

**SECOND FIVE-YEAR REVIEW REPORT FOR
STANDARD CHLORINE OF DELAWARE, INC. SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE**



Prepared by

**U.S. Environmental Protection Agency
Region 3
PHILADELPHIA, PENNSYLVANIA**

A handwritten signature in black ink, appearing to read "Dominique Lueckenhoff", is written over a horizontal line.

**Dominique Lueckenhoff, Acting Director
Hazardous Site Cleanup Division**

A handwritten date "7/7/16" in black ink is written over a horizontal line.

Date

Table of Contents

I. INTRODUCTION	1
Site Background.....	2
FIVE-YEAR REVIEW SUMMARY FORM.....	2
II. RESPONSE ACTION SUMMARY	3
Basis for Taking Action	3
Response Actions.....	4
Status of Implementation	7
IC Summary Table.....	9
Systems Operations/Operation & Maintenance.....	10
III. PROGRESS SINCE THE LAST REVIEW	11
IV. FIVE-YEAR REVIEW PROCESS	13
Community Notification, Involvement & Site Interviews.....	13
Document Review.....	13
Data Review	13
Site Inspection.....	14
V. TECHNICAL ASSESSMENT	14
QUESTION A: Is the remedy functioning as intended by the decision documents?.....	14
QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?	15
QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?.....	17
VI. ISSUES/RECOMMENDATIONS	17
OTHER FINDINGS.....	18
VII. PROTECTIVENESS STATEMENT	18
VIII. NEXT REVIEW	18

FIGURES

- 1 Site Location
- 2 Site Layout
- 3 Conceptual Site Model
- 4 Operable Unit 1
- 5 Operable Unit 2
- 6 Operable Unit 3
- 7 Operable Unit 4
- 8 Operable Unit 1 Interim Groundwater Remedial Components
- 9 Columbia Aquifer Groundwater Elevations – May 2015
- 10 Columbia Aquifer Groundwater Elevations – May 2006
- 11 Total Contaminants of Concern in Columbia Aquifer – July 2004
- 12 Total Contaminants of Concern in Columbia Aquifer – March 2015

REFERENCES

LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
DNAPL	dense non-aqueous phase liquid
DNREC	Delaware Department of Natural Resources and Environmental Control
EPA	Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	feasibility study
FYR	five-year review
GETS	groundwater extraction and treatment system
GMZ	groundwater management zone
HI	Hazard Index
IC	institutional control
LTTD	low temperature thermal desorption
mg/kg	milligram per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OU	operable unit
PCB	polychlorinated biphenyl
PRAP	Proposed Remedial Action Plan
RAO	remedial action objective
RI	remedial investigation
ROD	Record of Decision
SCD	Standard Chlorine of Delaware, Inc
SSC	State Superfund Contract
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TSSA	Temporary Soil Staging Area
UE	unlimited exposure
UU	unlimited use
VI	vapor intrusion

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Oil and Hazardous Substances Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the second FYR for the Standard Chlorine of Delaware, Inc. Superfund Site (Site). The triggering action for this **statutory** review is July 15, 2011, which is the signature date of the previous FYR. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

This FYR addresses those operable units (OUs) where the remedy has either been constructed and is operating or is under construction.

EPA has designated multiple OUs at the Site. A description of the OUs is provided below:

- OU-1. Interim groundwater remedy, as described in the 1995 Record of Decision (ROD). This containment remedy has been constructed and is currently operating. The OU-1 interim groundwater remedy consists of a subsurface barrier wall surrounding approximately 33 acres of the Site. Within this area is a groundwater extraction and treatment system designed to contain and treat contaminated groundwater within the Columbia Aquifer.
- OU-2. Final Remedy for spill soils and sediments, as described in the 1995 ROD and Amendment No. 2 to the 1995 ROD, issued in February 2016 (2016 ROD Amendment). The remedy has not yet been fully implemented. OU-2 addresses contaminated soils and sediment outside of the former Facility area, including the western drainage gully, wetland area, Red Lion Creek, and the former waste piles. The 2016 ROD Amendment addressed only the former waste pile soils and this portion of the remedy is currently under construction. Because the former waste piles are the only portion of the OU where remedy construction has been initiated, it is the only portion of the OU-2 remedy that can be evaluated in this FYR.
- OU-3. Final Remedy for former Facility area, as described in the 2010 ROD. The remedy consists of a multi-layer soil and geosynthetic material cap and soil gas collection and treatment system. OU-3 encompasses 23 acres and is entirely encompassed by the subsurface barrier wall that is a component of OU-1. On-site construction for the OU-3 remedial action was initiated on October 12, 2012. The cap is currently under construction and is scheduled for completion in 2017.
- OU-4. Final groundwater remedy. EPA is preparing the Remedial Investigation (RI) and Feasibility Study (FS) for OU-4, and a remedy has not yet been selected. The remedy ultimately selected for OU-4 will include a final remedy for groundwater that will address contamination in both the Columbia and Potomac aquifers.

The Site FYR was led by Remedial Project Manager Brad White. Participants included hydrogeologist Kathy Davies, toxicologist Martin Gehlhaus, Biological Technical Assistance Group biologist Bruce Pluta, community involvement coordinator Trish Taylor, and Delaware Department of Natural Resources and Environmental Control (DNREC) hydrologist Todd Keyser. The review began on October 19, 2015.

Site Background

The Site is located in a heavily industrialized area in New Castle County, Delaware. The Site is located approximately three miles northwest of Delaware City, Delaware, west of Route 9 (River Road) and south of Red Lion Creek, as shown in Figure 1. The Site is approximately 65 acres, and contains a fenced area that is the former location of a chlorobenzene manufacturing facility (Facility) that was owned and operated by Standard Chlorine of Delaware, Inc. (SCD) until December 1998, and then by Metachem Products, LLC (Metachem) until 2002. Additional features of the Site include an upland area located to the north of the former Facility area, and an adjacent wetlands. Figure 2 shows former and current features of the Site.

The Facility manufactured chlorobenzenes by combining chlorine and benzene purchased from adjacent industrial facilities, reacted and then distilled them at high temperature, and prepared and stored them prior to sale. Some of the chlorobenzenes were stored in heated steel aboveground storage tanks. Leakage from the pipes and tanks collected in the sumps of the drainage system, including Catch Basin #1, which released chlorobenzenes from a crack in its base. The leak in Catch Basin # 1 was discovered and repaired in March 1976. Bulk liquid chlorobenzenes were often transported by rail. A release of over 5,000 gallons of monochlorobenzene occurred in September 1981 in the rail car loading area on the west side of the Facility. In 1986, one of the aboveground storage tanks collapsed and the resulting release caused other tanks to fail. The 1986 release totaled over 569,000 gallons of di- and trichlorobenzenes. Together, these two major releases of chlorobenzene compounds contaminated soils, sediments and groundwater and led to the listing of the Site on the National Priorities List (NPL) on July 27, 1987.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Standard Chlorine of Delaware, Inc. (aka "Metachem")		
EPA ID: DED041212473		
Region: 3	State: DE	City/County: New Castle County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	Has the site achieved construction completion? No	
REVIEW STATUS		
Lead agency: EPA <i>[If "Other Federal Agency", enter Agency name]:</i>		
Author name (Federal or State Project Manager): Brad White		
Author affiliation: EPA Region 3		
Review period: 10/19/2015 - 7/1/2016		
Date of site inspection: 12/4/2015		
Type of review: Statutory		
Review number: 2		

Triggering action date: 7/15/2011
Due date (five years after triggering action date): 7/15/2016

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The following organic and inorganic compounds were identified as contaminants of concern (COCs) in the 1995 and 2010 RODs:

<i>Groundwater</i>	
<ul style="list-style-type: none">• Benzene• Chlorobenzene• 1,2-Dichlorobenzene• 1,3-Dichlorobenzene• 1,4-Dichlorobenzene• Hexachlorobenzene• Nitrobenzene• Pentachlorobenzene	<ul style="list-style-type: none">• 1,2,3,4-Tetrachlorobenzene• 1,2,4,5-Tetrachlorobenzene• Toluene• 1,2,3-Trichlorobenzene• 1,2,4-Trichlorobenzene• 1,3,5-Trichlorobenzene• 2,3,7,8-TCDD (aka Dioxin)• Polychlorinated biphenyls (PCBs)
<i>Soil and Sediment</i>	
<ul style="list-style-type: none">• Acenaphthene• Chlorobenzene• 1,4-Dichlorobenzene• 4,4'-DDD• 4,4'-DDT• Fluoranthene• Fluorene• Hexachlorobenzene	<ul style="list-style-type: none">• Pentachlorobenzene• Pentachlorophenol• Phenanthrene• Pyrene• 1,2,3,4-Tetrachlorobenzene• 2,3,7,8-TCDD (aka Dioxin)• 1,2,3-Trichlorobenzene• 1,2,4,5-Tetrachlorobenzene• 1,2,4-Trichlorobenzene
<i>Soil Gas</i>	
<ul style="list-style-type: none">• Benzene• Chlorobenzene• Carbon Tetrachloride• Chloroform	<ul style="list-style-type: none">• 1,2-Dichlorobenzene• 1,4-Dichlorobenzene• Tetrachloroethylene• Trichloroethylene

The surface and subsurface soils within the former Facility area (OU-3) were directly impacted by Site contaminants from historical spills and process leaks. Following the 1986 release of di- and trichlorobenzenes, contaminants entered the wetlands (OU-2) by overland flow. Contaminants at the Site migrated vertically into the unconfined Columbia Aquifer (OU-1). Upon entering the groundwater system, contaminants were transported downgradient in groundwater and discharged into the wetland sediments; and sediments and surface water of Red Lion Creek. Contaminants have also migrated down into the uppermost water-bearing sands of the Potomac Formation, which underlies the Columbia Aquifer. Figure 3 shows a graphical depiction of the current conceptual site model.

Response Actions

Following the 1986 spill, SCD used heavy equipment to collect as much of the spilled chlorobenzene as was practicable. Initial recovery efforts included the use of wet dredging and a flexible hose to direct contaminated dredge spoils into a lined sedimentation basin constructed on SCD's property just north of the Facility fence. Contaminated soils were also stockpiled in waste piles next to the wetlands. The waste piles were then covered with high density polyethylene plastic sheeting, and earthen berms were constructed around them.

EPA issued the first ROD for the Site on March 9, 1995. This ROD, which did not refer to OUs, selected an interim action for groundwater which included containment of groundwater to minimize the continued release of contaminants, as well as pumping and treating groundwater removed from the containment area. Additionally, a final remedy was selected for spill soils and sediments that included treatment by bioremediation, or a contingent remedy of Low Temperature Thermal Desorption (LTTD) in the event bioremediation was determined to not be effective at remediating the spill soils and sediments. EPA subsequently designated the interim groundwater remedy as OU-1 (see Figure 4), and the final spill soils and sediments remedy as OU-2 (see Figure 5). The Remedial Action Objectives (RAOs) and major components of the remedy selected in the 1995 ROD are:

RAOs for the Interim Groundwater Remedy (OU-1):

- Prevent exposure to the contaminated groundwater.
- Prevent further migration of the contaminated groundwater.
- Prevent further degradation of the environment caused by the discharge of contaminated groundwater to the unnamed tributary to Red Lion Creek and Red Lion Creek and to the wetlands along the unnamed tributary to Red Lion Creek.
- Remove any pools of Dense Non-aqueous Phase Liquid (DNAPL) which may act as a continuing source of groundwater, if shown to exist following additional investigation.

Major Components of Interim Groundwater Remedy:

- Construct a subsurface physical barrier such as a trench or slurry wall to contain groundwater and DNAPLs.
- Install low-volume recovery wells to remove pools of DNAPL which are identified during remedial design.
- Repair and upgrade (if necessary) the existing groundwater pump and treat system.
- Treat contaminated groundwater in the existing wastewater treatment plant along with treatment of all resulting air emissions.
- Establish Institutional Controls (ICs) to include deed restrictions and a Groundwater Management Zone to prevent the installation of drinking water wells in the area impacted by the releases from the Facility.
- Determine the extent of groundwater and DNAPL contamination.
- Evaluate the technical practicability of remediating groundwater to health-based levels.

The RAOs for the Final Action for Spill Soils and Sediments (OU-2):

- Remediate soils and sediments to levels that are protective of human health and the environment.
- Minimize infiltration, run-on, and run-off of precipitation to areas containing subsurface contaminated soils and sediments.
- Monitor and maintain the integrity of Catch Basin #1 to ensure that it does not serve as a continuing source of contamination to subsurface soils and groundwater.
- Reduce the toxicity of sediments to aquatic organisms.
- Reduce the bioaccumulation of contaminants.

The major components of Final Action for Soils and Sediments:

- Conduct biological treatability studies/pilot-scale studies to determine the ability of biological treatment to reduce the concentration of contaminants in the soils and sediments to cleanup criteria.
- Bioremediate the soils/sediments along the western drainage gully, the eastern drainage ditch, the soils adjacent to Catch Basin #1, those along the railroad tracks and along the unnamed tributary to Red Lion Creek, in addition to those soils in the waste piles and in the sedimentation basin using in situ (in place) or ex situ (excavated) treatment.

Contingency Action for Soils and Sediments (if bioremediation determined to not be effective):

- Excavate and treat the soils/sediments along the western drainage gully, the eastern drainage ditch, the soils adjacent to Catch Basin #1, those along the railroad tracks and along the unnamed tributary to Red Lion Creek, in addition to those soils in the waste piles and in the sedimentation basin using LTTD.
- Construct a low permeability asphalt cap along the railroad tracks and adjacent to Catch Basin #1.
- Restore the wetlands damaged by the remedial action.

Cleanup Criteria for Soils and Sediments:

- Soils within the former Facility area (subsequently designated OU-3):
 - 625 milligrams per kilogram (mg/kg) for total COCs
 - 450 mg/kg ceiling for 1,4-dichlorobenzene
 - Soils must pass Toxicity Characteristic Leaching Procedure (TCLP)
- Soils outside of the former Facility area (subsequently designated OU-2):
 - 33 mg/kg total COCs
 - Soils must pass TCLP analysis

In December of 1998, the Site was sold to Metachem, who resumed the manufacture of chlorobenzenes. Metachem continued remedial design activities for what became known as OU-1 and OU-2.

Metachem filed a bankruptcy petition on May 10, 2002, and abandoned the Site on May 14, 2002 to the custody and control of EPA and DNREC. All remedial response actions from that time until the present have been conducted by EPA and DNREC with the use of Federal and State funds.

From 2002 through 2006, EPA and DNREC conducted a time critical emergency removal action at the Site that included the stabilization of hazardous chemicals; operation of the Facility to return the bulk of hazardous chemicals to the stream of commerce and minimize disposal costs; and decontamination of the Facility equipment. Following decontamination of the equipment, EPA and DNREC oversaw the dismantling and removal of equipment by a third party salvage operation. None of the former Facility equipment remains at the Site.

EPA issued an amendment to the 1995 ROD in 2004 (2004 ROD Amendment). This amendment selected offsite disposal (incineration) for the bulk liquid wastes left onsite following Metachem's bankruptcy in 2002. Removal of the bulk liquid wastes was completed by December 31, 2009.

EPA issued an Explanation of Significant Differences (ESD) on March 6, 2008 that modified the 2004 ROD Amendment. The 2004 ROD Amendment established off-site incineration as the Selected Remedy for 1.3 million gallons of bulk liquid chemicals, but did not address any other excess bulk materials that remained on-site. The 2008 ESD significantly expanded the volume and associated treatment cost of excess bulk chemicals addressed under the 2004 ROD Amendment to include all excess bulk chemicals remaining on the Site.

EPA issued a ROD for OU-3 on September 29, 2010 to address contaminated vadose zone soils (soils above the water table) and soil gas in the former Facility area (see Figure 6). The RAOs in the 2010 ROD and major components of the remedy are:

RAOs for Human Health:

- Prevent exposure to non-carcinogens in the soil and soil gas at concentrations that would result in a target organ Hazard Index (HI) greater than 1 via the potential exposure routes of inhalation, ingestion, and dermal contact.
- Prevent exposure to carcinogens at concentrations that would result in a cumulative cancer risk in excess of 1E-05 via the potential exposure routes of inhalation, ingestions, and dermal contact.

RAOs for Environmental Protection:

- Prevent risks to ecological communities exposed directly to the soil COCs and indirectly via bioaccumulation of soil COCs in plants and earthworms.

RAOs for Limiting Further Migration of Contaminants:

- Minimize the further spread of contamination via any of the following major migration pathways:
 - Soil to groundwater
 - Soil to surface water
 - Soil to sediment
 - Soil to air

Major Components:

- Construction of a surface cap compliant with the applicable hazardous waste requirements. The requirement to construct a liner system beneath the waste is being waived due to the functional equivalence of the previously-constructed subsurface containment system (barrier wall keyed into the underlying naturally occurring clay). The surface cap will cover approximately 23 acres of the former Facility area and is being constructed of multiple layers of soil and geosynthetic material with a soil gas collection and treatment system.
- Implementation of ICs to restrict future land use.

EPA prepared a memorandum to the Site file on August 11, 2011 to document a minor change to the OU-3 Selected Remedy. The memorandum extended the boundary of the portion of the Site to be capped to the north, which increased the total cap area by approximately one acre. The additional area included the sedimentation basin that was created by Standard Chlorine following the 1986 spill. The sedimentation basin was used to contain wet dredge spoils recovered from the wetlands.

EPA issued the 2016 ROD Amendment on February 24, 2016 to amend the original remedy selected for the waste pile soils that were later staged in the Temporary Soil Staging Area (TSSA). The 2016 ROD Amendment established placement of the waste pile soils underneath the multi-layer cap as the Selected Remedy. The soils within the TSSA are currently being covered by the cap that is under construction. The RAOs and major components of the remedy selected in the 2016 ROD Amendment are:

RAOs for Human Health:

- Prevent exposure to contaminants in the soil and soil gas via the potential exposure routes of inhalation, ingestion, and dermal contact.

RAOs for Environmental Protection:

- Minimize infiltration, run-on, and run-off of precipitation to areas containing subsurface contaminated soils and sediments.
- Reduce bioaccumulation of contaminants.

Major Components:

- Transfer the waste pile soils within the TSSA to OU-3 and cover with the multi-layer cap.
- Capture and treat contaminated soil gas that accumulates underneath the multi-layer cap.

The final remedy for groundwater will be selected in the future as part of OU-4 (see Figure 7). EPA is currently completing a RI/FS for the final remedy for groundwater. Once the RI/FS is completed, EPA will issue a Proposed Plan describing EPA's preferred alternative for groundwater.

Status of Implementation

OU-1 Interim Groundwater Remedy

Physical onsite construction of the OU-1 interim groundwater remedy was initiated in July 2006 and completed in 2007. Figure 8 shows the OU-1 interim groundwater remedy components. The following elements comprise the OU-1 interim groundwater remedy:

- May 2007. Construction of subsurface barrier wall completed. The barrier wall, which has an average depth of 65 feet below ground surface, is 5,290 feet long and surrounds a large portion of the Site, including the former Facility area. The barrier wall extends down to a naturally occurring clay layer, called the Merchantville formation, which is about 65 feet beneath ground surface. The Merchantville formation separates the overlying Columbia Aquifer from the underlying Potomac Aquifer.
- August 2007. Construction of the groundwater extraction and treatment system (GETS) completed. A network of six extraction wells were drilled within the area of the barrier wall to pump contaminated groundwater from the overlying Columbia Aquifer. The treatment system was constructed with a combination of technologies, including air stripping, vapor and liquid phase carbon adsorption, bag filters and sand filters. The extraction wells were placed online and operation of the GETS was initiated.
- 2008. DNREC implemented a "Groundwater Management Zone" in the Delaware City Industrial Area to prevent the installation of drinking water wells in the area impacted by groundwater contamination.
- Operation and maintenance of the interim groundwater remedy is ongoing.

OU-2 Spill Area Soils and Sediments

Part of the design activities for OU-2 included conducting a bioremediation pilot test to evaluate the effectiveness of bioremediation to remediate the OU-2 soils and sediments, described in the 1995 ROD. Metachem submitted the results of a bioremediation study in March 2001. EPA evaluated the results of the bioremediation pilot test and determined that bioremediation would not be effective at remediating the most highly contaminated OU-2 soils and sediments and that the contingent remedy of LTTD should be implemented.

In 2003, EPA completed a preliminary remedial design to use LTTD to implement the OU-2 contingent remedy at the Site. For comparison purposes, the preliminary remedial design also evaluated off-site LTTD. The volume of soil and sediment requiring remediation was estimated to be 132,000 cubic yards. This estimate included the OU-2 Waste Pile Soils, which were estimated to contain 5,900 cubic yards of contaminated soil. The estimate also included a number of other areas that are being addressed under the OU-3 remedial action, including the railroad area; sedimentation basin; catch basin; and eastern drainage ditch.

The remedy for OU-2 has not yet been fully implemented. EPA is currently revising the human health and ecological risk assessment based on data from a recent large-scale characterization effort to determine the extent of soil and sediment to be remediated. EPA is working with the U.S. Geological Survey to evaluate various innovative in-situ and ex-situ bioremediation techniques for lesser-contaminated areas of the wetlands.

During construction of the barrier wall, EPA relocated the waste pile soils to an area within the area surrounded by the barrier wall. The waste piles were placed on a liner, covered with a geosynthetic clay liner and topsoil, and vegetated. This area, referred to as the TSSA, was designed to serve as a temporary containment measure until a final remedy for the soils could be implemented. The remedy selected in the 2016 ROD Amendment, which established containment of the former waste piles underneath the OU-3 multi-layer cap, is currently under construction. EPA has completed excavation of the soils, including the former waste pile soils, from the TSSA and has relocated them to the OU-3 cap area. The soils are now being covered with the multi-layer cap that is being constructed as part of the OU-3 remedial action. The remaining portion of the remedy for the spill soils and sediments, as selected in the 1995 ROD and subsequently designated as OU-2, has not yet been implemented.

OU-3 Former Facility Area

The OU-3 remedy is currently under construction, and is scheduled to be completed in 2017. The following components of the remedy have been completed:

- September 2012. Remedial action began with the dismantlement of the warehouse. This demolition was a discrete action that was completed while EPA waited for remaining remedial action funding to be made available.
- May 2015 to present. EPA received the full amount of funding to complete the OU-3 remedial action and contractors were mobilized to the Site. The following elements of the remedial action have been completed:
 - Clearing and grubbing of vegetation
 - Demolition and sizing of concrete process pads
 - Relocation of utilities
 - Construction of access road
 - Draining of sedimentation basin, treatment of the water in the basin, and filling the basin to establish subgrade
 - Construction of two stormwater detention basins
 - Abandonment of select monitoring wells and drilling of additional monitoring wells
 - Removal of and disposal of subsurface water lines
 - Excavation of perimeter drainage swale

IC Summary Table

Summary of Planned and/or Implemented ICs					
Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	Entire Site	Prevent the potable use of groundwater	DNREC Groundwater Management Zone. Memorandum of Agreement, April 2008
Access	Yes	Yes	Sitewide	Prevent trespass onto the Site	EPA and DNREC have maintained control of the Site since 2002. Site security fencing is in place.
Future use	Yes	Yes	OU-3 Former Facility Area	Protect integrity of cap cover system and associated remedial components	Deed restrictions are planned to be placed on the deed at time of transfer of ownership

The 1995 ROD specified the following ICs:

“Institutional controls for the Site will include use, access, and deed restrictions intended to limit future land and groundwater use and security fences to limit access. DNREC will also implement a groundwater management zone which will prevent the installation of drinking water wells in the area impacted by the releases.”

On May 14, 2002, a Bankruptcy Court issued an order approving part of a stipulation between Metachem, EPA, and DNREC which provided that Metachem would abandon the property (the Site) and relinquish control of the property to EPA and DNREC. Since that time, EPA and DNREC have maintained control of the Site and security fencing. EPA and DNREC will place deed restrictions and other appropriate institutional controls on the property if and when the property, or a portion thereof, is sold for eventual reuse.

In April 2008, DNREC issued a Memorandum of Agreement for the Delaware City Industrial Area that created a Groundwater Management Zone (GMZ). The area affected by the GMZ was specifically defined, and includes the Site and the area where groundwater has been impacted by Site-related contamination. Two separate areas were defined as Area A and Area B. The Site lies fully within Area A. The GMZ established the following:

- The area affected by the GMZ;
- No new public or domestic potable water supply wells will be allowed or permitted within the GMZ Area A;

- No new public or domestic potable water supply wells will be allowed in the unconfined Columbia Aquifer and any underlying aquifer hydraulically connected to the Columbia Aquifer within GMZ Area B. Potable wells in the GMZ Area B may be allowed or permitted provided: (1) they are drilled into a confined aquifer, (2) they are constructed to prevent the vertical movement of potential contaminants, (3) that contaminated groundwater, if encountered, will be sufficiently treated to applicable potable use standards, and (4) a joint review and approval is completed within DNREC.
- Non-potable wells, such as, but not limited to, industrial monitoring, observation, and contaminant recovery wells, may be installed in GMZ Areas A and B following review and approval by DNREC.
- Permits for wells in GMZ Area B may only be issued by DNREC following review and approvals.

The 2010 ROD specified the following ICs:

- Land Use Restrictions
 - Restrict use to commercial, light industrial, or open space
 - Maintain and protect the integrity of remedial components
 - Prohibit construction of any new building on Site without prior written approval from EPA. As part of its review process, EPA will verify that appropriate vapor intrusion mitigation is included in the building design.
- Groundwater Use Restrictions
 - Prevent groundwater use for commercial, domestic, or agricultural purposes
 - Restrict offsite pumping that would impair containment within the barrier wall

Systems Operations/Operation & Maintenance

Operation and maintenance of the groundwater extraction and treatment system is ongoing. The groundwater is pumped at an average flow rate of 60 gallons per minute and is treated to DNREC permit-equivalency standards. The treated water is discharged to a surface drainage on the east side of the Site that drains to the wetlands. To date, over 80 million gallons of water have been treated, and approximately 58,000 pounds of contaminants have been removed.

Since the last FYR, a number of improvements have been made to the treatment system. To increase the treatment capacity of the system, the existing multi-media filter tanks were replaced with larger units. The increased surface area of the larger units has reduced “channelization” of the filter media, reduced the number of backwashes required, and allows for greater overall flow. These units were obtained from another EPA Superfund site so there was no capital cost. Electrical surge protection has also been added to the treatment system in an effort to better isolate it from power surges. The large influent holding tanks were also replaced with conical-bottom stainless steel tanks. Routine replacement of pumps, blowers, and electrical components were also performed. The cumulative result of the many improvements made to the system is one that now operates at its design capacity.

In December 2013, EPA completed a hydraulic assessment of the subsurface barrier wall in the southern portion of the Site. The results of the hydraulic assessment indicated upgradient groundwater was leaking into the containment area in the southwest portion of the Site. Though hydraulic containment was effective in preventing groundwater within the barrier wall from further contaminating groundwater outside the barrier wall, this inward leakage of groundwater was adding to the volume of water to treat.

In April 2015, EPA completed a repair to the southwestern portion of the subsurface barrier wall. The repair consisted of a second wall installed using a One-Pass trencher adjacent to the alignment of the original wall in the vicinity of where the inward leakage was identified. A subsequent hydraulic assessment indicated the repair was effective in minimizing any inward leakage through the barrier wall.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the **last** FYR as well as the recommendations from the **last** FYR and the current status of those recommendations.

Protectiveness Determinations/Statements from the 2011 FYR		
OU #	Protectiveness Determination	Protectiveness Statement
1	Short-term Protective	The remedy at OU-1 is protective of human health and the environment in the short-term. In order to be protective in the long term, the remaining institutional controls called for in the OU-1 ROD need to be implemented.
2,3,4	Will be Protective	The remedies at OUs 2, 3, and 4 are expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The exceptions are: the soil cleanup goals from the 1995 ROD may no longer guarantee future protectiveness due to changes in toxicity factors; the 2010 soil cleanup goals may not be protective for future exposure, depending on how toxicity factors continue to change; the vacant buildings on the property adjacent to Standard Chlorine could expose future building occupants to vapor intrusion.

Status of Recommendations from the 2011 FYR					
OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	Vapor intrusion (VI) has not been evaluated in vacant Air Products buildings next door to the Site	Evaluate VI for the Air Products buildings.	Completed	A VI investigation was completed in a former office building, which is the only building within 100 feet of Site-related groundwater contamination. The results are described below.	9/19/2013
2, 3	Numerous toxicity factors changed since the 1995 and 2010 RODs.	Reevaluate soil cleanup goals.	Completed	Soil cleanup goals for the remaining portions of OU-2 (excluding the waste piles) are currently being evaluated as part of an updated risk assessment and pending decision document. The OU-3 remedy includes a cap over the entire area so a re-evaluation of toxicity factors with respect to OU-3 is not necessary.	4/25/2016
1, 3	Some ICs identified in the 1995 and 2010 RODs have not yet been implemented.	Implement remaining ICs identified in 1995 and 2010 RODs.	Ongoing	EPA currently maintains control of the Site. Deed restrictions and future use restrictions will be placed on the deed to the property if ownership is transferred.	

Vapor Intrusion (VI) Recommendation

EPA conducted a VI investigation at the former Air Products property in June of 2013. At that time, the property was for sale and no businesses were in operation on the property. While there were a number of unoccupied buildings, the only building within 100 feet of known Site-related groundwater contamination was a single-story former office building. Site-related contaminants of concern in the groundwater in the vicinity of this building include:

- Benzene
- Chlorobenzene
- 1,2-dichlorobenzene
- 1,3-dichlorobenzene
- 1,4-dichlorobenzene
- Toluene
- 1,2,4-trichlorobenzene
- 1,2,3-trichlorobenzene
- 1,3,5-trichlorobenzene

EPA collected a number of sub-slab and indoor air samples from the building over an 8-hour period using 6-liter evacuated canisters. The samples were analyzed by an EPA contract laboratory for TO-15 volatile organic compounds. Site-related contaminants of concern were detected in sub-slab samples, some of which were

detected at concentrations above Regional Screening Levels. Some Site-related contaminants of concern were also detected in indoor air samples, including 1,4-dichlorobenzene which was detected above the Regional Screening Level but within EPA's acceptable risk range.

EPA concluded that Site-related contaminants are present below the slab in concentrations high enough to cause concerns about the potential for vapor intrusion, though the concrete slab is in good condition and likely inhibiting the movement of vapors to the indoor air. EPA notified the owner at that time of the findings and recommended additional sampling during the heating season if and when the utilities are functioning and commercial occupancy of the building is anticipated. The property is now under new ownership and EPA has contacted the new owner to ensure their understanding of the VI investigation and recommendations. The building is now occupied for commercial use, and EPA and DNREC are maintaining communication with the current owner. EPA will conduct additional vapor intrusion sampling in the winter months to determine the necessity of vapor intrusion mitigation.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was placed in the Delaware News Journal on March 2, 2016 stating that there was a FYR and inviting the public to submit any comments to the U.S. EPA. The results of the review and the report will be made available online at www.epa.gov/arweb and at the following following information repositories:

EPA Administrative Records Room,
Attention: Administrative Coordinator
1650 Arch Street
Philadelphia, PA
(215) 814-3157
Hours: Monday through Friday, 8:00 am to 4:30 pm;
by appointment only.

Delaware Department of Natural Resources &
Environmental Control
Site Investigation and Restoration Section
391 Lukens Drive
New Castle, DE 19720-2774
302-395-2600

During the FYR process, EPA spoke with local officials and adjacent commercial property owners to document any perceived problems or successes with the remedy that has been implemented to date. People indicated a good understanding of the work being conducted at the Site and indicated they have been kept informed through routine communications, fact sheets, the January 2016 public meeting and public notices.

Document Review

This FYR included a review of relevant documents including the 1995 and 2010 RODs, the 2004 and 2016 ROD Amendments, the OU-3 Remedial Design, semi-annual Interim Remedial Action implementation reports, and the 2008 DNREC Memorandum of Agreement that established the Delaware City Industrial Area groundwater management zone.

Data Review

The Site is still several years away from achieving the construction completion milestone. Nevertheless, EPA has collected a significant amount of data to monitor the operation of the OU-1 interim groundwater remedy and investigate the nature and extent of contamination in the other OUs. The data reviewed for this FYR focused on the primary installed component of the remedy, the interim groundwater remedy. Therefore, the following data review reflects a summary of groundwater conditions in the Columbia Aquifer (shallow groundwater) at the Site.

The direction of groundwater flow in the Columbia Aquifer outside of the barrier wall is to the north toward Red Lion Creek. Figure 9 shows the groundwater flow under current conditions with the barrier wall in place, and Figure 10 shows groundwater flow prior to installation of the barrier wall. Data from the wells along the Red Lion Creek haul road to the north of the barrier wall indicate that COC concentrations have decreased substantially in wells MW-23, MW-25, and PMW-46 since construction of the barrier wall and GETS in 2007, and decreased somewhat in MW-21 and MW-22. To the northwest of the barrier, a decreasing trend was observed in wells MW-19 and PMW-45, while no trend was observed in MW-20. COCs have either not been detected or detected at low concentrations (less than 0.01 milligrams per liter) in Columbia wells located outside of the barrier to the south of the Site (CW-19, PW-7S, and MW-3). COC concentrations in Columbia wells located east and west of the barrier wall were relatively low prior to installation of the barrier wall and have remained low. Figure 11 shows COC concentrations in Columbia Aquifer wells prior to installation of the barrier wall, and Figure 12 shows the most recent COC concentrations since the barrier wall has been in place.

EPA completed a hydraulic assessment of the southern portion of the barrier wall in December 2014 to assess its integrity. It was suspected that water from outside of the barrier wall was seeping thru the barrier wall on the southwest side of the Site based on the following observations: non-uniform differential gradients between paired wells inside and outside the containment area; groundwater gradients that were not “flat” inside the containment area, as they should be under pumping conditions; and groundwater on the outside of the containment area on the southern portion of the barrier wall was not mounding against the wall. The results of the hydraulic assessment indicated leakage of upgradient groundwater in the southwestern portion of the barrier wall into the containment area. While this leakage did not result in mobilization of Site contaminants outside of the containment area, it increased the volume of water to treat within the containment area to maintain the water level differential specified in the remedial design.

To address the leakage of upgradient groundwater into the southwestern portion of the containment area, EPA completed a repair to that section of the barrier wall in April 2015. A new section of barrier wall, approximately 700 feet long, 65 feet deep, and 30 inches wide, was installed adjacent to the alignment of the original barrier wall using a One-Pass trencher. At each end of the repair, the new wall crossed through the existing wall to ensure containment. A post-repair hydraulic assessment was completed, and the results indicated the repair was effective in minimizing the amount of upgradient groundwater entering the containment area.

Site Inspection

The inspection of the Site was conducted on December 4, 2015. In attendance were Remedial Project Manager Brad White and DNREC Project Manager Todd Keyser. A tour of the Site was conducted to inspect the OU-1 interim groundwater remedy and to evaluate progress of construction of the OU-3 cap. No issues with the physical condition of the remedial action systems or perimeter security fencing were noted. Subsequent visits to the Site were conducted during the excavation of the TSSA and transfer of contaminated soil to the OU-3 cap area, which has been completed.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the results of the Site inspection indicate the OU-1 interim groundwater remedy is functioning as intended by the 1995 ROD. The observed long-term decreases in COC concentrations in wells located outside the barrier wall, along with water level data discussed above, suggest the barrier wall and the network of extraction wells within the barrier wall are acting as a hydraulic barrier to contaminant migration off-site, as it was designed. Overall, the data suggest the interim groundwater remedy is making progress toward achieving the RAOs listed in the 1995 ROD.

Construction of the former waste pile soils component of the OU-2 remedial action, as described in the 2016 ROD Amendment, is currently underway. Contaminated soil has been removed from the TSSA and relocated to the cap area. This portion of the OU-2 remedial action will be completed once the OU-3 remedy is fully constructed.

Construction of the OU-3 remedial action is currently under way, and is scheduled for completion in 2017. Perimeter security measures are in place, and include fencing and locked gates. Sediment and erosion control measures are in place and are inspected by a licensed inspector on a weekly basis. While work is occurring, EPA conducts air and dust monitoring to ensure worker safety and make sure there are no fugitive dust or VOC emissions leaving the Site above levels of concern.

The GMZ, detailed in Section III, established the IC to prevent dermal contact with and ingestion of contaminated groundwater by restricting drilling of any new public or domestic potable water supply wells within GMZ Area A, which includes the Site. Additional ICs were specified by the 2010 ROD to restrict land and groundwater use and maintain the integrity of the remedy. As stated above, EPA and DNREC will place deed restrictions and other appropriate ICs on the property if and when the property, or a portion thereof, is sold for eventual reuse.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The RAOs used at the time of remedy selection are still valid. Although some of the exposure assumptions, toxicity data, and cleanup levels have changed since the time of remedy selection, the remedies selected remain protective. The interim groundwater remedy (OU-1) prevents exposure to and migration of the contaminated groundwater in the Columbia Aquifer within the barrier wall, and the remedy being implemented for OU-3 (as well as the waste pile soils from OU-2) will prevent exposure through capping and soil gas capture and treatment. In addition, the continued implementation of institutional controls will prevent the future use of contaminated groundwater.

Changes in Standards and To Be Considereds (TBCs)

Have standards identified in the the ROD been revised, and does this call into question the protectiveness of the remedy? Do newly promulgated standards call into question the protectiveness of the remedy? Have TBCs used in selecting cleanup levels at the Site changed, and could this affect the protectiveness of the remedy?

The interim groundwater remedy detailed in the 1995 ROD (now part of OU-1) does not establish chemical specific cleanup goals for groundwater; it defers the setting of such goals to the final remedy for groundwater, which EPA has not yet issued. Instead, the 1995 ROD presented an interim action to prevent exposure to and further migration of groundwater, prevent degradation of the environment in Red Lion Creek due to discharge of contaminated groundwater, and to remove existing DNAPL which may be a continuing source of groundwater contamination.

The remedy for OU-3 selected in the 2010 ROD specified chemical specific cleanup goals and defined them for the on-facility area (footprint of the former Facility) and off-facility area (the area just to the north of the former Facility). During the remedial design, EPA conducted additional sampling in the off-facility area and determined it was necessary to include that area underneath the cap. Therefore, both the on-facility and off-facility areas defined in the 2010 ROD will be covered by the cap. The 450 mg/kg cleanup criteria for 1,4-dichlorobenzene for on-site soils results in a lifetime cancer risk of 2E-4 and slightly exceeds the acceptable cancer risk range of 1E-4 to 1E-6; however, provided that the on-site soils will be covered with a cap and soil gas extraction system (as described in 2010 ROD), the remedy selected will remain protective by eliminating exposure pathways. While the OU-3 remedy has not yet been fully implemented, it is expected to be fully protective of human health and the environment because the area will be capped, soil gas from beneath the cap will be captured and treated, and the surface will consist of certified clean topsoil and vegetation.

The remedy selected in the 2016 ROD Amendment for the OU-2 waste pile soils did not specify chemical-specific cleanup goals since the soils are being placed within the OU-3 cap area. The final remedy for soils and sediments in the 1995 ROD (now the remaining components of OU-2) does identify cleanup goals, but that remedy has not yet been fully implemented. EPA is currently evaluating implementation of the contingent remedy, along with other potential remedies, and will be issuing a future decision document to document any modifications to the remedy and cleanup standards.

Changes in Exposure Pathways

Has land use or expected land use on or near the Site changed?

Since the time of the 1995 ROD the Facility has ceased operation and has been completely dismantled. Some neighboring facilities have closed as well, but there is no indication that the land will be developed for residential use. Future commercial or light industrial reuse of the Site is possible, so the future worker scenario in the human health risk assessment is still appropriate. A GMZ has been implemented and land use restrictions will be implemented in accordance with the decision documents.

Have human health or ecological routes of exposure or receptors been newly identified or changed in a way that could affect the protectiveness of the remedy? Are there newly identified contaminants or contaminant sources? Are there unanticipated toxic byproducts of the remedy not previously addressed by the decision documents? Have physical site conditions or the understanding of these conditions changed in a way that could affect the protectiveness of the remedy?

The major new route of exposure that has been identified since the 1995 ROD, and which is a potential concern, is vapor intrusion into future buildings onsite under certain reuse scenarios. This concern is being addressed through the 2010 ROD for OU-3, which included a requirement for an institutional control that will ensure that any future buildings on the Site be designed with vapor mitigation systems. In addition, EPA is continuing to monitor the potential for vapor intrusion at an adjacent facility.

In the years since the 1995 ROD, EPA has detected non-Aroclor PCBs in the soils and sediments that are part of OU-2 and OU-3, as well as in the groundwater. The PCB analysis that was performed at the Site prior to 2002 only analyzed for the intentionally manufactured (Aroclor) PCBs, which were not present at concentrations that would have made them COCs. Since 2002, EPA has included non-Aroclor PCBs in its analysis and has found them to be present at levels of concern. The highest concentrations found onsite to date were from samples located within the OU-3 area, though at concentrations well below those that would trigger immediate response action or changes to the cap remedy that is being constructed. While PCBs are present in the Columbia Aquifer groundwater within the containment area, they are being removed via the groundwater treatment system. PCBs will be considered for inclusion as COCs in future Site RODs and, if appropriate, considered in selecting and designing the final remedies for OU-2 and OU-4.

Changes in Toxicity and Other Contaminant Characteristics

Have toxicity factors for contaminants of concern at the Site changed in a way that could affect the protectiveness of the remedy? Have other contaminant characteristics changed in a way that could affect the protectiveness of the remedy?

Toxicity factors have changed in the years since the 1995 and 2010 RODs; however, these changes are not expected to affect the protectiveness of the subsurface barrier wall, groundwater extraction system, or OU-3 cap. These changes in factors may affect the soil and sediment cleanup levels described in the 1995 ROD, as they apply to the remaining elements which are now designated as OU-2 (the contaminated soil in the western drainage gully, and contaminated sediment within the wetlands and Red Lion Creek; all of the remaining elements described in the 1995 ROD, with respect to the final remedy for soils and sediments, are now within OU-3 and are being covered by the cap which eliminates future exposure routes). EPA will reassess toxicity factors and other

contaminant characteristics that could affect protectiveness when it selects a final remedy for groundwater (OU-4) and when it designs the final remedy for OU-2 soils and sediment.

Changes in Risk Assessment Methods

Have standardized risk assessment methodologies changed in a way that could affect the protectiveness of the remedy?

There have been changes in EPA's risk assessment guidance since 1995. These include a major revision to the Human Health and Ecological Risk Assessment Guidance for Superfund, as well as changes in dermal guidance, inhalation methodologies, and exposure factors. While EPA will reassess how these changes could affect protectiveness when it designs the final remedy for OU-2 and selects a final remedy for groundwater (OU-4), the interim remedy selected for OU-1 remains protective and the remedy selected for OU-3 will be protective by eliminating exposure to contaminated media.

Expected Progress Towards Meeting RAOs

Is the remedy progressing as expected?

The OU-1 interim groundwater remedy is progressing as expected. Hydraulic containment of contaminated Columbia Aquifer groundwater within the barrier wall has been established through the operation of the six extraction wells. Contaminant levels have decreased significantly in Columbia Aquifer monitoring wells located downgradient from the containment area.

The remedies for OU-3 and the former waste pile soils of OU-2 are expected to achieve RAOs upon completion. During the remedial design for OU-3, the off-facility waste pile soils (a portion of OU-2 soils) was incorporated into the area being capped. Therefore, any exposure pathways associated with OU-3 and the waste soil piles from OU-2 will be eliminated once the remedy is implemented via the cap and soil gas collection and treatment system.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no other information that calls into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 1	Issue Category: Institutional Controls			
	Issue: Some ICs identified in the 1995 ROD have not yet been implemented.			
	Recommendation: Implement remaining ICs (deed restrictions) identified in 1995 ROD.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	EPA/State	EPA	If/when the Site, or any portion thereof, is sold.

OTHER FINDINGS

The following items were identified during the FYR but do not affect current protectiveness of the remedies in place or under construction:

There is a tide control structure located one half mile from the Site at the mouth of Red Lion Creek, where it discharges to the Delaware River. This tide control structure consists of a reinforced dike and five outflow gates and is designed to allow water to drain from Red Lion Creek into the Delaware River during low tide, provide protection from storm surge and flooding, and lower water levels along creeks to protect farmland and promote better drainage. A number of the outflow gates are not functioning properly and thereby water from the Delaware River enters Red Lion Creek during high tide or flooding conditions. The State of Delaware is currently working to obtain funding to construct a permanent repair to the tide control structure. The functionality of the tide control structure and varying flow conditions of Red Lion Creek need to be taken into account while designing the final remedy for OU-2.

Recent investigations of the Potomac Aquifer in support of the RI for OU-4 have provided EPA with a good understanding of local and regional influences on the aquifer. Groundwater pumping from nearby industrial facilities has been shown to influence the direction of groundwater flow in the Potomac Aquifer, and potentially the movement of groundwater contaminants in the vicinity of the Site. These regional influences will need to be contemplated when selecting the final groundwater remedy (OU-4) for the Site.

VII. PROTECTIVENESS STATEMENT

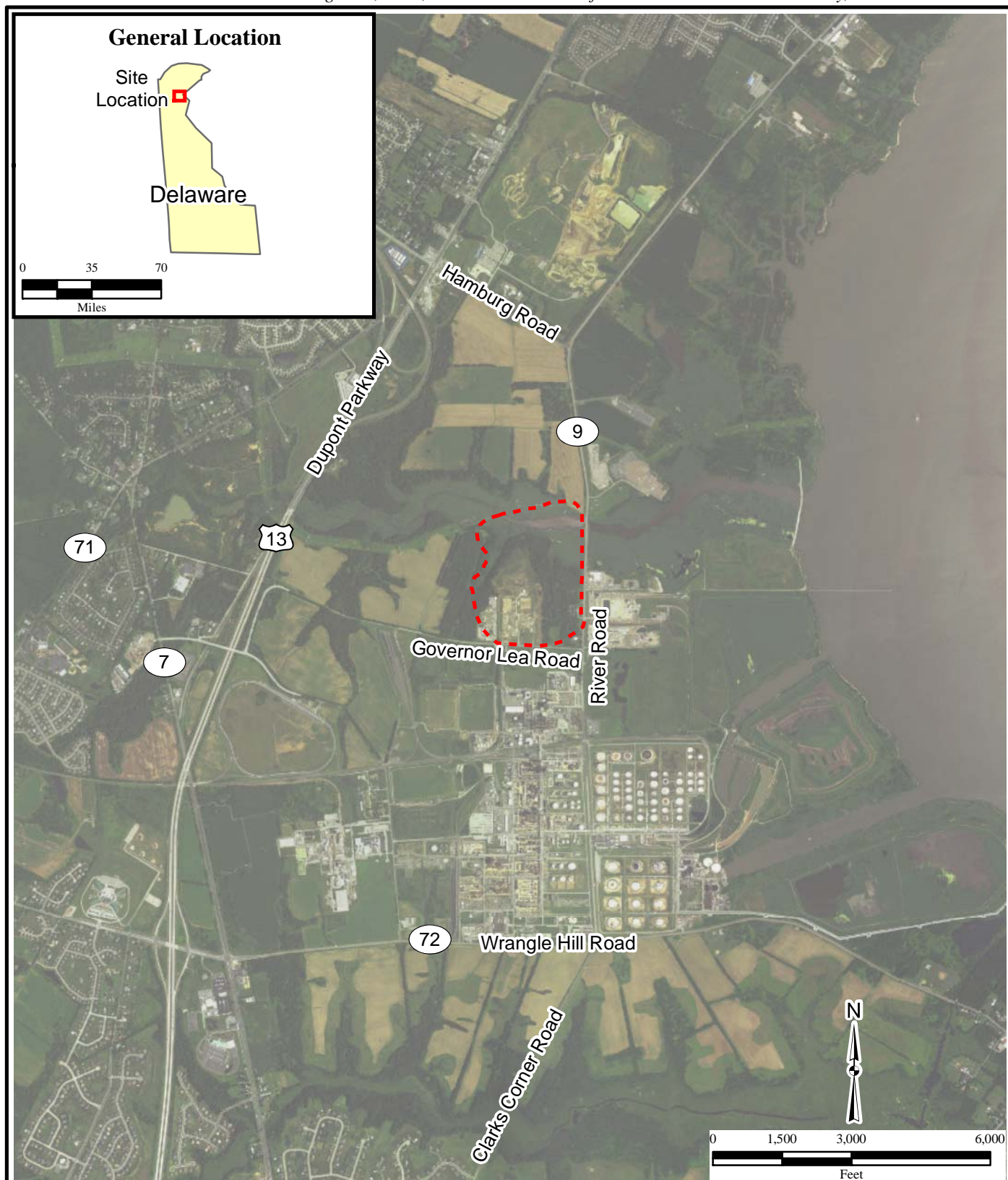
Protectiveness Statement(s)	
<i>Operable Unit:</i> 1	<i>Protectiveness Determination:</i> Short-term Protective
<i>Protectiveness Statement:</i> The interim groundwater remedy at OU-1 is protective of human health and the environment. Hydraulic containment of shallow groundwater within the barrier is established, and the extracted groundwater is being treated. ICs restricting the potable use of groundwater are in place, and deed restrictions will be placed on the property Site if and when it is sold.	

Protectiveness Statement(s)	
<i>Operable Unit:</i> 2,3	<i>Protectiveness Determination:</i> Will be Protective
<i>Protectiveness Statement:</i> The remedies at OU-2 (waste pile soils) and OU-3 (cap) are expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risk are being controlled. The final remedy for the remaining portions of OU-2 has not yet been constructed.	

VIII. NEXT REVIEW

The next FYR report for the Standard Chlorine of Delaware, Inc. Superfund Site is required five years from the completion date of this review.

FIGURES



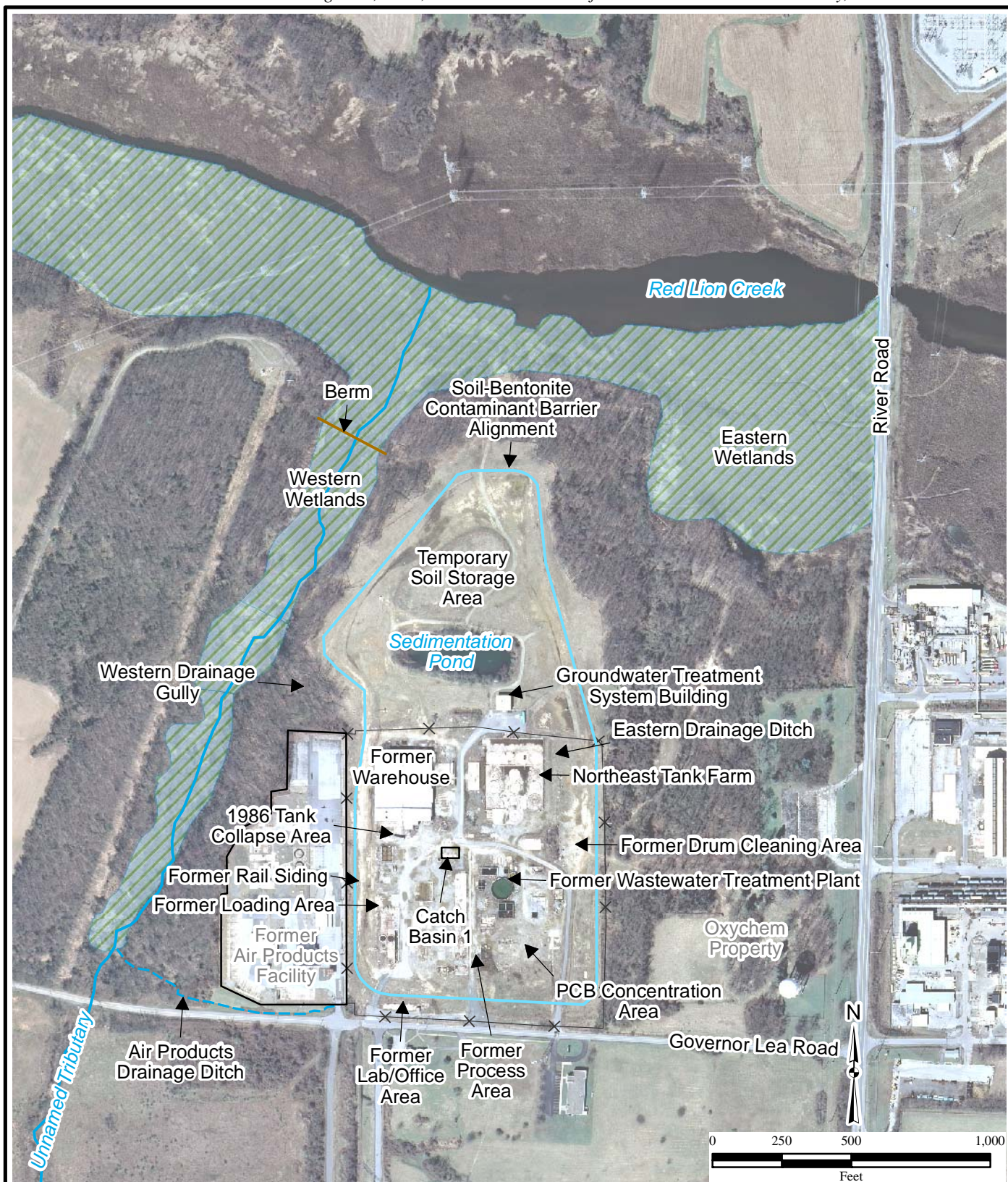
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7/15/2016 TB
Source: HGL
ESRI Online Aerial Imagery

Legend

--- Approximate Site Boundary

Figure 1
Site Location Map
Standard Chlorine
of Delaware, Inc.
Superfund Site





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Source: HGL
USGS aerial imagery dated 2010



Legend



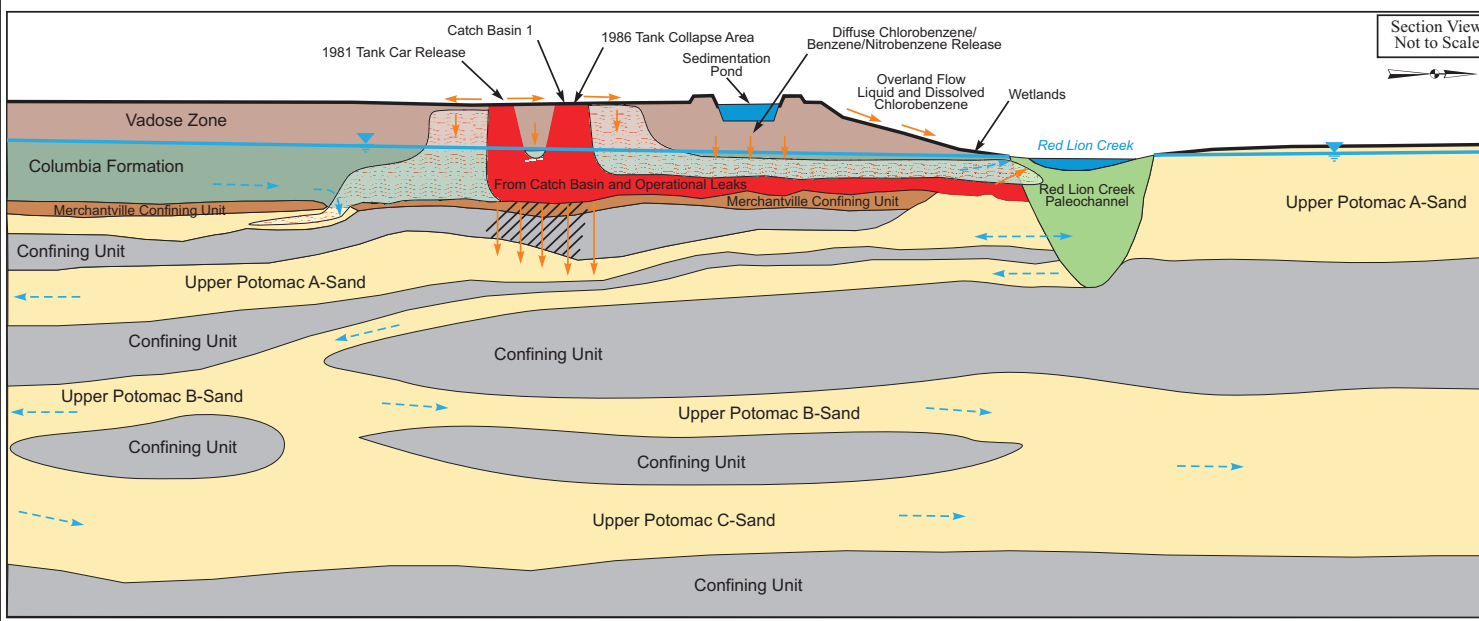
- ×—— Former Facility Area Fence
-  Wetland
-  Soil-Bentonite Barrier

Figure 2
Site Layout
Current and Former
Features

Figure 3
Graphical Conceptual Site Model



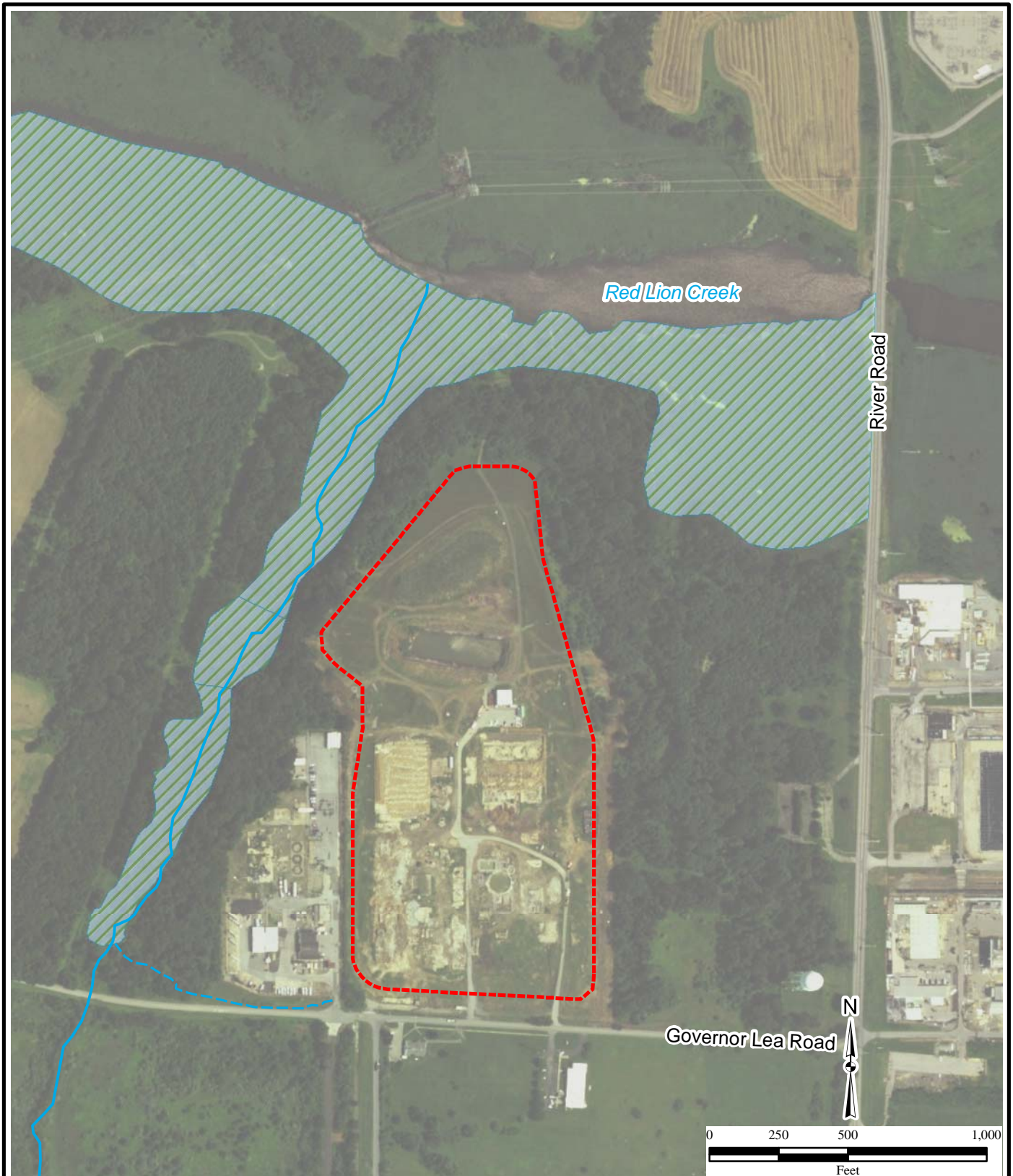
- Legend**
- Site Boundary
 - Containment Barrier
 - Groundwater Table (Generalized)
 - Groundwater Flow (Generalized)
 - Contaminant Pathway (Generalized)
 - Separate-Phase Contamination
 - Dissolved and Vapor-Phase Contamination
 - Vadose Zone
 - Columbia Formation
 - Merchantville Confining Unit
 - Merchantville Formation Thin or Absent
 - Sand
 - Confining Unit
 - Confining Unit Thin or Absent
 - Paleochannel

Notes:
All locational information on this figure is conceptual or approximate. See text for discussion.
Aerial Photograph Date: March 19, 2011.
Hydrostratigraphy is a generalized version of information in Brayton et al. (2004).

PCB=polychlorinated biphenyl

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7/28/2015 TB
Source: HGL





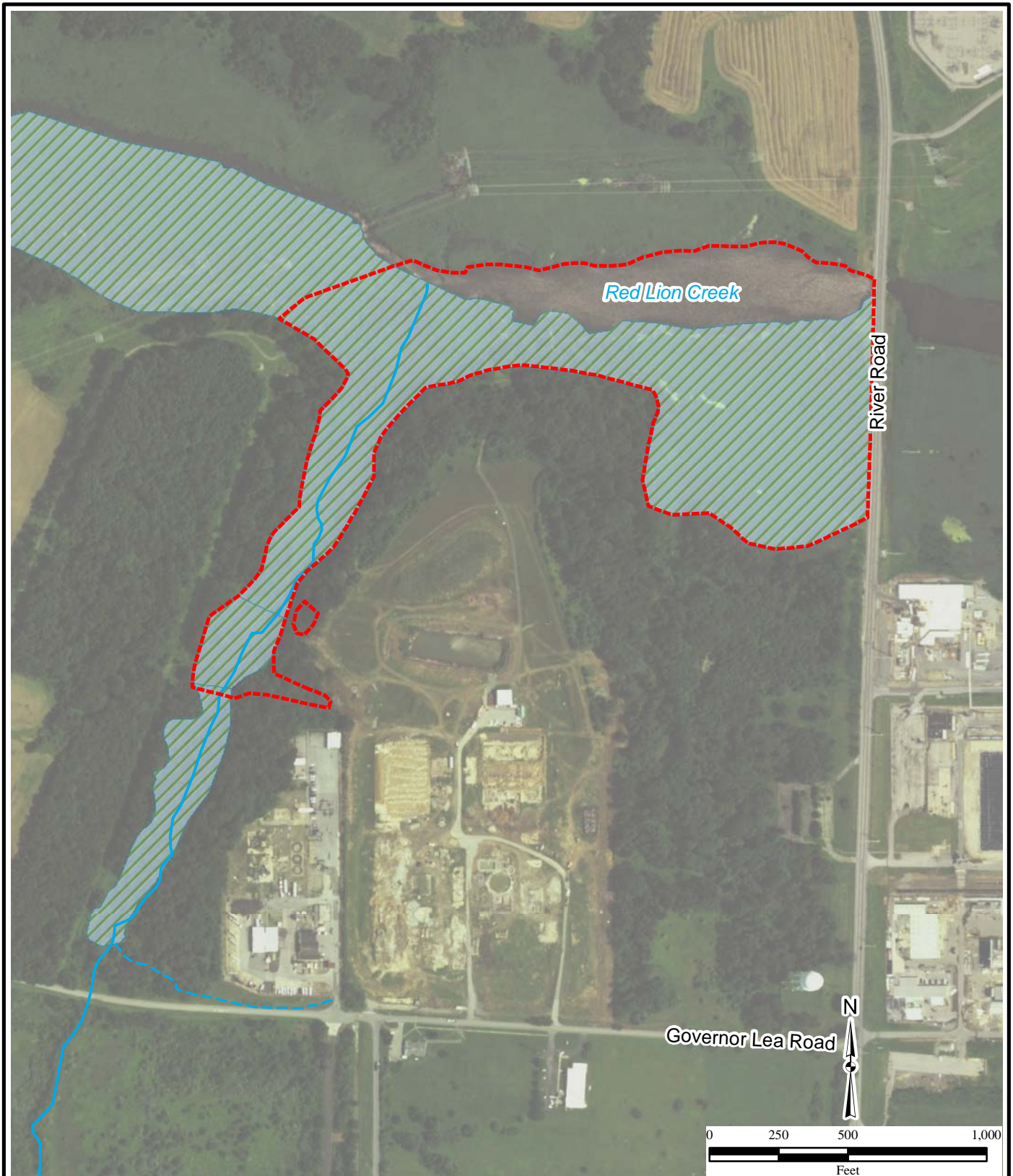
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Source: HGL
ArcGIS Online Imagery

Legend

- Approximate Extent of Operable Unit
- Wetland

Figure 4
Operable Unit 1





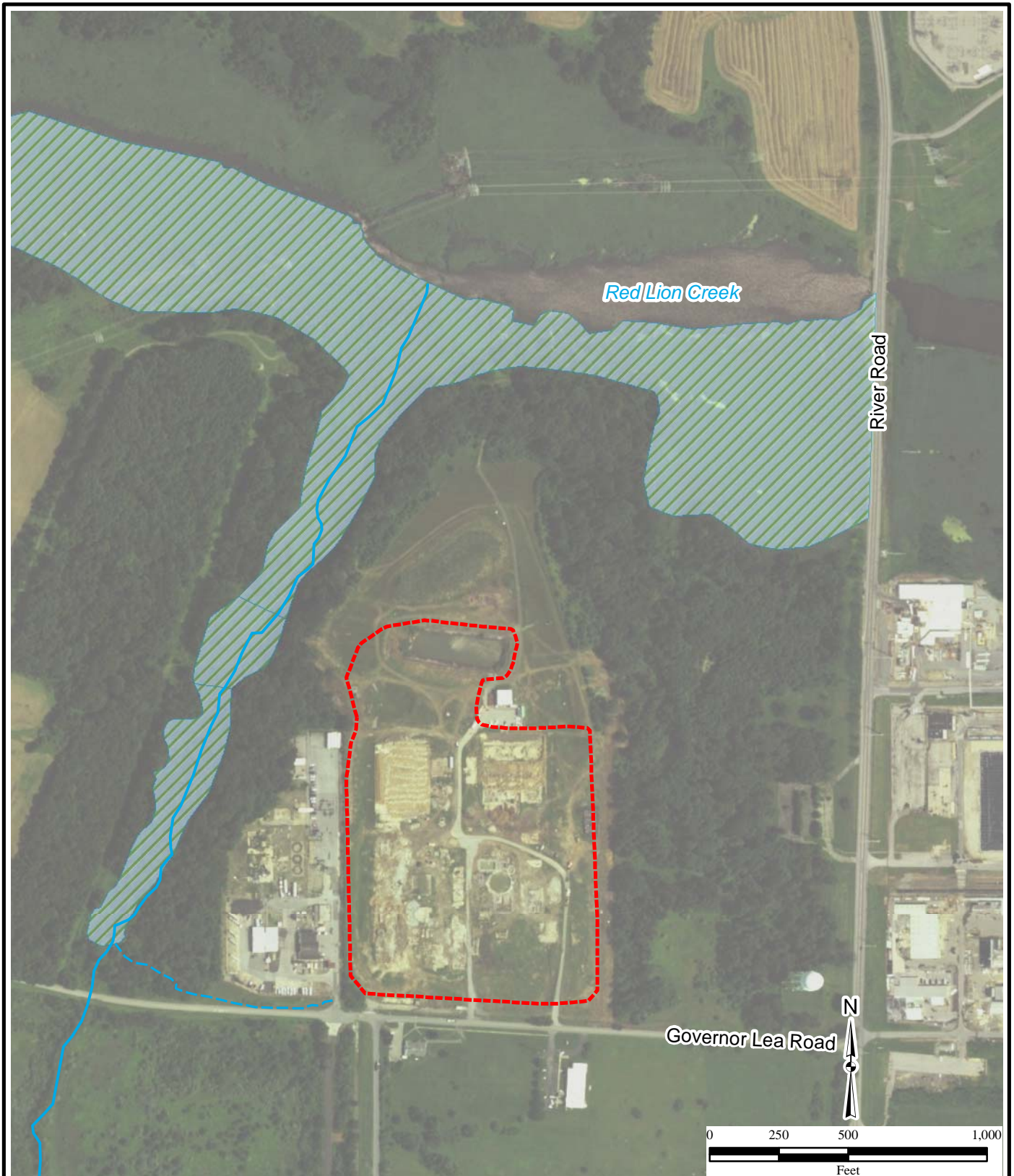
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Source: HGL
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Legend

- Approximate Extent of Operable Unit
- Wetland

Figure 5
Operable Unit 2





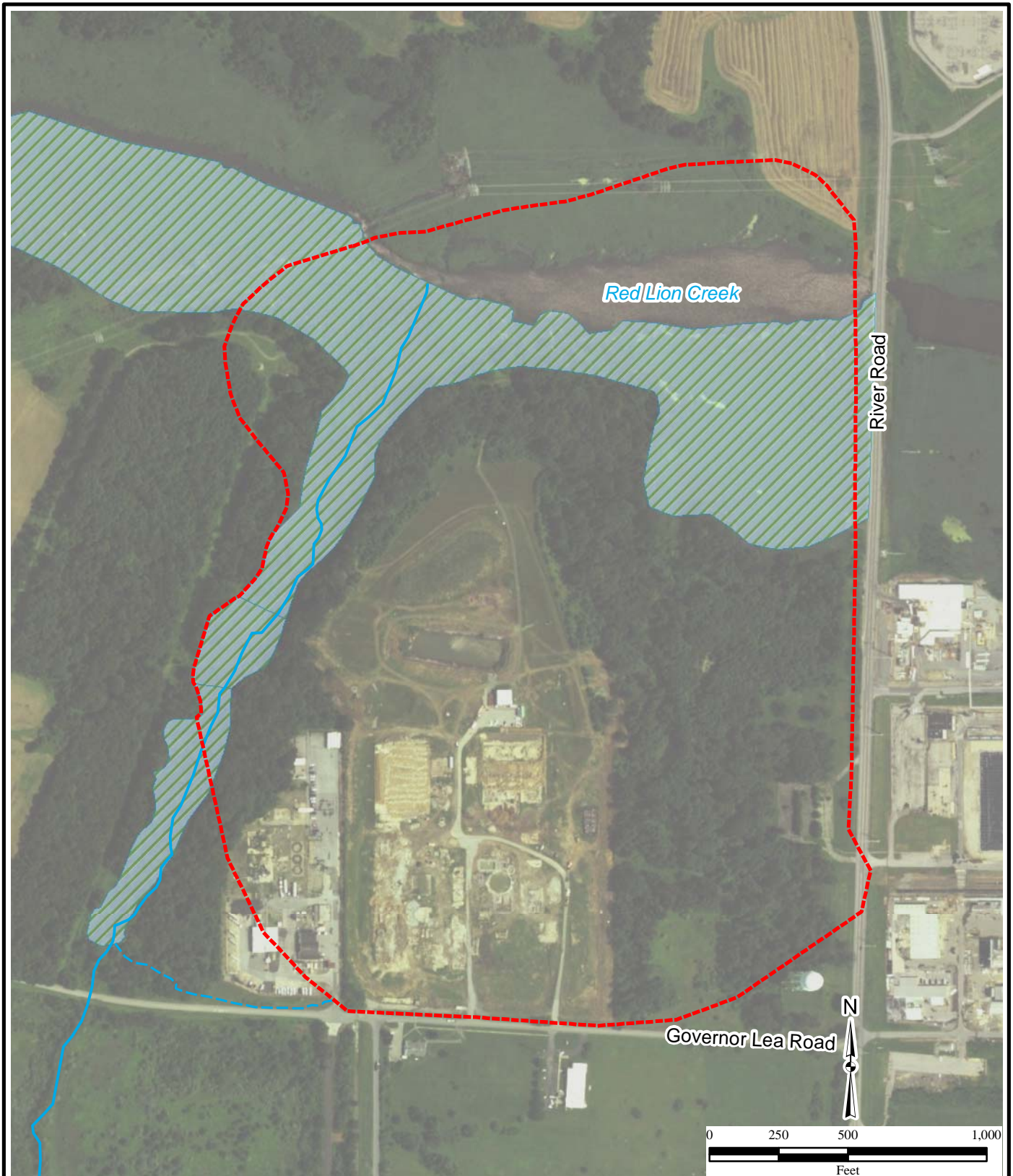
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Source: HGL
ArcGIS Online Imagery

Legend

- Approximate Extent of Operable Unit
- Wetland

Figure 6
Operable Unit 3





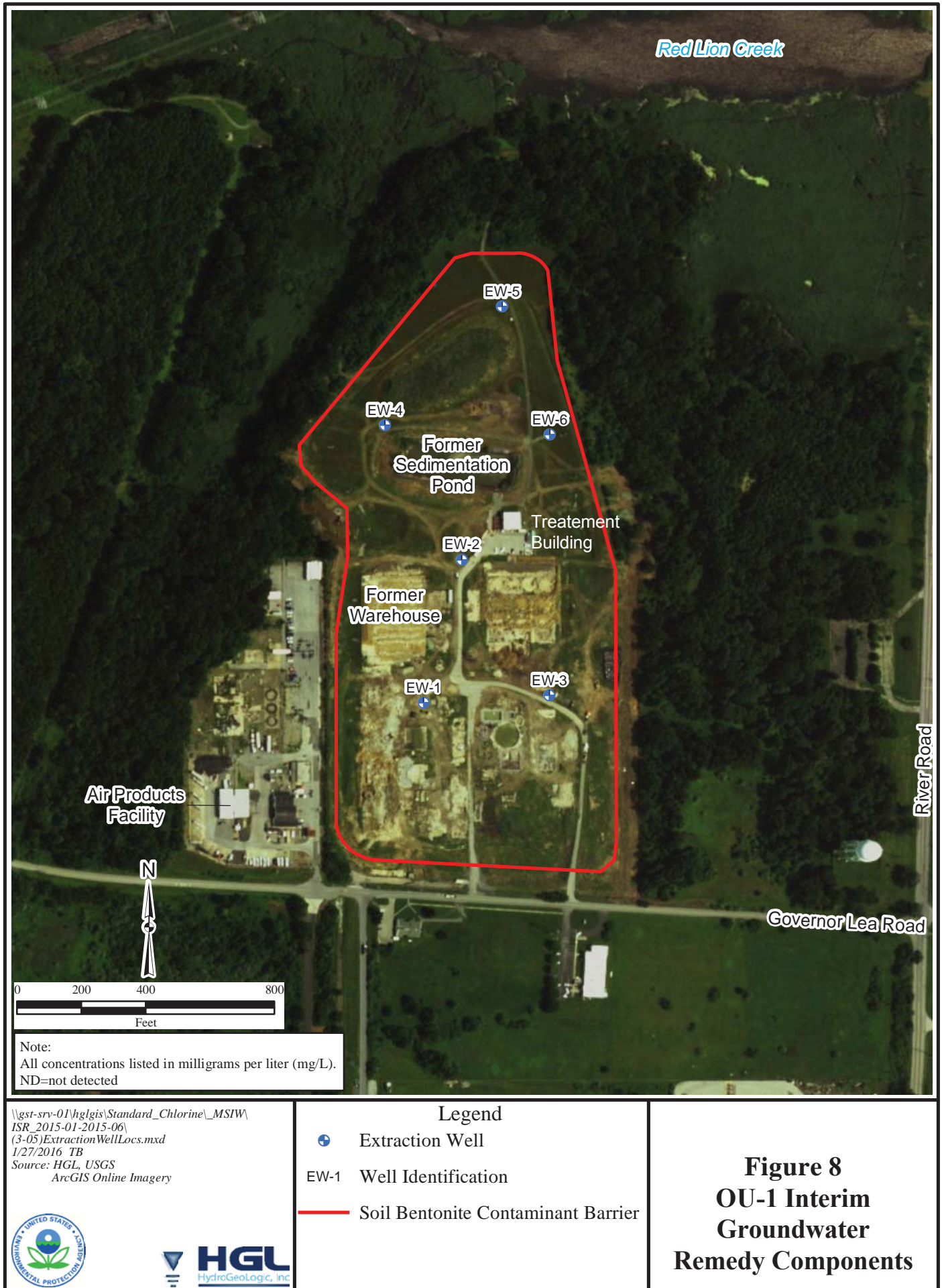
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Source: HGL
ArcGIS Online Imagery

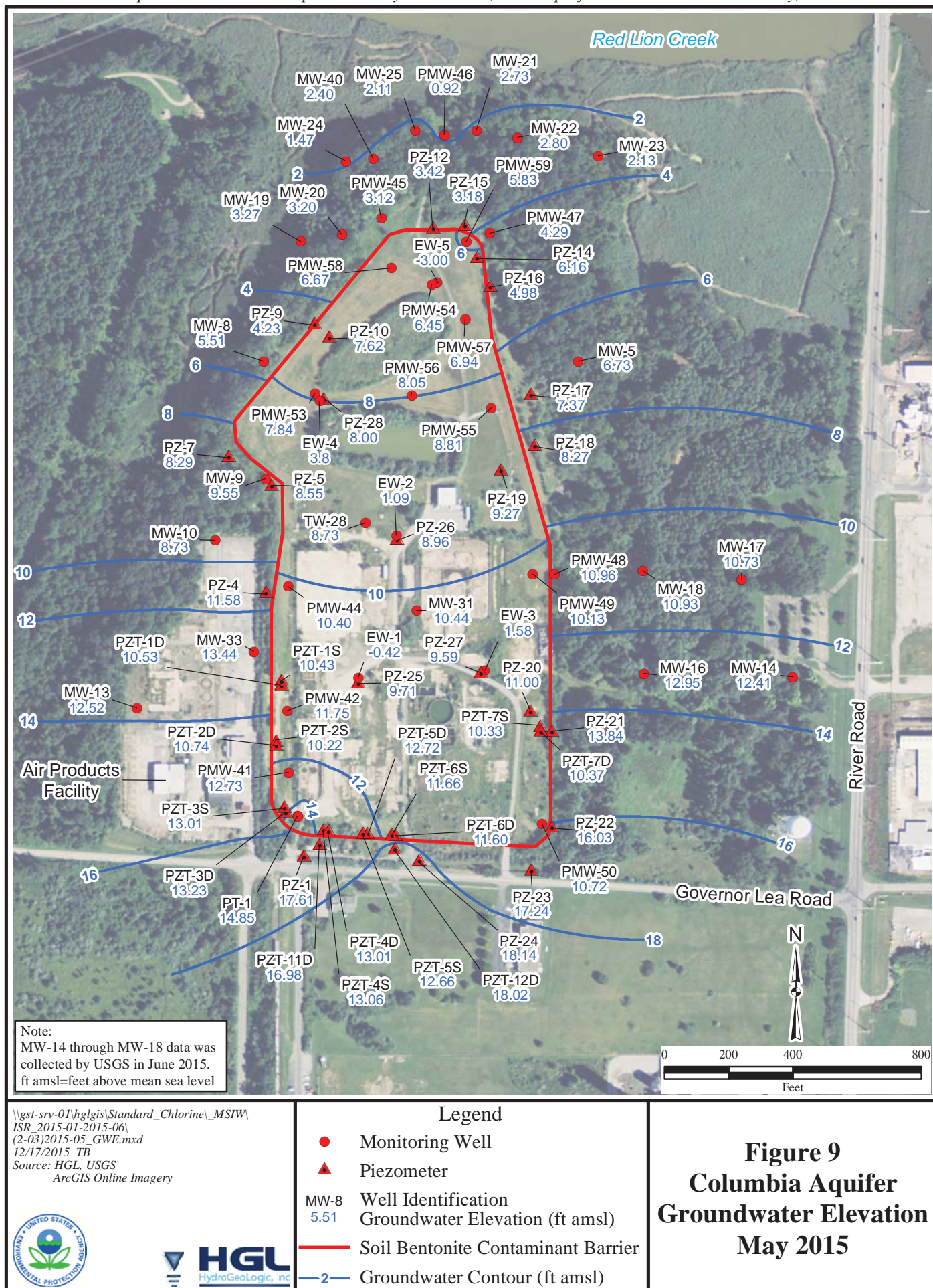
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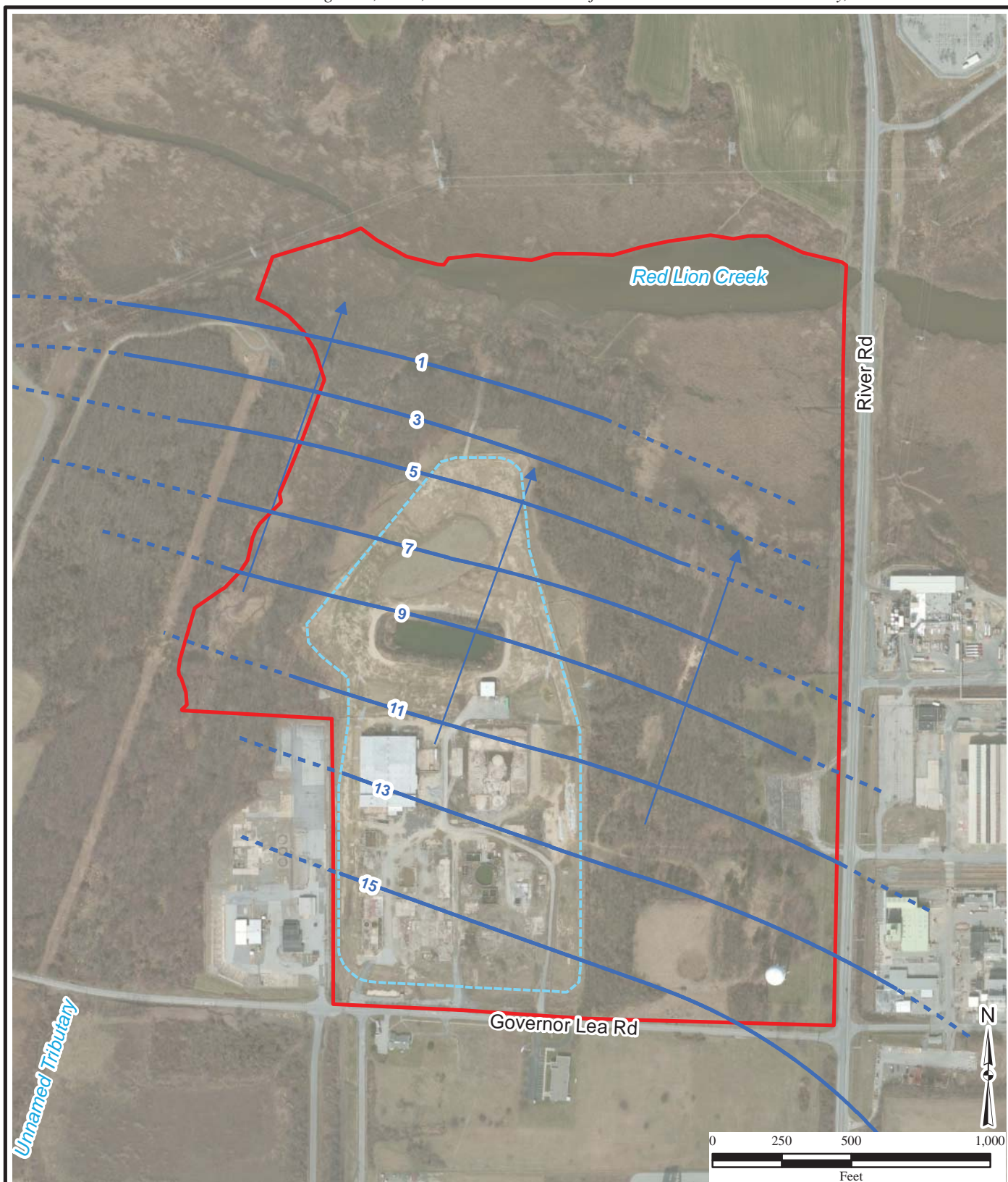
- Approximate Extent of Operable Unit
- Wetland

Figure 7
Operable Unit 4









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7/30/2015 TB
Source: HGL,
USGS aerial imagery dated 2010,
After Brayton et al. (2014)

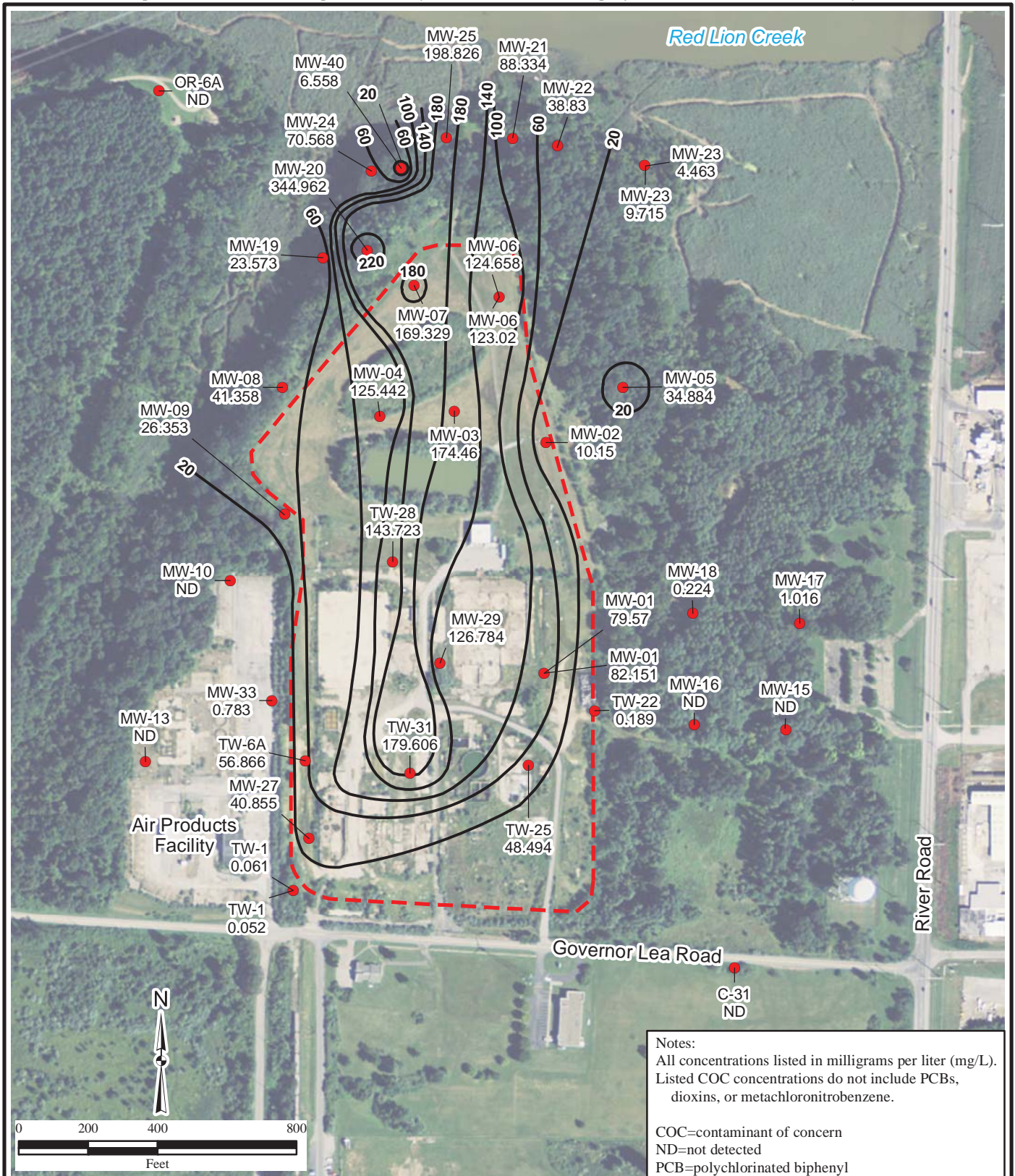


Legend

- 3.0— Groundwater Elevation (dashed where inferred, feet amsl)
- ➔ Generalized Groundwater Flow
- - - Soil-Bentonite Barrier (Not Yet Installed)
- ▭ Site Boundary

Notes:
ft=feet
amsl=above mean sea level

Figure 10
Groundwater
Elevations - Columbia
Aquifer Prior to Slurry
Wall Installation May
13, 2006

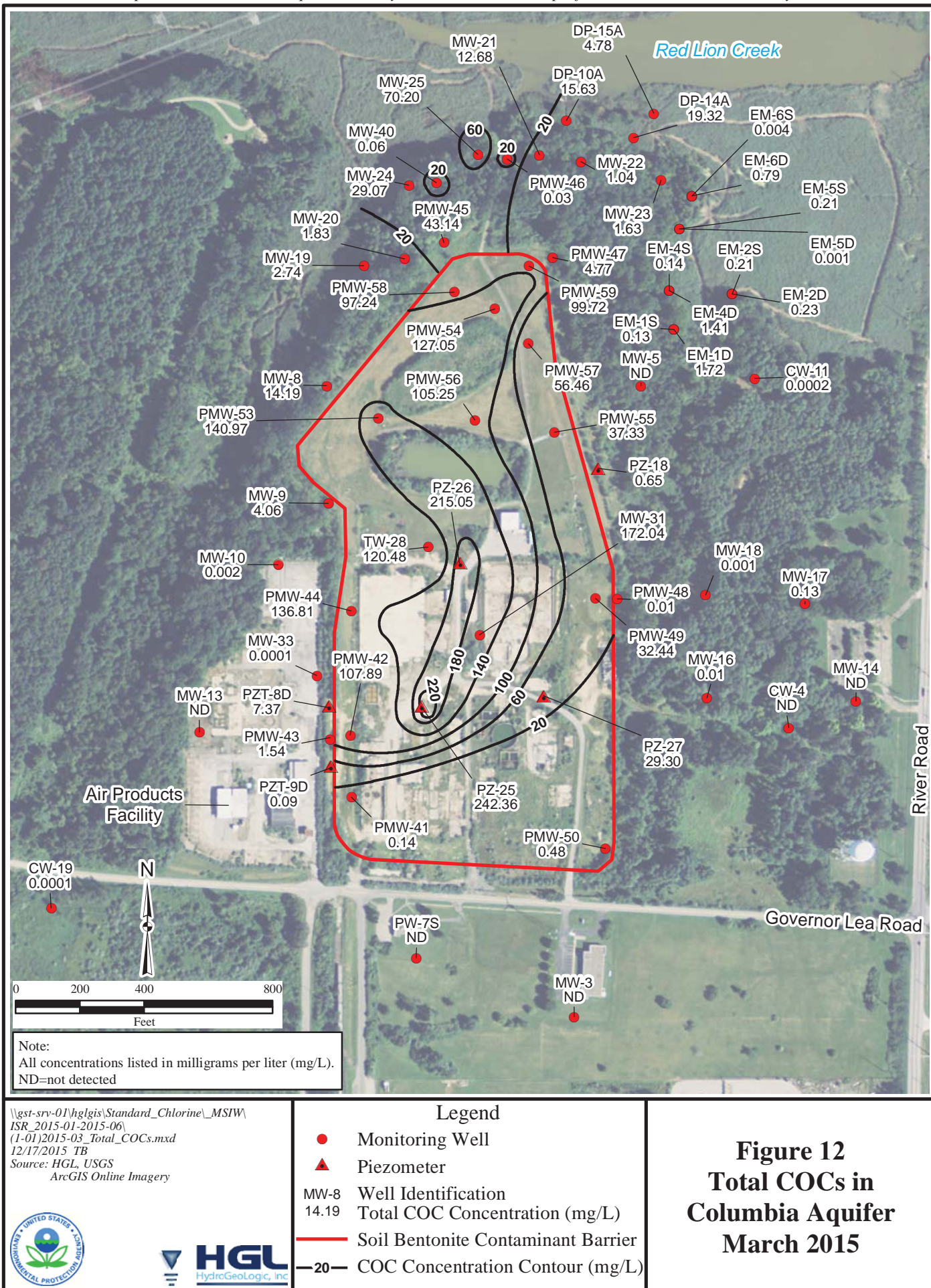


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 11/6/2015 TB
 Source: HGL, USGS
 ArcGIS Online Imagery



- Legend**
- Monitoring Well
 - MW-5 Well Identification
 - 34.884 Total COC Concentration (mg/L)
 - - - Future Soil Bentonite Contaminant Barrier
 - 20- COC Concentration Contour (mg/L)

Figure 11
Total COCs
in Columbia Aquifer
June 2004



REFERENCE LIST

Comprehensive Five Year Review Guidance, U.S. EPA, OSWER No. 9355.7-03B-P, June 2001.

Explanation of Significant Differences, SCD Superfund Site, March 2008.

Hydrogeologic Framework, Hydrology, and Refined Conceptual Model of Groundwater Flow for Coastal Plain Aquifers at the Standard Chlorine of Delaware, Inc. Superfund Site, U.S. Geological Survey, 2015.

Final Remedial Design for Operable Unit 3, SCD Superfund Site, June 2012.

Five Year Review, Standard Chlorine of Delaware, Inc. Superfund Site, July 2011.

Memorandum of Agreement for Delaware City Industrial Area, Delaware Department of Natural Resources and Environmental Control, April 2008.

Memorandum to Site File, SCD Superfund Site, August 2011.

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Record of Decision Amendment, SCD Superfund Site, September 2004.

Record of Decision, SCD Superfund Site, September 2010.

Record of Decision Amendment No. 2, SCD Superfund Site, February 2016.

Remedial Action Implementation Status Report, January to June 2015, SCD Superfund Site, February 2016.

Slurry Wall Leakage Assessment Report, SCD Superfund Site, December 2013.

Slurry Wall Test Report, SCD Superfund Site, January 2015.

Soil/Sediment Design Comparison Study, SCD Superfund Site, June 2003