U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION III

RECORD OF DECISION

Sharon Steel/Fairmont Coke Works Superfund Site
Fairmont, Marion County, West Virginia

December 2017

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
BRA	Baseline Risk Assessment
BJS	Big John's Salvage-Hoult Road Superfund Site
BTU	British Thermal Units
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHA	Coke Handling Area
COC	Contaminant or Chemical of Concern
COPC	Contaminant or Chemical of Potential Concern
CSA	Coal Storage Area
CSM	Conceptual Site Model
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
FCW	Fairmont Coke Works
FCT	Fairmont Coke Works Site Custodial Trust
FCLP	Fairmont Community Liaison Panel
FPA	Former Process Area
FWMA	Former Waste Management Area
ft	feet
GW/SW	Ground Water/Surface Water
HI	Hazard Index
HQ	Hazard Quotient
HHRA	Human Health Risk Assessment
ICs	Institutional Controls
IEUBK	Integrated Exposure Uptake Biokinetic
IRIS	Integrated Risk Information System
ISCO	In-situ Chemical Oxidation
LOS	Light Oil Storage Area
LT/PRB	Limestone Trench/Permeable Reactive Barrier
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation
MW	Monitoring Well
NA	Not Applicable
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priorities List
O&M	Operations Monitoring & Maintenance
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PPRTD	Provisional Peer Reviewed Toxicity Database
PRG	Preliminary Remediation Goal
RfD	Reference Dose
RfC	Reference Concentration
RAO	Remedial Action Objective

RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RME	Reasonable Maximum Exposure
S	Soil/Sediment
SLERA	Screening Level Ecological Risk Assessment
SL	Slope Factor
TBC	To-Be-Considered
U.S.C.	United States Code
µg/dL	micrograms per deciliter
µg/L	micrograms per liter
VIPA	Vapor Intrusion Protection Area
VOC	Volatile Organic Compound
WVDEP	West Virginia Department of Environmental Protection
WVPDES	West Virginia Pollutant Discharge Elimination System
WVSP	West Virginia State Police
WVSWQS	West Virginia Surface Water Quality Standards

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DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Sharon Steel/Fairmont Coke Works Site
Fairmont, Marion County, West Virginia
National Superfund Database Identification Number: WVD000800441

STATEMENT OF BASIS AND PURPOSE

In this Record of Decision (ROD) the U.S. Environmental Protection Agency (EPA) has selected the final remedy (Selected Remedy or Remedy) for the Sharon Steel/Fairmont Coke Works Site (FCW Site or Site) located in Fairmont, Marion County, West Virginia, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §§ 9601 et seq., and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300 et seq., as amended.

This ROD is based on the Administrative Record for the Site, which has been developed in accordance with Section 113(k) of CERCLA, 42 U.S.C. § 9613(k). This Administrative Record File is available for review online at http://www.epa.gov/arweb, at the EPA Region III Records Center in Philadelphia, Pennsylvania, and at the Marion County Public Library in Fairmont, West Virginia. The Administrative Record Index (Appendix D) identifies each document contained in the Administrative Record upon which the Selected Remedy is based.

The State of West Virginia has concurred with the Selected Remedy.

ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants from this Site which may present an imminent and substantial endangerment to public health or welfare.

DESCRIPTION OF THE SELECTED REMEDY

The Selected Remedy is Alternative 5, Limestone Trench/Permeable Reactive Barrier (LT/PRB); Remediation of Wetlands; Institutional Controls (ICs). The Selected Remedy consists of the following elements:

1. Remediate the plume of contaminated groundwater using a Limestone Trench/Permeable Reactive Barrier at the western end of the Site so that non-point source subsurface discharge to the Unnamed Tributary does not contribute to an exceedance to the West Virginia Water Quality Standards appropriate for secondary use recreation and protection of aquatic life. Additionally, the concentration of manganese in surface water must achieve

its risk-based Performance Standard for protection of recreational use (children). The specific Performance Standards are shown below:

•	pH	6-9	
•	iron	1.5	milligrams per liter (mg/L)
•	aluminum	0.75	mg/L
•	cyanide (as free cyanide HCN+CN-)	22	micrograms per liter (µg/L)
•	benzene	51	µg/L
•	manganese	6*	mg/L

* risk-based standard for recreational use (child)

2. Apply amendment of organic material capable of reducing bioavailability of inorganic contaminants of concern (COCs) to Wetland Areas 1 and 3. The specific amendments and application rates will be determined during the Remedial Design. Disturbed areas will be seeded with a native wetland seed mix. Wetland Area 2 does not warrant remediation due to its small size, inconsistent hydrology, and limited ecological functions.

3. Maintain existing ICs preventing residential land use and the extraction of groundwater from the aquifer beneath the Site for use as a potable water source. Additional ICs will be implemented to require vapor mitigation for any new habitable buildings constructed within the Vapor Intrusion Protection Area (VIPA) (Figure 9) unless a building-specific vapor intrusion evaluation determines mitigation to be unnecessary. The default pre-emptive vapor mitigation will include, at a minimum, a foundation vapor barrier and subsurface piping for a passive subslab venting system that can be converted to an active sub-slab depressurization system if necessary. Prior to occupancy, indoor air samples will be collected from within the building to confirm the efficacy of the passive venting system. If indoor air sample concentrations are equal to or exceed EPA risk-based criteria, the passive venting system will be activated and operated as an active subslab depressurization system, until such time as EPA, in consultation with the West Virginia Department of Environmental Protection (WVDEP), determines that the subsurface contamination no longer poses a vapor intrusion risk. ICs will also identify the VIPA as an area where construction workers required to work in a subsurface trench may be subject to conditions where a hazardous atmosphere could reasonably be expected to exist and standard precautions such as OSHA-mandated protocol to provide ventilation and proper respiratory protection would be required. In addition, ICs will prohibit any activity that would interfere with the operation of the LT/PRB and groundwater monitoring wells.

4. Long-term groundwater, surface water and pore water monitoring to measure the performance of the LT/PRB in accordance with the EPA-approved design. Long-term groundwater monitoring will also be required at the perimeter of the Site to confirm that groundwater with COCs exceeding Maximum Contaminant Levels (MCLs) or risk-based goals remains within the Site boundary.

The estimated timeframe to reach the Performance Standards for the Selected Remedy is 4 years. The cost is estimated to be $2,798,000.

STATUTORY DETERMINATION

The Selected Remedy is protective of human health and the environment; complies with all Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action; is cost-effective; and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This Remedy also satisfies the statutory preference for treatment as a principal element of the Remedy, because the Remedy reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants, as a principal element through treatment.

The Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow unlimited use and unrestricted exposure. Therefore, a statutory review of the Site will be conducted no less often than every five years after initiation of remedial action in accordance with Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), to ensure that the Remedy is, and will be, protective of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary of this ROD, while additional information can be found in the Administrative Record File for the Site:

- Contaminants of concern (COCs) and their respective concentrations;
- Baseline risk represented by the COCs;
- Cleanup levels established for COCs and the basis for these levels;
- How source materials constituting principal threats are addressed;
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD;
- Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy;
- Estimated capital, annual operation, monitoring and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the Remedy cost estimates are projected; and
- Key factors that led to selecting the Remedy.

AUTHORIZING SIGNATURE

This ROD documents the Selected Remedy at the FCW Site and is based on the Administrative Record for the Site. EPA selected this Remedy with the concurrence of WVDEP. The Director of the Hazardous Sites Cleanup Division for EPA Region III hereby approves this ROD.

Karen Melvin

Karen Melvin, Director
Hazardous Site Cleanup Division
EPA Region III

DEC 19 2017

Date

DECISION SUMMARY

This Record of Decision (ROD) is issued by the United States Environmental Protection Agency (EPA), the lead agency for the Sharon Steel/Fairmont Coke Works Site (FCW Site or Site) under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C. F. R. Part 300, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, (CERCLA), in consultation with the West Virginia Department of Environmental Protection (WVDEP), the support agency. The National Superfund Database Identification Number for the Site is WVD000800441. This ROD is based on documents contained in the Administrative Record file for the Site. The Administrative Record can be viewed online at https://semspub.epa.gov/src/collections/03/AR/WVD000800441, and select the **Remedial** Collection Description.

1.0 SITE NAME, LOCATION, AND DESCRIPTION

The FCW Site is located in Fairmont, Marion County, West Virginia (Figure 1). The Site consists of 97 acres along the southern edge of Suncrest Boulevard approximately 1,600 feet east of the Monongahela River. The FCW Site (Figure 2) is south-southeast of, and adjacent to, the Big John's Salvage Superfund Site (BJS Site). Approximately 55 acres of the FCW Site was used for historical industrial operations. Approximately 7 acres located along the periphery to the north and northeast was formerly residential and commercial properties that were purchased and incorporated into the FCW Site. The remaining 35 acres include a wooded hillside that descends to the Monongahela River at the western portion of the FCW Site. The geographic coordinates of the approximate center of the Site are +39.493610 degrees north latitude, and -80.114440 degrees west longitude. The western drainage from the FCW Site shares a common drainage system (the Unnamed Tributary) with the BJS Site.

The extent of contamination from the FCW Site includes the developed portions of the Site property and extends into the Monongahela River downstream (north) of the Site. Land surrounding the FCW Site is a mixture of industrial, commercial and residential properties. In 2013, the Fairmont Armed Forces Reserve Center (National Guard Armory) was constructed along the southern boundary of the Site. Lafayette Street was extended across the center of the Site where it intersects with 201st Artillery Drive, providing access to the National Guard Armory. In April 2017, the West Virginia State Police Troop 1 Headquarters (WVSP) was constructed and began operations on an approximately 3-acre parcel in the southern portion of the Site. Current and future land use of the FCW Site is subject to existing deed restrictions prohibiting residential use. The reasonably anticipated future land use at the FCW Site is commercial/civic, light industrial or recreational. All residential, commercial and governmental properties in the area are served by the public water supply drawn from the Monongahela River and processed through a filtration plant prior to distribution.

All environmental investigations and response actions undertaken at the Site from September 1997 through the present have been funded by ExxonMobil Corporation (ExxonMobil) in accordance with Administrative Orders on Consent discussed in more detail below. ExxonMobil prepared the Remedial Investigation/Feasibility Study (RI/FS) and provided technical assistance to EPA throughout the process.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The "Proposed Rule" proposing the Site to the National Priorities List (NPL) was published in the *Federal Register* on June 17, 1996. The "Final Rule" adding the Site to the NPL was published in the *Federal Register* on December 23, 1996 (61 Fed. Reg. 67656).

2.1. History of Activities that Led to Contamination

In 1918, Domestic Coke Corporation, a predecessor of ExxonMobil purchased the FCW Site for the construction and operation of a 60-oven by-product coke facility (Coke Plant or Plant). Domestic Coke Corporation operated the Coke Plant from 1920 through 1948. Sharon Steel Corporation (Sharon Steel) acquired the property and Plant in 1948 and operated it until 1979, when the facility shut down. In 1991, Sharon Steel filed for bankruptcy and ownership of the Site was transferred to FAC, Inc., a subsidiary of Sharon Steel. In June 1998, Green Bluff Development, Inc. (Green Bluff), a subsidiary of ExxonMobil, purchased the Site to facilitate cleanup.

During operation, the Coke Plant processed approximately 1,000 tons of coal daily to produce coke. By-products were produced from the coke-making process and included coal tar, phenol, ammonium sulfate, benzene, toluene, xylene, and coke oven gas. Process facilities included: coke ovens, coal and coke handling facilities, by-product recovery structures, coal tar tanks, other product and production intermediate tanks, gas scrubbers, and machinery and maintenance buildings. Coal tar was sold to Reilly Tar and Chemical Corporation (located on the adjacent property now referred to as the BJS Site). Coke oven gas was distributed by the local utility company.

Plant wastes were disposed of in on-Site landfills, sludge ponds, and waste piles located at the western portion of the Site. From 1920 through 1979 solid wastes were deposited in two on-Site landfills: the North Landfill and the South Landfill. Starting in the early 1960s, process water from the Coke Plant was treated in two wastewater oxidation impoundments. The impoundments were constructed along a former drainage ditch on the west end of the Plant production area and discharged to Sharon Steel Run. Tar sludge from the oil recovery operations was placed in a pit referred to as the Waste Tar Pit, located in the central plant area (northeast area of the Site) near the decanter tanks. Breeze (fine grained residue from coal and coke handling) was deposited in the Breeze Pile, adjacent to the North Landfill.

2.2. History of Previous Environmental Investigations and Removal Actions

EPA Removal Actions

At the request of the West Virginia Department of Natural Resources (WVDNR), which later changed its name to the West Virginia Department of Environmental Protection (WVDEP), EPA completed a removal assessment at the Site. Based on that assessment, from May 1993 through August 2, 1996, EPA completed an emergency removal action at the FCW Site to stabilize the Site. During this removal action EPA removed the contents of approximately 250 containers of unknown laboratory chemicals and several large above-ground tanks. EPA disposed of suspected asbestos-containing building materials, approximately 650 gallons of PCB-containing oil, and separated and disposed approximately 26,100 gallons of emulsified oil from water remaining on-Site. EPA treated and properly disposed of approximately 1.5 million gallons of benzene-contaminated water from the FCW Site. Several large tanks were decontaminated and dismantled. Other response actions performed by EPA included, but were not limited to, consolidation, re-grading and temporary containment of various waste materials to minimize erosion from the Site while EPA could plan for a more comprehensive cleanup. The FCW Site was listed on the NPL on December 23, 1996.

ExxonMobil Removal Actions

On September 17, 1997, EPA and ExxonMobil entered into an Administrative Order on Consent for Remedial Investigation/Feasibility Study (RI/FS), EPA Docket No. III-97-103-DC (RI/FS Order). Shortly thereafter, ExxonMobil proposed that EPA consider an alternative strategy for the investigation, risk assessment and selection and implementation of the response action at the FCW Site. For a description of this alternative strategy, see Overview of Project XL Cleanup Approach on Page 9. With WVDEP concurrence, EPA approved ExxonMobil's proposal to conduct a non-time critical removal to address the major source areas to be followed by an RI/FS and ROD to address contaminated groundwater and any other concerns which may exist due to post-removal residual contamination. On December 11, 1998 EPA and ExxonMobil entered into a Removal Order on Consent, EPA Docket No. III-99-0004-DC (Removal Order). Issuance of the Removal Order temporarily suspended the requirements of the RI/FS Order until after the non-time-critical removal action activities were complete.

ExxonMobil prepared and implemented an Expanded Site Investigation Work Plan pursuant to the Removal Order. The Site was divided into two geographic areas: Former Waste Management Area (FWMA) and the Former Process Area (FPA). The FWMA, located on the northwestern portion of the Site, included two landfills (north and south), oxidation ponds, a sludge impoundment and an area known as the breeze wash out area (Figure 2). The FPA, located on the southeastern portion of the Site, included the former production area, the coke ovens and the Light Oil Storage (LOS) Area.

ExxonMobil conducted Engineering Evaluations/Cost Analysis (EE/CAs) at the FWMA and FPA in two phases, with Phase I at the FWMA and Phase II at the FPA. Both Phase I and Phase II EE/CAs were conducted by ExxonMobil with EPA and WVDEP oversight. Action Memoranda approving the Phase I and Phase II EE/CAs were issued by EPA on June 6, 2000 and July 23, 2003, respectively.

The Phase I Action Memorandum selected the following response action:

- Excavate waste materials and contaminated soils from the North Landfill, the Breeze Washout Area, the Sludge Impoundment and Former Oxidation Pond;

- Excavated materials with a high British Thermal Unit (BTU) value will be segregated and transported to an off-Site energy recycling facility;
- Excavated materials and soil exceeding Site-specific cleanup standards that are not amenable to the BTU recycling process will be consolidated into the South Landfill; and,
- Construct a multi-layered cap that meets the substantive requirements of Resource Conservation and Recovery Act (RCRA) Subtitle C at the South Landfill.

Prior to issuance of the Phase II Action Memorandum, ExxonMobil completed pilot-scale treatability studies indicating that most of the waste materials and contaminated soil in the FWMA, including the South Landfill, were amenable to recycling for energy recovery through an on-Site treatment/blending process. The BTU-rich wastes could be recycled to generate a synthetic coal fuel product (synfuel). Subsequently, EPA approved ExxonMobil's proposal to excavate and segregate wastes from the South Landfill, in addition to other source areas in the FWMA for recycling, thereby rendering the multi-layered cap unnecessary.

The Phase II Action Memorandum selected the following response action:

- Excavate designated hot spot areas in the FPA exceeding Site-specific soil cleanup standards;
- Evaluate excavated materials from both FWMA and FPA for inclusion with the on-Site recycling process used to generate synfuel; and,
- Transport excavated waste and contaminated soil not amenable to the BTU recycling process off-Site to appropriately permitted treatment and/or disposal facilities.

The response actions outlined in the Phase I and Phase II Action Memoranda began in 2003 and were completed in September 2011. Major components of the removal action include excavation and recycling, and treatment and/or disposal of wastes and contaminated soils exceeding Site-specific cleanup standards from the FWMA and the FPA. See Attachment A for Soil Site-Specific Cleanup Standards established for removal actions. In addition, materials were excavated from the LOS Area and the Coal Storage Area (CSA) and Coke Handling Area (CHA). All off-site treatment and/or disposal activities were carried out in accordance with CERCLA § 121(d)(3) and 40 Code of Federal Regulations (CFR) § 300.440. During the period of February 2003 through December 2010, the following material was removed from the Site:

- 6,943.46 tons of high BTU waste materials was shipped off-Site for energy recovery to the Piney Creek Power Plant in Clarion, PA;
- 24,095.35 tons of contaminated soil determined to be RCRA-characteristic hazardous waste were shipped to RCRA-permitted facilities for treatment and/or disposal;
- 214,246.32 tons of contaminated but non-hazardous soils and debris were disposed of at appropriately permitted landfills; and
- 486,110.87 tons of synthetic fuel were generated by blending excavated wastes from Site landfills with coal and other amendments. This blended material was tested and it was determined that it was not a RCRA-characteristic waste. The product was subsequently shipped off-Site for energy recovery at the Grant Town Power Plant in Grant Town, WV.

A systematic post-excavation confirmation sampling program was conducted using 50 feet (ft) by 50 ft grids to demonstrate that source removal and risk reduction goals were achieved. Detailed descriptions of the removal actions completed are available in the following area-specific reports:

- Former Process Area Closeout Report (July 2011)
- Former Waste Management Area Closeout Report (August 2011)
- Former Light Oil Storage Area Closeout Report (August 2011)
- Coal Storage Area/Coke Handling Area Hot Spot Removal Report (July 2010)
- Final Pollution Report #455 (September 28, 2011)

The soil removal actions were performed to achieve risk-based cleanup standards that were established for various areas of the Site (Attachment A). Removal actions were completed in the North and South Landfills and the Byproducts Area to achieve site-specific cleanup standards established in the Action Memoranda for the protection of human health and underlying groundwater. Additional contaminants were added to the cleanup standards as new information became available during excavation activities to increase the likelihood that the Site could be safely reused when the removal was completed. The primary COCs driving the removal activities were benzene, naphthalene, polycyclic aromatic hydrocarbons (PAHs) such as benzo (a) pyrene, and arsenic.

As planned, after completion of Non-Time Critical Removal work the temporary suspension of the RI/FS Order was lifted on September 28, 2011. The RI/FS was performed in accordance with the RI/FS Work Plan approved by EPA on August 30, 2012, as amended, to address contaminated groundwater and any other remaining residual contamination requiring action to mitigate unacceptable risk to human health and the environment. A description of the RI findings is summarized below in Section 5.0 (Site Characteristics).

2.3. History of Enforcement Activities

The following is a summary of enforcement actions taken at the Site:

Sharon Steel filed for bankruptcy on November 30, 1992 and was subsequently liquidated. FAC, Inc., a subsidiary of Sharon Steel, became the Site property owner of record. In September 1993, EPA issued General Notice Letters to Sharon Steel informing it of potential liability for response costs at the FCW Site and received no response.

In April 1997, EPA issued General/Special Notice Letters to ExxonMobil informing it of its potential liability for response costs and inviting ExxonMobil to perform an RI/FS at the FCW Site. On September 17, 1997, EPA and ExxonMobil entered into an RI/FS Order.

Green Bluff, a subsidiary of ExxonMobil created for the sole purpose of expediting the cleanup process, purchased the FCW Site from FAC, Inc. in June 1998.

Overview of Project XL Cleanup Approach
Relevant Modifications to Standard Superfund Protocol

On May 24, 1999, ExxonMobil, EPA, WVDEP and local stakeholders including the City of Fairmont entered into a formal Project XL (e**X**cellence and **L**eadership) Agreement[1] to use a modified approach from the standard Superfund process at the Sharon Steel/Fairmont Coke Works Site (FCW Site). EPA's Project XL Program was a national pilot program developed to test innovative environmental management strategies to achieve better and more cost-effective environmental and public health protections. The concept at the FCW Site was to streamline the cleanup by working directly with the local community to envision a future redevelopment objective for the property and to work "smartly" to make the vision a reality. In addition to meeting the threshold protection requirements outlined in the NCP, ExxonMobil agreed to undertake beneficial restorative actions which were beyond EPA's authority to require under CERCLA. In return, EPA agreed to provide regulatory flexibility within its discretion rather than strict adherence to the traditional Superfund process.

Actions performed by ExxonMobil to obtain superior environmental benefit include:

- Enhanced stakeholder involvement in decision making through formation of the Fairmont Community Liaison Panel early in the process.
- Dismantled and properly disposed the huge dilapidated industrial complex remaining on the abandoned Site to eliminate a barrier to redevelopment, prior to any finding of environmental risk linked directly to structures.
- Acquired the 97-acre Site from previous owner to facilitate expedited response actions.
- Completed large removal actions by excavating wastes and contaminated soil, thereby minimizing legacy on-Site management of contaminated materials and enhancing future redevelopment options.
- Recycled high-BTU wastes excavated from on-Site landfills by creating a synthetic coal product used to generate more than 527,000 megawatts of electricity – enough to power more than 42,000 typical West Virginian homes for one year.

Regulatory flexibilities supported by Stakeholders and accepted by EPA include:

- Future use of the Site would remain commercial/industrial (i.e., no residential land use scenario for the Site).
- The risk assessment process would establish preliminary remediation goals (PRGs) at the 1 x 10^{-4} risk level (the upper boundary of the acceptable risk range) rather than the standard "point of departure" of 1 x 10^{-6} for carcinogens. *As a practical matter, actual risk reduction achieved by past response actions were significantly better.*
- Groundwater beneath the Site would not be used for potable purposes. The "point of compliance" is the Site boundary or the point of surface expression (Unnamed Tributary).

[1] The Project XL Agreement was negotiated between the parties and published in the Federal Register (64 FR 17663, April 12, 1999) for public comment prior to being finalized.

On December 11, 1998, EPA and ExxonMobil entered into a Removal Order temporarily suspending the RI/FS Order until the Removal Response Actions, discussed above, could be completed.

On September 13, 2002, EPA entered into a Consent Decree (Civil Action No. 1:01CV15) with ExxonMobil and Green Bluff, pursuant to Section 107 of CERCLA for reimbursement of $1,500,000 in past response costs.

On January 24, 2003, ExxonMobil and Green Bluff, entered into a Consent Decree with the State of West Virginia (Civil Action No. 1:02CV160) pursuant to CERCLA wherein the settling defendants agreed to, among other things, a) pay the State of West Virginia $500,000 for natural resources damages, b) establish a "Custodial Trust" with $2,000,000 to fund redevelopment at the Site with the State of West Virginia, the designated Trustee, and, c) transfer ownership of the FCW Site to the Custodial Trust to facilitate redevelopment of the Site. Green Bluff transferred ownership of the FCW Site to the Custodial Trust on March 20, 2004.

Prior to transferring property ownership of the Site to the Custodial Trust, Green Bluff, the City of Fairmont and West Virginia Department of Environmental Protection (collectively referred to as the "Parties") established a Declaration of Deed Restrictions (i.e., institutional control) limiting how the Site could be used in the future. The Declaration of Deed Restrictions was modified by the Parties on October 11, 2006, as recorded in the Marion County Clerk's office in Deed Book 1017 at page 89 through 371. The primary land use restrictions applied to the FCW Site are:

- no residential use, and
- no groundwater shall be extracted from beneath the Site for potable use.

Following completion of the non-time critical removal work, on September 28, 2011, the temporary suspension of the RI/FS Order between EPA and ExxonMobil was lifted and the RI/FS Report was completed in June 2016.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Throughout the course of its involvement with the Site, EPA has used a variety of means to learn of local stakeholder concerns and interests and keep the public informed of Site activities. Routine activities included issuing informational Fact Sheets, holding public meetings with formal public comment periods during key decision points and actively participating in the Fairmont Community Liaison Panel (FCLP) established as part of the Project XL Agreement described in more detail on Page 9. The FCLP was involved in establishing the reasonable future land use assumptions and associated land use restrictions placed on the FCW Site.

The FCLP was created to serve as a forum for open discussion of topics related to the FCW Site and met periodically throughout performance of the removal response actions. The FCLP included a cross section of community members including local officials, representatives of health professionals, law enforcement, clergy, local businesses and residents along with representatives of WVDEP, EPA and ExxonMobil. FCLP meetings were held several times per year to provide updates on ongoing cleanup activities and foster interaction between the community, the regulators overseeing the work and ExxonMobil performing the work. FCLP meetings were held in the community, open to the public, and advertised in the local and regional newspapers.

On July 9, 2016, pursuant to Section 113(k)(2)(B) of CERCLA, 42 U.S.C. § 113(k)(2)(B), EPA released for public comment the Proposed Remedial Action Plan (Proposed Plan) setting forth EPA's preferred remedial alternative for the Site. The Proposed Plan was based on documents contained in the Administrative Record File. EPA made these documents available to the public in the EPA Administrative Record Room in EPA Region III's office located at 1650 Arch Street in Philadelphia, Pennsylvania, and at the local information repository at the Marion County Public Library located at 321 Monroe Street in Fairmont, West Virginia. A notice of availability of these documents was published in the *Times West Virginian* on July 9, 2016. EPA opened a 30-day public comment period on July 9, 2016, to receive comments on EPA's preferred alternatives and the other alternatives identified in the Proposed Plan. Comments received during this public comment period, as well as EPA's response to such comments, are summarized in the Responsiveness Summary section of this ROD. EPA and WVDEP also held a public meeting on July 14, 2016 at the Armed Forces Reserve Center located at 201st Artillery Drive in Fairmont, West Virginia. Further discussion of community activities is presented in Section 10.9 (Community Acceptance) and the Responsiveness Summary.

More detailed documentation on the information contained in this ROD may be found in the Administrative Record which contains the RI/FS, and other information used by EPA in the decision making process. EPA encourages the public to review the Administrative Record in order to gain a more comprehensive understanding of the Site and the activities that have been and will be conducted there. The Administrative Record can be viewed at the Marion County Public Library located at 321 Monroe Street in Fairmont, West Virginia and is also available at the EPA Region III Office located at 1650 Arch Street in Philadelphia, Pennsylvania. To review the Administrative Record at EPA's Philadelphia office, contact Mr. Paul Van Reed, Administrative Record Coordinator, at (215) 814-3157. The Administrative Record can be viewed online at https://semspub.epa.gov/src/collections/03/AR/WVD000800441, and select the **Remedial** Collection Description. Copies of this ROD are available for public review in these information repositories.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

The Selected Remedy is intended to be the final remedy for the Site. Previous removal actions were implemented across the Site to eliminate waste materials and contaminated soils that presented a principle threat to human health and the environment when considering current and future land use at the Site. During these removal actions waste materials and contaminated soils that presented a continuing source of contamination migrating to the underlying groundwater were excavated. The role of the Selected Remedy is to address any residual contamination remaining in underlying groundwater or Site soil/sediment that present an unacceptable risk to human health and the environment.

The Selected Remedy will treat contaminated groundwater migrating toward the Site boundary and non-point source, subsurface discharges to surface water. Contaminated sediments in wetland areas will be remediated. ICs will be implemented to require that future buildings be constructed with vapor mitigation, as appropriate.

5.0 SITE CHARACTERISTICS

This section of the ROD describes the Conceptual Site Model (CSM) and provides an overview of the Site's characteristics, the sampling strategy used during the Site investigations, and the nature and extent of contamination remaining. Additional information regarding the nature and extent of contamination can be found in the RI/FS and other documents included in the Administrative Record.

5.1. Site Geology and Hydrogeology

The Site is located within an ancient meander of the Monongahela River, which was filled in with sediments as that river shifted to its present-day course after the last period of glaciation. The glacial Lake Monongahela, formed when the ancient Monongahela River was blocked by ice sheets to the north, drained and created the relatively flat remnant lake plain surface on which the Site was developed. The Site sits in a small valley with slopes extending up along the northern and southern property boundaries. The Site geology has been divided into three main units: fill, alluvium, and bedrock.

The fill unit is a mixture of reworked silt, sand, coal, gravel, and other debris present from ground surface to the top of the alluvium. This unit contains the shallow groundwater zone which is perched on the underlying fine-grained alluvium. The shallow groundwater zone is mostly absent in the LOS Area and a large part of the western side of the Site. A shallow groundwater-divide between the By-Products Area and the LOS Area causes shallow groundwater in the By-Products Area to flow west while shallow groundwater within the CSA/CHA and, where present within the LOS Area, flows to the east-southeast. Groundwater flow velocities in this zone were calculated to be less than 1 foot per year.

The alluvium is made of Quaternary aged sediments that directly underlie the fill unit and extend down to the surface of bedrock. Where the fill unit is absent, the alluvium unit occurs at the ground surface. The alluvium unit is made of native clay, silt, and sand layers deposited as either river or lake sediment. The combination of differing depositional environments and erosion through time has resulted in a varied alluvium composition laterally and vertically across the Site. Generally, the lower portion of the alluvial unit is more permeable and contains the intermediate groundwater zone. The upper layers of the unit tend to be finer-grained clay and silty clay which inhibits the downward migration of the perched shallow groundwater. Where these low permeability layers are absent the shallow groundwater zone may leach to the underlying intermediate zone. Groundwater in the intermediate zone generally flows toward a groundwater trough in the central portion of the Site before flowing west toward the Unnamed Tributary (Figure 3). In some western portions of the Site the intermediate zone is likely divided into separate flow zones separated by thin clay lenses. Groundwater flow velocity in the intermediate zone was calculated to range between 67 and 83 feet per year.

The bedrock beneath the Site is an interbedded sequence of Pennsylvanian aged shale, mudstone, siltstone, limestone, and sandstone of the Conemaugh Group. The upper portion of the series outcrops in the hillside just southwest of the Site. The Conemaugh Group contains the bedrock groundwater zone which generally flows to the west toward the Unnamed Tributary. Groundwater in the bedrock zone flows with a calculated velocity of approximately 1 foot per year. The weathered upper portion of the bedrock groundwater zone may be in direct hydraulic connection to the intermediate zone as there is a measured downward head gradient between lower portions of the intermediate zone and the weathered bedrock in the eastern portion of the Site and an upward vertical gradient in the vicinity of the Unnamed Tributary in the western portion of the Site. Based on the elevation of the tributary compared to the top of bedrock, and the upward vertical gradients observed between bedrock and the intermediate zone in this area, the tributary is acting as a hydrogeologic boundary for shallow bedrock groundwater at the Site.

5.1.1. Surface Water

The Unnamed Tributary flows through a relatively steep ravine along the boundary between the FCW Site and the Big John's Salvage Superfund Site (BJS Site) further to the west, before discharging to the Monongahela River approximately 1,600 feet downstream. The segment of the Unnamed Tributary that bisects the two Superfund Sites receives both surface water runoff and subsurface groundwater discharge from both Sites. Pursuant to a Consent Decree (Civil Action No. 1:08CV124) for the BJS Site entered in US District Court on October 10, 2012, a surveyed transect, formally referred to as the "Release Line," was established to legally separate responsibility for contaminant remediation in this area. The BJS Site project has accepted responsibility for remediating any unacceptable environmental conditions on its side of the Release Line. The Fairmont Coke Works Superfund project remains responsible for remediating any unacceptable environmental conditions east of the Release Line and to prohibit any unacceptable migration of contaminants or pollutants beyond the Release Line. There are two small streams flowing from the FCW Site to the Unnamed Tributary (Figure 2).

5.1.2. Wetlands

Three wetland areas are present on the relatively flat portion of the Site. The largest of these areas, Wetland Area 1 (SWA-1 on Figure 2) is a perennial wetland area located in the vicinity of the former North Landfill in the northwestern portion of the Site. This area extends a few hundred feet along the northern perimeter of the Site and surface water in this wetland drains west to the Unnamed Tributary. Wetlands Area 1 is characterized by a narrow band of cattails (*Typha sp*.) and other hydrophilic plants such as soft rush (*Juncus effusus*), hop sedge (*Carex lupulina*) and black willow (*Salix nigra*). Wetland Area 3 is in the southeast corner of the Site, in the former CSA/CHA. Wetland Area 3 habitat is a combination of wetland and tributary characterized by a small drainage area along the southeastern perimeter of the Site and several low-lying wet areas. The topography suggests that water in this area may have or previously had a hydrological connection to Hickman Run further southeast of the Site. Wetland Area 2 is located in the Byproducts Area and is limited both spatially and temporally.

5.2. Nature and Extent of Contamination

This section presents an understanding of the nature and extent of contamination following Removal Response Actions discussed above in Section 2.2 (History of Previous Environmental Investigations and Removal Actions), under current Site conditions.

5.2.1. Soil

A total of 861 soil samples, including 242 post-removal confirmation samples, were taken to characterize the current extent of contamination at the Site. These sample locations are shown on Figure 4. The confirmation samples from the FWMA and FPA demonstrate that the Removal Response Actions in these areas substantially reduced Site-related contamination and achieved the cleanup standards (Attachment A) set forth in the Phase I and Phase II Action Memoranda. Nevertheless, these data were evaluated again in the context of the Site-wide Human Health and Ecological Risk Assessments completed in the June 2016 RI, to assess risk from any remaining contamination.

A Human Health Risk Assessment (HHRA) was conducted on soil sample analytical results from on-Site and adjacent commercial and residential properties to determine if levels of soil contaminants exceeded EPA's acceptable risk range. The on-Site soil was found to have elevated levels of arsenic and PAHs making the Site unsuitable for residential use. Worker and recreational exposures to soil are within the acceptable risk range.

Lead was detected above screening levels in several random sampling points at the Site, but the vast majority of samples contained lead concentrations within acceptable ranges. A lead evaluation concluded that lead concentrations in surface and subsurface soils do not present a significant hazard based on a comparison with EPA target levels. Therefore, lead hot spots appear to be localized and should not pose a concern.

Historical sampling results from 1994 indicated that a single sample collected from the backyard of a residential property had elevated concentrations of PAHs. In 2014 a thorough sampling program using the incremental sampling protocol in that backyard demonstrated that there is no unacceptable risk. The more complete sampling effort demonstrated lower concentrations, suggesting that the historical sample was localized and not representative of the yard as a whole.

5.2.2. Groundwater/Groundwater to Surface Water

The nature and extent of groundwater contamination at the Site was characterized through the installation and monitoring of 62 groundwater monitoring wells installed in shallow, intermediate and deep (bedrock) water bearing units. The locations of all 62 wells can be viewed on Figure 2. There are 25 monitoring wells completed in the shallow groundwater zone, depicted with a monitoring well number ending in an "S." There are 28 monitoring wells completed in the intermediate groundwater zone, depicted with a monitoring well number ending in an "I." There are 9 monitoring wells completed in the bedrock groundwater zone, depicted with a monitoring well number ending in an "D." In addition to the 62 permanent monitoring wells referenced above, 8 extremely shallow wells were completed along the floodplain of the Unnamed Tributary and are depicted on Figure 2 with a monitoring well number beginning with "GW/SW."

Groundwater analytical results for the shallow groundwater zone are presented on Figure 5. Figure 5 shows COCs detected above their applicable Maximum Contaminant Levels (MCLs) promulgated at 40 C.F.R. Part 141 pursuant to Section 1412 of the Safe Drinking Water Act, 42 U.S.C. § 300g-1. The following metals were detected at one or more monitoring well (MW) above their respective MCLs: antimony, beryllium, cadmium, lead, selenium and thallium. The distribution of elevated concentrations of metals in the shallow groundwater zone was sporadic and primarily located in the interior of the Site. Benzene is present above its MCL in MW-12S in an area near the former North Landfill. Groundwater monitoring along the perimeter of the Site indicates that groundwater contamination in the shallow groundwater zone does not extend beyond the Site boundary.

Groundwater analytical results for the intermediate groundwater zone are presented on Figure 6 (COCs detected above MCLs). The following inorganics, often referred to as metals, were detected at one or more monitoring well above their respective MCLs: arsenic, antimony, beryllium, cadmium, chromium, lead, selenium and thallium. The distribution of elevated concentrations of inorganics in the intermediate groundwater zone is more wide-spread than distribution in the shallow groundwater zone. Most intermediate monitoring wells have detected at least one metal at a concentration above its MCL. The groundwater located in the FWMA between the former North and South Landfills is contaminated with the most inorganic contaminants (MW-9I, MW-11I, MW-14I, MW-16I and MW-29I). In addition to the inorganics exceeding MCLs described above, the groundwater within the intermediate groundwater zone in the western boundary area is extremely acidic (pH levels in the 2.4 to 5.0 range) with very high concentrations of aluminum (up to 169 mg/L), iron (up to 1520 mg/L) (Figure 7), and manganese (up to 66 mg/L).

There is a benzene plume observed in the FWMA between the former North and South Landfills extending toward the western boundary of the Site (Figure 8). The benzene plume does not extend beyond the northern or southern Site property boundary. The benzene plume within the intermediate groundwater zone is considered to be within the "water table" aquifer in the context of evaluating the potential for vapor intrusion to buildings because the perched/shallow groundwater zone is discontinuous. The highest concentrations of benzene have been observed at MW-16. Concentrations of benzene within the intermediate zone have trended downward but remain well above the MCL (5 µg/L benzene). For example, benzene at MW-16 was 24,000 µg/L in 1999 and 1,100 µg/L in the same well in 2015. Additional wells were installed along the western boundary of the Site in 2014 to determine if the benzene plume, or groundwater with inorganic contaminants or very acidic pH levels, discharges to, or migrates beneath, the Unnamed Tributary. It was determined that groundwater from the intermediate and weathered bedrock zone discharges to the Unnamed Tributary, which forms the hydrologic boundary to groundwater along the western portion of the Site.

The terrain slopes steeply, approximately 30 feet in elevation, down to a small flood plain adjacent to the Unnamed Tributary. A series of wells, referred to as Groundwater/Surface Water wells (GW/SW), were installed along the base of the slope between the known benzene plume and the stream to evaluate groundwater-to-surface water migration. Analytical results for the GW/SW wells are presented on Figure 6. Elevated benzene was detected at GW/SW-7 (1,800 µg/L), GW/SW-6 (5 µg/L) and GW/SW-8 (6.6 µg/L). Benzene was not detected at elevated levels in the other GW/SW locations. Most of the GW/SW wells contain elevated levels of iron (up to 259 mg/L) and manganese (up to 37 mg/L). The manganese in several GW/SW samples was of potential concern if children were to play in this water as it emerges from the ground, or if it migrated to surface water undiluted. GW/SW-7 and GW/SW-8 measured very low pH levels at 2.88 and 2.39, respectively. Groundwater discharging to the Unnamed Tributary likely contributes to the exceedance of the West Virginia Surface Water Quality Standards (WVSWQS) for pH (6.0-9.0), aluminum (0.75 mg/L), iron (1.5 mg/L) and benzene (51 µg/L).

The bedrock groundwater zone has generally not been impacted by Site related contaminants. Site related COCs were not detected or were detected below their respective MCLs in the bedrock zone wells, except for arsenic in MW-2D, which has been above the MCL since September 2010. MW-2D is located at the far eastern edge of the Site, indicating that the source of the elevated arsenic may be off-Site. No specific off-Site source has been identified.

5.2.3. Surface Water/Sediment in Wetland Area

A Screening-Level Ecological Risk Assessment (SLERA) was conducted on the surface water and sediment in the three on-Site wetland areas. Concentrations of the following metals: arsenic, cadmium, copper, iron, lead, manganese, nickel, selenium, silver and zinc were identified in sediment at one or more of the three wetland areas (discussed further below) at levels that present potential risk to amphibians, aquatic invertebrates, and insect-eating birds, such as red-winged blackbirds. Concentrations of cobalt, nickel and zinc were identified in surface water at levels that present potential risk to amphibians, aquatic invertebrates, and insectivorous birds.

5.2.4. Biota

A SLERA was completed for the Site as part of the RI. This assessment identified contaminants of potential concern (COPCs) based on published toxicity data and conservative assumptions regarding exposure and ecological effects. The SLERA evaluated site-wide soil data in addition to surface water and sediment data collected in the vicinity of the three wetland areas on the Site. In addition, shallow groundwater data (ranging in depth from approximately 1 to 5 ft bgs) upgradient of the Unnamed Tributary was collected for the purpose of evaluating the potential for groundwater from the western portion of the FCW Site to affect the Unnamed Tributary. The objective of the SLERA was to assess potential risks to ecological receptors as a result of possible exposure to COCs remaining after Removal Response Activities were completed.

The SLERA considered a full array of the types of plants and animals that may be present at the Site. For Site soil the SLERA included plants, soil and wetland invertebrates (e.g., earthworms and benthic invertebrates), terrestrial mammals and birds. Because it is not feasible to evaluate the relationship of COPCs to every species at the Site, specific receptors were selected to represent the organisms that could be present most frequently or are likely to be sensitive to the effects of Site-related COPCs.

The following ecological receptor populations were considered in the SLERA to evaluate soil exposures:

- Plants and soil invertebrates
- Insectivorous small mammals (short-tailed shrew [*Blarina brevicauda*])
- Herbivorous small mammals (meadow vole [*Microtus pennsylvanicus*])
- Herbivorous large mammals (white-tailed deer [*Odocoileus virginianus*])
- Insectivorous birds (American woodcock [*Scolopax minor*])
- Carnivorous birds (red-tailed hawk [*Buteo jamaicensis*])

To evaluate potential exposures to on-Site wetlands as well as sediments and surface water in the Unnamed Tributary, the following receptors were also considered:

- Benthic invertebrates
- Amphibians
- Herbivorous mammals (muskrat [*Ondatra zibethicus*])

- Insectivorous birds (red-winged blackbird [*Agelaius phoeniceus*] for wetland exposure and Eastern phoebe [*Sayornis phoebe*] for exposure in the Unnamed Tributary)

The SLERA determined that potentially unacceptable risk would be presented to ecological receptors living in two on-Site wetland areas (Wetland Areas 1 and 3) due to arsenic, cadmium, copper, iron, lead, manganese, nickel, selenium, silver and zinc found in sediment and cobalt, nickel and zinc in surface water. Shallow groundwater characterized by very acidic conditions and high concentrations of dissolved aluminum, iron, manganese and benzene is likely a non-point source subsurface discharge to the Unnamed Tributary. The subsurface discharges to the surface water likely contribute to in-stream concentrations of aluminum and iron greater than levels known to be protective of aquatic life. See Section 7.3 (Ecological Risks) for additional information.

5.3. Establishment of Vapor Intrusion Protection Area (VIPA)

Because of the presence of volatile organic chemicals (VOCs) in shallow groundwater, the possibility of vapor intrusion is a potential concern for buildings that could be constructed on the Site in the future.

Vapor intrusion is the migration of VOCs from the subsurface into overlying buildings through cracks, joints and utility openings. Depending on site-specific conditions, VOCs in contaminated groundwater can emit vapors that may migrate through subsurface soil and into air spaces of overlying buildings. In most cases, VOC concentrations are low such that vapors are not present at detectable concentrations. However, in extreme cases, the vapors accumulate in buildings to levels that may pose safety hazards, acute health effects or aesthetic problems.

Groundwater monitoring demonstrates that the contaminated groundwater plume in which VOCs exceed their respective MCLs has been confined to the Site (Figure 9) and there are no existing habitable buildings[1] on or off the Site close enough to the VOC plume to be at risk. However, groundwater within the FWMA is contaminated with benzene, a VOC, measured at concentrations several orders of magnitude above its MCL (5 µg/L benzene) and the water table is relatively shallow. In addition, other factors such as elevated benzene concentrations in the deep soil in the LOS Area and buried subsurface pipes and debris throughout the FPA exist. The subsurface debris has the potential of creating a preferential path for vapor migration in the vadose zone.

EPA's Vapor Intrusion guidance[2] recommends collecting and weighing "multiple lines of evidence" to evaluate whether potentially unacceptable vapor intrusion exposure may occur under reasonably expected future conditions, such as construction of new buildings on the Site. EPA has determined that there is potential for vapor intrusion into future buildings constructed on Site where benzene exceeds its respective MCLs by several orders of magnitude in the shallow groundwater or other relevant factors exist. However, it is impossible to complete a definitive study without specific information regarding both the location of any such future building and

1 The only existing buildings on Site are the abandoned Administrative Building and the new WVSP in an area without potential for vapor intrusion. Off-Site buildings were evaluated and determined not to be at risk for vapor intrusion from Site-related VOCs

2 Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (OSWER 9200-154, June 2015)

the materials and techniques used for construction. Accordingly, EPA has established a VIPA encompassing the areas that, based on the presence of VOCs in the subsurface, a vapor intrusion investigation or pre-emptive mitigation must be conducted for future habitable buildings. See Figure 9 for the map defining the proposed VIPA.

5.4. Conceptual Site Model

A CSM was developed to identify which human or ecological exposure pathways were complete or could be potentially complete in the future. A CSM is used to ensure that all sources of contamination, exposure pathways and people and wildlife potentially using the Site are considered in a risk assessment and presents an overall understanding of a site. The types of potential "receptors" that were considered in the human health and ecological risk assessments along with exposure media, and exposure pathways, are presented in Figures 10 and 11, respectively.

The current[3] and likely future use of the Site is for commercial/industrial/civic site workers. The Site is zoned Highway Commercial which includes commercial, civic and light industrial land uses, and a Declaration of Deed Restrictions has been recorded on the title to the Site land records that prohibit residential use and prohibit use of underlying groundwater for potable purposes. Future exposure to soil may occur if the Site is redeveloped. Therefore, risks from exposure to Site soils were evaluated. Residential soil risks were assessed in the HHRA. The results of the screening analysis show that even after the extensive removal actions performed at the Site, the residential risks from soil exposures under baseline conditions would be unacceptable. As stated previously, there is an environmental covenant which prevents residential development of the Site, therefore, this analysis was a hypothetical future use. Contact with shallow groundwater could occur by future construction workers during construction activities. Although the Site and surrounding community are served by a public water supply, hypothetical future residential exposures to groundwater were also evaluated.

As discussed in Section 5.3 (Biota), the CSM for ecological receptors considered site-wide soil, surface water and sediment data collected in the vicinity of the wetland areas. In addition, shallow groundwater data upgradient of the Unnamed Tributary was considered for the aquatic life and wildlife living near Unnamed Tributary. The CSM considered plants, soil and wetland invertebrates (e.g., earthworms and benthic invertebrates), terrestrial mammals and birds that may be present at the Site. The SLERA assessed potential risks to these ecological receptors as a result of exposure to COCs remaining after removal activities.

3 The recent construction of the WV State Police Troop 1 HQ on a parcel in the former CSA/CHA makes the on-Site Worker scenario a current use. Civic/governmental building land use is similar to commercial and industrial with respect to potential exposure considerations.

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

Ownership of the 97-acre Site was conveyed to the Fairmont Coke Works Site Custodial Trust (FCT) to promote and facilitate the beneficial reuse of the Site property after the appropriate response actions are completed. The State of West Virginia is the Trustee for the FCT. Approximately 62 acres of the Site are relatively flat land particularly well suited for redevelopment. The remaining 35 acres include a steep wooded hillside that descends to the Monongahela River at the western portion of the FCW Site, which would limit redevelopment opportunities.

The Project XL Agreement, discussed briefly on Page 9, resulted in significant engagement with local officials and citizens to determine the most appropriate future use for the Site property including structured discussions with an active Community Liaison Panel and subcommittees focused on property redevelopment. The community's decisions regarding the type of future reuse they would like to see has been incorporated by the City of Fairmont in the Planning and Zoning Code.

The FCW Site is currently zoned Highway Commercial, which allows for a variety of commercial/civic uses; residential use is specifically prohibited by the 2006 Declaration of Deed Restrictions discussed at Page 9. The West Virginia State Police Troop 1 Headquarters (WVSP) became the first redeveloped parcel on the Site when the new WVSP facility opened in April 2017. The WVSP was built on the southern portion of the Site and represents the only current use. The reasonably anticipated future land use at the FCW Site is commercial with the potential for industrial or recreational development. Current and future land use of the FCW Site is subject to existing deed restrictions prohibiting residential use.

Land use surrounding the FCW Site is a mixture of industrial, commercial and residential properties. In 2013, the Fairmont Armed Forces Reserve Center (National Guard Armory) was constructed along the southern boundary of the Site. Lafayette Street was extended across the center of the Site where it intersects with 201st Artillery Drive, providing access to the National Guard Armory and the WVSP. The area north of Suncrest Avenue is zoned Neighborhood Residential. All residential and commercial properties in the area are served by the public water supply drawn from the Monongahela River and processed through a filtration plant prior to distribution.

Existing deed restrictions prohibit the current and future use of groundwater beneath the FCW Site for potable uses. Groundwater generally flows west and discharges to the Unnamed Tributary. There are two small streams flowing from the FCW Site to the Unnamed Tributary. Current and future use of the wetlands/surface water on the Site is secondary use recreation and providing habitat for wildlife. The terrain at the western end of the Site slopes steeply down to the Unnamed Tributary which discharges to the Monongahela River approximately 1,600 feet downstream (north) of the Site. The steep terrain makes it difficult to access the Unnamed Tributary from the Site.

7.0 SUMMARY OF SITE RISKS

As part of the RI/FS, a baseline risk assessment (BRA) was completed to determine the risk that may be presented to human health or the environment by any contaminants remaining at the Site. A BRA is an analysis of the potential adverse human health and ecological effects of releases of hazardous substances from the Site in the absence of any additional actions or controls to mitigate such releases, under current and future land and resource uses. The BRA includes a HHRA and a Screening-Level Ecological Risk Assessment (SLERA). It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed if remedial action is determined to be necessary. This section of the ROD summarizes the results of the BRA for the Site.

7.1. Selection of Contaminants of Concern

The current uses of the area surrounding the Site include industrial businesses to the east, and residential usage in the adjacent neighborhood. The BRA evaluated and determined the Site does not present unacceptable risk to people living and working on properties surrounding the Site.

The BRA evaluated the future use of Site soils under trespasser, recreational, worker, and residential scenarios; the residential scenarios were mainly used to verify whether existing prohibitions continue to be warranted. Future recreational and current trespasser exposures to surface water were evaluated. For groundwater, future residential use, and the potential for migration of on-Site contaminants to usable wells, was assessed. Also considered were the migration of VOCs from the subsurface into local buildings, and the inhalation of VOCs by construction workers doing subsurface excavation related to future Site redevelopment. All of these risks were acceptable except where indicated in the Risk Characterization Summary Tables 1 (carcinogens) and 2 (non-carcinogens).

As summarized in Tables 1 and 2, the HHRA determined that there are no unacceptable risks to people at the Site under current land use scenarios. The HHRA determined that there may be potentially unacceptable risk presented to people under certain future land use scenarios considered. Manganese in surface water is a COC when considering the recreational land use scenario (for children). Benzene and cyanide are COCs in groundwater when considering the potential for industrial/commercial workers land use scenarios, specifically related to the potential for these compounds to migrate from the subsurface into new buildings constructed within the VIPA, or from construction workers being exposed to groundwater during trench digging.

The HHRA estimated cancer risks and non-cancer health hazards from exposures to chemicals at the Site. The HHRA quantitatively evaluates cancer risks and non-cancer hazards. Consistent with EPA's policies and guidance, the HHRA quantified cancer risks and non-cancer hazards as the total exposure to Contaminants of Potential Concern (COPCs) in the absence of remedial action and ICs, such as ICs preventing residential land use or the extraction of groundwater from the aquifer beneath the Site for use as a potable water source. From the COPCs, the HHRA identified those contaminants that drive the need for a remedial action. This subset of COPCs is referred to as COCs, and is the primary focus of the response action selected in this ROD.

The HHRA determined that COCs remain in soil and ground water beneath the Site at concentrations that would present an unacceptable risk to hypothetical residential users. The COCs in groundwater are benzene, aluminum, arsenic, chromium, cobalt, iron, manganese, nickel, lead, cyanide and thallium. In the event that the Site were used for residential use in the future, COCs in soil would be arsenic and PAHs, such as benzo (a) pyrene. In accordance with the terms of the Project XL Agreement discussed on Page 9, future use of the Site will not include residential use. Based on the findings of the risk assessment, the property and groundwater beneath the Site is not safe for residential land use.

There are no existing buildings on the Site in areas potentially vulnerable to soil vapor intrusion however conditions exist that warrant precautions be taken should new buildings be constructed within the proposed VIPA. Consistent with EPA guidance, EPA is requiring that any future buildings constructed within the VIPA (Figure 9) should incorporate pre-emptive vapor-intrusion mitigation unless a building-specific vapor intrusion evaluation determines mitigation to be unnecessary.

Lead was detected above screening levels in several random sampling points at the Site, but the majority of samples were within acceptable risk ranges. Based on a lead evaluation for hypothetical residential and future industrial/commercial workers, it was concluded that lead concentrations in surface and subsurface soils do not present a significant hazard based on a comparison with EPA target levels [i.e., statistics for all scenarios indicated less than 5 percent of an exposed population would be likely to exceed the EPA blood lead concentration threshold (i.e., threshold of 10 micrograms per deciliter (µg/dL)]. After EPA issued a memo[4] in December 2016 that indicated blood-lead levels lower than 10 µg/dL may be of concern, ARCADIS on behalf of ExxonMobil submitted an updated lead evaluation for the Site. The update confirms the original conclusions: groundwater exceeds the lead Action Level, and average soil lead concentrations are not a concern for permitted land uses. Lead hot spots appear to be localized and should not pose a concern.

7.2. Human Health Risk Assessment Definitions and Process.

A four-step process is used for assessing site-related human health risks for a reasonable maximum exposure (RME) scenario. The process includes:

- Hazard Identification – uses the analytical data collected to identify the COPCs at the site for each medium with consideration of a number of factors explained below;

- Exposure Assessment - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting fish) by which humans are potentially exposed;

4 Memorandum titled "Updated Scientific Considerations for Lead in Soil Cleanups," signed by Mathy Stanislaus, Assistant Administrator, Office of Land and Emergency Management (December 22, 2016)

- Toxicity Assessment - determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response); and

- Risk Characterization - summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks. The risk characterization also identifies contaminants with concentrations which exceed acceptable levels, defined by the National Contingency Plan (NCP) as an excess lifetime cancer risk greater than 1 x 10^{-4} to 1 x 10^{-6} or a Hazard Index (HI) greater than 1; contaminants at these concentrations are considered contaminants of concern (COCs) and are typically those that will require remediation at the site. Also included in this section is a discussion of the uncertainties associated with these risks.

The cancer risk and non-cancer hazard estimates in the HHRA are based on RME scenarios and were developed by taking into account various health protective estimates about the frequency and duration of an individual's exposure to chemicals selected as COCs as well as the toxicity of the contaminants.

Each of these steps is described below.

7.2.1. Hazard Identification

In this step of the HHRA process, the COPCs were identified in each medium based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations, mobility, persistence, and bioaccumulation. Analytical information that was collected to determine the nature and extent of contamination revealed the presence of contaminants in soils, surface water, sediments, and groundwater. Based on this information, the risk assessment focused on contaminants which may pose significant risk to human health, referred to as COCs. A comprehensive list of all COPCs can be found in the HHRA that is in the Administrative Record file for this ROD. A summary of those substances determined to be COCs is included in Table 3.

7.2.2. Exposure Assessment

Consistent with Superfund policy and guidance, the HHRA is a baseline risk assessment and, therefore, assumes no additional remediation or ICs will be implemented to mitigate or remove hazardous substance releases. Cancer risks and non-cancer hazard indices (HI) were calculated based on an estimate of the RME expected to occur under current and future conditions at the Site. The RME is defined as the highest exposure that is reasonably expected to occur at a site.

Typically, exposures are evaluated using a statistical estimate of the exposure point concentration (EPC), which is usually an upper bound estimate of the average concentration for each contaminant, but in some cases it may be the maximum detected concentration. A summary of the EPCs for the COCs in each medium can be found in Table 3 while a comprehensive list of the EPCs for all COPCs can be found in the HHRA, available in the Administrative Record file for this action.

Exposure pathways were identified for each potentially exposed population and each potential exposure scenario. The main exposure pathways and receptors evaluated in the HHRA are also found in Table 3.

7.2.3. Toxicity Assessment

In this step, the types of adverse health effects associated with contaminant exposures and the relationship between the magnitude of exposure and severity of adverse health effects were determined. Potential health effects are contaminant-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (e.g., changes in the effectiveness of the immune system). Some contaminants are capable of causing both cancer and non-cancer health effects.

Under current EPA guidelines, the likelihood of carcinogenic risks and non-cancer hazards as a result of exposure to site-related contaminants is considered separately. Consistent with current EPA policy, it was assumed that the toxic effects of the Site-related chemicals would be additive for non-carcinogens that affected the same target organs, and for carcinogens. Thus, cancer risks and non-cancer hazards associated with exposures to individual COPCs were summed to indicate the potential risks and hazards associated with mixtures of potential carcinogens and non-carcinogens, respectively.

Toxicity data for the HHRA were provided by the Integrated Risk Information System (IRIS) database, the Provisional Peer Reviewed Toxicity Database (PPRTD), or another source that is identified as an appropriate reference for toxicity values consistent with the May 2013 Tier 3 Toxicity Value White Paper (http://www.epa.gov/oswer/ risk assessment/pdf/tier3-oxicityvaluewhitepaper.pdf). This information is presented in Table 4 (non-cancer toxicity data summary) and Table 5 (cancer toxicity data summary). Additional toxicity information for all COPCs is presented in the HHRA, available in the Administrative Record file for this action.

7.2.4. Risk Characterization

Non-carcinogenic hazards were assessed using the HI approach, based on a comparison of expected contaminant intakes and benchmark comparison levels of intake (reference doses, reference concentrations). Reference doses (RfDs) and reference concentrations (RfCs) are estimates of daily exposure levels for humans (including sensitive individuals) which are thought to be safe over a lifetime of exposure. The estimated intake of chemicals identified in environmental media (e.g., the amount of a chemical ingested from contaminated soils) is compared to the RfD or the RfC to derive the Hazard Quotient (HQ) for the contaminant in the particular medium. The HI is obtained by adding the HQs for all compounds within a particular medium that impacts a particular receptor population.

The HQ for oral and dermal exposures is calculated as below. The HQ for inhalation exposures is calculated using a similar model that incorporates the RfC, rather than the RfD.

HQ = Intake/RfD

Where: HQ = hazard quotient;
Intake = estimated intake for a chemical (mg/kg-day); and
RfD = reference dose (mg/kg-day).

The intake and the RfD represent the same exposure period (i.e., chronic, subchronic, or acute).

The key concept for a non-cancer HI is that a "threshold level" (measured as an HI of 1 or less) exists below which non-cancer health effects are not expected to occur. Above an HI of 1, effects will not necessarily occur, but can no longer be ruled out.

As previously stated, the HI is calculated by summing the HQs for all contaminants for likely exposure scenarios for a specific population. An HI greater than 1 indicates that the potential exists for non-carcinogenic health effects to occur as a result of site-related exposures, with the potential for health effects increasing as the HI increases. When the HI is calculated for all contaminants for a specific population that exceeds an HI = 1, separate HI values are then calculated for those contaminants which are known to act on the same target organ. These discrete HI values are then compared to the acceptable limit of an HI = 1 to evaluate the potential for non-cancer health effects on a specific target organ. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. A summary of the non-carcinogenic hazards associated with these chemicals for each exposure pathway is presented in Table 4.

Non-cancer values exceeding the goal of protection of an HI = 1 are an HI= 2 for the child recreational user attributable to manganese in surface water; and an HI = 24 for the construction worker working in a trench at the Site attributable to benzene, and potentially cyanide, vapors migrating from groundwater and subsurface soil to the trench. The Site will not be used for residential purposes due to legal land use restrictions. However, for completeness, the HHRA documented that several additional compounds would be identified as COCs if the Site property were used for residential purposes (and the HIs would be 4 for child resident exposure to soil, 200 for child residential exposure to groundwater, 100 for adult residential exposure to groundwater, and 4 for residential vapor intrusion).

All other non-carcinogenic hazards associated with exposure to air, surface water, sediments and soil for various receptors identified in the CSM (Figure 10) are below EPA's goal of protection of an HI = 1.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen, using the cancer slope factor (SF) for oral and dermal exposures and the inhalation unit risk (IUR) for inhalation exposures. Excess lifetime cancer risk for oral and dermal exposures is calculated from the following equation, while the equation for inhalation exposures uses the IUR, rather than the SF:

Risk = LADD x SF

Where: Risk = a unitless probability (e.g., 1×10^{-4}) of an individual developing cancer; LADD = lifetime average daily dose averaged over 70 years (mg/kg-day); and SF = cancer slope factor, expressed as [1/(mg/kg-day)].

These risks are probabilities that are usually expressed in scientific notation (such as 1×10^{-4}). An excess lifetime cancer risk of 1×10^{-4} indicates that one additional incidence of cancer may occur in a population of 10,000 people who are exposed under the conditions identified in the assessment. As stated in the NCP, the acceptable risk range for site-related exposure is 10^{-6} (one in a million) to 10^{-4} (one in ten thousand).

Results of the HHRA presented in Table 1 indicate that the cancer risks from the current and reasonably anticipated future uses of the Site were all less than 1×10^{-4}, meaning that the cancer risk did not exceed the threshold for trigging action at the Site due to potential exposure of known or suspected carcinogens. The reasonably anticipate future use of the Site includes all the scenarios evaluated in the CSM (Table 10) excluding the residential use scenarios. As stated in Section 2.3, this Site is subject to a Declaration of Deed Restrictions prohibiting residential land use and extraction of groundwater beneath the Site for use as a potable water source. The Project XL Agreement established that cleanup goals at the Site would be based on commercial and industrial use[5], not residential use. Nevertheless, the HHRA considered residential land use as a hypothetical future use of this Site, primarily to determine whether past cleanup actions had achieved residual concentrations of hazardous substances low enough to render subsequent residential use safe. The residential assessment supports the need to continue the Site use restrictions.

Results of the HHRA presented in Table 1 indicate that the cancer risks to hypothetical future residents living on the Site would be 3×10^{-4}, or approximately 3 in ten thousand, due to exposure to arsenic and PAHs in site soil, which exceeds the goal of protection of 1×10^{-4}. Also, cancer risk to hypothetical residents drinking groundwater or breathing air in homes constructed in the VIPA without vapor controls was determined to exceed the NCP acceptable risk range.

7.3. Ecological Risks

A SLERA was completed for the Site as part of the RI. This assessment identified potential contaminants of concern (PCOCs) based on published toxicity data and conservative assumptions regarding exposure and ecological effects. The SLERA evaluated site-wide soil data in addition to surface water and sediment data collected in the vicinity of the three wetland areas on the Site. In addition, shallow groundwater data (ranging in depth from approximately 1 to 5 ft bgs) upgradient of the Unnamed Tributary were collected for the purpose of evaluating the potential for groundwater from the western portion of the FCW Site to affect the Unnamed Tributary. The SLERA considered plants, soil and wetland invertebrates (e.g., earthworms and

5 The risk assessment also considered and determined that there is no unacceptable cancer risk or non-cancer hazard presented to Off-Site residents or Off-Site Workers living and working on properties adjacent the Site.

benthic invertebrates), terrestrial mammals and birds that may be present at the Site. The objective of the SLERA was to assess potential risks to these ecological receptors as a result of exposure to COCs remaining at the Site after removal activities were completed.

The SLERA concluded that potentially unacceptable risk would be presented by Site contaminants to amphibians, to the eastern phoebe and the red-winged blackbird associated with the on-Site Wetlands. Elevated levels of arsenic, cadmium, copper, iron, lead, manganese, nickel, selenium, silver and zinc were identified in wetland sediment. Elevated levels of cobalt, nickel and zinc were identified in surface water.

The Unnamed Tributary flows between the FCW Site and the BJS Site, receiving groundwater recharge from groundwater flowing beneath both of the Superfund Sites. Shallow groundwater and groundwater/surface water interface sample results were used to evaluate potential ecological impacts to the Unnamed Tributary. Although uncertainty is associated with potential dilution and volatilization that may occur after discharging to surface water, these samples provided a conservative means of evaluating the influence of groundwater on the Unnamed Tributary.

To determine the potential for ecological effects, the concentrations in the GW/SW samples were compared to the West Virginia Surface Water Quality Standards (WV 47CSR2). Some constituents were found to exceed water quality standards for surface water, including aluminum, iron, cadmium and lead (GW/SW-001 only). However, the points with exceedances for the most constituents and the largest exceedances were GW/SW-007 and GW/SW-008 (including elevated benzene and very low pH). These samples are not actual surface water samples; GW/SW-007 and 008 appear to be more representative of groundwater samples in the intermediate zone. Of the six sample locations closest to the Unnamed Tributary, only iron and pH consistently exceeded the WVSWQS.

7.4. Summary of Human Health and Ecological Risks

The BRA indicates that current land use exposures to Site-related media do not result in unacceptable risks to human health. The BRA also confirms that existing land use restrictions prohibiting residential use of the Site and potable use of groundwater beneath the Site are appropriate and should be maintained. Future construction workers involved in subsurface work, such as installing utilities in a trench deeper than 4 ft, may be exposed to unacceptable risk levels due to inhalation of the ambient air in the trench if appropriate precautions are not taken.
A hypothetical future recreational land use scenario determined that contact with soil on the Site would not exceed the acceptable risk range; however, recreational contact with surface water or groundwater migrating to the Unnamed Tributary by children may exceed the acceptable risk range due to the presence of manganese.

In addition, vapor intrusion is a potential concern for future on-Site buildings due to the presence of benzene, and potentially free cyanide, in the subsurface.

The BRA determined that potentially unacceptable risk would be presented to ecological receptors living in two on-Site wetland areas (Wetland Areas 1 and 3) due to arsenic, cadmium, copper, iron, lead, manganese, nickel, selenium, silver and zinc found in sediment and cobalt, nickel and zinc in surface water. Shallow groundwater characterized by very acidic conditions and high concentrations of dissolved aluminum, iron, manganese and benzene is likely a non-point source subsurface discharge to the Unnamed Tributary. The subsurface discharges to the surface water likely contribute to in-stream concentrations of aluminum and iron greater than levels known to be protective of aquatic life.

7.5. Basis for Action

Based upon the results of the RI, the HHRA, and ERA, EPA has determined that the response action selected in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants into the environment.

8.0 REMEDIAL ACTION OBJECTIVES

To protect the public and the environment from potential current and future health risks, the following Remedial Action Objectives (RAOs) have been developed to address the contaminated groundwater, and sediments in wetland areas at the Site:

- Prevent the migration of groundwater containing COCs at concentrations greater than the Performance Standards into surface water. Areas to the north, south and east are upgradient from the Site and groundwater flows from the Site boundary towards the east-west centerline before turning westward and discharging into the Unnamed Tributary, with flow towards the Unnamed Tributary becoming more direct with depth. The Unnamed Tributary acts as a hydrologic barrier to groundwater flow, preventing groundwater from ever reaching the Site boundary. See Section 12.2 (Description of the Selected Remedy and Performance Standard) for the list of Performance Standards.

- Mitigate the potential human health risks for future construction workers involved in redevelopment of the Site who may breathe VOCs in the ambient air of a trench on-Site.

- Mitigate the potential for vapor intrusion of VOCs detected in groundwater and soil within the VIPA into indoor air of potential future on-Site buildings, as appropriate.

- Mitigate potential ecological risks to receptors which may contact surface water and sediments in wetland areas on-Site.

Land use restrictions have been placed on the FCW Site through local zoning regulations and enforceable deed restrictions implemented in accordance with the Project XL Agreement. To affirm that certain land use restrictions must remain in effect to ensure continued protectiveness, the following use restrictions are adopted as a common element to each of the response actions evaluated in this ROD:

- Residential use of the Site is prohibited.

- Extraction of groundwater from beneath the Site for potable use is prohibited.

9.0 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

The 2016 FS discusses a range of alternatives evaluated based on their ability to address risks presented by the Site. Together with the other documents in the Administrative Record, the FS provides information supporting the alternative ultimately selected by EPA in this ROD. As noted above, based on the potential impacts to human health and the environment, the following areas of the Site warrant additional cleanup action to minimize potential exposure to hazardous substances:

- Soil/Sediment (S) in the Wetland Areas
- Groundwater (GW) along the western Site boundary area (for the protection of surface water)

The remedial alternatives presented in the FS consist of the following:

- Alternative 1: No Further Action
- Alternative 2: Limited Actions (Monitored Natural Attenuation and Institutional Controls)
- Alternative 3: Groundwater Extraction, Treatment, and Discharge; Remediation of Wetlands; Institutional Controls
- Alternative 4: In-Situ Chemical Oxidation (ISCO), Remediation of Wetlands; Institutional Controls
- Alternative 5: Limestone Trench/Permeable Reactive Barrier (LT/PRB); Remediation of Wetlands; Institutional Controls

Common Elements to All Alternatives

Each of the alternatives, except the No Further Action alternative, includes the specific requirement to maintain ICs preventing residential land use and the extraction of groundwater from the aquifer beneath the Site for use as a potable water source. In addition, ICs would be implemented to require pre-emptive vapor mitigation for any new habitable buildings constructed within the VIPA (Figure 9) unless a building-specific vapor intrusion evaluation determines mitigation to be unnecessary. The default pre-emptive vapor mitigation would include, at a minimum, a foundation vapor barrier and subsurface piping for a passive subslab venting system that can be converted to an active sub-slab depressurization system if necessary. Prior to occupancy, indoor air samples shall be collected from within the building to confirm the efficacy of the passive venting system. If indoor air sample concentrations are equal to or exceed EPA risk-based criteria, the passive venting system shall be activated and operated as an active subslab depressurization system, until such time as EPA, in consultation with WVDEP, determines that the subsurface contamination no longer poses a vapor intrusion risk. At that time, the active venting system may revert to a passive venting system. ICs would also identify the VIPA as an area where construction workers who are required to work in a subsurface trench may be subject to conditions where a hazardous atmosphere could reasonably be expected to exist and standard precautions such as OSHA-mandated protocol to provide ventilation and proper respiratory protection would be required. ICs may include, but are not limited to, restrictive covenants, deed notices, and/or local ordinances.

Because each of the Alternatives evaluated would result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited land use and unrestricted exposure, a statutory review will be conducted no less than every five years to ensure that the remedy is, or will be, protective of human health and the environment.

Alternative 1: No Further Action

Estimated Capital Cost: $0
Estimated Annual Cost: $0 ($17,000 every five years)
Estimated Present Worth Cost: $36,600
Estimated Time to Completion: Immediate

The NCP requires that EPA consider a "No Action" alternative for every Superfund site to establish a baseline or reference point, against which each of the other Remedial Action alternatives are compared. In the event that the other identified Alternatives do not offer substantial benefits in the protection of human health and the environment, the No Action Alternative may be considered a feasible approach. This Alternative leaves the Site in its current state and all current and potential future risks would remain. Previous response actions addressed contaminated surface soil such that the Site can be safely reused for recreational, commercial or industrial purposes with the exception of future worker exposure in construction trenches and child recreational exposure to surface water at the western end of the Site. Also, ecological receptors would continue to be exposed to elevated risks due to inorganic contaminants in sediments within the wetland areas on the Site. In addition, non-point source subsurface discharge of shallow groundwater with acidic conditions and elevated concentrations of COCs would continue to contribute to an exceedance of WVSWQS in the Unnamed Tributary. Habitable buildings constructed above or near surficial groundwater contaminated with VOCs would be potentially subject to vapor intrusion. If the existing ICs listed in the Declaration of Deed Restrictions were to be lifted as a potential future use scenario, hypothetical future residents would be potentially subject to unacceptable health risks due to consumption of underlying groundwater, direct and frequent contact with Site soils and breathing soil vapor that has the potential to migrate into their on-Site homes. In the event the existing ICs were to be altered to allow recreational use in the area of surface water on the western end of the Site an unacceptable risk to small children exposed to stream water. Since significant response actions have already been implemented across the Site, the "no action" alternative is better described as "no further action."

Alternative 2: Limited Actions (Monitored Natural Attenuation and Institutional Controls)

Estimated Capital Cost: $92,100
Estimated Annual Cost: $51,350 (plus $17,000 every five years)
Estimated Present Worth Cost: $767,000
Estimated Time to Completion: 30 years (for cost estimating purposes)

Alternative 2 combines the Remedial Actions described in Alternatives S-2 and GW-2 in the RI/FS, as modified by EPA.

This Alternative relies on Monitored Natural Attenuation (MNA) to achieve Performance Standards at the Site boundary, or at the “release line” along the western end of the Site. (See Section 5.1.1 for additional discussion about the “release line”.) Natural attenuation processes (biodegradation, dispersion, dilution, sorption, volatilization and chemical or biological stabilization, transformation, or destruction of constituents), under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of constituents in soil and groundwater. MNA would be relied upon to reduce concentrations of COCs (primarily iron, manganese and benzene and increase pH), so that groundwater flowing beneath the Site and discharging to the Unnamed Tributary does not contribute to an exceedence of the WVSWQS. The primary source material has been removed and natural degradation and attenuation of benzene in groundwater has been demonstrated to be occurring. Groundwater acidity and concentrations of inorganic contaminants appear to be stable. Periodic groundwater monitoring would be used to document the decline of COCs via natural attenuation processes. A long-term monitoring plan would be carried out using a network of monitoring wells, supplemented with new monitoring wells, as necessary. For cost estimation purposes, it is assumed that four new well clusters (eight new wells) would be installed as sentinel wells at the western Site boundary and Performance Standards would be achieved in 30 years.

Under Alternative 2, no active remediation or treatment of contaminated soils or sediments in the wetlands would be conducted to reduce or prevent ecological exposure. Natural seasonal cycles would be relied upon to gradually increase the soil organic carbon as successive stands of decomposed plant materials accumulate in the wetland sediments and decrease the bioavailability of the inorganic contaminants.

Alternative 3: Groundwater Extraction, Treatment, and Discharge; Remediation of Wetlands; Institutional Controls

Estimated Capital Cost: $1,513,000
Estimated Annual Cost: $354,350 (plus $17,000 every five years)
Estimated Present Worth Cost: $5,410,000
Estimated Construction Time: 2 years
Estimated Time to Achieve RAOs: 1 year

Alternative 3 combines the Remedial Actions described in Alternatives S-2, S-3 and GW-3 in the RI/FS, as modified by EPA.

Under Alternative 3, a groundwater extraction and treatment system (groundwater treatment system) would be designed and operated to contain the migration of COCs in groundwater and to reduce the overall time necessary to achieve Performance Standards for groundwater discharging to the Unnamed Tributary. An array of groundwater extraction wells would be installed in a line generally perpendicular to the contaminated plume. Each well creates a cone of depression, or radial area of influence, as water is withdrawn from the aquifer. The wells are installed at close proximity so that the cones of depression overlap and, collectively, create a capture zone that prevents contaminated groundwater from by-passing the recovery well network. A water treatment plant would be constructed and operated to treat the recovered groundwater prior to its discharge to the Unnamed Tributary, or if accommodation can be made, the City of Fairmont Sewer System. Treated plant effluent would meet the substantive requirements of a West Virginia Pollutant Discharge Elimination System permit (WV 47 CSR 10).

For cost estimation purposes it was assumed that approximately seven extraction wells would be installed in the shallow and intermediate zones to intercept contaminated groundwater migrating beneath the western end of the Site. Recovered groundwater would be pumped to an on-Site water treatment plant. The conceptual groundwater treatment system would include the following processes in sequence: equalization tank; pH adjustment/metal precipitation to remove aluminum, iron and manganese; and air stripping and/or activated carbon technologies to achieve West Virginia Pollutant Discharge Elimination System (WVPDES) discharge limits prior to the effluent being discharged to either surface water or the local sanitary sewer authority. The actual number and location of extraction wells, the design flow rate and components of the groundwater treatment system would be determined during the design.

A groundwater monitoring program would be implemented to demonstrate that contaminated groundwater is being contained under the Site and not discharging to the surface water at concentrations that contribute to an exceedance of WVSWQS (WV 47 CSR 2). Additional monitoring wells will be installed as necessary to demonstrate such containment.

Wetland Areas 1 and 3 would be treated with an amendment capable of binding inorganic contaminants, rendering them less bioavailable to ecological receptors. An amendment, such as a blend of humic acid, fulvic acid, and humin, or other organic matter would be applied to the areas with elevated concentrations of inorganic COCs (cadmium, copper, lead, selenium and zinc). The specific amendments and application rates will be determined during the Remedial Design. Disturbed areas would be seeded with a native wetland seed mix. The effectiveness of the remedy would be assessed by the survival of wetland plant species that are sensitive to metal toxicity. Wetland Area 2 does not warrant remediation due to its small size, inconsistent hydrology, and limited ecological functions.

In addition to the ICs described in Common Elements to All Alternatives, above, an IC would be established to prohibit any activity that would adversely impact the operation of the groundwater treatment system.

Alternative 4: In-Situ Chemical Oxidation; Remediation of Wetlands; Institutional Controls

Estimated Capital Cost: $2,445,000
Estimated Annual Cost: $106,350 first 3 years; $56,350 thereafter (plus $17,000 every five years)
Estimated Present Worth Cost: $3,236,000
Estimated Time to Completion: 2 year

Alternative 4 combines the Remedial Actions described in Alternatives S-2, S-3 and GW-4 in the RI/FS, as modified by EPA.

Alternative 4 involves in-situ treatment of groundwater contaminants in the saturated subsurface with a chemical oxidant such as hydrogen peroxide. Chemical oxidation works when the oxidant comes into direct contact with an organic compound, such as benzene, and destroys it by converting the contaminant to innocuous compounds, such as carbon dioxide and water. The reaction is different when the contaminant is an inorganic chemical, such as iron or manganese. The oxidant would react with the dissolved inorganic chemicals to form a metallic oxide precipitate that would settle out of the groundwater. The chemical oxidant, such as hydrogen peroxide, is typically injected directly into the subsurface and allowed to flow with the groundwater into contaminated areas.

For cost estimation purposes, it is assumed that each injection point would extend 40 feet bgs and treat groundwater within a 5 to 10-foot radius. Approximately 250 injection points would be required within a 58,000 square feet area to treat the impacted groundwater zone. A minimum of four treatment events would be required over a one to two-year period. The actual configuration of the oxidant injection field, including depth and spacing of injectors and type of oxidant, would be determined during the design process.

The reduction of aluminum, iron, manganese and benzene in groundwater would achieve the Remedial Action Objective of preventing contaminated groundwater from flowing into the surface water at concentrations exceeding Performance Standards. A groundwater monitoring plan would be implemented to measure the effectiveness of the in-situ treatment system, including the groundwater flow patterns. The application of oxidant into the aquifer would be performed in a manner consistent with the substantive provisions of WV 47 CSR 13 governing underground injection wells.

This alternative includes the wetland remediation actions described in Alternative 3, above. In addition to the ICs described in Common Elements to All Alternatives, above, an IC would be established to prohibit any activity that would adversely impact the operation of the injection points.

Alternative 5: Limestone Trench/Permeable Reactive Barrier (LT/PRB); Remediation of Wetlands; Institutional Controls

Estimated Capital Cost: $1,790,000
Estimated Annual Cost: $65,350 (plus $17,000 every five years)
Estimated Present Worth Cost: $2,798,000
Estimated Time to Completion: 1 year

Alternative 5 combines the Remedial Actions described in Alternatives S-2, S-3 and GW-5 in the RI/FS, as modified by EPA.

Under Alternative 5, a Limestone Trench/Permeable Reactive Barrier (LT/PRB) would be installed across the extreme western portion of the Site to provide passive, in-situ treatment to groundwater passing through the permeable trench/barrier. Alternative 5 would build upon a pilot-scale study performed by ExxonMobil at the Site. The pilot-scale study performed included the placement of mushroom soil with the limestone in an anoxic (i.e., low oxygen) limestone trench. (Attachment B – Pilot Scale Summary)

The LT/PRB would include a trench, extending from the surface to the base of the intermediate aquifer, aligned perpendicular to the natural groundwater flow path. It would be filled with appropriate material (i.e., treatment media) capable of adjusting geochemical conditions in the groundwater to favor removal of contaminants through degradation and/or precipitation. The treatment media would likely include limestone to increase alkalinity and raise the pH of the passing groundwater; other materials such as organic compost would be included as appropriate to create optimal conditions for treatment.

Benzene is amenable to both aerobic and anaerobic biodegradation and both processes are occurring at various locations within the plume depending on the geochemistry and associated microbes. Benzene is currently degrading via aerobic biodegradation at the outer edges of the plume, where dissolved oxygen is higher. This passive in-situ treatment technology works best when little oxygen is available (anoxic conditions) until after the groundwater moves through the PRB. When the dissolved metals such as iron and manganese are exposed to available oxygen, insoluble hydroxides are formed and precipitate out of the groundwater. The anoxic conditions also support the anaerobic biodegradation of benzene. If the precipitation occurs within the PRB, effective lifespan of the treatment system is reduced.

The LT/PRB configuration may utilize "funnel and gate" and/or French drain concepts to influence groundwater flow. With a funnel and gate configuration, sections of impermeable walls are used to strategically divert the groundwater flow through the reactive zones and minimize by-pass. French drains are used to create areas of greater flow and may be utilized to convey treated groundwater to precipitation zones. For cost estimation purposes it is assumed that the LT/PRB would be approximately 18 feet deep and extend approximately 200 feet to the northeast from the western end of the PRB installed during the pilot study (Figure 12). The actual configuration of the LT/PRB, including alignment, composition of treatment media and wall thickness would be determined during the Remedial Design.

The reduction of iron, manganese and benzene in groundwater would achieve the RAO of preventing contaminated groundwater from flowing into the stream at concentrations that contribute to an exceedance of Performance Standards. A groundwater monitoring plan would be implemented to measure the effectiveness of the in-situ treatment system, including the groundwater flow patterns and effective permeability of the LT/PRB. Since any impediment to flow through a PRB system can have serious consequences to overall system performance, hydraulic integrity testing of the system would be conducted to document it is both constructed and operating as planned. The Remedial Design would include an operations and maintenance plan addressing periodic monitoring and maintenance, including but not limited to replacement of sacrificial treatment media.

Appropriate erosion and sediment controls consistent with best management practices will be implemented during the period of ground disturbance. Excavated soils will be sampled and contaminated material disposed off-site at an appropriately permitted facility.

This alternative includes the wetland remediation actions described in Alternative 3, above. In addition to the ICs described in Common Elements, an IC would be established to prohibit any activity that would adversely impact the operation of the LT/PRB.

10.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Criteria Used to Compare Cleanup Alternatives

The remedial alternatives summarized in this ROD have been evaluated against the nine decision criteria set forth in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (see 40 C.F.R. § 300.430(e)(9)). These nine criteria are organized into three categories which are: threshold criteria, primary balancing criteria, and modifying criteria. Threshold criteria must be satisfied in order for an alternative to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between alternatives. Modifying criteria are formally taken into account after public comment has been received. The nine criteria are set forth below:

Threshold Criteria

1. ***Overall Protectiveness of Human Health and the Environment*** addresses whether a remedy provides adequate protection of human health and the environment from unacceptable risks posed by hazardous substances or pollutants or contaminants and describes how risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. ***Compliance with Applicable or Relevant and Appropriate Requirements*** (ARARs) addresses whether a remedy will meet all of the applicable, or relevant and appropriate requirements of Federal and State environmental statutes and regulations and/or whether there are grounds for invoking a waiver.

Primary Balancing Criteria:

3. ***Long-Term Effectiveness*** considers the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals are achieved.

4. ***Reduction of Toxicity, Mobility, or Volume Through Treatment*** addresses the degree to which treatment will be used to reduce the toxicity, mobility, or volume of the contaminants causing site risks.

5. ***Short-Term Effectiveness*** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. ***Implementability*** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. ***Cost*** includes estimated capital and annual operation and maintenance costs, as well as present worth cost. Present Worth cost is the total cost of a remedy over time in today's dollar value. Cost estimates area expected to be accurate within a range of +50 to -30 percent.

Modifying Criteria:

8. ***State Acceptance*** indicates whether the State concurs with, opposes, or has no comment on the remedy.

9. ***Community Acceptance*** considers the public's general response to the alternatives described in the Proposed Plan, underlying RI/FS Reports and other documents in the Administrative Record.

The above criteria are used to evaluate the advantages and disadvantages of each alternative in order to select an appropriate remedy. The following is a brief summary evaluating and comparing each remedial alternative for the Site against the nine criteria.

10.1. Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial alternative be protective of human health and the environment. A remedy is protective if it reduces current and potential future risks to acceptable levels within the established risk range posed by each exposure pathway at the Site.

Overall protection of human health and the environment addresses whether each alternative reduces current and potential future risks to acceptable levels and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls and/or ICs.

Alternative 1 (No Further Action) would not provide adequate protection of human health and the environment. Groundwater containing elevated concentrations of iron, manganese and acidic pH would continue to discharge to the Unnamed Tributary, contributing to unsafe conditions to ecological receptors. The elevated manganese would continue to present an unacceptable risk to small child recreational users under a future recreational use scenario. Elevated concentrations of inorganic COCs in the wetland areas would continue to present unacceptable risk to amphibians and birds. People working in future buildings constructed in areas overlying VOC-contaminated groundwater may be at risk of exposure to unsafe levels of VOCs in the indoor air.

Construction worker exposure to subsurface contaminants in trenches would go unmanaged. Alternative 1 was retained for comparison purposes.

Alternative 2 (MNA and ICs) would likely not provide adequate protection of human health and the environment. MNA would likely reduce dissolved benzene sufficiently to achieve the Performance Standard for that contaminant within a reasonable timeframe, but groundwater containing elevated concentrations of iron, manganese and acidic pH would continue to discharge to the Unnamed Tributary, contributing to unsafe conditions to ecological receptors. The elevated manganese would continue to present an unacceptable risk to small children recreational users under a future recreational use scenario. Elevated concentrations of inorganic COCs in the wetland areas would continue to present unacceptable risk to amphibians and birds until sufficient organic material is naturally deposited in the area. ICs requiring vapor mitigation systems would prevent risk of vapor intrusion to future habitable buildings.

Alternative 3 (Groundwater Pump and Treat, Wetland Remediation and ICs), Alternative 4 (ISCO, Wetland Remediation and ICs) and Alternative 5 (LT/PRB, Wetland Remediation and ICs) would achieve protection of human health and the environment by preventing and mitigating exposure and achieving Performance Standards. Both Alternatives 3 and 5 would intercept contaminated groundwater migrating toward the Unnamed Tributary. Alternative 3 would extract the groundwater and treat that water ex-situ prior to discharging treated water. Alternative 5 would utilize an in-situ treatment process. Alternative 4 would target all groundwater within the treatment zone for in-situ treatment by chemical oxidation. The hazards related to handling the chemical oxidant on-Site can be safely managed using industry standard operating practices. Alternatives 3, 4 and 5 would treat sediments in wetland areas to reduce bioavailability of elevated inorganic COCs. ICs would prevent future risks due to potential vapor intrusion into buildings and would address construction worker exposure to trenches. The treatment components of Alternatives 3, 4 and 5 would constitute permanent solutions which would be protective of human health and the environment.

10.2. Compliance with ARARs

Any cleanup alternative selected by EPA must comply with all applicable or relevant and appropriate federal and state environmental requirements or provide the basis upon which such requirement(s) can be waived. ARARs include substantive provisions of any promulgated Federal or more stringent State environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements for a CERCLA site or action. *Applicable* requirements are those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. *Relevant and appropriate* requirements are requirements that, while not legally "applicable" to circumstances at a particular CERCLA site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited.

EPA will also consider to-be-considered material (TBCs) along with ARARs. TBCs are non-promulgated advisories or guidance issued by federal or state governments that are not legally binding and do not have the status of potential ARARs. However, EPA may use the TBCs in determining the necessary level of cleanup for protection of human health and the environment.

A complete listing of ARARs and TBCs for the remedial alternatives developed for the FCW Site is presented in Table 6 to this ROD.

Alternative 1 would not comply with ARARs because shallow groundwater would continue to passively discharge to the Unnamed Tributary and contribute to an exceedance of acceptable surface water quality standards in the Unnamed Tributary.

Alternative 2 is also unlikely to achieve ARARs in the Unnamed Tributary within a reasonable time period. The natural buffering capacity of the formation soils in the western end of Site extending to the Unnamed Tributary has been depleted, therefore low pH and high dissolved metals are not expected to attenuate within a reasonable timeframe. Accordingly, elevated aluminum and iron concentrations in shallow groundwater are expected to continue to recharge the Unnamed Tributary and contribute to in-stream concentrations exceeding ARARs.

Alternatives 3, 4 and 5 would eventually meet the contaminant-specific ARARs pertaining to the groundwater COCs passively discharging to the Unnamed Tributary. Alternative 3 would utilize a series of groundwater recovery wells to intercept the contaminated groundwater prior to its migration to the Unnamed Tributary, thereby reducing the flux of subsurface discharge to the stream. The recovered groundwater would be pumped through a groundwater treatment system and effluent would meet appropriate WVPDES discharge standards (WV 47 CSR 2). Alternative 4 would oxidize the benzene to harmless compounds and cause the inorganic contaminants to precipitate out of the groundwater before they migrate to the Unnamed Tributary. The application of oxidant into the aquifer would be performed in a manner consistent with the substantive provisions of WV 47 CSR 13 governing underground injection wells. Alternative 5 would utilize a LT/PRB to reduce contaminants in groundwater to meet Performance Standards prior to its passive discharge to the Unnamed Tributary. Any excess soil excavated during LT/PRB construction would be properly contained, sampled and disposed of in an appropriate manner.

Alternatives 2, 3, 4 and 5 would include groundwater monitoring along the perimeter of the Site to confirm that groundwater migrating beyond the Site boundary remains in compliance with Federal and State ARARs (WV 64 CSR 3-10).

10.3. Long-Term Effectiveness and Permanence

Alternatives 3, 4 and 5 would have a high degree of long-term effectiveness through the application of organic matter in the wetland areas and implementation of ICs to ensure future buildings subject to vapor intrusion are constructed with vapor mitigation measures, if necessary.

Alternative 3 would achieve surface water performance standards by reducing the migration of contaminated groundwater from the area of low pH/high metals toward the Unnamed Tributary. Alternative 3 would rely on the continued operation of the groundwater treatment system to

maintain its long-term effectiveness. The permanence of the control of groundwater migration would be linked to the perpetual operation of the groundwater treatment system.
Alternative 3 would utilize well understood technologies for capture and treatment of contaminated groundwater and would be effective in maintaining reliable protection of human health and the environment over time once cleanup goals are achieved downgradient of the interception point. The high concentration of iron and other inorganics in groundwater would require a robust maintenance schedule to rehabilitate well screens and manage solids at the plant. Operations and maintenance would be carried out in a manner that minimizes downtime of the groundwater treatment system, including recovery wells.

Alternative 4 would achieve its initial degree of effectiveness based on how successful the field injections are in delivering the oxidant to the contaminants in-situ. A series of oxidant injection events would be scheduled over the first several years. Each injection event would be expected to be followed by a reduction in contaminant concentrations in the aquifer as benzene is degraded to harmless compounds and the metals precipitate out of the dissolved phase. As time passes after the oxidant injection, a “rebound” of higher concentrations in the groundwater is expected as contaminants are desorbed from subsurface formation soils. Additional oxidant injection events would be scheduled over time, as necessary. Chemical oxidation of benzene would be a permanent non-reversible process. Precipitation of the inorganic contaminants would be stable if the pH does not revert to acidic conditions. Long-term effectiveness and permanence would be achieved by permanently reducing concentrations of COCs in the aquifer so that subsurface non-point source discharge to the surface water would not contribute to an exceedance in performance standards.

Alternative 5 would utilize a LT/PRB to passively adjust the geochemistry of the groundwater within and downgradient of the wall. The passive treatment of acidic and metal-rich groundwater as it flows though the LT/PRB would ensure that the groundwater naturally recharging the Unnamed Tributary achieves performance standards. Based on the observations of a pilot-scale study completed at the Site, the anoxic conditions and the presence of organic substrate would support the anaerobic biodegradation of benzene. Benzene biodegradation would be permanent. Precipitation of the inorganic contaminants would be stable downgradient of the LT/PRB provided the pH does not revert to acidic conditions. Alternative 5 does not require the daily active operational presence that Alternative 3 does, but the LT/PRB does require periodic performance monitoring and less frequent replacement or reworking of reactive media to maintain long-term effectiveness.

10.4. Reduction of Toxicity, Mobility, or Volume through Treatment

Section 121(b) of CERCLA, 42 U.S.C. § 9621(b), establishes a preference for Remedial Actions that include treatment that permanently and significantly reduces the toxicity, mobility, or volume of contaminants.

Alternatives 3, 4 and 5 reduces toxicity and mobility of inorganic contaminants in the wetland areas through application of organic matter. The treatment of the wetland areas with organic material will reduce the concentration and bioavailability of inorganic COCs in the sediment.

Alternative 3 would utilize a series of groundwater extraction wells as an engineering control to prevent contaminated groundwater from migrating to the Unnamed Tributary. The contaminant mass from the groundwater would continue to be removed from the environment and conveyed to the water treatment plant. Alternative 3 does achieve a reduction of toxicity, mobility or volume through treatment of the recovered contaminated groundwater. The water treatment would likely employ chemical precipitation to remove metals such as iron and manganese; air stripping and/or carbon filtration would be employed for benzene. Due to the relatively small mass of benzene that would be removed from the water each day, the treatment plant would likely utilize an air stripper with no air pollution control system required. The benzene would be safely released to the air untreated. The water treatment plant would generate two basic waste streams, a filter cake and spent carbon (if carbon filtration is utilized) in addition to a treated effluent.

Alternative 4 involves injecting a chemical oxidant into the saturated subsurface to cause a chemical reaction with the COCs. If the chemical oxidant can be effectively delivered into the subsurface so the reagent comes into direct contact with the COCs, ISCO would reduce toxicity of benzene by degrading it to innocuous compounds. ISCO should also reduce the mobility of dissolved inorganic contaminants by causing a chemical reaction that results in the dissolved inorganic chemical becoming a solid and dropping out of the groundwater. The oxidation process works well in a controlled laboratory environment but may be difficult to implement effectively in the field environment such as this Site due to discontinuous water bearing formations, highly variable transmissivity, high intrinsic oxygen demand within the formation soils and other complicating factors.

Alternative 5 would involve in-situ treatment of contaminated groundwater as it passively flows through the LT/PRB. The limestone media would increase the pH and alkalinity of the groundwater and dissolved metals would form an insoluble metallic oxide precipitate that would settle out of the groundwater when it moves into an oxygen-rich zone. The treatment process would reduce the toxicity, mobility and volume of inorganic contaminants via precipitation. Aerobic biodegradation of benzene would continue to occur at the oxygen-rich outer perimeter of the plume. The design and specific media to be used in the LT/PRB would promote anaerobic biodegradation (methanogenesis) of benzene within the PRB which is a non-reversible process. Alternative 5 achieves reduction of toxicity, mobility or volume through treatment, because it treats both organic and inorganic COCs effectively and reliably.

10.5. Short-Term Effectiveness

Alternative 3 would take approximately 18 months to design and another 6 months to construct the groundwater pump and treat system. There would be minimal short-term risks presented to the community during extraction well installation, subsurface pipeline installation and materials delivery for the water treatment plant. The water treatment plant would employ well understood technologies to minimize any risks presented by air emissions, effluent discharge, and sludge storage and handling. Alternative 3 would achieve the objective by reducing the non-point source discharge rate to the surface water. The quality of the groundwater discharging to the stream, and therefore the porewater quality in the impacted reach, would likely remain at a low pH level with elevated metals concentrations. Proper health and safety procedures and PPE would protect workers during the construction and operation of the treatment plant and collection of long-term monitoring samples.

It is estimated that Alternative 4 would take approximately 3 years to perform a series of oxidation applications into the subsurface. The effectiveness of the ISCO depends on the ability to deliver sufficient oxidant mass to the locations where the contaminants occur in the natural environment. The relatively low permeability of the saturated zone makes delivering the oxidant to the subsurface very difficult. The oxidant, for example hydrogen peroxide, does not maintain its ability to oxidize contaminants for very long once injected into the environment. The oxidant will react with any amenable compound as it will not selectively react with only the COCs. There are some short-term risks inherent to storing and handling strong oxidants on Site.

Short-term effectiveness of Alternative 5 would be better than both Alternative 3 and 4. Alternative 5 would also take approximately 18 months to design and another 6 months to construct the LT/PRB. There would be minimal short-term risks presented to the community during excavation of the trench and constructing the wall with limestone and other media, such as mushroom compost, as appropriate. Soil excavated during trench construction is not expected to be significantly contaminated and will be managed through standard engineering controls. Once constructed, the LT/PRB would function passively, beneath the ground surface. As groundwater flows through the permeable wall, the limestone would slowly dissolve and calcium carbonate would gradually infuse the saturated zone downgradient of the wall. When the dissolved metals such as iron and manganese in a solution of approaching neutral pH-levels are exposed to available oxygen, insoluble hydroxides are formed and precipitate out of the groundwater. Minimal risks would be presented to Site workers conducting periodic long-term monitoring to document performance of the remedy. Alternative 5 is expected to meet the RAOs approximately 2 years after installation. Proper health and safety procedures and PPE would protect workers during the construction and collection of long-term monitoring samples.

10.6. Implementability

This evaluation criterion addresses the difficulties and unknowns associated with implementing the cleanup technologies associated with each alternative, including the ability and time necessary to obtain required permits and approvals, the availability of services and materials, and the reliability and effectiveness of monitoring.

Alternatives 3 and 5 can reasonably be implemented using commonly employed engineering and construction methods, equipment, materials, and personnel. The groundwater treatment system would require more day-to-day man power to monitor and maintain the system. Well screens are expected to foul frequently due to high dissolved metals concentrations. Administratively, the water treatment plant will require a WVPDES-type discharge permit and routine water quality monitoring. Treatment plant sludge, or filter cake, will be tested and disposed in an appropriately permitted disposal facility. If the Fairmont Publicly Owned Treatment Works were to accept the captured groundwater for final treatment and discharge, then pretreatment of groundwater would be more simple because the pretreatment standards would be less stringent.

Alternative 4 is technically difficult to implement due to the challenge in delivering sufficient oxidant to the subsurface contaminants due to aquifer heterogeneity and by high natural oxidant demand due to geochemistry (high concentration of metals) in the formation soils. The successful chemical reaction requires the molecular collision between the oxidant and the target COCs. The oxidant will readily react with naturally occurring, non-COCs and does not maintain its ability to oxidize contaminants for very long time once injected into the subsurface. The oxidant would not move quickly through the relatively low permeability soils and would be quickly exhausted by the reducing environment. Conditions are likely to require multiple injections over time. If the chemical oxidant can be effectively delivered into the subsurface so the reagent comes into direct contact with the COCs, ISCO would reduce toxicity of benzene by degrading it to innocuous compounds. ISCO should also reduce the mobility of dissolved inorganic contaminants by causing a chemical reaction that results in the dissolved inorganic chemical becoming a solid and dropping out of the groundwater. The oxidation process works well in a controlled laboratory environment

Alternative 5, LT/PRB, is both technically and administratively feasible, however the performance of the wall would need to be monitored over time and periodic maintenance will be necessary. Once the LT/PRB is in place, it would operate passively with less day-to-day activity required than Alternative 3. The LT/PRB would be designed in a manner to optimize performance. The iron and manganese hydroxide solids can precipitate within the trench, and coat the surface of the limestone thereby reducing the effectiveness of the treatment media and the permeability of the wall. The design can utilize "low tech" engineering methods to convey treated groundwater to precipitation zones, thereby reducing the build-up of precipitates within the wall. Long-term monitoring would be required to determine when the reactive media requires reworking or replacement.

For all of the Alternatives presented in this ROD, regulatory and technical personnel are available to perform the 5-year reviews effectively, and companies are available to perform the requisite monitoring under all Alternatives. Alternatives 3, 4 and 5 also include an IC that would provide notice to future construction workers that may be involved with subsurface work associated with future redevelopment at the Site, such as installing utilities in a trench deeper than 4 ft, that a hazardous atmosphere could reasonably be expected to exist and standard precautions such as OSHA-mandated protocol to provide ventilation and proper respiratory protection would be required.

10.7. Cost

Evaluation of costs for each Alternative generally includes calculation of direct and indirect capital costs, and annual operations, monitoring and maintenance (O&M) costs, both calculated on a present worth basis. An estimated capital, annual O&M, and total present worth cost for each of the Alternatives has been calculated for comparative purposes, and is presented in Table 7, below.

Direct capital costs include costs of construction, equipment, building and services, and waste disposal. Indirect capital costs include engineering expenses, start-up and shutdown, and contingency allowances. Annual O&M costs include labor and material, chemicals, energy, and fuel; administrative costs and purchased services; monitoring costs; and insurance, taxes, and license costs. For cost estimation purposes, a period of 30 years has been used for O&M. The actual cost for each alternative is expected to be in a range from 50 percent higher than the costs estimated to 30 percent lower than the costs estimated. The evaluation was based on the Feasibility Study cost estimates. The present worth is based on both the capital and O&M costs, and provides the means of comparing the cost of different Alternatives. The present worth cost estimates includes capital construction and 30 years of long-term operation of the groundwater treatment system using a 7% discount rate.

Table 7
Summary of Estimated Costs

	Capital Cost	Annual O&M Cost	Present Worth[6]
Alternative 1	$0	$0	$36,600
Alternative 2	$92,100	$51,350	$767,000
Alternative 3	$1,513,000	$354,350	$5,410,000
Alternative 4	$2,445,000	$106,350	$3,236,000
Alternative 5	$1,790,000	$65,350	$2,798,000

10.8. State Acceptance

The State of West Virginia supports the selection of Alternative 5 and has concurred on this ROD.

10.9. Community Acceptance

A notice of availability of the Proposed Plan and the Administrative Record was published in the *Times West Virginian*. A public comment period was held to solicit comments on the Proposed Plan from the community from July 9, 2016 to August 8, 2016. In addition, a Fact Sheet was mailed to surrounding neighborhoods and a public meeting was held on July 14, 2016 to present the Proposed Plan to the local community and further solicit input from the citizens. All public comments received from the community were supportive of Alternative 5, EPA's "preferred alternative" in the Proposed Plan. A transcript of the public meeting is included in the Administrative Record. A summary of the comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is Appendix C of this ROD.

6 Present Worth calculations assume a 7% discount rate

11.0 PRINCIPAL THREAT WASTES

The NCP, at 40 CFR § 300.430(a)(l)(iii)(A), establishes an expectation that EPA will use treatment to address any principal threats posed by a site, whenever practicable. "Principal threat" wastes are generally defined as source materials (contaminated materials that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure) considered to be highly toxic or highly mobile such that risks from such materials cannot be effectively reduced through containment, or which would present a significant risk to human health or the environment should exposure occur. EPA addressed all materials constituting a “principal threat” source material during previous removal actions described in Section 2.2 (History of Previous Environmental Investigations and Removal Actions). EPA does not consider the residual contamination in wetland areas or groundwater to be "principal threat" wastes.

12.0 SELECTED REMEDY

Based upon the requirements of CERCLA, the results of the investigations, the detailed analysis of the Alternatives, and state and public comments, EPA has determined that Alternative 5 best satisfies the requirements of CERCLA Section 121, 42 U.S.C. § 9621, and provides the best balance of tradeoffs among the Remedial Alternatives with respect to the NCP’s nine evaluation criteria, 40 CFR § 300.430(e)(9). The Agency’s Selected Remedy is Alternative 5: Limestone Trench/Permeable Reactive Barrier (LT/PRB); Remediation of Wetlands; Institutional Controls, and Long-Term Monitoring.

12.1. Summary of the Rationale for the Selected Remedy

Alternative 1 (No Action) was not selected because it is not protective of human health and the environment. Alternative 2 (MNA, ICs) is not protective of human health and the environment because the acidic groundwater and associated high dissolved metals concentrations would persist, and as such the ARARs would not be achieved under this Alternative within a reasonable time period.

Alternative 5 (LT/PRB, Wetland Remediation, ICs), Alternative 4 (ISCO, Wetland Remediation, ICs) and Alternative 3 (Groundwater Pump and Treat, Wetland Remediation, ICs) are each expected to achieve RAOs. However, Alternative 5 rated higher than Alternative 3 particularly when considering Long-Term Effectiveness and Permanence, Reduction of Toxicity, Mobility and Volume through Treatment, and Cost-Effectiveness. Alternative 5 achieves the groundwater RAO through passive, in-situ treatment that will improve the quality of the groundwater naturally recharging the Unnamed Tributary with minimal obvious on-Site presence of constructed facilities and active personnel. This reduced on-Site presence will best support the community interest of establishing beneficial reuse of the Site property. Alternative 5 also rated higher than Alternative 4 with respect to Implementability due to the high degree of uncertainty associated with the technical feasibility of ISCO. Specifically, the prevalence of low permeability soils and high natural oxidant demand across the Site would likely make it difficult to successfully deliver sufficient oxidant to subsurface contaminants as described in Alternative

4. The Wetland Remediation and ICs provisions were common to Alternatives 3, 4 and 5 and, therefore, were not deciding factors in the selection of Alternative 5 as the Selected Remedy. The State of West Virginia concurs with EPA's Selected Remedy and all public comments received during the 30-day public comment period were supportive of the Selected Remedy.

12.2. Description of the Selected Remedy and Performance Standards

The Selected Remedy is Alternative 5, Limestone Trench/Permeable Reactive Barrier (LT/PRB); Remediation of Wetlands; Institutional Controls.

The major components of the Selected Remedy consist of the following elements:

A. Perform pre-design groundwater sampling and hydrostratigraphic characterization to refine understanding of the concentrations and flow paths for benzene, metals and pH in groundwater and optimize permeable reactive wall alignment at the western portion of the Site. Perform treatability study(s) to determine the most appropriate treatment media to utilize in the reactive permeable barrier designed to elevate pH and otherwise achieve Performance Standards.

B. Install a LT/PRB extending from the surface to the base of the intermediate aquifer (may include upper weathered bedrock zone as appropriate), nominally aligned perpendicular to the natural flow of groundwater. The specific treatment media and 3-dimensional wall alignment will be determined during the Remedial Design. Adequacy of the LT/PRB will be measured by achieving the Performance Standards identified below. Non-point source subsurface discharge to the Unnamed Tributary must not contribute to an exceedance to the West Virginia Surface Water Quality Standards appropriate for secondary use recreation and protection of aquatic life. Additionally, the concentration of manganese in surface water must achieve its risk-based Performance Standard for protection of recreational use (children). The specific Performance Standards are shown below:

• pH	6-9	
• iron	1.5	mg/L
• aluminum	0.75	mg/L
• cyanide (as free cyanide $HCN+CN^-$)	22	µg/L
• benzene	51	µg/L
• manganese	6*	mg/L

* risk-based standard for recreational use (child)

C. Apply amendment of organic material capable of reducing bioavailability of inorganic COCs to Wetland Areas 1 and 3. The specific amendments and application rates will be determined during the Remedial Design. Disturbed areas shall be seeded with a native wetland seed mix. The effectiveness of the remedy will be assessed by the survival of wetland plant species that are sensitive to metal toxicity. Successful wetland remediation will achieve:

- 80% cover of planted species after one year;
- 90% cover after three years;
- less than 10% invasive species; and,
- cover plants must not show evidence of metal toxicity.

D. Maintain the existing Institutional Controls to prevent residential land use and the extraction of groundwater from the aquifer beneath the Site for use as a potable water source. Additional ICs will be implemented to require vapor mitigation for any new habitable buildings constructed within the Vapor Intrusion Protection Area (Figure 9) unless a building-specific vapor intrusion evaluation determines mitigation to be unnecessary. The default pre-emptive vapor mitigation will include, at a minimum, a foundation vapor barrier and subsurface piping for a passive subslab venting system that can be converted to an active sub-slab depressurization system if necessary. Prior to occupancy, indoor air samples will be collected from within the building to confirm the efficacy of the passive venting system. If indoor air sample concentrations are equal or exceed EPA risk-based criteria, the passive venting system will be activated and operated as an active subslab depressurization system, until such time as EPA, in consultation with WVDEP, determines that the subsurface contamination no longer poses a vapor intrusion risk. ICs will also identify the VIPA as an area where construction workers required to work in a subsurface trench may be subject to conditions where a hazardous atmosphere could reasonably be expected to exist and standard precautions such as OSHA-mandated protocol to provide ventilation and proper respiratory protection will be required. In addition, ICs will prohibit any activity that would interfere with the operation of the LT/PRB system including groundwater monitoring wells.

E. Perform long-term groundwater, surface water and porewater monitoring to measure the performance of the LT/PRB in accordance with the EPA-approved design. The design must include a robust operation maintenance and monitoring plan capable of demonstrating groundwater flow patterns and the continued effectiveness of the treatment system over time. Long-term groundwater monitoring at the perimeter of the Site will also be required to confirm that groundwater with COCs exceeding MCLs or risk-based goals remains within the Site boundary.

The estimated timeframe to reach the Performance Standards for the Selected Remedy is 4 years. The cost is estimated to be $2,798,000.

12.3. Cost Estimate for the Selected Remedy

Table 8 presents a detailed summary of the estimated costs to implement the Selected Remedy. The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of Alternative 5. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering and design of the Selected Remedy. Changes may be documented in the form of a memorandum in the Administrative Record, an ESD, or ROD amendment depending on how significant any such changes are. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost.

The estimated costs to implement this Remedy are listed below and include installation of the LT/PRB, application of organic amendments in wetland areas and operation and maintenance of the permeable reactive barrier, including groundwater monitoring for a period of 30 years.

Estimated Capital Cost: $1,790,000
Estimated Annual Cost: $65,350 (plus $17,000 every five years)
Estimated Present Worth Cost: $2,798,000
Estimated Time to Completion: 2 year

12.4. Expected Outcome of the Selected Remedy

The portion of the FCW Site east of the LT/PRB installation construction site (approximately 45 acres) is immediately available for commercial, industrial or recreational use consistent with existing land use restrictions. Buildings constructed in the VIPA will need to include vapor control measures. Existing ICs prohibiting residential land use and the extraction of groundwater from the aquifer beneath the Site for use as a potable water source will remain in place. Wetland habitat quality will be enhanced during the first construction season through application of organic amendments to reduce bioavailability of elevated metal concentrations. The passive treatment of acidic and metal-rich groundwater as it flows though the LT/PRB will ensure that the groundwater naturally recharging the Unnamed Tributary will not contribute to an exceedance to the West Virginia Surface Water Quality Standards appropriate for secondary use recreation and protection of aquatic life. RAOs are expected to be met 2 years after installation of the LT/PRB.

The specific Performance Standards are shown below:

• pH	6-9	
• iron	1.5	mg/L
• aluminum	0.75	mg/L
• cyanide (as free cyanide HCN+CN-)	22	µg/L
• benzene	51	µg/L
• manganese	6*	mg/L

* risk-based performance standard for the protection of recreational use (child)

The reasonably anticipated future land use at the FCW Site is commercial with the potential for industrial or recreational development. Current and future land use of the FCW Site is subject to existing deed restrictions prohibiting residential use. An initial redevelopment project was successfully completed in spring 2017 with the construction of the West Virginia State Police Troop 1 Headquarters, on a 3.8-acre parcel on the northwestern portion of the FCW Site. EPA, WVDEP and other stakeholders coordinated with the development team for the project.

13.0 STATUTORY DETERMINATIONS

Under CERCLA (42 U.S.C. § 9621) and the NCP (40 C.F.R. § 300.430(f)(5)(ii)), EPA must select remedies that are protective of human health and the environment, comply with ARARs, are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery to the maximum extent possible. There is also a preference for remedies that use treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the Selected Remedy meets these statutory requirements.

13.1. Protection of Human Health and the Environment

The Selected Remedy, Alternative 5, will protect human health and the environment by providing in-situ treatment of contaminated groundwater as it passively flows through the permeable reactive barrier to be constructed upgradient of the Unnamed Tributary. The LT/PRB will neutralize pH and abate concentrations of COCs downgradient so that groundwater discharging to surface water is protective of the Unnamed Tributary designated uses. The Selected Remedy will be protective of environmental receptors in the wetland areas through the application of organic amendments in Wetland Areas 1 and 3. The remediation method will reduce bioavailability of elevated inorganic COCs and improve conditions for plants and wildlife. ICs will ensure that the future reuse of the Site property will be limited to commercial, industrial or recreational land use scenarios and groundwater beneath the Site will not be used for potable purposes. In addition, ICs addressing construction methods for future habitable buildings constructed within the VIPA will be protective of future workers at the Site. The implementation of the Selected Remedy will not pose unacceptable short-term risks or cross-media impacts.

13.2. Compliance with Applicable or Relevant and Appropriate Requirements

The NCP (40 C.F.R. § 300.430(f)(5)(ii)(B) and (C)) requires that a ROD describe Federal and State ARARs that the Remedy will attain or provide a justification for any waivers. ARARs include substantive provisions of any promulgated Federal or more stringent State environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements for a CERCLA site or action. *Applicable* requirements are those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. *Relevant and appropriate* requirements are requirements that, while not legally "applicable" to circumstances at a particular CERCLA site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited.

The Selected Remedy will comply with all Federal and State requirements, standards, criteria and limitations that are applicable or relevant and appropriate, as required by Section 121(c) of CERCLA, 42 U.S.C. § 9621(c). Such requirements, standards, criteria and limitations are identified in Table 6 of this ROD.

13.3. Cost Effectiveness

Section 300.430(f)(1)(ii)(D) of the NCP, 40 C.F.R. § 300.430(f)(1)(ii)(D), requires EPA to evaluate cost effectiveness by comparing all of the Alternatives that meet the threshold criteria against long-term effectiveness and permanence, short-term effectiveness, and reduction of toxicity, mobility or volume through treatment (collectively referred to as "overall effectiveness"). The NCP further states that overall effectiveness is then compared to cost to ensure that the remedy is cost effective and that its costs are proportional to its overall effectiveness.

EPA concludes, following an evaluation of these criteria, that the Selected Remedy is cost effective in providing overall protection in proportion to costs and meets all other requirements of CERCLA. The estimated present worth cost of the Selected Remedy is $2,798,000.

13.4. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The Selected Remedy complies with the statutory mandate to utilize permanent solutions, alternative treatment technologies, and resource recovery alternatives to the maximum extent practicable.

The principal threats once presented by hazardous substances at the FWC Site were treated through earlier removal response actions that included recycling high-BTU wastes excavated from on-Site landfills by creating a synthetic coal product used to generate more than 527,000 megawatts of electricity.

This Selected Remedy will provide in-situ treatment of residually contaminated groundwater at the western portion of the Site as the water flows through the LT/PRB. The LT/PRB will increase the pH of the groundwater and decrease the solubility of the inorganic contaminants, thereby improving conditions for biodegradation of benzene. The application of organic matter in the wetland areas provides treatment by chemically binding inorganic contaminants and rendering them less bioavailable. EPA has determined that the Selected Remedy represents the maximum extent practicable to which permanent solutions and treatment technologies can be utilized at the Site.

13.5. Preference for Treatment as a Principal Element

There are no "principal threats" remaining at the Site, however the Selected Remedy does address the contaminated groundwater though in-situ treatment in a permeable reactive barrier. By utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

13.6. Five-Year Review Requirements

This Remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that would otherwise allow for unlimited use and unrestricted exposure. Pursuant to Section 121(c) of CERCLA, statutory reviews will be conducted no less often than once every five years after the initiation of construction to ensure that the Remedy remains protective of human health and environment.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the FCW Site was released for public comment on July 9, 2016 and the comment period closed on August 8, 2016. EPA held a public meeting on July 14, 2016, to discuss the remedy selection process and present the Preferred Alternative in the Proposed Plan. EPA has reviewed and responded to verbal and written comments submitted during the public comment period in Appendix C of this ROD, the Responsiveness Summary. There are no significant changes from the Preferred Alternative presented in the Proposed Plan.

15.0 STATE ROLE

WVDEP, on behalf of the State of West Virginia, has reviewed the Remedial Alternatives presented in this ROD and has provided its concurrence with the Selected Remedy. WVDEP's concurrence letter is included in Appendix E.

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APPENDIX A

FIGURES

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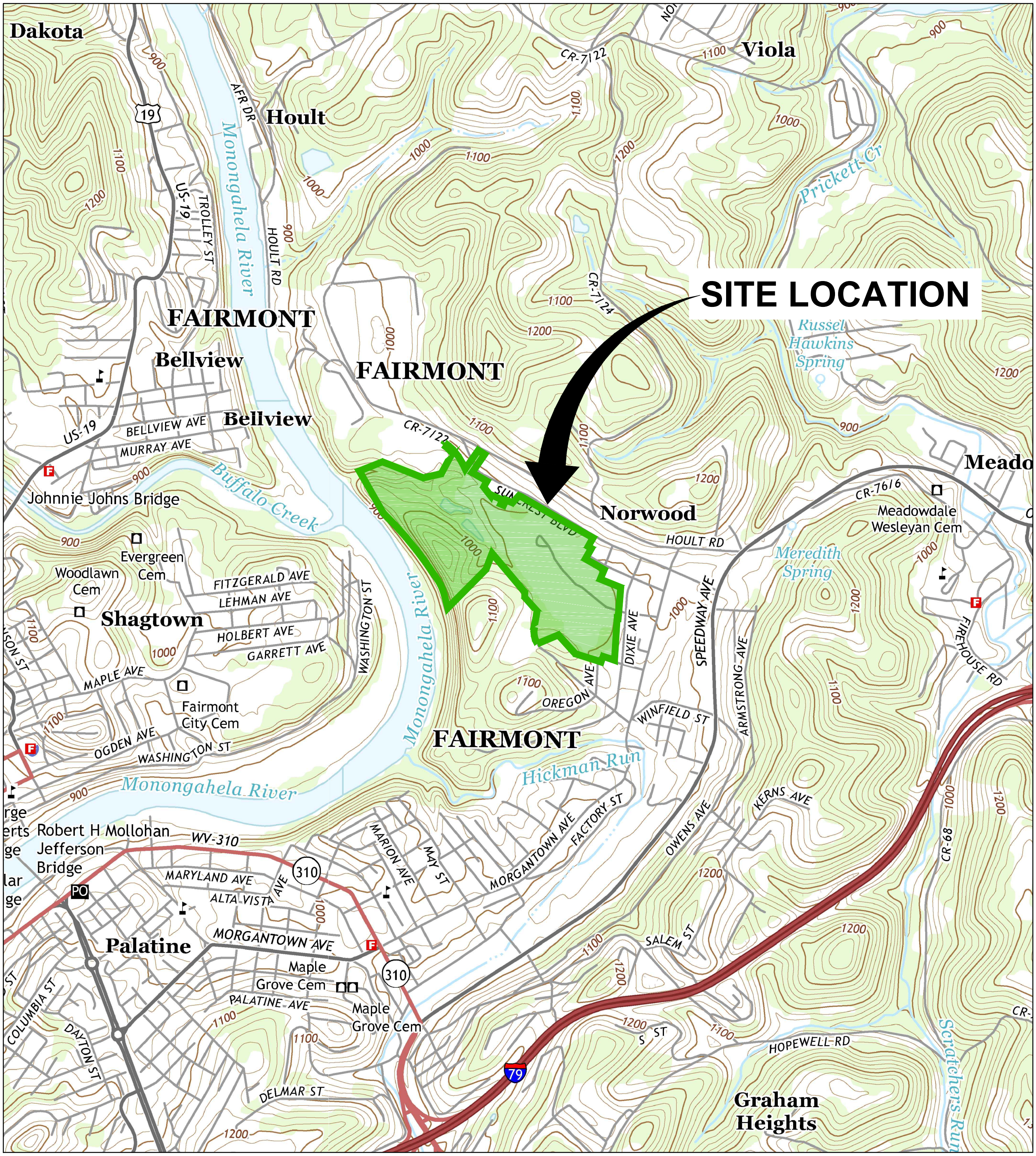

REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., GRANT TOWN, RIVESVILLE, FAIRMONT WEST, FAIRMONT EAST, WEST VIRGINIA, 2014.

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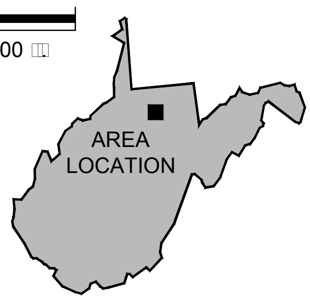

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

SITE LOCATION MAP

FIGURE
1

CITY: SYRACUSE NY DIV/GROUP: ENVCAD DB: E. KRAHMER LD:(Op.) PIC:(Op.) PM: D. MACK TM: C. FOSTER LYR:(Op)ON=*;OFF=*REF* PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/12/2016 3:54 PM BY: SCHILLING, ADAM
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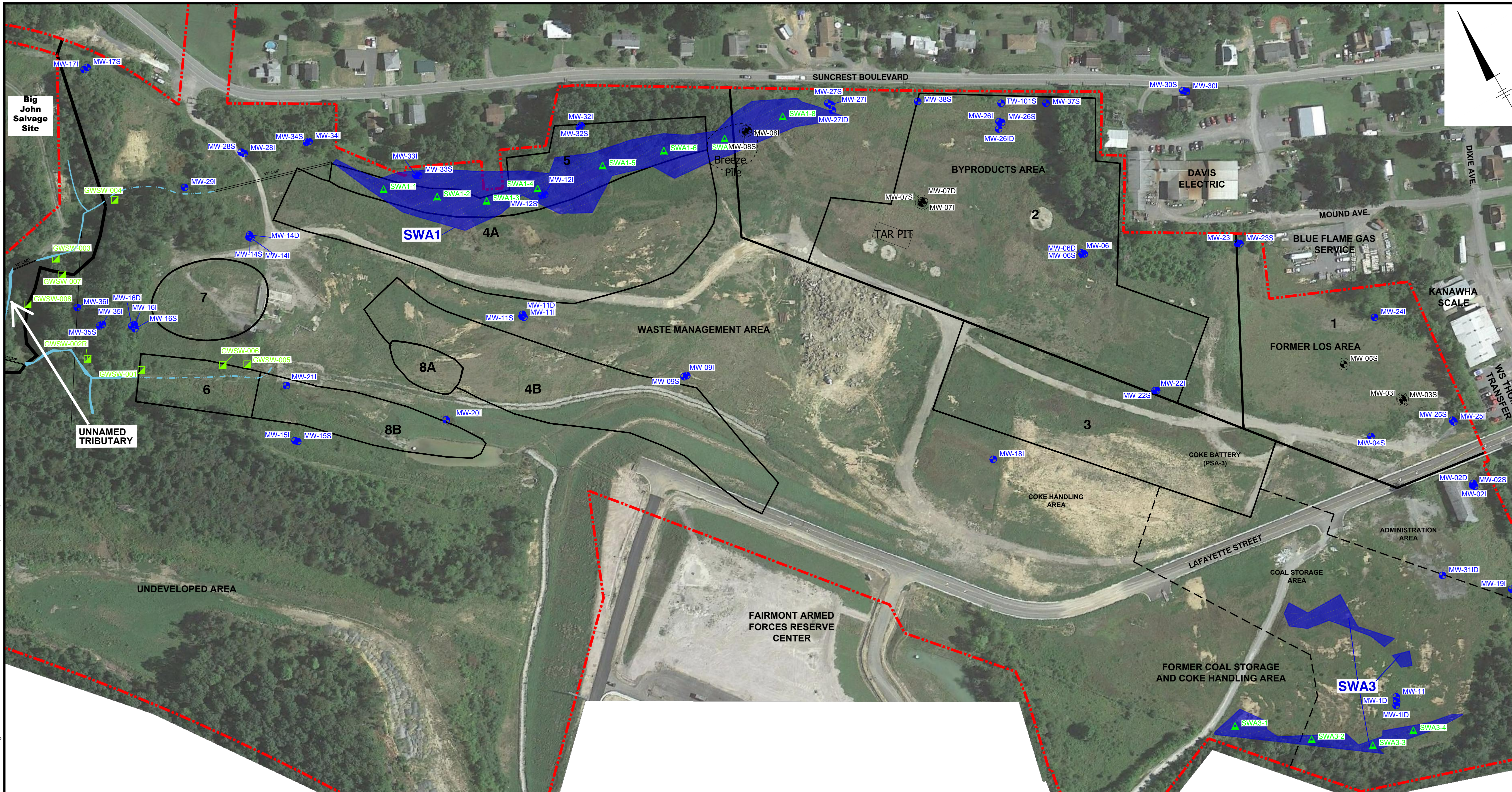

LEGEND:

- EXISITING MONITORING WELL
- GROUND WATER/SURFACE WATER SAMPLE (COLLECTED NOVEMBER 2012)
- ABANDONED MONITORING WELL
- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- APPROXIMATE PROPERTY BOUNDARY
- CORRUGATED METAL PIPE (CMP)
- SEASONALLY WET AREA (AS DETERMINED ON 11/19/2015)

HISTORIC POTENTIAL SOURCE AREAS

1	PSA1 – FORMER LIGHT OIL STORAGE AREA
2	PSA2 – FORMER BYPRODUCTS AREA
3	PSA3 – FORMER COKE BATTERY
4A	NORTH LANDFILL
4B	SOUTH LANDFILL
5	FORMER BREEZE WASHOUT AREA AND BREEZE PILE
6	FORMER IMPOUNDMENT
7	WASTE SLUDGE AND BREEZE STORAGE AREA
8A	FORMER SLUDGE STORAGE AREA
8B	FORMER OXIDATION IMPOUNDMENT NO. 1

NOTE:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, DATED SEPTEMBER 2013.
2. HORIZONTAL DATUM IS NAD 83 WV SPCS – NORTH ZONE. VERTICAL DATUM IS NAVD 1988.

0 100' 200'
GRAPHIC SCALE

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

SITE MAP

FIGURE
2

CITY: SYRACUSE, NY DIV/GROUP: ENVCADD DB: G. STOWELL, R. BASSETT, E. KRAHMER PIC: E. LYNCH PM/TM: R. PRICE TR: C. FOSTER LYR: ON=*;OFF=REF (FRZ) PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 6/24/2016 2:21 PM BY: SCHILLING, ADAM
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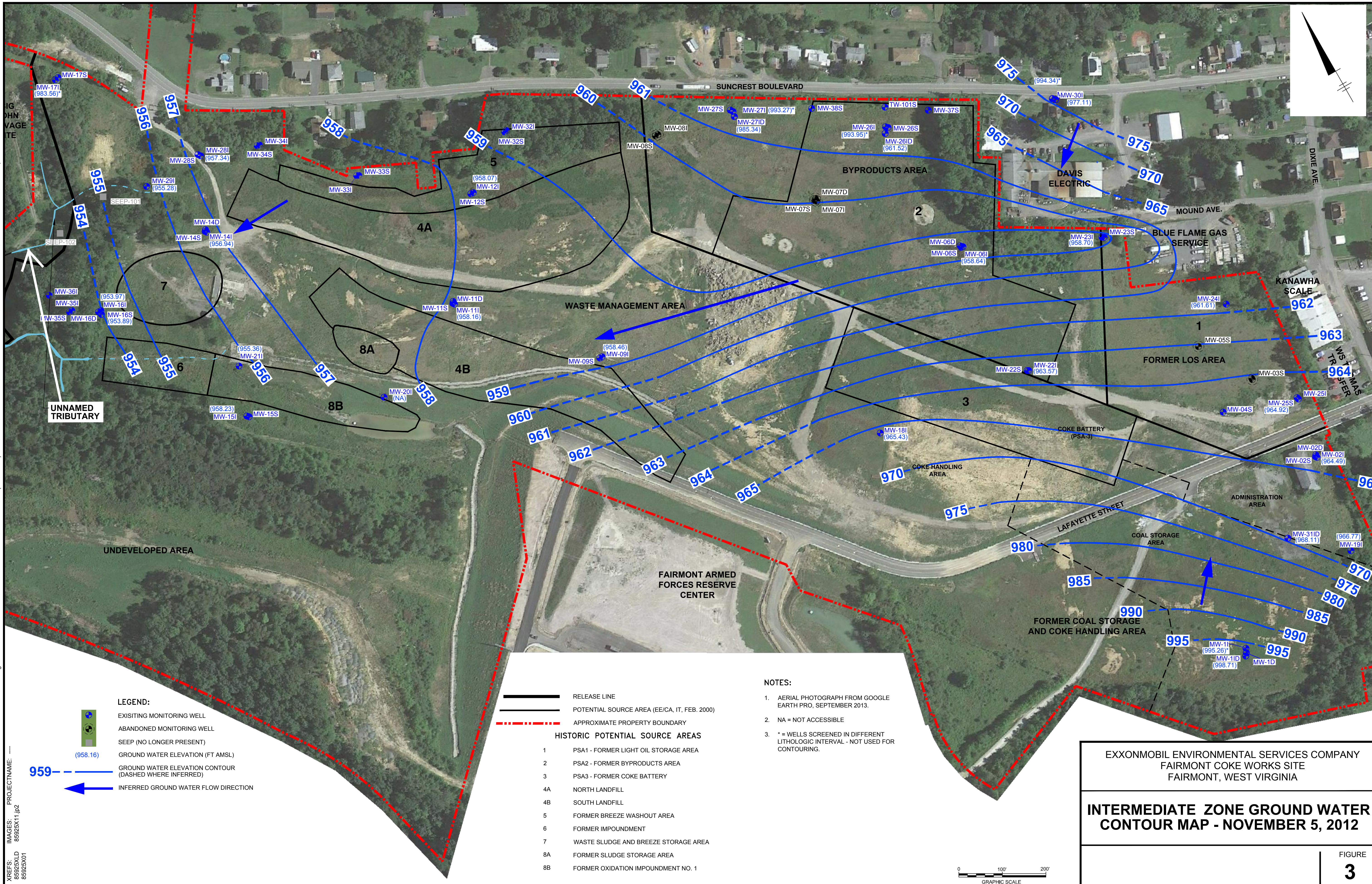

LEGEND:

- EXISITING MONITORING WELL
- ABANDONED MONITORING WELL
- SEEP (NO LONGER PRESENT)
- (958.16) GROUND WATER ELEVATION (FT AMSL)
- 959 GROUND WATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- INFERRED GROUND WATER FLOW DIRECTION
- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- APPROXIMATE PROPERTY BOUNDARY

HISTORIC POTENTIAL SOURCE AREAS

1	PSA1 - FORMER LIGHT OIL STORAGE AREA
2	PSA2 - FORMER BYPRODUCTS AREA
3	PSA3 - FORMER COKE BATTERY
4A	NORTH LANDFILL
4B	SOUTH LANDFILL
5	FORMER BREEZE WASHOUT AREA
6	FORMER IMPOUNDMENT
7	WASTE SLUDGE AND BREEZE STORAGE AREA
8A	FORMER SLUDGE STORAGE AREA
8B	FORMER OXIDATION IMPOUNDMENT NO. 1

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, SEPTEMBER 2013.
2. NA = NOT ACCESSIBLE
3. * = WELLS SCREENED IN DIFFERENT LITHOLOGIC INTERVAL - NOT USED FOR CONTOURING.

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

INTERMEDIATE ZONE GROUND WATER CONTOUR MAP - NOVEMBER 5, 2012

FIGURE 3

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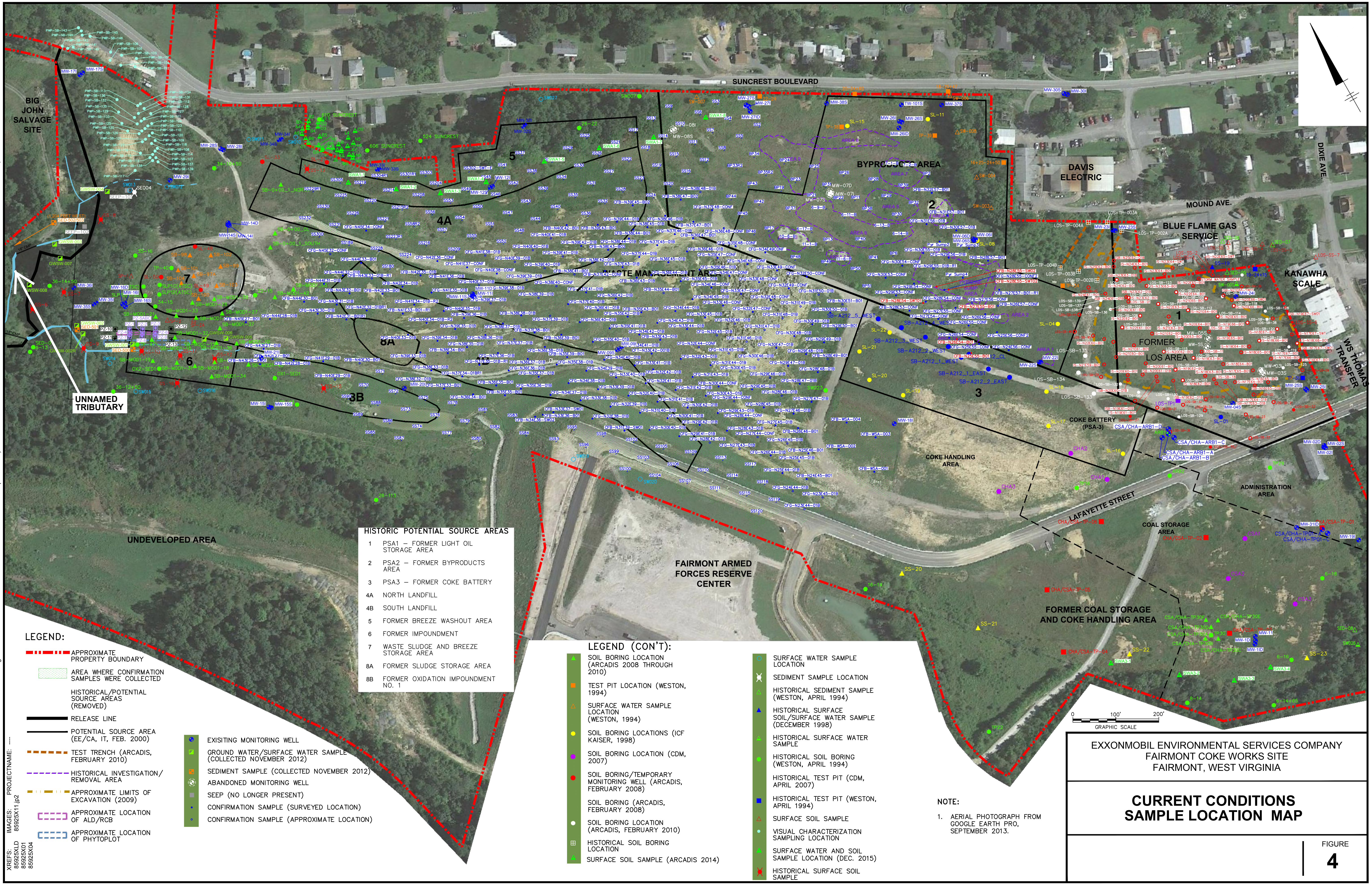

HISTORIC POTENTIAL SOURCE AREAS

1	PSA1 – FORMER LIGHT OIL STORAGE AREA
2	PSA2 – FORMER BYPRODUCTS AREA
3	PSA3 – FORMER COKE BATTERY
4A	NORTH LANDFILL
4B	SOUTH LANDFILL
5	FORMER BREEZE WASHOUT AREA
6	FORMER IMPOUNDMENT
7	WASTE SLUDGE AND BREEZE STORAGE AREA
8A	FORMER SLUDGE STORAGE AREA
8B	FORMER OXIDATION IMPOUNDMENT NO. 1

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- AREA WHERE CONFIRMATION SAMPLES WERE COLLECTED
- HISTORICAL/POTENTIAL SOURCE AREAS (REMOVED)
- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- TEST TRENCH (ARCADIS, FEBRUARY 2010)
- HISTORICAL INVESTIGATION/ REMOVAL AREA
- APPROXIMATE LIMITS OF EXCAVATION (2009)
- APPROXIMATE LOCATION OF ALD/RCB
- APPROXIMATE LOCATION OF PHYTOPLOT
- EXISITING MONITORING WELL
- GROUND WATER/SURFACE WATER SAMPLE (COLLECTED NOVEMBER 2012)
- SEDIMENT SAMPLE (COLLECTED NOVEMBER 2012)
- ABANDONED MONITORING WELL
- SEEP (NO LONGER PRESENT)
- CONFIRMATION SAMPLE (SURVEYED LOCATION)
- CONFIRMATION SAMPLE (APPROXIMATE LOCATION)

LEGEND (CON'T):

- SOIL BORING LOCATION (ARCADIS 2008 THROUGH 2010)
- TEST PIT LOCATION (WESTON, 1994)
- SURFACE WATER SAMPLE LOCATION (WESTON, 1994)
- SOIL BORING LOCATIONS (ICF KAISER, 1998)
- SOIL BORING LOCATION (CDM, 2007)
- SOIL BORING/TEMPORARY MONITORING WELL (ARCADIS, FEBRUARY 2008)
- SOIL BORING (ARCADIS, FEBRUARY 2008)
- SOIL BORING LOCATION (ARCADIS, FEBRUARY 2010)
- HISTORICAL SOIL BORING LOCATION
- SURFACE SOIL SAMPLE (ARCADIS 2014)
- SURFACE WATER SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- HISTORICAL SEDIMENT SAMPLE (WESTON, APRIL 1994)
- HISTORICAL SURFACE SOIL/SURFACE WATER SAMPLE (DECEMBER 1998)
- HISTORICAL SURFACE WATER SAMPLE
- HISTORICAL SOIL BORING (WESTON, APRIL 1994)
- HISTORICAL TEST PIT (CDM, APRIL 2007)
- HISTORICAL TEST PIT (WESTON, APRIL 1994)
- SURFACE SOIL SAMPLE
- VISUAL CHARACTERIZATION SAMPLING LOCATION
- SURFACE WATER AND SOIL SAMPLE LOCATION (DEC. 2015)
- HISTORICAL SURFACE SOIL SAMPLE

NOTE:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, SEPTEMBER 2013.

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

CURRENT CONDITIONS SAMPLE LOCATION MAP

FIGURE 4

CITY: SYRACUSE, NY DIV/GROUP: ENV/CADD DB: G. STOWELL, E. KRAMHER, R. BASSETT PIC: E. LYNCH PM/TM: R. PRICE TR: C. FOSTER LYR: ON=*;OFF=REF (FRZ)
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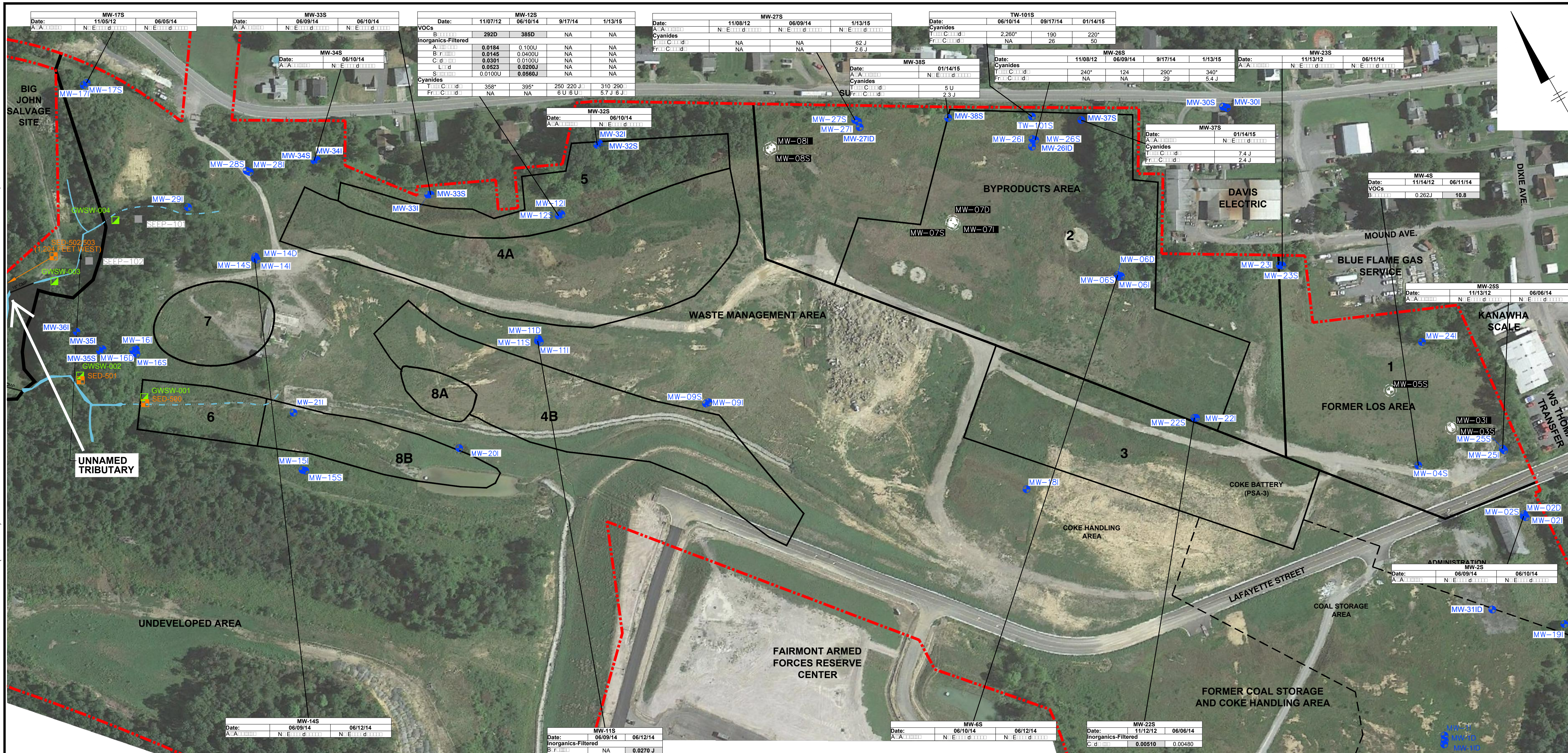


LEGEND:

- EXISITING MONITORING WELL
- GROUND WATER/SURFACE WATER SAMPLE (COLLECTED NOVEMBER 2012)
- SEDIMENT SAMPLE (COLLECTED NOVEMBER 2012)
- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- APPROXIMATE PROPERTY BOUNDARY

HISTORIC POTENTIAL SOURCE AREA

1	PSA1 – FORMER LIGHT OIL STORAGE AREA
2	PSA2 – FORMER BYPRODUCTS AREA
3	PSA3 – FORMER COKE BATTERY
4A	NORTH LANDFILL
4B	SOUTH LANDFILL
5	FORMER BREEZE WASHOUT AREA
6	FORMER IMPOUNDMENT
7	WASTE SLUDGE AND BREEZE STORAGE AREA
8A	FORMER SLUDGE STORAGE AREA
8B	FORMER OXIDATION IMPOUNDMENT NO. 1

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, SEPTEMBER 2013.
2. BOLD AND HIGHLIGHTED VALUES ARE ABOVE THE NOVEMBER 2012 USEPA MAXIMUM CONTAMINANT LEVEL (MCL).
3. RESULTS FOR VOCs, SVOCs AND CYANIDE ARE IN MICROGRAMS PER LITER ($\mu g/L$).
4. RESULTS FOR INORGANICS–FILTERED ARE IN MILLIGRAMS PER LITER (mg/L).
5. TOTAL INORGANIC CONCENTRATIONS WERE NOT CONSIDERED.

DATA QUALIFIERS:

U – THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED AT THE ASSOCIATED QUANTITATION LIMIT.
B – THE COMPOUND WAS FOUND IN THE ASSOCIATED LABORATORY METHOD BLANK.
D – CONCENTRATION IS BASED ON A DILUTED SAMPLE ANALYSIS.
J – ESTIMATED CONCENTRATION.
UL – THE COMPOUND WAS NOT DETECTED, QUANTITATION LIMIT IS PROBABLY HIGHER.
HT3 – SAMPLE RECIEVED WITH INSUFFICIENT HOLDING TIME REMAINING FOR ANALYSIS TO BE PERFORMED WITHIN METHOD'S HOLDING TIME REQUIREMENTS.
UB – COMPOUND CONSIDERED NON-DETECT AT THE LISTED VALUE DUE TO ASSOCIATED BLANK CONTAMINATION.
K – THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY AND THE REPORTED VALUE MAY BE BIASED HIGH.
L – THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY AND THE REPORTED VALUE MAY BE BIASED LOW.
NA – NOT ANALYZED.
WNPTS – WELL NOT PRESENT AT TIME OF SAMPLING
* – THE MCL FOR CYANIDE (200 $\mu g/L$) IS BASED ON FREE CYANIDE; TOTAL CYANIDE CONCENTRATIONS ARE NOT COMPARED TO THE MCL

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

CONSTITUENTS DETECTED ABOVE MCLs IN PERCHED ZONE GROUND WATER - 2012 TO 2015

FIGURE 5

MW-17I		
Date:	11/05/12	06/05/14
All Analytes	No Exceedances	No Exceedances

MW-28I		
Date:	11/08/12	06/04/14
Cyanides		
Total Cyanide	660*	153 UB 75.0 UB

MW-33I	
Date:	06/12/14
Inorganics-Filtered	
Lead	0.103 J
Thallium	0.00882 J

MW-27I		
Date:	11/08/12	06/09/14
All Analytes	No Exceedances	No Exceedances

MW-26I		
Date:	06/09/14	09/17/14
Cyanides		
Total Cyanide	2,620*	320*
Free Cyanide	NA	9.4

MW-6I		
Date:	11/12/12	06/10/14
All Analytes	No Exceedances	No Exceedances

MW-30S		
Date:	11/07/12	06/11/14
All Analytes	No Exceedances	No Exceedances

GWSW-004		
Date:	11/26/12	03/30/15
All Analytes	No Exceedances	No Exceedances

MW-29I		
Date:	11/12/12	06/11/14
All Analytes	No Exceedances	No Exceedances

MW-34I	
Date:	06/10/14
All Analytes	No Exceedances

MW-32I	
Date:	06/10/14
All Analytes	No Exceedances

MW-27ID		
Date:	11/08/12	06/09/14
All Analytes	No Exceedances	No Exceedances

MW-26ID		
Date:	11/14/12	06/10/14
All Analytes	No Exceedances	No Exceedances

MW-30I		
Date:	11/14/12	06/11/14
All Analytes	No Exceedances	No Exceedances

MW-23I		
Date:	11/13/12	06/11/14
All Analytes	No Exceedances	No Exceedances

GWSW-003		
Date:	11/26/12	03/30/15
All Analytes	No Exceedances	No Exceedances

GWSW-007	
Date:	03/30/15
VOCs	
Benzene	1,800 D
Inorganics-Filtered	
Arsenic	0.0292 J
Barium	0.0315
Chromium, Total	0.277 J
Lead	0.0384

MW-36I		
Date:	06/09/14	04/01/15
VOCs		
Benzene	183	20.0
Inorganics-Filtered		
Barium	0.0400 U	0.0318
Chromium, Total	0.0500 U	0.307
Lead	0.0500 U	0.0371

GWSW-008	
Date:	03/30/15
VOCs	
Benzene	6.60
Inorganics-Filtered	
Arsenic	0.0285 J
Barium	0.0101

MW-35S		
Date:	06/12/14	04/01/15
VOCs		
Benzene	NA	38.0 J
Inorganics-Filtered		
Barium	0.0380	0.0219
Chromium, Total	0.0840	0.184
Lead	0.0265 J	0.0300 U

MW-35I		
Date:	06/12/14	04/01/15
VOCs		
Benzene	NA	1,100 D
Inorganics-Filtered		
Antimony	0.100 U	0.166 J
Cadmium	0.0100 U	0.0120 J
Lead	0.228	1.50 U
Selenium	0.0990 J	0.0677 J

GWSW-002R	
Date:	03/31/15
Inorganics-Filtered	
Antimony	0.0259 J

MW-16I		
Date:	06/05/14	03/31/15
VOCs		
Benzene	2,140 D	1,100 D
Inorganics-Filtered		
Antimony	0.0100 U	0.0180 J
Barium	0.00840	0.00690 J

MW-16S		
Date:	06/05/14	03/31/15
VOCs		
Benzene	229 D	230 D [220 D]
Inorganics-Filtered		
Antimony	0.0100 U	0.0131 J [0.0102 J]

GWSW-001		
Date:	11/26/12	03/30/15
SVOCs		
bis(2-Ethylhexyl)phthalate	9.43 U [13.7]	5.00 U
Inorganics-Filtered		
Arsenic	0.0100 U [0.0100 U]	0.0314 J

GWSW-006	
Date:	03/30/15
VOCs	
Benzene	40.0 D
Inorganics-Filtered	
Arsenic	0.0316 J

MW-14I		
Date:	11/07/12	06/03/14
VOCs		
Benzene	844 D	894 D
Inorganics-Filtered		
Barium	0.0500 J	0.0270 J
Chromium VI	0.800 LJ	10.0 U
Lead	0.500 U	0.0210 J
Selenium	1.00 U	0.0530 J
Thallium	0.00200 U	0.00472 J

GWSW-005	
Date:	03/30/15
Inorganics-Filtered	
Arsenic	0.0475

MW-21I		
Date:	11/13/12	06/12/14
Cyanides		
Total Cyanide	291 K*	124 J

MW-15I		
Date:	11/13/12	06/09/14
Inorganics-Filtered		
Chromium VI	0.0100 UL	0.500 J

MW-11I		
Date:	11/15/12	06/04/14
VOCs		
Benzene	91.7	117 J
Inorganics-Filtered		
Barium	0.0150 J	0.0400 U
Cadmium	0.0100	0.0100 U
Lead	0.0210 J	0.0500 UJ
Cyanides		
Total Cyanide	304*	29.0

MW-12I		
Date:	11/08/12	06/10/14
Inorganics-Filtered		
Lead	0.0123	0.0158

MW-9I		
Date:	11/14/12	06/12/14
VOCs		
Benzene	48.5	24.0
Inorganics-Filtered		
Arsenic	0.0820 KJ	R
Barium	0.0480	0.0200 J
Lead	0.0310 J	0.319 J
Selenium	0.259	0.0620 J

MW-18I		
Date:	11/14/12	06/12/14
All Analytes	No Exceedances	No Exceedances

MW-1ID		
Date:	11/06/12	06/05/14
All Analytes	No Exceedances	No Exceedances

MW-22I		
Date:	11/12/12	06/06/14
SVOCs		
bis(2-Ethylhexyl)phthalate	8.56 J	9.90 UB

MW-24I		
Date:	11/08/12	06/11/14
SVOCs		
Benzo(a)pyrene	1.92 U	1.15 J
Pentachlorophenol	24.0 U	2.38 J

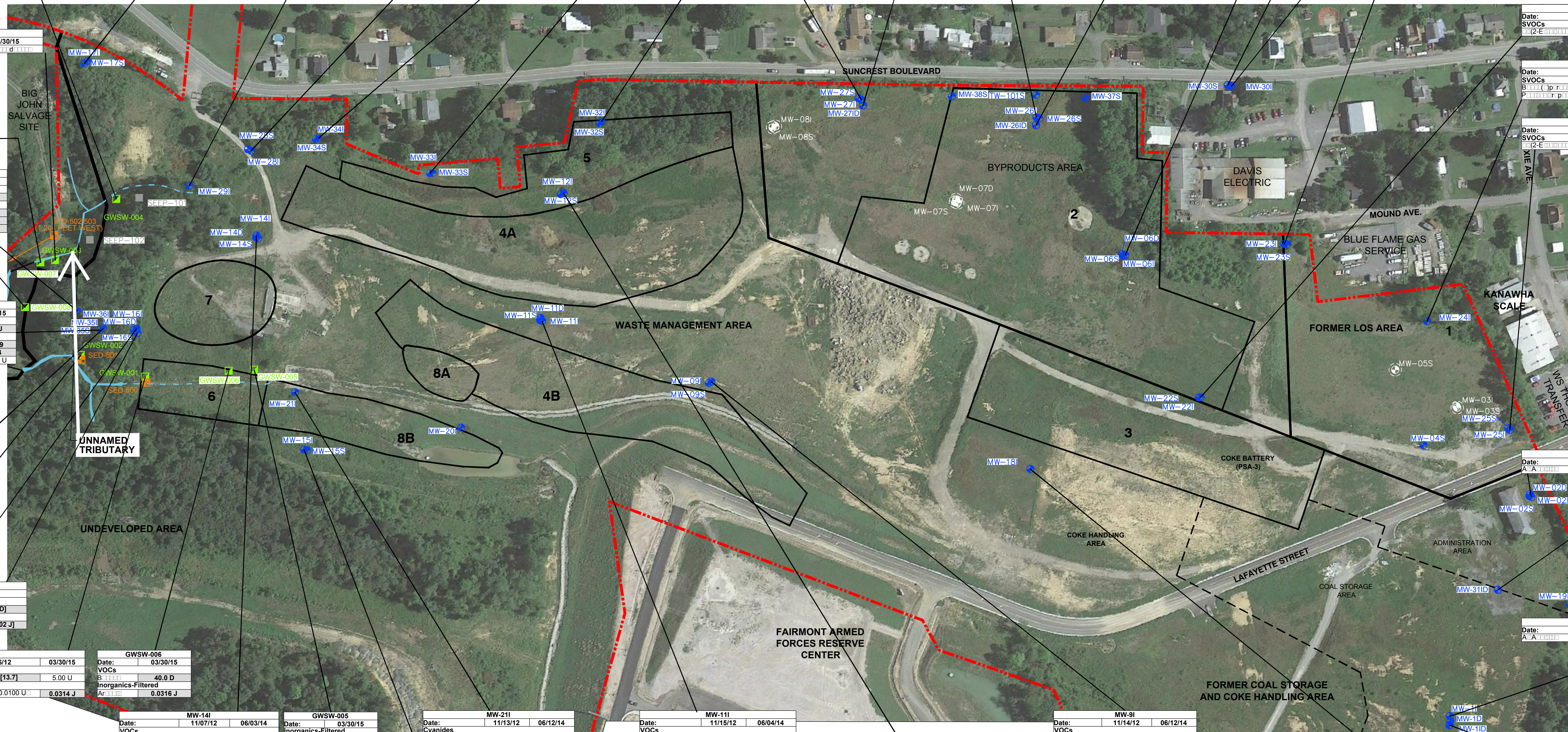
MW-25I		
Date:	11/13/12	06/06/14
SVOCs		
bis(2-Ethylhexyl)phthalate	11.6	10.1 UB

MW-2I		
Date:	11/07/12	06/04/14
All Analytes	No Exceedances	No Exceedances

MW-31ID		
Date:	11/13/12	06/11/14
Inorganics-Filtered		
Arsenic	0.0129	0.0100 U

MW-19I		
Date:	11/13/12	06/11/14
All Analytes	No Exceedances	No Exceedances

MW-1I		
Date:	11/06/12	06/05/14
Inorganics-Filtered		
Selenium	0.0557	0.0690 J



LEGEND:

- EXISITING MONITORING WELL
- GROUND WATER/SURFACE WATER SAMPLE (COLLECTED NOVEMBER 2012)
- SEDIMENT SAMPLE (COLLECTED NOVEMBER 2012)
- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- APPROXIMATE PROPERTY BOUNDARY

HISTORIC POTENTIAL SOURCE AREAS

1	PSA1 – FORMER LIGHT OIL STORAGE AREA
2	PSA2 – FORMER BYPRODUCTS AREA
3	PSA3 – FORMER COKE BATTERY
4A	NORTH LANDFILL
4B	SOUTH LANDFILL
5	FORMER BREEZE WASHOUT AREA
6	FORMER IMPOUNDMENT
7	WASTE SLUDGE AND BREEZE STORAGE AREA
8A	FORMER SLUDGE STORAGE AREA
8B	FORMER OXIDATION IMPOUNDMENT NO. 1

NOTES:

1. AERIAL PHOTOGRAPH FROM BING MAPS, MARCH 2013.
2. BOLD AND HIGHLIGHTED VALUES ARE ABOVE THE NOVEMBER 2012 USEPA MAXIMUM CONTAMINANT LEVEL (MCL).
3. RESULTS FOR VOCs, SVOCs AND CYANIDE ARE IN MICROGRAMS PER LITER (μg/L).
4. RESULTS FOR INORGANICS–FILTERED ARE IN MILLIGRAMS PER LITER (mg/L).
5. TOTAL INORGANIC CONCENTRATIONS WERE NOT CONSIDERED.
6. MW–16S AND MW–35S ARE SCREENED N THE UPPER INTERMEDIATE GROUNDWATER ZONE AND THEREFORE, ARE INCLUDED IN THIS FIGURE.

DATA QUALIFIERS:

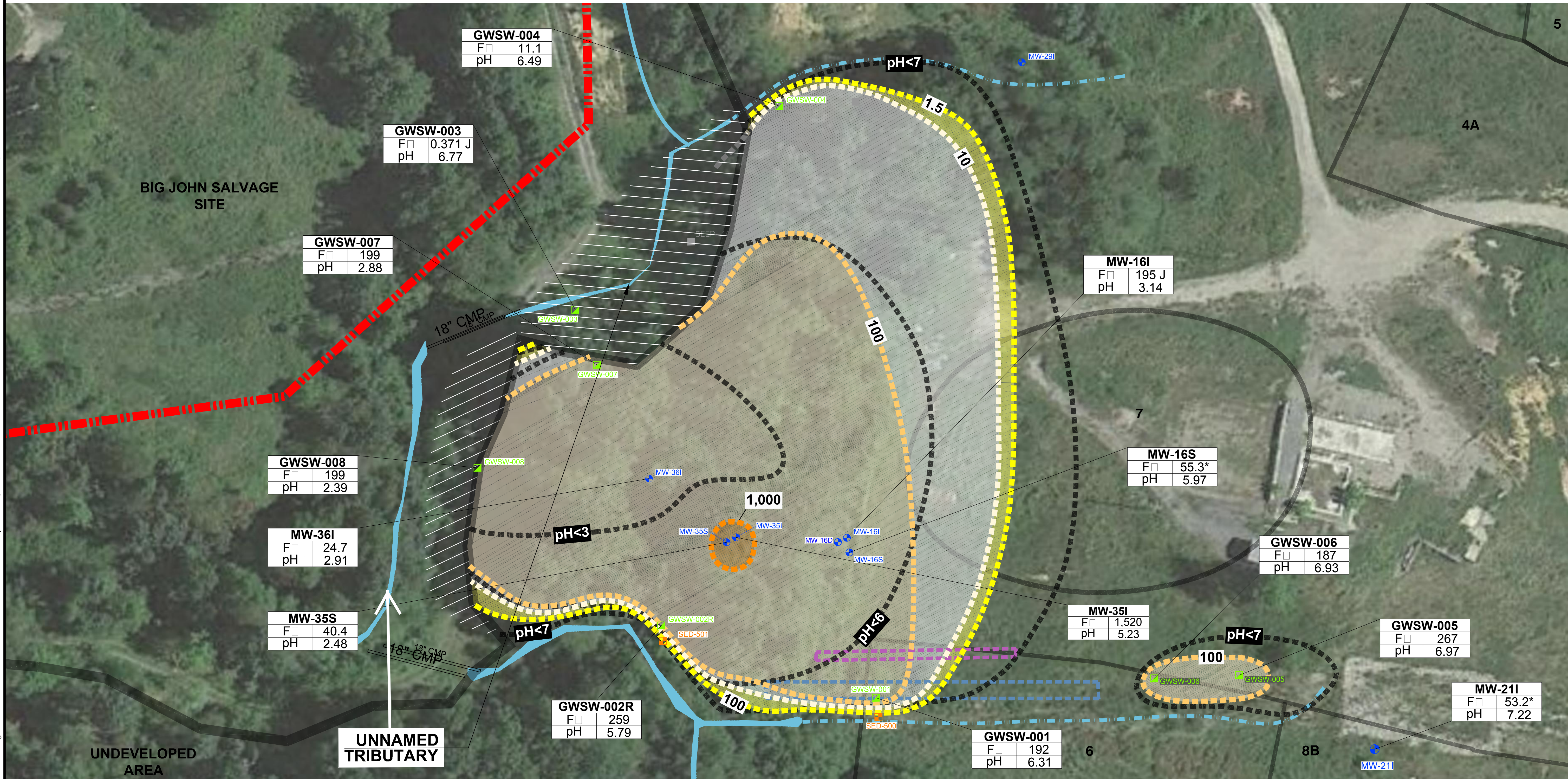
U – THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED AT THE ASSOCIATED QUANTITATION LIMIT.
B – THE COMPOUND WAS FOUND IN THE ASSOCIATED LABORATORY METHOD BLANK.
D – CONCENTRATION IS BASED ON A DILUTED SAMPLE ANALYSIS.
J – ESTIMATED CONCENTRATION.
UL– THE COMPOUND WAS NOT DETECTED, QUANTITATION LIMIT IS PROBABLY HIGHER.
UB – COMPOUND CONSIDERED NON–DETECT AT THE LISTED VALUE DUE TO ASSOCIATED BLANK CONTAMINATION.
K – THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY AND THE REPORTED VALUE MAY BE BIASED HIGH.
L – THE COMPOUND WAS POSITIVELY IDENTIFIED; HOWEVER, THE ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED CONCENTRATION ONLY AND THE REPORTED VALUE MAY BE BIASED LOW.
R – SAMPLE RESULT WAS REJECTED DURING VALIDATION.
NA – NOT ANALYZED.
[] – DUPLICATE SAMPLE RESULT.
WNPTS – WELL NOT PRESENT AT TIME OF SAMPLING.
* – THE MCL OF CYANIDE (200 μg/L) IS BASED ON FREE CYANIDE; TOTAL CYANIDE CONCENTRATIONS ARE NOT COMPARED TO THE MCL.

0 120' 240'
GRAPHIC SCALE

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

CONSTITUENTS DETECTED ABOVE MCLs IN INTERMEDIATE ZONE GROUND WATER - 2012 TO 2015

FIGURE
6



LEGEND:

- EXISITING MONITORING WELL
- GROUND WATER/SURFACE WATER SAMPLE
- SEDIMENT SAMPLE (COLLECTED NOVEMBER 2012)

- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- APPROXIMATE PROPERTY BOUNDARY

HISTORIC POTENTIAL SOURCE AREAS

- 4A NORTH LANDFILL
- 6 FORMER IMPOUNDMENT
- 7 WASTE SLUDGE AND BREEZE STORAGE AREA
- 8A FORMER SLUDGE STORAGE AREA
- 8B FORMER OXIDATION IMPOUNDMENT NO. 1

- ROUX ANOXIC LIMESTONE TRENCH
- PHYTOPLOT

IRON KEY:
(DASHED WHERE INFERRED)

- 1.5 mg/L
- 10 mg/L
- 100 mg/L
- 1,000 mg/L
- NO DATA AVAILABLE
- APPROXIMATE pH BOUNDARIES

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, SEPTEMBER 2013.
2. IRON (Fe) CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/L).
3. pH RESULTS ARE PRESENTED IN STANDARD UNITS.
4. * – JUNE 2014 RESULT.
5. MW-36I IRON CONCENTRATION NOT USED FOR CONTOURING.
6. MANGANESE EXTENT IS SIMILAR TO IRON DISTRIBUTION.
7. J – ESTIMATED CONCENTRATION
8. MW-16S AND MW-35S ARE SCREENED IN THE UPPER INTERMEDIATE GROUNDWATER ZONE AND THEREFORE, ARE SHOWN ON THIS FIGURE (BUT WERE NOT USED FOR CONTOURING).

0 30' 60'
GRAPHIC SCALE

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

IRON AND pH DISTRIBUTION ON WESTERN PORTION OF SITE - MARCH/APRIL 2015

FIGURE 7

CITY: SYRACUSE, NY DIV/GROUP: ENV/CADD DB: G. STOWELL, E. KRAHMER, R. BASSETT PIC: E. LYNCH PM/TM: R. PRICE TR: C. FOSTER LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0085925\1601\00501\DWG\EPA\85925C03.dwg LAYOUT: 7 SAVED: 6/24/2016 1:56 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 6/24/2016 2:23 PM BY: SCHILLING, ADAM
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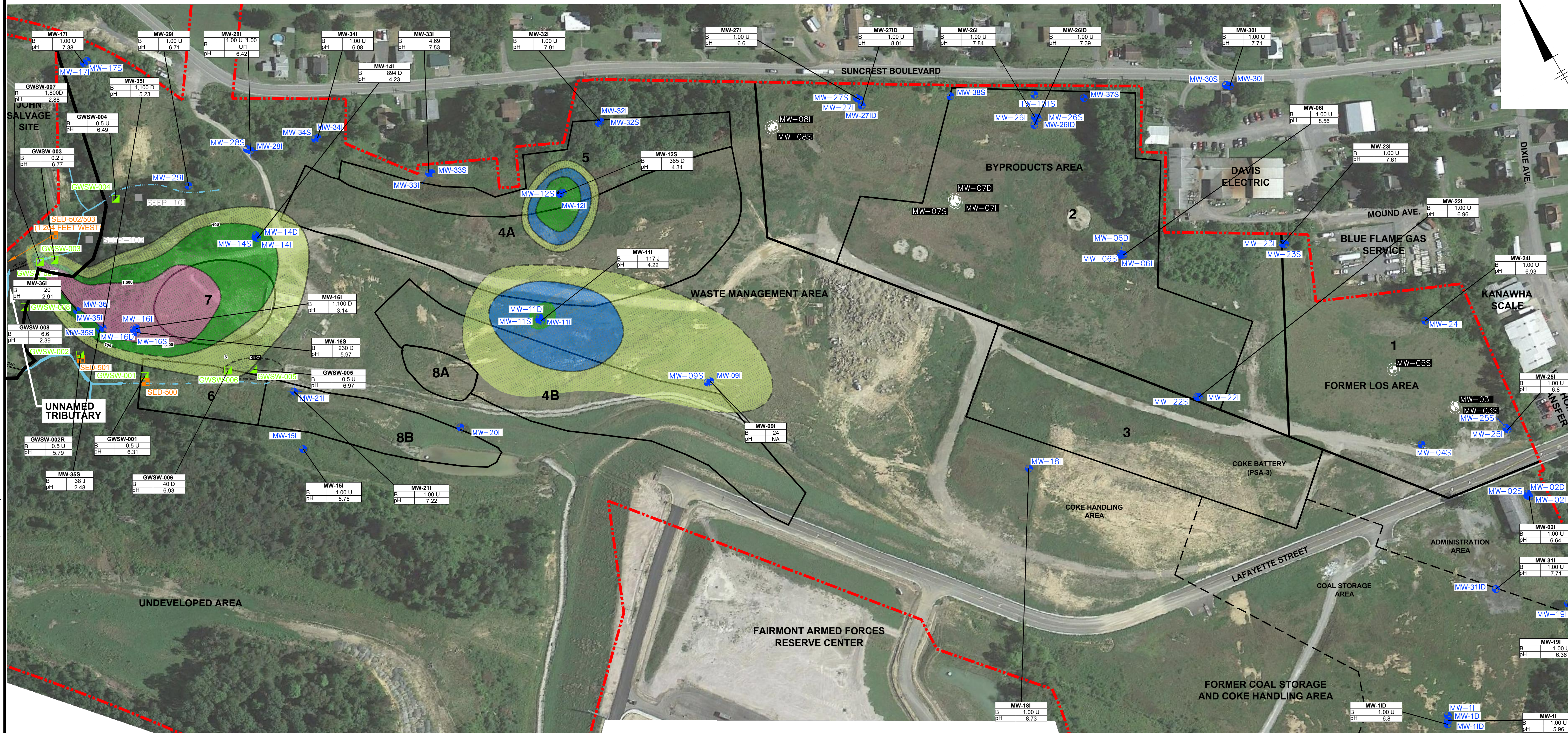


LEGEND:

- EXISITING MONITORING WELL
- GROUND WATER/SURFACE WATER SAMPLE (COLLECTED NOVEMBER 2012)
- SEDIMENT SAMPLE (COLLECTED NOVEMBER 2012)
- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- APPROXIMATE PROPERTY BOUNDARY

HISTORIC POTENTIAL SOURCE AREAS

1	PSA1 – FORMER LIGHT OIL STORAGE AREA
2	PSA2 – FORMER BYPRODUCTS AREA
3	PSA3 – FORMER COKE BATTERY
4A	NORTH LANDFILL
4B	SOUTH LANDFILL
5	FORMER BREEZE WASHOUT AREA
6	FORMER IMPOUNDMENT
7	WASTE SLUDGE AND BREEZE STORAGE AREA
8A	FORMER SLUDGE STORAGE AREA
8B	FORMER OXIDATION IMPOUNDMENT NO. 1

BENZENE CONCENTRATION

- >/= 5 µg/L
- >/= 50 µg/L
- >/= 100 µg/L
- >/= 1,000 µg/L
- >/= 10,000 µg/L
- DASHED WHERE INFERRED

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, SEPTEMBER 2013.
2. MW-16S AND MW-35S ARE SCREENED IN THE UPPER INTERMEDIATE GROUNDWATER ZONE AND THEREFORE, ARE SHOWN ON THIS FIGURE.
3. RESULTS ARE IN MICROGRAMS PER LITER (µg/L).
4. pH RESULTS ARE PRESENTED IN STANDARD UNITS.

DATA QUALIFIERS:

U – THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED AT THE ASSOCIATED QUANTITATION LIMIT.
B – THE COMPOUND WAS FOUND IN THE ASSOCIATED LABORATORY METHOD BLANK.
J – ESTIMATED CONCENTRATION.
D – ANALYZED AT A DILUTION.

0 100' 200'
GRAPHIC SCALE

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

INFERRED EXTENT OF BENZENE AND pH IN GROUND WATER 2014-2015

FIGURE
8

HISTORIC POTENTIAL SOURCE AREAS

1 PSA1 – FORMER LIGHT OIL STORAGE AREA
2 PSA2 – FORMER BYPRODUCTS AREA
3 PSA3 – FORMER COKE BATTERY
4A NORTH LANDFILL
4B SOUTH LANDFILL
5 FORMER BREEZE WASHOUT AREA
6 FORMER IMPOUNDMENT
7 WASTE SLUDGE AND BREEZE STORAGE AREA
8A FORMER SLUDGE STORAGE AREA
8B FORMER OXIDATION IMPOUNDMENT NO. 1

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- RELEASE LINE (BJS SITE)
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- HISTORICAL INVESTIGATION/ REMOVAL AREA
- VI RESTRICTION
- 100' BUFFER AROUND BENZENE IN GROUNDWATER > 5 µg/L

COLOR KEY		mg/Kg
GREEN		ND
BLUE		>ND–0.1
PURPLE		>0.1–1
YELLOW		>1–10
ORANGE		>10–100
RED		>100

NOTE:

1. ALL SOIL CONCENTRATIONS ARE IN MILLIGRAMS PER KILOGRAM (mg/Kg).
2. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, SEPTEMBER 2013.
3. COLOR DOTS REPRESENT BENZENE CONCENTRATION (PER "COLOR KEY") IN SOIL AT THE GIVEN LOCATION. WHERE MULTIPLE DEPTHS WERE SAMPLED AT A GIVEN LOCATION, COLOR DOT REPRESENTS MAXIMUM CONCENTRATION MEASURED.

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

VAPOR INTRUSION PROTECTION AREA

FIGURE 9

CITY: SYRACUSE, NY DIV/GROUP: ENV/CADD DB: G. STOWELL, E. KRAHMER, R. BASSETT PIC: E. LYNCH PM/TM: R. PRICE TR: C. FOSTER LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0085925\0001\00501\DWG\EPA\85925C06.dwg LAYOUT: 9 SAVED: 6/24/2016 1:59 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 6/24/2016 2:22 PM BY: SCHILLING, ADAM
XREFS: IMAGES: PROJECTNAME: ----
85925X01 85925X11.jp2
P-BENZENE

POTENTIAL RECEPTORS

CURRENT: Trespasser, Off-Site Worker, Off-Site Resident, Environmental Worker
FUTURE: On-Site Worker, Recreational User, Hypothetical On-Site Resident, Hypothetical Off-Site Resident, Construction Worker

Potential Primary Source	Secondary Release	Potential Secondary Source	Potential Secondary Release	Exposure Medium	Exposure Pathway	TRESPASSER	OFF-SITE WORKER	OFF-SITE RESIDENT	ENVIRONMENTAL WORKER	ON-SITE WORKER	RECREATIONAL USER	HYPOTHETICAL ON-SITE RESIDENT	HYPOTHETICAL OFF-SITE RESIDENT	CONSTRUCTION WORKER
SOIL	MIGRATION	GROUND WATER	TRANSIT/ PUMPING	Tap Water	INGESTION	○	◐	◐	○	○	○	●	◐	○
					DERMAL	○	◐	◐	○	○	○	●	◐	○
					INHALATION	○	◐	◐	○	○	○	●	◐	○
			IRRIGATION	Homegrown Produce	INGESTION	○	○	◐	○	○	○	●	◐	○
			INFILTRATION/ EXCAVATION	Surface Water	DERMAL	●	○	○	○	○	●	○	○	○
					INGESTION	●	○	○	○	○	●	○	○	○
				Trench Water	DERMAL	○	○	○	●	○	○	○	○	●
			VOLATILIZATION	Trench Air	INHALATION	○	○	○	●	○	○	○	○	●
			VOLATILIZATION/ VAPOR INTRUSION	Indoor Air	INHALATION	○	◐	●	○	●	○	●	●	○
		SOIL		Soil	DERMAL	●	●	●	●	●	●	●	●	●
					INGESTION	●	●	●	●	●	●	●	●	●
				Homegrown Produce	INGESTION	○	○	◐	○	○	○	◐	◐	○
			RESUSPENSION AS DUST	Ambient Air	INHALATION	●	●	●	●	●	●	●	●	●
			VOLATILIZATION	Ambient Air	INHALATION	◐	◐	◐	●	◐	◐	◐	◐	●
			VOLATILIZATION/ VAPOR INTRUSION	Indoor Air	INHALATION	○	◐	◐	○	◐	○	◐	◐	○

LEGEND

● Potentially complete exposure pathway

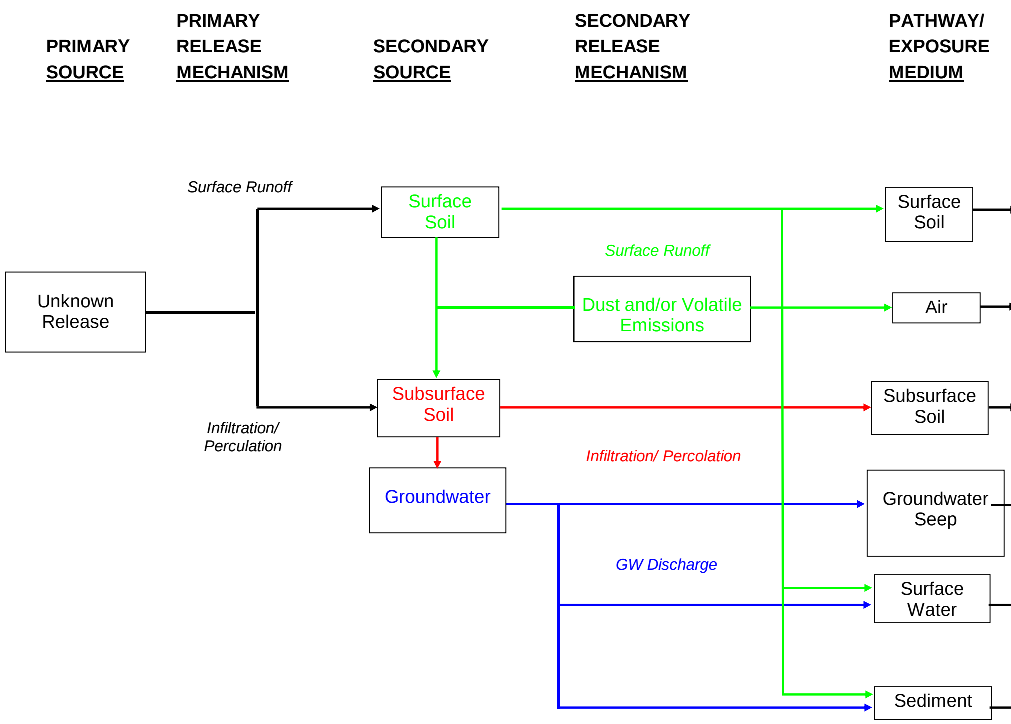
◐ Potentially complete exposure pathway expected to be minor; not quantitatively evaluated

○ Incomplete exposure pathway

FAIRMONT COKE WORKS SITE, FAIRMONT, WEST VIRGINIA
SITE-WIDE HUMAN HEALTH RISK ASSESSMENT

CONCEPTUAL SITE MODEL (CSM)

FIGURE **10**

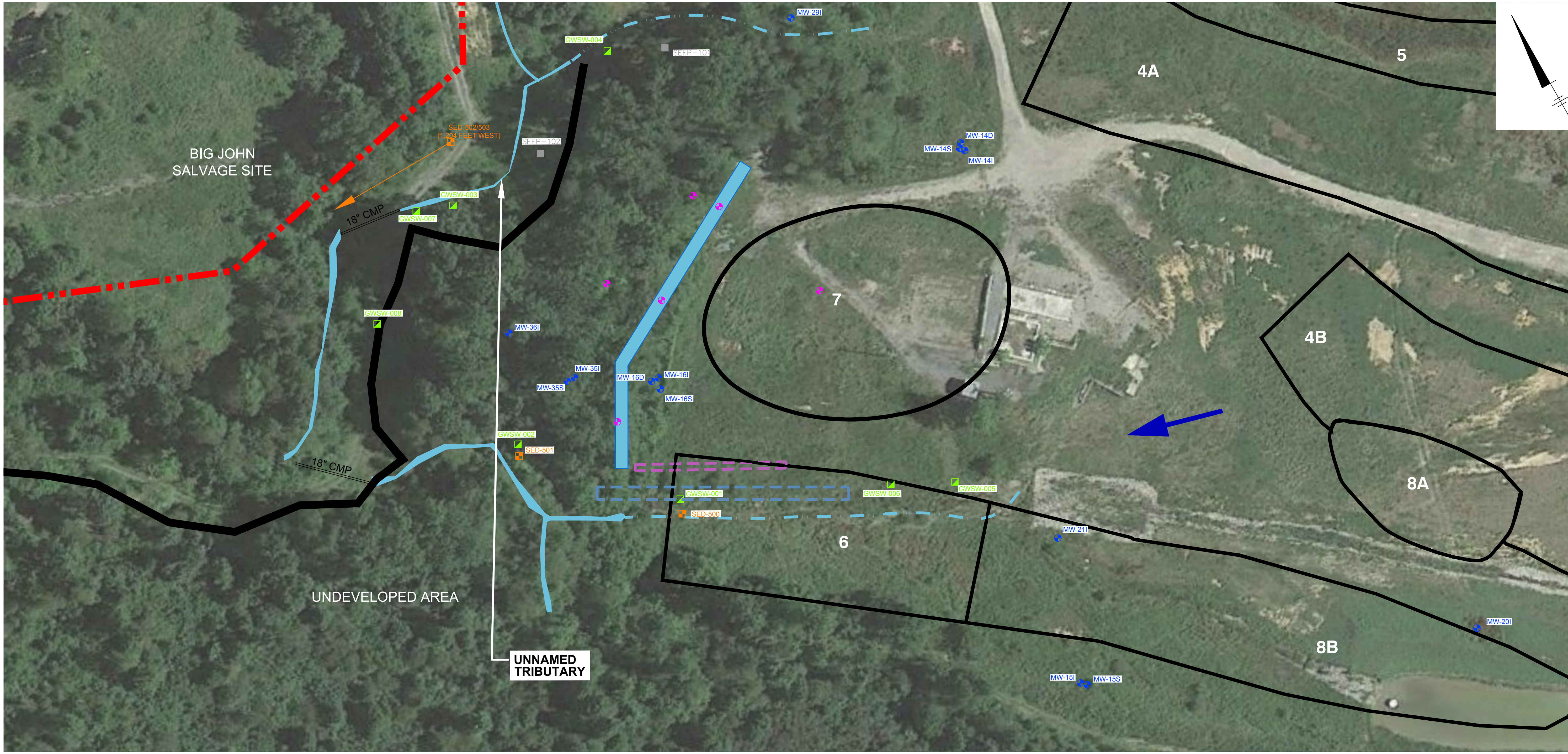


Pathway/Exposure Medium	Exposure Route	Onsite: Terrestrial/Wetland Wildlife	Onsite: Terrestrial/Wetland Plants	Onsite: Soil/Sediment Invertebrates	Unnamed Tributary: Wetland Wildlife	Unnamed Tributary: Sediment Invertebrates
Surface Soil	Ingestion	x	NA	x	NA	NA
	Direct Contact/Uptake	x	x	x	NA	NA
	Food Chain	x	NA	NA	NA	NA
Air	Inhalation	o	NA	NA	NA	NA
Subsurface Soil	Ingestion	NA	NA	NA	NA	NA
	Direct Contact/Uptake	o	NA	o	NA	NA
	Food Chain	NA	NA	NA	NA	NA
Groundwater Seep	Ingestion	o	NA	o	NA	NA
	Direct Contact/Uptake	o	o	o	NA	NA
	Food Chain	NA	NA	NA	NA	NA
Surface Water	Ingestion	o	NA	NA	x	x
	Direct Contact/Uptake	o	o	o	x	x
	Food Chain	NA	NA	NA	NA	NA
Sediment	Ingestion	o	NA	NA	x	x
	Direct Contact/Uptake	o	o	o	x	x
	Food Chain	NA	NA	NA	x	NA

NA Pathway not applicable.
x Complete Exposure Pathway
o Potentially Complete Exposure Pathway

Ecological Conceptual Site Model
Fairmont Coke Works
Fairmont, West Virginia

Figure 11



LEGEND:

- EXISITING MONITORING WELL
- GROUND WATER/SURFACE WATER SAMPLE (COLLECTED NOVEMBER 2012)
- SEDIMENT SAMPLE (COLLECTED NOVEMBER 2012)
- ABANDONED MONITORING WELL
- SEEP (NO LONGER PRESENT)
- PROPOSED MONITORING WELL CLUSTER
- ROUX ANOXIC LIMESTONE TRENCH
- PHYTOPLOT
- INFERRED GROUND WATER FLOW DIRECTION – INTERMEDIATE ZONE
- RELEASE LINE
- POTENTIAL SOURCE AREA (EE/CA, IT, FEB. 2000)
- APPROXIMATE PROPERTY BOUNDARY
- CONCEPTUAL PLACEMENT OF LT/PRB

HISTORIC POTENTIAL SOURCE AREAS

1	PSA1 – FORMER LIGHT OIL STORAGE AREA
2	PSA2 – FORMER BYPRODUCTS AREA
3	PSA3 – FORMER COKE BATTERY
4A	NORTH LANDFILL
4B	SOUTH LANDFILL
5	FORMER BREEZE WASHOUT AREA
6	FORMER IMPOUNDMENT
7	WASTE SLUDGE AND BREEZE STORAGE AREA
8A	FORMER SLUDGE STORAGE AREA
8B	FORMER OXIDATION IMPOUNDMENT NO. 1

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, SEPTEMBER 2013.
2. EXACT LOCATION OF PROPOSED MONITORING WELLS WILL BE DELINEATED DURING PRE–DESIGN INVESTIGATION.

0 40' 80'
GRAPHIC SCALE

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

CONCEPTUAL LAYOUT OF SELECTED REMEDY

FIGURE
12

CITY: SYRACUSE, NY DIV/GROUP: ENV/CAD DB: G. STOWELL E. KRAHMER PIC: E. LYNCH PM/TM: R. PRICE TR: A. BALARIA LYR: ON=*;OFF=REF, (FRZ) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 6/28/2016 1:00 PM BY: SCHILLING, ADAM
G:\ENVCAD\SYRACUSE\ACT\B0085925\1601\00501\DWG\EPA\85925B02.dwg LAYOUT: 10 SAVED: 6/28/2016 1:00 PM ACADVER: 19.1S (LMS TECH)
XREFS: 85925XLD 85925X01 IMAGES: 85925X11.jp2 PROJECTNAME: ----

APPENDIX B

TABLES AND ATTACHMENTS

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Table 1A: Risk Characterization Summary – Carcinogens / RI Appendix B [pairs with Table 2A]

Scenario Timeframe:		Future Use					
Receptor Population:		Recreational					
Receptor Age:		Child					
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Shallow Groundwater/Surface Water	Shallow Groundwater/Surface Water	Child Recreational	Manganese	-	-	NA	NA
						Shallow Groundwater/Surface Water risk total=	**0.E+00**
						Total risk=	**0.E+00**

Key

- : Toxicity criteria are not available to quantitatively address this route of exposure.
NA: Route of exposure is not applicable to this medium.

Table 1B: Risk Characterization Summary – Carcinogens / RAGS D Table 9.12 RME [pairs with Table 2B]

Scenario Timeframe:		Future Use					
Receptor Population:		On-Site Residents					
Receptor Age:		Child and Adult					
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Child + Adult	Arsenic	6E-5	6E-8	1E-5	7E-5
			Benz[a]anthracene	1E-5	3E-10	5E-6	2E-5
			Benzo[a]pyrene	1E-4	2E-9	4E-5	2E-4
			Benzo[b]fluoranthene	1E-5	2E-10	4E-6	2E-5
			Dibenz[a,h]anthracene	3E-5	7E-10	1E-5	5E-5
						Soil Risk Total=	**3E-4**
Groundwater	Potential future exposure through drinking and showering	Child + Adult	Benzene	4E-4	6E-4*	8E-5	1E-3
			Aluminum	-	-	-	-
			Arsenic	5E-4	-	4E-6	5E-4
			Chromium[1]	-	-	-	6E-4
			Cobalt	-	-	-	-
			Iron	-	-	-	-
			Manganese	-	-	-	-
			Nickel	-	-	-	-
			Lead[2]	-	-	-	-
			Cyanide	-	-	-	-
			Thallium	-	-	-	-
	Produce irrigated by groundwater	Child + Adult	Benzene	NA	-	-	NA
			Aluminum	NA	-	-	NA
			Arsenic	2E-5	-	-	2E-5
			Chromium	NA	-	-	NA
			Cobalt	NA	-	-	NA
			Iron	NA	-	-	NA
			Manganese	NA	-	-	NA
			Nickel	NA	-	-	NA
			Lead[2]	-	-	-	NA
			Cyanide	NA	-	-	NA

			Thallium	-	-	-	NA
						Groundwater Risk Total=	**2E-3**
Groundwater	Indoor Air Vapor potentially migrating from groundwater and/or subsurface soil into building	Child + Adult	Benzene	-	4E-4	-	4E-4
			Cyanide	-	NA	-	NA
						Vapor Intrusion Risk Total=	**4E-4**
						Total Risk=	**2E-3**

Key

- : Toxicity criteria are not available to quantitatively address this route of exposure.
NA: Route of exposure is not applicable to this medium.

These cancer risks have been rounded and focus on Chemicals of Concern. In addition to these risk-based chemicals of concern, the following chemicals also exceeded MCLs: antimony, beryllium, cadmium, selenium.
In addition to the risks from average groundwater concentrations summarized above, the most contaminated well had unacceptable concentrations of antimony, PCBs, PAHs, pentachlorophenol, and 4,6-dinitro-2-methylphenol (EPA 6/15/2016).

Cancer risks were shown under the "Adult" scenario in the HHRA risk tables, but actually consist of child + adult exposure, as described in further detail in the HHRA and as shown here.

[1]Based on Chromium VI. Risk displayed here is based on oral and dermal Cancer Slope Factors per EPA's 9/30/2013 review, based on CalEPA as cited in EPA's RSL Table and User's Guide.
[2]Lead risks are evaluated through blood-lead modeling. See Attachment E of the HHRA and ARCADIS memorandum 10/10/2017. Lead in water also exceeded its Action Level of 15 ug/L.

*EPA Region 3 found that the Foster and Chrostowski, 1987, showering model, which is typically used at Region 3 sites, could give different risk estimates than the Schaum/Andelman model described in the HHRA. However, the different models did not significantly change the outcome of these reports with respect to remedy selection, as the showering risks exceed a cancer risk of 1E-4 in either case (EPA 12/11/2014).

Table 1C: Risk Characterization Summary – Carcinogens / RAG Table 9.10 RME [pairs with Table 2C]

Scenario Timeframe:		Future Use					
Receptor Population:		Industrial or Commercial Worker					
Receptor Age:		Adult					
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air Vapor potentially migrating from groundwater and/or subsurface soil into building	Adult Industrial or Commercial Worker	Benzene	-	8E-5	-	8E-5
			Cyanide	-	NA	-	NA
						Vapor Intrusion Risk Total=	**8E-5**
						Total Risk=	**8E-5**

Key

- : Toxicity criteria are not available to quantitatively address this route of exposure.
NA: Route of exposure is not applicable to this medium.

In addition to the vapor intrusion from groundwater quantified above, volatile constituents such as benzene, naphthalene, cyanide, and other VOCs were also detected in soil. No mathematical model exists for soil, but the presence of high concentrations of volatile constituents in both soil and groundwater supports the need for pre-emptive vapor mitigation for new buildings in VIPA (EPA review 12/11/2014, confirmed during review of soil risk update in June 2016).

Table 1D: Risk Characterization Summary – Carcinogens / RAGS D Table 9.13 RME [pairs with Table 2D]

Scenario Timeframe:		Future Use					
Receptor Population:		Construction Worker					
Receptor Age:		Adult					
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Vapors from groundwater in a construction trench	Construction Worker	Benzene	-	3E-5	-	3E-5
			Cyanide	-	NA	-	NA
						Groundwater Vapor Risk Total=	**3E-5**
						Total Risk=	**3E-5**

Key

- : Toxicity criteria are not available to quantitatively address this route of exposure.
NA: Route of exposure is not applicable to this medium.

Table 2A: Risk Characterization Summary – Non-Carcinogens / RI Appendix B [pairs with Table 1A]

Scenario Timeframe:		Future Use						
Receptor Population:		Recreational						
Receptor Age:		Child						
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Shallow Groundwater/Surface Water	Shallow Groundwater/Surface Water	Child Recreational	Manganese	Neurological	-	NA	-	2*
Shallow Groundwater/Surface Water Hazard Index Total=								**2**
Receptor Hazard Index=								**2**
Neurological Hazard Index=								**2**

Key

NA: Route of exposure is not applicable to this medium.
*EPA also considered each GWSW location individually; the maximum is shown here. GWSW data appeared in an update to the Human Health Risk Assessment. This update appeared in Appendix B to the RI and was reviewed by EPA on 7/16/2015 and 12/9/2015. The HI of 2 shown here is based on Table E-1.a of RI Appendix B, showing that 5.55 mg/L of manganese corresponds to an HI of 1; therefore the EPC of 12.9 mg/L corresponds to an HI of 2.

Table 2B: Risk Characterization Summary – Non-Carcinogens / RAGS D Tables 9.11 RME and 9.12 RME [pairs with Table 1B]

Scenario Timeframe:		Future Use						
Receptor Population:		On-Site Residents						
Receptor Age:		Child and Adult						
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Child	Arsenic	Skin, cardiovascular; developmental (inhalation)	1	2E-3	0.2	1
			Benz[a]anthracene	-	NA	NA	NA	NA
			Benzo[a]pyrene	-	NA	NA	NA	NA
			Benzo[b]fluoranthene	-	NA	NA	NA	NA
			Dibenz[a,h]anthracene	-	NA	NA	NA	NA
		Adult	Arsenic	Skin, cardiovascular; developmental (inhalation)	0.1	2E-3	0.02	0.1
			Benz[a]anthracene	-	NA	NA	NA	NA
			Benzo[a]pyrene	-	NA	NA	NA	NA
			Benzo[b]fluoranthene	-	NA	NA	NA	NA
			Dibenz[a,h]anthracene	-	NA	NA	NA	NA
							Soil Hazard Index Total Child =	**1@**
							Soil Hazard Index Total Adult =	**0.1**
Groundwater	Potential future exposure through drinking and showering	Child	Benzene	Blood	8	6*	1	15
			Aluminum	Neurological	5	-	0.03	5
			Arsenic	Skin, cardiovascular	5	-	0.03	5
			Chromium[1]	None reported	8	-	4	12
			Cobalt	Thyroid	80	-	0.2	80
			Iron	Gastrointestinal	30	-	0.2	30
			Manganese[2]	Neurological	10	-	2	12
			Nickel	Whole body	1	-	0.4	1

			Lead[3]	NA	NA	-	NA	NA
			Cyanide	Testes; thyroid (inhalation)	3	10*	0.02	13
			Thallium[4]	Hair	-	-	-	4
		Adult	Benzene	Blood	4	6*	0.8	11
			Aluminum	Neurological	2	-	0.02	2
			Arsenic	Skin, cardiovascular	2	-	0.02	2
			Chromium[1]	None reported	3	-	2	5
			Cobalt	Thyroid	30	-	0.1	30
			Iron	Gastrointestinal	10	-	0.1	10
			Manganese[2]	Neurological	5	-	1	6
			Nickel	Whole body	0.5	-	0.02	0.5
			Lead[3]	NA	NA	-	NA	NA
			Cyanide	Testes; thyroid (inhalation)	1	10*	0.1	11
			Thallium[4]	Hair	-	-	-	2
	Produce irrigated by groundwater	Child	Benzene	Blood	NA	-	-	NA
			Aluminum	Neurological	0.02	-	-	0.02
			Arsenic	Skin, cardiovascular	0.2	-	-	0.2
			Chromium[1]	None reported	0.06	-	-	0.06
			Cobalt	Thyroid	2	-	-	2
			Iron	Gastrointestinal	0.1	-	-	0.1
			Manganese[2]	Neurological	3	-	-	3
			Nickel	Whole body	0.07	-	-	0.07
			Lead[3]	NA	NA	-	-	NA
			Cyanide	Testes	NA	-	-	NA
			Thallium	Hair	-	-	-	NA
		Adult	Benzene	Blood	NA	-	-	NA
			Aluminum	Neurological	8E-3	-	-	8E-3
			Arsenic	Skin, cardiovascular	0.08	-	-	0.08
			Chromium[1]	None reported	0.03	-	-	0.03
			Cobalt	Thyroid	0.7	-	-	0.7

			Iron	Gastrointestinal	0.06	-	-	0.06
			Manganese[2]	Neurological	1	-	-	1
			Nickel	Whole body	0.03	-	-	0.03
			Lead[3]	NA	NA	-	-	NA
			Cyanide	Testes	NA	-	-	NA
			Thallium	Hair	-	-	-	NA
							Groundwater Hazard Index Total Child	**200**
							Groundwater Hazard Index Total Adult	**100**
Groundwater	Indoor Air Vapor potentially migrating from groundwater and/or subsurface soil into building	Child	Benzene	Blood	-	4	-	4
			Cyanide	Thyroid	-	0.2	-	0.2
		Adult	Benzene	Blood	-	4	-	4
			Cyanide	Thyroid	-	0.2	-	0.2
							Vapor Intrusion Hazard Index Total Child =	**4**
							Vapor Intrusion Hazard Index Total Adult =	**4**

	Child	**Adult**
Receptor Hazard Index=	**200**	**100**
Skin, cardiovascular Hazard Index=	**6**	**2**
Developmental Hazard Index=	**2E-3**	**2E-3**
Whole body Hazard Index=	**1**	**0.5**
Blood Hazard Index=	**20**	**15**
Testes (Reproductive) Hazard Index=	**3**	**1**
Thyroid Hazard Index=	**90**	**40**
Neurological Hazard Index=	**20**	**9**
Gastrointestinal Hazard Index=	**30**	**10**
Hair Hazard Index=	**4**	**2**
Indeterminate (none reported) Hazard Index=	**12**	**5**

Key

These Hazard Indices have been rounded and focus on Chemicals of Concern. In addition to these risk-based chemicals of concern, the following chemicals also exceeded MCLs: antimony, beryllium, cadmium, selenium.

In addition to the risks from average groundwater concentrations summarized above, the most contaminated well had unacceptable concentrations of antimony, PCBs, PAHs, pentachlorophenol, and 4,6-dinitro-2-methylphenol (EPA 6/15/2016).

[1]Based on Chromium VI.
[2]EPA recommends adjusting the manganese RfD for diet and uncertainty, as noted on the Non-Cancer Toxicity Data Summary table. This would only increase the oral and dermal HI for manganese, which already exceed 1 (EPA review, 9/30/2013 and 12/11/2014).
[3]Lead risks are evaluated through blood-lead modeling. See Attachment E of the HHRA and ARCADIS memo 10/10/2017. Lead in water also exceeded its Action Level of 15 ug/L.
[4]On 9/30/2013 and 12/11/2014, EPA recommended also considering the provisional toxicity values for thallium, which generated the provisional HIs shown above. Thallium also exceeded its MCL.

- : Toxicity criteria are not available to quantitatively address this route of exposure.
NA: Route of exposure is not applicable to this medium.

Lead in soil was detected well above concentrations of concern in several areas of the site, but the vast majority of samples, as well as the averages over large areas, were within acceptable ranges. Therefore, hot spots appear to be localized and should not pose a concern unless small exposure units are developed on site (EPA 6/15/2016 and ARCADIS 10/10/2017).

@ Represents site-wide soil. If more localized exposure units are considered, then the CSA CHA subarea would have an HI of approximately 8, largely due to arsenic (EPA 6/15/2016).
*EPA Region 3 found that the Foster and Chrostowski, 1987, showering model, which is typically used at Region 3 sites, could give different risk estimates (most notably a higher HI for cyanide) than the Schaum/Andelman model described in the HHRA. However, the different models did not significantly change the outcome of these reports with respect to remedy selection, as the showering risks exceed a HI of 1 in either case (EPA 12/11/2014).

Table 2C: Risk Characterization Summary – Non-Carcinogens / RAGS D Table 9.10 RME [pairs with Table 1C]

Scenario Timeframe:		Future Use						
Receptor Population:		Industrial or Commercial Worker						
Receptor Age:		Adult						
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air Vapor potentially migrating from groundwater and/or subsurface soil into building	Adult Industrial or Commercial Worker	Benzene	Blood	-	0.9	-	0.9
			Cyanide	Thyroid	-	0.04	-	0.04
Vapor Intrusion Hazard Index Total=								**0.9**
Receptor Hazard Index=								**0.9**
Blood Hazard Index=								**0.9**
Thyroid Hazard Index=								**0.04**

Key

- : Toxicity criteria are not available to quantitatively address this route of exposure.
NA: Route of exposure is not applicable to this medium.

In addition to the vapor intrusion from groundwater quantified above, volatile constituents such as benzene, naphthalene, cyanide, and other VOCs were also detected in soil. No mathematical model exists for soil, but the presence of high concentrations of volatile constituents in both soil and groundwater supports the need for pre-emptive vapor mitigation for new buildings in VIPA (EPA review 12/11/2014, confirmed during review of soil risk update in June 2016).

Table 2D: Risk Characterization Summary – Non-Carcinogens / RAGS D Table 9.13 RME [pairs with Table 1D]

<table>
<tr><td colspan="3">Scenario Timeframe:</td><td colspan="7">Future Use</td></tr>
<tr><td colspan="3">Receptor Population:</td><td colspan="7">Construction Worker</td></tr>
<tr><td colspan="3">Receptor Age:</td><td colspan="7">Adult</td></tr>
<tr><td rowspan="2">Medium</td><td rowspan="2">Exposure Medium</td><td rowspan="2">Exposure Point</td><td rowspan="2">Chemical of Concern</td><td rowspan="2">Primary Target Organ</td><td colspan="4">Non-Carcinogenic Hazard Quotient</td></tr>
<tr><td>Ingestion</td><td>Inhalation</td><td>Dermal</td><td>Exposure Routes Total</td></tr>
<tr><td rowspan="2">Groundwater</td><td rowspan="2">Vapors from groundwater in a construction trench</td><td rowspan="2">Construction Worker</td><td>Benzene</td><td>Blood</td><td>-</td><td>4</td><td>-</td><td>4</td></tr>
<tr><td>Cyanide</td><td>Thyroid</td><td>-</td><td>20</td><td>-</td><td>20</td></tr>
<tr><td colspan="8">Groundwater Vapor Hazard Index Total=</td><td>24</td></tr>
<tr><td colspan="8">Receptor Hazard Index=</td><td>24</td></tr>
<tr><td colspan="8">Blood Hazard Index=</td><td>4</td></tr>
<tr><td colspan="8">Thyroid Hazard Index=</td><td>20</td></tr>
<tr><td colspan="9">Key

- : Toxicity criteria are not available to quantitatively address this route of exposure.
NA: Route of exposure is not applicable to this medium.</td></tr>
</table>

Table 3: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentrations / RI Appendix B

Scenario Timeframe:		Future Use							
Medium:		Shallow Groundwater/Surface Water							
Exposure Medium:		Shallow Groundwater/Surface Water							
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Child Recreational	Manganese	6.3	12.9	mg/L	6/6	12.9	mg/L	# Samples < 10 or # Detects < 5*

Key

mg/L: milligrams per liter

*EPA also considered each GWSW location individually; the maximum is shown here. GWSW data appeared in an update to the Human Health Risk Assessment. This update appeared in Appendix B to the RI and was reviewed by EPA on 7/16/2015 and 12/9/2015.

Table 3: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentrations / RAGS D Tables 2.1 and 3.2

Scenario Timeframe:		Future Use							
Medium:		Soil							
Exposure Medium:		Surface and Subsurface Soil							
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
On-Site Child and Adult Residents	Arsenic	5.9E-01	1.5E+03	mg/kg	857/918	4.5E+01	mg/kg	95% UCL
	Benz[a]anthracene	1.5E-02	2.6E+02	mg/kg	283/878	3.4E+00	mg/kg	95% UCL
	Benzo[a]pyrene	1.2E-02	2.4E+02	mg/kg	297/878	2.9E+00	mg/kg	95% UCL
	Benzo[b]fluoranthene	1.9E-02	2.6E+02	mg/kg	260/878	2.8E+00	mg/kg	95% UCL
	Dibenz[a,h]anthracene	1.3E-02	4.8E+01	mg/kg	152/878	8.5E-01	mg/kg	95% UCL

Key

95% UCL: 95% Upper Confidence Limit
mg/kg: milligrams per kilogram

Table 3: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentrations / RAGS D Tables 2.6 and 3.7

Scenario Timeframe:		Future Use							
Medium:		Groundwater							
Exposure Medium:		Groundwater; Produce irrigated by groundwater; Vapors from groundwater via intrusion or volatilization from construction trenches							
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
On-Site Child and Adult Residents; Industrial or Commercial Worker; Construction Worker	Benzene	2.6E-4	5.355	mg/L	76/285	0.52	mg/L	95% UCL
	Aluminum	0.05	940	mg/L	224/271	71	mg/L	95% UCL
	Arsenic	0.0037	0.371	mg/L	94/267	0.021	mg/L	95% UCL
	Chromium[1]	0.003	3.1	mg/L	127/264	0.38	mg/L	95% UCL
	Cobalt	5E-4	3.25	mg/L	181/272	0.37	mg/L	95% UCL
	Iron	0.0551	2930	mg/L	262/269	360	mg/L	95% UCL
	Manganese	0.001	108	mg/L	215/228	25	mg/L	95% UCL
	Nickel	0.0021	4.09	mg/L	166/271	0.35	mg/L	95% UCL
	Lead	0.002	0.209	mg/L	152/272	0.024	mg/L	mean
	Cyanide[2]	0.0094	0.029	mg/L	4/4	0.029	mg/L	maximum
	Thallium	2.1E-4	0.0089	mg/L	35/272	7E-4	mg/L	95% UCL

Key

NA: not available or not applicable
mg/L: milligrams per liter

[1]Based on chromium VI
[2]Based on free cyanide

Unfiltered data used for all chemicals except manganese and selenium, as described on RAGS D Table 3.7 in the HHRA.
Thallium EPC from EPA review 9/30/2013.
In addition to these risk-based chemicals of concern, the following chemicals also exceeded MCLs: antimony (maximum 0.074 mg/L), beryllium (maximum 0.116 mg/L), cadmium (maximum 0.244 mg/L), selenium (maximum 0.259 mg/L)

The Exposure Point Concentrations listed above were used to estimate risks from hypothetical future potable use of groundwater via ingestion and dermal exposure. These concentrations also served as the basis for modeling of the following routes of exposure:

Showering inhalation as described on RAGS D Table 3.8 and EPA's reviews on 9/30/2013 and 12/11/2014.

Plant uptake of inorganic metals in groundwater used as irrigation water as described on RAGS D Table 3.9, using the University of Tennessee (UT) root uptake (UT, 1999). See also Attachment D (Produce Uptake) of Appendix H (Final HHRA) of the Final Remedial Investigation/Feasibility Study Report, dated June 2016 (Final RI/FS) for input parameters and assumptions.

Volatilization of volatile constituents of potential concern from groundwater to indoor air, as described in RAGS D Tables 3.11 and 3.12, using the Office of Solid Waste and Emergency Response (OWSER) Vapor Intrusion Assessment Groundwater Concentration to Indoor Air Concentrations (GWC-IAC) Calculator (Version 2.0; USEPA 2012). See Tables 3.11.b and 3.12.b of Attachment B [Risk Assessment Guidance for Superfund (RAGS), Part D Tables] of Appendix H (Final HHRA) of the Final Remedial Investigation/Feasibility Study Report, dated June 2016 (Final RI/FS) for input parameters to Calculator. Free Cyanide is evaluated as Hydrogen Cyanide in the Calculator.

Volatilization of volatile constituents of potential concern (COPCs) from groundwater to trench air, as described in RAGS D Tables 3.13 and 3.14, using Virginia Department of Environmental Quality (VDEQ) model. Volatization Factors (VFs) for volatile COPCs (from VDEQ model; see Table 3.14.b for deviation and http://www.deq.virginia.gov/Programs/LandProtectionRevitalizationProgram/VoluntaryRemediationProgram/VRPRiskAssessmentGuidance/Guidance.aspx for rationale) were used to estimate air concentrations from groundwater as follows: C_{gw} x VF = C_{trench}

Benzene and cyanide were the chemicals of concern for the vapor intrusion and trench scenarios.

Table 4: Non-Cancer Toxicity Data Summary / RAGS D Tables 5.1 and 5.2

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ[1]	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YYYY)[2]
Benzene	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Blood	300	IRIS	03/10/2013
Benz[a]anthracene	Chronic	NA		NA		NA	NA		03/10/2013
Benzo[a]pyrene	Chronic	NA		NA		NA	NA		03/10/2013
Benzo[b]fluoranthene	Chronic	NA		NA		NA	NA		03/10/2013
Dibenz[a,h]anthracene	Chronic	NA		NA		NA	NA		03/10/2013
Aluminum	Chronic	1.0E+00	mg/kg-day	1.0E+00	mg/kg-day	Neurological	100	PPRTV	03/10/2013
Arsenic	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin, Cardiovascular	3	IRIS	03/10/2013
Chromium[3]	Chronic	3.0E-03	mg/kg-day	7.5E-05	mg/kg-day	None Reported	900	IRIS	03/10/2013
Cobalt	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Thyroid	3000	PPRTV	03/10/2013
Iron	Chronic	7.0E-01	mg/kg-day	7.0E-01	mg/kg-day	Gastrointestinal	1.5	PPRTV	03/10/2013
Manganese[4]	Chronic	1.4E-01	mg/kg-day	5.6E-03	mg/kg-day	Neurological	1	IRIS	03/10/2013
Nickel	Chronic	2.0E-02	mg/kg-day	8.0E-04	mg/kg-day	Whole Body	300	IRIS	03/10/2013
Lead[5]	Chronic	NA		NA		NA	NA		03/10/2013
Cyanide (CN-)	Chronic	6.0E-04	mg/kg-day	6.0E-04	mg/kg-day	Testes	3000	IRIS	03/10/2013
Thallium[6]	Chronic	1E-5	mg/kd-day	1E-5	mg/kg-day	Hair	3000	PPRTV Appendix	09/30/2013

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Primary Target Organ[1]	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (MM/DD/YYYY)[2]
Benzene	Chronic	3.0E-02	mg/m^3	Blood	300	IRIS	03/10/2013
Benz[a]anthracene	Chronic	NA		NA	NA		03/10/2013
Benzo[a]pyrene	Chronic	NA		NA	NA		03/10/2013

Benzo[b]fluoranthene	Chronic	NA		NA	NA		03/10/2013
Dibenz[a,h]anthracene	Chronic	NA		NA	NA		03/10/2013
Aluminum	Chronic	5.0E-03	mg/m^3	Neurological	300	PPRTV	03/10/2013
Arsenic	Chronic	1.5E-05	mg/m^3	Developmental	30	CalEPA	03/10/2013
Chromium[3]	Chronic	1.0E-04	mg/m^3	Respiratory	300	IRIS	03/10/2013
Cobalt	Chronic	6.0E-06	mg/m^3	Respiratory	300	PPRTV	03/10/2013
Iron	Chronic	NA		NA	NA		03/10/2013
Manganese	Chronic	5.0E-05	mg/m^3	Neurological	1000	IRIS	03/10/2013
Nickel	Chronic	9.0E-05	mg/m^3	Respiratory, Liver	30	ATSDR	03/10/2013
Lead[5]	Chronic	NA		NA	NA		03/10/2013
Cyanide (CN-)	Chronic	8.0E-04	mg/m^3	Thyroid	3000	IRIS	03/10/2013
Thallium	Chronic	NA		NA	NA		

Key

NA: not available
mg/kg: milligrams per kilogram
mg/kg-day: milligrams per kilogram per day
RfC: chronic reference concentration
RfD: chronic reference dose
IRIS: U.S. EPA Integrated Risk Information System
PPRTV: Provisional Peer-Reviewed Toxicity Values
HEAST: Health Effects Assessment Summary Tables
Cal EPA: California Environmental Protection Agency
ATSDR: Agency for Toxic Substances and Disease Registry

Notes:
[1]Primary target(s) listed are those associated with the critical effect(s) on which the RfD/RfC was based.
[2]Date is the date the database was searched.
[3]Based on Chromium VI.
[4]EPA recommends adjusting the manganese RfD for diet and uncertainty, resulting in an oral RfD of 2.4E-2 mg/kg/day as described in the IRIS file and as recorded in EPA's reviews on 9/30/2013 and 12/11/2014.
[5]Lead is evaluated separately using U.S. EPA lead models; see Attachment E of the HHRA and ARCADIS memo 10/10/2017.
[6]On 9/30/2013 and 12/11/2014, EPA recommended also considering the provisional toxicity values for thallium, which are shown above, and also appear in the RSL Table. The provisional value, target organ, and uncertainty factors originate in the 11/1/2012 appendix of the PPRTV for thallium.

Table 5: Cancer Toxicity Data Summary / RAGS D Tables 6.1 and 6.2

Pathway: Oral/Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description[1]	Source	Date (MM/DD/YYYY)[2]
Benzene	5.5E-02	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	03/10/2013
Benz[a]anthracene	7.3E-01	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	ECAO	03/10/2013
Benzo[a]pyrene	7.3E+00	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	03/10/2013
Benzo[b]fluoranthene	7.3E-01	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	ECAO	03/10/2013
Dibenz[a,h]anthracene	7.3E+00	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	ECAO	03/10/2013
Aluminum	NA	NA		NA		
Arsenic	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	03/10/2013
Chromium[3]	0.5	20	$(mg/kg\text{-}day)^{-1}$		CalEPA	09/30/2013
Cobalt	NA	NA		D		03/10/2013
Iron	NA	NA		D		03/10/2013
Manganese	NA	NA		D		03/10/2013
Nickel	NA	NA		NA		
Lead[4]	NA	NA		B2		03/10/2013
Cyanide	NA	NA		D		03/10/2013
Thallium	NA	NA				

Pathway: Inhalation

Chemical of Concern	Inhalation Unit Risk	Units	Weight of Evidence/Cancer Guideline Description[1]	Source	Date (MM/DD/YYYY)[2]
Benzene	7.8E-03	$(mg/m^3)^{-1}$	A	IRIS	03/10/2013
Benz[a]anthracene	1.1E-01	$(mg/m^3)^{-1}$	B2	CalEPA	03/10/2013
Benzo[a]pyrene	1.1E+00	$(mg/m^3)^{-1}$	B2	CalEPA	03/10/2013
Benzo[b]fluoranthene	1.1E-01	$(mg/m^3)^{-1}$	B2	CalEPA	03/10/2013
Dibenz[a,h]anthracene	1.2E+00	$(mg/m^3)^{-1}$	B2	CalEPA	03/10/2013
Aluminum	NA		NA		03/10/2013
Arsenic	4.3E+00	$(mg/m^3)^{-1}$	A	IRIS	03/10/2013
Chromium[3]	1.2E+01	$(mg/m^3)^{-1}$	A	IRIS	09/30/2013
Cobalt	9.0E+00	$(mg/m^3)^{-1}$	A	PPRTV	03/10/2013
Iron	NA		D		03/10/2013

Manganese	NA		D		03/10/2013
Nickel	2.6E-01	$(mg/m^3)^{-1}$	NA	CalEPA	03/10/2013
Lead[4]	NA		B2		03/10/2013
Cyanide	NA		D		03/10/2013
Thallium	NA				

Key

NA: not available, not applicable, or not assessed
ECAO: Environmental Criteria and Assessment Office
IRIS: Integrated Risk Information System, U.S. EPA
PPRTV: Provisional Peer-Reviewed Toxicity Values
CalEPA: California Environmental Protection Agency
mg/kg-day: milligram per kilogram per day

[1]U.S. EPA (1986) cancer weight-of-evidence categories
Group A: Carcinogenic to Humans (sufficient evidence of carcinogenicity in humans)
Group B: Probably Carcinogenic to Humans
B1 - limited evidence of carcinogenicity in humans
B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans
Group C: Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)
Group D: Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)

[2]Date is the date the database was searched.

[3]Based on Chromium VI. Oral and dermal CSFs per EPA's 9/30/2013 review, based on CalEPA as cited in EPA's RSL Table and User's Guide. EPA also recommended, in the 9/13/2013 review, including the adjustment to the inhalation IUR for chromium that would account for the likely composition of CrVI (a 1:6 adjustment, as described in the EPA RSL User's Guide). The adjusted IUR would then be 84 m^3/mg.

[4]Lead is evaluated separately using U.S. EPA lead models; see Attachment E to the HHRA and ARCADIS memo 10/10/2017.

Table 6
ARARs For Fairmont Coke Works Selected Remedy – Alternative 5

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Specification and/or Details Regarding ARARs in the Context of Remediation
Chemical Specific				
WV Requirements Governing Groundwater Standards: Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals	WV 64 CSR 3-10 Adoption of Federal Standard The following Federal standards are relevant and appropriate: 42 USC § 300(g-1); 40 CFR §§ 141.11-13; 40 CFR §§ 141.50-51; 40 CFR §§ 141.61-62	Relevant and Appropriate	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons. MCLGs are non-enforceable health-based goals for similar systems. These requirements are not directly applicable since ground water in the vicinity of the Site is not used as a private drinking water supply. However, under the circumstances of this Site, MCLs and MCLGs are relevant and appropriate requirements.	In accordance with the Fairmont Coke Works Project XL Agreement (64 FR 17663, April 12, 1999), the point of compliance for MCLs is the Site boundary. Long-term ground water monitoring will be required to document that standards are being met at the Site boundary.
WV Requirements Governing [Surface] Water Quality Standards	WV 47 CSR 2-3.2(a)-(f), 4.1, 4.1(a) and 4.1(b), 6, 7.1.(c) and Appendix E	Relevant and Appropriate	These regulations control the discharge of industrial wastes and other wastes into the waters of the State, and establishes water quality standards for the waters of the State standing or flowing over the surface of the State.	Relevant and Appropriate to aggregate nonpoint source subsurface discharge to Unnamed Tributary. The regulation requires that the in-stream water quality be protective of the respective State-designated use(s) and cites both quantitative and narrative standards which must be met in-stream. Appendix E lists contaminant-specific concentrations which must be met in-stream to be protective. Section 12.2 of the ROD lists the COCs and respective performance standard which must be met in-stream.
Action Specific				
Total Maximum Daily Loads (TMDLs) for the Unnamed Tributary at Sharon Steel Run, West Virginia U.S. EPA, Region 3, September 2001	Unnamed Tributary to the Monongahela River (RM-126.94) included on WV's 2012 Clean Water Act §303(d) list for aluminum impairments	TBC	EPA established Total Maximum Daily Loads (TMDLs) for the on-site streams for the protection of the Monongahela River. The TMDLs established for the Unnamed Tributary, including nonpoint sources, are iron (1.5 mg/L) and pH within 6-9 range.	Note that EPA-established TMDLs are neither promulgated as rules, nor enforceable, and, therefore, are not ARARs. However, the respective TMDLs were at the same levels as required by WV 47 CSR 2.

ARAR OR TBC	LEGAL CITATION	CLASSIFICATION	SUMMARY OF REQUIREMENT	FURTHER SPECIFICATION AND/OR DETAILS REGARDING ARARS IN THE CONTEXT OF REMEDIATION
WV Air Pollution Control Act	WV 45 CSR 25-4.3	Relevant and Appropriate	Facilities shall be designed, constructed, maintained and operated in a manner to minimize unplanned releases of hazardous constituents to the air.	During excavation, storage or use of LT/PRB treatment materials and other activities, measures will be employed to prevent unplanned releases of hazardous constituents, including fugitive air emissions.
West Virginia Uniform Environmental Covenants Act	WV Code Chapter 22, Article 22B	TBC	Procedures for implementing land and groundwater use restrictions	Standard protocols established in this act may be utilized to implement land and groundwater use restrictions described in the respective remedial alternatives.
WV Monitoring Well Construction and Abandonment Regulations	WV 47 CSR 60	Applicable	Requirements for minimum acceptable standards for the design, installation, construction, and abandonment of monitoring wells	All monitoring well construction and abandonment will be completed in a manner consistent with these regulations.
Location Specific				
Federal Protection of Wetlands Executive Order	Executive Order 11990	TBC	Requires the federal agencies to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands.	Cleanup will be conducted in a manner which minimizes loss or degradation of wetland areas.
Fish and Wildlife Coordination Act	16 U.S.C. §§ 661, 662, 663 and 665; 40 CFR Part 6.302(g)	Relevant and Appropriate	If waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or otherwise controlled or modified for any purpose, by any department or agency of the United States, consultation with the United States Fish and Wildlife Service is required, with a view to the conservation of wildlife resources.	EPA will continue to consult with USFWS and consider reasonable steps to minimize any adverse impact to wildlife resources during remediation of wetland sediment and contaminated groundwater mitigating to any water body.

Note: Table 7 embedded in Text

Table 8: Detailed Cost Estimate of Selected Remedy

Capital Costs	Quantity	Unit	Unit Rate	Cost
Administrative Actions				
H&S Controls - HASP & SOPs - LT/PRB	1	LS	$3,000	$3,000
H&S Controls - HASP & SOPs - Monitoring & IC	1	LS	$3,000	$3,000
H&S Controls - HASP & SOPs - Soil Stabilization	1	LS	$3,000	$3,000
Land Use Controls Report - Monitoring & IC	0	LS	$5,000	$0
Preparation and Submittal of Deed Restrictions - Monitoring & IC	1	LS	$5,000	$5,000
Predesign Investigations				
Predesign Investigations and Pilot Testing	1	LS	$100,000	$100,000
Limestone Trench/Permeable Reactive Barrier				
Permitting				
Local Construction/Soil Conservation District	1	LS	$5,000	$5,000
Mobilization/Demobilization				
Site Mobilization/Demobilization	1	LS	$45,000	$45,000
Site Specific Work Plan Preparations	1	LS	$7,500	$7,500
Utility Clearance	1	LS	$2,500	$2,500
Protection of Existing Monitoring Wells	1	LS	$1,000	$1,000
Surveying	1	LS	$5,000	$5,000
Site Preparation				
Erosion Sedimentation Controls and BMPs	1	LS	$5,000	$5,000
Stabilized Construction Entrance	1	EA	$7,000	$7,000
Clearing, Grubbing Vegetation & Disposal	1	LS	$5,000	$5,000
Stockpile Management Area	1	LS	$10,000	$10,000
Permeable Reactive Barrier Construction				
Soil Excavation + 20% Volume (Including Shoring Support)	1,600	CY	$200	$320,000
Stabilization of Wet Material (Assumes 75% of Total Volume)	1,200	CY	$35	$42,000
Portland Cement (3% by Weight) for Stabilization	47	Tons	$139	$6,600
Material Load-Out Activities	1,600	CY	$10	$16,000
Construction Dewatering - Pumps, Tanks, Hoses, etc.	1	LS	$20,000	$20,000
Frack Tank Storage (Costs include rental, decontamination)	8	EA	$7,500	$60,000
Limestone - Furnish & Install	2,800	Tons	$25	$70,000
Waste Characterization, Transportation, and Disposal				
Transportation and Disposal of Non-Hazardous Soil Materials	2,607	Tons	$75	$195,500
Transportation and Disposal of Non-Hazardous Water	160,000	GAL	$1	$128,000
Waste Characterization Sampling	8	EA	$750	$6,000
Site Restoration				
Topsoil	40	CY	$50	$2,000
Seeding/Mulching/Fertilize	1	LS	$1,500	$1,500
Installation of Monitoring Wells				
Installation of Monitoring Wells	4	EA	$3,000	$12,000
IDW Classification & Disposal	1	LS	$2,000	$2,000
Permitting (4 Monitoring Wells)	4	EA	$300	$1,200
Surveying	1	LS	$2,000	$2,000
Installation Oversight & Supplies	5	EA	$2,000	$10,000
Site Controls				
Air Monitoring and Dust Control	1	LS	$9,000	$9,000
Indirect Costs				
Engineering Design (% of Installation & Equipment Costs)	1	LS	15%	$149,500
Project Management (% of Installation & Equipment Costs)	1	LS	15%	$149,500
Contingency (% of Installation & Equipment Costs)	1	LS	15%	$149,500

Table 8: Detailed Cost Estimate of Selected Remedy

Capital Costs	Quantity	Unit	Unit Rate	Cost
Groundwater Monitoring & Institutional Controls				
Abandon Existing Well				
Monitoring Well Abandonment	30	EA	$500	$15,000
Well Abandonment Oversight	30	EA	$500	$15,000
Well Abandonment Report	1	LS	$5,000	$5,000
Installation of Monitoring Wells				
Installation of Monitoring Wells	4	EA	$3,000	$12,000
IDW Classification & Disposal	1	LS	$2,000	$2,000
Permitting (4 Monitoring Wells)	4	EA	$300	$1,200
Surveying	1	LS	$2,000	$2,000
Installation Oversight & Supplies	5	EA	$2,000	$10,000
Indirect Costs				
Engineering Design (% of Installation & Abandonment Costs)	1	LS	10%	$6,200
Project Management (% of Installation & Abandonment Costs)	1	LS	10%	$6,200
Contingency (% of Installation & Abandonment Costs)	1	LS	15%	$9,300
Soil Stabilization - Organic Amendment				
Permitting				
Local Construction/Soil Conservation District	1	LS	$5,000	$5,000
Mobilization/Demobilization				
Site Mobilization/Demobilization	2	Event	$7,500	$15,000
Site Specific Work Plan Preparations	1	LS	$7,500	$7,500
Organic Amendment Application - Surface Application by Blowing				
Subcontractor Cost for Application (3 man crew and blower)	2	Event	$18,000	$36,000
Organic Amendment - Mushroom Compost	1,100	Yard	$27	$29,700
Wetland Seed Mix (40 lbs. per acre - applied during spring event)	92	lb.	$10	$900
Oversight of Amendment Application (1 person per event each event 3 days)	2	EA	$4,500	$9,000
Site Controls				
Air Monitoring and Dust Control	2	EA	$1,000	$2,000
Indirect Costs				
Annual Reporting	1	EA	$10,000	$10,000
Project Management (% of Installation, Equipment Costs)	1	LS	15%	$15,800
Contingency (% of Installation, Equipment Costs)	1	LS	15%	$15,800
			Total	$1,789,900

Acronyms:
BMPs - Best Management Practices
CY - cubic yard
EA - Each
GAL - gallon
IC - Institutional Control
IDW - Investigation Derived Waste
lb. - pound
lbs. - pounds
LS - Lump Sum
LT/PRB - Limestone Trench/Permeable Reactive Barrier

Table 8: Detailed Cost Estimate of Selected Remedy

Operation and Maintenance Costs	Quantity	Unit	Unit Rate	Cost
Operation and Maintenance Costs (Annual)				
LT/PRB Performance Monitoring (Projected over 30 years)				
Semi-Annual Monitoring - Labor and Expenses (1 day 2 people)	1	LS	$3,000	$3,000
Semi-Annual Monitoring - Laboratory	10	samples	$600	$6,000
			Subtotal	$9,000
Groundwater Monitoring & Institutional Controls Costs (Projected over 30 years)				
Annual Monitoring - Labor & Expenses (2 people 4 days)	1	event	$16,000	$16,000
Annual Monitoring - Laboratory	32	sample	$600	$19,200
Annual LUC, and Performance Reporting	1	report	$15,000	$15,000
IDW Classification & Disposal	1	YR	$2,000	$2,000
Project Management (Annual % of Monitoring Costs)	1	YR	10%	$1,700
Contingency (Annual % of Monitoring Costs)	1	YR	15%	$2,500
			Subtotal	$56,400
Operation and Maintenance Costs (Total)				
Operation and Maintenance Costs (Annual)	30	YR	$65,400	$1,962,000
Periodic Reporting				
Five Year Review Reporting	6	EA	$15,000	$90,000
Update Institutional Controls Plan	6	EA	$2,000	$12,000
			Total	$2,064,000

Acronyms:

EA - Each

IDW - Investigation Derived Waste

LUC - Land Use Control

LS - Lump Sum

YR - year

Table 8: Detailed Cost Estimate of Selected Remedy

Present Value Costs	Year	Total Cost	Total Cost per Year	Discount Factor	Present Value
Limestone Trench/Permeable Reactive Barrier Performance Monitoring					
Capital Cost	0	$1,548,300	$1,548,300	1.000	$1,548,300
Annual Operations and Maintenance Costs	1-30	$270,000	$9,000	12.409	$111,700
Groundwater Monitoring & Institutional Controls					
Capital Cost	0	$91,900	$91,900	1.000	$91,900
Annual Operations and Maintenance Costs	1-30	$1,692,000	$56,400	12.409	$699,900
Five Year Review Reporting/Update Institutional Controls Plan	5	$17,000	$17,000	0.713	$12,100
Five Year Review Reporting/Update Institutional Controls Plan	10	$17,000	$17,000	0.508	$8,600
Five Year Review Reporting/Update Institutional Controls Plan	15	$17,000	$17,000	0.362	$6,200
Five Year Review Reporting/Update Institutional Controls Plan	20	$17,000	$17,000	0.258	$4,400
Five Year Review Reporting/Update Institutional Controls Plan	25	$17,000	$17,000	0.184	$3,100
Five Year Review Reporting/Update Institutional Controls Plan	30	$17,000	$17,000	0.131	$2,200
Soil Stabilization - Organic Amendment					
Capital Cost	0-2	$149,700	$74,850	1.000	$149,700
Annual Operations and Maintenance Costs	2-30	$0	$0	12.409	$0
				Total	$2,638,100

Discount Factor

D=1/(1+P)^n

P = periodic interest rate = 0.07
n = number of payments

Year	Discount Factor	Sum of Discount Factor
1	0.934579439	0.934579439
2	0.873438728	1.808018168
3	0.816297877	2.624316044
4	0.762895212	3.387211256
5	0.712986179	4.100197436
6	0.666342224	4.76653966
7	0.622749742	5.389289402
8	0.582009105	5.971298506
9	0.543933743	6.515232249
10	0.508349292	7.023581541
11	0.475092796	7.498674337
12	0.444011959	7.942686297
13	0.414964448	8.357650744
14	0.387817241	8.745467985
15	0.36244602	9.107914005
16	0.338734598	9.446648603
17	0.31657439	9.763222993
18	0.295863916	10.05908691
19	0.276508333	10.33559524
20	0.258419003	10.59401425
21	0.241513087	10.83552733
22	0.225713165	11.0612405
23	0.210946883	11.27218738
24	0.19714662	11.469334
25	0.184249178	11.65358318
26	0.172195493	11.82577867
27	0.160930367	11.98670904
28	0.150402212	12.13711125
29	0.140562815	12.27767407
30	0.131367117	12.40904118

Attachment A
Site Specific Soil Cleanup Standards and Not-To-Exceed Concentrations

Removal Action Completed September 28, 2011
Former Fairmont Coke Works Site
Fairmont, West Virginia

	North Landfill		South Landfill		All Areas Outside North and South Landfills	
	Standard (mg/kg)[a]	Not-To-Exceed (mg/kg)[b]	Standard (mg/kg)[a]	Not-To-Exceed (mg/kg)[b]	Standard (mg/kg)[a]	Not-To-Exceed (mg/kg)[b]
2,4-Dimethylphenol	27.1	271	30.5	305	28.5	285
2-Methylnaphthalene	88.5	885	99.6	996	93	930
2-Methylphenol	44.6	446	50.2	502	46.9	469
3/4-Methylphenol	4.25	42.5	4.78	47.8	4.47	44.7
4-Methylphenol	4.25	42.5	4.78	47.8	4.47	44.7
Acenaphthene	429	4290	483	4830	451	4510
Acenaphthylene	429	4290	483	4830	451	4510
Acetone	9.95	99.5	11.2	112	10.5	105
Anthracene	1,850	18,500	2,090	20,900	1,950	19,500
Arsenic	10.6	106	11.9	119	11.2	112
Barium	8,650	86,500	9,730	97,300	9,095	90,950
Benzene[c]	0.82	4.1	0.923	4.6	0.86	4.3
Benzo(a)pyrene	2.3	23	2.3	23	2.3	23
Beryllium	4,660	4,660[d]	5,240	5,240[d]	4,898	4,898[d]
bis(2-Ethylhexyl)phthalate[e]	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Cadmium	109	1,090	123	1,230	115	1,150
Carbazole	186	1860	209	2090	196	1960
Carbon Disulfide	73.5	735	82.7	827	77.4	774
Chromium VI	169	1,690	190	1,900	179	1,790
Chromium, Total[e]	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Copper	43,600	436,000	49,100	491,000	45,877	458,770
Cyanide	595	5,950	670	6,700	626	6,260
Dibenzofuran	30.5	305	34.3	343	32	320
Ethylbenzene	58.6	586	66	660	61.7	617
Fluoranthene	25,900	259,000	29,200	292,000	27,282	272,820
Fluorene	539	5,390	606	6,060	567	5,670
Lead	400	4,000	400	4,000	400	4,000
Manganese	3,840	38,400	4,320	43,200	4,041	40,410
Naphthalene[c]	0.62	3.1	0.698	3.5	0.65	3.3
Phenanthrene	1,850	18,500	2,090	20,900	1,950	19,500
Phenol	540	5,400	607	6,070	568	5,680
Pyrene	2,710	27,100	3,050	30,500	2,856	28,560
Pyridine	100	1,000	100	1,000	100	1,000
Selenium	75.5	755	85	850	79.5	795
Silver	123	1230	139	1,390	130	1,300
Thallium	14.9	149	16.8	168	15.7	157
Toluene	35.6	356	40.1	401	37.5	375
USEPA BAP TEQ(-NDs	2.3	23	2.3	23	2.3	23
Vanadium	21,000	21,000[d]	23,600	23,600[d]	22,081	22,081[d]
Xylenes (total)	677	6,770	762	7,620	713	7,130
Zinc	55,200	552,000	62,100	621,000	58,095	580,950

Notes:
1. [a]To be compared to the 95 percent upper confidence limit (95 UCL) site-wide.
2. [b]To be compared on a point by point basis. Not-to-exceed concentrations have been set at 10 times the site-specific standard, except where noted, as approved by USEPA.
3. [c]Not-to-exceed values have been set at 5 times the site-specific standard, as requested in the USEPA approval letter.
4. [d]Not-to-exceed concentration based on site-specific standard, as requested by USEPA.
5. [e]Site-specific standard exceeds 100 percent. Thus standard and not-to-exceed concentration have been set at 100%, as requested in the USEPA approval letter.

AR442930

Attachment B

Anoxic Limestone Drain/Reactive Compost Barrier Pilot Study

In October 2010, ExxonMobil initiated a pilot-scale study utilizing an anoxic (i.e., low oxygen) limestone drain (ALD) and reactive compost barrier (RCB) to remediate a series of groundwater seeps occurring along the hillside upgradient of the small stream draining the southwest corner of the Site (See Figure B-1). The groundwater seeps were characterized by low pH (approximately 3.5 pH), elevated concentrations of inorganics such as iron and aluminum and elevated concentrations of benzene.

The concept of the ALD/RCB is similar to a Limestone Trench/Permeable Reactive Barrier. ALDs generate bicarbonate alkalinity to increase the pH of groundwater passing through the system. The increase in pH facilitates precipitation of metals once that water moves to an oxygen-rich zone. The increased pH, along with RCB (spent mushroom compost) promotes geochemical conditions favorable to biodegradation of organic compounds such as benzene.

A trench approximately 5-ft wide by 121.5-ft long was excavated down to the underlying bedrock (approximately 10-ft deep), across the hillside aligned perpendicular to local groundwater flow. The ALD/RCB was installed in the trench in layers with the first layer installed directly on top of bedrock. Alternating layers of limestone and spent mushroom compost were installed with the first layer consisting of limestone (>90% calcium carbonate) which was approximately 1.5-feet thick at the bottom of the trench, followed by a 2.5- foot thick layer of spent mushroom compost, followed by a 1-foot thick layer of limestone and a finally a 2-foot thick layer of spent mushroom compost. Over the final layer of spent mushroom compost, a 40 mil thick PVC membrane was placed and then covered with a 1.5-foot thick layer of clay and then native fill to grade.

A series of three piezometers were installed upgradient of the ALD/RCB; three piezometers were installed within; and three piezometers were installed downgradient of the ALD/RCB. Benzene concentrations were observed to attenuate approximately 2 orders of magnitude primarily through anaerobic reduction and methanogenesis while passing through and just downgradient of the anoxic limestone trench. Benzene concentrations in the upgradient piezometers ranged between 360 and 2300 µg/L. Benzene concentrations downgradient of the ALD/RCB ranged between 2 and 32 µg/L. Methane concentrations downgradient of the pilot anoxic limestone trench increased significantly, indicating that anaerobic microbes were converting benzene to methane. Measurements indicated that pH levels decreased from approximately pH 4 in the upgradient piezometers to approximately pH 6 in the downgradient piezometers. Significant decreases in metals concentrations were not observed potentially due to the short travel distance and low dissolved oxygen present.

Additional information regarding the Pilot Study can be found in the RI/FS and other documents in the Administrative Record.

PZ-10	
Date	4/1/2015
Benzene (µg/L)	67.0 D
Iron (mg/L)	16.7
Manganese (mg/L)	2.77
pH (SU)	5.83

PZ-4	
Date	3/31/2015
Benzene (µg/L)	1900 D
Iron (mg/L)	369
Manganese (mg/L)	15.9
pH (SU)	3.84

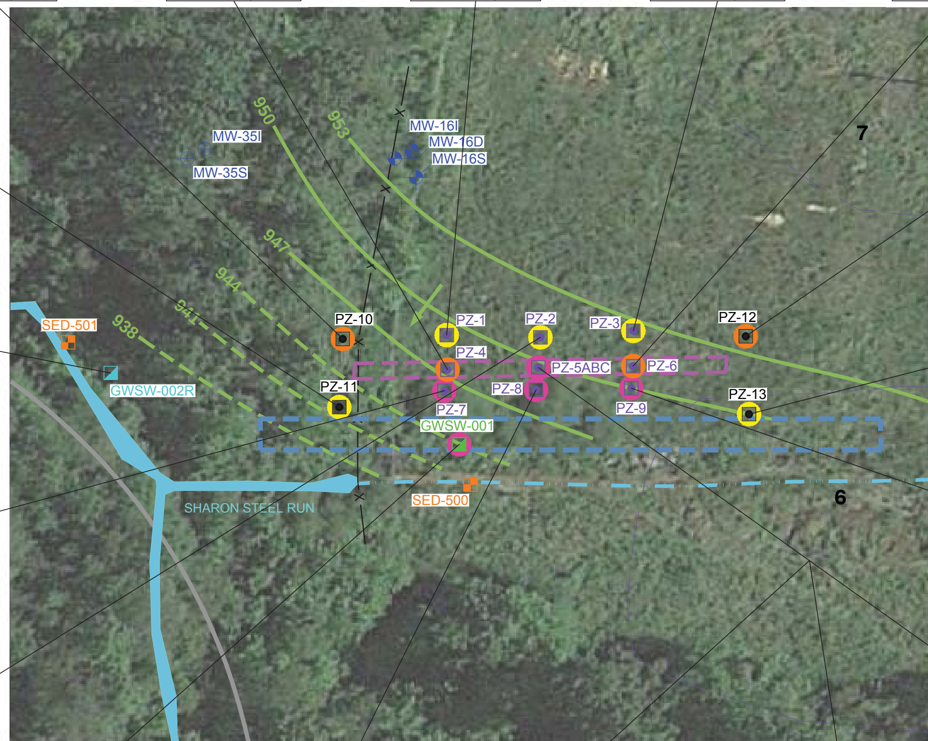
PZ-1	
Date	4/1/2015
Benzene (µg/L)	2300 D
Iron (mg/L)	378
Manganese (mg/L)	18.7
pH (SU)	4.43

PZ-3	
Date	3/27/2015
Benzene (µg/L)	2000 D
Iron (mg/L)	330
Manganese (mg/L)	22.6
pH (SU)	3.74

PZ-6	
Date	3/27/2015
Benzene (µg/L)	300 D
Iron (mg/L)	338
Manganese (mg/L)	16.6
pH (SU)	6.34

PZ-11	
Date	3/31/2015
Benzene (µg/L)	43.0 D
Iron (mg/L)	110
Manganese (mg/L)	10.5
pH (SU)	3.67

PZ-12	
Date	4/1/2015
Benzene (µg/L)	1700 D
Iron (mg/L)	292
Manganese (mg/L)	15.1
pH (SU)	5.97



GWSW-002R	
Date	3/31/2015
Benzene (µg/L)	0.500 U
Iron (mg/L)	259
Manganese (mg/L)	10.5
pH (SU)	5.79

PZ-13	
Date	4/1/2015
Benzene (µg/L)	2.70
Iron (mg/L)	1.27
Manganese (mg/L)	3.03
pH (SU)	6.76

PZ-7	
Date	3/31/2015
Benzene (µg/L)	32.0 D
Iron (mg/L)	259
Manganese (mg/L)	13.1
pH (SU)	5.6

PZ-9	
Date	3/31/2015
Benzene (µg/L)	28.0 D
Iron (mg/L)	312
Manganese (mg/L)	17.2
pH (SU)	6.32

PZ-2	
Date	3/27/2015
Benzene (µg/L)	360
Iron (mg/L)	223
Manganese (mg/L)	15.5
pH (SU)	6.08

GWSW-001	
Date	3/30/2015
Benzene (µg/L)	0.500 U
Iron (mg/L)	192
Manganese (mg/L)	12.6
pH (SU)	6.31

PZ-8	
Date	3/31/2015
Benzene (µg/L)	2.10
Iron (mg/L)	187 J
Manganese (mg/L)	13.4
pH (SU)	5.9

PZ-5A	
Date	3/27/2015
Benzene (µg/L)	65.0 D
Iron (mg/L)	180
Manganese (mg/L)	12.7
pH (SU)	6.23

PZ-5B	
Date	3/31/2015
Benzene (µg/L)	25.0 D [25.0 D]
Iron (mg/L)	268 J [266 J]
Manganese (mg/L)	19.7 [18.6]
pH (SU)	5.98

PZ-5C	
Date	3/31/2015
Benzene (µg/L)	4.40
Iron (mg/L)	66.6
Manganese (mg/L)	1.28
pH (SU)	6.85

LEGEND:

- EXISITING MONITORING WELL
- MONITORING WELL (INSTALLED 2010)
- MONITORING WELL (INSTALLED MAY 2014)
- GROUNDWATER/SURFACE WATER SAMPLING POINT (INSTALLED 2012)
- GROUNDWATER/SURFACE WATER SAMPLING POINT (INSTALLED 2015)
- SEDIMENT SAMPLE (COLLECTED NOVEMBER 2012)
- SEEP (NO LONGER PRESENT)
- EXISTING ROUX PIEZOMETER (SURVEYED IN 2015)
- HISTORIC SURFACE WATER LOCATIONS (1994)
- PIEZOMETER (INSTALLED MARCH 2015)
- ROUX ANOXIC LIMESTONE TRENCH (SURVEYED IN MARCH 2015)
- PHYTOREMEDIATION AREA (APPROXIMATE LOCATION)
- SURFACE WATER FEATURE (APPROXIMATE LOCATION)
- RELEASE LINE
- HISTORICAL/POTENTIAL SOURCE AREAS (REMOVED)
- APPROXIMATE PROPERTY BOUNDARY
- X EXISTING FENCE
- CORRUGATED METAL PIPE (CMP)
- 950 GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- MILD ANAEROBIC REDUCTION
- MODERATE ANAEROBIC REDUCTION
- STRONG ANAEROBIC REDUCTION
- 6 FORMER IMPOUNDMENT
- 7 WASTE SLUDGE AND BREEZE STORAGE AREA
- mg/L MILLIGRAMS PER LITER
- µg/L MICROGRAMS PER LITER
- D ANALYZED AT A DILUTION
- J ESTIMATED VALUE
- U NOT DETECTED ABOVE SPECIFIED REPORTING LIMIT
- NA NOT ANALYZED

NOTE:

1. AERIAL PHOTOGRAPH PROVIDED BY GOOGLE EARTH PRO, SEPTEMBER 2013.
2. HORIZONTAL DATUM IS NAD 83 WV SPCS – NORTH ZONE. VERTICAL DATUM IS NAVD 1988.
3. GWSW–002 WAS REINSTATED IN MARCH 2015 BECAUSE THE PREVIOUS SAMPLE LOCATION WAS ERODED.
4. CENTERLINE OF SHARON STEEL RUN AND TRIBUTARY, PZ–1 THROUGH PZ–13, AND GWSW–001 THROUGH GWSW–008 WERE SURVEYED BY ARCADIS ON APRIL 4, 2015.
5. RESULTS FOR GWSW–001 AND GWSW–002 ARE PROVIDED FOR REFERENCE.

0 20' 40'
GRAPHIC SCALE

EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY
FAIRMONT COKE WORKS SITE
FAIRMONT, WEST VIRGINIA

TRENCH EVALUATION RESULTS

ARCADIS

FIGURE
B-1

CITY: SYRACUSE, NY DIV/GROUP: ENV/CADD DB: G. STOWELL, E. KRAHMER PIC: E. LYNCH PM/TM: R. PRICE TR: C. FOSTER LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0085925\1501\00701\DWG\GWIR-West\85925C03.dwg LAYOUT: 7 SAVED: 5/27/2015 10:55 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/27/2015 10:55 AM BY: KRAHMER, ERIC
XREFS: 85925XLD IMAGES: 2013 Aerial West.jpg PROJECTNAME: ---

APPENDIX C

RESPONSIVENESS SUMMARY

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RESPONSIVENESS SUMMARY
FOR THE PROPOSED REMEDIAL ACTION PLAN
FOR THE SHARON STEEL/FAIRMONT COKE WORKS
SUPERFUND SITE

FAIRMONT, MARION COUNTY, WEST VIRGINIA

Public Comment Period
July 9, 2016 to August 8, 2016

Overview

On July 9, 2016, EPA released the Proposed Remedial Action Plan (Propose Plan) for the Sharon Steel/Fairmont Coke Works Superfund Site (Site), and announced the opening of the 30-day public comment period. In the Proposed Plan, EPA identified its proposed remedial action (Preferred Alternative) for the Site. On July 14, 2016, EPA and WVDEP held a public meeting in Fairmont, West Virginia to present the Proposed Plan to the local community and to seek comment. At this meeting, representatives from EPA and the WVDEP discussed the Site history, environmental investigations, feasibility studies, proposed response actions and answered general questions about Site conditions.

This Responsiveness Summary provides a summary of issues raised during the public comment period, including comments made during the July 14, 2016 public meeting. EPA carefully evaluated the comments submitted. Citizens submitting comments included area residents and local government.

1. <u>Comment:</u> A citizen noted that future buildings constructed in the area of the Site that has benzene contamination in the underlying groundwater would be subject to air monitoring and in follow-up asked whether the air monitoring would be performed with a continuous monitoring device or whether a periodic check would be performed.

EPA Response: For future buildings constructed in the Vapor Intrusion Protection Area, EPA is requiring that such buildings be constructed with vapor barriers and venting techniques along the base of the building. EPA has found that it is generally less expensive and more protective to construct new buildings in that manner than it is to conduct air sampling over time. In most cases, barriers and vents will passively prevent soil gas from collecting in a building with no further energy or sampling expenses. Usually a single sampling event is conducted after construction is completed to confirm safe conditions. In the event that elevated concentrations are detected, the situation can be remedied by placing small fans in the vent pipes to improve ventilation.

Continuous air sampling devices are generally not used in these circumstances. If there were existing buildings within the Vapor Intrusion Protection Area, EPA would perform an indoor air sampling event in those buildings during the colder time of year. During the cooler months, the conditions are most likely to draw vapors through cracks and discontinuities in the concrete slab/foundation into the building.

2. Comment: A citizen asked whether the potential for soil vapor intrusion presents an unacceptable risk to current residents living in the area.

EPA Response: Detailed studies performed along the northern boundary of the Site confirmed that area residents are not at risk for soil vapor intrusion. The studies identified the following four factors that led to the finding that even the homes nearest to the property boundary are not at risk:

- **Limited area of benzene contamination. There are 13 monitoring well locations spanning across the northern boundary of the Site. Only one of the 13 monitoring wells, MW-12S, has had detected concentrations of benzene in groundwater samples, which leads EPA to conclude that there is an isolated area with elevated benzene in the vicinity of monitoring well MW-12S. Most significantly, the three monitoring wells (MW-32S, MW-33S and MW-34S) placed in the area of the nearest homes were non-detect for benzene.**

- **Groundwater flow direction. Groundwater is naturally flowing away from the residential area. Local topography can be described as having a relatively steep slope up a mountainside directly north of Suncrest Blvd; groundwater flows southerly toward the middle of the Site before trending west toward the Unnamed Tributary. Therefore, groundwater is naturally flowing away from the residential area.**

- **Clay-type soil in the area. Well logs describe the geology in the vicinity of the Site, including the uppermost 15 feet at MW-33S, to be primarily clay. In addition, MW-32 has a total of 3 feet of sand within the uppermost 27 feet of formation soil; the remaining 24 feet is composed of clay and silt. The geology is significant because tight fine soils, such as clay and silt, resist transmission of soil vapors.**

- **Natural biodegradation of vapor phase benzene in soil. The fate and transport of benzene vapors in soil has been the subject of significant study in recent years, primarily because benzene is a large component found in gasoline. In short, benzene is readily degraded by microorganisms in biologically active soils and would be expected to migrate less than 30 feet beyond the edge of a benzene plume. MW- 12S is approximately 100 feet away from the nearest residence.**

3. <u>Comment:</u> Several citizens and local officials asked if ExxonMobil was still involved with cleanup efforts at the Site and who would be financially responsible for implementing the Selected Remedy after the ROD is issued.

EPA Response: All environmental investigations and response actions undertaken at the Site from September 1997 through the present have been funded by ExxonMobil in accordance with enforceable agreements entered into by ExxonMobil and EPA or WVDEP.

EPA anticipates that shortly after issuing the ROD, EPA will request that ExxonMobil negotiate an enforceable agreement, known as a consent decree, wherein ExxonMobil would agree to implement the Selected Remedy, including operations, monitoring and maintenance at the conclusion of the remedial action. In the event that the parties reach a proposed settlement, that enforceable agreement would be filed in U.S District Court and be released for a 30-day public comment period prior to being entered, or signed, by a U.S. District Court Judge. EPA expects that ExxonMobil will continue its cooperative efforts to remediate the Site.

4. <u>Comment:</u> A citizen asked if the Site property is redeveloped and put into productive reuse, will EPA and ExxonMobil continue to investigate the Site and make sure that it is safe?

EPA Response: Yes. EPA will complete "Five-Year Reviews" to ensure that the Selected Remedy remains protective of human health and the environment no less than every five years. See 40 CFR 300.430(f)(4)(ii). This periodic review is a legal requirement to ensure protectiveness at all Superfund sites when the selected remedy results in hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unrestricted use. The five-year review process is comprehensive including but not limited to a site inspection; data review, and an assessment to determine if exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection are still valid.

In the case of the FCW Site, the Selected Remedy allows for hazardous substances, pollutants or contaminants to remain on-Site and does not allow the Site property to be redeveloped for residential use and requires new buildings constructed within the Vapor Intrusion Protection Area to include soil vapor mitigation measures. Therefore, the FCW Site will be subject to Five-Year Reviews.

In addition, as part of the Project XL Agreement summarized in 2.0 (Site History and Enforcement Activities) of the Decision Summary portion of the ROD, ownership of the Site property was transferred to the Fairmont Coke Works Custodial Trust, pursuant to a Trust Agreement under which the WVDEP functions as the Trustee. In accordance with the Trust Agreement, WVDEP will be working closely with the City of Fairmont and other local officials to put the Site property back into productive reuse in a manner that fits community interests. WVDEP's close association with the future use of the Site property provides even greater

assurance that the future land use will be consistent with use restrictions and remain protective.

5. <u>Comment:</u> A citizen asked EPA to confirm that the Selected Remedy would include more frequent environmental monitoring than just the monitoring required to perform a review every five years.

EPA Response: Yes, the Selected Remedy will include more frequent monitoring. The Selected Remedy requires comprehensive long-term environmental monitoring necessary and appropriate to track the performance of the Limestone Trench/Permeable Reactive Barrier (LT/PRB) in accordance with the approved remedial design. The specific details, such as parameters, laboratory detection limits and sampling frequencies will be developed during the remedial design, and will be incorporated into a remedial design plan which must be approved by EPA, in consultation with WVDEP. In addition, long-term groundwater monitoring at the perimeter of the Site will be required to confirm that groundwater with contaminants of concern that exceed MCLs or risk-based goals remains within the Site boundary.

6. <u>Comment:</u> A citizen stated that she understood that the Selected Remedy would maintain Institutional Controls preventing residential land use or the extraction of groundwater from the aquifer beneath the Site for use as a potable water source. She then asked if use of the underlying groundwater for geothermal purposes would be prohibited.

EPA Response: The Selected Remedy does not specifically prohibit using the underlying aquifer for geothermal use. If any geothermal use at the Site were to be proposed it would be subject to local and state regulations as appropriate. Additionally, use of the groundwater for geothermal purposes would require a risk analysis to be performed to consider the novel potential exposure scenarios that may be presented by geothermal use. As a general observation, an open loop geothermal system would likely not be appropriate in the vicinity of the Site, as withdrawal and/or injection of potentially large volumes of water could alter natural groundwater flow patterns. However, a closed-loop system utilizing non-toxic heat transfer liquid such as potable water may be acceptable pending further study and review.

7. <u>Comment:</u> A citizen asked if the subsurface geology in the vicinity of the Site has characteristics that result in all the groundwater ultimately migrating to the Monongahela River.

EPA Response: Yes, the groundwater in the vicinity of the Site ultimately migrates to the Monongahela River. Groundwater beneath the Site generally flows very slowly in a western direction until it discharges to the Unnamed Tributary. The Unnamed Tributary flows through a relatively steep ravine along the boundary between the FCW Site and the Big John's Salvage Superfund Site further to the west, before discharging to the Monongahela River approximately 1,600 feet downstream.

8. Comment: Several citizens expressed words of support for Alternative 5, identified as the "Preferred Alternative" in the Proposed Plan.

EPA Response: EPA appreciates the input received from the community concerning this important matter. EPA received no negative comments regarding Alternative 5 and EPA received no comments supporting any of the other Alternatives evaluated in the Proposed Plan.

EPA received one written comment on the Proposed Plan, via email. The following is a summary of the comment received. The complete email can be viewed in the Administrative Record.

9. Comment: In written correspondence, a citizen stated her support for the selection of Alternative 5 (Limestone Trench/Permeable Reactive Barrier (LT/PRB); Remediation of Wetlands; Institutional Controls. The citizen also stated her concern whether a property, that has been as contaminated as the Sharon Steel/Fairmont Coke Works Site had been, could ever truly be reclaimed. The citizen also asserted that authorities should not approve a change to the existing land use restriction which prevents recreational or residential use of the Site.

EPA Response: The nature and extent of contamination at the Site is well understood. Under EPA oversight, ExxonMobil performed a Remedial Investigation at the Site which included a Human Health Risk Assessment (Risk Assessment) completed in 2016 in a manner consistent with Agency guidance. The Risk Assessment evaluated potential risks that could be presented to people using the Site under various land use scenarios.

As stated in the ROD, in 2006 a Declaration of Deed Restrictions was recorded on the land records for the Site property. That Declaration imposes land use restrictions on Site property prohibiting residential use and the extraction of groundwater from beneath the Site for potable use.

Based on the 2013 Risk Assessment, EPA determined that the Site property could not be safely be reused for residential purposes. Accordingly, based on existing information found in the Administrative Record, EPA would not support a proposal to modify the existing land use restriction to allow residential use of the Site. Therefore, the Selected Remedy requires the maintenance of the existing Institutional Control to prevent residential land use of Site property.

The Risk Assessment also evaluated a recreational land use scenario using data from environmental samples collected at the Site and exposure assumptions listed in RAGS Table 4 in Appendix B of the Risk Assessment. The Risk Assessment documented that an unacceptable risk would be presented to child recreational users exposed to surface water in the Unnamed Tributary due to elevated manganese concentrations. Such exposure to surface water was the only exposure route that resulted in an unacceptable risk to people under the recreational use

scenario. The Risk Assessment documented that existing surface soil at the Site would not present an unacceptable risk to recreational users. Accordingly, based on existing information, EPA would likely not object to a proposal to modify the existing land use restriction to allow recreational use provided that the concentration of manganese in surface water is reduced to below the risk-based performance standard listed in Section 12.2 (Description of the Selected Remedy and Performance Standards) of the ROD or the potential exposure pathway to the surface water is eliminated.

It is also worth noting that EPA will complete "Five-Year Reviews," as discussed in EPA's response to Comment 4, above, to ensure that the Selected Remedy is protective of human health and the environment no less than every five years.

APPENDIX D

ADMINISTRATIVE INDEX SUMMARY

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SHARON STEEL CORP (FAIRMONT COKE WORKS) *
OU 1 REMEDIAL ADMINISTRATIVE RECORD FILE
INDEX OF DOCUMENTS

II. REMEDIAL ENFORCEMENT PLANNING

1. Administrative Order on Consent for Remedial Investigation/Feasibility Study (RI/FS) In The Matter of: Sharon Steel Corporation-Fairmont Coke Works, Fairmont, WV, Exxon Corporation, Respondent, Docket No. III-97-103-DC, 9/17/97. **

2. Administrative Order by Consent for Removal Response Action In The Matter Of: Sharon Steel Corporation-Fairmont Coke Works Site, Fairmont, West Virginia, Exxon Corporation, Respondent, Docket No. 111-99-004-DC, 12/11/98. **

3. First Modification to the Administrative Order by Consent for Removal Response Action In The Matter Of: Sharon Steel Corporation-Fairmont Coke Works Site, Fairmont, WV, Exxon Corporation, Respondent, Docket No. III-99-004-DC, 5/21/99. **

4. Order, in the Matter of State of West Virginia v. ExxonMobil Corporation and Green Bluff Development, Inc., Civil Action No. 1:02CV160, 1/24/03. P. 200001-200027.

5. Agreement and Covenant Not to Sue the Fairmont Coke Works Site Custodial Trust, In the Matter of: Fairmont Coke Works Site; Fairmont Coke Works Site Custodial Trust, Settling Respondent, Docket No. CERC-03-2004-0001PP, 6/15/04. P. 200028-200047. An August 30, 2004, cover letter to Ms. Stephanie Timmermeyer, WV Department of Environmental Protection (WVDEP), from Ms. Bonnie Pugh Winkler, U.S. EPA, is attached.

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* Administrative Record File available 7/8/2016, **updated //.**

** Document is incorporated by reference from the *Fairmont Coke Works Removal Administrative Record File* finalized June 12, 2000.

6. Quitclaim Deed, Made by and between Green Bluff Development Inc., and Fairmont Coke Works Site Custodial Trust, 10/20/04. P. 200048-200116.

7. Letter to Robert Jackmore, Exxon Mobil Corporation, from Mr. Bruce McDaniel, City of Fairmont, re: Releasing coal and coke storage area for development, 1/4/07. P. 200117-200118.

8. Letter to Mr. Mark Tampoya, The Water Works LLC, from Mr. James Burke, U.S. EPA, re: Comfort Letter, 2/7/07. P. 200119-200142. The June 15, 2004, Agreement and Covenant Not to Sue the Fairmont Coke Works Site Custodial Trust, Docket No. CERC-03-2004-0001PP, is attached.

9. Letter to Mr. Tom Bass, WVDEP, from Mr. Jay Rogers, City of Fairmont, re: Request for Release for Transfer of real estate request, 6/8/11. P. 200143-200145. A description of the real estate survey is attached.

10. Letter to Maj. Gen. James Hoyer, State Armory Board, from Mr. Shawn Garvin, U.S. EPA, re: Consent to transfer Prospective Purchaser Agreement (PPA) covenants to the State Armory Board, 12/18/15. P. 200146-200176. Related documents are attached.

III-IV. REMEDIAL RESPONSE PLANNING

1. Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Assessment for Sharon Steel Corporation (a/k/a Fairmont Coke Works), Fairmont, Marion County, West Virginia, 11/18/97. P. 300001-300054.

2. Report: Project XL Final Project Agreement, prepared by the U.S. EPA and the West Virginia Department of Environmental Protection, 5/24/99. **

3. Report: Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS U.S., Inc. (ARCADIS), 9/28/11. P. 300055-300382.

4. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Transmittal of site photographs and upcoming site visit, 10/13/11. P. 300383-300388. Site photographs are attached.

5. Report: Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Addendum 1, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS U.S., Inc. (ARCADIS), 11/18/11. P. 300389-300399. Related electronic memoranda are attached.

6. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Michael Lamarre, ExxonMobil Environmental Services Company, re: Transmittal of site photos, 12/27/11. P. 300400-300404. A December 21, 2011, transmittal electronic memoranda to Mr. Michael Lamarre, ExxonMobil Environmental Services Company, from Mr. Richard Price, ARCADIS, and site photos are attached.

7. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Rob Anderson, ARCADIS, re: Monitoring MNA parameters for April 2012 sampling event, 4/12/12. P. 300405-300407. An April 11, 2012, electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Rob

Anderson, ARCADIS, regarding FCW groundwater sampling, is attached.

8. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Rob Anderson, ARCADIS, re: Response to request to complete MNA analysis in April groundwater monitoring, 4/23/12. P. 300408-300411. Related electronic memoranda are attached.

9. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Draft RI/FS Work Plan Comments, 5/14/12. P. 300412-300430.

10. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Richard Anderson, ARCADIS, re: Responses to U.S. EPA comments on RI/FS Work Plan, 6/20/12. P. 300431-300477.

11. Comments on Remedial Investigation/Feasibility Study Work Plan, Noteworthy Concerns Remaining Related to the Eco-Risk Sections, 7/9/12. P. 300478-300480.

12. Report: Remedial Investigation/Feasibility Study Work Plan, Report Body, Tables, Figures, Appendices A - B, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/3/12. P. 300481-309292.

13. Report: Remedial Investigation/Feasibility Study Work Plan, Appendices C - E Part 1 of 5, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/3/12. P. 309293-351329.

14. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix E Part 2 of 5, Fairmont Coke ΔΔ

ΔΔ This document - Appendix F from both Appendices E & G of the Remedial Investigation/Feasibility Study Work Plan, is made up of Laboratory Reports and Chains of Custody, which are too voluminous and large in file size to include in the online file. This document can be viewed at the U.S. EPA Region 3 Offices upon request. These documents are part of the AR Collection No. 64534.

Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/3/12.

15. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix E Part 3 of 5, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/3/12. ΔΔ

16. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix E Part 4 of 5, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/3/12. ΔΔ

17. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix E Part 5 of 5, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/3/12. P. 351330-359010.

18. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix F, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/12. P. 359011-402468.

19. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix G Part 1 of 3, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/12. P. 402469-426829.

20. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix G Part 2 of 3, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/12. ΔΔ

21. Report: Remedial Investigation/Feasibility Study Work Plan, Appendix G Part 3 of 3, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/12. P. 426830-431802.

22. Report: Remedial Investigation/Feasibility Study Work Plan, Appendices H - J, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 9/11, revised 8/12. P. 431803-432272.

23. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Comments on August 2012 RI/FS Work Plan, 8/30/12. P. 432273-432278. The first page of Consent Decree, Civil Action No. 1:08CV124, is attached.

24. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Thomas Bass, WVDEP, re: August 2012 Site Visit 29 and installation expansion of the road across the Site, 8/30/12. P. 432279-432282.

25. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Request for electronic data submission, 3/7/13. P. 432283-432286.

26. Electronic memorandum to Mr. Eric Newman, U.S. EPA, and Ms. Kathleen Patnode, U.S. Fish and Wildlife Service, from Mr. Bruce Pluta, U.S. EPA, re: Big John Salvage unnamed tributary watershed, 3/12/13. P. 432287-432288. Related electronic memoranda are attached.

27. Letter to Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Comments on the Draft RI/FS Report, 11/6/13. P. 432289-432312. Related documents are attached.

28. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Response to U.S. EPA comments on RI/FS Report, 1/17/14. P. 432313-432368. Related documents are attached. ***

29. Letter to Mr. Jake McDougal, WV Department of Environmental Protection (WVDEP), from Mr. Eric Newman, U.S. EPA, re: Request to identify West Virginia State Applicable Relevant and Appropriate Requirements (ARARs), 2/6/14. P. 432369-432376. A Table: Summary of Key ARARs for Big John Salvage Removal Alternatives, is attached.

*** Document has been redacted to protect the privacy of individuals. Redactions are evident from the face of the document.

30. Memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Review of response to RI comments for human health risk assessment issues, 2/12/14. P. 432377-432382. Suggested Guidance for Application of Manganese RfD to Specific Scenarios and an electronic transmittal memorandum from Ms. Jennifer Hubbard, U.S. EPA, to Mr. Eric Newman, Mr. Mark Leipert, and Mr. Bruce Pluta, U.S. EPA, are attached.

31. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Jason McDougal, WVDEP, re: Transmittal of State ARARs, 2/24/14. P. 432383-432386. Summary of Initial ARARs for Fairmont Coke (Sharon Steel) Table attached.

32. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Additional Groundwater Investigation Work Plan, 3/28/14. P. 432387-432413. An electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, Mr. Charles Armstead and Ms. Jamie Hopen, WVDEP, and Mr. Joe Carter, TechLaw, Inc., from Mr. Robert Anderson, ARCADIS, is attached.

33. Letter to Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Acceptance of additional groundwater well installation, 4/4/14. P. 432414-432414.

34. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Property parcel figures, 4/17/14. P. 432415-432417. Figure X: Approximate Area of Impacted Materials at BJS/FCW, and Figure 1: Fairmont Coke Works Property Boundary with Parcel Overlay, are attached.

35. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS Surface Soil Polynuclear Aromatic Hydrocarbon (PAH) Investigation Work Plan, 6/13/14. P. 432418-432421. ***

36. Letter to Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Acceptance of ***

off-site surface soil samples proposal, 6/13/14. P. 432422-432423. A June 13, 2014, electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, regarding transmittal of the *Surface Soil PAH Investigation Work Plan*, and an electronic memorandum to Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, regarding transmittal of EPA's acceptance letter, are attached.

37. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Revised RI/FS Surface Soil PAH Investigation Work Plan, 7/14/14. P. 432424-432430. Related electronic memoranda are attached. ***

38. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Remedial Investigation/Feasibility Study (RI/FS) - Surface Soil PAH Investigation - Summary Report, 7/21/14. P. 432431-432479. Related electronic memoranda are attached. ***

39. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS Surface Soil PAH Investigation - Summary Report, 8/12/14. P. 432480-432523. ***

40. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS Surface Soil PAH Investigation - Work Plan - Revised, 8/12/14. P. 432524-432528. ***

41. Electronic memorandum to Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Review and approval of the Surface Soil PAH Investigation Work Plan and Summary Report, 8/14/14. P. 432529-432530. An August 12, 2014, electronic transmittal memorandum to Mr. Eric Newman, from Ms. Janet Connolly, ARCADIS, is attached. ***

42. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Cyanide in Groundwater Work Plan, 9/16/14. P. 432531-432536. A September 16, 2014, electronic transmittal memorandum

to Mr. Eric Newman, U.S. EPA, Mr. Jason McDougal, WVDEP, and Mr. Joe Carter, TechLaw, Inc., from Mr. Robert Anderson, is attached.

43. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Cyanide in Groundwater Work Plan - Revised, 9/16/14. P. 432537-432543. Related electronic memoranda are attached.

44. Electronic memorandum to Mr. David Mack and Mr. Robert Anderson, ARCADIS, Mr. Jason McDougal, WVDEP, and Mr. Joe Carter, TechLaw, Inc., from Mr. Eric Newman, U.S EPA, re: Acceptance of Cyanide in Groundwater Work Plan, 9/16/14. P. 432544-432546. Related electronic memoranda are attached.

45. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Preliminary Sample Results - Cyanide in Groundwater, 9/25/14. P. 432547-432554. An electronic transmittal memorandum is attached.

46. Electronic memorandum to Mr. Eric Newman, Ms. Patricia Flores, and Ms. Jennifer Hubbard, U.S. EPA, and Mr. Rob Anderson, ARCADIS, from Ms. Janet Keating-Connolly, ARCADIS, re: Response to question whether the maximum contaminant level (MCL) of cyanide in groundwater applies to free or total cyanide, 9/26/14. P. 432555-432556. Related electronic memoranda are attached.

47. Electronic memorandum to Mr. Jason McDougal, WVDEP, from Mr. Robert Anderson, ARCADIS, re: Cyanide in groundwater - field measured pH results for wells that were resampled, 9/26/14. P. 432557-432559. Related electronic memoranda are attached.

48. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Patricia Flores, U.S. EPA, re: Review of preliminary sample results for cyanide in groundwater, 10/2/14. P. 432560-432561.

49. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Transmittal of

drilling logs for recently installed wells, 10/7/14. P. 432562-432577. April 22-May 21, 2014 drilling logs and related electronic memoranda are attached.

50. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Cyanide sampling methods, 10/8/14. P. 432578-432652. Related documents are attached.

51. Electronic memorandum to Ms. Jennifer Hubbard, Ms. Patricia Flores-Brown, Mr. Mark Leipert, Mr. Joseph McDowell, Mr. Gene Nance, U.S. EPA, Mr. Joe Carter and Mr. Gene Nance, TechLaw, Inc., and Mr. Jake McDougal, WVDEP, from Mr. Eric Newman, U.S. EPA, re: Review of sample results for benzene/total cyanide/free cyanide in groundwater, 10/8/14. P. 432653-432659. Related electronic memoranda are attached. ***

52. Electronic memorandum to Mr. Eric Newman, U.S EPA, and Mr. Jason McDougal, WVDEP, from Mr. Robert Anderson, ARCADIS, re: Submittal of approach for additional investigation of cyanide in groundwater, 10/15/14. P. 432660-432660.

53. Electronic memorandum to Mr. Robert Anderson, ARCADIS, and Mr. Jason McDougal, WVDEP, from Mr. Eric Newman, re: Concurrence with additional cyanide investigation in groundwater, 10/16/14. P. 432661-432662. An October 15, 2014, electronic memorandum to Mr. Eric Newman, U.S. EPA, and Mr. Jason McDougal WVDEP, from Mr. Robert Anderson, ARCADIS, regarding an approach for additional investigation of cyanide in groundwater, is attached.

54. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Additional Groundwater Investigation Work Plan - October 2014, 10/17/14. P. 432663-432669. An electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA and Mr. Jason McDougal, WVDEP, from Mr. David Mack, ARCADIS, is attached.

55. Letter to Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Acceptance of RI/FS Work Plan Amendment, 10/19/14. P. 432670-432672. Electronic transmittal memoranda are attached.

56. Electronic memorandum to Mr. Joe Carter, TechLaw, Inc., Mr. Eric Newman, U.S. EPA, and Mr. Jason McDougal, WVDEP, from Mr. David Mack, ARCADIS, re: Comments on the Remedial Investigation/Feasibility Study - Additional Groundwater Investigation Work Plan - October 2014, 10/21/14. P. 432673-432674. Related emails are attached.

57. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Revised RI/FS Report, 11/12/14. P. 432675-432738. ***

58. Report: Revised Remedial Investigation/ Feasibility Study Report, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 11/12/14. P. 432739-432982. ***

59. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Response to comments on the status of well installation, 12/8/14. P. 432983-432990. Related figures and electronic memoranda are attached.

60. Memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Bruce Pluta, U.S. EPA, re: Response to comments and November 2014 Revised RI/FS, 12/12/14. P. 432991-432995.

61. Electronic memorandum to Mr. Eric Newman, U.S. EPA, Mr. Jake McDougal WVDEP, and Mr. Joe Carter, TechLaw, Inc., from Mr. Robert Anderson, ARCADIS, re: Submittal of draft cyanide in groundwater results, 1/22/15. P. 432996-433027. Related documents are attached.

62. Electronic memorandum to Ms. Patricia Flores and Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Cyanide in groundwater results, 1/26/15.

P. 433028-433030. Related electronic memoranda are attached.

63. Electronic memorandum to Mr. Robert Anderson, ARCADIS, and Mr. Bruce Frink, ExxonMobil Environmental Service, from Mr. Eric Newman, U.S. EPA, re: Cyanide in groundwater results, 1/28/15. P. 433031-433035. Related documents are attached.

64. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Comments on uncertainties around cyanide vapor intrusion decision, 1/28/15. P. 433036-433037. A January 28, 2015, Fairmont Coke Cyanide and Vapor Intrusion: Uncertainty Assessment table, is attached.

65. Letter to Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Comments on the November 2014 RI/FS Report, 2/10/15. P. 433038-433056. Related documents are attached.

66. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Correction regarding EPA/WVDEP comments on the RI/FS, 2/10/15. P. 433057-433060. A February 10, 2015, electronic memorandum to Mr. Bruce Frink, ExxonMobil Environmental Services, and Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, regarding EPA/WVDEP comments on the RI/FS, and a Summary of Risks and Recommendations for the Development of Remedial Action Objectives Table, is attached.

67. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Comment Letter Work Plan, 3/6/15. P. 433061-433070. An electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, and Mr. Jason McDougal, WVDEP, from Mr. David Mack, ARCADIS, is attached.

68. Electronic memorandum to Mr. Bruce Frink, ExxonMobil Environmental Services, and Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Site visit on March 23, 2015, and comments on the RI/FS - Comment Letter Work Plan, 3/9/15. P. 433071-433073.

A March 6, 2015, electronic memorandum to Mr. Eric Newman, U.S. EPA, and Mr. Jason McDougal, WVDEP, from Mr. David Mack, ARCADIS, regarding transmittal of the RI/FS - Comment Letter Work Plan, and Figure 1: Proposed Sample Locations, are attached.

69. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Remedial Investigation/Feasibility Study (RI/FS) - Additional Groundwater Investigation Summary Report, 4/1/15. P. 433074-433153. An April 1, 2015, electronic memorandum to Mr. Eric Newman, U.S. EPA, Mr. Jason McDougal, WVDEP, and Mr. Joe Carter, TechLaw, Inc., from Mr. Robert Anderson, ARCADIS, regarding transmittal of the *Final Additional Groundwater Investigation Summary*, and a January 22, 2015, electronic memorandum regarding cyanide in groundwater results, are attached.

70. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Remedial Investigation/Feasibility Study (RI/FS) - Comment Letter Work Plan, 4/10/15. P. 433154-433170. An April 13, 2015, electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, Mr. Jason McDougal, WVDEP, and Mr. Joe Carter, TechLaw, Inc., from Mr. Robert Anderson, ARCADIS, is attached.

71. Electronic memorandum to Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Transmittal of surface water concentrations data, 4/15/16. P. 433171-433191. Related documents are attached.

72. Electronic memorandum to Mr. Jason McDougal, WVDEP, from Mr. Robert Anderson, ARCADIS, re: Preliminary groundwater results - transmittal of field pH readings for groundwater samples, 4/24/15. P. 433192-433193. Table X: Recorded pH - March/April 2015 Groundwater Sampling Table and related electronic memoranda are attached.

73. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Review of RI/FS revision, 9/29/15. P. 433194-433195. A

September 3, 2015, electronic memorandum to Mr. Joe Carter, TechLaw, Inc., Mr. Jason McDougal, WVDEP, Ms. Jennifer Hubbard, Mr. Bruce Pluta, and Mr. Mark Leipert, U.S. EPA, and Ms. Kathy Patnode, U.S. Fish & Wildlife Service, from Mr. Eric Newman, U.S. EPA, regarding expected submittal of a revised RI/FS, is attached.

74. Report: Fairmont Coke Works Screening-Level Ecological Risk Assessment, Fairmont, West Virginia, prepared by ARCADIS, revised 6/15. P. 433196-433512.

75. Report: Draft Groundwater Investigation Report - Western Portion of FCW Site, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 6/3/15. P. 433513-433588.

76. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Jason McDougal, WVDEP, re: Comments on Western End Report, 6/4/15. P. 433589-433589.

77. Electronic memorandum to Mr. Eric Newman, Mr. Bruce Pluta, and Mr. Mark Leipert, U.S. EPA, and Ms. Kathy Patnode, U.S. Fish & Wildlife Service, from Ms. Jennifer Hubbard, U.S. EPA, re: Comments on Western End Report, 6/11/15. P. 433590-433590.

78. Report: Site-Wide Human Health Risk Assessment, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 6/19/15. P. 433591-435630.

79. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Response to U.S. EPA comments on November 12, 2014, Revised RI/FS Report, 6/22/15. P. 435631-435663.

80. Report: Revised Remedial Investigation/Feasibility Study Report, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, revised 6/22/15. P. 435664-435961.

81. Electronic memorandum to Mr. Eric Newman, U.S. EPA, and Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Robert Anderson, ARCADIS, re:

Approval for distribution and copying of ExxonMobil's Revised RI/FS, 7/7/15. P. 435962-435962. A July 7, 2015, electronic memorandum to Mr. Robert Anderson, ARCADIS, and Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Eric Newman, regarding request for approval on distribution and copying of ExxonMobil's Revised RI/FS, is attached.

82. Memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: June 2015 RI/FS Revision, 7/16/15. P. 435963-435968. A July 16, 2015, electronic transmittal memorandum, is attached.

83. Memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Bruce Pluta, U.S. EPA, re: Response to comments and RI/FS, 7/24/15. P. 435969-435970.

84. Letter to Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Comments on the June 2015 Revised RI/FS Report, 8/7/15. P. 435971-435979.

85. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Jason McDougal, WVDEP, re: No further comments on the RI/FS, 9/29/15. P. 435980-435980.

86. Table, Table 2: GWSW Sample Results - Compared to Human Health Screening Values, Groundwater Investigation Report - Western Portion of FCW Site, 9/3/15. P. 435981-435982.

87. WVDEP Oversight of SWA Delineation Event at Fairmont Coke Works Site, Fairmont, WV, 11/11/15. P. 435983-435986. A November 20, 2015, electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Jason McDougal, WVDEP, is attached.

88. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Assessment of wet areas, 11/13/15. P. 435987-435987.

89. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Seasonally Wet Areas Investigation Work Plan, 12/2/15.

P. 435988-435998. An electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, Mr. Jason McDougal, WVDEP, and Mr. Joe carter, TechLaw, Inc., from Mr. Robert Anderson, ARCADIS, is attached.

90. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Jason McDougal, WVDEP, re: Comments on the Redevelopment Plan Human Health Risk Assessment (HHRA) Evaluation, 12/3/15. P. 435999-435999.

91. Memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Bruce Pluta, U.S. EPA, re: Review of December 2015 RI/FS - Seasonally Wet Areas Investigation Work Plan, 12/7/15. P. 436000-436002. Electronic transmittal memoranda are attached.

92. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Agreement to omit sample collection at SWA-3 area, 12/9/15. P. 436003-436004. December 7, 2015, electronic memoranda regarding comments on the RI/FS Seasonally Wet Areas Investigation Work Plan, are attached.

93. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Kathleen Patnode, U.S. Fish and Wildlife Service, re: Comments on Fairmont wetlands, 1/26/16. P. 436005-436005.

94. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from, Mr. Robert Anderson, ARCADIS, re: Response to questions regarding limestone trench, 2/11/16. P. 436006-436007. A January 28, 2016, electronic memorandum to Mr. Robert Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, regarding wetlands areas/eco-risk, is attached.

95. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: RI/FS - Seasonally Wet Areas Investigation Report, 2/16/16. P. 436008-436453. An, electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, and Mr. Joe Carter, TechLaw, Inc., from Mr. Robert Anderson, ARCADIS, is attached.

96. Electronic memorandum to Mr. Eric Newman and Ms. Patricia Flores, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Vapor intrusion figures, 3/7/16. P. 436454-436456. Related electronic memoranda are attached.

97. Memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Bruce Pluta, U.S. EPA, re: Review of February 2016 Seasonally Wet Areas Investigation Report, 3/11/16. P. 436457-436459. Electronic transmittal memoranda are attached.

98. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. David Mack, ARCADIS, re: Figure of location of proposed police barracks in comparison to the seasonally wet areas, 3/18/16. P. 436460-436461. Draft Figure 1: Seasonally Wet Area Sample Locations, is attached.

99. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Jason McDougal, WVDEP, re: Transmittal of unnamed tributary sampling data, 4/5/16. P. 436462-436475. Sampling data and related electronic memoranda are attached.

100. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. David Montali, WVDEP, re: 303(d) listing of unnamed tributary/Monongahela River RN, 126.94, 4/19/16. P. 436476-436967. The *2014 West Virginia Integrated Water Quality Monitoring and Assessment Report*, prepared by WVDEP, is attached.

101. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Jason McDougal, WVDEP, re: Comments on the April 2016 RI/FS, 5/9/16. P. 436968-436968.

102. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Transmittal of risk summary tables for site risks and on-site soil risks, 6/15/16. P. 436969-436972. Fairmont Coke 2016 Soil Risk Update and Fairmont Coke 2016 Update - Attachment 2: Summary of Risks and Recommendations for the Development of Remedial Action Objectives Tables, are attached.

103. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Review of updated soil risk tables, 6/16/16. P. 436973-436973.

104. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Review of RI/FS Revision, 6/16/16. P. 436974-436974.

105. Report: Remedial Investigation/Feasibility Study Report, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 11/14, final revision 6/16/16. P. 436975-442356.

106. Proposed Plan, Sharon Steel/Fairmont Coke Works Superfund Site, Fairmont, Marion County, West Virginia, 7/16. P. 442357-442410.

107. **Report: Remedial Investigation/Feasibility Study Report, Tables & Figures, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 11/14, final revision 6/16/16. P. 2249134.** ΔΔΔ

108. **Letter to Mr. Eric Newman, U.S. EPA, from Mr. Bruce Frink, ExxonMobil Environmental Services Company, re: RI/FS Report Certification, 7/12/16. P. 2249135.**

109. **Proposed Amendment to Quality Assurance Project Plan for Pre-Design Investigation, Fairmont Coke Works Site, Fairmont, WV, 5/17. P. 2249133. A July 28, 2017 electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, from Mr. David Mack, ARCADIS, and Attachment A - Laboratory Quality Assurance Manual and Standard Operating Procedures, are attached.**

110. **Letter to Mr. Eric Newman, U.S. EPA, from Mr. William Huggins, Jr., WVDEP, re: Review of the Pre-Design Investigation Work Plan - Limestone Trench Remedial Alternative, 6/8/17. P. 2249136.**

ΔΔΔ This document appears out of order because it was not included with the balance of the Remedial Investigation/Feasibility Study Report.

111. **Electronic memorandum to Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Transmittal of comments and approval of Pre-Design Investigation for Permeable Reactive Barrier/Limestone Trench Work Plan, 6/9/17. P. 2249138. A letter to Mr. Bruce Frink, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, regarding the Work Plan comments, is attached.**

112. **Proposed Amendment (#4) to Fairmont Coke Works Site Field Sampling Plan, Pre-Design Investigation, Procedure for Collection of Pre-Design Data, Fairmont Coke Works Site, Fairmont, WV, 7/17. P. 2249132. A July 28, 2017, electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, from Mr. David Mack, ARCADIS, is attached.**

113. **Report: Pre-Design Investigation Work Plan – Limestone Trench Remedial Alternative, Fairmont Coke Works Site, Fairmont, West Virginia, 4/27/17, revised 7/28/17. P. 2249139.**

114. **Memorandum to Ms. Jennifer Hubbard, U.S. EPA, from Ms. Janet Keating-Connolly, ARCADIS, re: Site-Wide Human Health Risk Assessment Supplement, 10/10/17. P. 2249137. Related documents attached.**

115. **Memorandum to Site File, U.S. EPA, from Mr. Eric Newman, U.S. EPA, re: Technical Memorandum – Potential for Vapor Intrusion and Rationale for Establishing a Vapor Intrusion Protection Area (VIPA), 10/24/17. P. 2249142. Two figures are attached.**

V. COMMUNITY INVOLVEMENT/CONGRESSIONAL CORRESPONDENCE/IMAGERY

1. U.S. EPA National Priorities Listing, Sharon Steel Corp (Fairmont Coke Works), 12/96. **

2. U.S. EPA Community Update: Fairmont Coke Works Site, entitled, "What's Up at the Fairmont Coke Works?" 6/07. P. 500001-500002.

3. U.S. EPA Fact Sheet: Sharon Steel Corporation - Fairmont Coke Works Superfund Site, Fairmont, West Virginia, entitled, "Cleanup Continues - Redevelopment Plans Underway," 4/08. P. 500003-500004.

4. U.S. EPA Fact Sheet: Sharon Steel Corporation - Fairmont Coke Works Superfund Site, Fairmont, West Virginia, entitled, "Project Overview: Cleanup Continues - Redevelopment Plans Underway," 11/08. P. 500005-500006.

5. U.S. EPA Fact Sheet: Sharon Steel Corporation - Fairmont Coke Works Superfund Site, Fairmont, West Virginia, entitled, "Project Overview: Cleanup Continues - Redevelopment Plans Underway," 5/09. P. 500007-500008.

6. U.S. EPA Fact Sheet: Sharon Steel Corporation - Fairmont Coke Works Superfund Site, Fairmont, West Virginia, entitled, "Project Overview: Cleanup Continues - Redevelopment Plans Underway," 1/10. P. 500009-500010.

7. U.S. EPA Fact Sheet: Sharon Steel Corporation - Fairmont Coke Works Superfund Site, Fairmont, West Virginia, entitled, "Project Overview: Cleanup Continues - Redevelopment Plans Underway," 6/10. P. 500011-500012.

8. U.S. EPA Fact Sheet: Sharon Steel Corporation - Fairmont Coke Works Superfund Site, Fairmont, West Virginia, entitled, "Project Overview: Cleanup Work Nearly Complete," 11/10. P. 500013-500014.

9. U.S. EPA Fact Sheet: Sharon Steel Corporation - Fairmont Coke Works Superfund Site, Fairmont, West Virginia, entitled, "Project Overview: Soil Removal Complete," 5/11. P. 500015-500016.

10. Memorandum to Members of the Fairmont Community Liaison Panel, Agency & Company Representatives, from Ms. Mary Green, Ann Green Communications, Inc., re: Progress at the Site, 5/8/14. P. 500017-500018. A May 8, 2014, electronic transmittal memorandum from Ms. Gail Miller, Ann Green Communications, Inc. is attached.

11. Letter to Ms. Patricia Hickman, WVDEP, from Mr. Kevin Sansalone, City of Fairmont, re: Reestablishing the Real Property Management Committee, 9/16/15. P. 500019-500019. ***

12. **U.S. EPA Public Notice, Sharon Steel/Fairmont Coke Works Superfund Site, re: Proposed Remedial Action Plan Released, 7/9/16. P. 2249141.**

13. **Transcript of Public Meeting, Proposed Remedial Action Plan, Sharon Steel/Fairmont Coke Works Superfund Site, 7/14/16. P. 2249131.**

14. **Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Sharon Hildebrand, Member of the Public, re: Proposed Plan, 7/23/16. P. 2249143.** ***

VI. REMOVAL RESPONSE PROJECTS

1. Memorandum to Mr. Abraham Ferdas, U.S. EPA, from Ms. Melissa Pennington, U.S. EPA, re: Request for approval of removal action at the Fairmont Coke Works Site, 6/6/00. **

2. Report: Final Report, Iron and Manganese (Total Maximum Daily Load) TMDLs for the Unnamed Tributary at Sharon Steel, West Virginia, prepared by U.S. EPA, Region 3, 9/01. P. 600001-600065. A Decision Rationale is for the report is attached.

3. Action memorandum to Mr. Abraham Ferdas, U.S. EPA, from Mr. Hilary Thornton, U.S. EPA, re: Request for non-time critical removal action, 7/21/03. P. 600066-600105. A memorandum to Mr. Barry Breen, U.S. EPA, from Mr. Abraham Ferdas, U.S. EPA, regarding transmittal of the Action Memorandum approving a ceiling increase and modification of scope, is attached.

4. Packet of Correspondence and Amendments to Phase I Response Action Plan (Waste Management Area), 4/16/03-5/21/04. P. 600106-600149.

5. Report: Response Action Plan (Phase II) for Process Area Removal Action at the Fairmont Coke Works Site, prepared by ExxonMobil Environmental Services, 7/6/05. P. 600150-600192.

6. Letter to Mr. Thomas Aruta, ExxonMobil Refining & Supply Company, from Mr. Eric Newman, U.S. EPA, re: Phase I Response Action Plan proposed Amendments #6 & #7, 1/4/07. P. 600193-600194.

7. Report: Investigation Work Plan for Light Oil Storage (LOS) Area at the Fairmont Coke Works Site, Fairmont, WV, prepared by Camp, Dresser, & McKee, Inc., 3/1/07. P. 600195-600201.

8. Report: Investigation Work Plan for Light Oil Storage (LOS) Area at the Fairmont Coke Works Site, Fairmont,

WV, Revision 1, prepared by Camp, Dresser, & McKee, Inc., 3/28/07. P. 600202-600209.

9. Memorandum to Ms. Jennifer Hubbard, U.S. EPA, from Mr. Eric Newman, U.S. EPA, re: Request for review of performance standards established in the Action Memoranda/RAP, 5/30/07. P. 600210-600220. Related documents are attached.

10. Letter to Mr. Brian Harrison, Exxon/Mobil Refining & Supply - Global Remediation, from Mr. Eric Newman, U.S. EPA, re: Proposal to establish performance standard for pyridine in soil, 6/18/07. P. 600221-600221.

11. Memorandum to Mr. Brian Harrison, Exxon/Mobil Refining & Supply - Global Remediation, from Mr. Wendell Barner, CDM, re: Proposal for site-wide soil cleanup value for benzo(a)pyrene, 8/6/07. P. 600222-600223.

12. Letter to Mr. Brian Harrison, ExxonMobil Refining and Supply - Global Remediation, from Mr. Eric Newman, U.S. EPA, re: Revised Response Action Plan Amendment 10, 11/13/07. P. 600224-600225.

13. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Brian Harrison, Exxon Mobil Corporation, re: Site-wide soil performance standards for polycyclic aromatic hydrocarbons (PAHs), 12/19/07. P. 600226-600229. Tables 1 and 2 are attached.

14. Letter to Mr. Brian Harrison, Exxon/Mobil Environmental Refining & Supply - Global Remediation, from Mr. Eric Newman, U.S. EPA, re: PAH site-specific performance standards, 12/31/07. P. 600230-600230.

15. Report: Trip Report - October 2007 Sediment Sampling Event, Fairmont Coke/Sharon Steel Site, Fairmont, WV, prepared by TechLaw, Inc., 2/11/08. P. 600231-600249.

16. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS U.S., Inc. (ARCADIS), re: Site Conceptual Model and Pilot Scale Remedial Alternatives

Investigation for the LOS Area, 2/12/08. P. 600250-600260.

17. Memorandum to Mr. Brian Harrison, ExxonMobil, from Mr. Mark Hurban, ARCADIS, re: Corrective actions for management of waste materials for off-site disposal, 7/10/08. P. 600261-600274.

18. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Evaluating post-remediation sampling with risk-based soil concentrations for the protection of groundwater, 10/1/08. P. 600275-600303.

19. Report: Light Oil Storage (LOS) Area - Remedial Action Plan, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 10/6/08. P. 600304-600492.

20. Letter to Dr. Brian Harrison, Exxon/Mobil Environmental Service Company, from Mr. Eric Newman, U.S. EPA, re: Evaluating post-remediation application of cleanup goals, 10/20/08. P. 600493-600494.

21. Letter to Dr. Brian Harrison, ExxonMobil Environmental Services Company, from Mr. Eric Newman, U.S. EPA, re: Comments on Light Oil Storage (LOS) Response Action Plan, 10/22/08. P. 600495-600496.

22. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Proposed not-to-exceed level for measuring attainment of cleanup goals, 12/19/08. P. 600497-600502. A Draft Table 1. Summary of State Approaches to Evaluate Compliance with Soil Cleanup Standards, is attached.

23. Letter to Mr. Rob Anderson, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Proposed not-to-exceed concentrations/post-remediation application of cleanup goals at Site, 1/8/09. P. 600503-600504.

24. Map, Manhole Location Depicted on a Portion of *Map Showing Survey of Sampling and Monitoring Points at the Old Sharon Steel Plant Site* Map, 1/19/09. P. 600505-600505.

25. Figure, Figure 1: Light Oil Storage Area In-Situ Waste Characterization Sampling Plan, revised 2/09. P. 600506-600506.

26. Report: Closure Report for Coal Storage and Coke Handling Area, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 2/26/09. P. 600507-600841.

27. Electronic memorandum to Mr. Dan Kemp, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Comments on proposal to revisit pipe in byproducts area 2/12, 7/7/09. P. 600842-600847. Related electronic memoranda are attached.

28. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Work Plan for Additional Power Probe Borings in Former Processing Area, 9/16/09. P. 600848-600851.

29. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: LOS Area Post-Excavation Work Plan, 10/20/09. P. 600852-600854.

30. Proposed Amendment (#11) to Fairmont Coke Works Remedial Action Plan for Site Removal Action, 10/23/09. P. 600855-600872.

31. Letter to Brig. Gen. Melvin Burch, WV Army National Guard, from Mr. Michael Lamarre, Exxon Mobil, re: Follow-up to October 21, 2009, meeting, 10/27/09. P. 600873-600874.

32. Report: Light Oil Storage Area Post Excavation Assessment, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 11/11/09. P. 600875-600983.

33. Figure, Pipe Removal Decision Matrix, 11/16/09. P. 600984-600984.

34. Report: Field Sampling Plan, Fairmont Coke Works Site Remediation Project, Fairmont, Marion County, West

Virginia, prepared by ARCADIS, revised 11/19/09. P. 600985-601156.

35. Letter Report to Mr. Michael Lamarre, ExxonMobil, Environmental Services, from Mr. Robert Anderson, ARCADIS, re: Coal Storage Area/Coke Handling Area - Hot Spot Assessment Work Plan, 12/29/09. P. 601157-601159.

36. Standard Operating Procedure (SOP), Pipe Plugging Procedure, 1/18/10. P. 601160-601161.

37. Report: Site-Wide Groundwater Monitoring Plan, Fairmont Coke Works Site, Fairmont, West Virginia, prepared by ARCADIS, 2/5/10. P. 601162-601246. A February 5, 2010, electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, is attached.

38. Letter Report to Mr. Michael Lamarre, ExxonMobil, Environmental Services, from Mr. Robert Anderson, ARCADIS, re: Former Light Oil Storage Area Grading Plan, 2/22/10. P. 601247-601250.

39. Electronic memorandum to Mr. Dan Kemp, ARCADIS, Mr. Eric Newman, U.S. EPA, and Mr. Joe Carter, TechLaw, Inc. from Mr. Thomas Bass, WVDEP, re: Response to Former Light Oil Storage Area Grading Plan, 2/24/10. P. 601251-601252. A February 23, 2010, electronic transmittal memorandum to Mr. Eric Newman, U.S. EPA, Mr. Joe Carter, TechLaw, Inc. and Mr. Thomas Bass, WVDEP from Mr. Dan Kemp, ARCADIS, is attached.

40. Draft letter to Mr. Eric Newman, U.S. EPA, from WVDEP's Division of Land Restoration, re: Site-Wide Groundwater Monitoring Plan, 3/1/10. P. 601253-601253.

41. Memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Bruce Rundell, U.S. EPA, re: Hydrogeologic review of Groundwater Monitoring Plan, 3/11/10. P. 601254-601254.

42. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: EPA's comments on Site-Wide Groundwater Monitoring Plan, 3/16/10. P. 601255-601256.

43. Letter Report to Mr. Michael Lamarre, ExxonMobil Environmental Service, from Mr. Robert Anderson, ARCADIS, re: In Situ Sampling Plan for Overburden Near Mod 1, 3/29/10. P. 601257-601259.

44. Electronic memorandum to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Confirmation of receipt of comments on backfill at the Site, 4/13/10. P. 601260-601265. Documents regarding backfill at the Site are attached.

45. Letter Report to Mr. Eric Newman U.S. EPA, from Mr. Michael Lamarre, ExxonMobil Environmental Service, re: Stream Water Quality Investigation, 4/20/10. P. 601266-601279. A March 29, 2010, sampling report is attached.

46. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Acceptance of Coal Storage Area/Coke Handling Area Hot Spot Assessment, Conclusions, and Proposed Further Actions, 4/20/10. P. 601280-601282. Related electronic memoranda are attached.

47. Letter Report to Mr. Michael Lamarre, ExxonMobil Environmental Service, from Mr. Robert Anderson, ARCADIS, re: Plan for Removal of Tar-Like Materials Adjacent to the LOS Area, 5/6/10. P. 601283-601289.

48. Electronic memorandum to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: Approval of plan regarding imported fill, 5/7/10. P. 601290-601292. A May 7, 2010, electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Michael Lamarre, ExxonMobil Environmental Services, regarding a request for response on use of imported fill, is attached.

49. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Service, from Mr. Thomas Bass, WVDEP, re: Approval of the Plan for Removal of Tar-Like Materials Adjacent to the LOS Area, 5/10/10. P. 601293-601293.

50. Letter Report to Mr. Michael Lamarre, ExxonMobil Environmental Service, from Mr. Robert Anderson, ARCADIS, re: March 2010 - Baseline Site-Wide Groundwater Monitoring Report, 7/8/10. P. 601294-601414.

51. Letter Report to Mr. Michael Lamarre, ExxonMobil Environmental Service, from Mr. Robert Anderson, ARCADIS, re: Coal Storage Area/Coke Handling Area - Hot Spot Removal Report, 7/9/10. P. 601415-601451.

52. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Assessment of Potential Waste Locations Work Plan, 8/4/10. P. 601452-601456.

53. Meeting Minutes, Coke Works/Fairmont Armed Forces Reserve Center (AFRC) Site Issues, 8/25/10. P. 601457-601461. AFRC Site Figures are attached.

54. Letter Report to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Work Plan for Removal of Off-Site Material at Areas 2 & 3, 10/14/10. P. 601462-601467.

55. Electronic memorandum to Mr. Matthew Swensson, ARCADIS, from Mr. Eric Newman, U.S. EPA, re: Approval of proposed Work Plans for Removal of Off-Site Material, 10/15/10. P. 601468-601469. An October 14, 2010, electronic memorandum to Mr. Eric Newman, U.S. EPA, Mr. Joe Carter, TechLaw, Inc., and Mr. Thomas Bass, WVDEP, from Mr. Matthew Swensson, ARCADIS, regarding submittal of *Work Plans for Removal of Off-Site Material*, is attached.

56. Memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Human health risk

assessment review of Groundwater Monitoring and LOS Reports, 11/15/10. P. 601470-601471.

57. Letter Report to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Robert Anderson, ARCADIS, re: September 2010 - Baseline Site-Wide Groundwater Monitoring Report, 12/21/10. P. 601472-601515.

58. Memorandum to Mr. Eric Newman, U.S. EPA, from Ms. Jennifer Hubbard, U.S. EPA, re: Human health risk assessment review of December 2010 Groundwater Report, 3/17/11. P. 601516-601517.

59. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: LOS Area Closeout Report, 3/25/11. P. 601518-601539.

60. Electronic memorandum to Mr. Eric Newman U.S. EPA, from Mr. Michael Lamarre, ExxonMobil Environmental Services, re: Seep Area #1 access agreement, 4/23/11. P. 601540-601541. Related electronic memoranda are attached.

61. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Erosion repairs, 7/5/11. P. 601542-601547. Related electronic memoranda and Site photos are attached.

62. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, re: Transmittal of erosion repair photos, 7/7/11. P. 601548-601552. Related electronic memoranda are attached.

63. Electronic memorandum to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. Eric Newman, U.S. EPA, re: E & S trouble spots at Site, 7/27/11. P. 601553-601553.

64. Letter to Mr. Eric Newman, U.S. EPA, from Mr. Michael Lamarre, ExxonMobil Environmental Services, re: Certification of Compliance - Final Report, Non-Time Critical Removal Action, 9/20/11. P. 601554-601555.

65. U.S. EPA Pollution Report #455 and Final, Fairmont Coke Works, 9/28/11. P. 601556-601567.

66. Letter to Mr. Michael Lamarre, ExxonMobil Environmental Services, from Mr. James Webb, U.S. EPA, re: Approval of Final Report and transition from Non-Time Critical Removal Action to Remedial Investigation/Feasibility Study, 9/28/11. P. 601568-601569.

67. Electronic memorandum to Mr. Bruce Pluta, U.S. EPA, and Ms. Kathleen Patnode, U.S. Fish & Wildlife Service, from Mr. Eric Newman, U.S. EPA, re: Soil sample and erosion repair, 10/13/11. P. 601570-601571. An October 13, 2011, electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Robert Anderson, ARCADIS, regarding erosion repair and the upcoming site visit, is attached.

68. Electronic memorandum to Mr. Eric Newman, U.S. EPA, from Mr. Rob Anderson, ARCADIS, re: Transmittal of and comments on Penn State University (PSU) Soil Test Report, 10/14/11. P. 601572-601581. PSU Soil Test Report and related electronic memoranda are attached.

69. U.S. EPA Newsletter: Technology News and Trends, Issue 56, EPA 542-N-11-005, 11/11. P. 601582-601587.

GUIDANCE DOCUMENTS

1. Memorandum to State of Oregon Department of Environmental Quality Staff, from Mr. Dennis Ades, Ms. RaeAnn Haynes, and Ms. Jennifer Wigal, State of Oregon Department of Environmental Quality, re: Implementation Instructions for Free and Total Cyanide Water Quality Criteria (CAS #: 57-12-5), 11/14/12.

2. City of Fairmont Planning and Zoning Code, effective 5/28/15.

APPENDIX E

WVDEP CONCURRENCE LETTER

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west virginia department of environmental protection

Division of Land Restoration
601 57th Street SE
Charleston, WV 25304
Phone: 304-926-0455

Jim Justice, Governor
Austin Caperton, Cabinet Secretary
dep.wv.gov

December 8, 2017

Ms. Karen Melvin, Director
Hazardous Site Cleanup Division
U.S. EPA Region 3
1650 Arch Street
Mail Code 3HS00
Philadelphia, PA 19103-2029

RE: State Concurrence with the Record of Decision (ROD), December 2017
Sharon Steel/Fairmont Coke Works Superfund Site
Fairmont, Marion County, West Virginia
EPA Identification No. WVD000800441

Dear Ms. Melvin:

This letter is to officially express that the State of West Virginia, Department of Environmental Protection, Office of Environmental Remediation (OER) has reviewed and is in concurrence with the ROD dated December 2017 for the Sharon Steel/Fairmont Coke Works Superfund Site (site), located in Fairmont, Marion County, West Virginia.

The OER has participated in the investigation, as well as the evaluation and selection of the remedies proposed for the site. The State looks forward to the implementation of the selected remedies, which we believe will be protective both to human health and the environment, as well as provide for cost-effective remediation of the site.

Sincerely,

Casey E. Korbini

Casey E. Korbini
Deputy Director for Remediation Programs,
Division of Land Restoration

ec: Eric Newman, Remedial Project Manager, U.S. EPA
ec: Jason McDougal, Program Manager, OER
ec: William Huggins Jr., Project Manager, OER