STATEMENT OF BASIS

OCCIDENTAL CHEMICAL CORPORATION FACILITY

NEW CASTLE, DELAWARE

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GLOSSARY

AOC – Area of Concern
AOC Policy – Area of Contamination Policy
cm/sec – centimeters per second
CAOs – Corrective Action Objectives
Chlorobenzenes - Chlorobenzene, 1,2-Dichlorobenzene,
1,3-Dichlorobenzene, 1,4-Dichlorobenzene and 1,2,4-Trichlorobenzene
CMS – Corrective Measures Study
COC – contaminant of concern
cy – cubic yards
DNAPL – dense non-aqueous phase liquid
DNREC – Delaware Department of Natural Resources and Environmental Control
ERA – Ecological Risk Assessment
FEMA – Federal Emergency Management Agency
FDRTC – Final Decision and Response to Comments
GSH – Glenn Springs Holdings
GWTS – Groundwater Treatment System
gpm – gallons per minute
GMZ – Groundwater Management Zone
HHRA – human health risk assessment
ICs – Institutional Controls
IM – Interim Measures
ISEB – In-Situ Enhanced Bioremediation
ISRM – In-Situ Redox Management
MCL – maximum concentration level
Media Cleanup Levels – Cleanup Levels
mg/kg – milligrams per kilogram
MNA – monitored natural attenuation
NAVD – National American Vertical Datum of 1988
NPDES – National Pollutant Discharge Elimination System
O&M – operations and maintenance
OSHA – Occupational Safety and Health Administration
OxyChem – Occidental Chemical Corporation, Inc.
RBC – risk-based concentration
RCRA – Resource Conservation and Recovery Act
RFA – RCRA Facility Assessment
RFI – RCRA Facility Investigation
SB – Statement of Basis
SVOC – semivolatile organic compound
SWMU – solid waste management unit

UECA – Uniform Environmental Covenant Act
USACE – United States Army Crops of Engineers
U.S.C. – United States Code
USEPA – United States Environmental Protection Agency
VOC – volatile organic compound

I. INTRODUCTION

This Statement of Basis (SB) describes the United States Environmental Protection Agency's (EPA's) proposed remedy for contaminated soil, groundwater, sediment, and surface water originating from the Occidental Chemical Corporation, Inc. (OxyChem) Plant located to the northwest of Delaware City, New Castle County, Delaware (Facility or Site).

Based on the findings set forth in the RCRA Facility Investigation (RFI), EPA has determined that past operations at the Facility have resulted in soil, groundwater, sediment and surface water contamination. The proposed remedy includes the continuation of certain Interim Measures (IMs) being performed by OxyChem. The proposed remedy for the Facility emphasizes source removal and source control through excavation, consolidation and capping of soils and sediments with concentrations of contaminants above Media Cleanup Levels (Cleanup Levels). The primary sources of groundwater contamination will continue to be controlled by barrier walls and free product removal, and targeted in-situ treatment will be used to address areas outside of the barrier wall containment areas and thereby restore groundwater to drinking water standards, or Maximum Concentration Levels (MCLs) promulgated by EPA pursuant to the Safe Drinking Water Act, 42 U.S.C. § 300g-1, et seq., and codified at 40 CFR Part 141. In addition, EPA proposes that institutional controls (ICs) be implemented as necessary to prevent current and potential future exposure to contamination. The ICs will be implemented by an enforceable document such as an order and/or an Environmental Covenant recorded in a manner consistent with the Delaware Uniform Environmental Covenants Act (UECA), Title 7 of the Delaware Code, Chapter 29, Subchapter II. Current and future groundwater uses from beneath the Site are prohibited by the restrictions of the Groundwater Management Zone (GMZ) established for the Delaware City Industrial Area by the State of Delaware.

EPA is issuing this SB pursuant to the Resource Conservation and Recovery Act (RCRA), as amended, 42 United States Code (U.S.C.) §§ 6901, et seq. The purpose of this SB is to solicit public comment on EPA's proposed remedy prior to EPA making its final remedy selection for the Facility. The public may participate in the remedy selection process by reviewing this SB and documents contained in the Administrative Record and submitting written comments to EPA during the public comment period. The information presented in this SB can be found in greater detail in the reports submitted by the Facility to EPA and the Delaware Department of Natural Resources and Environmental Control (DNREC). To gain a more comprehensive understanding of RCRA activities that have been conducted at the Facility, EPA encourages the public to review these documents, which are found in the Administrative Record.

The locations of the Administrative Record and details of the public participation process are provided in Section IX of this SB. EPA will address all significant comments submitted in response to the proposed remedy described in this SB. EPA will make a final remedy decision and issue a Final Decision and Response to Comments after considering information submitted during the public comment period. If EPA determines that new information or public comments warrant a modification to the proposed remedy,

EPA may modify the proposed remedy or select other alternatives based on such new information and/or public comments.

II. FACILITY BACKGROUND AND HISTORY

The approximately 300-acre Facility is located three miles northwest of Delaware City, in New Castle County, Delaware (Figure 1) and lies south of the confluence of Red Lion Creek and the Delaware River. The Facility is surrounded by a heavily industrial and commercial setting. Located to the immediate south is the former Kaneka PVC facility, which is now used as a warehouse by Tri-Supply and Equipment Inc. The Standard Chlorine of Delaware Inc. Superfund site is located to the west. A commercial packaging and transport company, Kuehne Chloromone Corporation, is located on the immediate northern boundary of the Facility. The PBF Energy Partners refinery is located to the south of the Facility. PBF Energy Partners owns and operates a dredge material storage area, a landfill, a land treatment area and two flyash disposal impoundments east and south of the Facility.

The Facility was built in 1964 to manufacture chlorine, hydrogen, sodium hydroxide, and potassium hydroxide. The Facility operated as a chlor-alkali plant from 1964 through 2007. Diamond Shamrock Chemicals Company was purchased by OxyChem in 1986. OxyChem operated the Facility from 1986 through 2007. The Facility stopped chlorine production in November 2005, and stopped production of anhydrous potassium hydroxide in 2007. Decommissioning and demolition of most plant structures was completed in 2007 and 2008. Remaining structures will be removed during implementation of the final remedy. Portions of the Facility are currently leased to others for industrial purposes. To address RCRA corrective action requirements applicable to the Site, OxyChem entered into an Administrative Order on Consent with EPA on June 28, 1991, pursuant to Section 3008(h) of RCRA. The Order required OxyChem to perform interim measures (IMs), and to complete a RFI and a Corrective Measures Study (CMS) in connection with the Site. For convenience of reference, OxyChem in this document refers to the Site, Facility or Facility owner/operator, and Glenn Springs Holdings (GSH) refers to an affiliate company of OxyChem with responsibility for managing historic environmental matters at the Facility.

III. SUMMARY OF PREVIOUS INVESTIGATIONS AND INTERIM MEASURES

A Phase I RCRA Facility Investigation (RFI) was completed by OxyChem in 1993. The focus of the Phase I RFI was to investigate Solid Waste Management Units (SWMUs) identified during the RFI Facility Assessment (RFA) completed by EPA in 1986 and to provide baseline characterization data. A Phase II RFI was completed by OxyChem in 1998. The focus of the Phase II RFI was to further investigate key SWMUs and sources of contamination and to characterize groundwater flow on a Site-wide basis. From 1998 to the present, several Areas of Concern (AOCs) and one SWMU were added to the RCRA corrective action project. Figure 2 presents the locations of SWMUs and AOCs identified during the investigations. Table 1 presents a listing of the SWMUs and AOCs. Figure 3 presents the groundwater monitoring well locations at the Site.

Based on the results of these investigations, EPA and OxyChem agreed to proceed with the implementation of several IMs to prevent releases of contaminants of concern (COCs) from Site processes, and control or limit the migration of existing COCs in Site soil and groundwater. The IMs included:

- Soil – IMs were completed at the Former Mercury Retorts (SWMU 11)/ Wastewater Treatment Plant (SWMU 13) in 1995-96; the Sand Blast Grit Area (SWMU 18) in 1998; Standard Chlorine Pipeline (AOC 1) in 2004; Stormwater Drainage Channels & Outfalls (AOC 6) in 2001; and the Former Lay Down Area (AOC 10) in 2008. In general, these IMs consisted of the excavation of 1,031 cubic yards (cy) of impacted soils and sediments and off-Site disposal or the on-Site consolidation and capping of 8,500 cy of impacted soils at Waste Lake 1 (prior to installation of an engineered cap).

- Groundwater – Source control IMs were completed at the Process Area (AOC 5) and Waste Lake 1 (SWMU 1) as follows:
  - A groundwater IM consisting of a low permeability barrier wall surrounding the entire Process Area and a collection trench within the barrier was constructed in 2003. The Process Area is defined as an approximate 20-acre portion of the Facility where the majority of the former manufacturing operations took place. Extracted groundwater is treated at the on-Site Groundwater Treatment System (GWTS) and discharged to the Delaware River. The groundwater IM includes ongoing performance monitoring.
  - A groundwater IM consisting of a low permeability barrier wall surrounding the entire Waste Lake 1 and extraction wells within the barrier was constructed in 2003. Waste Lake 1 is defined as an approximate 2.5 acre portion of the Facility that was constructed in 1965 as an unlined surface impoundment and used as a primary settling basin for plant process wastewater. Spoil material from the construction of the barrier walls and soils removed during the Standard Chlorine Pipeline IM (AOC 1) were consolidated on top of Waste Lake 1 (SWMU 1). An engineered cap was then placed on top of the spoils and tied into the barrier wall to minimize water infiltration and to eliminate direct contact with the materials in the waste lake. Extracted groundwater is treated at the on-Site GWTS and

discharged to the Delaware River. The groundwater IM includes ongoing performance monitoring.

- DNAPL Removal – A dense non-aqueous phase liquid (DNAPL) recovery program is currently ongoing at the Free-Phase DNAPL area northwest of Waste Lake 1 (AOC 13). This program consists of the periodic removal of DNAPL that has accumulated in recovery wells constructed as part of the IM. The DNAPL recovery began in July 2004 to address DNAPL in the Potomac A Sands beneath this area of the Site. By the end of 2010, a cumulative total of 1,052 gallons (9,695 pounds) of DNAPL were recovered. The recovered DNAPL is containerized and shipped off-Site as hazardous waste.

In addition to the completion of these IMs, several activities were completed by OxyChem in consultation with EPA to control exposure and stabilize Site conditions during the operational period of the Facility. The following are the most significant of these Site improvements:

- Closure and capping of the former waste lakes and landfills.
- Installing physical barriers and implementing administrative procedures to restrict access by Site employees to areas of potential exposure to COCs.
- Initiating a health and safety program designed to educate and protect Site personnel and contractors from exposure to COCs.
- A waste minimization program documenting the use and disposition of product and waste handling practices.
- Constructing and operating a wastewater treatment system (with periodic system improvements) to manage process water and collect Site surface water runoff.

After the implementation of the IMs, the RCRA corrective action project focused on completion of the CMS in order to develop a final remedial strategy for the Site. The CMS included the completion of a Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA). The ERA involved multiple field efforts since 2004 to collect data at ecological habitat areas including Red Lion Creek (AOC 3), the Tributary (AOC 8), and SWMU 2 (Waste Lake 2).

IV. SITE CHARACTERIZATION

A. SURFACE WATER HYDROLOGY

The Facility is bordered to the north by Red Lion Creek and to the east by the Delaware River. Surface water drainage from the Facility is toward Red Lion Creek, which then discharges to the Delaware River. The Delaware River flows from the north to the south along the east side of the Facility. The 100-year flood plain elevation is approximately 9 feet above mean sea level, as recorded by the Federal Emergency Management Agency (FEMA) in New Castle County in 2007, based on the North American Vertical Datum (NAVD) of 1988. About one half of the approximately 300-acre property (including the Process Area, landfills and waste lakes) lies above the 100-year flood plain. The other

half consists of marsh composed primarily of dense *Phragmites*. There is a tributary to Red Lion Creek (the Tributary) that lies north of the former plant area within the dense *Phragmites*. Stormwater from the former process and storage areas of the Facility is managed under a National Pollutant Discharge Elimination System Permit (NPDES), Number DE0050911, issued to the Facility by the DNREC.

B. GROUNDWATER HYDROLOGY

The hydrogeologic system at the Site consists of four distinct hydrogeologic units. The first, described as the Water Table Aquifer, refers to the groundwater in the Fill Material, Recent Sediments and/or Columbia Formation. The second consists of an underlying layer of fine-grained silty clay/clay that has a low permeability and serves as a semi-confining base of the Water Table Aquifer (Merchantville Formation or Potomac Formation). The third and fourth units consist of relatively pervious coarse sand material beneath the silty clay unit (Potomac A Sands and Potomac B Sands, respectively). The thicknesses of each unit are depicted on a representative cross section presented on Figure 4. There is also a regional sand unit in the Potomac, "Deep Potomac Sands", which is not influenced by the Site.

The water table groundwater flows from south to north across the Site with discharge to the Tributary. Groundwater IMs, consisting of vertical barrier walls through the Water Table Aquifer and keyed into the underlying low permeability formations, have altered groundwater flow. Since 2003, groundwater flowing onto the Facility from the south is forced to flow around the barrier walls; however, the ultimate discharge to the Tributary remains the same. The majority of groundwater flows in the Columbia Sands (versus in the Recent Sediments and Fill). The approximate groundwater discharge from the Columbia Sands to the Tributary is 100 gallons per minute (gpm). Groundwater flow in the Potomac A Sands and Potomac B Sands is local and, in general, also from south to north.

C. EXTENT OF KEY COCS

Thousands of samples from soil, groundwater, sediment and surface water have been collected at the Facility to characterize the nature and extent of the impacted media. Throughout the project, the results were screened to applicable regulatory criteria. Based on the Facility operations and monitoring results, the following chemicals are the Key COCs: benzene, chlorobenzenes (chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene and 1,2,4-trichlorobenzene), manganese and mercury. The following presents a summary of the extent of Key COCs that drive the remedial alternative selection process.

(1) Soil

Figures 5 and 6 present mercury and chlorobenzene dot plots for soil and sediment, respectively. Benzene and chlorobenzenes concentrations have been highest northwest of Waste Lake 1 and were found to be present between 0.018 milligrams per kilogram (mg/kg) and 566 mg/kg. Mercury concentrations have been highest inside the Process Area barrier wall and were found to be present between 0.243 mg/kg and 9,131 mg/kg.

Elevated mercury concentrations have also been detected at the Former Lay Down Area (AOC 10).

(2) Groundwater

Figures 7 and 8 present mercury and chlorobenzene dot plots, respectively, for the groundwater (Water Table Aquifer) and surface water (chlorobenzenes).

Water Table Groundwater

Benzene and chlorobenzenes concentrations have been highest northwest of Waste Lake 1 (SWMU 1) where they were found to be present between 1.0 micrograms per liter (ug/L) and 100,000 ug/L. Residual chlorobenzenes are present in the Water Table in this area.

Manganese concentrations have been highest northwest of Waste Lake 1 (SWMU 1) where they were found to be present between 11 ug/L and 115,000 ug/L. Manganese is naturally occurring, but has likely been mobilized by the change in geochemistry from the chlorobenzenes.

Mercury concentrations have been highest inside the Process Area (AOC 5) barrier wall. Elevated mercury concentrations have also been detected downgradient (north) of the Process Area barrier wall, inside the Waste Lake 1 barrier wall, and downgradient (northwest) of Waste Lake 1 (SWMU 1). Mercury concentrations ranged between 0.11 ug/L and 867 ug/L in the Water Table groundwater.

Potomac A Sands Groundwater

The concentrations of Key COCs have been highest northwest of Waste Lake 1 (SWMU 1). Concentrations of Key COCs have been commonly lower in the Potomac A Sands than in the Water Table Aquifer, with the exception of the DNAPL area northwest of Waste Lake 1. Benzene and chlorobenzene concentrations were found to be present between 2.1 ug/L and 32,000 ug/L in the Potomac A Sands groundwater.

Evidence of DNAPL has been observed in the upper two hydrogeologic units at many soil borings and monitoring well locations northwest of Waste Lake 1. In this area, the largest accumulation of DNAPL beneath the Facility is pooled on the Potomac A Sands. There is no evidence that DNAPL extends into the Potomac B Sands.

Potomac B Sands Groundwater

Key COC concentrations in the Potomac B Sands groundwater have had a few minor exceedances of the applicable screening criteria. Continued monitoring will be completed as part of the ongoing performance monitoring that is conducted for the groundwater IMs.

Deep Potomac Sands Groundwater

Key COC concentrations in the Deep Potomac Sands (AOC 2) groundwater have been below applicable screening criteria.

(3) Sediment

Figure 6 presents a chlorobenzene dot plot for sediment and Figure 5 presents a mercury dot plot for soils and sediments. Sediment in the Tributary (AOC 8) contains mercury and chlorobenzenes which were found to be present between 4.9 mg/kg and 1,920 mg/kg, and 0.018 mg/kg and 566 mg/kg, respectively. The area of highest total mercury concentrations occurs in the western portion of the Tributary downgradient of the former Process Area (AOC 5). Mercury concentrations are highest near the sediment surface. They are present in the top 6 inches and decrease with depth. The 6-inch depth has been correlated with deposition that occurred during Facility operations. The area of highest chlorobenzene concentrations occurs in the eastern portion of the Tributary downgradient of Waste Lake 1 (SWMU 1). Chlorobenzenes are present in the top 10 feet of the Tributary sediments.

(4) Surface Water

Surface water in the Tributary contains mercury and chlorobenzenes which were found to be present between 0.18 ug/L and 3.5 ug/L and 8 ug/L and 458 ug/L, respectively. As with sediment, the area of highest mercury concentrations in the Tributary surface water occurs in the western portion, which is downgradient of the former Process Area (AOC 5). Concentrations of chlorobenzenes are highest in the eastern portion of the Tributary downgradient of Waste Lake 1 (SWMU 1) where DNAPL is present in the subsurface.

V. SUMMARY OF HUMAN HEALTH RISK ASSESSMENT

As part of the RFI process, OxyChem performed a Site-specific human health risk assessment including identification of constituents of concern, exposure assessment, toxicity assessment and risk characterization. The methodology and results are presented in their entirety in the HHRA Report included in the Administrative Record. The results are summarized below.

The areas of the Site which have the potential to be developed were the focus of the HHRA. As the long term uses of the Site and surrounding area are for heavy industry, the concept of a residential area supplanting this industrial area is not practical in the near or long term. This fact was documented in the "Justification for a Future Land-Use Scenario" submittal. As such, the HHRA considered current and future land use scenarios for industrial purposes. No residential land use was considered.

A. SOIL

The HHRA considered the following current and future exposure scenarios:

- Current industrial worker direct contact with surface soil.
- Future industrial or construction worker direct contact with subsurface soil.
- Future industrial or construction worker inhalation of volatile organic compound (VOC) vapors from indoor air.

These exposure scenarios were evaluated to a target risk level for Cancer Risk of $1x10^{-5}$ and a Hazard Index of 1. Based on the HHRA, EPA determined that the Key COCs may exceed these target risk levels at some areas of the Site. Cleanup Levels were developed as part of the HHRA.

B. GROUNDWATER

Groundwater is considered an incomplete exposure pathway for the Facility because groundwater beneath the Facility is not used as a potable or industrial water source. Current and future groundwater uses from beneath the Site are prohibited by the restrictions of the GMZ established for the Delaware City Industrial Area by the State of Delaware. EPA is proposing ICs to prevent future potable groundwater use. This is supported by the GMZ.

C. SEDIMENT AND SURFACE WATER

The HHRA considered human exposure to the Tributary (AOC 8) sediment and surface water to be unlikely, therefore these media were not evaluated. The primary risks associated with the sediment and surface water in the Tributary are ecological in nature and were evaluated in the ecological risk assessment (ERA). The Tributary is essentially inaccessible to people due to the dense *Phragmites* vegetation that surrounds it and that covers most of the wetland areas of the Site. The *Phragmites* act as a natural physical barrier.

D. INDOOR AIR

The risk assessment incorporated soil-to-vapor and groundwater-to-vapor exposure pathways. Because the groundwater plumes do not migrate beyond Facility boundaries, there are no potential impacts to indoor air in off-site receptors from the contaminated groundwater. Although the plume and/or impacted soil may be present beneath certain Facility buildings remaining after demolition and decommissioning, they are constructed in a manner unlikely to allow significant migration or accumulation of subsurface volatiles to indoor air (e.g., partially open to the outside, or designed with air ventilation systems).

VI. SUMMARY OF ECOLOGICAL RISK ASSESSMENT

The ERA quantitatively predicted potential risks to ecological receptors. The evaluation incorporated multiple conservative assumptions to ensure that effects are not under-predicted.

The Site consists of areas that are ecological habitat and areas that are not considered ecological habitat, as described below. The non-ecological habitat areas consist of managed vegetation (mowed grass), buildings, and open areas covered by concrete and asphalt that prevent establishment of diverse plant and animal communities. Exposure pathways, between chemicals and ecological receptors, were assumed to be negligible in the areas of non-ecological habitat. The ERA activities concentrated on areas of ecological habitat.

Non-ecological habitat areas include:

- The former Process Area (AOC 5) where decommissioning and demolition of most structures was completed in 2007 and 2008. This area is mostly paved or covered by concrete foundations on top of 10 to 15 feet of fill material, with minimal (<10%) areas of managed vegetation.
- The landfill areas (totaling approximately 13 acres and covered with mowed grass) include Waste Lake 1 (SWMU 1), Waste Lake 3 (SWMU 3), the Old Brine Sludge Landfill (SWMU 4), and the New Brine Sludge Landfill (SWMU 5).
- The Chemfix Test Unit (SWMU 12) which is approximately 0.5 acres and is covered with mowed grass.
- The Former Lay Down Area (AOC 10) which is approximately 1.3 acres and is covered with gravel and asphalt pavement.

Ecological habitat areas include:

- Terrestrial Habitat
  - Waste Lake 2 (SWMU 2) and the wooded portion of AOC 14.
- Open Water (aquatic) Habitat
  - Red Lion Creek (AOC 3) which is located north of the Facility and flows from west to east into the Delaware River.
  - The Tributary (AOC 8) which is approximately 3 acres of shallow open water that lies north of the former plant area within the dense *Phragmites*.
  - SD-6 (AOC 11) which is a small (approximately 0.3 acres) isolated water body northeast of Waste Lake 2 (SWMU 2).
- Dense *Phragmites* Marsh Habitat
  - Dense marsh area north of the Process Area (AOC 12), the area north of Waste Lake 2 (AOC 4) and portions of AOC 14.

A summary of the evaluation for each media is provided in the following sections. The methodology and results of this assessment are presented in their entirety in the ERA Report.

A. TERRESTRIAL HABITAT (SOIL)

During the RFI, potential risks to worm-eating wildlife, primarily from mercury and methyl mercury, were identified. Paired samples of earthworms and surface soil were collected to better refine potential risks and estimate Site-specific rates of bioaccumulation. Concentrations of methyl mercury in a small area were identified at levels that could potentially pose a risk. Cleanup Levels were developed as part of the ERA. Based on the results, a Cleanup Level of 11.1 mg/kg for total mercury in soil was established.

B. OPEN WATER (AQUATIC) HABITAT (SEDIMENT AND SURFACE WATER)

The ERA evaluation identified potential risks posed by impacted sediments and surface water in the Tributary. Concentrations of mercury, manganese, and chlorobenzenes in sediment and surface water exceeded the risk-based screening criteria used in the evaluation. Cleanup Levels were developed as part of the ERA. The Cleanup Level for mercury in water is the water quality criterion for protection of aquatic life, 0.77 micrograms per liter (ug/L) as dissolved mercury. The Cleanup Level for mercury in sediments is 10 mg/kg. These Cleanup Levels were also determined to be protective of other receptors, such as fish-eating birds and aerial insectivores. The Cleanup Levels for chlorobenzenes are 33 mg/kg in sediments and 620 ug/L in surface water.

The ERA evaluation found no unacceptable risks in water, sediments, fish, and macroinvertebrates in Red Lion Creek or at SD-6 (AOC 11).

C. DENSE *PHRAGMITES* MARSH HABITAT

A survey of the dense *Phragmites* marsh was conducted to determine whether the area constituted good habitat. This survey showed that the marsh is essentially a monoculture of *Phragmites*, a non-native invasive plant which is not readily consumed by native wildlife. Dense *Phragmites* marshes do serve as nesting and resting habitat for marsh birds; however, potential risks from COCs exposure are unlikely.

VII. SUMMARY OF PROPOSED REMEDY

Based on the findings set forth in the RFI, EPA has determined that past operations at the Facility have resulted in soil, groundwater, sediment and surface water contamination. The proposed remedy for the Facility emphasizes source removal and source control through excavation, consolidation and capping of soils and sediments with concentrations of contaminants above Cleanup Levels. The primary sources of groundwater contamination are being and will continue to be controlled by barrier walls and free product removal, and targeted in-situ treatment will be used to address areas outside of the barrier wall containment areas and thereby restore groundwater to drinking water standards, or MCLs. In addition, EPA proposes that ICs be implemented to prevent current and potential future exposure to contamination.

Since the proposed remedy was identified on the basis of its ability to protect human health and the environment, and because of the likelihood that it can be implemented efficiently while facilitating reuse of the site, EPA did not find it necessary to provide a detailed analysis of all the remedial alternatives identified for the site as part of this SB. A description and analysis of the other alternatives considered by EPA can be found in the CMS Report prepared by OxyChem.

A. CORRECTIVE ACTION OBJECTIVES

The following Corrective Action Objectives (CAOs) were developed for each media based on conditions at the Site, identified current and future potential risks to human health and the environment, and applicable regulatory criteria and guidance.

(1) Soil

The CAOs for soil are to:

- Meet Cleanup Levels in surface soil.
- Eliminate exposure pathways in subsurface soil.

(2) Groundwater

The CAOs for groundwater are to:

- Reduce the groundwater contribution of Tributary COCs to Cleanup Levels as soon as practicable (Short-Term).
- Restore groundwater quality to its most beneficial use, including achieving MCLs while recognizing that these standards will take decades to achieve (Long-Term).
- Achieve surface water Cleanup Levels in the Tributary surface water downgradient of groundwater AOCs that discharge to surface water (Long-Term).
- Isolate, contain, and/or remove DNAPL.

(3) Sediment

The CAO for sediment is to:

- Protect the benthic ecological community in areas of known or potential ecological toxicity.

(4) Surface Water

The CAOs for surface water are to:

- Meet Cleanup Levels in surface water which are described in Section VI.B.
- Eliminate exposure pathways in surface water.

Sediment and groundwater corrective measures are being proposed, in part, to meet surface water CAOs.

(5) Indoor Air

The CAO for indoor air is to eliminate exposure pathways to indoor air.

B. REMEDIATION STANDARDS

Cleanup Levels were selected based on applicable federal and state requirements and established Site-specific criteria through the risk assessment evaluations. EPA has identified the following human health remediation standards (Cleanup Levels) for the Key COCs for soil and groundwater.

Key COCs	Direct Contact (surface soil) Industrial Worker (mg/kg)	Direct Contact (surface and subsurface soil) Construction/Utility Worker (mg/kg)	Groundwater [(1)] (ug/L)
Benzene	NC	24	5
Chlorobenzene	NC	NC	100
1,2-Dichlorobenzene	NC	NC	600
1,3-Dichlorobenzene	NC	NC	600 [(2)]
1,4-Dichlorobenzene	NC	84	75
1,2,4-Trichlorobenzene	NC	170	70
Mercury	61	11	2
Manganese	3,600	540	730

NC- Not considered a COC in the Human Health Risk Assessment.
(1) Cleanup Levels are EPA-Drinking Water MCLs or EPA RBCs. If, for a given parameter, there is a primary MCL, then the MCL applies. If there is a secondary MCL or no MCL, then the EPA Region III tap water RBC applies (November 2010). EPA National Primary Drinking Water Regulations- Maximum Contaminant Levels (MCLs) (EPA 816-F-03-016, June 2003).
(2) There is no established EPA MCL or RBC for 1,3-Dichlorobenzene; as a guide the NJ MCL is cited (2011).

C. PROPOSED REMEDY

The proposed remedy consists of a soil component, a sediment component, a groundwater component, and facility wide non-engineering controls or ICs. The location and approximate extent of the various elements of the proposed remedy are depicted on Figure 9. The proposed remedy for each SWMU/AOC is presented on Table 2. Groundwater, soil and sediment remediation will allow surface water concentrations to meet the applicable surface water Cleanup Levels.

(1) Soil

The proposed final remedy for soil consists of hot spot excavation, consolidation on-Site at the former cell building portion of the process area (AOC 5), and capping. Excavation will occur at locations in the Process Area (AOC 5), the Tributary (AOC 8), the Former Lay Down Area (AOC 10), and Outfall 003 (SWMU 6). The proposed final remedy for soil will utilize EPA's Area of Contamination (AOC) policy (see Management of Remediation Waste under RCRA, EPA 530-F-98-026, October 1998) to facilitate implementation of the remedy. The AOC policy allows for consolidation and other *in situ* waste management techniques to be used within an area of generally dispersed contamination or "area of contamination" without triggering permitting, land disposal restrictions or minimum technology requirements. The AOC policy has particular

application because the Site exhibits contiguous areas of generally dispersed contamination that are linked through historical operational activities and the potential migration of constituents of concern from operational areas. Some portions of the Stormwater Drainage Pond (SWMU 6) and the Former Lay Down Area (AOC 10) will be capped/covered. The former landfills and waste lakes are capped/covered and no additional remedies are required. In addition, Site-wide ICs will be implemented to provide non-engineering controls to prevent potential future exposure and to prevent activities which could interfere with the integrity and protectiveness of the remedy.

(2) Groundwater

Proposed final remedies for groundwater consist of the existing barrier walls and extraction and treatment systems at the Process Area (AOC 5) and Waste Lake 1 (SWMU 1). DNAPL will be addressed through periodic removal or extraction from the recovery wells constructed as part of the IM. Groundwater outside the barrier walls (AOC 7 and AOC 9) will be addressed with active remedies as detailed below. Groundwater remedies will be performed with the short-term goal of protection of surface water in the Tributary and with the long-term goal of achieving MCLs.

IMs will be continued as part of the proposed final remedy for groundwater. Groundwater extraction and treatment inside the barrier walls will continue to be implemented to create a neutral or inward gradient, which will control the migration of contaminated groundwater. DNAPL recovery will continue until it can no longer be extracted, or until less than one inch per month of free-phase DNAPL accumulates in all four recovery wells, whichever occurs first.

For AOC 7, In-Situ Enhanced Bioremediation (ISEB) at the Source Area & Air Sparge Treatment Curtain at the Tributary is proposed as the final remedy. ISEB is a treatment process whereby contaminants are metabolized into less toxic or non-toxic compounds by naturally occurring microorganisms. ISEB will degrade chlorobenzenes and benzene to carbon dioxide, water, chloride and chloride salts. The In-Situ air sparge curtain will treat volatile organic groundwater contaminants and manganese prior to discharge to the Tributary (AOC 8). Groundwater extraction and treatment will be implemented as a contingency remedy if the in-situ remedy is determined to not be effective in meeting the cleanup objectives and cleanup levels for AOC 7. The time frame and criteria to be used for evaluating the effectiveness of the in-situ remedy will be developed in greater detail as part of the implementation plans for the selected corrective measures, and will be subject to EPA review and approval.

For AOC 9, In-Situ Redox Management (ISRM) is the proposed final remedy. ISRM will be designed to precipitate mercury in an innocuous essentially insoluble form and treat the chlorinated solvents including tetrachloroethene and carbon tetrachloride at the same time. Groundwater extraction and treatment will be implemented as a contingency remedy if the in-situ remedy is determined not to be effective in meeting the cleanup objectives and cleanup levels for AOC 9. The time frame and criteria to be used for evaluating the effectiveness of the in-situ remedy will be developed in greater detail as part of the implementation plans for the selected measures, and will be subject to EPA review and approval.

(3) Sediment

Proposed final remedies for Tributary (AOC 8) sediment consist of placing a reactive cap or mat over the east Tributary, dredging and backfilling the west Tributary and ICs. No sediment remedy is required for Red Lion Creek (AOC 3).

(4) Surface Water

Sediment and groundwater corrective measures are being performed, in part, to meet surface water CAOs. Once these measures are performed, the CAOs for surface water will be met.

(5) Institutional Controls

Certain ICs have been developed and already implemented to support the corrective measures at the Site. The existing ICs include:

- Heavy industrial zoning prohibiting residential development.
- An Excavation Procedure and Health & Safety Plan that guides how workers handle materials encountered during subsurface work at the Facility.
- Restrictions on potable use of groundwater at the Facility. An existing IC for groundwater is currently in place. The Site is located in a GMZ that restricts installation of potable drinking water supply wells. DNREC established the GMZ on April 10, 2008.
- DNREC well permitting program with regard to the installation of monitoring and supply wells.

Additional ICs are necessary to support the corrective measures to be implemented at the Site. Given the extent and nature of impacted media left in place, more than one IC is necessary to prevent activities which could interfere with the integrity and protectiveness of the remedy. The ICs will be implemented by an enforceable document such as an order and/or an Environmental Covenant recorded in a manner consistent with the Delaware Uniform Environmental Covenants Act (UECA), Title 7 of the Delaware Code, Chapter 29, Subchapter II. Accordingly, EPA's proposed remedy includes the following ICs to ensure the short and long-term effectiveness of the remedy:

- Restrictions on the property deed to prevent conversion to residential use.
- Restrictions on the property deed to prevent potable use of groundwater at the Site.
- Restrictions for land disturbance at the Site.
- A Materials Management Plan, including an Excavation Procedure and Health & Safety Plan that will guide how future workers will handle materials encountered during future subsurface work at the Facility.
- Inspections and reporting to DNREC regarding compliance with the Environmental Covenant.
- Future development at the Site will include vapor barriers beneath buildings to eliminate the vapor pathway.

GSH will be required by EPA to submit biennial review reports on the effectiveness of the ICs in meeting the human health and environmental protection objectives. This review may include, but not be limited to, review of: GSH's compliance with the Environmental Covenant requirements; groundwater and land uses within 0.5 miles of the Facility; and zoning maps or planning documents that may affect future land use in the impacted area. Additionally, GSH will be required to submit five-year review reports on the progress of the remedial measures and of meeting the Cleanup Levels and/or CAOs. DNREC is essential to the effectiveness of the IC program proposed for the Site, and will be provided with GSH's biennial review reports and five-year review reports.

VIII. EVALUATION OF PROPOSED REMEDY

This section provides a description of the criteria EPA uses to evaluate proposed remedies under the RCRA Corrective Action Program. The criteria are applied in two phases. In the first phase, EPA evaluates three remedy threshold criteria as general goals. In the second phase, for those remedies that meet the threshold criteria, EPA evaluates seven balancing criteria to determine which proposed remedy alternative provides the best relative combination of attributes.

The proposed remedy selected by EPA (in consultation with DNREC) meets all of the evaluation criteria.

A. THRESHOLD CRITERIA

(1) Overall Protection of Human Health and the Environment

The following proposed remedial activities achieve the overall protection of human health and the environment for soil, groundwater, sediment, and surface water that present potential excess risk to human and ecological receptors.

For soil, the proposed final remedy of hot spot excavation, consolidation on-Site at the former cell building area, capping, and ICs, will eliminate the direct contact exposure pathway at the Facility. EPA proposes implementation of ICs to prevent potential future exposure due to unanticipated land use changes or potential future construction activities that may deviate from the current exposure scenario.

For groundwater, the barrier walls and extraction and treatment system have been operating at the Facility since 2003. DNAPL recovery has been performed since 2004. These IMs have controlled groundwater migration and reduced the source mass of COCs remaining on-Site. The proposed final remedy includes continued operation of the groundwater extraction and treatment systems inside the barrier walls and DNAPL recovery system. Implementation of in-situ groundwater remedies in the vicinity of Waste Lake 1 (AOC 7) and in the vicinity of the Process Area (AOC 9) will ensure protectiveness outside the barrier walls. Continued monitoring and the implementation of groundwater use restrictions will ensure protectiveness of human health and the environment. EPA is proposing that groundwater use restriction ICs be maintained while

the groundwater is being remediated to prevent future potential exposure to COCs. These include the existing DNREC GMZ and well permitting program, which prohibit current and future use of groundwater in the area of the Site.

For sediment, the Tributary (AOC 8) will be remediated through removal of impacted sediment and backfilling in the western portion and placement of a reactive cap or mat in the eastern portion. The removal will extend over the western portion of the Tributary where mercury concentrations pose an excess risk. The capping will extend over the eastern portion of the Tributary where both mercury and chlorobenzenes pose an excess risk. The remedy, combined with performance monitoring, will provide isolation of biota from mercury and chlorobenzenes.

For surface water, implementation of the groundwater and sediment corrective measures will result in the achievement of surface water Cleanup Levels and CAOs.

(2) Attainment of Media Cleanup Standards

For soil, the proposed remedy, hot spot removal and consolidation on Site, will meet the Cleanup Levels in the surface soil. The implementation of ICs will control exposure via the soil pathways. These controls will also provide guidance to the owner when utility and construction workers must excavate.

For groundwater, the proposed remedy meets the objectives of isolating, containing, and removing DNAPL, being protective of the Tributary (Short-Term) and achieving MCLs for the groundwater COCs (Long-Term). In addition, the proposed remedy will eliminate human exposure to groundwater via ICs (GMZ).

For sediment, the proposed remedy, removal or capping impacted sediments, will meet the Cleanup Levels.

For surface water, implementation of the groundwater and sediment corrective measures will achieve the surface water Cleanup Levels.

(3) Source Control

The proposed remedy will control the source of releases by using barrier walls, engineered caps, and groundwater extraction and treatment where the sources of soil and groundwater impacts are located, the level of impact is highest, and where any DNAPL may be present. Source control will be achieved at the Site by the following steps:

- Consolidation and capping of soils to eliminate exposure to the most impacted soils and to eliminate leaching of COCs from those soils.
- Installation of barrier walls to isolate the source mass and eliminate the migration of impacted groundwater beyond the source areas.
- Removal of DNAPL from the subsurface.

- Targeted in-situ treatment of groundwater by ISEB and ISRM at certain areas outside of the barrier walls to reduce concentrations of COCs and enhance natural attenuation processes.
- Sediment removal and capping in the Tributary and select areas to remove and isolate the source mass and eliminate exposure.

B. BALANCING CRITERIA

(1) Long-Term Reliability and Effectiveness

The long-term reliability and effectiveness of the remedy is expected to be high. Long-term reliability and effectiveness of soil and sediment excavation and capping is considered to be high. Barrier wall containment has a high degree of reliability and effectiveness with lower maintenance requirements in comparison to other technologies used for containment. Soil consolidation and containment using low-permeability caps and vegetative cover is expected to have average long-term reliability and effectiveness when compared to other effective technologies. The combination of targeted in-situ groundwater treatment remedies for groundwater outside the containment areas is expected to have high long-term reliability and effectiveness, given source containment by the barrier walls. A combination of engineering controls, ICs, groundwater monitoring and operations and maintenance (O&M) will be required to maintain and ensure the long-term reliability and effectiveness of the proposed remedy. ICs will be necessary to limit land use at the Site to commercial and industrial purposes and to prevent uncontrolled exposure to environmental media remaining in place with concentrations of COCs above applicable Cleanup Levels.

(2) Reduction of Waste Toxicity, Mobility, or Volume

The proposed remedy will result in the reduction of the toxicity, mobility and volume of COCs present in environmental media at the Site. The mobility of COCs at the Site will be reduced by consolidation and capping of impacted media within barrier walls. Recovery wells and a collection trench will be used in the area inside the barrier walls to recover impacted groundwater. DNAPL recovery will remove accumulated free product, thereby further reducing the toxicity, mobility and volume of COCs. Targeted in-situ remediation of groundwater will reduce the toxicity, mobility and volume of COCs in groundwater outside the barrier walls containment areas. The removal and capping of shallow-impacted sediments will reduce both the volume and mobility of COCs remaining in the Tributary sediment.

(3) Short-Term Effectiveness

Potential short-term risks posed by the proposed remedy to workers at the Site, the environment, and the community will be controlled and minimized by implementation of good construction and work practices, use of appropriate health and safety measures, utilization of standard dust suppression techniques, implementation of erosion and sediment control measures, use of personal protection equipment, use of real-time air monitoring, and management of non-hazardous and hazardous waste in accordance with

applicable federal and state requirements. The methodologies to safely perform these activities and mitigate short-term risks will be described in greater detail in the corrective measures implementation plans and associated health and safety plans.

(4) Implementability

The proposed remedy is implementable.

Several components of the final remedy have already been implemented including:

- Barrier walls around the Process Area (AOC 5) and Waste Lake 1 (SWMU 1).
- Groundwater extraction and treatment system inside barrier walls.
- Capping/cover of former landfills and waste lakes.
- Removal of DNAPL at the DNAPL Area (AOC 13).
- Several ICs are in place (DNREC well permitting, Excavation Procedure, and GMZ).

Excavation and dredging are well-proven and readily implementable technologies that are commonly used to remediate contaminated sites. The areas at the Site where excavation/dredging of soils/sediments are expected to occur are readily accessible for equipment and there is sufficient room to set up required decontamination and staging areas. The shallow excavation/dredging depths that are proposed will not require shoring or stabilization and therefore excavation procedures will be relatively simple to undertake. Excavation and consolidation of materials, and construction of caps are well-proven and readily implementable technologies that are commonly used to remediate contaminated sites.

Targeted in-situ remediation techniques such as ISEB, air sparging, and ISRM are readily implementable technologies that are commonly used to remediate groundwater in conjunction with source containment. These technologies are proven technologies for treatment of the type of dissolved phase COCs that remain in groundwater outside the barrier wall containment areas. Furthermore, treatability and field pilot tests will be utilized, as needed, to confirm these technologies and design the final implementation. Groundwater extraction and treatment will be utilized as a contingency in the event that these technologies are not successful.

ICs are readily implementable to support the corrective measures proposed for the Site. The ICs will be implemented by an enforceable document such as an order and/or an Environmental Covenant recorded in a manner consistent with the Delaware Uniform Environmental Covenants Act (UECA), Title 7 of the Delaware Code, Chapter 29, Subchapter II.

(5) Cost

The total estimated cost to implement the proposed remedy is $8,000,000 in capital, and $11,000,000 in Operation and Maintenance (O & M) costs for the next 30 years. The previous costs incurred from 1998 to 2011 to construct and operate IMs at the Facility including O & M are in excess of $12,000,000. The IMs included construction of the

barrier walls, construction and operation of the groundwater extraction and treatment system, consolidation of materials, and construction and maintenance of the Waste Lake 1 (SWMU 1) engineered cap.

(6) Community Acceptance

Community Acceptance of EPA's proposed remedy will be evaluated based on comments received during the public comment period and will be described in the Final Decision and Response to Comments.

(7) State Acceptance

EPA's proposed remedy for the Facility was evaluated and accepted by DNREC prior to EPA's proposing the remedy in this SB. Furthermore, EPA has solicited state input throughout the investigation process.

IX. PUBLIC COMMENT

On September 26, 2011 EPA placed an announcement in the Delaware News Journal to notify the public of EPA's proposed remedy and the location of the Administrative Record. Copies of this SB will be mailed to anyone who requests a copy. The Administrative Record, including this SB, is available for review during business hours at two locations:

United States Environmental Protection
Agency Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103
Telephone Number: (215) 814-3427
Attn: Ms. Donna McCartney (3LC20)

and

Department of Natural Resources and Environmental Control
Division of Waste and Hazardous Substances
89 Kings Highway
Dover, Delaware 19901
Telephone Number: (302) 739-9403
Attn: Mr. Bryan A. Ashby

EPA is requesting comments from the public on the remedy proposed in this SB. The public comment period will last 30 calendar days beginning September 26, 2011 and ending October 26, 2011. Comments on, or questions regarding, EPA's proposed remedy may be submitted to:

United States Environmental Protection
Agency Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103
Telephone Number: (215) 814-3427
Fax Number: (215) 814-3113

Attn: Ms. Donna McCartney (3LC20)
Email: mccartney.donna@epa.gov

Following the 30-day public comment period, EPA will hold a public meeting on EPA's proposed remedy if sufficient public interest indicates that a meeting would be valuable for distributing information and communicating ideas. After evaluation of the public's comments, EPA will prepare a Final Decision Document and Response to Comments (FDRTC) that identifies the final selected remedy. The FDRTC will also address all significant written comments and any significant oral comments generated at the public meeting. The FDRTC will be made available to the public. If, on the basis of such comments or other relevant information, significant changes are proposed to be made to the corrective measures identified by EPA in this SB, EPA may seek additional public comments.

The final remedy will be implemented using available legal authorities including, but not necessarily limited to, RCRA § 3008(h), 42 U.S.C. 6928(h). EPA anticipates that the remedy will be implemented through an Administrative Order on Consent with EPA.

CONCURRENCES								
SYMBOL	3LC20	3RC43	3RC43	3RC40	3LC20	3LC00		
SURNAME	McCartney	Nadolski	Ajl	Rodrigues	Pizarro	Ferdas		
DATE								

EPA Form 1320-1 (12-70) OFFICIAL FILE COPY

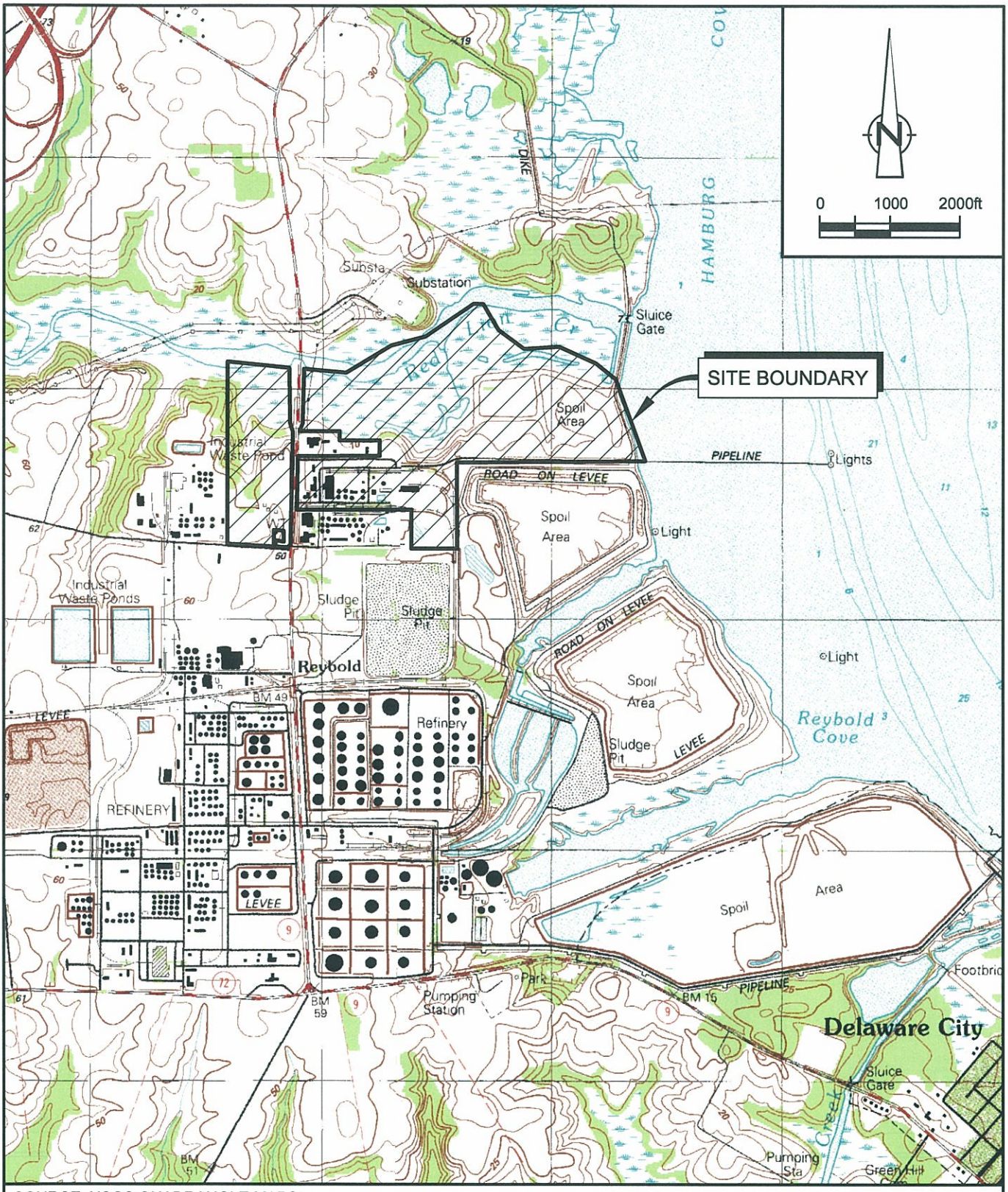
TABLE 1
SOLID WASTE MANAGEMENT UNITS (SWMUs)
AND AREAS OF CONCERN (AOCs)
OxyChem
New Castle County, Delaware

SWMUs and AOCs	***DESCRIPTION***
SWMU 1	WASTE LAKE 1
SWMU 2	WASTE LAKE 2
SWMU 3	WASTE LAKE 3
SWMU 4	OLD BRINE SLUDGE LANDFILL AREA
SWMU 5	NEW BRINE SLUDGE LANDFILL AREA
SWMU 6	STORMWATER DRAINAGE POND AND OUTFALL 003
SWMU 7	KCL BACKWASH UNIT
SWMU 8	PCB STORAGE BIN
SWMU 9	CARBON TETRACHLORIDE AREA
SWMU 10	CONTAINER STORAGE AREA
SWMU 11	FORMER MERCURY RETORT TANKS
SWMU 12	CHEMFIX TEST UNIT AREA
SWMU 13	WASTEWATER TREATMENT PLANT
SWMU 14	SURGE TANK
SWMU 15	BRINE SLUDGE PAD AND TANKS
SWMU 16	CHLORINATION PIT
SWMU 17	DUMPSTER STORAGE AREA
SWMU 18	SAND BLAST GRIT AREA
AOC 1	STANDARD CHLORINE PIPELINE AREA
AOC 2	DEEP POTOMAC SANDS
AOC 3	RED LION CREEK
AOC 4	MARSH AREA DOWNGRADIENT OF WASTE LAKE 2
AOC 5	PROCESS AREA
AOC 6	STORMWATER DRAINAGE CHANNELS AND OUTFALLS
AOC 7	GROUNDWATER IN THE VICINITY OF WASTE LAKE 1
AOC 8	TRIBUTARY
AOC 9	GROUNDWATER IN THE VICINITY OF THE PROCESS AREA
AOC 10	FORMER LAY DOWN AREA
AOC 11	SD-6
AOC 12	MARSH AREA BETWEEN AOC 1 & AOC 8
AOC 13	FREE-PHASE DNAPL AREA
AOC 14	SURFACE RUNOFF TO THE TRIBUTARY

TABLE 2
PROPOSED FINAL REMEDIES FOR EACH SWMU AND AOC
OxyChem
New Castle County, Delaware

SWMUs & AOCs	DESCRIPTION	PROPOSED FINAL REMEDY [1]
SWMU 1	WASTE LAKE 1	IMs (ENGINEERED CAP, BARRIER WALL, & GROUNDWATER EXTRACTION & TREATMENT)
SWMU 2	WASTE LAKE 2	ICs (USE RESTRICTIONS)
SWMU 3	WASTE LAKE 3	ICs (USE RESTRICTIONS)
SWMU 4	OLD BRINE SLUDGE LANDFILL AREA	ICs (USE RESTRICTIONS)
SWMU 5	NEW BRINE SLUDGE LANDFILL AREA	RCRA CLOSED LANDFILL (POST CLOSURE PERMIT UNDER DNREC)
SWMU 6	STORMWATER DRAINAGE POND AND OUTFALL 003	COVER (VEGETATED SOIL OR GRAVEL) & SEDIMENT REMOVAL AT OUTFALL 003
SWMU 7	KCL BACKWASH UNIT	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 8	PCB STORAGE BIN	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 9	CARBON TETRACHLORIDE AREA	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 10	CONTAINER STORAGE AREA	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 11	FORMER MERCURY RETORT TANKS	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 12	CHEMFIX TEST UNIT AREA	ICs (USE RESTRICTIONS)
SWMU 13	WASTEWATER TREATMENT PLANT	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 14	SURGE TANK	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 15	BRINE SLUDGE PAD AND TANKS	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 16	CHLORINATION PIT	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 17	DUMPSTER STORAGE AREA	FINAL REMEDY ADDRESSED UNDER AOC 5
SWMU 18	SAND BLAST GRIT AREA	ICs (USE RESTRICTIONS)
AOC 1	STANDARD CHLORINE PIPELINE AREA	IMs (REROUTING OF PIPELINE; REMOVAL OF CONTAMINATED SOIL; REGRADING OF AREA)
AOC 2	DEEP POTOMAC SANDS	NO REMEDY REQUIRED
AOC 3	RED LION CREEK	NO REMEDY REQUIRED
AOC 4	MARSH AREA DOWNGRADIENT OF WASTE LAKE 2	NO REMEDY REQUIRED
AOC 5	PROCESS AREA	GROUNDWATER: IMS BARRIER WALL & GROUNDWATER EXTRACTION & TREATMENT. SOIL: ENGINEERED CAP OVER CELL BUILDING; HOT SPOT SOIL EXCAVATION; CONSOLIDATION OF EXCAVATED SOIL AT CELL BUILDING
AOC 6	STORMWATER DRAINAGE CHANNELS AND OUTFALLS	FINAL REMEDY ADDRESSED UNDER AOC 5
AOC 7	GROUNDWATER IN THE VICINITY OF WASTE LAKE 1	IN SITU ENHANCED BIOREMEDIATION (ISEB) AT THE SOURCE & IN-SITU AIR SPARGE (IAS) TREATMENT CURTAIN AT THE TRIBUTARY [2]
AOC 8	TRIBUTARY	REACTIVE CAPPING (EAST TRIB) & DREDGING AND BACKFILLING (WEST TRIB)
AOC 9	GROUNDWATER IN THE VICINITY OF THE PROCESS AREA	IN-SITU REDOX MANAGEMENT (ISRM) [2]
AOC 10	FORMER LAY DOWN AREA	COVER (VEGETATED SOIL) OR CAP (ASPHALT) & SEDIMENT/SOIL REMOVAL ADJACENT TO AOC 10
AOC 11	SD-6	NO REMEDY REQUIRED
AOC 12	MARSH AREA BETWEEN AOC 1 & AOC 8	NO REMEDY REQUIRED
AOC 13	FREE-PHASE DNAPL AREA	AUTOMATED OR MANUAL DNAPL RECOVERY
AOC 14	SURFACE RUNOFF TO THE TRIBUTARY	NO REMEDY REQUIRED

Notes:
1. All proposed final remedies include Site-wide Institutional Controls (ICs).
2. Contingency remedy is groundwater extraction and treatment.



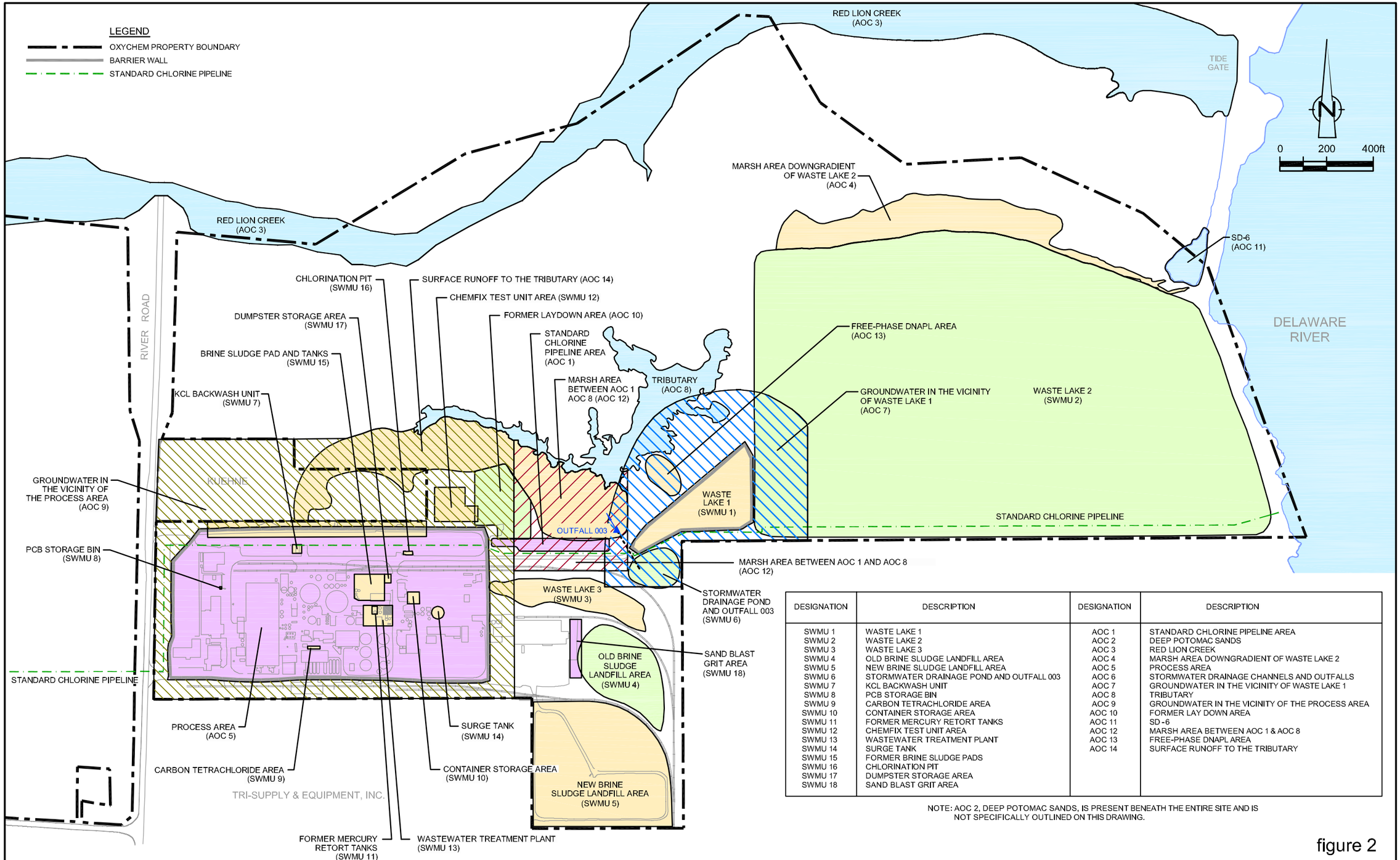
SOURCE: USGS QUADRANGLE MAPS;
DELAWARE CITY AND ST. GEORGES, DEL-NJ

OXY Glenn Springs Holdings

figure 1

SITE LOCATION MAP

OxyChem, Delaware City, Delaware



DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
SWMU 1	WASTE LAKE 1	AOC 1	STANDARD CHLORINE PIPELINE AREA
SWMU 2	WASTE LAKE 2	AOC 2	DEEP POTOMAC SANDS
SWMU 3	WASTE LAKE 3	AOC 3	RED LION CREEK
SWMU 4	OLD BRINE SLUDGE LANDFILL AREA	AOC 4	MARSH AREA DOWNGRADIENT OF WASTE LAKE 2
SWMU 5	NEW BRINE SLUDGE LANDFILL AREA	AOC 5	PROCESS AREA
SWMU 6	STORMWATER DRAINAGE POND AND OUTFALL 003	AOC 6	STORMWATER DRAINAGE CHANNELS AND OUTFALLS
SWMU 7	KCL BACKWASH UNIT	AOC 7	GROUNDWATER IN THE VICINITY OF WASTE LAKE 1
SWMU 8	PCB STORAGE BIN	AOC 8	TRIBUTARY
SWMU 9	CARBON TETRACHLORIDE AREA	AOC 9	GROUNDWATER IN THE VICINITY OF THE PROCESS AREA
SWMU 10	CONTAINER STORAGE AREA	AOC 10	FORMER LAY DOWN AREA
SWMU 11	FORMER MERCURY RETORT TANKS	AOC 11	SD-6
SWMU 12	CHEMFIX TEST UNIT AREA	AOC 12	MARSH AREA BETWEEN AOC 1 & AOC 8
SWMU 13	WASTEWATER TREATMENT PLANT	AOC 13	FREE-PHASE DNAPL AREA
SWMU 14	SURGE TANK	AOC 14	SURFACE RUNOFF TO THE TRIBUTARY
SWMU 15	FORMER BRINE SLUDGE PADS		
SWMU 16	CHLORINATION PIT		
SWMU 17	DUMPSTER STORAGE AREA		
SWMU 18	SAND BLAST GRIT AREA		

NOTE: AOC 2, DEEP POTOMAC SANDS, IS PRESENT BENEATH THE ENTIRE SITE AND IS NOT SPECIFICALLY OUTLINED ON THIS DRAWING.

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LAND FEATURES AS OF MARCH 2007

figure 2

LOCATION MAP OF SWMUs AND AOCs
OxyChem, Delaware City, Delaware

07462-D21102(062)GN-WA002 AUG 05/2011

NOTES:

1. IN AOC 13, THE FREE-PHASE DNAPL EXTRACTION WELLS (IW-1, IW-2, IW-3 & IW-4) ARE NOT SHOWN ON THIS DRAWING.
2. SURVEY: DELAWARE STATE PLANE COORDINATES ARE NAD 27.

RED LION CREEK

RED LION CREEK

TIDE GATE

DELAWARE RIVER

RIVER ROAD

KUEHNE

TRI-SUPPLY & EQUIPMENT, INC.

PBF ENERGY PARTNERS REFINERY

0 200 400ft

A-29 OB A-29S A-29D

A-32S A-32D A-32 OB

A-30 OB A-30D

A-31 OB A-31D

A-73 A-74 A-75 A-65 A-76 A-77 A-72 A-71 A-69 A-70 A-37S A-37D A-79 A-61D A-60S A-38D A-60D A-78 A-59S A-61S A-58 A-59D A-55 A-47 EW-2 A-56 A-54

A-66D A-67D A-66S A-67S A-44 A-27S A-27D A-25D A-57 EW-1 A-39D A-39S A-39 OB R-110

A-49 A-50 A-35D A-35S A-40D A-68S A-68D A62S A62D A-34D A-34S A-33S A-33D R-112 A-53 A-46 A-18 A-51 A-52 A-45 A-26S A-26 OB A-26D B-5 A-48R A-36D A-36S A-11A A-16 A-24 A-17 A-15 A-23 A-14 A-12 A-8 A-13 A-7A A-6A

LEGEND

- OXYCHEM PROPERTY BOUNDARY
- BARRIER WALL
- STANDARD CHLORINE PIPELINE
- SWMU / AOC BOUNDARY
- COLLECTION TRENCH
- A-31 OB — OVERBURDEN WELL LOCATION
- A-44 — WATER TABLE WELL LOCATION (RECENT AND COLUMBIA)
- EW-1 — COLUMBIA EXTRACTION WELL LOCATION
- A-37D — POTOMAC A SANDS WELL LOCATION
- A-58 — POTOMAC B SANDS WELL LOCATION
- A-17 — DEEP POTOMAC FORMATION WELL
- EW-2 — POTOMAC A SANDS EXTRACTION WELL LOCATION

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LAND FEATURES AS OF MARCH 2007

figure 3

MONITORING WELL LOCATIONS

OxyChem, Delaware City, Delaware

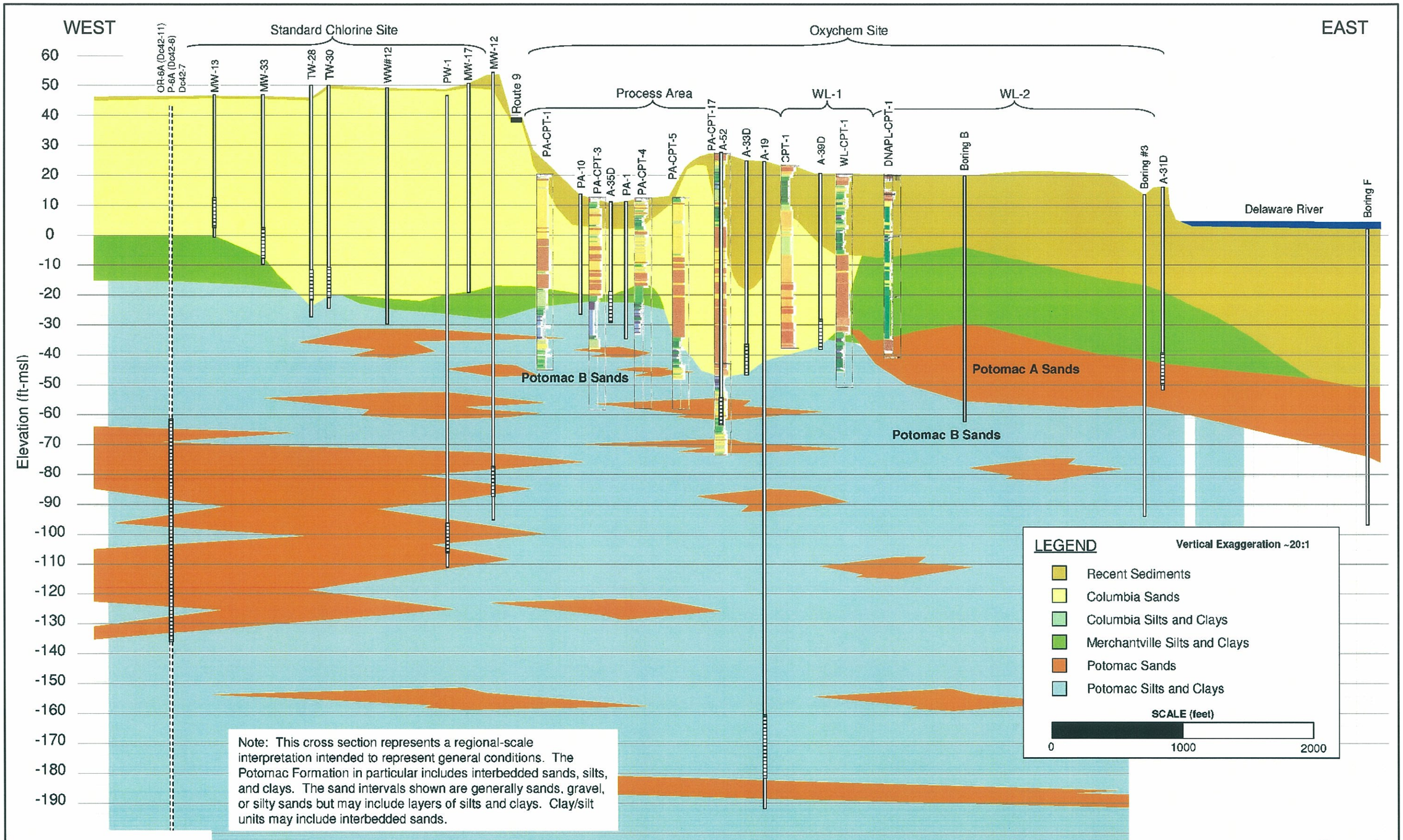


figure 4

REPRESENTATIVE WEST-EAST CROSS-SECTION
OxyChem, Delaware City, Delaware

Glenn Springs Holdings

07462-D21102(062)GN-WA004 JUL 29/2011

LEGEND

- OXYCHEM PROPERTY BOUNDARY
- BARRIER WALL
- STANDARD CHLORINE EFFLUENT PIPELINE
- SWMU / AOC BOUNDARY

RED LION CREEK

RED LION CREEK

TIDE GATE

DELAWARE RIVER

RIVER ROAD

KUEHNE

TRI-SUPPLY & EQUIPMENT, INC.

N

0 200 400ft

MERCURY CONCENTRATIONS IN SOIL (mg/kg) (2)

- NON-DETECT - <61
- 61 - <600
- ≥600

MERCURY CONCENTRATIONS IN SEDIMENT (mg/kg) (3)

- NON-DETECT - <10
- 10 - <100
- 100 - <1,000
- ≥1,000

NOTES:

1. DATA SHOWN IS FROM THE RELEVANT DATA USED IN THE CMS.
2. THE MERCURY CONCENTRATIONS IN THE SURFACE SOIL DOT PLOT ARE BASED ON THE HUMAN HEALTH CLEANUP LEVEL OF 61mg/kg FOR THE INDUSTRIAL WORKER.
3. THE MERCURY CONCENTRATIONS IN THE SEDIMENT DOT PLOT ARE BASED ON THE ECOLOGICAL CLEANUP LEVEL OF 10mg/kg FOR BIOLOGICAL RECEPTORS.

figure 5

MERCURY CONCENTRATIONS IN SURFACE SOIL (0-2 ft.) AND SEDIMENT (0-0.5 ft.)

OxyChem, Delaware City, Delaware

Glenn Springs Holdings

LAND FEATURES AS OF MARCH 2007

07462-D21102(062)GN-WA008 SEP 13/2011

LEGEND

- OXYCHEM PROPERTY BOUNDARY
- BARRIER WALL
- STANDARD CHLORINE EFFLUENT PIPELINE
- SWMU / AOC BOUNDARY

RED LION CREEK

RED LION CREEK

TIDE GATE

RIVER ROAD

DELAWARE RIVER

KUEHNE

TRI-SUPPLY & EQUIPMENT, INC.

0 200 400ft

CHLOROBENZENES
CONCENTRATIONS IN SEDIMENT (mg/kg) (3)

- NON-DETECT - <33
- 33 - <100
- ≥100

NOTES:

1. DATA SHOWN IS FROM THE RELEVANT DATA USED IN THE CMS.
2. CHLOROBENZENES IS CALCULATED AS SUM OF 1,2-DICHLOROBENZENE, 1,3-DICHLOROBENZENE, 1,4-DICHLOROBENZENE, 1,2,4-TRICHLOROBENZENE, AND CHLOROBENZENE, WITH NON-DETECTS EQUAL TO ZERO.
3. THE CHLOROBENZENES CONCENTRATION IN THE SEDIMENT DOT PLOT ARE BASED ON THE ECOLOGICAL CLEANUP LEVEL OF 33mg/kg FOR THE BIOLOGICAL RECEPTORS.

figure 6

CHLOROBENZENES CONCENTRATIONS IN SEDIMENT (0-0.5 ft.)

OxyChem, Delaware City, Delaware

Glenn Springs Holdings

LAND FEATURES AS OF MARCH 2007

LEGEND

- OXYCHEM PROPERTY BOUNDARY
- BARRIER WALL
- STANDARD CHLORINE EFFLUENT PIPELINE
- SWMU / AOC BOUNDARY

RED LION CREEK

RED LION CREEK

TIDE GATE

0 200 400ft

RIVER ROAD

KUEHNE

DELAWARE RIVER

TRI-SUPPLY & EQUIPMENT, INC.

MERCURY (DISSOLVED) CONCENTRATIONS IN GROUNDWATER (µg/L) (2)

- NON-DETECT - <2
- 2 - <20
- 20 - <200
- ≥200

MERCURY (DISSOLVED) CONCENTRATIONS IN SURFACE WATER (µg/L) (3)

- NON-DETECT - <0.77
- ≥0.77

NOTES:

1. DATA COLLECTED DURING 4TH QUARTER, 2010 (ANNUAL PMP SAMPLING)
2. THE DISSOLVED MERCURY CONCENTRATIONS IN THE GROUNDWATER DOT PLOT ARE BASED ON THE HUMAN HEALTH CLEANUP LEVEL OF 2µg/L (EPA DRINKING WATER MCL).
3. THE DISSOLVED MERCURY CONCENTRATIONS IN THE SURFACE WATER DOT PLOT ARE BASED ON THE ECOLOGICAL CLEANUP LEVEL OF 0.77µg/L FOR BIOLOGICAL RECEPTORS.

figure 7

DISSOLVED MERCURY CONCENTRATIONS IN GROUNDWATER (WATER TABLE AQUIFER) AND SURFACE WATER

OxyChem, Delaware City, Delaware

Glenn Springs Holdings

LAND FEATURES AS OF MARCH 2007

LEGEND

- OXYCHEM PROPERTY BOUNDARY
- BARRIER WALL
- STANDARD CHLORINE EFFLUENT PIPELINE
- SWMU / AOC BOUNDARY

RED LION CREEK

RED LION CREEK

TIDE GATE

RIVER ROAD

KUEHNE

DELAWARE RIVER

TRI-SUPPLY & EQUIPMENT, INC.

N

0 200 400ft

CHLOROBENZENE CONCENTRATIONS IN GROUNDWATER (µg/L) (3)

- NON-DETECT - <100
- 100 - <1,000
- 1,000 - <10,000
- 10,000 - <100,000
- > 100,000

CHLOROBENZENES CONCENTRATIONS IN SURFACE WATER (µg/L) (4)

- NON-DETECT - <620
- ≥620

NOTES:
1. DATA COLLECTED DURING 4TH QUARTER, 2010 (ANNUAL PMP SAMPLING)
2. CHLOROBENZENES IS CALCULATED AS SUM OF 1,2-DICHLOROBENZENE, 1,3-DICHLOROBENZENE, 1,4-DICHLOROBENZENE, 1,2,4-TRICHLOROBENZENE, AND CHLOROBENZENE.
3. THE CHLOROBENZENE CONCENTRATIONS IN THE GROUNDWATER DOT PLOT ARE BASED ON THE HUMAN HEALTH CLEANUP LEVEL OF 100µg/L (EPA DRINKING WATER MCL).
4. THE CHLOROBENZENES CONCENTRATIONS IN THE SURFACE WATER DOT PLOT ARE BASED ON THE ECOLOGICAL CLEANUP LEVEL OF 620µg/L FOR BIOLOGICAL RECEPTORS.

figure 8

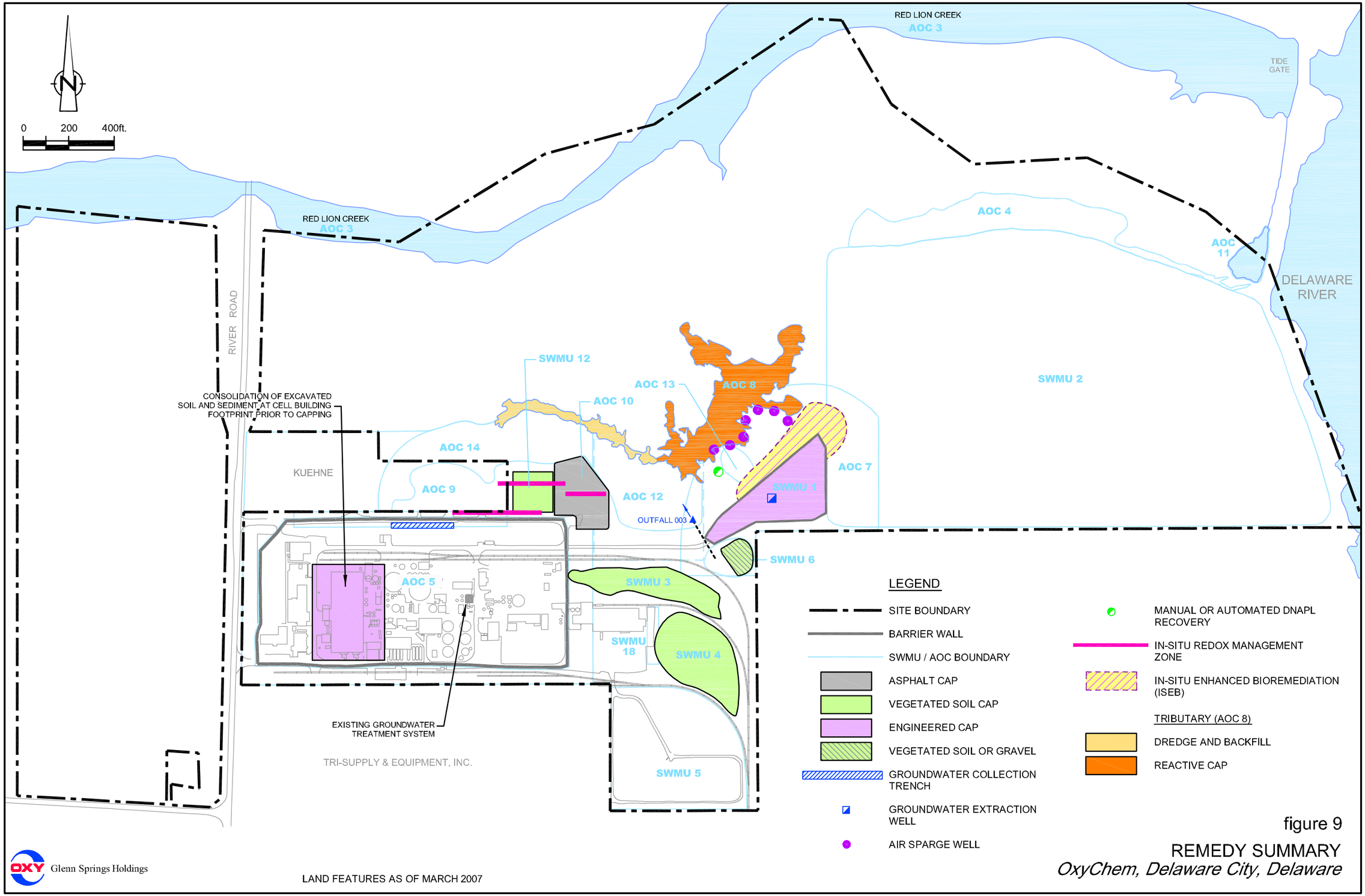
CHLOROBENZENE CONCENTRATIONS IN GROUNDWATER (WATER TABLE AQUIFER) AND CHLOROBENZENES CONCENTRATIONS IN SURFACE WATER

OxyChem, Delaware City, Delaware

Glenn Springs Holdings

LAND FEATURES AS OF MARCH 2007

07462-D21102(062)GN-WA007 AUG 08/2011



Glenn Springs Holdings

LAND FEATURES AS OF MARCH 2007

figure 9

REMEDY SUMMARY

OxyChem, Delaware City, Delaware

07462-D21102(062)GN-WA005 AUG 17/2011