FOCUSED FEASIBILITY STUDY REPORT

STANDARD CHLORINE CHEMICAL CO. INC. SITE

KEARNY, NEW JERSEY

Prepared for:

Performing Parties Group

(Beazer East, Inc., Cooper Industries, LLC, Tierra Solutions, Inc. on behalf of Occidental Chemical Corporation, and Apogent Transition Corporation)

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ABBREVIATIONS/ACRONYMS

ACM	Asbestos-Containing Materials
ACO	Administrative Consent Order
Agreement	Administrative Settlement Agreement and Order on Consent
AOC	Area of Contamination
Beazer	Beazer East, Inc.
BHHRA	Baseline Human Health Risk Assessment
CA	Consolidation Area
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cloroben	Cloroben Chemical Corporation
cm/sec	Centimeters per Second
COCs	Constituents of Concern
COPR	Chromite Ore Processing Residue
DCB	Dichlorobenzene
DNAPL	Dense Non-Aqueous Phase Liquid
Edison	Thomas A. Edison, Inc. Emark Battery Corporation
EE/CA	Engineering Evaluation/Cost Analysis
FFS	Focused Feasibility Study
gpm	Gallons per Minute
GRA	General Response Action
Group	Performing Parties Group
GWQC	Groundwater Quality Criteria
HABS	Historic American Buildings Survey
HASP	Health and Safety Plan
HCIA	Hudson County Improvement Authority
HCTS	Hydraulic Control Treatment System
HDPE	High-density polyethylene
ICs	Institutional Controls
ICTM	Identification of Candidate Technologies Memorandum
IRA	Interim Response Action
IRAR	Interim Response Action Report
IRAW	Interim Response Action Work Plan
IRM	Interim Remedial Measure
KEY	Key Environmental, Inc.
Langan	Langan Engineering and Environmental Services
MCL	Maximum Contaminant Levels
mg/kg	Milligram per Kilogram
NAPL	Non-Aqueous Phase Liquid

ABBREVIATIONS/ACRONYMS
(Continued)

NCP	National Contingency Plan
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJPDES	New Jersey Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation, Maintenance, and Monitoring
OCC	Occidental Chemical Corporation
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
oz/sy	Ounce per Square Yard
PRG	Peninsula Restoration Group
RA	Removal Action
RAOs	Remedial Action Objectives
RATM	Remedial Alternatives Technical Memorandum
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
RI/FFS	Remedial Investigation/Focused Feasibility Study
SCCC	Standard Chlorine Chemical Co., Inc.
SCSR	Site Characterization Summary Report
Sitex	The Sitex Group
SLERA	Screening Level Ecological Risk Assessment
SNP	Standard Naphthalene Products Company, Inc.
SOW	Statement of Work
SSP	Steel Sheet Pile
TI	Technical Impracticability
Tierra	Tierra Solutions, Inc.
USEPA	United States Environmental Protection Agency
WRA	Well Restriction Area

EXECUTIVE SUMMARY

This Focused Feasibility Study Report (FFS Report) for the Standard Chlorine Chemical Co. Inc. (SCCC) Site (SCCC Site) [1] located in Kearny, New Jersey has been prepared by Key Environmental, Inc., (KEY) on behalf of the SCCC Site Performing Parties Group (Group). The Group consists of Beazer East, Inc. (Beazer), Cooper Industries, LLC, Tierra Solutions, Inc. (Tierra), on behalf of Occidental Chemical Corporation (OCC), and Apogent Transition Corp. This work is being conducted pursuant to the Remedial Investigation/Focused Feasibility Study (RI/FFS) Statement of Work (SOW) issued by the United States Environmental Protection Agency (USEPA) as Appendix A of the Administrative Settlement Agreement and Order on Consent dated May 3, 2013 (Agreement). For the purposes of this FFS Report, the SCCC Site has been divided into two areas designated as Area 1 and Area 2. Area 1 is within the existing barrier wall system (i.e., slurry wall) and includes the entire SCCC Property and the impacted subsurface soil and groundwater within the slurry wall in the western part of the Hudson County Improvement Authority (HCIA) property (former Seaboard Site) that represent contiguous impacts associated with the SCCC Site. Area 2 includes the area located outside of the slurry wall to the southwest of Area 1, and is comprised of a portion of the HCIA property outboard of the slurry wall and a portion of the NJDOT right-of-ways for the Belleville Turnpike and Newark Turnpike.

The development and evaluation of the remedial alternatives in this FFS Report consider the reasonably anticipated future uses of the SCCC Site. Where practicable and cost-effective, the remedial alternative selected would be designed to accommodate potential commercial/industrial development of Area 1. As directed by the USEPA, the demolition of the Edison Buildings on the SCCC Property has been added as a component of each remedial alternative presented herein with the exception of the "No Action" Alternative (Alternative I). The majority of the acreage within Area 2 is a New Jersey Department of Transportation right-of-way occupied by highway and associated steep embankments. It is reasonably anticipated that the future use of Area 2 will be the same as its current use.

Areas and/or Volumes of Media

The surface area of Area 1 of the SCCC Site is approximately 25 acres consisting primarily of the former SCCC Property. Approximately 17.25 acres of the SCCC Site are covered with various Interim Remedial Measures (IRM) cover as depicted in Figure 1-4. The combined volume of

[1] As explained in Section 1.2.1, the term "SCCC Site" is defined to include the property boundaries of the historical SCCC Property as well as adjacent and nearby areas subject to contamination and in very close proximity to the contamination necessary for the implementation of the response action.

impacted soil and fill beneath existing surface covers, assuming an average depth of six feet to the top of the meadow mat, is approximately 167,000 cubic yards, of which 7,300 cubic yards is comprised of the remediated lagoon solids.

The groundwater beneath the 13 acres on the western portion of the adjacent HCIA (former Seaboard) Site that is enclosed by the barrier wall system is also considered part of Area 1. The volume of impacted groundwater within the containment system beneath the SCCC Site and Seaboard Site is estimated at 56 million gallons assuming a saturated thickness of 15 feet (seven feet for the shallow fill unit and eight feet for the deep sand unit) and porosity of 30%.

The impacted groundwater limits for Area 2 were identified based on the presence of dense non-aqueous phase liquids (DNAPL) and SCCC Site-related constituent concentrations exceeding their respective Maximum Contaminant Levels (MCLs) and/or New Jersey Groundwater Quality Criteria (GWQC). These approximate impacted groundwater limits encompass approximately 3.8 acres.

The Area 2 DNAPL gauging results are presented in the Remedial Investigation Report Addendum. In addition to the monitoring well locations where DNAPLs have accumulated, soil boring locations where a free phase DNAPL layer was observed were used to define the DNAPL impacted area. The area in which DNAPL has been observed within Area 2 comprises approximately 1.1 acres.

The preliminary areal extents and volumes of media stated above may be refined during subsequent technical evaluations and design phases.

Remedial Action Objectives (RAOs)

The RAOs for the SCCC Site are summarized as follows:

- Eliminate human exposure to COCs in surface soil and subsurface soil via direct contact, incidental ingestion, and inhalation.
- Eliminate the transport of impacted surface soil by erosion and runoff or wind.
- Prevent human exposures to SCCC Site-related contaminated groundwater via direct contact, incidental ingestion, and inhalation.
- Eliminate the release or threat of release of asbestos and lead into the environment from the dilapidated Edison Buildings.
- Prevent future unacceptable risks due to soil vapor intrusion into new buildings.
- Prevent the migration of SCCC Site-related DNAPL into areas without DNAPL contamination.
- Prevent the migration of contaminated groundwater into uncontaminated groundwater, surface water, and wetlands.

- Reduce the mass of SCCC Site-related DNAPL in the subsurface to the extent practicable.

Restoration of groundwater is not an RAO for Area 1 and Area 2 for the reasons presented in Section 4.5, Justification of TI Waiver and Appendix A, Technical Impracticability Waiver Evaluation Report.

Evaluation and Screening of Technologies

Technology screening was conducted to focus the number of viable technologies from which remedial alternatives are assembled and evaluated with respect to their effectiveness, implementability, and cost. The following technologies and associated process options were retained for further consideration and subsequent alternatives development:

No Action (Area 1 and Area 2)

Institutional Controls (Area 1 and Area 2)

- Updated Classification Exception Area/Well Restriction Area for Area 1 and new Classification Exception Area/Well Restriction Area for Area 2;
- Land Use Deed Notices and other land use controls; and.
- Soil Management/Health &Safety Deed Notices.

Land Use Administration (Area 1)

- Health and Safety Requirements

Existing Remediation (Area 1)

- Continued Operation, Maintenance & Monitoring (O&M) of the Groundwater Extraction and Treatment, DNAPL Recovery/Disposal and Barrier Wall Systems

Targeted Placement of Cover Materials (Area 1)

- Cap/Cover

SCCC Site-wide Fill – Cover Placement *(Area 1)*

- Cap/Cover

Stormwater Management Improvements (Area 1)

- Drainage Controls

Vapor Control (Area 1)

- Vapor Control Barriers if new buildings are constructed

Collection and Disposal of DNAPL (Area 2)

- Passive Recovery (Wells and/or Trenches)/Off-site Disposal; and,
- Additional O&M including a TI Waiver

Development of Alternatives

The retained technologies were combined into comprehensive alternatives. The major components of the alternatives are presented below.

Alternative I: No Action (an alternative required for evaluation by the National Contingency Plan (NCP))

Alternative II:

- Passive DNAPL Recovery in Area 1 and Area 2
- Institutional Controls
- Demolition of the Edison Buildings
- Operation, Maintenance and Monitoring (O&M) and Five Year Reviews

Alternative III:

- Targeted Area 1 Cap/Cover
- Passive DNAPL Recovery in Area 1 and Area 2
- Institutional Controls
- Demolition of the Edison Buildings
- O&M and Five Year Reviews

Alternative IV:

- Site-wide Engineered Cap/Cover
- Passive DNAPL Recovery in Area 1 and Area 2;
- Institutional Controls

- Demolition of the Edison Buildings
- O&M and Five Year Reviews

Analysis of Alternatives

Each of the four alternatives was evaluated in detail and compared relative to seven of the nine criteria established under §300.430(e)(9)(iii) of the NCP. Following the individual analysis of each alternative, a comparative analysis was performed to assess each alternative relative to the others with respect to the seven of nine NCP criteria. The remaining two criteria, State acceptance and Community Acceptance, will be assessed by the USEPA in the Record of Decision to be issued following a public comment period.

Summary of Alternatives Analysis Results and Conclusions

A conceptual plan for redevelopment of the SCCC Property for use as a warehousing and distribution facility has been prepared. The remedial alternatives developed and evaluated herein are compatible with this potential future use of the property. When practicable and cost-effective, the remedial alternative selected would be designed to accommodate other potential commercial/industrial development in Area 1, including the 13-acre portion of the HCIA property included in Area 1 while at the same time maintaining the protectiveness provided by the remedy. A summary of the alternatives analysis results and conclusions is presented below.

- Alternative I does not meet the threshold criteria of Overall Protection of Human Health and the Environment and Compliance with Applicable or Relevant and Appropriate Requirements. For this reason, it is not considered further in the comparative analysis.

- Alternatives II, III, and IV are equivalent with respect to satisfying the threshold criteria of Overall Protection of Human Health and the Environment and Compliance with Applicable or Relevant and Appropriate Requirements.

- Alternative II, III, and IV are equivalent with respect to satisfying the balancing criteria of Long Term Effectiveness and Permanence, and Implementability evaluation criteria.

- Alternatives II and III are better than Alternative IV in terms of the balancing criterion of Short Term Effectiveness as these alternatives can be constructed in shorter time frames.

- Alternative IV is slightly better with respect to the balancing criterion of Reduction of Toxicity, Mobility, or Volume because the geomembrane component of this alternative virtually eliminates infiltration (although not through treatment). The reduction of

toxicity and volume of COCs via the Area 1 groundwater treatment system and other technologies in impacted media would continue for Alternatives II, III, and IV.

- Estimated costs for Alternative II and Alternative III are fairly similar, with costs for Alternative III being slightly higher than Alternative II. The estimated cost of Alternative IV is substantially higher than Alternatives II and III.

1.0 INTRODUCTION

This Focused Feasibility Report (FFS Report) for the Standard Chlorine Chemical Co. Inc. (SCCC) Site (SCCC Site)[2] located in Kearny, New Jersey (Figure 1-1) has been prepared by Key Environmental, Inc., (KEY) on behalf of the SCCC Site Group. The Performing Parties Group (Group) consists of Beazer East, Inc. (Beazer), Cooper Industries, LLC, Tierra Solutions, Inc. (Tierra), on behalf of Occidental Chemical Corporation (OCC), and Apogent Transition Corp. This work is being conducted pursuant to the Remediation Investigation/Focused Feasibility Study Report (RI/FFS) Statement of Work (SOW) issued by the United States Environmental Protection Agency (USEPA) as Appendix A of the Agreement.

This FFS Report is the third of three feasibility study-related documents for the SCCC Site. The first such document was an Identification of Candidate Technologies Memorandum (ICTM) dated April 2014 (KEY, April 2014). The ICTM was prepared to address the SOW Section VI, Task 5 – Identification of Candidate Technologies. The ICTM was approved by the USEPA on June 3, 2014 and, in part, formed the basis for the second feasibility study-related document titled Development and Screening of Remedial Alternatives Technical Memorandum (Remedial Alternatives Technical Memorandum, or RATM). The RATM was submitted to the USEPA on February 23, 2015 (KEY, February 2015) to address the requirements of the SOW, Section X, Task 9 – Development and Screening of Remedial Alternatives. The USEPA issued comments pertaining to the RATM on March 30, 2015 (USEPA, March 2015). The USEPA comments on the RATM have been addressed where applicable in this FFS Report. Also, this FFS Report has been prepared (with minor modifications) in accordance with the draft FFS Report Table of Contents sent by email to the USEPA on June 18, 2015 (KEY, June 2015). The Draft FFS Report was submitted to the USEPA on July 28, 2015 (KEY, July 2015). The USEPA issued FFS comments in the letter dated October 1, 2015 (USEPA, October 2015). The FFS was subsequently submitted to the USEPA on March 31, 2016 (KEY, March 2016). In addition, this report incorporates the responses to the USEPA's comments on the FFS, provided via email on February 22, 2016 and February 25, 2016. KEY presented a summary of the FFS during a meeting at the USEPA, New York office on April 14, 2016. The meeting was attended by representatives from the USEPA, the NJDEP and the Group, and the Group responded to USEPA and NJDEP

[2] As explained in Section 1.2.1, the term "SCCC Site" is defined to include the property boundaries of the historical SCCC Property as well as adjacent and nearby areas subject to contamination and in very close proximity to the contamination necessary for the implementation of the response action. Where context requires, which the report makes self-evident, the definition of SCCC Site should be construed accordingly.

comments/questions as part of the meeting. This revised FFS includes the responses to the FFS comments provided by the USEPA in the letter dated May 20, 2016 (USEPA, May 2016).

The activities presented in the FFS Report are limited to upland issues at the SCCC Site and do not address contamination in the Hackensack River. Certain river investigations have been implemented by members of the Group. These investigations served as the basis for interim response actions including construction of the barrier wall system and the removal, stabilization, and on-site consolidation of impacted near shore sediments within 50 feet of the SCCC Site bank. Potential additional investigation of the Hackensack River with respect to historic releases at the SCCC Site is under consideration by the USEPA and NJDEP. The USEPA and NJDEP agree that the barrier wall system is currently preventing unauthorized discharges from the SCCC Site to the Hackensack River.

The SOW specifically recognizes that significant remedies are already in place for the SCCC Site and that the Feasibility Study for the SCCC Site under current conditions should be a focused effort (i.e., preparation of an FFS Report). The remedial activities completed to date have a direct bearing on any additional future responses and associated technologies/process options to be considered as the completed remedial actions were intended and specifically implemented to represent major components of a final remedy for the SCCC Site.

This FFS Report has been prepared based on consideration of all historical remedial activities including work completed under Interim Remedial Measures (IRMs), the multi-site Interim Response Actions (IRAs) and historical/ongoing SCCC Site characterization. To facilitate implementation of the IRA, building demolition work was also completed on Lots 48 and 49 subject to approval by the New Jersey Department of Environmental Protection (NJDEP) and asbestos abatement and construction (demolition) permits issued by the Town of Kearny. Detailed information regarding the IRA is provided in documents listed in the Reference section of this FFS Report (i.e., KEY, December, 2010, April, 2011, December 2011, March, 2012, April 2012, and May 2012).

Figure 1-2 shows the historical SCCC Property arrangement plan (pre-IRA). For the purposes of this FFS, the Site has been divided into two areas designated as Area 1 and Area 2 as shown on Figure 1-3. Area 1 is within the existing slurry wall as described in the RATM. Area 1 includes the SCCC Property minus the riparian parcel and the impacted subsurface soil and groundwater within the SCCC Site slurry wall in the western part of the HCIA property (former Seaboard Site) that represent contiguous impacts associated with the SCCC Site. The RI Report (KEY, October 2015) covering Area 1 was approved by the USEPA by letter dated October 9, 2015.

Area 2 includes the area located outside of the slurry wall to the southwest of Area 1 as shown on Figure 1-3. DNAPL and impacted groundwater have been identified outside of the slurry wall in

this area. Investigation activities were completed to determine the extent of DNAPL and impacted groundwater in Area 2 and assess the recoverability of DNAPL in this area. The results of the Area 2 investigation are provided in the RIR Addendum (KEY, January 2016). The RIR Addendum was approved by the USEPA by letter dated March 1, 2016.

1.1 FFS REPORT OBJECTIVES

This FFS Report has been prepared to address the requirements of the SOW, Section XI, Task 10 – FFS Report. As specified in the SOW, the FFS Report shall:

- Describe the existing remedial measures or responses;
- Summarize the FFS Objectives;
- Summarize the remedial action objectives (RAOs);
- Articulate the general response actions (GRAs);
- Identify and screen remedial technologies;
- Describe the remedial alternatives;
- Perform a detailed analyses of the remedial alternatives; and,
- Present the FFS summary and conclusions.

This FFS Report also includes the information requested as part of the USEPA RATM comments letter. No treatability studies per Section VII, Task 6 of the SOW (Treatability Studies, As Necessary) are warranted at this time to support the development of remedial alternatives.

The development and evaluation of the remedial alternatives in this FFS Report considers the reasonably anticipated future uses of the SCCC Site. With respect to Area 1, the Town of Kearny, which owns the SCCC Property, recently adopted a resolution (Resolution 2016-250) conditionally designating the Sitex Group, LLC (Sitex) as the redeveloper for the SCCC Property and adjacent Diamond Site. Currently, Sitex is planning to construct an 850,000 square foot warehouse and distribution center on the SCCC Property and adjacent Diamond Site. Plans for redevelopment of the portion of Area 1 on the HCIA property are also underway. According to information provided by HCIA to the USEPA, HCIA has entered into a Purchase and Sale Agreement with Morris Kearny Associates, LLC (MKA) to develop the former Koppers Seaboard Site, including the 13 acres of land within the SCCC Site barrier wall system. The current redevelopment plan includes the construction of four new industrial warehouse buildings, totaling approximately 2.1 million square feet, along with paved parking lots, paved roads, and utility infrastructure.

It is reasonably anticipated that the future use of Area 2 will remain consistent with its current use which is primarily as an NJDOT right-of-way with the majority of acreage within Area 2 occupied by highway and associated steep embankments.

1.2 SITE BACKGROUND

The SCCC Property is located at 1025-1035 Belleville Turnpike in Kearny, New Jersey. Figure 1-1 is a SCCC Site location map that shows the existing SCCC Property boundaries on a base map which consists of combined portions of two United States Geologic Survey 7.5 minute quadrangles (Jersey City and Weehawken, New Jersey). The SCCC Site is situated adjacent to the Hackensack River in Hudson County, New Jersey, and is located approximately 4,000 feet east of the intersection of I-95 and I-280. The SCCC Site is bounded on the northeast by the Hackensack River, on the south by the adjacent Seaboard Site, on the north by the adjacent Diamond Site, and to the west by the Belleville Turnpike. Substantial remedial measures have been implemented at the SCCC Site as summarized in Section 1.2.7. The Historical SCCC Property Arrangement Plan is provided as Figure 1-2.

1.2.1 SCCC Site Description

The following descriptors used in this report are defined as follows:

"SCCC Property" – The property formerly owned by Standard Chlorine Chemical Co. Inc. and/or its affiliated company Standard Naphthalene Products Company, Inc. comprised of Kearny Tax Map Block 287 Lots 48 through 52 and 52R.

"Area 1" – This area includes the upland portions of the SCCC Property (i.e., Lots 48 through 52) and the 13 acres of the adjacent HCIA property (aka, the former Koppers Seaboard Site) which is enclosed within the SCCC Site barrier wall system as shown on Figure 1-3.

"Area 2" – The area to the south of the barrier wall extension onto the HCIA property as shown on Figure 1-3. The area is defined as the areal extent of SCCC Site-related contamination and areas in very close proximity necessary for implementation of the remedial action.

"SCCC Site" – The SCCC Site is defined herein as the portion of the SCCC Property included within Area 1 and Area 2 (and may include adjacent and nearby area subject to contamination and in very close proximity to the contamination necessary for the implementation of the response action).

The boundaries of each of these areas are shown in Figure 1-3. The SCCC Property occupies an area of approximately 25 acres, consisting of six upland parcels and one riparian parcel. Five of the upland parcels and the riparian parcel, referred to on the Tax Map of the Town of Kearny as Block 287, Lots 48, 49, 50, 51, 52, and 52R, respectively are currently owned by the Town of Kearny. The property boundaries for these lots encompass another parcel (Lot 32.01) that is a former railroad right-of-way currently owned by the HCIA. Lot 32.01 roughly bisects the property

owned by the Town of Kearny from north to south. Figure 1-2 identifies the lot numbers for the various SCCC Site parcels. The SCCC Property is located along the tidal portion of the Hackensack River. The entire property lies within the 100-year floodplain of the Hackensack River (EDR, May 5, 2008).

The SCCC Site is located in a former meadow that was filled during the first half of the 20th century. The filling occurred to support industrial development of the SCCC Property and surrounding properties at that time. Significant areas of meadowlands remain north and west of the SCCC Site.

1.2.2 SCCC Site History

Since 1916, various forms of industrial manufacturing, chemical refining, blending/mixing, and/or processing have occurred on the different parcels that make up the SCCC Site. Activities included naphthalene refining and product formulation; lead-acid battery manufacture; formulation of drain cleaner; dye-carrier production; and distillation and purification of various chlorinated benzenes. Additionally, fill materials, including those containing chromite ore processing residue (COPR) and COPR-impacted soils, have been emplaced at the SCCC Site. These activities were performed by multiple parties on different parcels of the SCCC Site. Figure 1-2 is a map that shows the historical SCCC Site arrangement just prior to initiation of an extensive IRA completed from 2010 through 2011. The property lines and parcels, as well as the building numbers subsequently referenced, are also identified on Figure 1-2.

The northern portion of the SCCC Property, defined herein as Lots 48 and 49, was originally sold to the White Tar Company of New Jersey in 1916. White Tar Company was eventually acquired by the Koppers Company (and successors).

The southern portion of the SCCC Property, defined as Lots 50, 51, 52 and 52R (also known as 52.01) were acquired by Thomas Edison in 1917 and 1918 and, through a number of related party transfers, were owned by Thomas A. Edison, Inc. Emark Battery Corporation (Edison) by 1929, and used for lead acid battery production up to 1953. Lot 50 continued to be owned by Edison until December 1953 when the property was sold first to Crown Rubber Products and later to Keaton Rubber Company. For the period between 1954 and 1963, Tanatex Chemical Corporation leased space in Building 3 for its operations. For some or all of that period, it also leased space in Building 1 for its operations. By 1962, Lot 50 was sold to SCCC and its subsidiary Cloroben Chemical Corporation (Cloroben). Cloroben continued operating facilities at the SCCC Site until 1993.

In 1946, Koppers acquired Lots 51, 52 and 52R from Edison, and by 1962 sold all of its properties to Standard Naphthalene Products Company, Inc. (SNP) a wholly-owned subsidiary of SCCC. SNP and/or SCCC continued operations on Lots 51, 52, and 52R until 1981.

Information regarding past ownership and operations on Lot 32.01 is limited. The Lot is approximately twenty-five feet (25') wide and roughly bisects the SCCC Site as well as portions of the Seaboard Site to the south. The Lot formerly contained working rail lines associated with the former New York and Greenwood Lake Railroad and has not been used for industrial activities. Sometime after rail use was discontinued and prior to 1993, Lot 32.01 was acquired by the HCIA.

1.2.3 Current Ownership – SCCC Site

On October 10, 2010, the Town of Kearny, New Jersey completed a tax foreclosure on Lots 48, 49, 50, 51, 52, and 52R and is now the owner of those portions of the SCCC Site (i.e., the SCCC Property). Lot 32.01 is currently owned by the HCIA, as is the 13-acre portion of the Former Koppers Seaboard Site that is enclosed within the SCCC Site barrier wall system comprising a portion of Area 1. The majority of Area 2 consists of NJDOT right-of-way. A small portion of Area 2, located between the SCCC Site barrier wall and the northern limit of the NJDOT right-of-way for the Belleville Turnpike, is owned by HCIA.

A conceptual plan for redevelopment of the SCCC Property (as well as the adjoining Diamond Site) for use as a warehousing and distribution facility has been prepared. The conceptual plan would require the placement of several feet of structural fill over the majority of the SCCC Site as described to the Group by the Town of Kearny and the prospective site developer during a February 10, 2016 meeting. Final surface covers constructed on top of the structural fill would be comprised of buildings, concrete, asphalt, or vegetated areas. The remedial alternatives developed and evaluated herein are compatible with this potential future use of the property. Where practicable and cost-effective, the remedial alternative selected would be designed to accommodate other potential commercial/industrial development in Area 1, including the 13-acre portion of the HCIA property included in Area 1 while at the same time maintaining the protectiveness provided by the remedy.

1.2.4 Regulatory History

In October 1989, the NJDEP and SCCC entered into an Administrative Consent Order (ACO). This ACO required SCCC to plan and implement the following:

- IRMs to prevent potential contact with materials in the lagoon area and to secure damaged tanks and containers;

- A Remedial Investigation and Feasibility Study; and,
- Selected Remedial Alternative(s).

Subsequent to the ACO, an RI was conducted in a phased approach between 1990 and 1999. A number of contractors were involved with assessments of the lagoons, near-shore river environment, on-Site soils and fill material, groundwater, surface waters and sediments. The SCCC Site has also been investigated and remediated for chromium-related impacts pursuant to the April 1990 ACO between the NJDEP and OCC[3]. In addition, various IRMs and IRAs were completed, as described in Section 1.2.7.

In 1999, the NJDEP indicated that remaining RI activities could be completed concurrently with certain remedial activities. Hence, a Remedial Action Work Plan (RAWP) was submitted to NJDEP in 2000 (Enviro-Sciences, Inc., November 2000), and a RAWP Addendum was submitted in May 2001 (Enviro-Sciences, Inc., May 2001). However, the NJDEP did not act on either the RAWP or the RAWP Addendum, for various stated reasons including a lack of financial assurance from SCCC. Subsequently, in October 2003, SCCC, Tierra (itself and on behalf of OCC), and Beazer formed the Peninsula Restoration Group (PRG) to jointly address the SCCC Site, in large part to facilitate the pending redevelopment initiatives for sites on the Kearny Peninsula.

In December 2001, NJDEP referred the SCCC Site to the USEPA for proposed inclusion on the National Priorities List (NPL). On April 30, 2003, the USEPA proposed to add the SCCC Site to the NPL and the SCCC Site was subsequently listed on September 19, 2007. Work under the SCCC ACO with NJDEP continued through and for a period after the SCCC Site NPL listing, and included the development of an NJDEP-approved Interim Response Action Work Plan (IRAW) prepared by KEY. Upon SCCC Site listing, an Engineering Evaluation/Cost Analysis (EE/CA) prepared by KEY corresponding to the response proposed in the NJDEP-approved IRAW was submitted to (and approved by) the USEPA. The USEPA designated NJDEP as the lead agency for implementation of the IRA as described in the IRAW and EE/CA; however, the USEPA is the lead agency for all activities required by the current Agreement and SOW.

In June of 2010, SCCC and Beazer entered into an Agreement [i.e., Removal Action (RA) Order]. The RA Order required the sealing of openings in the former process area buildings and the maintenance, and replacement as necessary, of the existing fencing surrounding the eastern portion of the SCCC Site and the warning signs along the fencing. The work required by the RA Order was completed and a Final Report documenting the work was submitted to the USEPA in

[3] Tierra is also a party to this ACO but only with respect to the adjacent Diamond Site. The 1990 ACO is now modified and superseded by the September 7, 2011 Consent Judgment.

December 2010. By letter dated January 20, 2011 regarding the Administrative Order Notice of Completion, the USEPA notified SCCC and Beazer of its approval of the Final Report and that the work required by the RA Order has been completed in accordance with the RA Order.

1.2.5 Current SCCC Site Conditions

At the current time, SCCC Site access is restricted, SCCC Site soils are covered by clean fill or pavement, and the only structures remaining on the SCCC Site are the shells of five historic structures (i.e., Buildings 1, 2, 3, 4 and 23) once part of Edison's operations and the newly built structure that houses the Hydraulic Control Treatment System (HCTS). Building materials testing data from 2004 indicate the presence of asbestos and lead-based paint in certain portions of the Edison Buildings. The USEPA has determined that the asbestos and lead-based paint in these dilapidated structures constitute a release or threat of release of hazardous substances to the environment. A brief description of the five historic buildings shown on Figure 1-4 is provided below.

Portions of Building 1 (former "Engineering Building") were utilized as office space until early 2006. The building is currently in a state of disrepair with water leaks from the ceiling, broken windows, and lack of heat or maintenance.

Building 2 (former "Battery Plant Building"), Building 3 (former "Service and Maintenance Building") and Building 4 (former "Boiler House") are dilapidated and exhibit cracking or spalling of the concrete or stucco facing and many windows are broken. Extensive and severe structural damage to the roofs exist to the extent that Buildings 2, 3, and 4 are considered unsalvageable and unsafe to enter due to the potential for further roof collapses.

Building 23 (former "Gate House") is a very small building (approximately 15 feet by 11 feet) located due west of the Engineering Building (Building 1) on Lot 50 at a former entrance to the SCCC Site along the Belleville Turnpike. Like the other buildings, the structural condition of this building is poor. Windows are broken, the exterior walls are cracked, and a portion of the tile roof is damaged.

Several concrete slabs are all that remain of the other former industrial facilities. A mounded area constituting the Consolidation Area (CA) exists on the eastern portion of the SCCC Site; it has an engineered cover that was installed in 2012. A number of monitoring wells, DNAPL recovery wells, groundwater extraction wells, and piezometers associated with ongoing operation, monitoring, and maintenance of the IRAs exist at the SCCC Site.

1.2.6 Pre-RI/FFS Investigations

Numerous environmental investigations, dating back to the early 1980s, were completed for the SCCC Site prior to issuance of the Agreement, as follows:

1983-1984	Hydrogeologic Investigation	Roy F. Weston, Inc.
1985	Phase II Dioxin Investigation	E.C. Jordan, Inc.
1987	Stage 1 Dioxin Investigation	Roy F. Weston, Inc.
1988	Stage 2 and 3 Dioxin Investigations	Roy F. Weston, Inc.
1991	Chromium Delineation	French & Parrello Associates
1990-1993	Remedial Investigation/Supplemental RI	Roy F. Weston, Inc.
1996-1997	Focused Remedial Investigation	ERM, Inc.
1997-1999	Supplemental Remedial Investigation	Key Environmental, Inc.
2000	Soil/Sediment Sampling and Analysis	Enviro-Sciences, Inc.
2000	Characterization of Containerized Materials	Enviro-Sciences, Inc.
2002	Surface Water and Sediment Sampling	USEPA TAT
2008-2009	IRA Pre-Design Investigation	Key Environmental, Inc.
2008-2009	Phase II Supplemental RI	Key Environmental, Inc.

Most of these activities were completed on behalf of or by SCCC or the PRG. Table 1-1 of the October 2015 RI Report (KEY, October 2015) presents a timeline for the principal historical investigations. Each of the investigations conducted prior to 2010 resulted in the collection of data that were used to define SCCC Site conditions and to develop the remedial measures that are currently in place. The majority of the early investigations focused on the nature and extent of SCCC Site-related constituents in various environmental media such as lagoon solids/liquids, surface water and sediment, groundwater, or soils. While the PRG and NJDEP were in the process of negotiating a scope of work for an IRA, activities such as multiple work plan submittals, an asbestos and lead paint survey, wetlands delineation, an aerial topographic survey, waste classification requests, off-Site disposal of demolition debris, numerical groundwater model development, vault content sampling and analysis, and a request to use the USEPA's Area of Contamination (AOC) Policy were completed proactively by the PRG.

1.2.7 Previous Response Actions and Other Activities

Multiple response actions have been undertaken at the SCCC Site, consisting of IRMs, an IRA consisting of multiple tasks, a Removal Action, and other miscellaneous responses. Brief descriptions of these responses follow in this section.

1.2.7.1 IRMs Completed

Since the early 1990s, various IRMs have been completed to prevent potential exposures to chromium-impacted soils, to preclude access to impacted soils and the lagoon in the former process area, to control fugitive dust emissions, to provide protection of the lagoon area from flooding, and to control potential constituent migration via existing storm sewers. These IRMs were completed in accordance with an NJDEP-approved work plan. IRM activities were as follows:

- Installation of security fencing surrounding the former production area and lagoons to prevent unauthorized access;
- Addition of soil to the lagoon berm to increase its height and freeboard to prevent potential overflows;
- Placement of stabilizing geotextile and rip rap along the Hackensack River shoreline in the vicinity of the former lagoons;
- Removal of the contents of five above-ground storage tanks and repackaging of asbestos-containing material (ACM) removed from the former distillation building; and,
- Installation of a dust fence barrier along Lot 32.01 (former railroad right-of-way) and the north fence line of the former northeast process area to control potential fugitive dust emissions from the former process and lagoon areas.

To mitigate potential risk of human exposure to soil containing concentrations of total chromium exceeding 75 mg/kg (the NJDEP action level at the relevant time), additional IRMs were implemented by Chemical Land Holdings in February 1991 in the western and central sections of the SCCC Site. The chromium-related soil IRMs implemented at the SCCC Site were as follows:

- Installation of an asphalt pavement overlay on traffic areas where existing asphalt pavement was present;

- Exposed soils with total chromium concentrations exceeding 75 mg/kg were covered with geotextile fabric overlain by four inches of dense graded aggregate, overlain by four inches of asphalt on all remaining unpaved traffic areas;

- An interim surface cover consisting of a geotextile/geomembrane liner overlain with four inches of dense graded aggregate was constructed in non-traffic areas west of Lot 32.01; and,

- Installation of fencing to restrict access to the SCCC Site by unauthorized personnel.

In the mid-1970s, a 48-inch reinforced concrete stormwater sewer pipe was installed along the northern boundary of Lots 48 and 49 under NJDEP oversight. Stormwater entered the pipe via several catch basins along its 2,000-foot length extending from Belleville Turnpike to the Hackensack River. In 2008, the stormwater pipe was upgraded (Brown and Caldwell, September 2008) to mitigate the potential for migration of shallow groundwater into the manholes, catch basins, sewer pipes, or the backfill materials, and hence eliminate this potential migration pathway. Manholes, lateral pipes, catch basins, and cleanouts were rehabilitated as part of this effort. In addition, four pressure-grouted cutoff dams (anti-seep collars) were installed in the bedding of the storm sewer.

Remediation was required for a small, shallow, below-grade concrete vault containing Non-Aqueous Phase Liquid (NAPL) within the central portion of the SCCC Site. The material was characterized and a Waste Classification Request was submitted to, and subsequently approved by, NJDEP on June 12, 2008 (NJDEP, June 2008). Following NJDEP approval, the NAPL was subsequently removed from the vault. The sides and bottom of the vault were pressured-washed and the influent and effluent lines were sealed off using air plugs. The vault contents and wash water were placed into eighteen (18) 55-gallon steel drums. The vault was secured via placement of a ½-inch thick steel cover, and then coved with a plastic tarp. The eighteen (18) drums of NAPL and two (2) additional drums of debris and used personal protective equipment were transported to an off-site disposal facility. A letter describing removal of the vault contents was prepared by KEY and subsequently sent to NJDEP on August 25, 2008 (KEY, August 2008). SCCC Site conditions upon completion of the IRMs (2008) are presented in Figure 1-5.

1.2.7.2 IRA Activities

Subsequent to the completion of the IRMs previously described, an NJDEP-approved IRAW (KEY, October 2008) and IRAW addenda (KEY, March 2009) specified that certain additional remedial activities be completed for the SCCC Site. These activities were completed from July 2010 through December 2011. Figure 1-4 depicts specific information regarding the existing cover materials at the SCCC Site. Compete details of the IRA were presented in the IRA Report (IRAR) (KEY, December 2011). The major components of the IRA were as follows:

- ***Site Preparation Activities*** - SCCC Site preparation consisted of work required to ready the SCCC Site for subsequent construction activities or to otherwise augment the effectiveness of the remedy. These activities consisted of the following:
    - Utility protection, relocation, and abandonment;
    - Disposal of previously containerized materials located on the SCCC Site;
    - Former process area tank/saddle removal;
    - Decommissioning of septic tanks;

- Former transformer pad sampling removal and disposal;
- Abandonment in place of four 3'x3'x2' concrete vaults (CA);
- Repair of existing IRMs; and,
- Monitoring well abandonment.

Detailed information regarding these SCCC Site preparation-related activities is provided in the IRAR (KEY, December 2011).

- ***Barrier Wall System*** - A barrier wall system consisting of a 6,880 foot cement bentonite slurry wall and a 1,230 foot SSP wall was constructed in 2011. The cement bentonite slurry wall has a permeability of $1x10^{-7}$ centimeters per second (cm/sec), is three feet in width, and encloses the SCCC Property (owned by the Town of Kearny, New Jersey), the adjacent Diamond Site owned by Tierra, and a portion of the adjoining Seaboard Site owned by the HCIA as shown on Figure 1-4. The SSP wall is primarily a structural component that is located along the Hackensack River frontage. The SSP wall connects to a previously installed SSP wall along the adjacent Seaboard Site river frontage. A cathodic protection system was also installed to protect the SSP from corrosion. The slurry wall is keyed a minimum of three feet into the varved clay confining unit which is continuous beneath the SCCC Site and is generally encountered at a depth of 20 to 25 feet below ground surface. Spoils resulting from excavation of the slurry wall were placed into one of two CAs (one on the SCCC Site and one on the adjacent Diamond Site) pursuant to a USEPA-approved AOC policy request. The SCCC Site CA was constructed in the location of two former lagoons.

- ***Near-Shore River Sediment Removal and Management*** - This component consisted of the removal of near-shore Hackensack River sediments. The sediments were excavated to a maximum distance of 50 feet from the SSP wall and to a maximum depth of three feet below existing grades. Sediments from the SCCC Site frontage and those from a portion of the adjacent Diamond Site frontage were placed into the SCCC Site CA in accordance with the AOC policy request. The sediment removal area was restored via placement of granular backfill.

- ***Hydraulic Control System*** - A shallow groundwater hydraulic control system and a groundwater treatment plant (i.e., HCTS) with an average design flow of 20 gallons per minute (gpm), a design capacity of 40 gpm and a peak flow of 50 gpm was constructed. The hydraulic control wells and treatment plant were designed to accommodate extraction of groundwater to prevent filling of the fully enclosed cell. The treatment plant consists of multiple unit operations including hexavalent chromium reduction, bulk metals precipitation and removal, total suspended solids removal,

removal of dissolved phase organics, and separation/recovery of DNAPL. In addition, the HCTS building was constructed with measures to mitigate potential vapor intrusion. The plant is currently being operated subject to the requirements of a NJPDES permit (NJPDES Permit No. NJG0175102) and treated effluent is discharged to the Hackensack River as authorized by the permit.

- ***DNAPL Recovery System*** - A DNAPL recovery system consisting of sixteen (16) 18-inch diameter high-density polyethylene (HDPE) recovery wells with 10 foot sumps was installed. The design of the DNAPL collection units allows for effective in-well gravimetric separation of groundwater and DNAPL. DNAPL is accumulated by gravity drainage, recovered from the sumps via pumping at the wellheads and is placed in a portable storage vessel for off-site recycling or treatment in accordance with State and Federal regulatory requirements.

- ***Lagoon Dewatering and Backfilling*** - Dewatering, solidification, and backfilling of the SCCC Site lagoons was completed as a source control measure and to accommodate construction of the SCCC Site CA. Dewatering was accomplished via pumping and treatment of water in the lagoons subject to the requirements of the aforementioned NJPDES Permit. Several soft spots in the lagoons were conditioned with calcium chloride (desiccant) and Portland cement to tie up excess moisture and geogrids were placed as a structural component. Materials generated as a result of construction of the barrier wall system, pipe trenching, near-shore Hackensack River sediment removal, and South Ditch soft soil removal were placed in the CA, which, pursuant to the approved AOC policy request, included some of the former lagoon air space.

- ***Drainage Ditch Soft Soil Removal*** - Soft materials located in a former drainage ditch along the southern property boundary were removed to facilitate installation of new stormwater controls. Excavated materials were conditioned and placed in the CA per the approved AOC request. As necessary, intermittent in-situ stabilization of some subgrade compressible soils (with Portland cement) was also completed to facilitate placement of pipe bedding and pipe and manhole installation. Stormwater piping consists of welded HDPE pipe to prevent intrusion of groundwater into the stormwater system. The piping discharges to the Hackensack River and includes a backflow prevention duckbill valve to prevent inflow of river water during high tides.

- ***Surface Cover Installation and Stormwater Controls*** - New surface covers were constructed in two portions of the SCCC Site. A liner and gravel surface cover was installed in the former process area located to the north of the former lagoons (Figure 1-4). A multi-layer cover system was installed over the newly constructed CA. The

cover system included a 60 mil linear low density polyethylene liner, geosynthetic drainage layer, structural fill, and top soil. Perimeter catch basins and piping to the stormwater control system were installed in the CA during construction of the soil cover. Existing surface cover materials across the SCCC Site were repaired any time breaching of the cover materials occurred (i.e., for installation of utilities or HCTS pipe and wiring runs). Butt-fused, HDPE stormwater conveyance piping, catch basins, and manholes were installed to convey water historically carried by the South Ditch. The newly installed stormwater system is approximately 2,980 feet long and extends from the northwestern corner of the SCCC Site to the Hackensack River. Two lateral lines extend from the main line into the interior of the SCCC Site.

Finally, a number of former process or administrative buildings were (or are) present on SCCC Site and these buildings were either demolished or were identified for evaluation as potential historic landmarks under the National Historic Preservation Act. Buildings without potential historic value were demolished during or shortly after the construction of the IRA. Demolition of Buildings 16, 19 and 20, which were impediments to IRA-related construction activities, was conducted between December 2010 and late January 2011. Demolition of Buildings 5, 7, 8, 9, 10, 14, 15, 17, 18, 21, and 22 was initiated in late October 2011 and completed in mid-April 2012. The demolition activities are summarized in various reports (KEY, December 2010; KEY, April 2011; KEY, March 2012; KEY, April 2012; and KEY, May 2012).

Operation, Maintenance, and Monitoring (O&M) of the above-listed components is performed in accordance with the O&M Plan included as Appendix D (KEY, July 2013) of the USEPA-approved RI/FFS Workplan. O&M reports are submitted to the USEPA and NJDEP on a quarterly schedule as an appendix to the applicable monthly progress report.

1.2.7.3 Removal Action

An RA was completed at the SCCC Site in 2010. It consisted of sealing existing structures on Lot 49 that were perceived to be potential sources of wind-borne particulates. The RA was completed pursuant to an Agreement for RA entered into between the USEPA, SCCC, and Beazer dated June 7, 2010. An Administrative Order Notice of Completion was issued by the USEPA on January 20, 2011. The buildings that were sealed have since been demolished and removed from the SCCC Site.

1.2.7.4 Classification Exception Areas/Well Restriction Areas

As part of a separate remedial program with oversight by NJDEP, Tierra, on behalf of OCC, has established a CEA/WRA that covers certain COPR sites on the Kearny Peninsula. This CEA/WRA extends over the entire SCCC Property. The constituents listed in the COPR Sites

CEA/WRA include total chromium, hexavalent chromium, total dissolved solids, and chloride. Also as part of a separate remedial program, Beazer has established a CEA/WRA that addresses only the approximately 13 acres of the western portion HCIA property that is enclosed within the SCCC Site barrier wall system. The COIs listed in the Seaboard Site CEA include various VOCs, SVOCs and metals. The limits of the various CEA/WRAs on the Kearny Peninsula are shown on Figure 1-6. Neither of the CEAs/WRAs cover the NJDOT right-of-way that is part of Area 2.

2.0 RESULTS OF THE RI

Historical pre-RI/FFS data collected prior to 2013 was summarized in the SCSR in accordance with Section II of the SOW. Supplemental SCCC Site characterization activities were undertaken pursuant to the Agreement and USEPA-approved RI/FFS Work Plan dated September 2013 (KEY, September 2013). The results of the supplemental investigation were submitted to the USEPA in a SCCC Site Characterization Summary Report (SCSR) Addendum (KEY, March 2014). Subsequent to the USEPA approval of the SCSR Addendum, the Group completed a Screening Level Ecological Risk Assessment (SLERA) (KEY, September 2014) and Baseline Human Health Risk Assessment (BHHRA) (KEY, December 2014). The SLERA and BHHRA were approved by the USEPA by letters dated September 17, 2014 and January 22, 2015, respectively. In October 2015, the Group submitted the Final RI Report for the SCCC Site. The Final RI Report was approved by the USEPA on October 9, 2015.

The Final RI report summarizes the results of the tasks outlined in the RI/FFS Work Plan approved in September 2013 and demonstrates that the data and information acquired pursuant to the RI/FFS Work Plan, combined with that from previous investigations and remedial actions, have adequately characterized the nature and extent of SCCC Site contamination (with the exception of impacts beyond the barrier wall (i.e., Area 2), which are discussed separately below) as necessary to support the acceptance of remedial measures completed to constitute the primary elements of the final remedy and augment those with any additional measures as defined in this FFS.

2.1 RI SUMMARY

The results of the RI are summarized in this Section. This summary includes a description of the SCCC Site geology/hydrogeology and nature and extent of impact to environmental media. Further details are provided in the October 2015 RI Report.

2.1.1 Geology and Hydrogeology

Borings completed for the various characterization and remedial design activities have defined the SCCC Site geology as consisting of the following units, in descending order from the ground surface:

- A Fill Unit consisting of materials used to fill the former meadowlands to support industrial development form the uppermost unit at the SCCC Site. Fill materials include COPR, COPR-containing soils and other historic fill. Thickness of this unit varies, and ranges to 10 feet. This unit is the uppermost groundwater bearing zone beneath the SCCC Site.

- The Meadow Mat, consisting of naturally occurring organic materials found in wet marshy areas throughout this region of the state, lies beneath the Fill. This unit is typically 2 to 8 feet thick beneath the SCCC Site, but may have been removed locally during various historical construction activities. The Meadow Mat acts as a semi-confining unit.

- A Sand Unit, lying beneath the Meadow Mat, is a semi-confined water-bearing zone approximately 5 to 10 feet thick.

- The Varved Clay Unit, at least 40 feet thick, underlies the Sand Unit. The varved clay is a continuous, low permeability zone acting as an aquitard.

Figure 2-1 is a geologic cross-section depicting the near surface geology at the SCCC Site. The depth to groundwater is typically three to four feet below original ground surface (i.e., prior to any remedial cover). Vertical hydraulic gradients are downward indicating that groundwater flows from the Fill Unit into the deeper Sand Unit. Prior to installation of the barrier wall groundwater flowed from north to south. Natural lateral groundwater flow patterns have been diverted by the construction of the barrier wall, and shallow groundwater in the Fill and Sand Units is now contained within the barrier wall.

2.1.2 Nature and Extent of Impact to Environmental Media

This section provides a general summary of the historic sources, nature and extent of contamination in soil/fill, groundwater, surface water, sediment and air, as well as a summary of the remedial actions completed to remove or consolidate and contain the known and/or potential sources on the SCCC Site.

Former Lagoons

Historic analytical results confirmed the lagoons as a significant source area. Lagoon solids were found to consist of an estimated 77 percent naphthalene and the remainder largely chlorinated benzenes, methylnaphthalene, phenols, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), arsenic, lead and hexavalent chromium. The accumulated liquids in the Former Lagoons were collected and treated on the SCCC Site during the Interim Response Action (IRA), and the solids were stabilized primarily with Portland cement and encapsulated in place. The solids were stabilized to provide sufficient strength to support the placement of materials in the Consolidation Area and the associated engineered surface cover, which were constructed over the Former Lagoons.

Former Septic Tank Areas

The contents of six identified septic tanks were sampled and analyzed to determine appropriate disposal methods and requirements. The tank solids contained benzene, various chlorobenzenes, naphthalene, other polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and several metals. Solids were removed and disposed off-site. Liquids were removed and treated in a temporary on-site treatment facility built and used to manage liquids generated during IRA activities, and discharged through the NPDES outfall. Once the tanks were emptied, they were filled with a flowable concrete grout, and confirmatory soil samples were collected from the native fill materials at depths corresponding to the tank bottoms.

Surface and Subsurface Soil

Impacts to SCCC Site soil were defined to extend over large portions of the SCCC Site. Constituent groups related to the SCCC Site include chlorinated benzenes, polycyclic aromatic hydrocarbons (PAHs [including naphthalene]), polychlorinated biphenyls (PCBs), dioxins/furans (or polychlorinated dibenzodioxin/polychlorinated dibenzofuran (PCDD/PCDF)), and metals, including hexavalent chromium.

Chlorinated benzenes were found in soil in both the eastern and western portions of the SCCC Site, generally near former chlorinated benzene distillation, purification, storage or handling areas and the lagoons. Chlorinated benzene concentrations were generally highest in soil at depth in the lower Sand Unit due to their accumulation on top of the underlying varved clay as mobile/recoverable DNAPL. Recent investigations have confirmed the underlying varved clay acts as an effective barrier to vertical migration of dissolved phase groundwater contamination and DNAPL.

Naphthalene and other PAHs and to a lesser extent, PCBs and PCDD/PCDF, were found in the eastern SCCC Site soil and lagoons. Naphthalene and other PAHs were also found in the western Site soil within areas of fill. The highest concentration impacts were associated with the lagoons and DNAPL beneath/near the former lagoons and extending west.

Chromium was found in the western, eastern, and southern portions of the SCCC Site and on a portion of the western area of the Seaboard Site. Hexavalent chromium was found primarily within the upper 10 feet of shallow fill. The reducing capacity of the underlying Meadow Mat was found to effectively mitigate and impede the downward migration of hexavalent chromium.

South Ditch Soft Soils

South Ditch soft soils were found to contain chlorinated benzenes (1,4-dichlorobenzene most frequently), naphthalene and other PAHs, and to a lesser extent PCBs and dioxin/furans, chromium and lead. South Ditch soft soils were excavated, stabilized with Portland cement, and placed in the Consolidation Area.

Groundwater

Investigations of shallow groundwater within the upper Fill Unit found SCCC Site-related constituents in groundwater including: chlorinated benzenes, several volatile organic compounds (VOCs), naphthalene and other PAHs, phenols, PCBs and chromium in at least one sample. The highest levels of chlorinated benzenes and PAHs were found in the former lagoon area, although chlorinated benzenes were also found in the shallow fill groundwater in the western portion of the SCCC Site near Building 2.

Investigation of the deeper Sand Unit found a similar suite of chemical constituents in deeper groundwater, with the notable exception of hexavalent chromium due to the reducing influence of the underlying Meadow Mat, an organic rich layer that reduces hexavalent to trivalent chromium. Detected impacts of organic constituents in the lower Sand Unit were found to be laterally more extensive, but vertically limited to the lower sand unit due to the underlying varved clay acting as a massive and competent barrier to downward migration.

Surface Water

Historical data indicated impacts to surface water in drainage ditches on the SCCC Site from chlorinated benzenes, naphthalene and other PAHs and total chromium. Lagoon surface water representing accumulated precipitation in contact with lagoon solids contained dichlorobenzene, phenols, total chromium, and lead. However, the stagnant nature of surface water in the ditches appeared to have limited surface water impacts to the SCCC Site, as no significant impacts to Hackensack River surface water were discovered during several historical sampling events.

Hackensack River Sediments

The near-shore Hackensack River sediments were found to be impacted by PAHs, chlorobenzenes, dioxins and metals. Hackensack River sediments within approximately 50 feet outboard of the SCCC Site and Diamond Site SSP wall and to a depth of three feet or to the surface of the underlying meadow mat, whichever was encountered first were excavated, stabilized, and placed in the SCCC Site and Diamond Site Consolidation Areas respectively.

2.2 RISK ASSESSMENT SUMMARY

The December 2014 USEPA-approved BHHRA and September 2014 USEPA-approved SLERA have been considered during the development of remedial alternatives. A summary of each of these efforts is provided in the following sub sections.

2.2.1 BHHRA Summary

The BHHRA was conducted on soils (surface and to a depth of 10 feet) and shallow Fill Unit groundwater under various hypothetical exposure scenarios, per the USEPA risk assessment guidance. Under current conditions at the SCCC Site, there is no potential for SCCC Site-related exposures, and the potential for off-site migration of any Site-related constituents is eliminated because of the IRA and Interim Remedial Measures (IRMs) activities completed to date. However, a quantitative assessment was performed to evaluate direct contact with the materials beneath the covers and with the shallow groundwater and with the potential for vapors associated with migration from soil and shallow groundwater to become entrained in a future building.

Under current SCCC Site conditions there are no risks to potential receptors because of the lack of complete exposure pathways (i.e., the interim remedies prevent direct contact with soils as long as they are maintained). If the cover materials are disturbed under current land use conditions, carcinogenic risks and/or non-carcinogenic hazard indices exceed the acceptable ranges for most receptors under both the reasonable maximum exposure and the central tendency scenarios. Finally, disturbance of the cover materials, with subsequent exposures to subsurface/surface soils and shallow groundwater present risks to the future receptors (construction workers and utility workers) that exceed the acceptable risk range of 1E-4, with non-carcinogenic risks greater than unity for one or more target organs.

The construction of future occupied industrial or commercial facilities without vapor mitigation systems was calculated to result in an unacceptable inhalation risk to future occupants due to the potential for intrusion of vapors originating from contaminants in soil and groundwater. Therefore, future development including buildings would be expected to require the use of construction techniques to mitigate the potential for intrusion of vapors into buildings or other measures to address this pathway.

To summarize, the conclusion of the risk characterization performed as part of the BHHRA is that no unacceptable risks exist under current conditions because there are no complete exposure pathways for potential human receptors. However, risks were estimated for a future scenario where the existing surface covers are disturbed allowing potential exposure to surface soil, subsurface soil, and/or shallow groundwater.

2.2.2 SLERA Summary

A Screening Level Ecological Risk Assessment (SLERA) was completed for the SCCC Site under current land use conditions. No complete exposure pathways were identified, resulting in the conclusion that ecological risks were negligible and that a Baseline Ecological Risk Assessment was not warranted. Accordingly, no numerical ecological risk estimates were calculated. The SLERA was approved by the USEPA in September 2014.

2.3 SUMMARY OF AREA 2 RI

Additional RI activities were completed for a specific area adjacent to the southern limb of the existing SCCC Site slurry wall, in the vicinity of boring D-25 on the adjacent Hudson County Improvement Authority (HCIA) property and the New Jersey Department of Transportation (NJDOT) right-of-way for the Belleville Turnpike. This work was completed in accordance with a work plan approved by the USEPA (KEY, July 2014). The first phase of field activities, comprised of soil boring completion and monitoring well installation, was undertaken consistent with the approved work plan in July 2015. Sample analyses and data evaluation were completed, and a second phase of field activities was performed to complete the delineation of DNAPL and impacted groundwater in the deep sand unit in this area. These activities and results were described in the Remedial Investigation Report (RIR) Addendum, Area 2 (KEY, January, 2016) and are summarized in the following paragraphs.

SCCC Site-related impacts within Area 2 are limited to subsurface soil and groundwater within the deeper sand unit. No evidence of SCCC Site-related impacts was observed in fill materials above the meadow mat. The horizontal extent of SCCC Site-related impacts in the deeper sand unit appears to be limited to the vegetated highway median between the westbound lane of the Belleville Turnpike and the Newark Turnpike. Analytical data for subsurface soil and groundwater indicate limited dissolved phase impact as evidenced by significant reductions in dichlorobenzene (DCB) concentrations within a short distance downgradient (i.e., to the east as the primary direction of flow) from DNAPL impacted areas.

The varved clay unit directly underlies the deeper sand unit and is continuous beneath Area 2. Based upon data and information acquired for this unit from within Area 1, it is believed that this unit also acts as an effective barrier to vertical migration of DNAPL beneath Area 2. The configuration of the upper surface of the varved clay appears to have some control on the distribution of DNAPL in Area 2. The area where free-phase DNAPL was observed corresponds to a localized broad depression in the varved clay surface. The clay surface appears to rise slightly to the south and west preventing further DNAPL movement in that direction.

The Area 2 RI is documented in the RIR Addendum submitted to USEPA on January 6, 2016. The USEPA approved the RIR addendum on March 1, 2016.

2.4 CULTURAL RESOURCES ACTIVITIES

In addition to the environmental investigations listed above, historical surveys have been completed on the former Edison Buildings. These surveys were necessary to comply with the requirements of the National Historic Preservation Act when assessing remedial alternatives in the FFS. The documents prepared on behalf of the Group and submitted to the USEPA pursuant to the SOW are:

- Historic American Buildings Survey [(HABS), Langan, October, 2015] – This document provides details on the architectural aspects of the Edison-related buildings. It includes information on the Emark plant and the chronology of its operation. This document includes multiple photographs and copies of some original architectural drawings to meet HABS III standards.

- This is the Story of Emark – A Product of Thomas A. Edison, Inc. (Langan, October 2015) – This document is a public information bulletin to promote public understanding and appreciation of the SCCC Site's historic significance.

- This is the Story of Emark: Learning from New Jersey History – Teacher's Guide and Lesson Plans Grade 4 (Langan, October 2015) - This document was prepared to fulfill specific standards and goals of the New Jersey Core Curriculum Content Standards for Social Studies and Science and to foster local pride.

- Phase IA Cultural Resource Survey for the SCCC Site, IRAW – Town of Kearny, Hudson County, New Jersey (Langan, August 2009) – This document was developed in preparation for the installation of the slurry wall at the SCCC Site in order to assess the presence or absence of cultural resources and the potential impacts on those resources by implementation of the IRAW. This report concluded that there was a low to moderate potential for deep archaeological deposits and that the IRA activities would have only a temporary adverse effect on the historic buildings.

- A Phase IB Archaeological Survey During Slurry Wall Construction (Langan, May 11, 2011) was completed during slurry wall construction. Samples were collected from deep alluvial soil (approximately nine to 17 feet below grade) excavated during the SCCC Site slurry wall excavation to evaluate potential evidence of prehistoric use at the SCCC Site. The results of this survey resulted in possible artifacts recovered primarily along the eastern alignment of the slurry wall along the Hackensack River.

A recommendation for conducting potential additional archaeological surveying was included in the report if other deep excavation activities are implemented.

A Memorandum of Agreement (MOA) pursuant to the National Historic Preservation Act has been signed by representatives of the USEPA and New Jersey State Historic Preservation Office. The MOA documents the measures that have been implemented to mitigate planned adverse effects to the cultural resources.

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

Section 121(d)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by Superfund Amendments and Reauthorization Act in 1986, requires that, among other things, the selected remedy comply with federal and state environmental laws. These other environmental laws are known as "applicable" or "relevant and appropriate" requirements (ARARs). The ARARs for the remedial alternatives for the SCCC Site have been compiled and are summarized in this Section.

Remedial Action Objectives (RAOs) are specific goals for protecting human health and the environment. RAOs can be expressed as concentrations criteria, target risk levels or in terms of eliminating exposures or migration pathways. The RAOs are developed to address Constituents of Concern (COCs), media of concern, potential exposure pathways, and preliminary remediation levels or goals. Response actions and technologies will be screened and then assembled into specific alternatives that satisfy the RAOs.

This section includes the identification of the ARARs, SCCC Site-specific RAOs, the quantification of approximate areas and/or volumes of impacted media, and the identification and screening of technologies.

3.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

"Applicable" requirements are standards and other substantive requirements that specifically address the situation at a CERCLA site, and are defined as any statute or regulation that directly corresponds to the on-site circumstances and actions at a particular site. On-site actions must comply with only the substantive portions of a given requirement (i.e., permitting, record-keeping and reporting requirements are not considered to be substantive requirements). "Relevant and appropriate" requirements must be both relevant (i.e., is the site-specific situation sufficiently similar to the circumstances of the statute or regulation?) and appropriate (i.e., is the statute or regulation well-suited to site conditions?). Whether a requirement is relevant and appropriate is determined by professional judgment, taking into account environmental and technical issues at the site.

This section presents an assessment of the ARARs identified for the SCCC Site. There are three types of ARARs discussed in this section:

- Chemical-Specific ARARs – Health or risk-based values or methodologies that, when applied to site-specific conditions, establish numerical values for the acceptable amount or concentration of a chemical that may remain in the environment.

- Location-Specific ARARs – Restrictions on certain activities or on concentrations of hazardous substances because of the environmentally-sensitive nature of the land or land use concerns.
- Action-Specific ARARs – Technology or activity-based requirements and limitations applicable to actions taken with respect to hazardous substances at the site, including remedial design, construction, and operating requirements.

Compliance with ARARs is met on either a substantive or an administrative basis. Remedies conducted entirely on-site must comply only with the substantive portion of ARARs. Section 121(e)(1) of CERCLA exempts on-site actions from requirements to obtain federal, state, or local permits although the substantive requirements of the associated permit must still be met.

Table 3-1 presents a summary of the ARARs for the SCCC Site identified via a search of federal, state, and local statutes, regulations, and ordinances. The ARARs are segregated by the classifications listed above. Some ARARs are not restricted to just one of the ARAR classifications, but for the purpose of the FFS Report have been placed in the most relevant category.

3.1.1 Chemical-Specific ARARs

Chemical-specific ARARs for the SCCC Site include both New Jersey and federal groundwater and soil standards (see Table 3-1). These values are typically based on the protection of human or environmental health.

3.1.2 Location-Specific ARARs

Location-specific ARARs for the SCCC Site are based on the presence of surface water bodies, floodplains, and wetlands (see Table 3-1). Early investigations (Weston, 1988) identified the floodplain as having high habitat value.

A floodplain assessment would be completed as part of the remedial design activities prior to remedial action implementation and would include the following information:

- A description of the proposed remedial action;
- The effects of the proposed remedial action on the floodplain;
- A discussion of the impacts of the proposed action as compared to the other options; and,
- The measures required to mitigate potential impacts to the floodplain area if there is no practicable alternative to locating in or affecting the floodplain, including impacts to

the proposed remedial action from flooding events both during and after implementation of the proposed remedy.

Location-specific ARARs include federal and New Jersey regulations for activities in wetlands and floodplains and will be addressed in the development of alternatives. Floodplain ARARs include Executive Order 11998: and Executive Order 13690. Potential impacts to wetlands as part of future remedial action implementation may require additional wetlands mitigation measures.

3.1.3 Action-Specific ARARs

Action-specific ARARs for the SCCC Site are presented in Table 3-1 and are dependent upon the remedial actions selected. Action-specific ARARs consist of federal and New Jersey statutes, regulations and ordinances.

3.1.4 To-Be-Considered Criteria

In addition to the chemical, location, and action-specific ARARs identified in the preceding sections and Table 3-1, there are also ecological and DNAPL in groundwater criteria, chromium and COPR guidance and other advisories and guidance which contain information that can be considered to determine the protectiveness of selected remedies. Several "to be considered" criteria were evaluated as described below.

Ecological Considerations

No wild and scenic rivers, coastal barriers, wilderness areas, or significant agricultural lands exist on or in the vicinity of the SCCC Site. The SCCC Site is not located within the state designated coastal zone. Therefore, the Wild and Scenic Rivers Act, the Coastal Barriers Resources Act, the Wilderness Act, the Farmland Protection Policy Act, and the Coastal Zone Management Act are not considered applicable to the SCCC Site.

The implementation of the remedial actions discussed in the FFS should not affect any essential fish habitat, or the federally-listed endangered Atlantic sturgeon. Therefore, at this time it appears likely that the Endangered Species Act and Magnuson-Stevens Act are not applicable for the remedial alternatives under consideration in this FFS.

Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration

In September 1993, USEPA published its *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration* (TI Guidance). In this document, USEPA acknowledges that "experience over the past decade has shown that restoration to drinking water quality (or more stringent levels where required) may not be achievable due to limitations of available remediation

technologies. The USEPA, therefore, must evaluate whether ground-water restoration at Superfund and RCRA ground-water cleanup sites is attainable from an engineering perspective." Thus, the stated purpose of the TI Guidance is to outline "EPA's approach to evaluating the technical impracticability of attaining required ground-water cleanup levels and establishing alternative, protective remedial strategies where restoration is determined to be technically impracticable." Factors that make groundwater restoration impracticable are specified in the TI Guidance and grouped into three general categories as follows:

- Hydrogeologic factors (e.g., complex sedimentary deposits, low permeability aquifers);
- Contaminant-related factors (e.g., DNAPLs); and,
- Remedial system design inadequacies.

Section 3.0 of the TI Guidance is dedicated to remedial strategies for DNAPL sites. USEPA states in this section that "[r]emoval of DNAPL mass should be pursued wherever practicable and, in general, where significant reduction of current or future risk will result," and where DNAPL mass removal satisfies the Superfund remedy selection criteria, as appropriate. USEPA also states that "[w]here it is technically impracticable to remove subsurface DNAPLs, USEPA expects to contain the DNAPL zone to minimize further release of contaminants to the surrounding groundwater, wherever practicable." Moreover, when DNAPL can be contained, USEPA wishes to cleanup and restore the groundwater outside of the DNAPL zone where it is technically practicable to do so.

In September 2011, USEPA issued OSWER Directive #9355.5-32, "Clarification of OSWER 1995 Technical Impracticability Waiver Policy." This directive clarified that the presence of DNAPL at a site should not be the sole basis for considering a TI Waiver. The September 2011 directive further clarified that even at sites where a TI Waiver is issued, the USEPA expects that remedies will be employed as necessary to prevent further plume migration, prevent exposure to contaminated groundwater, reduce risk, and protect human health and the environment. Thus, various remedial actions may be necessary in conjunction with a TI Waiver to satisfy RAOs for a site.

3.2 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

The RAOs for the impacted media in Area 1 and Area 2 have been established through consideration of (1) remedies implemented to date, (2) analytical data collected through numerous investigations, and (3) land and water use at the SCCC Site and in the surroundings. The RAOs are presented below in consideration of the current and reasonably anticipated future use of the SCCC Site.

3.2.1 Current and Reasonably Anticipated Future Land Use

Under current conditions, land use is industrial in nature. The SCCC Site is undeveloped and activities at the SCCC Site consist of operation of the HCTS, other operation, maintenance and monitoring (O&M) activities associated with the IRA and various inspections.

The SCCC Site is currently zoned H-I (i.e., heavy industrial) as is indicated on the Town of Kearny webpage (http://www.kearnyusa.com/EGovernmentMaps). However, the New Jersey Meadowlands Commission (February 2013) designated the SCCC Site and surrounding properties (a total of 74 properties on 367 acres) for redevelopment, with the goal of capitalizing on existing road, rail and marine transportation prospects in the area to return the property to productive industrial or commercial uses. In this plan, the SCCC Site was designated for Intermodal B land uses. Intermodal facilities are typically those where cargo is transferred from one mode of transportation to another. Recommended uses for the area consist of the following categories: 1) Industrial/storage/trucking uses; 2) Transport support services; 3) Neighborhood services (e.g., truck stops or retail to support working people); 4) Public or quasi/public uses (e.g., utilities); or, 5) Water-dependent uses (boat sales and repair or port facilities).

The USEPA has received information regarding a proposed conceptual plan for the redevelopment of the SCCC Site and adjacent Diamond Site. The Town of Kearny has conditionally designated Sitex as the redeveloper for this property. The Sitex conceptual plan includes the construction of an approximately 850,000 square foot warehouse and distribution center building, paved parking areas, paved roads, landscaping and utility infrastructure. Based on information provided by the Town of Kearny and Sitex during a February 10, 2016 meeting with Group representatives, structural fill placement, consisting of recycled concrete material to achieve ground surface elevations consistent with the current FEMA 100-year floodplain map, is contemplated to facilitate future SCCC Property development as a warehousing and distribution facility. The conceptual redevelopment plan would provide for structural fill placement over the entire SCCC Property and surface covers over the structural fill consisting of either buildings, concrete, asphalt or vegetated areas. When practicable and cost-effective, the final design of the selected remedy will be coordinated with the Town of Kearny and its developer to accommodate future development plans while at the same time maintaining the environmental protectiveness provided by the remedy.

Based on information provided in a letter dated April 18, 2016 from HCIA to the USEPA, the HCIA (owner of the adjacent Seaboard Site) has entered into a purchase and sale agreement with Morris Kearny Associates to develop the HCIA property (including the approximately 13 acres within the SCCC Site barrier wall system). The conceptual HCIA property plan includes a similar industrial use as that contemplated for the SCCC Property (i.e., construction of four new industrial warehouse buildings, paved parking, paved roads, and utility infrastructure).

When practicable and cost-effective, the final design of the selected remedy on the portion of the HCIA property included in Area 1 will be determined in coordination with HCIA and/or its developer to accommodate future development plans while at the same time maintaining the environmental protectiveness provided by the remedy.

It is reasonably anticipated that the future use of Area 2 will remain consistent with its current use, which is primarily an NJDOT right-of-way with the majority of acreage within Area 2 occupied by highway and associated steep embankments.

The current conceptual redevelopment plans are consistent with the SCCC Site-specific remedial objectives and assumptions used in the BHHRA including future use of the SCCC Site for commercial/industrial uses and maintenance of Site-wide surface covers to eliminate direct contact with soils. As indicated in the risk assessment, either vapor mitigation will need to be incorporated into any future building design or a study will need to be conducted to demonstrate that a vapor mitigation system is not necessary.

3.2.2 RAOs for Area 1

As shown on Figure 1-4, cover materials are in-place over potential exposure areas at the SCCC Site. Hence, direct contact and/or emission of fugitive dust from impacted soils are prevented under existing SCCC Site conditions. Such potential exposures could occur, however, if the cover materials were to deteriorate or be disturbed as a result of construction activities, demolition of existing structures, or utility work. In the event of such activities, incidental exposure to impacted near-surface and subsurface soils and groundwater could occur. The USEPA-determined release or threat of release of asbestos and lead into the environment would be addressed via demolition of the dilapidated Edison Buildings. In addition, the potential for intrusion of vapors exists in the event that future buildings are constructed at the SCCC Site without measures to mitigate the potential for vapor intrusion (note: the HCTS building was constructed with measures to mitigate potential vapor intrusion). Restoration of groundwater within Area 1 is not an RAO for the reasons presented in Appendix A, Technical Impracticability Waiver Evaluation Report. The RAOs for each applicable Area 1 medium are provided below.

3.2.2.1 Surface Soil

The RAOs for Area 1 surface soil are:

- Eliminate human exposure to COCs in surface soil via incidental ingestion, direct contact, and inhalation of; and,
- Eliminate the transport of impacted surface soil by erosion and runoff or wind.

3.2.2.2 Subsurface Soil

The RAOs for Area 1 subsurface soil are:

- Eliminate human exposure by direct or indirect (i.e., transport-related) contact to subsurface soil via incidental ingestion, dermal contact, and inhalation of volatiles and particulates; and,
- Prevent future unacceptable risks due to soil vapor intrusion into new buildings.

3.2.2.3 Groundwater

The RAOs for Groundwater in Area 1 are:

- Prevent human exposures to SCCC Site-related contaminated groundwater via incidental ingestion, direct contact, and inhalation.
- Eliminate potential discharge of impacted groundwater to surface water and wetlands.
- Eliminate migration of impacted groundwater into uncontaminated groundwater; and,
- Prevent future unacceptable risks due to soil vapor intrusion into new buildings.

3.2.2.4 DNAPL

The RAOs for DNAPL in Area 1 are:

- Prevent the migration of SCCC Site-related DNAPL into areas without DNAPL contamination; and,
- Reduce the DNAPL mass to the extent practicable.

3.2.2.5 Other

The other RAO for Area 1 is:

- Eliminate the release or threat of release of asbestos and lead into the environment from the dilapidated Edison Buildings.

3.2.3 RAOs for Area 2

The presence of DNAPL to the south of the Area 1 outside of the slurry wall (Area 2) has been summarized in the Area 2 addendum to the RI Report (KEY, 2016). The objectives of the investigation were to determine the extent of DNAPL and groundwater impacts in Area 2 and assess the recoverability of DNAPL in this area. Prevention of any potential exposures is considered an appropriate RAO for this portion of the SCCC Site. Restoration of groundwater is

not a RAO for Area 2 based on the reasons stated in Appendix A, Technical Impracticability Waiver Evaluation Report. The RAOs for each applicable Area 2 medium are provided below.

3.2.3.1 Groundwater

The RAOs for Groundwater in Area 2 are:

- Prevent the migration of contaminated groundwater into uncontaminated groundwater, surface water, and wetlands; and,
- Prevent human exposure to SCCC Site-related contaminated groundwater via direct contact, incidental ingestion, and inhalation.

3.2.3.2 DNAPL

The RAOs for DNAPL in Area 2 are:

- Prevent the migration of SCCC Site-related DNAPL into areas without DNAPL contamination; and,
- Reduce the DNAPL mass to the extent practicable.

3.2.4 RAO Summary

The RAOs for the SCCC Site are summarized as follows:

- Eliminate human exposure to COCs in surface soil and subsurface soil via direct contact, incidental ingestion, and inhalation.
- Eliminate the transport of impacted surface soil by erosion and runoff or wind.
- Prevent human exposures to SCCC Site-related contaminated groundwater via direct contact, incidental ingestion, and inhalation.
- Eliminate the release or threat of release of asbestos and lead into the environment from the dilapidated Edison Buildings.
- Prevent future unacceptable risks due to soil vapor intrusion into new buildings.
- Prevent the migration of SCCC Site-related DNAPL into areas without DNAPL contamination.
- Prevent the migration of contaminated groundwater into uncontaminated groundwater, surface water and wetlands.
- Reduce the mass of SCCC Site-related DNAPL in the subsurface to the extent practicable.

Restoration of groundwater is not an RAO for Area 1 and Area 2 for the reasons presented in Appendix A, Technical Impracticability Waiver Evaluation Report.

3.3 IDENTIFICATION OF AREAS AND/OR VOLUMES OF MEDIA

This section includes the areas or volumes of impacted media to which the GRAs may apply. As previously mentioned, the SCCC Site remedial alternative evaluation has been based on an area approach, and the estimated areas or volumes of affected media has been developed for each area below. The information presented in this Section is based on information collected to date and is appropriate for FFS level analysis. The specific areas and volumes have been quantified and included in the cost estimate tables (Section 3.3). The information provided below and in the cost estimate tables is preliminary and may be refined during subsequent technical evaluations and design phases.

3.3.1 Area 1

The Area 1 surface area is approximately 25 acres on the SCCC Property. Approximately 17.25 acres of the SCCC Site are covered with various IRM cover as depicted on Figure 1-4. The combined volume of impacted soil and fill beneath existing surface covers, assuming an average depth of six feet to the top of the meadow mat, is approximately 167,000 cubic yards of which 7,300 cubic yards is comprised of the remediated lagoon solids.

The groundwater beneath the 13 acres on the western portion of the adjacent HCIA (former Seaboard) Site that is enclosed by the barrier wall system is also considered part of Area 1. The estimated volume of impacted groundwater within the containment system beneath the SCCC Site and Seaboard Site is 56 million gallons assuming a saturated thickness of 15 feet (seven feet for the shallow fill unit and eight feet for the deep sand unit) and porosity of 30%.

3.3.2 Area 2

The estimated areas of impacted groundwater and DNAPL are provided below.

3.3.2.1 Area 2 Groundwater Impacts

The groundwater analytical results are provided in the RIR Addendum, and a summary is provided in Table 3-2. The impacted groundwater limits for Area 2 were identified based on the presence of DNAPL and SCCC Site-related constituent concentrations exceeding their respective Maximum Contaminant Levels (MCLs) and/or New Jersey Groundwater Quality Criteria (GWQC). These approximate impacted groundwater limits are shown on Figure 3-1 and encompass approximately 3.8 acres.

3.3.2.2 Area 2 DNAPL Impacts

The Area 2 DNAPL gauging results are presented in the RIR Addendum. In addition to the monitoring well locations where DNAPLs have accumulated, soil boring locations where a free phase DNAPL layer was observed were used to define the DNAPL impacted area. The location of the DNAPL impacted area is shown on Figure 3-1. The area in which DNAPL has been observed within Area 2 comprises approximately 1.1 acres.

3.4 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

Based on the RAOs described in Section 3.2, potential GRAs and associated technologies are identified in this section. The GRAs correspond to potentially applicable technologies and process options which have been screened in this section. The GRAs identified in this section are outlined in Table 3-3. The process options associated with the technologies are also presented in Table 3-3. Additionally, summaries of the SCCC Site characterization information and general comments are included in Table 3-3.

3.4.1 Development of General Response Actions

GRAs are medium-specific and are broad scope remedial approaches capable of meeting the RAOs. The GRAs considered in this FFS Report are discussed in this section.

The potential GRAs identified for the SCCC Site are:

1. No Action.
2. Institutional Controls (ICs).
3. Engineering Controls.
4. Containment.
5. Ex-situ Treatment.
6. In-situ Treatment.
7. Removal.

Descriptions of these GRAs are provided below.

3.4.1.1 No Action

As required by the National Contingency Plan (NCP), the No Action GRA is retained for further evaluation to document the need for remedial action. The No Action alternative is a statutory requirement of CERCLA and is intended to represent a baseline scenario for comparison to other response actions. A No Action alternative for Area 1 would result in discontinuation of ongoing O&M.

No Action is also considered both a baseline and potential alternative to be considered for Area 2. The No Action GRA does not include active remediation, institutional controls, or O&M.

3.4.1.2 Institutional Controls

Institutional controls are a general response that primarily relies on legal mechanisms to control potential exposures via restrictions on land and water use. The proposed institutional controls would include:

1. A CEA/WRA for Area 1 (existing CEA/WRA to be updated as necessary) and a new CEA/WRA for Area 2.
2. SCCC Site land use deed notices and/or other land use controls.
3. Soil management and health & safety deed notice protocols for potential implementation of future SCCC Site excavation and building/construction activities.

CEAs/WRAs have been established at the SCCC Site and in the surrounding area and will remain in effect. Specifically, a CEA/WRA has been established for the Diamond Site and surrounding properties that include the SCCC Site. A separate CEA/WRA has also been established for the former Koppers Company Inc. Seaboard Site, now owned by the HCIA. The Diamond Site CEA/WRA encompasses approximately 96 acres and was established on July 11, 2003. The HCIA (former Seaboard Site) CEA/WRA encompasses approximately 125 acres and was established August 12, 2011. The existing Diamond Site and Seaboard Site CEAs only cover the Constituents of Concern (COCs) for each of the respective sites. A new CEA/WRA will be established for SCCC-Site related constituents to cover Areas 1 and 2.

Environmental covenants such as deed notices are also appropriate institutional controls for the SCCC Site. The SCCC Site is currently owned by the Town of Kearny, and the town has agreed (via a settlement agreement entered into June 9, 2010) to restrict land use at the SCCC Site and to sign any required deed notices. The establishment of the institutional controls for the SCCC Site would consist of ensuring that an appropriate deed notice is in place (with the cooperation of the property owner(s)). Prohibitions and limitations on future activities at the SCCC Site would be instated through a duly recorded land use control applicable to Area 1 and Area 2.

The ICs also include the administrative controls which typically rely on the control of activity patterns and/or personal protective equipment to prevent potential adverse exposures and are generally applicable for potential occupational exposures. Limitation on the amount of time spent in a potential exposure area is an example of an administrative control. The use of additional administrative controls for the SCCC Site above and beyond those already in place as specified in the SCCC Site Health and Safety Plan (HASP) is not considered necessary with one exception. Given that restrictive covenants such as deed notices will likely be necessary, an additional

administrative control in the form of a Risk Management Plan, Soil Management Plan, or equivalent may be required to ensure that land use and SCCC Site activities are consistent with the ICs and intended use and are adequately protective of human health and the environment. ICs are applicable to both Area 1 and Area 2.

3.4.1.3 Engineering Controls

Engineering controls generally rely on the use of physical means to prevent potential direct contact exposures, releases, or emissions. Examples of engineering controls include the installation of cover materials to prevent direct contact exposure and stormwater infiltration, installation of fences to preclude direct access to impacted areas, and the installation of vapor barriers to prevent vapor intrusion. Engineering controls in the form of covers exist over a substantial portion of the SCCC Site and consist of covers placed as chromium IRMs and the cap placed over the SCCC Site CA.

For the purposes of this FFS Report, engineering controls also include the O&M procedures for existing remedies and proposed technologies. Monitoring is implemented to provide information to determine if the RAOs are achieved and to determine if additional or reduced remedial action or monitoring is necessary. Engineering controls are potentially applicable to both Area 1 and Area 2.

3.4.1.4 Containment

Containment as a general response typically consists of the use of physical barriers to prevent migration, most often in the subsurface environment. The slurry wall, SSP wall, and CAs already installed at the SCCC Site are effective containment responses for Area 1.

Containment options were initially identified as potential remedies for Area 2 (i.e., expansion of the slurry wall to contain the area) in the ICTM. However, current land use in this area (e.g., the elevated entrance ramp to northbound Belleville Turnpike and the associated embankment that abuts the impacted area) and other accessibility impediments make containment impracticable for Area 2.

3.4.1.5 Removal

The removal GRA involves the physical removal of impacted media or source material and transport for off-site management. This GRA is applicable to the SCCC Site in that DNAPL is recovered passively from recovery well sumps within the slurry wall and transported off-site for destruction or reuse as fuel. DNAPL recovery operations will continue for Area 1 and may be expanded to include removal and off-site disposal of DNAPL from Area 2, if applicable. The removal GRA is not practicable for soil or groundwater in Area 1 given the large volumes of these

impacted media and the effective containment remedies currently in place; however, at this time, this GRA is considered potentially applicable to groundwater in Area 2.

Active DNAPL recovery has been considered as a potential process option. The issues related to active DNAPL recovery versus passive DNAPL recovery are described below.

1. The SCCC Site is encompassed by a slurry wall that has a hydraulic conductivity of 10^{-7} cm/sec which provides containment of DNAPL, prohibiting the potential for DNAPL to migrate off-site.
2. Passive recovery has resulted in a total of 6,330 gallons of DNAPL recovered since startup in January 2012 through June 2016 indicating that passive DNAPL recovery is effective.
3. The HCTS will continue to operate for the foreseeable future. As a result, passive DNAPL recovery is implemented in a very cost-effective manner by utilizing the treatment system operators. Thus, the costs associated with transforming to active DNAPL recovery outweigh any benefit associated with an increase in the DNAPL recovery volume per unit time.

The only benefit of active DNAPL recovery versus passive DNAPL recovery in Area 2 would be a potential but only marginal increase in the rate (volume of DNAPL recovered per unit time) of DNAPL recovery. However, the cost would increase substantially for active recovery over passive recovery and the incremental benefit would be negligible since DNAPL is (i) stable, (ii) not migrating, and (iii) a substantial volume of unrecoverable residual DNAPL would remain. The residual DNAPL would act as a long-term source of dissolved phase impacts that would persist and prevent achievement of ARARs. Active DNAPL recovery would generate a substantial increase in the waste volume generated due to the large volume of groundwater generated during pumping that must be managed and treated. The additional volume of treated groundwater increases the quantity of treatment plant residuals requiring off-site disposal. This would require either the installation of treatment facilities and power supplies within the unsecure NJDOT ROW and/or the installation of conveyance piping and electrical lines from Area 1 beneath Belleville Turnpike to Area 2. Because passive DNAPL recovery can be employed cost-effectively using the on-site treatment plant personnel, an active DNAPL recovery approach is not deemed practicable given the cost and implementability issues associated with installation of facilities and infrastructure needed for active DNAPL recovery within Area 2. The implementability issues associated with active DNAPL recovery for Area 2 include:

Water Management – Active DNAPL recovery would generate a large volume of groundwater (likely more than 1,000 gallons per day) requiring management and treatment. Installation of conveyance piping from Area 2 to the existing HCTS is impracticable due to the presence of the

highway. Daily trucking of the groundwater from Area 2 to the HCTS is not practicable for safety reasons as explained below.

Safety – Active DNAPL recovery within Area 2 would require operations personnel to access the NJDOT right-of-way on an anticipated daily basis. Access to and from the NJDOT right-of-way is by a heavily travelled, high speed multi-lane roadway with a limited sight distance in the vicinity of Area 2 access points. Traffic control was employed to provide for safe ingress and egress during the Area 2 Remedial Investigation. However, provision of traffic control on a long-term continuous basis is not practicable and ingress/egress from Area 2 is not safe in the absence of costly traffic control due to traffic volume, speed of traffic and limited sight distance.

Security – Access to the NJDOT right-of-way by unauthorized personnel is uninhibited. Permanent facilities installed above-grade in the right-of-way in support of active DNAPL recovery would be subject to repeated vandalism, whereas passive DNAPL recovery may be conducted via low profile flush-mount and secured recovery wells accessible to only authorized personnel.

3.4.1.6 Ex-Situ Treatment

Ex-situ treatment is a potential general response for soil and groundwater and would include excavation of impacted soils and/or collection of groundwater and subsequent treatment. Groundwater is already collected and effectively treated through the HCTS. Multiple potential treatment methods exist for soils including chemical methods, physical methods, biological methods, and thermal methods. The ex-situ treatment GRA is not practicable for soil in Area 1 given the large volumes of impacted soil, the variability of the chemical constituents in the soil and the effective containment remedies currently in place for Area 1.

Given that the impacted soils of concern in Area 2 (outside the existing containment area) are located at depth and are proximate to the existing slurry wall, ex-situ treatment of soils is not considered a viable response given access and implementability issues. Ex-situ treatment of the deep soils would require that they first be excavated and brought to the surface for treatment. Deep excavation of the soils cannot be completed proximal to the slurry wall due to the potential for the barrier wall to structurally fail if the adjacent soils are removed. Also, the recent off-site investigation has indicated that DNAPL affected soils extend beneath the adjacent highway where completion of a deep excavation is considered impracticable. However, groundwater treatment methods that are already in place at the SCCC Site may be suitable for use for dissolved phase constituents located outside the existing slurry wall.

3.4.1.7 In-Situ Treatment

In-situ treatment is a potential general response for soil and groundwater. In-situ treatment of both media can be accomplished via chemical, physical, biological, or thermal methods under ideal conditions. The in-situ treatment GRA is not practicable for soil or groundwater in Area 1 given the large volumes of these impacted media. Moreover, the effective containment remedy currently in place renders such an approach of limited utility. Given the access limitations in Area 2, the in-situ treatment responses are expected to be infeasible.

3.4.2 Identification and Initial Screening of Technologies

The technologies that were initially screened for the SCCC Site and each Area are described below.

3.4.2.1 No Action

Under the No Action general response, there are no technologies or process options. No additional capital expenditures would occur and the No Action GRA would result in discontinuation of ongoing O&M. No Action is intended for baseline comparison.

3.4.2.2 Institutional Controls

ICs are expected to be necessary for the SCCC Site to supplement the IRMs and IRA completed to date regardless of any other foreseeable responses. ICs will likely take the form of controls on property use to prevent potentially adverse exposure by restricting or prohibiting activities and uses (e.g., subsurface excavation) that could result in exposure to subsurface contamination. These controls will: 1) prohibit groundwater use; 2) establish specific requirements to be adhered to for any activity which may result in disturbance of the CA; 3) prohibit intrusive SCCC Site activities below the existing ground surface unless appropriate health and safety measures, emission control measures (e.g., dust monitoring and suppression) and SCCC Site restoration activities are employed; 4) prohibit residential use on the SCCC Site and limit the use of the SCCC Site to commercial or industrial purposes; and, 5) require the use of vapor barriers for any new building construction. It is expected that the most robust method of establishing the appropriate institutional controls will be through the use of a deed notice. A draft Deed Notice is provided as Appendix B herein. The final deed notice(s) will be prepared following issuance of the Record of Decision in accordance with the selected remedy.

A CEA/WRA has been established for the SCCC Site as a result of the presence of chromium (CEA-2240) pursuant to the N.J.A.C. The CEA/WRA was established for chromium, chloride, and total dissolved solids. A new and separate CEA/WRA request will be submitted for Areas 1 and 2. This new CEA/WRA will cover the SCCC Site, the western portion of the HCIA property within the SCCC Site barrier wall system and the TI Zone within the NJDOT right-of-way in Area

2. The new CEA/WRA will include all SCCC Site chemicals of concern that were detected in Areas 1 and 2 at levels greater than the NJ GWQC and/or MCLs. Regulatory citations currently applicable to CEAs are in the Ground Water Quality Standards at N.J.A.C. 7:9C-1.6 and 1.9(b), the Technical Requirements for Site Remediation at N.J.A.C. 7:26E-4.3(a)7 and 4.9(a)7, and the Administrative Requirements for Remediation of Contaminated Sites at N.J.A.C. 7:26C-7.3, 7.5(c)2 and 7.5(d)2. The ARRCS requirements codified at N.J.A.C. 7:26C-7.3 specify the procedures for establishing, revising, and removing a CEA for existing ground water contamination at a contaminated Site, which includes use of the CEA/WRA Fact Sheet Form.

The ICs will also include the administrative controls to prevent exposure through the management of activity patterns and personal protective equipment and typically fall under the purview of the Occupational Safety and Health Administration (OSHA). Any investigative or remedial work undertaken at the SCCC Site will be conducted in a manner compliant with 29 Code of Federal Regulations (CFR) 1910 Subpart H (Hazardous Materials), specifically 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response) as a matter of course as well as 29 CFR 1926.1101, where applicable. In the context of a final remedy for the SCCC Site, two primary areas where administrative controls are considered appropriate are the O&M of the HCTS, including the various groundwater and NAPL recovery wells, and any potential future intrusive activities.

A Site-Specific HASP (FTS, March 2013) has been prepared for all SCCC operations associated with the HCTS and continued observation of the requirements of the HASP is appropriate as part of the ongoing operations. Implementation of the final remedy for the SCCC Site will be conducted in accordance with a HASP that is compliant with 29 CFR 1910.120. Additional administrative controls are appropriate to prevent potential exposures in the event of intrusive activities such as excavation (for utility or construction purposes). Any such activities must be completed in full compliance with both 29 CFR 1926 Subpart P (Excavations) and with the hazardous materials regulations codified under 29 CFR 1910. Ensuring compliance with these requirements is best affected through continued OSHA compliance for the HCTS, and via inclusion of specific requirements regarding intrusive activities in the administrative controls established for the SCCC Site.

3.4.2.3 Engineering Controls

Engineering controls (covers/barriers) can be used to prevent potential direct contact and fugitive dust emission from impacted soils, to prevent potential vapor intrusion under future land use conditions, and to manage stormwater runoff and infiltration. Direct contact with SCCC Site constituents is largely precluded by existing IRM and IRA cover materials/caps over the majority of the SCCC Site. Any engineering controls that consist of placement of cover materials must consider drainage issues and would be designed to prevent ponding and infiltration on the SCCC

Site. Careful consideration of increases in the low permeability area of the SCCC Site would be necessary to ensure that requirements regarding stormwater retention and treatment are attained. Also, in the context of the existing SCCC Site remedies, engineering controls include continued O&M.

Possible engineering controls that may be applicable for the SCCC Site consist of the following:

- Existing cover material improvements and continued maintenance;
- Placement of cover materials in targeted areas;
- Enhanced stormwater control;
- SCCC Site-wide fill and cover material placement; and,
- Continued O&M.

Existing Cover Material Improvements and Continued Maintenance - These activities, which are currently being implemented, would consist of ensuring that existing cover materials placed as IRMs (direct contact barriers) remain effective and are also effective at reducing infiltration. Patching, sealing, or repairing of concrete and/or asphalt covers are the appropriate process options for this technology.

Placement of Cover Materials in Targeted Areas - This option would most likely consist of the placement of additional asphaltic concrete (or other appropriate materials) in discrete portions of the SCCC Site. Such placement would occur in areas that do not currently have cover materials (as a result of the absence of surface impacts) and would primarily be completed as a stormwater control mechanism. Targeted areas would be identified via inspection of existing cover materials (or lack thereof) and buildings and via review of available groundwater monitoring data to identify areas where significant infiltration and groundwater recharge may be occurring. Such infiltration may occur as a result of direct precipitation or snowmelt in exposed areas, as a result of contributions from existing building downspouts, and possibly via sheet flow onto the SCCC Site.

Enhanced Stormwater Control - This approach could entail the use of additional technologies such as drainage controls and stormwater retention. As with the targeted placement of cover materials, the use of soil/topsoil to increase field capacity, grading to prevent ponding and revegetation to promote evapotranspiration has been given consideration using this technological approach. Such approaches are emerging as best management practices for stormwater across the country. It will likely be appropriate that careful consideration be given to the types of grasses or other upland plants to be used were a soil cover process option is to be employed.

SCCC Site-Wide Fill and Cover Material Placement - This option would consist of placement of fill materials of equal or lower permeability than those that currently exist in portions of the SCCC Site and could possibly include the use of low-permeability geomembranes. Use of this technology would require assessment of potential impacts on adjacent properties, increases in impervious area

and attendant requirements for stormwater management, and the potential impacts of lateral and shear loads on the slurry wall.

Continued O&M and Additional O&M– This option would consist of continuing the O&M activities identified in the two existing O&M Manuals.

Continued SCCC Site inspections and monitoring activities include the following:

- SSP wall inspections;
- SSP wall cathodic protection system inspections;
- CA cover system inspections;
- IRM cover systems inspections;
- Groundwater potentiometric surface elevation monitoring;
- Apparent DNAPL thickness measurements;
- HCTS influent and effluent monitoring;
- Stormwater management, erosion and sediment control, and permanent vegetation inspections;
- Slurry wall working platform inspections; and,
- SCCC Site security (e.g., fencing) and access inspections.

Potential continued SCCC Site maintenance (as needed based on the results of the inspections) could include the repair of the following components:

- SSP wall;
- CA cover;
- IRM cover systems;
- HCTS unit operations and associated equipment;
- Monitoring wells and piezometers;
- Stormwater/erosion and sediment control features and vegetation;
- Slurry wall platform; and,
- SCCC Site security/access features.

Existing Area 1 Components that undergo O&M are the:

- HCTS;
- Hydraulic control wells;
- DNAPL recovery wells; and,
- The SSP wall cathodic protection system.

Additional O&M would include the activities necessary to facilitate the effective remediation associated with the Area 2 technologies including DNAPL removal/disposal and recovery well maintenance. The additional O&M procedures would be added to the existing O&M Plans.

3.4.2.4 Containment

As previously discussed the existing slurry wall and SSP wall at the SCCC Site act as containment structures to control the migration of DNAPL and dissolved phase constituents in groundwater in Area 1. Extension of the containment wall could be considered for Area 2 impacts outside the wall. However, given the location of the existing slurry wall and the proximity of both the wall and the peripheral impacted area to the Belleville Turnpike, it is considered technically and/or administratively infeasible to tie into the existing slurry wall and extend an additional cell to encompass the impacted Area 2. A working platform would be necessary and the platform would have to extend into the Belleville Turnpike right-of-way.

Other Area 2 containment options (above and beyond a slurry wall extension) exist. The general Area 2 containment technology is the use of vertical physical barrier, and process options consist of jet-grouted overlapping columns, auger mixed overlapping columns, and SSP. These process options are described below and have been summarized in Table 3-3.

Jet-Grouted Columns - Use of this technology would involve high pressure (~5,000 pounds per square inch) injection of grout around the perimeter of the impacted area in Area 2 as a series of overlapping columns. Soils would be liquefied with the grout to a depth of approximately 25 feet such that the columns extend into the varved clay. The grout would solidify and act as an effective barrier to preclude potential subsurface migration of dissolved constituents and free phase material, if any. Jet-grouting could likely be completed such that the new barrier is an integral extension of the existing slurry wall. Difficulties may be encountered as a result of the likely presence of subsurface utilities such as storm sewers. Given the existing topography in Area 2, which includes a steep embankment up to the elevation of the Belleville Turnpike, use of this technology would likely require either a working platform or the use of temporary retaining walls and bench excavation in the right-of-way. Careful evaluation of the potential impacts of high-pressure jet grouting on the existing slurry wall would be required. Concerns also exist with respect to the viability of a grout wall that will penetrate a meadow mat layer and the possible formation of voids.

Auger-Mixed Columns – Auger-mixed columns are, in general, comparable to the jet-grouted columns. A hollow stem auger with large flights would be used to work the soil in Area 2. Grout would be injected under pressure through the hollow stem and the auger would be used to mechanically mix the existing soil, sand, or meadow mat. This technology would be similar to the jet-grouting application in that use of a working platform or bench work in the right of way would be necessary to accommodate access by the equipment. Concerns regarding the likely existence of utilities also exist with this technology. Careful evaluation of the potential impacts of auger mixing and pressure injection on the existing slurry wall would be required. As with the jet-grouted columns, concerns also exist with respect to the viability of a grout wall that will penetrate a meadow mat layer and the possible formation of voids.

Steel Sheet Pile Walls – The use of driven, interlocking SSP is a containment process option potentially applicable for Area 2. The use of steel sheet piling would likely entail the use of benching or a working platform in the right of way as previously discussed. Use of this technology would also likely require the use of some jet-grouting applications at the intersection of the SSP wall and the existing slurry wall given that driving sheet pile too close to the wall could likely damage the wall. Given the small area expected to be addressed via this technology, it is also likely that specialized fabrication of sheets would be required to turn tight corners.

Hydraulic containment is another potentially applicable technology. However, given that pumping of groundwater would necessitate treatment to remove dissolved phase constituents (at a minimum) this technology is described under the ex-situ treatment applications.

3.4.2.5 Removal

The removal technology is applicable for the collection and management of DNAPL in both Area 1 and Area 2. Multiple passive DNAPL recovery wells are currently in operation at the SCCC Site in Area 1 and recoverable DNAPL has been confirmed to be present in a monitoring well installed beyond the barrier wall in Area 2. The existing recovery wells are constructed of HDPE, are 18-inch in diameter, and are equipped with 10-foot sumps below the screened section for the accumulation of DNAPL. The wells are performing as intended and, in the event that opportunities for the collection of additional DNAPL exist, wells configured in this manner are an appropriate process option for DNAPL recovery. DNAPL is currently thermally treated (incinerated) or recycled via fuel blending off-site, per the current waste management procedures for the SCCC Site. This technology may also be appropriate for the impacted area located outside the existing slurry wall if recoverable DNAPL is identified at that location. DNAPL situated inside the slurry wall system is contained. While optimization of DNAPL recovery operations for locations inside the slurry wall may be considered, no new technologies beyond those currently in place for DNAPL collection are envisioned. Optimization of DNAPL recovery inside the wall will be evaluated in the context of ongoing SCCC Site O&M activities to the extent necessary.

3.4.2.6 Ex-Situ Treatment

Two preliminary ex-situ treatment options have been identified for the SCCC Site and both are considered applicable for the impacted material in Area 2 located outside the wall. One of these is for the solid media (i.e., subsurface soils) and the second is for groundwater.

Ex-situ treatment options (either on-site or off-site) would entail the excavation of material located between the Belleville Turnpike and the existing slurry wall to a depth of 25 feet or more. This excavation would be a necessary prerequisite to any ex-situ treatment options. Given the topography of the area, the presence of an active highway directly adjacent to the area, and the

presence of a functioning slurry wall abutting the area, ex-situ treatment is not considered viable because of the difficulties that would be encountered during excavation of the material and the potential detrimental effects on the highway, buried utilities, and the slurry wall. The potential for causing a failure of the slurry wall is a major concern. Excavation of the impacted soils located in the deep sand, and therefore, any ex-situ soil treatment options, will not be considered further in the feasibility study process.

Ex-situ treatment of groundwater is the second ex-situ treatment option. The existing treatment plant has the hydraulic capacity to accept more pumped groundwater at present. The technologies necessary to accomplish treatment (e.g., chromium reduction, metals removal, solids removal, and organic compound removal) are already in place at the HCTS treatment plant. The treatment technologies will not be evaluated further in the feasibility study process.

The process options for the ex-situ treatment technology for groundwater (i.e., pump and treat) focus on the groundwater collection component rather than the actual treatment. Pumping of groundwater from the deep sand is considered a feasible process option for the management of impacted groundwater located outside the existing slurry wall (i.e., in Area 2). This process option may be an appropriate response to act as a combined removal and containment option for the groundwater, and recoverable DNAPL (if present) located outside the wall. Groundwater collected from this location would most likely be conveyed to the treatment plant via hard piping or could be collected in a temporary storage vessel for subsequent transport to the treatment plant.

3.4.2.7 In-Situ Treatment

Various technologies and process options exist for in-situ treatment of soils and groundwater and these technologies are typically suitable for addressing both soils and groundwater. Given that the SCCC Site Area 1 constituents are contained by the existing slurry wall, the use of in-situ treatment technologies would be focused on the one area where impacts are present outside the slurry wall. Various Area 2 technologies that could conceivably be suitable to address the soil and groundwater impacts at this location consist of biological, chemical, physical, and thermal methods or combinations thereof. The potential technologies/process options may be described in more detail as follows:

Biological Treatment – Biological treatment is considered a viable means of reducing the mass of constituents in Area 2. Given the nature of the constituents present in the area, it is likely that a two stage biological treatment process would be appropriate. The first stage would consist of an interior (i.e., proximal to the source) anaerobic zone. An edible vegetable oil or other suitable substrate could be injected to the target zone to promote the formation of anaerobic conditions (oxidation-reduction potential on the order of -400 millivolts). The anaerobic zone could result in the dechlorination of the DCB isomers and monochlorobenzene. A second zone, outside the

primary treatment zone would be established that would consist of either an aerobic or sulfate-reducing zone. This zone would be targeted downgradient of the primary zone and would be used to accomplish the degradation of the metabolic product of the first stage anaerobic treatment (i.e., benzene). Although this type of technology has been employed for some sites, it is still considered under development for chlorinated benzene derivatives.

Chemical Treatment – Chemical in-situ treatment typically relies on the use of oxidants to destroy the COCs. Hydrogen peroxide, permanganate, and persulfate, as well as Fenton's reagent, are potential oxidizing agents/mixtures that may be used to affect the oxidation of the COCs. In addition to the fact that substantial oxidant is typically required to satisfy the soil oxidant demand, the use of oxidizing agents in the vicinity of an existing slurry wall is considered imprudent as the oxidants would likely have a detrimental effect on the integrity of the wall. In-situ chemical treatment will not be considered further during the FFS process.

Physical Treatment – Physical in-situ treatment of the impacted media in Area 2 would be accomplished in a manner similar to the methods discussed under physical containment. Auger-mixing or jet grouting would be used to physically stabilize the materials, resulting in reduced mobility as a result of macro-encapsulation and attendant reduction of leachability as well as a reduction in leaching potential as a result of reduced permeability. Given the location of the area adjacent to the Belleville Turnpike and the existing slurry wall, injection of large quantities of stabilizing materials could be problematic in that heaving conditions can occur as a result of volumetric increases. This would require careful evaluation during the feasibility study process. The treatment zone is in the deep sand and since a potentially compressible layer (i.e., the meadow mat) exists above the deep sand it may be possible to accomplish in-situ stabilization without promotion of heaving conditions. This technology (and the process options of auger-mixing and jet grouting) will be retained for further evaluation during the FFS process. Portland cement and bentonite, and possible admixtures such as carbon, may be appropriate materials for the physical treatment technologies.

Thermal Treatment – Multiple potential thermal treatment methods exist although, in spite of the application of such processes at multiple sites, limited success has been achieved to date. Thermal processes include in-situ vitrification, in-situ radio frequency heating, thermal desorption (e.g., steam stripping), and electrical resistivity heating using multi-phase electrical current. Given that (i) the target treatment zone is located at depth in a transmissive saturated zone (i.e., the deep sand) which would supply copious quantities of water with substantial heat capacity, (ii) recovery of potential volatilized constituents would be difficult given the existence of the meadow mat and a thin vadose zone, and (iii) substantial surface mounted equipment is required for the use of thermal technologies, the use of thermal methods is considered inappropriate for Area 2. Energy intensive thermal treatment methods will not be considered further in the feasibility study process.

Permeable Reactive Barrier – Permeable reactive barriers are an emerging technology and such systems have been used with some success at a number of sites. This technology consists of the use of a permeable wall through which impacted groundwater flows. The permeable wall is constructed of porous material that has the ability to react with constituents in the groundwater, resulting in their in-situ destruction. Examples of media used for such applications are zero-valent iron and peat. Such technologies may be deployed as either free standing walls or via the use of a funnel and gate technology. These technologies are used as a migration control rather than source reduction mechanism. Such technologies are generally employed for water table aquifers. Given that the impacted area of interest at the SCCC Site is the deep sand, the excavation to depth and installation of a permeable reactive barrier is not considered viable. This technology will not be evaluated further during the FFS process.

3.4.3 Evaluation and Screening of Technologies

The technologies corresponding to the GRAs described above are identified in Table 3-3. The process options associated with the technologies are also presented in Table 3-3. Additionally, summaries of the SCCC Site characterization information and general comments are included in Table 3-3. The information in Table 3-3 was utilized as the basis to complete the initial technology screening and process option screening for Area 1 and Area 2 as shown in Table 3-4.

Technology screening is conducted to narrow down the number of viable technologies from which remedial alternatives are assembled and evaluated with respect to their effectiveness, implementability and cost (USEPA, 1988). The screening criteria and evaluation of technologies are described below, and Table 3-5 shows how these criteria have been applied to the technologies potentially applicable at Area 1 and Area 2.

3.4.3.1 Effectiveness Screening

The effectiveness screening process evaluates whether the technology is proven and reliable with respect to remediating the COCs and achieving the RAOs. Effectiveness considerations for technology screening include:

- Reduction in toxicity, mobility or volume of COCs in the impacted media;
- Degree of risk reduction and long term protection;
- Timeframe for achieving risk reduction and long term protection; and,
- Potential short term impacts to human health and the environment.

3.4.3.2 Implementability Screening

The implementability screening process evaluates whether the technology can be constructed or implemented considering SCCC Site characteristics, the commercial availability of the technology, and the administrative feasibility of implementing it.

3.4.3.3 Cost Screening

The cost screening process evaluates the cost-effectiveness of a given technology and seeks to identify higher cost alternatives that should not be carried forward. Among other things, alternatives may be screened out if they provide effectiveness and implementability similar to another alternative, but at a higher cost, or if their cost is grossly excessive compared to their overall effectiveness. Cost estimates at this stage are approximate and focus on relative, not absolute, accuracy. Approximate costs are compared to the no further action GRA. More comprehensive cost estimates will be generated as part of the alternatives evaluation.

3.4.3.4 Selection of Technologies

The technologies and related process options have either been retained for further consideration or eliminated from further consideration in this section. The technologies were retained or eliminated based on effectiveness, implementability, and cost screening information as shown in Table 3-5. Table 3-5 also includes the basis for retention or elimination of certain technologies for Area 1 and Area 2. The technologies and associated process options that have been retained for further consideration and subsequent alternative development for Area 1 and Area 2 are listed in Table 3-6.

4.0 DEVELOPMENT OF ALTERNATIVES

Section 3.0 of this FFS Report included the identification of ARARs and the RAOs applicable to each media. Within Section 3.0, a series of GRAs and their associated technology types and processes were identified. The prospective technologies were then screened based on effectiveness, implementability and cost in Table 3-6, and the appropriate technologies were retained as shown in Table 3-7 based upon the results of the Table 3-6 screening process. The purpose of this section is to develop the retained technologies into comprehensive remedial alternatives. These alternatives are subsequently evaluated in detail in Section 5.0. Abbreviated summaries of each potential alternative that have been developed are provided below followed by a description of each alternative.

Implementation of any of the alternatives will result in COCs remaining on the SCCC Site above levels that would allow for unlimited use and unrestricted exposure. Therefore, a review of the SCCC Site conditions will be conducted by the USEPA at least once every five years, as required by CERCLA.

A conceptual plan has been prepared for the redevelopment of the SCCC Site as part of a warehousing and distribution facility, as described in Section 3.2.1 above. Although this plan is conceptual in nature, it appears, based on available information, that each of the remedial alternatives (other than Alternative 1 – No Action) is compatible with the currently contemplated future use of the SCCC Site. The remedial approaches described in this FFS include the necessary flexibility to potentially retrofit the proposed redevelopment fill placement activities. The remedial alternatives would be designed to accommodate other potential commercial/industrial development in Area 1, including the 13-acre portion of the HCIA property included in Area 1, when practicable and cost-effective while at the same time maintaining the protectiveness provided by the remedy.

As detailed in Section 1.2.5, the only structures remaining on the SCCC Site other than the groundwater treatment building are the shells of five historic structures (i.e., Buildings 1, 2, 3, 4 and 23) once part of Edison's operations. The Edison Buildings are deteriorated beyond repair. An asbestos survey and lead based paint survey conducted within the buildings in March 2004 as part of an earlier redevelopment initiative indicated that asbestos is present as a component of commercially available materials, such as window and roofing materials. Lead was detected in the various paint samples collected. USEPA has determined that the window and roofing components of the buildings are so degraded that open exposure pathways for contamination exist and cannot be closed, and that these materials could weather and break down over time. As such, USEPA has determined that such conditions constitute a release or threat of release to the environment. Accordingly, demolition of the Edison Buildings would be completed as part of implementing Alternative II, Alternative III, and Alternative IV.

4.1 ALTERNATIVE I: NO ACTION

As required by the NCP, the No Action alternative is evaluated to document the need for remedial action and to present a baseline for comparison against the other alternatives. Alternative I would include no further remedial actions, institutional controls, or O&M. This alternative would leave the existing remedial components in place; however, no further operation, maintenance or monitoring of those components would be performed. Operation of the DNAPL recovery system and the hydraulic control system would cease.

4.2 ALTERNATIVE II: CONTINUED DNAPL RECOVERY IN AREA 1, DNAPL RECOVERY IN AREA 2, INSTITUTIONAL CONTROLS, AND BUILDING DEMOLITION

This alternative would include the barrier wall system and continued DNAPL recovery in Area 1, construction of a passive DNAPL recovery system in Area 2, ICs in the form of deed notice and CEA/WRA, and demolition of the Edison Buildings. Federal and state groundwater ARARs in Area 1 and Area 2 that cannot be met would be waived due to technical impracticability, consistent with the Technical Impracticability Evaluation Report, which is Appendix A of this FFS.

The technologies associated with Alternative II are compatible with the current and reasonably anticipated future land use/development activities previously described in Section 3.2.1 above.

The Area 1 technology that applies to Alternative II is passive DNAPL recovery. The recovered DNAPL would be collected periodically and disposed of off-site. The existing Area 1 O&M procedures would be implemented as described in the existing O&M Manuals and updated as appropriate. Additional recovery wells would be installed in Area 1 if needed.

The Area 2 technology that applies to Alternative II is passive DNAPL recovery. The areas where DNAPL was previously observed in the Area 2 soil borings and monitoring wells would be addressed via installing large-diameter DNAPL recovery wells. The conceptual locations of the DNAPL recovery wells are shown on Figure 4-1. These well locations could be refined during the remedial design phase. Following initial well placement, the DNAPL removal procedures would be optimized, and consideration given to the installation of additional recovery wells if needed. The basis for the phased well placement approach includes, among other things, the observations of variable DNAPL recovery results in the Area 1 wells. Based on recently acquired DNAPL accumulation information for Area 2 monitoring well MW-D-28 reported in the RIR Addendum, passive DNAPL recovery is feasible within Area 2. The recovery wells will be designed with large diameter sumps to accommodate temporary storage of the DNAPL. The recovered DNAPL would be collected periodically and disposed of off-site in the same manner as is currently done for DNAPL that is recovered from within the barrier wall system.

ICs would be prepared as previously described to restrict future use of the SCCC Site, prohibit groundwater use and include the administrative controls such as health and safety considerations regarding appropriate management of activities during intrusive work activities and personal protective equipment. The groundwater use prohibition would apply to Area 1 and Area 2. A deed notice and/or other ICs to prohibit and limit potential future uses of the SCCC Site would be duly recorded in the Hudson County Registrar's office. A draft deed notice is included in Appendix B. In addition, ICs in the form of a CEA/WRA would be established for Area 1 and Area 2 to prohibit future groundwater use. A TI Waiver of groundwater ARARs would be established for Area 1 and Area 2. A groundwater monitoring plan would be developed and implemented. Proposed groundwater monitoring locations are shown on Figure 4-1.

USEPA has determined that demolition of the existing Edison Buildings is necessary and demolition would be completed as part of this alternative. The building foundations would be left in place. Fill will then be added within the building footprints, as necessary, to bring the surface to grade. Non-hazardous debris resulting from the building demolition will be consolidated within the building footprint to the extent practical. The final surface would be graded to promote positive stormwater drainage.

Alternative II includes O&M of the SCCC Site and the remedial components of this alternative.

Alternative II would result in COCs remaining on the SCCC Site above levels that would allow for unlimited use and unrestricted exposure. Therefore, a review of the SCCC Site conditions would be conducted by USEPA at least once every five years, as required by CERCLA.

4.3 ALTERNATIVE III: TARGETED CAP/COVER, AREA 1 DNAPL RECOVERY, AREA 2 DNAPL RECOVERY, INSTITUTIONAL CONTROLS, AND BUILDING DEMOLITION

Alternative III would include placement of targeted engineered cap/cover in specific locations within the Area 1 as a barrier to potential dermal contact, to reduce infiltration for optimization of O&M, and to reduce the transport of impacted surface soil via erosion and runoff or wind. The targeted cap/cover areas are shown in Figure 4-2 and include the remaining areas that are not capped/covered including wetlands areas and stone and vegetative cover areas. The existing stone cover areas would be covered with a more permanent cover such as asphalt paving. This alternative would also include repairing the existing IRM and IRA covers (e.g., repairing the asphalt) to the extent necessary. Stormwater management enhancements would be incorporated into the remedial design. The conceptual targeted cap/cover system SCCC Site plan and cap/cover details are shown on Figure 4-2.

Alternative III also would include the same DNAPL recovery in Area 1 and Area 2, ICs and demolition of the Edison Buildings as described in Alternative II. The conceptual locations for the new DNAPL recovery wells in Area 2 are shown on Figure 4-2.

The technologies associated with Alternative III are compatible with the current and reasonably anticipated future land use/development activities previously described in Section 3.2.1 above.

For conceptual planning and cost estimating purposes, Alternative III includes the following conceptual cap/cover assumptions.

Asphalt Cover of Existing Vegetation and Stone Cover Areas

The existing vegetated areas and stone cover areas (approximately eight acres) would be capped as follows:

- Two inches of wearing course and two inches of asphalt binder course above a four inch layer of granular subgrade (above existing vegetation and stone cover areas);
- Low lying areas of the existing asphalt or areas observed to be in disrepair would be lined with additional asphalt to facilitate positive stormwater drainage or reduce infiltration as necessary; and,
- Capillary break, as necessary.

Existing Wetlands Area Cap/Cover

The existing wetlands on-site that would be capped/covered include freshwater emergent wetlands that were formed as a result of stormwater runoff. Following Interim Remedial Activities conducted in 2011, wetlands restoration in the freshwater emergent wetlands included the planting of salt meadow cordgrass, spike grass, prairie cord grass, black grass, swamp mallow, big cordgrass, seaside goldenrod, salt marsh bulrush, switch grass, and groundsel bush. The proposed Alternative III cap/cover to be installed in the freshwater emergent wetlands would be constructed within the approximate footprint of the existing wetlands in the following manner. One foot of the surface soil within the wetlands areas would be excavated and the following cap/cover components would be placed in ascending order:

- 10 ounce per square yard (oz/sy) geotextile;
- 60-mil capillary break geomembrane (or other capillary break component as needed);
- 10 oz/sy geotextile; and,
- One (1) foot of wetlands planting substrate and revegetation.

Proposed topsoil composition, planned plant species, and post-restoration monitoring requirements will be determined during the remedial design. However, for developing estimated

costs for this remedial alternative, it is assumed that the wetlands planting substrate would consist of a silty organic soil followed by wetlands plants. The list of plants would be determined during the design phase and likely would be consistent with existing restoration efforts. It is assumed that the seed mixture to establish first year coverage would consist of annual rye, fall panicum, switch grass, coastal panic grass, and lady's thumb. A freshwater emergent wetlands restoration monitoring plan would be prepared as part of the remedial design. The plan would include invasive species management, post-construction monitoring (growing seasons one and two), specifications, and a final wetlands monitoring report.

Based on the conceptual scenario provided for Alternative III, the current hydrology would be minimally affected. It is anticipated that there would be a slight increase in stormwater runoff draining to the wetlands due to the cap/cover improvements; however, the elevation of the wetlands and the overall drainage area would be unchanged and, therefore, it is expected that the proposed cap/cover would not greatly affect the hydrology of the wetlands.

The detailed specifications for the cap/cover system components would be developed as part of the remedial design phase, but for the purposes of this FFS Report it has been assumed to consist of two separate cap/cover systems (the asphalt cover system for the stone covered and vegetated areas and the geomembrane cap in the wetlands areas) as shown on Figure 4-2. The proposed cap/cover systems would be retrofitted into the existing cap/cover systems.

Alternative III includes O&M of the SCCC Site and the remedial components of this alternative.

Alternative III would result in COCs remaining the SCCC Site above levels that would allow for unlimited use and unrestricted exposure. Therefore, a review of the SCCC Site conditions would be conducted by USEPA at least once every five years, as required by CERCLA.

4.4 ALTERNATIVE IV: SCCC SITE-WIDE ENGINEERED CAP/COVER, AREA 1 DNAPL RECOVERY, AREA 2 DNAPL RECOVERY, INSTITUTIONAL CONTROLS, AND BUILDING DEMOLITION

Alternative IV would include an engineered cap/cover system on the SCCC Property (a new cap/cover for all but the consolidation area that already has a cap/cover consisting of vegetative cover underlain by a geomembrane) as a barrier to potential dermal contact, to reduce infiltration for optimizing O&M, and to minimize transport of impacted surface soil via erosion and runoff or wind. The engineered cap/cover areas and the conceptual engineering cap/cover system plan are shown in Figure 4-3. The capillary break cap/cover components and the stormwater management enhancements associated with Alternative III would also be installed as part of Alternative IV.

Alternative IV also would include the same DNAPL recovery in Area 1 and Area 2, ICs and demolition of the Edison Buildings as described in Alternative II. The engineered cap/cover over

Area 1 would extend over the prepared surface of the Edison building footprints. The conceptual locations for the new DNAPL recovery wells in Area 2 are shown on Figure 4-3.

The technologies associated with Alternative IV are compatible with the current and reasonably anticipated future land use/development activities previously described in Section 3.2.1 above.

For conceptual planning and cost estimating purposes, Alternative IV includes the following cap/cover tentative assumptions and components:

Existing Wetland Area Cap/Cover

The existing wetlands on-site that would be capped/covered include freshwater emergent wetlands that were formed as a result of stormwater runoff. Following Interim Remedial Activities conducted in 2011, wetlands restoration in the freshwater emergent wetlands included the planting of salt meadow cordgrass, spike grass, prairie cord grass, black grass, swamp mallow, big cordgrass, seaside goldenrod, salt marsh bulrush, switch grass, and groundsel bush.

The proposed Alternative IV cap/cover to be installed in the freshwater emergent and isolated wetlands would be constructed with the approximate footprint of the existing wetlands in the following manner. One foot of the surface soil within the wetlands areas would be excavated followed by the following cap/cover components in ascending order:

- 10 oz/sy geotextile;
- 60-mil capillary break geomembrane (or other capillary break component as needed);
- 10 oz/sy geotextile; and,
- One (1) foot of wetlands planting substrate and revegetation.

Based on the conceptual scenario provided for Alternative IV, the current hydrology would be minimally affected. It is anticipated that there would be an increase in stormwater runoff draining to the wetlands due to the cap/cover improvements and increase in SCCC Site grades, however, the change in elevation of the wetlands would be consistent with the overall change in elevation of the SCCC Site, the drainage area would be unchanged and therefore it is expected that the proposed cap/cover would not greatly affect the hydrology of the wetlands. In addition, the existing catch basins and stormwater structures would be modified to accommodate the addition of the cap/cover fill materials. Also, this alternative would include the option to relocate existing non-permitted pre-IRA wetlands to other areas on the SCCC Site or to utilize the wetland banking option and purchase wetland credits off-site. If the existing wetlands are relocated on the SCCC Site, the relocation area would be of sufficient size to compensate for the existing wetlands. The relocated wetlands would be constructed in the same manner as the cap/cover installation methods in the freshwater emergent wetlands described above and the location will be determined during the remedial design.

Proposed topsoil composition, planned plant species, and post-restoration monitoring requirements will be determined during the remedial design. However, for developing estimated costs for this remedial alternative, it is assumed that the wetlands planting substrate would consist of a silty organic soil followed by wetlands plants. The list of plants would be determined during the design phase and likely would be consistent with existing restoration efforts. It is assumed that the seed mixture to establish first year coverage would consist of annual rye, fall panicum, switch grass, coastal panic grass, and lady's thumb. A freshwater emergent wetlands restoration monitoring plan would be prepared as part of the remedial design. The plan would include invasive species management, post-construction monitoring (growing seasons one and two), specifications, and a final wetlands monitoring report.

SCCC Site-wide Cap/Cover Placement

The SCCC Site-wide cap/cover system would include the following components (in ascending order):

- 10 oz/sy geotextile;
- 60-mil geomembrane ;
- 10 oz/sy geotextile;
- Approximately 33 inches of general fill (including a capillary break as needed);
- Approximately three inches of topsoil; and,
- Seeding and mulching of the topsoil.

The detailed specifications for the cap/cover system components would be developed as part of the remedial design phase, but for the purposes of this FFS Report has been assumed to consist of a 60 mil geomembrane placed between two layers of non-woven geotextile material and covered with a general fill soil layer followed by topsoil layer as shown on the detail on Figure 4-2. Because the cap/cover approach would essentially encompass the entire SCCC Site, no repair of the existing IRA and IRM covers would be necessary. The final configuration of the cap/cover would be integrated into a future SCCC Site land use development scenario.

Alternative IV includes O&M of the SCCC Site and the remedial components of this alternative.

Alternative IV would result in COCs remaining on the SCCC Site above levels that would allow for unlimited use and unrestricted exposure. Therefore, a review of the SCCC Site conditions would be conducted by USEPA at least once every five years, as required by CERCLA.

4.5 JUSTIFICATION OF TI WAIVER

Restoration of groundwater to ARARs was considered and it was concluded, based on the information presented in Appendix A, that no practicable alternatives could be implemented. Consequently, the development of alternatives (except Alternative I) included invoking an ARAR waiver for the groundwater at the SCCC Site due to technical impracticability. A common element of Alternatives II, III, and IV is the establishment of a TI Waiver for the Area 1 and Area 2 groundwater ARARs. The TI Evaluation Report is included as Appendix A. The specific federal and state ARARs that are proposed to be waived in Area 1 and Area 2 are listed in Table 4-2 of Appendix A. The applicability and appropriateness of a TI Waiver is evaluated based on the following three criteria as stated in the TI Guidance:

- Hydrogeologic factors (e.g., complex sedimentary deposits, low permeability aquifers);
- Contaminant-specific factors (e.g., DNAPL); and,
- Remedial system design inadequacies.

The third criterion listed above (design inadequacies) is not applicable because groundwater remediation systems have not been designed or operated within Area 2. Instead, SCCC Site-specific implementation factors will be utilized as a third evaluation criterion.

Hydrogeologic Factors

Observations made during soil boring drilling at the SCCC Site indicate that the vast majority of DNAPL is distributed at the base of the sand unit at the contact with the underlying varved clay confining unit. This distribution is consistent with the very high DNAPL specific gravity (greater than 1.3) and suggests that the DNAPL migration and distribution are more controlled by the topography of the upper surface of the varved clay than influenced by the direction of groundwater flow. Evaluation of geologic information shows that the surface of the varved clay beneath Areas 1 and 2 is relatively flat with localized undulations that result in depressions where free phase DNAPL accumulates. Thus, the DNAPL will migrate along the varved clay surface until it becomes trapped and pooled within low lying areas in the upper varved clay surface such as is the case beneath both Area 1 and Area 2. Under such conditions it is considered technically impracticable to locate and therefore recover all DNAPL pooled within the low lying areas within the varved clay surface.

Contaminant Related Factors

The dissolved DCB constituents in Area 2 groundwater are derived from a DNAPL source. Section 1.1 of the TI Guidance notes that contaminant-related factors "may limit the success of an extraction or *in situ* treatment process." It says, "NAPLs that are denser than water (DNAPLs)

often are particularly difficult to locate and remove from the subsurface; their ability to sink through the water table and penetrate deeper aquifers is one of the properties that makes them very difficult to remediate." The primary contaminant at the SCCC Site are DCBs, a DNAPL, and its qualities and distribution at the SCCC Site make remediation of groundwater to meet ARARs technically impracticable. Among other things:

- DCBs are denser than water. This attribute makes it extremely difficult to precisely locate the source material and remediate groundwater in a cost-effective manner, especially in complex geologic systems such as those found at the deep sand/varved clay contact beneath the SCCC Site.
- A significant fraction of DNAPL at the SCCC Site will persist as non-recoverable residual DNAPL. This residual DNAPL is immobile even under extreme hydraulic gradient conditions as a result of capillary tension in the soil. Therefore, DNAPL could persist at the SCCC Site as a source of dissolved constituents for several decades.
- Lastly, DCBs are only sparingly soluble in water. This limited solubility causes the DNAPL source to persist for long periods of time and prevents the removal of significant mass via groundwater extraction.

SCCC Site-Specific Implementation Factors

The Town of Kearny, which owns the SCCC Property, recently adopted a resolution (Resolution 2016-250) conditionally designating Sitex as the Redeveloper for the SCCC Property and adjacent Diamond Site. Currently, Sitex is planning to construct an 850,000 square foot warehouse and distribution center on the SCC property and adjacent Diamond Site.

Plans for redevelopment of the portion of Area 1 on the HCIA property are also underway. According to information provided by HCIA to USEPA, HCIA has entered into a Purchase and Sale Agreement with Morris Kearny Associates, LLC (MKA) to develop the former Koppers Seaboard Site including the 13 acres of land within the SCCC Site barrier wall system. The current redevelopment plan includes the construction of four new industrial warehouse buildings, totaling approximately 2.1 million square feet, along with paved parking lots, paved roads, and utility infrastructure. The installation and long term operation of active remedial systems designed to aggressively remove contaminant mass is incompatible with the planned future land use in Area 1.

DNAPL exists beneath the Belleville Turnpike, which is a heavily travelled multi-lane roadway in the area (see Figure 3-1). The installation and operation of an active remedial system within the limits of the highway is impracticable and unsafe due to the use of this area for vehicular traffic. Due to undulating surface of the varved clay, as discussed previously, it is not technically practicable to mobilize all of the DNAPL from beneath the roadway to recovery points located adjacent to the highway. Similarly, it is not considered practicable to inject reagents adjacent to

the highway to successfully treat DNAPL located beneath the roadway as it would not be possible to ensure that the reagents could be delivered successfully to the areas containing DNAPL. Thus, accessibility issues and physical constraints associated with DNAPL trapped beneath the Belleville Turnpike make restoration of groundwater in this area to MCLs or New Jersey GWQC technically impracticable within a reasonable timeframe.

4.6 SUMMARY OF ALTERNATIVES

This section includes an overall summary of the technologies and associated components for each alternative. This summary provides the basis for the detailed analysis of each alternative in Section 5.0. Table 4-1 includes a summary of the alternatives.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

This section includes a detailed analysis of each of the alternatives developed and described in Section 4.0. The alternatives are evaluated and compared relative to the criteria established under §300.430(e)(9)(iii) of the NCP.

5.1 EVALUATION CRITERIA FOR ALTERNATIVES

A description of each of the nine evaluation criteria is provided below. These criteria are categorized in the NCP as either threshold criteria, balancing criteria, or modifying criteria.

Threshold Criteria:

1) ***Compliance with ARARs*** – This criterion is used to determine whether the alternative will comply with the ARARs identified in Section 3.1.

2) ***Overall Protection of Human Health and the Environment*** – This criterion provides an assessment of the degree to which the alternative provides adequate protection of human health and the environment with respect to the RAOs identified in Section 3.2.

Balancing Criteria:

1) ***Long-Term Effectiveness and Permanence –*** The evaluation of this criterion includes an assessment of whether the alternative will prove successful in the long-term. Factors to be considered, as appropriate, include the potential for residual risk remaining after the alternative is implemented.

2) ***Reduction of Toxicity, Mobility, or Volume Through Treatment –*** This criterion includes an evaluation of whether the alternative will permanently and significantly reduce the toxicity, mobility, or volume of the COCs through treatment in the impacted media.

3) ***Short-term Effectiveness –*** The short-term impacts of the alternative will be assessed, including the impacts on public health and the environment during remedial construction. The reliability of protective measures during construction and the timeframe required to achieve short-term protection are also considered.

4) ***Implementability –*** This criterion includes an evaluation of the technical and administrative feasibility of implementing the alternative. Factors to be considered include the feasibility of acquiring any administrative or regulatory approvals, availability of various services and materials required to construct the remedy and provide O&M after the remedy is constructed.

5) ***Cost –*** A present worth cost estimate is provided for each alternative. The estimate includes the capital costs along with the yearly O&M cost along with the present value of the annual O&M costs over a 30-year timeframe. Costs developed are expected to provide an accuracy of plus 50 percent to minus 30 percent (USEPA, 1988).

Modifying Criteria:

1) ***State Agency Acceptance*** – NJDEP, as the support agency, may provide input on the alternatives evaluation and remedy selection processes. This criterion will be addressed in the Record of Decision once comments on the proposed plan have been received.

2) ***Community Acceptance*** – This assessment includes an evaluation of the current and potential public issues and concerns related to the alternative. The community acceptance analysis will be completed in the future following the receipt of any public comments on USEPA's Proposed Plan for the SCCC Site.

5.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

This section includes an individual analysis of the alternatives for the alternatives developed in Section 4.0.

5.2.1 Alternative I Analysis

This section provides an individual analysis of Alternative I (No Action) based on the threshold criteria and balancing criteria listed above.

Overall Protection of Human Health and the Environment

Alternative I would not reduce the potential SCCC Site risks or meet the RAOs established for the SCCC Site.

Compliance with ARARs

The chemical-specific ARARs that pertain to the SCCC Site remediation are groundwater quality standards based upon potable use, as well as pathway elimination criteria. These ARARs at a minimum establish a need for ICs. Thus, Alternative I would not comply with chemical-specific ARARs because no ICs would be established.

Action-specific and location-specific ARARs do not apply to Alternative I because no remedial activities would be performed.

Long-Term Effectiveness and Permanence

The discontinuation of the O&M activities would result in localized flooding or groundwater overtopping the slurry wall in some areas. Also, the existing covers would likely deteriorate over time. The No Action alternative does not satisfy the long-term effectiveness and permanence criterion.

Reduction of Toxicity, Mobility, or Volume

The direct reduction of the toxicity and volume of COCs and DNAPL through treatment would cease if the O&M activities were discontinued. The mobility of the COCs in soil could increase via stormwater runoff as a result of the deterioration of the existing soil covers and the mobility of COCs in groundwater could increase via localized flooding and/or groundwater overtopping the barrier wall system.

Short-Term Effectiveness

No construction activities are included as part of Alternative I. Implementation of Alternative I could generally be considered effective in the short-term because no potential short-term exposure scenarios exist. Because this alternative does not include active remediation activities, no increased short term risks to on-site workers or disturbance of ecological features would exist.

Implementability

The No Action alternative could be readily implemented since no active remediation would be required.

Cost

The No Action alternative does not include any capital or O&M costs. The cost of this alternative is $0.

5.2.2 Alternative II Analysis

This section provides an individual analysis of Alternative II (continued Area 1 O&M, Area 2 DNAPL recovery, additional O&M of the Area 2 DNAPL recovery wells, demolition of the Edison Buildings and ICs) based on the threshold criteria and balancing criteria listed above.

Overall Protection of Human Health and the Environment

Alternative II implementation would result in the establishment of the ICs for the SCCC Site (with the cooperation of the property owners), which would result in additional protection of human health and the environment. Also, the continued and additional O&M activities would further

reduce the potential SCCC Site risks by maintaining the existing soil covers and continuing the hydraulic control and DNAPL removal programs in Area 1 and instituting passive DNAPL recovery within Area 2. Thus, this alternative would meet the surface and subsurface soil, groundwater and DNAPL RAOs established for the SCCC Site. The USEPA-determined release or threat of release of asbestos and lead into the environment would be addressed via demolition of the dilapidated Edison Buildings.

Compliance with ARARs

The chemical-specific ARARs that pertain to groundwater include promulgated federal and state standards. Comparison to these benchmarks establishes the need for ICs, and this alternative would include the ICs needed to meet RAOs. It is technically impracticable to achieve chemical-specific ARARs, and as such, a TI Waiver is being sought. The ARARs that pertain to asbestos and lead would be met.

Location-specific and action-specific ARARs apply to the continued and additional O&M but, would not be applicable above and beyond O&M because Alternative II does not include additional active remediation.

The action-specific ARARs that would apply include the ongoing management of the HCTS residuals and DNAPL.

Long-Term Effectiveness and Permanence

This alternative could be effective over the long term because of the existing slurry wall, and continued groundwater extraction and treatment and DNAPL removal. In addition, the existing soil IRMs would be maintained to preclude direct contact with impacted soils. There are small and isolated areas (non-permitted pre-IRA wetland areas comprising 0.2 acres) on-site that are not covered with materials considered to be a barrier to direct contact, therefore, the RAO pertaining to mitigating potential direct contact with surface soil would not be met in these small and isolated areas. This alternative could be designed for compatibility with the potential future use of the property as a warehousing and distribution facility or other commercial/industrial uses.

Reduction of Toxicity, Mobility, or Volume

A direct reduction in the toxicity, mobility, and volume of COCs and DNAPL would continue because the current passive DNAPL recovery and groundwater treatment activities would continue in Area 1 and passive DNAPL recovery would be initiated in Area 2. The mobility of the COCs would continue to be controlled due to the existing slurry wall in conjunction with the hydraulic control system and maintenance of the existing soil covers.

Short-Term Effectiveness

The estimated timeframe is approximately three months to complete the Alternative II. Implementation of Alternative II could generally be considered effective in the short-term because no potential short-term exposure scenarios exist. Because this alternative does not include additional active remediation activities with the exception of the Area 2 DNAPL recovery well installation, minimal increased short term risks to on-site workers or disturbance of ecological features would exist.

Implementability

This alternative could be readily implemented because the only active remediation would be the DNAPL recovery well installation in Area 2 along with securing the land use controls for Area 1. A new access agreement will have to be obtained from the NJDOT for the installation of the DNAPL recovery wells. An access agreement is in place with the Town of Kearny for continued O&M in Area 1 and the Group has secured an agreement with the Town of Kearny for establishment of a land use restriction prohibiting future residential use of the SCCC Site.

Cost

The capital cost components for Alternative II include the items listed in Table 5-1. The estimated capital cost is approximately $1,392,000.

The annual costs include O&M and are based on the known annual O&M budget established for the SCCC Site to date, along with estimates for additional Area 2 DNAPL recovery and TI Zone monitoring. The estimated direct annual O&M cost is $541,000. The estimated present worth of annual costs is approximately $8,367,000. This amount is based on costs for an assumed SCCC Site O&M duration of 30 years and a seven percent discount rate. The total estimated Alternative II cost items, including cost assumptions, are provided in Table 5-1. The total estimated present worth cost for Alternative II is approximately $9,759,000.

5.2.3 Alternative III Analysis

This section provides an individual analysis of Alternative III (targeted Area 1 cap/cover, continued O&M, Area 2 DNAPL recovery, demolition of the Edison Buildings and ICs) based on the threshold criteria and balancing criteria listed above.

Overall Protection of Human Health and the Environment

Alternative III implementation would result in increased protection of human health and the environment by placement of a low permeability layer above the uncapped areas of the SCCC Site.

Protection of human health and the environment by establishment of ICs and maintenance of the existing remedial components by continuation/expansion of the O&M program would be afforded by Alternative III. The risk of the potential release of asbestos and lead into the environment in the future would be addressed via demolition of the dilapidated Edison Buildings.

Compliance with ARARs

The chemical-specific ARARs that pertain to groundwater include promulgated federal and state standards. Comparison to these benchmarks establishes the need for ICs and this alternative would include the required ICs necessary to meet RAOs. It is technically impracticable to achieve chemical-specific ARARs, and as such, a TI Waiver is being sought. Location-specific ARARs identified for Alternative III include potential excavation and filling activities in wetlands and floodplains, therefore, location-specific ARARs would be applicable. To the extent that wetlands and floodplains are filled during remedial activities, the applicable substantive regulatory requirements would be met. The ARARs that pertain to asbestos and lead would be met.

Because this alternative does include additional active remediation activities, action-specific ARARs would be applicable. Action-specific ARARs that could apply to Alternative III include erosion and sediment control/stormwater management regulations and hazardous and solid waste management regulations. The applicable substantive regulatory requirements would be met with respect to action-specific ARARs.

Long-Term Effectiveness and Permanence

The long term effectiveness would be increased via the cap/covers added to the unlined areas of the SCCC Site by decreasing stormwater infiltration and preventing potential direct contact with the soil. The long-term effectiveness would be maintained as the targeted cap/covers areas would be added to the O&M program to ensure that inspections and any necessary repairs would be made. Also, long-term effectiveness is provided via the existing barrier wall system, and continued groundwater extraction and treatment and existing/expanded DNAPL removal. In addition, the soil covers would be maintained to preclude direct contact with impacted soils. This alternative is could be designed for compatibility with the potential future use of the property as a warehousing and distribution facility or other commercial/industrial uses.

Reduction of Toxicity, Mobility, or Volume

The additional cap/cover areas would further reduce the infiltration of groundwater and the mobility and volume of impacted groundwater. The direct reduction of the toxicity and volume of COCs and DNAPL would continue because the current passive DNAPL recovery and groundwater treatment activities would continue and O&M would be expanded to include Area 2

passive DNAPL recovery. The mobility of the COCs would continue to be controlled due to the existing barrier wall system in conjunction with the hydraulic control system.

Short-Term Effectiveness

The estimated timeframe is approximately six months to complete construction of Alternative III. Because this alternative includes additional active remediation activities, short term risks to on-site workers and disturbance of wetlands would exist during construction. However, because the remedial activities would generally be non-intrusive with the exception of the new DNAPL recovery well drilling in Area 2, the risk to on-site workers would be relatively low. The wetlands would be affected in the short-term but would be restored.

Implementability

This alternative could be readily implemented because the cap/cover placement and Area 2 DNAPL well installation are straight-forward technologies and the area for cap/cover placement is relatively small. Implementation of the O&M for the existing remedial measures has been performed for several years and no implementability issues exist. Establishment of the institutional controls is an implementable administrative task. A new access agreement will have to be obtained from the NJDOT for the installation of the DNAPL recovery wells. An access agreement is in place with the Town of Kearny for continued O&M in Area 1 and the Group has secured an agreement with the Town of Kearny for establishment of a land use restriction prohibiting future residential use of the SCCC Site.

Cost

The capital cost components for Alternative III include the items listed in Table 5-2. The estimated capital cost is approximately $4,618,000.

The annual costs include existing and expanded (Area 2) O&M. The estimated direct annual O&M cost is $396,000. The estimated present worth of annual costs is approximately $6,628,000, and is based on an assumed 29 percent reduction in the direct annual O&M budget established for the SCCC Site. The cost reduction premise accounts for the reduced stormwater infiltration afforded by the targeted cap/cover which would result in less groundwater being pumped to the HCTS for treatment. An evaluation conducted using the HELP model indicated that the Alternative III cover would reduce infiltration by an estimated 46 percent compared to current conditions. HELP Model documentation is provided as Appendix C. This reduction in infiltration quantities was factored into the current O&M cost tracking spreadsheet which indicated a resultant 29 percent reduction in overall O&M expenditures compared to 2015 actual costs. Expanded O&M activities include Area 2 DNAPL recovery and biannual resealing and maintenance of the asphalt cover to maintain

infiltration reduction long-tem. The estimated present worth amount is based on an assumed SCCC Site O&M duration of 30 years and a seven percent discount rate.

The total estimated Alternative III cost items, including cost assumptions, are provided in Table 5-2. The total estimated present worth cost for Alternative III is approximately $11, 246,000.

5.2.4 Alternative IV Analysis

This section provides an individual analysis of Alternative IV (SCCC Site-wide Area 1 cap/cover, continued O&M, Area 2 DNAPL recovery, demolition of the Edison Buildings and ICs) based on the threshold criteria and balancing criteria listed above. The construction of the wetlands relocation area defined in Section 4.5 is included as a conceptual construction component for Alternative IV.

Overall Protection of Human Health and the Environment

Alternative IV implementation would result in increased protection of human health and the environment by placement of a SCCC Site-wide cap/cover. ICs and continuation/expansion of the current O&M program afford additional protection of human health and the environment for Alternative IV. The risk of potential release of asbestos and lead into the environment in the future would be addressed via demolition of the dilapidated Edison Buildings.

Compliance with ARARs

The chemical-specific ARARs that pertain to groundwater include promulgated federal and state standards. Comparison to these benchmarks establishes the need for ICs and this alternative would include the ICs as necessary to meet RAOs. It is technically impracticable to achieve chemical-specific ARARs for groundwater, and as such, a TI Waiver is being sought. The ARARs that pertain to asbestos and lead would be met.

Location-specific ARARs identified for Alternative IV include potential excavation and filling activities in floodplains and/or wetlands, therefore, location-specific ARARs would be applicable. To the extent that wetlands or floodplains are filled during remedial activities, the applicable substantive regulatory requirements would be met.

Because this alternative includes additional active remediation activities, action-specific ARARs would be applicable. Action-specific ARARs that could apply to Alternative IV include erosions and sediment control/stormwater management regulations and hazardous and solid waste management regulations. The applicable substantive regulatory requirements would be met with respect to action-specific ARARs.

Long-Term Effectiveness and Permanence

The long term effectiveness would be increased via the cap/cover added to the entire SCCC Site by decreasing stormwater infiltration and preventing potential direct contact with the soil. This alternative would also result in enhanced stormwater management. The SCCC Site-wide cap/cover would be effective over the long-term because the new cap/cover would be added to the O&M program to ensure that inspections and any necessary repairs would be made. Also, long-term effectiveness is provided via the existing barrier wall system, and continued groundwater extraction and treatment and existing and expanded DNAPL removal. In addition, the soil covers and the geomembrane liner would be maintained to preclude direct contact with impacted soils. This alternative could be designed for compatibility with the potential future use of the property as a warehousing and distribution facility or other commercial/industrial uses.

Reduction of Toxicity, Mobility, or Volume

The SCCC Site-wide cap/cover would reduce the infiltration of groundwater and the mobility and volume of impacted groundwater. A direct reduction in the toxicity, mobility, and volume of COCs and DNAPL would continue in Area 1 because the current passive DNAPL recovery and groundwater treatment activities would continue in Area 1 and O&M would be initiated in Area 2 to include passive DNAPL recovery. The mobility of the COCs would continue to be controlled due to the existing barrier wall system in conjunction with the operation of the hydraulic control system and maintenance of the existing soil covers.

Short-Term Effectiveness

The estimated timeframe is approximately one year to complete construction of Alternative IV. Because this alternative includes additional active remediation activities, short term risks to on-site workers and disturbance of wetlands would exist. However, because the remedial activities would generally be non-intrusive with the exception of the new DNAPL well drilling in Area 2, the risk to on-site workers would be relatively low. The wetlands would be affected in the short-term, but, would be restored or otherwise mitigated.

Implementability

This alternative could be readily implemented because the SCCC Site-wide cap/cover placement and Area 2 DNAPL well installation are straight forward technologies. However, the area of cap/cover placement for Alternative IV is relatively large. Implementation of the O&M for the existing remedial measures has been performed for several years and no implementability issues exist. Establishment of the institutional controls is an implementable administrative task. A new access agreement will have to be obtained from the NJDOT for the installation of the DNAPL recovery wells. An access agreement is in place with the Town of Kearny for continued O&M in

Area 1 and the Group has secured an agreement with the Town of Kearny for establishment of a land use restriction prohibiting future residential use of the SCCC Site.

Cost

The capital cost components for Alternative IV include the items listed in Table 5-3. The estimated capital cost is approximately $13,456,000.

The annual costs include existing and expanded O&M. The estimated direct annual O&M cost is $231,000. The estimated present worth of annual costs is $3,843,000 and is based on an assumed 62 percent reduction in the direct annual O&M budget established for the Area 1 of the SCCC Site. The cost reduction premise includes the reduced stormwater infiltration afforded by the SCCC Site-wide cap/cover which would result in less groundwater being pumped to the HCTS for treatment. An evaluation conducted using the HELP model indicated that the Alternative IV cover would reduce infiltration by an estimated almost 100 percent compared to current conditions. HELP Model documentation is provided as Appendix C. This reduction was factored into the current O&M cost tracking spreadsheet which indicated a resultant 62 percent reduction in overall O&M expenditures compared to 2015 actual costs. Expanded O&M activities include Area 2 DNAPL recovery and mowing of the vegetation atop of the SCCC Site-wide soil cover. The estimated present worth is based on an assumed SCCC Site O&M duration of 30 years and a seven percent discount rate.

The total estimated Alternative IV cost items, including cost assumptions, are provided in Table 5-3. The total estimated present worth cost for Alternative IV is $17,299,000.

5.3 COMPARATIVE ANALYSIS SUMMARY

This section includes a comparative analysis of the four alternatives developed for the Area 1 and Area 2. Each alternative is compared relative to the seven evaluation criteria.

Overall Protection of Human Health and the Environment

Alternative I would leave conditions as-is at the SCCC Site without further remediation and therefore does not provide adequate protection of human health and the environment. The existing covers would not be maintained and potential groundwater overtopping of the barrier wall system could occur. In addition, the USEPA has determined that the dilapidated condition of the Edison Buildings constitute a release or threat of release of hazardous substances, and these conditions would not be addressed under Alternative I.

Alternatives II, III, and IV would be protective of human health and the environment because these alternatives address the RAOs established for the SCCC Site. The placement of cap/cover systems

(Alternatives III and IV) would provide greater protection to human health and the environment than Alternative II due to the additional reduction in exposure potential and reduction in transport of impacted soil. The additional protection provided by Alternatives III and IV is considered equivalent, in that the cap/covers of the two alternatives would fully extend over Area 1 and thereby eliminate human exposure to COCs in the surface soil and subsurface soil. The USEPA-determined release or threat of release of asbestos and lead into the environment would be addressed in Alternatives II, III and IV via demolition of the dilapidated Edison Buildings.

Compliance with ARARs

The chemical-specific ARARs that apply to all the alternatives include state and federal groundwater quality standards. As explained above and in the Technical Impracticability Evaluation Report attached hereto as Appendix A, for Alternatives II, III and IV, a TI Waiver would be sought for the groundwater standards in Areas 1 and 2 because it is not technically practicable to achieve the standards in a reasonable timeframe. Issuance of a TI Waiver by USEPA would waive the requirements for the selected remedy to achieve these groundwater ARARs. ICs, such as the CEA/WRA, would prohibit groundwater use within those areas exceeding ARAR standards. Alternative I would not comply with chemical-specific ARARs and, as the No Action alternative, does not include a TI Waiver.

Because no additional remedial activities are included as part of Alternative I, location-specific ARARs are not applicable. Location-specific ARARs would apply to Alternatives II, III and IV including potential excavation and filling activities in wetland or floodplain areas for Alternatives III and IV. To the extent that wetlands and floodplain areas are filled during remedial activities, the pertinent ARARs would be met.

Because no additional remedial activities are included as part of Alternative I, action-specific ARARs are not applicable. Action-specific ARARs that could apply to Alternatives II, III, and IV include erosion and sediment control/stormwater management regulations and hazardous and solid waste management regulations.

Alternatives II, III and IV are considered to be equivalent with respect to Compliance with ARARs.

Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence is not afforded by Alternative I because, among other reasons, the maintenance of the existing soil covers and hydraulic control of groundwater would be discontinued and there would be no institutional controls to protect against risk during intrusive activities. In contrast, Alternatives II, III, and IV are anticipated to have both long-term effectiveness and permanence as all three alternatives include monitoring and maintenance to ensure that the remedies remain protective.

Reduction of Toxicity, Mobility, or Volume

For Alternative I, cessation of hydraulic control activity could lead to groundwater flooding the SCCC Site and/or overtopping the barrier wall system and could further result in an increase of the groundwater mobility. The cessation of the groundwater treatment system would eliminate the ongoing reduction of the toxicity and volume of COCs. The reduction of toxicity and volume of COCs via the groundwater treatment system and other technologies in impacted media would continue for Alternatives II, III, and IV. The additional cap/cover areas (Alternatives III and IV) would further reduce the infiltration of stormwater and the volume of impacted groundwater and provide enhanced direct contact protection. Alternative IV provides for the greatest reduction in infiltration due to the installation of a geomembrane and thus slightly better reduction in mobility and volume.

Short-Term Effectiveness

The implementation of Alternative I would not include additional remedial construction activities; therefore this alternative would not result in any short term adverse effects on human health.

The construction activities associated with Alternatives II, III, and IV would generally be surficial with the exception of the Area 2 DNAPL well drilling/installation, and only relatively small quantities of impacted SCCC Site media would need to be managed during the active construction. Therefore, the short-term human risks resulting from these actions are considered to be minimal. The potential short-term risks for Alternative IV would be slightly greater than Alternatives II and III due to the larger volumes of fill soil to be transported and placed and longer duration of construction activities.

The estimated time to complete Alternative II is approximately three months. The estimated time to complete Alternative III is approximately six months, and the estimated time to complete Alternative IV is approximately one year. The longer timeframes are due to more extensive construction requirements. These construction schedules are within typical and expected remedial construction timeframes.

Implementability

No technical or administrative implementability issues are anticipated if Alternative I is selected. The technical and administrative issues increase progressively for the other alternatives. However, the cap/cover alternatives have commonly been utilized at similar sites including previously at the SCCC Site. Implementation of Alternatives II, III, and IV would require specialized contractors and equipment which are readily available. The clearing and grubbing requirements would be more significant for Alternative IV than Alternative III, however, the difference is not significant.

Management of potentially impacted media and DNAPL may be required for Alternatives II, III, and IV.

Alternatives II and III and IV are considered to be equivalent with respect to Implementability.

Cost

A summary of the total estimated cost for each remedial alternative is provided in this section for comparative analysis. The total estimated present worth costs (including the applicable capital and O&M costs) range from $0 for Alternative I to $15,850,000 for Alternative IV as shown in the table below.

Alternative	Estimated Capital Cost	Estimated Direct Annual O&M Cost	Estimated O&M Present Worth Cost for 30 Years	Total Estimated Present Worth Cost
I	$ 0	$ 0	$ 0	$ 0
II	$ 1,392,000	$ 541,000	$ 8,367,000	$ 9,759,000
III	$ 4,618,000	$ 396,000	$ 6,628,000	$ 11,246,000
IV	$ 13,456,000	$ 231,000	$ 3,843,000	$ 17,299,000

Estimated costs for Alternative II and Alternative III are similar with Alternative III being slightly higher than Alternative II. The estimated cost of Alternative IV is substantially higher than Alternative II and Alternative III.

6.0 SUMMARY AND CONCLUSIONS

This FFS presents remedial alternatives for the SCCC Site. A conceptual plan for redevelopment of the SCCC Site for use as a warehousing and distribution facility has been prepared. The remedial alternatives developed and evaluated herein are compatible with this potential future use of the property. When practicable and cost-effective, the remedial alternative selected would be designed to accommodate other potential commercial/industrial development in Area 1, including the 13-acre portion of the HCIA property included in Area 1 while at the same time maintaining the environmental protectiveness provided by the remedy. Table 6-1 summarizes the final evaluation of the alternatives. Specifically, the results of the two threshold criteria and five balancing criteria analyses for each alternative has been assigned a qualitative rating value (i.e., poor, fair, good, best) indicative of its ability to satisfy each criterion in Table 6-1. Consistent with CERCLA guidance, modifying criteria are to be evaluated following comment on the Proposed Plan. The evaluation of remedial alternatives is also summarized below.

- Alternative I does not meet the threshold criteria of Overall Protection of Human Health and the Environment and Compliance with Applicable or Relevant and Appropriate Requirements. For this reason, it is not considered further in the comparative analysis.

- Alternatives II, III and IV are equivalent with respect to satisfying the threshold criteria of Overall Protection of Human Health and the Environment, and Compliance with ARARs.

- Alternatives II, III and IV are equivalent with respect to satisfying the balancing criteria of Long Term Effectiveness and Permanence, and Implementability evaluation criteria.

- Alternatives II and III are better than Alternative IV in terms of the balancing criterion of Short Term Effectiveness as these alternatives can be constructed in shorter time frames.

- Alternative IV is slightly better with respect to the balancing criterion of Reduction of Toxicity, Mobility, and Volume (although not through treatment) because the geomembrane component of this alternative virtually eliminates infiltration.

- Estimated costs for Alternative II and Alternative III are similar with Alternative III being slightly higher than Alternative II. The estimated cost of Alternative IV is substantially higher than Alternatives II and III.

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FIGURES

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/10/15	KEY ENVIRONMENTAL INCORPORATED
CHKD: MJV	DATE: 03/01/16	
APPD: JSZ	DATE: 03/01/16	
SCALE:	1"= 2000'	

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES OF JERSEY CITY, AND WEEHAWKEN, NEW JERSEY

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

SITE LOCATION MAP

PROJECT NO: 201501-05

FIGURE 1-1

y:\00civil\kearny\focused feasibility study\figure 1-1 site location map.dwg Last Saved By: Scomer 6/9/2016 3:58 PM Plotted By: Shelly Comer 6/16/2016 4:24 PM Scale: 1:1

LEGEND

- PROPERTY BOUNDARY
- EXISTING GROUND SURFACE ELEVATION
- RIVER/CHANNEL
- SURFACE COVER IRM COMPRISED OF ASPHALTIC CONCRETE
- SURFACE COVER IRM COMPRISED OF SOIL
- SURFACE COVER IRM COMPRISED OF GEOMEMBRANE OVERLAIN WITH AGGREGRATE
- EAST AND WEST LAGOONS
- SOUTH DITCH
- WETLANDS
- BUILDING
- INTERNAL ACCESS ROUTES
- BLOCK AND LOT LINE

PERFORMING PARTIES GROUP

DRWN:	SCC	DATE:	11/10/15
CHKD:	MJV	DATE:	03/01/16
APPD:	JSZ	DATE:	03/01/16
SCALE:	AS SHOWN		

KEY ENVIRONMENTAL INCORPORATED

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

HISTORICAL SITE ARRANGEMENT

PROJECT NO: 201501-05

FIGURE 1-2

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

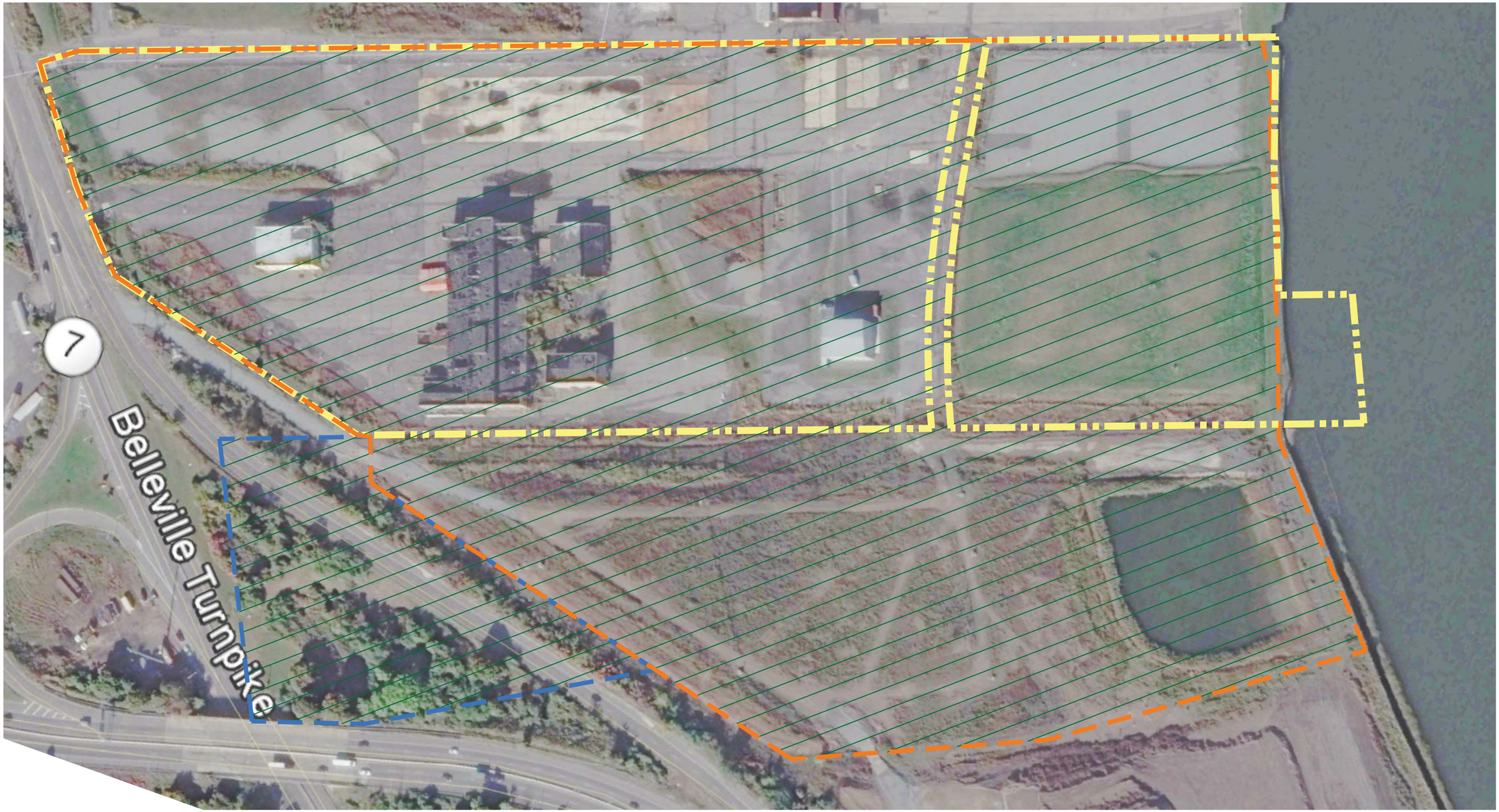
REFERENCE:

1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE:NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
2. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
3. EXISTING WETLANDS PER WETLAND DELINEATION BY PRINCETON HYDRO, LLC FOR KEY ENVIRONMENTAL, INC. PERFORMED IN MARCH 2009.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\0Civil\kearny\focused feasibility study\figure 1-2 historical site arrangement.dwg Last Saved By: Scomer 6/9/2016 3:58 PM Plotted By: Shelly Comer 6/16/2016 4:24 PM Scale: 1:1



LEGEND

SCCC PROPERTY

AREA 1

AREA 2

SCCC SITE

0 150 300 FEET

REV #	DATE	DESCRIPTION	APPD
1			
2			
3			

REFERENCE:

1. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
2. IMAGE PROVIDED BY GOOGLE EARTH DATED OCTOBER, 2015.

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KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 06/15/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

SITE PLAN

PROJECT NO: 201501-05

FIGURE 1-3

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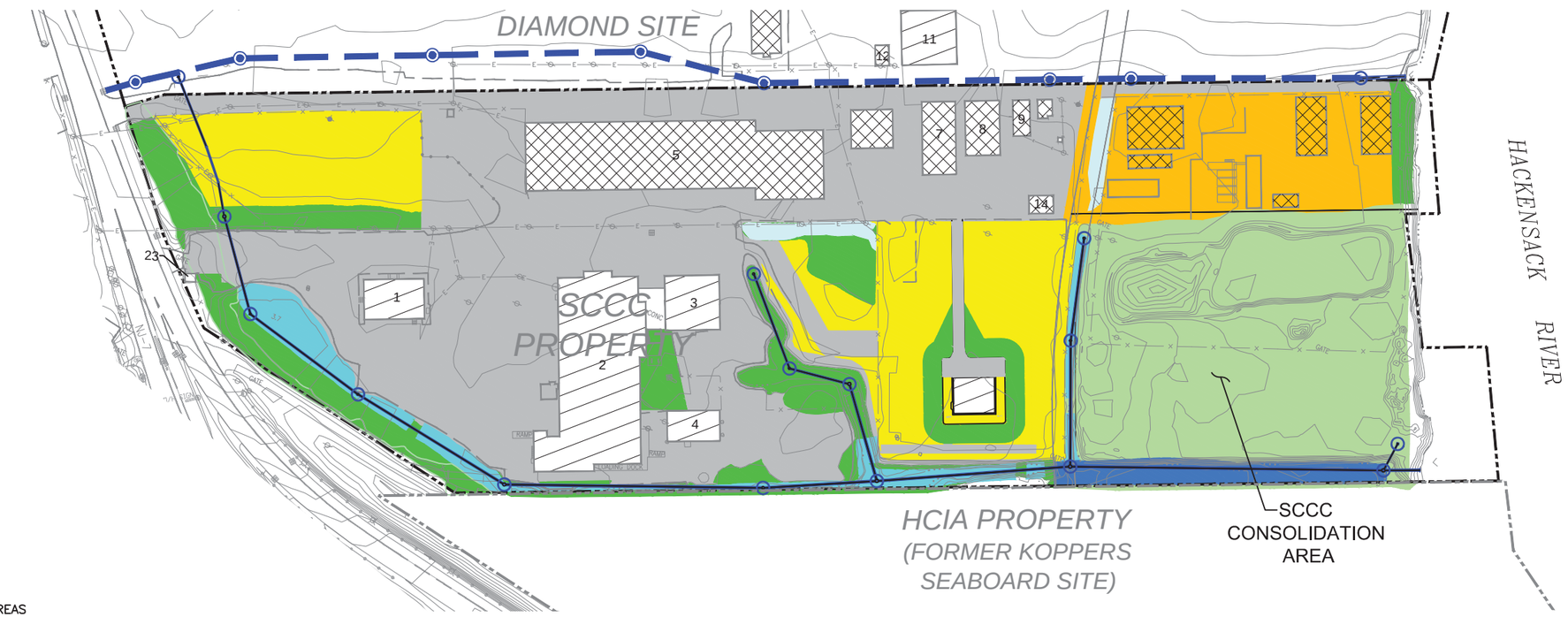
LEGEND

- EXISTING ACCESS ROAD
- EXISTING NEW JERSEY TRANSIT RAILROAD (ACTIVE)
- EXISTING FENCE
- EXISTING STRUCTURES
- EXISTING UTILITY POLES
- EXISTING LIGHT STANDARD
- EXISTING OVERHEAD POWER LINE
- PROPERTY BOUNDARY
- EXISTING CONCRETE PAD
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- EXISTING VEGETATION
- EXISTING STREAM, POND AND RIVER BANK
- x41 EXISTING ELEVATION (FEET–MSL)
- EXISTING STORM DRAIN (48" PIPE)
- CULVERT(S)
- DROP INLET
- DROP INLET
- 2 EXISTING BUILDING
- 5 FORMER BUILDING FOUNDATION/SLAB
- WETLANDS
- NON–PERMITTED PRE–IRA WETLAND AREAS
- WETLAND UNDERLAIN BY GEOSYNTHETIC LINER
- VEGETATIVE COVER
- VEGETATIVE COVER UNDERLAIN WITH GEOSYNTHETIC LINER
- STONE COVER
- ASPHALT
- GEOMEMBRANE OVERLAIN WITH AGGREGATE



0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/10/15	KEY ENVIRONMENTAL INCORPORATED
CHKD: MJV	DATE: 03/01/16	
APPD: JSZ	DATE: 03/01/16	
SCALE: AS SHOWN		

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

EXISTING SITE INTERIM REMEDIAL MEASURE COVERS

PROJECT NO: 201501–05
FIGURE 1–4

REV #	DATE	DESCRIPTION	APPD
△			
△			
0	11–27–13	LABELED BUILDING 23.	CAZ

REFERENCE:

1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE:NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
2. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
3. EXISTING WETLANDS PER WETLAND DELINEATION BY PRINCETON HYDRO, LLC FOR KEY ENVIRONMENTAL, INC. PERFORMED IN MARCH 2009.

ISSUE DATE:

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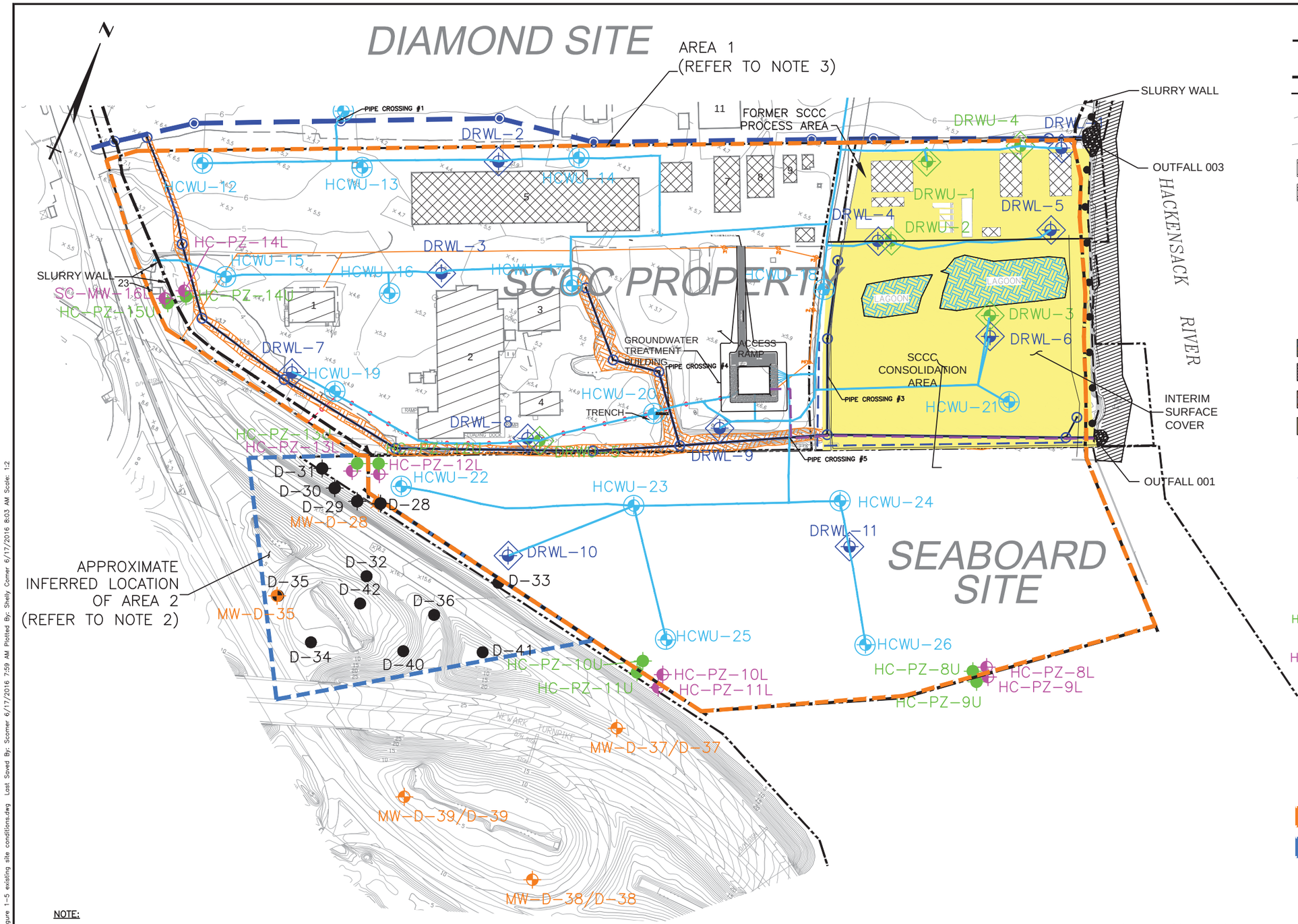
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\00civil\kearny\focused feasibility study\figure 1-4 existing site irm cover.dwg Last Saved By: Scomer 6/9/2016 4:01 PM Plotted By: Shelly Comer 6/16/2016 4:19 PM Scale: 1:2



LEGEND

- PROPERTY BOUNDARY
- SPOT ELEVATION (FEET–MSL)
- SLURRY WALL LOCATION
- STEEL SHEET PILE WALL LOCATION
- EXISTING GROUND SURFACE ELEVATION
- RIVER/CHANNEL
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB
- GROUNDWATER CONVEYANCE PIPING TRENCH ALIGNMENT
- FILL UNIT GROUNDWATER EXTRACTION (HYDRAULIC CONTROL) WELL LOCATION
- FILL UNIT DNAPL RECOVERY WELL LOCATION
- SAND UNIT DNAPL RECOVERY WELL LOCATION
- LAGOON DEWATERED AND BACKFILLED
- NEAR–SHORE SEDIMENT REMOVAL
- DRAINAGE DITCH REMEDIATION (EXCAVATED AND BACKFILLED)
- INTERIM SURFACE COVER
- TREATED GROUND WATER PERMITTED DISCHARGE PIPE
- STORM DRAIN (48" DIA. PIPE)
- STORM WATER DRAIN (PIPE DIA. VARIES)
- DROP INLET
- DROP INLET
- RIPRAP OUTFALL
- POWER AND PHONE LINES (OVERHEAD)
- WATER LINE TO TREATMENT BUILDING
- HC–PZ–9U HYDRAULIC CONTROL PIEZOMETER UPPER ZONE
- HC–PZ–9L HYDRAULIC CONTROL PIEZOMETER LOWER ZONE
- SEMI–DEEP ANODE WELL LOCATION
- SUPPLEMENTAL RI DNAPL DELINEATION BORING LOCATION
- SUPPLEMENTAL RI CONTINGENCY BORING LOCATION
- MONITORING WELL LOCATION
- LOCATION OF AREA 1
- APPROXIMATE INFERRED LOCATION OF AREA 2

0 100 200 FEET

NOTE:

1. AS–BUILT DRAWING WAS PREPARED BASED ON THE CORRESPONDING INTERIM RESPONSE ACTION CIVIL ENGINEERING DESIGN DRAWING. THIS AS–BUILT DRAWING DEPICTS MAJOR CHANGES TO OR DEVIATIONS FROM THE DESIGN DRAWING, AS DOCUMENTED BY FIELD INSPECTION BY KEY'S CQA PERSONNEL. AS–BUILT DIMENSIONS OR MEASUREMENTS MAY VARY SLIGHTLY FROM THOSE DEPICTED ON THIS AS–BUILT DRAWING.
2. THE AREA 2 LIMITS WILL BE ESTABLISHED DURING REMEDIAL DESIGN.
3. AREA 1 INCLUDES THE PROPERTY WITHIN THE EXISTING SLURRY WALL.

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/10/15	KEY ENVIRONMENTAL INCORPORATED
CHKD: MJV	DATE: 03/01/16	
APPD: JSZ	DATE: 03/01/16	
SCALE: AS SHOWN		

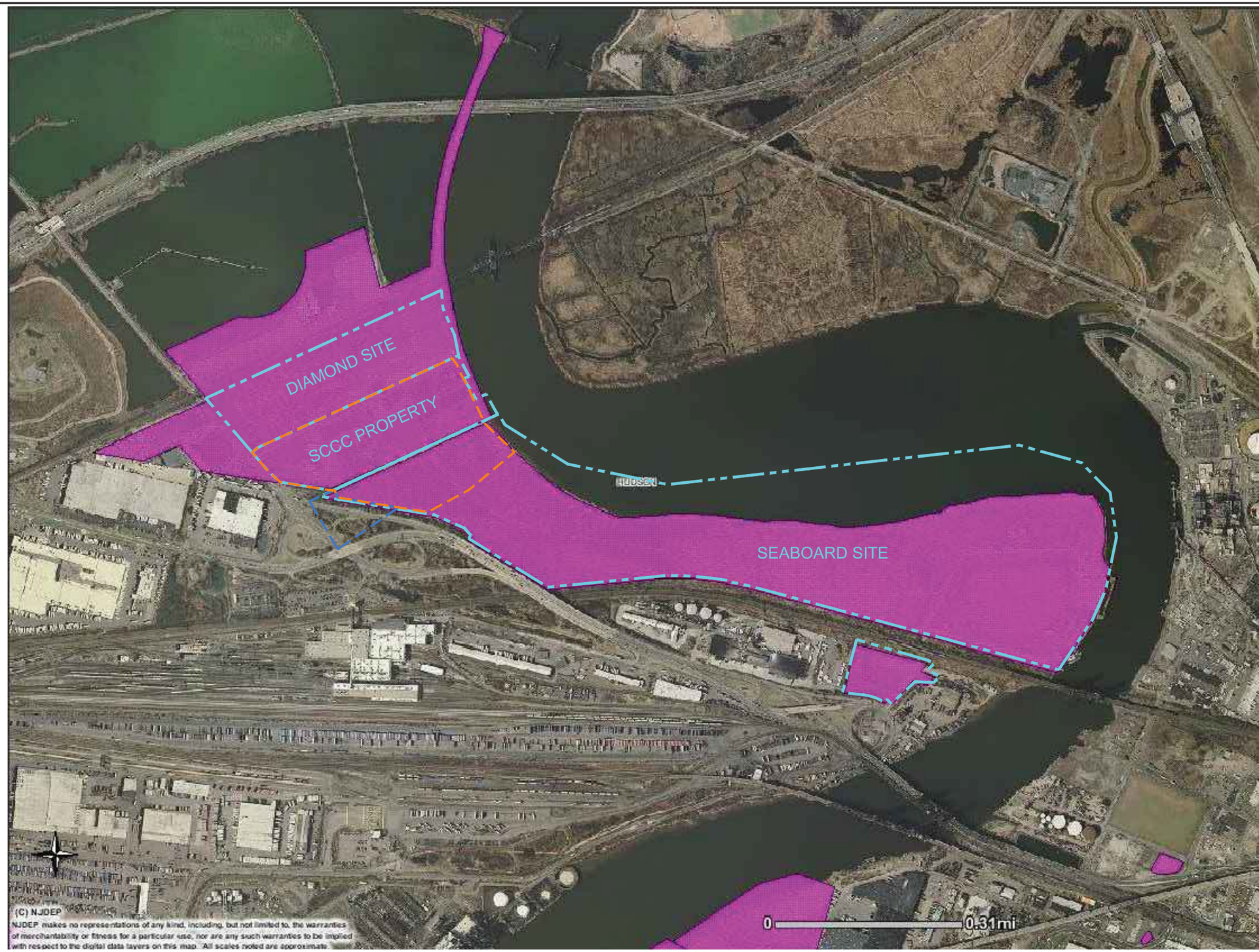
FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

EXISTING SCCC SITE CONDITIONS

PROJECT NO: 201501–05

FIGURE 1–5

y:\00civil\kearny\focused feasibility study\figure 1–5 existing site conditions.dwg Last Saved By: Scomer 6/17/2016 7:59 AM Plotted By: Shelly Comer 6/17/2016 8:03 AM Scale: 1:2



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Scale 1:11501

Counties
Groundwater Contamination Areas (CEA)

Aerial Photos 2007
Mid-Atlantic States
New Jersey
Other States

LEGEND

PROPERTY BOUNDARY
LOCATION OF AREA 1
APPROXIMATE INFERRED LOCATION OF AREA 2

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 06/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

CLASSIFICATION EXCEPTION AREAS

PROJECT NO: 201601-02
FIGURE 1-6

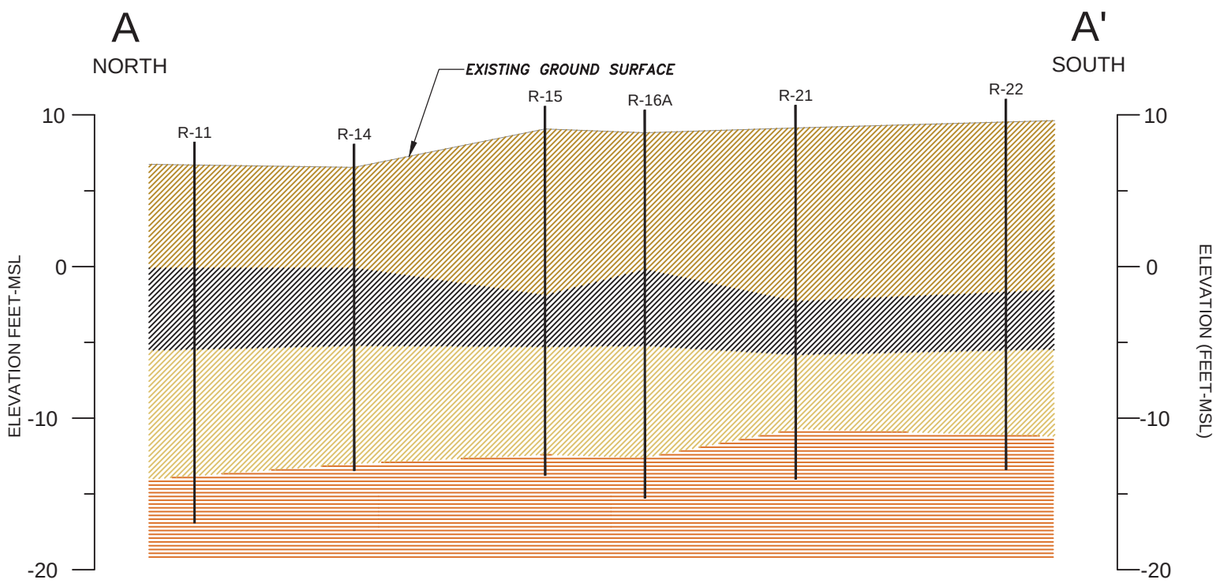
REV #	DATE	DESCRIPTION	APPD
1			
2			
3			

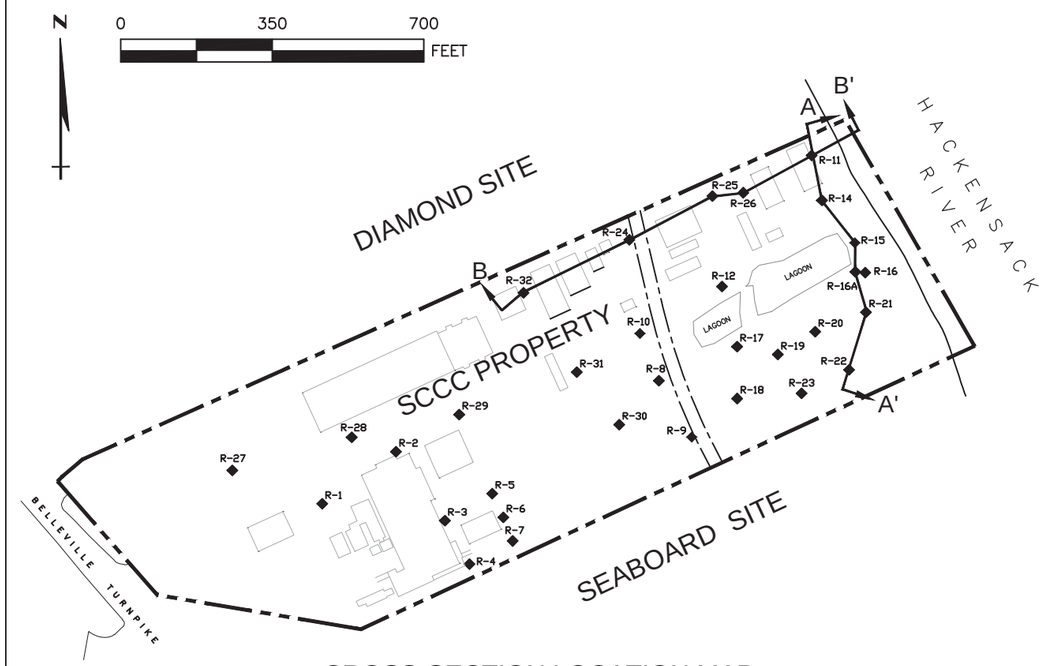
REFERENCE:
FIGURE OBTAINED FROM THE NJDEP WEBSITE.

ISSUE DATE:

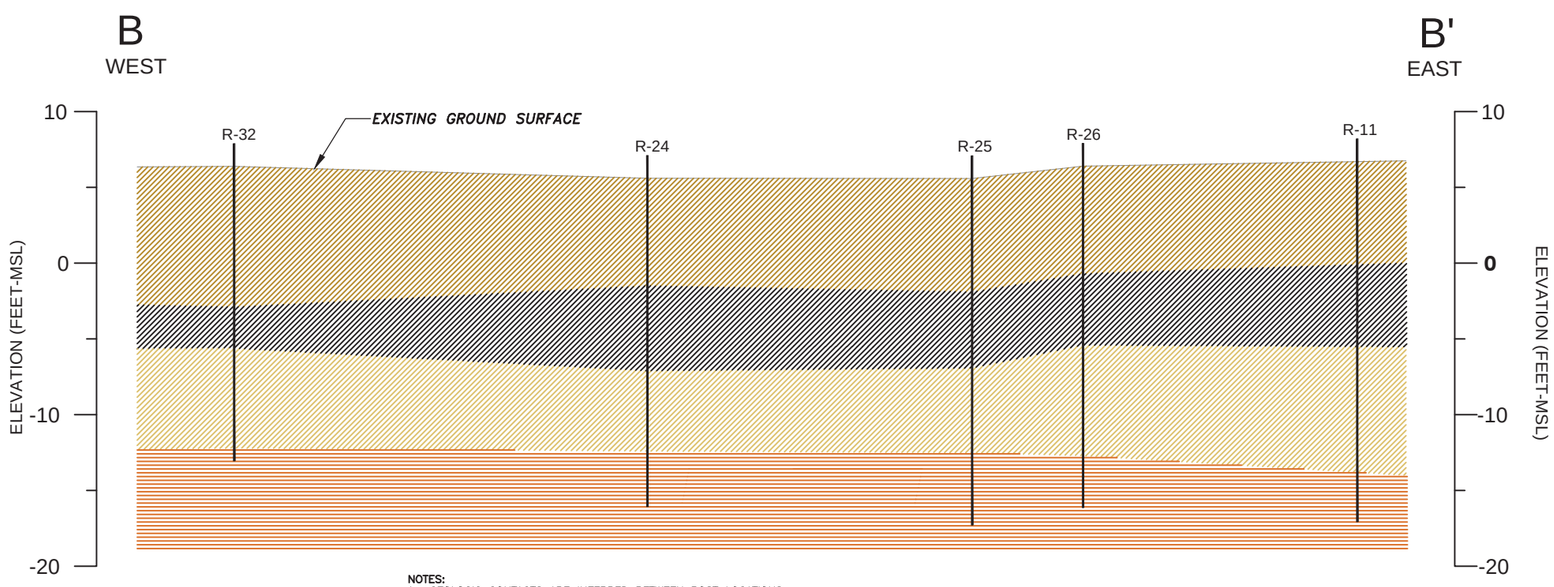
KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\00civil\keamy\focused feasibility study\figure 1-6 classification exception area.dwg Last Saved By: Scorner 6/16/2016 4:19 PM Plotted By: Shelly Corner 6/17/2016 8:00 AM Scale: 1:1





CROSS-SECTION LOCATION MAP



LEGEND

- SHALLOW FILL MATERIAL
- MEADOW MAT
- DEEPER FINE SAND
- VARVED CLAY
- R-16A — ROST BORING LOCATION (CROSS-SECTION)
- R-27 — ROST BORING LOCATION
- PROPERTY BOUNDARY
- STRUCTURES/BUILDINGS
- RIGHT OF WAY
- B — B' CROSS SECTION LOCATION

10 — 0 — 100

SCALES IN FEET

NOTES:
1. GEOLOGIC CONTACTS ARE INFERRED BETWEEN ROST LOCATIONS.
2. HISTORICAL SITE CONDITIONS DEPICTED ON CROSS-SECTION LOCATION MAP.

REV #	DATE	DESCRIPTION	APPD
△			
△			
△			

REFERENCE: 1. STANDARD CHLORINE CHEMICAL COMPANY SITE SURVEY, NEGLIA ENGINEERING ASSOCIATES, JANUARY 1999. ADDITIONAL BUILDING LOCATIONS OBTAINED FROM ERM, INC. FIGURES 1, 3-1, 3-2, 3-3 AND 3-4, PROPOSED REMEDIAL ACTION PLAN, STANDARD CHLORINE SITE, KEARNY NEW JERSEY.

2. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 06/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

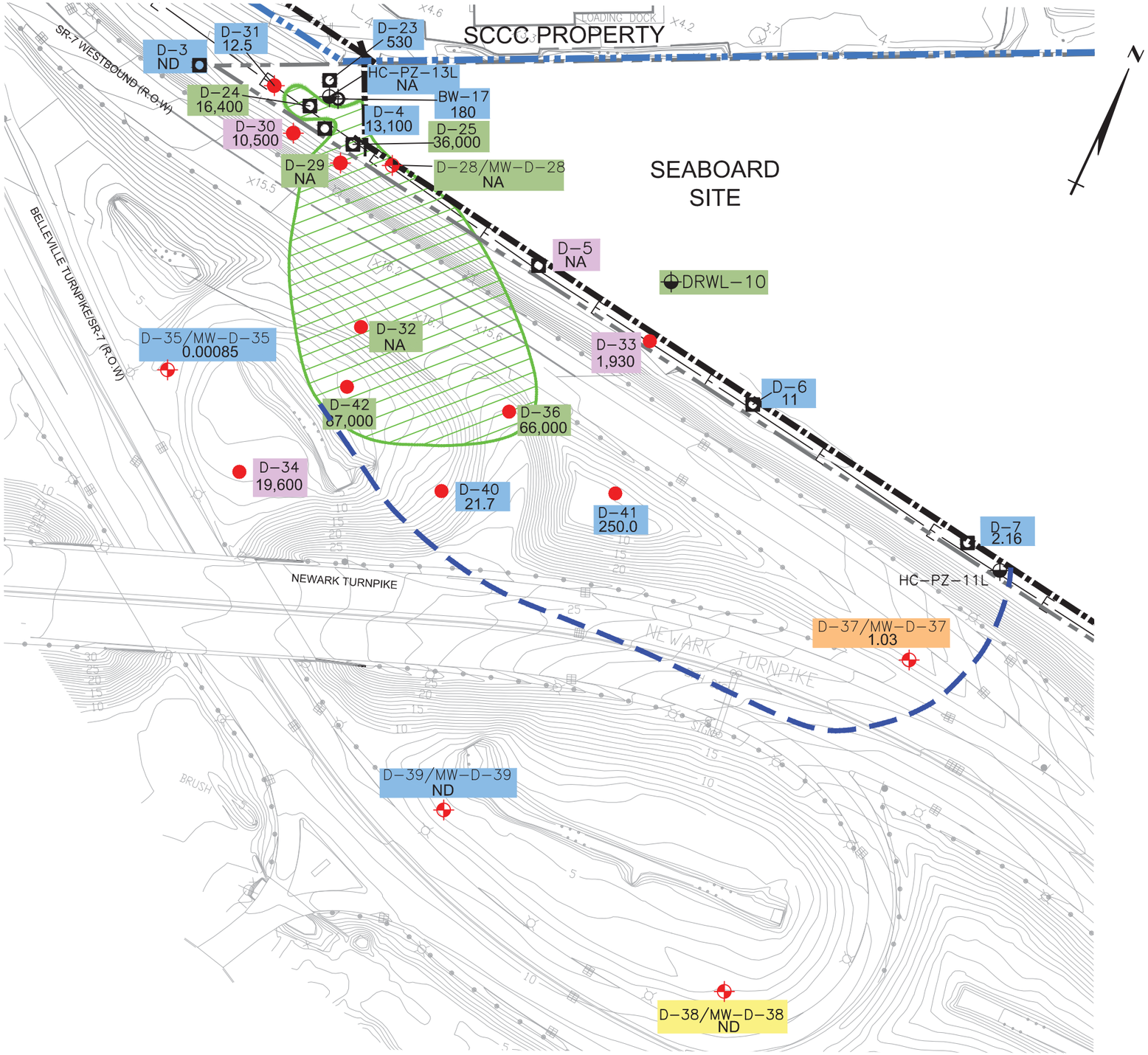
FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

GEOLOGIC CROSS SECTIONS

PROJECT NO: 201601-02

FIGURE 2-1

y:\00civil\kearny\focused feasibility study\figure 2-1 geologic cross-section.dwg Last Saved By: Scorner 6/9/2016 4:01 PM Plotted By: Shelly Corner 6/16/2016 4:18 PM Scale: 1:1



LEGEND

- STANDARD CHLORINE PROPERTY BOUNDARY
- SEABOARD SITE BOUNDARY
- SLURRY WALL LOCATION
- INFERRED EXTENT OF DISSOLVED PHASE PLUME IN SAND UNIT
- 10 — EXISTING GROUND CONTOUR ELEVATIONS
- BARRIER WALL ALIGNMENT BORING
- RI DNAPL DELINEATION BORINGS
- HYDRAULIC CONTROL PIEZOMETER
- DNAPL DELINEATION BORING LOCATION
- CONTINGENCY BORING LOCATION
- MONITORING WELL LOCATION
- SOIL BORING/MONITORING WELL LOCATION INSTALLED IN 2015
- SAND UNIT INFERRED LIMIT OF SCCC PROPERTY RELATED FREE PHASE DNAPL IN AREA 2
- 180 — TOTAL DICHLOROBENZENE CONCENTRATIONS IN SAND UNIT AT THE VARVED CLAY INTERFACE (MG/KG)
- NA — NOT ANALYZED
- ND — NON-DETECT

SCCC-SITE RELATED DNAPL OBSERVED IN SAND UNIT

- POSSIBLE FREE-PHASE DNAPL
- POSSIBLE RESIDUAL DNAPL
- NO DNAPL OBSERVED

DNAPL NOT RELATED TO SCCC SITE

- OBSERVED IN FILL MATERIAL
- OBSERVED IN SAND UNIT

NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 12/01/15
CHKD: JMV	DATE: 03/01/16
APPD: JSZ	DATE: 03/01/16
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

INFERRED DNAPL AND DISSOLVED PHASE PLUME LIMITS OUTSIDE OF SLURRY WALL

PROJECT NO: 2015-01

FIGURE 3-1

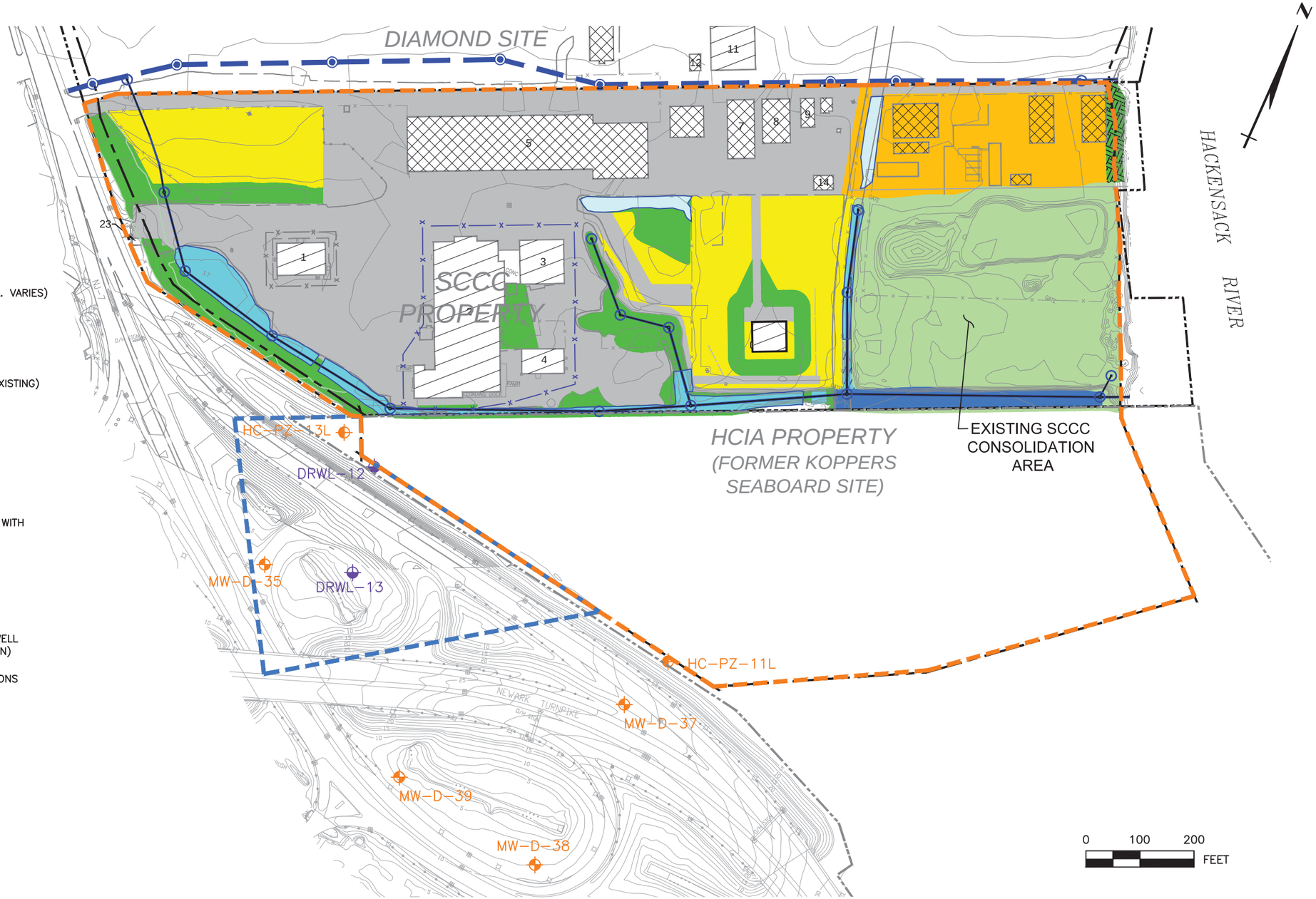
REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: EXISTING GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\00civil\kearny\focused feasibility study\figure 3-1.dwg Last Saved By: Scomer 6/9/2016 4:02 PM Plotted By: Shelly Corner 6/16/2016 4:18 PM Scale: 1:1



LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION
- EXISTING RIVER/CHANNEL
- EXISTING SLURRY WALL
- EXISTING STORM DRAIN (48" DIA. PIPE)
- EXISTING STORM WATER DRAIN (PIPE DIA. VARIES)
- EXISTING DROP INLET
- EXISTING DROP INLET
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB (EXISTING)
- EXISTING WETLANDS
- EXISTING NON-PERMITTED PRE-IRAW WETLANDS AREAS
- EXISTING WETLANDS UNDERLAIN BY GEOSYNTHETIC LINER IRM
- EXISTING VEGETATION
- EXISTING VEGETATIVE COVER UNDERLAIN WITH GEOSYNTHETIC LINER IRM
- EXISTING STONE COVER IRM
- EXISTING ASPHALT IRM
- EXISTING GEOMEMBRANE OVERLAIN WITH AGGREGATE IRM
- PROPOSED PASSIVE DNAPL RECOVERY WELL (FORMER CONTINGENCY BORING LOCATION)
- PROPOSED TI ZONE MONITORING LOCATIONS
- PROPOSED SECURITY FENCE
- LOCATION OF AREA 1
- APPROXIMATE INFERRED LOCATION OF AREA 2

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/12/15
CHKD: MJV	DATE: 03/01/16
APPD: JSZ	DATE: 03/01/16
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ALTERNATIVE II
AREA 1 EXISTING CONDITIONS/
AREA 2 DNAPL RECOVERY PLAN

PROJECT NO: 201501-05

FIGURE 4-1

REV #	DATE	DESCRIPTION	APPD
1			
2			
3			

REFERENCE:

1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE:NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
2. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
3. EXISTING WETLANDS PER WETLANDS DELINEATION BY PRINCETON HYDRO, LLC FOR KEY ENVIRONMENTAL, INC. PERFORMED IN MARCH 2009.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
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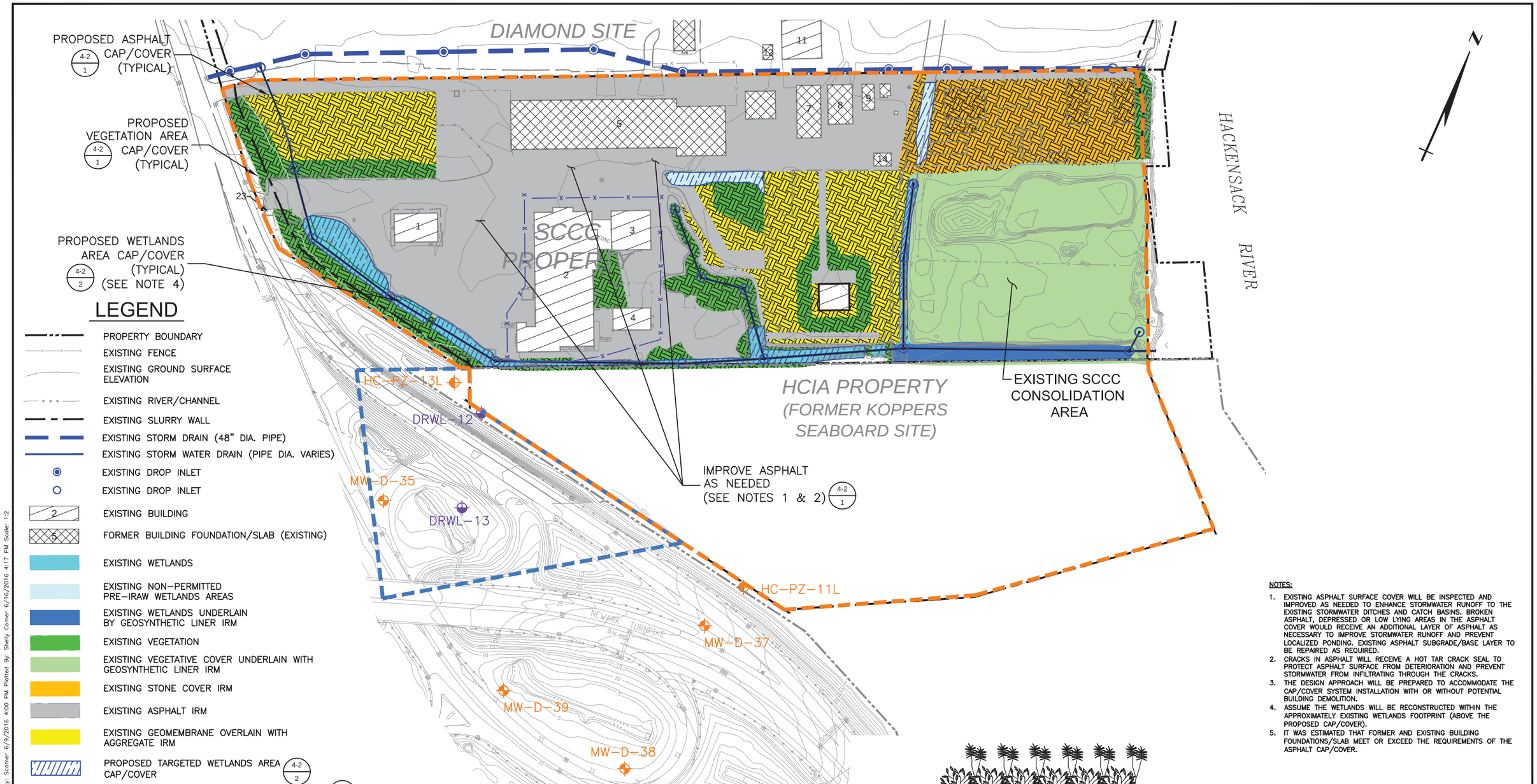
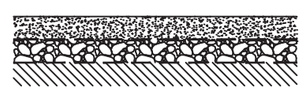


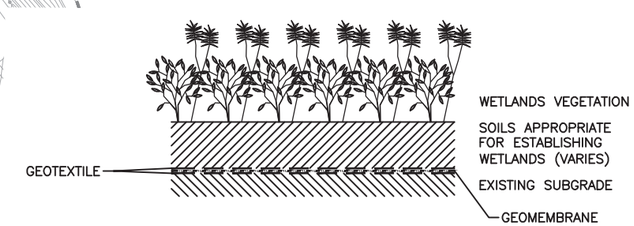
LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION
- EXISTING RIVER/CHANNEL
- EXISTING SLURRY WALL
- EXISTING STORM DRAIN (48" DIA. PIPE)
- EXISTING STORM WATER DRAIN (PIPE DIA. VARIES)
- EXISTING DROP INLET
- EXISTING DROP INLET
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB (EXISTING)
- EXISTING WETLANDS
- EXISTING NON-PERMITTED PRE-IRAW WETLANDS AREAS
- EXISTING WETLANDS UNDERLAIN BY GEOSYNTHETIC LINER IRM
- EXISTING VEGETATION
- EXISTING VEGETATIVE COVER UNDERLAIN WITH GEOSYNTHETIC LINER IRM
- EXISTING STONE COVER IRM
- EXISTING ASPHALT IRM
- EXISTING GEOMEMBRANE OVERLAIN WITH AGGREGATE IRM
- PROPOSED TARGETED WETLANDS AREA CAP/COVER 4-2/2
- PROPOSED ASPHALT CAP/COVER FOR TARGETED VEGETATION AND STONE COVER AREAS 4-2/1
- PROPOSED PASSIVE DNAPL RECOVERY WELL
- PROPOSED TI ZONE MONITORING LOCATIONS
- PROPOSED SECURITY FENCE
- LOCATION OF AREA 1
- APPROXIMATE INFERRED LOCATION OF AREA 2



NOTE:
GRANULAR SUBBASE MAY BE DESIGNED TO FUNCTION AS A CAPILLARY BREAK IF NECESSARY.

4-2/1 PROPOSED ASPHALT CAP/COVER FOR TARGETED VEGETATION AND STONE AREA



4-2/2 PROPOSED TARGETED AREA CAP/COVER ABOVE EXISTING WETLANDS AREAS
N.T.S

NOTES:

1. EXISTING ASPHALT SURFACE COVER WILL BE INSPECTED AND IMPROVED AS NEEDED TO ENHANCE STORMWATER RUNOFF TO THE EXISTING STORMWATER DITCHES AND CATCH BASINS. BROKEN ASPHALT, DEPRESSED OR LOW LYING AREAS IN THE ASPHALT COVER WOULD RECEIVE AN ADDITIONAL LAYER OF ASPHALT AS NECESSARY TO IMPROVE STORMWATER RUNOFF AND PREVENT LOCALIZED PONDING. EXISTING ASPHALT SUBGRADE/BASE LAYER TO BE REPAIRED AS REQUIRED.
2. CRACKS IN ASPHALT WILL RECEIVE A HOT TAR CRACK SEAL TO PROTECT ASPHALT SURFACE FROM DETERIORATION AND PREVENT STORMWATER FROM INFILTRATING THROUGH THE CRACKS.
3. THE DESIGN APPROACH WILL BE PREPARED TO ACCOMMODATE THE CAP/COVER SYSTEM INSTALLATION WITH OR WITHOUT POTENTIAL BUILDING DEMOLITION.
4. ASSUME THE WETLANDS WILL BE RECONSTRUCTED WITHIN THE APPROXIMATELY EXISTING WETLANDS FOOTPRINT (ABOVE THE PROPOSED CAP/COVER).
5. IT WAS ESTIMATED THAT FORMER AND EXISTING BUILDING FOUNDATIONS/SLAB MEET OR EXCEED THE REQUIREMENTS OF THE ASPHALT CAP/COVER.

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/12/15	KEY ENVIRONMENTAL INCORPORATED
CHKD: MJV	DATE: 03/01/16	
APPD: JSZ	DATE: 03/01/16	
SCALE: AS SHOWN		

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ALTERNATIVE III
TARGETED (AREA 1) CAP/COVER AND AREA 2 DNAPL RECOVERY PLAN

PROJECT NO: 201501-05

FIGURE 4-2

REV #	DATE	DESCRIPTION	APPD

REFERENCE:

1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE:NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
2. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
3. EXISTING WETLANDS PER WETLANDS DELINEATION BY PRINCETON HYDRO, LLC FOR KEY ENVIRONMENTAL, INC. PERFORMED IN MARCH 2009.

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DIAMOND SITE

SCCC PROPERTY

HCIA PROPERTY
(FORMER KOPPERS SEABOARD SITE)

EXISTING SCCC CONSOLIDATION AREA

HACKENSACK RIVER

NEWARK TURNPIKE

HC-PZ-13L

DRWL-12

MW-D-35

DRWL-13

HC-PZ-11L

MW-D-37

MW-D-39

MW-D-38

PROPOSED TARGETED WETLANDS AREA CAP/COVER (4-3 / 2)

PROPOSED APPROXIMATE LIMITS OF PROPOSED SITE-WIDE CAP/COVER (SEE NOTE 4). (4-3 / 1)

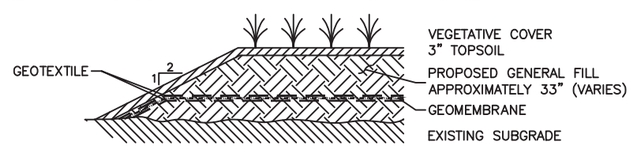
LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION
- EXISTING RIVER/CHANNEL
- EXISTING GROUND CONTOUR ELEVATIONS
- EXISTING STORM DRAIN (48" DIA. PIPE)
- EXISTING STORM WATER DRAIN (PIPE DIA. VARIES)
- EXISTING DROP INLET
- EXISTING DROP INLET
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB (EXISTING)
- EXISTING SLURRY WALL
- APPROXIMATE LIMITS OF PROPOSED SITE-WIDE CAP/COVER
- EXISTING WETLANDS
- EXISTING NON-PERMITTED PRE-IRAW WETLANDS AREAS
- EXISTING WETLANDS UNDERLAIN BY GEOSYNTHETIC LINER IRM
- EXISTING VEGETATION
- EXISTING VEGETATIVE COVER UNDERLAIN WITH GEOSYNTHETIC LINER IRM
- EXISTING STONE COVER IRM
- EXISTING ASPHALT IRM
- EXISTING GEOMEMBRANE OVERLAIN WITH AGGREGATE IRM
- PROPOSED WETLAND AREA RELOCATION CAP/COVER (4-3 / 2)
- PROPOSED PASSIVE DNAPL RECOVERY WELL
- PROPOSED TI ZONE MONITORING LOCATIONS
- PROPOSED SECURITY FENCE
- LOCATION OF AREA 1
- APPROXIMATE INFERRED LOCATION OF AREA 2

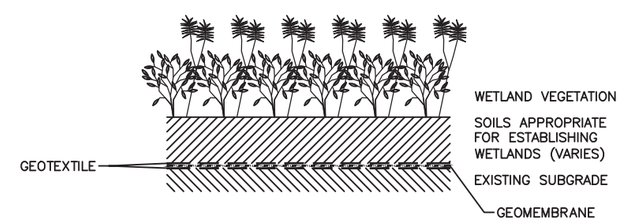
0 100 200 FEET

NOTES:

1. CAP/COVER MATERIAL TO BE PLACED ABOVE EXISTING GROUND SURFACE.
2. EXISTING STORMWATER CATCH BASINS AND CONVEYANCE PIPING LOCATED IN THE AREA TO RECEIVE SITE WIDE CAP/COVER MATERIALS WILL BE MODIFIED AS NECESSARY TO IMPROVE STORMWATER RUNOFF FLOW PATTERNS.
3. WETLANDS TO BE RELOCATED AS NECESSARY. THE WETLANDS RELOCATION AREA(S) TO BE DETERMINED DURING THE DESIGN PHASE.
4. OFF-SITE WETLANDS CREDITS MAY BE PURCHASED IF NECESSARY.
5. THE CAP/COVER LIMITS AND DETAILS WILL BE FINALIZED AS PART OF THE DESIGN PHASE. THE FINAL GRADES WILL BE ESTABLISHED TO FACILITATE POSITIVE STORMWATER DRAINAGE FOR THE PURPOSE OF THIS FFS, ASSUME THE TOTAL FILL LAYER WILL BE APPROXIMATELY 3' THICK.



(4-3 / 1) TYPICAL PROPOSED SITE-WIDE CAP/COVER DETAIL
N.T.S



(4-3 / 2) PROPOSED WETLAND AREA RELOCATION CAP/COVER
N.T.S

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/09/15
CHKD: MJV	DATE: 03/01/16
APPD: JSZ	DATE: 03/01/16
SCALE:	AS SHOWN

KEY ENVIRONMENTAL INCORPORATED

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

ALTERNATIVE IV
SITE-WIDE (AREA 1) CAP/COVER AND AREA 2 DNAPL RECOVERY

PROJECT NO: 201501-05

FIGURE 4-3

y:\0Civil\kearny\focused feasibility study\figure 4-3.dwg Last Saved By: Scomer 6/9/2016 3:59 PM Plotted By: Shelly Comer 6/16/2016 4:23 PM Scale: 1:2

TABLES

TABLE 3-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

CHEMICAL-SPECIFIC ARARs				
ARAR	**Legal Citation**	**Classification**	**Summary of the Requirement**	**Additional Comments**
Groundwater Regulations				
National Primary Drinking Water Standards (Safe Drinking Water Act)	40 CFR 141	Applicable	Establishes drinking water standards (maximum contaminant levels [MCLs]).	Comparison to these benchmarks establishes the need for institutional controls such as a Well Restriction Area and Classification Exception Area.
New Jersey Ground Water Quality Standards (NJ GWQS)	N.J.A.C. 7:9C	Applicable	Establishes the water quality standards for State's ground waters based on the type of groundwater use including narrative and constituent-specific standards.	Comparison to these benchmarks establishes the need for institutional controls such as a Well Restriction Area and Classification Exception Area.
Soil Regulations				
New Jersey Remediation Standards	N.J.A.C. 7:26D	Applicable	Establishes the standards for soil remediation by instituting the non-residential direct contact soil remediation standards.	Attainment of the NJDEP remediation standards will be obtained through the use of engineering controls (pathway elimination), and administrative and institutional controls.
USEPA Regional Screening Levels (SLs)	None	TBC	Screening Levels are generic screening values. Site-specific risk based remediation goals can be derived using the Site Baseline Risk Assessment results.	The SLs could be used as guidance in the case where a NJ non-residential standard is not available for a particular constituent of concern.
Asbestos and Lead Regulations				
New Jersey Asbestos Containing Material (ACM) Generator and Transporter Requirements	N.J.A.C. 7:26-1 et seq.	Potentially Applicable	This requirement establishes the generator and transporter requirements for the management, transportation and disposal of ACM.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.
New Jersey Lead Hazard Evaluation and Abatement Code	N.J.A.C. 5:17	Potentially Applicable	This code provides the certification requirements for any company offering to perform lead hazard evaluation or abatement in New Jersey.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.
New Jersey Asbestos Control and Licensing Act (ACLA) and Regulations	N.J.S.A. 34:5A-32 et seq. N.J.A.C. 12:120	Potentially Applicable	Requires that asbestos abatement work involving the application, enclosure, repair, removal and encapsulation of asbestos be performed by State certified companies and individuals.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.
New Jersey Asbestos Control and Licensing Act	N.J.S.A. 34:5A-32 et seq. N.J.A.C. 8:60 N.J.A.C. 12:120	Potentially Applicable	These regulations provide for: a standardized training course for all asbestos workers; licensing of asbestos abatement contractors; and issuing asbestos worker performance permits for asbestos abatement workers.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.
New Jersey Uniform Construction Code Act and Asbestos Hazard Abatement Subcode	N.J.S.A. 52:27D-119 et seq. N.J.A.C. 5:23-8	Potentially Applicable	This code and subcode requires that where asbestos was used originally to satisfy fire code requirements, it shall not be removed unless it is replaced, as part of the project, with material or assembly which has equivalent fire resistive or heat resistive characteristics.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.
New Jersey Disposal of Asbestos Containing Waste Materials (ACWM) Generator Requirements	N.J.A.C. 7:26-2.12	Potentially Applicable	Requires that generators of ACWM shall comply with the standards for waste disposal at 40 C.F.R. 61.149 and 40 C.F.R. 61.150 and reporting requirements of the following agencies: United States Environmental Protection Agency, at 40 CFR 61.145 to 61.155; the New Jersey Department of Community Affairs, at N.J.A.C. 5:23-8; the New Jersey Department of Labor and Workforce Development, at N.J.A.C. 12:120-7.2; and the New Jersey Department of Health and Senior Services, at N.J.A.C. 8:60-7.2.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.
Clean Air Act (CAA) National Emissions Standard for Hazardous Air Pollutants (NESHAP)	40 CFR Parts 61 and 63 Subpart M	Potentially Applicable	Regulates transportation, disposal of ACWM (ACWM) from asbestos milling, manufacturing, fabricating, demolition, renovation, air cleaning, and spraying operations.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.

TABLE 3-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ARAR	Legal Citation	Classification	Summary of the Requirement	Additional Comments
Hazardous Materials Transportation Act	49 USC § 01801-1813 49 CFR Parts 171-172 40 CFR Part 263	Potentially Applicable	Sets standards that apply to the transport of hazardous waste including asbestos. Transportation of asbestos waste requires waste containment and shipping papers.	This ARAR is not applicable to current SCCC Site conditions because no threat of current or potential future release of asbestos and lead has been documented. This ARAR would be applicable as part of the building demolition.
LOCATION-SPECIFIC ARARs				
Wetlands and Floodplain Regulations				
New Jersey Freshwater Wetland Protection Act Rules	N.J.S.A. § 13:9B-1 N.J.A.C. 7:7A	Applicable	Regulates construction or other activities (including remedial action) that will have an impact on wetlands.	Any impacts to wetlands on Site would be mitigated by restoration or relocation, including a monitoring plan and consideration of a wetland banking option.
Clean Water Act Section 404 Requirements	40 CFR parts 230 to 233	Applicable	Under this requirement, no activity that adversely affects a wetland is permitted if a practicable alternative that does not affect wetlands is available. If no other practicable alternative exists, impacts on wetlands must be mitigated.	Remedial actions should meet the guidelines for Specification of Disposal Sites for Dredge or Fill Material set forth in this policy.
Clean Water Act Section 404 Requirements	33 CFR Parts 320-330	Applicable	Administration of 40 CFR 230 by U.S. Army Corps of Engineers regulations. Regulatory policies and permit requirements for the discharge of dredged or fill material to waters of the US including wetlands.	Any remedial action that impacts a wetland will require permit equivalency performance.
New Jersey Flood Hazard Control Act Standards	N.J.S.A. § 58:16A-50 N.J.A.C. 7:13	Applicable	Regulates activities (including remedial action) within flood hazard areas that will impact stream carrying capacity or flow velocity to avoid increasing impacts of flood waters, to minimize degradation of water quality, protect wildlife and fisheries and protect and enhance public health and welfare.	Applicable to remedial actions that could cause flooding within the flood hazard area or impact vegetation within the riparian zone of a regulated water.
Executive Order 11988, Floodplain Management	40 CFR 6 Appendix A and 40 CFR 9	TBC	Directs federal agencies to evaluate the potential effects of actions that may be taken in a floodplain and to avoid, to the extent possible, long-term and short-term adverse effects associated with the occupancy and modification of floodplains, and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.	Applies to federally funded projects. A floodplain assessment will be completed as part of remedial design activities prior to remedial action implementation.
Executive Order 13690, Flood Risk Management	E.O. 11988 Amendment	TBC	Manage to the extent possible the potential short-term and long-term adverse impacts associated with the occupancy and modifications to floodplains.	Applies to federally funded projects. Superfund projects are considered critical actions. A floodplain assessment would be completed as part of remedial design activities prior to remedial action implementation.
Executive Order 11990, Protection of Wetlands	40 CFR 6 Appendix A and 40 CFR 9	TBC	Directs that activities conducted by federal agencies avoid, to the extent possible, long-term and short-term adverse effects associated with the modification or destruction of wetlands. Federal agencies are to avoid direct or indirect support of new construction in wetlands when there are practical alternatives; harm to wetlands must be minimized when there is no practical alternative available. These considerations are applicable to any remedial work in wetlands.	Applies to federally funded projects and federal property. Any impacts to wetlands on-site would be mitigated by restoration or relocation, including a monitoring plan and consideration of a wetland banking option.
EPA's 1985 Policy, Floodplain/Wetlands Assessments for CERCLA	OSWER Directive 9280.0-02	TBC	Superfund actions should meet the substantive requirements of E.O. 11988, E.O. 11990 and Appendix A of 40 CFR Part 6.	For remedial actions, a floodplain/wetlands assessment should be included with the remedial action planning.
Coastal Zone Regulations				
Coastal Zone Management Program	N.J.A.C. 7:7E	Applicable	This program establishes standards for use and development of coastal resources in coastal waters to the limit of tidal influence.	Applicable to remedial action that occurs in the 100 year floodplain, impacts wetlands, riparian zones, or outfalls, such as the placement of caps/covers. 7:7E-5 requirements for impervious cover and vegetative cover for general land areas. 7:7E-3 requirements for riparian zones, wetlands, flood hazard areas (applies to areas delineated by A or V Zones defined by FEMA) and outfalls and intakes.

TABLE 3-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ARAR	Legal Citation	Classification	Summary of the Requirement	Additional Comments
Coastal Permit Program Rules	N.J.A.C 7:7	Applicable	Establishes the standards for waterfront area development within any part of the Hackensack Meadowland Development District and includes any tidal waterway and all lands lying thereunder, up to and including the mean high water line.	N.J.A.C. 7:7-6.11 provides substantive requirements of a general permit for investigation, cleanup, removal, or remediation of hazardous substances within the Hackensack Meadowland Development District.
Wildlife Protection Regulations				
Migratory Bird Treaty Act	16 U.S.C. § 703	Applicable	Requires that federal agencies consult with USFWS during remedial design and remedial construction to ensure that cleanup of the Site does not unnecessarily impact migratory birds.	Consultation with USFWS would occur during remedial design.
Endangered Species Act of 1973	16 USC § 1531 et seq. 50 CFR 17	Relevant and Appropriate	The act establishes rules to protect and recover species of fish, wildlife and plants that are threatened or endangered in the U.S. or elsewhere.	No endangered species are currently present in the Site vicinity. Substantive requirements would apply if endangered species are confirmed to exist in the vicinity of the Site (50 CFR 17.11 & 17.12 list current endangered and threatened wildlife and plants).
Other				
Federal National Historic Preservation Act	16 USC § 470 et seq. 36 CFR Part 800	Applicable	This requirement requires federal agencies to take into account the effects of any federally assisted undertaking on any district, site, building, structure or object included in, or eligible for inclusion in, the National Register of Historic Places. If the undertaking results in adverse effects, the agency must consult with the New Jersey Historic Preservation Office and other parties to develop ways to avoid, reduce, minimize, or mitigate any adverse impacts to those identified properties.	Historic structures (buildings associated with Thomas Edison) exist at the property. The Site has been subject to several cultural resource investigations. A Memorandum of Agreement pursuant to NHPA has been signed by representatives of EPA and NJSHPO, outlining measures that have been implemented to mitigate planned adverse effects.
New Jersey Register of Historic Places Rules	N.J.A.C 7:4	Applicable	If federally assisted undertaking on any district, site, building, structure or object included in, or eligible for inclusion in, the National Register of Historic Places results in adverse effects, the agency must consult with the New Jersey Historic Preservation Office and other parties to develop ways to avoid, reduce, minimize, or mitigate any adverse impacts to those identified properties.	Historic structures (buildings associated with Thomas Edison) exist at the property. The Site has been subject to several cultural resource investigations. A Memorandum of Agreement pursuant to NHPA has been signed by representatives of EPA and NJSHPO, outlining measures that have been implemented to mitigate planned adverse effects.
Worker and Community Right to Know Regulation	N.J.A.C. 7:1G	Relevant and Appropriate	This requirement establishes the information that the community has the right to know and establishes the procedures for notifying the community.	Project updates are prepared to inform the community, local officials and other interested parties of the status of activities at the Site and as specified in the site Community Involvement Plan.
Emergency Planning and Community Right to Know Act	SARA Title III	Relevant and Appropriate	Statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans.	September 19, 2007 the Site was added to the National Priorities List. Annual Report Summaries are currently submitted to EPA.
Licensing of Water Supply and Wastewater Treatment System Operators	N.J.A.C. 7:10A	Applicable	Rules governing the eligibility, examining and licensing of Industrial Wastewater Treatment System Operators.	Applicable to the HCTS operators.

TABLE 3-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ARAR	Legal Citation	Classification	Summary of the Requirement	Additional Comments
ACTION-SPECIFIC ARARs				
Well Regulations				
Well Construction and Maintenance; Sealing of Abandoned Wells	N.J.A.C. 7:9D	Applicable	Establishes requirements and procedures for the construction, installation, operation and maintenance of wells.	Substantive requirements of these regulations will be attained if additional groundwater monitoring wells, groundwater extraction wells or DNAPL recovery wells are installed or abandoned.
Erosion and Sediment Control / Stormwater Management				
New Jersey Pollutant Discharge Elimination System (NJPDES)	N.J.A.C. 7:14A	Applicable	Establishes effluent discharge standards to protect water quality. N.J.A.C. 7:14, Subchapter 12, Appendix B identifies effluent standards (for specified constituents) for remediation projects.	An NJPDES permit is in place for the existing HCTS. The State of New Jersey has primacy for administration of the NJPDES program.
New Jersey Stormwater Management	N.J.A.C. 7:8	Potentially Applicable	Contains general requirements for stormwater management plans and stormwater control ordinances. Provides the content requirements and procedures for the adoption and implementation of regional stormwater management plans and municipal stormwater management plans.	Establishes design and performance standards for stormwater management measures and establishes safety standards for stormwater management basins. May be applicable if low permeability cap/covers are installed or existing stormwater features are modified.
New Jersey Standards for Soil Erosion and Sediment Control	N.J.S.A. § 4:24-30 N.J.A.C. 2:90-1.3	Applicable	Regulates construction that will potentially result in erosion of soils and sediment: requires preparation of stormwater pollution prevention plan, designation of construction waste collection site, and preparation site plan for construction related erosion.	Technical criteria and control measures applicable to land disturbance activities involving greater than 5,000 square feet.
Hazardous and Solid Waste Management Regulations				
Discharges of Petroleum and Other Hazardous Substances Rules	N.J.A.C. 7:1E	Applicable	These rules set forth guidelines and procedures to be followed by all persons in the event of a discharge of a hazardous substance.	Applies to temporary storage of recovered DNAPL in drums on Site prior to disposal.
Pollution Prevention Program Rules	N.J.A.C. 7:1K	Applicable	Establishes rules regarding the use and release of hazardous substances and the generation of hazardous substances as non-product output by industrial facilities and establishes guidelines and procedures for the development of Pollution Prevention Plans, Pollution Prevention Plan Summaries and Pollution Prevention Plan Progress reports.	Applies to DNAPL recovered and temporary storage on site.
New Jersey Solid Waste Management Act Regulations	N.J.S.A. § 13:1E-1 et seq. N.J.A.C. 7:26	Applicable	Establishes standards and procedures pertaining to, among other things, the management, treatment and disposal of solid wastes. Also includes requirements for Beneficial Use Determinations. On September 14, 1998, EPA granted New Jersey full program determination of adequacy for all areas of its municipal solid waste landfill program. New Jersey hazardous waste management rules incorporate RCRA regulations by reference, with few significant differences. There are no disposal facilities located in New Jersey licensed to accept hazardous waste (RCRA Subtitle C).	Applicable to solid wastes generated and managed both on and off-site. Beneficial Use Determination may be applicable if placement of fill is considered for the site. Applicable to demolition debris. Also applicable given the generation of filter cake from groundwater treatment.
New Jersey Hazardous Waste Management Regulations	N.J.A.C. 7:26G	Applicable	Procedure for identifying and listing hazardous wastes. Applies to any person who generates, transports, stores, treats or disposes of a hazardous waste. Establishes standards for disposal of hazardous wastes generated during remediation and the requirements for waste transporters, manifesting, and recordkeeping.	Applies if any materials at, or transported from, the Site are hazardous waste. Recovered DNAPL from the site is currently being managed as hazardous waste.

TABLE 3-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ARAR	Legal Citation	Classification	Summary of the Requirement	Additional Comments
New Jersey Transportation of Hazardous Materials	N.J.A.C. 16:49	Applicable	Governs the transportation of hazardous materials in NJ and regulates the shipping, packaging, marking, labeling, placarding, handling, and transportation of hazardous materials and waste, and, to the maximum extent practicable, conforms to the requirements of the regulations issued by the United States Department of Transportation.	Applies if any materials at, or transported from, the Site are classified as hazardous waste. Recovered DNAPL from the Site is currently being managed as hazardous waste.
Federal Hazardous Waste Transportation	49 U.S.C. §§ 1801-1819 49 CFR Parts 107, 171-177	Applicable	Regulates the transportation of hazardous materials, and includes the procedures for the packaging, labeling, manifesting, and transporting of hazardous waste to a licensed off-site disposal facility.	Applies if any materials at, or transported from, the Site are classified as hazardous waste. Recovered DNAPL from the Site is currently being managed as hazardous waste.
RCRA Hazardous Waste Management System	40 CFR 260	Applicable	Sets forth rules EPA uses in making information available to the public and requirements that generators and transporters must follow to assert claims of business confidentiality with respect to information that is submitted to EPA.	Applies if any materials at, or transported from, the Site are classified as hazardous waste. Recovered DNAPL from the Site is currently being managed as hazardous waste.
RCRA Identification and Listing of Hazardous Wastes	40 CFR 261	Applicable	Describes methods for identifying hazardous wastes and lists known hazardous wastes, including solid wastes containing lead concentrations of 5.0 mg/L (261.24).	Provides detailed information regarding identification of characteristic or listed hazardous wastes that must be managed under RCRA.
RCRA Standards Applicable to Generators of Hazardous Wastes	40 CFR 262	Applicable	Describes standards applicable to generators of hazardous wastes, including registration, manifesting, packaging, recordkeeping and accumulation time, e.g.: 1) 262.30 - pre-transportation packaging requirements; 2) 262.31 - pre-transportation labeling requirements; 3) 262.32 - pre transportation marking requirements; and 4) 262.33 - pre transportation placarding requirements.	The current generator status for the Site is Large Quantity Generator (LQG).
RCRA Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Applicable	Establishes standards for hazardous waste transporters, including transfer facility requirements, the requisite manifest system and recordkeeping procedures, and protocols in case of hazardous waste discharges in transport.	Applies if any materials transported from the Site are classified as hazardous waste. Recovered DNAPL from the Site is currently being managed as hazardous waste.
RCRA Land Disposal Restrictions	40 CFR 268	Potentially Applicable	This regulation identifies hazardous wastes restricted for land disposal and provides treatment standards for land disposal.	Criteria to be considered in the event that materials subject to land disposal are generated.
RCRA Hazardous Waste Permit Program	40 CFR 270	Applicable	This regulation establishes provisions covering basic EPA permitting requirements.	The USEPA ID Number (NJD 002 175 057) satisfies the permit requirements for management of hazardous waste.
Resource Conservation and Recovery Act (RCRA)	42 U.S.C. § 6921 et seq.	Applicable	RCRA establishes requirements for generators, transporters and facilities that manage non-hazardous solid waste and hazardous waste.	
National Emission Standard for Asbestos	42 U.S.C. § 7401 et seq. Section 112, 40 CFR Part 61, Subpart M.	Applicable	Establishes emission standards for asbestos.	Provides standards for asbestos emission control during, and disposal after, demolition, including: 1) 61.145 - inspection, notification, and asbestos emission control procedures; 2) 61.150 - protocols for disposal of asbestos following demolition; and 3) 61.152 - protocols to be followed when using air cleaning devices during demolition.
Health and Safety / Air Monitoring Regulations				
New Jersey Safety and Health Standards	N.J.A.C. 12:100	Applicable	Regulates occupational health and safety for workers who may be exposed to hazardous substances.	Applicable for on-Site workers that operate the HCTS or participate in monitoring or remediation activities.
New Jersey Air Pollution Control Act Standards	N.J.S.A. § 26:2C et seq. N.J.A.C. 7:27	Applicable	Describes requirements and procedures for obtaining air permits and certificates; rules that govern the emission of contaminants into the ambient atmosphere from stationary and mobile sources. Prohibits air pollution, particle emissions and toxic VOC emissions.	Emissions from the on-Site HCTS are subject to regulation under the CAA and an air permit is in place. May be applicable if construction activities with the potential for particulate emissions are undertaken (cap/cover construction).

TABLE 3-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
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STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ARAR	Legal Citation	Classification	Summary of the Requirement	Additional Comments
Clean Air Act (CAA) -- National Primary and Secondary Ambient Air Quality Standards (NAAQs)	40 CFR 50	Applicable	Provides air quality standards for particulate matter, lead, NO2, SO2, CO, and volatile organic matter. Standard for lead set at 1.5 micrograms per cubic meter, maximum arithmetic mean averaged over a calendar quarter (40 CFR 50.12).	Emissions from the on-Site HCTS are subject to regulation under the CAA and an air permit is in place.
Standards of Performance for New Stationary Sources	40 CFR 60	Applicable	Sets the general requirements for air quality.	Emissions from the on-Site HCTS are subject to regulation under the CAA and an air permit is in place.
National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Applicable	Provides air quality standards for hazardous air pollutants.	Emissions from the on-Site HCTS are subject to regulation under the CAA and an air permit is in place.
Safety and Health Regulations for Construction	29 CFR 1926.1101	Applicable	Regulates asbestos exposure during building demolition.	
Noise Control	N.J.S.A. § 13:1g-1 et seq. N.J.A.C. 7:20	Relevant and Appropriate	Regulates noise levels for certain types of activities and facilities such as commercial, industrial, community service and public service facilities. Relevant and appropriate for establishing allowable noise levels.	
General Site Remediation				
New Jersey Uniform Construction Code	N.J.A.C. 5:23	Applicable	This code provides the requirements for any construction performed during remediation of the site.	May be applicable if construction of surface covers or placement of fill materials is undertaken as part of the remedial action.
Administrative Requirements for the Remediation of Contaminated Sites	N.J.A.C. 7:26C	Applicable	Establishes the administrative procedures and requirements for the remediation of contaminated sites.	Many provisions of this rule are not applicable for CERCLA sites, however institutional controls for soil (Deed Notice) and groundwater (CEA) will be required assuming impacted soils and groundwater at levels above the most restrictive standards remain on site. Biennial protectiveness certifications will be submitted to case manager.
New Jersey Technical Requirements For Site Remediation	N.J.A.C. 7:26E	Applicable	Sets forth technical requirements for site remediation including preliminary assessments, remedial investigations, remedial action work plans, remediation, post remediation monitoring and institutional controls.	Substantive requirements are applicable to all Remedial Actions evaluated
District Zoning Regulations	N.J.A.C. 19:4	Potentially Applicable	The NJMC Master Plan sets policies that guide development in the District by setting forth development in a floodplain and Site plan requirements.	Applicable for Remedial Actions such as importing fill or modifications to stormwater features, vegetated cover systems, zoning approval, changes or occupancy of HCTS.
National Contingency Plan (NCP)	40 CFR 300, Subpart E	Applicable	This regulation outlines procedures for remedial actions and for planning and implementing off-site removal actions.	The SCCC Site is listed on the NPL and hence the provisions of the NCP are applicable.
NJDEP SRP Technical Guidance on the Capping of Sites Undergoing Remediation	N/A	Potentially Applicable	Technical guidance pertaining to capping remedies given site conditions and the evaluation of a capillary break.	IRM/IRA covers and capillary breaks currently exist on a portion of the Site.
Town of Kearny Building Code	N/A	Applicable	Establishes requirements for the construction or demolition of existing structures.	Town of Kearny Building Code Act would be applicable for any construction or demolition activities.

Acronyms
TBC: To be considered
HCTS: Hydraulic Control Treatment System
N/A: Not Available

TABLE 3-2
AREA 2 GROUNDWATER ANALYTICAL RESULTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ANALYTE NAME	UNITS	HC-PZ-13L HC-PZ-13L-11042015 11/4/2015	MW-D-28 MW-D-28-11042015 11/4/2015	MW-D-35 MW-D-35-11032015 11/3/2015	MW-D-37 MW-D-35-11042015 11/4/2015	MW-D-38 MW-D-38-11032015 11/3/2015	MW-D-38 DUP MW-D-99-11032015 11/3/2015	MW-D-39 MW-D-39-11032015 11/3/2015
VOC								
Chloromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromomethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Vinyl Chloride	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Chloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Methylene Chloride	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Acetone	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
Carbon Disulfide	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Trichlorofluoromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1-Dichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1-Dichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
trans-1,2-Dichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
cis-1,2-Dichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Chloroform	ug/l	20 U	200 U	1.0 U	31	0.71 J	0.80 J	1.2
1,2-Dichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
2-Butanone	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
1,1,1-Trichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Carbon Tetrachloride	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromodichloromethane	ug/l	20 U	200 U	1.0 U	3.2 J	2.0 U	2.0 U	1.0 U
1,2-Dichloropropane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
cis-1,3-Dichloropropene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Trichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Dibromochloromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1,2-Trichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Benzene	ug/l	43	1300	1.0 U	28	1.7 J	1.6 J	1.0 U
trans-1,3-Dichloropropene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromoform	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
4-Methyl-2-Pentanone (MIBK)	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
2-Hexanone	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
Tetrachloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Toluene	ug/l	20 U	200 U	1.0 U	56	0.54 J	2.0 U	1.0 U
Chlorobenzene	ug/l	680	2100	0.94 J	32	2.0 U	2.0 U	1.0 U
Ethylbenzene	ug/l	20 U	200 U	1.0 U	78	10	10	1.0 U
Styrene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
m,p-Xylenes	ug/l	20 U	200 U	1.0 U	100	10	10	1.0 U
o-Xylene	ug/l	20 U	200 U	1.0 U	49	7.7	7.4	1.0 U
Freon TF	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Methyl tertbutyl ether	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	0.37 J
Cyclohexane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,3-Dichlorobenzene	ug/l	2300	29000	1.0 U	160	2.0 U	2.0 U	1.0 U
1,4-Dichlorobenzene	ug/l	3900	43000	1.0 U	250	2.0 U	2.0 U	1.0 U
1,2-Dichlorobenzene	ug/l	3200	34000	0.29 J	220	2.0 U	2.0 U	1.0 U
Dichlorodifluoromethane	ug/l	110	1800	1.0 U	5.2 J	2.0 U	2.0 U	1.0 U

TABLE 3-2
AREA 2 GROUNDWATER ANALYTICAL RESULTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ANALYTE NAME	UNITS	HC-PZ-13L HC-PZ-13L-11042015 11/4/2015	MW-D-28 MW-D-28-11042015 11/4/2015	MW-D-35 MW-D-35-11032015 11/3/2015	MW-D-37 MW-D-35-11042015 11/4/2015	MW-D-38 MW-D-38-11032015 11/3/2015	MW-D-38 DUP MW-D-99-11032015 11/3/2015	MW-D-39 MW-D-39-11032015 11/3/2015
1,2,4-Trichlorobenzene	ug/l	9.9 J	190 J	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromochloromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Isopropylbenzene	ug/l	20 U	200 U	1.0 U	5.2 J	2.0	2.1	1.0 U
Methyl Acetate	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
Methylcyclohexane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,3,5-Trichlorobenzene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,4-Dioxane	ug/l	1.1 J	1.3 J	2.0 U	1.5 J	2.0 U	2.0 U	2.0 U
1,2-Dibromo-3-chloropropane	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
1,2-Dibromoethane	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
SVOC								
Phenol	ug/l	10 U	41 J	10 U	520 U	52 U	50 U	10 U
2-Chlorophenol	ug/l	4.7 J	53 J	10 U	520 U	52 U	50 U	10 U
2-Methylphenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
4-Methylphenol	ug/l	10 U	31 J	10 U	520 U	52 U	50 U	10 U
2-Nitrophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4-Dimethylphenol	ug/l	10 U	100 U	10 U	50 J	52 U	50 U	10 U
2,4-Dichlorophenol	ug/l	11	79 J	10 U	520 U	52 U	50 U	10 U
4-Chloro-3-methylphenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4,6-Trichlorophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4,5-Trichlorophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4-Dinitrophenol	ug/l	21 U	210 U	20 U	1000 U	100 U	100 U	20 U
4-Nitrophenol	ug/l	21 U	210 U	20 U	1000 U	100 U	100 U	20 U
4,6-Dinitro-2-Methylphenol	ug/l	21 U	210 U	20 U	1000 U	100 U	100 U	20 U
N-Nitroso-Di-N-Propylamine	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Hexachloroethane	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Nitrobenzene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Isophorone	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
bis(2-Chloroethoxy) Methane	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Naphthalene	ug/l	10 U	100 U	1.7 J	5800	940	850	10 U
4-Chloroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Hexachlorobutadiene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
2-Methylnaphthalene	ug/l	10 U	100 U	10 U	770	160	150	10 U
Hexachlorocyclopentadiene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2-Chloronaphthalene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2-Nitroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Dimethylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Acenaphthylene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,6-Dinitrotoluene	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
3-Nitroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Acenaphthene	ug/l	10 U	100 U	69	330 J	91	83	1.4 J
Dibenzofuran	ug/l	10 U	100 U	10 U	84 J	27 J	23 J	10 U
2,4-Dinitrotoluene	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
Diethylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U

TABLE 3-2
AREA 2 GROUNDWATER ANALYTICAL RESULTS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ANALYTE NAME	UNITS	HC-PZ-13L HC-PZ-13L-11042015 11/4/2015	MW-D-28 MW-D-28-11042015 11/4/2015	MW-D-35 MW-D-35-11032015 11/3/2015	MW-D-37 MW-D-35-11042015 11/4/2015	MW-D-38 MW-D-38-11032015 11/3/2015	MW-D-38 DUP MW-D-99-11032015 11/3/2015	MW-D-39 MW-D-39-11032015 11/3/2015
4-Chlorophenyl-phenylether	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Fluorene	ug/l	10 U	100 U	10 U	210 J	69	63	10 U
4-Nitroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
N-Nitrosodiphenylamine	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
4-Bromophenyl-phenylether	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Phenanthrene	ug/l	10 U	100 U	14	270 J	85	78	10 U
Anthracene	ug/l	10 U	100 U	10 U	520 U	9.3 J	7.4 J	10 U
Carbazole	ug/l	10 U	100 U	10 U	150 J	29 J	27 J	10 U
Di-n-Butylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Fluoranthene	ug/l	10 U	100 U	0.84 J	520 U	11 J	9.6 J	10 U
Pyrene	ug/l	10 U	100 U	1.0 J	520 U	5.2 J	4.4 J	10 U
Butylbenzylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
3,3'-Dichlorobenzidine	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Chrysene	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
bis(2-Ethylhexyl)phthalate	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
Di-n-Octyl phthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Benzo(k)fluoranthene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Indeno(1,2,3-cd)pyrene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Dibenz(a,h)anthracene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Benzo(g,h,i)perylene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
1,1'-Biphenyl	ug/l	10 U	100 U	10 U	120 J	20 J	19 J	10 U
Acetophenone	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Benzaldehyde	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Caprolactum	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Atrazine	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
2,2'-Oxybis(1-Chloropropane)	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
1,2,4,5-Tetrachlorobenzene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,3,4,6-Tetrachlorophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Benzo(a)anthracene	ug/l	0.26 U	5.2 U	0.050 U	1.0 U	0.19 J	0.19 J	0.050 U
Benzo(a)pyrene	ug/l	0.26 U	5.2 U	0.050 U	1.0 U	0.26 U	0.25 U	0.050 U
Benzo(b)fluoranthene	ug/l	0.26 U	5.2 U	0.050 U	1.0 U	0.26 U	0.25 U	0.050 U
Pentachlorophenol	ug/l	1 U	21 U	0.20 U	4.2 U	1.0 U	1.0 U	0.20 U
Hexachlorobenzene	ug/l	0.1 U	2.1 U	0.02 U	0.42 U	0.10 U	0.10 U	0.02 U
Bis-(2-Chloroethyl) Ether	ug/l	0.1 U	5.2	0.02 U	0.42 U	0.10 U	0.10 U	0.02 U

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an estimated value.
U : Indicates the analyte was analyzed for but not detected.

TABLE 3-3
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, TECHNOLOGY AND PROCESS OPTIONS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1						
Media	**Remedial Action Objectives**	**General Response Actions**	**Technologies**	**Process Options**	**Site Characterization Information**	**General Comments**
Area 1 (Within the Barrier Wall): Surface Soil	1. Continue to mitigate current and potential future exposure to impacted surface soil via incidental ingestion, dermal contact, and inhalation of volatile organics and particulates. 2. Continue to mitigate the current or potential future transport of impacted surface soil by erosion and runoff or wind.	No Action	No Action	No Action	Site-related constituent groups include chlorinated benzenes, polycyclic aromatic hydrocarbons (PAHs [including naphthalene]), polychlorinated biphenyls (PCBs), dioxins/furans (or polychlorinated dibenzodioxin/polychlorinated dibenzofuran (PCDD/PCDF)), and metals, including hexavalent chromium.	Nearly the entire 25-acre surface soil area is covered with an IRM cover of some sort.
		Institutional Controls	Institutional Controls	Deed Notices		
				Health and Safety Requirements		
		Engineering Controls	Existing Remedies	Continued OM&M		
			Cover Material Improvements	Cap/Cover		
			Targeted Placement of Cover Materials	Cap/Cover		
			Site wide Fill - Cover Placement	Cap/Cover		
			Stormwater Management Enhancements	Drainage Controls		
Area 1 (Within the Barrier Wall): Subsurface Soil (Unsaturated and Saturated Zones)	1. Continue to mitigate current and potential future direct or indirect (i.e., transport-related) exposures to impacted subsurface soil via incidental ingestion, dermal contact, and inhalation of volatiles and particulates. 2. Mitigate potential soil vapor intrusion in the event that buildings are constructed in potential volatile organic source areas.	No Action	No Action	No Action	Site-related constituents are similar to surface soil. Chlorinated benzene concentrations were generally highest in soil at depth in the lower Sand Unit within the eastern and western portions of the Site. The underlying varved clay to act as an effective barrier to vertical migration. Naphthalene and other PAHs and to a lesser extent, PCBs and PCDD/PCDF were found in the eastern and western Site soil and former lagoons. Chromium was found in the western, eastern and southern portions of the Site and on a portion of the western area of the Seaboard Site. Hexavalent chromium was found primarily within the upper 10 feet of shallow fill. The reducing capacity of the underlying Meadow Mat was found to impede the downward migration of hexavalent chromium.	The subsurface soil has been/is being remediated as part of the ongoing IRAR activities.
		Institutional Controls	Institutional Controls	Deed Notices		
				Health and Safety Requirements		
		Engineering Controls	Existing Remedies	Continued OM&M		
			Vapor Control	Vapor Control Barriers		
Area 1 (Within the Barrier Wall): Groundwater	1. Continue to mitigate potential exposures to impacted groundwater via ingestion, dermal contact or inhalation. 2. Continue to mitigate the potential discharge of impacted groundwater to surface water. 3. Continue to mitigate potential migration of impacted groundwater. 4. Mitigate potential soil vapor intrusion in the event that buildings are constructed in potential volatile organic source areas.	No Action	No Action	No Action	Impacts have been observed within two distinct units: the shallow Fill Unit and underlying Sand Unit. The upper Fill Unit found Site COCs in groundwater including: chlorinated benzenes, several VOCs, naphthalene and other PAHs, phenols, PCBs and chromium. Investigation of the deeper Sand Unit found a similar suite of chemical constituents in deeper groundwater, with the notable exception of hexavalent chromium due to the reducing influence of the underlying Meadow Mat, an organic rich layer that reduces hexavalent to trivalent chromium.	Impacted groundwater within the shallow fill unit and deep sand unit is contained within the existing barrier wall system. The impacted groundwater in the shallow fill unit is being removed and treated as part of the ongoing IRA activities.
		Institutional Controls	Institutional Controls	Deed Notices and CEA/WRA		
		Engineering Controls	Existing Remedies	Continued OM&M - Existing Groundwater Extraction		
				Continued OM&M - Existing Groundwater Treatment System		
				Continued OM&M - Containment - Barrier Wall		
Area 1 (Within the Barrier Wall): DNAPL	1. Continue to contain DNAPL within the fully enclosed barrier wall system. 2. Continue to remove free-phase/mobile/accumulated DNAPL to the extent practicable.	No Action	No Action	No Action	DNAPL is predominantly present in the lower sand unit. It has been observed as a relatively thin layer at the contact between the deep sand unit and the underlying varved clay. The DNAPL exists in the former lagoon area, the western section of the SCCC Site and western section of the adjacent Seaboard Site.	The DNAPL is contained within the barrier wall system and is being recovered as part of the ongoing IRA activities.
		Institutional Controls	Institutional Controls	Deed Notices		
		Engineering Controls	Existing Remedies	Continued OM&M - Passive DNAPL Recovery. Active DNAPL recovery to be considered.		

TABLE 3-3
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, TECHNOLOGY AND PROCESS OPTIONS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 2						
Media	**Remedial Action Objectives**	**General Response Actions**	**Technologies**	**Process Options**	**Site Characterization Information**	**General Comments**
Area 2 (Outside the Barrier Wall): Groundwater	1. Mitigate potential migration of impacted groundwater into surface water or wetland areas if complete migration pathways exist or could be complete in the future. 2. Mitigate potential direct future exposures to groundwater via potable use (ingestion, inhalation, dermal contact).	No Action	No Action	No Action	Dissolved phase constituents were detected at concentrations greater than applicable groundwater quality standards in a groundwater sample obtained from existing piezometers located outside of the southwestern corner of the barrier wall (i.e., Area 2).	It is unlikely that the existence of groundwater impacts pose any risk to potential human or ecological receptors.
		Institutional Controls	Institutional Controls	Deed Notices and CEA/WRA		
		Engineering Controls	Selected Technologies	Additional OM&M		
		Containment	Hydraulic Control	Recovery Wells		
		Ex-Situ Treatment	Physical Treatment Units	Existing Groundwater Treatment System		
Area 2 (Outside the Barrier Wall): DNAPL	1. Removal of free-phase/mobile/ accumulated DNAPL to the extent practicable.	No Action	No Action	No Action	Results of the additional remedial investigation activities confirmed the presence of DNAPL in soil located in Area 2. Site related DNAPL is present in the lower sand unit. It has been observed as a relatively thin layer at the contact between the deep sand unit and the underlying varved clay. The DNAPL appears to be contained within a topographic low of the top of the varved clay in the area south of the south west corner of the site and located within the NJDOT right-of-way.	Since the source of DNAPL has been contained within the barrier wall, the DNAPL observed outside the barrier wall in Area 2 is unlikely to migrate and pose a current or potential future risk of exposure based on surrounding land and groundwater use.
		Institutional Controls	Institutional Controls	Deed Notices		
		Removal	Recovery/Disposal of DNAPL	Passive Recovery (Wells and/or Trenches)/Offsite Disposal		
		Containment	Physical Barrier	Jet-Grouted Columns		
				Auger-Mixed Columns		
				Steel sheet pile walls		
		In-Situ Treatment	Chemical/Physical Treatment	Solidification/Stabilization (Jet-Grouted Columns or Auger-Mixed Columns)		
		Ex-Situ Treatment	Physical Treatment Units	Existing Groundwater Treatment System		
		Engineering Controls	Selected Technologies	Additional OM&M. Active DNAPL recovery to be considered.		

TABLE 3-4
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Process Option Description	Screening Comments
1 - (Within the Barrier Wall) Surface Soil	No Action	No Action	No Action	No additional action beyond those already implemented.	The No Action option is included as a statutory requirement of the National Contingency Plan.
	Institutional Controls	Institutional Controls	Deed Notices	Establish criteria for near surface disturbance of Site, and limit Site usage.	Layered institutional controls are appropriate for the protection of human health.
		Land Use Administration	Health and Safety Requirements	Surface soil management/H&S protocol for potential excavation activities.	H&S protocol are appropriate for the protection of human health during potential intrusive activities.
	Engineering Controls	Existing Remedies	Continued Operation, Maintenance and Monitoring	Site inspections, and cover materials maintenance and repairs.	Activities identified in OM&M manuals have been successfully implemented.
		Targeted placement of cap/cover materials	Cap/Cover	This technology would consist of the placement of cap/covers in discrete portions of the Site. Targeted areas would be identified via inspection of existing cover materials.	Common, proven technology at numerous sites. The most appropriate cap/cover system would be finalized during the design phase.
		Site-Wide placement of cap/cover materials	Cap/Cover	This technology would consist of placement of low permeability fill materials above essentially the entire Site.	Common, proven technology at numerous sites. The most appropriate cap/cover system would be finalized during the design phase.
		Stormwater Management Enhancements	Drainage Controls	Best management practices to enhance the existing E&S/stormwater management features.	Any enhancements would be retrofitted to existing features and finalized during the design phase.

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Process Option Description	Screening Comments
1 - (Within the Barrier Wall) Subsurface Soil	No Action	No Action	No Action	No additional action beyond those already implemented.	The No Action option is included as a statutory requirement of the National Contingency Plan.
	Institutional Controls	Institutional Controls	Deed Notices	Establish criteria for subsurface activities within the Site and limit Site usage.	Layered institutional controls are appropriate for the protection of human health.
		Land Use Administration	Health and Safety Requirements	Subsurface soil management/H&S protocol for potential excavation activities.	H&S protocol are appropriate for the protection of human health during potential intrusive subsurface activities.
	Engineering Controls	Existing Remedies	Continued Operation, Maintenance and Monitoring	Site inspections, monitoring, Site maintenance and HCTS OM&M.	Activities identified in OM&M manuals have been successfully implemented.
		Vapor Control	Vapor Control Barriers	This technology would include preventing vapors from infiltrating potential future structures on the Site.	Vapor intrusion control currently included as part of the HCTS building. The most appropriate vapor control barrier would be finalized as part of the design phase.

TABLE 3-4
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Process Option Description	Screening Comments
1 - (Within the Barrier Wall) Groundwater	No Action	No Action	No Action	No additional action beyond those already implemented.	The No Action option is included as a statutory requirement of the National Contingency Plan.
	Institutional Controls	Institutional Controls	Deed Notices	CEA/WRA, prohibit usage of groundwater.	Layered institutional controls are appropriate for the protection of human health.
	Engineering Controls	Existing Remedies	Continued Operation and Maintenance - Existing Groundwater Pumping	O&M of the existing groundwater recovery wells.	Groundwater pumping activities identified in the HCTS OM&M manual have been successfully implemented.
		Existing Remedies	Continued Operation and Maintenance - Existing Groundwater Treatment System	O&M of the existing HCTS.	Groundwater treatment activities identified in the HCTS OM&M manual have been successfully implemented.
		Existing Remedies	Continued Operation and Maintenance - Barrier Wall	Maintenance of the existing slurry wall working platform and steel sheet pile wall cathodic protection system.	Slurry wall maintenance activities identified in the Site OM&M manual have been successfully implemented. The sheet pile all cathodic protection system is operational.
Area/ Medium	**General Response Actions**	**Remedial Technology**	**Process Options**	**Process Option Description**	**Screening Comments**
1 - (Within the Barrier Wall) DNAPL	No Action	No Action	No Action	No additional action beyond those already implemented.	The No Action option is included as a statutory requirement of the National Contingency Plan.
	Institutional Controls	Institutional Controls	Deed Notices	Criteria for subsurface activities within SCCC Site and limit potential exposure to DNAPL.	Layered institutional controls are appropriate for the protection of human health.
	Engineering Controls	Existing Remedies	Continued OM&M. Existing Passive DNAPL Recovery Wells/Off-Site Disposal. Active DNAPL recovery to be considered	Continue to remove and manage (off-site) DNAPL from existing recovery wells.	Passive DNAPL recovery activities identified in OM&M manuals have been successfully implemented.
	Removal	Collection and Disposal	Supplemental Passive Recovery Trenches/Off-Site Disposal	Supplement the existing DNAPL recovery wells by adding DNAPL collection trenches.	Proven technology. However, passive DNAPL recovery activities identified in OM&M manuals have been successfully implemented.
			Active DNAPL Recovery/Off-Site Disposal	Supplement the existing passive DNAPL recovery wells by adding active recovery of DNAPL.	Active DNAPL recovery has been attempted at the Site in the past, however, technical issues were observed and reported.

TABLE 3-4
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Process Option Description	Screening Comments
2 - (Outside the Barrier Wall) Groundwater	No Action	No Action	No Action	No additional action beyond those already implemented.	The No Action option is included as a statutory requirement of the National Contingency Plan.
	Institutional Controls	Institutional Controls	Deed Notices and CEA/WRA	CEA/WRA, prohibit usage of groundwater.	Layered institutional controls are appropriate for the protection of human health. Coordination with NJDOT would be required.
	Engineering Controls	Selected Technologies	Additional OM&M	OM&M of the potential groundwater technologies selected.	The scope of Area 2 OM&M would be determined after the groundwater technologies are selected. Coordination with NJDOT would be required.
	Containment	Hydraulic Control	Recovery Wells	Installation of additional groundwater recovery wells within the Area 2 impacted groundwater.	Retrofitting Area 2 groundwater collected to the existing Area 1 hydraulic control system could be problematic due to physical constraints, slurry wall penetration issues and the distance to the HCTS. Coordination with NJDOT would be required.
	Ex-situ Treatment	Physical Treatment Units	Existing Groundwater Treatment System	Treating potential new Area 2 groundwater recovered via the existing HCTS.	There is flow capacity available in the existing HCTS. The potential organic loading of Area 2 groundwater would be evaluated.
Area/ Medium	**General Response Actions**	**Remedial Technology**	**Process Options**	**Process Option Description**	**Screening Comments**
2 - (Outside the Barrier Wall) DNAPL	No Action	No Action	No Action	No additional action beyond those already implemented.	The No Action option is included as a statutory requirement of the National Contingency Plan.
	Institutional Controls	Institutional Controls	Deed Notices	Criteria for subsurface activities in Area 2 and limit potential exposure to DNAPL.	Layered institutional controls are appropriate for the protection of human health. Coordination with NJDOT would be required.
	Engineering Controls	Selected Technologies	Additional OM&M, Active DNAPL Recovery to be considered	OM&M of potential DNAPL technologies selected.	Passive DNAPL recovery activities identified in OM&M manuals have been successfully implemented. Coordination with NJDOT would be required.
	Removal	Recovery/Disposal of DNAPL	Passive Recovery Wells/Off-Site Disposal	Remove and manage (off-site) DNAPL from potential proposed recovery wells.	Proven technology. Passive DNAPL recovery activities identified in OM&M manuals have been successfully implemented. Coordination with NJDOT would be required.
	Containment	Physical Barrier	Jet Grouter Columns	High pressure injection of grout around the perimeter of the impacted area. Grout solidifies, creating a barrier.	Topography and close proximity of active roadway could create issues. Existing utility and stormwater management system locations and the need for a working platform to be constructed could hinder this option. Evaluation of the potential impacts on the slurry wall would also need to be investigated. Coordination with NJDOT would be required.
			Auger-Mixed Columns	Hollow stem auger with large flights would be used to work the soil, followed by grout injection under pressure through the hollow stem that could create a barrier.	Topography and close proximity of active roadway could create issues. Existing utility and stormwater management system locations and the need for a working platform to be constructed could hinder this option. Evaluation of the potential impacts on the slurry wall would also need to be investigated. Coordination with NJDOT would be required.
			Steel Sheet Pile walls	Interlocking steel sheets that prevent the migration of COCs.	Topography and close proximity of active roadway could create issues. Existing utility and stormwater management system locations and the need for a working platform to be constructed could hinder this option. Evaluation of the potential impacts on the slurry wall would also need to be investigated. Coordination with NJDOT would be required.
	In-Situ Treatment	Chemical/Physical Treatment	Solidification/Stabilization	Technology consists of injection and mechanical mixing of binding agent to macroencapsulate the soil/DNAPL and reduce the dissolution of DNAPL.	Topography and close proximity of active roadway could create issues. Existing utility and stormwater management system locations and the need for a working platform to be constructed could hinder this option. Evaluation of the potential impacts on the slurry wall would also need to be investigated. Coordination with NJDOT would be required.

TABLE 3-5
EVALUATION OF TECHNOLOGIES
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Screening Result (Eliminated or Retained)
1 - (Within the Barrier Wall) Surface Soil	No Action	No Action	No Action	Does not remain effective in the long-term, as covers will deteriorate without maintenance. Does not reduce stormwater infiltration in uncovered areas.	Readily implementable but unlikely to be acceptable to federal and state regulators.	No Cost.	Eliminated - Does not reduce the potential Site risks, meet the RAOs established for the Site, or comply with ARARs.
	Institutional Controls	Institutional Controls	Deed Notices	Effective at controlling human exposures.	Readily implementable.	Administrative and legal costs required. Relatively low costs.	Retained - Reduces potential soil exposure risks for public.
		Land Use Administration	Health and Safety Requirements	Effective at controlling human exposures via health and safety protocol.	Readily implementable.	Relatively low costs.	Retained - Reduces potential soil exposure risks for construction workers.
	Engineering Controls	Existing Remedies	Continued Operation, Maintenance and Monitoring	Maintenance of existing covers effective in reducing potential exposure.	Continued OM&M implementable.	Relatively low cost for cap/cover maintenance.	Retained - needed to reduce toxicity and volume of COPCs and DNAPL by maintaining the cap/cover systems and reducing stormwater infiltration.
		Targeted placement of cap/cover materials	Cap/Cover	Effective in the reduction of potential direct surface soil exposure and reducing stormwater infiltration.	Implementable following Site preparation.	Moderate capital costs.	Retained - Reduce potential direct soil contact and stormwater infiltration.
		Site-Wide placement of cap/cover materials	Cap/Cover	Effective in reduction of potential direct surface soil exposure and reducing stormwater infiltration.	Implementable following Site preparation.	Moderate capital costs.	Retained - Reduce potential direct soil contact and stormwater infiltration.
		Stormwater Management Enhancements	Drainage Controls	Effective in enhancing the reduction in stormwater infiltration.	Readily implementable.	Relatively low cost assuming that the enhancements do not include infrastructure modifications.	Retained - Additional measures to minimize stormwater infiltration.

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Screening Result (Eliminated or Retained)
1 - (Within the Barrier Wall) Subsurface Soil	No Action	No Action	No Action	Does not reduce risk for potential human exposure during intrusive activities.	Readily implementable but unlikely to be acceptable to federal and state regulators.	No Cost.	Eliminated - Does not reduce the potential Site risks, meet the RAOs established for the Site, or comply with ARARs.
	Institutional Controls	Institutional Controls	Deed Notices	Effective at controlling human exposures during intrusive activities.	Readily implementable.	Administrative and legal costs required. Relatively low costs.	Retained - Reduces potential Site risks for public.
		Land Use Administration	Health and Safety Requirements	Effective at reducing human exposure via health and safety protocol.	Readily implementable.	Relatively low costs to implement health and safety protocol during construction.	Retained - Reduces potential Site risks for construction workers.
	Engineering Controls	Existing Remedies	Continued Operation, Maintenance and Monitoring	OM&M of groundwater treatment and DNAPL recovery systems will reduce COCs in saturated subsurface soil.	Continued OM&M implementable.	Relatively high cost for overall OM&M.	Retained - Reduces volume of COCs.
		Vapor Control	Vapor Control Barriers	Effective at reducing human air exposure in potential new buildings.	Readily implementable during potential future building construction.	Moderate capital costs.	Eliminated - no new buildings are anticipated at this point in time. Would be included as a component of Deed Notices for potential new building construction.

TABLE 3-5
EVALUATION OF TECHNOLOGIES
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Screening Result (Eliminated or Retained)
1 - (Within the Barrier Wall) Groundwater	No Action	No Action	No Action	Does not reduce risk for potential exposure to groundwater.	Readily implementable but unlikely to be acceptable to federal and state regulators.	No Cost.	Eliminated - Does not reduce the potential Site risks, meet the RAOs established for the Site, or comply with ARARs.
	Institutional Controls	Institutional Controls	Deed Notices	Effective at controlling human exposures	Readily implementable.	Administrative and legal costs required. Relatively low costs.	Retained - Reduces potential groundwater exposure for the public.
	Engineering Controls	Existing Remedies	Continued Operation and Maintenance - Existing Groundwater Pumping	OM&M of groundwater recovery wells effective in reducing mobility and volume of COPCs. The continued OM&M is necessary to prevent groundwater overtopping of the slurry wall.	Continued OM&M implementable.	Moderate costs for OM&M of wells.	Retained - Reduces COPC volume and mobility, and integral to maintain existing remedy effectiveness (i.e. prevent groundwater overtopping of the slurry wall).
		Existing Remedies	Continued Operation and Maintenance - Existing Groundwater Treatment System	OM&M of groundwater treatment system effective in reducing mobility and volume of COPCs.	Continued OM&M implementable.	Relatively high costs for OM&M of HCTS.	Retained - Treatment reduces the COPC volume.
		Existing Remedies	Continued Operation and Maintenance - Barrier Wall	Maintenance of slurry wall working platform and O&M of SSP wall effective in reducing mobility of COPCs.	Continued OM&M implementable.	Moderate costs for slurry wall and sheet pile wall OM&M.	Retained- Reduce the migration of the COCs, and integral to maintain the existing remedy effectiveness.
Area/ Medium	**General Response Actions**	**Remedial Technology**	**Process Options**	**Effectiveness**	**Implementability**	**Cost**	**Screening Result (Eliminated or Retained)**
1 - (Within the Barrier Wall) DNAPL	No Action	No Action	No Action	Does not reduce risk for potential exposure to DNAPL.	Readily implementable but unlikely to be acceptable to federal and state regulators.	No Cost.	Eliminated - Does not reduce the potential Site risks, meet the RAOs established for the Site, or comply with ARARs.
	Institutional Controls	Institutional Controls	Deed Notices	Effective at controlling human exposures.	Readily implementable.	Administrative and legal costs required. Relatively low costs.	Retained - Reduces potential DNAPL exposure for public.
	Engineering Controls	Existing Remedies	Existing Passive DNAPL Recovery Wells/Off-site Disposal. Active DNAPL recovery to be considered.	Continued removal and disposal of DNAPL effective in reducing DNAPL volume.	Continued DNAPL recovery readily implementable.	Ongoing passive recovery relatively low cost. DNAPL Disposal costs moderate.	Retained - Has proven to be effective for removing DNAPL, and is cost-effective.
	Removal	Collection and Disposal	Supplemental Passive Recovery Trenches/Off-Site Disposal	Trenches can be effective in recovering DNAPL and reducing the DNAPL volume.	Moderately implementable. Impacted material from excavations would be generated. Would require penetration of existing covers.	Trench construction and DNAPL disposal costs moderate.	Eliminated - Potential benefits outweighed by drawbacks.

TABLE 3-5
EVALUATION OF TECHNOLOGIES
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Area/ Medium	General Response Actions	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Screening Result (Eliminated or Retained)
2 - (Outside the Barrier Wall) Groundwater	No Action	No Action	No Action	Does not reduce risk for potential exposure to groundwater.	Readily implementable but unlikely to be acceptable to federal and state regulators.	No Cost.	Eliminated - Does not reduce the potential Area 2 risks, meet the RAOs established for Area 2, or comply with ARARs.
	Institutional Controls	Institutional Controls	Deed Notices	Effective at controlling human exposures.	Readily implementable. Would require NJDOT coordination.	Administrative and legal costs required. Relatively low costs.	Retained - Reduces potential Area 2 risks for public.
	Engineering Controls	Selected Remedies	Additional OM&M	OM&M effective in meeting RAOs.	Additional OM&M implementable. Would require NJDOT coordination.	Moderate costs for OM&M of selected remedies.	Retained -
	Containment	Hydraulic Control	Recovery Wells	May be effective given the sand unit formation conditions. Further analyses (e.g. modeling) would be required to design the wells.	Retrofitting Area 2 groundwater collected to the existing Area 1 hydraulic control system could be problematic due to physical constraints, slurry wall penetration issues and the distance to the HCTS. Coordination with NJDOT would be required.	Moderate costs for system installation and longer term OM&M.	Retained
	Ex-situ Treatment	Physical Treatment Units	Existing Groundwater Treatment System	Treating potential Area 2 extracted groundwater with the existing HCTS could be effective.	Would be determined via an evaluation of groundwater quality and flow rate versus the existing HCTS conditions.	Would increase the relatively high costs for OM&M of HCTS.	Retained
Area/ Medium	**General Response Actions**	**Remedial Technology**	**Process Options**	**Effectiveness**	**Implementability**	**Cost**	**Screening Result (Eliminated or Retained)**
2 - (Outside the Barrier Wall) DNAPL	No Action	No Action	No Action	Does not reduce risk for potential exposure to DNAPL.	Readily implementable but unlikely to be acceptable to federal and state regulators.	No Cost.	Eliminated - Does not reduce the potential Site risks, meet the RAOs established for the Site, or comply with ARARs.
	Institutional Controls	Institutional Controls	Deed Notices	Effective at controlling human exposures.	Readily implementable.	Administrative and legal costs required. Relatively low costs.	Retained - Reduces potential Site risks for public.
	Engineering Controls	Selected Remedies	Additional OM&M. Active DNAPL Recovery to be considered	Removal and disposal of DNAPL effective in reducing DNAPL volume. The effectiveness of supplementing passive DNAPL recovery with active DNAPL recovery could be evaluated.	Area 2 OM&M would be implementable. Coordination with the NJDOT would be required.	Additional passive recovery relatively low cost. DNAPL disposal costs moderate.	Retained
	Removal	Recovery/Disposal of DNAPL	Passive Recovery Wells and/or Trenches/Off-Site Disposal	Wells and/or trenches could be effective in recovering DNAPL and reducing the DNAPL volume.	Implementable. Impacted material from wells and excavations would be generated. Passive DNAPL recovery activities identified in OM&M manuals have been successfully implemented.	Trench construction and well installation and DNAPL disposal costs moderate.	Retained
	Containment	Physical Barrier	Jet Grouted Columns	Potentially effective at creating a barrier to prevent the migration of DNAPL. The potential impacts to the existing slurry wall could be an issue.	Topography and close proximity of active roadway could create issues. Existing utility and stormwater management system locations and the need for a working platform to be constructed could hinder this option. Evaluation of the potential impacts on the slurry wall would also need to be investigated. Coordination with NJDOT would be required.	Relatively high costs due to the construction of a working platform, and grout column construction.	Eliminated - Current land use renders this option impractical
			Auger-Mixed Columns	Potentially effective at creating a barrier to prevent the migration of DNAPL. The potential impacts to the existing slurry wall could be an issue.	Topography and close proximity of active roadway could create issues. Existing utility and stormwater management system locations and the need for a working platform to be constructed could hinder this option. Evaluation of the potential impacts on the slurry wall would also need to be investigated. Coordination with NJDOT would be required.	Relatively high costs due to the construction of a working platform, and auger mix column construction.	Eliminated - due to unsure impacts on slurry wall
			Steel Sheet Pile walls	Potentially moderately effective, however may need specialized fabrication sheets. The potential impacts to the existing slurry wall could be an issue.	Topography and close proximity of active roadway could create issues. Existing utility and stormwater management system locations and the need for a working platform to be constructed could hinder this option. Evaluation of the potential impacts on the slurry wall would also need to be investigated. Coordination with NJDOT would be required.	Relatively high costs due to the construction of a working platform and sheet pile construction.	Eliminated - costly option due to specialized sheets for smaller area.
	In-Situ Treatment	Chemical/Physical Treatment	Solidification/Stabilization	Potentially effective at treating DNAPL, however will be detrimental to slurry wall.	Not readily implemental due to close proximity of the slurry wall.	Moderate costs of chemicals for treatment.	Eliminated - due to detrimental effect on slurry wall due to it's close proximity.

TABLE 3-6
SELECTION OF TECHNOLOGIES
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1	
Technologies	**Process Options**
No Action	No Action
Institutional Controls	Updated CEA/WRA
	Site Land Use Deed Notices
	Soil Management/H&S Deed Notices
Existing Remedies	Continued OM&M including a TI Waiver
Existing Cover Material Improvements	Cap/Cover
Targeted Placement of Cover Materials	Cap/Cover
Sitewide Fill - Cover Placement	Cap/Cover
Stormwater Management Improvements	Drainage Controls
AREA 2	
Technologies	**Process Options**
No Action	No Action
Institutional Controls	Updated CEA/WRA
	Site Land Use Deed Notices
	Soil Management/H&S Deed Notices
Removal	Recovery/Disposal of DNAPL
Selected Technologies	Additional OM&M including a TI Waiver

TABLE 4-1
SUMMARY OF ALTERNATIVES
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, NEW JERSEY

Alternative	Main Technologies	Technology Components	Approximate Area (Acres)
Alternative I	No Action	N/A	N/A
Alternative II	CONTINUED OM&M, AREA 2 DNAPL RECOVERY AND INSTITUTIONAL CONTROLS	- Area 1 Existing Covers with Continued OM&M	19.2
		- Area 2 DNAPL Recovery - install 2 DNAPL Recovery Wells	3.8
		- Institutional Controls	29
Alternative III	TARGETED AREA 1 CAP/COVER, CONTINUED OM&M, AREA 2 DNAPL RECOVERY AND INSTITUTIONAL CONTROLS	- Area 1 Targeted Vegetation and Stone Area Cap/Cover - install 4" asphalt/4" granular subbase - existing asphalt cap O&M	 7.3 10.8
		- Area 1 Wetland Area Cap/Cover and Revegetation (In-Place) - 60 mil HDPE geomembrane/10oz/sy geotextile each side - 12" wetland substrate - revegetation	1.1
		- Area 2 DNAPL Recovery - install 2 DNAPL recovery wells	3.8
		- Institutional Controls	29
Alternative IV	SCCC SITE-WIDE AREA 1 CAP/COVER, CONTINUED OM&M, AREA 2 DNAPL RECOVERY AND INSTITUTIONAL CONTROLS	- Site Wide Cap/Cover - 33" general fill - 60 mil HDPE geomembrane/10oz/sy geotextile each side - 3" topsoil - revegetation	18.1
		- Wetland Area Cap/Cover and Revegetation (Relocated)* - 60 mil HDPE geomembrane/10oz/sy geotextile each side - wetland substrate - revegetation	1.1
		- Area 2 DNAPL Recovery - install 2 DNAPL recovery wells	3.8
		- Institutional Controls	29

N/A = Not Applicable
* Wetlands may either be relocated on the SCCC Site or off-site as part of a wetland bank agreement.

TABLE 5-1
ALTERNATIVE II COST ESTIMATE
CONTINUED OM&M, AREA 2 DNAPL RECOVERY, INSTITUTIONAL CONTROLS, AND BUILDING DEMOLITION
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, NEW JERSEY

Item	Description	Quantity	Unit	Unit Price	Cost
	DIRECT CAPITAL COSTS				
1.01	Demolition	1	LS	$ 800,000	$ 800,000
Area 2 DNAPL Recovery Well					
1.02	Well Installation	1	LS	$ 285,000	$ 285,000
Institutional Controls					
1.03	Deed Notices	1	LS	$ 20,000	$ 20,000
1.04	CEA/WRA	1	LS	$ 20,000	$ 20,000
1.05	Security Fencing Around Existing Buildings	1750	lf	$ 20	$ 35,000
				Subtotal Direct Capital Cost	**$ 1,160,000**
Total Capital Costs					
2.01	Subtotal Direct Capital Costs				$ 1,160,000
2.02	Contingency			20%	$ 232,000
Total Capital Costs					**$ 1,392,000**
	OPERATION MAINTENANCE AND MONITORING				
Item	**Description**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Direct Annual OM&M Costs					
1.01	2015 OM&M Budget	1	LS	$ 500,000	$ 500,000
1.02	Estimated Area 2 DNAPL Recovery Well OM&M	1	LS	$ 41,000	$ 41,000
				Subtotal Direct Annual OM&M Costs	**$ 541,000**
Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs					
2.01	*Direct OM&M Costs - Present Value of 30 year Annual Cost*			7%	$ 6,713,000
2.02	*Present value of EPA Five-Year Reviews*			7%	$ 108,000
2.03	*Present value of TI Zone Monitoring for 30 Years*			7%	$ 152,000
				Subtotal Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs	**$ 6,973,000**
Indirect OM&M Costs					
3.01	Administrative Costs			10%	$ 697,000
3.02	Contingency			10%	$ 697,000
				Subtotal Indirect O&M Costs	**$ 1,394,000**
Total Present Worth of 30 years OM&M					**$ 8,367,000**
Total Cost Alternative II					**$ 9,759,000**

Alternative II—Continued OM&M, Area 2 DNAPL Recovery and Institutional Controls

Direct Capital Costs

Area 2 DNAPL Recovery Well

Item 1.01 Demolition

- Based on budgetary/estimated Contractor quotes.

Item 1.02 Well Installation

- Based on actual costs for IRA well installation and cost estimate obtained from a local drilling contractor for the installation of two DNAPL recovery wells and includes well completion, oversight and disposal costs.

Institutional Controls

Item 1.03 Deed Notices

- Based on previous experience with preparation of institutional controls for similar projects.

Item 1.04 CEA/WRA

- Based on previous experience with the preparation of institutional controls for similar projects.

Item 1.05 Security Fencing (Around Existing Buildings)

- Length of fencing is 1,750 linear foot. Assume cost (based on contractor information) of $18/linear foot for a 6-foot high chain link fence with barbed wire.

Total Capital Costs

Item 2.02 Contingency – 20% of Subtotal Direct and Indirect Capital Costs

- Engineering judgment – A 20% percentage contingency was added to the total cost of construction based on previous experience with similar projects.

Operation Maintenance and Monitoring

Direct Annual OM&M Costs

Item 1.01 2015 OM&M Budget

Based on the SCCC Site 2015 OM&M

Item 1.02 Estimated Area 2 DNAPL Recovery Well OM&M

- Based on 2015 OM&M budget for monthly gauging of the Area 1 wells and cost estimate obtained from a local transportation and disposal waste hauler to perform quarterly DNAPL recovery via vacuum extraction and bulk DNAPL transport for fuel blending ($6,000/event).
- A cost estimate for traffic control is based on the cost associated with traffic control employed during the Remedial Investigation in Area 2 ($3,000/event).

Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs[1]

Item 2.01 Direct OM&M Costs – Present Value of 30 year Annual Cost

- Includes both HCTS operation and DNAPL recovery
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA.

Item 2.02 Present Value of EPA Five-Year Reviews

- Report prepared every 5 years for a total of 6 reports.
- Assume cost to conduct review is $50,000 each, based on professional experience with similar project reviews.
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA.

Item 2.03 Present Value of TI Zone Monitoring

- Assume six existing wells/piezometers sampled per event (HC-PZ-13L, MW-D-35, MW-D-37 MW-D-38 MW-D-39, and HC-PZ-13L).
- All samples are to be analyzed for volatile organic compounds by EPA Method 8260 and semi-volatile organic compounds by EPA Method 8270.
- Sampling to be performed quarterly for Years 1 and 2, annually for Years 3 through 7 and at 5-Year frequencies for Years 8 through 30.
- Estimated cost is $12,100 per sampling event based on recently completed work.
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA

[1] USEPA 540-R-00-002, OSWER 9355.0-75, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", July 2000.

Indirect OM&M Costs

Item 3.01 Administrative Costs

- Professional judgment - Based on previous experience with administrative cost for similar projects.

Item 3.02 Contingency

- Professional judgment – A 10% contingency assigned to the total cost of Direct Annual OM&M Costs based on previous experience with similar projects.

TABLE 5-2
ALTERNATIVE III COST ESTIMATE
TARGETED AREA 1 CAP/COVER, CONTINUED OM&M, AREA 2 DNAPL RECOVERY, INSTITUTIONAL CONTROLS, AND BUILDING DEMOLITION
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, NEW JERSEY

Item	Description	Quantity	Unit	Unit Price	Cost
	DIRECT CAPITAL COSTS				
1.01	Mobilization/Demobilization			5%	$ 138,000
1.02	Erosion and Sedimentation Controls (Silt Fence)	1700	LF	$ 2.32	$ 4,000
1.03	Temporary Decontamination Pad and Equipment Decontamination	1	LS	$ 25,000	$ 25,000
1.04	General Site Preparation	1	LS	$ 25,000	$ 25,000
1.05	Demolition	1	LS	$ 800,000	$ 800,000
Area 1 Targeted Cap/Cover Placement (Vegetation and Stone Cover Areas)					
1.06	Proposed Target Area Asphalt Cap/Cover Material and Placement	38600	SY	$ 20.73	$ 800,000
1.07	Aggregate Subgrade, Transport, Place and Compact	4300	CY	$ 64.90	$ 279,000
1.08	Asphalt Transportation	4300	CY	$ 11.57	$ 50,000
Area 1 Wetland Area Cap/Cover and Revegetation					
1.09	Dewater Wetlands	2	DAY	$ 964	$ 2,000
1.10	Excavation of Existing Wetland Areas	1700	CY	$ 5.50	$ 9,000
1.11	Transportation and Disposal Wetland Surface Soils- Non Hazardous	2380	Tons	$ 90	$ 214,000
1.12	Capillary Break - Geomembrane	5160	SY	$ 12.11	$ 62,000
1.13	Capillary Break - 10 oz/sy Geotextile (2 layers)	10320	SY	$ 3.94	$ 41,000
1.14	Wetland Planting Substrate	1700	CY	$ 63.50	$ 108,000
1.15	Wetland Revegetation	5160	SY	$ 7.90	$ 41,000
1.16	Waterfowl Exclusion Fence Installation	5160	SY	$ 4.50	$ 23,000
Area 2 DNAPL Recovery					
1.17	Well Installation	1	LS	$ 285,000	$ 285,000
Institutional Controls					
1.18	Deed Notices	1	LS	$ 20,000	$ 20,000
1.19	CEA/WRA	1	LS	$ 20,000	$ 20,000
1.20	Security Fencing Around Existing Buildings	1750	lf	$ 20	$ 35,000
				Subtotal Direct Capital Costs	**$ 2,981,000**
Indirect Capital Costs					
2.01	Engineering, Design and Permitting			15%	$ 447,000
2.02	Construction Oversight - 15% of Construction Cost			15%	$ 420,000
				Subtotal Indirect Capital Costs	**$ 867,000**
Total Capital Costs					
3.01	Subtotal Direct and Indirect Capital Costs				$ 3,848,000
3.02	Contingency			20%	$ 770,000
Total Capital Costs					**$ 4,618,000**
	OPERATION MAINTENANCE AND MONITORING				
Item	**Description**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Direct Annual OM&M Costs					
1.01	SCCC Site 2015 OM&M Budget Reduced for Cap Improvements	1	LS	$ 355,000	$ 355,000
1.02	Estimated Area 2 DNAPL Recovery Well OM&M	1	LS	$ 41,000	$ 41,000
				Subtotal Direct Annual OM&M Costs	**$ 396,000**
Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs					
2.01	*Direct OM&M Costs - Present Value, 30 yr Annual Cost*			7%	$ 4,914,000
2.02	*Present value of EPA Five-Year Reviews*			7%	$ 108,000
2.03	*Present value of TI Zone Monitoring for 30 Years*			7%	$ 152,000
				Subtotal Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs	**$ 5,174,000**
Present Value of Direct Semi Annual Maintenance Costs Associated with Cap/Cover					
3.01	*Direct Maintenance Costs - Present Value, 30 yr, Biannual Cost*	1	LS	$350,000	$ 350,000
				Subtotal Direct Biannual Maintenance Costs	**$ 350,000**
Indirect OM&M Costs (Annual and Biannual)					
2.01	Administrative costs			10%	$ 552,000
2.02	Contingency			10%	$ 552,000
				Subtotal Indirect OM&M Costs	**$ 1,104,000**
Total Present Worth of 30 years OM&M					**$ 6,628,000**
Total Cost Alternative III					**$ 11,246,000**

Alternative III—Targeted Area 1 Cap/Cover, Continued OM&M, Area 2 DNAPL Recovery and Institutional Controls

Direct Capital Costs

Item 1.01 Mobilization/Demobilization

- Mobilization of all equipment, materials and personnel is 5% of overall site wide direct capital costs (exclusive of the costs for establishment of the institutional controls (CEA/WRA, Deed Notices and TI Waiver)).

Item 1.02 Erosion & Sedimentation Controls (Silt Fence)

- Lineal footage estimate based on the use of silt fence along the southern SCCC site boundary and surrounding all catch basins. Silt fence, 3' high, install and maintain and remove[1].

Item 1.03 Temporary Decontamination Pad and Equipment Decontamination

- Based on previous experience, cost to construct a decontamination pad is approximately $15,000 and an additional $10,000 to maintain and transfer collected water to the HCTS for a period of 1 month.

Item 1.04 General Site Preparation

- Based on previous experience with site preparation for similar projects.

Item 1.05 Demolition

- Based on budgetary/estimated Contractor quotes.

Targeted Cap/Cover Placement (Vegetation and Stone Cover Areas)

Item 1.06 Proposed Target Area Asphalt Cap/Cover

- 2" of plant mix asphalt wearing course[2] and 2" of asphalt binder course[3] will be placed over 4" of granular subgrade (Item 1.06) to be installed at the existing vegetation and stone cover areas. Cost estimate included Standard Union Labor rates for Hackensack New Jersey.

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[1] RSMeans Online, 2015 Heavy Construction, Line No. 312514161000
[2] RSMeans Online, 2015 Heavy Construction, Line No. 321216130380, does not include hauling
[3] RSMeans Online, 2015 Heavy Construction, Line No. 321216130120, does not include hauling

- Low lying areas of the existing asphalt surface cover will also receive additional asphalt as necessary to improve stormwater runoff and prevent localized ponding. Estimated area of asphalt to be improved is based on a field measurement of approximately 2,300 SY.

Item 1.07 Aggregate Subgrade, Transport, Place, and Compact

- 4" of granular subgrade, ¾" stone placed and compacted.
- Cost estimate based on proposed costs obtained from contractors on similar projects.

Item 1.08 Asphalt Transportation

- Cost estimate for hauling material to site: Cycle hauling, 15 wait and load, 20 mile haul at 35 MPH, 12 CY truck[4]. 1.10 LCY = 1.0 CY therefore =$11.57/ CY.
- Volume of asphalt material to be transported on site: 2" of asphalt wearing course, 2" of asphalt binder course, each at 37,900 SY. Therefore approximately 4,200 CY of material to be transported onsite.

Wetland Area Cap/Cover and Restoration (Within the Existing Footprint)

Total area of wetland areas were estimated from KEY Figure 4-2. In addition, during the design phase, the wetland banking option will be evaluated and considered. For the purposes of this cost estimate, assume the wetlands are capped/covered within the existing footprint.

Item 1.09 Dewater Wetlands

- Wetland areas are excavated 1'.
- Volume of excavation is 1,600 CY=43,200 cft=323,000 gallons.
- Estimated porosity of soil is 30%, therefore if soil is saturated the volume of water to pump is 97,000 gallons.
- 50% of soil water is recoverable by pumping.
- Pumping 8 hr. attended, 2" diaphragm pump, including 20 LF of suction hose and 100 LF of discharge hose. All water will be pumped to the HCTS for treatment.
- Estimate two days[5].

[4] RSMeans Online 2015, Heavy Construction, Line No. 312323201068
[5] RSMeans Online 2015, Heavy Construction, Line No. 312319200800

Item 1.10 Excavation of Existing Wetland Areas

The estimated wetland area to be excavated based on ACAD software computer program analysis of KEY Figure 4-1.

- Volume of excavation is the total area of wetland estimated 1 foot deep or 1600 CY.
- Cost estimated from top soil stripping and stockpiling, loam or topsoil, removal, 200 HP Dozer, 6" deep, 200' haul[6]. $2.74 multiply times 2 for 1' deep excavation.

Item 1.11 Transportation and Disposal Wetland Surface Soils-Non Hazardous

- $90/ton for T&D in New Jersey based on previous experience at this Site.
- Estimated 1.4 tons per cubic yard of material.

Item 1.12 Capillary Break- Geomembrane

- Wetland reconstruction may occur within the existing footprint of the wetlands.
- 60 mil HDPE
- Geomembrane will be installed as shown on Figure 4-2. Cost estimate is $11.42/SY[7] for material and installation and an annual inflation rate of 3% was used to determine the unit price.

Item 1.13 Capillary Break- 10 oz/sy Geotextile (2 layers)

- One layer of 10 oz/sy of geotextile will be placed top and bottom of geomembrane in the wetland.
- Cost for geotextile is from 2010 Kearny Interim Remedial Measure Contractor Bid document. Cost is $3.50/SY material and installation, and a 3% annual inflation rate was used to determine the unit price.

Item 1.14 Wetland Planting Substrate

- Volume of material was estimated from the existing wetland areas. It was estimated that 1' of substrate will be placed over top of the geomembrane.
- Cost of substrate material and installation was obtained based on experience at a similar project.

[6] RSMeans Online 2015, Heavy Construction, Line No. 311413231420
[7] RSMeans, 2011, Heavy Construction pg 345 33 47 13.53– 1200

Item 1.15 Wetland Revegetation

- Cost to revegetate the wetlands would be similar to the cost provided as part of the 2010 Kearny Interim Remedial Measure construction (i.e., $7/SY). Annual inflation rate of 3% was used to determine the unit price of $7.90/SY.

Item 1.16 Waterfowl Exclusion Fence Installation

- Cost to install the waterfowl exclusion fence in the wetlands would be similar to the cost as part of the 2010 Kearny Interim Remedial Measure (i.e., $4/SY). Annual inflation rate of 3% was used to determine the unit price of $4.50/SY.

Area 2 DNAPL Recovery Well

Item 1.17 Well Installation

- Based on actual costs for IRA well installation and cost estimate obtained from a local drilling contractor for the installation of two DNAPL recovery wells and includes well completion, oversight and disposal costs.

Institutional Controls

Item 1.18 Deed Notices

- Based on previous experience with preparation of institutional controls for similar projects.

Item 1.19 CEA/WRA

- Based on previous experience with the preparation of institutional controls for similar projects.

Item 1.20 Security Fencing (Around Existing Buildings)

- Length of fencing is 1,750 linear foot. Assume cost (based on contractor information) of $18/linear foot for a 6-foot high chain link fence with barbed wire.

Indirect Capital Costs

Item 2.01 Engineering, Design and Permitting – 15% of Direct Capital Costs

- Professional judgment - Based on previous experience with the preparation of engineering, design and permitting documents for similar projects.

Item 2.02 Construction Oversight – 15% of Construction Cost

- General assumption for construction oversight is 15% of the total cost for construction related activities.
- Cost for construction related activities = subtotal direct capital costs - cost for institutional controls - cost for mobilization.

Operation Maintenance and Monitoring

Direct Annual OM&M Costs

Item 1.01 SCCC Site 2015 OM&M Budget Reduced for Cap Improvements

- Placement of additional cover may reduce the quantity of storm water infiltration an estimated 46%[8].
- Reduction in infiltration will reduce OM&M costs that are directly related to HCTS flow rate. (i.e. activated carbon usage)
- Applying a 46% reduction in infiltration to OM&M costs that are directly related to HCTS flow rate result in an overall reduction of 29% in OM&M cost for the site.
- Cost to remove DNAPL from Area 1 is included in the 2015 OM&M Budget.

Item 1.02 Estimated Area 2 DNAPL Recovery Well OM&M

- Based on 2015 OM&M budget for monthly gauging of the Area 1 wells and cost estimate obtained from a local transportation and disposal waste hauler to perform quarterly DNAPL recovery via vacuum extraction and bulk DNAPL transport for fuel blending ($6,000/event).
- A cost estimate for traffic control is included and based on the cost associated with traffic control employed during the Remedial Investigation in Area 2 ($3,000/event).

Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs[9]

Item 2.01 Direct OM&M Costs – Present Value of 30 year Annual Cost

- Includes both HCTS operation and DNAPL recovery
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA.

[8] Based on Infiltration Evaluation calculation conducted for the Site using the HELP Model.
[9] USEPA 540-R-00-002, OSWER 9355.0-75, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study," July 2000.

Item 2.02 Present Value of EPA Five-Year Reviews

- Estimate report prepared every 5 years for a total of 6 reports.
- Assume cost to conduct review is $50,000 each, based on professional experience with similar project reviews.
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA.

Item 2.03 Present Value of TI Zone Monitoring

- Assume six existing wells/piezometers sampled per event (HC-PZ-13L, MW-D-35, MW-D-37 MW-D-38 MW-D-39, and HC-PZ-13L).
- All samples are to be analyzed for volatile organic compounds by EPA Method 8260 and semi-volatile organic compounds by EPA Method 8270.
- Sampling to be performed quarterly for Years 1 and 2, annually for Years 3 through 7 and at 5-Year frequencies for Years 8 through 30.
- Estimated cost is $12,100 per event based on recently completed work.
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA.

Present Value Direct Biannual Maintenance Costs Associated with Cap/Cover

Item 3.1 Direct Maintenance Cost – Present Value, 30 year, Biannual Cost

- Maintenance of the asphalt surface cover using a tack coat, emulsion[10], estimated to be $50,000 per application.
- Maintenance of the asphalt will occur every other year.

Indirect OM&M Costs

Item 4.01 Administrative Costs

- Professional judgment - Based on previous experience with administrative cost for similar projects.

Item 4.02 Contingency

- Professional judgment – A 10% contingency assigned to the total cost of Direct Annual OM&M Costs and Direct Biannual Maintenance Costs Associated with Cap/Cover based on previous experience with similar projects.

[10] RSMeans Online, Heavy Construction, Line Number 320113623275

TABLE 5-3
ALTERNATIVE IV COST ESTIMATE
SCCC SITE-WIDE AREA 1 CAP/COVER, CONTINUED OM&M, AREA 2 DNAPL RECOVERY, INSTITUTIONAL CONTROLS, AND BUILDING DEMOLITION
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, NEW JERSEY

Item	Description	Quantity	Unit	Unit Price	Cost
	DIRECT CAPITAL COSTS				
1.01	Mobilization/Demobilization			5%	$ 410,000
1.02	Erosion and Sedimentation Controls (Silt Fence)	5700	LF	$ 2.32	$ 13,000
1.03	Temporary Decontamination Pad and Equipment Decontamination	1	LS	$ 25,000	$ 25,000
1.04	General Site Preparation	1	LS	$ 25,000	$ 25,000
1.05	Demolition	1	LS	$ 800,000	$ 800,000
Site Wide Cap/Cover Placement					
1.06	Transportation of General Fill	117000	CY	$ 11.57	$ 1,354,000
1.07	General Fill for Cap (36")	117000	CY	$ 25.27	$ 2,957,000
1.08	Seeding and Mulching of Cap	20	ACRE	$ 5,171	$ 101,000
1.09	Geomembrane	90000	SY	$ 12.11	$ 1,090,000
1.10	10 oz/sy Geotextile (2 layers)	180000	SY	$ 3.94	$ 709,000
Wetland Area Cap/Cover and Revegetation					
1.11	Dewater Wetlands	2	DAY	$ 964	$ 2,000
1.12	Excavation of Existing Wetland Areas	2400	CY	$ 5.50	$ 13,200
1.13	Transportation and Disposal Wetland Surface Soils- Non Hazardous	3360	Tons	$ 90	$ 302,400
1.14	Capillary Break - Geomembrane	5160	SY	$ 12.11	$ 62,000
1.15	Capillary Break - 10 oz/sy Geotextile (2 layers)	10320	SY	$ 3.94	$ 41,000
1.16	Wetland Planting Substrate	2400	CY	$ 63.50	$ 152,000
1.17	Wetland Revegetation	5160	SY	$ 7.90	$ 41,000
1.18	Waterfowl Exclusion Fence Installation	5160	SY	$ 4.50	$ 23,000
Storm Water Drainage Improvements					
1.19	Raise Existing Catch Basins (13 Basins)	1	LS	$ 74,000	$ 74,000
HCWU, DRWU, DRWL, Electric Distribution, Water Conveyance Modifications					
1.20	Labor	1	LS	$ 38,500	$ 38,500
1.21	Materials	1	LS	$ 79,000	$ 79,000
1.22	Equipment	1	LS	$ 5,000	$ 5,000
Area 2 DNAPL Recovery					
1.23	Well Installation	1	LS	$ 285,000	$ 285,000
Institutional Controls					
1.24	Deed Notices	1	LS	$ 20,000	$ 20,000
1.25	CEA/WRA	1	LS	$ 20,000	$ 20,000
1.26	Security Fencing Around Existing Buildings	1750	lf	$ 20	$ 35,000
				Subtotal Direct Capital Costs	**$ 8,677,000**
Indirect Capital Costs					
2.01	Engineering, Design and Permitting			15%	$ 1,302,000
2.02	Construction Oversight - 15% of Construction Cost			15%	$ 1,234,000
				Subtotal Indirect Capital Costs	**$ 2,536,000**
Total Capital Costs					
3.01	Subtotal Direct and Indirect Capital Costs				$ 11,213,000
3.02	Contingency			20%	$ 2,243,000
Total Capital Costs					**$ 13,456,000**
	OPERATION MAINTENANCE AND MONITORING				
Item	**Description**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Direct Annual OM&M Costs					
1.01	SCCC Site OM&M 2015 Budget Reduced for Cap Improvements	1	LS	$ 190,000	$ 190,000
1.02	Estimated Area 2 DNAPL Recovery Well OM&M	1	LS	$ 41,000	$ 41,000
				Subtotal Direct Annual OM&M Costs	**$ 231,000**
Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs					
2.01	Direct OM&M Costs - Present Value, 30 yr Annual Cost			7%	$ 2,866,000
2.02	Present value of EPA Five-Year Reviews			7%	$ 108,000
2.03	Present value of TI Zone Monitoring for 30 Years			7%	$ 152,000
				Subtotal Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs	**$ 3,126,000**
Present Value Direct Annual Maintenance Costs Associated with Cap/Cover					
3.01	Direct Maintenance Costs - Present Value, 30 yr, Annual Cost	1	LS	$ 77,000	$ 77,000
				Subtotal Direct Semi Annual Maintenance Costs	**$ 77,000**
Indirect OM&M Costs (Annual)					
4.01	Administrative Costs			10%	$ 320,000
4.02	Contingency			10%	$ 320,000
				Subtotal Indirect OM&M Costs	**$ 640,000**
Total Present Worth of 30 years OM&M					**$ 3,843,000**
Total Cost Alternative IV					**$ 17,299,000**

Alternative IV—Site-Wide Area 1 Cap/Cover, Continued OM&M, Area 2 DNAPL Recovery and Institutional Controls

Direct Capital Costs

Item 1.01 Mobilization/Demobilization

- Mobilization of all equipment, materials and personnel is 5% of overall site wide direct capital costs (exclusive of the costs for establishment of the institutional controls (CEA/WRA, Deed Notice and TI waiver).

Item 1.02 Erosion and Sedimentation Controls (Silt Fence)

- Lineal footage based on the use of silt fence along the site perimeter and all catch basins. Silt fence, 3' high, install and maintain and remove[1].

Item 1.03 Temporary Decontamination Pad and Equipment Decontamination

- Based on previous experience, cost to construct a decontamination pad is approximately $15,000 and an additional $10,000 to maintain and transfer collected water to the HCTS for a period of 1 month.

Item 1.04 General Site Preparation

- Based on previous experience of site preparation for similar projects.

Item 1.05 Demolition

- Based on budgetary/estimated Contractor quotes.

Site-Wide Cap/Cover Placement

Item 1.06 Transportation of General Fill and Topsoil Material

- Cycle hauling, 15 wait and load, 20 mile haul at 35 MPH, 12 CY truck[2], $10.42/LCY.
- 1.10 LCY = 1.0 CY therefore =$11.57/ CY.

Item 1.07 General Fill and Topsoil for Cap (assume 36" total thickness)

- Volume of fill determined from Civil 3D, ACAD software computer program based on a conceptual/preliminary grading plan. Cover material is tied into existing grade 2 feet

[1] RSMeans Online, 2015 Heavy Construction, Line No. 312514161000
[2] RSMeans Online, 2015 Heavy Construction, Line No. 312323201068

from the perimeter of all site property lines with the exception of physical offsets as shown. Assume an average 36" (total) of fill is placed above existing grade and that the thickness will vary.

- The cost for general fill was estimated to be the cost for clay backfill material, cost to place fill from stockpile, 300 H.P., 2-1/2 CY, 300' haul, spread with front end loader and compact 12" lifts[3].

Item 1.08 Seeding and Mulching of Cap

- Area from Figure 4-2. Cover material tie into existing grade is 2 feet from the perimeter of all site property lines or physical offsets as shown. 3 feet of material is placed above existing grade. Area was measured from ACAD, Civil 3D computer program to be 20 acres.
- Cost for Seeding, Vegetative cover including large power mulcher, oat straw (1"), mechanical seeding (50lb/MSY) and watering by truck. Adjusted using historical cost index for 2005 (73.3)[4].

Item 1.09 Geomembrane

- 60 mil geomembrane will be installed over all areas receiving a cap/cover and as shown on Figure 4-2. Cost estimate is $11.42/SY[5] and an annual inflation rate of 3% was used to calculate the current unit price.

Item 1.10 Capillary Break – 10 oz/sy Geotextile (2 layers)

- One layer of 10 oz/sy of geotextile will be placed top and bottom of geomembrane.
- Cost for geotextile is from 2010 Kearny Interim Remedial Measure Contractor Bid document. Cost was $3.50/SY material and installation, and a 3% annual inflation rate was used to calculate the current unit price.

Wetland Area Cap/Cover and Vegetation (Onsite Wetland Relocation)

Total area of wetland areas were estimated from KEY Figure 4-3. In addition, during the design phase, the wetland banking option will be evaluated and considered. For the purposes of this cost estimate, the wetland construction will occur onsite.

[3] RSMeans Online, 2015 Heavy Construction Line, Nos. 354113200050 and 312323170190
[4] RSMeans Environmental Remediation: Unit Cost Book (2005) Line No. 18050402
[5] RSMeans, 2011, Heavy Construction, pg. 345 33 47 13.53– 1200

Item 1.11 Dewater Wetlands

- Wetland areas are excavated 1'.
- Volume of excavation is 1,600 CY=43,200 cft=323,000 gallons.
- Porosity of soil is 30%, therefore if soil is saturated the volume of water to pump is 97,000 gallons.
- 50% of soil water is recoverable by pumping.
- Pumping 8 hr. attended, 2" diaphragm pump, including 20 LF of suction hose and 100 LF of discharge hose. All water will be pumped to the HCTS for treatment.
- Estimate two days[6].

Item 1.12 Excavation of Existing Wetland Areas

The estimated wetland area to be excavated based on ACAD software computer program analysis of KEY Figure 4-1

- Volume of excavation is the total area of wetland estimated 1 foot deep or 1600 CY.
- Cost estimated from top soil stripping and stockpiling, loam or topsoil, removal, 200 HP Dozer, 6" deep, 200' haul[6]. $2.74 multiply times 2 for 1' deep excavation.

Item 1.13 Transportation and Disposal Wetland Surface Soils-Non Hazardous

- $90/ton for T&D in New Jersey based on previous experience at this Site.
- Estimated 1.4 tons per cubic yard of material.

Item 1.14 Capillary Break - Geomembrane

- Assume that a cap/cover will be necessary within the onsite wetland relocation area.
- 60 mil geomembrane will be installed as shown on Figure 4-2. Cost estimate is $11.42/SY[7] and an annual inflation rate of 3% was used to calculate the current unit price.

Item 1.15 Capillary Break – 10 oz/sy Geotextile (2 layers)

- One layer of 10 oz/sy of geotextile will be placed top and bottom of geomembrane in the wetland.
- Cost for geotextile is from 2010 Kearny Interim Remedial Measure Contractor Bid document. Cost is $3.50/SY material and installation, and a 3% annual inflation rate was used to calculate the current unit price.

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[6] RSMeans Online, 2015 Heavy Construction, Line No. 312319200800
[6] RSMeans Online, 2015, Heavy Construction, Line No. 311413231420
[7] RSMeans, 2011, Heavy Construction, pg. 345 33 47 13.53– 1200

Item 1.16 Wetland Planting Substrate

- Volume of material was estimated from the existing wetland areas. 1' of substrate will be placed over top of the geomembrane in the wetland relocation area.
- Cost of substrate material and installation was obtained based on experience at a similar project.

Item 1.17 Wetland Revegetation

- Cost to revegetate the wetlands would be similar to the cost provided as part of the 2010 Kearny Interim Remedial Measure construction (i.e., $7/SY). An annual inflation rate of 3% was used to calculate the unit price of $7.90/SY.

Item 1.18 Waterfowl Exclusion Fence Installation

- Cost to install the waterfowl exclusion fence in the wetlands would be similar to the cost as part of the 2010 Kearny Interim Remedial Measure (i.e., $4/SY). An annual inflation rate of 3% was used to calculate the unit price of $4.50/SY.

Storm Water Drainage Improvements

Item 1.19 Raise Catch Basins (13 Basins)

- Cut and remove the existing fiberglass grate cover
- Weld a three foot extension of 32" HDPE DR 32.5 on to the existing catch basin. – Cost estimate for this was estimated from a cost for a HDPE 32.5, 48" diameter valve box built by Lee Supply. Valve box included an aluminum hatch door and stairs. Estimated cost of new fiberglass grate to be equivalent to cost of aluminum hatch door. (Cost of Fiberglass grate 4' x 4' from Grainger, Inc. ranged from $300 to $500 each).
- Cost includes a mini excavator, extrusion welder and FTS labor (3 men) for nine days.
- The storm water conveyance pipe would remain at the existing elevation.

HCWU, DRWU, DRWL, Electric Distribution, Water Conveyance Modifications

Item 1.20 through 1.22 Wells HCWU, DRWU and DRWL, Electric Modifications and Water Conveyance Modifications

- Cost estimate based on similar work to be conducted for wells located on the adjacent former Koppers Seaboard site. Estimated that 3 feet of material would be added to each well casing and each vault on the SCCC site. Estimated that all conveyance water lines would be replaced and all conduit and electric wiring would be replaced. Added a 20% contingency.

Area 2 DNAPL Recovery Well

Item 1.23 Well Installation

- Based on actual costs for IRA well installation and cost estimate obtained from a local drilling contractor for the installation of two DNAPL recovery wells and includes well completion, oversight and disposal costs.

Institutional Controls

Item 1.24 Deed Notices

- Based on previous experience with preparation of institutional controls for similar projects.

Item 1.25 CEA/WRA

- Based on previous experience with the preparation of institutional controls for similar projects.

Item 1.26 Security Fencing

- Length of fencing is 1,750 linear foot. Assume cost (based on contractor information) of $18/linear foot for a 6-foot high chain link fence with barbed wire.

Indirect Capital Costs

Item 2.01 Engineering, Design and Permitting – 15% of Direct Capital Costs

- Professional judgment - Based on previous experience with the preparation of engineering, design and permitting documents for similar projects.

Item 2.02 Construction Oversight – 15% of Construction Costs

- General assumption for construction oversight is 15% of the total cost for construction related activities.
- Costs for construction related activities = subtotal direct capital costs - cost for institutional controls - cost for mobilization.

Total Capital Costs

Item 3.02 Contingency – 20% of Subtotal Direct and Indirect Capital Costs

- Professional judgment – A contingency percentage assigned to the total cost of construction based on previous experience with similar projects.

Operation Maintenance and Monitoring

Direct Annual OM&M Costs

Item 1.01 2015 SCCC Site OM&M Budget Reduced for Cap Improvements

- Placement of additional cover may reduce the quantity of storm water infiltration an estimated 99%[8].
- Reduction in infiltration will reduce OM&M costs that are directly related to HCTS flow rate. (i.e. activated carbon usage)
- Applying a 99% reduction in infiltration to OM&M costs that are directly related to HCTS flow rate result in an overall reduction of 62% in OM&M cost for the site.
- Cost to remove DNAPL from Area 1 is included in the 2015 OM&M Budget.

Item 1.02 Estimated Area 2 DNAPL Recovery Well OM&M

- Based on 2015 OM&M budget for monthly gauging of the Area 1 wells and cost estimate obtained from a local transportation and disposal waste hauler to perform quarterly DNAPL recovery via vacuum extraction and bulk DNAPL transport for fuel blending ($6,000/event).
- A cost estimate for traffic control is included and based on the cost associated with traffic control employed during the Remedial Investigation in Area 2 ($3,000/event).

Present Value of 30 year Annual Cost of Direct and Variable OM&M Costs[9]

Item 2.01 Direct OM&M Costs – Present Value of 30 year Annual Cost

- Includes both HCTS operation and DNAPL recovery
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA.

Item 2.02 Present Value of EPA Five-Year Reviews

- Estimate report prepared every 5 years for a total of 6 reports.
- Assume cost to conduct review is $50,000 each, based on professional experience with similar project reviews.
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA.

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[8] Based on Infiltration Evaluation calculation conducted for the Site using the HELP Model.
[9] USEPA 540-R-00-002, OSWER 9355.0-75, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study," July 2000.

Item 2.03 Present Value of TI Zone Monitoring

- Assume six existing wells/piezometers sampled per event (HC-PZ-13L, MW-D-35, MW-D-37 MW-D-38 MW-D-39, and HC-PZ-13L).
- All samples are to be analyzed for volatile organic compounds by EPA Method 8260 and semi-volatile organic compounds by EPA Method 8270.
- Sampling to be performed quarterly for Years 1 and 2, annually for Years 3 through 7 and at 5-Year frequencies for Years 8 through 30.
- Estimated cost is $12,100 per event based on recently completed work.
- A discount rate of 7% was used in developing prevent value cost for future monitoring as recommended by USEPA

Present Value Direct Annual Maintenance Costs Associated with Cap/Cover

Item 3.01 Direct Maintenance Cost – Present Value, 30 year, Annual Cost

- Cost for mowing grass and grass cover maintenance 4 times per year[10].

Indirect OM&M Costs

Item 4.01 Administrative Costs

- Professional judgment - Based on previous experience with administrative cost for similar projects.

Item 4.02 Contingency

- Professional judgment – A 10% contingency assigned to the total cost of Direct Annual OM&M Costs based on previous experience with similar projects.

[10] RSMeans Online, 2015, Heavy Construction, Line No. 320190194170.

TABLE 6-1
QUALITATIVE ALTERNATIVES ANALYSIS SUMMARY
FOCUSED FEASIBILITY STUDY REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

	Alternative I	Alternative II	Alternative III	Alternative IV
ALTERNATIVE EVALUATION CRITERIA				
Threshold Criteria				
Overall Protection of Human Health and the Environment	Poor	Good	Good	Good
Compliance with ARARs	Poor	Good	Good	Good
Primary Balancing Criteria				
Long-Term Effectiveness and Permanence	Poor	Good	Good	Good
Reduction of Toxicity, Mobility, or Volume	Poor	Good	Good	Best
Short-term Effectiveness	N/A	Good	Good	Fair
Implementability	N/A	Good	Good	Fair
Cost	N/A	Good	Good	Poor
Modifying Criteria				
State Agency Acceptance	TBD	TBD	TBD	TBD
Community Acceptance	TBD	TBD	TBD	TBD

NOTES:
N/A - not applicable because alternative does not meet threshold criteria
TBD - to be determined at a later date

APPENDIX A

TECHNICAL IMPRACTICABILITY EVALUATION REPORT

TECHNICAL IMPRACTICABILITY EVALUATION REPORT

STANDARD CHLORINE CHEMICAL CO. INC. SITE KEARNY, NEW JERSEY

Prepared for:

Performing Parties Group

(Beazer East, Inc., Cooper Industries, LLC, Tierra Solutions, Inc., on behalf of Occidental Chemical Corporation and Apogent Transition Corporation)

Prepared by:

Key Environmental, Inc.
200 Third Avenue
Carnegie, Pennsylvania 15106

JUNE 2016

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ACRONYMS/ABBREVIATIONS

ARARs	applicable or relevant and appropriate requirements
CBCs	Chlorobenzene compounds
COCs	constituents of concern
CSM	Conceptual Site Model
DCB	Dichlorobenzene
DNAPL	Dense non-aqueous phase
FFS Report	Focused Feasibility Study Report
HCIA	Hudson County Improvement Authority
IRA	Interim Response Action
IRM	Interim Remedial Measure
KEY	Key Environmental, Inc.
MCLs	Maximum Contaminant Levels
mg/kg	milligrams per kilogram
NJDOT	New Jersey Department of Transportation
NRC	National Research Council
PCBs	polychlorinated biphenyls
RIR	Remedial Investigation Report
RSL	EPA Regional Screening Level
SCCC	Standard Chlorine Chemical Co. Inc.
Site	SCCC Site
SRI	Supplemental Remedial Investigation
SVOCs	semi-volatile organic compounds
TCL	Target Compound List
TI	Technical Impracticability
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	volatile organic compounds

1.0 INTRODUCTION

This Technical Impracticability (TI) Evaluation Report (TI Report) for the Standard Chlorine Chemical Co. Inc. (SCCC) Site (SCCC Site)[1] located in Kearny, New Jersey (Figure 1-1) has been prepared by Key Environmental, Inc., (KEY) on behalf of the SCCC Site Performing Parties Group. The Group consists of Beazer East, Inc., Cooper Industries, LLC, Tierra Solutions, Inc., on behalf of Occidental Chemical Corporation, and Apogent Transition Corp. For the purposes of the Remedial Investigation/Focused Feasibility Study (RI/FFS), the SCCC Site has been divided into two areas designated as Area 1 and Area 2. Area 1 is defined as the area within the existing barrier wall system as shown on Figure 1-2 (i.e., the slurry wall). Area 1 includes the entire SCCC property (exclusive of Riparian Parcel Lot 52R) and the impacted subsurface soil and groundwater within the SCCC Site slurry wall in the western part of the Hudson County Improvement Authority (HCIA) property (former Seaboard Site) that represent contiguous impacts associated with the SCCC Site. Area 2 includes the area located outside of the slurry wall to the south of Area 1 as shown on Figure 1-2. Area 2 includes a portion of the HCIA property outboard of the SCCC Site slurry wall and a portion of the NJDOT right-of-ways for the Belleville Turnpike and Newark Turnpike.

The results of separate investigations in Areas 1 and 2 found that dense non-aqueous phase liquid (DNAPL) is present in some of the subsurface zones. The results of the Area 1 investigation are documented in the Remedial Investigation Report (RIR) (KEY, October 2015), which was approved by the United States Environmental Protection Agency (USEPA) by letter dated October 9, 2015. The results of the Area 2 investigation are documented in the RIR Addendum, Area 2 (KEY, January 2016), which was approved by USEPA by letter dated March 1, 2016. Soil and groundwater impacted by organic and inorganic contaminants beneath Area 1 are contained within the barrier wall system. Because certain remedial alternatives presented in the FFS for the SCCC Site do not achieve chemical specific applicable or relevant and appropriate requirements (ARARs), the Group is seeking a TI Waiver for Areas 1 and 2 as supported by this TI Report.

1.1 PURPOSE OF TI EVALUATION REPORT

The purpose of this TI Evaluation Report is to:

- Demonstrate and document the technical impracticability of restoring groundwater to meet the ARARs for groundwater constituents of concern (COCs);

[1] In general, this document refers to the SCCC Site by reference to the property boundaries of the historical SCCC property but recognizes that in specific contexts the definition may include other off-property areas into which SCCC property-related contaminants have come to be located. Where context requires, which the report makes self-evident, the definition of SCCC Site should be construed accordingly.

- Evaluate risk reduction consistent with the alternative remedial strategies described in the *TI Guidance Document*; and,
- Establish a TI waiver zone for groundwater ARARs (i.e., Maximum Contaminant Levels – MCLs) due to contaminant-specific, hydrogeologic, and other Site-specific factors.

This report contains the applicable and appropriate information as stipulated in the USEPA Guidance Documents titled *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration* (1993) and *Clarification of OSWER 1995 Technical Impracticability Waiver Policy* (*TI Guidance Documents*).

1.2 EVALUATION CRITERIA

As stated in the *TI Guidance Document* referenced above, the applicability and appropriateness of a TI Waiver is evaluated according to the following three criteria:

- Hydrogeologic factors (e.g., permeability, stratigraphy, etc.);
- Contaminant-specific factors (e.g., solubility, density, partitioning coefficient, etc.); and,
- Remedial system design inadequacies.

The third criterion listed above (design inadequacies) is not considered applicable because active groundwater remediation systems have not been designed or operated with the goal of achieving groundwater ARARs.[2] Instead, the current hydraulic control groundwater extraction and treatment system was designed to provide hydraulic control for the area within the slurry wall. Site-specific implementation factors will be utilized as a third evaluation criterion. These Site-specific criteria for the groundwater include:

- Land use considerations (the DNAPL-impacted area lies, in part, directly beneath heavily travelled major highways); and,
- Exposure considerations (improbability of contact with or exposure to impacted environmental media [e.g., no current groundwater use and improbability of future groundwater use]).

An evaluation of these criteria is presented in Section 4.0 of this report.

[2] The treatment system consists of multiple unit operations including hexavalent chromium reduction, bulk metals precipitation, and removal, total suspended solids removal, removal of dissolved phase organics, and separation/recovery of DNAPL. The plant is currently being operated subject to the requirements of a NJPDES permit (NJPDES Permit No. NJG0175102) and treated effluent satisfies ARARs.

2.0 AREA DESCRIPTION AND LAND USE

2.1 AREA 1

Existing site conditions of Area 1 are shown on Figure 2-1. Area 1 includes five upland parcels (designated as Block 287, Lots 48 through 52) comprising the SCCC property that are currently owned by the Town of Kearny. The SCCC property occupies approximately 25 acres. Area 1 also includes the western portion (approximately 13 acres) of the HCIA property and a former railroad right-of-way that bisects the SCCC property which is currently owned by HCIA. Area 1 is located along the tidal portion of the Hackensack River and lies within the 100-year floodplain of the Hackensack River.

Area 1 is located in a former meadow that was filled over the first half of the 20th century. The filling occurred to support industrial development of the Site and surrounding properties at that time. Significant areas of meadowlands remain north and west of Area 1.

Area 1 access is restricted, soils are covered by clean fill or pavement, and the only structures remaining on the Site are the shells of four historic structures once part of Thomas A. Edison Inc.'s Emark Battery operations and the newly built structure that houses the hydraulic control treatment system. Several concrete slabs are all that remain of the other former industrial facilities. A number of monitoring wells, DNAPL recovery wells, groundwater extraction wells, and piezometers associated with ongoing operation, monitoring, and maintenance of the interim response actions exist in Area 1.

2.2 AREA 2

Figure 2-2 is a plan map of Area 2 which includes a portion of the HCIA property (also referred to in historical documents as the former Koppers Seaboard Site) adjacent to Belleville Turnpike and parts of the NJDOT right-of-ways to the south of the westbound lane of the Belleville Turnpike. Figure 2-2 also shows the locations of the soil borings and monitoring wells completed in Area 2 as part of the SCCC Site RI.

Area 2 consists primarily of NJDOT right-of-way property and the narrow strip of land on the HCIA property between the southern flank of the SCCC Site slurry wall and the Belleville Turnpike highway embankment. The portion of the HCIA property that is enclosed by the SCCC Site slurry wall is located in Area 1, to the north and east of Area 2. NJDOT right-of-way is located to the west and south of Area 2. Land cover is comprised of paved roadways/shoulders and vegetated areas located between the westbound and eastbound lanes of Belleville Turnpike and ramps connecting Belleville Turnpike with Newark Turnpike. The ground surface topography between the roadways is uneven. The westbound lane of Belleville Turnpike abutting the HCIA

property is elevated 15 feet or more above the existing ground surface on the SCCC Site and HCIA property. Due to topography and the presence of soil covers on the SCCC Site, surficial transport of contaminants from the SCCC Site to Area 2 is impossible under current conditions. More details regarding the SCCC Site description, history, current conditions, and previous investigations can be found in the FFS Report, Section 1.0 (KEY, June 2016).

3.0 CONCEPTUAL SITE MODEL

A preliminary Conceptual Site Model (CSM) was originally developed for the SCCC Site and was presented in the Site Characterization Summary Report (KEY, March 2013). This preliminary CSM covered Area 1. A separate CSM was developed for Area 2 and is based on information reported in the RIR (KEY, July 2015) and the RIR Addendum (KEY, January 2016). The current version of the Area 2-focused CSM described in this report is based in part on consideration of the fully-enclosing perimeter subsurface barrier wall system around Area 1. The barrier wall is a current source control measure implemented for DNAPL and other organic and inorganic impacts in Area 1 soil and groundwater. The barrier wall benefits Area 2 by preventing further migration of DNAPL to Area 2.

Figure 3-1 and Figure 3-2 are graphical representations of the Area 1 and Area 2 CSMs respectively. Under current conditions and use, confirmed completed exposure pathways are lacking. The potential for future off-site migration from Area 1 has been eliminated with the barrier wall. Additional DNAPL migration to and within Area 2 has been eliminated due to Area 1 containment, the topography of the clay surface beneath Area 2, DCB-DNAPL characteristics (i.e., low viscosity, high specific gravity), and the decades of time since the SCCC Site ceased manufacturing operations.

3.1 GEOLOGY AND HYDROSTRATIGRAPHY

The Area 1 and Area 2 geology is similar. The geologic profile beginning at the ground surface and proceeding downward consists of the following units:

- Fill material of varying composition and thickness (fill thicknesses ranges from approximately 2 to 25 feet); groundwater is first encountered toward the base of the Fill Unit;

- Meadow Mat, an organic rich unit, is continuous (Meadow Mat thicknesses ranges from approximately 0.3 to 8 feet);

- A thin saturated Sand Unit ranges in thickness from approximately 2 to 10 feet; the average thickness of the Sand Unit in Area 2 is 4.0 feet whereas the average thickness of the Sand Unit in Area 1 is slightly thicker (4.8 feet); and,

- Varved clay is continuous across both Areas and has been demonstrated based on data acquired in Area 1 to act as an effective barrier to vertical DNAPL migration throughout the study area. The varved clay was encountered directly beneath the deep

Sand Unit in all borings completed within Area 2. This unit was not completely penetrated in the Area 2 borings but information obtained at the SCCC Site and the HCIA property indicate that this unit is at least 40 feet thick beneath the SCCC Site and the western portion of the HCIA property.

The geologic conditions in Area 2 are depicted graphically on several cross-sections prepared from the geologic information obtained from soil borings completed in 2015 and from pre-existing soil borings. A plan view map of the cross-section locations is provided as Figure 3-3. The cross-sections were located and prepared as follows:

- Figure 3-4 (Cross-Section A-A') provides a west to east trending cross-section that is oriented parallel to the southern limb of the barrier wall containment system on the Seaboard Site. The cross-section extends from soil boring D-3 on its western end through the area of soil borings D-24, D-4, D-25, and D-28 to soil boring D-7 and piezometer HC-PZ-11L on its eastern end.

- Figure 3-5 (Cross-Section B-B') provides a west to east trending cross-section that extends from the western area (D-35/MW-D-35) of the Belleville Turnpike vegetated median and extends eastward to soil boring/monitoring well location D-37/MW-D-37.

- Figure 3-6 (Cross-Section C-C') provides a north to south trending cross-section through the western portion of Area 2. This cross-section extends from the vicinity of the slurry wall at the SCCC/Seaboard property boundary (soil boring location D-23) south to soil boring D-34 located in the vegetated median between the Belleville Turnpike and Newark Turnpike.

- Figure 3-7 (Cross-Section D-D') provides a north to south trending cross-section through the central section of Area 2. This cross-section extends from soil boring location D-5, located in the vicinity of the slurry wall on the Seaboard Site, south to soil boring/monitoring well location D-39/MW-D-39.

- Figure 3-8 (Cross-Section E-E') provides a north to south trending cross-section through the eastern portion of the Site. This cross-section extends from the vicinity of the slurry wall in the area of soil boring D-7 and piezometer HC-PZ-11L on the Seaboard Site south to soil boring/monitoring well location D-38/MW-D-38 located in the median of the Belleville Turnpike.

In addition to the Area 2 geology, the cross-sections also show field observations regarding the presence of DNAPL, analytical data for subsurface soil and groundwater, monitoring well screen intervals, and potentiometric surface elevations.

The Area 2 Sand Unit water level measurements are summarized in Table 3-1. A potentiometric surface elevation contour map for the Sand Unit is provided as Figure 3-9. Sand Unit potentiometric surface elevations measured in the Area 2 monitoring wells are consistently lower than those measured outside of and immediately adjacent to the barrier wall containment system, indicating that Area 2 is located hydraulically downgradient of Area 1. In the southern portion of Area 2, the Sand Unit potentiometric data indicate groundwater flows to the north, toward the center of Area 2. This northward component of groundwater flow would act to limit migration of dissolved phase constituents further to the south.

Potentiometric data acquired from HC-PZ-13U and HC-PZ-13L (clustered piezometers positioned on the edge of Area 2) indicates the existence of a downward vertical gradient between the shallow fill material and the deeper Sand Unit adjacent to the slurry wall in the northern portion of Area 2. No clustered piezometers exist in the central or southern portion of Area 2. Based on examination of the cross-sections, it appears that the base of the drainage swale located within Area 2 is several feet above the top of the Meadow Mat semi-confining unit that separates the shallow Fill Unit and underlying Sand Unit. This being the case, it is probable that the swale has minimal if any influence on the vertical gradient relationships in Area 2 and a downward vertical component of flow between the Fill and Sand Units is expected in Area 2.

The Area 1 geology is similar to Area 2, which is expected considering their close proximity. Area 1 has been extensively characterized in previous reports including but not limited to the RI Report (KEY, October 2015). Area 1 is completely enclosed by a slurry wall that was installed as part of the 2010 Interim Response Action. The barrier wall prevents migration of constituents from Area 1.

3.2 DNAPL DISTRIBUTION

Historical and recent DNAPL delineation efforts have focused on several distinct portions of the Site. DNAPL was identified in the vicinity of the Former Lagoons, near several monitoring wells located on the western portion of the Site, in an area south of the Site on the former Seaboard Site, and outside of the barrier wall to the south of the Site on the NJDOT right-of-way. The DNAPL in Area 1 is contained by the barrier wall. The DNAPL in both Area 1 and Area 2 is primarily confined to depressions in the varved clay surface. This section contains information on the various DNAPL distribution investigations that have occurred at the Site, as summarized below.

3.2.1 Area 1 DNAPL Distribution

A comprehensive evaluation of all available information regarding occurrence of DNAPL was completed as part of the 1999 Supplemental Remedial Investigation (SRI) data evaluation process. Information reviewed and considered in the SRI included Laser-Induced Fluorescence readings, boring log descriptions, DNAPL thickness measurements, soil analytical data and groundwater analytical data.

The SRI results indicated that DNAPL was more widely distributed in the underlying Sand Unit than in the Fill Unit, and is present directly on the top of the varved clay. DNAPL was present from west of the lagoon area to beyond the vicinity of the former railroad right-of-way. Also, DNAPL was present in the deeper Sand Unit at the northern property boundary and in the area between the lagoons and the river. DNAPL was also inferred to be present in the area south of the lagoons and along the southwest property boundary in the vicinity of Buildings 2 and 4.

Additional information regarding the DNAPL distribution in Area 1 was acquired during the 2008-2009 pre-design investigations completed in support of the design of the interim response action for the SCCC Site. Data acquired and observations made during this investigation demonstrated that DNAPL extended beneath the western portion of the HCIA property (former Seaboard Site). This was one factor that necessitated an extension of the proposed barrier wall system onto the HCIA property.

In 2013, an investigation was conducted to evaluate the extent of DNAPL in the western portion of the property and in the vicinity of boring D-4, located in the western portion of the Seaboard Site outside the barrier wall. These data were collected to supplement previous DNAPL delineation activities. Continuous coring was used throughout each of these additional DNAPL delineation borings to document the presence/absence of DNAPL. Subsurface soil samples were collected from 19 locations (D-14 through D-27, VC-1 through VC-5). A total of 22 samples were collected and submitted for analysis from the 19 locations. One sample from the deep Sand Unit was submitted for analysis from each boring location, and Meadow Mat samples from two locations were submitted for analysis. Samples of the Fill Unit or Meadow Mat were submitted for analysis if DNAPL was observed in the sample. Analytical results for the Fill Unit, Sand Unit, and Meadow Mat samples are presented in the RI Report (KEY, October 2015).

Visual observations regarding the presence or absence of DNAPL in the field were documented and Figure 3-10 depicts the inferred limits of the SCCC Site-related free-phase DNAPL in Area 1, based on visual observations of the soil cores. Visual observations correlate well with analytical data. Area 1 and Area 2 borings were used to generate a varved clay surface elevation map (Figure 3-11). The configuration of this low permeability unit is believed to have a strong influence on

the distribution of DNAPL in the deeper Sand Unit given the high specific gravity of the SCCC Site DNAPL (specific gravity of greater than 1.3).

3.2.2 Area 2 DNAPL Distribution

In 2015, fifteen (15) soil borings (D-28 through D-42) were completed as part of the RI to further delineate the horizontal extent of DNAPL within the Sand Unit outside of the barrier wall on the portion of Area 2 located on the HCIA property and within the portion of Area 2 located in the NJDOT right-of-way for the Belleville Turnpike. This information is also supplemented by information obtained from several DNAPL delineation and barrier wall alignment pre-design investigation borings completed to support the design of the interim response action. Information from these borings was used to generate the contour map of the upper surface of the varved clay unit (Figure 3-11) as the configuration of this low permeability unit is believed to have a strong influence on the distribution of DNAPL in the deeper Sand Unit.

The visual observations regarding the presence or absence of DNAPL in the field were supplemented by laboratory analysis of subsurface samples collected from the deeper Sand Unit at its interface with the varved clay unit. Table 3-2 provides a listing of the soil borings, lithologic units, DNAPL observations, and samples submitted for analysis. The analytical results of the soil samples collected from the soil borings and analyzed for dichlorobenzene (DCB) isomers are presented in Table 3-3.

The analytical results show correlation with field observations of the presence/absence of DNAPL and the elevation of the varved clay surface. The DCB isomer concentrations for groundwater samples collected from the Sand Unit are depicted on Figure 3-12. Figure 3-13 depicts the inferred limits of the SCCC Site-related free-phase DNAPL in Area 2, based on visual observations of the soil cores. Figure 3-13 also displays the total DCB concentrations in the sand unit at the varved clay interface. Total DCB isomer concentrations in samples observed to contain SCCC Site-related free-phase DNAPL range from 16,400 milligrams per kilogram (mg/kg) to 87,000 mg/kg.

In general, soil samples collected from locations where no visual evidence of SCCC Site-related DNAPL was observed, adjacent to the barrier wall, exhibit relatively low total DCB isomer concentrations. Total DCB isomer concentrations in these samples range from below detection limits to 530 mg/kg at soil boring D-23, which is located immediately outside the barrier wall at the boundary between the SCCC and Seaboard properties. For the samples collected from borings within the NJDOT right-of-way that exhibited no visual evidence of SCCC Site-related DNAPL, total DCB isomer concentrations ranged from below detection limits to 250 mg/kg. Given that the analysis of saturated soil samples can be used as a screening surrogate for groundwater samples, the subsurface saturated soil analytical results strongly suggest that dissolved DCB concentrations

decrease sharply within a short distance downgradient of the DNAPL impacted areas. Groundwater monitoring analytical data also suggests there is a sharp decrease in dissolved DCB concentrations within a short distance of DNAPL impacted areas and is discussed in Section 3.4 of this report.

Free-phase DNAPL, which is not believed to be SCCC Site-related, was also observed in the Sand Unit in soil boring/monitoring well D-37/MW-D-37 and in the fill material above the Meadow Mat in soil boring D-38 (See Figure 3-8 Cross-Section E-E'). Field observations indicated that this DNAPL possessed a coal tar or creosote-like odor and so was not suspected of being Site-related. Further, this DNAPL was observed only at two locations within Area 2: 1) at the Sand Unit/varved clay interface (28.75-29.25 feet below ground surface [ft-bgs]) at location D-37; and, 2) at the fill/Meadow Mat interface (10.3 to 10.8 ft-bgs) at location D-38. The presence of this DNAPL at shallower depths at locations furthest from the SCCC Site, along with its absence at shallower depths closer to the SCCC Site, also supports a conclusion that the entry zone (i.e., the location where the DNAPL entered into the subsurface) is not related to the SCCC Site. Lastly, as discussed in the following section, the results of the laboratory analyses of soil samples show that the DNAPL observed at locations D-37 and D-38 has a much different chemical composition than the DNAPL observed at location MW-D-28, which is believed to have emanated from the SCCC Site.

3.3 DNAPL DESCRIPTIVE INFORMATION (PHYSICO-CHEMICAL PROPERTIES)

Area 1 DNAPL samples were sampled from two monitoring wells (MW-3L and MW-13L) in 2008 and table 3-4 presents the analytical results for these two samples. The sample from MW-3L (located approximately 100 feet south of Building 1) was primarily 1,4-dichlorobenzene (520,000 mg/kg) and chlorobenzene (8,800 mg/kg) with trace amounts of other chemicals including dioxins/furans. The sample from MW-13L was primarily hexachlorobenzene (12,000 mg/kg), and various polychlorinated biphenyls (i.e., Aroclor 1016, 1248, 1260, and 1268 at concentrations ranging to 8,600 mg/kg). Both samples contained 1,4-dichlorobenzene, chlorobenzene and tetrachloroethene at concentrations that exceeded the Toxicity Characteristic Leaching Procedure guidelines. Naphthalene concentrations detected in groundwater and soil samples at other locations also suggest that it is also a component of DNAPL in some areas.

Area 2 DNAPL samples were collected from monitoring wells MW-D-28 and MW-D-37 and analyzed for Target Compound List (TCL)-volatile organic compounds (VOCs), TCL-semi-volatile organic compounds (SVOCs) and diesel range organics. In addition, a soil sample of the DNAPL-impacted fill material from soil boring D-38 was collected for analysis for TCL VOCs and TCL SVOCs. The analytical results of the DNAPL collected from wells MW-D-28 and MW-

D-37 and the soil boring D-38 fill sample are presented in Table 3-5. These analytical results demonstrate the dissimilarity between the DNAPLs present in monitoring wells MW-D-28 and MW-D-37. These data show that the DNAPL from monitoring well MW-D-28 is comprised primarily of DCB isomers whereas the DNAPL from well MW-D-37 is comprised primarily of polynuclear aromatic hydrocarbons and other SVOCs. Further, the analytical results for the DNAPL-impacted fill sample collected from soil boring D-38 strongly suggest that the DNAPL observed at shallow depths in that boring is of similar composition to the DNAPL observed in the Sand Unit in monitoring well MW-D-37. The laboratory analytical data packages are included as Appendix B of the RIR Addendum (KEY, January 2016).

A summary of relevant physico-chemical information for frequently detected Site-related organic constituents in the major chemical classes including molecular weight, density, water solubility, vapor pressure, organic carbon partition coefficient (K_{oc}), and dimensionless Henry's Law Constant is provided in the Table 3-6.

The various chlorinated aromatic hydrocarbons and naphthalene possess low pure compound aqueous solubility in water ranging from 31 mg/l for naphthalene to approximately 500 mg/l for chlorobenzene. Their solubilities in water as the result of dissolution of a DNAPL comprised of a mixture of chemicals will be less than their individual pure compound solubilities. The solubility of a compound derived from a DNAPL mixture is termed its effective solubility and is a function of the mole fraction of the compound within the DNAPL mixture. The effective solubility is equal to the pure compound aqueous solubility multiplied by the mole fraction of the compound in the DNAPL mixture. Since the mole fraction is less than unity, effective solubility is always less than pure compound solubility. Dissolution time frames calculated using pure compound solubility will underestimate the time for a DNAPL to dissolve in groundwater.

All of the chemicals exhibit some affinity for sorption to soils as evidenced by their organic carbon partition coefficients. This means that extraction of these constituents via pumping of groundwater would be difficult and time consuming because the compounds would tend to sorb to organic carbon in the aquifer matrix. The detection of relatively high concentrations of all of these compounds in subsurface soil, particularly in comparison to the concentrations detected in groundwater and surface water, is consistent with their sorptive nature. Henry's law constants presented in Table 3-6 show that the DNAPL constituents are only moderately volatile. However, the DNAPL compounds are sufficiently volatile to present a vapor intrusion concern if present at shallow depths beneath occupied structures. The only structures remaining on the Site are unoccupied structures (Edison Buildings) and the structure that houses the hydraulic control treatment system. The Edison Buildings will be demolished. The treatment system building was constructed on top of several feet of clean fill to raise it above the floodplain elevation. Therefore, vapor intrusion is not a concern for that structure. Neither shallow groundwater impacts, nor

occupied structures, exist within Area 2, nor are any future occupied structures reasonably anticipated given the status of Area 2 as highway and related right-of-way use.

The chlorinated hydrocarbons are much denser than water with specific gravities of approximately 1.3. These values comport with actual specific gravity measurements of DNAPL samples collected from the SCCC Site. The presence of the DNAPL mass at the sand/varved clay geologic contact is consistent with the high specific gravity of the SCCC Site-related DNAPL. Taken all together, the physical and chemical properties of the DNAPL constituents are not favorable for physical removal of these constituents from groundwater plumes.

3.4 DISSOLVED PHASE CONTAMINANT PLUMES

Historical investigations of groundwater conditions at the Site have focused on delineation of impacts in the shallow fill and deep Sand Units as well as on delineation and characterization of the extent of DNAPL associated with former naphthalene and chlorinated aromatic hydrocarbon processing. This section contains brief descriptions of constituent plumes. More detailed information regarding historical sampling events and analytical results can be found in previous reports such as the RI Report and RIR Addendum (KEY, October 2015 and January 2016).

3.4.1 Area 1 Dissolved Phase Contaminant Plumes

Historical investigations at the SCCC Site included the installation and sampling of shallow Fill Unit monitoring wells. At various times, these wells were sampled for VOCs, SVOCs, PCBs, metals, hexavalent chromium, and/or dioxin. The Fill and Sand Unit constituents are discussed below. In general, the inorganic constituents are more prevalent and extensive in the shallow fill unit while organic constituents in the form of dissolved phase constituents and DNAPL are more prevalent and extensive in the underlying sand unit. More details regarding the sampling events and analytical results can be found in previous reports such as the RI Report (KEY, October 2015).

3.4.1.1 Area 1 Shallow Fill Unit

Historically, the shallow groundwater samples were found to contain several VOCs, naphthalene, 1,2,4-trichlorobenzene, and hexavalent chromium at concentrations that exceeded the EPA Regional Screening Levels (RSLs) for tapwater. In 2008, samples were collected by KEY from four shallow monitoring wells and five shallow piezometers. The results of these analyses are summarized in Table 3-7. Well locations and analytical data for select constituents of interest are presented on Figure 3-14. These samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and metals including hexavalent chromium. Various chlorobenzenes, naphthalene, 2-methylnaphthalene, phenols and PCBs were detected in at least one sample at concentrations that exceeded the applicable tapwater RSL. Samples from wells MW-11U and MW-14U, located in

the former lagoon area, contained the highest concentrations of the chlorobenzenes. In addition, hexavalent chromium was reported in three samples at concentrations that exceeded the tapwater RSL criterion of 0.035 ug/L. Total chromium was detected in two samples at concentrations that exceeded the tapwater RSL criterion of 2200 ug/L. Multiple other metals were identified at concentrations greater than their corresponding tapwater RSLs, including iron, lead, mercury, vanadium and zinc.

3.4.1.2 Area 1 Deep Sand Unit

Between 1988 and 1993, 20 monitoring wells were installed in the deeper Sand Unit to facilitate water level measurement and sampling and analysis. Analyses included VOCs, SVOCs, PCBs, dioxins/furans, metals, and/or hexavalent chromium. In 1999, two additional deeper wells were installed and sampled for SVOCs.

In 2008, eight deeper Sand Unit monitoring wells were sampled by KEY, and the samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. The results of these analyses are summarized in Table 3-8. Well locations and analytical data for select constituents of interest are presented on Figure 3-15. Samples from wells MW-2L, MW-3L, MW-4L, MW-8L, MW-14L and MW-15L yielded concentrations of various chlorobenzenes in excess of RSLs/MCLs. Some of these samples also yielded concentrations of naphthalene and/or phenols in excess of comparison criteria. Overall, the concentrations found in the samples from the deeper wells exceeded those reported for the Fill Unit wells with the exception of hexavalent chromium, which is reduced as a result of the presence of the organic rich Meadow Mat which exists between the units. Concentrations of hexavalent chromium in the deep Sand Unit groundwater did not exceed the RSL; however, total chromium exceeded NJ DEP criteria in three samples.

3.4.2 Area 2 Dissolved Phase Contaminant Plumes

On November 3-4, 2015, groundwater samples were collected from new Area 2 monitoring wells MW-D-28, MW-D-35, MW-D-37, MW-D-38, and MW-D-39, and existing barrier wall piezometer HC-PZ-13L. The Work Plan specified that the samples be analyzed for DCB isomers. However, due to the presence of the potential non-SCCC Site-related DNAPL, the parameter list was expanded to include the full list of TCL VOCs and TCL SVOCs. The groundwater analytical results are summarized in Table 3-9. Figures 3-12 and 3-16 display the analytical data for detected VOCs and SVOCs, respectively. The analytical data packages, data evaluation summaries, data quality review, and sampling details are described in the RIR Addendum (KEY, January 2016).

3.4.2.1 Deep Sand Unit VOCs

Based on a review of the analytical results, the highest concentrations of DCB isomers were detected in groundwater samples collected from wells MW-D-28 (free-phase DNAPL measured in well) and HC-PZ-13L, at concentrations of 106,000 micrograms per liter (µg/l) and 9,400 µg/l, respectively (Table 3-9 and Figure 3-12). No DCB isomers were detected in monitoring wells MW-D-38 or MW-D-39. Also, 1,2-DCB was detected in monitoring well MW-D-35 at a concentration of 0.29J µg/l (estimated result less than the analytical reporting limit). The total DCB concentration detected in MW-D-37 was 630 µg/l. Using soil samples as a surrogate for groundwater concentrations; the subsurface saturated soil analytical results strongly suggest that dissolved DCB concentrations decrease sharply within a short distance downgradient of the DNAPL impacted area.

3.4.2.2 Deep Sand Unit SVOCs

The SVOC analytical data (Table 3-9 and Figure 3-16) shows impacts from the potential non-SCCC Site-related DNAPL in the groundwater samples collected from monitoring wells MW-D-37 and MW-D-38. The SVOC data for the other groundwater samples suggest that the dissolved phase groundwater impacts associated with the potential non-SCCC Site-related DNAPL appear to be limited to the vicinity of monitoring wells MW-D-37 and MW-D-38.

3.5 POTENTIAL MIGRATION PATHWAYS

Area 1 Fill Unit and Sand Unit groundwater is currently contained within a slurry wall. There are no anticipated groundwater or DNAPL migration pathways due to the containment system in place. DNAPL accumulates in sumps at the well locations and is removed from the sumps on a periodic, as-needed, basis. Eleven DNAPL recovery wells were installed in the Sand Unit and hydraulic control within the slurry wall is achieved through a series of groundwater collection wells (26) installed in the fill unit which are routed to the onsite treatment plant. The treatment plant was designed to remove the various organic constituents of interest as well as metals (via chromium reduction and precipitation processes). The treated effluent is discharged to the Hackensack River via a NJPDES permitted outfall. Sampling and analysis of the effluent is conducted on a routine basis and the results are reported to NJDEP via monthly Discharge Monitoring Reports.

DNAPL migration from Area 1 to Area 2 likely occurred prior to the installation of the barrier wall surrounding Area 1. Lateral DNAPL migration can occur on top of the lower permeability varved clay and DNAPL appears to accumulate in clay surface depressions. Along the southern and western boundaries of Area 2, the varved clay rises in elevation, which prevents further migration of the DNAPL. The slight upward slope in the clay surface is also shown on Figures 3-6 through

3-8; Cross-Sections C-C', D-D' and E-E'. No further migration of DNAPL is expected in the future based on DNAPL density, viscosity, the nature, and slope of the varved clay and time since releases were abated. In addition, the barrier wall installation further prevents migration of DNAPL from Area 1 to Area 2. DCBs also have low aqueous solubilities. Thus, the DNAPL will slowly solubilize over time and dissolved constituents will attenuate via physical, chemical, and biological processes within a short distance from areas of free-phase or residual DNAPL. A northward component of groundwater flow along the southern boundary of Area 2 will limit the migration of dissolved constituents further to the south.

The naphthalene-based DNAPL identified in the fill material along the southern portion of Area 2 (D-37 and D-38) did not originate from the SCCC Site as indicated by the presence of this DNAPL at shallower depths at locations furthest from the SCCC Site, along with the absence at shallower depths closer to the SCCC Site (as discussed in Section 3.2 of this document). This non-SCCC Site-related DNAPL may continue to migrate north toward the center of Area 2. The clay surface slopes toward the center of Area 2 from the south. This DNAPL will slowly solubilize over time and dissolved constituents will attenuate via physical, chemical, and biological processes within a short distance of the free-phase DNAPL.

Volatilization of SCCC Site-related DNAPL is not a pathway of concern in Area 2, considering that no Site-related impacts were observed in the fill materials above the Meadow Mat. Vapors will not be produced if no volatile or semi-volatile constituents are present in the shallow groundwater zone. The non-SCCC Site-related DNAPL present above the Meadow Mat south of Area 2 (D-38) could potentially produce vapors, but is located approximately 400 feet from the southern border of Area 2.

4.0 TECHNICAL IMPRACTICABILITY EVALUATION

This section includes identification of the specific ARARs for which a TI Waiver is sought; an evaluation of restoration potential; a summary of the justification for the TI decision; and the spatial extent of the proposed TI Waiver Zone.

4.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR WHICH A TI WAIVER IS SOUGHT

ARARs that pertain to Areas 1 and 2 are discussed in Section 3.1 of the FFS Report (KEY, June 2016). The ARARs for which a waiver is sought include Federal and State groundwater quality criteria and more specifically, the following:

- National Primary and Secondary Drinking Water Standards (i.e., MCLs);
- USEPA Regional Screening Levels; and,
- New Jersey Ground Water Quality Standards.

A waiver of these ARARs is sought within Areas 1 and 2.

4.2 PROPOSED TI WAIVER ZONE

The limits of the proposed TI Waiver Zone for the Area 1 shallow Fill Unit, Area 1 deep Sand Unit, and Area 2 deep Sand Unit are shown on Figure 4-1 and will be co-extensive with the CEA/WRA limits discussed below. The DNAPL zones shown in Figures 3-10 and 3-13, along with contaminated groundwater are included in the proposed TI Waiver Zone boundary.

Groundwater monitoring will be conducted to demonstrate that the dissolved COCs remain entirely within the established TI Waiver Zone. Existing monitoring wells or monitoring wells to be installed in the future will serve as sentinel wells to detect any potential advancement of the dissolved plume front or any increase in concentrations within the core of the plume.

Groundwater use prohibitions in the form of a Classification Exception Area/Well Restriction Area (CEA/WRA) as provided by the New Jersey Administrative Requirements for Remediation of Contaminated Sites will be established to prevent future use of groundwater within the TI Waiver Zone once the zone is established.

4.3 EVALUATION OF RESTORATION POTENTIAL

This section includes information pertaining to the source delineation and the potential DNAPL recovery observations, natural attenuation considerations, a restoration timeframe analysis, and the comparison of the SCCC Site restoration timeframe.

4.3.1 Source Delineation, Area 1 IRAs, and Potential DNAPL Recovery

Since the early 1990s multiple interim remedial measures (IRMs) and interim response actions (IRAs) were completed in Area 1. IRAs completed from July 2010 through December 2011 included a barrier wall system, a hydraulic control system, and a passive DNAPL recovery system among other IRAs. More detailed information regarding IRMs and IRAs can be found in previous Site documents such as the FFS Report (KEY, June 2016).

A barrier wall system surrounding Area 1 was installed to contain contaminants. A hydraulic control system and groundwater treatment plant were installed, *inter alia*, to prevent filling of the fully enclosed cell. A DNAPL recovery system consisting of sixteen (16) 18-inch diameter high-density polyethylene (HDPE) recovery wells with 10 foot sumps were installed. The passive recovery has resulted in a total of approximately 6,100 gallons of DNAPL recovered since start up in January 2012 through March 2016 which indicates that passive DNAPL recovery is effective in Area 1.

DNAPL has been delineated in Area 2 as described in Section 3.2 of this document. Observed Area 2 DNAPL thickness in soil borings has been documented in Table 3-2. As indicated in Table 3-1, apparent DNAPL thicknesses of up to 5.4 feet have been measured in monitoring well MW-D-28. The efficacy of the passive DNAPL recovery system in Area 1 demonstrates that passive DNAPL recovery from the Sand Unit is feasible in Area 2. After evaluation of remedial technologies and consideration of balancing criteria in the FFS Report, (KEY, June 2016) remedial alternatives involving passive DNAPL recovery wells for Area 2 were determined to be appropriate consistent with the Alternative Remedial Strategy described in the *TI Guidance Document*. Future installation of passive DNAPL recovery wells, as described in the FFS Report (KEY, June, 2016) remedial alternatives, should remove a substantial amount of DNAPL mass in Area 2 and reduce the potential for future mobility of the DNAPL. However, as previously described, substantial quantities of DNAPL either as free-phase or residual DNAPL trapped by capillary forces in the aquifer matrix of the lower varved clay sand unit will remain in the subsurface and will act as a long-term source of dissolved phase impacts in both Area 1 and Area 2. Residual DNAPL is immobile even under extreme hydraulic gradient conditions as a result of capillary tension in the soil. Thus, while DNAPL mass recovery is achievable it is not sufficient for reducing dissolved phase concentrations in groundwater to levels defined by ARARs.

4.3.2 Natural Attenuation

Natural degradation of various organic chemicals, or classes of organic chemicals, is dictated by physico-chemical properties, local geochemistry, and indigenous microbial populations. Chlorobenzene compound (CBC) characteristics of high density, low absolute solubility, high soil-sorption coefficient, and low degradability suggest that the initial step in the natural attenuation processes (i.e., dissolution) will be slow within the DNAPL source area.

Natural attenuation of DNAPL is a multistep process involving dissolution, biodegradation (i.e., natural degradation), and sorption. DNAPL dissolution rates depend on solubility of DNAPL components (Table 3-6) and groundwater velocity flowing over the DNAPL surface. The complete DNAPL solubilization timeframe depends on the total areal extent and mass of DNAPL present in the subsurface. After dissolution, dissolved constituents will biodegrade (Lawrence, 2006). A 2006 USGS publication by Lawrence describes biodegradation pathways and kinetics of DCB isomers (Table 4-1). This USGS Report concludes that CBCs will be dechlorinated and transformed into carbon dioxide over time. In aerobic zones, oxygen is respired by microbes as electron donors (such as CBCs) are oxidized. In anaerobic zones, the CBCs serve as electron acceptors as microbes consume naturally occurring organic substrates. Chlorobenzene is an intermediate product of DCB degradation, before complete biodegradation to carbon dioxide. Chlorobenzene concentrations in groundwater in Areas 1 and 2 suggest that DCB is degrading. Biodegradation rates vary based on site-specific conditions (constituent type, microbial populations, and geochemistry). Sorption of dissolved constituents will also contribute to natural attenuation. Volatilization will not be a significant natural attenuation process considering that dissolved constituents are not exposed to the air-water interface and that no DNAPL has been observed in the vadose zone.

4.3.3 Restoration Timeframe Analysis

Degradation of dissolved phase constituents occurs relatively fast after DNAPL dissolution. Dissolution of DNAPL is the restoration limiting step. A general timeframe analysis was done to estimate the time for complete dissolution and degradation of Area 2 DNAPL. The DNAPL dissolution timeframe estimate involved the following steps:

- Estimate DNAPL mass:
    - Measure the approximate area where DNAPL was delineated and estimate average DNAPL thickness.
    - Calculate DNAPL volume based on area and thickness estimations.
    - Calculate DNAPL mass by using DNAPL volume and density.

- Estimate time needed to dissolve DNAPL mass
    - Using DNAPL solubility, calculate volume of water required for complete DNAPL dissolution.
    - Use measured hydraulic parameters (hydraulic conductivity, hydraulic gradient, and cross sectional area) to calculate the water discharge rate through the delineated DNAPL zone.
    - Calculate the time required for a sufficient volume of water to pass through the DNAPL zone and solubilize free-phase DNAPL.

Dissolution of DNAPL is estimated to take more than 150 years based on this general analysis. This timeframe may change if Area 2 conditions change. The amount of DNAPL in the subsurface is one factor that is difficult to determine and it will have a major influence on restoration timeframe. A low estimate of DNAPL thickness in the DNAPL delineated zone was used to produce the lower bound estimate of 150 years for DNAPL dissolution.

The timeframe for degradation of dissolved constituents to MCL levels is likely orders of magnitude less than the timeframe for DNAPL dissolution. However, degradation of dissolved constituents only occurs after dissolution of DNAPL occurs. Half-lives of CBCs have been studied and compiled in the referenced 2006 USGS Report. Based on published 1,4-DCB biodegradation rates, it will take between 2.7 and 36 years for dissolved 1,4-DCB to fully degrade to carbon dioxide once the DNAPL source is depleted. It is realized that other DCB isomers (1,2-DCB and 1,3-DCB) exist as a portion of the DNAPL in addition to 1,4-DCB. All three DCB isomers have similar physico-chemical characteristics such that the use of 1,4-DCB properties in determining a degradation timeframe is adequate in determining a general timeframe. This degradation timeframe estimate varies based on geochemical conditions. This biodegradation estimate does not account for sorption of dissolved constituents to organic matter. Sorption will cause dissolved concentrations to decrease and will limit dissolved constituent migration to a short distance from the source.

Particulate organic matter is likely present in the Sand Unit. A substantial organic matter source is located in the Meadow Mat unit, located immediately above the Sand Unit, and a downward vertical gradient may transport particulate organic matter into the Sand Unit. Sorption will accelerate the attenuation of dissolved constituents. The USEPA *Soil Screening Guidance: Technical Background Document* suggests that a default fraction of organic carbon value of 0.002 gram/gram is typically representative of subsurface soils (USEPA, 1996). A substantial portion of dissolved constituents will partition to the sorbed phase. The attenuation of dissolved constituents can be expected to occur closer to the 2.7 year estimate due to sorptive processes.

As stated above, there are multiple steps involved in estimating the restoration timeframe. Regardless of the timeframe for degradation of dissolved constituents, DNAPL dissolution is the restoration limiting step which will occur over approximately 150 years. The total restoration timeframe is the sum of the dissolution timeframe as well as degradation and sorption, occurring after dissolution. The total restoration timeframe is approximately 160 years; however, implementation of passive DNAPL recovery could reduce this estimate. A calculation brief documenting the restoration timeframe analysis is included as Attachment A.

The result of this analysis concludes that restoration of Area 2 groundwater will not be achieved within a reasonable timeframe (approximately 100 years). Previous Site investigations show that contamination is more extensive in Area 1 and the restoration timeframe for Area 1 is, therefore, expected to be greater than Area 2. Area 1 is contained with a barrier wall to prevent migration of constituents. The same processes of dissolution and degradation are applicable to Area 1. The restoration timeframe for Area 1 is less critical compared to Area 2 due to the containment system currently in place.

4.3.4 Comparable Sites Restoration Timeframe

Comparison of the SCCC Site with case studies analyzed in the 2013 NRC Report was considered. Appendix C of the 2013 NRC Report, analysis of 80 facilities with contaminated groundwater deleted from the national priorities list, was reviewed. Of the 80 sites reviewed, multiple sites that contained CBCs did not obtain MCL standards and were required to use institutional controls.

In summarizing its views on current technologies available to remove or contain contamination at complex sites, particularly those sites with source zones containing chlorinated compound DNAPLs, Page seven of the NRC Report (emphasis in original) stated:

> **Significant limitations with currently available remedial technologies persist that make achievement of MCLs throughout the aquifer unlikely at most complex groundwater sites in a timeframe of 50-100 years**. Furthermore, future improvements in these technologies are likely to be incremental, such that long-term monitoring and stewardship at sites with groundwater contamination should be expected.

After reviewing the timeframe analysis described above, consideration of published case studies, and consideration of the NRC Report conclusions, it is technically impracticable to obtain CBCs MCL standards in a reasonable timeframe, which is considered to be approximately 100 years. Given the nature of the DNAPL present in Areas 1 and 2, the timeframe for remediation is approximately 160 years.

4.4 JUSTIFICATION FOR TI DECISION

The justification for a TI Decision is presented in this section. In addition to the applicable criteria specified in the *TI Guidance Document* (hydrogeologic factors and contaminant related factors), two other Site-specific criteria (land use considerations and exposure potential considerations) are evaluated.

4.4.1 Hydrogeologic Factors

Observations made during soil boring drilling indicate that the DNAPL is distributed at the base of the Sand Unit at the contact with the underlying varved clay confining unit. This distribution is consistent with the very high DNAPL specific gravity (greater than 1.3) and suggests that the DNAPL migration and distribution are controlled by the topography of the upper surface of the varved clay and are not directly influenced by the direction of groundwater flow. Evaluation of geologic information shows that the surface of the varved clay beneath Areas 1 and 2 is undulatory. The undulating clay surface is depicted in Figure 3-11. The DNAPL will migrate along the varved clay surface until it becomes trapped and pooled within low lying areas in the upper varved clay surface. Under such conditions it is considered technically impracticable to locate and, therefore, recover all DNAPL pooled within the low lying areas within the varved clay surface.

Certain hydrogeologic characteristics are consistent with the impracticability of remediation of impacted groundwater to achieve groundwater quality ARARs for COCs within a reasonable timeframe. The subsurface stratigraphy has been characterized and described in Section 3.1 of this document. The continuous varved clay layer is a competent aquitard, which minimizes vertical migration. Stratigraphic characteristics of the varved clay such as alternating clay and sand seams are expected to increase DNAPL diffusion into the upper surface and pose a significant remedial challenge to effective DNAPL dissolution. DNAPL has been found to infiltrate a short distance into the upper portion of the varved clay layer as a result of diffusion and this would complicate mass removal or reduction as a result of back diffusion into the overlying Sand Unit.

4.4.2 Contaminant-Specific Factors

The dissolved DCBs, naphthalene, and other constituents in groundwater are derived from a DNAPL source(s). Section 1.1 of the *TI Guidance Document* notes that contaminant-related factors "may limit the success of an extraction or *in situ* treatment process." It says, "NAPLs that are denser than water (DNAPLs) often are particularly difficult to locate and remove from the subsurface; their ability to sink through the water table and penetrate deeper aquifers is one of the properties that makes them very difficult to remediate." The qualities and distribution of contaminants at the SCCC Site make remediation of groundwater to meet ARARs technically impracticable. Among other things:

- DNAPL is denser than water. This attribute makes it extremely difficult to precisely locate the source material and remediate groundwater in a cost-effective manner, especially in complex geologic systems such as those found at the deep sand/varved clay contact beneath Areas 1 and 2. Regardless of the effort expended, it is impracticable to locate all DNAPL as accumulations, if present, could be very small in terms of areal extent. Some DNAPL that has infiltrated the upper clay varves is also impracticable to remove.
- A significant fraction of DNAPL in Areas 1 and 2 will persist as non-recoverable residual DNAPL. This residual DNAPL is immobile even under extreme hydraulic gradient conditions as a result of capillary tension in the soil. Therefore, DNAPL could persist as a source of dissolved constituents.
- DNAPLs have low solubility. This low solubility causes the DNAPL to persist for long periods of time and prevents the removal of significant mass via active extraction.

Even if complete DNAPL removal in Area 1was achievable (which it is not), total and dissolved chromium and other dissolved organic constituents that are not components of Area 1 DNAPL would remain at concentrations exceeding applicable ARARs. Therefore, the infeasibility of restoration of Area 1 groundwater quality to ARARs is compounded by conditions beyond DNAPL abatement. The contaminant-specific factors are consistent with the impracticability of obtaining groundwater quality ARARs in the Area 1 shallow Fill Unit, Area 1 Deep Sand Unit, and Area 2 Deep Sand Unit within a reasonable timeframe. Chlorinated solvent groundwater contamination sites are among the most problematic sites to remediate (National Research Council (NRC), 2013). SCCC Site-related DNAPL is composed primarily of DCB isomers (1,2-DCB, 1,3-DCB, and 1,4-DCB) and naphthalene. Chemical characteristics that influence the feasibility of remediation include the following: contaminant phase, partitioning behavior of compounds, and degradation rates.

DNAPL is difficult to locate and remove from the subsurface due to its ability to sink through the water table and penetrate deeper portions of aquifers (USEPA, 1993). 1,2-DCB, 1,3-DCB, 1,4-DCB, and naphthalene have specific gravities of 1.31, 1.29, 1.25, 1.03 respectively (Oak Ridge National Laboratory, 2013). Residual DNAPL is immobile even under extreme hydraulic gradient conditions as a result of capillary tension in the soil. Accordingly, it is technically impracticable to remove enough DNAPL to lower DCB and naphthalene concentrations to meet ARARs through utilization of extraction wells alone.

DCB and naphthalene isomers have low pure compound and effective solubilities. However, these solubilities are several orders of magnitude greater than their ARARs. 1,2-DCB 1,3-DCB, 1,4-DCB, and naphthalene have solubilities of 156 mg/L, 125 mg/L, 81.3 mg/L, and 31 mg/L respectively (Oak Ridge National Laboratory, 2013). MCLs for 1,2-DCB and 1,4-DCB are 0.6

mg/L and 0.075 mg/L, respectively. Figure 3-12 shows Area 2 VOC concentrations in the deep Sand Unit. MW-D-28 contains multiple DCB detections with 1,4-DCB being detected at a concentration of 43 mg/L. Groundwater in close proximity to free-phase or residual DNAPL, located on the varved clay surface, contains DCB concentrations that approach solubility limits. However, dissolved phase concentrations of DCB in Area 2 are reduced significantly within a short distance from the DNAPL source.

Dissolved constituents will sorb to organic carbon within the aquifer matrix and then slowly desorb over time. Slow desorption can serve as an additional dissolved constituent source for an extended period of time. A 2006 United States Geological Survey literature review compiled physico-chemical properties and evaluated natural attenuation studies of 27 VOCs frequently detected in groundwater. In the USGS literature review, chlorobenzene compounds (CBCs) and naphthalene were reported as having some of the highest organic carbon partitioning coefficients (K_{oc}) compared to the other VOCs reviewed (Lawrence, 2006). The Meadow Mat that overlies the deep Sand Unit contains primarily organic material. A downward component of groundwater flow from the shallow Fill Unit, through the Meadow Mat, has likely transported particulate organic material into the deep Sand Unit. Thus, the underlying deep Sand Unit likely contains significant amounts of organic material. CBCs and naphthalene are likely subject to high retardation factors due to sorption and desorption.

CBCs and naphthalene are relatively recalcitrant compounds in the environment; however, microbial-induced natural degradation will occur over time. Literature studies show that natural degradation of chlorobenzenes in groundwater can occur under both aerobic and anaerobic geochemical conditions (Lawrence, 2006). Table 4-1 shows CBCs degradation half-lives published in literature. Natural biodegradation rates are not sufficient to meet ARARs in a reasonable timeframe.

4.4.3 SCCC Site-Specific Implementation Factors

Land use considerations (the DNAPL-impacts in Area 2 lie, in part, directly beneath heavily travelled major highways) and exposure considerations (improbability of contact with or exposure to impacted environmental media [e.g., no current groundwater use and improbability of future groundwater use]) were considered in evaluating the impracticability of remediation to groundwater MCLs. This section will focus on Area 2. Area 1 site-specific implementation factors are less applicable considering that IRAs and IRMs, including a containment system have already been installed/implemented in Area 1.

4.4.3.1 Area 1 Land Use Considerations

Area 1 remedial alternatives described in the FFS Report (KEY, June 2016) will decrease the restoration timeframe and will address potential exposures. However, regardless of which remedial technologies are applied, it is unlikely that constituents will be reduced below MCL concentrations within a reasonable timeframe.

The Town of Kearny, who owns the SCCC Property, recently adopted a resolution (Resolution 2016-250) conditionally designating the Sitex Group, LLC ("Sitex") as the redeveloper for the SCCC Property and adjacent Diamond Site. Currently, Sitex is planning to construct an 850,000 square foot warehouse and distribution center on the SCCC property and adjacent Diamond Site.

Plans for redevelopment of the portion of Area 1 on the HCIA property are also underway. According to information provided by HCIA to EPA, HCIA has entered into a Purchase and Sale Agreement with Morris Kearny Associates, LLC (MKA) to develop the former Koppers Seaboard Site including the 13 acres of land within the SCCC Site barrier wall system. The current redevelopment plan includes the construction of four new industrial warehouse buildings, totaling approximately 2.1 million square feet, along with paved parking lots, paved roads, and utility infrastructure. The installation and long term operation of active remedial systems designed to aggressively remove contaminant mass is incompatible with the planned future land use in Area 1.

4.4.3.2 Area 2 Land Use Considerations

DNAPL exists beneath the Belleville Turnpike which is a heavily travelled, multi-lane roadway in the area (see Figure 2-2). The active and disruptive types of remedial operations that would have to be implemented to achieve ARARs are not deemed practicable for the following reasons:

- The installation and operation of an active remedial system within the limits of the highway is impracticable and unsafe due to the use of this area for vehicular traffic.
- Due to the undulating surface of the varved clay, as discussed previously, it is not technically practicable to locate and remove all of the DNAPL from beneath the roadway to recovery points located adjacent to the highway. It is impractical to remove DNAPL that has infiltrated into the upper varves of the clay. Similarly, it is not considered practicable to inject and effectively monitor reagents adjacent to the highway to successfully treat DNAPL located beneath the roadway because it would not be possible to ensure that the treatment reagents would ultimately travel to all DNAPL impacted areas beneath the roadway. Nor would it be possible to effect monitoring to control the injected media and ensure that injection did not promote DNAPL migration.

- Installation of wells or other engineered controls would not be possible above the active roadway. The area encompassed by the roadway needs to remain clear to allow for vehicle transportation. Similarly, other sections of Area 2 are inaccessible to equipment required for site remediation due to the existence of steep highway embankments.
- Road closures may be necessary for the installation of wells or engineered controls adjacent to the roadway. Users of the road would be inconvenienced as a result of road closures.

Based upon the forgoing, accessibility issues and physical constraints associated with DNAPL trapped beneath the Belleville Turnpike make restoration of groundwater in this area to MCLs or New Jersey Groundwater Quality Criteria technically impracticable within a reasonable timeframe.

4.4.3.3 Areas 1 and 2 Potential Exposure Considerations

The CSM figures 3-1 and 3-2 display all potential exposure pathways. Under current conditions and use, confirmed completed exposure pathways are lacking for both Areas. Groundwater in the shallow and deep zones is not currently being used for any purpose in the vicinity of Areas 1 and 2. Only the deep zone in Area 2 has been impacted by SCCC Site-related COCs. The conclusion drawn from this evaluation is that the potential for exposure to impacted groundwater in the vicinity of Areas 1 and 2 is extremely remote for the following reasons:

- Water from the public supply is readily available to businesses in the vicinity of Areas 1 and 2. Also, note that there are no residences with one mile or more of the Site.
- The Areas are surrounded by industrial sites. Shallow groundwater in the broader area likely has been impacted from nearby industrial sites. Shallow groundwater in the vicinity of Areas 1 and 2 will never be utilized as a drinking water source.
- The industrial land use throughout much of the local area, and the overall urban setting would dictate against the development of groundwater supplies, due to a wide range of potential water quality concerns. Specific conductance measurements taken during sampling of monitoring wells indicate that groundwater contains elevated levels of dissolved solids which are believed to be naturally occurring. The existence of naturally degraded groundwater precludes the use of groundwater for potable purposes.
- A Receptor Evaluation Search was conducted through the NJDEP online database. This search retrieves all approved/accepted well documents for potentially potable wells received by the NJDEP that have been electronically data managed. No receptors were identified within a one mile radius of the Site.

- Area 2 impacts that are related to the presence of SCCC Site-related DNAPL are at significant depths below the ground surface.
- The Area 2 impacts are limited to an area within the NJDOT right-of-way which is bounded by major highways. Due to the depth to the impacted groundwater, it is highly unlikely that construction workers and/or utility workers would be exposed to the DNAPL or impacted groundwater.
- The Area 2 inhalation pathway is not complete. Soil vapor is not of concern because there is no volatile DNAPL in the vadose zone and there is no evidence of SCCC Site-related groundwater impact in the water table aquifer within Area 2 and none is expected because the DNAPL presence is restricted to the Sand Unit/varved clay interface. Furthermore, the potential for construction of habitable structures within Area 2 is virtually non-existent due to the status of Area 2 as highway and related right-of-way use.
- As shown on Figure 3-1, Area 1 has no current potentially complete and significant exposure pathways. After implementation of FFS remedial alternatives, all future potentially complete and significant exposure pathways will be addressed.
- Natural attenuation of the dissolved constituents in both Areas is likely occurring at a rate sufficient to prevent expansion of dissolved phase plumes.

It is considered unlikely that any receptors (ecological or human) are at risk as a result of these impacts given the lack of a completed exposure pathways under current use.

5.0 SUMMARY AND CONCLUSIONS

The applicability of a TI Waiver for groundwater ARARs in Areas 1 and 2 was evaluated relative to the three criteria specified in *TI Guidance Document* (hydrogeologic factors, contaminant related factors and SCCC Site-specific implementation factors) along with two other site-specific criteria (land use considerations and exposure potential considerations). All criteria favor the decision to establish a TI Waiver for groundwater ARARs in Areas 1 and 2 as described below.

Hydrogeologic Factors - The varved clay surface is uneven and DNAPL likely migrated previously from the original source in Area 1 to current depressions in the varved clay surface located in Area 2. The varved clay conditions at the SCCC Site are favorable for limiting any further migration of free-phase DNAPL and dissolved plume; however, these same conditions hinder locating and removing DNAPL and dissolved COCs.

Contaminant-Related Factors - Remediation of groundwater to meet ARARs is technically impracticable due to the chemical and physical characteristics of DNAPL. The contaminant-related factors are:

- DCBs and naphthalene are denser than water, making it difficult to locate and remediate;
- A significant fraction of DNAPL will persist as non-recoverable residual DNAPL even after mass removal of free-phase DNAPL via passive recovery; and,
- DCBs and naphthalene are only partially soluble in water preventing complete mass removal via DNAPL dissolution in a reasonable timeframe.

The DCBs and naphthalene are recalcitrant due to multiple contaminant-specific characteristics including the following: high density, low absolute solubility, high soil-sorption coefficient, and low degradability. These contaminant-specific characteristics cause extraction or in situ technologies to be ineffective in reducing DNAPL mass and dissolved phase concentrations to MCLs.

Land Use Considerations – Regarding Area 1, currently the developer selected by the Town of Kearny is planning to construct an 850,000 square foot warehouse and distribution center on the SCCC property and adjacent Diamond Site. In addition, the current redevelopment plan for the portion of Area 1 on the HCIA property includes the construction of four new industrial warehouse buildings, totaling approximately 2.1 million square feet, along with paved parking lots, paved roads, and utility infrastructure. The installation and long term operation of active remedial systems designed to aggressively remove contaminant mass is incompatible with this planned future land use.

Regarding Area 2, DNAPL exists beneath the Belleville Turnpike which is a heavily travelled, multi-lane roadway which creates accessibility issues and physical constraints to remedy implementation. The installation and operation of an active remedial system within the limits of the highway is impracticable and unsafe due to the use of this area for vehicular traffic.

The active types of remedial operations (extraction, in situ treatment or containment) required to achieve ARARs are not practicable given the land use in Area 2. Recovery wells cannot be positioned where roadways exist. Road closures may be necessary for installation of recovery wells adjacent to the roadways. The topography in Area 2 is uneven and there are steep grades at some locations. Area 2 is surrounded by industrial sites, and groundwater within Area 2 or in the general vicinity of Area 2 is not currently, and will not be utilized within the foreseeable future, for drinking water.

Potential Exposure Considerations - Groundwater in the shallow and deep zones is not currently being used for any purpose in the vicinity of the Areas 1 and 2. The conclusion drawn from this evaluation is that the potential for exposure to impacted groundwater in the vicinity of Areas 1 and 2 is extremely remote. It is considered unlikely that any receptors (ecological or human) are at risk as a result of these impacts.

Evaluation of Restoration Potential - After consideration of published case studies, the NRC Report conclusions, and the information provided in Table 4-1, it is technically impracticable to obtain COC MCL standards in a reasonable timeframe. Considering the extent of DNAPL and possible remedial alternatives described in the FFS Report (KEY, June 2016) for Areas 1 and 2, the timeframe for groundwater restoration is estimated to be approximately150 years.

For all the reasons outlined herein a TI Waiver for the SCCC Site Areas 1 and 2 is appropriate and consistent with USEPA Guidance.

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TABLES

TABLE 3-1
2015 WELL GAUGING INFORMATION / DNAPL RECOVERY
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

September 24, 2015

Well	Depth Measurements[1]			TOC[2] Elevation (ft-msl)	Groundwater[3] Elevation (ft-msl)	DNAPL Thickness (feet)	DNAPL Recovery (gallons)
	Groundwater (feet)	DNAPL (feet)	Total (feet)				
Sand Unit Wells							
HC-PZ-9L	13.10	NP[4]	28.75	15.30	2.20	NP	NA[5]
HC-PZ-11L	8.44	NP	22.02	8.96	0.52	NP	NA
HC-PZ-13L	3.42	NP	16.22	4.77	1.35	NP	NA
SC-MW-16L	5.21	NP	19.81	8.02	2.81	NP	NA
MW-D-28	8.73	20.5	25.90	8.88	0.15	5.40	1
MW-D-35	6.52	NP	24.40	7.11	0.59	NP	NA
MW-D-37	NI[6]	NI	NI	NI	NI	NI	NI
MW-D-38	NI	NI	NI	NI	NI	NI	NI
MW-D-39	NI	NI	NI	NI	NI	NI	NI

October 23, 2015

Well	Depth Measurements[1]			TOC[2] Elevation (ft-msl)	Groundwater[3] Elevation (ft-msl)	DNAPL Thickness (feet)	DNAPL Recovery (gallons)
	Groundwater (feet)	DNAPL (feet)	Total (feet)				
Sand Unit Wells							
HC-PZ-9L	12.64	NP[4]	28.72	15.30	2.66	NP	NA
HC-PZ-11L	8.18	NP	22.02	8.96	0.78	NP	NA
HC-PZ-13L	3.22	NP	16.22	4.77	1.55	NP	NA
SC-MW-16L	5.11	NP	19.80	8.02	2.91	NP	NA
MW-D-28	8.50	19.62	25.89	8.88	0.38	4.80	1
MW-D-35	6.37	NP	24.39	7.11	0.74	NP	NA
MW-D-37	NI	NI	NI	NI	NI	NI	NI
MW-D-38	NI	NI	NI	NI	NI	NI	NI
MW-D-39	NI	NI	NI	NI	NI	NI	NI

November 3 & 4, 2015

Well	Depth Measurements[1]			TOC[2] Elevation (ft-msl)	Groundwater[3] Elevation (ft-msl)	DNAPL Thickness (feet)	DNAPL Recovery (gallons)
	Groundwater (feet)	DNAPL (feet)	Total (feet)				
Sand Unit Wells							
HC-PZ-9L	NM	NM	NM	15.30	NM	NM	NA
HC-PZ-11L	NM	NM	NM	8.96	NM	NM	NA
HC-PZ-13L	3.17	NP[4]	16.22	4.77	1.60	NP	NA
SC-MW-16L	NM	NM	NM	8.02	NM	NM	NA
MW-D-28	8.25	22.67	25.89	8.88	0.63	3.22	NR [7]
MW-D-35	6.30	NP	24.39	7.11	0.81	NP	NA
MW-D-37	14.30	31.46	31.69	15.13	0.83	0.23	NA
MW-D-38	5.30	NP	22.72	6.57	1.27	NP	NA
MW-D-39	3.80	NP	20.67	4.77	0.97	NP	NA

November 24, 2015

Well	Depth Measurements[1]			TOC[2] Elevation (ft-msl)	Groundwater[3] Elevation (ft-msl)	DNAPL Thickness (feet)	DNAPL Recovery (gallons)
	Groundwater (feet)	DNAPL (feet)	Total (feet)				
Sand Unit Wells							
HC-PZ-9L	12.42	NP[4]	28.70	15.30	2.88	NP	NA
HC-PZ-11L	8.06	NP	22.05	8.96	0.90	NP	NA
HC-PZ-13L	3.07	NP	16.18	4.77	1.70	NP	NA
SC-MW-16L	4.97	NP	19.82	8.02	3.05	NP	NA
MW-D-28	8.36	21.01	25.91	8.88	0.52	4.90	3
MW-D-35	6.19	NP	24.42	7.11	0.92	NP	NA
MW-D-37	14.18	31.3	31.70	15.13	0.95	0.40	NA
MW-D-38	5.52	NP	22.76	6.57	1.05	NP	NA
MW-D-39	3.72	NP	20.69	4.77	1.05	NP	NA

Notes:

1. Depth in feet to water, DNAPL, and bottom of well measured relative to top of casing
2. TOC - Top of Casing. Elevations are in feet above mean sea level relative to NAVD 88
3. Groundwater elevations are in feet above mean sea level relative to NAVD 88
4. NP - none present
5. NA - not applicable
6. NI - not installed, well not installed as of date
7. NR - not recovered

TABLE 3-2
AREA 2 - ANALYTICAL SOIL SAMPLE SUMMARY AND DNAPL OBSERVATIONS
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Boring No.	Depth	Stratum	DNAPL Observation	DNAPL Observation Depth Interval (ft)	Analytical Soil Sample Depth Interval (ft)	VOCs 8260C	SVOCs 8270D
D-28	0 - 7.7 ft	Fill	None				
	7.7 -16.75 ft	Meadow Mat	None				
	16.75 -18.7 ft	Sand	Free-Phase	18.5-18.7			
	18.7 - 24 ft	Varved Clay	None				
D-29	0 - 6.3 ft	Fill	None				
	6.3 -11.6 ft	Meadow Mat	None				
	11.6 -16 ft	Sand	Free-Phase	15.9-16.0			
	16 - 20 ft	Varved Clay	None				
D-30	0 - 8.5 ft	Fill	None				
	8.5 -13.5 ft	Meadow Mat	None				
	13.5 -15.4 ft	Sand	Residual	15.3-15.4	15-15.4	X	
	15.4 - 20 ft	Varved Clay	None				
D-31	0 - 1.8 ft	Fill	None				
	1.8 -11.3 ft	Meadow Mat	None				
	11.3 -14.75 ft	Sand	None		14.25-14.75	X	
	14.75 - 20 ft	Varved Clay	None				
D-32	0 - 19.9 ft	Fill	None				
	19.9 -22.1 ft	Meadow Mat	None				
	22.1 -26.15 ft	Sand	Free-Phase	25-26.15			
	26.15- 30 ft	Varved Clay	None				
D-33	0 - 12 ft	Fill	None				
	12 -16.2 ft	Meadow Mat	None				
	16.2 -20.1 ft	Sand	None		19.6-20.1	X	
	20.1 - 25 ft	Varved Clay	None				
D-34	0 - 7.7 ft	Fill	None				
	7.7 -14.6 ft	Meadow Mat	None				
	14.6 -17.3 ft	Sand*	Residual	17.2-17.3	16.8-17.3	X	
	17.3 - 20 ft	Varved Clay	None				
D-35	0 - 15.3 ft	Fill	None				
	15.3 -17.7 ft	Meadow Mat	None				
	17.7 -20.3 ft	Sand	None		20-20.3	X	
	20.3 - 25 ft	Varved Clay	None				
D-36	0 - 25.3 ft	Fill	None				
	25.3 - 30.3 ft	Meadow Mat	None				
	30.3 -34.2 ft	Sand	Free-Phase	33.5-34.2	33.5-34.2	X	
	34.2 - 35 ft	Varved Clay	None				
D-37	0 - 20.5 ft	Fill	None				
	20.5 -25.5 ft	Meadow Mat	None				
	25.5 -29.25 ft	Sand	Free-Phase**	28.75-29.25	28.75-29.25	X	
	29.25 - 34.5 ft	Varved Clay	None				
D-38	0 - 10.8 ft	Fill	Free-Phase**	10.3-10.8	10.3-10.8	X	X***
	10.8 -17 ft	Meadow Mat	None				
	17 -20 ft	Sand	None		19.5-20	X	
	20 - 29.5 ft	Varved Clay	None				
D-39	0 - 10.4 ft	Fill	None				
	10.4 -14 ft	Meadow Mat	None				
	14 -18.2 ft	Sand	None		17.7-18.2	X*	
	18.2 - 24.5 ft	Varved Clay	None				
D-40	0 - 18.9 ft	Fill	None				
	18.9 -23.8 ft	Meadow Mat	None				
	23.8 -26.4 ft	Sand	None		25.9-26.4	X	
	26.4 - 30 ft	Varved Clay	None				
D-41	0 - 11.8 ft	Fill	None				
	11.8 -16 ft	Meadow Mat	None				
	16 - 20.1 ft	Sand	None		19.6-20.1	X	
	20.1 - 25 ft	Varved Clay	None				
D-42	0 - 9.3 ft	Fill	None				
	9.3 -15.5 ft	Meadow Mat	None				
	15.5 -19 ft	Sand	Free-Phase	18.5-19	18.5-19	X	
	19 - 20 ft	Varved Clay	None				

* Field Duplicate Sample
** Free-Phase DNAPL has a coal tar or creosote like odor, thus, is not related to DNAPL observed on the SCCC Site
*** Free-Phase DNAPL has a coal tar or creosote like odor, thus, analyzed for SVOCs

TABLE 3-3
AREA 2 - SUBSURFACE SOIL ANALYTICAL RESULTS - VOC DICHLOROBENZENE ISOMERS
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

	Boring Number	D-30	D-31	D-33	D-34	D-34 Duplicate (D-32A 20-22)	D-35	D-36	D-37	D-38	D-38	D-39	D-39 Duplicate (D-32B 15-15.5)	D-40	D-41	D-42
	Ground Surface Elevation															
	Sample Interval	15-15.4	14.25-14.75	19.6-20.1	16.8-17.3	16.8-17.3	20-20.3	33.5-34.2	28.75-29.25	10.3-10.8	19.5-20.0	17.7-18.2	15-15.5	25.9-26.4	19.6-20.1	18.5-19
	Sample Elevation															
	Geologic Unit	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Fill	Sand	Sand	Sand	Sand	Sand	Sand
	Sample Date	07/06/15	06/30/15	07/08/15	07/10/15	07/10/15	07/13/15	07/13/15	10/20/15	10/22/15	10/22/15	10/23/15	10/22/15	10/26/15	10/27/15	10/27/15
Constituent	**Units**															
1,2-Dichlorobenzene	mg/kg	3000	4.6 J	560	5,500 J	1600 J	0.00023 J	19000	0.31	0.33 U	0.00013 U	0.00012 U	0.00011 U	6.0	70	24,000 J
1,3-Dichlorobenzene	mg/kg	3100	3.1 J	610	6,400 J	1900 J	0.00024 J	21000	0.31	0.50 U	0.00011 U	0.00010 U	0.000092 U	6.7	81	29,000 J
1,4-Dichlorobenzene	mg/kg	4400	4.8 J	760	7,700 J	2300 J	0.00038 J	26000	0.41	0.50 U	0.00012 U	0.00011 U	0.00010 U	9.0	99	34,000 J
Total Dichlorobenzenes	**mg/kg**	**10500**	**12.5**	**1,930**	**19,600**	**5800**	**0.00085**	**66000**	**1.03**	**0**	**0**	**0**	**0**	**21.7**	**250**	**87,000**

Notes:
J : Result is less than the RL but greater than or equal to the MDL. The concentration is an estimated value.
U : Indicates the analyte was analyzed for but not detected.

TABLE 3-4

AREA 1 DNAPL ANALYTICAL RESULTS - 2008
STANDARD CHLORINE CHEMICAL COMPANY INC. SITE
KEARNY, NEW JERSEY

Analyte	Units	Criterion [1]	SC-MW-3L 04/30/08 Primary		SC-MW-13L 04/30/08 Primary	
Polychlorinated Dioxins/Furans						
1,2,3,4,6,7,8-HpCDD	ug/kg	--	9.2		6000	U
1,2,3,4,6,7,8-HpCDF	ug/kg	--	1200	B	400000	
1,2,3,4,7,8,9-HpCDF	ug/kg	--	35		12000	U
1,2,3,4,7,8-HxCDD	ug/kg	--	0.83	QJ	890	U
1,2,3,4,7,8-HxCDF	ug/kg	--	310	QB	130000	
1,2,3,6,7,8-HxCDD	ug/kg	--	3	J	2300	U
1,2,3,6,7,8-HxCDF	ug/kg	--	63	QB	15000	J
1,2,3,7,8,9-HxCDD	ug/kg	--	1.6	QJ	1500	U
1,2,3,7,8,9-HxCDF	ug/kg	--	0.34	QJ	580	U
1,2,3,7,8-PCDD	ug/kg	--	1.7	QJ	1900	U
1,2,3,7,8-PCDF	ug/kg	--	8.7		2600	U
2,3,4,6,7,8-HxCDF	ug/kg	--	15		5100	U
2,3,4,7,8-PCDF	ug/kg	--	28	Q	16000	J
2,3,7,8-TCDD	ug/kg	--	0.55	QJ	210	U
2,3,7,8-TCDF	ug/kg	--	5.4	Q	13000	
OCDD	ug/kg	--	32	B	23000	U
OCDF	ug/kg	--	2100	B	880000	
Total HpCDD	ug/kg	--	23		6000	U
Total HpCDF	ug/kg	--	1300	B	430000	
Total HxCDD	ug/kg	--	24	Q	5600	U
Total HxCDF	ug/kg	--	770	QB	210000	
Total PeCDD	ug/kg	--	31	Q	7700	U
Total PeCDF	ug/kg	--	380	Q	70000	
Total TCDD	ug/kg	--	43	Q	20000	
Total TCDF	ug/kg	--	250	Q	34000	
Polychlorinated Dioxins/Furans (2,3,7,8 Equivalents)						
1,2,3,4,6,7,8-HpCDD	0.01	--	0.092		--	
1,2,3,4,6,7,8-HpCDF	0.01	--	12		4000	
1,2,3,4,7,8,9-HpCDF	0.01	--	0.35		--	
1,2,3,4,7,8-HxCDD	0.10	--	0.083		--	
1,2,3,4,7,8-HxCDF	0.10	--	31		13000	
1,2,3,6,7,8-HxCDD	0.10	--	0.3		--	
1,2,3,6,7,8-HxCDF	0.10	--	6.3		1500	
1,2,3,7,8,9-HxCDD	0.10	--	0.16		--	
1,2,3,7,8,9-HxCDF	0.10	--	0.034		--	
1,2,3,7,8-PCDD	1.00	--	1.7		--	
1,2,3,7,8-PCDF	0.05	--	0.435		--	
2,3,4,6,7,8-HxCDF	0.10	--	1.5		--	
2,3,4,7,8-PCDF	0.50	--	14		8000	
2,3,7,8-TCDD	1.00	--	0.55		--	
2,3,7,8-TCDF	0.10	--	0.54		1300	
OCDD	0.0001	--	0.0032		--	
OCDF	0.0001	--	0.21		88	
Total 2,3,7,8-TCDD Equivalents	mg/kg	2.20E-05	**6.9E-02**		**2.8E+01**	
Metals						
Chromium (Hexavalent)	mg/kg	6.3	2	U	2	U
Toxicity Characteristic Leaching Procedure [2]						
1,1-Dichloroethene	mg/L	0.7	58	U	58	U
1,2-Dichloroethane	mg/L	0.5	55	U	55	U
1,4-Dichlorobenzene	mg/L	7.5	**520000**		**6300**	J
2,4,5-Trichlorophenol	mg/L	400	970	U	970	U
2,4,6-Trichlorophenol	mg/L	2	700	U	700	U
2,4-Dinitrotoluene	mg/L	0.13	900	U	900	U
2-Butanone	mg/L	200	49	U	49	U

TABLE 3-4

AREA 1 DNAPL ANALYTICAL RESULTS - 2008
STANDARD CHLORINE CHEMICAL COMPANY INC. SITE
KEARNY, NEW JERSEY

Analyte	Units	Criterion [1]	SC-MW-3L 04/30/08 Primary		SC-MW-13L 04/30/08 Primary	
Toxicity Characteristic Leaching Procedure [2] (Continued)						
Benzene	mg/L	0.5	**110**	J	52	U
Carbon tetrachloride	mg/L	0.5	45	U	45	U
Chlorobenzene	mg/L	100	**8800**		**410**	
Chloroform	mg/L	6	53	U	53	U
Cresols	mg/L	200	43	J	**1400**	J
Hexachlorobenzene	mg/L	0.13	820	U	**12000**	
Hexachlorobutadiene	mg/L	0.5	1400	U	1400	U
Hexachloroethane	mg/L	3	1400	U	1400	U
Nitrobenzene	mg/L	2	940	U	940	U
Pentachlorophenol	mg/L	100	690	U	690	U
Pyridine	mg/L	5	510	U	510	U
Tetrachloroethene	mg/L	0.7	**120**	J	**220**	J
Trichloroethene	mg/L	0.5	56	U	**58**	J
Vinyl chloride	mg/L	0.2	56	U	56	U
Arsenic	mg/L	5	0.9	B	0.29	B
Barium	mg/L	100	0.18	B	0.19	B
Cadmium	mg/L	1	0.047	U	0.047	U
Chromium	mg/L	5	0.42	B	0.63	
Lead	mg/L	5	0.16	U	0.16	U
Mercury	mg/L	0.2	0.028	B	0.019	B
Selenium	mg/L	1	0.29	U	0.84	
Silver	mg/L	5	0.037	U	0.037	U
Polychlorinated Biphenyls (Aroclors)						
Aroclor 1016	mg/kg	1	0.74	U	**8600**	
Aroclor 1221	mg/kg	1	0.95	U	190	U
Aroclor 1232	mg/kg	1	0.86	U	170	U
Aroclor 1242	mg/kg	1	0.81	U	160	U
Aroclor 1248	mg/kg	1	0.47	U	**6000**	
Aroclor 1254	mg/kg	1	0.71	U	140	U
Aroclor 1260	mg/kg	1	0.71	U	**2100**	
Aroclor 1262	mg/kg	1	1.1	U	220	U
Aroclor 1268	mg/kg	1	0.64	U	**600**	J
RCRA Characteristics and Indicator Parameters						
Cyanide (Reactivity)	mg/kg	23000	0.42	B	0.44	B
Total Sulfide (Reactivity)	mg/kg	--	40		552	
Flashpoint (Ignitability)	^{o}F	>200	**151**		>200	
Corrosivity (pH)	SU	2<pH<12.5	4.8		2.9	
Total Organic Halogens	mg/kg	--	266000	J	258000	J

Notes:

1. USEPA Region 3 Screening Level (RSL) for industrial land use (November 2014).
   Target Risk = 1E-6, Target Hazard Quotient = 0.1. For compounds without criteria, values for similar compounds are presented.
2. Toxicity Characteristic Leaching Procedure limits as specified in 40 Code of Federal Regulations 261.24 - available at
   Exceedances are shown in bold, shaded typeface. Data qualifiers are as follows:
   B - Organic results. Analyte detected in associated method blank
   B - Inorganic results. Result is an estimate. Quantitation between the detection limit and the reporting limit.
   J - Organic results. Result is an estimate. Quantitated between the detection limit and the reporting limit.
   Q - One or more quality control criteria for identification not attained. Value is an Estimated Maximum Possible Concentration. Analyte may be present below the quantitation limit indicated.
   U - Not detected at the detection limit indicated.
   -- - Not analyzed or criteria unavailable.

TABLE 3-5
AREA 2 - DNAPL/SOIL ANALYTICAL RESULTS
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

PARAMETER	UNITS	MW-D-28 SITE-RELATED (DCB) DNAPL SAMPLE 11/4/2015	MW-D-37 NON-SITE RELATED DNAPL SAMPLE 11/4/2015	D-38 10.3-10.8 NON-SITE RELATED SOIL SAMPLE 10/22-26/2015
VOC				
1,2,3-Trichlorobenzene	mg/kg	560 J	50 U	53 U
1,2,4-Trichlorobenzene	mg/kg	4100	50 U	41 U
1,3-Dichlorobenzene	mg/kg	160000	54	50 U
1,4-Dichlorobenzene	mg/kg	220000	70	50 U
Benzene	mg/kg	280 J	54	2.0
Chlorobenzene	mg/kg	2100	12 J	36 U
Ethylbenzene	mg/kg	880 U	580	57
Isopropylbenzene	mg/kg	880 U	56	17
m,p-Xylenes	mg/kg	880 U	850	32
o-Xylene	mg/kg	880 U	370	35
Toluene	mg/kg	880 U	240	0.82 J
1,2-Dichlorobenzene	mg/kg	160000	49 J	33 U
SVOC				
1,1'-Biphenyl	mg/kg	49 U	5900	170 J
1,2,4,5-Tetrachlorobenzene	mg/kg	430	490 U	17 U
2-Methylnaphthalene	mg/kg	38 J	28000	870
Acenaphthene	mg/kg	49 U	25000	450
Acenaphthylene	mg/kg	49 U	1400	25 J
Anthracene	mg/kg	49 U	5600	250
Benzo(a)anthracene	mg/kg	49 U	4900	99
Benzo(a)pyrene	mg/kg	49 U	2100	38
Benzo(b)fluoranthene	mg/kg	49 U	3000	64
Benzo(g,h,i)perylene	mg/kg	49 U	730	23 J
Benzo(k)fluoranthene	mg/kg	49 U	1200	20 J
Carbazole	mg/kg	49 U	1900	21 J
Chrysene	mg/kg	49 U	4300	150 J
Dibenzofuran	mg/kg	49 U	17000	420
Fluoranthene	mg/kg	49 U	25000	590
Fluorene	mg/kg	49 U	17000	570
Indeno(1,2,3-cd)pyrene	mg/kg	49 U	820	28
Naphthalene	mg/kg	270	84000	2300
N-Nitrosodiphenylamine	mg/kg	49 U	260 J	21 U
Phenanthrene	mg/kg	37 J	52000	1900
Pyrene	mg/kg	49 U	22000	280
Diesel Range Organics (C10-C44)	mg/kg	320000	620000	----

Notes:
J : Result is less than the RL but greater than or equal to the MDL. The concentration is an estimated value.
U : Indicates the analyte was analyzed for but not detected.

TABLE 3-6
CONSTITUENT CHEMICAL AND PHYSICAL PROPERTIES
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Representative Constituents of Interest	Molecular Weight (g/mol)	Density (g/cm^3)	Solubility (mg/L)	Vapor Pressure (mmHg)	Organic Carbon Coefficient (K_{OC}) (L/kg)	Henry's Law Constant (none)
Chlorobenzene	1.13E+02	1.11E+00	4.98E+02	1.20E+01	2.34E+02	1.27E-01
1,2-Dichlorobenzene	1.47E+02	1.31E+00	1.56E+02	1.36E+00	3.83E+02	7.85E-02
1,3-Dichlorobenzene	1.47E+02	1.29E+00	1.25E+02	2.15E+00	3.75E+02	1.08E-01
1,4-Dichlorobenzene	1.47E+02	1.25E+00	8.13E+01	1.74E+00	3.75E+02	9.85E-02
1,2,4-Trichlorobenzene	1.81E+02	1.46E+00	4.90E+01	4.60E-01	1.36E+03	5.81E-02
Naphthalene	1.28E+02	1.03E+00	3.10E+01	8.50E-02	1.54E+03	1.80E-02

Physical property information obtained from the Oak Ridge National Laboratory Risk Assessment Information System. Available online at http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem_spef.

TABLE 3-7

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - FILL UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Analyte	Units	Criterion[1]	SC-MW-11U 04/24/08 Primary		SC-MW-12U 04/23/08 Primary		SC-MW-12U 04/23/08 Duplicate		SC-MW-14U 04/24/08 Primary		SC-MW-15U 04/23/08 Primary		SC-PZ-1U 04/23/08 Primary		SC-PZ-2U 04/23/08 Primary		SC-PZ-3U 04/23/08 Primary		SC-PZ-4U 04/25/08 Primary		SC-PZ-5U 04/24/08 Primary	
Volatile Organics																						
1,1,1-Trichloroethane	ug/L	200	32	U	0.79	U	0.79	U	40	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U
1,1,2,2-Tetrachloroethane	ug/L	0.076	25	U	0.63	U	0.63	U	31	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U
1,1,2-Trichloroethane	ug/L	5	32	U	0.79	U	0.79	U	40	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U
1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	--	49	U	1.2	U	1.2	U	62	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U
1,1-Dichloroethane	ug/L	5	41	U	1	U	1	U	51	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethene	ug/L	7	35	U	0.87	U	0.87	U	44	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U
1,2,4-Trichlorobenzene	ug/L	70	**5000**		0.42	U	1.2	J	**230**	J	0.42	U	0.42	U	0.89	J	0.42	U	4.1	J	11	
1,2-Dibromoethane	ug/L	0.05	26	U	0.64	U	0.64	U	32	U	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U
1,2-Dichlorobenzene	ug/L	600	**5200**		4	J	11		**7200**		0.84	J	0.65	U	10		4.5	J	4.2	J	3.4	J
1,2-Dichloroethane	ug/L	5	26	U	0.64	U	0.64	U	32	U	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U
1,2-Dichloropropane	ug/L	5	27	U	0.67	U	0.67	U	33	U	0.67	U	0.67	U	0.67	U	0.67	U	0.67	U	0.67	U
1,3-Dichlorobenzene	ug/L	600	**1100**		10		18		**5600**		2.6	J	0.66	U	3.4	J	0.66	U	2.6	J	0.66	U
1,4-Dichlorobenzene	ug/L	75	**1800**		35		55		**9000**		4.4	J	0.6	U	3.2	J	1	J	4.4	J	3.5	J
2-Butanone	ug/L	560	29	U	0.73	U	0.73	U	37	U	0.73	U	0.73	U	0.73	U	0.73	U	0.73	U	15	
2-Hexanone	ug/L	3.8	18	U	0.45	U	0.45	U	22	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
4-Methyl-2-pentanone	ug/L	120	19	U	0.46	U	0.46	U	23	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
Acetone	ug/L	1,400	200	U	5	U	5	U	250	U	5	U	5	U	17	J	5	U	5	U	63	
Benzene	ug/L	5	**36**	J	0.81	U	0.91	J	41	U	**85**		0.81	U	1.5	J	**10**		0.81	U	**15**	
Bromodichloromethane	ug/L	80	23	U	0.58	U	0.58	U	29	U	0.58	U	0.58	U	0.58	U	0.58	U	0.58	U	0.58	U
Bromoform	ug/L	80	15	U	0.37	U	0.37	U	18	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U
Bromomethane	ug/L	0.75	30	U	0.75	U	0.75	U	37	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U
Carbon disulfide	ug/L	81	43	U	1.1	U	1.1	U	54	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U
Carbon tetrachloride	ug/L	5	37	U	0.91	U	0.91	U	46	U	0.91	U	0.91	U	0.91	U	0.91	U	0.91	U	0.91	U
Chlorobenzene	ug/L	100	**450**		37		53		**490**		**320**		0.71	U	10		2.4	J	17		25	
Chloroethane	ug/L	2100	44	U	1.1	U	1.1	U	55	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U
Chloroform	ug/L	80	31	U	0.78	U	0.78	U	39	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U	0.78	U
Chloromethane	ug/L	19	35	U	0.87	U	0.87	U	44	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U	0.87	U
cis-1,2-Dichloroethene	ug/L	70	46	J	1	U	1	U	50	U	1	U	1	U	1	U	2.4	J	1	U	1	U
cis-1,3-Dichloropropene	ug/L	0.47	32	U	0.79	U	0.79	U	40	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U	0.79	U
Cyclohexane	ug/L	7	43	U	1.1	U	1.1	U	54	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U
Dibromochloropropane	ug/L	0.2	50	U	1.3	U	1.3	U	63	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U
Dibromochloromethane	ug/L	80	20	U	0.5	U	0.5	U	25	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Dichlorodifluoromethane	ug/L	20	42	U	1	U	1	U	**200**	J	1	U	1	U	1	U	1	U	1	U	1	U
Ethylbenzene	ug/L	700	23	U	0.58	U	1.1	J	29	U	0.58	U	0.58	U	0.58	U	10		0.58	U	0.58	U
Isopropylbenzene	ug/L	45	29	U	0.72	U	0.72	U	36	U	0.72	U	0.72	U	0.72	U	3.1	J	0.72	U	0.72	U
Methyl Acetate	ug/L	2000	19	U	0.47	U	0.47	U	23	U	0.47	U	0.47	U	0.47	U	0.47	U	0.47	U	0.47	U
Methylcyclohexane	ug/L	--	44	U	1.1	U	1.1	U	55	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U
Methylene chloride	ug/L	5	30	U	0.75	U	0.75	U	**46**	J	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U	0.75	U
Methyltert-butylether	ug/L	14	31	U	0.77	U	0.77	U	38	U	0.77	U	0.77	U	0.77	U	0.77	U	0.77	U	0.77	U
Styrene	ug/L	100	32	U	0.8	U	0.8	U	40	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Tetrachloroethylene	ug/L	5	**42**	J	0.57	U	0.57	U	28	U	0.57	U	0.57	U	0.57	U	0.57	U	0.67	J	0.57	U
Toluene	ug/L	1000	32	U	0.8	U	0.94	J	40	U	0.8	U	0.8	U	0.8	U	2.9	JB	0.8	U	1.6	J
trans-1,2-Dichloroethene	ug/L	100	36	U	0.9	U	0.9	U	45	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U
trans-1,3-Dichloropropene	ug/L	0.47	23	U	0.57	U	0.57	U	28	U	0.57	U	0.57	U	0.57	U	0.57	U	0.57	U	0.57	U
Trichloroethylene	ug/L	5	35	U	0.88	U	0.88	U	44	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U	0.88	U
Trichlorofluoromethane	ug/L	110	32	U	0.8	U	0.8	U	40	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Vinyl chloride	ug/L	2	38	U	0.94	U	0.94	U	47	U	0.94	U	0.94	U	0.94	U	0.94	U	0.94	U	0.94	U
Xylene (total)	ug/L	10000	98	U	2.4	U	2.9	J	120	U	2.4	U	2.4	U	2.4	U	39		2.4	U	2.4	U

TABLE 3-7

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - FILL UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Analyte	Units	Criterion[1]	SC-MW-11U 04/24/08 Primary		SC-MW-12U 04/23/08 Primary		SC-MW-12U 04/23/08 Duplicate		SC-MW-14U 04/24/08 Primary		SC-MW-15U 04/23/08 Primary		SC-PZ-1U 04/23/08 Primary		SC-PZ-2U 04/23/08 Primary		SC-PZ-3U 04/23/08 Primary		SC-PZ-4U 04/25/08 Primary		SC-PZ-5U 04/24/08 Primary	
Semivolatile Organics																						
1,1'-Biphenyl	ug/L	0.083	**33**		**1.2**	J	**5.6**	J	**3.2**	J	0.63	U	0.75	U	0.64	U	**28**		0.69	U	0.73	U
1,2,4-Trichlorobenzene	ug/L	4.5	NA		NA		NA		NA		NA		NA		NA		3.1		NA		NA	
1,4-Dichlorobenzene	ug/L	75	NA		NA		NA		NA		NA		NA		NA		2.4		NA		NA	
2,2'-oxybis(1-chloropropane)	ug/L	--	0.29	U	0.3	U	0.28	U	0.29	U	0.27	U	0.32	U	0.27	U	0.28	U	0.3	U	0.32	U
2,4,5-Trichlorophenol	ug/L	120	37		0.71	U	0.68	U	0.69	U	0.66	U	0.78	U	0.66	U	0.68	U	0.72	U	0.76	U
2,4,6-Trichlorophenol	ug/L	120	11		0.65	U	0.62	U	0.63	U	0.6	U	0.71	U	0.6	U	0.62	U	0.65	U	0.69	U
2,4-Dichlorophenol	ug/L	4.6	**46**		1.4	J	1.1	J	0.54	U	0.51	U	0.61	U	0.51	U	0.53	U	0.56	U	0.59	U
2,4-Dimethylphenol	ug/L	36	**99**		12		29		7.8	J	6.9	J	0.65	U	3.3	J	12		9.8	J	13	
2,4-Dinitrophenol	ug/L	3.9	14	U	15	U	14	U	14	U	13	U	16	U	14	U	14	U	15	U	16	U
2,4-Dinitrotoluene	ug/L	0.24	0.5	U	0.51	U	0.49	U	0.5	U	0.47	U	0.56	U	0.48	U	0.49	U	0.52	U	0.55	U
2,6-Dinitrotoluene	ug/L	0.048	0.56	U	0.58	U	0.55	U	0.56	U	0.53	U	0.64	U	0.54	U	0.55	U	0.58	U	0.62	U
2-Chloronaphthalene	ug/L	75	0.49	U	0.5	U	0.48	U	0.49	U	0.46	U	0.55	U	0.47	U	0.48	U	0.51	U	0.54	U
2-Chlorophenol	ug/L	9.1	0.5	U	0.52	U	0.49	U	0.5	U	0.48	U	0.57	U	0.48	U	0.49	U	0.52	U	0.55	U
2-Methylnaphthalene	ug/L	3.6	**260**		0.69	J	**14**		3.6	J	0.49	U	0.59	U	1.2	J	**590**		1.4	J	**4.3**	J
2-Methylphenol	ug/L	9	**49**		3.5	J	**14**		3.5	J	7.6	J	0.64	U	1.1	J	7.4	J	**11**	J	**110**	
2-Nitroaniline	ug/L	19	0.52	U	0.54	U	0.52	U	0.53	U	0.5	U	0.59	U	0.5	U	0.52	U	0.55	U	0.58	U
2-Nitrophenol	ug/L	--	0.59	U	0.62	U	0.59	U	0.6	U	0.57	U	0.68	U	0.57	U	0.59	U	0.62	U	3.4	J
3,3-Dichlorobenzidine	ug/L	0.12	0.45	U	0.47	U	0.45	U	0.45	U	0.43	U	0.51	U	0.43	U	0.45	U	0.47	U	0.5	U
3-Nitroaniline	ug/L	--	0.44	U	0.46	U	0.44	U	0.45	U	0.42	U	0.5	U	0.43	U	0.44	U	0.46	U	0.49	U
4,6-Dinitro-2-methylphenol	ug/L	0.15	16	U	16	U	15	U	16	U	15	U	18	U	15	U	15	U	16	U	17	U
4-Bromophenylphenyl ether	ug/L	--	0.55	U	0.56	U	0.54	U	0.55	U	0.52	U	0.62	U	0.53	U	0.54	U	0.57	U	0.6	U
4-Chloroaniline	ug/L	0.36	0.51	U	0.53	U	0.5	U	0.51	U	0.49	U	0.58	U	0.49	U	0.5	U	0.53	U	0.56	U
4-Chlorophenyl phenyl ether	ug/L	--	0.47	U	0.49	U	0.46	U	0.47	U	0.45	U	0.53	U	0.45	U	0.46	U	0.49	U	0.52	U
4-Chloro-3-methylphenol	ug/L	140	0.65	U	0.67	U	0.64	U	0.66	U	0.62	U	0.74	U	0.63	U	0.64	U	0.68	U	0.72	U
4-Methylphenol	ug/L	190	140		16		63		8.9	J	31		0.92	U	3.3	J	18		23		**810**	
4-Nitroaniline	ug/L	3.8	0.28	U	0.29	U	0.28	U	0.28	U	0.27	U	0.32	U	0.27	U	0.28	U	0.29	U	0.31	U
4-Nitrophenol	ug/L	--	0.77	U	0.8	U	0.76	U	0.78	U	0.74	U	0.88	U	0.74	U	0.76	U	0.81	U	0.86	U
Acenaphthene	ug/L	53	30		3.4	J	13		**97**		6.1	J	0.65	U	1.2	J	**61**		5.6	J	0.64	U
Acenaphthylene	ug/L	180	0.51	U	0.59	J	0.5	U	1.6	J	0.49	U	0.58	U	0.49	U	0.5	U	0.85	J	0.56	U
Acetophenone	ug/L	190	2.4	J	0.53	U	0.58	J	0.51	U	0.49	U	0.58	U	0.49	U	0.5	U	0.53	U	1.6	J
Anthracene	ug/L	180	20		0.66	J	1.2	J	1.3	J	0.53	U	0.63	U	0.54	U	1.4	J	1	J	0.62	U
Atrazine	ug/L	3	0.43	U	0.44	U	0.42	U	0.43	U	0.41	U	0.49	U	0.41	U	0.42	U	0.45	U	0.48	U
Benzaldehyde	ug/L	--	0.6	U	0.62	U	0.59	U	0.6	U	0.57	U	0.68	U	0.57	U	0.59	U	0.62	U	3.4	J
Benzo(a)anthracene	ug/L	0.034	**1.6**	J	0.47	U	0.45	U	0.46	U	0.43	U	0.51	U	0.44	U	0.45	U	**2.3**	J	0.5	U
Benzo(a)pyrene	ug/L	0.2	**0.72**	J	0.5	U	0.48	U	0.49	U	0.46	U	0.55	U	0.46	U	0.48	U	**2.2**	J	0.53	U
Benzo(b)fluoranthene	ug/L	0.034	**1.1**	J	0.36	U	0.34	U	0.35	U	0.33	U	0.39	U	0.33	U	0.34	U	**3.8**	J	0.38	U
Benzo(ghi)perylene	ug/L	180	0.3	U	0.31	U	0.3	U	0.3	U	0.29	U	0.34	U	0.29	U	0.3	U	1.9	J	0.34	U
Benzo(k)fluoranthene	ug/L	0.34	**0.53**	J	0.45	U	0.43	U	0.44	U	0.41	U	0.49	U	0.42	U	0.43	U	0.45	U	0.48	U
Bis(2-chloroethoxy)methane	ug/L	5.9	1.3	U	1.4	U	1.3	U	1.4	U	1.3	U	1.5	U	1.3	U	1.3	U	1.4	U	1.5	U
Bis(2-chloroethyl)ether	ug/L	0.014	0.51	U	0.52	U	0.5	U	0.51	U	0.48	U	0.58	U	0.49	U	0.5	U	0.53	U	0.56	U
Bis(2-ethylhexyl)phthalate	ug/L	6	1.4	J	1.5	J	2.6	J	1.7	J	1.3	U	1.5	J	2.6	J	1.8	J	1.4	U	2.1	J
Butyl benzyl phthalate	ug/L	1300	1.5	U	1.6	U	1.5	U	1.5	J	1.4	U	1.7	U	1.5	U	1.5	U	1.6	U	1.7	U
Caprolactam	ug/L	990	2.1	U	3.8	J	6.3	J	2.1	U	2	U	3.2	J	5	J	3.6	J	2.2	U	2.3	U
Carbazole	ug/L	80	5.7	J	0.6	U	2.6	J	2.1	J	0.55	U	0.65	U	0.55	U	2.4	J	0.6	U	0.64	U
Chrysene	ug/L	3.4	1.2	J	0.41	U	0.39	U	0.5	J	0.37	U	0.44	U	0.38	U	0.39	U	2.1	J	0.43	U
Dibenzo(a,h)anthracene	ug/L	0.0034	0.38	U	0.4	U	0.38	U	0.39	U	0.37	U	0.44	U	0.37	U	0.38	U	0.4	U	0.43	U
Dibenzofuran	ug/L	0.79	**51**		**3**	J	**11**		**46**		0.56	U	0.67	U	0.57	U	**20**		0.61	U	0.65	U
Diethyl phthalate	ug/L	1500	2.7	U	2.8	U	2.7	U	2.7	U	2.6	U	3	U	2.6	U	2.7	U	2.8	U	3	U

TABLE 3-7

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - FILL UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Analyte	Units	Criterion[1]	SC-MW-11U 04/24/08 Primary		SC-MW-12U 04/23/08 Primary		SC-MW-12U 04/23/08 Duplicate		SC-MW-14U 04/24/08 Primary		SC-MW-15U 04/23/08 Primary		SC-PZ-1U 04/23/08 Primary		SC-PZ-2U 04/23/08 Primary		SC-PZ-3U 04/23/08 Primary		SC-PZ-4U 04/25/08 Primary		SC-PZ-5U 04/24/08 Primary	
Semivolatile Organics (Continued)																						
Dimethyl phthalate	ug/L	--	0.46	U	0.48	U	0.46	U	0.47	U	0.44	U	0.53	U	0.45	U	0.46	U	0.49	U	0.52	U
Di-n-butyl phthalate	ug/L	90	0.51	U	0.53	U	0.51	U	0.51	U	0.49	U	0.58	U	0.49	U	0.51	U	0.53	U	0.57	U
Di-n-octyl phthalate	ug/L	20	0.47	U	0.49	U	0.46	U	0.47	U	0.45	U	0.53	U	0.45	U	0.46	U	0.49	U	0.52	U
Fluoranthene	ug/L	80	6.8	J	1.1	J	1.6	J	2	J	0.71	J	0.62	U	0.52	U	0.54	U	3.8	J	0.6	U
Fluorene	ug/L	29	**31**		2.1	J	6.9	J	23		3.9	J	0.68	U	0.57	U	10	J	0.62	U	0.66	U
Hexachlorobenzene	ug/L	1	0.48	U	0.5	U	0.47	U	0.48	U	0.46	U	0.54	U	0.46	U	0.47	U	0.5	U	0.53	U
Hexachlorobutadiene	ug/L	0.3	0.41	U	0.43	U	0.41	U	0.42	U	0.39	U	0.47	U	0.4	U	0.41	U	0.43	U	0.46	U
Hexachlorocyclopentadiene	ug/L	50	0.88	U	0.91	U	0.87	U	0.89	U	0.84	U	1	U	0.85	U	0.87	U	0.92	U	0.98	U
Hexachloroethane	ug/L	0.69	0.48	U	0.5	U	0.47	U	0.48	U	0.46	U	0.54	U	0.46	U	0.47	U	0.5	U	0.53	U
Indeno(1,2,3-cd)pyrene	ug/L	0.034	0.52	U	0.54	U	0.52	U	0.53	U	0.5	U	0.59	U	0.5	U	0.52	U	**1.7**	J	0.58	U
Isophorone	ug/L	78	0.52	U	0.54	U	0.52	U	0.53	U	0.5	U	0.59	U	0.5	U	0.52	U	0.54	U	0.58	U
Naphthalene	ug/L	0.17	**14000**		**6.2**	J	**310**		**740**		0.45	U	0.54	U	**2.1**	J	**5000**		**21**		**50**	
Nitrobenzene	ug/L	0.14	0.7	U	0.73	U	0.7	U	0.71	U	0.67	U	0.8	U	0.68	U	0.7	U	0.74	U	0.78	U
N-Nitrosodiphenylamine	ug/L	12	0.54	U	0.56	U	0.53	U	0.54	U	0.51	U	0.61	U	0.52	U	0.53	U	0.56	U	0.6	U
N-Nitrosodipropylamine	ug/L	0.011	0.65	U	0.68	U	0.65	U	0.66	U	0.62	U	0.74	U	0.63	U	0.65	U	0.68	U	0.73	U
Pentachlorophenol	ug/L	1	**10**	J	0.95	U	0.9	U	0.92	U	0.87	U	1	U	0.88	U	0.9	U	0.95	U	1	U
Phenanthrene	ug/L	180	39		1	J	6.2	J	11		0.81	J	0.69	U	1.1	J	5.2	J	1.4	J	0.67	U
Phenol	ug/L	580	49		5.1	J	36		5.1	J	39		0.28	U	6.9	J	5.8	J	29		**870**	
Pyrene	ug/L	12	3.6	J	0.77	J	1.2	J	1.2	J	0.59	U	0.71	U	0.6	U	0.62	U	2.9	J	0.69	U
Metals																						
Aluminum	ug/L	2000	1130		40.3	B	27	B	191	B	55	B	1160		1750		136	B	**2910**	J	189	B
Antimony	ug/L	6	**34**		2.9	U	2.9	U	2.9	U	4.4	B	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U
Arsenic	ug/L	10	9.5	B	2.2	U	2.2	U	2.2	U	2.2	U	3	B	2.2	U	**16**		2.2	U	2.2	U
Barium	ug/L	2000	524	J	19.2	BJ	17.1	B	28	B	352	J	280	J	149	BJ	50.7	BJ	12.3	B	1080	J
Beryllium	ug/L	4	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U	0.32	U
Cadmium	ug/L	5	0.38	B	0.23	U	0.23	U	0.23	U	0.23	U	0.67	B	0.23	U	0.23	U	2	B	0.23	U
Calcium	ug/L	--	35200	J	45700	J	53000	J	85900	J	103000	J	63800	J	289000	J	10500	J	74500	J	546000	J
Chromium (Total)	ug/L	2200	396		32.6		6.4		427		3.1	B	119		**4690**		142		**3650**		2090	
Chromium (Hexavalent)	ug/L	0.035	50	U	10	U	10	U	10	U	10	U	250	U	**4070**		10	U	**453**		**1650**	
Cobalt	ug/L	0.6	**3.3**	B	**0.74**	B	0.7	U	**1.8**	B	0.7	U	**2.8**	B	0.7	U	0.7	U	**6.6**	B	**2.5**	B
Copper	ug/L	1300	58.5		2.5	B	1.4	B	2.9	B	1.3	B	25.8		1.2	B	1.9	B	12.6	B	19.1	B
Iron	ug/L	1400	**4280**		673		275		475		**7950**		**46100**		33.4	B	**1720**		**6550**		833	
Lead	ug/L	15	**550**		2.4	U	2.4	U	11.9		**37.7**		3.2		2.4	U	2.4	U	**15.5**		10	
Magnesium	ug/L	--	97600	J	30300	J	18100	J	150000	J	19900	J	15500	J	73	BJ	11000	J	17400	J	2810	B
Manganese	ug/L	43	37.7		35		23.1		**119**		**514**		**701**		0.32	U	24.2		**71**		10.4	B
Mercury	ug/L	2	**17.5**		0.055	U	0.055	U	0.19	B	0.055	U	0.076	B	0.055	U	0.12	B	0.11	B	0.055	U
Nickel	ug/L	390	28	B	1.2	B	1.4	B	3.2	B	1.5	B	17.7	B	1.7	B	2.4	B	31.7	B	5.2	B
Potassium	ug/L	--	4880	B	2410	B	2100	B	6580		12900		3760	B	1140	B	14100		2210	B	944	B
Selenium	ug/L	50	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
Silver	ug/L	9.4	0.72	B	0.59	U	0.59	U	0.96	B	0.59	U	0.59	U	0.64	B	0.59	U	0.89	B	0.59	U
Sodium	ug/L	--	78300		36600		37600		68700		45300		113000		27000		195000		8780		82100	
Thallium	ug/L	2	3.1	U	**4.8**	BJ	3.1	U	3.1	U	3.1	U	**3.6**	BJ	3.1	U	3.1	U	3.1	U	3.1	U
Vanadium[3]	ug/L	8.6	**48.6**	B	4.8	BJ	1	U	**11.2**	B	1.3	BJ	**48.7**	BJ	1	U	**9.9**	BJ	**135**		1	U
Zinc	ug/L	600	32.4		1.3	U	1.3	U	5	B	1.3	U	**1940**		107		108		**5350**		**2430**	

TABLE 3-7

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - FILL UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Analyte	Units	Criterion[1]	SC-MW-11U 04/24/08 Primary		SC-MW-12U 04/23/08 Primary		SC-MW-12U 04/23/08 Duplicate		SC-MW-14U 04/24/08 Primary		SC-MW-15U 04/23/08 Primary		SC-PZ-1U 04/23/08 Primary		SC-PZ-2U 04/23/08 Primary		SC-PZ-3U 04/23/08 Primary		SC-PZ-4U 04/25/08 Primary		SC-PZ-5U 04/24/08 Primary	
PCBs																						
Aroclor 1016	ug/L	0.14	**1.3**		0.11	U	0.11	U	0.1	U	0.11	U	0.12	U	0.11	U	0.11	U	0.1	U	0.1	U
Aroclor 1221	ug/L	0.0046	0.1	U	0.11	U	0.11	U	0.1	U	0.11	U	0.12	U	0.11	U	0.11	U	0.1	U	0.1	U
Aroclor 1232	ug/L	0.0046	0.12	U	0.13	U	0.13	U	0.12	U	0.13	U	0.14	U	0.13	U	0.13	U	0.12	U	0.12	U
Aroclor 1242	ug/L	0.039	0.077	U	0.085	U	0.083	U	0.077	U	0.08	U	0.091	U	0.082	U	0.081	U	0.077	U	0.077	U
Aroclor 1248	ug/L	0.039	0.094	U	0.1	U	0.1	U	0.095	U	0.098	U	0.11	U	0.1	U	0.099	U	0.095	U	0.094	U
Aroclor 1254	ug/L	0.039	0.094	U	0.1	U	0.1	U	0.095	U	0.099	U	0.11	U	0.1	U	0.1	U	0.095	U	0.094	U
Aroclor 1260	ug/L	0.039	0.056	U	0.062	U	0.061	U	0.056	U	0.059	U	0.066	U	0.06	U	0.059	U	0.056	U	0.056	U
Aroclor 1262	ug/L	0.039	0.085	U	0.094	U	0.092	U	0.086	U	0.089	U	0.1	U	0.091	U	0.09	U	0.086	U	0.085	U
Aroclor 1268	ug/L	0.039	0.11	U	0.12	U	0.12	U	0.11	U	0.12	U	0.13	U	0.12	U	0.12	U	0.11	U	0.11	U
Pesticides																						
4,4'-DDD	ug/L	0.031	0.008	U	0.0088	U	0.0086	U	0.008	U	0.0083	U	0.0094	U	0.0085	U	0.0084	U	0.008	U	0.0094	J
4,4'-DDE	ug/L	0.23	0.015	J	0.0077	U	0.0076	U	0.012	J	0.0073	U	0.0083	U	0.0074	U	0.0074	U	0.007	U	0.007	U
4,4'-DDT	ug/L	0.23	0.014	U	0.016	U	0.015	U	0.014	U	0.015	U	0.017	U	0.015	U	0.015	U	0.014	U	0.014	U
Aldrin	ug/L	0.0046	0.011	U	0.013	U	**0.038**	J	0.012	U	0.012	U	0.014	U	0.012	U	0.012	U	0.012	U	0.011	U
alpha-BHC	ug/L	0.0071	0.016	U	0.017	U	0.017	U	0.016	U	0.016	U	0.018	U	0.017	U	0.017	U	0.016	U	0.016	U
alpha-Chlordane	ug/L	2	0.012	U	0.013	U	0.013	U	0.012	U	0.012	U	0.014	U	0.012	U	0.012	U	0.012	U	0.012	U
beta-BHC	ug/L	0.025	0.015	U	0.017	U	0.016	U	0.015	U	0.016	U	0.018	U	0.016	U	0.016	U	0.015	U	0.015	U
delta-BHC	ug/L	--	0.0097	U	0.011	U	0.011	U	0.0098	U	0.01	U	0.012	U	0.01	U	0.01	U	0.0098	U	0.0097	U
Dieldrin	ug/L	0.0017	0.0082	U	0.0091	U	0.009	U	0.0083	U	0.0086	U	0.0098	U	0.0088	U	0.0087	U	0.0083	U	0.0082	U
Endosulfan I	ug/L	10	0.019	J	0.0085	U	0.0083	U	0.0077	U	0.008	U	0.009	U	0.0082	U	0.0081	U	0.0077	U	0.0076	U
Endosulfan II	ug/L	10	0.016	U	0.017	U	0.017	U	0.016	U	0.016	U	0.018	U	0.017	U	0.016	U	0.016	U	0.016	U
Endosulfan sulfate	ug/L	10	0.016	U	0.018	U	0.018	U	0.017	U	0.017	U	0.019	U	0.018	U	0.017	U	0.017	U	0.016	U
Endrin	ug/L	2	0.015	J	0.0087	U	0.0085	U	0.0079	U	0.0082	U	0.0093	U	0.0084	U	0.0083	U	0.0079	U	0.0079	U
Endrin aldehyde	ug/L	--	0.012	U	0.014	U	0.013	U	0.013	U	0.013	U	0.015	U	0.013	U	0.013	U	0.013	U	0.012	U
Endrin ketone	ug/L	--	0.01	U	0.011	U	0.011	U	0.01	U	0.011	U	0.012	U	0.011	U	0.011	U	0.01	U	0.01	U
gamma-Chlordane	ug/L	2	0.074		0.0086	U	0.0085	U	0.0079	U	0.0082	U	0.0092	U	0.0083	U	0.0082	U	0.0079	U	0.0078	U
Heptachlor	ug/L	0.4	0.038	J	0.016	U	0.016	U	0.014	U	0.015	U	0.017	U	0.015	U	0.015	U	0.014	U	0.014	U
Heptachlor epoxide	ug/L	0.2	0.022	J	0.011	U	0.011	U	0.01	U	0.011	U	0.012	U	0.011	U	0.011	U	0.01	U	0.01	U
Lindane	ug/L	0.2	**0.46**		0.017	U	0.047	J	0.028	J	0.016	U	0.018	U	0.078		0.017	U	0.016	U	0.016	U
Methoxychlor	ug/L	40	0.019	U	0.021	U	0.02	U	0.019	U	0.02	U	0.022	U	0.02	U	0.02	U	0.019	U	0.019	U
Toxaphene	ug/L	3	0.42	U	0.47	U	0.46	U	0.43	U	0.44	U	0.5	U	0.45	U	0.45	U	0.43	U	0.42	U
Indicators																						
Biological Oxygen Demand (BOD)	mg/L	--	34.6		63.6		NA		19.3		16.4		7.8		5	U	21.4		5	U	21.7	
Carbon	mg/L	--	21.2	J	46.6	J	NA		31.4	J	6	J	0.48	BJ	3.9	J	9	J	2.1	J	17.5	J
Chemical Oxygen Demand (COD)	mg/L	--	86.5		156		NA		224		7.6	B	3.4	U	5.9	B	31.8		7.2	B	36.8	
Oil & Grease (HEM)	mg/L	--	0.54	U	0.51	U	NA		0.54	U	0.52	U	0.52	U	0.51	U	0.51	U	0.54	U	5.3	
Residue, filterable	mg/L	--	780		424		NA		944		413		527		684		525		91		1300	
Residue, non-filterable	mg/L	--	129		4	U	NA		9.2		19.6		163		4	U	6		58.8		64.8	
Total Alkalinity	mg/L	--	359	J	73	J	NA		595	J	437	J	447	J	742	J	365	J	86	J	1420	J

Notes:

1. USEPA Regional Screening Levels for Tapwater (November 2014). Risk-based value presented unless an MCL is available. For compounds without criteria, values for similar compounds are presented.

Exceedances are shown in bold, shaded typeface.
NA - Not analyzed in this fraction
Data qualifiers are as follows:

B - Inorganic results. Result is an estimate. Quantitation between the detection limit and the reporting limit.
J - Organic results. Result is an estimate. Quantitated between the detection limit and the reporting limit.
J - Inorganic results. Result is an estimated concentration. Quantitated below the reporting limit.
U - Not detected at the detection limit indicated.
-- - Not analyzed or criteria unavailable.

TABLE 3-8

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - DEEP SAND UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Constituent of Interest	Units	Criterion[1]	SC-MW-12L 04/25/08 Primary		SC-MW-13L 04/25/08 Primary		SC-MW-14L 04/24/08 Primary		SC-MW-15L 04/24/08 Primary		SC-MW-2L 04/24/08 Primary		SC-MW-3L 04/24/08 Primary		SC-MW-4L 04/24/08 Primary		SC-MW-8L 04/24/08 Primary	
Volatile Organics																		
1,1,1-Trichloroethane	ug/L	200	79	U	20	U	20	U	200	U	79	U	200	U	79	U	79	U
1,1,2,2-Tetrachloroethane	ug/L	0.076	63	U	16	U	16	U	160	U	63	U	160	U	63	U	63	U
1,1,2-Trichloroethane	ug/L	5	79	U	20	U	20	U	200	U	79	U	200	U	79	U	79	U
1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	--	120	U	31	U	31	U	310	U	120	U	310	U	120	U	120	U
1,1-Dichloroethane	ug/L	5	100	U	25	U	25	U	250	U	100	U	250	U	100	U	100	U
1,1-Dichloroethene	ug/L	7	87	U	22	U	22	U	220	U	87	U	220	U	87	U	87	U
1,2,4-Trichlorobenzene	ug/L	70	**4200**		**2400**		**3400**		**440**	J	**840**		**1700**		**400**	J	**6700**	
1,2-Dibromoethane	ug/L	0.05	64	U	16	U	16	U	160	U	64	U	160	U	64	U	64	U
1,2-Dichlorobenzene	ug/L	600	**12000**		**700**		**5300**		**36000**		**12000**		**29000**		**9300**		**10000**	
1,2-Dichloroethane	ug/L	5	64	U	16	U	16	U	160	U	64	U	160	U	64	U	64	U
1,2-Dichloropropane	ug/L	5	67	U	17	U	17	U	170	U	67	U	170	U	67	U	67	U
1,3-Dichlorobenzene	ug/L	600	**4600**		160		**1900**		**26000**		**9700**		**20000**		**9000**		**3700**	
1,4-Dichlorobenzene	ug/L	75	**6200**		**380**		**2400**		**42000**		**15000**		**32000**		**13000**		**4900**	
2-Butanone	ug/L	560	73	U	18	U	18	U	180	U	73	U	180	U	73	U	73	U
2-Hexanone	ug/L	3.8	45	U	11	U	11	U	110	U	45	U	110	U	45	U	45	U
4-Methyl-2-pentanone	ug/L	120	46	U	12	U	12	U	120	U	46	U	120	U	46	U	46	U
Acetone	ug/L	1,400	500	U	280	J	120	U	1200	U	500	U	1200	U	500	U	500	U
Benzene	ug/L	5	**280**	J	20	U	**150**		**350**	J	81	U	200	U	**380**	J	**270**	J
Bromodichloromethane	ug/L	80	58	U	15	U	15	U	150	U	58	U	150	U	58	U	58	U
Bromoform	ug/L	80	37	U	9.2	U	9.2	U	92	U	37	U	92	U	37	U	37	U
Bromomethane	ug/L	0.75	75	U	19	U	19	U	190	U	75	U	190	U	75	U	75	U
Carbon disulfide	ug/L	81	110	U	27	U	27	U	270	U	110	U	270	U	110	U	110	U
Carbon tetrachloride	ug/L	5	91	U	23	U	23	U	230	U	91	U	230	U	91	U	91	U
Chlorobenzene	ug/L	100	**770**		33	J	**920**		**7800**		**730**		**1700**		**440**	J	**1700**	
Chloroethane	ug/L	2100	110	U	28	U	28	U	280	U	110	U	280	U	110	U	110	U
Chloroform	ug/L	80	78	U	19	U	19	U	190	U	78	U	190	U	78	U	78	U
Chloromethane	ug/L	19	87	U	22	U	22	U	220	U	87	U	220	U	87	U	87	U
cis-1,2-Dichloroethene	ug/L	70	100	U	25	U	34	J	250	U	100	U	250	U	100	U	100	U
cis-1,3-Dichloropropene	ug/L	0.47	79	U	20	U	20	U	200	U	79	U	200	U	79	U	79	U
Cyclohexane	ug/L	7	110	U	27	U	27	U	270	U	110	U	270	U	110	U	110	U
Dibromochloropropane	ug/L	0.2	130	U	31	U	31	U	310	U	130	U	310	U	130	U	130	U
Dibromochloromethane	ug/L	80	50	U	12	U	12	U	120	U	50	U	120	U	50	U	50	U
Dichlorodifluoromethane	ug/L	20	100	U	26	U	26	U	260	U	**410**	J	**370**	J	100	U	100	U
Ethylbenzene	ug/L	700	150	J	15	U	15	U	150	U	58	U	150	U	260	J	58	U
Isopropylbenzene	ug/L	45	72	U	18	U	18	U	180	U	72	U	180	U	72	U	72	U
Methyl Acetate	ug/L	2000	47	U	12	U	12	U	120	U	47	U	120	U	47	U	47	U
Methylcyclohexane	ug/L	--	110	U	27	U	27	U	270	U	110	U	270	U	110	U	110	U
Methylene chloride	ug/L	5	75	U	19	U	19	U	190	U	75	U	190	U	75	U	**150**	J
Methyltert-butylether	ug/L	14	77	U	19	U	19	U	190	U	77	U	190	U	77	U	77	U
Styrene	ug/L	100	80	U	20	U	20	U	200	U	80	U	200	U	80	U	80	U
Tetrachloroethylene	ug/L	5	57	U	14	U	**340**		140	U	57	U	140	U	57	U	**640**	
Toluene	ug/L	1000	820		20	U	20	U	200	U	80	U	200	U	80	U	80	U
trans-1,2-Dichloroethene	ug/L	100	90	U	23	U	23	U	230	U	90	U	230	U	90	U	90	U
trans-1,3-Dichloropropene	ug/L	0.47	57	U	14	U	14	U	140	U	57	U	140	U	57	U	57	U
Trichloroethylene	ug/L	5	88	U	22	U	**1100**		220	U	88	U	220	U	88	U	**1900**	
Trichlorofluoromethane	ug/L	110	80	U	20	U	20	U	200	U	80	U	200	U	80	U	80	U
Vinyl chloride	ug/L	2	94	U	24	U	**30**	J	240	U	94	U	240	U	94	U	94	U
Xylene (total)	ug/L	10000	810	J	61	U	61	U	610	U	240	U	610	U	240	U	240	U

TABLE 3-8

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - DEEP SAND UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Constituent of Interest	Units	Criterion[1]	SC-MW-12L 04/25/08 Primary		SC-MW-13L 04/25/08 Primary		SC-MW-14L 04/24/08 Primary		SC-MW-15L 04/24/08 Primary		SC-MW-2L 04/24/08 Primary		SC-MW-3L 04/24/08 Primary		SC-MW-4L 04/24/08 Primary		SC-MW-8L 04/24/08 Primary	
Semivolatile Organics																		
1,1'-Biphenyl	ug/L	0.083	0.66	U	**140**		**59**		0.63	U	0.63	U	**0.87**	J	**4.6**	J	**21**	
1,2,4-Trichlorobenzene	ug/L	4.5	NA		NA		NA		NA		NA		NA		NA		NA	
1,4-Dichlorobenzene	ug/L	75	NA		NA		NA		NA		NA		NA		NA		NA	
2,2'-oxybis(1-chloropropane)	ug/L	--	0.28	U	1.4	U	0.28	U	0.27	U	0.27	U	0.28	U	0.29	U	0.3	U
2,4,5-Trichlorophenol	ug/L	120	0.68	U	3.4	U	0.68	U	0.66	U	0.66	U	0.68	U	0.7	U	73	
2,4,6-Trichlorophenol	ug/L	120	0.62	U	**170**		0.61	U	0.6	U	0.6	U	1.2	J	0.64	U	120	
2,4-Dichlorophenol	ug/L	4.6	0.53	U	2.6	U	0.52	U	**48**		**360**		**1000**		**170**		**450**	
2,4-Dimethylphenol	ug/L	36	**2500**		**3100**	J	**28000**		3.9	J	6.7	J	4.2	J	**680**		**660**	
2,4-Dinitrophenol	ug/L	3.9	14	U	70	U	14	U	13	U	13	U	14	U	14	U	15	U
2,4-Dinitrotoluene	ug/L	0.24	0.49	U	2.5	U	0.49	U	0.47	U	0.47	U	0.49	U	0.51	U	0.51	U
2,6-Dinitrotoluene	ug/L	0.048	0.55	U	2.8	U	0.55	U	0.53	U	0.53	U	0.55	U	0.57	U	0.58	U
2-Chloronaphthalene	ug/L	75	0.48	U	2.4	U	0.48	U	0.46	U	0.46	U	8.5	J	0.5	U	0.5	U
2-Chlorophenol	ug/L	9.1	**26**		2.5	U	0.49	U	0.48	U	**18**		**35**		5.1	J	**75**	
2-Methylnaphthalene	ug/L	3.6	**150**	J	**790**		**700**	J	0.89	J	0.73	J	2	J	**32**		**290**	
2-Methylphenol	ug/L	9	**2100**		**4000**	J	**20000**		1.4	J	3	J	1.8	J	**160**		**190**	
2-Nitroaniline	ug/L	19	0.52	U	2.6	U	0.51	U	0.5	U	0.5	U	0.52	U	0.53	U	0.54	U
2-Nitrophenol	ug/L	--	0.59	U	2.9	U	0.58	U	0.57	U	0.57	U	0.59	U	0.61	U	0.62	U
3,3-Dichlorobenzidine	ug/L	0.12	0.45	U	2.2	U	0.44	U	0.43	U	0.43	U	0.45	U	0.46	U	0.47	U
3-Nitroaniline	ug/L	--	0.44	U	2.2	U	0.43	U	0.42	U	0.42	U	0.44	U	0.45	U	0.46	U
4,6-Dinitro-2-methylphenol	ug/L	0.15	15	U	77	U	15	U	15	U	15	U	15	U	16	U	16	U
4-Bromophenylphenyl ether	ug/L	--	0.54	U	2.7	U	0.54	U	0.52	U	0.52	U	0.54	U	0.56	U	0.56	U
4-Chloroaniline	ug/L	0.36	0.5	U	2.5	U	0.5	U	0.49	U	0.49	U	0.5	U	0.52	U	0.53	U
4-Chlorophenyl phenyl ether	ug/L	--	0.46	U	2.3	U	0.46	U	0.45	U	0.45	U	0.46	U	0.48	U	0.49	U
4-Chloro-3-methylphenol	ug/L	140	0.64	U	3.2	U	0.64	U	0.62	U	0.62	U	0.64	U	0.66	U	0.67	U
4-Methylphenol	ug/L	190	**7000**		**19000**		**68000**		5.6	J	11		7.7	J	**260**		**1200**	
4-Nitroaniline	ug/L	3.8	0.28	U	1.4	U	0.27	U	0.27	U	0.27	U	0.28	U	0.28	U	0.29	U
4-Nitrophenol	ug/L	--	0.76	U	3.8	U	0.76	U	0.74	U	0.74	U	0.76	U	0.79	U	0.8	U
Acenaphthene	ug/L	53	**380**		11000	U	560	U	1	J	2.5	J	0.57	U	**200**		21	
Acenaphthylene	ug/L	180	35		78		0.5	U	0.49	U	0.49	U	0.5	U	3.4	J	0.53	U
Acetophenone	ug/L	190	0.5	U	2.5	U	0.5	U	0.49	U	0.72	J	0.5	U	0.52	U	6.8	J
Anthracene	ug/L	180	32		77		15		0.53	U	0.55	J	0.55	U	0.8	J	6.3	J
Atrazine	ug/L	3	0.42	U	2.1	U	0.42	U	0.41	U	0.41	U	0.42	U	0.44	U	0.44	U
Benzaldehyde	ug/L	--	0.59	U	2.9	U	0.58	U	0.57	U	0.57	U	0.59	U	0.61	U	0.62	U
Benzo(a)anthracene	ug/L	0.034	0.45	U	2.2	U	0.44	U	0.43	U	0.43	U	0.45	U	0.46	U	**0.99**	J
Benzo(a)pyrene	ug/L	0.2	0.48	U	2.4	U	**1.9**	J	0.46	U	0.46	U	0.48	U	0.49	U	0.5	U
Benzo(b)fluoranthene	ug/L	0.034	0.34	U	1.7	U	0.34	U	0.33	U	0.33	U	0.34	U	0.35	U	**1**	J
Benzo(ghi)perylene	ug/L	180	0.3	U	1.5	U	0.3	U	0.29	U	0.29	U	0.3	U	0.31	U	0.31	U
Benzo(k)fluoranthene	ug/L	0.34	0.43	U	2.1	U	0.43	U	0.41	U	0.41	U	0.43	U	0.44	U	0.45	U
Bis(2-chloroethoxy)methane	ug/L	5.9	1.3	U	6.6	U	1.3	U	1.3	U	1.3	U	1.3	U	1.4	U	1.4	U
Bis(2-chloroethyl)ether	ug/L	0.014	0.5	U	2.5	U	0.5	U	0.48	U	0.48	U	0.5	U	0.52	U	0.52	U
Bis(2-ethylhexyl)phthalate	ug/L	6	1.3	U	6.5	U	3.8	J	1.8	J	1.3	U	2	J	2	J	1.7	J
Butyl benzyl phthalate	ug/L	1300	1.5	U	7.5	U	1.5	U	2.5	J	1.4	U	1.5	U	1.5	J	1.6	U
Caprolactam	ug/L	990	2	U	10	U	2	U	5.1	J	2	U	5.3	J	2.1	U	2.1	U
Carbazole	ug/L	80	28		36	J	7	J	2	J	0.55	U	0.6	J	2.8	J	2.7	J
Chrysene	ug/L	3.4	0.39	U	1.9	U	0.38	U	0.37	U	0.37	U	0.39	U	0.4	U	0.81	J
Dibenzo(a,h)anthracene	ug/L	0.0034	0.38	U	1.9	U	0.38	U	0.37	U	0.37	U	0.38	U	0.39	U	0.4	U
Dibenzofuran	ug/L	0.79	**94**		2.9	U	**56**		0.56	U	**1**	J	0.58	U	**32**		**26**	
Diethyl phthalate	ug/L	1500	2.7	U	13	U	2.6	U	2.6	U	2.6	U	2.7	U	2.7	U	2.8	U
Dimethyl phthalate	ug/L	--	0.46	U	2.3	U	0.46	U	0.44	U	0.44	U	0.46	U	0.47	U	0.48	U

TABLE 3-8

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - DEEP SAND UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Constituent of Interest	Units	Criterion[1]	SC-MW-12L 04/25/08 Primary		SC-MW-13L 04/25/08 Primary		SC-MW-14L 04/24/08 Primary		SC-MW-15L 04/24/08 Primary		SC-MW-2L 04/24/08 Primary		SC-MW-3L 04/24/08 Primary		SC-MW-4L 04/24/08 Primary		SC-MW-8L 04/24/08 Primary	
Semivolatile Organics (Continued)																		
Di-n-butyl phthalate	ug/L	90	0.51	U	2.5	U	0.5	U	0.49	U	0.49	U	0.51	U	0.6	J	0.53	U
Di-n-octyl phthalate	ug/L	20	0.46	U	2.3	U	0.46	U	0.45	U	0.45	U	0.46	U	0.48	U	0.49	U
Fluoranthene	ug/L	80	7.6	J	13	J	0.53	U	0.61	J	0.52	U	0.54	U	1.2	J	3.8	J
Fluorene	ug/L	29	**76**		**170**		**32**		0.57	U	0.94	J	0.59	U	6.4	J	17	
Hexachlorobenzene	ug/L	1	**43**		2.4	U	0.47	U	0.46	U	0.46	U	0.47	U	**1.1**	J	**7.8**	J
Hexachlorobutadiene	ug/L	0.3	0.41	U	2	U	0.41	U	0.39	U	0.39	U	0.41	U	0.42	U	0.43	U
Hexachlorocyclopentadiene	ug/L	50	0.87	U	4.4	U	0.86	U	0.84	U	0.84	U	0.87	U	0.9	U	0.91	U
Hexachloroethane	ug/L	0.69	0.47	U	2.4	U	0.47	U	0.46	U	0.46	U	0.47	U	0.49	U	0.5	U
Indeno(1,2,3-cd)pyrene	ug/L	0.034	0.52	U	2.6	U	0.51	U	0.5	U	0.5	U	0.52	U	0.53	U	0.54	U
Isophorone	ug/L	78	0.52	U	2.6	U	0.51	U	0.5	U	0.5	U	0.52	U	0.53	U	0.54	U
Naphthalene	ug/L	0.17	**2400**		**1700**	J	**9100**	J	**24**		**30**		**57**		**350**		**5300**	
Nitrobenzene	ug/L	0.14	0.7	U	3.5	U	0.69	U	0.67	U	0.67	U	0.7	U	0.72	U	0.73	U
N-Nitrosodiphenylamine	ug/L	12	0.53	U	2.7	U	0.53	U	0.51	U	0.51	U	0.53	U	0.55	U	0.56	U
N-Nitrosodipropylamine	ug/L	0.011	0.65	U	3.2	U	0.64	U	0.62	U	0.62	U	0.65	U	0.67	U	0.68	U
Pentachlorophenol	ug/L	1	0.9	U	4.5	U	0.9	U	0.87	U	0.87	U	0.9	U	0.93	U	0.95	U
Phenanthrene	ug/L	180	49		19	J	8.2	J	0.85	J	0.98	J	0.76	J	11		18	
Phenol	ug/L	580	**3700**		**19000**		**40000**		7.2	J	8.2	J	6.5	J	55		**1500**	
Pyrene	ug/L	12	8.3	J	**31**	J	12		0.59	U	0.59	U	0.62	U	0.84	J	2.2	J
Metals																		
Aluminum	ug/L	2000	**4890**	J	**390000**	J	**13000**		123	B	**4210**		308		**7950**		**3400**	
Antimony	ug/L	6	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U
Arsenic	ug/L	10	**25**		**56.5**		6	B	2.2	U	**268**		**191**		**330**		9.1	B
Barium	ug/L	2000	18.9	B	44.5	B	24.3	B	88.9	B	240	J	417	J	220	J	50.6	B
Beryllium	ug/L	4	1.1	B	**14.4**		0.32	U	0.32	U	**7.4**		0.6	B	**17.8**		1.2	B
Cadmium	ug/L	5	0.23	U	0.23	U	0.49	B	0.23	U	5		1.2	B	0.65	B	2	B
Calcium	ug/L	--	208000	J	443000	J	495000	J	57600	J	94000	J	63200	J	49700	J	66600	J
Chromium (Total)	ug/L	2200	57.4		**6930**		132		4.3	B	**12100**		171		**10700**		281	
Chromium (Hexavalent)	ug/L	0.035	10	U	20	U	10	U	10	U	250	U	250	U	500	U	10	U
Cobalt	ug/L	0.6	**11.1**	B	**162**		**8.4**	B	0.7	U	**5.3**	B	**0.9**	B	**6.5**	B	**14.2**	B
Copper	ug/L	1300	0.72	U	0.72	U	0.82	B	1.3	B	16.5	B	1	B	12	B	8.9	B
Iron	ug/L	1400	**73600**		**309000**		**45600**		**8120**		**44600**		**105000**		**55300**		**118000**	
Lead	ug/L	15	2.4	U	**401**		2.4	U	**79.4**		**26.4**		2.4	U	12.1		3.2	
Magnesium	ug/L	--	27300	J	133000	J	70200	J	27400	J	75200	J	79800	J	43500	J	93600	J
Manganese	ug/L	43	**1000**		**3590**		**646**		**268**		**715**		**1510**		**1080**		**8580**	
Mercury	ug/L	2	0.055	U	0.085	B	0.055	U	0.055	U	0.16	B	0.055	U	0.2		0.055	U
Nickel	ug/L	390	68.3		**1980**		71.9		1.2	B	47.3		4.1	B	70.5		14.7	B
Potassium	ug/L	--	13900		200000		18200		13600		27700		39100		31400		45900	
Selenium	ug/L	50	5.1		34.3		6.2		2.5	U	4.3	B	2.5	U	5.9		2.5	U
Silver	ug/L	9.4	0.65	B	0.83	B	0.59	U	0.59	U	0.94	B	0.97	B	1.8	B	2.3	B
Sodium	ug/L	--	210000		1010000		226000		64200		1440000		771000		1370000		1430000	
Thallium	ug/L	2	3.1	U	15.4	U	3.1	U	3.1	U	**3.3**	B	3.1	U	3.1	U	3.1	U
Vanadium	ug/L	8.6	**24.4**	B	**386**		8	B	6.4	B	**531**	J	**77.7**	J	**1520**	J	**286**	J
Zinc	ug/L	600	78.7		**818**		42.1		1.5	B	115		2.2	B	45.2		36.6	

TABLE 3-8

AREA 1 - GROUNDWATER ANALYTICAL RESULTS - DEEP SAND UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Constituent of Interest	Units	Criterion[1]	SC-MW-12L 04/25/08 Primary		SC-MW-13L 04/25/08 Primary		SC-MW-14L 04/24/08 Primary		SC-MW-15L 04/24/08 Primary		SC-MW-2L 04/24/08 Primary		SC-MW-3L 04/24/08 Primary		SC-MW-4L 04/24/08 Primary		SC-MW-8L 04/24/08 Primary	
PCBs																		
Aroclor 1016	ug/L	0.14	**4.5**		**7.5**		**1.2**		0.1	U	0.1	U	0.1	U	0.1	U	**78**	
Aroclor 1221	ug/L	0.0046	0.1	U	1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	2.1	U
Aroclor 1232	ug/L	0.0046	0.12	U	1.2	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	2.4	U
Aroclor 1242	ug/L	0.039	0.077	U	0.76	U	0.076	U	0.076	U	0.076	U	0.076	U	0.077	U	1.5	U
Aroclor 1248	ug/L	0.039	0.095	U	0.93	U	**0.61**	PG	0.093	U	0.093	U	0.093	U	0.095	U	**58**	
Aroclor 1254	ug/L	0.039	0.095	U	0.93	U	0.093	U	0.093	U	0.093	U	0.093	U	0.095	U	1.9	U
Aroclor 1260	ug/L	0.039	**1.4**		0.55	U	0.055	U	0.055	U	0.055	U	0.055	U	0.056	U	**14**	
Aroclor 1262	ug/L	0.039	0.086	U	0.84	U	0.084	U	0.084	U	0.084	U	0.084	U	0.086	U	1.7	U
Aroclor 1268	ug/L	0.039	0.11	U	1.1	U	0.11	U	0.11	U	0.11	U	0.11	U	0.11	U	2.3	U
Pesticides																		
4,4'-DDD	ug/L	0.031	0.0087	JPG	0.079	U	0.0079	U	0.0079	U	0.0079	U	0.0079	U	0.008	U	0.08	U
4,4'-DDE	ug/L	0.23	0.21		0.069	U	0.043	J	0.0069	U	0.0069	U	0.0069	U	0.013	J	**0.59**	PG
4,4'-DDT	ug/L	0.23	0.014	U	0.14	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	**0.24**	J
Aldrin	ug/L	0.0046	0.012	U	**0.12**	JPG	0.011	U	0.011	U	0.011	U	0.011	U	0.012	U	0.12	U
alpha-BHC	ug/L	0.0071	0.016	U	0.15	U	0.015	U	0.015	U	0.015	U	0.015	U	0.016	U	0.16	U
alpha-Chlordane	ug/L	2	0.012	U	0.38	J	0.011	U	0.011	U	0.011	U	0.011	U	0.018	J	0.12	U
beta-BHC	ug/L	0.025	0.015	U	0.15	U	0.015	U	0.015	U	0.015	U	0.015	U	0.015	U	0.15	U
delta-BHC	ug/L	--	0.0098	U	0.24	J	0.09		0.0097	U	0.0097	U	0.0097	U	0.021	J	2.8	
Dieldrin	ug/L	0.0017	0.0083	U	0.082	U	0.0082	U	0.0082	U	0.0082	U	0.0082	U	**0.024**	J	0.083	U
Endosulfan I	ug/L	10	0.0077	U	0.076	U	0.0076	U	0.0076	U	0.0076	U	0.0076	U	0.0077	U	0.21	J
Endosulfan II	ug/L	10	0.063	PG	0.15	U	0.015	U	0.015	U	0.015	U	0.015	U	0.016	U	0.16	J
Endosulfan sulfate	ug/L	10	0.017	U	0.16	U	0.016	U	0.016	U	0.016	U	0.016	U	0.017	U	0.49	J
Endrin	ug/L	2	0.0079	U	0.078	U	0.012	J	0.0078	U	0.0078	U	0.0078	U	0.0079	U	0.1	J
Endrin aldehyde	ug/L	--	0.013	U	0.12	U	0.085	PG	0.012	U	0.012	U	0.012	U	0.013	U	0.13	U
Endrin ketone	ug/L	--	0.025	JPG	0.1	U	0.028	J	0.01	U	0.01	U	0.01	U	0.01	U	0.1	U
gamma-Chlordane	ug/L	2	0.0079	U	0.077	U	0.0077	U	0.0077	U	0.0077	U	0.0077	U	0.0079	U	0.079	U
Heptachlor	ug/L	0.4	0.066	PG	0.17	JPG	0.042	J	0.014	U	0.014	U	0.014	U	0.014	U	**2.1**	
Heptachlor epoxide	ug/L	0.2	0.079		0.1	U	0.077	PG	0.01	U	0.01	U	0.01	U	0.018	J	**0.93**	PG
Lindane	ug/L	0.2	0.016	U	0.15	U	0.2		0.015	U	0.015	U	0.015	U	0.016	U	**0.62**	PG
Methoxychlor	ug/L	40	0.019	U	0.19	U	0.019	U	0.019	U	0.019	U	0.019	U	0.019	U	0.19	U
Toxaphene	ug/L	3	0.43	U	4.2	U	0.42	U	0.42	U	0.42	U	0.42	U	0.43	U	4.3	U
Indicators																		
Biological Oxygen Demand (BOD)	mg/L	--	297		457		415		129		120		17.3		240		40.9	
Carbon	mg/L	--	886	J	7050	J	849	J	18.4	J	51.4	J	67.6	J	245	J	136	J
Chemical Oxygen Demand (COD)	mg/L	--	2950		23900		2810		66		275		227		687		504	
Oil & Grease (HEM)	mg/L	--	26.9		15.9		6		0.52	U	NA		0.52	U	NA		7	
Residue, filterable	mg/L	--	2970		21700		4390		454		6300		2930		7070		5330	
Residue, non-filterable	mg/L	--	39.6		30.8		31.5		8		14.5		167		26.8		21.5	
Total Alkalinity	mg/L	--	10.7	J	0.41	U	0.41	U	316	J	1090	J	748	J	1940	J	836	J

Notes:

1. USEPA Regional Screening Levels for Tapwater (November 2014). Risk-based value presented unless an MCL is available. For compounds without criteria, values for similar compounds are presented.
Exceedances are shown in bold, shaded typeface.
Data qualifiers are as follows:

B - Inorganic results. Result is an estimate. Quantitation between the detection limit and the reporting limit.
J - Organic results. Result is an estimate. Quantitated between the detection limit and the reporting limit.
J - Inorganic results. Result is an estimated concentration. Quantitated below the reporting limit.
U - Not detected at the detection limit indicated.
-- - Not analyzed or criteria unavailable.

TABLE 3-9
AREA 2 - GROUNDWATER ANALYTICAL RESULTS - DEEP SAND UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ANALYTE NAME	UNITS	HC-PZ-13L HC-PZ-13L-11042015 11/4/2015	MW-D-28 MW-D-28-11042015 11/4/2015	MW-D-35 MW-D-35-11032015 11/3/2015	MW-D-37 MW-D-35-11042015 11/4/2015	MW-D-38 MW-D-38-11032015 11/3/2015	MW-D-38 DUP MW-D-99-11032015 11/3/2015	MW-D-39 MW-D-39-11032015 11/3/2015
VOC								
Chloromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromomethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Vinyl Chloride	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Chloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Methylene Chloride	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Acetone	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
Carbon Disulfide	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Trichlorofluoromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1-Dichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1-Dichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
trans-1,2-Dichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
cis-1,2-Dichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Chloroform	ug/l	20 U	200 U	1.0 U	31	0.71 J	0.80 J	1.2
1,2-Dichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
2-Butanone	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
1,1,1-Trichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Carbon Tetrachloride	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromodichloromethane	ug/l	20 U	200 U	1.0 U	3.2 J	2.0 U	2.0 U	1.0 U
1,2-Dichloropropane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
cis-1,3-Dichloropropene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Trichloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Dibromochloromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1,2-Trichloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Benzene	ug/l	43	1300	1.0 U	28	1.7 J	1.6 J	1.0 U
trans-1,3-Dichloropropene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromoform	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
4-Methyl-2-Pentanone (MIBK)	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
2-Hexanone	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
Tetrachloroethene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,1,2,2-Tetrachloroethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Toluene	ug/l	20 U	200 U	1.0 U	56	0.54 J	2.0 U	1.0 U
Chlorobenzene	ug/l	680	2100	0.94 J	32	2.0 U	2.0 U	1.0 U
Ethylbenzene	ug/l	20 U	200 U	1.0 U	78	10	10	1.0 U
Styrene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
m,p-Xylenes	ug/l	20 U	200 U	1.0 U	100	10	10	1.0 U
o-Xylene	ug/l	20 U	200 U	1.0 U	49	7.7	7.4	1.0 U
Freon TF	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Methyl tertbutyl ether	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	0.37 J
Cyclohexane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,3-Dichlorobenzene	ug/l	2300	29000	1.0 U	160	2.0 U	2.0 U	1.0 U
1,4-Dichlorobenzene	ug/l	3900	43000	1.0 U	250	2.0 U	2.0 U	1.0 U
1,2-Dichlorobenzene	ug/l	3200	34000	0.29 J	220	2.0 U	2.0 U	1.0 U
Dichlorodifluoromethane	ug/l	110	1800	1.0 U	5.2 J	2.0 U	2.0 U	1.0 U

TABLE 3-9
AREA 2 - GROUNDWATER ANALYTICAL RESULTS - DEEP SAND UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ANALYTE NAME	UNITS	HC-PZ-13L HC-PZ-13L-11042015 11/4/2015	MW-D-28 MW-D-28-11042015 11/4/2015	MW-D-35 MW-D-35-11032015 11/3/2015	MW-D-37 MW-D-35-11042015 11/4/2015	MW-D-38 MW-D-38-11032015 11/3/2015	MW-D-38 DUP MW-D-99-11032015 11/3/2015	MW-D-39 MW-D-39-11032015 11/3/2015
1,2,4-Trichlorobenzene	ug/l	9.9 J	190 J	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,2,3-Trichlorobenzene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Bromochloromethane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
Isopropylbenzene	ug/l	20 U	200 U	1.0 U	5.2 J	2.0	2.1	1.0 U
Methyl Acetate	ug/l	100 U	1000 U	5.0 U	50 U	10 U	10 U	5.0 U
Methylcyclohexane	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,3,5-Trichlorobenzene	ug/l	20 U	200 U	1.0 U	10 U	2.0 U	2.0 U	1.0 U
1,4-Dioxane	ug/l	1.1 J	1.3 J	2.0 U	1.5 J	2.0 U	2.0 U	2.0 U
1,2-Dibromo-3-chloropropane	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
1,2-Dibromoethane	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
SVOC								
Phenol	ug/l	10 U	41 J	10 U	520 U	52 U	50 U	10 U
2-Chlorophenol	ug/l	4.7 J	53 J	10 U	520 U	52 U	50 U	10 U
2-Methylphenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
4-Methylphenol	ug/l	10 U	31 J	10 U	520 U	52 U	50 U	10 U
2-Nitrophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4-Dimethylphenol	ug/l	10 U	100 U	10 U	50 J	52 U	50 U	10 U
2,4-Dichlorophenol	ug/l	11	79 J	10 U	520 U	52 U	50 U	10 U
4-Chloro-3-methylphenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4,6-Trichlorophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4,5-Trichlorophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,4-Dinitrophenol	ug/l	21 U	210 U	20 U	1000 U	100 U	100 U	20 U
4-Nitrophenol	ug/l	21 U	210 U	20 U	1000 U	100 U	100 U	20 U
4,6-Dinitro-2-Methylphenol	ug/l	21 U	210 U	20 U	1000 U	100 U	100 U	20 U
N-Nitroso-Di-N-Propylamine	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Hexachloroethane	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Nitrobenzene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Isophorone	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
bis(2-Chloroethoxy) Methane	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Naphthalene	ug/l	10 U	100 U	1.7 J	5800	940	850	10 U
4-Chloroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Hexachlorobutadiene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
2-Methylnaphthalene	ug/l	10 U	100 U	10 U	770	160	150	10 U
Hexachlorocyclopentadiene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2-Chloronaphthalene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2-Nitroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Dimethylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Acenaphthylene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,6-Dinitrotoluene	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
3-Nitroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Acenaphthene	ug/l	10 U	100 U	69	330 J	91	83	1.4 J
Dibenzofuran	ug/l	10 U	100 U	10 U	84 J	27 J	23 J	10 U
2,4-Dinitrotoluene	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
Diethylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U

TABLE 3-9
AREA 2 - GROUNDWATER ANALYTICAL RESULTS - DEEP SAND UNIT
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

ANALYTE NAME	UNITS	HC-PZ-13L HC-PZ-13L-11042015 11/4/2015	MW-D-28 MW-D-28-11042015 11/4/2015	MW-D-35 MW-D-35-11032015 11/3/2015	MW-D-37 MW-D-35-11042015 11/4/2015	MW-D-38 MW-D-38-11032015 11/3/2015	MW-D-38 DUP MW-D-99-11032015 11/3/2015	MW-D-39 MW-D-39-11032015 11/3/2015
4-Chlorophenyl-phenylether	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Fluorene	ug/l	10 U	100 U	10 U	210 J	69	63	10 U
4-Nitroaniline	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
N-Nitrosodiphenylamine	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
4-Bromophenyl-phenylether	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Phenanthrene	ug/l	10 U	100 U	14	270 J	85	78	10 U
Anthracene	ug/l	10 U	100 U	10 U	520 U	9.3 J	7.4 J	10 U
Carbazole	ug/l	10 U	100 U	10 U	150 J	29 J	27 J	10 U
Di-n-Butylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Fluoranthene	ug/l	10 U	100 U	0.84 J	520 U	11 J	9.6 J	10 U
Pyrene	ug/l	10 U	100 U	1.0 J	520 U	5.2 J	4.4 J	10 U
Butylbenzylphthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
3,3'-Dichlorobenzidine	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Chrysene	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
bis(2-Ethylhexyl)phthalate	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
Di-n-Octyl phthalate	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Benzo(k)fluoranthene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Indeno(1,2,3-cd)pyrene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Dibenz(a,h)anthracene	ug/l	1 U	10 U	1.0 U	52 U	5.2 U	5.0 U	1.0 U
Benzo(g,h,i)perylene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
1,1'-Biphenyl	ug/l	10 U	100 U	10 U	120 J	20 J	19 J	10 U
Acetophenone	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Benzaldehyde	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Caprolactum	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Atrazine	ug/l	2.1 U	21 U	2.0 U	100 U	10 U	10 U	2.0 U
2,2'-Oxybis(1-Chloropropane)	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
1,2,4,5-Tetrachlorobenzene	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
2,3,4,6-Tetrachlorophenol	ug/l	10 U	100 U	10 U	520 U	52 U	50 U	10 U
Benzo(a)anthracene	ug/l	0.26 U	5.2 U	0.050 U	1.0 U	0.19 J	0.19 J	0.050 U
Benzo(a)pyrene	ug/l	0.26 U	5.2 U	0.050 U	1.0 U	0.26 U	0.25 U	0.050 U
Benzo(b)fluoranthene	ug/l	0.26 U	5.2 U	0.050 U	1.0 U	0.26 U	0.25 U	0.050 U
Pentachlorophenol	ug/l	1 U	21 U	0.20 U	4.2 U	1.0 U	1.0 U	0.20 U
Hexachlorobenzene	ug/l	0.1 U	2.1 U	0.02 U	0.42 U	0.10 U	0.10 U	0.02 U
Bis-(2-Chloroethyl) Ether	ug/l	0.1 U	5.2	0.02 U	0.42 U	0.10 U	0.10 U	0.02 U

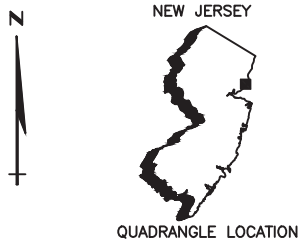
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an estimated value.
U : Indicates the analyte was analyzed for but not detected.

TABLE 4-1
CHLOROBENZENE COMPOUNDS DEGRADATION BY-PRODUCTS AND HALF-LIVES
TECHNICAL IMPRACTICABILITY EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Compound	Degradation by-products	Half-life (days)	Literature reference
Aerobic Conditions			
chlorobenzene	3-chlorocatechol, CO2	69-150	Rathbun, 1998; McLeish, 2005
1,2-dichlorobenzene	chlorobenzene	28-180	Rathbun, 1998
1,4-dichlorobenzene	chlorobenzene	28-180	Rathbun, 1998
1,2,4-trichlorobenzene	succinate, chloroacetate	28-180	Rathbun, 1998; Renhao, 2005; Yao, 2006
Anaerobic Conditions			
chlorobenzene	CO2	280-580	Rathbun, 1998; Monferran and others, 2005
1,2-dichlorobenzene	CO2	119-722	Rathbun, 1998
1,4-dichlorobenzene	chlorobenzene	112-722	Rathbun, 1998 and Yao, 2006
1,2,4-trichlorobenzene	1,4-DCB, chlorobenzene	112-722	Rathbun, 1998 and Yao, 2006

From 2006 USGS literature review, available online at
http://pubs.usgs.gov/of/2006/1338/pdf/ofr2006-1338.pdf

FIGURES



PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE:	1"= 2000'	

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES OF JERSEY CITY, AND WEEHAWKEN, NEW JERSEY

ISSUE DATE:

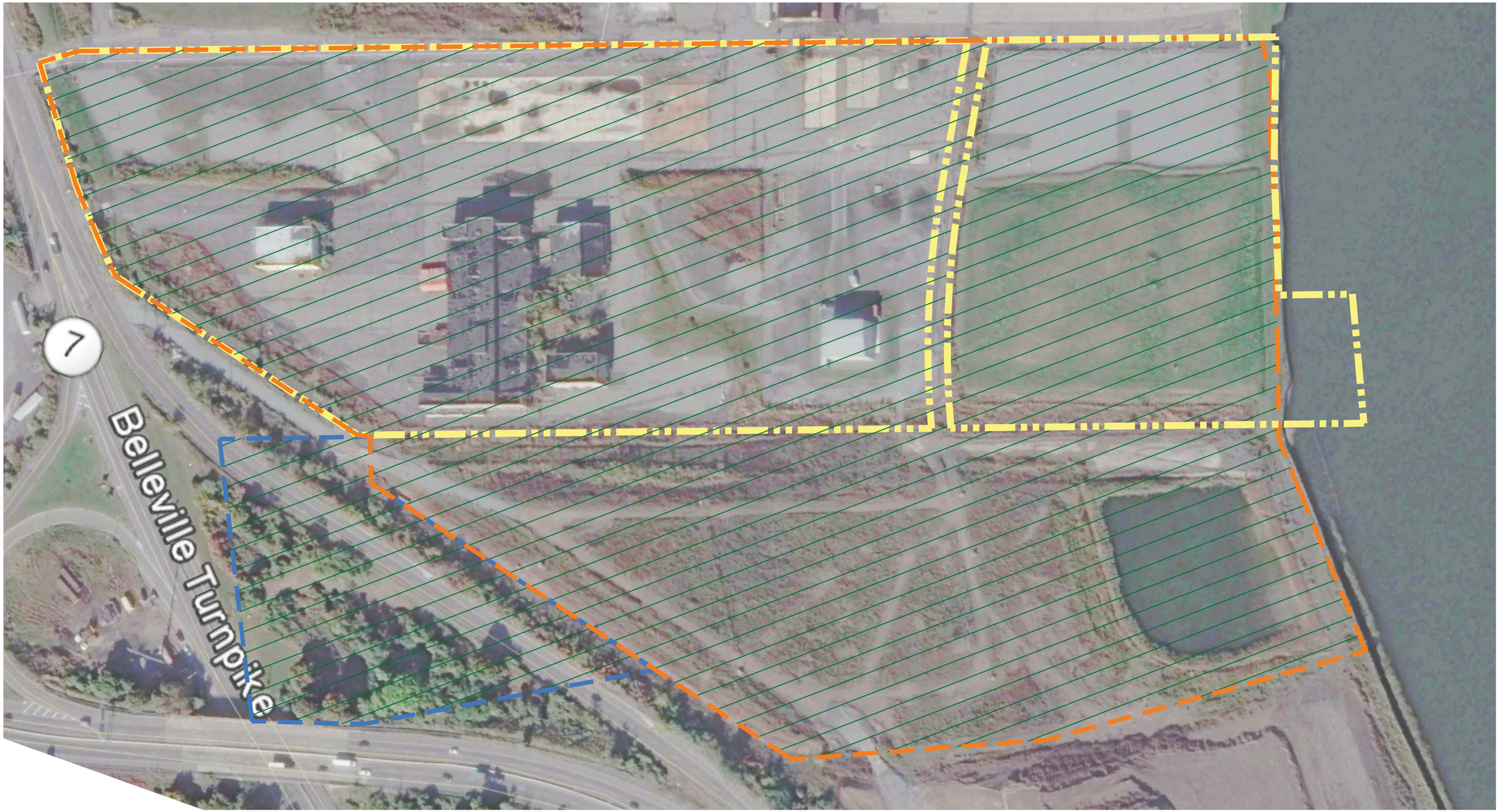
KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

SITE LOCATION MAP

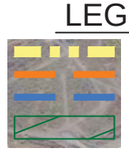
PROJECT NO: 201601-03

FIGURE 1-1

y:\00civil\kearny\ti evaluation report\figure 1-1 site location map.dwg Last Saved By: Scomer 4/4/2016 2:11 PM Plotted By: Shelly Comer 6/16/2016 4:32 PM Scale: 1:1



LEGEND



SCCC PROPERTY

AREA 1

AREA 2

SCCC SITE

0 150 300 FEET

REV #	DATE	DESCRIPTION	APPD
1			
2			
3			

REFERENCE:

1. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
2. IMAGE PROVIDED BY GOOGLE EARTH DATED OCTOBER, 2015.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 06/15/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

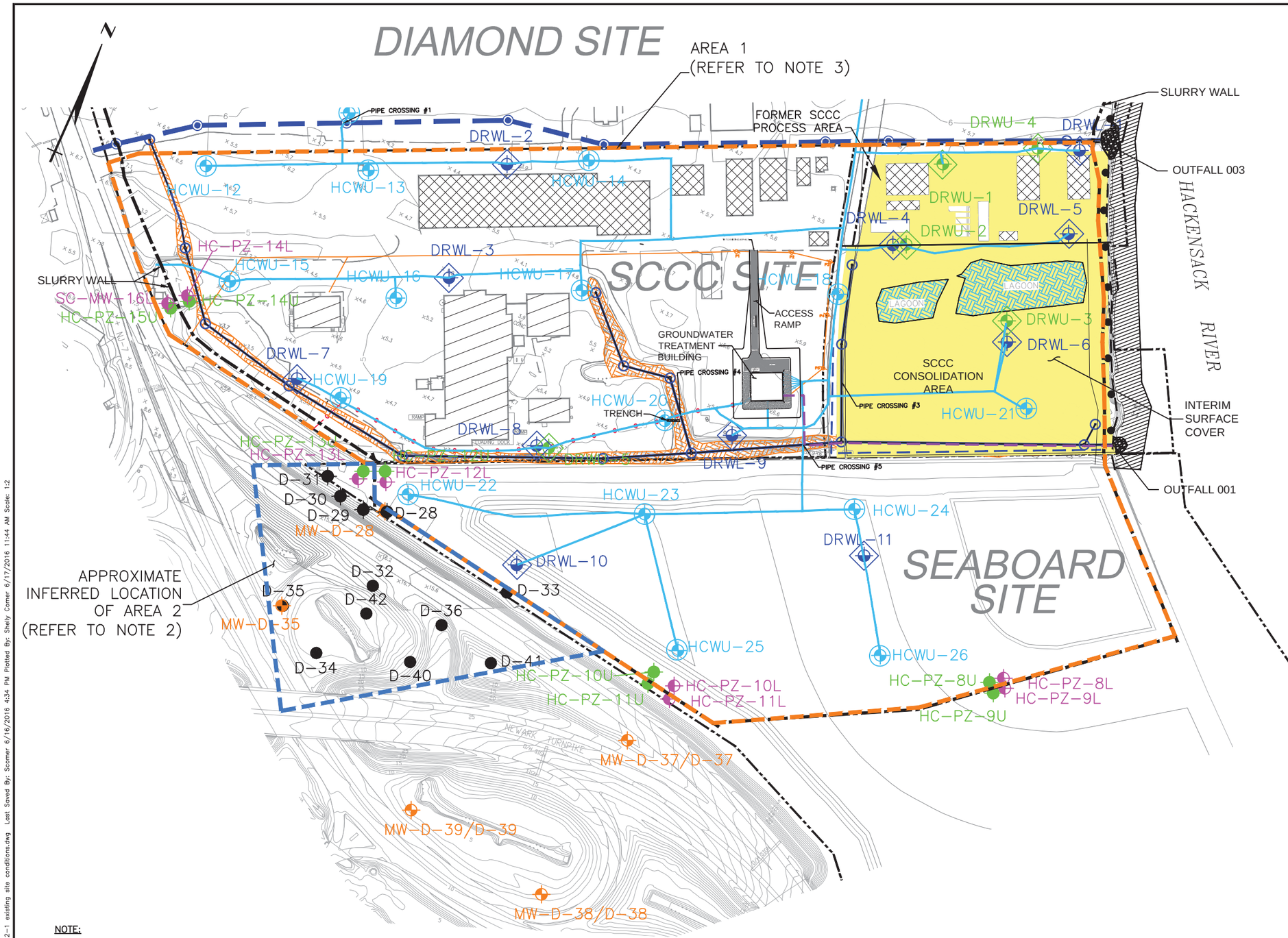
TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

SITE PLAN

PROJECT NO: 201501-05

FIGURE 1-2

y:\06civil\kearny\ti evaluation report\figure 1-2 site plan.dwg Last Saved By: Scomer 6/17/2016 11:40 AM Plotted By: Shelly Comer 6/17/2016 11:43 AM Scale: 1:1



LEGEND

- PROPERTY BOUNDARY
- SPOT ELEVATION (FEET–MSL)
- SLURRY WALL LOCATION
- STEEL SHEET PILE WALL LOCATION
- EXISTING GROUND SURFACE ELEVATION
- RIVER/CHANNEL
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB
- GROUNDWATER CONVEYANCE PIPING TRENCH ALIGNMENT
- FILL UNIT GROUNDWATER EXTRACTION (HYDRAULIC CONTROL) WELL LOCATION
- FILL UNIT DNAPL RECOVERY WELL LOCATION
- SAND UNIT DNAPL RECOVERY WELL LOCATION
- LAGOON DEWATERED AND BACKFILLED
- NEAR–SHORE SEDIMENT REMOVAL
- DRAINAGE DITCH REMEDIATION (EXCAVATED AND BACKFILLED)
- INTERIM SURFACE COVER
- TREATED GROUND WATER PERMITTED DISCHARGE PIPE
- STORM DRAIN (48" DIA. PIPE)
- STORM WATER DRAIN (PIPE DIA. VARIES)
- DROP INLET
- DROP INLET
- RIPRAP OUTFALL
- E — POWER AND PHONE LINES (OVERHEAD)
- W — WATER LINE TO TREATMENT BUILDING
- HC–PZ–9U — HYDRAULIC CONTROL PIEZOMETER UPPER ZONE
- HC–PZ–9L — HYDRAULIC CONTROL PIEZOMETER LOWER ZONE
- SEMI–DEEP ANODE WELL LOCATION
- SUPPLEMENTAL RI DNAPL DELINEATION BORING LOCATION
- SUPPLEMENTAL RI CONTINGENCY BORING LOCATION
- MONITORING WELL LOCATION
- LOCATION OF AREA 1
- APPROXIMATE INFERRED LOCATION OF AREA 2

NOTE:

1. AS–BUILT DRAWING WAS PREPARED BASED ON THE CORRESPONDING INTERIM RESPONSE ACTION CIVIL ENGINEERING DESIGN DRAWING. THIS AS–BUILT DRAWING DEPICTS MAJOR CHANGES TO OR DEVIATIONS FROM THE DESIGN DRAWING, AS DOCUMENTED BY FIELD INSPECTION BY KEY'S CQA PERSONNEL. AS–BUILT DIMENSIONS OR MEASUREMENTS MAY VARY SLIGHTLY FROM THOSE DEPICTED ON THIS AS–BUILT DRAWING.
2. THE AREA 2 LIMITS WILL BE ESTABLISHED DURING REMEDIAL DESIGN.
3. AREA 1 INCLUDES THE PROPERTY WITHIN THE EXISTING SLURRY WALL.

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

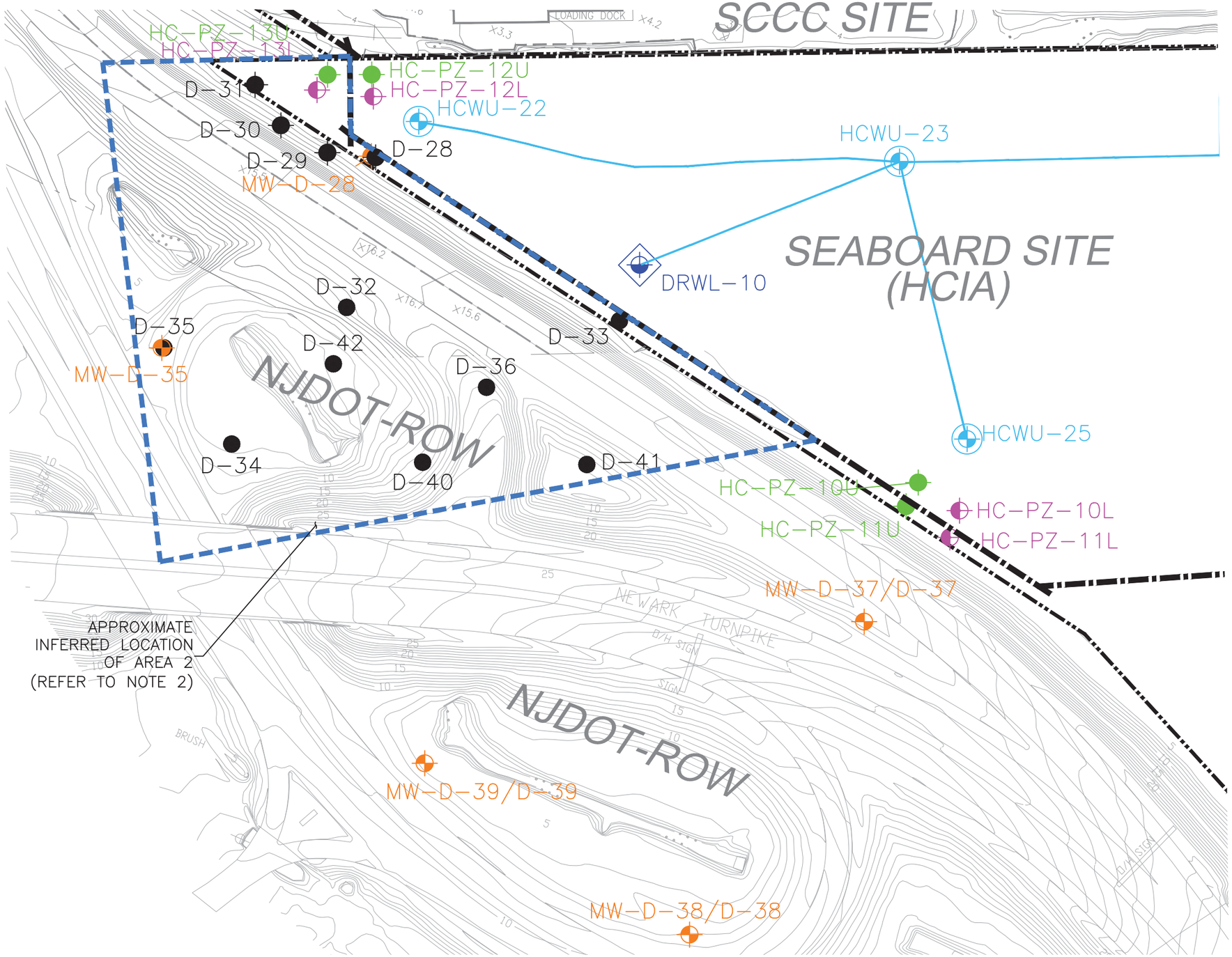
TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

EXISTING SCCC SITE CONDITIONS

PROJECT NO: 201501–05

FIGURE 2–1

y:\00civil\kearny\ti evaluation report\figure 2–1 existing site conditions.dwg Last Saved By: Scomer 6/16/2016 4:34 PM Plotted By: Shelly Comer 6/17/2016 11:44 AM Scale: 1:2



LEGEND

- PROPERTY BOUNDARY
- SLURRY WALL LOCATION
- EXISTING GROUND SURFACE ELEVATION
- GROUNDWATER CONVEYANCE PIPING TRENCH ALIGNMENT
- FILL UNIT GROUNDWATER EXTRACTION (HYDRAULIC CONTROL) WELL LOCATION
- SAND UNIT DNAPL RECOVERY WELL LOCATION
- HC-PZ-9U — HYDRAULIC CONTROL PIEZOMETER UPPER ZONE
- HC-PZ-9L — HYDRAULIC CONTROL PIEZOMETER LOWER ZONE
- SUPPLEMENTAL RI DNAPL DELINEATION BORING LOCATION
- SUPPLEMENTAL RI CONTINGENCY BORING LOCATION
- MONITORING WELL LOCATION
- APPROXIMATE INFERRED LOCATION OF AREA 2

NOTE:

1. AS-BUILT DRAWING WAS PREPARED BASED ON THE CORRESPONDING INTERIM RESPONSE ACTION CIVIL ENGINEERING DESIGN DRAWING. THIS AS-BUILT DRAWING DEPICTS MAJOR CHANGES TO OR DEVIATIONS FROM THE DESIGN DRAWING, AS DOCUMENTED BY FIELD INSPECTION BY KEY'S CQA PERSONNEL. AS-BUILT DIMENSIONS OR MEASUREMENTS MAY VARY SLIGHTLY FROM THOSE DEPICTED ON THIS AS-BUILT DRAWING.
2. THE AREA 2 LIMITS WILL BE ESTABLISHED DURING REMEDIAL DESIGN.

0 50 100 FEET

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).

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PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 2 PLAN MAP

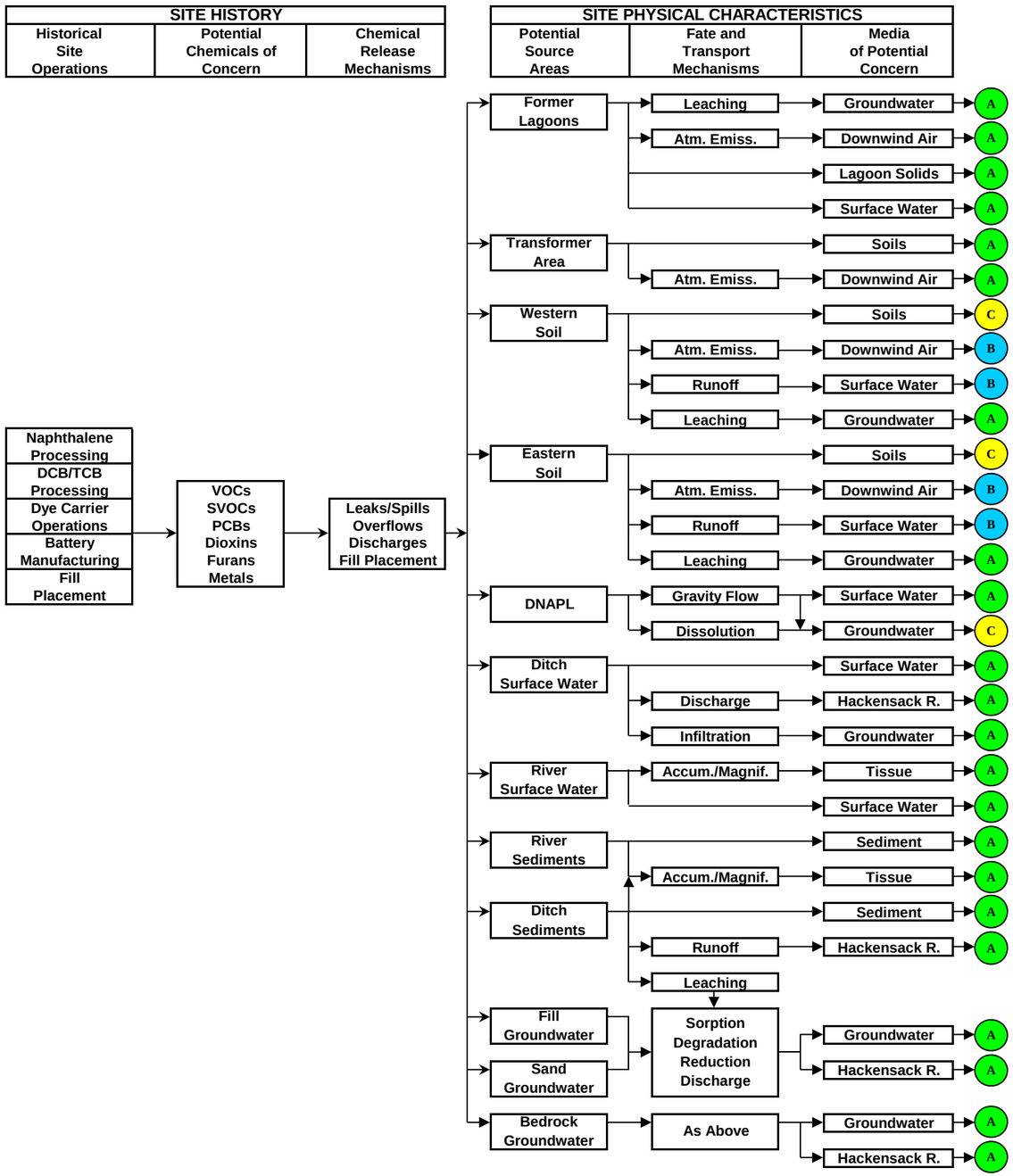
PROJECT NO: 201601-03

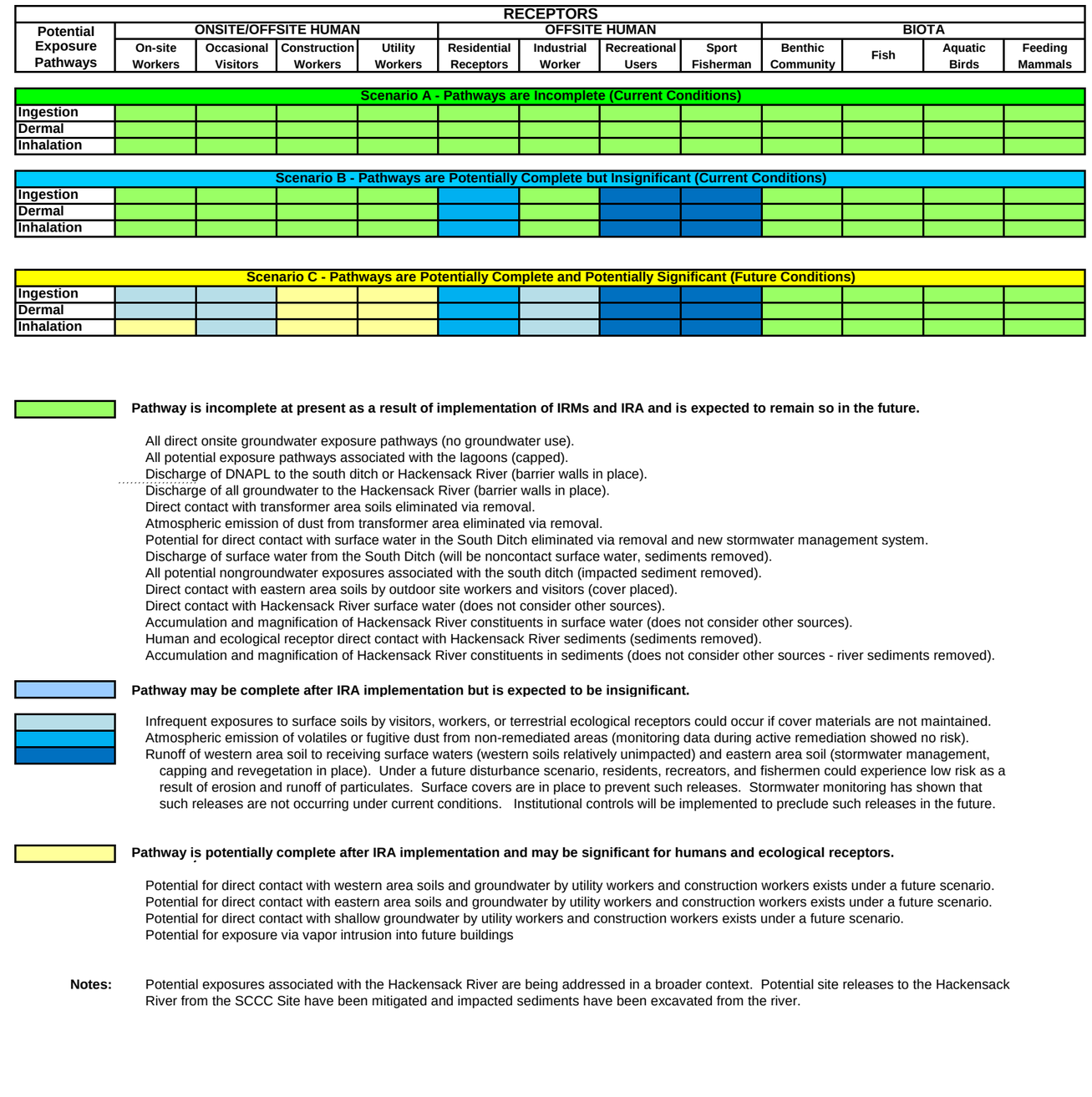
FIGURE 2-2

y:\00civil\Kearny\ti evaluation report\figure 2-2.dwg Last Saved By: Scomer 6/16/2016 4:35 PM Plotted By: Shelly Comer 6/17/2016 11:44 AM Scale: 1:2

FIGURE 3-1

AREA 1 CONCEPTUAL SITE MODEL
SCCC SITE - KEARNY, NEW JERSEY





Pathway is incomplete at present as a result of implementation of IRMs and IRA and is expected to remain so in the future.

All direct onsite groundwater exposure pathways (no groundwater use).
All potential exposure pathways associated with the lagoons (capped).
Discharge of DNAPL to the south ditch or Hackensack River (barrier walls in place).
Discharge of all groundwater to the Hackensack River (barrier walls in place).
Direct contact with transformer area soils eliminated via removal.
Atmospheric emission of dust from transformer area eliminated via removal.
Potential for direct contact with surface water in the South Ditch eliminated via removal and new stormwater management system.
Discharge of surface water from the South Ditch (will be noncontact surface water, sediments removed).
All potential nongroundwater exposures associated with the south ditch (impacted sediment removed).
Direct contact with eastern area soils by outdoor site workers and visitors (cover placed).
Direct contact with Hackensack River surface water (does not consider other sources).
Accumulation and magnification of Hackensack River constituents in surface water (does not consider other sources).
Human and ecological receptor direct contact with Hackensack River sediments (sediments removed).
Accumulation and magnification of Hackensack River constituents in sediments (does not consider other sources - river sediments removed).

Pathway may be complete after IRA implementation but is expected to be insignificant.

Infrequent exposures to surface soils by visitors, workers, or terrestrial ecological receptors could occur if cover materials are not maintained.
Atmospheric emission of volatiles or fugitive dust from non-remediated areas (monitoring data during active remediation showed no risk).
Runoff of western area soil to receiving surface waters (western soils relatively unimpacted) and eastern area soil (stormwater management, capping and revegetation in place). Under a future disturbance scenario, residents, recreators, and fishermen could experience low risk as a result of erosion and runoff of particulates. Surface covers are in place to prevent such releases. Stormwater monitoring has shown that such releases are not occurring under current conditions. Institutional controls will be implemented to preclude such releases in the future.

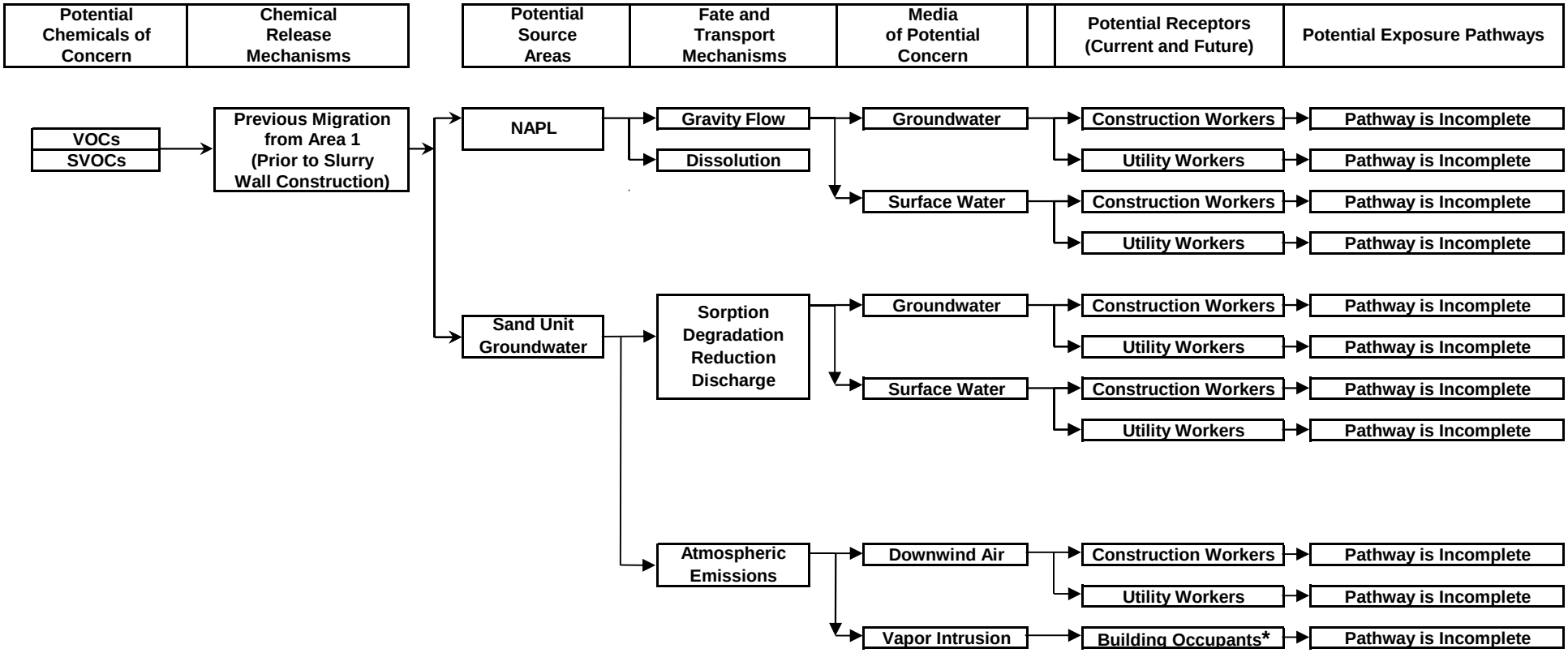
Pathway is potentially complete after IRA implementation and may be significant for humans and ecological receptors.

Potential for direct contact with western area soils and groundwater by utility workers and construction workers exists under a future scenario.
Potential for direct contact with eastern area soils and groundwater by utility workers and construction workers exists under a future scenario.
Potential for direct contact with shallow groundwater by utility workers and construction workers exists under a future scenario.
Potential for exposure via vapor intrusion into future buildings

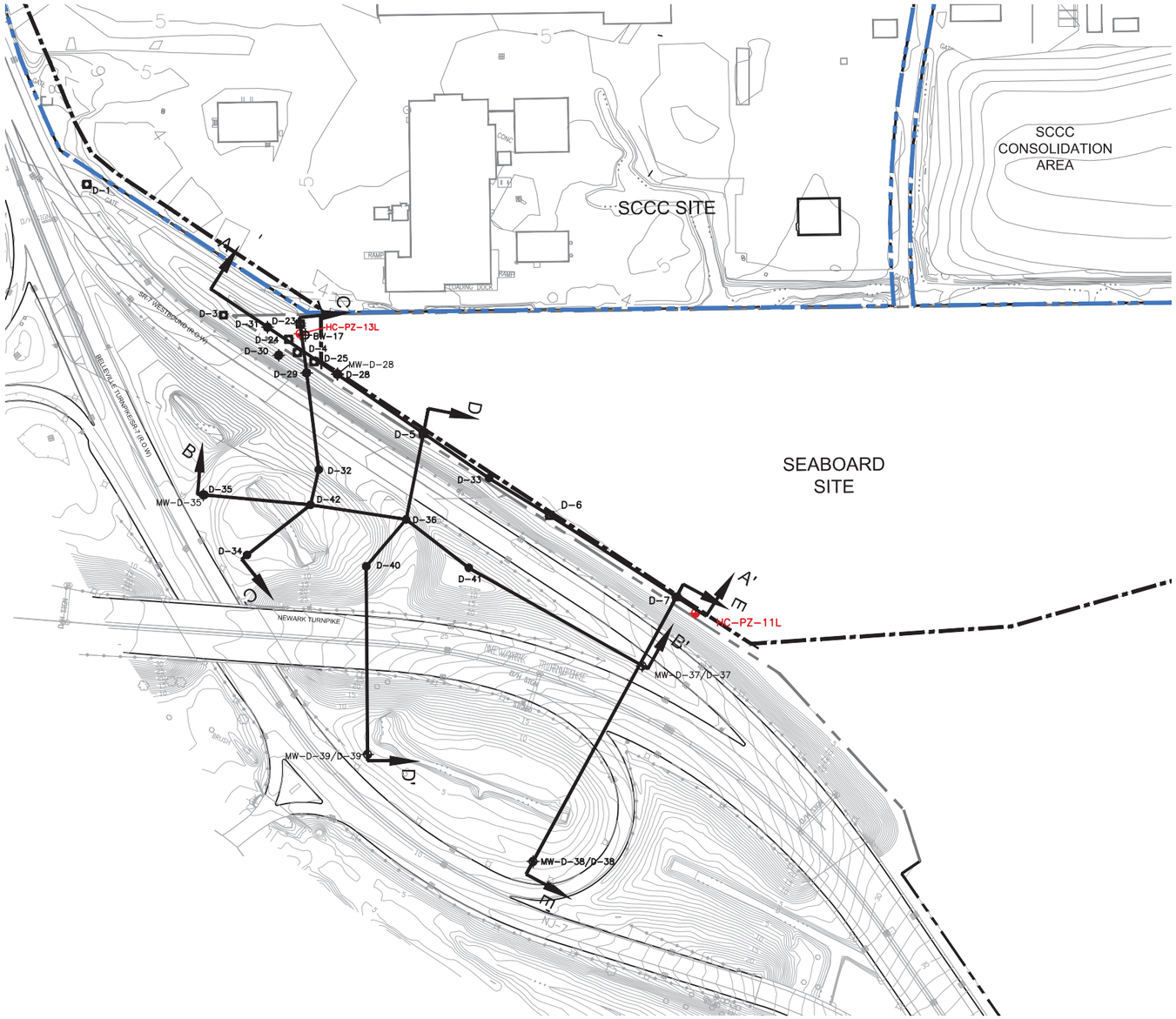
Notes: Potential exposures associated with the Hackensack River are being addressed in a broader context. Potential site releases to the Hackensack River from the SCCC Site have been mitigated and impacted sediments have been excavated from the river.

FIGURE 3-2

AREA 2 CONCEPTUAL SITE MODEL
SCCC SITE - KEARNY, NEW JERSEY



* Potential future receptor scenario only. No buildings currently exist in Area 2.



LEGEND

- STANDARD CHLORINE SITE BOUNDARY
- SEABOARD SITE BOUNDARY
- SLURRY WALL LOCATION
- BARRIER WALL ALIGNMENT BORING
- RI DNAPL DELINEATION BORINGS
- HYDRAULIC CONTROL PIEZOMETER
- DNAPL DELINEATION BORING LOCATION
- CONTINGENCY BORING LOCATION
- MONITORING WELL LOCATION

NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

0 200 400 FEET

NOTE:
SAMPLES WERE NOT SUBMITTED FOR ANALYSIS FROM LOCATIONS WHERE FREE PHASE DNAPL WAS OBSERVED.

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

CROSS-SECTION LOCATION MAP

PROJECT NO: 201601-03
FIGURE 3-3

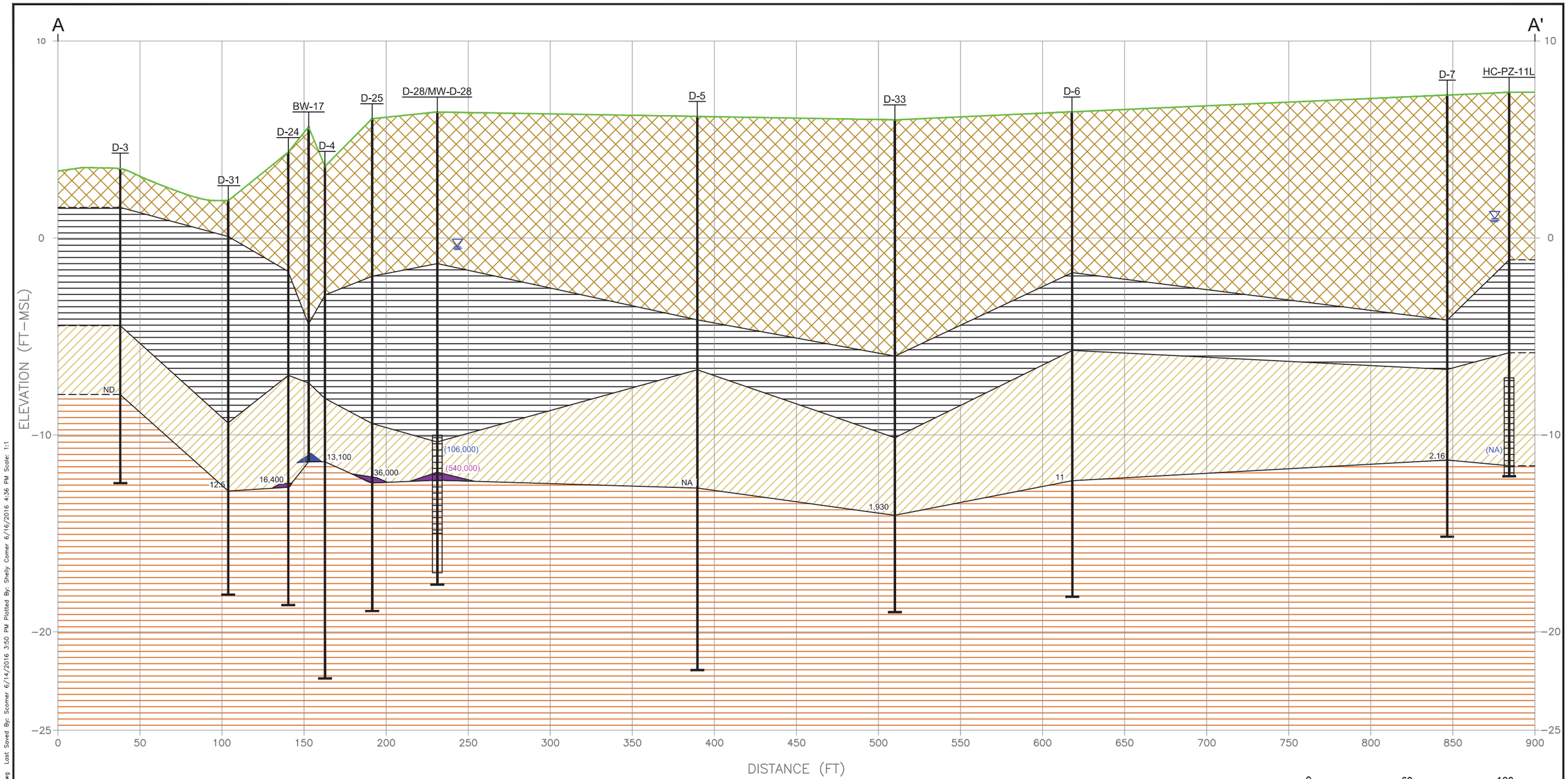
REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\GOcivil\kearny\ti evaluation report\figure 3-3 through 3-8 cross sections.dwg Last Saved By: Scomer 6/14/2016 3:50 PM Plotted By: Shelly Comer 6/16/2016 4:35 PM Scale: 1:1



LEGEND

- GROUND SURFACE
- SHALLOW FILL MATERIAL
- MEADOW MAT
- DEEPER FINE SAND
- VARVED CLAY

(106,000)	GROUNDWATER TOTAL DICHLOROBENZENE CONCENTRATIONS (UG/L)
(540,000)	DNAPL TOTAL DICHLOROBENZENE CONCENTRATIONS (MG/KG)
12.5	TOTAL DICHLOROBENZENE CONCENTRATION IN SAND UNIT SOIL SAMPLE AT THE VARVED CLAY INTERFACE (MG/KG)
NA	NOT ANALYZED
ND	NOT DETECTED

- SAND UNIT POTENTIOMETRIC SURFACE ELEVATION
- BORE HOLE
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL SUMP INTERVAL BELOW SCREEN
- BORE HOLE TOTAL DEPTH

- STAINING OR RESIDUAL DNAPL (OBSERVED IN SOIL CORE)
- FREE PHASE DNAPL (OBSERVED IN SOIL CORE)

NOTES:
1. CROSS-SECTION HAS A VERTICAL EXAGGERATION OF 12.
2. DNAPL THICKNESS EXAGGERATED FOR VISUAL PRESENTATION.
3. GEOLOGIC CONTACTS SHOWN BETWEEN SOIL BORING LOCATIONS ARE INFERRED AS A DIRECT AND CONSISTENT INTERPOLATION OF THE GEOLOGIC INFORMATION ACQUIRED AT THE BORING LOCATIONS. ACTUAL GEOLOGIC CONDITIONS IN THE AREAS BETWEEN THE BORING LOCATIONS MAY DIFFER FROM WHAT IS SHOWN ON THIS CROSS-SECTIONS.

H: 0 60 120 FEET

V: 0 5 10 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

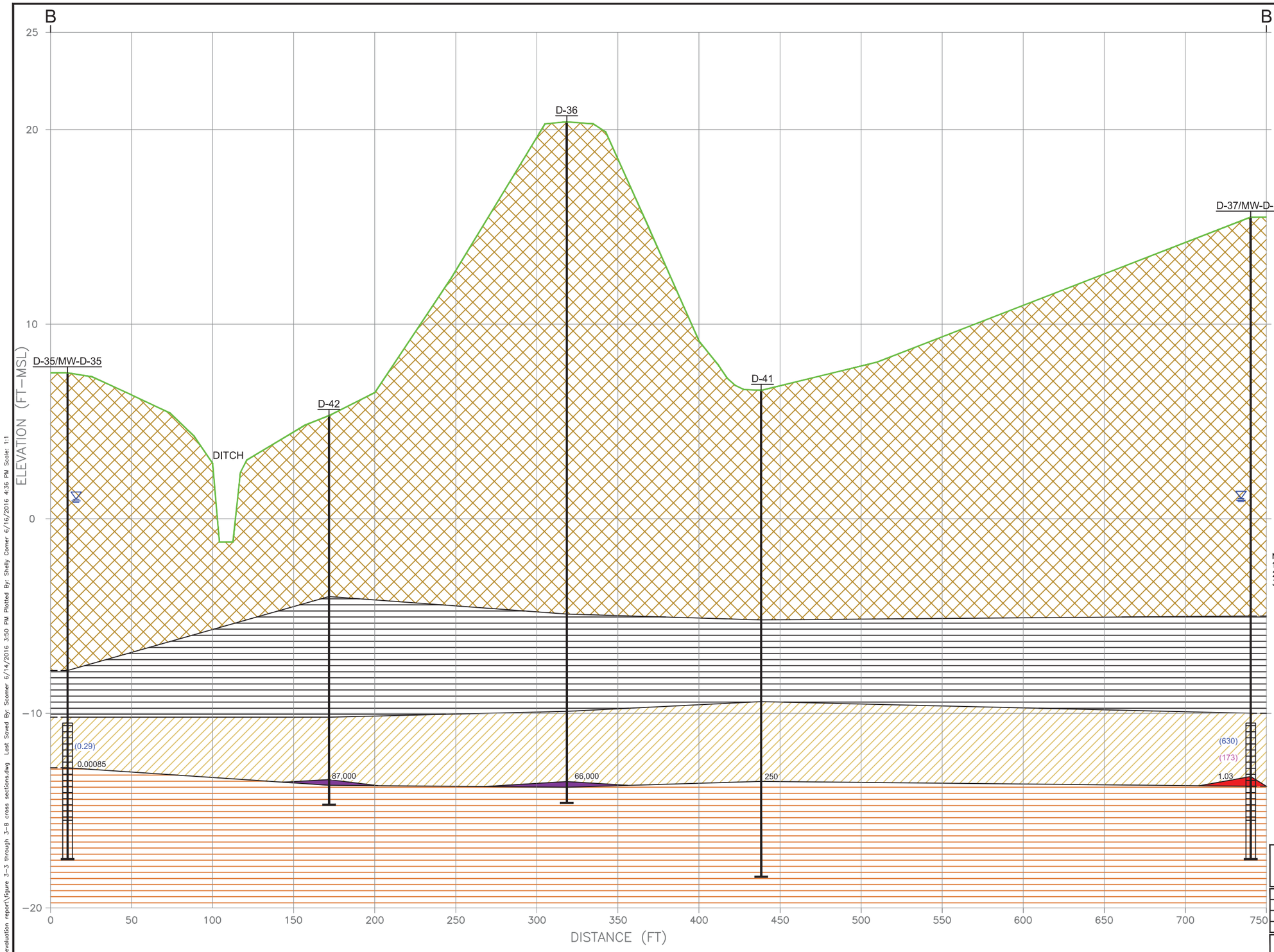
KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

CROSS-SECTION A-A'

PROJECT NO: 201601-03

FIGURE 3-4

y:\00civil\kearny\ti evaluation report\figure 3-3 through 3-8 cross sections.dwg Last Saved By: Scorner 6/14/2016 3:50 PM Plotted By: Shelly Corner 6/16/2016 4:36 PM Scale: 1:1



LEGEND

- GROUND SURFACE
- SHALLOW FILL MATERIAL
- MEADOW MAT
- DEEPER FINE SAND
- VARVED CLAY
- (630) GROUNDWATER TOTAL DICHLOROBENZENE CONCENTRATIONS (UG/L)
- (173) DNAPL TOTAL DICHLOROBENZENE CONCENTRATIONS (MG/KG)
- 1.03 TOTAL DICHLOROBENZENE CONCENTRATION IN SAND UNIT SOIL SAMPLE AT THE VARVED CLAY INTERFACE (MG/KG)
- NA NOT ANALYZED
- ND NOT DETECTED
- FREE PHASE DNAPL (OBSERVED IN SOIL CORE)
- FREE−PHASE DNAPL UNRELATED TO SITE (OBSERVED IN SOIL CORE)
- SAND UNIT POTENTIOMETRIC SURFACE ELEVATION
- BORE HOLE
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL SUMP INTERVAL BELOW SCREEN
- BORE HOLE TOTAL DEPTH

NOTES:
1. CROSS−SECTION HAS A VERTICAL EXAGGERATION OF 12.
2. DNAPL THICKNESS EXAGGERATED FOR VISUAL PRESENTATION.
3. GEOLOGIC CONTACTS SHOWN BETWEEN SOIL BORING LOCATIONS ARE INFERRED AS A DIRECT AND CONSISTENT INTERPOLATION OF THE GEOLOGIC INFORMATION ACQUIRED AT THE BORING LOCATIONS. ACTUAL GEOLOGIC CONDITIONS IN THE AREAS BETWEEN THE BORING LOCATIONS MAY DIFFER FROM WHAT IS SHOWN ON THIS CROSS−SECTIONS.

H: 0 60 120 FEET

V: 0 5 10 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

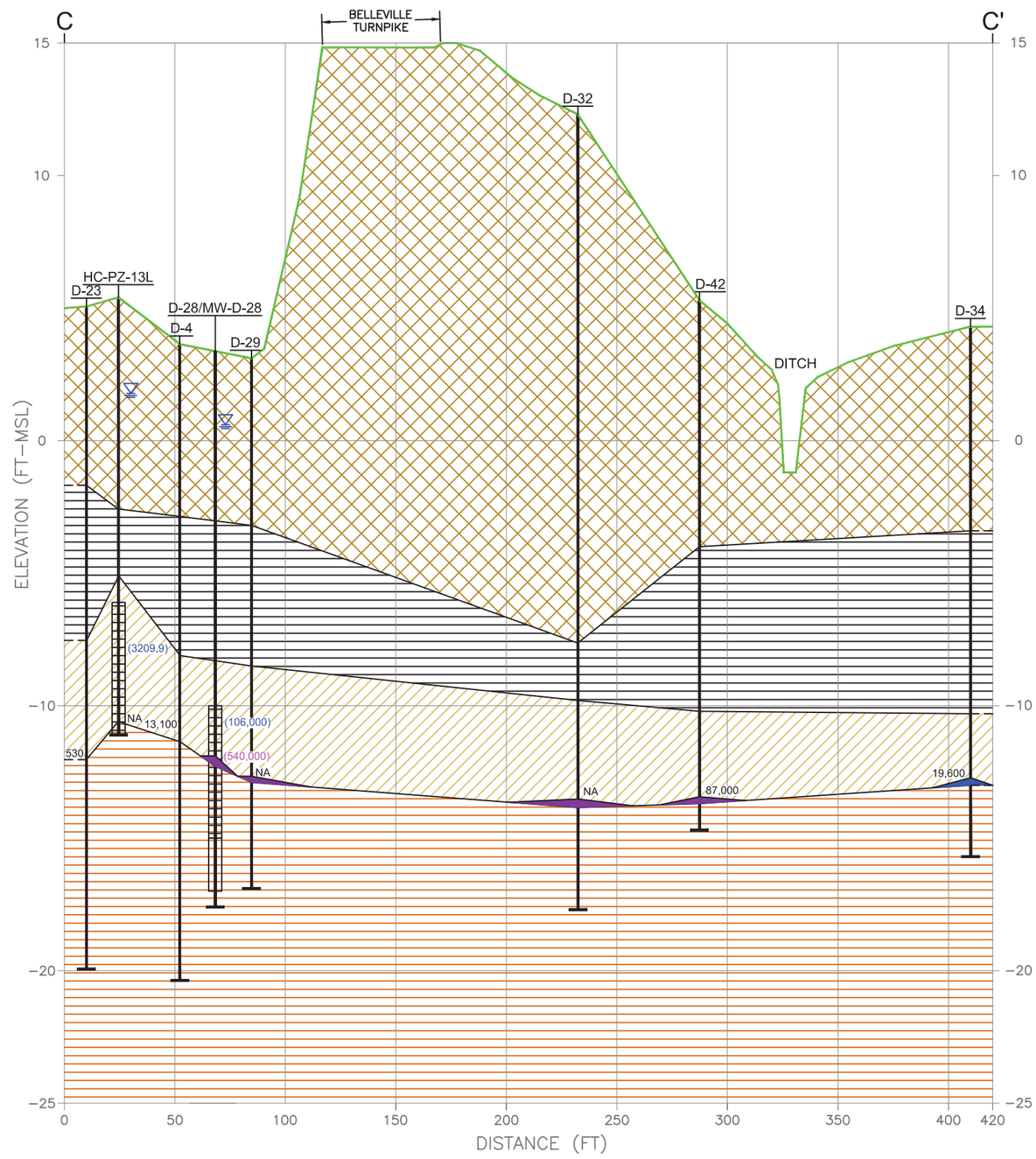
KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

CROSS−SECTION B−B'

PROJECT NO: 201601−03

FIGURE 3−5

y:\0Civil\kearny\ti evaluation report\figure 3-3 through 3-8 cross sections.dwg Last Saved By: Scomer 6/14/2016 3:50 PM Plotted By: Shelly Comer 6/16/2016 4:36 PM Scale: 1:1



LEGEND

- GROUND SURFACE
- SHALLOW FILL MATERIAL
- MEADOW MAT
- DEEPER FINE SAND
- VARVED CLAY
- (3209.9) GROUNDWATER TOTAL DICHLOROBENZENE CONCENTRATIONS (UG/L)
- (540,000) DNAPL TOTAL DICHLOROBENZENE CONCENTRATIONS (MG/KG)
- 19,600 TOTAL DICHLOROBENZENE CONCENTRATION IN SAND UNIT SOIL SAMPLE AT THE VARVED CLAY INTERFACE (MG/KG)
- NA NOT ANALYZED
- ND NOT DETECTED
- STAINING OR RESIDUAL DNAPL (OBSERVED IN SOIL CORE)
- FREE PHASE DNAPL (OBSERVED IN SOIL CORE)
- SAND UNIT POTENTIOMETRIC SURFACE ELEVATION
- BORE HOLE
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL SUMP INTERVAL BELOW SCREEN
- BORE HOLE TOTAL DEPTH

NOTES:
1. CROSS-SECTION HAS A VERTICAL EXAGGERATION OF 12.
2. DNAPL THICKNESS EXAGGERATED FOR VISUAL PRESENTATION.
3. GEOLOGIC CONTACTS SHOWN BETWEEN SOIL BORING LOCATIONS ARE INFERRED AS A DIRECT AND CONSISTENT INTERPOLATION OF THE GEOLOGIC INFORMATION ACQUIRED AT THE BORING LOCATIONS. ACTUAL GEOLOGIC CONDITIONS IN THE AREAS BETWEEN THE BORING LOCATIONS MAY DIFFER FROM WHAT IS SHOWN ON THIS CROSS-SECTIONS.

H: 0 60 120 FEET

V: 0 5 10 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

CROSS-SECTION C-C'

PROJECT NO: 201601-03

FIGURE 3-6

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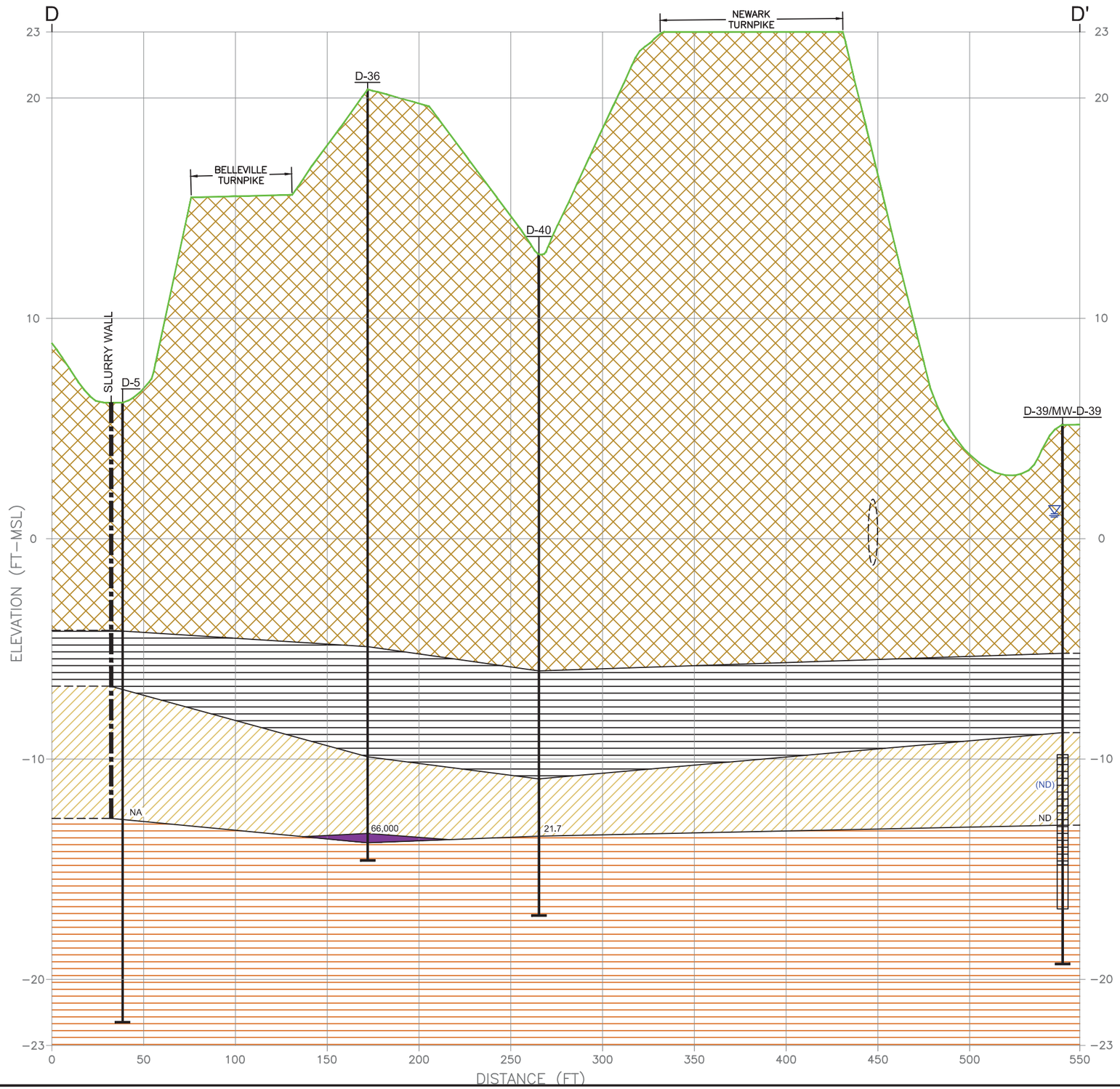


LEGEND

- GROUND SURFACE
- SHALLOW FILL MATERIAL
- MEADOW MAT
- DEEPER FINE SAND
- VARVED CLAY
- (NA) GROUNDWATER TOTAL DICHLOROBENZENE CONCENTRATIONS (UG/L)
- 12.5 TOTAL DICHLOROBENZENE CONCENTRATION IN SAND UNIT SOIL SAMPLE AT THE VARVED CLAY INTERFACE (MG/KG)
- NA NOT ANALYZED
- ND NOT DETECTED
- FREE PHASE DNAPL (OBSERVED IN SOIL CORE)
- SAND UNIT POTENTIOMETRIC SURFACE ELEVATION
- BORE HOLE
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL SUMP INTERVAL BELOW SCREEN
- BORE HOLE TOTAL DEPTH
- STORMWATER CULVERT (ESTIMATED LOCATION/DEPTH)

NOTES:
1. CROSS-SECTION HAS A VERTICAL EXAGGERATION OF 12.
2. DNAPL THICKNESS EXAGGERATED FOR VISUAL PRESENTATION.
3. GEOLOGIC CONTACTS SHOWN BETWEEN SOIL BORING LOCATIONS ARE INFERRED AS A DIRECT AND CONSISTENT INTERPOLATION OF THE GEOLOGIC INFORMATION ACQUIRED AT THE BORING LOCATIONS. ACTUAL GEOLOGIC CONDITIONS IN THE AREAS BETWEEN THE BORING LOCATIONS MAY DIFFER FROM WHAT IS SHOWN ON THIS CROSS-SECTIONS.

H: 0 60 120 FEET

V: 0 5 10 FEET

REFERENCE: GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

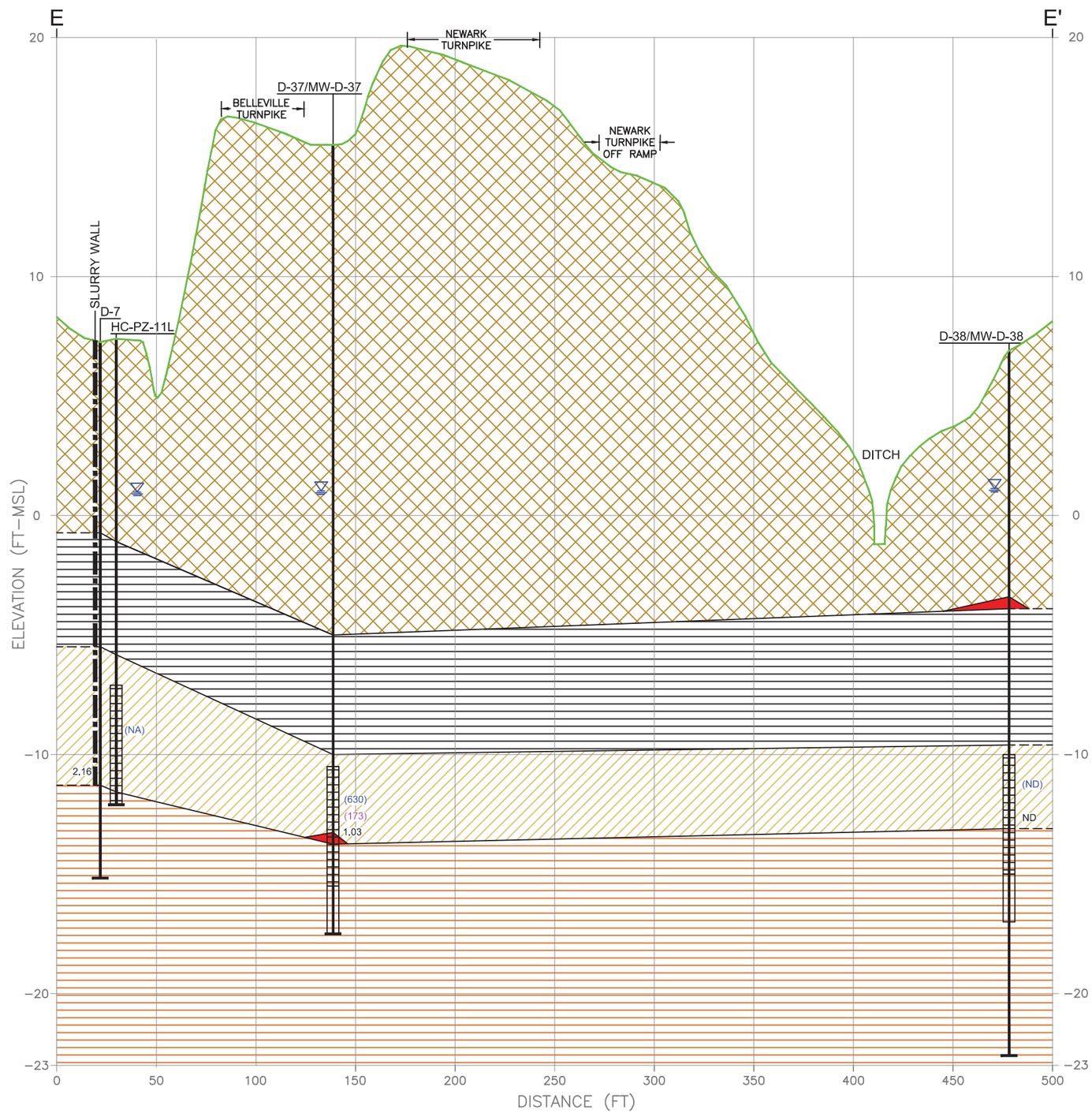
TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

CROSS-SECTION D-D'

PROJECT NO: 201601-03

FIGURE 3-7

y:\00civil\kearny\ti evaluation report\figure 3-3 through 3-8 cross sections.dwg Last Saved By: Scomer 6/14/2016 3:50 PM Plotted By: Shelly Comer 6/16/2016 4:36 PM Scale: 1:1



LEGEND

- GROUND SURFACE
- SHALLOW FILL MATERIAL
- MEADOW MAT
- DEEPER FINE SAND
- VARVED CLAY
- (630) GROUNDWATER TOTAL DICHLOROBENZENE CONCENTRATIONS (UG/L)
- (173) DNAPL TOTAL DICHLOROBENZENE CONCENTRATIONS (MG/KG)
- 1.03 TOTAL DICHLOROBENZENE CONCENTRATION IN SAND UNIT SOIL SAMPLE AT THE VARVED CLAY INTERFACE (MG/KG)
- NA NOT ANALYZED
- ND NOT DETECTED
- FREE-PHASE DNAPL UNRELATED TO SITE (OBSERVED IN SOIL CORE)
- SAND UNIT POTENTIOMETRIC SURFACE ELEVATION
- BORE HOLE
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL SUMP INTERVAL BELOW SCREEN
- BORE HOLE TOTAL DEPTH

NOTES:
1. CROSS-SECTION HAS A VERTICAL EXAGGERATION OF 12.
2. DNAPL THICKNESS EXAGGERATED FOR VISUAL PRESENTATION.
3. GEOLOGIC CONTACTS SHOWN BETWEEN SOIL BORING LOCATIONS ARE INFERRED AS A DIRECT AND CONSISTENT INTERPOLATION OF THE GEOLOGIC INFORMATION ACQUIRED AT THE BORING LOCATIONS. ACTUAL GEOLOGIC CONDITIONS IN THE AREAS BETWEEN THE BORING LOCATIONS MAY DIFFER FROM WHAT IS SHOWN ON THIS CROSS-SECTIONS.

H: 0 60 120 FEET

V: 0 5 10 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

CROSS-SECTION E-E'

PROJECT NO: 201601-03

FIGURE 3-8

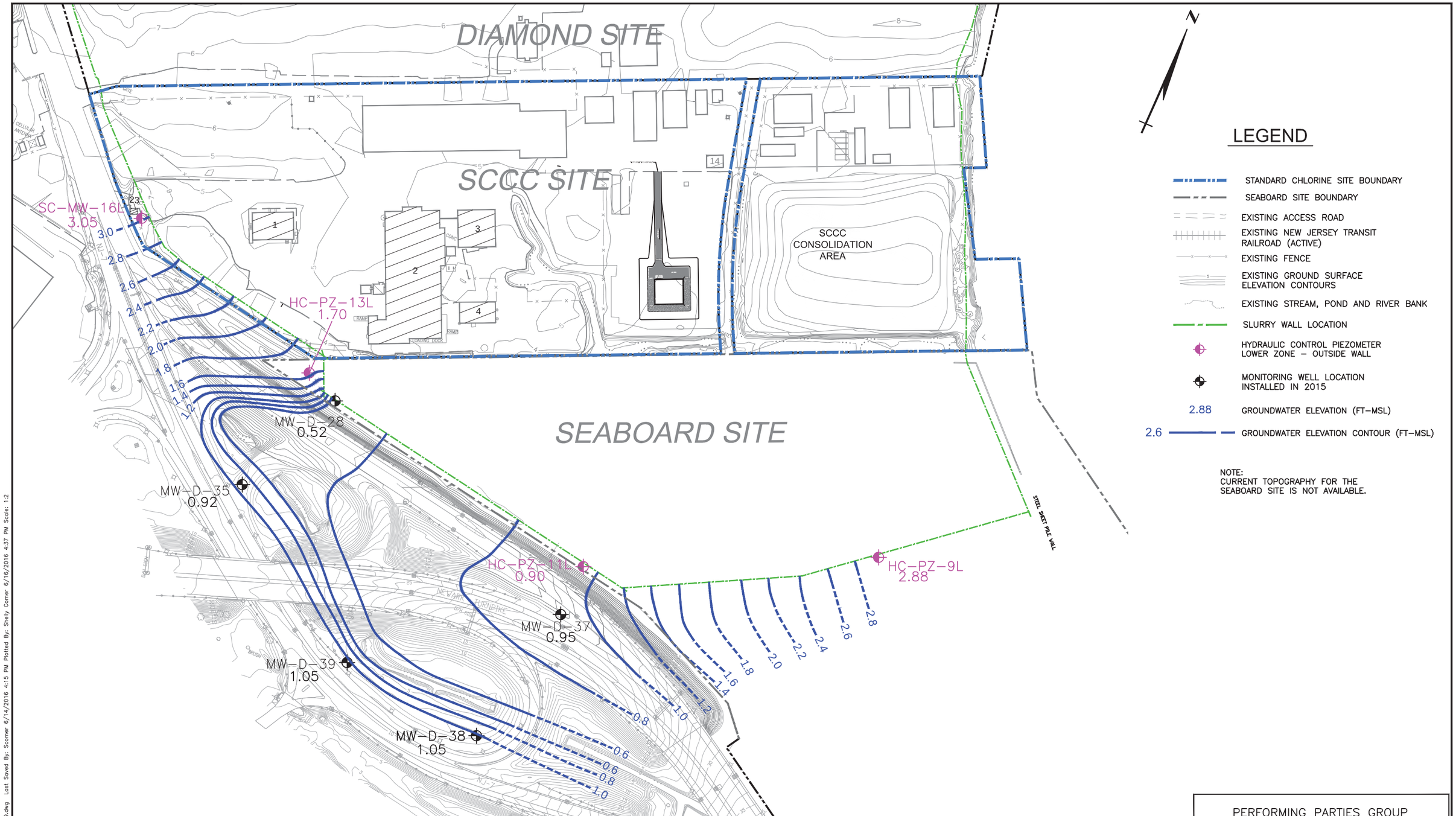
REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\00civil\kearny\ti evaluation report\figure 3-3 through 3-8 cross sections.dwg Last Saved By: Scomer 6/14/2016 3:50 PM Plotted By: Shelly Comer 6/16/2016 4:36 PM Scale: 1:1



NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE:		

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

GROUNDWATER ELEVATION CONTOURS –DEEP SAND UNIT – NOVEMBER 2015

PROJECT NO: 2015–01

FIGURE 3–9

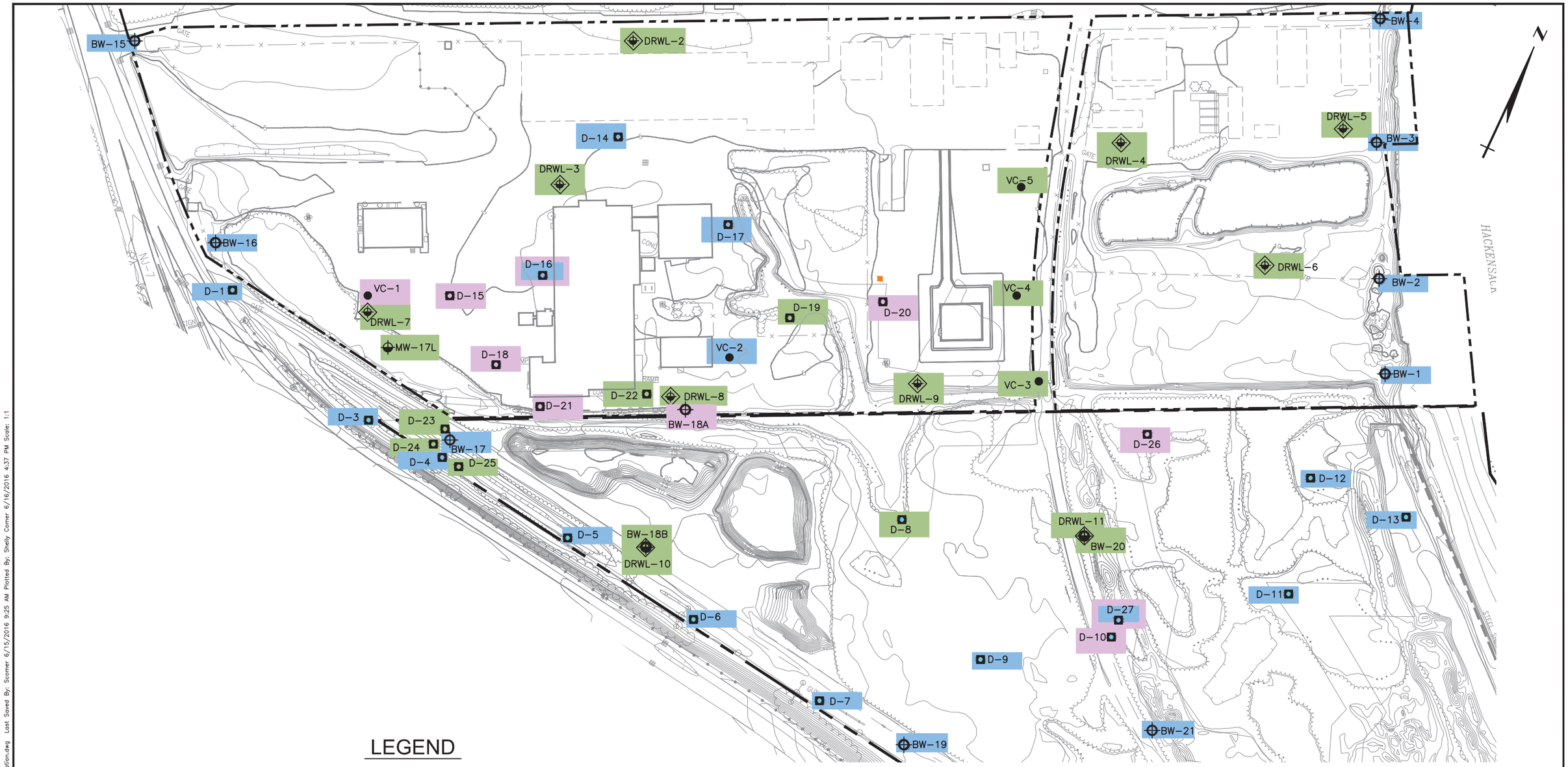
REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:
1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 11–14–04. PHOTOGRAMMETRIC AERIAL BASED ON N.J. STATE PLANE COORDINATE SYSTEM NAD 1927. VERTICAL DATUM BASED ON NGVD 1929.
2. EXISTING SCCC CONSOLIDATION AREA TOPOGRAPHY PER LANDMARKER GEOSPATIAL DATED 09–29–11.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\00civil\kearny\ti evaluation report\figure 3–9.dwg Last Saved By: Scomer 6/14/2016 4:15 PM Plotted By: Shelly Comer 6/16/2016 4:37 PM Scale: 1:2



LEGEND

- PROPERTY BOUNDARY
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- EXISTING STREAM, POND AND RIVER BANK
- EXISTING VEGETATION
- EXISTING ACCESS ROAD
- EXISTING FENCE
- EXISTING STRUCTURES
- FORMER STRUCTURE
- EXISTING UTILITY POLES
- BARRIER WALL GEOTECHNICAL BORING
- DNAPL RECOVERY WELL LOCATION
- PREVIOUS RI DNAPL DELINEATION BORING
- RI DNAPL DELINEATION BORINGS
- RI VARVED CLAY SAMPLE LOCATION

DNAPL OBSERVED IN SAND UNIT

- POSSIBLE FREE-PHASE DNAPL
- POSSIBLE RESIDUAL DNAPL
- NO DNAPL OBSERVED
- RESIDUAL DNAPL OBSERVED MEADOW MAT

0 150 300 FEET

NOTES:
1. RESIDUAL DNAPL OBSERVED IN MEADOW MAT IN BORING D-16 AND IN FILL JUST ABOVE MEADOW MAT IN BORING D-27.
2. NO DNAPL WAS OBSERVED IN D-16 AND D-27 IN THE SAND UNIT.

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1 INFERRED DNAPL LIMITS

PROJECT NO: 2015-01

FIGURE 3-10

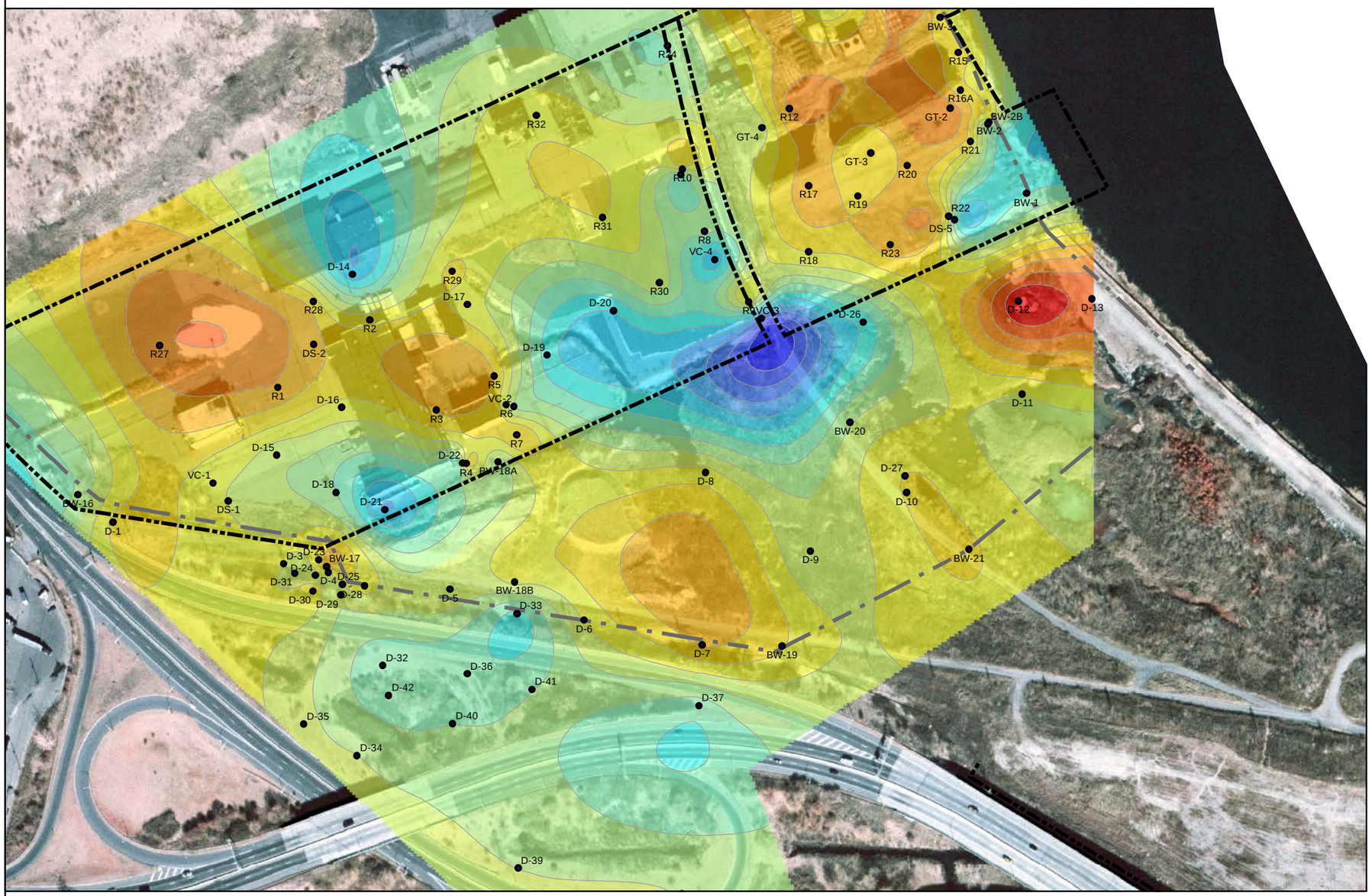
REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\00civil\kearny\ti evaluation report\figure 3-10 delineation borings dnapl observation.dwg Last Saved By: Scomer 6/15/2016 9:25 AM Plotted By: Shelly Comer 6/16/2016 4:37 PM Scale: 1:1



Legend

- Property Boundary
- Slurry_Wall
- Soil Boring Location
- -9.5
- -10
- -10.5
- -11
- -11.5
- -12
- -12.5
- -13
- -13.5
- -14
- -14.5
- -15
- -15.5
- -16
- -16.5

N

200 100 0 200
Feet

NOTE:
A MINIMUM CURVATURE (MC) ALGORITHM THAT RESIDES WITHIN THE SOFTWARE SURFER V. 12 WAS USED TO CREATE AN INTERPOLATED SURFACE THAT REPRESENTS THE ELEVATION OF THE TOP OF THE VARVED CLAY. THE MC ALGORITHM IS CONSIDERED A REASONABLE APPROACH FOR CONTOURING GEOLOGICAL AND GEOPHYSICAL DATA (BRIGGS, 1974). THE MC APPROACH IS OFTEN DESCRIBED AS BEING A SMOOTHING INTERPOLATOR AND PROVIDES RESULTS CONSIDERED MORE REPRESENTATIVE OF GEOLOGIC SURFACES RELATIVE TO EXACT INTERPOLATORS SUCH AS KRIGING. HOWEVER, AS A SMOOTHING INTERPOLATOR, THE INTERPOLATED SURFACE OUTPUT MAY SLIGHTLY UNDERSHOOT OR OVERSHOOT LOCALIZED EXTREMES IN THE TARGET DATA SET.

REFERENCE - BRIGGS, IAN C., MACHINE CONTOURING USING MINIMUM CURVATURE, GEOPHYSICS, VOL. 39, NO. 1, P. 38-48.

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD: JMV	DATE: 03/11/16	
APPD: JSZ	DATE: 03/11/16	

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV#	DATE	DESCRIPTION	APPD
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△			
△1			

REFERENCE:

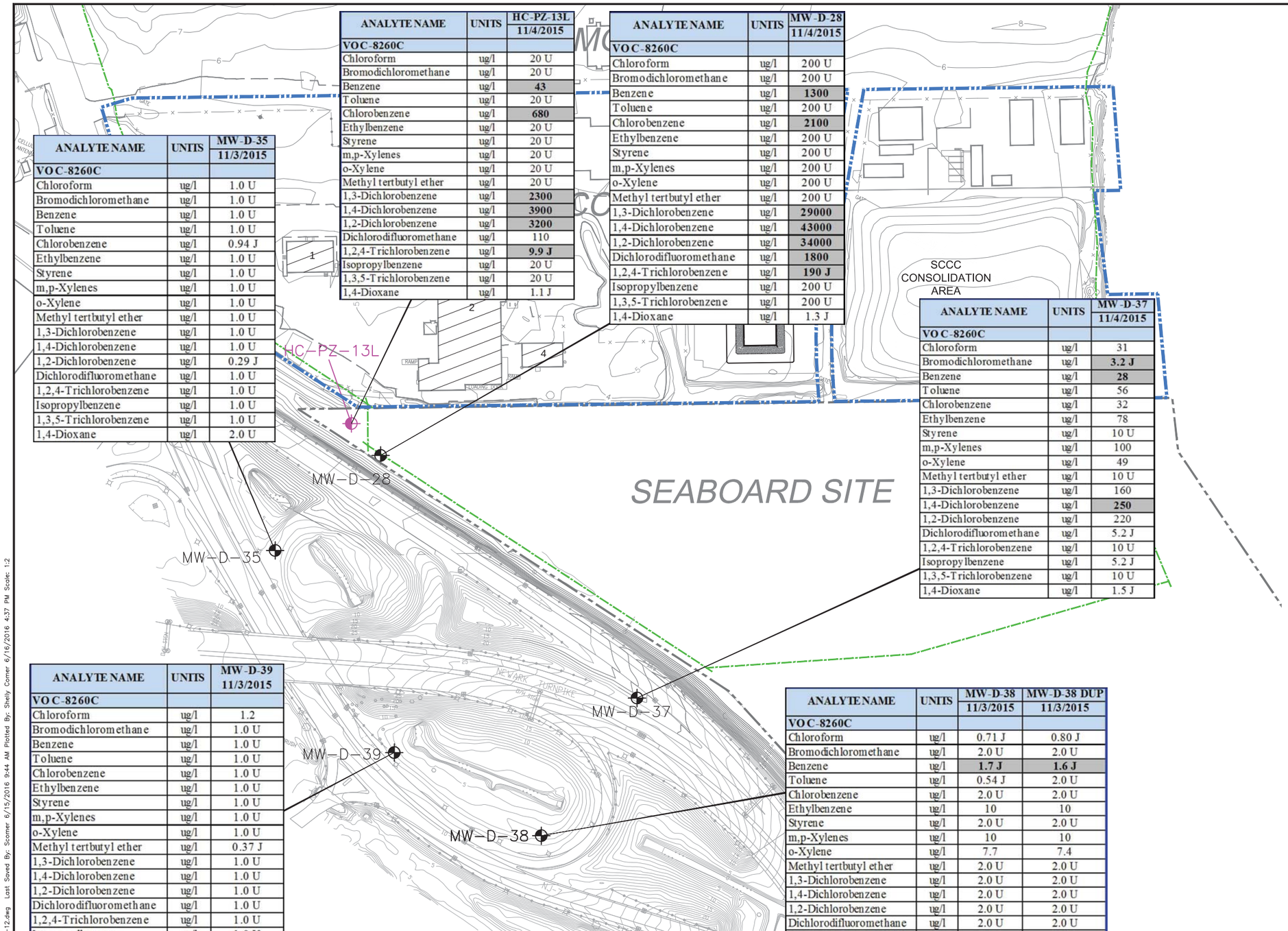
ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

VARVED CLAY SURFACE
ELEVATION CONTOUR MAP

PROJECT NO: 201501-02

FIGURE 3-11



ANALYTE NAME	UNITS	MW-D-35 11/3/2015
VOC-8260C		
Chloroform	ug/l	1.0 U
Bromodichloromethane	ug/l	1.0 U
Benzene	ug/l	1.0 U
Toluene	ug/l	1.0 U
Chlorobenzene	ug/l	0.94 J
Ethylbenzene	ug/l	1.0 U
Styrene	ug/l	1.0 U
m,p-Xylenes	ug/l	1.0 U
o-Xylene	ug/l	1.0 U
Methyl tertbutyl ether	ug/l	1.0 U
1,3-Dichlorobenzene	ug/l	1.0 U
1,4-Dichlorobenzene	ug/l	1.0 U
1,2-Dichlorobenzene	ug/l	0.29 J
Dichlorodifluoromethane	ug/l	1.0 U
1,2,4-Trichlorobenzene	ug/l	1.0 U
Isopropylbenzene	ug/l	1.0 U
1,3,5-Trichlorobenzene	ug/l	1.0 U
1,4-Dioxane	ug/l	2.0 U

ANALYTE NAME	UNITS	HC-PZ-13L 11/4/2015
VOC-8260C		
Chloroform	ug/l	20 U
Bromodichloromethane	ug/l	20 U
Benzene	ug/l	**43**
Toluene	ug/l	20 U
Chlorobenzene	ug/l	**680**
Ethylbenzene	ug/l	20 U
Styrene	ug/l	20 U
m,p-Xylenes	ug/l	20 U
o-Xylene	ug/l	20 U
Methyl tertbutyl ether	ug/l	20 U
1,3-Dichlorobenzene	ug/l	**2300**
1,4-Dichlorobenzene	ug/l	**3900**
1,2-Dichlorobenzene	ug/l	**3200**
Dichlorodifluoromethane	ug/l	110
1,2,4-Trichlorobenzene	ug/l	**9.9 J**
Isopropylbenzene	ug/l	20 U
1,3,5-Trichlorobenzene	ug/l	20 U
1,4-Dioxane	ug/l	1.1 J

ANALYTE NAME	UNITS	MW-D-28 11/4/2015
VOC-8260C		
Chloroform	ug/l	200 U
Bromodichloromethane	ug/l	200 U
Benzene	ug/l	**1300**
Toluene	ug/l	200 U
Chlorobenzene	ug/l	**2100**
Ethylbenzene	ug/l	200 U
Styrene	ug/l	200 U
m,p-Xylenes	ug/l	200 U
o-Xylene	ug/l	200 U
Methyl tertbutyl ether	ug/l	200 U
1,3-Dichlorobenzene	ug/l	**29000**
1,4-Dichlorobenzene	ug/l	**43000**
1,2-Dichlorobenzene	ug/l	**34000**
Dichlorodifluoromethane	ug/l	**1800**
1,2,4-Trichlorobenzene	ug/l	**190 J**
Isopropylbenzene	ug/l	200 U
1,3,5-Trichlorobenzene	ug/l	200 U
1,4-Dioxane	ug/l	1.3 J

ANALYTE NAME	UNITS	MW-D-37 11/4/2015
VOC-8260C		
Chloroform	ug/l	31
Bromodichloromethane	ug/l	**3.2 J**
Benzene	ug/l	**28**
Toluene	ug/l	56
Chlorobenzene	ug/l	32
Ethylbenzene	ug/l	78
Styrene	ug/l	10 U
m,p-Xylenes	ug/l	100
o-Xylene	ug/l	49
Methyl tertbutyl ether	ug/l	10 U
1,3-Dichlorobenzene	ug/l	160
1,4-Dichlorobenzene	ug/l	**250**
1,2-Dichlorobenzene	ug/l	220
Dichlorodifluoromethane	ug/l	5.2 J
1,2,4-Trichlorobenzene	ug/l	10 U
Isopropylbenzene	ug/l	5.2 J
1,3,5-Trichlorobenzene	ug/l	10 U
1,4-Dioxane	ug/l	1.5 J

ANALYTE NAME	UNITS	MW-D-39 11/3/2015
VOC-8260C		
Chloroform	ug/l	1.2
Bromodichloromethane	ug/l	1.0 U
Benzene	ug/l	1.0 U
Toluene	ug/l	1.0 U
Chlorobenzene	ug/l	1.0 U
Ethylbenzene	ug/l	1.0 U
Styrene	ug/l	1.0 U
m,p-Xylenes	ug/l	1.0 U
o-Xylene	ug/l	1.0 U
Methyl tertbutyl ether	ug/l	0.37 J
1,3-Dichlorobenzene	ug/l	1.0 U
1,4-Dichlorobenzene	ug/l	1.0 U
1,2-Dichlorobenzene	ug/l	1.0 U
Dichlorodifluoromethane	ug/l	1.0 U
1,2,4-Trichlorobenzene	ug/l	1.0 U
Isopropylbenzene	ug/l	1.0 U
1,3,5-Trichlorobenzene	ug/l	1.0 U
1,4-Dioxane	ug/l	2.0 U

ANALYTE NAME	UNITS	MW-D-38 11/3/2015	MW-D-38 DUP 11/3/2015
VOC-8260C			
Chloroform	ug/l	0.71 J	0.80 J
Bromodichloromethane	ug/l	2.0 U	2.0 U
Benzene	ug/l	**1.7 J**	**1.6 J**
Toluene	ug/l	0.54 J	2.0 U
Chlorobenzene	ug/l	2.0 U	2.0 U
Ethylbenzene	ug/l	10	10
Styrene	ug/l	2.0 U	2.0 U
m,p-Xylenes	ug/l	10	10
o-Xylene	ug/l	7.7	7.4
Methyl tertbutyl ether	ug/l	2.0 U	2.0 U
1,3-Dichlorobenzene	ug/l	2.0 U	2.0 U
1,4-Dichlorobenzene	ug/l	2.0 U	2.0 U
1,2-Dichlorobenzene	ug/l	2.0 U	2.0 U
Dichlorodifluoromethane	ug/l	2.0 U	2.0 U
1,2,4-Trichlorobenzene	ug/l	2.0 U	2.0 U
Isopropylbenzene	ug/l	2.0	2.1
1,3,5-Trichlorobenzene	ug/l	2.0 U	2.0 U
1,4-Dioxane	ug/l	2.0 U	2.0 U

LEGEND

- STANDARD CHLORINE SITE BOUNDARY
- SEABOARD SITE BOUNDARY
- EXISTING ACCESS ROAD
- EXISTING NEW JERSEY TRANSIT RAILROAD (ACTIVE)
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- EXISTING STREAM, POND AND RIVER BANK
- SLURRY WALL LOCATION
- HYDRAULIC CONTROL PIEZOMETER LOWER ZONE – OUTSIDE WALL
- MONITORING WELL LOCATION INSTALLED IN 2015

NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

SHADED RESULTS EXCEEDS GROUNDWATER QUALITY CONCENTRATION CRITERION.

U.S. EPA Maximum Contaminant Levels (MCLs) and New Jersey Ground Water Quality Criteria (GWQC)		
Analyte Name	EPA MCL (ug/l)	NJ GWQC (ug/l)
Chloroform	-----	70
Bromodichloromethane	-----	1
Benzene	5	1
Toluene	1000	600
Chlorobenzene	100	50
Ethylbenzene	700	700
Styrene	100	100
Xylene (Total)	10000	1000
Methyl tertiary butyl ether	-----	70
1,3-Dichlorobenzene	-----	600
1,4-Dichlorobenzene	75	75
1,2-Dichlorobenzene	600	600
Dichlorodifluoromethane	-----	1000
1,2,4-Trichlorobenzene	-----	9
Isopropylbenzene	-----	-----
1,3,5-Trichlorobenzene	-----	-----
1,4-Dioxane	-----	-----
----- Indicates no groundwater quality criterion for listed analyte.		

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:
1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 11–14–04. PHOTOGRAMMETRIC AERIAL BASED ON N.J. STATE PLANE COORDINATE SYSTEM NAD 1927. VERTICAL DATUM BASED ON NGVD 1929.
2. EXISTING SCCC CONSOLIDATION AREA TOPOGRAPHY PER LANDMARKER GEOSPATIAL DATED 09–29–11.
3. NEW JERSEY ADMINISTRATIVE CODE. N.J.A.C 7:9C GROUND WATER QUALITY STANDARDS DATE LAST AMENDED: JULY 22, 2010, READOPTED WITHOUT CHANGE: MARCH 4, 2014.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

DETECTED VOC ANALYTICAL RESULTS – AREA 2
DEEP SAND UNIT GROUNDWATER

PROJECT NO: 2015–01
FIGURE 3–12

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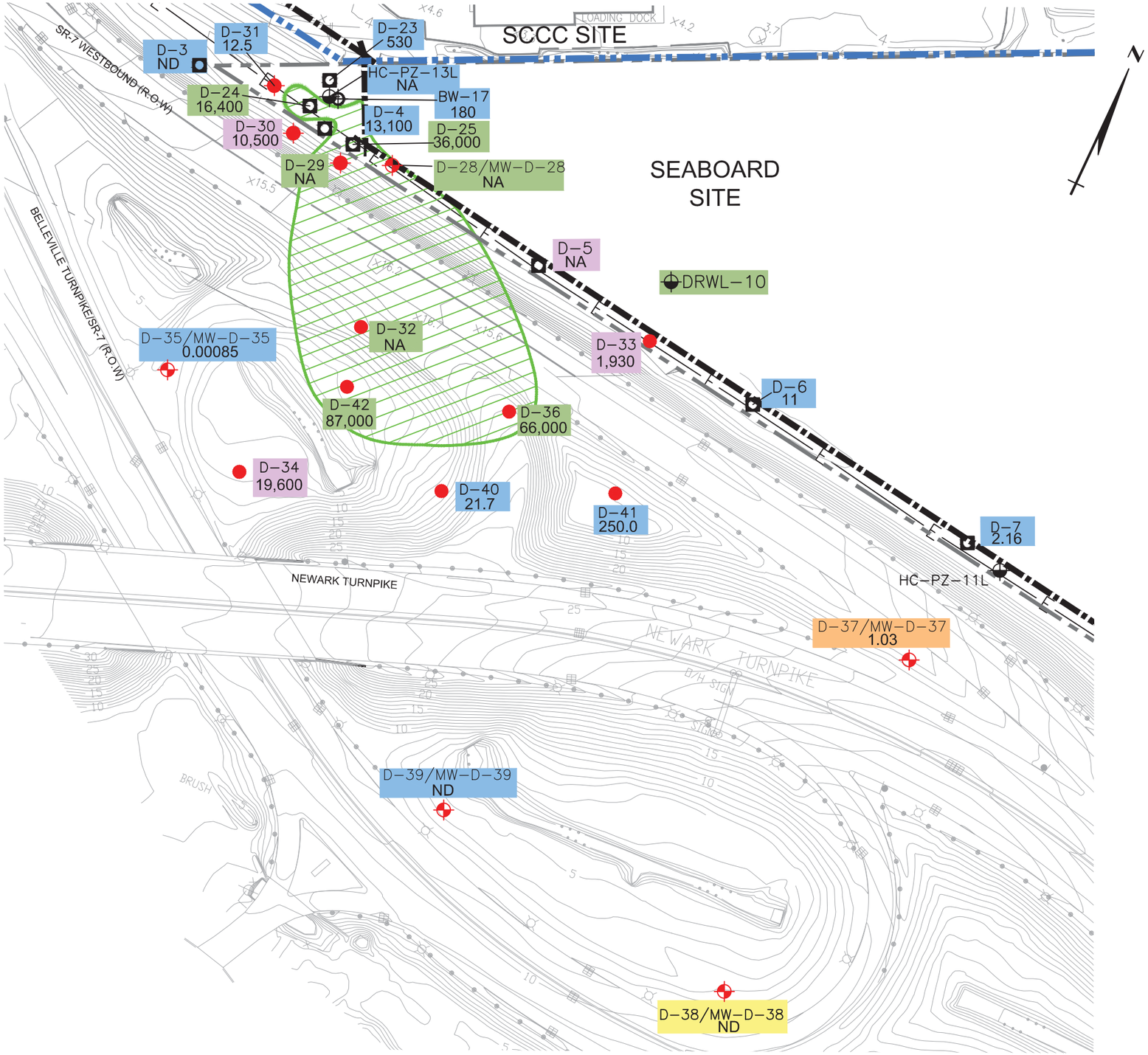

LEGEND

- STANDARD CHLORINE SITE BOUNDARY
- SEABOARD SITE BOUNDARY
- SLURRY WALL LOCATION
- BARRIER WALL ALIGNMENT BORING
- RI DNAPL DELINEATION BORINGS
- HYDRAULIC CONTROL PIEZOMETER
- DNAPL DELINEATION BORING LOCATION
- CONTINGENCY BORING LOCATION
- MONITORING WELL LOCATION
- SOIL BORING/MONITORING WELL LOCATION INSTALLED IN 2015
- SAND UNIT INFERRED LIMIT OF SCCC SITE RELATED DNAPL IN AREA 2
- 180 — TOTAL DICHLOROBENZENE CONCENTRATIONS IN SAND UNIT AT THE VARVED CLAY INTERFACE (MG/KG)
- NA — NOT ANALYZED
- ND — NON-DETECT

SCCC-SITE RELATED DNAPL OBSERVED IN SAND UNIT

- POSSIBLE FREE-PHASE DNAPL
- POSSIBLE RESIDUAL DNAPL
- NO DNAPL OBSERVED

DNAPL NOT RELATED TO SCCC SITE

- OBSERVED IN FILL MATERIAL
- OBSERVED IN SAND UNIT

NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16
CHKD:	DATE:
APPD:	DATE:
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: EXISTING GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

INFERRED DNAPL LIMITS OUTSIDE OF SLURRY WALL

PROJECT NO: 2015-01

FIGURE 3-13

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Analyte	SC-PZ-1U 04/23/08 Primary	
1,2,4-TCB	0.42	U
1,2-DCB	0.65	U
1,3-DCB	0.66	U
1,4-DCB	0.6	U
BNZ	0.81	U
CB	0.71	U
2,4,6-TCP	0.71	U
2,4-DCP	0.61	U
2,4-DMP	0.65	U
2-CP	0.57	U
2-MNAP	0.59	U
B(a)A	0.51	U
B(a)P	0.55	U
B(b)F	0.39	U
B(k)F	0.49	U
HCB	0.54	U
I(1,2,3)P	0.59	U
NAP	0.54	U
PCP	1	U
PHL	0.28	U
Cr	119	
Cr^{+6}	250	U
1016	0.12	U
1248	0.11	U
1260	0.066	U

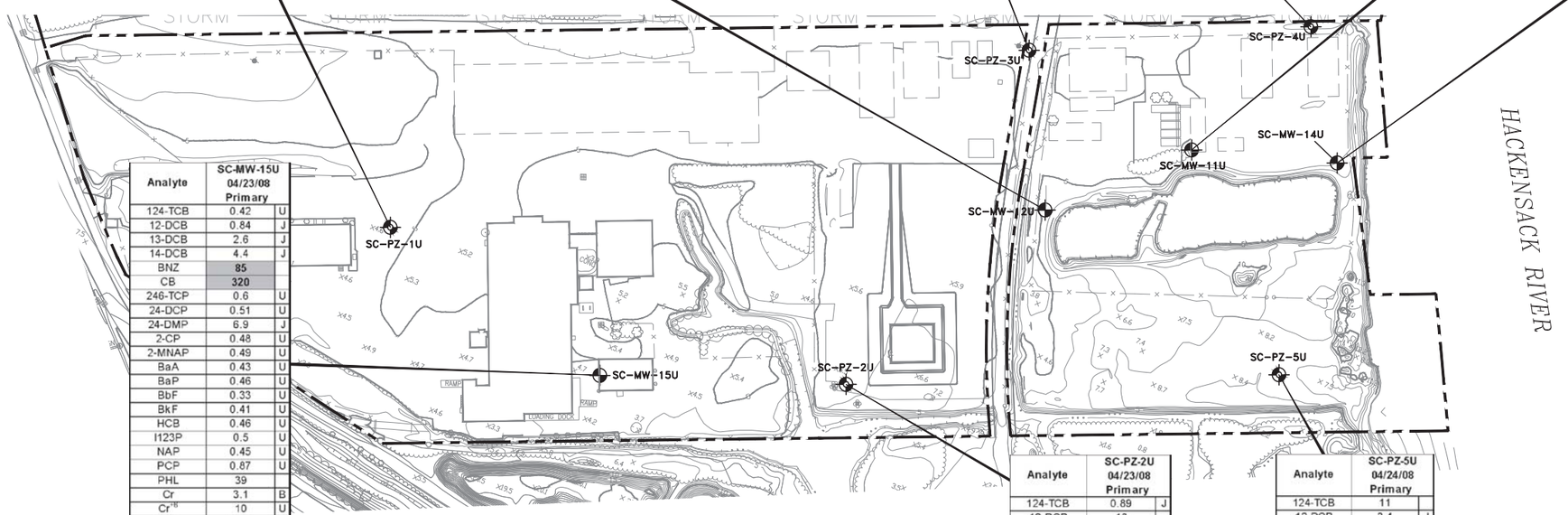
Analyte	SC-MW-12U 04/23/08 Primary		SC-MW-12U 04/23/08 Duplicate	
124-TCB	0.42	U	1.2	J
12-DCB	4	J	11	
13-DCB	10		18	
14-DCB	35		55	
BNZ	0.81	U	0.91	J
CB	**37**		**53**	
246-TCP	0.65	U	0.62	U
24-DCP	1.4	J	1.1	J
24-DMP	12		29	
2-CP	0.52	U	0.49	U
2-MNAP	0.69	J	**14**	
BaA	0.47	U	0.45	U
BaP	0.5	U	0.48	U
BbF	0.36	U	0.34	U
BkF	0.45	U	0.43	U
HCB	0.5	U	0.47	U
I123P	0.54	U	0.52	U
NAP	**6.2**	J	**310**	
PCP	0.95	U	0.9	U
PHL	5.1	J	36	
Cr	32.6		6.4	
Cr^{+6}	10	U	10	U
1016	0.11	U	0.11	U
1248	0.1	U	0.1	U
1260	0.062	U	0.061	U

Analyte	SC-PZ-3U 04/23/08 Primary	
124-TCB	0.42	U
12-DCB	4.5	J
13-DCB	0.66	U
14-DCB	1	J
BNZ	**10**	
CB	2.4	J
246-TCP	0.62	U
24-DCP	0.53	U
24-DMP	**12**	
2-CP	0.49	U
2-MNAP	**590**	
BaA	0.45	U
BaP	0.48	U
BbF	0.34	U
BkF	0.43	U
HCB	0.47	U
I123P	0.52	U
NAP	**5000**	
PCP	0.9	U
PHL	5.8	J
Cr	142	
Cr^{+6}	10	U
1016	0.11	U
1248	0.099	U
1260	0.059	U

Analyte	SC-PZ-4U 04/25/08 Primary	
1,2,4-TCB	4.1	J
1,2-DCB	4.2	J
1,3-DCB	2.6	J
1,4-DCB	4.4	J
BNZ	0.81	U
CB	**17**	
2,4,6-TCP	0.65	U
2,4-DCP	0.56	U
2,4-DMP	9.8	J
2-CP	0.52	U
2-MNAP	1.4	J
B(a)A	**2.3**	J
B(a)P	**2.2**	J
B(b)F	**3.8**	J
B(k)F	0.45	U
HCB	0.5	U
I(1,2,3)P	**1.7**	J
NAP	**21**	
PCP	0.95	U
PHL	29	
Cr	**3650**	
Cr^{+6}	**453**	
1016	0.1	U
1248	0.095	U
1260	0.056	U

Analyte	SC-MW-11U 04/24/08 Primary	
124-TCB	**5000**	
12-DCB	**5200**	
13-DCB	**1100**	
14-DCB	**1800**	
BNZ	**36**	J
CB	**450**	
246-TCP	11	
24-DCP	**46**	
24-DMP	**99**	
2-CP	0.5	U
2-MNAP	**260**	
BaA	**1.6**	J
BaP	**0.72**	J
BbF	**1.1**	J
BkF	0.53	J
HCB	0.48	U
I123P	0.52	U
NAP	**14000**	
PCP	**10**	J
PHL	49	
Cr	396	
Cr^{+6}	50	U
1016	**1.3**	
1248	0.094	U
1260	0.056	U

Analyte	SC-MW-14U 04/24/08 Primary	
124-TCB	**230**	J
12-DCB	**7200**	
13-DCB	**5600**	
14-DCB	**9000**	
BNZ	41	U
CB	**490**	
246-TCP	0.63	U
24-DCP	0.54	U
24-DMP	7.8	J
2-CP	0.5	U
2-MNAP	3.6	J
BaA	0.46	U
BaP	0.49	U
BbF	0.35	U
BkF	0.44	U
HCB	0.48	U
I123P	0.53	U
NAP	**740**	
PCP	0.92	U
PHL	5.1	J
Cr	427	
Cr^{+6}	10	U
1016	0.1	U
1248	0.095	U
1260	0.056	U



Analyte	SC-MW-15U 04/23/08 Primary	
124-TCB	0.42	U
12-DCB	0.84	J
13-DCB	2.6	J
14-DCB	4.4	J
BNZ	**85**	
CB	**320**	
246-TCP	0.6	U
24-DCP	0.51	U
24-DMP	6.9	J
2-CP	0.48	U
2-MNAP	0.49	U
BaA	0.43	U
BaP	0.46	U
BbF	0.33	U
BkF	0.41	U
HCB	0.46	U
I123P	0.5	U
NAP	0.45	U
PCP	0.87	U
PHL	39	
Cr	3.1	B
Cr^{+6}	10	U
1016	0.11	U
1248	0.098	U
1260	0.059	U

Analyte	SC-PZ-2U 04/23/08 Primary	
124-TCB	0.89	J
12-DCB	10	
13-DCB	3.4	J
14-DCB	3.2	J
BNZ	1.5	J
CB	10	
246-TCP	0.6	U
24-DCP	0.51	U
24-DMP	3.3	J
2-CP	0.48	U
2-MNAP	1.2	J
BaA	0.44	U
BaP	0.46	U
BbF	0.33	U
BkF	0.42	U
HCB	0.46	U
I123P	0.5	U
NAP	**2.1**	J
PCP	0.88	U
PHL	6.9	J
Cr	**4690**	
Cr^{+6}	**4070**	
1016	0.11	U
1248	0.1	U
1260	0.06	U

Analyte	SC-PZ-5U 04/24/08 Primary	
124-TCB	11	
12-DCB	3.4	J
13-DCB	0.66	U
14-DCB	3.5	J
BNZ	**15**	
CB	**25**	
246-TCP	0.69	U
24-DCP	0.59	U
24-DMP	13	
2-CP	0.55	U
2-MNAP	**4.3**	J
BaA	0.5	U
BaP	0.53	U
BbF	0.38	U
BkF	0.48	U
HCB	0.53	U
I123P	0.56	U
NAP	**50**	
PCP	1	U
PHL	**870**	
Cr	2090	
Cr^{+6}	**1650**	
1016	0.1	U
1248	0.094	U
1260	0.056	U

Analyte	Abbreviation	Units	Criterion[1]
Volatile Organics (VOCs)			
1,2,4-Trichlorobenzene	124-TCB	ug/L	70
1,2-Dichlorobenzene	12-DCB	ug/L	600
1,3-Dichlorobenzene	13-DCB	ug/L	600
1,4-Dichlorobenzene	14-DCB	ug/L	75
Benzene	BNZ	ug/L	5
Chlorobenzene	CB	ug/L	100
Semivolatile Organics (SVOCs)			
2,4,6-Trichlorophenol	246-TCP	ug/L	120
2,4-Dichlorophenol	24-DCP	ug/L	4.6
2,4-Dimethylphenol	24-DMP	ug/L	36
2-Chlorophenol	2-CP	ug/L	9.1
2-Methylnaphthalene	2-MNAP	ug/L	3.6
Benzo(a)anthracene	BaA	ug/L	0.034
Benzo(a)pyrene	BaP	ug/L	0.2
Benzo(b)fluoranthene	BbF	ug/L	0.034
Benzo(k)fluoranthene	BkF	ug/L	0.34
Hexachlorobenzene	HCB	ug/L	1
Indeno(1,2,3-cd)pyrene	I123P	ug/L	0.034
Naphthalene	NAP	ug/L	0.17
Pentachlorophenol	PCP	ug/L	1
Phenol	PHL	ug/L	580
Metals			
Chromium (Total)	Cr	ug/L	2200
Hexavalent Chromium	Cr^{+6}	ug/L	0.035
Polychlorinated Biphenyls (Aroclors) (PCBs)			
Aroclor 1016	1016	ug/L	0.14
Aroclor 1248	1248	ug/L	0.039
Aroclor 1260	1260	ug/L	0.039

NOTE:
1. Criteria are USEPA Region 3 Screening Levels (November 2014) for tapwater. MCL is presented if available.

Exceedances are shown in bold, shaded typeface.

Data qualifiers are as follows:
U - Not detected at the detection limit indicated.
J - Organic results. Result is an estimate.
Quantitated between the detection limit and the reporting limit.
B - Inorganic results. Result is an estimate.
Quantitation between the detection limit and the reporting limit.
P - Organic results.
Percent difference between initial and confirmation column results is greater than 40%.

0 200 400 FEET

LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING BUILDING/STRUCTURES
- FORMER BUILDING/STRUCTURES
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- SC-MW-11U — SHALLOW (FILL) UNIT GROUNDWATER MONITORING WELL LOCATION
- SC-PZ-5U — SHALLOW (FILL) UNIT PIEZOMETER LOCATION

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

NOTE:
GROUNDWATER ON THE SCCC SITE IS CURRENTLY CONFINED WITHIN THE LIMITS OF THE SLURRY/SHEET PILE WALLS.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC DATE: 03/09/16
CHKD: DATE:
APPD: DATE:
SCALE: AS SHOWN

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1 – FILL UNIT
GROUNDWATER ANALYTICAL RESULTS

PROJECT NO: 2015–01
FIGURE 3–14

y:\00civil\kearny\ti evaluation report\figure 3-14 shallow groundwater analytical.dwg Last Saved By: Scomer 6/15/2016 9:21 AM Plotted By: Shelly Comer 6/16/2016 4:42 PM Scale: 1:1

Analyte	SC-MW-15L 04/24/08 Primary	
124-TCB	440	J
12-DCB	36000	
13-DCB	26000	
14-DCB	42000	
BNZ	350	J
CB	7800	
246-TCP	0.6	U
24-DCP	48	
24-DMP	3.9	J
2-CP	0.48	U
2-MNAP	0.89	J
BaA	0.43	U
BaP	0.46	U
BbF	0.33	U
BkF	0.41	U
HCB	0.46	U
I123P	0.5	U
NAP	24	
PCP	0.87	U
PHL	7.2	J
Cr	4.3	B
Cr^{+6}	10	U
1016	0.1	U
1248	0.093	U
1260	0.055	U

Analyte	SC-MW-2L 04/24/08 Primary	
1,2,4-TCB	840	
1,2-DCB	12000	
1,3-DCB	9700	
1,4-DCB	15000	
BNZ	81	U
CB	730	
2,4,6-TCP	0.6	U
2,4-DCP	360	
2,4-DMP	6.7	J
2-CP	18	
2-MNAP	0.73	J
B(a)A	0.43	U
B(a)P	0.46	U
B(b)F	0.33	U
B(k)F	0.41	U
HCB	0.46	U
I(1,2,3)P	0.5	U
NAP	30	
PCP	0.87	U
PHL	8.2	J
Cr	12100	
Cr^{+6}	250	U
1016	0.1	U
1248	0.093	U
1260	0.055	U

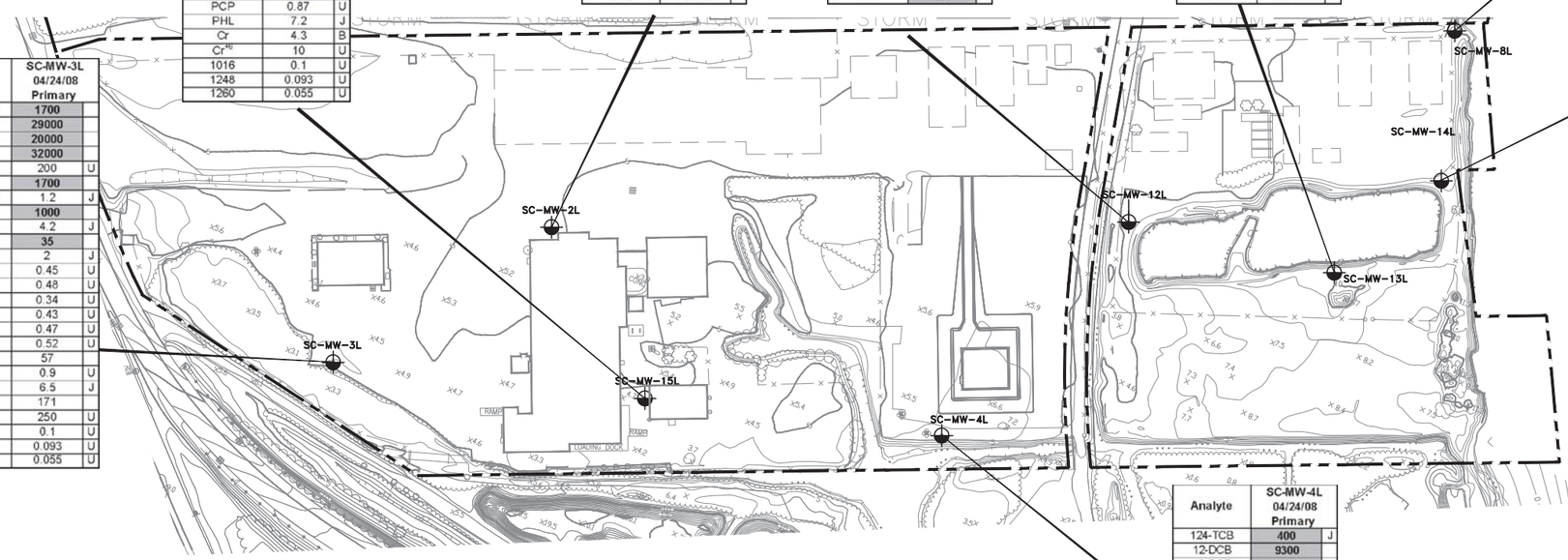
Analyte	SC-MW-12L 04/25/08 Primary	
1,2,4-TCB	4200	
1,2-DCB	12000	
1,3-DCB	4600	
1,4-DCB	6200	
BNZ	280	J
CB	770	
2,4,6-TCP	0.62	U
2,4-DCP	0.53	U
2,4-DMP	2500	
2-CP	26	
2-MNAP	150	J
B(a)A	0.45	U
B(a)P	0.48	U
B(b)F	0.34	U
B(k)F	0.43	U
HCB	43	
I(1,2,3)P	0.52	U
NAP	2400	
PCP	0.9	U
PHL	3700	
Cr	57.4	
Cr^{+6}	10	U
1016	4.5	
1248	0.095	U
1260	1.4	

Analyte	SC-MW-13L 04/25/08 Primary	
124-TCB	2400	
12-DCB	700	
13-DCB	160	
14-DCB	380	
BNZ	20	U
CB	33	J
246-TCP	170	
24-DCP	2.6	U
24-DMP	3100	J
2-CP	2.5	U
2-MNAP	790	
BaA	2.2	U
BaP	2.4	U
BbF	1.7	U
BkF	2.1	U
HCB	2.4	U
I123P	2.6	U
NAP	1700	J
PCP	4.5	U
PHL	19000	
Cr	6930	
Cr^{+6}	20	U
1016	7.5	
1248	0.93	U
1260	0.55	U

Analyte	SC-MW-8L 04/24/08 Primary	
124-TCB	6700	
12-DCB	10000	
13-DCB	3700	
14-DCB	4900	
BNZ	270	J
CB	1700	
246-TCP	120	
24-DCP	450	
24-DMP	660	
2-CP	75	
2-MNAP	290	
BaA	0.99	J
BaP	0.5	U
BbF	1	J
BkF	0.45	U
HCB	7.8	J
I123P	0.54	U
NAP	5300	
PCP	0.95	U
PHL	1500	
Cr	281	
Cr^{+6}	10	U
1016	78	
1248	58	
1260	14	

Analyte	SC-MW-14L 04/24/08 Primary	
1,2,4-TCB	3400	
1,2-DCB	5300	
1,3-DCB	1900	
1,4-DCB	2400	
BNZ	150	
CB	920	
2,4,6-TCP	0.61	U
2,4-DCP	0.52	U
2,4-DMP	28000	
2-CP	0.49	U
2-MNAP	700	J
B(a)A	0.44	U
B(a)P	1.9	J
B(b)F	0.34	U
B(k)F	0.43	U
HCB	0.47	U
I(1,2,3)P	0.51	U
NAP	9100	J
PCP	0.9	U
PHL	40000	
Cr	132	
Cr^{+6}	10	U
1016	1.2	
1248	0.61	PG
1260	0.055	U

Analyte	SC-MW-3L 04/24/08 Primary	
1,2,4-TCB	1700	
1,2-DCB	29000	
1,3-DCB	20000	
1,4-DCB	32000	
BNZ	200	U
CB	1700	
2,4,6-TCP	1.2	J
2,4-DCP	1000	
2,4-DMP	4.2	J
2-CP	35	
2-MNAP	2	J
B(a)A	0.45	U
B(a)P	0.48	U
B(b)F	0.34	U
B(k)F	0.43	U
HCB	0.47	U
I(1,2,3)P	0.52	U
NAP	57	
PCP	0.9	U
PHL	6.5	J
Cr	171	
Cr^{+6}	250	U
1016	0.1	U
1248	0.093	U
1260	0.055	U



Analyte	SC-MW-4L 04/24/08 Primary	
124-TCB	400	J
12-DCB	9300	
13-DCB	9000	
14-DCB	13000	
BNZ	380	J
CB	440	J
246-TCP	0.64	U
24-DCP	170	
24-DMP	680	
2-CP	5.1	J
2-MNAP	32	
BaA	0.46	U
BaP	0.49	U
BbF	0.35	U
BkF	0.44	U
HCB	1.1	J
I123P	0.53	U
NAP	350	
PCP	0.93	U
PHL	55	
Cr	10700	
Cr^{+6}	500	U
1016	0.1	U
1248	0.095	U
1260	0.056	U

Analyte	Abbreviation	Units	Criterion[1]
Volatile Organics (VOCs)			
1,2,4-Trichlorobenzene	124-TCB	ug/L	70
1,2-Dichlorobenzene	12-DCB	ug/L	600
1,3-Dichlorobenzene	13-DCB	ug/L	600
1,4-Dichlorobenzene	14-DCB	ug/L	75
Benzene	BNZ	ug/L	5
Chlorobenzene	CB	ug/L	100
Semivolatile Organics (SVOCs)			
2,4,6-Trichlorophenol	246-TCP	ug/L	120
2,4-Dichlorophenol	24-DCP	ug/L	4.6
2,4-Dimethylphenol	24-DMP	ug/L	36
2-Chlorophenol	2-CP	ug/L	9.1
2-Methylnaphthalene	2-MNAP	ug/L	3.6
Benzo(a)anthracene	BaA	ug/L	0.034
Benzo(a)pyrene	BaP	ug/L	0.2
Benzo(b)fluoranthene	BbF	ug/L	0.034
Benzo(k)fluoranthene	BkF	ug/L	0.34
Hexachlorobenzene	HCB	ug/L	1
Indeno(1,2,3-cd)pyrene	I123P	ug/L	0.034
Naphthalene	NAP	ug/L	0.17
Pentachlorophenol	PCP	ug/L	1
Phenol	PHL	ug/L	580
Metals			
Chromium (Total)	Cr	ug/L	2200
Hexavalent Chromium	Cr^{+6}	ug/L	0.035
Polychlorinated Biphenyls (Aroclors) (PCBs)			
Aroclor 1016	1016	ug/L	0.14
Aroclor 1248	1248	ug/L	0.039
Aroclor 1260	1260	ug/L	0.039

NOTE:
1. Criteria are USEPA Region 3 Screening Levels (November 2014) for tapwater. MCL is presented if available.

Exceedances are shown in bold, shaded typeface.

Data qualifiers are as follows:
U - Not detected at the detection limit indicated.
J - Organic results. Result is an estimate.
Quantitated between the detection limit and the reporting limit.
B - Inorganic results. Result is an estimate.
Quantitation between the detection limit and the reporting limit.
P - Organic results.
Percent difference between initial and confirmation column results is greater than 40%.

0 200 400 FEET

LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING BUILDING/STRUCTURES
- FORMER BUILDING/STRUCTURES
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- SC-MW-13L — SAND UNIT GROUNDWATER MONITORING WELL LOCATION

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

NOTE:
GROUNDWATER ON THE SCCC SITE IS CURRENTLY CONFINED WITHIN THE LIMITS OF THE SLURRY/SHEET PILE WALLS.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1 – SAND UNIT
GROUNDWATER ANALYTICAL RESULTS

PROJECT NO: 2015–01

FIGURE 3–15

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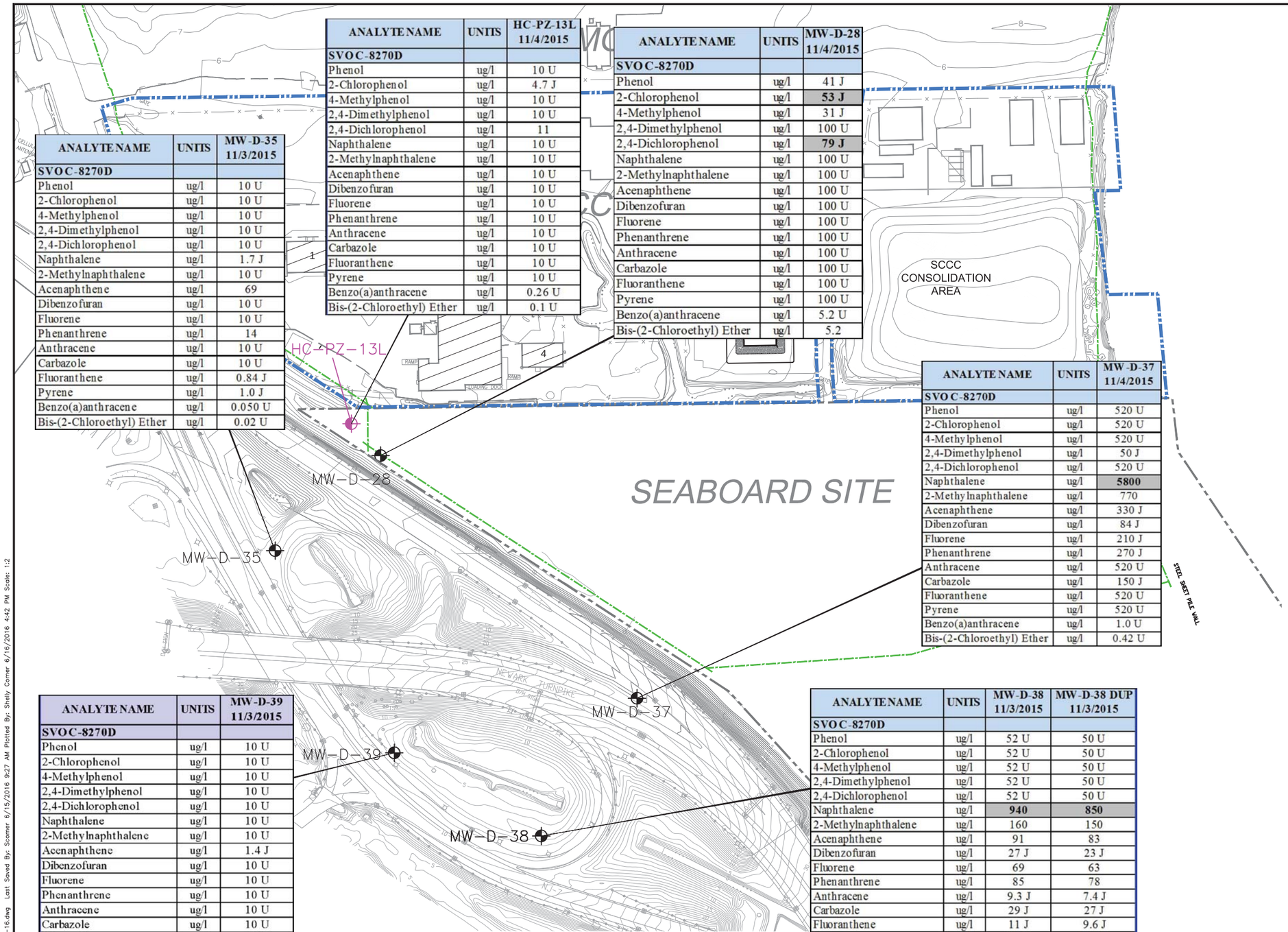

ANALYTE NAME	UNITS	MW-D-35 11/3/2015
SVOC-8270D		
Phenol	ug/l	10 U
2-Chlorophenol	ug/l	10 U
4-Methylphenol	ug/l	10 U
2,4-Dimethylphenol	ug/l	10 U
2,4-Dichlorophenol	ug/l	10 U
Naphthalene	ug/l	1.7 J
2-Methylnaphthalene	ug/l	10 U
Acenaphthene	ug/l	69
Dibenzofuran	ug/l	10 U
Fluorene	ug/l	10 U
Phenanthrene	ug/l	14
Anthracene	ug/l	10 U
Carbazole	ug/l	10 U
Fluoranthene	ug/l	0.84 J
Pyrene	ug/l	1.0 J
Benzo(a)anthracene	ug/l	0.050 U
Bis-(2-Chloroethyl) Ether	ug/l	0.02 U

ANALYTE NAME	UNITS	HC-PZ-13L 11/4/2015
SVOC-8270D		
Phenol	ug/l	10 U
2-Chlorophenol	ug/l	4.7 J
4-Methylphenol	ug/l	10 U
2,4-Dimethylphenol	ug/l	10 U
2,4-Dichlorophenol	ug/l	11
Naphthalene	ug/l	10 U
2-Methylnaphthalene	ug/l	10 U
Acenaphthene	ug/l	10 U
Dibenzofuran	ug/l	10 U
Fluorene	ug/l	10 U
Phenanthrene	ug/l	10 U
Anthracene	ug/l	10 U
Carbazole	ug/l	10 U
Fluoranthene	ug/l	10 U
Pyrene	ug/l	10 U
Benzo(a)anthracene	ug/l	0.26 U
Bis-(2-Chloroethyl) Ether	ug/l	0.1 U

ANALYTE NAME	UNITS	MW-D-28 11/4/2015
SVOC-8270D		
Phenol	ug/l	41 J
2-Chlorophenol	ug/l	**53 J**
4-Methylphenol	ug/l	31 J
2,4-Dimethylphenol	ug/l	100 U
2,4-Dichlorophenol	ug/l	**79 J**
Naphthalene	ug/l	100 U
2-Methylnaphthalene	ug/l	100 U
Acenaphthene	ug/l	100 U
Dibenzofuran	ug/l	100 U
Fluorene	ug/l	100 U
Phenanthrene	ug/l	100 U
Anthracene	ug/l	100 U
Carbazole	ug/l	100 U
Fluoranthene	ug/l	100 U
Pyrene	ug/l	100 U
Benzo(a)anthracene	ug/l	5.2 U
Bis-(2-Chloroethyl) Ether	ug/l	5.2

ANALYTE NAME	UNITS	MW-D-37 11/4/2015
SVOC-8270D		
Phenol	ug/l	520 U
2-Chlorophenol	ug/l	520 U
4-Methylphenol	ug/l	520 U
2,4-Dimethylphenol	ug/l	50 J
2,4-Dichlorophenol	ug/l	520 U
Naphthalene	ug/l	**5800**
2-Methylnaphthalene	ug/l	770
Acenaphthene	ug/l	330 J
Dibenzofuran	ug/l	84 J
Fluorene	ug/l	210 J
Phenanthrene	ug/l	270 J
Anthracene	ug/l	520 U
Carbazole	ug/l	150 J
Fluoranthene	ug/l	520 U
Pyrene	ug/l	520 U
Benzo(a)anthracene	ug/l	1.0 U
Bis-(2-Chloroethyl) Ether	ug/l	0.42 U

ANALYTE NAME	UNITS	MW-D-39 11/3/2015
SVOC-8270D		
Phenol	ug/l	10 U
2-Chlorophenol	ug/l	10 U
4-Methylphenol	ug/l	10 U
2,4-Dimethylphenol	ug/l	10 U
2,4-Dichlorophenol	ug/l	10 U
Naphthalene	ug/l	10 U
2-Methylnaphthalene	ug/l	10 U
Acenaphthene	ug/l	1.4 J
Dibenzofuran	ug/l	10 U
Fluorene	ug/l	10 U
Phenanthrene	ug/l	10 U
Anthracene	ug/l	10 U
Carbazole	ug/l	10 U
Fluoranthene	ug/l	10 U
Pyrene	ug/l	10 U
Benzo(a)anthracene	ug/l	0.050 U
Bis-(2-Chloroethyl) Ether	ug/l	0.02 U

ANALYTE NAME	UNITS	MW-D-38 11/3/2015	MW-D-38 DUP 11/3/2015
SVOC-8270D			
Phenol	ug/l	52 U	50 U
2-Chlorophenol	ug/l	52 U	50 U
4-Methylphenol	ug/l	52 U	50 U
2,4-Dimethylphenol	ug/l	52 U	50 U
2,4-Dichlorophenol	ug/l	52 U	50 U
Naphthalene	ug/l	**940**	**850**
2-Methylnaphthalene	ug/l	160	150
Acenaphthene	ug/l	91	83
Dibenzofuran	ug/l	27 J	23 J
Fluorene	ug/l	69	63
Phenanthrene	ug/l	85	78
Anthracene	ug/l	9.3 J	7.4 J
Carbazole	ug/l	29 J	27 J
Fluoranthene	ug/l	11 J	9.6 J
Pyrene	ug/l	5.2 J	4.4 J
Benzo(a)anthracene	ug/l	**0.19 J**	**0.19 J**
Bis-(2-Chloroethyl) Ether	ug/l	0.10 U	0.10 U

LEGEND

- STANDARD CHLORINE SITE BOUNDARY
- SEABOARD SITE BOUNDARY
- EXISTING ACCESS ROAD
- EXISTING NEW JERSEY TRANSIT RAILROAD (ACTIVE)
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- EXISTING STREAM, POND AND RIVER BANK
- SLURRY WALL LOCATION
- HYDRAULIC CONTROL PIEZOMETER LOWER ZONE – OUTSIDE WALL
- MONITORING WELL LOCATION INSTALLED IN 2015

NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

SHADED RESULTS EXCEEDS GROUNDWATER QUALITY CONCENTRATION CRITERION.

U.S. EPA Maximum Contaminant Levels (MCLs) and New Jersey Ground Water Quality Criteria (GWQC)		
Analyte Name	EPA MCL (ug/l)	GWQC (ug/l)
Phenol	-----	2000
2-Chlorophenol	-----	40
4-Methylphenol	-----	-----
2,4-Dimethylphenol	-----	100
2,4-Dichlorophenol	-----	20
Naphthalene	-----	300
2-Methylnaphthalene	-----	-----
Acenaphthene	-----	400
Dibenzofuran	-----	-----
Fluorene	-----	300
Phenanthrene	-----	-----
Anthracene	-----	2000
Carbazole	-----	-----
Fluoranthene	-----	300
Pyrene	-----	200
Benzo(a)anthracene	-----	0.1
Bis-(2-Chloroethyl) Ether	-----	7

----- Indicates no groundwater quality criterion for listed analyte.

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

DETECTED SVOC ANALYTICAL RESULTS –AREA 2
DEEP SAND UNIT GROUNDWATER

PROJECT NO: 2015-01
FIGURE 3-16

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:
1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 11-14-04. PHOTOGRAMMETRIC AERIAL BASED ON N.J. STATE PLANE COORDINATE SYSTEM NAD 1927. VERTICAL DATUM BASED ON NGVD 1929.
2. EXISTING SCCC CONSOLIDATION AREA TOPOGRAPHY PER LANDMARKER GEOSPATIAL DATED 09-29-11.
3. NEW JERSEY ADMINISTRATIVE CODE. N.J.A.C 7:9C GROUND WATER QUALITY STANDARDS DATE LAST AMENDED: JULY 22, 2010, READOPTED WITHOUT CHANGE: MARCH 4, 2014.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

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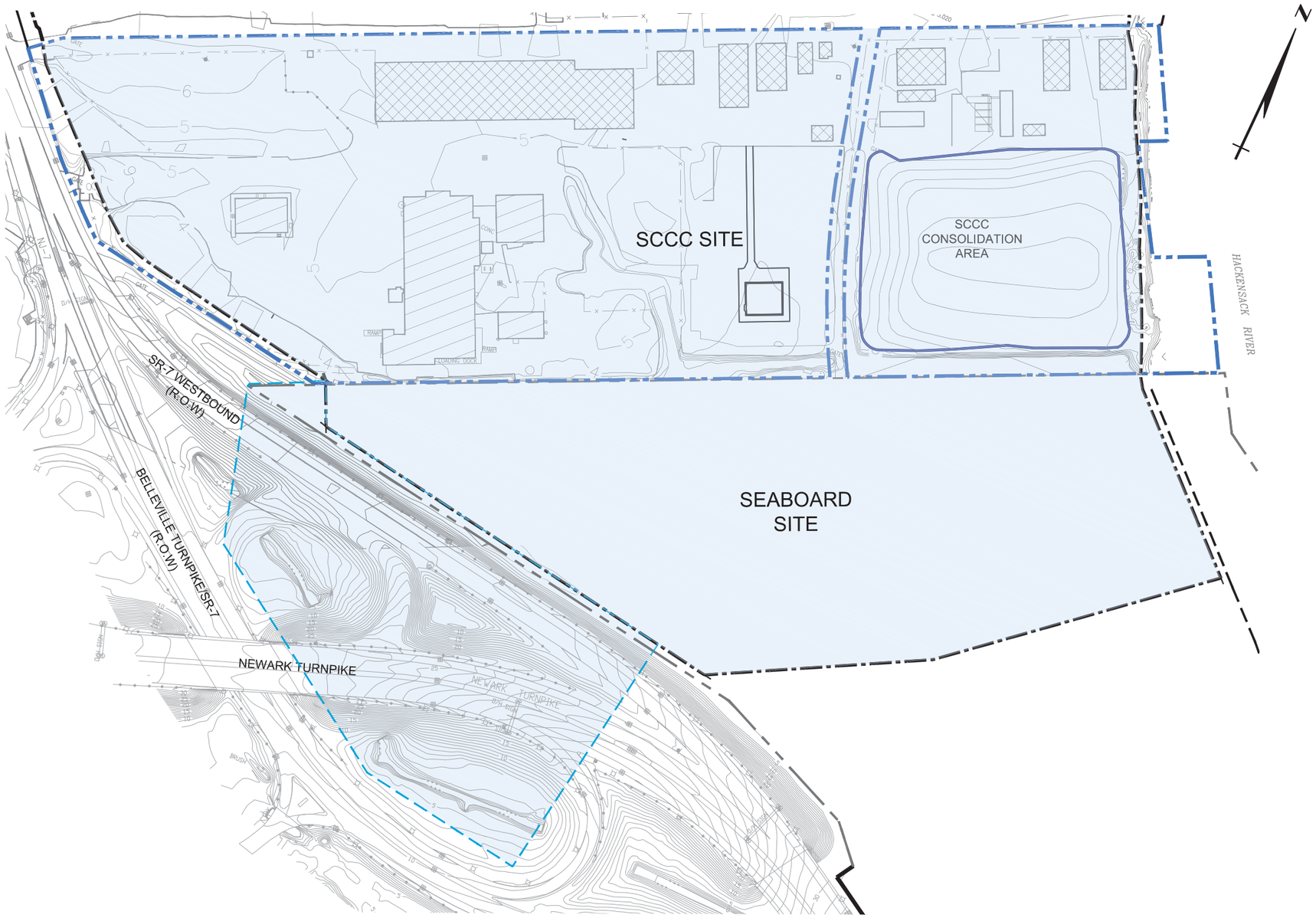

LEGEND

- STANDARD CHLORINE SITE BOUNDARY
- SEABOARD SITE BOUNDARY
- SLURRY WALL LOCATION
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB
- PROPOSED TI ZONE

NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 03/09/16	KEY ENVIRONMENTAL INCORPORATED
CHKD:	DATE:	
APPD:	DATE:	
SCALE: AS SHOWN		

TI EVALUATION REPORT
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: EXISTING GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

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KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

ESTIMATED EXTENTO OF PROPOSED TI ZONE

PROJECT NO: 201601-03

FIGURE 4-1

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ATTACHMENT A

Attachment A
Area 2 Restoration Timeframe Analysis
Standard Chlorine Chemical Co. Inc.

Introduction

A restoration timeframe for the Area 2 Sand Unit is presented in this analysis. A restoration timeframe is a required component of the Technical Impracticability Evaluation Report. This analysis uses a series of calculations to provide a restoration timeframe estimate.

Methods and Calculations

Solubilization

1,4-DCB is likely the primary component of the DNAPL and 1,4-DCB physico-chemical properties were used for this analysis. 1,4-DCB has similar physico-chemical properties to other DCB isomers that make up the DNAPL. The timeframe for solubilization of DNAPL was calculated using the following steps:

1. Estimate DNAPL mass:
    a. Measure the approximate area where DNAPL was delineated and estimate average DNAPL thickness.
    b. Calculate DNAPL volume based on area and thickness estimations.

Eq. 1

$$V_D = A \times d$$

V_D = volume DNAPL
A = DNAPL delineated area
d = DNAPL thickness

    c. Calculate DNAPL mass by using DNAPL volume and density.

Eq. 2

$$M = D \times V_D$$

M = DNAPL mass
D = DNAPL density
V_D = volume DNAPL

2. Estimate time needed to dissolve DNAPL mass
    a. Using DNAPL solubility, calculate volume of water required for complete DNAPL dissolution.

Eq. 3

$$V_W = \frac{M}{S}$$

V_W = volume water
M = DNAPL mass
S = DNAPL solubility

b. Use measured hydraulic parameters (hydraulic conductivity, hydraulic gradient, and cross sectional area) to calculate the water discharge rate through the delineated DNAPL zone.

Eq. 4

$$Q = -KA_{CS}\frac{dh}{dx}$$

Q = discharge rate
K = hydraulic conductivity
A_{CS} = cross sectional area
$\frac{dh}{dx}$ = hydraulic gradient

c. Calculate the time required for a sufficient volume of water to pass through the DNAPL zone and solubilize DNAPL.

Eq. 5

$$t_s = \frac{V_W}{Q}$$

t_s = time for DNAPL solubilization
V_W = volume water
Q = discharge rate

Table 1. Solubilization calculation spreadsheet with input and output values.

Input Parameters	**abbreviation**	**Input Value**	**units**	**Source**
Approx. DNAPL area	A	45000	ft^2	Measured DNAPL delineated area from drawing
Approx. DNAPL thickness	d	0.2	ft	Estimated DNAPL thickness from boring observations
Approx. DNAPL density (1,4-DCB)	D	1250	mg/L	Oak Ridge National Laboratory, 2013
Approx. DNAPL solubility (1,4-DCB)	S	81.3	mg/L	Oak Ridge National Laboratory, 2014
sand hydraulic conductivity	K	5.34	ft/day	Pump test during RI
sand thickness	-	4	ft	Thickness of sand in most borings
width of DNAPL area	-	190	ft	Measured from DNAPL delineated area drawing
MW D-37 head	-	0.95	ft	Field Measured
MW D-28 head	-	0.52	ft	Field Measured
distance between D37 and D28	-	680	ft	Measured from drawing
Outputs Parameters	**abbreviation**	**Output Value**	**units**	**Source**
Approx. DNAPL volume	V_D	9000	ft^3	calculated
Approx. DNAPL volume	V_D	254851	L	calculated
cross sectional area	A_{CS}	760	ft^2	calculated
discharge	Q	2.57	ft^3/day	calculated
DNAPL mass	M	318564000	mg	calculated
DNAPL mass	M	318564	kg	calculated
volume of water required to dissolve DNAPL	V_W	3918376	L	calculated
volume of water required to dissolve DNAPL	V_W	138376	ft^3	calculated
time for complete solubilization	t_s	53920	days	calculated
time for complete solubilization	t_s	148	years	calculated

Biodegradation

Biodegradation and sorption occur after solubilization of DNAPL. Biodegradation rates published in a 2006 USGS report were used to calculate a slow and fast degradation estimate. The end product in the degradation of DCB isomers is carbon dioxide. The timeframe for biodegradation was calculated by using solubility, MCL, and reported half-lives (aerobic and anaerobic) of 1,4-DCB. The following is the equation used:

Eq. 6

$$C_t = C_0 \left(\frac{1}{2}\right)^{\frac{t_d}{t_{\frac{1}{2}}}}$$

Also written as:

Eq. 7

$$t_d = \left[\frac{ln\left(\frac{C_0}{C_t}\right)}{ln2}\right]\left(t_{\frac{1}{2}}\right)$$

t_d = time required for degradation to MCL concentration

$t_{\frac{1}{2}}$ = half life

C_0 = initial concentration (solubility limit)

C_t = MCL concentration

The half-lives used for this analysis were reported in literature and are not site specific. Actual biodegradation rates depend on site specific conditions such as geochemistry and indigenous microbial populations.

Table 2. Biodegradation calculation spreadsheet with input and output values.

Aerobic					
Parameter	**abbreviation**	**low range**	**high range**	**units**	**Source**
1,4-DCB half life	$t_{1/2}$	97	330	days	USGS, 2006
1,4-DCB half life	$t_{1/2}$	0.266	0.904	years	calculated
Approx. DNAPL solubility (1,4-DCB)	C_0	81.3	81.3	mg/L	Oak Ridge National Laboratory, 2014
time to reach 0.075 mg/L MCL	t_d	10.082	10.082	half lives	calculated
time to reach 0.075 mg/L MCL	t_d	2.7	9.1	years	calculated
Anaerobic					
Parameter	**abbreviation**	**low range**	**high range**	**units**	**Source**
1,4-DCB half life	$t_{1/2}$	392	1302	days	USGS, 2006
1,4-DCB half life	$t_{1/2}$	1.074	3.567	years	calculated
Approx. DNAPL solubility (1,4-DCB)	C_0	81.3	81.3	mg/L	Oak Ridge National Laboratory, 2014
time to reach 0.075 mg/L MCL	t_d	10.082	10.082	half lives	calculated
time to reach 0.075 mg/L MCL	t_d	11	36	years	calculated

Sorption

Dissolved constituents will not be transported far from DNAPL because sorption to organic material will occur. Sorption is not a destructive process, but it retards the transport of dissolved constituents. Sorption and biodegradation processes will likely prevent dissolved constituents from being transported outside of Area 2.

Recovery Wells

Recovery wells to be installed in Area 2, as described in the FFS alternatives, will further remove DNAPL mass and reduce the solubilization timeframe. It is impossible to determine the exact amount of DNAPL that will be recovered through operation of recovery wells. However, removal of 10,000 gallons of DNAPL via recovery wells would reduce the solubilization timeframe by approximately 20 years.

Restoration Timeframe Estimates Summary

The calculations described above were evaluated in Excel. The time required for complete solubilization of DNAPL is approximately 150 years. The time required for degradation of dissolved constituents is approximately 2.7 – 36 years. The degradation timeframe is presented as a range because aerobic conditions and anaerobic conditions will yield different degradation rates. Sorption was not quantitatively evaluated, but it is expected to contribute to natural attenuation of dissolved constituents as well. The installation of recovery wells will reduce the solubilization timeframe. **Overall, after consideration of solubilization, degradation, sorption, and recovery wells, the restoration timeframe to achieve groundwater MCL concentrations is approximately 150 years.**

TI REPORT ADDENDUM

TECHNICAL IMPRACTICABILITY EVALUATION REPORT ADDENDUM

STANDARD CHLORINE CHEMICAL CO. INC. SITE KEARNY, NEW JERSEY

Prepared for:

Performing Parties Group

(Beazer East, Inc., Cooper Industries, LLC, Tierra Solutions, Inc., on behalf of Occidental Chemical Corporation and Apogent Transition Corporation)

Prepared by:

Key Environmental, Inc.
200 Third Avenue
Carnegie, Pennsylvania 15106

JULY 2016

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1.0 INTRODUCTION

This Technical Impracticability (TI) Evaluation Report (TI Report) Addendum for the Standard Chlorine Chemical Co. Inc. (SCCC) Site (SCCC Site)[1] located in Kearny, New Jersey has been prepared by Key Environmental, Inc., (KEY) on behalf of the SCCC Site Performing Parties Group. The Group consists of Beazer East, Inc., Cooper Industries, LLC, Tierra Solutions, Inc., on behalf of Occidental Chemical Corporation (OCC), and Apogent Transition Corp. The TI Report was submitted to United States Environmental Protection Agency (USEPA) on June 20, 2016 as an appendix to the SCCC Site Focused Feasibility Study (FFS). This TI Report Addendum addresses USEPA comments that were received via electronic mail on July 12, 2016 and July 13, 2016. The purpose of this TI Report Addendum is to present supplemental data collected in previous investigations in order to more thoroughly describe the conceptual site model and groundwater remediation technical impracticability at the SCCC Site.

The primary objectives of this TI Report Addendum are as follows:

1. Provide additional Area 1 dense non-aqueous phase liquid (DNAPL) and historic fill descriptions;
2. Present the DNAPL and historic fill lateral extent in Area 1;
3. Identify groundwater classifications present in Areas 1 and 2; and,
4. Define constituents of concern (COCs), Applicable or Relevant and Appropriate Requirements (ARARs), and standards for which the TI Waiver is sought in Areas 1 and 2.

[1] In general, this document refers to the SCCC Site by reference to the property boundaries of the historical SCCC property but recognizes that in specific contexts the definition may include other off-property areas into which SCCC property-related contaminants have come to be located. Where context requires, which the report makes self-evident, the definition of SCCC Site should be construed accordingly.

2.0 AREA 1 DNAPL AND HISTORIC FILL DESCRIPTIONS AND DELINEATIONS

DNAPL exists at the SCCC Site in free-phase and residual forms. The free-phase DNAPL accumulates above the low permeability varved clay and will continue to slowly solubilize over time. Residual DNAPL wets and sorbs to solid subsurface media and will continue to slowly solubilize over time. As a result, both of these DNAPL forms will serve as long-term sources of dissolved phase constituents in groundwater.

Historic fill, some of which contained chromite ore processing residue (COPR), has been historically placed at various locations on the SCCC Property. Inorganic constituents can leach from the historic fill into the groundwater. Inorganic COCs in groundwater are attributed in part to historic fill.

2.1 AREA 1 DNAPL CHARACTERIZATION

The presence of subsurface DNAPL and distribution of widespread COCs in Area 1 have been documented and served as a basis for the location of the slurry wall containment system installed at the SCCC Site. The USEPA-approved Engineering Evaluation/Cost Analysis (KEY, May 2009) included the proposed slurry wall location in order to contain DNAPL and other COCs in groundwater.

A cone penetrometer and Rapid Optical Screening Tool (ROST) were used to delineate the extent of SCCC Site DNAPL during the Supplemental Remedial Investigation (RI) Report (KEY, 1999). A ROST equipped cone penetrometer system utilizes laser light to detect hydrocarbon-based chemicals present in the subsurface. DNAPL presence was less extensive in the Fill Unit than in the Sand Unit. Three ROST borings indicated DNAPL in Meadow Mat below the former lagoon area. An additional three ROST borings indicated DNAPL in the Meadow Mat in the vicinity of Building 2. The presence of DNAPL in the Meadow Mat in different locations indicates that there were likely multiple zones of entry throughout Area 1. Thirty-one ROST soundings were completed throughout the SCCC Site.

DNAPL was also delineated via observations from the pre-design and various RI borings completed between 2008 and 2015. A DNAPL ranking system was utilized to provide consistency in the documentation of DNAPL observations (KEY, 2015). Samples assigned a DNAPL rank of 2 (residual DNAPL) or 3 (free-phase DNAPL) were submitted for analysis based upon the Work Plan criteria (maximum one sample from the Fill Unit/Meadow Mat and one from the Sand Unit per boring). A DNAPL ranking of 1 indicates the presence of staining or an odor and a ranking of 0 is indicative of no evidence of impact. The RI samples collected from the fill/ Meadow Mat and/or deep sand (Lower Zone) were discrete grab samples from the interval exhibiting the most significant DNAPL impacts.

The Sand Unit RI residual and free-phase DNAPL observations, along with ROST survey results, are displayed on Figure 2-1. Figure 2-1 shows that the interpolated DNAPL lateral extent approaches the Area 1 borders (i.e., slurry wall). The DNAPL is widely dispersed but not continuous throughout Area 1, as indicated by borings where no residual or free-phase DNAPL were observed. The inferred boundary of DNAPL is approximately 26 acres in Area 1.

Low viscosity and high specific gravity characteristics of the DNAPL have resulted in widespread impacts throughout Area 1 above the varved clay surface. The Focused RI (ERM, 1997) included sampling and analyzing DNAPL physical and chemical characteristics from two locations. DNAPL sampled from MW-8L, located near the Hackensack River, had a specific gravity of 1.38 and DNAPL from MW13L, located south of the former lagoon area, had a specific gravity of 1.34. DNAPL with a specific gravity of 1.3 will sink through the water table and flow/spread out on the relatively impermeable varved clay. DNAPL will flow under the influence of gravity on top of the varved clay surface and will not flow along a hydraulic head gradient. The undulating nature of the varved clay surface makes it difficult to precisely identify and recover DNAPL pools.

Furthermore, analysis of DNAPL samples over time indicates that the DNAPL in Area 1 is a mixture of chemical compounds that vary in composition. The two samples collected during the Focused RI (ERM, 1997) each varied in composition. Two additional DNAPL samples collected from the east (SC-MW-13L) and west (SC-MW-3L) portions of the SCCC Site during the 2008 RI (KEY) also varied in composition. Additionally, the ROST investigations completed in 1999 reported two separate DNAPL signatures (KEY, 1999). One DNAPL signature included chlorobenzene compounds (primarily dichlorobenzene) and polychlorinated compounds. The other DNAPL signature included chlorobenzene compounds (primarily dichlorobenzene), polychlorinated compounds, and naphthalene. Both DNAPL signatures likely contain trace amounts of additional organic compounds. Thus, the Area 1 DNAPL serves as a long-term source for multiple dissolved constituents.

Additionally, DNAPL will serve as a long term groundwater COC source due to its low absolute solubility and the fact that it cannot be removed below its residual saturation level. In particular, residual DNAPL cannot be removed due to capillary forces that hold it in place and to a lesser extent from sorption of DNAPL to subsurface materials. Residual DNAPL is unrecoverable and will slowly desorb and dissolve into groundwater over an extended period of time. The DNAPL solubility, viscosity, and specific gravity described above contribute to the technical impracticability of groundwater remediation to groundwater ARAR standards.

2.2 AREA 1 HISTORIC FILL CHARACTERIZATION

The presence of historic fill in Area 1 soils has been documented and served as the basis for interim soil covers installed in the early 1990's. The SCCC Site is located in a former meadow that was filled over the first half of the 20th century. The filling occurred to support industrial development

of the SCCC Property and surrounding properties at that time. The Area 1 surface area is approximately 25 acres for the former SCCC property. Approximately 17.25 acres of the SCCC Site were conservatively covered with various Interim Remedial Measures (IRM) cover. The combined volume of impacted soil and fill beneath existing surface covers, assuming an average depth of six feet to the top of the meadow mat, is approximately 167,000 cubic yards of which 7,300 cubic yards is comprised of the lagoon solids.

Surface soil sampling was conducted in 1991 (French and Parrello) and surface and subsurface sampling was conducted in 2008 (KEY) to delineate the chromium impacts (Figure 2-2). Historic fill also may serve as a source of other metals in addition to chromium. Chromium detections in surface soil were observed in the northern, eastern, and western portions of the SCCC Property. The presence of chromium is, in part, attributed to the placement of historic fill containing COPR. However, chromium was not continuous throughout the SCCC Site (see Figure 2-2). SCCC Site soils have been covered by clean fill, pavement, or other cover materials as described in previous reports such as the RI Report (KEY, 2015). Historic fill also serves as a source for dissolved inorganic COCs in Area 1 groundwater.

3.0 DISSOLVED COCS AND ARARS WAIVER

There are a range of dissolved COCs in groundwater in Areas 1 and 2 that exceed state and federal standards. The range of dissolved COCs in conjunction with the presence of high concentrations, and residual DNAPL that will continue to leach high concentrations far into the future, makes groundwater remediation technically impracticable within a reasonable timeframe. Furthermore, many of the dissolved COCs are derived from persistent source materials (i.e., DNAPL, lagoon wastes and historic fill). The COCs and groundwater ARARs listed in Table 3-1 are to be included in this TI Waiver.

As part of a separate remedial program with oversight by New Jersey Department of Environmental Protection (NJDEP), Tierra, on behalf of OCC, has established a Classification Exemption Area/Well Restriction Area (CEA/WRA) that covers certain COPR sites on the Kearny Peninsula. This CEA/WRA extends over the entire SCCC Property. The constituents listed in the COPR Sites CEA/WRA include total chromium, hexavalent chromium, total dissolved solids, and chloride. Also as part of a separate remedial program, Beazer has established a CEA/WRA that addresses only the approximately 13 acres of the western portion of the HCIA property that is enclosed within the SCCC Site slurry wall system. The COCs listed in the Seaboard Site CEA include various volatile organic compounds, semi-volatile organic compounds and metals. A new CEA/WRA will be established to prevent future use of groundwater within the TI Waiver Zone once the zone is established.

3.1 AREA 1

The groundwater in Area 1 is classified in accordance with the New Jersey Groundwater Quality Standards as Class II-A for purposes of determining groundwater ARARs. The groundwater in this area is partially saline due to naturally occurring salt water intrusion. Groundwater sampling from 2008 (Table 3-2) showed that four out of eight wells screened in the sand unit contained total dissolved solid (TDS) concentrations that exceeded 5,000 mg/L, which is the NJDEP Class III threshold (N.J.A.C. 7:9C-1.5). The sand unit is assumed to be Class II-A because the sample results from all of the wells did not exceed the Class III TDS threshold concentration. However, the partially saline nature of the groundwater contributes to the technical impracticability of remediating groundwater to drinking water standards.

Area 1 dissolved COCs are primarily derived from DNAPL, lagoon wastes and historic fill (Figure 3-1). Furthermore, the range of dissolved COCs present in Area 1 groundwater complicates the development of remedial alternatives. The best available technologies for DNAPL, lagoon wastes and chromium recovery, given SCCC Site specific characteristics, have been incorporated into remedial alternatives described in the FFS. The technologies included in Alternatives II, III, and

IV of the FFS will significantly reduce the restoration timeframe, but not to the extent needed to obtain groundwater ARARs within a reasonable timeframe.

3.2 AREA 2

The groundwater in Area 2 is classified as Class II-A for purposes of determining groundwater ARARs. Area 2 groundwater samples were not analyzed for TDS and the extent of salt water intrusion is unknown. Given the close proximity of Areas 1 and 2, it is likely that the natural geochemistry of the Area 2 Sand Unit resembles that of Area 1. Partial salinity is a natural form of groundwater degradation that should be considered in support of this TI Waiver.

Area 2 dissolved COCs are primarily derived from DNAPL. There are fewer COCs identified in Area 2 relative to Area 1 as shown on Table 3-1. Area 2 possesses unique remediation obstacles that Area 1 does not have. The driving factors for the Area 2 TI Waiver include the presence of unrecoverable DNAPL in conjunction with land use that is incompatible with remedial technology implementability.

4.0 AREA 2 HORIZONTAL WELL DNAPL RECOVERY FEASIBILITY

There are no remedial technologies that can be reasonably expected to restore Area 2 groundwater to drinking water standards within a reasonable timeframe. DNAPL is present beneath major roadways in Area 2, on top of the varved clay surface. Furthermore, steep slopes exist adjacent to the roadways. Passive DNAPL recovery using vertical wells has been identified as the best available technology, considering the SCCC Site specific attributes, and is a component of Alternatives II, III, and, IV described in the FFS. DNAPL recovery wells will be installed in Area 2 where feasible as defined in the FFS remedial alternatives. Application of DNAPL recovery will significantly reduce the restoration timeframe. However, DNAPL recovery cannot be expected to remediate groundwater to ARARs within a reasonable timeframe.

Horizontal drilling under the roadway and steep slopes has been considered; however, this approach would not provide an added DNAPL recovery benefit compared to traditional vertical recovery wells. The horizontal drilling procedure is feasible, but this approach is impracticable for DNAPL recovery because of the difficulty associated with directing the horizontal well bore to the top grades of the undulating varved clay surface in order to intercept overlying DNAPL. The removal of DNAPL that exists as a thin layer on top of the undulating varved clay surface is an impracticable target via horizontal drilling technologies.

The area immediately adjacent to the roadways and steep slopes is to be included in the TI Waiver Zone. This area contains DNAPL and is in close proximity to the DNAPL under the roadway. Passive DNAPL recovery will remediate this area to the extent practicable. However, remediation to groundwater ARAR standards is not practicable for the reason stated above. Residual mass will remain that cannot be recovered by available technologies and remain an ongoing source of dissolved phase groundwater impact preventing achievement of ARARs within the foreseeable future.

5.0 SUMMARY AND CONCLUSIONS

This TI Report Addendum has been prepared to address the comments provided by the USEPA for the TI Report submitted to the USEPA on June 16, 2016. The information provided in the TI Report and this Addendum supports a modified TI Waiver for groundwater ARARs in the SCCC Site Areas 1 and 2 as described below.

The limits of the proposed TI Waiver Zone for the Area 1 shallow Fill Unit, Area 1 deep Sand Unit, and Area 2 deep Sand Unit are shown on Figure 5-1 and the TI Waiver Zone will be co-extensive with the CEA/WRA limits previously presented in the TI Report. The slurry wall that defines the Area 1 borders was strategically placed to, among other matters, contain DNAPL and associated dissolved phase impacts. The findings of the TI report and this Addendum conclude that it is technically impracticable to remediate groundwater contained anywhere within the slurry wall (Area 1) to ARARs in a reasonable timeframe for a variety of reasons including the following:

- Presence of DNAPL
- Presence of historic fill
- Presence of the Consolidation Area and underlying source material
- Dissolved COCs that are derived from DNAPL and historic fill
- Wide range of dissolved COC classes
- High concentrations of COCs
- Naturally degraded groundwater due to partial salt water intrusion
- Presence of complex undulating varved clay surface
- Inability to precisely identify and remove all DNAPL pool locations
- Inability to remove residual DNAPL.

The findings of the TI Report and this Addendum also conclude that it is technically impracticable to remediate groundwater contained within Area 2 to ARARs in a reasonable timeframe. Many of the same Area 1 characteristics in support of the TI Waiver are applicable to Area 2. Area 2 also contains additional land use/land cover remediation obstacles that not present in Area 1. Presence of DNAPL and land use/land cover are the primary driving factors in support of the Area 2 TI Waiver.

6.0 REFERENCES

ERM (Environmental Resources Management, Inc.) January 1997. Focused Remedial Investigation (FRI) Report. Exton, Pennsylvania.

KEY (Key Environmental, Inc.) May 2009. Engineering Evaluation/Cost Analysis. Carnegie, Pennsylvania.

KEY (Key Environmental, Inc.) October 2015. Remedial Investigation Report. Carnegie, Pennsylvania.

KEY (Key Environmental, Inc.) April 1999. Supplemental Remedial Investigation Report. Carnegie, Pennsylvania.

TABLES

TABLE 3-1

COC AND ARAR WAIVERS
TECHNICAL IMPRACTICABILITY EVALUATION REPORT ADDENDUM
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1 FILL AND SAND UNITS			
Constituent of Concern	**ARAR**	**Standard**	**Units**
Volatile Organics			
1,2,4-Trichlorobenzene	NJGWQS	9	ug/L
1,2-Dichlorobenzene	MCL	600	ug/L
1,3-Dichlorobenzene	NJGWQS	600	ug/L
1,4-Dichlorobenzene	MCL	75	ug/L
Benzene	NJGWQS	0.2	ug/L
Chlorobenzene	NJGWQS	50	ug/L
Methylene chloride	NJGWQS	3	ug/L
Tetrachloroethylene	NJGWQS	0.4	ug/L
Toluene	NJGWQS	600	ug/L
Trichloroethylene	NJGWQS	1	ug/L
Vinyl chloride	NJGWQS	0.08	ug/L
Semivolatile Organics			
2,4,6-Trichlorophenol	NJGWQS	1	ug/L
2,4-Dichlorophenol	NJGWQS	20	ug/L
2,4-Dimethylphenol	NJGWQS	100	ug/L
2-Chlorophenol	NJGWQS	40	ug/L
Benzo(a)anthracene	NJGWQS	0.05	ug/L
Benzo(a)pyrene	NJGWQS	0.005	ug/L
Benzo(b)fluoranthene	NJGWQS	0.05	ug/L
Benzo(k)fluoranthene	NJGWQS	0.5	ug/L
Bis(2-ethylhexyl)phthalate	NJGWQS	2	ug/L
Hexachlorobenzene	NJGWQS	0.02	ug/L
Indeno(1,2,3-cd)pyrene	NJGWQS	0.05	ug/L
Naphthalene	NJGWQS	300	ug/L
Pentachlorophenol	NJGWQS	0.3	ug/L
Phenol	NJGWQS	2000	ug/L
Polychlorinated biphenyls	MCL	0.5	ug/L
Metals			
Aluminum	NJGWQS	200	ug/L
Antimony	MCL	6	ug/L
Arsenic	NJGWQS	0.02	ug/L
Beryllium	NJGWQS	1	ug/L
Cadmium	NJGWQS	4	ug/L
Chromium (Total)	NJGWQS	70	ug/L
Iron	NJGWQS	300	ug/L
Lead	NJGWQS	5	ug/L
Manganese	NJGWQS	50	ug/L
Mercury	MCL	2	ug/L
Nickel	NJGWQS	100	ug/L
Sodium	NJGWQS	50000	ug/L
Thallium	NJGWQS	0.5	ug/L
Zinc	NJGWQS	2000	ug/L
Pesticides			
4,4'-DDE	NJGWQS	0.1	ug/L
4,4'-DDT	NJGWQS	0.1	ug/L
Aldrin	NJGWQS	0.002	ug/L
alpha-Chlordane	NJGWQS	0.01	ug/L
Dieldrin	NJGWQS	0.002	ug/L
Heptachlor	NJGWQS	0.008	ug/L
Heptachlor epoxide	NJGWQS	0.004	ug/L
Lindane	NJGWQS	0.03	ug/L
AREA 2 SAND UNIT			
Constituent of Concern	**ARAR**	**Standard**	**Units**
Volatile Organics			
1,2,4-Trichlorobenzene	NJGWQS	9	ug/L
1,2-Dichlorobenzene	MCL	600	ug/L
1,3-Dichlorobenzene	NJGWQS	600	ug/L
1,4-Dichlorobenzene	MCL	75	ug/L
Benzene	NJGWQS	0.2	ug/L
Bromodichloromethane	NJGWQS	0.6	ug/L
Chlorobenzene	NJGWQS	50	ug/L
Dichlorodifluoromethane	NJGWQS	1000	ug/L
Ethylbenzene	MCL	700	ug/L
m,p-Xylenes	NJGWQS	1000	ug/L
Methyl tertbutyl ether	NJGWQS	70	ug/L
o-Xylene	NJGWQS	1000	ug/L
Semivolatile Organics			
2,4-Dichlorophenol	NJGWQS	20	ug/L
2-Chlorophenol	NJGWQS	40	ug/L
Benzo(a)anthracene	NJGWQS	0.005	ug/L
Bis-(2-Chloroethyl) Ether	NJGWQS	0.03	ug/L
Naphthalene	NJGWQS	300	ug/L

Notes:

1. New Jersey Ground Water Quality Standards (NJGWQS) and National Primary Drinking Water Standards Maximum Contaminant Limit (MCLs) were considered. NJGWQS for Class IIA standards were considered. The most stringent ARAR standard has been identified in this table. The federal MCL is identified when both state and federal standards are the same.

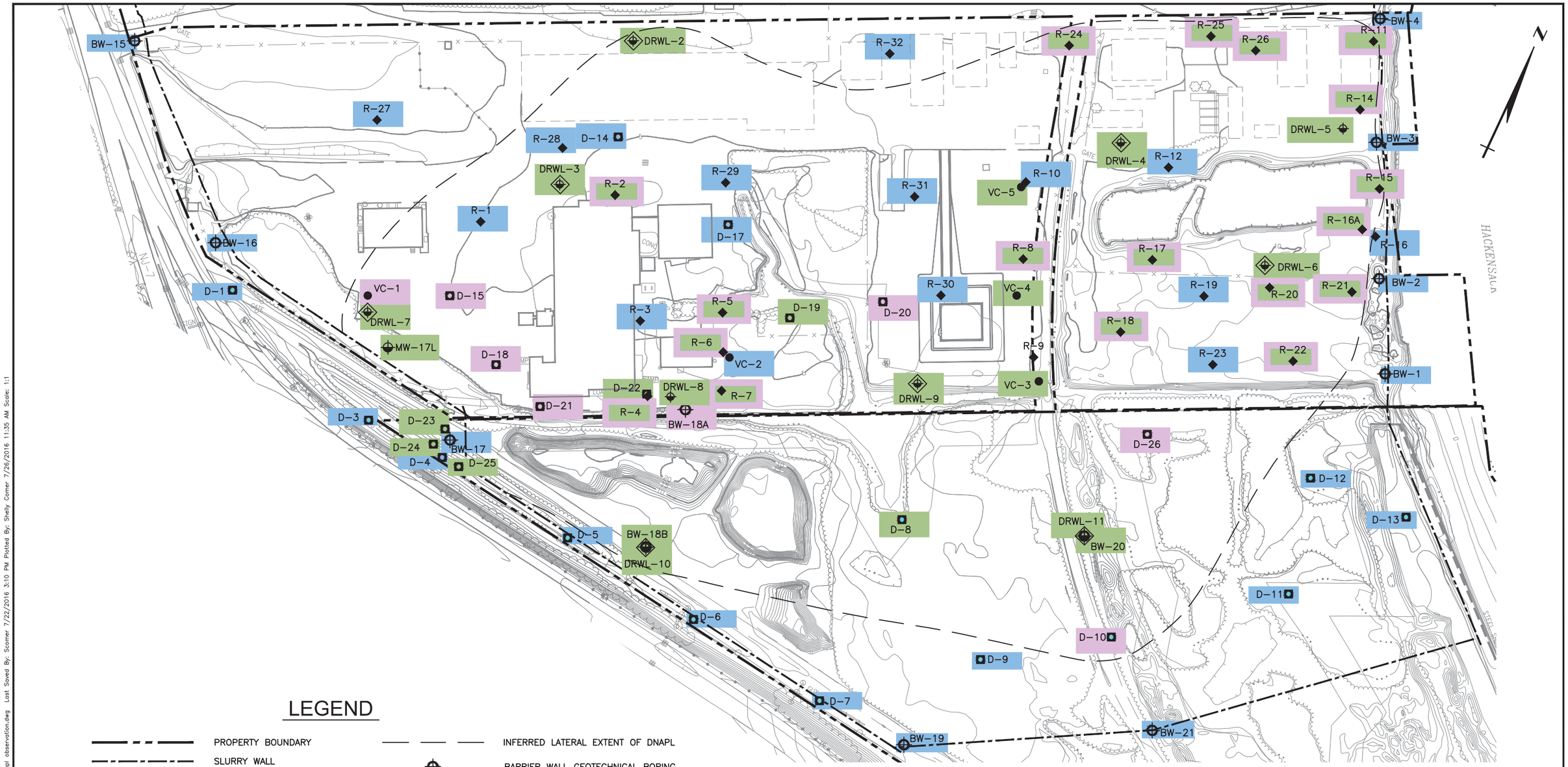
TABLE 3-2
SAND UNIT TDS
TECHNICAL IMPRACTICABILITY EVALUATION REPORT ADDENDUM
STANDARD CHLORINE CHEMICAL CO. INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

Constituent of Concern	Units	Criterion[1]	MW-109 04/23/08 Primary		SC-MW-11U 04/24/08 Primary		SC-MW-12L 04/25/08 Primary		SC-MW-12U 04/23/08 Primary		SC-MW-12U 04/23/08 Duplicate		SC-MW-13L 04/25/08 Primary		SC-MW-14L 04/24/08 Primary		SC-MW-14U 04/24/08 Primary		SC-MW-15L 04/24/08 Primary		SC-MW-15U 04/23/08 Primary	
General Chemistry																						
pH		6.5-8.5	6.35		7.78		5.41		8.26				1.08		4.2		7.86		6.64		6.95	
Specific Conductance	ms/cs		99.9		0.945		1.488		0.494				36.14		2.827		1.183		0.106		0.678	
TDS	mg/L	500	315		**780**		**2970**		424				**21700**		**4390**		**944**		454		413	
Metals																						
Iron	ug/L	300	**13900**		**4280**		**73600**		**673**		275		**309000**		**45600**		**475**		**8120**		**7950**	
Manganese	ug/L	50	**2060**		37.7		**1000**		35		23.1		**3590**		**646**		**119**		**268**		**514**	
Sodium	ug/L	50000	**54300**		**78300**		**210000**		36600		37600		**1010000**		**226000**		**68700**		**64200**		45300	

Constituent of Concern	Units	Criterion[1]	SC-MW-2L 04/24/08 Primary		SC-MW-3L 04/24/08 Primary		SC-MW-4L 04/24/08 Primary		SC-MW-8L 04/24/08 Primary		SC-PZ-1U 04/23/08 Primary		SC-PZ-2U 04/23/08 Primary		SC-PZ-3U 04/23/08 Primary		SC-PZ-4U 04/25/08 Primary		SC-PZ-5U 04/24/08 Primary	
General Chemistry																				
pH		6.5-8.5	7.45		7.3		7.24		6.26		7.26		12.7		9.11		8.2		12.91	
Specific Conductance	ms/cs		0.641		3.477		5.191		6.771		0.453		0.489		0.745		0.224		3.931	
TDS	mg/L	500	**6300**		**2930**		**7070**		**5330**		**527**		**684**		**525**		91		**1420**	
Metals																				
Iron	ug/L	300	**44600**		**105000**		**55300**		**118000**		**46100**		33.4	B	**1720**		**6550**		**833**	
Manganese	ug/L	50	**715**		**1510**		**1080**		**8580**		**701**		0.32	U	24.2		**71**		10.4	B
Sodium	ug/L	50000	**1440000**		**771000**		**1370000**		**1430000**		**113000**		27000		**195000**		8780		**82100**	

1. Specific Ground Water Quality Criteria - Class IIA - from Appendix Table 1 New Jersey Administrative Code 7:9C unless otherwise noted. Last amended July 7, 2010.

FIGURES



LEGEND

- PROPERTY BOUNDARY
- SLURRY WALL
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- EXISTING STREAM, POND AND RIVER BANK
- EXISTING VEGETATION
- EXISTING ACCESS ROAD
- EXISTING FENCE
- EXISTING STRUCTURES
- FORMER STRUCTURE
- EXISTING UTILITY POLES
- INFERRED LATERAL EXTENT OF DNAPL
- BARRIER WALL GEOTECHNICAL BORING
- DNAPL RECOVERY WELL LOCATION
- PREVIOUS RI DNAPL DELINEATION BORING
- RI DNAPL DELINEATION BORINGS
- RI VARVED CLAY SAMPLE LOCATION
- ROST BORING LOCATION

DNAPL OBSERVED IN SAND UNIT

- POSSIBLE FREE-PHASE DNAPL
- POSSIBLE RESIDUAL DNAPL
- POSSIBLE FREE-PHASE/RESIDUAL DNAPL (LASER INDUCED FLORESCENCE TEST DATA)
- NO DNAPL OBSERVED

0 150 300 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 07/19/16	KEY ENVIRONMENTAL INCORPORATED
CHKD: AEF	DATE: 07/26/16	
APPD: JSZ	DATE: 07/26/16	
SCALE: AS SHOWN		

TI EVALUATION REPORT–ADDENDUM
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1 INFERRED DNAPL LIMITS

PROJECT NO: 2015–01

FIGURE 2–1

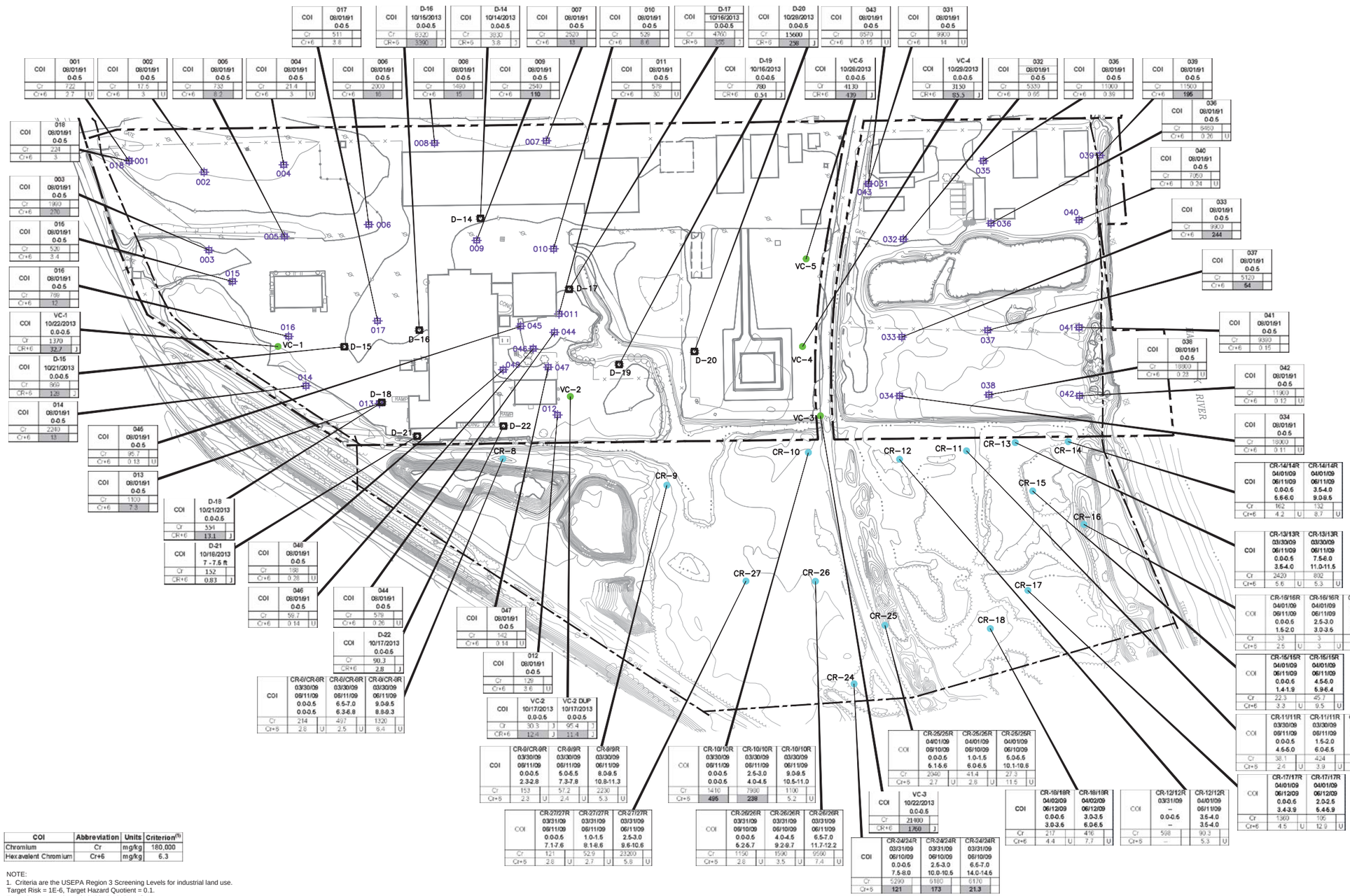
REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

y:\Civil\kearny\ti evaluation report\addendum\figure 2-1 delineation borings dnapl observation.dwg Last Saved By: Scomer 7/22/2016 3:10 PM Plotted By: Shelly Comer 7/26/2016 11:35 AM Scale: 1:1



NOTES:
ALL SAMPLE LOCATIONS IN THE EASTERN PORTION OF THE SITE ARE BELOW COVER MATERIALS PLACED DURING IMPLEMENTATION OF THE IRA.

HISTORICAL SAMPLE LOCATIONS BASED ON PREVIOUS REPORTS BY OTHERS. MANY HISTORICAL SAMPLE LOCATIONS NOT SURVEYED.

COI	Abbreviation	Units	Criterion[1]
Chromium	Cr	mg/kg	180,000
Hexavalent Chromium	Cr+6	mg/kg	6.3

NOTE:
1. Criteria are the USEPA Region 3 Screening Levels for industrial land use. Target Risk = 1E-6, Target Hazard Quotient = 0.1.
Exceedances are shown in bold, shaded typeface.

Data qualifiers are as follows:
J - Organic results. Result is an estimate.
Quantitated between the detection limit and the reporting limit.
U - Not detected at the detection limit indicated.

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:
1. VERTICAL REFERENCE: NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
2. EXISTING GROUND SURFACE ELEVATION CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
3. PROPERTY BOUNDARY PER PAULUS, SOKOLOWSKI, SARTOR, CONSULTING ENGINEERS, AUGUST 1995.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 07/19/16
CHKD: AEF	DATE: 07/26/16
APPD: JSZ	DATE: 07/26/16
SCALE: AS SHOWN	

KEY ENVIRONMENTAL INCORPORATED

TI EVALUATION REPORT–ADDENDUM
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1 INFERRED CHROMIUM LIMITS

PROJECT NO: 201501–02

FIGURE 2–2

y:\00civil\kearny\ti evaluation report\addendum\figure 2-2 surface soil analytical data historical-rev.dwg Last Saved By: Scomer 7/26/2016 11:34 AM Plotted By: Shelly Comer 7/26/2016 11:34 AM Scale: 1:1

Analyte	SC-MW-15L 04/24/08 Primary	
124-TCB	440	J
12-DCB	36000	
13-DCB	26000	
14-DCB	42000	
BNZ	350	J
CB	7800	
246-TCP	0.6	U
24-DCP	48	
24-DMP	3.9	J
2-CP	0.48	U
2-MNAP	0.89	J
BaA	0.43	U
BaP	0.46	U
BbF	0.33	U
BkF	0.41	U
HCB	0.46	U
I123P	0.5	U
NAP	24	
PCP	0.87	U
PHL	7.2	J
Cr	4.3	B
Cr^{+6}	10	U
1016	0.1	U
1248	0.093	U
1260	0.055	U

Analyte	SC-MW-2L 04/24/08 Primary	
1,2,4-TCB	840	
1,2-DCB	12000	
1,3-DCB	9700	
1,4-DCB	15000	
BNZ	81	U
CB	730	
2,4,6-TCP	0.6	U
2,4-DCP	360	
2,4-DMP	6.7	J
2-CP	18	
2-MNAP	0.73	J
B(a)A	0.43	U
B(a)P	0.46	U
B(b)F	0.33	U
B(k)F	0.41	U
HCB	0.46	U
I(1,2,3)P	0.5	U
NAP	30	
PCP	0.87	U
PHL	8.2	J
Cr	12100	
Cr^{+6}	250	U
1016	0.1	U
1248	0.093	U
1260	0.055	U

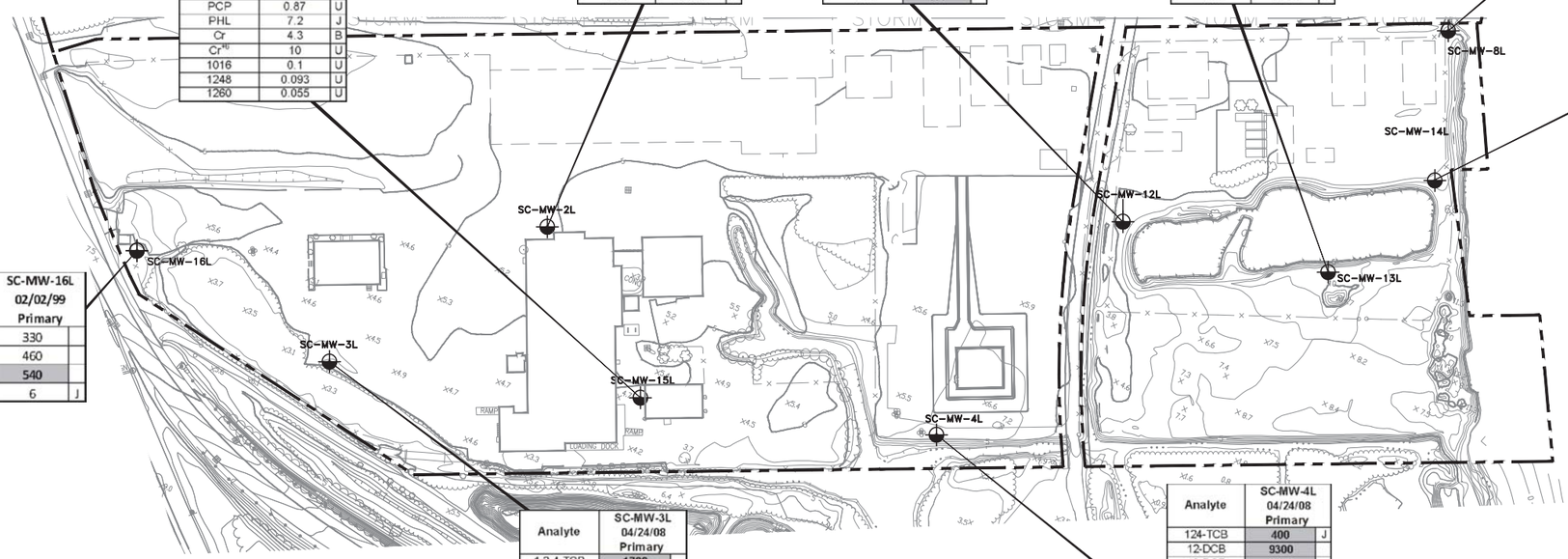
Analyte	SC-MW-12L 04/25/08 Primary	
1,2,4-TCB	4200	
1,2-DCB	12000	
1,3-DCB	4600	
1,4-DCB	6200	
BNZ	280	J
CB	770	
2,4,6-TCP	0.62	U
2,4-DCP	0.53	U
2,4-DMP	2500	
2-CP	26	
2-MNAP	150	J
B(a)A	0.45	U
B(a)P	0.48	U
B(b)F	0.34	U
B(k)F	0.43	U
HCB	43	
I(1,2,3)P	0.52	U
NAP	2400	
PCP	0.9	U
PHL	3700	
Cr	57.4	
Cr^{+6}	10	U
1016	4.5	
1248	0.095	U
1260	1.4	

Analyte	SC-MW-13L 04/25/08 Primary	
124-TCB	2400	
12-DCB	700	
13-DCB	160	
14-DCB	380	
BNZ	20	U
CB	33	J
246-TCP	170	
24-DCP	2.6	U
24-DMP	3100	J
2-CP	2.5	U
2-MNAP	790	
BaA	2.2	U
BaP	2.4	U
BbF	1.7	U
BkF	2.1	U
HCB	2.4	U
I123P	2.6	U
NAP	1700	J
PCP	4.5	U
PHL	19000	
Cr	6930	
Cr^{+6}	20	U
1016	7.5	
1248	0.93	U
1260	0.55	U

Analyte	SC-MW-8L 04/24/08 Primary	
124-TCB	6700	
12-DCB	10000	
13-DCB	3700	
14-DCB	4900	
BNZ	270	J
CB	1700	
246-TCP	120	
24-DCP	450	
24-DMP	660	
2-CP	75	
2-MNAP	290	
BaA	0.99	J
BaP	0.5	U
BbF	1	J
BkF	0.45	U
HCB	7.8	J
I123P	0.54	U
NAP	5300	
PCP	0.95	U
PHL	1500	
Cr	281	
Cr^{+6}	10	U
1016	78	
1248	58	
1260	14	

Analyte	SC-MW-14L 04/24/08 Primary	
1,2,4-TCB	3400	
1,2-DCB	5300	
1,3-DCB	1900	
1,4-DCB	2400	
BNZ	150	
CB	920	
2,4,6-TCP	0.61	U
2,4-DCP	0.52	U
2,4-DMP	28000	
2-CP	0.49	U
2-MNAP	700	J
B(a)A	0.44	U
B(a)P	1.9	J
B(b)F	0.34	U
B(k)F	0.43	U
HCB	0.47	U
I(1,2,3)P	0.51	U
NAP	9100	J
PCP	0.9	U
PHL	40000	
Cr	132	
Cr^{+6}	10	U
1016	1.2	
1248	0.61	PG
1260	0.055	U

Analyte	SC-MW-16L 02/02/99 Primary	
1,2-DCB	330	
1,3-DCB	460	
1,4-DCB	540	
NAP	6	J



Analyte	SC-MW-3L 04/24/08 Primary	
1,2,4-TCB	1700	
1,2-DCB	29000	
1,3-DCB	20000	
1,4-DCB	32000	
BNZ	200	U
CB	1700	
2,4,6-TCP	1.2	J
2,4-DCP	1000	
2,4-DMP	4.2	J
2-CP	35	
2-MNAP	2	J
B(a)A	0.45	U
B(a)P	0.48	U
B(b)F	0.34	U
B(k)F	0.43	U
HCB	0.47	U
I(1,2,3)P	0.52	U
NAP	57	
PCP	0.9	U
PHL	6.5	J
Cr	171	
Cr^{+6}	250	U
1016	0.1	U
1248	0.093	U
1260	0.055	U

Analyte	SC-MW-4L 04/24/08 Primary	
124-TCB	400	J
12-DCB	9300	
13-DCB	9000	
14-DCB	13000	
BNZ	380	J
CB	440	J
246-TCP	0.64	U
24-DCP	170	
24-DMP	680	
2-CP	5.1	J
2-MNAP	32	
BaA	0.46	U
BaP	0.49	U
BbF	0.35	U
BkF	0.44	U
HCB	1.1	J
I123P	0.53	U
NAP	350	
PCP	0.93	U
PHL	55	
Cr	10700	
Cr^{+6}	500	U
1016	0.1	U
1248	0.095	U
1260	0.056	U

Analyte	Abbreviation	Units	Criterion[1]
Volatile Organics (VOCs)			
1,2,4-Trichlorobenzene	124-TCB	ug/L	70
1,2-Dichlorobenzene	12-DCB	ug/L	600
1,3-Dichlorobenzene	13-DCB	ug/L	600
1,4-Dichlorobenzene	14-DCB	ug/L	75
Benzene	BNZ	ug/L	5
Chlorobenzene	CB	ug/L	100
Semivolatile Organics (SVOCs)			
2,4,6-Trichlorophenol	246-TCP	ug/L	120
2,4-Dichlorophenol	24-DCP	ug/L	4.6
2,4-Dimethylphenol	24-DMP	ug/L	36
2-Chlorophenol	2-CP	ug/L	9.1
2-Methylnaphthalene	2-MNAP	ug/L	3.6
Benzo(a)anthracene	BaA	ug/L	0.034
Benzo(a)pyrene	BaP	ug/L	0.2
Benzo(b)fluoranthene	BbF	ug/L	0.034
Benzo(k)fluoranthene	BkF	ug/L	0.34
Hexachlorobenzene	HCB	ug/L	1
Indeno(1,2,3-cd)pyrene	I123P	ug/L	0.034
Naphthalene	NAP	ug/L	0.17
Pentachlorophenol	PCP	ug/L	1
Phenol	PHL	ug/L	580
Metals			
Chromium (Total)	Cr	ug/L	2200
Hexavalent Chromium	Cr^{+6}	ug/L	0.035
Polychlorinated Biphenyls (Aroclors) (PCBs)			
Aroclor 1016	1016	ug/L	0.14
Aroclor 1248	1248	ug/L	0.039
Aroclor 1260	1260	ug/L	0.039

NOTE:
1. Criteria are USEPA Region 3 Screening Levels (November 2014) for tapwater. MCL is presented if available.

Exceedances are shown in bold, shaded typeface.

Data qualifiers are as follows:
U - Not detected at the detection limit indicated.
J - Organic results. Result is an estimate.
Quantitated between the detection limit and the reporting limit.
B - Inorganic results. Result is an estimate.
Quantitation between the detection limit and the reporting limit.
P - Organic results.
Percent difference between initial and confirmation column results is greater than 40%.

0 200 400 FEET

LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING BUILDING/STRUCTURES
- FORMER BUILDING/STRUCTURES
- EXISTING GROUND SURFACE ELEVATION CONTOURS
- SC-MW-13L — SAND UNIT GROUNDWATER MONITORING WELL LOCATION

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

NOTE:
GROUNDWATER ON THE SCCC SITE IS CURRENTLY CONFINED WITHIN THE LIMITS OF THE SLURRY/SHEET PILE WALLS.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

PERFORMING PARTIES GROUP

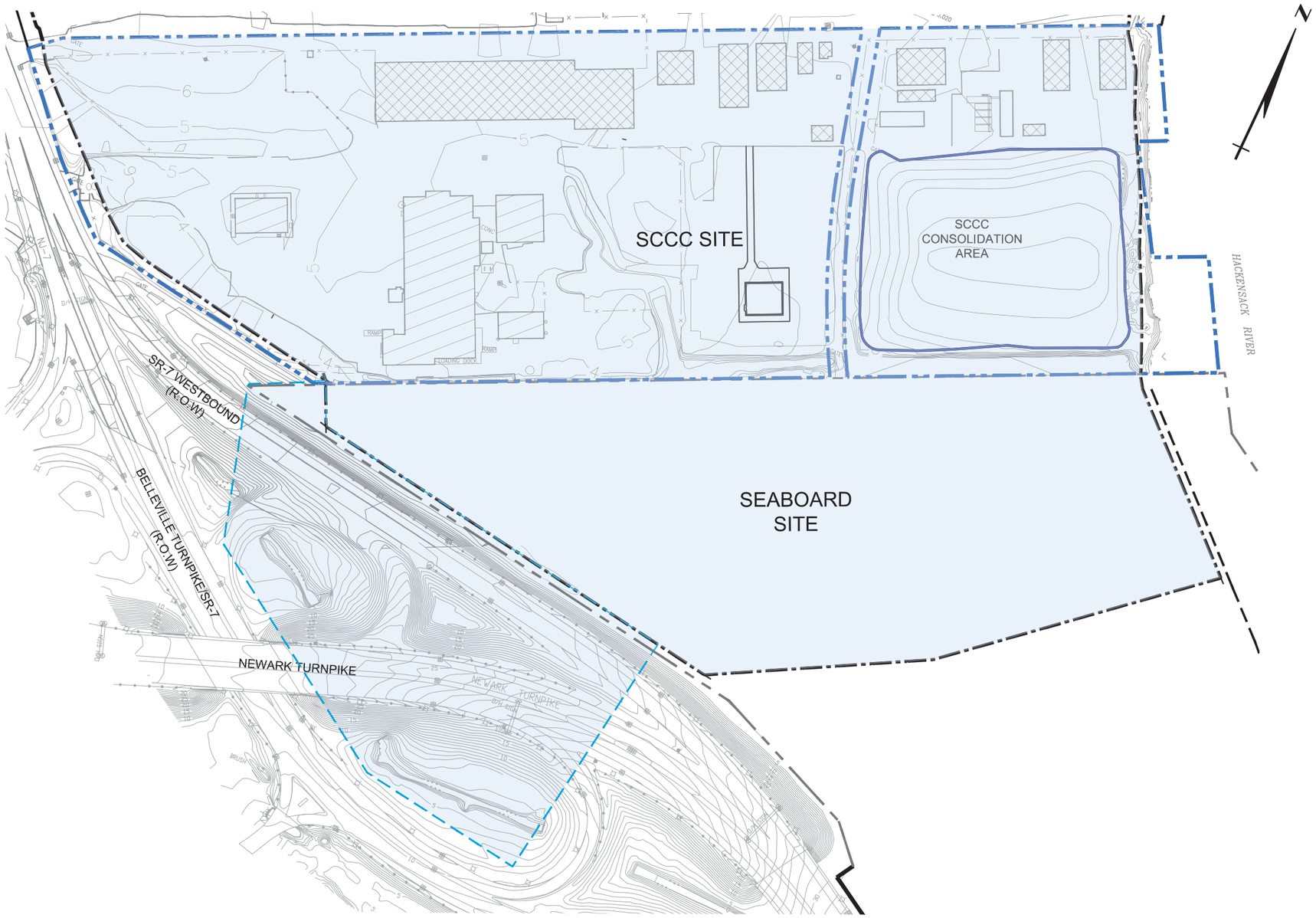
DRWN: SCC	DATE: 07/19/16	KEY ENVIRONMENTAL INCORPORATED
CHKD: AEF	DATE: 07/26/16	
APPD: JSZ	DATE: 07/26/16	
SCALE: AS SHOWN		

TI EVALUATION REPORT–ADDENDUM
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

AREA 1 – SAND UNIT
GROUNDWATER ANALYTICAL RESULTS

PROJECT NO: 2015–01
FIGURE 3–1

y:\00civil\kearny\ti evaluation report\addendum\figure 3-1 deep groundwater analytical.dwg Last Saved By: Scomer 7/22/2016 3:23 PM Plotted By: Shelly Comer 7/26/2016 11:34 AM Scale: 1:1



LEGEND

- STANDARD CHLORINE SITE BOUNDARY
- SEABOARD SITE BOUNDARY
- SLURRY WALL LOCATION
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB
- PROPOSED TI ZONE

NOTE:
CURRENT TOPOGRAPHY FOR THE SEABOARD SITE IS NOT AVAILABLE.

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 07/19/16	KEY ENVIRONMENTAL INCORPORATED
CHKD: AEF	DATE: 07/26/16	
APPD: JSZ	DATE: 07/26/16	
SCALE: AS SHOWN		

TI EVALUATION REPORT–ADDENDUM
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE: EXISTING GROUND SURFACE ELEVATION CONTOURS PER BORBAS SURVEYING & MAPPING, LLC.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

ESTIMATED EXTENT OF PROPOSED TI ZONE

PROJECT NO: 201601–03

FIGURE 5–1

y:\00civil\kearny\ti evaluation report\addendum\figure 5-1.dwg Last Saved By: Scomer 7/22/2016 10:28 AM Plotted By: Shelly Comer 7/26/2016 11:36 AM Scale: 1:1

APPENDIX B

DRAFT DEED NOTICE

NOTE: THIS IS A COURTESY COPY OF THIS RULE. ALL OF THE DEPARTMENT'S RULES ARE COMPILED IN TITLE 7 OF THE NEW JERSEY ADMINISTRATIVE CODE.

APPENDIX B - MODEL DEED NOTICE

DEED NOTICE

This shell document contains blanks and matter in brackets [ ]. These blanks shall be replaced with the required site information prior to recording.

Matter bracketed [ ] is not intended for deletion, but rather is intended to be descriptive of the variable information that may be contained in the final document.

IN ACCORDANCE WITH N.J.S.A. 58:10B-13, THIS DOCUMENT IS TO BE RECORDED IN THE SAME MANNER AS ARE DEEDS AND OTHER INTERESTS IN REAL PROPERTY.

Prepared by: _____
[Signature]

_____
[Print name below signature]

Recorded by: _____
[Signature, Officer of County Recording Office]

_____
[Print name below signature]

DEED NOTICE

This Deed Notice is made as of the _____ day of _____, ____, by *[Insert the full legal name and address of each current property owner*] (together with his/her/its/their successors and assigns, collectively "Owner").

1. THE PROPERTY. [*Insert the full legal name and address of each current property owner*] [*Insert as appropriate: "is", or "are"*] the owner in fee simple of certain real property designated as Block(s) _____ Lot(s) _____, on the tax map of the [*Insert, as appropriate: City/Borough/Township/Town*] of [*Insert the name of municipality*], [*Insert the name of county*] County; the New Jersey Department of Environmental Protection Program Interest Number (Preferred ID) for the contaminated site which includes this property is [*Insert the Program Interest Number (Preferred ID)*]; and the property is more particularly described in Exhibit A, which is attached hereto and made a part hereof (the "Property"). The Property is a Superfund site, and the United States Environmental Protection Agency is the lead agency.

2. REMEDIATION.

i. [*Insert name of the Licensed Site Remediation Professional and LSRP License No. of the LSRP that approved this Deed Notice*] has approved this Deed Notice as an institutional control for the Property, which is part of the remediation of the Property.

ii. N.J.A.C. 7:26C-7 requires the Owner, among other persons, to obtain a soil remedial action permit for the soil remedial action at the Property. That permit will contain the monitoring, maintenance and biennial certification requirements that apply to the Property.

3. SOIL CONTAMINATION. [*Insert the full legal name of the person that was responsible for conducting the remediation*] has remediated contaminated soil at the Property, such that soil contamination remains in certain areas of the Property that contains contaminants in concentrations that do not allow for the unrestricted use of the Property; this soil contamination is described, including the type, concentration and specific location of such contaminants, in Exhibit B, which is attached hereto and made a part hereof. As a result, there is a statutory requirement for this Deed Notice [*include if appropriate:* and engineering controls] in accordance with N.J.S.A. 58:10B-13.

4. CONSIDERATION. In accordance with the remedial action for the site which included the Property, and in consideration of the terms and conditions of that remedial action, and other good and valuable consideration, Owner has agreed to subject the Property to certain statutory and regulatory requirements that impose restrictions upon the use of the Property, to restrict certain uses of the Property, and to provide notice to subsequent owners, lessees and operators of the restrictions and the monitoring, maintenance, and biennial certification requirements outlined in this Deed Notice and required by law, as set forth herein.

5A. RESTRICTED AREAS. Due to the presence of contamination remaining at concentrations that do not allow for unrestricted use, the Owner has agreed, as part of the remedial action for the Property, to restrict the use of certain parts of the Property (the "Restricted Areas"); a narrative description of these restrictions is provided in Exhibit C, which is attached hereto and made a part hereof. The Owner has also agreed to maintain a list of these restrictions on site for inspection by governmental officials.

5B. RESTRICTED LAND USES. The following statutory land use restrictions apply to the Restricted Areas:

i. The Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-12.g(10), prohibits the conversion of a contaminated site, remediated to non-residential soil remediation standards that require the maintenance of engineering or institutional controls, to a child care facility, or public, private, or charter school without the Department’s prior written approval, unless a presumptive remedy is implemented; and

ii. The Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-12.g(12), prohibits the conversion of a landfill, with gas venting systems and or leachate collection systems, to a single family residence or a child care facility without the Department’s prior written approval.

[*Insert the following paragraph when engineering controls are also implemented at the site:*

5C. ENGINEERING CONTROLS. Due to the presence and concentration of these contaminants, the Owner has also agreed, as part of the remedial action for the Property, to the placement of certain engineering controls on the Property; a narrative description of these engineering controls is provided in Exhibit C.]

6A. CHANGE IN OWNERSHIP AND REZONING.

i. The Owner and the subsequent owners and lessees, shall cause all leases, grants, and other written transfers of an interest in the Restricted Areas to contain a provision expressly requiring all holders thereof to take the Property subject to the restrictions contained herein and to comply with all, and not to violate any of the conditions of this Deed Notice. Nothing contained in this Paragraph shall be construed as limiting any obligation of any person to provide any notice required by any law, regulation, or order of any governmental authority.

ii. The Owner and the subsequent owners shall provide written notice to the Department of Environmental Protection on a form provided by the Department and available at www.nj.gov/srp/forms within thirty (30) calendar days after the effective date of any conveyance, grant, gift, or other transfer, in whole or in part, of the owner’s interest in the Restricted Area.

iii. The Owner and the subsequent owners shall provide written notice to the Department, on a form available from the Department at www.nj.gov/srp/forms, within thirty (30) calendar days after the owner’s petition for or filing of any document initiating a rezoning of the Property to residential.

6B. SUCCESSORS AND ASSIGNS. This Deed Notice shall be binding upon Owner and upon Owner's successors and assigns, and subsequent owners, lessees and operators while each is an owner, lessee, or operator of the Property.

7A. ALTERATIONS, IMPROVEMENTS, AND DISTURBANCES.

i. The Owner and all subsequent owners and lessees shall notify any person, including, without limitation, tenants, employees of tenants, and contractors, intending to conduct invasive work or excavate within the Restricted Areas, of the nature and location of contamination in the Restricted Areas, and, of the precautions necessary to minimize potential human exposure to contaminants.

ii. Except as provided in Paragraph 7B, below, no person shall make, or allow to be made, any alteration, improvement, or disturbance in, to, or about the Property which disturbs any engineering control at the Property without first obtaining a soil remedial action permit modification pursuant to N.J.A.C. 7:26C-7. Nothing herein shall constitute a waiver of the obligation of any person to comply with all applicable laws and regulations including, without limitation, the applicable rules of the Occupational Safety and Health Administration.

iii. Notwithstanding subparagraph 7Aii., above, a soil remedial action permit modification is not required for any alteration, improvement, or disturbance provided that the owner, lessee or operator:

(A) Notifies the Department of Environmental Protection of the activity by calling the DEP Hotline, at 1-877-WARN-DEP or 1-877-927-6337, within twenty-four (24) hours after the beginning of each alteration, improvement, or disturbance;

(B) Restores any disturbance of an engineering control to pre-disturbance conditions within sixty (60) calendar days after the initiation of the alteration, improvement or disturbance;

(C) Ensures that all applicable worker health and safety laws and regulations are followed during the alteration, improvement, or disturbance, and during the restoration;

(D) Ensures that human exposure to contamination in excess of the remediation standards does not occur; and

(E) Describes, in the next biennial certification the nature of the alteration, improvement, or disturbance, the dates and duration of the alteration, improvement, or disturbance, the name of key individuals and their affiliations conducting the alteration, improvement, or disturbance, a description of the notice the Owner gave to those persons prior to the disturbance.

7B. EMERGENCIES. In the event of an emergency which presents, or may present, an unacceptable risk to the public health and safety, or to the environment, or immediate environmental concern, see N.J.S.A. 58:10C-2, any person may temporarily breach an engineering control provided that that person complies with each of the following:

i. Immediately notifies the Department of Environmental Protection of the emergency, by calling the DEP Hotline at 1-877-WARNDEP or 1-877-927-6337;

ii. Hires a Licensed Site Remediation Professional (unless the Restricted Areas includes an unregulated heating oil tank) to respond to the emergency;

iii. Limits both the actual disturbance and the time needed for the disturbance to the minimum reasonably necessary to adequately respond to the emergency;

iv. Implements all measures necessary to limit actual or potential, present or future risk of exposure to humans or the environment to the contamination;

v. Notifies the Department of Environmental Protection when the emergency or immediate environmental concern has ended by calling the DEP Hotline at 1-877-WARNDEP or 1-877-927-6337; and

vi. Restores the engineering control to the pre-emergency conditions as soon as possible, and provides notification to the Department of Environmental Protection within sixty (60) calendar days after completion of the restoration of the engineering control, including: (a) the nature and likely cause of the emergency; (b) the potential discharges of or exposures to contaminants, if any, that may have occurred; (c) the measures that have been taken to mitigate the effects of the emergency on human health and the environment; (d) the measures completed or implemented to restore the engineering control; and (e) the changes to the engineering control or site operation and maintenance plan to prevent reoccurrence of such conditions in the future.

8. TERMINATION OF DEED NOTICE.

i. This Deed Notice may be terminated only upon filing of a Termination of Deed Notice, available at N.J.A.C. 7:26C Appendix C, with the office of the [*Insert as appropriate the County Clerk/Register of Deeds and Mortgages*] of [*Insert the name of the County*] County, New Jersey, expressly terminating this Deed Notice.

ii. Within thirty (30) calendar days after the filing of a Termination of Deed Notice, the owner of the property shall apply to the Department for termination of the soil remedial action permit pursuant to N.J.A.C. 7:26C-7.

9. ACCESS. The Owner, and the subsequent owners, lessees and operators agree to allow the Department, its agents and representatives access to the Property to inspect and evaluate the continued protectiveness of the remedial action that includes this Deed Notice and to conduct additional remediation to ensure the protection of the public health and safety and of the environment if the subsequent owners, lessees and operators, during their ownership, tenancy, or operation, and the Owner fail to conduct such remediation pursuant to this Deed Notice as required by law. The Owner, and the subsequent owners and lessees, shall also cause all leases, subleases, grants, and other written transfers of an interest in the Restricted Areas to contain a provision expressly requiring that all holders thereof provide such access to the Department.

10. ENFORCEMENT OF VIOLATIONS.

i. This Deed Notice itself is not intended to create any interest in real estate in favor of the Department of Environmental Protection, nor to create a lien against the Property, but merely is intended to provide notice of certain conditions and restrictions on the Property and to reflect the regulatory and statutory obligations imposed as a conditional remedial action for this site.

ii. The restrictions provided herein may be enforceable solely by the Department against any person who violates this Deed Notice. To enforce violations of this Deed Notice, the Department may initiate one or more enforcement actions pursuant to N.J.S.A. 58:10-23.11, and N.J.S.A. 58:10C, and require additional remediation and assess damages pursuant to N.J.S.A. 58:10-23.11, and N.J.S.A. 58:10C.

11. SEVERABILITY. If any court of competent jurisdiction determines that any provision of this Deed Notice requires modification, such provision shall be deemed to have been modified automatically to conform to such requirements. If a court of competent jurisdiction determines that any provision of this Deed Notice is invalid or unenforceable and the provision is of such a nature that it cannot be modified, the provision shall be deemed deleted from this instrument as though the provision had never been included herein. In either case, the remaining provisions of this Deed Notice shall remain in full force and effect.

12A. EXHIBIT A. Exhibit A includes the following maps of the Property and the vicinity:

i. Exhibit A-1: Vicinity Map - A map that identifies by name the roads, and other important geographical features in the vicinity of the Property (for example, USGS Quad map, Hagstrom County Maps);

ii. Exhibit A-2: Metes and Bounds Description - A tax map of lots and blocks as wells as metes and bounds description of the Property, including reference to tax lot and block numbers for the Property;

iii. Exhibit A-3: Property Map - A scaled map of the Property, scaled at one inch to 200 feet or less, and if more than one map is submitted, the maps shall be presented as overlays, keyed to a base map; and the Property Map shall include diagrams of major surface topographical features such as buildings, roads, and parking lots.

12B. EXHIBIT B. Exhibit B includes the following descriptions of the Restricted Areas:

i. Exhibit B-1: Restricted Area Map - A separate map for each restricted area that includes:

(A) As-built diagrams of each engineering control, including caps, fences, slurry walls, (and, if any) ground water monitoring wells, extent of the ground water classification exception area, pumping and treatment systems that may be required as part of a ground water engineering control in addition to the deed notice

(B) As-built diagrams of any buildings, roads, parking lots and other structures that function as engineering controls; and

(C) Designation of all soil and sediment sample locations within the restricted areas that exceed any soil or sediment standard that are keyed into one of the tables described in the following paragraph.

ii. Exhibit B-2: Restricted Area Data Table - A separate table for each restricted area that includes either (A) or (B) through (F):

(A) Only for historic fill extending over the entire site or a portion of the site and for which analytical data are limited or do not exist, a narrative that states that historic fill is present at the site, a description of the fill material (e.g., ash, cinders, brick, dredge

material), and a statement that such material may include, but is not limited to, contaminants such as PAHs and metals;

(B) Sample location designation from Restricted Area map (Exhibit B-1);

(C) Sample elevation based upon mean sea level;

(D) Name and chemical abstract service registry number of each contaminant with a concentration that exceeds the unrestricted use standard;

(E) The restricted and unrestricted use standards for each contaminant in the table; and

(F) The remaining concentration of each contaminant at each sample location at each elevation.

12C. EXHIBIT C. Exhibit C includes narrative descriptions of the institutional controls [*Insert as appropriate: and engineering controls*] as follows:

i. Exhibit C-1: Deed Notice as Institutional Control: Exhibit C-1 includes a narrative description of the restriction and obligations of this Deed Notice that are in addition to those described above, as follows:

(A) Description and estimated size of the Restricted Areas as described above;

(B) Description of the restrictions on the Property by operation of this Deed Notice; and

(C) The objective of the restrictions.

[*Insert the following if engineering controls are part of the remedial action for the site*:

ii. Exhibit C-2: [*Insert the name of the first engineering control*]: Exhibit C-2 includes a narrative description of [*Insert the name of the first engineering control*] as follows:

(A) Description of the engineering control;

(B) The objective of the engineering control; and

(C) How the engineering control is intended to function.

[*Repeat the contents of Exhibit C-2, renumbering accordingly, for each separate engineering control that is part of the remedial action for the site.*]

13. SIGNATURES. IN WITNESS WHEREOF, Owner has executed this Deed Notice as of the date first written above.

NOTE: THIS IS A COURTESY COPY OF THIS RULE. ALL OF THE DEPARTMENT'S RULES ARE COMPILED IN TITLE 7 OF THE NEW JERSEY ADMINISTRATIVE CODE.

[If Owner is an individual]

WITNESS: _____
[Signature]

_____
[Print name below signature]

STATE OF [State where document is executed] SS.:
COUNTY OF [County where document is executed]

I certify that on _____, 20__, [Name of Owner] personally came before me, and this person acknowledged under oath, to my satisfaction, that this person [or if more than one person, each person]

(a) is named in and personally signed this document; and

(b) signed, sealed and delivered this document as his or her act and deed.

_____

_____, Notary Public
[Print Name and Title]

14. SIGNATURES. IN WITNESS WHEREOF, Owner has executed this Deed Notice as of the date first written above.

[If Owner is a corporation]

ATTEST: [Name of corporation]

_____ By_____

_____ _____
[Print name and title] [Signature]

STATE OF [State where document is executed] SS.:
COUNTY OF [County where document is executed]

I certify that on _____, 20__, [Name of person executing document on behalf of Owner] personally came before me, and this person acknowledged under oath, to my satisfaction, that:

(a) this person is the [secretary/assistant secretary] of [Owner], the corporation named in this document;

(b) this person is the attesting witness to the signing of this document by the proper corporate officer who is the [president/vice president] of the corporation;

(c) this document was signed and delivered by the corporation as its voluntary act and was duly authorized;

(d) this person knows the proper seal of the corporation which was affixed to this document; and

(e) this person signed this proof to attest to the truth of these facts.

_____
[Signature]

_____
[Print name and title of attesting witness]

Signed and sworn before me on _____, 20__

_____, Notary Public

_____
[Print name and title]

APPENDIX C

HELP MODEL DOCUMENTATION

CAP/COVER STORMWATER INFILTRATION RATE
AND ESTIMATED OM&M COST REDUCTION EVALUATION SUMMARY
STANDARD CHLORINE CHEMICAL CO. INC. SITE

A stormwater Infiltration Rate Evaluation and associated OM&M cost evaluation was completed at the Standard Chlorine Chemical Co. Inc. (SCCC) Site (Site) for the three cap/cover alternatives presented in the Focused Feasibility Study (FFS) Report, dated March 2015 (KEY, March 2015). The three cap/cover scenarios presented in the draft FFS are described below.

Alternative II– Area 1 Existing Conditions as shown on Figure 4-1 of the FFS

Alternative III – Targeted (Area 1) Cap/Cover as shown on Figure 4-2 of the FFS. Alternative III includes placing an asphalt cap/cover above the existing unlined vegetated and gravel areas and a geomembrane cap/cover above the existing unlined wetland areas and gravel areas and repairing the existing asphalt cover.

Alternative IV – Site-Wide (Area 1) Cap/Cover as shown on Figure 4-3 of the FFS. Alternative IV includes placing a geomembrane and a general earth fill cap/cover above the SCCC Site including the existing unlined wetland areas.

Version 3 of the Hydrologic Evaluation of Landfill Performance (HELP) computer model, developed by the United State Environmental Protection Agency (USEPA)[1], was used to evaluate the three cap/covers scenarios. The HELP model is used for conducting water balance analysis of landfills, cover systems and other solid waste containment facilities and to assist in the comparison of design alternatives. For this analysis, SCCC Site-specific data were utilized where available as input into the model. Where SCCC Site-specific data were not available, applicable parameter values from the HELP Model database or data from published literature were used.

[1] Hydrologic Evaluation of Landfill Performance (HELP). WHI UnSat Suite Plus (Version 2.2) [Computer software]. Waterloo, ON: Waterloo Hydrogeologic, Inc.

After evaluating the three Alternatives presented in the FFS, Alternatives 3 and 4 were further evaluated for the effect that potential final grade slope has on the stormwater infiltration rate. A 2.5% surface grade and a 5.0% surface grade were evaluated.

Model Input

Below is a list of the various parameters and the corresponding data input used to evaluate the three cap/cover scenarios previously described.

- Historical weather data for Newark, New Jersey were utilized in the model.

- Existing Surficial Fill Materials: In the absence of data specific to the SCCC Site, data and information obtained at the adjoining Diamond Site was used in the model as descriptions made by investigators at both sites indicate that the surficial fill materials are similar at both sites. As reported in the Revised Remedial Investigation Report, Site 113 [2] (RRIR) (Brown & Caldwell, 2008), the surficial materials are comprised of artificial fill that consists of sand, clay, rock fragments and anthropogenic materials. The hydraulic characteristics of the fill are reported to be highly variable. The fill material is classified based upon laboratory grain size analyses as poorly sorted sand with some silt. Based on this information, it was assumed that the existing material is similar to a loamy fine sand and data available in the HELP Model's database were used as default input soil parameters for total porosity, field capacity and wilting point. A geometric mean horizontal hydraulic conductivity of 1.4×10^{-3} cm/sec for the fill material was reported in the RRIR based on slug tests conducted at the Diamond Site. Therefore it was estimated that the vertical hydraulic conductivity of the existing surficial fill is 1.4×10^{-4} cm/sec based on the generally accepted approximation that vertical hydraulic conductivity is an order of magnitude less than the horizontal hydraulic conductivity.

[2] Revised Remedial Investigation Report Site 113 (Diamond Site): Kearny, New Jersey. Volume I of III - Report Text prepared by Brown and Caldwell (June 2008), prepared for Tierra Solutions, Inc.

- Asphalt
  - Existing asphalt exhibits deterioration as indicated by the appearance of fatigue cracking ('crocodile' cracking). In addition, due to the flat existing grades and the conditions of the existing buildings, a relatively large volume of stormwater runoff from the existing asphalt accumulates around the existing buildings and drains into the foundations/basements. Also, the asphalt was placed a number of years ago, and older asphalt typically was constructed using larger aggregate mixture resulting in a higher void percent (relative to current asphalt practices) which results in an increased hydraulic conductivity. Research has been conducted regarding asphalt permeability and the correlation between aggregate size and void percent. An estimation of the asphalt hydraulic conductivity was used for the model using best engineering judgment. Asphalt hydraulic conductivity can be approximately estimated when the void space of the asphalt is known[3]. Assuming the existing asphalt has a 15% void space, a hydraulic conductivity was estimated to be 1.2×10^{-2} cm/sec for the existing conditions. This value was used as the input value for the existing asphalt layer for Alternatives 2 and 4. It was estimated that the existing asphalt layer is four inches thick.
  - An improved asphalt cap/cover is proposed for Alternative 3 in the FFS. It is assumed that the proposed four inch total thickness of asphalt would be installed with a fine graded aggregate mixture in the area of the SCCC Site currently not covered with asphalt (existing vegetation and stone cover areas). In addition, it was assumed that maintenance activities would be conducted on the existing asphalt cover materials to decrease the asphalt permeability such that the permeability would be equivalent to the new asphalt cover. To ensure a low permeability pavement, the National Center for Asphalt Technology at Auburn University recommends (for a fine graded aggregate) that the in-place air voids content be between six and seven percent or lower and that a reasonable asphalt placement

[3] Kanitpong, K., Bahia, H., Benson, C., & Wang, X. (2003). *Measuring and Predicting Hydraulic Conductivity (Permeability) of Compacted Asphalt Mixtures in the Laboratory.* Transportation Research Board 82nd Annual Meeting, 03-3998, 5.

could achieve a 6.2% void space[4]. Therefore, it was assumed that the proposed asphalt cap/cover material would have a 6.2% void space, which results in hydraulic conductivity estimated to be 1.95x10-5 cm/sec. In addition, it was assumed that the existing asphalt would have a hydraulic conductivity of 1.95x10-5 cm/sec, also, following the application of a surface sealant and maintenance on existing cracks.

- Gravel properties were assumed to be similar to the properties of gravel as defined in the HELP model - default properties/database of soil properties. However, the HELP model default properties represent a clean poorly graded gravel material. Because the existing gravel contains fine particle soils, the HELP model default property for saturated hydraulic conductivity was adjusted from 3 x 10-4 cm/sec to that of a gravel sand mixture as defined by the Unified Soil Classification System Group Symbol GW with a saturated hydraulic conductivity of 3 x 10-2 cm/sec.
- Wetland vegetation was assumed to consist of an established stand of grass. These parameters are used by the model to estimate the amount of evapotranspiration. The parameters used in the model for the wetlands favor a substantial rate of evapotranspiration.
- Wetland substrate was assumed to be a one foot thick layer of silty loam soil. The default properties for silty loam soil were obtained from the Model database of soil properties.
- Proposed low permeability cover material assumed to be similar to a fine sandy loam. Hydraulic conductivity was assumed to be $1x10^{-5}$ cm/sec. Remaining soil properties for fine sandy loam are the default values from the model's database of soil properties.
- High Density Polyethylene (HDPE) was selected from the Model database of barrier layer materials.
    - The existing geomembrane liner properties were estimated from the HELP model default parameters. Because of the age and condition of the existing material it was assumed that the existing geomembrane would have one pinhole leak for each square meter of material on the SCCC Site.

[4] Transportation Research Board (July 2004). *Relationship of Air Voids, Lift Thickness, and Permeability in Hot Mix Asphalt Pavements*. National Cooperative Highway Research Program Report 531. Page 18.

  - Proposed geomembrane liner, to be installed as per Alternative 4 defined in the FFS, material properties were estimated from the HELP model default parameters and were used for the evaluation.
- Top soil was assumed to be a three inch thick layer of average silty loam. The default properties for silty loam soil were obtained from the Model database of soil properties. Vegetation was conservatively assumed to be a poor stand of grass.
- General fill was assumed to be a total 33 inch thick layer of fine sandy loam and sandy loam. The default properties for the general fill were obtained from the Model database for soil properties.

HELP Model Evaluation Results

Using the data inputs described above, the HELP model was used to evaluate the existing conditions at the SCCC Site and a comparison of the FFS remedial alternatives cover systems was conducted. All results are summarized in the attached table titled Summary of HELP Model Results. The existing cover conditions at the SCCC Site are represented by Alternative 2 in the FFS and consist of wetland, asphalt, gravel overlying existing soil-like fill material, gravel over HDPE membrane, and existing cover (exposed fill material). Using the stormwater infiltration rate for the cover material, as determined by the HELP model and the corresponding surface area for each of the cover materials, the estimated volume of stormwater infiltration was calculated to be a weighted average of 12.7 inches per year which translates to be 6.6 million gallons per year. Alternative 3, as presented in the FFS, consists of wetland and an improved SCCC Site-wide asphalt cap/cover. The stormwater infiltration rate (weighted average) for the Alternative 3 cover materials as determined by the HELP model was determined to be 6.8 inches per year which equates to 3.5 million gallons per year. The proposed SCCC Site-wide cap/cover material presented in Alternative 4 in the FFS is assumed to be a geomembrane liner covered with general fill. The HELP model results indicated that the stormwater infiltration rate for Alternative 4 will be a weighted average of less than 1 inch per year which equates to 7 gallons per year.

Additional analyses of Alternative 3 and 4 were conducted to evaluate methods for reducing stormwater infiltration rates at the SCCC Site and the results are presented in the attached table titled Summary of HELP Model Results. An evaluation was conducted to determine if an

increased final surface grade (2.5% and 5.0% slope) would impact the stormwater infiltration rate for the SCCC Site. The results of the evaluation indicated that stormwater infiltration did not reasonably change with an increase in slope.

The Alternative 3 proposed surface cover materials evaluation resulted in an anticipated weighted average stormwater infiltration rate of 6.8 in/yr which is an estimated 46% reduction in stormwater infiltration compared to existing conditions modeled as Alternative 2. Alternative 4 proposed surface cover materials resulted in an anticipated weighted average stormwater infiltration rate of less than one inch per year which is an estimated almost 100% reduction in stormwater infiltration compared to existing conditions modeled as Alternative 2.

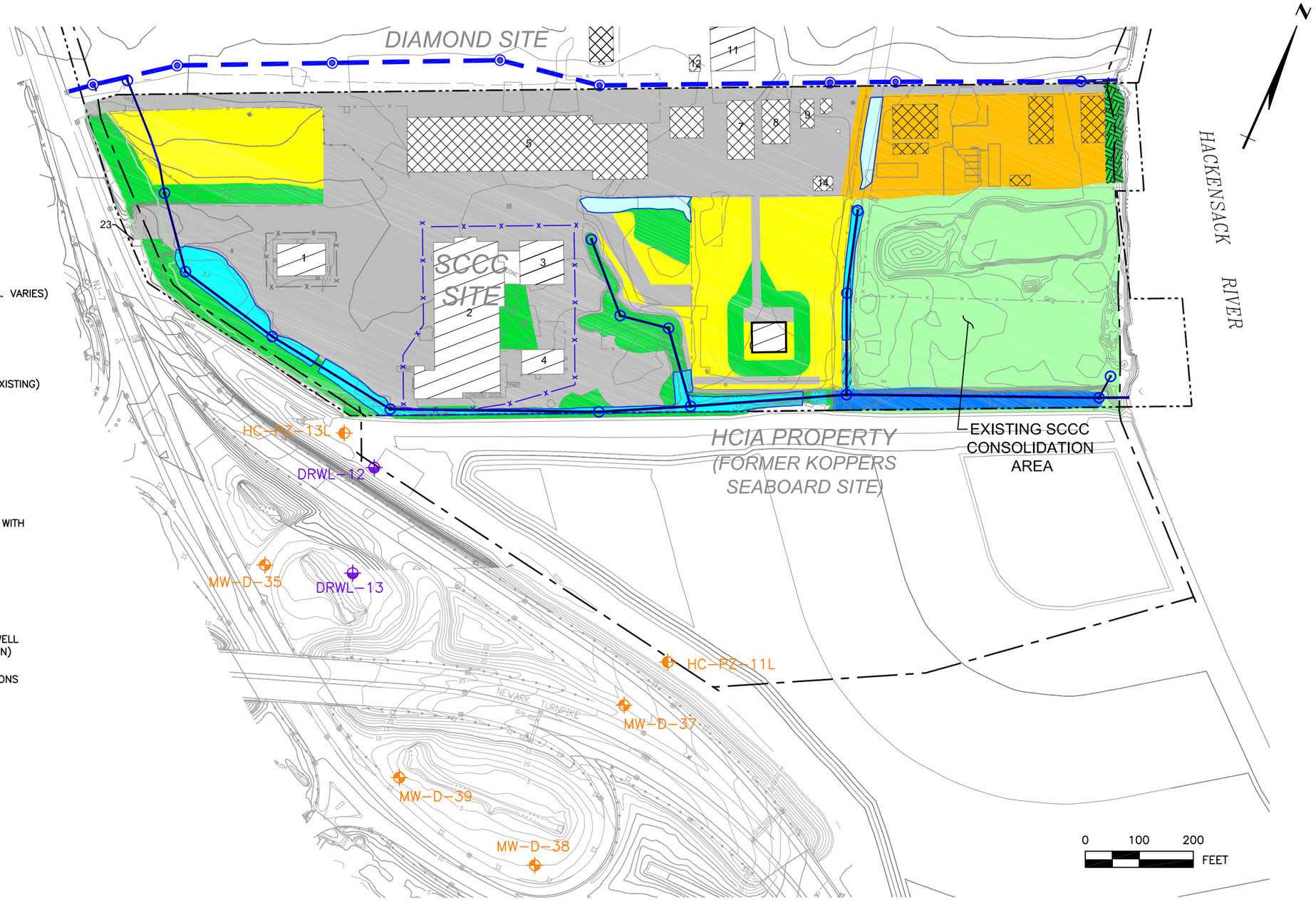
Cost Evaluation

It is anticipated that a reduction in stormwater infiltration at the SCCC Site could substantially reduce the operation maintenance and monitoring (OM&M) costs associated with the Hydraulic Control Treatment System (HCTS). Using actual OM&M costs provided by Field and Technical Services, LLC as a baseline, the expected cost reductions resulting from reduced stormwater infiltration rates that are directly related to operation of the HCTS were estimated and are presented in the attached Table. The reduction in stormwater infiltration afforded by Alternative 3 (improved asphalt cover) reduces the infiltration 46% compared to Alternative 2. The reduction in stormwater infiltration would result in less groundwater being treated in the HCTS and the annual OM&M costs related to HCTS operations would be reduced by an estimated 29% and provides an estimated annual OM&M cost reduction of $145,000 per year when compared to current costs (Alternative 2).

Alternative 4, as presented in the FFS, includes the installation of a geomembrane barrier liner and general fill cap/cover system with a final grade slope of 1%. The reduction in stormwater infiltration afforded by this cap/cover system reduces the infiltration to almost 0%. The reduced stormwater infiltration would result in less groundwater being treated in the HCTS and the annual OM&M costs related to HCTS operations would be reduced by an estimated 62% or $310,000 per year in comparison to Alternative 2 (current conditions).

Conclusions

The HELP model was used to estimate the stormwater infiltration rates for the three cap/cover alternatives presented in the SCCC Site FFS. The results of the analysis demonstrated that implementation of Alternative 3 and Alternative 4 would decrease the stormwater infiltration at the SCCC Site. It is estimated that the Alternative 3 cap/cover system would decrease the stormwater infiltration by 46% and result in a 29% reduction in the annual OM&M cost, and Alternative 4 site wide cap/cover, as presented in the FFS will decrease the stormwater infiltration by almost 100% and result in a 62% reduction in annual OM&M cost.



LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION
- EXISTING RIVER/CHANNEL
- EXISTING SLURRY WALL
- EXISTING STORM DRAIN (48" DIA. PIPE)
- EXISTING STORM WATER DRAIN (PIPE DIA. VARIES)
- EXISTING DROP INLET
- EXISTING DROP INLET
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB (EXISTING)
- EXISTING WETLANDS
- EXISTING NON-PERMITTED PRE-IRAW WETLANDS AREAS
- EXISTING WETLANDS UNDERLAIN BY GEOSYNTHETIC LINER IRM
- EXISTING VEGETATION
- EXISTING VEGETATIVE COVER UNDERLAIN WITH GEOSYNTHETIC LINER IRM
- EXISTING STONE COVER IRM
- EXISTING ASPHALT IRM
- EXISTING GEOMEMBRANE OVERLAIN WITH AGGREGATE IRM
- PROPOSED PASSIVE DNAPL RECOVERY WELL (FORMER CONTINGENCY BORING LOCATION)
- PROPOSED TI ZONE MONITORING LOCATIONS
- PROPOSED SECURITY FENCE

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/12/15	KEY ENVIRONMENTAL INCORPORATED
CHKD: MJV	DATE: 03/01/16	
APPD: JSZ	DATE: 03/01/16	
SCALE: AS SHOWN		

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE:NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
2. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
3. EXISTING WETLANDS PER WETLANDS DELINEATION BY PRINCETON HYDRO, LLC FOR KEY ENVIRONMENTAL, INC. PERFORMED IN MARCH 2009.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

ALTERNATIVE II
AREA 1 EXISTING CONDITIONS/
AREA 2 DNAPL RECOVERY PLAN

PROJECT NO: 201501-05

FIGURE 4-1

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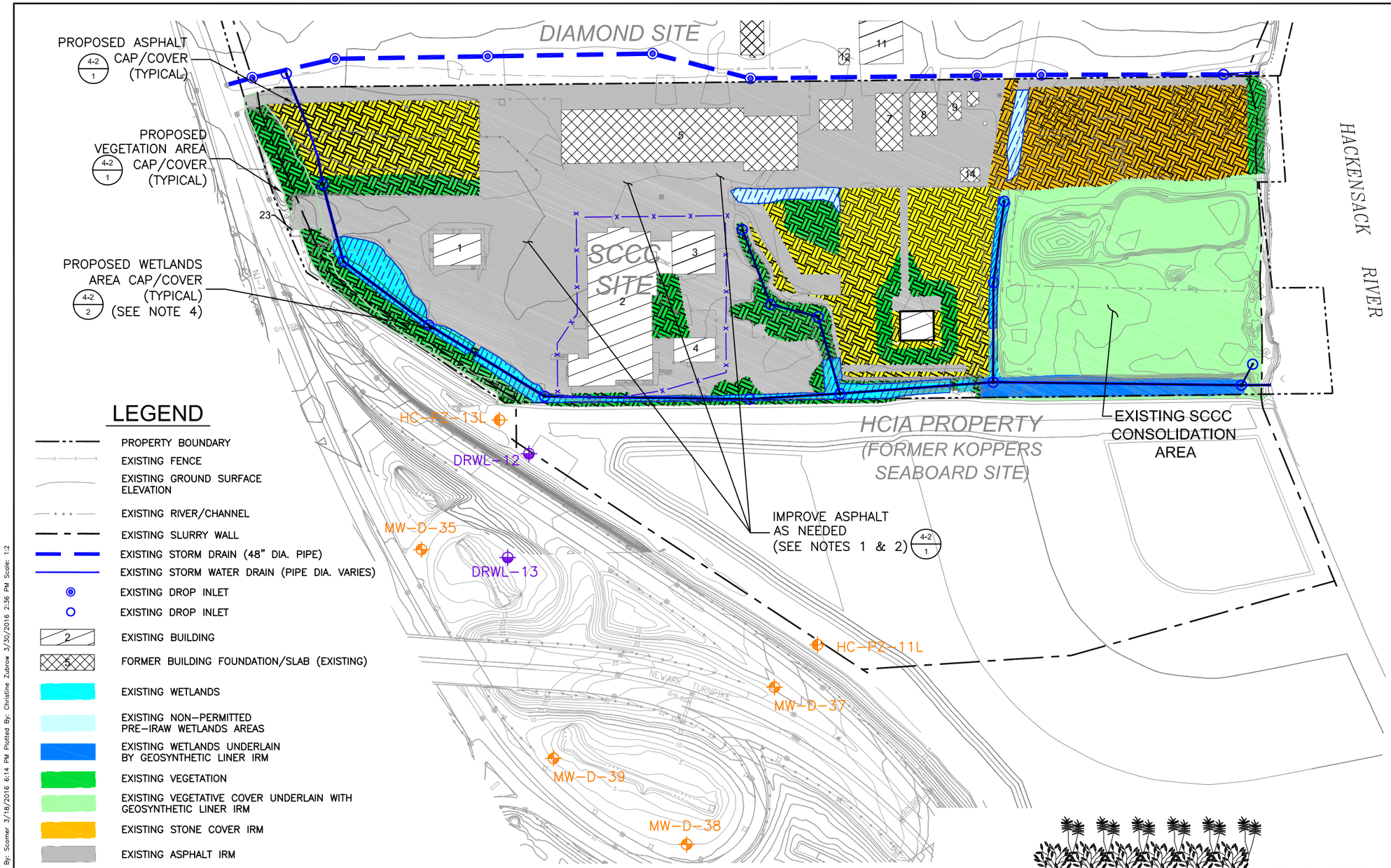
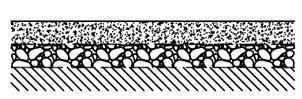


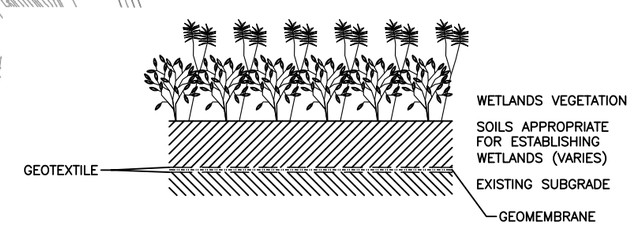
LEGEND

- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION
- EXISTING RIVER/CHANNEL
- EXISTING SLURRY WALL
- EXISTING STORM DRAIN (48" DIA. PIPE)
- EXISTING STORM WATER DRAIN (PIPE DIA. VARIES)
- EXISTING DROP INLET
- EXISTING DROP INLET
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB (EXISTING)
- EXISTING WETLANDS
- EXISTING NON-PERMITTED PRE-IRAW WETLANDS AREAS
- EXISTING WETLANDS UNDERLAIN BY GEOSYNTHETIC LINER IRM
- EXISTING VEGETATION
- EXISTING VEGETATIVE COVER UNDERLAIN WITH GEOSYNTHETIC LINER IRM
- EXISTING STONE COVER IRM
- EXISTING ASPHALT IRM
- EXISTING GEOMEMBRANE OVERLAIN WITH AGGREGATE IRM
- PROPOSED TARGETED WETLANDS AREA CAP/COVER 4-2/2
- PROPOSED ASPHALT CAP/COVER FOR TARGETED VEGETATION AND STONE COVER AREAS 4-2/1
- PROPOSED PASSIVE DNAPL RECOVERY WELL
- PROPOSED TI ZONE MONITORING LOCATIONS
- PROPOSED SECURITY FENCE



NOTE:
GRANULAR SUBBASE MAY BE DESIGNED TO FUNCTION AS A CAPILLARY BREAK IF NECESSARY.

4-2/1 PROPOSED ASPHALT CAP/COVER FOR TARGETED VEGETATION AND STONE AREA



4-2/2 PROPOSED TARGETED AREA CAP/COVER ABOVE EXISTING WETLANDS AREAS
N.T.S

NOTES:

1. EXISTING ASPHALT SURFACE COVER WILL BE INSPECTED AND IMPROVED AS NEEDED TO ENHANCE STORMWATER RUNOFF TO THE EXISTING STORMWATER DITCHES AND CATCH BASINS. BROKEN ASPHALT, DEPRESSED OR LOW LYING AREAS IN THE ASPHALT COVER WOULD RECEIVE AN ADDITIONAL LAYER OF ASPHALT AS NECESSARY TO IMPROVE STORMWATER RUNOFF AND PREVENT LOCALIZED PONDING. EXISTING ASPHALT SUBGRADE/BASE LAYER TO BE REPAIRED AS REQUIRED.
2. CRACKS IN ASPHALT WILL RECEIVE A HOT TAR CRACK SEAL TO PROTECT ASPHALT SURFACE FROM DETERIORATION AND PREVENT STORMWATER FROM INFILTRATING THROUGH THE CRACKS.
3. THE DESIGN APPROACH WILL BE PREPARED TO ACCOMMODATE THE CAP/COVER SYSTEM INSTALLATION WITH OR WITHOUT POTENTIAL BUILDING DEMOLITION.
4. ASSUME THE WETLANDS WILL BE RECONSTRUCTED WITHIN THE APPROXIMATELY EXISTING WETLANDS FOOTPRINT (ABOVE THE PROPOSED CAP/COVER).
5. IT WAS ESTIMATED THAT FORMER AND EXISTING BUILDING FOUNDATIONS/SLAB MEET OR EXCEED THE REQUIREMENTS OF THE ASPHALT CAP/COVER.

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/12/15	KEY ENVIRONMENTAL INCORPORATED
CHKD: MJV	DATE: 03/01/16	
APPD: JSZ	DATE: 03/01/16	
SCALE: AS SHOWN		

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
△			
△			
0			

REFERENCE:

1. EXISTING GROUND SURFACE CONTOURS PER AIR SURVEY, DULLES, VIRGINIA, APRIL 14, 2001. HORIZONTAL REFERENCE: NEW JERSEY STATE PLANE COORDINATES (NAD 1927). VERTICAL REFERENCE:NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
2. PROPERTY BOUNDARY SHOWN HEREON FROM SHEET 1 OF 1 TITLED "SURVEY OF PROPERTY, TAX LOTS 32.02, 46, 47 & 47R, BLOCK 287, TAX LOTS 48, 49, 50, 51, 52 AND 52R, BLOCK 287, TOWN OF KEARNY, HUDSON COUNTY, NEW JERSEY," DATED JULY 1, 2009 (REVISION 2: JULY 29, 2009), PREPARED BY DYKSTRA ASSOCIATES, PC.
3. EXISTING WETLANDS PER WETLANDS DELINEATION BY PRINCETON HYDRO, LLC FOR KEY ENVIRONMENTAL, INC. PERFORMED IN MARCH 2009.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

ALTERNATIVE III
TARGETED (AREA 1) CAP/COVER
AND AREA 2 DNAPL RECOVERY PLAN

PROJECT NO: 201501-05

FIGURE 4-2

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DIAMOND SITE

SCCC SITE

HCIA PROPERTY
(FORMER KOPPERS
SEABOARD SITE)

HACKENSACK RIVER

EXISTING SCCC
CONSOLIDATION
AREA

PROPOSED TARGETED
WETLANDS AREA CAP/COVER (4-3 / 2)

PROPOSED APPROXIMATE LIMITS
OF PROPOSED SITE-WIDE
CAP/COVER (SEE NOTE 4). (4-3 / 1)

HC-PZ-13L

DRWL-12

MW-D-35

DRWL-13

HC-PZ-11L

MW-D-37

MW-D-39

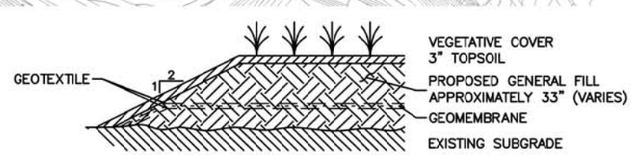
MW-D-38

LEGEND

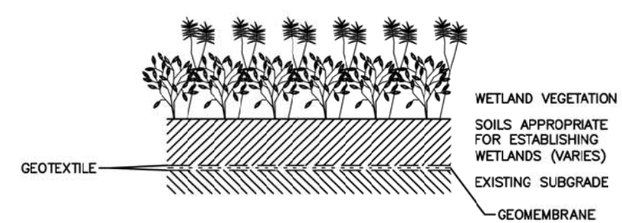
- PROPERTY BOUNDARY
- EXISTING FENCE
- EXISTING GROUND SURFACE ELEVATION
- EXISTING RIVER/CHANNEL
- EXISTING GROUND CONTOUR ELEVATIONS
- EXISTING STORM DRAIN (48" DIA. PIPE)
- EXISTING STORM WATER DRAIN (PIPE DIA. VARIES)
- EXISTING DROP INLET
- EXISTING DROP INLET
- EXISTING BUILDING
- FORMER BUILDING FOUNDATION/SLAB (EXISTING)
- EXISTING SLURRY WALL
- APPROXIMATE LIMITS OF PROPOSED SITE-WIDE CAP/COVER
- EXISTING WETLANDS
- EXISTING NON-PERMITTED PRE-IRAW WETLANDS AREAS
- EXISTING WETLANDS UNDERLAIN BY GEOSYNTHETIC LINER IRM
- EXISTING VEGETATION
- EXISTING VEGETATIVE COVER UNDERLAIN WITH GEOSYNTHETIC LINER IRM
- EXISTING STONE COVER IRM
- EXISTING ASPHALT IRM
- EXISTING GEOMEMBRANE OVERLAIN WITH AGGREGATE IRM
- PROPOSED WETLAND AREA RELOCATION CAP/COVER (4-3 / 2)
- PROPOSED PASSIVE DNAPL RECOVERY WELL
- PROPOSED TI ZONE MONITORING LOCATIONS
- PROPOSED SECURITY FENCE

NOTES:

1. CAP/COVER MATERIAL TO BE PLACED ABOVE EXISTING GROUND SURFACE.
2. EXISTING STORMWATER CATCH BASINS AND CONVEYANCE PIPING LOCATED IN THE AREA TO RECEIVE SITE WIDE CAP/COVER MATERIALS WILL BE MODIFIED AS NECESSARY TO IMPROVE STORMWATER RUNOFF FLOW PATTERNS.
3. WETLANDS TO BE RELOCATED AS NECESSARY. THE WETLANDS RELOCATION AREA(S) TO BE DETERMINED DURING THE DESIGN PHASE.
4. OFF-SITE WETLANDS CREDITS MAY BE PURCHASED IF NECESSARY.
5. THE CAP/COVER LIMITS AND DETAILS WILL BE FINALIZED AS PART OF THE DESIGN PHASE. THE FINAL GRADES WILL BE ESTABLISHED TO FACILITATE POSITIVE STORMWATER DRAINAGE FOR THE PURPOSE OF THIS FFS, ASSUME THE TOTAL FILL LAYER WILL BE APPROXIMATELY 3' THICK.



4-3 / 1 TYPICAL PROPOSED SITE-WIDE CAP/COVER DETAIL
N.T.S



4-3 / 2 PROPOSED WETLAND AREA RELOCATION CAP/COVER
N.T.S

0 100 200 FEET

PERFORMING PARTIES GROUP

DRWN: SCC	DATE: 11/09/15	KEY ENVIRONMENTAL INCORPORATED
CHKD: MJV	DATE: 03/01/16	
APPD: JSZ	DATE: 03/01/16	
SCALE:	AS SHOWN	

FOCUSED FEASIBILITY STUDY
STANDARD CHLORINE CHEMICAL CO., INC. SITE
KEARNY, HUDSON COUNTY, NEW JERSEY

REV #	DATE	DESCRIPTION	APPD
3			
2			
1			

REFERENCE:

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

ALTERNATIVE IV
SITE-WIDE (AREA 1) CAP/COVER
AND AREA 2 DNAPL RECOVERY

PROJECT NO: 201501-05

FIGURE 4-3

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SUMMARY OF HELP MODEL RESULTS
INFILTRATION RATE EVALUATION
OF THE FOCUSED FEASIBILITY STUDY CAP/COVER ALTERNATIVERS
STANDARD CHLORINE CHEMICAL COMPANY

Alternative 2								
	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5			
	Wetland Area	**Asphalt Cover**	**Gravel over Existing Material**	**Gravel over Geomembrane**	**Vegetation**	**Total**	**Total (gallons/yr)**	**Percent Reduction (%)**
Existing Area from Figure 4-1 (ft^2)	46390	473781	82567	130154	104571	837463		
Ratio of Total Area	0.055	0.566	0.099	0.155	0.125			
Infiltration Rate from HELP (in/yr)	10.973	15.028	12.711	6.442	10.829			
Averaged Infiltration Rate (in/yr)	0.608	8.502	1.253	1.001	1.352	12.7162	6,638,570	0%

Alternative 3 - Target Area Cap/Cover					
	Profile 1	Profile 2	**Total**	**Total (gallons/yr)**	**Percent Reduction (%)**
	Wetland Area	**Asphalt Cover**			
Proposed Area from Figure 4-1 (ft^2)	46390	791073	837463		
Ratio of Total Area	0.055	0.945			
Infiltration Rate from HELP - (in/yr)	0.000	7.184			
Averaged Infiltration Rate (in/yr)	0.000	6.786	6.786	3,542,692	46%

Alternative 4 - Site Wide Cap/Cover								
	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5			
	Geomembrane, 24" General fill 12" Substrate	3" Topsoil, 33" General Fill and Geomembrane Over All				**Total**	**Total (gallons/yr)**	**Percent Reduction (%)**
	Wetland Area	**Asphalt Cover**	**Gravel over Existing Material**	**Gravel over Geomembrane**	**Vegetation**			
Proposed Area from Figure 4-2 (ft^2)	46390	473781	82567	130154	104571	837463		
Ratio of Total Area	0.055	0.566	0.099	0.155	0.125			
Infiltration Rate from HELP - (in/yr)	0.000	0.00000	0.00001	0.00001	0.00009			
Averaged Infiltration Rate (in/yr)	0.000	0.000	0.000	0.000	0.000	0.00001	7	100%

COST ANALYSIS FOR THE INFILTRATION REDUCTION EVALUATION
HCTS ANNUAL OPERATION, MAINTENANCE & MONITORING
STANDARD CHLORINE CHEMICAL COMPANY

Phase	Description	Task #	2015 Budget	Comments	SCCC Allocation %	SCCC Allocation Based on 2015	Alternative 3 - Target Area Cap/Cover		Alternative 4 - Site Wide Cap/Cover	
							Percent Reduction	Estimated Annual Cost	Percent Reduction	Estimated Annual Cost
013	Waste Management									
	- DNAPL	14	$ 26,240	Based upon lower recovery volumes than anticipated by the 2015 budget. Also considers additional DNAPL recovery from MW-D-28 (FFS)	100.00%	$ 26,240	0%	$ 26,239.80	0%	$ 26,239.80
	- Filter Cake	16	14,823		58.79%	$ 8,714	46%	$ 4,705.80	99%	$ 87.14
	- GAC	18	1,246	Decreased budget based upon 2014 actuals and the 2015 burn rate	100.00%	$ 1,246	46%	$ 672.84	99%	$ 12.46
	- GAC - Organoclay	19	120	No organoclay	100.00%	$ 120	46%	$ 64.80	99%	$ 1.20
	- Misc. (PPE/General Site)	25	4,548	Decreased budget based upon 2014 actuals and the 2015 burn rate	58.79%	$ 2,673	0%	$ 2,673.48	0%	$ 2,673.48
	Subtotal 013		$ 46,976			$ 38,994		$ 34,357		$ 29,014
028	System Repairs and Maintenance									
	- Cathodic Protection	12	$ 1,166	Based upon 2015 purchase order for a cathodic protection inspection	52.00%	$ 606	0%	$ 606.32	0%	$ 606.32
	- DRW Well Field	15	2,423	Decreased budgets based upon 2014 actuals and the 2015 burn rate	100.00%	$ 2,423	46%	$ 1,308.42	99%	$ 24.23
	- HC Control Well Field	20	35,639		57.69%	$ 20,560	46%	$ 11,102.32	99%	$ 205.60
	- Inorganic (Cr Reduction)	22	11,555		58.79%	$ 6,793	46%	$ 3,668.32	99%	$ 67.93
	- Organics (GAC)	28	6,173		100.00%	$ 6,173	46%	$ 3,333.42	99%	$ 61.73
	- Sludge Mgmt	32	3,336		58.79%	$ 1,961	46%	$ 1,059.07	99%	$ 19.61
	Subtotal 028		$ 60,292			$ 38,517		$ 21,078		$ 985
091	GW/Surface Water - Gauging									
	- DRW Well Field	15	$ 8,932	Scope increased to include monthly gauging of water level, DNAPL thickness & total depth for five new monitoring wells (MW-D-28, MW-D-35, MW-D-37, MW-D-38 and MW-D-39	100.00%	$ 8,932	0%	$ 8,932.00	0%	$ 8,932.00
	- HC Control Well Field	20	10,264	Overall decreased budget based upon 2014 actuals and the 2015 burn rate	57.69%	$ 5,921	0%	$ 5,921.30	0%	$ 5,921.30
	- PZ Monitoring Network	29	17,642		57.14%	$ 10,081	0%	$ 10,080.64	0%	$ 10,080.64
	Subtotal		$ 36,838			$ 24,934	0%	$ 24,934		$ 24,934
094	Remedial System Operations									
	- Cathodic Protection	12	$ 13,814	The variance between budget and actuals is that the system was not operating in 2014	52.00%	$ 7,183	0%	$ 7,183.28	0%	$ 7,183.28
	- DRW Well Field	15	16,290		100.00%	$ 16,290	0%	$ 16,290.00	0%	$ 16,290.00
	- HC Control Well Field	20	60,144		57.69%	$ 34,697	46%	$ 18,736.26	99%	$ 346.97
	- HCTS Bldg Security & Upkeep	21	33,530		58.79%	$ 19,712	0%	$ 19,712.29	0%	$ 19,712.29
	- Inorganic (Cr Reduct)	22	138,470		58.79%	$ 81,407	46%	$ 43,959.52	99%	$ 814.07
	- Organics (GAC)	28	127,460		100.00%	$ 127,460	46%	$ 68,828.40	99%	$ 1,274.60
	- Sludge Mgmt	32	39,484		58.79%	$ 23,213	46%	$ 12,534.95	99%	$ 232.13
	Subtotal		$ 429,192			$ 309,962		$ 187,245		$ 45,853
096	Effluent Monitoring & Reporting									
	- Air Permit (Air & Influent)	10	$ 15,496		100.00%	$ 15,496	0%	$ 15,496.00	0%	$ 15,496.00
	- NPDES (Outfall 001)	27	21,736	Decreased budgets based upon reduction from quarterly to semi-annual wet TOX sampling.	58.79%	$ 12,779	0%	$ 12,778.59	0%	$ 12,778.59

COST ANALYSIS FOR THE INFILTRATION REDUCTION EVALUATION
HCTS ANNUAL OPERATION, MAINTENANCE & MONITORING
STANDARD CHLORINE CHEMICAL COMPANY

Phase	Description	Task #	2015 Budget	Comments	SCCC Allocation %	SCCC Allocation Based on 2015	Alternative 3 - Target Area Cap/Cover		Alternative 4 - Site Wide Cap/Cover	
							Percent Reduction	Estimated Annual Cost	Percent Reduction	Estimated Annual Cost
	Subtotal		$ 37,232			$ 28,275		$ 28,275	0%	$ 28,275
222	Site Supervision									
	- Cathodic Protection	12	$ 2,866	Overall decreased budget based upon 2014 actuals and the 2015 burn rate	52.00%	$ 1,490	0%	$ 1,490.32	0%	$ 1,490.32
	- DRW Well Field	15	3,989		100.00%	$ 3,989	0%	$ 3,989.00	0%	$ 3,989.00
	- HC Control Well Field	20	4,914		57.69%	$ 2,835	0%	$ 2,834.89	0%	$ 2,834.89
	- Inorganic (Cr Reduct)	22	4,653		58.79%	$ 2,735	0%	$ 2,735.50	0%	$ 2,735.50
	- Organics (GAC)	28	4,914		100.00%	$ 4,914	0%	$ 4,914.00	0%	$ 4,914.00
	- Sludge Mgmt	32	4,123		58.79%	$ 2,424	0%	$ 2,423.91	0%	$ 2,423.91
	- Waste Mgmt	36	3,071		58.79%	$ 1,805	0%	$ 1,805.44	0%	$ 1,805.44
	Subtotal		$ 28,530			$ 20,193		$ 20,193		$ 20,193
Total Site			$ 639,060			$ 460,874		$ 316,081		$ 149,254

CPG NHCTS - 2016 Budget

Phase	Description	Task #	2015 Budget	Comments	SCCC Allocation %	SCCC Allocation Based on 2015	Alternative 3 - Improved Asphalt		Alternative 4 - 3' Soil Cap	
							Percent Reduction	Estimated Annual Cost	Percent Reduction	Estimated Annual Cost
028	System Repairs and Maintenance									
	- CA Cap	11	$ 1,211	Decreased budget based upon 2014 actuals and the 2015 burn rate	100%	$ 1,211	0%	$ 1,211.00	0%	$ 1,211.00
	- Site Security Access	30	346	Immaterial Variance	100%	$ 346	0%	$ 346.00	0%	$ 346.00
	- Stormwater Controls	34	316	Decreased budget based upon 2014 actuals and the 2015 burn rate	100%	$ 316	0%	$ 316.00	0%	$ 316.00
	- IRM Asphalt Cover	38	208	In line with budget. The 2014 actuals include the annual re-sealing which is now reflected under 093 Post Construction Care	100%	$ 208	0%	$ 208.00	0%	$ 208.00
	Subtotal 028		$ 2,081			2,081		2,081		2,081
093										
	- Fresh WW (Insp., Mtnce, Rptg)	17	$ 3,281		100%	$ 3,281	0%	$ 3,281.00	0%	$ 3,281.00
	- Inspections(SWControl, CA, SSP, W	24	8,586	Decreased budget based upon 2014 actuals	100%	$ 8,586	0%	$ 8,586.00	0%	$ 8,586.00
	- Site Security Access (Inspections & Maintenance)	31	3,910	Increased budget based upon 2014 actuals and the 2015 burn rate	100%	$ 3,910	0%	$ 3,910.00	0%	$ 3,910.00
	- Vegetative CM (CA, SW Control, W	35	6,964	The 2015 budget was deficient as it did not	100%	$ 6,964	0%	$ 6,964.00	0%	$ 6,964.00
	- IRM Asphalt Cover	38	4,772	Immaterial Variance	100%	$ 4,772	0%	$ 4,772.00	0%	$ 4,772.00
	Subtotal 093		$ 27,513			27,513	0%	27,513	0%	27,513
222	Site Supervision									
	- Inspections	23	$ 2,050	Overall decreased budget based upon 2014 actuals and the 2015 burn rate	100%	$ 2,050	0%	$ 2,050.00	0%	$ 2,050.00
	- Mowing & Vegetative Cover Maint.	26	1,553		100%	$ 1,553	0%	$ 1,553.00	0%	$ 1,553.00
	- Site Security Access	30	1,887		100%	$ 1,887	0%	$ 1,887.00	0%	$ 1,887.00
	- Stormwater Monitoring & Reporting	33	-		100%	$ -	0%	$ -	0%	$ -
	- Wetlands Insp. & Maintenance	37	1,655		100%	$ 1,655	0%	$ 1,655.00	0%	$ 1,655.00
	- IRM Asphalt Cover	38	1,157		100%	$ 1,157	0%	$ 1,157.00	0%	$ 1,157.00
	Subtotal 222		$ 8,302			8,302		8,302		8,302
Total Site Budget			$ 37,896			37,896		37,896		37,896
	Overall Site Budget		$ 676,956			498,770		353,977		187,150
					Percent Reduction in OM&M	0%		29%		62%

Standard Chlorine and Chemical Co., Kearny New Jersey, Infiltration Rate Evaluation, FFS Alternative 2
1% Slope

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07 (1 November 1997)                 **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************

TIME:  22:52     DATE:   3/ 3/2016

******************************************************************************

   TITLE:  Wetland Area

******************************************************************************


   NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
          COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
     THICKNESS                =     60.96   CM
     POROSITY                 =     0.5010 VOL/VOL
     FIELD CAPACITY           =     0.2840 VOL/VOL
     WILTING POINT            =     0.1350 VOL/VOL
     INITIAL SOIL WATER CONTENT  =     0.3016 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
    NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.90
          FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  45
     THICKNESS                =     60.86   CM
     POROSITY                 =     0.4570 VOL/VOL
     FIELD CAPACITY           =     0.1310 VOL/VOL
     WILTING POINT            =     0.0580 VOL/VOL
     INITIAL SOIL WATER CONTENT  =     0.3152 VOL/VOL
     EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC



              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
          GOOD STAND OF GRASS, A SURFACE SLOPE OF  1.%
          AND A SLOPE LENGTH OF   76. METERS.

   SCS RUNOFF CURVE NUMBER            =     74.98
   FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE =     0.4047 HECTARES
   EVAPORATIVE ZONE DEPTH             =     20.3    CM
   INITIAL WATER IN EVAPORATIVE ZONE  =     5.041  CM
```

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UPPER LIMIT OF EVAPORATIVE STORAGE  =     10.180  CM
LOWER LIMIT OF EVAPORATIVE STORAGE  =      2.743  CM
INITIAL SNOW WATER                  =      0.000  CM
INITIAL WATER IN LAYER MATERIALS    =     37.570  CM
TOTAL INITIAL WATER                 =     37.570  CM
TOTAL SUBSURFACE INFLOW             =      0.00   MM/YR


              EVAPOTRANSPIRATION AND WEATHER DATA
              -----------------------------------

       NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
              Newark              NJ

         STATION LATITUDE                    =  40.72 DEGREES
         MAXIMUM LEAF AREA INDEX             =   4.00
         START OF GROWING SEASON (JULIAN DATE)  =    108
         END OF GROWING SEASON (JULIAN DATE)    =    301
         EVAPORATIVE ZONE DEPTH              =   8.0  INCHES
         AVERAGE ANNUAL WIND SPEED           =  10.20 MPH
         AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  64.00 %
         AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  61.00 %
         AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  66.00 %
         AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  68.00 %

*******************************************************************************

   AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    1
-------------------------------------------------------------------------------
                          INCHES          CU. FEET       PERCENT
                       -------------------  -------------  ---------
 PRECIPITATION                38.96    (   0.000)     141421.7     100.00

 RUNOFF                      0.052   (  0.0000)       187.49      0.133

 EVAPOTRANSPIRATION           27.940   (  0.0000)     101420.91     71.715

 PERCOLATION/LEAKAGE THROUGH    10.97294 (  0.00000)     39830.897    28.16463
   LAYER  2

 CHANGE IN WATER STORAGE       -0.005   (  0.0000)       -17.57     -0.012

*******************************************************************************


   TITLE:  Asphalt Cover

*******************************************************************************

   NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
          COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  46
       THICKNESS                =     10.16   CM
       POROSITY                 =      0.4200 VOL/VOL
       FIELD CAPACITY           =      0.1310 VOL/VOL
       WILTING POINT            =      0.0580 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.0721 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.120000000000E-01 CM/SEC


                        LAYER  2
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  43
       THICKNESS                =     10.16   CM
```

POROSITY = 0.3970 VOL/VOL
FIELD CAPACITY = 0.0320 VOL/VOL
WILTING POINT = 0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0638 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.300000000000E-01 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 45
THICKNESS = 40.67 CM
POROSITY = 0.4570 VOL/VOL
FIELD CAPACITY = 0.1310 VOL/VOL
WILTING POINT = 0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2833 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.140000000000E-03 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER = 88.00
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 1.380 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 8.301 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 0.721 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 12.903 CM
TOTAL INITIAL WATER = 12.903 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.96 (0.000)	141421.7	100.00
RUNOFF	1.041 (0.0000)	3778.00	2.671
EVAPOTRANSPIRATION	22.907 (0.0000)	83149.57	58.795
PERCOLATION/LEAKAGE THROUGH LAYER 3	15.02819 (0.00000)	54551.142	38.57338
CHANGE IN WATER STORAGE	-0.016 (0.0000)	-56.99	-0.040

****

TITLE: Gravel Over Existing Material

****

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 43
THICKNESS = 10.16 CM
POROSITY = 0.3970 VOL/VOL
FIELD CAPACITY = 0.0320 VOL/VOL
WILTING POINT = 0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0130 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.300000000000E-01 CM/SEC

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 45
THICKNESS = 50.80 CM
POROSITY = 0.4570 VOL/VOL
FIELD CAPACITY = 0.1310 VOL/VOL
WILTING POINT = 0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2755 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.140000000000E-03 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER = 85.00
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 2.373 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 8.677 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 0.721 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 14.126 CM

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      TOTAL INITIAL WATER              =    14.126  CM
      TOTAL SUBSURFACE INFLOW          =     0.00   MM/YR

*******************************************************************************


   AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    1
-------------------------------------------------------------------------------
                            INCHES          CU. FEET       PERCENT
                        -------------------  -------------  ---------
 PRECIPITATION              38.96    (   0.000)     141421.7     100.00

 RUNOFF                    0.579   (  0.0000)      2103.37      1.487

 EVAPOTRANSPIRATION          25.671   (  0.0000)      93183.15     65.890

 PERCOLATION/LEAKAGE THROUGH    12.71094 (  0.00000)     46139.716     32.62562
   LAYER  2

 CHANGE IN WATER STORAGE       -0.001   (  0.0000)        -4.51     -0.003

*******************************************************************************


   TITLE:  Gravel Over HDPE Membrane

*******************************************************************************

   NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
          COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                     LAYER  1
                     --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  43
      THICKNESS                =     10.16   CM
      POROSITY                 =     0.3970 VOL/VOL
      FIELD CAPACITY           =     0.0320 VOL/VOL
      WILTING POINT            =     0.0130 VOL/VOL
      INITIAL SOIL WATER CONTENT  =     0.2370 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.300000000000E-01 CM/SEC


                     LAYER  2
                     --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
      THICKNESS                =      0.10   CM
      POROSITY                 =     0.0000 VOL/VOL
      FIELD CAPACITY           =     0.0000 VOL/VOL
      WILTING POINT            =     0.0000 VOL/VOL
      INITIAL SOIL WATER CONTENT  =     0.0000 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.200000000000E-12 CM/SEC
      FML PINHOLE DENSITY         =  10000.00   HOLES/HECTARE
      FML INSTALLATION DEFECTS    =      2.00   HOLES/HECTARE
      FML PLACEMENT QUALITY       =  4 - POOR


                     LAYER  3
                     --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  45
      THICKNESS                =     50.70   CM
      POROSITY                 =     0.4570 VOL/VOL
      FIELD CAPACITY           =     0.1310 VOL/VOL
      WILTING POINT            =     0.0580 VOL/VOL
      INITIAL SOIL WATER CONTENT  =     0.2836 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER = 85.00
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 10.2 CM
INITIAL WATER IN EVAPORATIVE ZONE = 2.408 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 4.033 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 0.132 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 16.784 CM
TOTAL INITIAL WATER = 16.784 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 4.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.96	(0.000)	141421.7	100.00
RUNOFF	6.554	(0.0000)	23791.65	16.823
EVAPOTRANSPIRATION	25.966	(0.0000)	94254.50	66.648
PERCOLATION/LEAKAGE THROUGH LAYER 2	6.44148	(0.00000)	23382.068	16.53358
AVERAGE HEAD ON TOP OF LAYER 2	1.215	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 3	6.44165	(0.00000)	23382.663	16.53400
CHANGE IN WATER STORAGE	-0.002	(0.0000)	-7.09	-0.005

****

TITLE: Existing Material

****

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 45
THICKNESS = 60.96 CM
POROSITY = 0.4570 VOL/VOL
FIELD CAPACITY = 0.1310 VOL/VOL
WILTING POINT = 0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2634 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.140000000000E-03 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER = 82.00
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 4.233 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 9.286 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 1.179 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 16.060 CM
TOTAL INITIAL WATER = 16.060 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.96	(0.000)	141421.7	100.00

RUNOFF	0.911	(0.0000)	3308.57	2.340
EVAPOTRANSPIRATION	27.222	(0.0000)	98814.63	69.872
PERCOLATION/LEAKAGE THROUGH LAYER 1	10.82950	(0.00000)	39310.240	27.79647
CHANGE IN WATER STORAGE	-0.003	(0.0000)	-11.72	-0.008

****

Standard Chlorine and Chemical Co., Kearny New Jersey, Infiltration Rate Evaluation, FFS Alternative 3
1% Slope

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07 (1 November 1997)                 **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
TIME:  10:59     DATE:   2/18/2016


******************************************************************************

    TITLE:  Wetland Area

******************************************************************************

    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
           COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
        THICKNESS                =     30.48   CM
        POROSITY                 =      0.5010 VOL/VOL
        FIELD CAPACITY           =      0.2840 VOL/VOL
        WILTING POINT            =      0.1350 VOL/VOL
        INITIAL SOIL WATER CONTENT  =      0.4641 VOL/VOL
        EFFECTIVE SAT. HYD. COND.   =  0.190000425600E-03 CM/SEC


                        LAYER  2
                        --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
                 MATERIAL TEXTURE NUMBER  35
        THICKNESS                =      0.10   CM
        POROSITY                 =      0.0000 VOL/VOL
        FIELD CAPACITY           =      0.0000 VOL/VOL
        WILTING POINT            =      0.0000 VOL/VOL
        INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
        EFFECTIVE SAT. HYD. COND.   =  0.200000000000E-12 CM/SEC
        FML PINHOLE DENSITY         =      2.00   HOLES/HECTARE
        FML INSTALLATION DEFECTS    =      2.00   HOLES/HECTARE
        FML PLACEMENT QUALITY       =  3 - GOOD


                        LAYER  3
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   5
        THICKNESS                =     30.38   CM
        POROSITY                 =      0.4570 VOL/VOL
        FIELD CAPACITY           =      0.1310 VOL/VOL
        WILTING POINT            =      0.0580 VOL/VOL
        INITIAL SOIL WATER CONTENT  =      0.1477 VOL/VOL
        EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC


              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------

        NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
GOOD STAND OF GRASS, A SURFACE SLOPE OF 1.%
AND A SLOPE LENGTH OF 76. METERS.

SCS RUNOFF CURVE NUMBER = 74.98
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 9.057 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 10.180 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 2.743 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 18.634 CM
TOTAL INITIAL WATER = 18.634 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.96	(0.000)	141421.7	100.00
RUNOFF	7.434	(0.0000)	26983.36	19.080
EVAPOTRANSPIRATION	31.259	(0.0000)	113467.38	80.233

```
PERCOLATION/LEAKAGE THROUGH     0.26700 (  0.00000)       969.189     0.68532
  LAYER  2

AVERAGE HEAD ON TOP            8.285 (    0.000)
  OF LAYER  2

PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)         0.000     0.00000
  LAYER  3

CHANGE IN WATER STORAGE        0.267   (  0.0000)       970.98      0.687

*******************************************************************************

TITLE:  Asphalt cover

*******************************************************************************

   NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
          COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                    LAYER  1
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  46
      THICKNESS                =     10.16   CM
      POROSITY                 =     0.4200 VOL/VOL
      FIELD CAPACITY             =     0.1310 VOL/VOL
      WILTING POINT              =     0.0580 VOL/VOL
      INITIAL SOIL WATER CONTENT  =     0.1852 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.195000000000E-04 CM/SEC


                    LAYER  2
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  43
      THICKNESS                =     10.16   CM
      POROSITY                 =     0.3970 VOL/VOL
      FIELD CAPACITY             =     0.0320 VOL/VOL
      WILTING POINT              =     0.0130 VOL/VOL
      INITIAL SOIL WATER CONTENT  =     0.0752 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.300000000000E-01 CM/SEC


                    LAYER  3
                    --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  45
      THICKNESS                =     60.96   CM
      POROSITY                 =     0.4570 VOL/VOL
      FIELD CAPACITY             =     0.1310 VOL/VOL
      WILTING POINT              =     0.0580 VOL/VOL
      INITIAL SOIL WATER CONTENT  =     0.2923 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

     NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

     SCS RUNOFF CURVE NUMBER            =     93.00
     FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
     AREA PROJECTED ON HORIZONTAL PLANE  =     40.4686 HECTARES
     EVAPORATIVE ZONE DEPTH             =     20.3    CM
     INITIAL WATER IN EVAPORATIVE ZONE   =      2.645  CM
     UPPER LIMIT OF EVAPORATIVE STORAGE  =      8.301  CM
     LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.721  CM
     INITIAL SNOW WATER                 =      0.000  CM
     INITIAL WATER IN LAYER MATERIALS    =     20.464  CM
     TOTAL INITIAL WATER                =     20.464  CM
     TOTAL SUBSURFACE INFLOW            =      0.00   MM/YR


            EVAPOTRANSPIRATION AND WEATHER DATA
```

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 0.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.96	(0.000)	14142171.8	100.00
RUNOFF	6.479	(0.0000)	2351657.51	16.629
EVAPOTRANSPIRATION	25.297	(0.0000)	9182468.80	64.930
PERCOLATION/LEAKAGE THROUGH LAYER 3	7.18378	(0.00000)	2607655.548	18.43886
CHANGE IN WATER STORAGE	0.001	(0.0000)	390.10	0.003

****

Alternative IV: Geomembrane, 33" General Fill, 3" Topsoil over Existing Material

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******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**          HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                   **
**           HELP MODEL VERSION 3.07 (1 November 1997)                      **
**            DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**             USAE WATERWAYS EXPERIMENT STATION                            **
**         FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                  **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************

TIME:  13:54     DATE:   3/29/2016


******************************************************************************

    TITLE:  Wetland Area

******************************************************************************


    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
           COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
        THICKNESS                =     30.48   CM
        POROSITY                 =      0.5010 VOL/VOL
        FIELD CAPACITY           =      0.2840 VOL/VOL
        WILTING POINT            =      0.1350 VOL/VOL
        INITIAL SOIL WATER CONTENT  =      0.4737 VOL/VOL
        EFFECTIVE SAT. HYD. COND.   =  0.190000425600E-03 CM/SEC
      NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.90
             FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

              TYPE 4 - FLEXIBLE MEMBRANE LINER
                 MATERIAL TEXTURE NUMBER  35
        THICKNESS                =      0.10   CM
        POROSITY                 =      0.0000 VOL/VOL
        FIELD CAPACITY           =      0.0000 VOL/VOL
        WILTING POINT            =      0.0000 VOL/VOL
        INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
        EFFECTIVE SAT. HYD. COND.   =  0.200000000000E-12 CM/SEC
        FML PINHOLE DENSITY      =      2.00   HOLES/HECTARE
        FML INSTALLATION DEFECTS    =      2.00   HOLES/HECTARE
        FML PLACEMENT QUALITY       =  3 - GOOD
```

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                    LAYER  3
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  43
  THICKNESS                =     60.96   CM
  POROSITY                 =      0.4530 VOL/VOL
  FIELD CAPACITY             =      0.1900 VOL/VOL
  WILTING POINT              =      0.0850 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2008 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.720000000000E-03 CM/SEC


                    LAYER  4
                    --------

           TYPE 4 - FLEXIBLE MEMBRANE LINER
             MATERIAL TEXTURE NUMBER  35
  THICKNESS                =      0.10   CM
  POROSITY                 =      0.0000 VOL/VOL
  FIELD CAPACITY             =      0.0000 VOL/VOL
  WILTING POINT              =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.200000000000E-12 CM/SEC
  FML PINHOLE DENSITY        =      2.00   HOLES/HECTARE
  FML INSTALLATION DEFECTS    =      2.00   HOLES/HECTARE
  FML PLACEMENT QUALITY       =  4 - POOR


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  45
  THICKNESS                =     60.86   CM
  POROSITY                 =      0.4570 VOL/VOL
  FIELD CAPACITY             =      0.1310 VOL/VOL
  WILTING POINT              =      0.0580 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.1320 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC


         GENERAL DESIGN AND EVAPORATIVE ZONE DATA
         ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
        SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
        GOOD STAND OF GRASS, A SURFACE SLOPE OF  1.%
        AND A SLOPE LENGTH OF   76. METERS.

SCS RUNOFF CURVE NUMBER            =     74.98
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      0.4047 HECTARES
EVAPORATIVE ZONE DEPTH             =     20.3    CM
INITIAL WATER IN EVAPORATIVE ZONE   =      9.348  CM
UPPER LIMIT OF EVAPORATIVE STORAGE  =     10.180  CM
LOWER LIMIT OF EVAPORATIVE STORAGE  =      2.743  CM
INITIAL SNOW WATER                 =      0.000  CM
INITIAL WATER IN LAYER MATERIALS    =     34.710  CM
TOTAL INITIAL WATER                =     34.710  CM
TOTAL SUBSURFACE INFLOW            =      0.00   MM/YR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.96 (0.000)	141421.7	100.00
RUNOFF	9.212 (0.0000)	33437.83	23.644
EVAPOTRANSPIRATION	29.405 (0.0000)	106738.15	75.475
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.34551 (0.00000)	1254.178	0.88684
AVERAGE HEAD ON TOP OF LAYER 2	7.965 (0.000)		
PERCOLATION/LEAKAGE THROUGH	0.06900 (0.00000)	250.447	0.17709

```
  LAYER  4

AVERAGE HEAD ON TOP            1.510 (    0.000)
  OF LAYER  4

PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.000     0.00000
  LAYER  5

CHANGE IN WATER STORAGE        0.343   (  0.0000)      1245.74      0.881

******************************************************************************


******************************************************************************

    TITLE:  Geomembrane and General Fill Over Asphalt Cover

******************************************************************************


    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
           COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
       THICKNESS                =      7.62   CM
       POROSITY                 =      0.5010 VOL/VOL
       FIELD CAPACITY           =      0.2840 VOL/VOL
       WILTING POINT            =      0.1350 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.2186 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
      NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.90
             FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   7
       THICKNESS                =     30.48   CM
       POROSITY                 =      0.4730 VOL/VOL
       FIELD CAPACITY           =      0.2220 VOL/VOL
       WILTING POINT            =      0.1040 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.4634 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.100000000000E-04 CM/SEC



                        LAYER  3
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  43
       THICKNESS                =     53.34   CM
       POROSITY                 =      0.4530 VOL/VOL
       FIELD CAPACITY           =      0.1900 VOL/VOL
       WILTING POINT            =      0.0850 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.4530 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.720000000000E-03 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 46
THICKNESS = 10.16 CM
POROSITY = 0.4200 VOL/VOL
FIELD CAPACITY = 0.1310 VOL/VOL
WILTING POINT = 0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4200 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.120000000000E-01 CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 43
THICKNESS = 10.16 CM
POROSITY = 0.3970 VOL/VOL
FIELD CAPACITY = 0.0320 VOL/VOL
WILTING POINT = 0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.3970 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.300000000000E-01 CM/SEC

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35
THICKNESS = 0.10 CM
POROSITY = 0.0000 VOL/VOL
FIELD CAPACITY = 0.0000 VOL/VOL
WILTING POINT = 0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.200000000000E-12 CM/SEC
FML PINHOLE DENSITY = 2.00 HOLES/HECTARE
FML INSTALLATION DEFECTS = 2.00 HOLES/HECTARE
FML PLACEMENT QUALITY = 4 - POOR

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 45
THICKNESS = 40.67 CM
POROSITY = 0.4570 VOL/VOL
FIELD CAPACITY = 0.1310 VOL/VOL
WILTING POINT = 0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1401 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.140000000000E-03 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
POOR STAND OF GRASS, A SURFACE SLOPE OF 1.%
AND A SLOPE LENGTH OF 76. METERS.

SCS RUNOFF CURVE NUMBER = 87.21
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 7.381 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 9.825 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 2.349 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 53.950 CM
TOTAL INITIAL WATER = 53.950 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

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   AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    1
-------------------------------------------------------------------------------
                          INCHES          CU. FEET       PERCENT
                      --------------------  -------------  ---------
 PRECIPITATION                38.96    (   0.000)     141421.7     100.00

 RUNOFF                      8.249   (  0.0000)      29944.44     21.174

 EVAPOTRANSPIRATION           29.090   (  0.0000)     105594.68     74.667

 PERCOLATION/LEAKAGE THROUGH     1.00213 (  0.00000)      3637.642     2.57219
  LAYER  6

 AVERAGE HEAD ON TOP           39.067 (    0.000)
  OF LAYER  6

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.000     0.00000
  LAYER  7

 CHANGE IN WATER STORAGE        1.621   (  0.0000)      5882.59      4.160

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   TITLE:  Geomembrane and General Fill Over Gravel Over Existing Material

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   NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
          COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                        LAYER  1
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
       THICKNESS                =      7.62   CM
       POROSITY                 =      0.5010 VOL/VOL
       FIELD CAPACITY           =      0.2840 VOL/VOL
       WILTING POINT            =      0.1350 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.3820 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
      NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.90
           FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   7
       THICKNESS                =     30.48   CM
       POROSITY                 =      0.4730 VOL/VOL
       FIELD CAPACITY           =      0.2220 VOL/VOL
       WILTING POINT            =      0.1040 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.4736 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.100000000000E-04 CM/SEC
```

```
                LAYER  3
                --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER  43
THICKNESS               =     53.34   CM
POROSITY                =     0.4530 VOL/VOL
FIELD CAPACITY          =     0.1900 VOL/VOL
WILTING POINT           =     0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.4530 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000000000E-03 CM/SEC


                LAYER  4
                --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER  43
THICKNESS               =     10.16   CM
POROSITY                =     0.3970 VOL/VOL
FIELD CAPACITY          =     0.0320 VOL/VOL
WILTING POINT           =     0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.3970 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000000000E-01 CM/SEC


                LAYER  5
                --------

         TYPE 4 - FLEXIBLE MEMBRANE LINER
          MATERIAL TEXTURE NUMBER  35
THICKNESS               =      0.10   CM
POROSITY                =     0.0000 VOL/VOL
FIELD CAPACITY          =     0.0000 VOL/VOL
WILTING POINT           =     0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.200000000000E-12 CM/SEC
FML PINHOLE DENSITY       =     2.00   HOLES/HECTARE
FML INSTALLATION DEFECTS    =     2.00   HOLES/HECTARE
FML PLACEMENT QUALITY      =  4 - POOR


                LAYER  6
                --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER  45
THICKNESS               =     50.80   CM
POROSITY                =     0.4570 VOL/VOL
FIELD CAPACITY          =     0.1310 VOL/VOL
WILTING POINT           =     0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.1393 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC


      GENERAL DESIGN AND EVAPORATIVE ZONE DATA
      ----------------------------------------
```

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
POOR STAND OF GRASS, A SURFACE SLOPE OF 1.%
AND A SLOPE LENGTH OF 76. METERS.

SCS RUNOFF CURVE NUMBER = 87.21
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 8.935 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 9.825 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 2.349 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 52.619 CM
TOTAL INITIAL WATER = 52.619 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

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   AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    1
-------------------------------------------------------------------------------
                           INCHES          CU. FEET       PERCENT
                       -------------------  -------------  ---------
 PRECIPITATION                38.96    (   0.000)     141421.7     100.00

 RUNOFF                      8.868   (  0.0000)      32189.38     22.761

 EVAPOTRANSPIRATION           29.113   (  0.0000)     105677.70     74.725

 PERCOLATION/LEAKAGE THROUGH     0.97230 (  0.00000)      3529.383     2.49564
  LAYER  5

 AVERAGE HEAD ON TOP           35.512 (    0.000)
  OF LAYER  5

 PERCOLATION/LEAKAGE THROUGH     0.00001 (  0.00000)        0.028     0.00002
  LAYER  6

 CHANGE IN WATER STORAGE        0.979   (  0.0000)      3554.62      2.513

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   TITLE:  Geomembrane and General Fill Over Gravel Over Existing Membrane

*******************************************************************************


   NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
          COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                        LAYER  1
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   9
       THICKNESS                =      7.62   CM
       POROSITY                 =      0.5010 VOL/VOL
       FIELD CAPACITY           =      0.2840 VOL/VOL
       WILTING POINT            =      0.1350 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.3820 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
      NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.90
            FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                        LAYER  2
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   7
       THICKNESS                =     30.48   CM
       POROSITY                 =      0.4730 VOL/VOL
       FIELD CAPACITY           =      0.2220 VOL/VOL
       WILTING POINT            =      0.1040 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.4736 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.100000000000E-04 CM/SEC
```

```
                LAYER  3
                --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER  43
THICKNESS               =     53.34   CM
POROSITY                =     0.4530 VOL/VOL
FIELD CAPACITY          =     0.1900 VOL/VOL
WILTING POINT           =     0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.4530 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000000000E-03 CM/SEC


                LAYER  4
                --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER  43
THICKNESS               =     10.16   CM
POROSITY                =     0.3970 VOL/VOL
FIELD CAPACITY          =     0.0320 VOL/VOL
WILTING POINT           =     0.0130 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.3970 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000000000E-01 CM/SEC


                LAYER  5
                --------

         TYPE 4 - FLEXIBLE MEMBRANE LINER
          MATERIAL TEXTURE NUMBER  35
THICKNESS               =     0.10   CM
POROSITY                =     0.0000 VOL/VOL
FIELD CAPACITY          =     0.0000 VOL/VOL
WILTING POINT           =     0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.200000000000E-12 CM/SEC
FML PINHOLE DENSITY       =     2.00   HOLES/HECTARE
FML INSTALLATION DEFECTS    =     2.00   HOLES/HECTARE
FML PLACEMENT QUALITY       =  4 - POOR


                LAYER  6
                --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
          MATERIAL TEXTURE NUMBER  45
THICKNESS               =     50.70   CM
POROSITY                =     0.4570 VOL/VOL
FIELD CAPACITY          =     0.1310 VOL/VOL
WILTING POINT           =     0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.1393 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC


      GENERAL DESIGN AND EVAPORATIVE ZONE DATA
      ----------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
       SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
```

POOR STAND OF GRASS, A SURFACE SLOPE OF 1.%
AND A SLOPE LENGTH OF 76. METERS.

SCS RUNOFF CURVE NUMBER = 87.21
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 0.4047 HECTARES
EVAPORATIVE ZONE DEPTH = 20.3 CM
INITIAL WATER IN EVAPORATIVE ZONE = 8.935 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 9.825 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 2.349 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 52.606 CM
TOTAL INITIAL WATER = 52.606 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

****

```
   AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    1
-------------------------------------------------------------------------------
                          INCHES          CU. FEET       PERCENT
                      -------------------  -------------  ---------
 PRECIPITATION                38.96    (   0.000)     141421.7     100.00

 RUNOFF                      8.868   (  0.0000)      32189.38     22.761

 EVAPOTRANSPIRATION           29.113   (  0.0000)     105677.70     74.725

 PERCOLATION/LEAKAGE THROUGH     0.97230 (  0.00000)      3529.383     2.49564
  LAYER  5

 AVERAGE HEAD ON TOP          35.512 (    0.000)
  OF LAYER  5

 PERCOLATION/LEAKAGE THROUGH     0.00001 (  0.00000)        0.028     0.00002
  LAYER  6

 CHANGE IN WATER STORAGE        0.979   (  0.0000)      3554.62      2.513

*******************************************************************************


*******************************************************************************

   TITLE:   Geomembrane, General Fill Over Existing Material

*******************************************************************************


   NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
          COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                         LAYER  1
                         --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
       THICKNESS                =      7.62   CM
       POROSITY                 =      0.5010 VOL/VOL
       FIELD CAPACITY           =      0.2840 VOL/VOL
       WILTING POINT            =      0.1350 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.3827 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.190000000000E-03 CM/SEC
      NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.90
            FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                         LAYER  2
                         --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   7
       THICKNESS                =     30.48   CM
       POROSITY                 =      0.4730 VOL/VOL
       FIELD CAPACITY           =      0.2220 VOL/VOL
       WILTING POINT            =      0.1040 VOL/VOL
       INITIAL SOIL WATER CONTENT  =      0.4736 VOL/VOL
       EFFECTIVE SAT. HYD. COND.   =  0.100000000000E-04 CM/SEC
```

```
                    LAYER  3
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
  THICKNESS                =     53.34   CM
  POROSITY                 =     0.4530 VOL/VOL
  FIELD CAPACITY             =     0.1900 VOL/VOL
  WILTING POINT              =     0.0850 VOL/VOL
  INITIAL SOIL WATER CONTENT  =     0.4530 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.720000000000E-03 CM/SEC


                    LAYER  4
                    --------

           TYPE 4 - FLEXIBLE MEMBRANE LINER
             MATERIAL TEXTURE NUMBER  35
  THICKNESS                =     0.10   CM
  POROSITY                 =     0.0000 VOL/VOL
  FIELD CAPACITY             =     0.0000 VOL/VOL
  WILTING POINT              =     0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =     0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.200000000000E-12 CM/SEC
  FML PINHOLE DENSITY        =     2.00   HOLES/HECTARE
  FML INSTALLATION DEFECTS    =     2.00   HOLES/HECTARE
  FML PLACEMENT QUALITY       =  4 - POOR


                    LAYER  5
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  45
  THICKNESS                =     60.96   CM
  POROSITY                 =     0.4570 VOL/VOL
  FIELD CAPACITY             =     0.1310 VOL/VOL
  WILTING POINT              =     0.0580 VOL/VOL
  INITIAL SOIL WATER CONTENT  =     0.1398 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.140000000000E-03 CM/SEC


        GENERAL DESIGN AND EVAPORATIVE ZONE DATA
        ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
        SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
        POOR STAND OF GRASS, A SURFACE SLOPE OF  1.%
        AND A SLOPE LENGTH OF   76. METERS.

SCS RUNOFF CURVE NUMBER            =     87.21
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =     0.4047 HECTARES
EVAPORATIVE ZONE DEPTH             =     20.3    CM
INITIAL WATER IN EVAPORATIVE ZONE   =     8.941  CM
UPPER LIMIT OF EVAPORATIVE STORAGE  =     9.825  CM
LOWER LIMIT OF EVAPORATIVE STORAGE  =     2.349  CM
INITIAL SNOW WATER                 =     0.000  CM
INITIAL WATER IN LAYER MATERIALS    =    50.036  CM
TOTAL INITIAL WATER                =    50.036  CM
TOTAL SUBSURFACE INFLOW            =     0.00   MM/YR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Newark NJ

STATION LATITUDE = 40.72 DEGREES
MAXIMUM LEAF AREA INDEX = 4.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 301
EVAPORATIVE ZONE DEPTH = 8.0 INCHES
AVERAGE ANNUAL WIND SPEED = 10.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 64.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 61.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 66.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	3.05	4.15	3.57	3.59	2.94
3.85	4.30	3.66	3.09	3.59	3.42

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.30	32.80	41.20	52.10	62.30	71.50
76.80	75.50	68.20	57.20	46.50	35.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Newark NJ
AND STATION LATITUDE = 41.07 DEGREES

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.96 (0.000)	141421.7	100.00
RUNOFF	8.937 (0.0000)	32442.07	22.940
EVAPOTRANSPIRATION	29.148 (0.0000)	105804.49	74.815
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.86773 (0.00000)	3149.781	2.22723
AVERAGE HEAD ON TOP	31.553 (0.000)		

OF LAYER 4

PERCOLATION/LEAKAGE THROUGH 0.00009 (0.00000) 0.329 0.00023
LAYER 5

CHANGE IN WATER STORAGE 0.875 (0.0000) 3174.83 2.245

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