.10	0.855	SG-022
Cyclohexane	UG/M3	177	73	0.280	1.63E+04	428.1	SG-043
Dichlorodifluoromethane	UG/M3	183	86	0.490	40.00	4.90	SG-040
Ethanol	UG/M3	75	53	24.50	1.22E+04	545.0	SG-080
Ethylbenzene	UG/M3	183	104	0.500	127.0	14.25	SG-079
Hexane	UG/M3	44	14	1.70	8,000	1,246	SG-043
Isopropylbenzene (Cumene)	UG/M3	102	13	0.790	4.10	1.86	SG-021

Only Detected Results Reported.

TABLE 2-8
STATISTICAL SUMMARY OF DETECTED COMPOUNDS IN OFF-SITE SOIL VAPOR SAMPLES
FORMER KLINK COSMO CLEANERS SITE

Parameter	Units	No. of Samples	No. of Detections	Range of Detections			Location of Max Value
				Min	Max	Avg	
Volatile Organic Compounds							
Methyl ethyl ketone (2-Butanone)	UG/M3	183	67	1.70	251.0	19.69	SG-116
Methyl tert-butyl ether	UG/M3	183	6	0.500	7.50	3.18	SG-054
Methylcyclohexane	UG/M3	92	44	0.880	560.0	87.14	SG-043
Methylene chloride	UG/M3	183	68	0.380	6,640	316.4	SG-087
n-Butane	UG/M3	10	2	5.30	4,900	2,453	SG-092
n-Hexane	UG/M3	41	23	3.10	88.90	30.85	SG-061R
Styrene	UG/M3	183	56	0.300	14.20	2.57	SG-046
t-Butyl alcohol	UG/M3	85	3	1.60	35.50	13.50	SG-059
Tetrachloroethene	UG/M3	183	162	1.22	4.82E+07	5.79E+05	SG-060
Tetrahydrofuran	UG/M3	62	7	0.300	1.60	0.694	SG-057
Toluene	UG/M3	183	140	0.710	1,090	72.80	SG-078
Trichloroethene	UG/M3	183	141	0.720	2.30E+05	4,568	SG-049
Trichlorofluoromethane	UG/M3	183	97	0.560	5,270	216.9	SG-057
Vinyl acetate	UG/M3	6	5	3.03	4.72	4.09	SG-195
Vinyl chloride	UG/M3	183	31	0.290	1,450	135.9	SG-049
Xylene (total)	UG/M3	183	127	1.40	474.0	58.70	SG-079

Only Detected Results Reported.

TABLE 2-9
CONTAMINANTS OF POTENTIAL CONCERN
FORMER KLINK COSMO SITE

Parameter	Matrix			
	Subsurface Soil	Floor Drain Sediment	Groundwater	Soil Vapor
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	--	--	X	--
1,1,1-Trichloroethane	--	--	X	--
1,1,2-Trichloroethane	--	--	--	--
1,1-Dichloroethane	--	--	X	--
1,1-Dichloroethene	--	--	X	--
1,2,3-Trichlorobenzene	--	--	--	--
1,2,3-Trichloropropane	--	--	X	--
1,2,4-Trichlorobenzene	--	--	X	--
1,2,4-Trimethylbenzene	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--
1,2-Dichloroethane	--	--	X	--
1,2-Dichloroethene (cis)	--	--	X	--
1,2-Dichloroethene (trans)	--	--	X	--
1,2-Dichloropropane	--	--	X	--
1,3,5-Trimethylbenzene	--	--	--	--
1,4-Dichlorobenzene	--	--	X	--
Acetone	X	--	X	--
Benzene	--	--	X	--
Carbon disulfide	--	--	--	--
Carbon tetrachloride	--	--	--	--
Chloroethane	--	--	--	--
Chloromethane	--	--	--	--
Chloroform	--	--	X	--
Ethylbenzene	--	--	--	--
Isopropylbenzene	--	--	--	--
Methyl ethyl ketone	--	--	--	--
Methylene chloride	X	--	--	X
Methyl tert-butyl ether	--	--	--	--
sec-Butylbenzene	--	--	--	--
Styrene	--	--	--	--
Tetrachloroethene	X	X	X	X
Toluene	--	--	X	--
Trichloroethene	X	--	X	X
Trichlorofluoromethane	--	--	X	--
Vinyl chloride	--	--	X	--
Xylene (total)	X	--	X	--
Semivolatile Organic Compounds				
1,1'-Biphenyl	--	--	--	NA
2-Methylnaphthalene	X	--	--	NA
Acenaphthene	--	--	--	NA
Acenaphthylene	--	--	--	NA
Anthracene	--	--	--	NA
Benzo(a)anthracene	X	--	--	NA
Benzo(a)pyrene	X	--	--	NA
Benzo(b)fluoranthene	X	--	--	NA
Benzo(g,h,i)perylene	--	--	--	NA
Benzo(k)fluoranthene	X	--	--	NA
bis(2-Ethylhexyl)phthalate	--	--	--	NA

TABLE 2-9
CONTAMINANTS OF POTENTIAL CONCERN
FORMER KLINK COSMO SITE

Parameter	Matrix			
	Subsurface Soil	Floor Drain Sediment	Groundwater	Soil Vapor
Butylbenzylphthalate	--	--	--	NA
Chrysene	X	--	--	NA
Dibenz(a,h)anthracene	X	--	--	NA
Dibenzofuran	--	--	--	NA
Diethylphthalate	--	--	--	NA
Di-n-butylphthalate	X	X	--	NA
Fluoranthene	--	--	--	NA
Fluorene	--	--	--	NA
Indeno(1,2,3-cd)pyrene	X	--	--	NA
Naphthalene	--	--	--	NA
Phenanthrene	--	--	--	NA
Phenol	--	--	--	NA
Pyrene	--	--	--	NA
Pesticides				
4,4'-DDD	X	X	--	NA
4,4'-DDE	--	X	--	NA
4,4'-DDT	--	X	--	NA
Aldrin	X	--	--	NA
alpha-Chlordane	--	--	--	NA
Dieldrin	--	X	X	NA
Endosulfan I	--	--	--	NA
Endosulfan II	--	--	--	NA
Endrin	--	X	--	NA
gamma Chlordane	--	--	--	NA
gamma-BHC (Lindane)	--	--	X	NA
Heptachlor epoxide	--	X	--	NA
Methoxychlor	--	--	--	NA
Metals				
Aluminum	X	--	--	NA
Antimony	--	X	--	NA
Arsenic	X	X	X	NA
Barium	X	--	X	NA
Beryllium	--	--	X	NA
Cadmium	X	X	X	NA
Calcium	X	X	--	NA
Chromium	X	X	X	NA
Cobalt	X	X	--	NA
Copper	X	X	X	NA
Iron	X	X	X	NA
Lead	X	X	X	NA
Magnesium	--	--	X	NA
Manganese	--	X	X	NA
Mercury	X	X	--	NA
Nickel	X	X	X	NA
Selenium	--	--	--	NA
Silver	--	--	--	NA
Sodium	--	--	X	NA
Thallium	--	--	X	NA
Vanadium	X	X	--	NA
Zinc	X	X	--	NA

NA - Not analyzed.
-- - Not detected above the applicable standard, criteria or guidance (SCG) value .
X - Detected in 1 or more samples at a concentration above the applicable SCG value.

TABLE 2-10
POTENTIAL PATHWAYS OF EXPOSURE
CURRENT USE SCENARIOS
FORMER KLINK COSMO SITE

Potentially Contaminated Medium	Potential Routes of Exposure	Potential Receptors	Potential Pathway Complete
Surface Soil	None	None	No. There is no surface soil at the site. All soil is covered by the building, pavement or sidewalks.
Subsurface Soil	Dermal absorption, ingestion.	Construction workers	Yes. Contact with soil may occur during intrusive construction activities.
Soil Vapor/Indoor Air	Inhalation of VOCs from soil vapor.	Construction workers	Yes. Disturbance of soil vapors may occur during intrusive activities.
	Inhalation of VOCs from soil vapor beneath onsite building.	Onsite employees	Yes. There is potential for VOCs to migrate from the subsurface into the building through the vapor phase.
	Inhalation of VOCs from soil vapor beneath homes.	Public	Yes. There is potential for VOCs to migrate from the subsurface into homes/businesses through the vapor phase.
Outdoor Air	Inhalation of VOCs from soil or fugitive dust.	Public	Yes. There are CPCs in soil at this site. Disturbance of soil during construction activities may release VOCs to outdoor air.
Groundwater	Dermal absorption, inhalation.	Construction workers	No. Groundwater level greater than 11 feet below ground surface would not impact disturbance of subsurface soil during intrusive activities.
	Ingestion.	Onsite employees, public	No. No current potable water use at or near site.

TABLE 2-11
POTENTIAL PATHWAYS OF EXPOSURE
FUTURE USE SCENARIO
FORMER KLINK COSMO SITE

Potentially Contaminated Medium	Potential Routes of Exposure	Potential Receptors	Potential Pathway Complete
Surface Soil	None	None	No. There is no surface soil at the site. All soil is covered by the building, pavement or sidewalks.
Subsurface Soil	Dermal absorption, ingestion.	Construction workers	Yes. Contact with soil may occur during intrusive construction activities.
Soil Vapor/Indoor Air	Inhalation of VOCs from soil vapor.	Construction workers	Yes. Disturbance of soil vapors may occur during intrusive activities.
	Inhalation of VOCs from soil vapor beneath onsite building.	Onsite employees	Yes. There is potential for VOCs to migrate from the subsurface into the building through the vapor phase.
	Inhalation of VOCs from soil vapor beneath homes.	Public	Yes. There is potential for VOCs to migrate from the subsurface into homes through the vapor phase.
Outdoor Air	Inhalation of VOCs from soil or fugitive dust.	Public	Yes. There are CPCs in soil at this site. Disturbance of soil during construction activities may release VOCs to outdoor air.
Groundwater	Dermal absorption, inhalation.	Construction workers	No. Groundwater level > 11 feet bgs would not impact disturbance of subsurface soil during potential future intrusive activities.
	Ingestion.	Onsite employees, Public	No. Due to existing public water supply systems in the area, no potable water use at or near the site is anticipated.

TABLE 4-1
SUMMARY OF REMEDIAL TECHNOLOGY SCREENING

General Response Actions	Remedial Technologies for Soil	Description	Screening Comments
Institutional Controls	Site Management Plan	SMP would include ICs/ECs and monitoring to manage residual contamination.	Retained for development of alternatives.
Containment	Soil Cover	The existing concrete slab at 368 Richardson Street would be maintained to prevent direct contact with contaminated soil	Retained for development of alternatives.
Removal	Excavation and Off-Site Disposal	Excavation of contaminated soil under building and disposed of off-site.	Not retained for development of alternatives.
	Soil Vapor Extraction and Air Sparging	Sparging volatilizes VOCs in groundwater and SVE extracts volatilized VOCs and VOCs in soil.	Retained for development of alternatives.
	Electrical Resistance Heating (ERH)	Heat transfers VOCs from soil to vapor that is collected by SVE system.	Not retained for development of alternatives.

TABLE 4-1
SUMMARY OF REMEDIAL TECHNOLOGY SCREENING

General Response Actions	Remedial Technologies for Groundwater	Description	Screening Comments
Institutional Controls	ICs in form of Environmental Easement (EE) with Site Management Plan	SMP would include controls to manage residual contamination.	Retained for development of alternatives.
Exposure Point Mitigation	Point of Entry (POET) Systems	Groundwater treated at each individual residence or business by individual treatment unit.	Not retained for development of alternatives.
Containment	Hydraulic Control	Groundwater is pumped from extraction well to prevent migration. Collected groundwater is treated before discharge.	Retained for development of alternatives.
Removal	Extraction Wells	Wells are used for to extract contaminated groundwater.	Retained for development of alternatives.
	SVE and Air Sparging	Subsurface air injection transfers VOCs to vapor that is collected by SVE system.	Retained for IRM but not development of alternatives.
	Electrical Resistance Heating (ERH)	Heat transfers VOCs from soil to vapor that is collected by SVE system.	Not retained for development of alternatives.
In-Situ Treatment	Permanganate Injection	Sodium permanganate is injected into groundwater to oxidize contaminants.	Retained for development of alternatives.
	EHC Injection	EHC and zero valent iron (ZVI) is injected into groundwater to promote in-situ chemical reduction of chlorinated volatile organic compound contaminants.	Retained for development of alternatives.
	Ozone and Hydrogen Peroxide Injection	Ozone or hydrogen peroxide are injected into groundwater to oxidize contaminants.	Not retained for development of alternatives.
	Permeable Reactive Barrier (PRB)	A subsurface wall is constructed with materials that will chemically tranform contaminants to non-toxic compounds.	Not retained for development of alternatives.

TABLE 4-1
SUMMARY OF REMEDIAL TECHNOLOGY SCREENING

General Response Actions	Remedial Technologies for Soil Vapor	Description	Screening Comments
Institutional Controls	ICs in form of Environmental Easement (EE) with Site Management Plan	SMP would include controls to manage residual contamination.	Retained for development of alternatives.
Exposure Point Mitigation	Subsurface Depressurization Systems (SSDS)	SSD system creates a vacuum under a building floor that prevents migration of contaminated vapors into the building.	Retained for development of alternatives.
Removal	Air Sparging (AS) and Soil Vapor Extraction (SVE) Sytems	Contaminants below building are volatilized and then removed before entering the building.	Retained for IRM but not retained for development of alternatives.

TABLE 5-1
SUMMARY OF REMEDIAL ALTERNATIVE COMPONENTS

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Description	No Action, ICs with Site Management	IRM SVE/AS, Soil Cover, SSDS, ICs with Site Management	IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, ICs with Site Management	IRM SVE/AS, EHC Injection, Soil Cover, SSDS, ICs with Site Management	IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, ICs with Site Management
Source Control	None	SVE/AS adjacent to and under building	SVE/AS adjacent to and under building	SVE/AS adjacent to and under building	SVE/AS adjacent to and under building
Remedial Actions for Soil	Deed restrictions to prevent exposure	Deed restrictions and soil cover to prevent exposure	Deed restrictions and soil cover to prevent exposure	Deed restrictions and soil cover to prevent exposure	Deed restrictions and soil cover to prevent exposure
Remedial Actions for Groundwater	Deed restrictions to prevent groundwater use	Deed restrictions to prevent groundwater use	Permanganate injections and deed restrictions to prevent groundwater use	EHC injections and deed restrictions to prevent groundwater use	Permanganate Injections, Hydraulic Containment and deed restrictions to prevent groundwater use
Remedial Actions for Soil Vapor	None	SSD sytems installed as needed in existing, modified or new buildings	SSD sytems installed as needed in existing, modified or new buildings	SSD sytems installed as needed in existing, modified or new buildings	SSD sytems installed as needed in existing, modified or new buildings

Klink Cosmo
Feasibility Study
TABLE 6-1
COST ESTIMATE SUMMARY

Client NYSDEC
Project Klink Cosmo FS
Title Cost Estimate

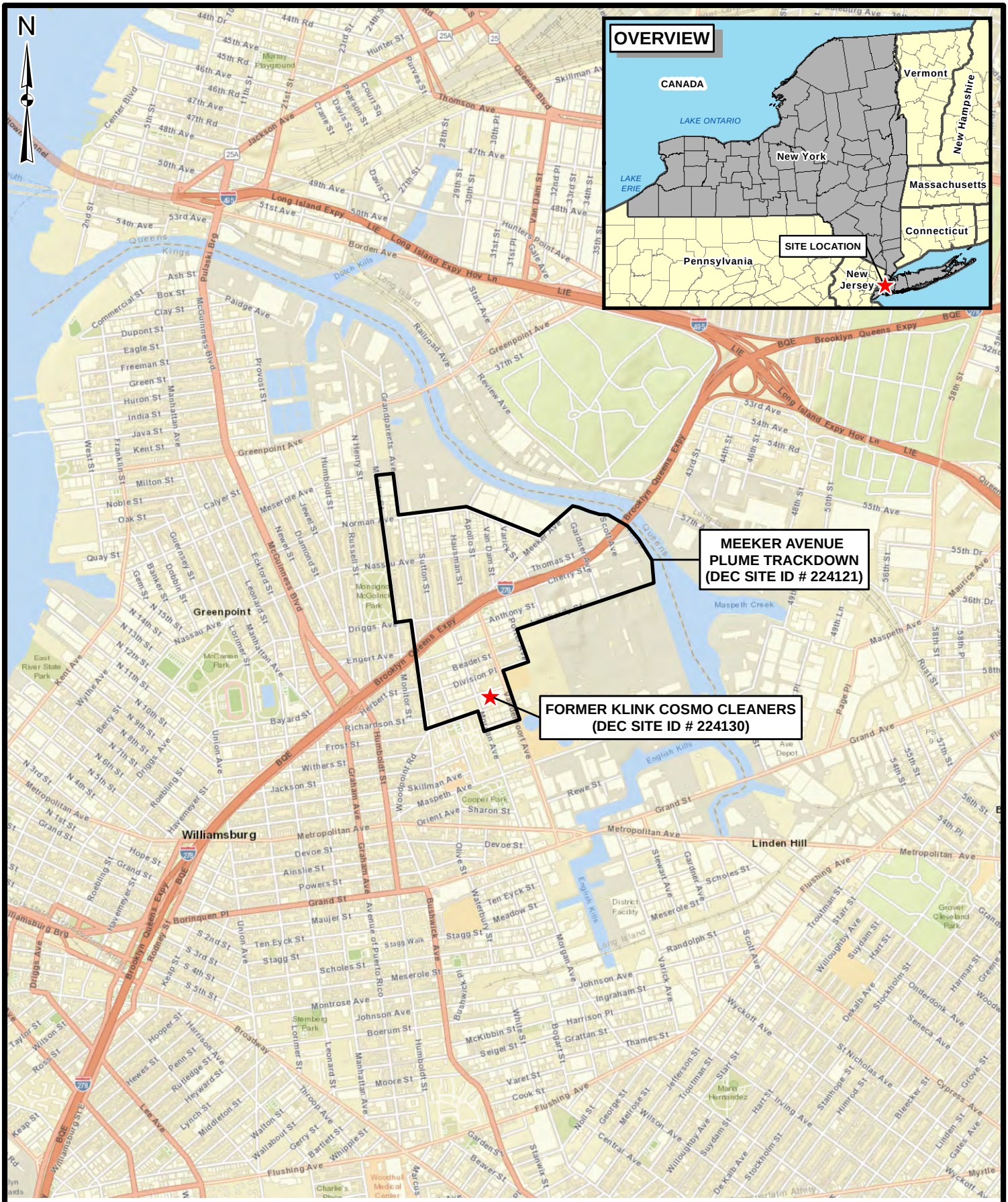
Project Number 60521141
Calculated By: DNM Date: 7-24-18
Checked By: MG Date: 7-24-18

CAPITAL COSTS			ALTERNATIVE 1: No Action, Institutional Controls with Site Management	ALTERNATIVE 2: IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management	ALTERNATIVE 3: IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management	ALTERNATIVE 4: IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management	ALTERNATIVE 5: IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management
Item	Description	Units	COST	COST	COST	COST	COST
1	Site Services	LS	$0	$16,336	$126,605	$137,492	$178,896
2	SSD Systems	LS	$0	$16,292	$16,292	$16,292	$16,292
3	SVE/AS System	LS	$0	$406,879	$406,879	$406,879	$406,879
4	Injection Well Construction	LS	$0	$0	$246,621	$246,621	$246,621
5	Permanganate Injection	LS	$0	$0	$1,103,855	$0	$1,103,855
6	EHC Injection	LS	$0	$0	$0	$1,165,504	$0
7	Hydraulic Containment	LS	$0	$0	$0	$0	$1,928,097
8	2 years of Quarterly Startup Groundwater Monitoring	LS	$0	$202,129	$202,129	$202,129	$202,129
9	Site Management Plan	LS	$40,600	$40,600	$40,600	$40,600	$40,600
	Capital Cost SubTotal		**$40,600**	**$682,236**	**$2,142,981**	**$2,215,517**	**$4,123,369**

MARKUPS			Markup	Cost	Markup	Cost	Markup	Cost	Markup	Cost	Markup	Cost
Markup 1	Mobilization/Demobilization, percentage of Capital Cost Subtotal	%	5%	$2,030	5%	$34,112	5%	$107,149	5%	$110,776	5%	$206,168
Markup 2	Bonds and Insurance, percentage of Capital Cost Subtotal	%	2%	$812	2%	$13,645	2%	$42,860	2%	$44,310	2%	$82,467
Markup 3	Engineering & CM, percentage of Capital Cost Subtotal plus Markup 1	%	15%	$6,395	15%	$107,452	15%	$337,519	15%	$348,944	15%	$649,431
Markup 4	Contingency, percentage of Capital Cost Subtotal plus Markups 1, 2 and 3	%	25%	$12,459	25%	$209,361	25%	$657,627	25%	$679,887	25%	$1,265,359
Markup 5	Escalation to Midpoint of Construction (2021), 3% per year. Percentage of Capital Cost Subtotal plus Markups 1 through 4	%	9.3%	$5,793	9.3%	$97,353	9.3%	$305,797	9.3%	$316,147	9.3%	$588,392
	TOTAL CAPITAL COST		**$68,089**		**$1,144,159**		**$3,593,933**		**$3,715,582**		**$6,915,187**	
ANNUAL COSTS			Cost Per Year		Cost Per Year		Cost Per Year		Cost Per Year		Cost Per Year	
A1	Annual Monitoring - 30 Years	Lump Sum	$17,400		$17,400		$17,400		$17,400		$17,400	
A2	Annual Reporting & 5-year Review	Lump Sum	$14,400		$14,400		$14,400		$14,400		$14,400	
A3	SSD System O&M	Lump Sum	$0		$8,180		$8,180		$8,180		$8,180	
A4	Hydraulic Containment/Removal O&M	Lump Sum	$0		$0		$0		$0		$61,600	
A5	SVE/AS System O&M (5 years; not included in Present Worth calculation)	Lump Sum	$0		$303,900		$303,900		$303,900		$303,900	
	TOTAL ANNUAL COST (not including SVE/AS O&M)		**$31,800**		**$39,980**		**$39,980**		**$39,980**		**$101,580**	
	PRESENT WORTH of ANNUAL COST (5% for 30 years) (1)		**$488,846**		**$614,593**		**$614,593**		**$614,593**		**$1,561,539**	
			ALTERNATIVE 1		ALTERNATIVE 2		ALTERNATIVE 3		ALTERNATIVE 4		ALTERNATIVE 5	
TOTAL CAPITAL plus PW of ANNUAL COST			**$557,000**		**$2,063,000**		**$4,512,000**		**$4,634,000**		**$8,781,000**	

Notes:
(1) Present Worth Factor = 15.3725

FIGURES



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URS

FORMER KLINK COSMO CLEANERS SITE
SITE LOCATION

FIGURE 2-1

N

DRIGGS AVE
ANTHONY ST
VANDERVOORT AVE
LOMBARDY ST
BEADEL ST
RICHARDSON ST
DIVISION PL
MORGAN AVE
FROST ST
WITHERS ST
PORTER AVE

A
A'
B
B'
C
C'
D
D'
E
E'

MW-098
MW-018
MW-019

DEC-016
DEC-016D
DEC-017
DEC-017D
DEC-079
DEC-080
DEC-080D
DEC-052
DEC-095
DEC-095D
DEC-081
DEC-018
DEC-018D
DEC-018TC
DEC-096
DEC-096D
DEC-082
DEC-026
DEC-040
DEC-040D
DEC-041
DEC-041TC
DEC-041D
DEC-005
DEC-005D
DEC-022D
DEC-039
DEC-027
DEC-042
DEC-006TC
DEC-006D
DEC-006DD
DEC-004
DEC-008
DEC-007
DEC-007D
DEC-088
DEC-088D
DEC-028D
DEC-028
DEC-028TC
DEC-097
DEC-097D
DEC-071
DEC-009D
DEC-009
DEC-015R
DEC-015D
DEC-015
DEC-043
DEC-043D
DEC-089
DEC-089D
DEC-074
DEC-073
DEC-072
DEC-010D
DEC-010
DEC-030
DEC-030D
DEC-064D
DEC-064
DEC-029D
DEC-029
DEC-029TC
DEC-013D
DEC-013
DEC-014D
DEC-014R
DEC-111
DEC-111D
DEC-142D
DEC-142
DEC-090
DEC-090D
DEC-075
DEC-078
DEC-077
DEC-127
DEC-128
DEC-126
DEC-125
DEC-126D
DEC-076
DEC-012
DEC-011D
DEC-011
DEC-065
DEC-065D
SB-15
SEE INSET
DEC-045
DEC-045D
DEC-066
DEC-066D
DEC-098
DEC-099
DEC-129
DEC-133
SB-16
SB-17
SB-20
SB-21
DEC-091
DEC-091D
DEC-102
SB-12
DEC-032
DEC-101
DEC-132
DEC-033R
DEC-131
DEC-033
SB-13
DEC-046
SB-14
DEC-046D
DEC-130
DEC-100
DEC-134
DEC-105
DEC-104
DEC-103
DEC-048
DEC-047

SB-10
SB-09
SB-08
SB-07
SB-06
SB-05
SB-04
SB-03
SB-02
SB-01
SB-11

INSET

DEC-031
DEC-031TC
DEC-031D
OW-01
OW-02
OW-03
DEC-141
DEC-141D
DEC-044D
DEC-044
SB-22
AWL-01
SB-18
E'
DEC-140
DEC-140D
AWL-02
AWL-03
AWL-04
AWL-05
AWL-06
SB-19

Legend

- ExxonMobil Monitoring Well
- NYSDEC Monitoring Well Location
- Soil Boring Location
- Cross-Section Location (A – A')
- On-site Area
- Off-Site Area

Source: ESRI World Imagery

200 0 200 Feet

FORMER KLINK COSMO CLEANERS SITE
MONITORING WELL AND
CROSS SECTION LOCATIONS

URS

FIGURE 2-2

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase III\03-02 Cross-Section Locations_rev.mxd 9/28/2017

WEST
A

EAST
A’

DEC-075 PROJECTED
DEC-072
DEC-073
DEC-074
DEC-009D
DEC-009
DEC-097
DEC-097D
DEC-028D
DEC-028
DEC-028TC
DEC-007D
DEC-007

FILL
SANDY SILT
CLAYEY SILT
SILT
SILTY SAND
FINE TO COARSE SAND
CLAY
FINE TO COARSE SAND
SILTY SAND
CLAYEY SILT
SILTY SAND
SANDY SILT
CLAYEY SILT
FINE TO COARSE SAND
SILTY SAND
CLAYEY SILT
SANDY SILT
SILTY SAND
CLAY
SILT
SILTY SAND
CLAYEY SILT
FINE TO COARSE SAND
SILT
FINE TO COARSE SAND
SILTY SAND
CLAYEY SILT
TOP OF RARITAN FORMATION
CLAY

40’ TD
35’ TD
55’ TD
50’ TD
68’ TD
50’ TD
65’ TD
50’ TD
80’ TD
114’ TD
46’ TD
95’ TD

?
?

ELEVATION
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90

Fill
Fine Sand or Fine-Coarse Sand
Silty Sand
Sandy Silt
Clay
Clayey Silt
Silt
Gravel
Cobbles

DEC-072 ← Monitoring Well Number
← Potentiometric Surface 12/12/2014
← Screened Interval of Monitoring Well
← Borehole Termination
35’ TD = Total Depth

Horizontal Scale: 1” = 100’
Vertical Scale: 1” = 20’
10x Vertical Exaggeration

NOTES:
1. Geologic conditions shown are representative of conditions encountered at each boring location to the depth drilled. Extrapolations between borings have been interpreted using standardly accepted geologic practices and principles. Actual conditions may vary between borings from those shown.
2. Elevations based on North American Vertical Datum, 1988.

AG207198-111763900-011916-GCM

FORMER KLINK COSMO CLEANERS SITE
CROSS SECTION A - A’

URS

FIGURE 2-3

SOUTH

B

B'

NORTH

DEC-032 | DEC-066 | DEC-066D | DEC-140 | DEC-140D | DEC-031 | DEC-031D | DEC-031TC | DEC-111 | DEC-111D | DEC-030 | DEC-030D | DEC-015 | DEC-015D | DEC-015R | DEC-028TC | DEC-028D | DEC-028 | DEC-008 | DEC-027 | DEC-005 | DEC-005D | MW-018

ELEVATION

40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90

FILL
SILTY SAND
CLAYEY SILT
COARSE SAND
SILTY FINE SAND
MEDIUM SAND
FINE TO COARSE SAND
FINE-MEDIUM SAND
FINE-COARSE SAND
FINE SAND
NOT SAMPLED
SANDY SILT
COARSE SAND AND GRAVEL
SILTY MEDIUM SAND
SILT AND SANDY SILT
FINE-MEDIUM SAND
FINE-COARSE SAND
SAND/SILT/GRAVEL
MEDIUM-COARSE SAND
SILT AND CLAY
FINE TO MEDIUM SAND
CLAY
SILTY CLAY
CLAYEY SILT
SANDY SILT
2' SUMP
TOP OF RARITAN FORMATION

45' TD | 41' TD | 45' TD | 45' TD | 45' TD | 46' TD | 45' TD | 50' TD | 50' TD | 50' TD | 49' TD | 45' TD | 80' TD | 80' TD | 81' TD | 80' TD | 81' TD | 82' TD | 81' TD | 72' TD | 114' TD | 115' TD

Not To Scale

DEC-005 ← Monitoring Well Number

← Potentiometric Surface 3/6/14

← Screened Interval of Monitoring Well

← Borehole Termination

49' TD = Total Depth

- Cobbles
- Gravel
- Silty Sand
- Clay
- Fill
- Clayey Silt/ Silty Clay
- Very Coarse or Coarse Sand
- Fine Sand or Fine-Coarse Sand
- Sandy Silt

NOTES:

1. Geologic conditions shown are representative of conditions encountered at each boring location to the depth drilled. Extrapolations between borings have been interpreted using standardly accepted geologic practices and principles. Actual conditions may vary between borings from those shown.
2. Elevations based on North American Vertical Datum, 1988.
3. Water levels not taken at DEC-005, DEC-005D, DEC-030, DEC-030D and MW-018 on 3/6/14.

FORMER KLINK COSMO CLEANERS SITE
CROSS SECTION B - B'

URS

FIGURE 2-4

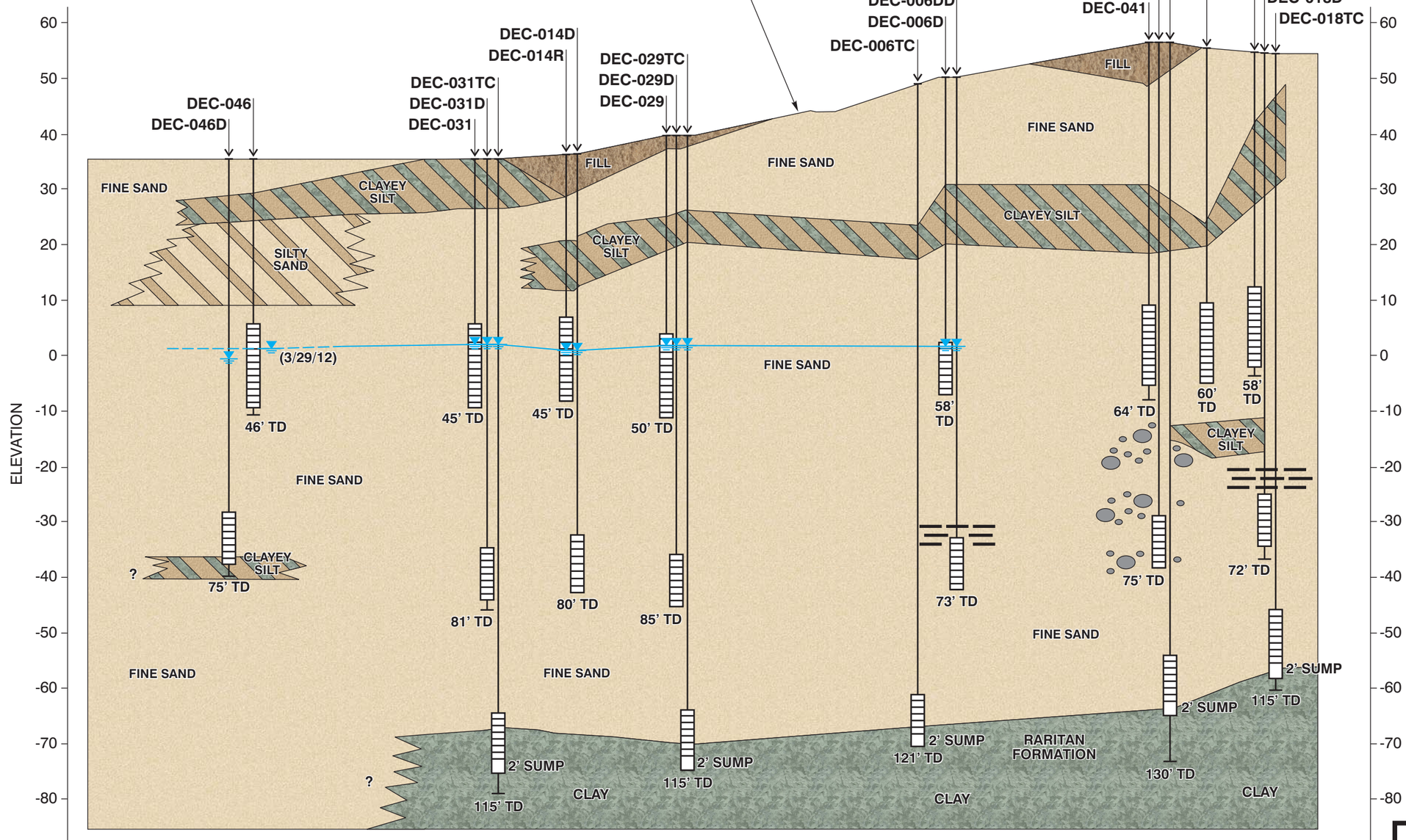
AG20720B-111763901-122915-GCM

SOUTHWEST

C

NORTHEAST

C'



Horizontal Scale: 1" = 200'
Vertical Scale: 1" = 20'
10x Vertical Exaggeration

DEC-041 ← Monitoring Well Number

← Potentiometric Surface 3/6/14

← Screened Interval of Monitoring Well

← Borehole Termination

64' TD = Total Depth

- Fill
- Clay
- Fine Sand
- Silty Sand
- Clayey Silt
- Gravel and Cobbles
- Sand with Silt and Clay Lenses

NOTES:

1. Geologic conditions shown are representative of conditions encountered at each boring location to the depth drilled. Extrapolations between borings have been interpreted using standardly accepted geologic practices and principles. Actual conditions may vary between borings from those shown.
2. Elevations based on North American Vertical Datum, 1988.
3. Water levels not taken at DEC-018, DEC-018D, DEC-018TC, DEC-041, DEC-041D, DEC-041TC, DEC-046, and DEC-082 on 3/6/14.

FORMER KLINK COSMO CLEANERS SITE
CROSS SECTION C - C'

URS

FIGURE 2-5

AG20721A-111763900-061114-GCM

WEST

D

EAST

D’

Not To Scale

WAREHOUSE BUILDING

VANDERVOORT AVENUE

AWL-04 | AWL-03 | AWL-02 | AWL-01

CONCRETE

FILL

FINE-MEDIUM SAND

COBBLES

SILT AND FINE SAND

FINE SAND

FINE-COARSE SAND

FINE-MEDIUM SAND

MEDIUM-COARSE SAND

FINE-COARSE SAND AND FINE-GRAVEL TRACE COBBLES

38’ TD

40’ TD

ELEVATION

40 | 35 | 30 | 25 | 20 | 15 | 10 | 5 | 0 | -5

AWL-01 ← Monitoring Well Number

← Potentiometric Surface 5/2015

← Borehole Termination

40’ TD = Total Depth

Cobbles

Gravel

Silt and Fine Sand

Fill

Fine Sand or Fine-Coarse Sand

NOTES:

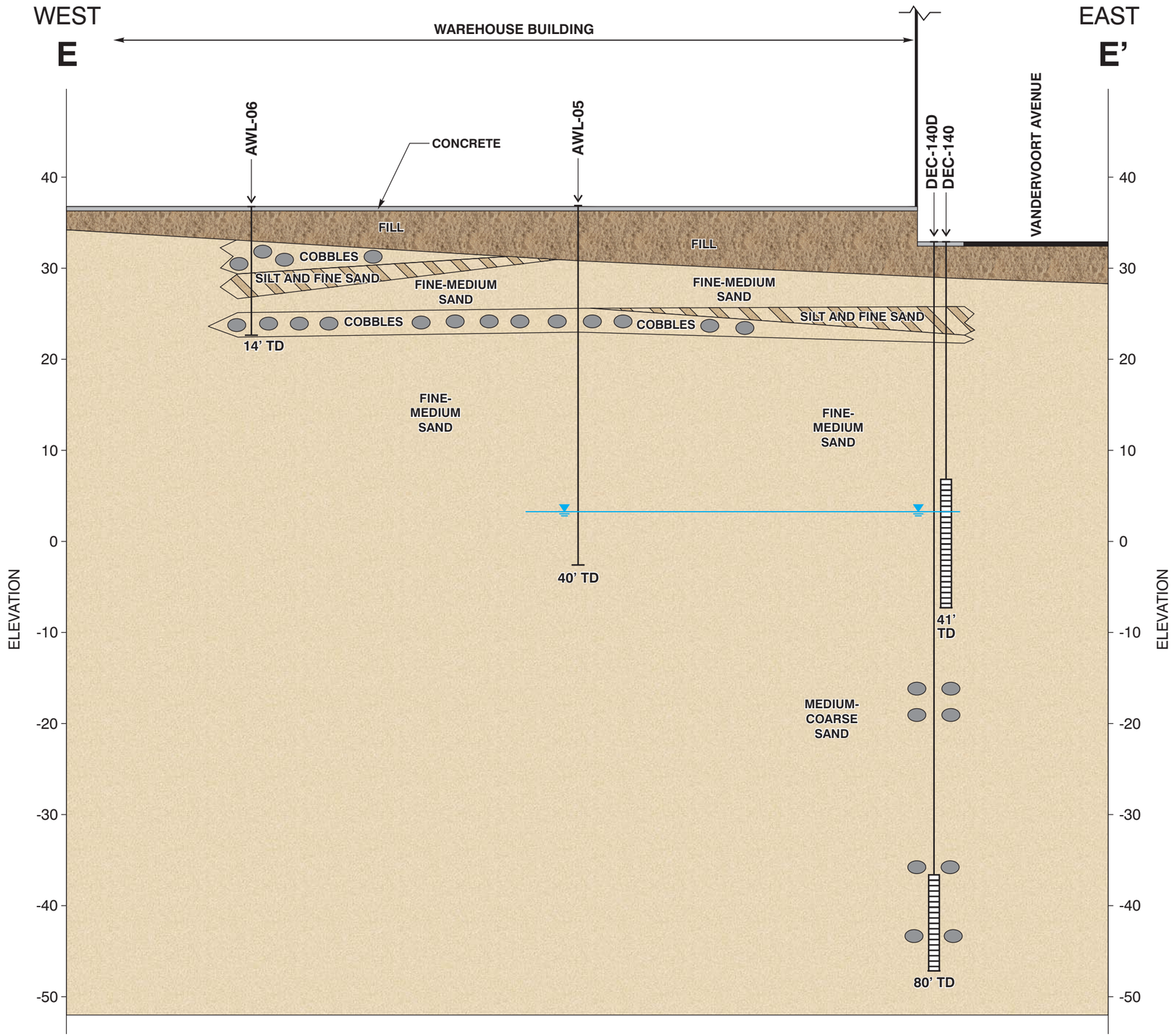
1. Geologic conditions shown are representative of conditions encountered at each boring location to the depth drilled. Extrapolations between borings have been interpreted using standardly accepted geologic practices and principles. Actual conditions may vary between borings from those shown.
2. Elevations based on North American Vertical Datum, 1988.

FORMER KLINK COSMO CLEANERS SITE
CROSS SECTION D - D’

URS

FIGURE 2-6

AG21082A-11176390-011516-GCM



Not To Scale

DEC-140 ← Monitoring Well Number

← Potentiometric Surface 5/2015

← Screened Interval of Monitoring Well

← Borehole Termination

41' TD = Total Depth

Cobbles

Gravel

Silt and Fine Sand

Fill

Fine Sand or Fine-Coarse Sand

NOTES:

1. Geologic conditions shown are representative of conditions encountered at each boring location to the depth drilled. Extrapolations between borings have been interpreted using standardly accepted geologic practices and principles. Actual conditions may vary between borings from those shown.
2. Elevations based on North American Vertical Datum, 1988.

FORMER KLINK COSMO CLEANERS SITE
CROSS SECTION E - E'

URS

FIGURE 2-7

AG21083A-111763900-011516-GCM

N

DRIGGS AVE

ANTHONY ST

LOMBARDY ST

VANDERVOORT AVE

BEADEL ST

DIVISION PL

MORGAN AVE

RICHARDSON ST

FROST ST

WITHERS ST

LOMBARDY ST

DEC-018TC, -56.95

DEC-041TC, -65.32

DEC-006TC, -68.83

DEC-028TC, -69.05

DEC-029TC, -74.05

DEC-031TC, -73.31

-30 -35 -60 -65 -70 -75 -80

Legend

- NYSDEC Monitoring Well
- Top of Raritan Elevation Contour (NAVD 88)

DEC-031TC, -73.31
Well ID — Surface Elevation

Source: ESRI World Imagery

200 0 200 Feet

FORMER KLINK COSMO CLEANERS SITE
TOP OF RARITAN FORMATION ISOPLETH

URS

FIGURE 2-8

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase II\03-08 Surface Elev Raritan.mxd 5/11/2018

N

DRIGGS AVE

ANTHONY ST

LOMBARDY ST

LOMBARDY ST

VANDERVOORT AVE

BEADEL ST

DIVISION PL

MORGAN AVE

RICHARDSON ST

FROST ST

WITHERS ST

DEC-022D, 1.71

DEC-039, 1.88

DEC-027, 1.93

DEC-042, 1.88

DEC-004, 2.07

DEC-006D, 1.74

DEC-008, 1.87

DEC-007, 1.82

DEC-088, 1.98

DEC-028, 1.68

DEC-009, 2.07

DEC-015R, 1.97

DEC-015, 2.15

DEC-043, 1.94

DEC-089, 2.03

DEC-029, 2.03

DEC-064, 2.13

DEC-010, 2.33

DEC-013, 1.99

DEC-030, 1.94

DEC-014R, 2.04

DEC-090, 2.07

DEC-012, 2.20

DEC-031, 2.07

DEC-045, 2.08

DEC-065, 2.31

DEC-044, 2.13

DEC-011, 3.01

DEC-066, 2.12

DEC-091, 2.10

DEC-032, 2.03

DEC-033, 2.88

DEC-046, 2.20

DEC-048, 2.28

DEC-047, 2.32

1.8

2.0

1.8

2.2

2.4

2.6

2.8

3.0

Legend

- NYSDEC Monitoring Well Location
- Approximate Direction of Groundwater Flow
- Groundwater Potentiometric Surface (NAVD 88)

DEC-066, 2.12

Well ID — Groundwater Elevation

Note: DEC-015 was not included in contour creation

Source: ESRI World Imagery

200 0 200 Feet

FORMER KLINK COSMO CLEANERS SITE
SHALLOW OVERBURDEN GROUNDWATER POTENTIOMETRIC SURFACE (3/28/2012-3/29/2012)

URS

FIGURE 2-9

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase III\03-12 GW Elev Shallow 120329.mxd 5/11/2018

N

DRIGGS AVE

ANTHONY ST

LOMBARDY ST

VANDERVOORT AVE

BEADEL ST

DIVISION PL

MORGAN AVE

RICHARDSON ST

FROST ST

WITHERS ST

DEC-006DD, 1.72

DEC-007D, 1.94

DEC-088D, 1.92

DEC-028D, 1.98

DEC-015D, 1.96

DEC-043D, 1.48

DEC-089D, 2.02

DEC-029D, 2.06

DEC-064D, 2.09

DEC-030D, 2.01

DEC-013D, 2.06

DEC-014D, 2.05

DEC-090D, 2.10

DEC-031D, 2.08

DEC-044D, 2.17

DEC-045D, 2.11

DEC-065D, 1.96

DEC-066D, 2.14

DEC-091D, 2.11

DEC-011D, 2.57

DEC-046D, 0.31

1.8

2.0

1.6

2.2

2.4

2.0

Legend

- NYSDEC Monitoring Well Location
- Approximate Direction of Groundwater Flow
- Groundwater Potentiometric Surface (NAVD 88)

DEC-066D, 2.92

Well ID — Groundwater Elevation

Note: DEC-046D was not included in contour creation

Source: ESRI World Imagery

200 0 200 Feet

FORMER KLINK COSMO CLEANERS SITE
DEEP OVERBURDEN GROUNDWATER POTENTIOMETRIC SURFACE (3/28/2012-3/29/2012)

URS

FIGURE 2-10

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase II\03-13 GW Elev Deep 120329.mxd 5/18/2018

N

RICHARDSON STREET

VANDERVORT AVENUE

MORGAN AVENUE

FORMER KLINK COSMO CLEANERS

DEC-142D

DEC-142

CATCH BASIN

SEW-SD-1

DEC-141D

SP-02/OW-04

DEC-141

SP-01

OW-01

SVE-01

SVE-02

OW-02

AWL-SV-1

AWL-01

OW-03

SP-03

DEC-140

AWL-02

AWL-SV-2

AWL-03

DEC-140D

AWL-04

AWL-SV-3

OVERHEAD DOOR

AWL-05

AWL-SV-5

AWL-SV-4

AWL-FD-1

AWL-FD-2

AWL-06

STAIRS

AWL-SV-6

AWL-FD-4

AWL-FD-3

COLUMN (TYP.)

DEC-033R

Legend

- Air Sparging Well
- Floor Drain Sample Location
- Catch Basin Sample Location
- Soil Gas Sample Location
- Soil Vapor Extraction Well
- Observation Well
- Soil Boring Location
- NYSDEC Monitoring Well Location

40 0 40 Feet

FORMER KLINK COSMO CLEANERS SITE ON-SITE PHASE III REMEDIAL INVESTIGATION SAMPLING LOCATIONS

URS

FIGURE 2-11

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase III\02-01 Investigation Locations.mxd 1/25/2016

N

BEADEL ST

MORGAN AVE

DIVISION PL

VANDERVOORT AVE

RICHARDSON ST

FROST ST

WITHERS ST

DEC-142D
OW-02
DEC-141D
AS-02/OW-04
AS-03
OW-01
DEC-140
DEC-140D

AS-01 (24' - 25')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	04/15
VOCs:					
Acetone	0.05	500	0.05	--	0.0824
Tetrachloroethene	1.3	150	1.3	--	11.5

SVE-01 (23' - 24')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	04/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	5.61

AWL-01 (4' - 5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	249

AWL-01 (17' - 18')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	160

AWL-01 (34' - 35')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	15.7

AWL-03 (1.5' - 2.2')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	191
Trichloroethene	0.47	200	0.47	--	1.14

AWL-03 (10' - 11.5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	1.75

AWL-03 (39.5' - 40')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Acetone	0.05	500	0.05	--	0.0789

AWL-02 (0.4' - 1.5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	273
Trichloroethene	0.47	200	0.47	--	0.803

AWL-02 (4' - 5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	119

AWL-04 (0.5' - 1.5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	48.8

AWL-04 (9' - 10')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	14.9

AWL-05 (5' - 6')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	44

AWL-06 (0.5' - 1.5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
VOCs:					
Tetrachloroethene	1.3	150	1.3	--	9.6

Legend

- NYSDEC Soil Sample

Source: ESRI World Imagery

Notes: CRIT 1 = Unrestricted Use Criteria; CRIT 2 = Commercial Use Criteria;
CRIT 3 = Protection of Groundwater Use Criteria; CRIT 4 = Soil Background Criteria. Units in mg/kg.

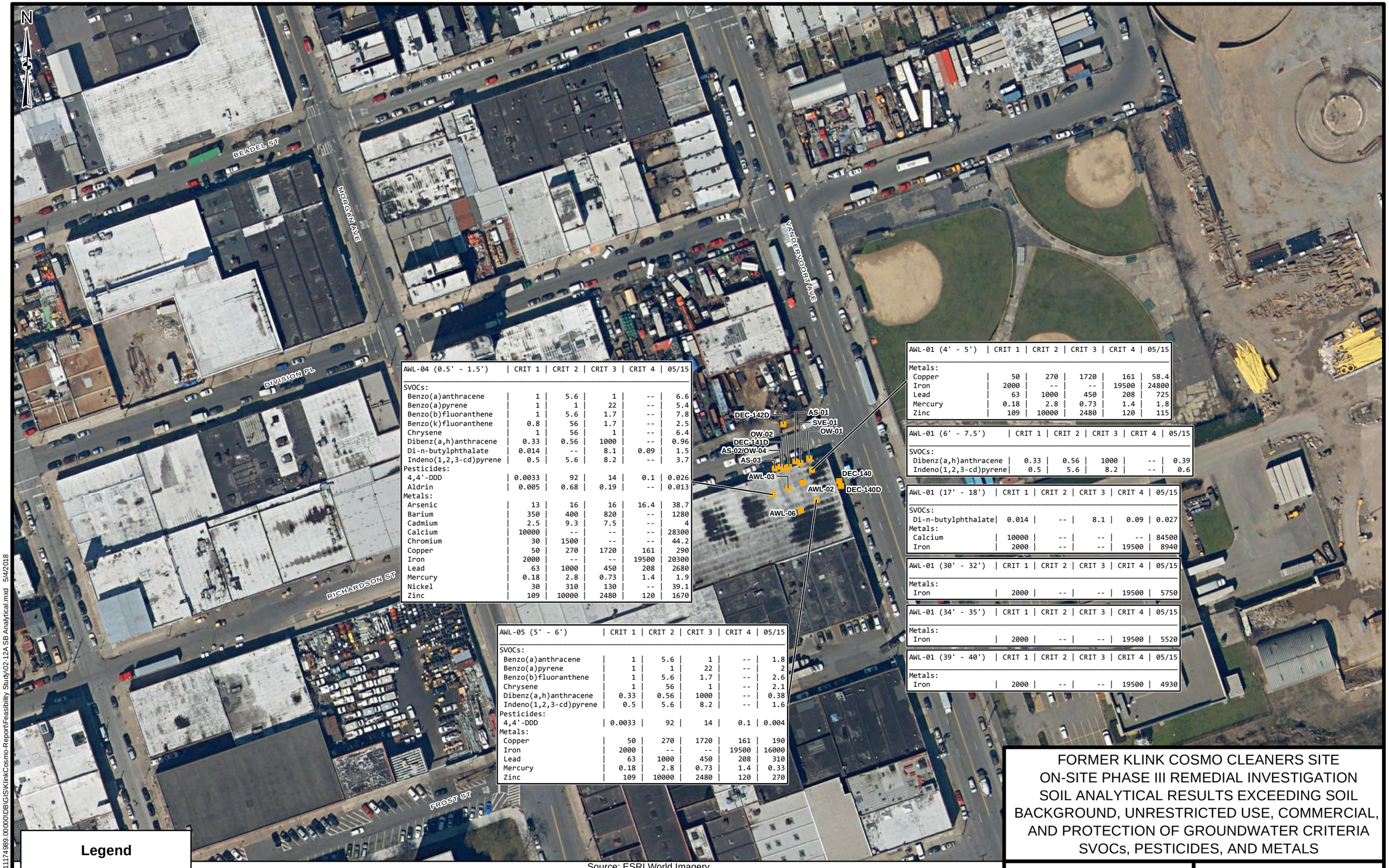
100 0 100 Feet

FORMER KLINK COSMO CLEANERS SITE
ON-SITE PHASE III REMEDIAL INVESTIGATION
SOIL ANALYTICAL RESULTS EXCEEDING SOIL BACKGROUND, UNRESTRICTED USE, COMMERCIAL, AND PROTECTION OF GROUNDWATER CRITERIA
VOCs

URS

FIGURE 2-12

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-12 SB Analytical VOC.mxd 5/4/2018



AWL-04 (0.5' - 1.5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
SVOCs:					
Benzo(a)anthracene	1	5.6	1	--	6.6
Benzo(a)pyrene	1	1	22	--	5.4
Benzo(b)fluoranthene	1	5.6	1.7	--	7.8
Benzo(k)fluoranthene	0.8	56	1.7	--	2.5
Chrysene	1	56	1	--	6.4
Dibenz(a,h)anthracene	0.33	0.56	1000	--	0.96
Di-n-butylphthalate	0.014	--	8.1	0.09	1.5
Indeno(1,2,3-cd)pyrene	0.5	5.6	8.2	--	3.7
Pesticides:					
4,4'-DDD	0.0033	92	14	0.1	0.026
Aldrin	0.005	0.68	0.19	--	0.013
Metals:					
Arsenic	13	16	16	16.4	38.7
Barium	350	400	820	--	1280
Cadmium	2.5	9.3	7.5	--	4
Calcium	10000	--	--	--	28300
Chromium	30	1500	--	--	44.2
Copper	50	270	1720	161	290
Iron	2000	--	--	19500	20300
Lead	63	1000	450	208	2680
Mercury	0.18	2.8	0.73	1.4	1.9
Nickel	30	310	130	--	39.1
Zinc	109	10000	2480	120	1670

AWL-05 (5' - 6')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
SVOCs:					
Benzo(a)anthracene	1	5.6	1	--	1.8
Benzo(a)pyrene	1	1	22	--	2
Benzo(b)fluoranthene	1	5.6	1.7	--	2.6
Chrysene	1	56	1	--	2.1
Dibenz(a,h)anthracene	0.33	0.56	1000	--	0.38
Indeno(1,2,3-cd)pyrene	0.5	5.6	8.2	--	1.6
Pesticides:					
4,4'-DDD	0.0033	92	14	0.1	0.004
Metals:					
Copper	50	270	1720	161	190
Iron	2000	--	--	19500	16000
Lead	63	1000	450	208	310
Mercury	0.18	2.8	0.73	1.4	0.33
Zinc	109	10000	2480	120	270

AWL-01 (4' - 5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
Metals:					
Copper	50	270	1720	161	58.4
Iron	2000	--	--	19500	24800
Lead	63	1000	450	208	725
Mercury	0.18	2.8	0.73	1.4	1.8
Zinc	109	10000	2480	120	115

AWL-01 (6' - 7.5')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
SVOCs:					
Dibenz(a,h)anthracene	0.33	0.56	1000	--	0.39
Indeno(1,2,3-cd)pyrene	0.5	5.6	8.2	--	0.6

AWL-01 (17' - 18')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
SVOCs:					
Di-n-butylphthalate	0.014	--	8.1	0.09	0.027
Metals:					
Calcium	10000	--	--	--	84500
Iron	2000	--	--	19500	8940

AWL-01 (30' - 32')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
Metals:					
Iron	2000	--	--	19500	5750

AWL-01 (34' - 35')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
Metals:					
Iron	2000	--	--	19500	5520

AWL-01 (39' - 40')	CRIT 1	CRIT 2	CRIT 3	CRIT 4	05/15
Metals:					
Iron	2000	--	--	19500	4930

Legend

- NYSDEC Soil Sample

Source: ESRI World Imagery

Notes: CRIT 1 = Unrestricted Use Criteria; CRIT 2 = Commercial Use Criteria; CRIT 3 = Protection of Groundwater Use Criteria; CRIT 4 = Soil Background Criteria. Units in mg/kg.

100 0 100 Feet

FORMER KLINK COSMO CLEANERS SITE
ON-SITE PHASE III REMEDIAL INVESTIGATION
SOIL ANALYTICAL RESULTS EXCEEDING SOIL BACKGROUND, UNRESTRICTED USE, COMMERCIAL, AND PROTECTION OF GROUNDWATER CRITERIA
SVOCs, PESTICIDES, AND METALS

URS

FIGURE 2-12A

J:\Projects\11174989.00000\DBG\GIS\KlinkCosmo-Report\Feasibility Study\02-12A SB Analytical.mxd 5/4/2018

N

ANTHONY ST
VANDERVOORT AVE
PORTER AVE
VARICK AVE
MORGAN AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-022, 0.013
DEC-027, ND
DEC-042, ND
SB-11, 0.036
DEC-006, 0.023
DEC-004, ND
DEC-008, 0.0039
SG-088, ND
SG-078, ND
DEC-088D, ND
DEC-028, 0.013
DEC-028TC, ND
DEC-097D, 0.021
SG-092, 0.0011
DEC-071, ND
DEC-009D, 0.0077
DEC-009, 0.0036
DEC-015, 0.037
SG-079, ND
DEC-043D, ND
DEC-089D, ND
DEC-029, ND
SG-113, ND
DEC-029TC, ND
DEC-029D, ND
DEC-064D, ND
SG-197, ND
SG-080, ND
DEC-010, 0.016
DEC-030, 0.018
DEC-030D, ND
SG-196, ND
DEC-013, 0.0025
SG-199, ND
SG-081, ND
DEC-014, 0.0039
SG-097, ND
SG-195, ND
DEC-014D, ND
SG-112, ND
SG-114, 0.0011
DEC-111D, ND
SG-082, 0.0014
SG-127, 0.0056
SG-200, ND
DEC-090D, ND
DEC-142D, 0.017
SG-083, 0.011
SG-115, 0.011
DEC-012, 0.0021
DEC-045, ND
DEC-011, ND
DEC-065D, ND
SG-084, 0.014
SG-085, ND
SG-117, 0.0028
SEE INSET
SG-118, ND
SG-086, 0.0014
DEC-066D, 0.0048
SB-20, ND
SG-087, ND
SB-21, ND
SG-119, ND
DEC-091D, ND
DEC-032, ND
SB-13, ND
SG-207, ND
SG-121, ND
DEC-033, ND
DEC-046, ND
SB-14, ND
SG-120, ND

INSET

DEC-031, 0.2
OW-01, 0.125
AS-01, 11.5
DEC-141D, 0.0035
SVE-01, 5.61
OW-02, 0.0451
AWL-01, 249
SB-18, 0.26
AS-02/OW-04, 0.0046
AS-03, 0.0054
DEC-140, ND
AWL-02, 273
AWL-03, 191
DEC-140D, 0.41
SG-116, 0.0043
AWL-04, 48.8
AWL-05, 44
SB-19, 0.084
AWL-06, 9.6
20 0 Feet

Legend

- NYSDEC Soil Boring Location

PCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 100
- 1000
- 10000

Well ID | PCE Concentration
SG-092, 0.0011

ND = Not Detected

Note: Units are in mg/kg. Results shown are maximum values at soil boring location.

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE TETRACHLOROETHENE ISOCONCENTRATION CONTOURS IN SOIL MAY2007-MAY2015

URS

FIGURE 2-13

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase III\04-05 PCE Isoconc Soil.mxd 1/21/2016

Note: Units are in mg/kg. Results shown are maximum values at soil boring location.

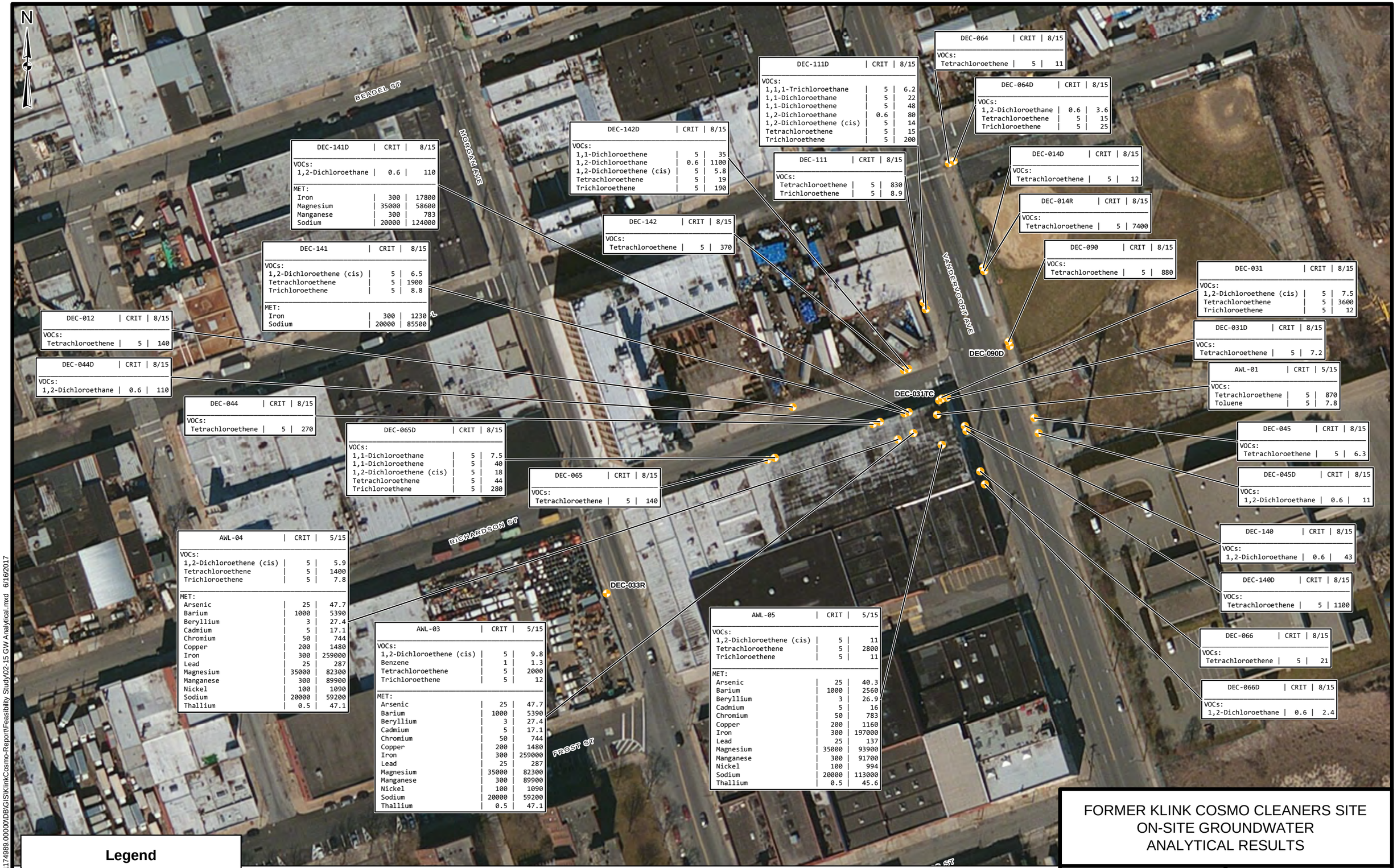
Source: ESRI World Imagery

FORMER KLINK COSMO CLEANERS SITE
TRICHLOROETHENE CONCENTRATIONS IN SOIL
MAY 2007 - MAY 2015

URS

FIGURE 2-14

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase II\04-06 TCE Isoconc Soil.mxd 1/26/2016



Legend

NYSDEC Groundwater Sample

Notes:
Units in µg/L
Criteria: NYSDEC TOGS 1.1.1 Ambient Water Quality Standards, Class GA

Source: ESRI World Imagery

100 0 100 Feet

FORMER KLINK COSMO CLEANERS SITE
ON-SITE GROUNDWATER
ANALYTICAL RESULTS

URS

FIGURE 2-15

J:\Projects\11174989.00000\DBGIS\KlinkCosmo-Report\Feasibility Study\02-15 GW Analytical.mxd 6/16/2017

N

ANTHONY ST
VANDERVOORT AVE
VARICK AVE
MORGAN AVE
LOMBARDY ST
PORTER AVE
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-022D, 1300
DEC-039, 79
DEC-027, 34
DEC-042, 84
DEC-006D, 8000
DEC-004, 4.4
DEC-008, 3000
DEC-007, 2600
DEC-156, 29
DEC-038, 150
DEC-028, 4200
DEC-097, 240
DEC-071, 56
DEC-015R, 120
DEC-015, 490
DEC-009, 260
DEC-043, 37
DEC-089, 59
DEC-029, 17000
DEC-167, 1800
DEC-064, 220
DEC-010, 47
DEC-030, 4400
DEC-144, 492
DEC-013, 7800
DEC-014, 5900
DEC-014R, 46000
DEC-163, 140
DEC-111, 1300
DEC-090, 6400
DEC-142, 370
DEC-012, 1200
DEC-141, 1900
DEC-031, 33000
DEC-045, 130
DEC-044, 3600
DEC-140, ND
DEC-011, 13
DEC-065, 200
DEC-066, 220
AWL-04, 1400
AWL-03, 2000
AWL-01, 870
AWL-05, 2800
DEC-032, 3
DEC-091, ND
DEC-033R, 2.7
DEC-033, 3.6
DEC-046, 11

Legend

- NYSDEC Monitoring Well

PCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 100
- 1000
- 10000

Well ID | PCE Concentration
DEC-029, 17000

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
TETRACHLOROETHENE ISOCONCENTRATION CONTOURS IN SHALLOW GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-16

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-16 PCE Isoconc Shallow GW MAX CONC.mxd 8/16/2017

Legend

- NYSDEC Monitoring Well

TCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 100
- 1000
- 10000

Well ID | TCE Concentration

DEC-028, 240

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN SHALLOW GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-17

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-17 TCE Isoconc Shallow GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
VANDERVOORT AVE
VARICK AVE
MORGAN AVE
LOMBARDY ST
PORTER AVE
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-022D, 42
DEC-039, 24
DEC-027, 48
DEC-042, 21
DEC-006D, 82
DEC-004, 33
DEC-008, 85
DEC-007, 54
DEC-156, 87
DEC-088, 2
DEC-028, 91
DEC-097, 54
DEC-071, 230
DEC-015R, 27
DEC-015, 19
DEC-009, 51
DEC-043, ND
DEC-089, 2.1
DEC-029, 36
DEC-010, 13
DEC-167, 33
DEC-064, 2.3
DEC-030, 27
DEC-144, 15.8
DEC-013, 100
DEC-014, 13
DEC-014R, 39
DEC-163, 2.8
DEC-111, 3.8
DEC-090, 16
DEC-142, 1.2
DEC-031, 34
DEC-012, 18
DEC-141, 6.5
DEC-044, 120
DEC-045, 5.2
DEC-140, ND
DEC-011, ND
DEC-065, ND
AWL-04, 5.9
DEC-066, 16
AWL-03, 9.8
AWL-01, 1.8
AWL-05, 11
DEC-091, ND
DEC-032, ND
DEC-033R, ND
DEC-033, ND
DEC-046, ND

Legend

NYSDEC Monitoring Well

cis 1,2-DCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | cis 1,2-DCE Concentration

DEC-071, 130

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
CIS 1,2-DICHLOROETHENE ISOCONCENTRATION CONTOURS IN SHALLOW GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-18

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-18 cis12DCE Isoconc Shallow GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
VANDERVOORT AVE
VARICK AVE
MORGAN AVE
LOMBARDY ST
PORTER AVE
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-022D, 1.2
DEC-039, 1
DEC-027, 3.9
DEC-042, ND
DEC-006D, ND
DEC-004, 2.9
DEC-008, 6.4
DEC-007, ND
DEC-156, ND
DEC-088, ND
DEC-028, 3.5
DEC-097, 1.8
DEC-071, 48
DEC-015R, ND
DEC-015, ND
DEC-043, ND
DEC-009, 1.5
DEC-089, ND
DEC-029, ND
DEC-167, ND
DEC-064, ND
DEC-010, ND
DEC-030, ND
DEC-144, ND
DEC-013, 1.7
DEC-014, ND
DEC-014R, ND
DEC-163, ND
DEC-111, ND
DEC-090, ND
DEC-142, ND
DEC-031, ND
DEC-012, ND
DEC-141, ND
DEC-045, ND
DEC-044, ND
DEC-140, ND
DEC-011, ND
DEC-065, ND
AWL-04, ND
DEC-066, ND
AWL-03, ND
AWL-01, ND
AWL-05, ND
DEC-091, ND
DEC-032, ND
DEC-033R, ND
DEC-033, ND
DEC-046, ND

Legend

NYSDEC Monitoring Well

trans 1,2-DCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | trans 1,2-DCE Concentration

DEC-071, 3.3

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
TRANS 1,2-DICHLOROETHENE CONCENTRATIONS IN SHALLOW GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-19

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-19 trans12DCE Isoconc Shallow GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
MORGAN AVE
VANDERVOORT AVE
VARICK AVE
POMEROY AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-022D, ND
DEC-039, ND
DEC-027, ND
DEC-042, ND
DEC-006D, ND
DEC-004, 1
DEC-008, 19
DEC-007, ND
DEC-156, ND
DEC-088, ND
DEC-028, 22
DEC-097, 35
DEC-071, 0.69
DEC-015R, ND
DEC-015, ND
DEC-043, ND
DEC-009, 54
DEC-089, ND
DEC-029, ND
DEC-167, ND
DEC-064, ND
DEC-010, ND
DEC-030, ND
DEC-144, ND
DEC-013, ND
DEC-014, ND
DEC-014R, ND
DEC-163, ND
DEC-111, ND
DEC-090, ND
DEC-142, ND
DEC-031, ND
DEC-012, ND
DEC-141, ND
DEC-045, ND
DEC-044, ND
DEC-140, ND
DEC-011, ND
DEC-065, ND
AWL-04, ND
DEC-066, 4
AWL-03, ND
AWL-01, ND
AWL-05, ND
DEC-091, ND
DEC-032, ND
DEC-033R, ND
DEC-033, ND
DEC-046, ND

Legend

NYSDEC Monitoring Well

VC Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | VC Concentration

DEC-097, 6.7

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
VINYL CHLORIDE CONCENTRATIONS
IN SHALLOW GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-20

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-20 VC Isoconc Shallow GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
MORGAN AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST
VANDERVOORT AVE
POMEROY AVE
VARICK AVE

DEC-005D, 1100
DEC-039D, 20
DEC-006TC, 4900
DEC-006DD, 750
DEC-007D, 400
DEC-156D, ND
DEC-088D, 190
DEC-028TC, ND
DEC-028D, 13
DEC-071D, ND
DEC-097D, 17
DEC-015D, 640
DEC-009D, 17
DEC-043D, 9
DEC-089D, 1200
DEC-029D, 7000
DEC-029TC, 4500
DEC-010D, 210
DEC-064D, 15
DEC-030D, 43
DEC-144D, 66
DEC-013D, 190
DEC-014D, 31
DEC-163D, 19
DEC-111D, 18
DEC-090D, 10
DEC-142D, 19
DEC-031TC, 3.4
DEC-031D, 20
DEC-141D, 1.4
DEC-044D, 1.5
DEC-011D, 3.3
DEC-140D, 1100
DEC-045D, 0.44
DEC-065D, 83
DEC-066D, 1.7
DEC-091D, 3.3
DEC-046D, 4.1

Legend

NYSDEC Monitoring Well

PCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | PCE Concentration

DEC-029TC, 900

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
TETRACHLOROETHENE ISOCONCENTRATION CONTOURS
IN DEEP GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-21

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-21 PCE Isoconc Deep GW MAX CONC.mxd 6/22/2017

N

ANTHONY ST
MORGAN AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST
VANDERVOORT AVE
PORTER AVE
VARICK AVE

DEC-005D, 70000
DEC-039D, 1300
DEC-006TC, 410
DEC-006DD, 220
DEC-007D, 280
DEC-156D, 710
DEC-088D, 2.7
DEC-028TC, ND
DEC-028D, 110
DEC-071D, 770
DEC-097D, 140
DEC-015D, 93
DEC-009D, 260
DEC-043D, 1.4
DEC-089D, 7.9
DEC-029D, 30
DEC-029TC, 460
DEC-010D, 92
DEC-064D, 160
DEC-030D, 320
DEC-144D, 38
DEC-013D, 24
DEC-014D, 3.6
DEC-163D, 72
DEC-111D, 220
DEC-090D, 1.8
DEC-142D, 190
DEC-031TC, ND
DEC-031D, 1.2
DEC-141D, ND
DEC-044D, 1.1
DEC-011D, 5.5
DEC-140D, 4.3
DEC-045D, ND
DEC-065D, 670
DEC-066D, ND
DEC-091D, 0.6
DEC-046D, 3.3

Legend

NYSDEC Monitoring Well

TCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | TCE Concentration

DEC-028D, 69

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN DEEP GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-22

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-22 TCE Isoconc Deep GW MAX CONC.mxd 6/22/2017

N

ANTHONY ST
MORGAN AVE
VANDERVOORT AVE
VARICK AVE
LOMBARDY ST
POMEROY AVE
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-005D, 3200
DEC-039D, 71
DEC-006TC, 50
DEC-006DD, 16
DEC-007D, 15
DEC-156D, 200
DEC-088D, 3.9
DEC-028TC, ND
DEC-028D, 38
DEC-071D, 290
DEC-097D, 57
DEC-015D, 9.5
DEC-009D, 23
DEC-043D, ND
DEC-089D, 4.8
DEC-029D, 72
DEC-029TC, 16
DEC-010D, 16
DEC-064D, 2
DEC-030D, 6.3
DEC-144D, 3.7
DEC-013D, 2.1
DEC-014D, 2
DEC-163D, 63
DEC-111D, 14
DEC-090D, 1.7
DEC-142D, 5.8
DEC-031TC, ND
DEC-031D, 1.2
DEC-141D, ND
DEC-044D, ND
DEC-011D, 0.91
DEC-140D, 2.5
DEC-045D, ND
DEC-065D, 18
DEC-066D, ND
DEC-091D, ND
DEC-046D, ND

Legend

NYSDEC Monitoring Well

cis 1,2-DCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | cis 1,2-DCE Concentration

DEC-097D, 57

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
CIS 1,2-DICHLOROETHENE ISOCONCENTRATION CONTOURS IN DEEP GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-23

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-23 cis12DCE Isoconc Deep GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
MORGAN AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST
VANDERVOORT AVE
PORTER AVE
VARICK AVE

DEC-005D, 210
DEC-039D, 10
DEC-006TC, ND
DEC-006DD, ND
DEC-007D, ND
DEC-156D, 67
DEC-088D, ND
DEC-028TC, ND
DEC-028D, 15
DEC-071D, 23
DEC-097D, 16
DEC-015D, ND
DEC-009D, 6.7
DEC-043D, ND
DEC-089D, ND
DEC-029D, ND
DEC-029TC, 2.6
DEC-010D, ND
DEC-064D, ND
DEC-030D, ND
DEC-144D, ND
DEC-013D, ND
DEC-014D, ND
DEC-163D, ND
DEC-111D, ND
DEC-090D, ND
DEC-142D, ND
DEC-031TC, ND
DEC-031D, ND
DEC-141D, ND
DEC-044D, ND
DEC-011D, ND
DEC-140D, ND
DEC-045D, ND
DEC-065D, ND
DEC-066D, ND
DEC-091D, ND
DEC-046D, ND

Legend

NYSDEC Monitoring Well

trans 1,2-DCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | trans 1,2-DCE Concentration

DEC-097D, 11

ND = Not Detected

Note: Units are in µg/L

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
TRANS 1,2-DICHLOROETHENE CONCENTRATIONS IN DEEP GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 2-24

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-24 trans12DCE Isoconc Deep GW MAX CONC.mxd 8/16/2017


N
ANTHONY ST
MORGAN AVE
VANDERVOORT AVE
VARICK AVE
POMEROY AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST
DEC-005D, 59
DEC-039D, ND
DEC-006TC, ND
DEC-006DD, ND
DEC-007D, ND
DEC-088D, ND
DEC-156D, ND
DEC-028TC, ND
DEC-028D, 2.3
DEC-097D, 41
DEC-071D, ND
DEC-015D, ND
DEC-043D, ND
DEC-009D, ND
DEC-089D, 36
DEC-029D, ND
DEC-029TC, ND
DEC-010D, ND
DEC-064D, ND
DEC-030D, ND
DEC-144D, ND
DEC-013D, ND
DEC-014D, ND
DEC-163D, ND
DEC-111D, 1.1
DEC-090D, ND
DEC-142D, ND
DEC-031TC, ND
DEC-031D, ND
DEC-141D, ND
DEC-044D, ND
DEC-011D, ND
DEC-140D, ND
DEC-045D, ND
DEC-065D, ND
DEC-066D, ND
DEC-091D, ND
DEC-046D, ND
Legend
NYSDEC Monitoring Well
VC Isoconcentration:
Estimated Extent of Iso-Contour
100
1000
10000
Well ID
VC Concentration
DEC-097D, 24
ND = Not Detected
Note: Units are in µg/L
Source: ESRI World Imagery
150
0
150 Feet
FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
VINYL CHLORIDE CONCENTRATIONS
IN DEEP GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017
URS
FIGURE 2-25
J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-25 VC Isoconc Deep GW MAX CONC.mxd 8/16/2017

AWL-SV-2	5/15
VOCs:	
1,2-Dichloroethene (cis)	809
Acetone	442
Chloroform	1420
Tetrachloroethene	1950000
Trichloroethene	7380
Xylene (total)	547

AWL-SV-1	5/15
VOCs:	
1,2,4-Trimethylbenzene	206
1,2-Dichloroethene (cis)	3570
Acetone	891
Chloroform	132
Ethylbenzene	208
Methyl ethyl ketone (2-Butanone)	88.5
Tetrachloroethene	1080000
Toluene	113
Trichloroethene	7320
Xylene (total)	1560

AWL-SV-3	5/15
VOCs:	
1,2-Dichloroethene (cis)	95.2
Acetone	696
Chloroform	703
Ethylbenzene	188
Tetrachloroethene	550000
Trichloroethene	1920
Xylene (total)	1510

AWL-SV-4	5/15
VOCs:	
1,2-Dichloroethene (cis)	987
Acetone	128
Chloroform	2400
Tetrachloroethene	2090000
Trichloroethene	4920

AWL-SV-6	5/15
VOCs:	
Acetone	4390
Tetrachloroethene	551000
Trichloroethene	3480
Xylene (total)	2190

AWL-SV-5	5/15
VOCs:	
1,1,1-Trichloroethane	10.6
1,2,4-Trimethylbenzene	27.3
1,2-Dichloroethene (cis)	5.95
1,3,5-Trimethylbenzene (Mesitylene)	8.85
Acetone	1280
Chloroform	93.8
Ethylbenzene	108
Methyl ethyl ketone (2-Butanone)	18.6
Methylene chloride	867
Tetrachloroethene	27300
Toluene	235
Trichloroethene	140
Xylene (total)	682

Legend

▲ Sub-Slab Sample Location

Note: Units in µg/m^3

Source: ESRI World Imagery

100 0 100 Feet

FORMER KLINK COSMO CLEANERS SITE
ON-SITE SOIL VAPOR ANALYTICAL RESULTS

URS

FIGURE 2-26

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\RI Phase III\04-13 SS Analytical.mxd 1/22/2016

FORMER KLINK COSMO CLEANERS SITE
TETRACHLOROETHENE ISOCONCENTRATION CONTOURS IN SOIL VAPOR, MAXIMUM CONCENTRATIONS THROUGH 2017

URS

FIGURE 2-27

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-27 PCE Isoconc SG MAX CONC.mxd 10/10/2017

N

ANTHONY ST
VANDERVOORT AVE
MORGAN AVE
PORTER AVE
VARICK AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

SG-039, 97
SG-040, 4100
SG-022, 360
SG-019, 17
SG-088, 1.1
SG-042, 2850
SG-020, 33
SG-078, ND
SG-021, 17
SG-041, 50
SG-023, 370
SG-044, 17
SG-017, 24
SG-043, 2000
SG-092, 620
SG-016, 84
SG-079, 3.5
SG-045, 440
SG-055, 105
SG-047, 150
SG-018, 110
SG-046, 870
SG-113, 139
SG-054, 5200
SG-197, ND
SG-080, 74.9
SG-056, 5000
SG-048, 90
SG-196, ND
SG-199, 1.02
SG-097, 130
SG-195, 9.03
SG-081, 776
SG-112, 1000
SG-114, 2460
SG-082, 208
SG-127, 1600
SG-200, ND
SG-083, 318
SG-049, 230000
SG-115, 27.2
AWL-SV-1, 7320
AWL-SV-2, 7380
SG-116, 67600
SG-084, 300
SG-057, 1.3
SG-058, 61
SG-117, 4800
SG-085, 114
SG-118, 148
SG-086, 899
AWL-SV-3, 1920
AWL-SV-6, 3480
SG-060, 220000
AWL-SV-5, 140
SG-062, 71.6
SG-087, 968
AWL-SV-4, 4920
SG-119, 1620
SG-207, 450
SG-059, 2.5
SG-121, ND
SG-120, 16.2

Legend

NYSDEC Soil Vapor Implant

TCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | TCE Concentration

SG-054, 5200

ND = Not Detected

Source: ESRI World Imagery

Note: Units are in µg/m^3.

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN SOIL VAPOR, MAXIMUM CONCENTRATIONS THROUGH 2017

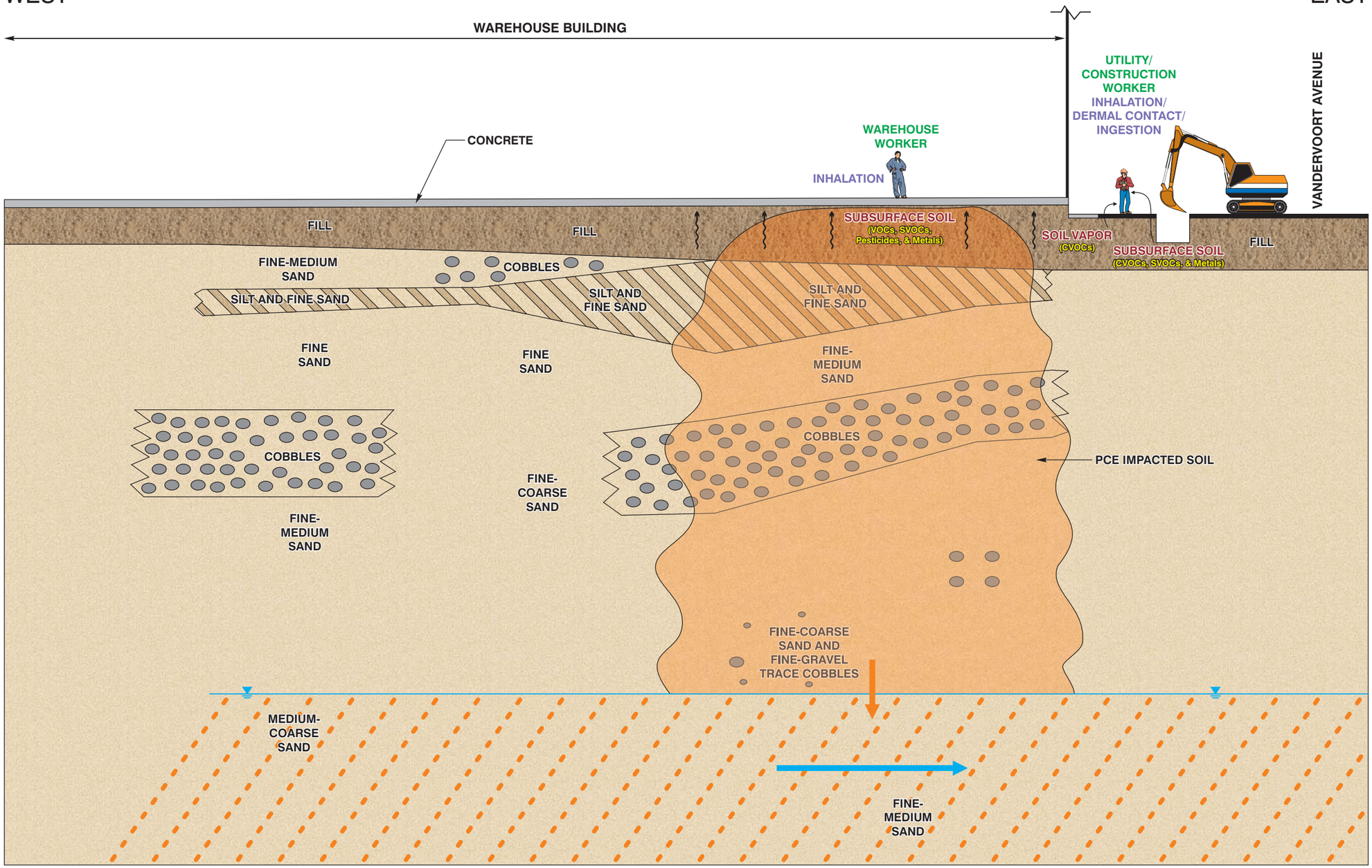
URS

FIGURE 2-28

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\02-28 TCE Isoconc SG MAX CONC.mxd 10/10/2017

WEST

EAST



LEGEND

RECEPTORS

EXPOSURE PATHWAY/ ROUTE OF EXPOSURE

SOURCE

CVOCs - Chlorinated Volatile Organic Compounds

VOCs - Volatile Organic Compounds

SVOCs - Semi-Volatile Organic Compounds

- Groundwater Elevation

- Migration Pathway

- Dissolved Phase PCE/CVOC Plume

- Groundwater Flow Direction

- PCE Impacted Soil

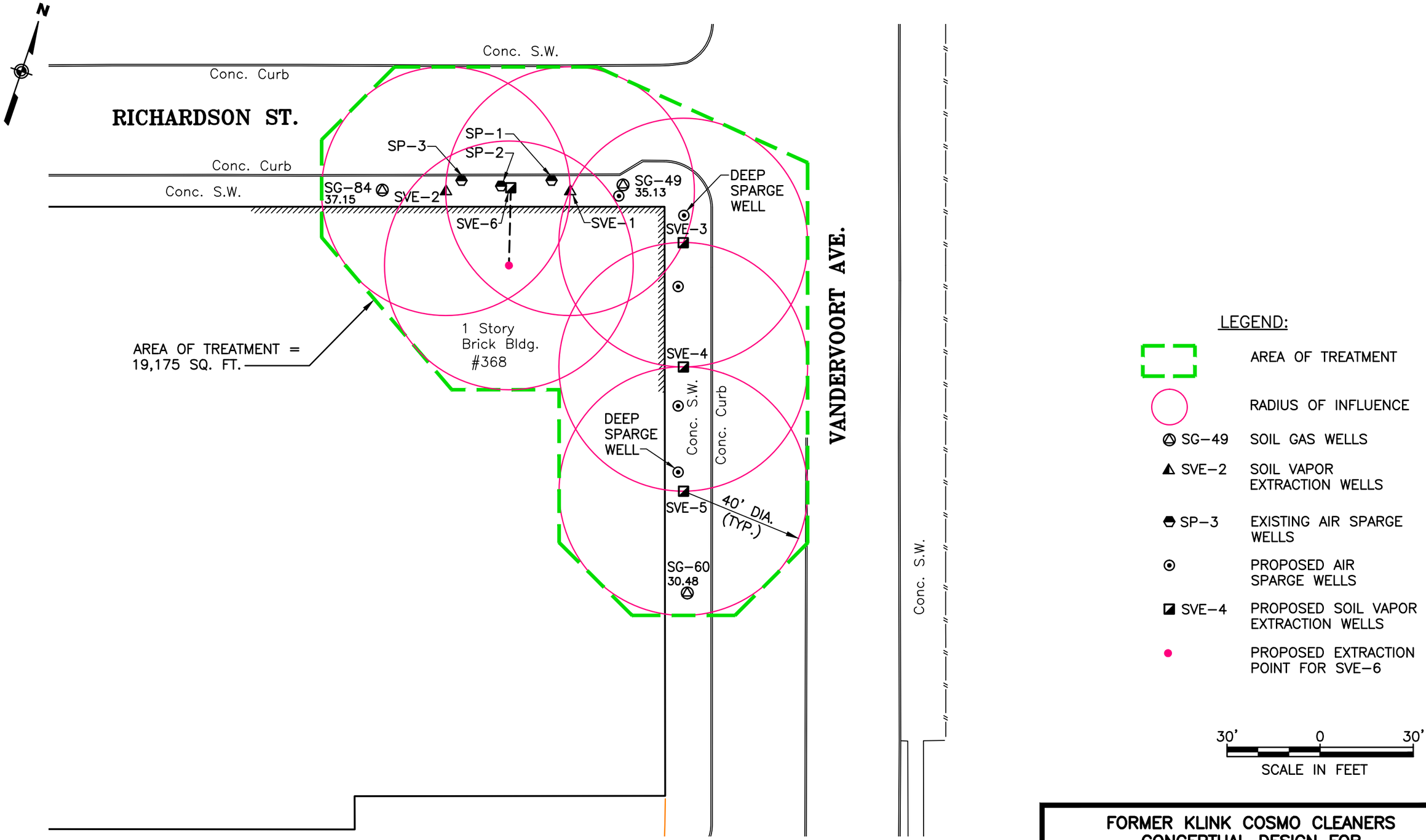
NOT TO SCALE

FORMER KLINK COSMO CLEANERS SITE CONCEPTUAL SITE MODEL

URS

FIGURE 2-29

AG21085-11176390-011516-GCM



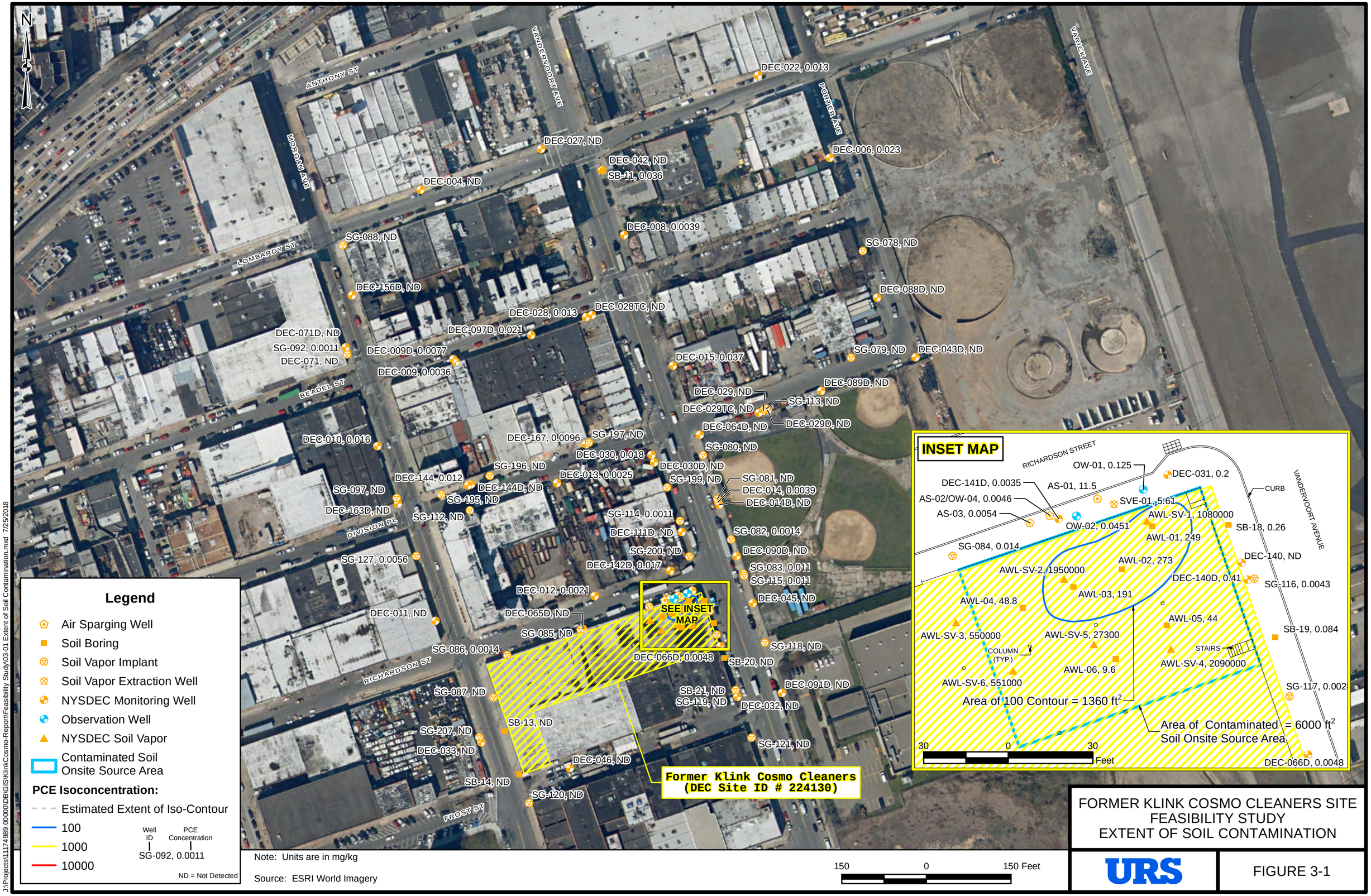
PLAN

FORMER KLINK COSMO CLEANERS
CONCEPTUAL DESIGN FOR
PERIMETER SOURCE TREATMENT

URS

FIGURE 2-30

J:\Projects\11176390\CAD\Pilot test work plan #1\JAN 2016 SUBMISSION\CONCEPTUAL DESIGN\FIGURE 2-30.dwg 9/6/17 - 2 RAL



Legend

- Air Sparging Well
- Soil Boring
- Soil Vapor Implant
- Soil Vapor Extraction Well
- NYSDEC Monitoring Well
- Observation Well
- NYSDEC Soil Vapor
- Contaminated Soil Onsite Source Area

PCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 100
- 1000
- 10000

Well ID | PCE Concentration
SG-092, 0.0011

ND = Not Detected

Note: Units are in mg/kg

Source: ESRI World Imagery

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
EXTENT OF SOIL CONTAMINATION

URS

FIGURE 3-1

J:\Projects\11174989.00000\DB\GIS\klinkCosmo-Report\Feasibility Study\03-01 Extent of Soil Contamination.mxd 7/25/2018

N

ANTHONY ST
VANDERVOORT AVE
MORGAN AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST
PORTER AVE
VARICK AVE

DEC-022D, 1300
DEC-039, 79
DEC-027, 34
DEC-004, 4.4
DEC-042, 84
DEC-006D, 8000
DEC-008, 3000
DEC-007, 2600
DEC-156, 29
DEC-088, 150
DEC-028, 4200
DEC-097, 240
DEC-071, 56
DEC-015R, 120
DEC-015, 490
DEC-043, 37
DEC-009, 260
DEC-089, 59
DEC-029, 17000
DEC-010, 47
DEC-167, 1800
DEC-064, 220
DEC-030, 4400
DEC-144, 492
DEC-163, 140
DEC-013, 7800
DEC-014, 5900
DEC-014R, 46000
DEC-111, 1300
DEC-090, 6400
DEC-142, 370
DEC-012, 1200
DEC-141, 1900
DEC-031, 33000
DEC-044, 3600
DEC-045, 130
DEC-140, ND
DEC-011, 13
DEC-065, 200
DEC-066, 220
AWL-04, 1400
AWL-03, 2000
AWL-01, 870
AWL-05, 2800
DEC-032, 3
DEC-091, ND
DEC-033R, 2.7
DEC-033, 3.6
DEC-046, 11

Area of 1,000 Contour = 281,380 ft^2

Area of 10,000 Contour = 13,651 ft^2

Legend

- NYSDEC Monitoring Well

PCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 100
- 1000
- 10000

Well ID | PCE Concentration

DEC-029, 17000

ND = Not Detected

Note: Units are in µg/L

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
EXTENT OF PCE IN SHALLOW GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 3-2

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\03-02 PCE Isoconc Shallow GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
VANDERVOORT AVE
MORGAN AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST
PORTER AVE
VARICK AVE

DEC-022D, 130
DEC-039, 240
DEC-027, 750
DEC-004, 580
DEC-042, 210
DEC-006D, 71
DEC-008, 190
DEC-007, 81
DEC-088, 1.7
DEC-156, 2100
DEC-028, 240
DEC-097, 37
DEC-071, 1000
DEC-009, 100
DEC-015R, 9.1
DEC-015, 22
DEC-043, 1.9
DEC-089, 1.7
DEC-029, 86
DEC-064, 6.8
DEC-010, 110
DEC-167, 76
DEC-030, 36
DEC-144, 16.5
DEC-013, 220
DEC-163, 26
DEC-014, 36
DEC-014R, 300
DEC-111, 8.9
DEC-090, 12
DEC-142, 2.9
DEC-012, 29
DEC-141, 8.8
DEC-031, 54
DEC-045, 11
DEC-044, 180
DEC-140, ND
DEC-011, 33
DEC-065, 3.6
AWL-04, 7.8
AWL-03, 12
AWL-01, 1.8
AWL-05, 11
DEC-066, 4.5
DEC-032, 1.3
DEC-091, ND
DEC-033R, ND
DEC-033, 2
DEC-046, 2.4

Legend

- NYSDEC Monitoring Well

TCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 100
- 1000
- 10000

Well ID | TCE Concentration
DEC-028, 240

ND = Not Detected

Note: Units are in µg/L

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
EXTENT OF TCE IN SHALLOW GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 3-3

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\03-03 TCE Isoconc Shallow GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
MORGAN AVE
LOMBARDY ST
VANDERVOORT AVE
PORTER AVE
VARICK AVE
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-005D, 1100
DEC-039D, 20
DEC-006TC, 4900
DEC-006DD, 750
DEC-007D, 400
DEC-088D, 190
DEC-156D, ND
DEC-028TC, ND
DEC-028D, 13
DEC-097D, 17
DEC-071D, ND
DEC-009D, 17
DEC-015D, 640
DEC-043D, 9
DEC-089D, 1200
DEC-029D, 7000
DEC-029TC, 4500
DEC-064D, 15
DEC-010D, 210
DEC-030D, 43
DEC-144D, 66
DEC-013D, 190
DEC-163D, 19
DEC-014D, 31
DEC-111D, 18
DEC-090D, 10
DEC-142D, 19
DEC-031TC, 3.4
DEC-141D, 1.4
DEC-031D, 20
DEC-044D, 1.5
DEC-011D, 3.3
DEC-140D, 1100
DEC-045D, 0.44
DEC-065D, 83
DEC-066D, 1.7
DEC-091D, 3.3
DEC-046D, 4.1

Area of 1,000 Contour = 42,205 ft^2

Area of 1,000 Contour = 10,553 ft^2

Area of 1,000 Contour = 1,285 ft^2

Legend

NYSDEC Monitoring Well

PCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | PCE Concentration

DEC-029TC, 900

ND = Not Detected

Note: Units are in µg/L

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
EXTENT OF PCE IN DEEP GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 3-4

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\03-04 PCE Isoconc Deep GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
MORGAN AVE
VANDERVOORT AVE
PORTER AVE
VARICK AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

DEC-005D, 70000
DEC-039D, 1300
DEC-006TC, 410
DEC-006DD, 220
DEC-007D, 280
DEC-156D, 710
DEC-088D, 2.7
DEC-028TC, ND
DEC-028D, 110
DEC-071D, 770
DEC-097D, 140
DEC-015D, 93
DEC-009D, 260
DEC-043D, 1.4
DEC-089D, 7.9
DEC-029D, 30
DEC-029TC, 460
DEC-010D, 92
DEC-064D, 160
DEC-030D, 320
DEC-144D, 38
DEC-013D, 24
DEC-014D, 3.6
DEC-163D, 72
DEC-111D, 220
DEC-090D, 1.8
DEC-142D, 190
DEC-031TC, ND
DEC-141D, ND
DEC-031D, 1.2
DEC-044D, 1.1
DEC-011D, 5.5
DEC-140D, 4.3
DEC-045D, ND
DEC-065D, 670
DEC-066D, ND
DEC-091D, 0.6
DEC-046D, 3.3

Legend

NYSDEC Monitoring Well

TCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | TCE Concentration

DEC-028D, 69

ND = Not Detected

Note: Units are in µg/L

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
EXTENT OF TCE IN DEEP GROUNDWATER
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 3-5

J:\Projects\11174989.00000\DBG\SWklinkCosmo-Report\Feasibility Study\03-05 TCE Isoconc Deep GW MAX CONC.mxd 8/16/2017

N

ANTHONY ST
VANDERVOORT AVE
MORGAN AVE
PORTER AVE
VARICK AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

SG-039, 210
SG-040, 19000
SG-022, 5700
SG-019, 1200
SG-088, 53
SG-078, 48.4
SG-020, 380
SG-042, 803000
SG-021, 440
SG-041, 6300
SG-044, 2800
SG-023, 13000
SG-043, 48500
SG-017, 220
SG-016, 150
SG-092, 480
SG-079, 21000
SG-055, 584
SG-045, 22400
SG-047, 661
SG-018, 7200
SG-046, 4400
SG-113, 388
SG-197, 2.51
SG-054, 17000
SG-080, 1670
SG-056, 88900
SG-048, 34000
SG-196, 8.61
SG-199, 1.22
SG-097, 4100
SG-195, 62.6
SG-081, 22100
SG-112, 89000
SG-114, 2080
SG-082, 75300
SG-127, 8700
SG-200, 0.81
SG-083, 280000
SG-049, 13100000
SG-115, 796
AWL-SV-1, 1080000
AWL-SV-2, 1950000
SG-116, 23600000
SG-084, 282000
SG-058, 176000
SG-117, 287000
SG-057, 10800
SG-085, 7460
SG-118, 320000
SG-086, 69500
AWL-SV-3, 550000
SG-060, 482000
AWL-SV-6, 551000
AWL-SV-5, 27300
SG-062, 35
SG-087, 227000
AWL-SV-4, 2090000
SG-119, 1740000
SG-207, 500
SG-059, 2580
SG-121, 225
SG-120, 3070

Legend

- NYSDEC Soil Vapor Implant

PCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 100
- 1000
- 10000

Well ID | PCE Concentration
SG-054, 17000

ND = Not Detected

Note: Units are in µg/m^3.

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
EXTENT OF PCE IN SOIL VAPOR
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 3-6

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\03-06 PCE Isoconc SG MAX CONC.mxd 9/5/2017

N

ANTHONY ST
VANDERVOORT AVE
MORGAN AVE
PORTER AVE
VARICK AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST

SG-039, 97
SG-040, 4100
SG-022, 360
SG-019, 17
SG-088, 1.1
SG-078, ND
SG-020, 33
SG-042, 2850
SG-021, 17
SG-041, 50
SG-044, 17
SG-023, 370
SG-043, 2000
SG-017, 24
SG-016, 84
SG-092, 620
SG-079, 3.5
SG-045, 440
SG-055, 105
SG-047, 150
SG-018, 110
SG-046, 870
SG-113, 139
SG-197, ND
SG-054, 5200
SG-080, 74.9
SG-056, 5000
SG-048, 90
SG-196, ND
SG-199, 1.02
SG-081, 776
SG-195, 9.03
SG-097, 130
SG-114, 2460
SG-112, 1000
SG-082, 208
SG-127, 1600
SG-200, ND
SG-083, 318
SG-049, 230000
SG-115, 27.2
AWL-SV-1, 7320
AWL-SV-2, 7380
SG-116, 67600
SG-084, 300
SG-058, 61
SG-117, 4800
SG-057, 1.3
SG-085, 114
SG-118, 148
SG-086, 899
AWL-SV-3, 1920
AWL-SV-6, 3480
SG-060, 220000
SG-062, 71.6
AWL-SV-5, 140
SG-087, 968
AWL-SV-4, 4920
SG-119, 1620
SG-207, 450
SG-059, 2.5
SG-121, ND
SG-120, 16.2

Legend

NYSDEC Soil Vapor Implant

TCE Isoconcentration:

Estimated Extent of Iso-Contour

100

1000

10000

Well ID | TCE Concentration

SG-054, 5200

ND = Not Detected

Note: Units are in µg/m^3.

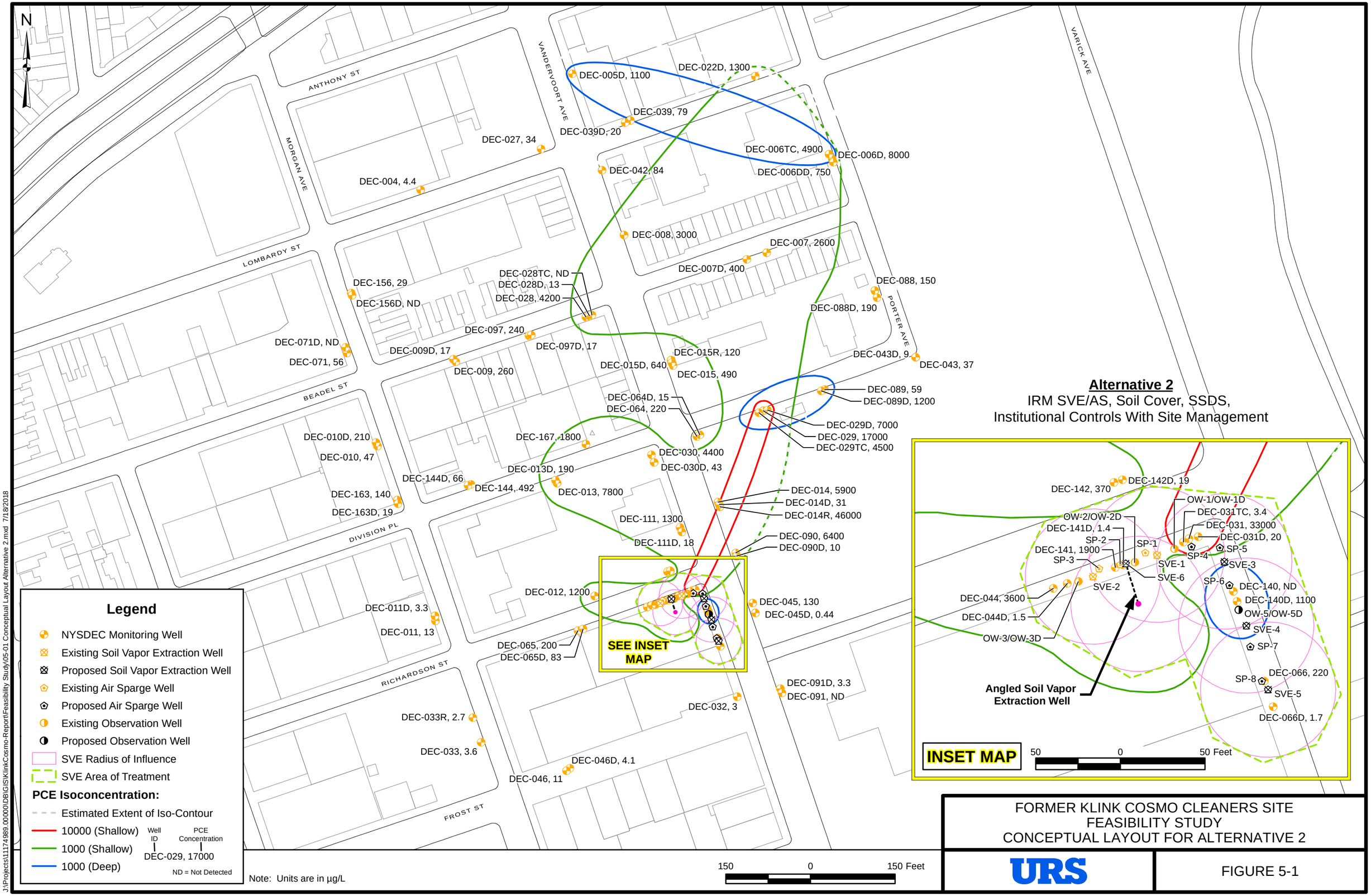
150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
EXTENT OF TCE IN SOIL VAPOR
MAXIMUM CONCENTRATIONS THROUGH FEBRUARY 2017

URS

FIGURE 3-7

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\03-07 TCE Isoconc SG MAX CONC.mxd 9/5/2017



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FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
CONCEPTUAL LAYOUT FOR ALTERNATIVE 2

URS

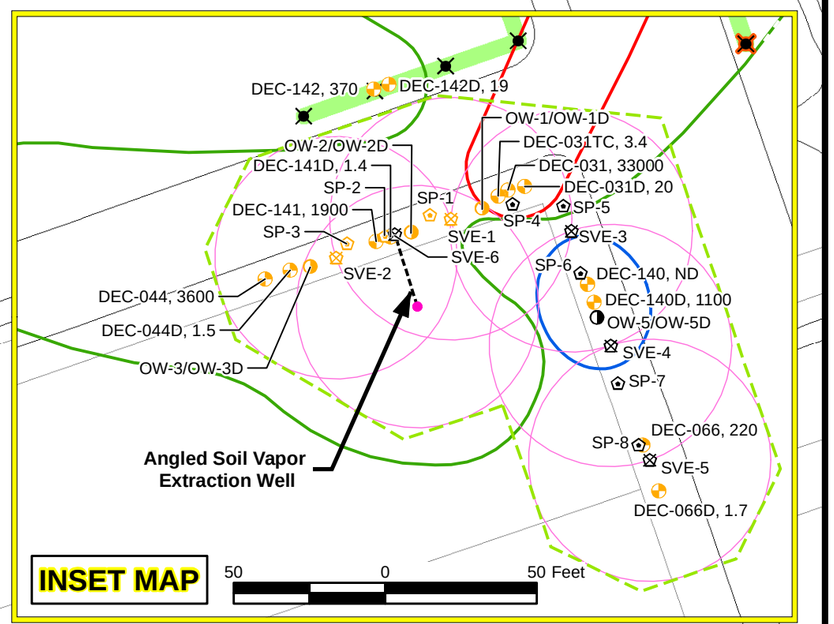
FIGURE 5-1

N

ANTHONY ST
VANDERVOORT AVE
VARICK AVE
MORGAN AVE
LOMBARDY ST
BEADEL ST
PORTER AVE
DIVISION PL
RICHARDSON ST
FROST ST

DEC-005D, 1100
DEC-022D, 1300
DEC-039, 79
DEC-039D, 20
DEC-027, 34
DEC-004, 4.4
DEC-042, 84
DEC-006TC, 4900
DEC-006D, 8000
DEC-006DD, 750
DEC-008, 3000
DEC-007, 2600
DEC-007D, 400
DEC-088, 150
DEC-088D, 190
DEC-156, 29
DEC-156D, ND
DEC-028TC, ND
DEC-028D, 13
DEC-028, 4200
Division East
DEC-097, 240
DEC-097D, 17
DEC-009D, 17
DEC-009, 260
DEC-071D, ND
DEC-071, 56
DEC-015R, 120
DEC-015D, 640
DEC-015, 490
DEC-043D, 9
DEC-043, 37
DEC-089, 59
DEC-089D, 1200
DEC-064D, 15
DEC-064, 220
DEC-029D, 7000
DEC-029, 17000
DEC-029TC, 4500
DEC-010D, 210
DEC-010, 47
DEC-167, 1800
DEC-013D, 190
DEC-144D, 66
DEC-144, 492
DEC-030, 4400
DEC-030D, 43
DEC-163, 140
DEC-163D, 19
DEC-013, 7800
DEC-014, 5900
DEC-014D, 31
DEC-014R, 46000
DEC-111, 1300
DEC-111D, 18
DEC-090, 6400
DEC-090D, 10
Source Perimeter
DEC-012, 1200
DEC-045, 130
DEC-045D, 0.44
DEC-011D, 3.3
DEC-011, 13
SEE INSET MAP
DEC-065, 200
DEC-065D, 83
DEC-091D, 3.3
DEC-091, ND
DEC-032, 3
DEC-033R, 2.7
DEC-033, 3.6
DEC-046D, 4.1
DEC-046, 11

Alternative 3
IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls With Site Management



Legend

- NYSDEC Monitoring Well
- Existing Soil Vapor Extraction Well
- Proposed Soil Vapor Extraction Well
- Existing Air Sparge Well
- Proposed Air Sparge Well
- Existing Observation Well
- Proposed Observation Well
- Proposed Injection Well Pair
- Proposed Shallow Injection Well
- Proposed Deep Injection Well
- Groundwater Treatment Well Array
- SVE Radius of Influence
- SVE Area of Treatment

PCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 10000 (Shallow)
- 1000 (Shallow)
- 1000 (Deep)

Well ID / PCE Concentration
DEC-029, 17000

ND = Not Detected

Note: Units are in µg/L

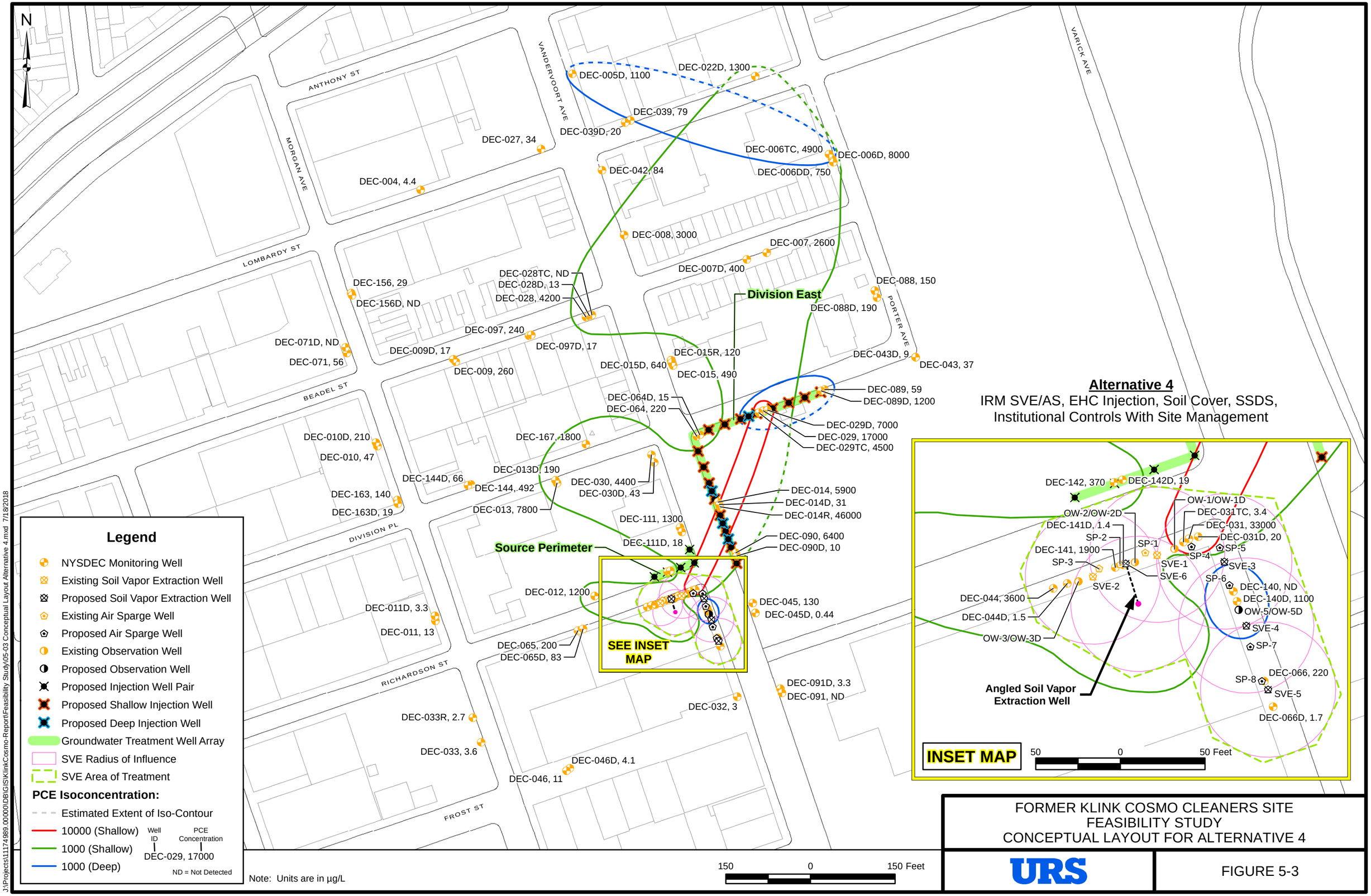
150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
CONCEPTUAL LAYOUT FOR ALTERNATIVE 3

URS

FIGURE 5-2

J:\Projects\11174989.00000\DBGIS\KlinkCosmo-Report\Feasibility Study\05-02 Conceptual Layout Alternative 3.mxd 7/19/2018

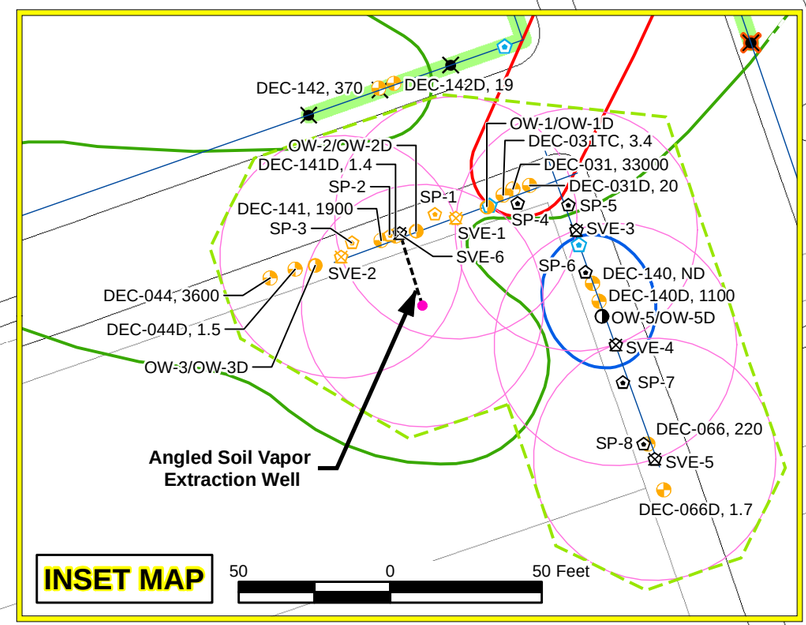

N
ANTHONY ST
VANDERVOORT AVE
MORGAN AVE
LOMBARDY ST
BEADEL ST
DIVISION PL
RICHARDSON ST
FROST ST
PORTER AVE
VARICK AVE
DEC-005D, 1100
DEC-022D, 1300
DEC-039, 79
DEC-039D, 20
DEC-027, 34
DEC-004, 4.4
DEC-042, 84
DEC-006TC, 4900
DEC-006D, 8000
DEC-006DD, 750
DEC-008, 3000
DEC-007, 2600
DEC-007D, 400
DEC-088, 150
DEC-088D, 190
DEC-043D, 9
DEC-043, 37
DEC-028TC, ND
DEC-028D, 13
DEC-028, 4200
DEC-156, 29
DEC-156D, ND
DEC-097, 240
DEC-097D, 17
DEC-009D, 17
DEC-009, 260
DEC-071D, ND
DEC-071, 56
DEC-015R, 120
DEC-015D, 640
DEC-015, 490
DEC-089, 59
DEC-089D, 1200
DEC-064D, 15
DEC-064, 220
DEC-029D, 7000
DEC-029, 17000
DEC-029TC, 4500
DEC-167, 1800
DEC-010D, 210
DEC-010, 47
DEC-013D, 190
DEC-144D, 66
DEC-144, 492
DEC-030, 4400
DEC-030D, 43
DEC-163, 140
DEC-163D, 19
DEC-013, 7800
DEC-014, 5900
DEC-014D, 31
DEC-014R, 46000
DEC-111, 1300
DEC-111D, 18
DEC-090, 6400
DEC-090D, 10
DEC-012, 1200
DEC-011D, 3.3
DEC-011, 13
DEC-065, 200
DEC-065D, 83
DEC-045, 130
DEC-045D, 0.44
DEC-091D, 3.3
DEC-091, ND
DEC-032, 3
DEC-033R, 2.7
DEC-033, 3.6
DEC-046D, 4.1
DEC-046, 11
Division East
Source Perimeter
SEE INSET MAP
Legend
NYSDEC Monitoring Well
Existing Soil Vapor Extraction Well
Proposed Soil Vapor Extraction Well
Existing Air Sparge Well
Proposed Air Sparge Well
Existing Observation Well
Proposed Observation Well
Proposed Injection Well Pair
Proposed Shallow Injection Well
Proposed Deep Injection Well
Groundwater Treatment Well Array
SVE Radius of Influence
SVE Area of Treatment
PCE Isoconcentration:
Estimated Extent of Iso-Contour
10000 (Shallow)
1000 (Shallow)
1000 (Deep)
Well ID
PCE Concentration
DEC-029, 17000
ND = Not Detected
Note: Units are in µg/L
150 0 150 Feet
Alternative 4
IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls With Site Management
DEC-142, 370
DEC-142D, 19
OW-1/OW-1D
OW-2/OW-2D
DEC-031TC, 3.4
DEC-141D, 1.4
DEC-031, 33000
SP-2
DEC-031D, 20
SP-1
DEC-141, 1900
SP-4
SP-5
SP-3
SVE-1
SVE-3
SVE-6
SP-6
SVE-2
DEC-140, ND
DEC-044, 3600
DEC-140D, 1100
DEC-044D, 1.5
OW-5/OW-5D
OW-3/OW-3D
SVE-4
SP-7
DEC-066, 220
SP-8
SVE-5
DEC-066D, 1.7
Angled Soil Vapor Extraction Well
INSET MAP
50 0 50 Feet
FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
CONCEPTUAL LAYOUT FOR ALTERNATIVE 4
URS
FIGURE 5-3
J:\Projects\11174989.00000\DBG\SWKlinkCosmo-Report\Feasibility Study\05-03 Conceptual Layout Alternative 4.mxd 7/19/2018

N

ANTHONY ST
VANDERVOORT AVE
VARICK AVE
MORGAN AVE
LOMBARDY ST
BEADEL ST
PORTER AVE
DIVISION PL
RICHARDSON ST
FROST ST

DEC-005D, 1100
DEC-022D, 1300
DEC-039, 79
DEC-039D, 20
DEC-027, 34
DEC-004, 4.4
DEC-042, 84
DEC-006TC, 4900
DEC-006D, 8000
DEC-006DD, 750
DEC-008, 3000
DEC-007, 2600
DEC-007D, 400
DEC-088, 150
DEC-088D, 190
DEC-156, 29
DEC-156D, ND
DEC-028TC, ND
DEC-028D, 13
DEC-028, 4200
Division East
DEC-097, 240
DEC-097D, 17
DEC-009D, 17
DEC-009, 260
DEC-071D, ND
DEC-071, 56
DEC-015R, 120
DEC-015D, 640
DEC-015, 490
DEC-043D, 9
DEC-043, 37
DEC-089, 59
DEC-089D, 1200
DEC-064D, 15
DEC-064, 220
DEC-029D, 7000
DEC-029, 17000
DEC-029TC, 4500
DEC-010D, 210
DEC-010, 47
DEC-167, 1800
DEC-013D, 190
DEC-144D, 66
DEC-144, 492
DEC-030, 4400
DEC-030D, 43
DEC-163, 140
DEC-163D, 19
DEC-013, 7800
DEC-014, 5900
DEC-014D, 31
DEC-014R, 46000
DEC-111, 1300
DEC-111D, 18
DEC-090, 6400
DEC-090D, 10
Source Perimeter
DEC-012, 1200
DEC-045, 130
DEC-045D, 0.44
DEC-011D, 3.3
DEC-011, 13
SEE INSET MAP
DEC-065, 200
DEC-065D, 83
DEC-091D, 3.3
DEC-091, ND
DEC-032, 3
DEC-033R, 2.7
DEC-033, 3.6
DEC-046D, 4.1
DEC-046, 11

Alternative 5
IRM SVE/AS, Permanganate Injection,
Hydraulic Containment/Removal, Soil Cover, SSDS,
Institutional Controls With Site Management



Legend

- NYSDEC Monitoring Well
- Existing Soil Vapor Extraction Well
- Proposed Soil Vapor Extraction Well
- Existing Air Sparge Well
- Proposed Air Sparge Well
- Existing Observation Well
- Proposed Observation Well
- Proposed Extraction Well
- Proposed Injection Well Pair
- Proposed Shallow Injection Well
- Proposed Deep Injection Well
- Groundwater Treatment Well Array
- SVE Radius of Influence
- SVE Area of Treatment

PCE Isoconcentration:

- Estimated Extent of Iso-Contour
- 10000 (Shallow)
- 1000 (Shallow)
- 1000 (Deep)

Well ID / PCE Concentration
DEC-029, 17000

ND = Not Detected

Note: Units are in µg/L

150 0 150 Feet

FORMER KLINK COSMO CLEANERS SITE
FEASIBILITY STUDY
CONCEPTUAL LAYOUT FOR ALTERNATIVE 5

URS

FIGURE 5-4

J:\Projects\11174989.00000\DB\GIS\KlinkCosmo-Report\Feasibility Study\05-04 Conceptual Layout Alternative 5.mxd 7/18/2018

Legend

- NYSDEC Monitoring Well
- NYSDEC Extraction Well
- Soil Boring
- ExxonMobil Monitoring Well
- Well Covered with Concrete/Missing
- Decommissioned Monitoring Well
- Source of PCE and/or TCE Contamination
- Potential Source of CVOC Contamination Inside EOA
- Potential Source of PCE and/or TCE Contamination
- ACME Steel Metal Works Area
- ACME Steel Brass Foundry Area
- Expanded Outreach Area
- Klink Cosmo Area
- Spic and Span Area
- Goodman Bros. Area
- Potential Source Areas West of Morgan Avenue
- Potential Source Areas West of Kingsland Avenue
- Meeker Avenue Plume Trackdown Project Boundary

Source: NYS Digital Ortho-Imagery Program, Borough of Brooklyn, 2016

Notes: New Monitoring Well Installed in 2017
New Monitoring Well Installed in 2018

400 0 400 Feet

MEEKER AVENUE PLUME TRACKDOWN MONITORING WELL, EXTRACTION WELL AND SOIL BORING LOCATION STATUS AS OF FEBRURARY 16, 2018

URS

PLATE 1

Legend

- NYSDEC Soil Vapor Implant
- ExxonMobil Soil Vapor Implant
- Previously Decommissioned Soil Vapor Implant with Sidewalk Flag Replaced
- 2017 Soil Vapor Implant Decommissioned with Sidewalk Flag Not Replaced/Not Concrete Surface
- Destroyed/Missing Soil Vapor Implant
- Source of PCE and/or TCE Contamination
- Potential Source of CVOC Contamination Inside EOA
- Potential Source of PCE and/or TCE Contamination
- ACME Steel Metal Works Area
- ACME Steel Brass Foundry Area
- Expanded Outreach Area
- Klink Cosmo Area
- Spic and Span Area
- Potential Source Areas West of Morgan Avenue
- Potential Source Areas West of Kingsland Avenue
- Meeker Avenue Plume Trackdown Project Boundary

Source: NYS Digital Ortho-Imagery Program, Borough of Brooklyn, 2016
Notes: **New Soil Vapor Implant Installed in 2017**

400 0 400 Feet

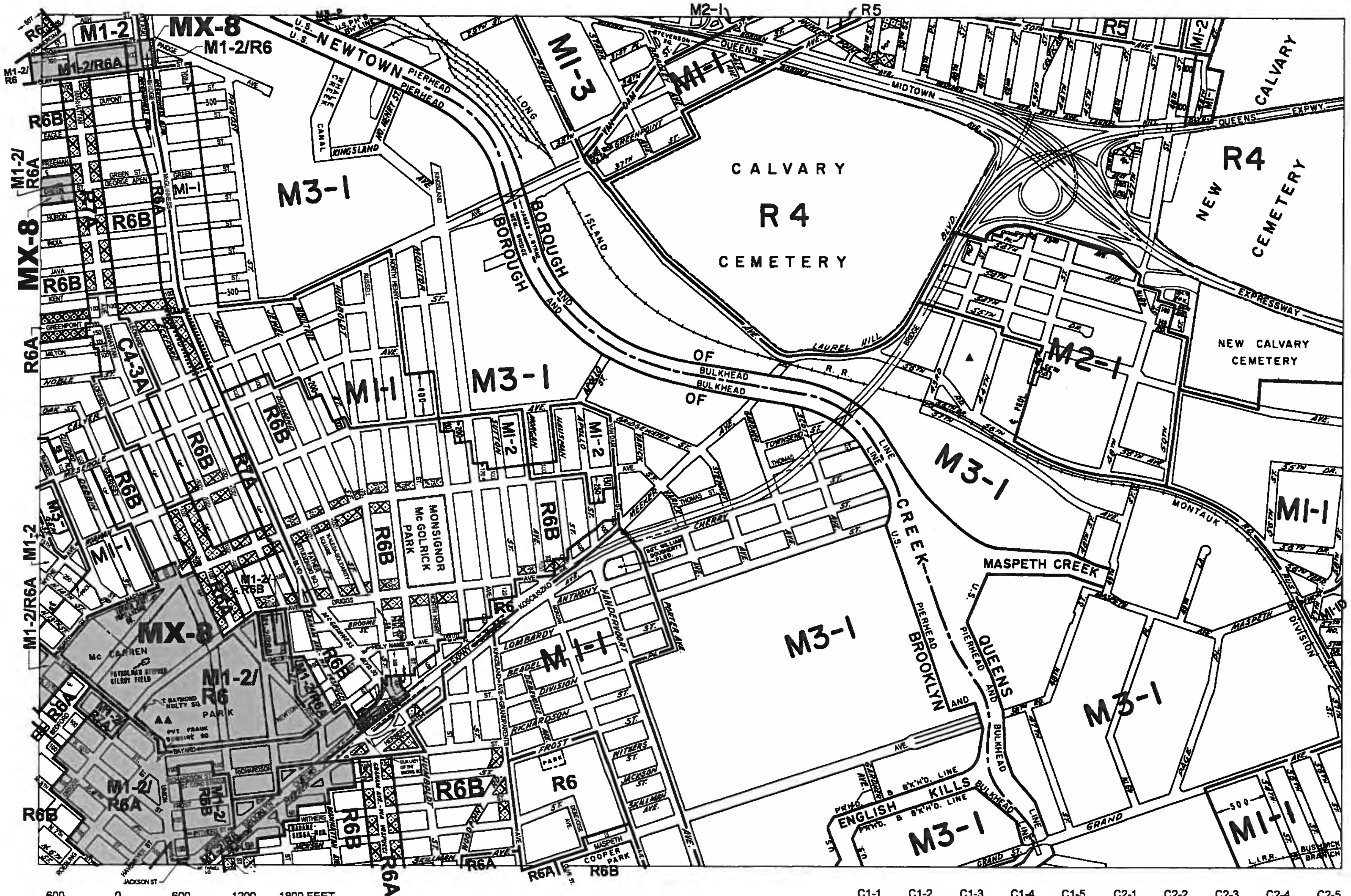
MEEKER AVENUE PLUME TRACKDOWN SITE CHARACTERIZATION SOIL VAPOR IMPLANT LOCATIONS AND STATUS

URS

PLATE 2

APPENDIX A

ZONING MAP



NOTE: Where no dimensions for zoning district boundaries appear on the zoning maps, such dimensions are determined in Article VII, Chapter 6 (Location of District Boundaries) of the Zoning Resolution.

ZONING MAP

THE NEW YORK CITY PLANNING COMMISSION

Major Zoning Classifications:

The number(s) and/or letter(s) that follows an R, C or M District designation indicates use, bulk and other controls as described in the text of the Zoning Resolution.

R – RESIDENTIAL DISTRICT

C – COMMERCIAL DISTRICT

M – MANUFACTURING DISTRICT

SPECIAL PURPOSE DISTRICT
The letter(s) within the shaded area designates the special purpose district as described in the text of the Zoning Resolution.

AREA(S) REZONED

Effective Date(s) of Rezoning:

12-10-2012 C 100218 ZMK

Special Requirements:

For a list of lots subject to CEQR environmental requirements, see APPENDIX C.

For a list of lots subject to "D" restrictive declarations, see APPENDIX D.

For Inclusionary Housing designated areas and Mandatory Inclusionary Housing areas on this map, see APPENDIX F.

CITY MAP CHANGE(S):

▲▲ 06-08-2016 C 110254 MMK

▲ 02-28-2015 C 070109 MMQ

MAP KEY

8d	9b	9d
12c	**13a**	13c
12d	13b	13d

ZONING MAP 13a

NOTE: Zoning information as shown on this map is subject to change. For the most up-to-date zoning information for this map, visit the Zoning section of the Department of City Planning website: www.nyc.gov/planning or contact the Zoning Information Desk at (212) 720-3291.

APPENDIX B

SODIUM PERMANGANATE INJECTION CALCULATIONS

RemOx® S and RemOx® L
ISCO Reagents
Estimation Spreadsheet

Input data into box with black font

Site Name: Klink Cosmo - Division East
Date: 10/2/2017

	Estimates	Units		Estimates	Units
Treatment Area Volume			**Injection Volume for RemOx S**		
Length	**550**	ft	Injection Concentration	**4.0%**	%
Width	**100**	ft	Total Volume of Injection Fluid	138,795	gal
Area	55,000	sq ft	Pore Volume Replaced	2.25	%
Thickness	**50**	ft			
Total Volume	101,852	cu yd	**Amount of RemOx S Estimated:**	**46,302**	**pounds**
Soil Characteristics/Analysis					
Porosity	**30**	%			
Total Plume Pore Volume	6,171,428	gal			
Avg Contaminant Conc	**5**	ppm	**Injection Volume for RemOx L**		
Mass of Contaminant	257.51	lb	Injection Concentration	**5.0%**	%
PNOD	**1**	g/kg	Calculated Specific Gravity	1.05	g/ml
Effective PNOD	**10**	%	Total Volume of Injection Fluid	95,286	gal
Effective PNOD Calculated	0.100		Pore Volume Replaced	1.54	%
PNOD Oxidant Demand	30,250.00	lb			
Avg Stoichiometric Demand	**2.4**	lb/lb	**Amount of RemOx L Estimated:**	**103,948**	**pounds**
Contaminant Oxidant Demand	618.03	lb		**9,094**	**gallons**
Theoretical Oxidant Demand	30,868.03	lb			
Confidence Factor	**1.5**				
Calculated Oxidant Demand	46,302.05				

Carus Remediation Technologies

RemOx® S and RemOx® L
ISCO Reagents
Estimation Spreadsheet

Input data into box with black font

Site Name: Klink Cosmo - Source Perimeter
Date: 10/2/2017

	Estimates	Units
Treatment Area Volume		
Length	**100**	ft
Width	**100**	ft
Area	10,000	sq ft
Thickness	**50**	ft
Total Volume	18,519	cu yd
Soil Characteristics/Analysis		
Porosity	**30**	%
Total Plume Pore Volume	1,122,078	gal
Avg Contaminant Conc	**3**	ppm
Mass of Contaminant	28.09	lb
PNOD	**1**	g/kg
Effective PNOD	**10**	%
Effective PNOD Calculated	0.100	
PNOD Oxidant Demand	5,500.00	lb
Avg Stoichiometric Demand	**2.4**	lb/lb
Contaminant Oxidant Demand	67.42	lb
Theoretical Oxidant Demand	5,567.42	lb
Confidence Factor	**1.5**	
Calculated Oxidant Demand	8,351.13	

	Estimates	Units
Injection Volume for RemOx S		
Injection Concentration	**4.0%**	%
Total Volume of Injection Fluid	25,033	gal
Pore Volume Replaced	2.23	%
Amount of RemOx S Estimated:	**8,351**	**pounds**
Injection Volume for RemOx L		
Injection Concentration	**5.0%**	%
Calculated Specific Gravity	1.05	g/ml
Total Volume of Injection Fluid	17,186	gal
Pore Volume Replaced	1.53	%
Amount of RemOx L Estimated:	**18,748**	**pounds**
	1,640	**gallons**

APPENDIX C

EHC INJECTION CALCULATIONS

EHC® Liquid ISCR Reagent Demand Calculations

3-Oct-2017

Customer:	**AECOM**	**Prepared by:**	
Contact:	**Gutmann**	**John Valkenburg, PE**	
Site Location:	**Brooklyn**	**1-517-669-5400**	
Proposal Number:	**CRM 20692**	**John.Valkenburg@peroxychem.com**	

PRODUCT OVERVIEW

EHC® Liquid is a cold-water soluble formulation of EHC reagent specially designed for injection via existing wells or hydraulic injection networks for the treatment of a wide range of groundwater contaminants. The base composition is ELS™ Emulsified Lecithin Substrate, a controlled-release organic carbon microemulsion, with an organo-iron compound, which are both food-grade materials.

Packaging:

EHC Liquid is delivered in 2 parts and mixed together with water in the field:

Part 1: ELS Microemulsion delivered in 55-USG drums, filled with 50 USG / 420 lbs per drum.

Part 2: EHC Liquid Mix, a water soluble organo-iron compound and other additives delivered in 24.6 lb bags.

SITE INFORMATION / ASSUMPTIONS

	Value	Unit	Comment
Treatment Area Dimensions:			
Width of targeted zone (perpendicular to gw flow)	150	ft	customer supplied
Length of targeted zone (parallel to gw flow)	10	ft	customer supplied
Depth to top of treatment zone	40	ft bgs	customer supplied
Treatment zone thickness	50	ft	customer supplied
Treatment volume	75,000	ft3	calculated value
Total Porosity	35	%	default value
Groundwater volume	26,250	ft3	calculated value
Soil bulk density	90	lbs/ft3	default value
Soil mass	3,375	ton	calculated value

CONTAMINANTS OF CONCERN (COCs)

Constituent	GW (mg/L)	Soil* (mg/kg)	Total COC Mass** (lb)
PCE	5	1.315	529.8

*Unless provided, sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values. For a more refined estimate, it is recommended that actual values be verified via direct sampling of the targeted treatment interval.

**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOCHEMICAL DATA

Competing Electron Acceptors	GW (mg/L)	
Dissolved oxygen	2	customer provided
Nitrate (as N)	5	customer provided
Manganese (estimated conc. Mn(II) generated)*	1550	default value
Iron (estimated conc. Fe(II) generated)*	2614	default value
Sulfate	141	customer provided

*An estimated projection of dissolved concentrations of Mn and Fe following ERD/ISCR were used to estimate H demand from the reduction of oxidized Fe and Mn minerals (typically only a portion of actual soil concentrations will be reduced).

ORP (mV)	+100 to -50	
pH	6.5	

STOICHIOMETRIC DEMAND CALCULATIONS

	GW (mg/L)	Soil (mg/kg)
H2 Demand from COCs	0.24	0.06
H2 Demand from Competing Electron Acceptors	116.46	0.00
Total H2 Demand	116.71	0.06

H2 Demand from Soil within Targeted Area	0.43	lb
H2 Demand from GW within Targeted Area	191.28	lb
H2 Demand from Influx over Design Life	11968.77	lb
Total Estimated H2 Demand	12160.49	lb

EHC LIQUID DEMAND CALCULATIONS

The stoichiometric demand for the targeted area was calculated using available data presented above, noting that the stoichiometric demand represents minimum requirements and require a complete geochemical data set to be calculated accurately. Therefore, the resulting EHC Liquid dosing required to meet the estimated stoichiometric demand was compared to our minimum guidelines for the selected type of application, selecting the higher number.

Application type: Injection PRB

	Value	Unit
Specific H2 capacity of ELS (100% concentrate)	349	g H2/Kg
Concentration EHC Liquid in GW to meet H2 demand	21246.9	mg/L
Safety factor*	2	
Recommended conc. of EHC Liquid in pore water	42,494	mg/L
Mass of ELS Concentrate required	69,648	lbs
Mass ELS per container	460	lbs
Number of Containers	152	containers
Mass ELS (rounded based on container size)	**69,920**	**lbs**
Mass of EHC Liquid Mix (Fe component)	16,381	lbs
Mass of EHC Liquid Mix per container	24.6	lbs
Number of EHC Liquid Mix containers required	666	bags
Mass EHC Liquid Mix (rounded based on container size)	**16,384**	**lbs**

*A safety factor has been applied to account for uncertainties in data and variability in the rate and extent of hydrogen consumption.

OPTIONAL pH BUFFER

If groundwater pH is below 6.5 or inoculants are to be applied together with the EHC Liquid, we recommend that the EHC Liquid injection solution be pH buffered to create optimal conditions for microbial growth. Based on laboratory tests, potassium bicarbonate, a fully soluble buffer, applied at a rate of 25 lbs / 11 kg per drum (420 lb) of EHC Liquid will buffer the pH of the injectate solution to circum-neutral. If baseline pH conditions were to be below 6, additional pH buffer will be needed to raise the pH of the groundwater to 7. The amount of buffer required to raise the pH of the groundwater to 7 will depend on the site-specific buffering capacity of the soil and will have to be determined by conducting a pH titration test.

Total $KHCO_3$ demand = amount $KHCO_3$ to neutralize EHC Liquid solution + amount needed to raise ground water / soil to a pH of 7

Soil buffering amount = KHCO3 for ground water / soil pH adjustment, which can be determined in the laboratory via titration.

	Value	Unit	
Mass $KHCO_3$ to neutralize EHC Liquid solution	16,648	lbs	default value
Estimated soil buffering amount	0	lbs	estimated value
Total $KHCO_3$ demand	16,648	lbs	

OPTIONAL DHC INOCULANT

Although not typically required for ISCR, DHC inoculants have shown to improve removal kinetics, in particular for potential daughter products such as cis-DCE and VC. The DHC will be added after EHC-L application, once favorable redox conditions (ORP < -75 mV, DO <0.2 mg/L, pH between 6 and 8.5) have been attained. The DHC inoculant will contain at least 5 x10E10 cfu/L of live bacteria including high numbers of dehalococcoides species with known abilities to biodegrade DCE. The target density of DHC cells in the treated aquifer is 1x10E6 cfu/L.

	Value	Unit
Dechlorinating consortium concentration in inoculant	5.00E+10	DHC/L
Design final concentration after dilution in aquifer	1.00E+06	DHC/L
Volume of Inoculant Required	15	L

COST ESTIMATE

Item	Quantity	Unit	Price	Cost
ELS Concentrate	69,920	lbs	$2.80	$195,776
EHC Liquid Mix	16,383.6	lbs	$7.40	$121,239
Optional items:				
pH Buffer ($KHCO_3$)	16,650	lbs	$3.00	$49,950
DHC Inoculum (incl. minimum)	15	L	$90	$1,350

1) Price valid for 90 days from date at top of document. Terms: net 30 days.

2) Any applicable taxes not included. Please provide a copy of your tax exempt certificate or resale tax number when placing your order. In accordance with the law, applicable state and local taxes will be applied at the time of invoicing if PeroxyChem has not been presented with your fully executed tax exemption documentation.

3) Price excludes shipping. Freight estimates available upon request. Volumes were rounded up based on container size.

4) Return Policy: Within 90 days after sale, following approval by PeroxyChem, products in their unopened containers, which by analysis meet the original specifications under which they were shipped, will be accepted for return at invoiced price, less 25% handling charge and return freight, excluding original freight paid by buyer. Products made to order or custom blended are non-returnable.

5) All sales are per PeroxyChem's Terms and Conditions.

Disclaimer:

The estimated dosage and recommended application methodology described in this document are based on the site information provided to us, but are not meant to constitute a guaranty of performance or a predictor of the speed at which a given site is remediated. The calculations in the Cost Estimate regarding the amount of product to be used in your project are based on stoichiometry or default minimum guideline values, and do not take into account the kinetics, or speed of the reaction. Note that the Stoichiometric mass represents the minimum anticipated amount needed to address the constituents of concern (COCs). As a result, these calculations should be used as a general approximation for purposes of an initial economic assessment. PeroxyChem recommends that you or your consultants complete a comprehensive remedial design that takes into consideration the precise nature of the COC impact and actual site conditions.

INSTALLATION

The EHC Liquid will be delivered as two components, which will be mixed together in the field. The first component, a 25% or 100% ELS Emulsified Lecithin Substrate, will be provided in 55-USG drums, with 50 USG/190 litres per drum. The second component is the EHC Liquid Mix which contains the ferrous iron powder, and is delivered as a dry powder and added to the liquid component in the field. The EHC Liquid Mix is proportioned so that one bag (24.6 lbs / 11.2 kg) of EHC Liquid Mix is added per drum of ELS 25% microemulsion.

Depending on the application method, between 10% and 100% of the effective porosity is normally targeted during EHC Liquid injection, with a higher percent pore fill normally targeted during low-flow injections into wells and injection networks. This is in contrast to applications via direct push technology (DPT) where normally around 10 to 15% is targeted. To facilitate the desired injection volume, the EHC Liquid components will be diluted in the field.

The below table shows examples of mixing recipes for the proposed container size and the resulting total injection volume and percent pore fill. Alternative packaging options are available upon request and the below mixing recipe may be scaled depending on mix batch and packaging size.

Packaging:	Drum
Mass per container (lbs):	460
Concentration as delivered:	100% concentrate

EHC Liquid Mixing Recipe (per container)

Dilution:	**10-fold**	**20-fold**	**30-fold**
Volume ELS Microemulsion per drum (USG)	50	50	50
Mass EHC Liquid Mix (lbs)	107.8	107.8	107.8
Volume water per drum (USG)	496	1,047	1,598
Resulting volume injection solution per drum (USG)	546	1,097	1,648
Resulting EHC Liquid concentration (ELS + Fe mix)	12.3%	6.2%	4.1%
Total volume water (USG)	75,400	159,177	242,954
Total injection volume (USG)	82,999	166,776	250,554
Resulting injection volume to total pore volume	42.2%	84.8%	127.4%

Injection recommendations (can be altered):

The EHC Liquid solution could be injected via fixed wells or using direct push. The injection spacing would be determined based on the radius of influence achieved for the specific implementation method and lithology.

	Value	**Unit**	**Comment**
Dilution of EHC Liquid emulsion (can be altered)	10		can be altered
Total volume of water required	75,400	U.S. gallons	calculated value
Approximate volume of solution to inject	82,999	U.S. gallons	calculated value
Number of injection lines for PRB	1	lines	customer provided
Injection spacing within lines	10	ft	customer provided
Number of injection points	15	locations	calculated value
Injection volume per point	5,533	U.S. gallons	calculated value
Injection volume per vertical foot	111	U.S. gallons	calculated value
Injection volume to total pore space volume	42	percent	calculated value

Note that the construction estimates presented above can be readily modified in the field or per recommendations from the injection contractor as required (for example, the concentration of the EHC Liquid solution could be changed to modify the total injection volume or the injections spacing could be altered based on installation technology).

Review and follow guidance in the appropriate Safety Data Sheet (SDS) with all workers prior to use.

EHC® Liquid ISCR Reagent Demand Calculations

3-Oct-2017

Customer:	**AECOM**	**Prepared by:**	
Contact:	**Gutmann**	**John Valkenburg, PE**	
Site Location:	**Brooklyn**	**1-517-669-5400**	
Proposal Number:	**CRM 20692**	**John.Valkenburg@peroxychem.com**	

PRODUCT OVERVIEW

EHC® Liquid is a cold-water soluble formulation of EHC reagent specially designed for injection via existing wells or hydraulic injection networks for the treatment of a wide range of groundwater contaminants. The base composition is ELS™ Emulsified Lecithin Substrate, a controlled-release organic carbon microemulsion, with an organo-iron compound, which are both food-grade materials.

Packaging:

EHC Liquid is delivered in 2 parts and mixed together with water in the field:

Part 1: ELS Microemulsion delivered in 55-USG drums, filled with 50 USG / 420 lbs per drum.

Part 2: EHC Liquid Mix, a water soluble organo-iron compound and other additives delivered in 24.6 lb bags.

SITE INFORMATION / ASSUMPTIONS

	Value	Unit	Comment
Treatment Area Dimensions:			
Width of targeted zone (perpendicular to gw flow)	100	ft	customer supplied
Length of targeted zone (parallel to gw flow)	10	ft	customer supplied
Depth to top of treatment zone	35	ft bgs	customer supplied
Treatment zone thickness	50	ft	customer supplied
Treatment volume	50,000	ft3	calculated value
Total Porosity	35	%	default value
Groundwater volume	17,500	ft3	calculated value
Soil bulk density	90	lbs/ft3	default value
Soil mass	2,250	ton	calculated value

CONTAMINANTS OF CONCERN (COCs)

Constituent	GW (mg/L)	Soil* (mg/kg)	Total COC Mass** (lb)
PCE	10	2.63	706.5

*Unless provided, sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values. For a more refined estimate, it is recommended that actual values be verified via direct sampling of the targeted treatment interval.

**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOCHEMICAL DATA

Competing Electron Acceptors	GW (mg/L)	
Dissolved oxygen	2	customer provided
Nitrate (as N)	5	customer provided
Manganese (estimated conc. Mn(II) generated)*	1550	customer provided
Iron (estimated conc. Fe(II) generated)*	2614	customer provided
Sulfate	141	customer provided

*An estimated projection of dissolved concentrations of Mn and Fe following ERD/ISCR were used to estimate H demand from the reduction of oxidized Fe and Mn minerals (typically only a portion of actual soil concentrations will be reduced).

ORP (mV)	+100 to -50	
pH	6.5	

STOICHIOMETRIC DEMAND CALCULATIONS

	GW (mg/L)	Soil (mg/kg)
H2 Demand from COCs	0.48	0.13
H2 Demand from Competing Electron Acceptors	116.46	0.00
Total H2 Demand	116.95	0.13

H2 Demand from Soil within Targeted Area	0.57	lb
H2 Demand from GW within Targeted Area	127.79	lb
H2 Demand from Influx over Design Life	7995.70	lb
Total Estimated H2 Demand	8124.05	lb

EHC LIQUID DEMAND CALCULATIONS

The stoichiometric demand for the targeted area was calculated using available data presented above, noting that the stoichiometric demand represents minimum requirements and require a complete geochemical data set to be calculated accurately. Therefore, the resulting EHC Liquid dosing required to meet the estimated stoichiometric demand was compared to our minimum guidelines for the selected type of application, selecting the higher number.

Application type: Injection PRB

	Value	Unit
Specific H2 capacity of ELS (100% concentrate)	349	g H2/Kg
Concentration EHC Liquid in GW to meet H2 demand	21291.6	mg/L
Safety factor*	2	
Recommended conc. of EHC Liquid in pore water	42,583	mg/L
Mass of ELS Concentrate required	46,530	lbs
Mass ELS per container	460	lbs
Number of Containers	102	containers
Mass ELS (rounded based on container size)	**46,920**	**lbs**
Mass of EHC Liquid Mix (Fe component)	10,993	lbs
Mass of EHC Liquid Mix per container	24.6	lbs
Number of EHC Liquid Mix containers required	447	bags
Mass EHC Liquid Mix (rounded based on container size)	**10,996**	**lbs**

*A safety factor has been applied to account for uncertainties in data and variability in the rate and extent of hydrogen consumption.

OPTIONAL pH BUFFER

If groundwater pH is below 6.5 or inoculants are to be applied together with the EHC Liquid, we recommend that the EHC Liquid injection solution be pH buffered to create optimal conditions for microbial growth. Based on laboratory tests, potassium bicarbonate, a fully soluble buffer, applied at a rate of 25 lbs / 11 kg per drum (420 lb) of EHC Liquid will buffer the pH of the injectate solution to circum-neutral. If baseline pH conditions were to be below 6, additional pH buffer will be needed to raise the pH of the groundwater to 7. The amount of buffer required to raise the pH of the groundwater to 7 will depend on the site-specific buffering capacity of the soil and will have to be determined by conducting a pH titration test.

Total $KHCO_3$ demand = amount $KHCO_3$ to neutralize EHC Liquid solution + amount needed to raise ground water / soil to a pH of 7

Soil buffering amount = KHCO3 for ground water / soil pH adjustment, which can be determined in the laboratory via titration.

	Value	Unit	
Mass $KHCO_3$ to neutralize EHC Liquid solution	11,171	lbs	default value
Estimated soil buffering amount	0	lbs	estimated value
Total $KHCO_3$ demand	11,171	lbs	

OPTIONAL DHC INOCULANT

Although not typically required for ISCR, DHC inoculants have shown to improve removal kinetics, in particular for potential daughter products such as cis-DCE and VC. The DHC will be added after EHC-L application, once favorable redox conditions (ORP < -75 mV, DO <0.2 mg/L, pH between 6 and 8.5) have been attained. The DHC inoculant will contain at least 5 x10E10 cfu/L of live bacteria including high numbers of dehalococcoides species with known abilities to biodegrade DCE. The target density of DHC cells in the treated aquifer is 1x10E6 cfu/L.

	Value	Unit
Dechlorinating consortium concentration in inoculant	5.00E+10	DHC/L
Design final concentration after dilution in aquifer	1.00E+06	DHC/L
Volume of Inoculant Required	10	L

*Note: The minimum shipping volume is 15 L (one small keg) exceeds the calculated requirement, and was therefore used in the quotation below.

COST ESTIMATE

Item	Quantity	Unit	Price	Cost
ELS Concentrate	46,920	lbs	$2.80	$131,376
EHC Liquid Mix	10,996.2	lbs	$7.40	$81,372
Optional items:				
pH Buffer ($KHCO_3$)	11,200	lbs	$3.00	$33,600
DHC Inoculum (incl. minimum)	15	L	$90	$1,350

1) Price valid for 90 days from date at top of document. Terms: net 30 days.

2) Any applicable taxes not included. Please provide a copy of your tax exempt certificate or resale tax number when placing your order. In accordance with the law, applicable state and local taxes will be applied at the time of invoicing if PeroxyChem has not been presented with your fully executed tax exemption documentation.

3) Price excludes shipping. Freight estimates available upon request. Volumes were rounded up based on container size.

4) Return Policy: Within 90 days after sale, following approval by PeroxyChem, products in their unopened containers, which by analysis meet the original specifications under which they were shipped, will be accepted for return at invoiced price, less 25% handling charge and return freight, excluding original freight paid by buyer. Products made to order or custom blended are non-returnable.

5) All sales are per PeroxyChem's Terms and Conditions.

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Dilution:	**10-fold**	**20-fold**	**30-fold**
Volume ELS Microemulsion per drum (USG)	50	50	50
Mass EHC Liquid Mix (lbs)	107.8	107.8	107.8
Volume water per drum (USG)	496	1,047	1,598
Resulting volume injection solution per drum (USG)	546	1,097	1,648
Resulting EHC Liquid concentration (ELS + Fe mix)	12.3%	6.2%	4.1%
Total volume water (USG)	50,597	106,816	163,035
Total injection volume (USG)	55,697	111,916	168,135
Resulting injection volume to total pore volume	42.5%	85.4%	128.3%

Injection recommendations (can be altered):

The EHC Liquid solution could be injected via fixed wells or using direct push. The injection spacing would be determined based on the radius of influence achieved for the specific implementation method and lithology.

	Value	**Unit**	**Comment**
Dilution of EHC Liquid emulsion (can be altered)	10		can be altered
Total volume of water required	50,597	U.S. gallons	calculated value
Approximate volume of solution to inject	55,697	U.S. gallons	calculated value
Number of injection lines for PRB	1	lines	customer provided
Injection spacing within lines	10	ft	customer provided
Number of injection points	10	locations	calculated value
Injection volume per point	5,570	U.S. gallons	calculated value
Injection volume per vertical foot	111	U.S. gallons	calculated value
Injection volume to total pore space volume	43	percent	calculated value

Note that the construction estimates presented above can be readily modified in the field or per recommendations from the injection contractor as required (for example, the concentration of the EHC Liquid solution could be changed to modify the total injection volume or the injections spacing could be altered based on installation technology).

Review and follow guidance in the appropriate Safety Data Sheet (SDS) with all workers prior to use.

APPENDIX D

REMEDIAL ALTERNATIVE COST ESTIMATES

Klink Cosmo
Feasibility Study

COST ESTIMATE SUMMARY

Client NYSDEC
Project Klink Cosmo FS
Title Cost Estimate

Project Number 60521141
Calculated By: DNM Date: 7-24-18
Checked By: MG Date: 7-24-18

CAPITAL COSTS			ALTERNATIVE 1: No Action, Institutional Controls with Site Management	ALTERNATIVE 2: IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management	ALTERNATIVE 3: IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management	ALTERNATIVE 4: IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management	ALTERNATIVE 5: IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management
Item	Description	Units	COST	COST	COST	COST	COST
1	Site Services	LS	$0	$16,336	$126,605	$137,492	$178,896
2	SSD Systems	LS	$0	$16,292	$16,292	$16,292	$16,292
3	SVE/AS System	LS	$0	$406,879	$406,879	$406,879	$406,879
4	Injection Well Construction	LS	$0	$0	$246,621	$246,621	$246,621
5	Permanganate Injection	LS	$0	$0	$1,103,855	$0	$1,103,855
6	EHC Injection	LS	$0	$0	$0	$1,165,504	$0
7	Hydraulic Containment	LS	$0	$0	$0	$0	$1,928,097
8	2 years of Quarterly Startup Groundwater Monitoring	LS	$0	$202,129	$202,129	$202,129	$202,129
9	Site Management Plan	LS	$40,600	$40,600	$40,600	$40,600	$40,600
	Capital Cost SubTotal		**$40,600**	**$682,236**	**$2,142,981**	**$2,215,517**	**$4,123,369**

MARKUPS			Markup	Cost	Markup	Cost	Markup	Cost	Markup	Cost	Markup	Cost
Markup 1	Mobilization/Demobilization, percentage of Capital Cost Subtotal	%	5%	$2,030	5%	$34,112	5%	$107,149	5%	$110,776	5%	$206,168
Markup 2	Bonds and Insurance, percentage of Capital Cost Subtotal	%	2%	$812	2%	$13,645	2%	$42,860	2%	$44,310	2%	$82,467
Markup 3	Engineering & CM, percentage of Capital Cost Subtotal plus Markup 1	%	15%	$6,395	15%	$107,452	15%	$337,519	15%	$348,944	15%	$649,431
Markup 4	Contingency, percentage of Capital Cost Subtotal plus Markups 1, 2 and 3	%	25%	$12,459	25%	$209,361	25%	$657,627	25%	$679,887	25%	$1,265,359
Markup 5	Escalation to Midpoint of Construction (2021), 3% per year. Percentage of Capital Cost Subtotal plus Markups 1 through 4	%	9.3%	$5,793	9.3%	$97,353	9.3%	$305,797	9.3%	$316,147	9.3%	$588,392
	TOTAL CAPITAL COST		**$68,089**		**$1,144,159**		**$3,593,933**		**$3,715,582**		**$6,915,187**	
ANNUAL COSTS			Cost Per Year		Cost Per Year		Cost Per Year		Cost Per Year		Cost Per Year	
A1	Annual Monitoring - 30 Years	Lump Sum	$17,400		$17,400		$17,400		$17,400		$17,400	
A2	Annual Reporting & 5-year Review	Lump Sum	$14,400		$14,400		$14,400		$14,400		$14,400	
A3	SSD System O&M	Lump Sum	$0		$8,180		$8,180		$8,180		$8,180	
A4	Hydraulic Containment/Removal O&M	Lump Sum	$0		$0		$0		$0		$61,600	
A5	SVE/AS System O&M (5 years; not included in Present Worth calculation)	Lump Sum	$0		$303,900		$303,900		$303,900		$303,900	
	TOTAL ANNUAL COST (not including SVE/AS O&M)		**$31,800**		**$39,980**		**$39,980**		**$39,980**		**$101,580**	
	PRESENT WORTH of ANNUAL COST (5% for 30 years) (1)		**$488,846**		**$614,593**		**$614,593**		**$614,593**		**$1,561,539**	
			ALTERNATIVE 1		ALTERNATIVE 2		ALTERNATIVE 3		ALTERNATIVE 4		ALTERNATIVE 5	
TOTAL CAPITAL plus PW of ANNUAL COST			**$557,000**		**$2,063,000**		**$4,512,000**		**$4,634,000**		**$8,781,000**	

Notes:
(1) Present Worth Factor = 15.3725

Klink Cosmo
Feasibility Study

ALTERNATIVE 1 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141		
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18	
Title	Alternative 1 - No Action, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18	

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
1	**Site Services**				**$0**	**$0**		
Health and Safety			ls	$200.00	$0	$0	Engineer's Judgement	
Community Air Monitoring			day	$1,500.00	$0	$0	Ronkonkoma Average Bid	
Erosion and Sediment Control			ls	$200.00	$0	$0	Engineer's Judgement	
Spill Containment			ls	$500.00	$0	$0	Engineer's Judgement	
Survey			day	$1,163.62	$0	$0	MII 2016 Cost Book	
Contractor's Project Manager			day	$960.00	$0	$0	Engineer's Judgement	
Office Trailer Rental			mo	$440.00	$0	$0	MII 2016 Cost Book	
Storage Box Rental			mo	$108.00	$0	$0	MII 2016 Cost Book	
Port-A-John Rental			mo	$99.00	$0	$0	MII 2016 Cost Book	
20 CY C&D Dumpster Rental with service			week	$565.00	$0	$0	MII 2016 Cost Book	
Temporary Electric - Transformer			ea	$3,246.96	$0	$0	MII 2016 Cost Book	
Temporary Electric - Underground Feed			ea	$2,116.96	$0	$0	MII 2016 Cost Book	
Temporary Electric - Trailer Connection			ea	$1,123.48	$0	$0	MII 2016 Cost Book	
Office Supplies			mo	$80.00	$0	$0	MII 2016 Cost Book	
Office Equipment			mo	$200.00	$0	$0	MII 2016 Cost Book	
Electric Bill			mo	$160.00	$0	$0	MII 2016 Cost Book	
Water Bill			mo	$30.00	$0	$0	Engineer's Judgement	
Phone/Internet Bill			mo	$85.00	$0	$0	MII 2016 Cost Book	
Site Security			day	$500.00	$0	$0	Engineer's Judgement	
Geophysical Survey			day	$2,500.00	$0	$0	IRM Cost Estimate - Page 8	
Project Sign			ls	$1,000.00	$0	$0	Engineer's Judgement	
Submittals			ls	$5,000.00	$0	$0	Engineer's Judgement	
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
2	**SSD Systems**				**$0**	**$0**		
Radon Fan			ea	$389.00	$0	$0	Grainger	
PVC Piping			lf	$5.44	$0	$0	Grainger	Assume 50 lf per system
Pipe hangers, elbows, couplings, etc.			ls	$0.00	$0	$0	Engineer's Judgement	Assume 10% of cost of piping
Installation Labor (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 5 days total
Electric - Conductor			lf	$0.88	$0	$0	Grainger	Assume 50 lf per system
Electric - Conduit			lf	$1.51	$0	$0	Grainger	Assume 50 lf per system
Electric - hangers, elbows, couplings, etc.			ls	$0.00	$0	$0	Engineer's Judgement	Assume 10% of cost of conduit
Startup and Testing Labor (1 @ $59.83)			hr	$59.83	$0	$0	Engineer's Judgement	Assume 2 hours per system
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

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Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 1 - No Action, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
3	**SVE/AS System**				**$0**	**$0**		
SVE Well Installation			ea	$6,247.00	$0	$0	IRM Cost Estimate - Page 2	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
AS Well Installation			ea	$6,671.00	$0	$0	IRM Cost Estimate - Page 3	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
System Procurement			ls	$3,618.00	$0	$0	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System Construction			ls	$93,015.00	$0	$0	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System On-Site Installation and Startup			ls	$21,540.00	$0	$0	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
Sidewalk Demo, transport and disposal			sy	$46.91	$0	$0	IRM Cost Estimate - Page 1	
Trench Excavation, Transport and Disposal			cy	$602.00	$0	$0	IRM Cost Estimate - Page 1	
Install SVE/AS Piping			lf	$30.19	$0	$0	IRM Cost Estimate - Page 1	
Trench Backfill and Compaction			cy	$34.83	$0	$0	IRM Cost Estimate - Page 1	
Manifold Chamber Excavation, Transport and Disposal			cy	$1,430.92	$0	$0	IRM Cost Estimate - Page 1	
Manifold Chamber Backfill and Compaction			cy	$50.26	$0	$0	IRM Cost Estimate - Page 1	
AS/SVE Chambers			ea	$1,700.00	$0	$0	IRM Cost Estimate - Page 1	
Entry Boot Fittings			ea	$61.00	$0	$0	IRM Cost Estimate - Page 1	
Lifting Cover Handles			ea	$354.00	$0	$0	IRM Cost Estimate - Page 1	
Manifold Chambers			ea	$5,940.00	$0	$0	IRM Cost Estimate - Page 10	
Sidewalk Restoration			sf	$40.00	$0	$0	IRM Cost Estimate - Page 6	
Sample analysis			ea	$225.00	$0	$0	IRM Cost Estimate - Page 7	
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

4	**Injection Well Installation**				**$0**	**$0**		
Source Perimiter					**$0**	**$0**		
Injection Well Installation			ea	$6,291.00	$0	$0	IRM Cost Estimate - Page 9	
Well Development and IDW T&D			ea	$1,200.00	$0	$0	IRM Cost Estimate - Page 9	
Division East					**$0**	**$0**		
Injection Well Installation			ea	$6,380.00	$0	$0	IRM Cost Estimate - Page 10	
Well Development and IDW T&D			ea	$1,200.00	$0	$0	IRM Cost Estimate - Page 10	
Division West					**$0**	**$0**		
Injection Well Installation			ea	$6,165.00	$0	$0	IRM Cost Estimate - Page 11	
Well Development and IDW T&D			ea	$1,200.00	$0	$0	IRM Cost Estimate - Page 11	

5	**Permanganate Injection**				**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Source Perimeter					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division East					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division West					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 1 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141		
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18	
Title	Alternative 1 - No Action, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18	

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
6	**EHC Injection**				**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Total of 3 areas	
Source Perimeter					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division East					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division West					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

7	**Hydraulic Containment**				**$0**	**$0**		
Purtchase Adjoining Property			ls	$1,650,000.00	$0	$0	Market Listing for Nearby Property	
Treatment System Enclosure			ls	$60,590.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Extraction Well Installation			ea	$8,300.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Treatment System Piping			lf	$14.39	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Assume 100 lf per well
Trench Excavation Across Richardson Street			cy	$8.49	$0	$0	RS Means	Assume 100 lf of trench, 3ft x 6 ft
Pipe Trench Backfill & Compaction			cy	$53.75	$0	$0	RS Means	Assume same as trench excavation volume
Asphalt Saw-Cutting			lf	$2.06	$0	$0	RS Means	Assume 30 ft road crossing
Sidewalk Demo, Transport and Disposal			sy	$46.91	$0	$0	IRM Cost Estimate - Page 1	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Asphalt Restoration			sf	$4.79	$0	$0	RS Means	Assume 60 ft road crossing, 3 ft wide
Sidewalk Restoration			sf	$40.00	$0	$0	IRM Cost Estimate - Page 6	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Groundwater Pump			ea	$3,857.84	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Centrifugal Pump			ea	$4,150.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Equalization Tank			ea	$3,320.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Air Stripper			ea	$25,773.16	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Carbon Vessel			ea	$22,605.88	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Bag Filter			ea	$524.56	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Instrumentation, Electrical			ls	$25,000.00	$0	$0	Engineer's Judgement	
Startup and Testing			ls	$10,000.00	$0	$0	Engineer's Judgement	
Additional Overhead and Profit (does not include property acquisition)		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 1 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 1 - No Action, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
8	**Startup Groundwater Monitoring - Quarterly for 2 years**				**$0**	**$0**		
Labor (2 @ $35)			hr	$70.00	$0	$0	Engineer's Judgement	Assume 2 workers, 60 hrs each per event, 9 total events
Sampling Equipment			ls	$3,000.00	$0	$0	Engineer's Judgement	Assume $3,000 per event
Laboratory Analysis			ea	$69.47	$0	$0	NYSDEC Standby Contract Rate	40 samples per event
Report Preparation			ea	$5,000.00	$0	$0	Engineer's Judgement	Assume $5,000 per event
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

9	**Site Management Plan**				**$40,600**	**$40,600**		
Labor		450.00	hr	$90.00	$40,500	$40,500	Engineer's Judgement	
Direct Costs		1	ls	$100.00	$100	$100	Engineer's Judgement	

Sales Tax Rate 1.08875

TOTAL CAPITAL COST OF ALTERNATIVE **$40,600**

Klink Cosmo
Feasibility Study

ALTERNATIVE 2 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141		
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18	
Title	Alternative 2 - IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18	

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
1	**Site Services**				**$15,126**	**$16,336**		
Health and Safety		1	ls	$200.00	$200	$218	Engineer's Judgement	
Community Air Monitoring		0	day	$1,500.00	$0	$0	Ronkonkoma Average Bid	
Erosion and Sediment Control		1	ls	$200.00	$200	$218	Engineer's Judgement	
Spill Containment		1	ls	$500.00	$500	$544	Engineer's Judgement	
Survey		0	day	$1,163.62	$0	$0	MII 2016 Cost Book	
Contractor's Project Manager		1	day	$960.00	$960	$1,045	Engineer's Judgement	
Office Trailer Rental		0	mo	$440.00	$0	$0	MII 2016 Cost Book	
Storage Box Rental		1	mo	$108.00	$108	$118	MII 2016 Cost Book	
Port-A-John Rental		1	mo	$99.00	$99	$108	MII 2016 Cost Book	
20 CY C&D Dumpster Rental with service		1	week	$565.00	$565	$615	MII 2016 Cost Book	
Temporary Electric - Transformer		0	ea	$3,246.96	$0	$0	MII 2016 Cost Book	
Temporary Electric - Underground Feed		0	ea	$2,116.96	$0	$0	MII 2016 Cost Book	
Temporary Electric - Trailer Connection		0	ea	$1,123.48	$0	$0	MII 2016 Cost Book	
Office Supplies		0	mo	$80.00	$0	$0	MII 2016 Cost Book	
Office Equipment		0	mo	$200.00	$0	$0	MII 2016 Cost Book	
Electric Bill		0	mo	$160.00	$0	$0	MII 2016 Cost Book	
Water Bill		0	mo	$30.00	$0	$0	Engineer's Judgement	
Phone/Internet Bill		0	mo	$85.00	$0	$0	MII 2016 Cost Book	
Site Security		5	day	$500.00	$2,500	$2,722	Engineer's Judgement	
Geophysical Survey		1	day	$2,500.00	$2,500	$2,722	IRM Cost Estimate - Page 8	
Project Sign		1	ls	$1,000.00	$1,000	$1,089	Engineer's Judgement	
Submittals		1	ls	$5,000.00	$5,000	$5,444	Engineer's Judgement	
Additional Overhead and Profit		20	%		$1,494	$1,494	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
2	**SSD Systems**				**$16,015**	**$16,292**		
Radon Fan		4	ea	$389.00	$1,556	$1,694	Grainger	
PVC Piping		200	lf	$5.44	$1,088	$1,185	Grainger	Assume 50 lf per system
Pipe hangers, elbows, couplings, etc.		1	ls	$108.80	$109	$109	Engineer's Judgement	Assume 10% of cost of piping
Installation Labor (2 @ $59.83)		80	hr	$119.66	$9,573	$9,573	Engineer's Judgement	Assume 5 days total
Electric - Conductor		200	lf	$0.88	$176	$192	Grainger	Assume 50 lf per system
Electric - Conduit		200	lf	$1.51	$302	$329	Grainger	Assume 50 lf per system
Electric - hangers, elbows, couplings, etc.		1	ls	$17.60	$18	$18	Engineer's Judgement	Assume 10% of cost of conduit
Startup and Testing Labor (1 @ $59.83)		8	hr	$59.83	$479	$479	Engineer's Judgement	Assume 2 hours per system
Additional Overhead and Profit		20	%		$2,715	$2,715	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 2 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 2 - IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
3	**SVE/AS System**				**$379,240**	**$406,879**		
SVE Well Installation		4	ea	$6,247.00	$24,988	$27,206	IRM Cost Estimate - Page 2	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
AS Well Installation		5	ea	$6,671.00	$33,355	$36,315	IRM Cost Estimate - Page 3	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
System Procurement		1	ls	$3,618.00	$3,618	$3,939	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System Construction		1	ls	$93,015.00	$93,015	$101,270	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System On-Site Installation and Startup		1	ls	$21,540.00	$21,540	$23,452	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
Sidewalk Demo, transport and disposal		98	sy	$46.91	$4,597	$5,005	IRM Cost Estimate - Page 1	
Trench Excavation, Transport and Disposal		38	cy	$602.00	$22,575	$24,579	IRM Cost Estimate - Page 1	
Install SVE/AS Piping		770	lf	$30.19	$23,246	$25,309	IRM Cost Estimate - Page 1	
Trench Backfill and Compaction		38	cy	$34.83	$1,333	$1,451	IRM Cost Estimate - Page 1	
Manifold Chamber Excavation, Transport and Disposal		5	cy	$1,430.92	$6,582	$7,166	IRM Cost Estimate - Page 1	
Manifold Chamber Backfill and Compaction		5	cy	$50.26	$264	$288	IRM Cost Estimate - Page 1	
AS/SVE Chambers		13	ea	$1,700.00	$22,100	$24,061	IRM Cost Estimate - Page 1	
Entry Boot Fittings		26	ea	$61.00	$1,586	$1,727	IRM Cost Estimate - Page 1	
Lifting Cover Handles		3	ea	$354.00	$1,062	$1,156	IRM Cost Estimate - Page 1	
Manifold Chambers		1	ea	$5,940.00	$5,940	$6,467	IRM Cost Estimate - Page 10	
Sidewalk Restoration		1,000	sf	$40.00	$40,000	$43,550	IRM Cost Estimate - Page 6	
Sample analysis		25	ea	$225.00	$5,625	$6,124	IRM Cost Estimate - Page 7	
Additional Overhead and Profit		20	%		$67,813	$67,813	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

4	**Injection Well Installation**				**$0**	**$0**		
Source Perimiter					**$0**	**$0**		
Injection Well Installation			ea	$6,291.00	$0	$0	IRM Cost Estimate - Page 9	
Well Development and IDW T&D			ea	$1,200.00	$0	$0	IRM Cost Estimate - Page 9	
Division East					**$0**	**$0**		
Injection Well Installation			ea	$6,380.00	$0	$0	IRM Cost Estimate - Page 10	
Well Development and IDW T&D			ea	$1,200.00	$0	$0	IRM Cost Estimate - Page 10	
Division West					**$0**	**$0**		
Injection Well Installation			ea	$6,165.00	$0	$0	IRM Cost Estimate - Page 11	
Well Development and IDW T&D			ea	$1,200.00	$0	$0	IRM Cost Estimate - Page 11	

5	**Permanganate Injection**				**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Source Perimeter					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division East					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division West					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 2 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141		
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18	
Title	Alternative 2 - IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18	

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
6	**EHC Injection**				**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Total of 3 areas	
Source Perimeter					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division East					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division West					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

7	**Hydraulic Containment**				**$0**	**$0**		
Purchase Adjoining Property			ls	$1,650,000.00	$0	$0	Market Listing for Nearby Property	
Treatment System Enclosure			ls	$60,590.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Extraction Well Installation			ea	$8,300.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Treatment System Piping			lf	$14.39	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Assume 100 lf per well
Trench Excavation Across Richardson Street			cy	$8.49	$0	$0	RS Means	Assume 100 lf of trench, 3ft x 6 ft
Pipe Trench Backfill & Compaction			cy	$53.75	$0	$0	RS Means	Assume same as trench excavation volume
Asphalt Saw-Cutting			lf	$2.06	$0	$0	RS Means	Assume 30 ft road crossing
Sidewalk Demo, Transport and Disposal			sy	$46.91	$0	$0	IRM Cost Estimate - Page 1	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Asphalt Restoration			sf	$4.79	$0	$0	RS Means	Assume 60 ft road crossing, 3 ft wide
Sidewalk Restoration			sf	$40.00	$0	$0	IRM Cost Estimate - Page 6	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Groundwater Pump			ea	$3,857.84	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Centrifugal Pump			ea	$4,150.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Equalization Tank			ea	$3,320.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Air Stripper			ea	$25,773.16	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Carbon Vessel			ea	$22,605.88	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Bag Filter			ea	$524.56	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Instrumentation, Electrical			ls	$25,000.00	$0	$0	Engineer's Judgement	
Startup and Testing			ls	$10,000.00	$0	$0	Engineer's Judgement	
Additional Overhead and Profit (does not include property acquisition)		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 2 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 2 - IRM SVE/AS, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
8	**Startup Groundwater Monitoring - Quarterly for 2 years**				**$202,129**	**$202,129**		
Labor (2 @ $35)		1,080.00	hr	$70.00	$75,600	$75,600	Engineer's Judgement	Assume 2 workers, 60 hrs each per event, 9 total events
Sampling Equipment		9	ls	$3,000.00	$27,000	$27,000	Engineer's Judgement	Assume $3,000 per event
Laboratory Analysis		360	ea	$69.47	$25,009	$25,009	NYSDEC Standby Contract Rate	40 samples per event
Report Preparation		9	ea	$5,000.00	$45,000	$45,000	Engineer's Judgement	Assume $5,000 per event
Additional Overhead and Profit		20	%		$29,520	$29,520	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

9	**Site Management Plan**				**$40,600**	**$40,600**		
Labor		450.00	hr	$90.00	$40,500	$40,500	Engineer's Judgement	
Direct Costs		1	ls	$100.00	$100	$100	Engineer's Judgement	

Sales Tax Rate 1.08875

TOTAL CAPITAL COST OF ALTERNATIVE **$682,236**

Klink Cosmo
Feasibility Study

ALTERNATIVE 3 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 3 - IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
1	**Site Services**				**$120,228**	**$126,605**		
Health and Safety		1	ls	$1,000.00	$1,000	$1,000	Engineer's Judgement	
Community Air Monitoring		30	day	$1,500.00	$45,000	$48,994	Ronkonkoma Average Bid	Assume CAMP required during any intrusive work
Erosion and Sediment Control		1	ls	$200.00	$200	$200	Engineer's Judgement	
Spill Containment		1	ls	$1,000.00	$1,000	$1,000	Engineer's Judgement	
Contractor's Project Manager		10	day	$960.00	$9,600	$9,600	Engineer's Judgement	
Office Trailer Rental		2	mo	$440.00	$880	$958	MII 2016 Cost Book	
Storage Box Rental		2	mo	$108.00	$216	$235	MII 2016 Cost Book	
Port-A-John Rental		2	mo	$99.00	$198	$216	MII 2016 Cost Book	
20 CY C&D Dumpster Rental with service		8	week	$565.00	$4,520	$4,921	MII 2016 Cost Book	
Temporary Electric - Transformer		1	ea	$3,246.96	$3,247	$3,535	MII 2016 Cost Book	
Temporary Electric - Underground Feed		1	ea	$2,116.96	$2,117	$2,305	MII 2016 Cost Book	
Temporary Electric - Trailer Connection		1	ea	$1,123.48	$1,123	$1,223	MII 2016 Cost Book	
Office Supplies		2	mo	$80.00	$160	$174	MII 2016 Cost Book	
Office Equipment		2	mo	$200.00	$400	$436	MII 2016 Cost Book	
Electric Bill		2	mo	$160.00	$320	$348	MII 2016 Cost Book	
Water Bill		2	mo	$30.00	$60	$60	Engineer's Judgement	
Phone/Internet Bill		2	mo	$85.00	$170	$185	MII 2016 Cost Book	
Site Security		56	day	$500.00	$28,000	$28,000	Engineer's Judgement	
Geophysical Survey		1	day	$2,500.00	$2,500	$2,722	IRM Cost Estimate - Page 8	
Project Sign		1	ls	$1,000.00	$1,000	$1,089	Engineer's Judgement	
Submittals		1	ls	$10,000.00	$10,000	$10,888	Engineer's Judgement	
Additional Overhead and Profit		20	%		$8,516	$8,516	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

2	**SSD Systems**				**$16,015**	**$16,292**		
Radon Fan		4	ea	$389.00	$1,556	$1,694	Grainger	
PVC Piping		200	lf	$5.44	$1,088	$1,185	Grainger	Assume 50 lf per system
Pipe hangers, elbows, couplings, etc.		1	ls	$108.80	$109	$109	Engineer's Judgement	Assume 10% of cost of piping
Installation Labor (2 @ $59.83)		80	hr	$119.66	$9,573	$9,573	Engineer's Judgement	Assume 5 days total
Electric - Conductor		200	lf	$0.88	$176	$192	Grainger	Assume 50 lf per system
Electric - Conduit		200	lf	$1.51	$302	$329	Grainger	Assume 50 lf per system
Electric - hangers, elbows, couplings, etc.		1	ls	$17.60	$18	$18	Engineer's Judgement	Assume 10% of cost of conduit
Startup and Testing Labor (1 @ $59.83)		8	hr	$59.83	$479	$479	Engineer's Judgement	Assume 2 hours per system
Additional Overhead and Profit		20	%		$2,715	$2,715	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 3 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 3 - IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
3	**SVE/AS System**				**$379,240**	**$406,879**		
SVE Well Installation		4	ea	$6,247.00	$24,988	$27,206	IRM Cost Estimate - Page 2	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
AS Well Installation		5	ea	$6,671.00	$33,355	$36,315	IRM Cost Estimate - Page 3	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
System Procurement		1	ls	$3,618.00	$3,618	$3,939	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System Construction		1	ls	$93,015.00	$93,015	$101,270	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System On-Site Installation and Startup		1	ls	$21,540.00	$21,540	$23,452	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
Sidewalk Demo, transport and disposal		98	sy	$46.91	$4,597	$5,005	IRM Cost Estimate - Page 1	
Trench Excavation, Transport and Disposal		38	cy	$602.00	$22,575	$24,579	IRM Cost Estimate - Page 1	
Install SVE/AS Piping		770	lf	$30.19	$23,246	$25,309	IRM Cost Estimate - Page 1	
Trench Backfill and Compaction		38	cy	$34.83	$1,333	$1,451	IRM Cost Estimate - Page 1	
Manifold Chamber Excavation, Transport and Disposal		5	cy	$1,430.92	$6,582	$7,166	IRM Cost Estimate - Page 1	
Manifold Chamber Backfill and Compaction		5	cy	$50.26	$264	$288	IRM Cost Estimate - Page 1	
AS/SVE Chambers		13	ea	$1,700.00	$22,100	$24,061	IRM Cost Estimate - Page 1	
Entry Boot Fittings		26	ea	$61.00	$1,586	$1,727	IRM Cost Estimate - Page 1	
Lifting Cover Handles		3	ea	$354.00	$1,062	$1,156	IRM Cost Estimate - Page 1	
Manifold Chambers		1	ea	$5,940.00	$5,940	$6,467	IRM Cost Estimate - Page 10	
Sidewalk Restoration		1,000	sf	$40.00	$40,000	$43,550	IRM Cost Estimate - Page 6	
Sample analysis		25	ea	$225.00	$5,625	$6,124	IRM Cost Estimate - Page 7	
Additional Overhead and Profit		20	%		$67,813	$67,813	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

4	**Injection Well Installation**				**$226,510**	**$246,621**		
Source Perimiter					**$74,910**	**$81,558**		
Injection Well Installation		10	ea	$6,291.00	$62,910	$68,493	IRM Cost Estimate - Page 9	
Well Development and IDW T&D		10	ea	$1,200.00	$12,000	$13,065	IRM Cost Estimate - Page 9	
Division East					**$151,600**	**$165,055**		
Injection Well Installation		20	ea	$6,380.00	$127,600	$138,925	IRM Cost Estimate - Page 10	
Well Development and IDW T&D		20	ea	$1,200.00	$24,000	$26,130	IRM Cost Estimate - Page 10	
Division West					**$0**	**$8**		
Injection Well Installation		0	ea	$6,165.00	$0	$0	IRM Cost Estimate - Page 11	
Well Development and IDW T&D		0	ea	$1,200.00	$0	$8	IRM Cost Estimate - Page 11	

5	**Permanganate Injection**				**$1,028,871**	**$1,103,855**		
Material Purchase		112,472	gal	$6.00	$674,832	$734,723	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds		2	ls	$8,329.37	$16,659	$18,137	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)		32	hr	$119.66	$3,829	$4,169	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)		1,250	hr	$119.66	$149,575	$162,850	Total of 3 areas	
Source Perimeter					**$136,215**	**$146,106**		
Material Purchase		17,186	gal	$6.00	$103,116	$112,268	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds		1	ls	$8,329.37	$8,329	$9,069	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		16	hr	$119.66	$1,915	$1,915	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		191	hr	$119.66	$22,855	$22,855	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division East					**$708,680**	**$760,159**		
Material Purchase		95,286	gal	$6.00	$571,716	$622,456	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds		1	ls	$8,329.37	$8,329	$9,069	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		16	hr	$119.66	$1,915	$1,915	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		1,059	hr	$119.66	$126,720	$126,720	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division West					**$0**	**$0**		
Material Purchase		0	gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds		0	ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		0	hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		0	hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Additional Overhead and Profit		20	%		$183,976	$183,976	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 3 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 3 - IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
6	**EHC Injection**				**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Total of 3 areas	
Source Perimeter					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division East					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division West					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

7	**Hydraulic Containment**				**$0**	**$0**		
Purtchase Adjoining Property			ls	$1,650,000.00	$0	$0	Market Listing for Nearby Property	
Treatment System Enclosure			ls	$60,590.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Extraction Well Installation			ea	$8,300.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Treatment System Piping			lf	$14.39	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Assume 100 lf per well
Trench Excavation Across Richardson Street			cy	$8.49	$0	$0	RS Means	Assume 100 lf of trench, 3ft x 6 ft
Pipe Trench Backfill & Compaction			cy	$53.75	$0	$0	RS Means	Assume same as trench excavation volume
Asphalt Saw-Cutting			lf	$2.06	$0	$0	RS Means	Assume 30 ft road crossing
Sidewalk Demo, Transport and Disposal			sy	$46.91	$0	$0	IRM Cost Estimate - Page 1	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Asphalt Restoration			sf	$4.79	$0	$0	RS Means	Assume 60 ft road crossing, 3 ft wide
Sidewalk Restoration			sf	$40.00	$0	$0	IRM Cost Estimate - Page 6	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Groundwater Pump			ea	$3,857.84	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Centrifugal Pump			ea	$4,150.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Equalization Tank			ea	$3,320.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Air Stripper			ea	$25,773.16	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Carbon Vessel			ea	$22,605.88	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Bag Filter			ea	$524.56	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Instrumentation, Electrical			ls	$25,000.00	$0	$0	Engineer's Judgement	
Startup and Testing			ls	$10,000.00	$0	$0	Engineer's Judgement	
Additional Overhead and Profit (does not include property acquisition)		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 3 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 3 - IRM SVE/AS, Permanganate Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
8	**Startup Groundwater Monitoring - Quarterly for 2 years**				**$202,129**	**$202,129**		
Labor (2 @ $35)		1,080.00	hr	$70.00	$75,600	$75,600	Engineer's Judgement	Assume 2 workers, 60 hrs each per event, 9 total events
Sampling Equipment		9	ls	$3,000.00	$27,000	$27,000	Engineer's Judgement	Assume $3,000 per event
Laboratory Analysis		360	ea	$69.47	$25,009	$25,009	NYSDEC Standby Contract Rate	40 samples per event
Report Preparation		9	ea	$5,000.00	$45,000	$45,000	Engineer's Judgement	Assume $5,000 per event
Additional Overhead and Profit		20	%		$29,520	$29,520	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

9	**Site Management Plan**				**$40,600**	**$40,600**		
Labor		450.00	hr	$90.00	$40,500	$40,500	Engineer's Judgement	
Direct Costs		1	ls	$100.00	$100	$100	Engineer's Judgement	

Sales Tax Rate 1.08875

$0

TOTAL CAPITAL COST OF ALTERNATIVE **$2,142,981**

Klink Cosmo
Feasibility Study

ALTERNATIVE 4 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 4 - IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
1	**Site Services**				**$130,228**	**$137,492**		
Health and Safety		1	ls	$1,000.00	$1,000	$1,000	Engineer's Judgement	
Community Air Monitoring		30	day	$1,500.00	$45,000	$48,994	Ronkonkoma Average Bid	Assume CAMP required during any intrusive work
Erosion and Sediment Control		1	ls	$200.00	$200	$200	Engineer's Judgement	
Spill Containment		1	ls	$1,000.00	$1,000	$1,000	Engineer's Judgement	
Contractor's Project Manager		10	day	$960.00	$9,600	$9,600	Engineer's Judgement	
Office Trailer Rental		2	mo	$440.00	$880	$958	MII 2016 Cost Book	
Storage Box Rental		2	mo	$108.00	$216	$235	MII 2016 Cost Book	
Port-A-John Rental		2	mo	$99.00	$198	$216	MII 2016 Cost Book	
20 CY C&D Dumpster Rental with service		8	week	$565.00	$4,520	$4,921	MII 2016 Cost Book	
Temporary Electric - Transformer		1	ea	$3,246.96	$3,247	$3,535	MII 2016 Cost Book	
Temporary Electric - Underground Feed		1	ea	$2,116.96	$2,117	$2,305	MII 2016 Cost Book	
Temporary Electric - Trailer Connection		1	ea	$1,123.48	$1,123	$1,223	MII 2016 Cost Book	
Office Supplies		2	mo	$80.00	$160	$174	MII 2016 Cost Book	
Office Equipment		2	mo	$200.00	$400	$436	MII 2016 Cost Book	
Electric Bill		2	mo	$160.00	$320	$348	MII 2016 Cost Book	
Water Bill		2	mo	$30.00	$60	$60	Engineer's Judgement	
Phone/Internet Bill		2	mo	$85.00	$170	$185	MII 2016 Cost Book	
Site Security		56	day	$500.00	$28,000	$28,000	Engineer's Judgement	
Geophysical Survey		1	day	$2,500.00	$2,500	$2,722	IRM Cost Estimate - Page 8	
Project Sign		1	ls	$1,000.00	$1,000	$1,089	Engineer's Judgement	
Submittals		1	ls	$20,000.00	$20,000	$21,775	Engineer's Judgement	
Additional Overhead and Profit		20	%		$8,516	$8,516	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
2	**SSD Systems**				**$16,015**	**$16,292**		
Radon Fan		4	ea	$389.00	$1,556	$1,694	Grainger	
PVC Piping		200	lf	$5.44	$1,088	$1,185	Grainger	Assume 50 lf per system
Pipe hangers, elbows, couplings, etc.		1	ls	$108.80	$109	$109	Engineer's Judgement	Assume 10% of cost of piping
Installation Labor (2 @ $59.83)		80	hr	$119.66	$9,573	$9,573	Engineer's Judgement	Assume 5 days total
Electric - Conductor		200	lf	$0.88	$176	$192	Grainger	Assume 50 lf per system
Electric - Conduit		200	lf	$1.51	$302	$329	Grainger	Assume 50 lf per system
Electric - hangers, elbows, couplings, etc.		1	ls	$17.60	$18	$18	Engineer's Judgement	Assume 10% of cost of conduit
Startup and Testing Labor (1 @ $59.83)		8	hr	$59.83	$479	$479	Engineer's Judgement	Assume 2 hours per system
Additional Overhead and Profit		20	%		$2,715	$2,715	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 4 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141		
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18	
Title	Alternative 4 - IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18	

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
3	**SVE/AS System**				**$379,240**	**$406,879**		
SVE Well Installation		4	ea	$6,247.00	$24,988	$27,206	IRM Cost Estimate - Page 2	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
AS Well Installation		5	ea	$6,671.00	$33,355	$36,315	IRM Cost Estimate - Page 3	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
System Procurement		1	ls	$3,618.00	$3,618	$3,939	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System Construction		1	ls	$93,015.00	$93,015	$101,270	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System On-Site Installation and Startup		1	ls	$21,540.00	$21,540	$23,452	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
Sidewalk Demo, transport and disposal		98	sy	$46.91	$4,597	$5,005	IRM Cost Estimate - Page 1	
Trench Excavation, Transport and Disposal		38	cy	$602.00	$22,575	$24,579	IRM Cost Estimate - Page 1	
Install SVE/AS Piping		770	lf	$30.19	$23,246	$25,309	IRM Cost Estimate - Page 1	
Trench Backfill and Compaction		38	cy	$34.83	$1,333	$1,451	IRM Cost Estimate - Page 1	
Manifold Chamber Excavation, Transport and Disposal		5	cy	$1,430.92	$6,582	$7,166	IRM Cost Estimate - Page 1	
Manifold Chamber Backfill and Compaction		5	cy	$50.26	$264	$288	IRM Cost Estimate - Page 1	
AS/SVE Chambers		13	ea	$1,700.00	$22,100	$24,061	IRM Cost Estimate - Page 1	
Entry Boot Fittings		26	ea	$61.00	$1,586	$1,727	IRM Cost Estimate - Page 1	
Lifting Cover Handles		3	ea	$354.00	$1,062	$1,156	IRM Cost Estimate - Page 1	
Manifold Chambers		1	ea	$5,940.00	$5,940	$6,467	IRM Cost Estimate - Page 10	
Sidewalk Restoration		1,000	sf	$40.00	$40,000	$43,550	IRM Cost Estimate - Page 6	
Sample analysis		25	ea	$225.00	$5,625	$6,124	IRM Cost Estimate - Page 7	
Additional Overhead and Profit		20	%		$67,813	$67,813	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

4	**Injection Well Installation**				**$226,510**	**$246,621**		
Source Perimiter					**$74,910**	**$81,558**		
Injection Well Installation		10	ea	$6,291.00	$62,910	$68,493	IRM Cost Estimate - Page 9	
Well Development and IDW T&D		10	ea	$1,200.00	$12,000	$13,065	IRM Cost Estimate - Page 9	
Division East					**$151,600**	**$165,055**		
Injection Well Installation		20	ea	$6,380.00	$127,600	$138,925	IRM Cost Estimate - Page 10	
Well Development and IDW T&D		20	ea	$1,200.00	$24,000	$26,130	IRM Cost Estimate - Page 10	
Division West					**$0**	**$8**		
Injection Well Installation		0	ea	$6,165.00	$0	$0	IRM Cost Estimate - Page 11	
Well Development and IDW T&D		0	ea	$1,200.00	$0	$8	IRM Cost Estimate - Page 11	

5	**Permanganate Injection**				**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Source Perimeter					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division East					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division West					**$0**	**$0**		
Material Purchase			gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 4 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 4 - IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
6	**EHC Injection**				**$1,086,332**	**$1,165,504**		
ECH Material Purchase and Delivery		138,696	gal	$4.45	$617,197	$671,973	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds		2	ls	$8,329.37	$16,659	$18,137	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)		32	hr	$119.66	$3,829	$4,169	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)		1,541	hr	$119.66	$184,396	$200,761	Total of 3 areas	
Mixing and Delivery per truck		35	ea	$2,000.00	$70,000	$76,213	Total of 3 areas	
Source Perimeter					**$360,165**	**$382,901**		
ECH Material Purchase and Delivery		55,697	gal	$4.45	$247,852	$269,848	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds		1	ls	$8,329.37	$8,329	$9,069	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		16	hr	$119.66	$1,915	$1,915	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		619	hr	$119.66	$74,070	$74,070	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck		14	ea	$2,000.00	$28,000	$28,000	Engineer's Judgement	4,000 gal truck
Division East					**$531,916**	**$565,435**		
ECH Material Purchase and Delivery		82,999	gal	$4.45	$369,346	$402,125	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds		1	ls	$8,329.37	$8,329	$9,069	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		16	hr	$119.66	$1,915	$1,915	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		922	hr	$119.66	$110,327	$110,327	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck		21	ea	$2,000.00	$42,000	$42,000	Engineer's Judgement	4,000 gal truck
Division West					**$0**	**$0**		
ECH Material Purchase and Delivery		0	gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds		0	ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		0	hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		0	hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck		0	ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Additional Overhead and Profit		20	%		$194,251	$194,251	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
7	**Hydraulic Containment**				**$0**	**$0**		
Purchase Adjoining Property			ls	$1,650,000.00	$0	$0	Market Listing for Nearby Property	
Treatment System Enclosure			ls	$60,590.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Extraction Well Installation			ea	$8,300.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Treatment System Piping			lf	$14.39	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Assume 100 lf per well
Trench Excavation Across Richardson Street			cy	$8.49	$0	$0	RS Means	Assume 100 lf of trench, 3ft x 6 ft
Pipe Trench Backfill & Compaction			cy	$53.75	$0	$0	RS Means	Assume same as trench excavation volume
Asphalt Saw-Cutting			lf	$2.06	$0	$0	RS Means	Assume 30 ft road crossing
Sidewalk Demo, Transport and Disposal			sy	$46.91	$0	$0	IRM Cost Estimate - Page 1	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Asphalt Restoration			sf	$4.79	$0	$0	RS Means	Assume 60 ft road crossing, 3 ft wide
Sidewalk Restoration			sf	$40.00	$0	$0	IRM Cost Estimate - Page 6	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Groundwater Pump			ea	$3,857.84	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Centrifugal Pump			ea	$4,150.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Equalization Tank			ea	$3,320.00	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Air Stripper			ea	$25,773.16	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Carbon Vessel			ea	$22,605.88	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Bag Filter			ea	$524.56	$0	$0	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Instrumentation, Electrical			ls	$25,000.00	$0	$0	Engineer's Judgement	
Startup and Testing			ls	$10,000.00	$0	$0	Engineer's Judgement	
Additional Overhead and Profit (does not include property acquisition)		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 4 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 4 - IRM SVE/AS, EHC Injection, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
8	**Startup Groundwater Monitoring - Quarterly for 2 years**				**$202,129**	**$202,129**		
Labor (2 @ $35)		1,080.00	hr	$70.00	$75,600	$75,600	Engineer's Judgement	Assume 2 workers, 60 hrs each per event, 9 total events
Sampling Equipment		9	ls	$3,000.00	$27,000	$27,000	Engineer's Judgement	Assume $3,000 per event
Laboratory Analysis		360	ea	$69.47	$25,009	$25,009	NYSDEC Standby Contract Rate	40 samples per event
Report Preparation		9	ea	$5,000.00	$45,000	$45,000	Engineer's Judgement	Assume $5,000 per event
Additional Overhead and Profit		20	%		$29,520	$29,520	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

9	**Site Management Plan**				**$40,600**	**$40,600**		
Labor		450.00	hr	$90.00	$40,500	$40,500	Engineer's Judgement	
Direct Costs		1	ls	$100.00	$100	$100	Engineer's Judgement	

Sales Tax Rate 1.08875

$0

TOTAL CAPITAL COST OF ALTERNATIVE **$2,215,517**

Klink Cosmo
Feasibility Study

ALTERNATIVE 5 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 5 - IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
1	**Site Services**				**$169,926**	**$178,896**		
Health and Safety		1.0	ls	$1,000.00	$1,000	$1,000	Engineer's Judgement	
Community Air Monitoring		40.0	day	$1,500.00	$60,000	$65,325	Ronkonkoma Average Bid	Assume CAMP required during any intrusive work
Erosion and Sediment Control		1.0	ls	$200.00	$200	$200	Engineer's Judgement	
Spill Containment		1.0	ls	$1,000.00	$1,000	$1,000	Engineer's Judgement	
Contractor's Project Manager		20.0	day	$960.00	$19,200	$19,200	Engineer's Judgement	
Office Trailer Rental		2.5	mo	$440.00	$1,100	$1,198	MII 2016 Cost Book	
Storage Box Rental		2.5	mo	$108.00	$270	$294	MII 2016 Cost Book	
Port-A-John Rental		2.5	mo	$99.00	$248	$269	MII 2016 Cost Book	
20 CY C&D Dumpster Rental with service		10.0	week	$565.00	$5,650	$6,151	MII 2016 Cost Book	
Temporary Electric - Transformer		1.0	ea	$3,246.96	$3,247	$3,535	MII 2016 Cost Book	
Temporary Electric - Underground Feed		1.0	ea	$2,116.96	$2,117	$2,305	MII 2016 Cost Book	
Temporary Electric - Trailer Connection		1.0	ea	$1,123.48	$1,123	$1,223	MII 2016 Cost Book	
Office Supplies		2.5	mo	$80.00	$200	$218	MII 2016 Cost Book	
Office Equipment		2.5	mo	$200.00	$500	$544	MII 2016 Cost Book	
Electric Bill		2.5	mo	$160.00	$400	$436	MII 2016 Cost Book	
Water Bill		2.5	mo	$30.00	$75	$75	Engineer's Judgement	
Phone/Internet Bill		2.5	mo	$85.00	$213	$231	MII 2016 Cost Book	
Site Security		70.0	day	$500.00	$35,000	$35,000	Engineer's Judgement	
Geophysical Survey		2.0	day	$2,500.00	$5,000	$5,444	IRM Cost Estimate - Page 8	
Project Sign		1.0	ls	$1,000.00	$1,000	$1,089	Engineer's Judgement	
Submittals		1.0	ls	$20,000.00	$20,000	$21,775	Engineer's Judgement	
Additional Overhead and Profit		20	%		$12,384	$12,384	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook
2	**SSD Systems**				**$16,015**	**$16,292**		
Radon Fan		4	ea	$389.00	$1,556	$1,694	Grainger	
PVC Piping		200	lf	$5.44	$1,088	$1,185	Grainger	Assume 50 lf per system
Pipe hangers, elbows, couplings, etc.		1	ls	$108.80	$109	$109	Engineer's Judgement	Assume 10% of cost of piping
Installation Labor (2 @ $59.83)		80	hr	$119.66	$9,573	$9,573	Engineer's Judgement	Assume 5 days total
Electric - Conductor		200	lf	$0.88	$176	$192	Grainger	Assume 50 lf per system
Electric - Conduit		200	lf	$1.51	$302	$329	Grainger	Assume 50 lf per system
Electric - hangers, elbows, couplings, etc.		1	ls	$17.60	$18	$18	Engineer's Judgement	Assume 10% of cost of conduit
Startup and Testing Labor (1 @ $59.83)		8	hr	$59.83	$479	$479	Engineer's Judgement	Assume 2 hours per system
Additional Overhead and Profit		20	%		$2,715	$2,715	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 5 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 5 - IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
3	**SVE/AS System**				**$379,240**	**$406,879**		
SVE Well Installation		4	ea	$6,247.00	$24,988	$27,206	IRM Cost Estimate - Page 2	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
AS Well Installation		5	ea	$6,671.00	$33,355	$36,315	IRM Cost Estimate - Page 3	Cost includes well installation, pre-clearing and well development/IDW T&D. Geophysical survey, H&S and mob are estimated elsewhere.
System Procurement		1	ls	$3,618.00	$3,618	$3,939	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System Construction		1	ls	$93,015.00	$93,015	$101,270	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
System On-Site Installation and Startup		1	ls	$21,540.00	$21,540	$23,452	IRM Cost Estimate - Page 5	Cost for Labor, Subs and Equipment
Sidewalk Demo, transport and disposal		98	sy	$46.91	$4,597	$5,005	IRM Cost Estimate - Page 1	
Trench Excavation, Transport and Disposal		38	cy	$602.00	$22,575	$24,579	IRM Cost Estimate - Page 1	
Install SVE/AS Piping		770	lf	$30.19	$23,246	$25,309	IRM Cost Estimate - Page 1	
Trench Backfill and Compaction		38	cy	$34.83	$1,333	$1,451	IRM Cost Estimate - Page 1	
Manifold Chamber Excavation, Transport and Disposal		5	cy	$1,430.92	$6,582	$7,166	IRM Cost Estimate - Page 1	
Manifold Chamber Backfill and Compaction		5	cy	$50.26	$264	$288	IRM Cost Estimate - Page 1	
AS/SVE Chambers		13	ea	$1,700.00	$22,100	$24,061	IRM Cost Estimate - Page 1	
Entry Boot Fittings		26	ea	$61.00	$1,586	$1,727	IRM Cost Estimate - Page 1	
Lifting Cover Handles		3	ea	$354.00	$1,062	$1,156	IRM Cost Estimate - Page 1	
Manifold Chambers		1	ea	$5,940.00	$5,940	$6,467	IRM Cost Estimate - Page 10	
Sidewalk Restoration		1,000	sf	$40.00	$40,000	$43,550	IRM Cost Estimate - Page 6	
Sample analysis		25	ea	$225.00	$5,625	$6,124	IRM Cost Estimate - Page 7	
Additional Overhead and Profit		20	%		$67,813	$67,813	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
4	**Injection Well Installation**				**$226,510**	**$246,621**		
Source Perimiter					**$74,910**	**$81,558**		
Injection Well Installation		10	ea	$6,291.00	$62,910	$68,493	IRM Cost Estimate - Page 9	
Well Development and IDW T&D		10	ea	$1,200.00	$12,000	$13,065	IRM Cost Estimate - Page 9	
Division East					**$151,600**	**$165,055**		
Injection Well Installation		20	ea	$6,380.00	$127,600	$138,925	IRM Cost Estimate - Page 10	
Well Development and IDW T&D		20	ea	$1,200.00	$24,000	$26,130	IRM Cost Estimate - Page 10	
Division West					**$0**	**$8**		
Injection Well Installation		0	ea	$6,165.00	$0	$0	IRM Cost Estimate - Page 11	
Well Development and IDW T&D		0	ea	$1,200.00	$0	$8	IRM Cost Estimate - Page 11	

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
5	**Permanganate Injection**				**$1,028,871**	**$1,103,855**		
Material Purchase		112,472	gal	$6.00	$674,832	$734,723	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds		2	ls	$8,329.37	$16,659	$18,137	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)		32	hr	$119.66	$3,829	$4,169	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)		1,250	hr	$119.66	$149,575	$162,850	Total of 3 areas	
Source Perimeter					**$136,215**	**$146,106**		
Material Purchase		17,186	gal	$6.00	$103,116	$112,268	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds		1	ls	$8,329.37	$8,329	$9,069	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		16	hr	$119.66	$1,915	$1,915	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		191	hr	$119.66	$22,855	$22,855	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division East					**$708,680**	**$760,159**		
Material Purchase		95,286	gal	$6.00	$571,716	$622,456	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds		1	ls	$8,329.37	$8,329	$9,069	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		16	hr	$119.66	$1,915	$1,915	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		1,059	hr	$119.66	$126,720	$126,720	Engineer's Judgement	Assume 3 gpm, 2 laborers
Division West					**$0**	**$0**		
Material Purchase		0	gal	$6.00	$0	$0	Cost per IRM Cost Estimate, quantity per CRT Calculation	Assume cost includes delivery and mixing
Injection piping, valves, flow meters, pressure gauges, and manifolds		0	ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)		0	hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)		0	hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Additional Overhead and Profit		20	%		$183,976	$183,976	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 5 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 5 - IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
6	**EHC Injection**				**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Total of 3 areas	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Total of 3 areas	
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Total of 3 areas	
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Total of 3 areas	
Source Perimeter					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division East					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Division West					**$0**	**$0**		
ECH Material Purchase and Delivery			gal	$4.45	$0	$0	Cost and Quantity per PeroxyChem Quote/calculation	
Injection piping, valves, flow meters, pressure gauges, and manifolds			ls	$8,329.37	$0	$0	Grainger/Engineer's Judgement	Manifold can be constructed once and re-used. One per injection area.
Labor for Piping/Manifold Setup (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	1 day for 2 workers to construct. One per Injection Area.
Labor for Administering Injections (2 @ $59.83)			hr	$119.66	$0	$0	Engineer's Judgement	Assume 3 gpm, 2 laborers
Mixing and Delivery per truck			ea	$2,000.00	$0	$0	Engineer's Judgement	4,000 gal truck
Additional Overhead and Profit		20	%		$0	$0	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

7	**Hydraulic Containment**				**$1,908,972**	**$1,928,097**		
Purchase Adjoining Property		1.00	ls	$1,650,000.00	$1,650,000	$1,650,000	Market Listing for Nearby Property	
Treatment System Enclosure		1	ls	$66,649.00	$66,649	$72,564	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Extraction Well Installation		3	ea	$9,130.00	$27,390	$29,821	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Groundwater Treatment System Piping		300	lf	$15.83	$4,749	$5,171	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Assume 100 lf per well
Trench Excavation Across Richardson Street		67	cy	$8.49	$569	$619	RS Means	Assume 100 lf of trench, 3ft x 6 ft
Pipe Trench Backfill & Compaction		67	cy	$53.75	$3,601	$3,921	RS Means	Assume same as trench excavation volume
Asphalt Saw-Cutting		60	lf	$2.06	$124	$135	RS Means	Assume 30 ft road crossing
Sidewalk Demo, Transport and Disposal		17	sy	$46.91	$797	$868	IRM Cost Estimate - Page 1	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Asphalt Restoration		180	sf	$4.79	$862	$939	RS Means	Assume 60 ft road crossing, 3 ft wide
Sidewalk Restoration		150	sf	$40.00	$6,000	$6,533	IRM Cost Estimate - Page 6	Assume 3 sidewalk flags on either side of the street, 25 sf ea.
Groundwater Pump		3	ea	$4,243.62	$12,731	$13,861	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Centrifugal Pump		2	ea	$4,565.00	$9,130	$9,940	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Equalization Tank		1	ea	$3,652.00	$3,652	$3,976	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Air Stripper		1	ea	$28,350.48	$28,350	$30,867	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Carbon Vessel		2	ea	$24,866.47	$49,733	$54,147	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Bag Filter		2	ea	$577.02	$1,154	$1,256	Chem Core FS Estimate (Escalated from 2002, 66% per USACE guidance), marked up 10% for work in NYC	Cost reference is for a 40 gpm system, so assume the same capacity
Instrumentation, Electrical		1	ls	$25,000.00	$25,000	$25,000	Engineer's Judgement	
Startup and Testing		1	ls	$10,000.00	$10,000	$10,000	Engineer's Judgement	
Additional Overhead and Profit (does not include property acquisition)		20	%		$8,480	$8,480	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook

Klink Cosmo
Feasibility Study

ALTERNATIVE 5 ESTIMATE SUMMARY

Client	NYSDEC	**Project Number**	60521141	
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date: 7-24-18
Title	Alternative 5 - IRM SVE/AS, Permanganate Injection, Hydraulic Containment/Removal, Soil Cover, SSDS, Institutional Controls with Site Management	**Checked By:**	MG	Date: 7-24-18

Item	Description	Qty	UOM	Unit Cost	Total Cost	Total Cost plus Tax	Reference	Assumptions
8	**Startup Groundwater Monitoring - Quarterly for 2 years**				**$202,129**	**$202,129**		
Labor (2 @ $35)		1,080.00	hr	$70.00	$75,600	$75,600	Engineer's Judgement	Assume 2 workers, 60 hrs each per event, 9 total events
Sampling Equipment		9	ls	$3,000.00	$27,000	$27,000	Engineer's Judgement	Assume $3,000 per event
Laboratory Analysis		360	ea	$69.47	$25,009	$25,009	NYSDEC Standby Contract Rate	40 samples per event
Report Preparation		9	ea	$5,000.00	$45,000	$45,000	Engineer's Judgement	Assume $5,000 per event
Additional Overhead and Profit		20	%		$29,520	$29,520	20% of select costs (engineers's judgement, vendor/online quotes, IRM Cost Estimate), no sales tax	O&P already included in costs obtained from bids, similar projects, and MII 2016 Costbook
9	**Site Management Plan**				**$40,600**	**$40,600**		
Labor		450.00	hr	$90.00	$40,500	$40,500	Engineer's Judgement	
Direct Costs		1	ls	$100.00	$100	$100	Engineer's Judgement	

Sales Tax Rate 1.08875

$0

TOTAL CAPITAL COST OF ALTERNATIVE **$4,123,369**

Klink Cosmo
Feasibility Study

ANNUAL COSTS SUMMARY

Client	NYSDEC	**Project Number**	60521141		
Project	Klink Cosmo FS	**Calculated By:**	DNM	Date:	4/27/2018
Title	Annual Costs	**Checked By:**		Date:	

Description	QTY	UNITS	UNIT COST	TOTAL COST
1 Annual Groundwater Monitoring				**$17,400.00**
Groundwater Analysis - VOCs	40	ea	$70.00	$2,800.00
Sampling Labor	120	hr	$80.00	$9,600.00
Supplies and sampling equipment	1	ls	$5,000.00	$5,000.00
2 Annual and 5-year Reporting				**$14,400.00**
Labor for Annual Report	120	hr	$100.00	$12,000.00
Direct Cost for Annual Report	1	ls	$200.00	$200.00
Labor for 5-Year Review (on annual basis)	20	hr	$110.00	$2,200.00
Direct Cost for 5-Year Review (on annual basis)	1	ls	$200.00	$200.00
3 SSD System O&M (Annual)				**$8,180.00**
Labor (8 hours per month)	96	hr	$80.00	$7,680.00
Supplies/tools	1	ls	$500.00	$500.00
4 Hydraulic Containment/Removal System O&M (Annual)				**$61,600.00**
Labor (1 eight-hour site visit per week)	416	hr	$80.00	$33,280.00
Management and Supervision	100	hr	$80.00	$8,000.00
Supplies/tools	1	ls	$1,000.00	$1,000.00
Carbon Vessel Replacement (once per year)	2	ea	$3,600.00	$7,200.00
Monthly Effluent Sampling/Analysis	12	mo	$300.00	$3,600.00
Cost for Sewer Discharge	12	mo	$100.00	$1,200.00
Equipment Maintenance and Repair	1	ls	$3,000.00	$3,000.00
Utiulity Cost for System Operation	12	mo	$350.00	$4,200.00
Bag Filter Replacement (12 times per year)	24	ea	$5.00	$120.00
5 SVE/AS System O&M (Annual)				**$60,780.00**
Labor (1 eight-hour site visit per week)	416	hr	$80.00	$33,280.00
Management and Supervision	100	hr	$80.00	$8,000.00
Supplies/tools	1	ls	$1,000.00	$1,000.00
Carbon Vessel Replacement (once per year)	2	ea	$3,600.00	$7,200.00
Monthly Effluent Sampling/Analysis	12	mo	$300.00	$3,600.00
Waste Water Disposal	1	ls	$500.00	$500.00
Equipment Maintenance and Repair	1	ls	$3,000.00	$3,000.00
Utiulity Cost for System Operation	12	mo	$350.00	$4,200.00