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SAUGET INDUSTRIAL CORRIDOR SITES NATURAL RESOURCE DAMAGE ASSESSMENT

PATHWAY REPORT FOR TERRESTRIAL AND AQUATIC RESOURCES

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1.0 INTRODUCTION

The Sauget Industrial Corridor (SIC) is situated outside of the City of East St. Louis, located in St. Clair County, Illinois, directly adjacent to and located within the floodplain of the East Bank of the Mississippi River, known as the American Bottoms. Within the SIC, individual parcels of land were used historically as sand and gravel borrow pits, wastewater impoundments, and in some cases waste disposal sites, resulting in the environmental releases of hazardous substances. In September 2001 a number of specific sites within the SIC were proposed for listing on the National Priority List (NPL) as a Superfund site by the U.S. Environmental Protection Agency (EPA). Since that time, EPA has been responsible for overseeing emergency response actions and remediation of portions of the SIC included on the NPL. EPA delineated two areas (Sauget Areas 1 and 2), which contain distinct sub-sites (henceforth, SIC Sites), in order to focus remediation within these portions of the SIC (Solutia/GSI 2012; URS Corporation 2004). Two chemical manufacturing facilities, the Clayton Chemical Company facility and the W.G. Krummrich Plant, sit adjacent to the sub-sites in Areas 1 and 2, and in addition to other potentially responsible parties (PRPs), have contributed to releases of hazardous substances within the SIC, though these facilities are not officially designated as part of the Superfund sites.

Numerous hazardous substances have been documented in surface waters, sediment, soils, groundwater, and air resources within the SIC, as well as in wildlife inhabiting the area. The U.S. Fish and Wildlife Service (FWS), Illinois Environmental Protection Agency (IEPA), Illinois Department of Natural Resources (IDNR), and Missouri Department of Natural Resources (MDNR) (collectively, the "Trustees") are therefore conducting a natural resource damage assessment (NRDA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at the SIC. The NRDA is a process that is conducted separately from the remediation of the SIC, but the Trustees take the remedy into consideration. The goal of the NRDA is to identify and quantify injuries to natural resources stemming from releases of hazardous substances, and then to identify, scale, and implement environmental restoration to compensate the public for natural resource losses, including losses experienced over the time that it takes for the remedy to be completed. Assessment efforts are being conducted consistent with the NRDA regulations at 43 CFR § 11 and pursuant to the NRDA Plan for the SIC Sites (Trustees 2013). The NRDA Plan outlines the approaches and activities to be conducted during the NRDA, including the individual Trustee agencies that will take the lead in addressing injuries to trust resources (Trustees 2013). Assessment activities are planned to address injuries to groundwater resources (to be conducted by Illinois State Trustees); natural resources in the Mississippi River (to be conducted by Illinois and Missouri State Trustees); and natural resources in Dead Creek and other terrestrial and aquatic resources (to be conducted by Illinois State Trustees and Federal Trustees).

As part of the NRDA process, Trustees document the pathways hazardous substance releases follow or followed to expose natural resources (including surface waters and sediment, groundwater, geologic resources, air resources, and wildlife). Pathway

documentation by the Trustees is part of the injury determination phase of the NRDA (43 CFR § 11.63). This pathway report addresses the resources of Dead Creek, as well as other terrestrial and aquatic resources at the SIC Sites. The uses, disposal practices, and/or industrial operations at each SIC sub-site are discussed; hazardous substance releases are documented; and aquatic and terrestrial resource exposure analyses are presented.[1] Separate reports will address in greater detail pathways for groundwater and Mississippi River resources.

The sections of this report are organized as follows:

- Section 2: Geographic Scope
- Section 3: Natural Resources
- Section 4: Hazardous Substances
- Section 5: Pathways

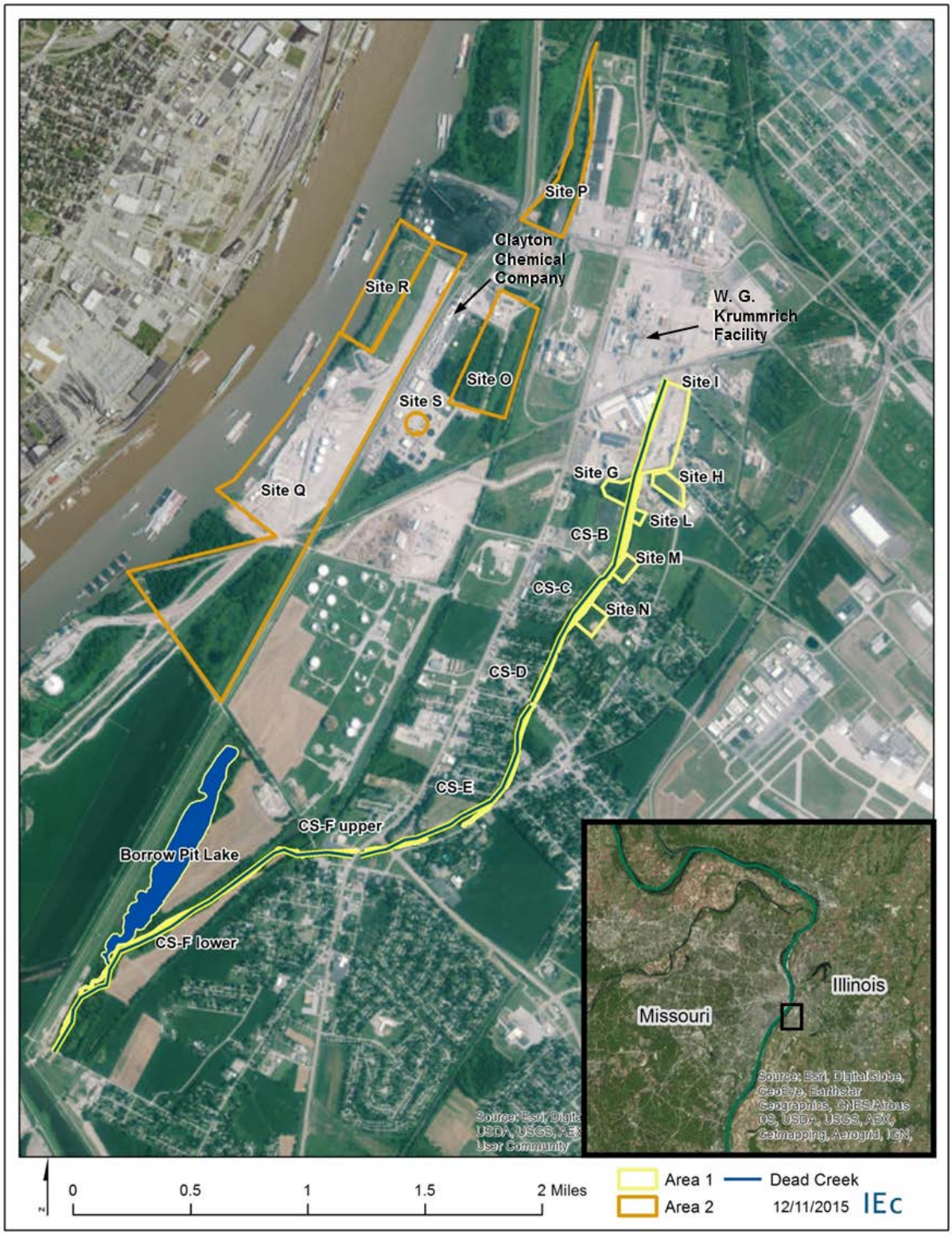
As needed, this pathway report may be revised in the future to include additional resources and contaminants as more information becomes available.

2.0 GEOGRAPHIC SCOPE

The SIC is situated within the Villages of Sauget, Cahokia, and East St. Louis, in St. Clair County, Illinois, on the Illinois (east) side of the Mississippi River outside of the City of St. Louis (Exhibit 1). The Village of Sauget encompasses approximately 25 square miles and is bordered by East St. Louis to the north and the Village of Cahokia to the south. The geographic scope of the NRDA has been delineated in preceding documents, including the Assessment Plan (Trustees 2013), which outlines the approach the Trustees are taking to conduct the NRDA. The assessment area encompasses the delineated lettered SIC sub-sites and adjacent natural resources within the Mississippi River floodplain, as well as the W.G. Krummrich Plant and the former Clayton Chemical Company facility. For remedial purposes, the disposal sites, landfills, borrow pits, and other facilities located within the SIC were grouped into two main numbered areas. Areas 1 and 2 were proposed for listing on the EPA National Priorities List (NPL) on September 13, 2001. Area 1 includes Dead Creek Segments A-F, Borrow Pit Lake, and Sites G, H, I, L, M, and N in Sauget and Cahokia. Area 2 encompasses Sites O, P, Q, R, and S, as well as a groundwater "Plume Discharge Area" adjacent to Site R on the Mississippi River. The W.G. Krummrich Plant and the former Clayton Chemical Company facility are located within the NRDA assessment area but are not formally considered as part of the Area 1 or Area 2 Superfund sites.

[1] Supporting investigations used in this report to document pathways in some cases also document the parties responsible for the releases of hazardous substances (i.e., PRPs). Where possible, this document also identifies PRPs in an effort to highlight the key players within the complex industrial setting of the SIC Sites, but any lists of PRPs are not meant to be inclusive and may change in the future.

EXHIBIT 1 SAUGET INDUSTRIAL CORRIDOR (SIC) SITES WITHIN AREAS 1 AND 2



GEOLOGY

Areas 1 and 2 are situated on the relatively flat American Bottoms floodplain. Local topography consists of bottomlands[2] ranging from 400 to 410 feet above mean sea level (Solutia/GSI 2012). American Bottoms soil within the assessment area is composed of recent alluvium-- silty sand with interbedded silt and clay material-- measuring between 15 and 30 feet thick (Solutia/GSI 2012; URS 2008). This is underlain by unconsolidated sand and gravel deposits approximately 80 to 100 feet thick, and then Mississippian and Pennsylvanian bedrock composed of limestone and dolomite (Solutia/GSI 2012). In limited areas, sub-surface soils were altered due to historical excavation and disposal activities (URS 2008).

Alluvial soils like those present at the SIC Sites are particularly amenable to groundwater flows. Porous bottomland soils, with high percentages of sand and silt, are present throughout SIC Sites and allow for increased vertical transport of surface waters and pooled rainwater to sub-surface soils and groundwater. Percolation of water through contaminated soils can lead to leaching or dissolution of bound contaminants, eventually exposing groundwater resources to contaminants in surface waters, sediments, or soils. These mechanisms lead to further natural resource exposures when groundwater discharges to streams and rivers.[3]

HYDROLOGY

Three streams (Dead Creek, Prairie du Pont Creek, and Cahokia Chute) and the Mississippi River originate in, receive runoff from, or are otherwise hydrologically connected to the assessment area. Dead Creek is channelized and serves as the main outlet for surface water drainage in Sauget Area 1 (Solutia/GSI 2012). However, Area 1 does not contain a constructed stormwater drainage system to divert precipitation to Dead Creek, so localized ponding and runoff of rainwater on terrestrial soils is common (Solutia/GSI 2012). The Mississippi River forms the western border of the SIC and receives Area 2 groundwater discharge (EPA 2013b). Within Area 2, Sites O, P, and S are located east of a flood control levee. Sites Q and R are located on the west (river) side and have been subject to flooding from the Mississippi River (URS 2008). All Area 1 Sites are located east of the levee.

Three hydrogeological units result from the dominant geological features in Sauget Areas 1 and 2: a shallow hydrogeological unit (SHU) within the Cahokia Alluvium, comprised of silty and poorly graded sands, and middle (MHU) and deep hydrogeologic units (DHU), which are located within the Henry Formation and comprised of poorly graded sands and gravel. Groundwater generally flows east to west, toward the Mississippi

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[2] Bottomlands are low-lying areas subject to overflow from rivers and streams during flooding events.

[3] A Groundwater Migration Control System (GMCS) was installed as part of remedial actions to intercept contaminated groundwater flowing toward the Mississippi River. Effectiveness monitoring suggests that some but not all contaminated groundwater flowing from Sauget Areas 1 and 2, Clayton Chemical, and the W.G. Krummrich facility toward the River is captured by the GMCS (USEPA 2013b).

River, and has hydrological connection such that groundwater is an exposure pathway from SIC Sites to the Mississippi. Separate pathway assessments will be conducted for groundwater and Mississippi River resources (Trustees 2013).

LAND USE

Current land use within Areas 1 and 2 is urban, with a mix of residential and industrial uses. Some agricultural lands are present to the south, and habitats include ponds and streams with associated riparian and wetland areas, emergent and seasonal wetlands, forests, and terrestrial grasslands (Solutia/GSI 2012; URS 2008). Some sites are used for ongoing industrial activities, while others are clearly not actively used, or are fenced to limit access. Dead Creek, Borrow Pit Lake, and Sites G, H, M, N, O, Q, and S contain undeveloped areas that are covered with vegetation. Portions of Sites G, I, L, O, P, Q, R, and S contain developed areas covered by cinders, gravel, asphalt, and/or other materials. Notably, several SIC Sites have been physically altered as a result of remedial activities to address hazardous substance releases and contamination. For example, sediments and soils from the entire length of Dead Creek segment A were removed and the area was completely backfilled (i.e., filled in) with soil as part of the Area 1 remedy, altogether destroying the creek habitat (EPA 2013a).

GEOGRAPHIC EXTENT

The geographic extent of this pathway report includes the SIC sub-sites that have been previously delineated and lettered as part of the remedial process, and adjacent areas for which data are readily available and relevant for completion of a pathway analysis. This includes:

- Dead Creek and Borrow Pit Lake;
- Floodplain soils of Dead Creek;
- Sites G, H, I, L, M, and N in Area 1;
- Sites O, P, Q, R, and S in Area 2; and
- the W.G. Krummrich Plant and former Clayton Chemical Company facility.

As detailed in the sections that follow, pathways of hazardous substances through multiple resources exist within and, in many cases, away from these geographically delineated areas.

3.0 NATURAL RESOURCES

As defined in 43 C.F.R. §11.14(z), natural resources are:

"…land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States…[or] any State or local government… These natural resources have been categorized into the following five groups: surface water resources, groundwater resources, air resources, geologic resources, and biological resources."

This pathway report focuses on natural resources within the assessment area for which sufficient data currently exist, and documents movement of hazardous substances between these resources by processes such as water-, wind-, and biologically-facilitated transport.

SURFACE WATER RESOURCES

Surface water resources are defined in 43 C.F.R. Section 11.14(pp) as:

"The waters of the United States, including the sediments suspended in water or lying on the bank, bed, or shoreline."

Surface waters were and continue to be exposed to hazardous substances originally discharged directly to Dead Creek or transmitted through the movement of contaminated surface water and/or groundwater. These contaminants have subsequently been re-released and further mobilized through natural processes including bioturbation, porewater exchange, and/or weathering. Surface waters and sediments also have been exposed to hazardous substances through the release of contaminants from mobilized sediments and floodplain soils. Surface waters and sediments exposed to SIC-related contaminants are present in:

- Dead Creek, Segments A-F, and Site M, until CS-A and Site M were backfilled[4];
- Borrow Pit Lake;
- Site Q ponds;
- Wetlands of the American Bottoms floodplain, including those located at sites Q and R; and
- The Mississippi River.[5]

GROUNDWATER RESOURCES

Groundwater is defined in 43 C.F.R. Section 11.14(t) as:

"Water in a saturated zone or stratum beneath the surface of land or water and the rocks and sediment through which ground water moves. It includes ground water resources that meet the definition of drinking water supplies."

Groundwater resources exposed to SIC-related contaminants include portions of the American Bottoms aquifers. As noted above, groundwater serves as a pathway of exposure of other natural resources, particularly surface water and geological resources. Groundwater pathways are summarized in this report, and will be discussed in greater detail under separate cover.

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[4] As part of remedial actions in 2000-2001, Dead Creek Segment A and Site M were both backfilled, resulting in the total loss of these aquatic habitats and their associated surface water resources.

[5] The Mississippi River is addressed in a separate pathway and injury determination report.

GEOLOGIC RESOURCES

Geologic resources are defined in 43 C.F.R. Section 11.14(s) as:

"Those elements of the Earth's crust such as soils, sediments, rocks, and minerals… that are not included in the definitions of ground and surface water resources."

Geologic resources exposed to SIC-related contaminants include the following:

- Floodplain soils located in upland areas closely associated with the Mississippi River, and
- Floodplain soils within the American Bottoms.

Geologic resources are a pathway to surface water and groundwater resources, as well as biological resources within the assessment area. For example, ponding of precipitation within the SIC leads to leaching of contaminants (from both surface and sub-surface soils) into groundwater. Contaminated soils are also readily mobilized in runoff events, enabling them to reach and contaminate surface waters. Finally, biological resources such as earthworms ingest soil and other biota dig and burrow into soils, which exposes these organisms to hazardous substances in soils.

BIOLOGICAL RESOURCES

Biological resources are defined in 43 C.F.R. Section 11.14(f) as:

"Those natural resources referred to in § 101(16) of CERCLA as fish and wildlife and other biota. Fish and wildlife include marine and freshwater aquatic and terrestrial species; game, nongame, and commercial species; and threatened, endangered, and State sensitive species. Other biota encompass shellfish, terrestrial and aquatic plants, and other living organisms not otherwise listed in this definition."

Biological resources are given particular attention in the context of NRDA as an endpoint for determining and quantifying injury. Biota in the assessment area consuming contaminated water, soils, plants, and animals transfer hazardous substances up the food chain. This transfer of contaminants up the food chain also represents a pathway through which higher trophic level biota are exposed to hazardous substances.

AIR RESOURCES

Air resources are defined in 43 C.F.R. Section 11.14(b) as:

"Those naturally occurring constituents of the atmosphere, including those gases essential for human, plant, and animal life."

Air resources have been exposed to SIC-related contaminants through releases of contaminants mobilized through processes including volatilization and burning. For example, spontaneous combustion and/or burning of waste materials occurred at Site G on several occasions in 1994. Air resources are a pathway to geological, surface water, and biological resources.

4.0 HAZARDOUS SUBSTANCES

The focus of this report is on hazardous substances to which natural resources have been exposed as a result of releases from SIC Sites. Hazardous substances are defined based on certain criteria set forth in CERCLA, which include characteristics of wastes considered to be hazardous, as well as a list of substances understood to be hazardous. Hazardous substances at the SIC are numerous, given the diversity of waste disposal and other land use practices over the course of decades, as well as discharges, emissions, and other direct or indirect contaminant releases. However, consistent with the Preassessment Screen (PAS) (Trustees 2009) and Assessment Plan (Trustees 2013), the Trustees focus here on substances for which ecotoxicity information (i.e., information about the adverse effects caused by ecological exposures to such hazardous substances) is readily available. This section describes the classes of contaminants that have been documented at SIC Sites (including polychlorinated biphenyls (PCBs) and dioxins, volatile and semivolatile organic compounds, and metals) upon which this report focuses. Many of these contaminants experience minimal degradation and persist in the environment for years and even decades. Others, such as metals, are elements and do not degrade at all. Several of the contaminants discussed below can also bioaccumulate or biomagnify as they are transferred up the food chain.[6]

POLYCHLORINATED BIPHENYLS (PCBS)

PCBs are a class of synthetic chlorinated hydrocarbon chemicals. PCBs are resistant to breakdown by heat and are chemically stable. These characteristics resulted in their use in a variety of industrial and commercial applications, including, for example, as insulation in electrical equipment. In 1979, their manufacture and use were phased out due to their known toxicity, in particular their propensity to cause birth defects and cancer (EPA 1979). PCBs' chemical properties also, unfortunately, resulted in PCBs persisting in the environment and accumulating in wildlife tissues, and even becoming increasingly concentrated in upper trophic level consumers such as piscivorous fish (i.e., fish that eat other fish), birds, and mammals (Eisler 2000).

PCBs were originally manufactured (and subsequently released) as mixtures known as Aroclors, which were composed of varying specifications of individual PCB congeners. Individual PCB congeners are differentiated by the number and physical arrangement of chlorine atoms in the PCB molecule. From the 1930s until the 1970s, PCBs were manufactured by the Monsanto Company at the W.G. Krummrich Plant in Sauget, Illinois within the SIC. Approximately 99 percent of the PCBs used for industrial purposes in the United States were produced by Monsanto in Sauget in the SIC (ATSDR 2000). For perspective, from 1929 to 1977, more than 571,000 metric tons of PCB mixtures were produced and/or used in the United States (ATSDR 2000 and sources therein). Thus,

[6] Bioaccumulation refers to the uptake and assimilation of contaminants into the tissues of biological organisms. Biomagnification refers to a process by which some contaminants increase in concentration as they bioaccumulate in organisms that are at higher trophic levels (i.e., higher on the food chain).

enormous quantities of PCBs were manufactured within the assessment area. PCBs were released within the assessment area in various ways over the course of production, including to air due to volatilization of PCBs from soil and water and incineration of PCB-contaminated equipment (which was likely responsible for the release of dioxins to the environment; see below); to water through waste water discharge to municipal sewers; and to soils through direct dumping in landfills (ATSDR 2000 and sources therein).

DIOXINS

Dioxins are a class of hazardous substances, like furans and other dioxin-like compounds, which are typically produced through burning of organic matter at high temperatures (ATSDR 2000). Dioxins are known to cause cancer and other endocrine disrupting effects. They are also extremely stable compounds that are known to biomagnify in food webs. Dioxins are found within the SIC and are likely the byproduct of PCB incineration. As noted above, incineration at high temperatures was one method used to dispose of PCBs and PCB-contaminated materials.

VOLATILE ORGANIC COMPOUNDS (VOCS)

Volatile organic compounds (VOCs) are a class of organic chemicals (i.e., chemicals that contain carbon) that have a high vapor pressure at standard temperature, and thus volatilize (i.e., evaporate) readily into the air at room and common ambient temperatures. Many of these chemicals are used in household products, such as paint, solvents, and cleaning products; and many can be toxic to humans and wildlife. VOCs have been released within and are widely distributed throughout the assessment area (Solutia/GSI 2012; URS 2008). Examples of VOCs documented in natural resources at SIC Sites include benzene, chlorobenzene, styrene, toluene, and xylene. These compounds were either manufactured and/or used at facilities located within or adjacent to the assessment area, or were disposed of within the SIC Sites. For example, the Clayton Chemical Company's facility recovered waste oil and a wide range of solvents and is a documented source of VOC groundwater contamination within the assessment area (Solutia/GSI 2012). Similarly, the W.G. Krummrich plant manufactured feedstock chemicals, such as benzene and its derivatives including several semi-volatile organic compounds, which are documented in natural resources within the SIC (Solutia 2000).

SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCS)

Semivolatile organic compounds have a higher boiling point than water, and volatilize at temperatures somewhat higher than room and common ambient temperatures. These chemicals have a wide range of applications and are used in, for example, pesticides, cleaning products, and as additives to furniture, cookware, food packaging, and electronics. This class of compounds includes phthalates, used to soften plastic; polycyclic aromatic hydrocarbons (PAHs), a class of chemicals found in petroleum and formed during the combustion of organic materials; phenols, used as a disinfectant and as a chemical precursor for synthesizing other compounds; and halogenated compounds, such as chlorinated benzenes. As with other classes of compounds that are the focus of

this report, many of SVOCs are recalcitrant and do not readily break down in the environment.

A wide variety of SVOCs are known to have been released within the assessment area (Solutia/GSI 2012; URS 2008). Examples of SVOCs found in natural resources at SIC Sites include 4-chloroaniline, bis(2-ethylhexyl) phthalate, phenol, pentachlorophenol, phenanthrene, and naphthalene. Plastics manufacturing, as was conducted at the Monsanto Company's facility, is known to use and result in the release of SVOCs. Additionally, halogenated solvents were disposed of at the Clayton Chemical facility, and similar SVOC chemicals (e.g., hexachlorobutadiene) have subsequently been found in environmental media (EPA 2002; Trustees 2013).

Finally, pesticides such as 2,4,-dichlorophenoxyacetic acid (2,4-D; a component of Agent Orange manufactured at the W.G. Krummrich Plant for many years), endosulfan, dieldrin, and 4,4'-dichlorodiphenyltrichloroenane (4,4'-DDT), which are considered SVOCs, have been found within environmental media within the assessment area (Solutia 2000).

METALS

Metals are elements found in the earth's crust, have been mined and used for thousands of years, and have a variety of industrial uses. As elements, they do not degrade, though the extent to which they react with the environment can change over time. For example, metals can form inorganic complexes with other elements such as oxygen and sulfur (e.g., iron can react with oxygen to form rust), or form chemical complexes with organic compounds, which can alter their chemical properties and bioavailability. Metals can also be toxic. Numerous metals have been released within the assessment area (Solutia/GSI 2012; URS 2008). Aluminum, arsenic, cadmium, copper, lead, mercury, nickel, zinc, and a number of additional metals have been documented as contaminants in natural resources at SIC Sites (Solutia/GSI 2012; URS 2008). Metals were released within the assessment area due to a variety of industrial practices, including direct disposal within landfills, borrow pits, and/or via direct dumping into Dead Creek. In particular, the Cerro Copper facility in Sauget, IL produced a wide range of metal materials, including industrial copper tubing, plumbing systems, and refrigeration systems, and generated metal waste which was disposed of at Site O and the Clayton Chemical facility (EPA 2005a).

5.0 PATHWAY

Pathway is defined in 43 C.F.R. Section 11.14(dd) as:

"The route or medium which … a hazardous substance is or was transported from the source of the discharge or release to the injured resource."

Site-specific information about the release of hazardous substances, knowledge of chemical properties that govern the fate and transport of contaminants, and knowledge of

the assessment area indicate multiple pathways for hazardous substances from source areas within the SIC Sites to natural resources. A variety of organic and inorganic contaminants have been documented throughout the SIC (AMEC 2008; EPA 1999; EPA 2000a; Menzie-Cura et al. 2001; Solutia/GSI 2012; Trustees 2009; Trustees 2013; URS 2008). In many cases, contaminants originally buried at unpermitted hazardous waste sites were not properly contained. In addition, waste water, industrial waste, seepage, and storm water containing hazardous substances were discharged into Dead Creek starting in 1928 and proceeding until the sewer connection to the creek was closed as part of remedial actions in 1990 (EPA 1999; Solutia/GSI 2012).

This section documents and defines the relative importance of exposure pathways within the assessment area. Although this section is generally organized by site, in many cases natural resources, such as soils and stormwater, are not confined to sites, so pathways of hazardous substances emanating away from individual sites are also discussed. In developing this report the Trustees considered and evaluated:

- hazardous substances generally understood to be of concern at the SIC Sites, with known toxicity to biota, and for which information was readily available;
- the history of and operations at the SIC Sites, including industrial and disposal practices;
- environmental mechanisms that re-distribute, re-release, or otherwise mobilize hazardous substances in the environment over time;
- documented exposures of natural resources; and
- remedial actions implemented to-date.

W.G. KRUMMRICH PLANT AND CLAYTON CHEMICAL COMPANY

The W.G. Krummrich Plant and the Clayton Chemical Company facility have been investigated as sources of environmental contamination. In 2000, Solutia documented the nature and extent of impacted groundwater and soil from operations at the W.G. Krummrich Plant, stemming from a decades-long history of chemical manufacturing on a parcel of land covering 120 acres just north of Dead Creek (Solutia 2000). Contaminants such as benzene, phenol, chlorobenzene, naphthalene, chloroaniline, and PCBs, which were manufactured and/or used at the Krummrich Plant, were documented in nearby groundwater and soils. The Krummrich Plant is currently in use and is the subject of a Resource Conservation and Recovery Act (RCRA) Corrective Action (EPA 2013a). The former Clayton Chemical Company (a.k.a., Resource Recovery Group) covers 7.35 acres that was used over time as a railroad repair yard, a crude oil topping facility, and a solvent reclamation facility until 1998 (URS 2008). Clayton Chemical utilized an area now known as Site S for disposal of paint sludges and solvent still bottoms, and has been the subject of CERCLA corrective actions due to groundwater contamination (URS 2008). Both the Krummrich Plant and Clayton Chemical facility are cited in a 2015

Consent Decree as key sources of groundwater and soil contamination (EPA 2015).[7] These facilities not only represent important sources of on-site releases of hazardous substances, but also are relevant to our discussion of area-wide pathways given that the manufacturing and waste disposal practices at these facilities highlight their roles in contamination at other locations throughout the SIC.

AREA 1

Area 1 consists of closed waste disposal areas (Sites G, H, and I), a backfilled impoundment (Site L), an inactive borrow pit (Site M), an area for the disposal of construction debris (Site N), and a portion of Dead Creek (Segments A-F) which connects to Borrow Pit Lake. Area 1 is adjacent to and located east/southeast of Area 2.

Remedial investigations have calculated that disposal locations in Area 1 contain approximately 796,000 cubic yards of soil and buried waste, some of which contained hazardous substances. Given the hazardous substances documented in surface water, sediment, and surrounding soils posed significant human health and ecological risks, remedial actions to-date have focused on cleanup and removal of sediments and creek soils from Dead Creek, Site M, and Borrow Pit Lake (EPA 2000b). Remedies at certain sub-sites are considered completed. Though hazardous wastes are no longer actively being dumped into Dead Creek and much of the contaminated sediments and underlying creek soils have been removed, hazardous substances remain in the system, albeit at levels lower than they were historically. Floodplain soil sampling of transects adjacent to Dead Creek also documented a suite of hazardous substances that were either transported from historical flooding of Dead Creek and Borrow Pit Lake or from runoff from neighboring sites (Solutia/GSI 2012).

The Record of Decision (ROD) for Area 1 evaluated the remaining principal threat wastes[8] contained within Area 1 environmental media, as determined by sampling and analysis conducted in the Remedial Investigation (RI) (EPA 2013a; Solutia/GSI 2012). Source investigations found pools of non-aqueous phase liquids (NAPL) that underlie portions of Sites G, H, and I (South) within the aquifer matrix (EPA 2013a). Continued contamination from subsurface soils in the utility corridor adjacent to Sites H and I, as well as from NAPL contained in soils underlying Sites G, H, and I within the alluvial aquifer, although addressed in the ROD, represent pathways for continued natural resource exposure at Sauget Area 1 (EPA 2013a). This includes exposure of air resources to volatile organic contaminants, which was documented by sampling at locations upwind and downwind of Sites G, H, I, and L (Solutia/GSI 2012). Site-specific sampling has documented a suite of contaminants in surface and sub-surface soils, air resources,

[7] The Clayton Chemical Company and W.G. Krummrich Plant are identified as generators of wastes that were disposed of, released into, and/or transported to SIC Sites, and sampling data confirm a suite of contaminants in groundwater and/or soil at these locations.

[8] "Principal threat wastes" are source materials that (1) cannot be reliably contained, or (2) would present a significant risk to human health or the environment upon exposure.

groundwater, and biota. Complex pathways exist among these resources and environmental compartments, and are explored for each sub-site in this report. The following sections outline the history and contamination at each Area 1 site, with emphasis on sites that are active sources and pathways of contamination.

Dead Creek (Segments A-F) and Borrow Pit Lake

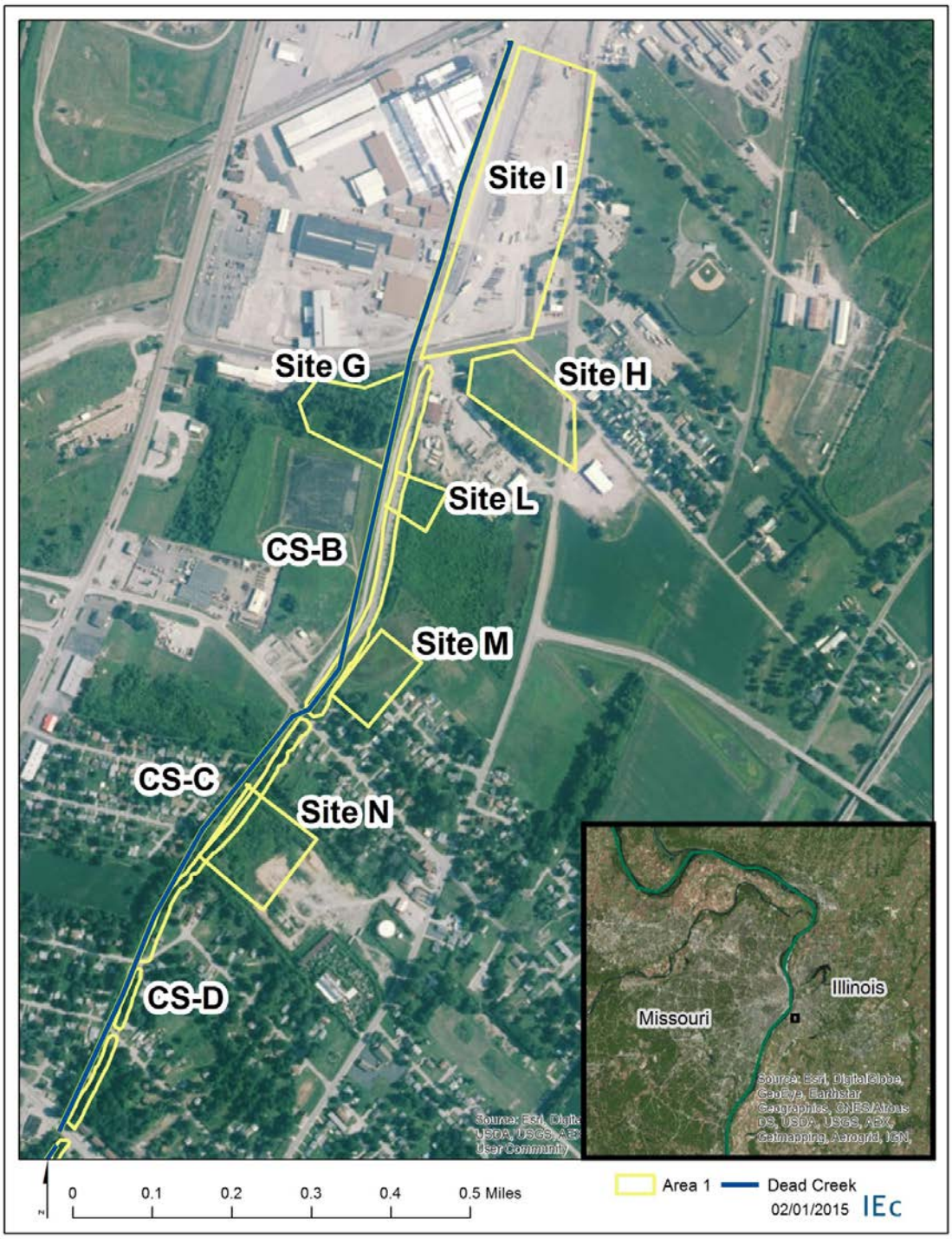
Dead Creek is approximately 17,000 feet in length and flows south from the Alton & Southern Railroad at its northern end, through Sauget and Cahokia, and into Borrow Pit Lake before joining Prairie du Pont Creek and discharging into the Mississippi River. Prior to 1930, industries along Dead Creek disposed of waste water directly into the creek. Between 1939 and 1943, the Village of Sauget used the creek as a surge pond within the sewage system, and it received waste water discharges from industries and residences until the sewer connection was closed in 1990 (EPA 1999, EPA 2013a). Dead Creek was divided into six creek segments (CS) for purposes of remedial investigation and implementation. CS-A is the northernmost segment and historically included two periodically-dredged holding ponds that directly received hazardous waste via the municipal sewer system. CS-B is just downstream from CS-A, and was hydrologically connected to the adjacent Site M, which was a historical borrow pit (Exhibit 2). The middle segments (CS-C, CS-D, and CS-E) connect the upper and lower reaches of Dead Creek. Borrow Pit Lake is an intermittent wetland covering approximately 70 acres, and receives flow from Dead Creek CS-F. It is used for stormwater retention purposes, but like other wetlands in the area, provides habitat for a host of wildlife, including migratory birds (Trustees 2013).

Hazardous substances, including PCBs, VOCs, SVOCs, and metals, have been documented in surface water and sediment samples from all creek segments (EPA 1999; Trustees 2013). An EPA Administrative Order on Consent (AOC) identified several entities that generated wastes disposed of or released into Dead Creek; transported wastes to Dead Creek; or disposed of wastes which migrated from other disposal areas to Dead Creek. These PRPs include but are not limited to Monsanto Corporation/Solutia, Incorporated; Cerro Copper Products Company; Amax Zinc Corporation; ExxonMobil (formerly the Mobil Oil Corporation); the Village of Sauget; Sauget and Company; Paul Sauget; and Ruan Transportation Company. Additionally, the AOC identifies ten companies that owned and/or operated on portions of Dead Creek, also considered PRPs (EPA 1999).

Dead Creek received extensive remediation from 1990 to 2006 to remove contaminated sediments and underlying creek soils, which reduced the magnitude of sediment and soil exposure pathways. However, hazardous substances were previously disposed of into Dead Creek and some are still present. In 1990, Cerro Flow Products conducted remedial activities at CS-A under the direction of IEPA (EPA 2013a). CS-A was dredged to native soils (removing 20,000 cubic yards of contaminated sediment), back-filled, and covered with gravel. In 2000, work was completed by Monsanto Company and Solutia, Inc. under the direction of EPA to lower contamination risks through flooding by replacing Dead Creek culverts (EPA 2013a). In addition, work was extended to include dredging 46,000

cubic yards of sediments from Dead Creek Segments B through E and Site M, and installation of a Toxic Substances Control Act- (TSCA) and Resource Conservation and Recovery Act- (RCRA) compliant containment cell adjacent to CS-B.

EXHIBIT 2 SAUGET AREA 1 SITES ADJACENT TO DEAD CREEK



Post-remedial sampling of creek bottom soils in Dead Creek and Borrow Pit Lake indicated elevated contaminant levels, and an additional soil removal action occurred from 2005-2006 to remove remaining hot spots of contaminated soils (5,000 cubic yards from Dead Creek and 7,300 cubic yards from Borrow Pit Lake) and place them within the containment cell (EPA 2013a, Solutia 2008). Soil removal was based on target concentrations of certain contaminants, but some contaminated soils were left in place. Lower concentrations of mercury, dioxin, beta-hexachlorocyclohexane, and the pesticide dieldrin persist in Dead Creek sediments (Solutia 2008). Currently, the EPA considers the Dead Creek remedy complete and is not planning further remedial actions (EPA 2013a).

Remedial investigation sampling conducted prior to the completion of time-critical remedial actions demonstrates that surface waters in Dead Creek and Borrow Pit Lake contained elevated VOCs (including acetone, chlorobenzene, benzene), SVOCs, pesticides, PCBs, dioxins, and metals (Solutia/GSI 2012). A large number of pesticides and metals were present at multiple sampling locations from CS-B through CS-F. Dead Creek and Borrow Pit Lake contained a similar suite of contaminants in sediments prior to remedial actions, though sediments contained higher concentrations and a larger number of hazardous substances than surface waters (Solutia/GSI 2012). Several of the hazardous substances documented in surface waters and sediments of Dead Creek and Borrow Pit Lake, such as acetone, dioxins, arsenic, mercury, and zinc, were also documented in Prairie du Pont Creek sediments, indicating a continuous downstream pathway via surface water and sediment movement extending throughout the full length of Dead Creek and Borrow Pit Lake.

Currently, Dead Creek serves as the main conduit for surface water conveyance in Sauget Area 1. A system is in place to allow Dead Creek and Borrow Pit Lake to retain stormwater until the water reaches a designated level after which pumps automatically drain excess water into Prairie du Pont Creek. Overbank flooding is less likely to occur due to this automated process for draining Borrow Pit Lake, and subsequently, Dead Creek. However, localized rainwater ponding occurs throughout Area 1 because there is no system to convey rainwater to Dead Creek. Dead Creek floodplain soil sampling indicates that hazardous substances such as SVOCs, PCBs, dioxins, and copper are present, and that soil concentrations are influenced by ponded precipitation, runoff from other Sites, and flooding that exposes floodplain soils to Dead Creek surface waters and sediments (Solutia/GSI 2012).

Dead Creek surface waters and sediments have also been a route of exposure for biological resources utilizing the creek habitat. Wildlife historically used the creek as a source of food, water, and habitat (Solutia/GSI 2012). Toxicity testing and food chain modeling in Dead Creek and Borrow Pit Lake have also indicated that benthic invertebrates living and feeding in these aquatic habitats were exposed to hazardous substances (Menzie-Cura et al. 2001). Aquatic biota such as benthic invertebrates therefore have represented a biological pathway for exposure of higher trophic level biota

to hazardous substances released in Area 1, though it is unclear if this pathway has persisted after the completion of the Dead Creek remedy.

Site G

Site G occupies approximately five acres in the Village of Sauget and was historically a dumping site for hazardous wastes. From the 1940s to 1966, Site G was operated as a landfill, and then was the site of intermittent dumping until it was closed and fenced in the 1980s. Waste disposal areas at Site G are owned by Harold W. Wiese and Cerro Copper, and Wiese Planning & Engineering operates an equipment repair business on the property (EPA 1999). The EPA has identified additional companies, including Monsanto and ExxonMobil, as disposers of hazardous wastes at the site (EPA 1999). As of 2012, the majority of Site G was vegetated, fenced, and unused, although a portion of the site extends beyond the fenced area to a parking lot and industrial storage building operated by Wiese Planning & Engineering (EPA 2013a).

Buried wastes at Site G are estimated to cover a footprint of 3.32 acres, with approximately 107,000 cubic yards of waste extending 20 feet deep (Solutia/GSI 2012). Two CERCLA-related removal actions have been conducted at Site G. The first removal action was conducted in 1988 and included fencing the site (EPA 1999). The second removal action was conducted in 1995 in response to uncontrolled combustion of surface and sub-surface wastes, and involved removal of soils containing PCBs, metals, dioxins, and other organic chemicals; solidification of oil pits; and covering the site with a soil cap (EPA 1999; Solutia/GSI 2012).

More recently, in 1999-2000, sampling detected the presence of 13 pesticides, PCBs, dioxins, and metals in surface soil (see Table 3-2 of Solutia/GSI 2012); 15 VOCs, 25 SVOCs, pesticides and herbicides, PCBs, and metals in sub-surface soil; and 15 drums, pyrophoric materials, and oily wastes (Solutia/GSI 2012). Although the highest chemical concentrations were detected 10 to 25 feet below ground surface, contamination was elevated above screening benchmarks and/or background concentrations in surface soils (copper, vanadium, zinc, 2,3,7,8-TCDD, and various pesticides) and sub-surface soils (16 of 63 detected compounds exceeded a benchmark or background concentration) (Menzie-Cura et al. 2001). This suite of hazardous substances present in surface and sub-surface soils exposed air through uncontrolled burning of waste and/or volatilization and continue to expose groundwater resources and terrestrial wildlife. Mobilization of these surface soils by wind and/or runoff of surface water constitute a pathway for exposure of other natural resources in proximity to Site G. Anthropogenic or natural processes that uncover sub-surface soils at Site G will further increase resources exposures.

As part of the 1999-2000 remedial investigation, groundwater samples were collected beneath Site G as well as downgradient from the site in a location that also receives groundwater contributions from Sites H and L. Sampling in the alluvial aquifer beneath the site detected a suite of VOCs, SVOCs, pesticides, herbicides, dioxin, and metals (see Table 3-27 of Solutia/GSI 2012), as did the downgradient groundwater sampling (see Table 3-30 of Solutia/GSI 2012). Flux from pooled dense NAPL (DNAPL) beneath Site

G is expected to represent the main ongoing source of contamination to downgradient groundwater, as compared to leaching of unsaturated source materials from Site G to groundwater (Solutia/GSI 2012; EPA 2013a). Given the presence of residual DNAPL beneath Site G, the EPA plans to conduct additional remedial actions that may decrease the magnitude of hazardous substance transport away from the Site (EPA 2013a).

Air samples were also collected upwind and downwind of Site G during remedial investigation sampling. The sampling detected several VOCs (including acetone, dichloromethane, styrene, and toluene) downwind of Site G at concentrations that exceeded twice the upwind concentration (see Table 3-17 of Solutia/GSI 2012). Such documentation of volatile compounds indicates that air serves as a pathway for the exposure of other environmental media, as well as any biota in proximity to Site G.

Together, a wide range of environmental data demonstrate the presence of hazardous substances in surface and sub-surface soils, air resources, and groundwater, which indicate that multiple exposure pathways exist at Site G. Additionally, buried wastes and soils expose ambient air to hazardous substances, and the release of DNAPL exposes groundwater resources beneath and extending away from Site G. Thus, biological resources present at the site, particularly plants and animals that interact with soils, are exposed to hazardous substances.

Site H

Site H occupies approximately six acres and is bisected by the dividing line between the Villages of Sauget and Cahokia. Prior to the construction of Queeny Avenue (circa 1949-1950), Site H and Site I were connected as part of the Sauget-Monsanto Landfill (Solutia/GSI 2012; EPA 1999). Site H was operated as an industrial waste landfill from the 1930s to the 1950s, and encompasses land owned and/or operated by Leo Sauget and Rogers Cartage Company. Additional companies, including Monsanto Corporation and Solutia, Inc., have been identified by the EPA as disposers of hazardous wastes at the site (EPA 1999). Currently, Site H is graded and grass-covered (Solutia/GSI 2012; EPA 2013a).

Buried wastes at Site H are estimated to cover a footprint of 4.87 acres and include approximately 157,000 cubic yards of waste extending 20 feet deep (Solutia/GSI 2012). An excavation in July 2002 found waste materials including filter paper, crystalline material, catalyst beads, sand-like material, and various soils. Chemical sampling detected three VOCs, 11 SVOCs, nine pesticides, two herbicides, PCBs, dioxins, and metals in surface soil (see Table 3-3 of Solutia/GSI 2012). Similarly, in deeper, sub-surface soil 13 VOCs, 32 SVOCs, three pesticides, PCBs, 18 metals, and total cyanide were detected, in addition to partial drums and drum fragments, brick, wood, plastic, and other garbage (Solutia/GSI 2012). Ambient air sampling demonstrated similar or increased concentrations of VOCs, SVOCs, metals, and dioxins downwind of Site H compared to upwind samples, which confirms that air serves as a pathway for the dispersion of hazardous substances (Solutia/GSI 2012). Detection, movement, and mass flux of groundwater contaminants downgradient of Site H are similar to Site G, as

described above. Groundwater sampling generally identified similar constituents as those found in Site G groundwater, and are detailed in Table 3-28 of the RI (Solutia/GSI 2012). Residual DNAPL underlies portions of Site H, within the alluvial aquifer, and contributes to increased concentrations of SVOCs in the middle hydrological unit as compared to the shallow unit (Solutia/GSI 2012). Given the documented pathway of VOCs and SVOCs to downgradient groundwater and the residual contamination in the aquifer, the EPA plans to conduct additional remedial actions at Site H (EPA 2013a).

These sampling data demonstrate the presence of hazardous substances in surface and sub-surface soils, air resources, and groundwater, which indicate that multiple exposure pathways exist at Site H. Given the natural grass cover at Site H and presence of hazardous substances in surface soils, biological resources such as plants and soil invertebrates, as well as wildlife that consume plants and soil invertebrates, are exposed to hazardous substances. Activities that expose or disperse surface soils, including wind or flooding events, will increase soil dispersal and therefore increase the availability of contaminants to wildlife in the surrounding area.

Due to its location within the Dead Creek floodplain, Site H receives hazardous substances from contaminated surface waters and sediments emanating from Dead Creek and other sites during runoff or flooding events. Leaching during rain and flooding events transports hazardous substances through sub-surface soils and groundwater, and residual DNAPL underlying Site H is a source of hazardous substances to groundwater. In addition, volatilization to air resources has occurred, and concentrations of hazardous substances downwind of Site H indicate that it is one of the larger contributors of hazardous substances to air resources within Area 1.

Site I

Site I occupies approximately 19 acres in the Village of Sauget. Prior to the construction of Queeny Avenue (circa 1949-1950), Sites H and I were connected as part of the Sauget-Monsanto Landfill (Solutia/GSI 2012; EPA 1999). Site I has been divided into Site I North, which was not connected to the landfill, and Site I South, which was historically part of the landfill (EPA 2013a). Site I South received industrial and municipal wastes from 1931 to 1957, as well as dredged sediments from CS-A (EPA 1999). Site I contains land owned and/or operated by Leo Sauget, Paul Sauget, Cerro Copper Products Company, Alton & Southern Railroad, and the Village of Sauget (EPA 1999). Additional companies, including but not limited to Monsanto Corporation/Solutia, Amax Zinc Corporation, and ExxonMobil, have been identified by the EPA as disposers of hazardous wastes at the site (EPA 1999). Currently, Site I is fenced, covered in gravel, and used for equipment parking (EPA 2013a; Menzie-Cura et al. 2001).

Approximately 56,000 cubic yards of buried wastes exist at Site I North. Wastes are characterized as construction debris, such as bricks, sheet metal, and wood at approximately five feet below ground surface (Solutia/GSI 2012). Site I South includes approximately 355,000 cubic yards of waste and is the largest disposal area within Area 1, accounting for roughly half of the total volume of buried wastes (Solutia/GSI 2012).

Waste characterization at Site I South included crushed waste drums and drum fragments and uncontained solid wastes. Surface and sub-surface soil sampling efforts detected hazardous substances extending to 38 feet below ground surface (Solutia/GSI 2012).

Soil sampling at Site I demonstrated elevated VOCs such as chlorobenzene, SVOCs such as 1,4-dichlorobenzene and hexachlorobenzene, PCBs, and metals such as lead (EPA 1999; Solutia/GSI 2012). Ambient air sampling demonstrated higher concentrations of some VOCs and SVOCs downwind of Site I compared to upwind samples. A number of VOCs and SVOCs were detected in groundwater beneath Site I South, though VOCs and SVOCs were not detected in shallow groundwater beneath Site I North (EPA 1999; Solutia/GSI 2012). Total VOCs and SVOCs in groundwater beneath Site I South were an order-of-magnitude higher in the shallow unit as compared to deeper layers, and SVOCs were detected at even higher concentrations in weathered bedrock samples that are influenced by the presence of pooled DNAPL beneath Site I South (Solutia/GSI 2012).[9] Detection, movement, and mass flux of contaminants downgradient of Site I are similar to Sites G and H, as described above.

Pathways of hazardous substance exposure at Site I South included leaching toward CS-A, as well as to downstream stretches of Dead Creek, at least until CS-A was remediated in 1990 (Solutia/GSI 2012). Concentrations of hazardous substances in groundwater indicate that a source of contaminants is closer to shallow groundwater. Compared to Sites G, H, and L, the groundwater downgradient of Site I contains higher concentrations of hazardous substances. The presence of contaminants in surface and sub-surface soils, as well as air and groundwater resources, indicates multiple pathways for the transport of hazardous substances to and from the Site. Due to its location within the Dead Creek floodplain, Site I receives hazardous substances from surface waters and sediments transported from other nearby contaminated sites during flooding events. Further, given the porous nature of the gravel covering Site I, leaching is expected to occur during rain and flooding events, transporting contaminants to sub-surface soils and groundwater. Due to the presence of gravel covering surface soils and active use of the site for parking, a pathway for the direct exposure of biological resources such as plants is less likely, though soil invertebrates are exposed to hazardous substances and volatilization to air resources occurs. Any activities that disrupt the gravel, including increased traffic within the parking lot or major wind events, would increase soil dispersal and therefore increase the availability of contaminants to wildlife in the surrounding area.

Site L

Site L occupies approximately one acre in the Village of Cahokia. From 1971-1981, Site L was used for the disposal of wash water from cleaning operations of trucks used to transport hazardous waste (EPA 1999). Site L encompasses land owned and/or operated

[9] The GMCS captures and removes some DNAPL underlying Site I (personal communication, Illinois Environmental Protection Agency).

by Tony and Velma Lechner (Metro Construction Equipment), Keeley Paving and Construction Company, Ruan Transport Corporation, Harold Waggoner, and Rogers Cartage Company (EPA 1999). Additionally, Monsanto Corporation/Solutia, Waggoner & Company, Ruan Transportation, and Olin Corporation, have been identified by the EPA as PRPs at the site (EPA 1999). Site L now consists of two enclosed impoundments, and is covered with cinders and used for equipment storage (EPA 2013a).

The Site L impoundments are estimated to cover a footprint of 0.17 acres (7,600 square feet) and hold a volume of 17,500 cubic yards of buried waste material. Wastes are characterized as construction debris such as bricks and concrete but crushed drums and drum fragments were also discovered (e.g., "a black tar-like substance was noted to be leaking from several drums"; Solutia/GSI 2012), indicating that Site L was used for unauthorized disposal of hazardous substances. Remedial sampling detected hazardous substances at five to 15 feet below ground surface (Solutia/GSI 2012). Soil samples demonstrated elevated VOCs, SVOCs, and PCBs (EPA 1999; Solutia/GSI 2012). Ambient air sampling demonstrated low concentrations of VOCs and SVOCs downwind of Site L. A number of VOCs, SVOCs, and metals were detected in shallow groundwater beneath Site L (EPA 1999; Solutia/GSI 2012). Detection, movement, and mass flux of contaminants downgradient of Site L are similar to Sites G and H, as described above.

Together, site use history representing multiple release scenarios and the documented presence of hazardous substances in soil, air, and groundwater at Site L indicate multiple complete pathways for mobility of hazardous substances within and from the Site. Due to its location within the Dead Creek floodplain, transport of hazardous substances from surface waters and sediments during flooding events to Site L also represents another pathway of contamination. Further, the permeable cinder covering at Site L means leaching of rainwater to sub-surface soils and groundwater contributes to contaminant mobility. Sampling has also indicated that volatilization of contaminants to ambient air has occurred. The cinder covering inhibits plant growth at the site, but any soil invertebrates present at the Site are exposed to hazardous substances in surface soils. Activities that cause soil disturbance, including wind-induced dispersal, will increase the availability of contaminants to wildlife in the surrounding area.

Site M

Site M occupies fewer than two acres in the Village of Cahokia and was historically used as a sand and gravel borrow pit; and was connected hydrologically to Dead Creek (EPA 2013a). Backfilled in 2001, Site M contains land owned and/or operated by H. H. Hall Construction Company (EPA 1999). Additional companies, including but not limited to Monsanto Corporation/Solutia, Cerro Copper Products, and ExxonMobil, have been identified by the EPA as disposers of hazardous wastes at the site (EPA 1999). Site M is currently fenced.

Prior to being back-filled, contaminated Dead Creek surface waters infiltrated the Site, serving as one pathway for hazardous substances to be introduced into Site M. In 2000-

2001, as part of Dead Creek remedial actions, 3,600 cubic yards of contaminated sediments were removed at Site M and, as noted above, the site was then back-filled (EPA 2013a), resulting in a total loss of aquatic habitat. Waste characterization performed prior to remedial actions indicated that surface waters within Site M contained a suite of VOCs, SVOCs, PCBs, and pesticides (EPA 1999). Further sampling and analysis have not been conducted since the removal actions and back-filling occurred.

Historically, the main exposure pathways existed through an exchange of Dead Creek surface waters and sediments with resources present at Site M. As part of remedial actions, the site was regraded to drain to CS-B, and thus a connection between Site M and Dead Creek still exists. Additional pathways may contribute to hazardous substance movement and natural resource exposure at Site M, including but not limited to the leaching of hazardous substances from runoff to surface and sub-surface soils and underlying groundwater, though additional data collection may be necessary to confirm these pathways.

Site N

Site N is a former sand and gravel borrow pit developed in the 1940s, which was subsequently used to dispose of construction materials. It borders Dead Creek and is located in the easternmost portion of Area 1. The 4.5 acres of Site N are owned and/or operated by Leo Sauget, ExxonMobil, and H.H. Hall Construction Company (EPA 1999). Additionally, H.H. Hall Construction has been identified by the EPA as a disposer of hazardous wastes at the site (EPA 1999). Within the estimated 103,000 cubic yards of waste at Site N, investigations found 31 waste drums. According to the remedial investigation report, “whitish and pasty white substances were noted in several of the crushed and partially crushed drums” (Solutia/GSI 2012). Site N is currently fenced.

Site N is adjacent to Dead Creek and receives runoff from the surrounding area (Solutia/GSI 2012). Runoff of contaminated sediment, surface water, and soil from surrounding sites is a pathway of hazardous substances to Site N surface soils. Historic sampling found SVOCs (e.g., phenanthrene, fluoranthrene, and pyrene) and mercury in surface soils (EPA 1999). According to the Baseline Ecological Risk Assessment (BERA) conducted for Area 1, surface soil concentrations exceed screening benchmarks for dioxins, barium, lead, selenium, copper, vanadium, and zinc. Additional documented contaminants include pesticides and PAHs (Menzie-Cura et al. 2001).

However, site-specific sampling of sub-surface soils and groundwater at Site N was not conducted within the remedial investigation or the BERA. Therefore, soil contaminants may be sourced from buried wastes or from transport of contaminants from other sites through runoff, erosion, and other transport mechanisms. In addition to exposure from wastes buried at Site N, exposure pathways for natural resources may include: wind-driven transport of contaminated soils; uptake of hazardous substances in surface soils by plants and soil invertebrates, which may expose higher trophic levels such as songbirds and small mammals; volatilization of VOCs and SVOCs to the atmosphere; and leaching of hazardous substances in surface soils to subsurface soils and groundwater. Additional

sampling is necessary to determine the relative importance of these pathways to terrestrial organisms utilizing Site N.

AREA 2

Area 2 includes Sites O, P, Q, R, and S, in addition to Mississippi River floodplain soils, and is located mainly within the Village of Sauget (Exhibit 1). Area 2 covers approximately 312 acres with more than twenty industrial facilities and supporting operations such as railroads, waste disposal areas, and recycling facilities (URS 2008; EPA 2013b). Area 2 sites include lagoons formerly used as part of a wastewater treatment plant (Site O), landfills (Sites P, Q, R), and a disposal area (Site S; Exhibit 3). Sites Q and R are located to the west of the floodwall and levee, which are designed to protect the surrounding cities from Mississippi River floodwaters. Area 2 regularly has ponded precipitation and surface water runoff from adjacent locations, and borders the Mississippi River at Sites Q and R. Site Q contains surface water, sediment, and aquatic organisms in two perennial ponds. Portions of Sites O, P, and R are classified as wetlands, while Site S and the remaining portions of other sites are terrestrial in nature. Based on historical photographs, most land within Area 2 was originally wetland and has since been filled as a result of development and/or disposal activities.

According to site investigations, Area 2 includes an estimated 4.5 million cubic yards of contaminated soil and waste, most of which is buried below ground (EPA 2013b). However, numerous instances of exposed wastes have been documented, and contamination is present in surface soils and surface waters to which biota are readily exposed (URS 2008). Remedial actions ordered by the EPA have focused on limiting the ability of contaminated groundwater to reach the Mississippi River and to-date, 3,271 waste drums and 14,000 tons of PCB-contaminated soil have been removed from Site Q (EPA 2013b). Remaining remedial actions will address wastes at all Area 2 Sites (EPA 2013b). The possibility of continued releases of hazardous substances leaching from soils and DNAPL to groundwater; groundwater flow and discharge to the Mississippi River; volatilization to ambient air; and erosion due to ponding, runoff, and leaching of contaminants bound to soil particles represent pathways for continued natural resource exposure at Sauget Area 2. Erosion is of particular concern at Sites Q and R, given the history of flooding from Mississippi River waters.

The following sections outline the history and contamination at each Area 2 Site, with emphasis on Sites that are active sources and pathways of contamination.

EXHIBIT 3 SAUGET AREA 2 SITES

Site O

Site O is approximately 28 acres in size and contains four former sewage sludge dewatering lagoons for the Village of Sauget wastewater treatment plant (WWTP). The Village of Sauget began operating a wastewater treatment plant within the bounds of Site O in 1952 (EPA 2013b). The dewatering lagoons were operational from July 1966 to 1978 and received sludge from the treatment plant (URS 2008). When the lagoons were active, the Sauget WWTP treated 10 million gallons of wastewater per day and 95 percent of the wastewater originated from local industries (URS 2008).

Site O is located on the dry side (east) of the Mississippi River floodwall, and is bordered to the west by Clayton Chemical Company.[10] Site O is topographically flat with mixed surface soils including silt, sand, and silty clay. Review of aerial photographs led to the extension of Site O to include Site O North (the location of pits associated with the WWTP) and Site O South (the location of a breach in the sludge lagoon dike) (URS 2008). Site O contains land owned and/or operated by the Village of Sauget and the Sauget Sanitary Development and Research Association (EPA 2000a). Additionally, EPA has identified a number of parties as disposers of hazardous wastes at Site O, including but not limited to Amax Zinc Corporation, ExxonMobil, Monsanto Chemical Company, Clayton Chemical Company, Cerro Copper Products Company, and American Zinc Company (EPA 2000a). The Site O lagoons were closed permanently in 1980, stabilized with lime, and covered with a 3.5-foot thick low permeability clay soil by the Village of Sauget (EPA 2013b; URS 2008). The site is currently vegetated.

The volume of buried waste at Site O is estimated at 317,000 cubic yards, with an additional 63,000 cubic yards at Site O North and 10,000 cubic yards at Site O South (URS 2008). The remedy at Site O includes installation of a RCRA Subtitle C-compliant soil cap over the waste areas to limit direct contact with and exposure to hazardous substances in industrial wastes and sludge (EPA 2013b). Soil samples from the Site contain elevated levels of VOCs, such as benzene, toluene and chlorobenzene; SVOCs, such as 1,4-dichlorobenzenez and phenanthrene; PCBs; dioxins, and metals including copper, mercury, and zinc (EPA 2000a; EPA 2013b). The high levels of zinc are consistent with Amax Zinc Company's discharges to the Site O lagoons (EPA 2005a). Groundwater at Site O has been documented to contain elevated concentrations of VOCs and SVOCs, as well arsenic and lead (EPA 2000a). It is believed that Site O does not contain buried drums or NAPL (EPA 2013b).

Erosion and leaching are not currently expected to be a major migration pathway for contaminated soil near the Site O lagoons, because Site O is located on the dry side of the levee and a low-permeability clay layer covers the former lagoons (URS 2008). However,

[10] The Clayton Chemical Company was a solvent and waste oil recovery facility. Time-critical removal actions at this site have involved removal of liquid hazardous substances contained in drums, tanks, and other containers, as well as additional characterization and removal of solids and contaminated soils. A cap was installed over remaining contaminated soils (EPA 2013b).

the clay layer itself may have been a source of contamination, and does not cover the entirety of Site O, and thus erosion, runoff, and leaching are expected to expose and transport hazardous substances bound to surface soils at Sites O North and South. Further, contaminants could have been mobilized away from the site prior to 1980, as is suggested by the investigation of the area to the south, which was subject to overflow. Leaching of hazardous substances in soil to the shallow groundwater unit may be reduced by a clay layer present in the area (URS 2008). A single air sample was collected at Site O to evaluate the potential for vapor intrusion to a nearby building, and detected approximately 20 VOCs at low concentrations, which indicates a pathway for volatile compounds to migrate into ambient air at Site O.

In general, subsurface soils contain more contaminants at higher levels than surface soils. Ethylbenzene, xylenes, pentachlorophenol, dioxins and furans, mercury, and selenium from Site O soil samples were identified as being of greatest concern in the Area 2 ecological risk assessment (AMEC 2008). Plants and invertebrates utilizing surface soils as habitat, and any higher trophic organisms consuming those plants and animals, such as insectivorous birds and small mammals, are exposed to hazardous substances. Site O therefore is a continuing source of hazardous substance contamination and will continue to be at least until remedial actions are complete (EPA 2013b).

Site P

Site P occupies approximately 20 acres in Area 2 and was historically operated by Sauget and Company as a landfill form 1973 until the early 1980s. The landfill was permitted by IEPA to accept general wastes that included diatomaceous earth filter cake from Edwin Cooper (aka, Ethyl Corporation) and non-chemical wastes from Monsanto, but was not permitted to accept hazardous wastes (EPA 2000a). Site P sits on land owned and/or operated by the Solutia, Inc., Southern Railway System, Norfolk Southern Corp., and Sauget and Company, among others (EPA 2000a). Additionally, EPA has identified disposers of hazardous wastes at Site P, including Monsanto Chemical Company, Kerr-McGee Chemical Corporation, and Edwin Cooper (EPA 2000a). Currently, Site P is inactive and unfenced.

Despite the presence of a permitted general waste landfill at the site, hazardous wastes have been documented at Site P, including waste drums of phosphorus pentasulfide, chlorine waste, and other filter residues; and documents indicate that Monsanto was unable to segregate its hazardous waste from municipal waste that could be disposed at Site P (EPA 2000a; EPA 2005b). Buried wastes are present at shallow depths (1.3 to 19.3 feet below ground surface), mainly composed of construction debris, and municipal and industrial solid wastes. The estimated waste volume is 1,018,000 cubic yards (URS 2008). Site P is partially covered by an asphalt parking lot and a building used as a night club, and exposed soils at Site P consist of permeable silty clay and cinders. The permeable surface allows leaching of surface and subsurface soil contaminants to surficial groundwater and deeper soils, though a layer of clay underlies the buried waste and may reduce infiltration to deeper groundwater. Surface soils contain VOCs, SVOCs, PCBs, dioxins, and metals (URS 2008). Subsurface soil samples contain a similar suite of

contaminants, generally at higher maximum concentrations than surface soils (EPA 2000a; URS 2008). NAPL is present beneath Site P (URS 2008) and groundwater in this area, as noted above, flows generally toward the Mississippi River. Ambient air sampling measured 35 VOCs adjacent to the single building located at Site P, indicating a pathway for volatile compounds to migrate through ambient air at Site P, presumably from surface soils.

Erosion of ravines at Site P was documented in remedial investigations, and indicates that once-buried waste materials were exposed in some areas and thus hazardous wastes were transported off-site through runoff or wind-driven movement of solid wastes and soils. Given the extent of solid waste at the site, the shallow burial, and the hazardous substance concentrations in soils, plants and invertebrates utilizing surface soils as habitat are subsequently exposed to hazardous substances. These resources then serve as a biological pathway to transfer hazardous substances to higher trophic levels, such as insectivorous birds and small mammals. The BERA for Area 2 identified several contaminants at Site P, including dioxins and furans, cobalt, mercury, and vanadium, as posing an exposure risk to small mammals based on levels in environmental media (AMEC 2008).

No response actions have occurred to-date at this location. As part of planned remedial actions for Site P, it is anticipated that the EPA will collect, treat, and dispose of NAPL near a leachate well; install an asphalt cap over the mobile source area; install a solid waste landfill cap over remaining waste areas; conduct vapor intrusion mitigation; and implement institutional access controls. These remedial actions are intended to minimize current exposure pathways to groundwater and biological resources, as well as transport of uncovered wastes outside the site boundaries (EPA 2013b). Until they are completed, though, numerous pathways for the mobilization of hazardous substances away from Site P will persist.

Site Q

Site Q is located in Sauget and Cahokia, Illinois and is bounded to the west by the Mississippi River. Site Q has been divided into North (52 acres), Central (67 acres), and South (87 acres in addition to 13 acres for the Site Q Ponds) sub-areas for remedial purposes, as the larger site includes several distinct waste disposal sub-sites. Site Q has a long history of waste disposal activities. Parts of the site (e.g., Site Q North and Central) were used as the Sauget Municipal Landfill from the 1950s until the 1970s, and the landfill received industrial, commercial, and municipal waste, as well as septic pumpings, drums, solvents, and paint sludges (URS 2008). In July 1972 an IEPA inspection discovered an underground fire at the landfill, which persisted for months.

Site Q is located on land owned and/or operated by the Monsanto Company, Norfolk Southern Corporation, Village of Cahokia, Village of Sauget, Clayton Chemical Company, and Sauget and Company, among others (EPA 2000a). Given that part of Site Q is a former landfill, the EPA has identified a large number of parties as disposers of hazardous wastes at Site Q, including but not limited to Monsanto Chemical Company, Dow Chemical, Amax Zinc Corporation, Clayton Chemical Company, ExxonMobil, and

Kerr McGee Chemical Corporation (EPA 2000a). Currently, access to Site Q North and Central is restricted by fences while Site Q South allows unrestricted access.

Site Q is relatively flat and has been flooded several times since 1973. Even with riprap covering 2,580 feet of the Mississippi River bank bordering Site Q, flooding and erosional events have previously occurred (EPA 2013b). Site Q includes a historical liquid waste holding pit and dozens of drums containing liquid wastes, oil, or similar substances, which were unearthed during a flood in 1973. A major flooding event in 1993 affected Sites Q and R exposing Mississippi waters to contaminants in SIC surface soils. The extent of the 1993 flood was depicted as part of the Area 2 remedial investigation (URS 2009, Figure 5-2). The need for removal actions initiated in 1995 by USEPA was caused by erosion of Mississippi River bank soils from Site Q that exposed buried drums. Forms submitted by Clayton Chemical Company document their disposal of chemical waste and drums at the landfill, including paint sludges and solvent still bottoms (URS 2008). Site Q soil samples contain elevated levels of VOCs, SVOCs, PCBs, dioxins, and metals including copper, mercury, and zinc (EPA 2000a; EPA 2013b). Groundwater at Site Q has elevated VOCs and SVOCs, as well arsenic and cyanide, which may originate from NAPL underlying parts of Site Q (EPA 2000a; URS 2008). Specific natural resource exposure pathways and planned remedial actions are discussed individually, below, for Site Q North, Central, South, and the ponds.

Site Q North. The average depth of waste material at Site Q North is 13.8 feet below ground surface, with an estimated volume of 1,157,000 cubic yards (URS 2008). NAPL is present underneath portions of Site Q North and leaches to groundwater. Remedial investigations determined that leaching to groundwater beneath Site Q was most likely from Sites Q North and R (URS 2008). The surface at Site Q North is composed of gravel and cinders, and the layer underlying the buried waste is composed of silt, which indicates that leaching of hazardous substances to sub-surface soils and groundwater is possible. Erosion has occurred along the western edge of the site, on the bank of the Mississippi River, which is covered by riprap (EPA 2013b). Flooding conditions exacerbate erosion. Ambient air sampling detected 45 VOCs near the four buildings located on Site Q North, indicating a pathway from hazardous substances in soils and buried wastes that may expose wildlife through respiration. Planned remedial actions at Site Q North include installation of a crushed rock cap over a specified area, mitigation of vapor intrusion, and implementation of institutional and access controls (EPA 2013b). Future remedial actions at this site may decrease the importance of certain pathways. However, continued leaching of hazardous substances through the permeable ground cover to underlying soils and groundwater, flooding from the Mississippi River, and erosion of contaminated soils into the Mississippi River represent ongoing pathways.

Site Q Central. The average depth of waste material at Site Q Central is 18.6 feet below ground surface, with an estimated volume of 2,018,000 cubic yards (URS 2008). Soil and waste sampling determined an estimated 296,000 cubic yards exceed the soil remediation objectives (EPA 2013b). Remedial actions already conducted at Site Q Central include a removal action in 1995 to excavate PCB-contaminated soils and drums that were spilling

into the Mississippi River. The Mississippi River bank that is part of Site Q Central has a higher risk of erosion due to a lower riprap thickness than is present at other locations. Remediation at Site Q Central will involve in-situ soil vapor extraction, a crushed rock cap over a specified area, shoreline erosion protection, and institutional and access controls (EPA 2013b). However, significant erosion and leaching pathways have persisted for decades and past remediation does not fully address continued leaching of hazardous substances through the permeable ground cover.

Site Q South. The average depth of waste material at Site Q South is 12.3 feet below ground surface, with an estimated volume of 1,326,000 cubic yards (URS 2008). In 1999 and 2000, a removal action occurred to excavate 3,271 drums and 14,000 tons of PCB-contaminated soils and debris, though some contaminated soils were left in place near the Site Q Ponds (EPA 2013b; URS 2008). The surface at Site Q South is composed of permeable materials and is vegetated, which indicates a pathway for the leaching of hazardous substances to sub-surface soils and groundwater. To the extent that vegetation is present, it decreases the magnitude of soil erosion as a viable pathway to transport hazardous substances off-site. Vegetation has not been analyzed for contaminants, though, if contaminated, it acts as a pathway for the exposure of other natural resources. The BERA identified ecological risk to herbivores and carnivores foraging within the floodplain at Site Q South, based on contaminant levels in surface soils (AMEC 2008). This indicates that pathways expose wildlife at Site Q South, such as exposure to hazardous substances in soils and biological resources such as plants. Remediation at Site Q South and the Site Q Ponds will involve removal of intact drums, installation of a RCRA Subtitle C-compliant cap over waste areas, and institutional and access controls (EPA 2013b).

Site Q Ponds. At the Site Q Ponds, benzene was detected at low concentrations in surface waters (EPA 2013b), though the greatest ecological risk was calculated based on sediment concentrations of dioxins and furans (AMEC 2008). Toxicity testing indicated surface waters and sediments were toxic to aquatic invertebrates and fish (AMEC 2008). Bioaccumulation studies determined that PCBs, dioxins/furans, calcium, and barium accumulated in clams utilizing pond sediments (AMEC 2008). Together, these results for the Site Q Ponds indicate complete pathways from surface water and sediments to aquatic wildlife, and indicate a biological pathway to expose higher trophic levels foraging on aquatic invertebrates and fish.

Site R

Site R occupies approximately 35 acres adjacent to the Mississippi River, on the western (wet) side of the floodwall, and was formerly known as the River's Edge Landfill, the Monsanto Landfill, and the Sauget Toxic Dump. Monsanto owned and operated Site R as a landfill for disposing of industrial and chemical wastes from 1957 to 1977 (EPA 2000a). Site R contains land owned and/or operated by the Monsanto Chemical Company, Solutia, Inc., Cahokia Trust Properties, and Sauget and Company (EPA 2000a). Additionally, EPA has identified a number of parties as disposers of hazardous wastes at Site R, and does not differentiate these PRPs for Site Q and Site R (EPA

2000a). A clay cap was installed in 1979 to cover the waste, and the site is currently fenced (EPA 2013b). Site R is located adjacent to the Mississippi River and has previously received flood waters from the river.

Site R contains approximately 594,000 cubic yards of buried waste at an average bottom depth of 17 feet below ground surface. Buried wastes include construction debris, industrial waste, and soils. Site R has been sampled by EPA, IEPA, and the Monsanto Company since the 1980s (EPA 2000a). Sediments collected from a drainage ditch contained VOCs, SVOCs, PCBs, and heavy metals, which indicate a complete pathway from surface waters (e.g., from the Mississippi River, ponded rainwater, or runoff from adjacent Sites) to the resources at Site R, including surface waters, surface soils, underlying soils, and groundwater (EPA 2000a; EPA 2013b). Dioxins were measured among other hazardous substances found in sub-surface soils at Site R, and were also measured in leachate samples adjacent to the Mississippi River (see EPA 2000a) as well as in surface water samples collected in the Mississippi River adjacent to Site R (URS 2008). This indicates a complete pathway for the exposure of Mississippi River resources to hazardous substances present at Site R.

VOCs, SVOCs, pesticides, herbicides, PCBs, and metals were also detected in sub-surface soils (URS 2008). Similar contaminants were detected in surface soils at lower concentrations (URS 2008). Groundwater sampling documented the presence of VOCs and SVOCs (EPA 2000a). NAPL is present at Site R, and some groundwater contamination originating from Site R is captured by the Groundwater Migration Control System (URS 2008; Trustees 2013).

The surface soil at Site R is composed of low permeability silty clay, which decreases the magnitude of leaching as a soil exposure pathway (URS 2008). But given the proximity to the Mississippi River, flooding and subsequent erosion are documented pathways for exposure and mobilization of soil resources. The suite of volatile compounds present in surface soils at the site indicates that a pathway exists for exposing air resources to site-specific hazardous substances in soils and flooding surface waters, though ambient air sampling has not been conducted (URS 2008). In addition, wildlife is exposed to soil contaminants at Site R, and the BERA determined that metals are the drivers of risk for plant species at the site (AMEC 2008). The extent of wildlife exposure will vary according to the flooding regime at Site R, which mobilizes site-specific hazardous substances as well as introduces contaminants from other locations. As part of planned remedial actions, the EPA will install a RCRA Subtitle C-compliant soil cap over the entire site and implement institutional and access controls, which may decrease the magnitude of expected soil exposure to sub-surface soils, flooding waters, and wildlife (EPA 2013b).

Site S

Site S is located on less than one acre adjacent to the Clayton Chemical Site in the Village of Sauget. Site S was used as a disposal area for wastes from Clayton Chemical in the 1960s, including the disposal of still bottom wastes, and subsequent investigations

found remnants of waste drums (EPA 2013b; Trustees 2013; URS 2008). Site S encompasses land owned and/or operated by multiple companies, including but not limited to Monsanto Chemical Company, Clayton Chemical Company, Village of Sauget, and Norfolk Southern Corporation (EPA 2000a). Additionally, EPA identified the Clayton Chemical Company as a disposer of hazardous wastes at Site S (EPA 2000a). Currently, the site is fenced and covered with either grass or crushed rock (EPA 2013b).

Waste characterization documented wastes at shallow depths (1.4 to 5.8 feet below ground surface), mainly composed of industrial waste, soil, and drum remnants. The estimated waste volume is 8,000 cubic yards, all of which is estimated to exceed IEPA soil remediation objectives (URS 2008). Surface and sub-surface soil samples contain VOCs, SVOCs, PCBs, and metals (EPA 2000a; EPA 2013b). In soils, VOCs include constituents such as toluene and ethylbenzene; SVOCs such as include naphthalene and phthalates; PCBs; and elevated metals, such as copper, mercury, and zinc (EPA 2000a). Surface soil at Site S is composed of a low permeability silty clay layer, and Site S is located on the dry side of the floodwall, which may decrease but not eliminate the magnitude of erosion, runoff, and leaching as soil exposure pathways (EPA 2013b). Ambient air sampling near two buildings detected up to 25 VOCs, indicating a pathway exists for the exposure of air resources to site-specific hazardous substances. The BERA for Area 2 identified PCBs as the most significant contaminant in food chain modeling for terrestrial mammals, highlighting the biological pathway as potentially significant at this site (AMEC 2008).

No response actions have occurred to-date at Site S. As part of planned remedial actions, an in-situ soil vapor extraction (SVE) system that includes a vertical soil vapor extraction well, a RCRA Subtitle C-compliant soil cap over the entire site, and institutional and access controls will be installed (EPA 2013b). Therefore, the pathways documented above will exist at least until remedial and restoration actions are implemented.

SUMMARY OF PATHWAYS

The information presented herein fulfills the requirements of section 11.63 of the DOI NRDA regulations pertaining to pathway determination. Documentation of the presence of hazardous substances in natural resources within the SIC and the movement of these hazardous substances within and away from their release sites through physical and chemical processes constitutes the determination that multiple resource pathways exist.

As detailed in Exhibit 4, pathways between resources can be complex. Numerous pathways expose natural resources to hazardous substances disposed of or buried at SIC Sites. For each sub-site in Areas 1 and 2, this report documents historical site ownership, land use, and disposal practices at each site over time; describes the major classes of hazardous substances present over time; and discusses the extent of contamination within and in some cases between sub-sites, and whether this is consistent with the site geology, known disposal practices, and remediation that has occurred to-date. This information, when combined with sampling data showing historic and/or current exposure of multiple natural resources, completes the documentation of natural resource exposure pathways

present within the SIC. Exhibit 5 summarizes information pertaining to hazardous substance pathways for each sub-site.[11]

The SIC Sites contain a diverse suite of hazardous substances, which have moved through the system from source areas to mobile resources such as surface water, air resources, soils, and groundwater through various chemical, physical, and biological processes. Movement of hazardous substances away from sub-sites is still occurring and is further exposing wildlife and other biota to hazardous substances found in water and air, bound to particulate matter in soils and sediments, or assimilated by lower trophic level organisms. Although remedial actions are expected to diminish or minimize some of these pathways, and in some cases have diminished pathways that were more significant in the past, such actions have not addressed all pathways that expose natural resources to hazardous substances.

[11] Some pathways documented in Exhibits 4 and 5 may have diminished over time, but were present in the past and are relevant to the natural resource damage assessment.

EXHIBIT 4 SIC PATHWAY SUMMARY

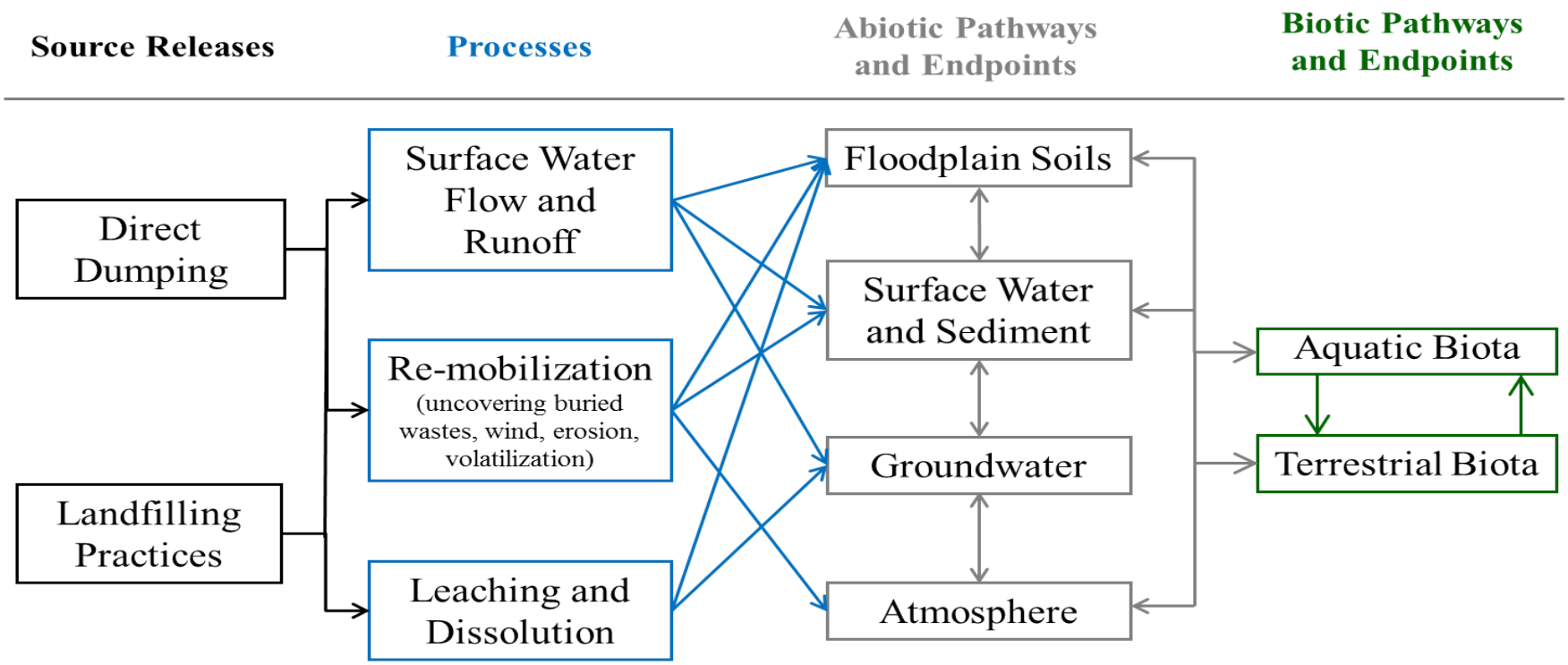


EXHIBIT 5 SUMMARY OF EXPOSURE PATHWAYS AT SIC SITES

SITE	DESCRIPTION	RELEASE	WASTE TYPE	REMEDY	PATHWAYS OF EXPOSURE [1]					
					SURFACE WATER	SEDIMENT	SOIL	GROUND-WATER	AIR	BIOTA
Dead Creek	Dead Creek extends 17,000 feet through Sauget Area 1, and is divided up into six creek segments (CS-A through CS-F). CS-A was backfilled and is now covered with gravel. CS-B has been lined as a result of remedial actions.	Dead Creek historically received industrial and municipal waste discharges through direct dumping. It received 95 percent of the industrial waste stream in Sauget, IL. CS-A was used as a municipal sewer holding pond.	Multiple wastes, containing industrial wastes, were dumped into Dead Creek. Sampling detected numerous hazardous substances (VOCs, SVOCs, PCBs, and metals) in surface water, sediment, and underlying creek soils. Surface waters also found to contain pesticides.	CS-A (1990-1991): Removal of contaminated sediment, installation of HDPE liner, backfilled with clean soils and gravel. CS-B through CS-F (1999-2006): Replacement of culverts, removal of sediments and underlying soils. CS-B (2007): Installation of impermeable liner.	Yes	Yes	Yes	Yes	--	Yes
Borrow Pit Lake	Borrow Pit Lake is an intermittent wetland covering 70 acres. Connected to Dead Creek at CS-F, Borrow Pit Lake retains Dead Creek flow before draining into Prairie du Pont Creek.	Borrow Pit Lake received contaminated surface water and sediment flows from Dead Creek.	Hazardous substances in Borrow Pit Lake are similar to those documented in Dead Creek resources.	(2003-2006): Removal of contaminated sediment.	Yes	Yes	Yes	Yes	--	Yes

SITE	DESCRIPTION	RELEASE	WASTE TYPE	REMEDY	PATHWAYS OF EXPOSURE [1]					
					SURFACE WATER	SEDIMENT	SOIL	GROUND-WATER	AIR	BIOTA
Site G	Site G was historically operated as a landfill and occupies five acres. It is covered by vegetation and a soil cap.	Site G received wastes as a landfill and dumping site until it was closed in the 1980s.	Hazardous substances documented in resources at Site G include VOCs, SVOCs, pesticides, herbicides, PCBs, dioxins, and metals.	(1995): Removal of contaminated soils; solidification of two oil pits; installation of a barrier wall on the eastern site boundary; installation of a soil cover.	Yes	--	Yes	Yes	Yes	Yes
Site H	Site H was historically operated as a landfill and occupies five to seven acres. It is vegetated.	Site H received industrial wastes as a landfill from the 1930s until the 1950s.	Hazardous substances documented in resources at Site H include VOCs, SVOCs, pesticides, herbicides, PCBs, dioxins, and metals.	(2000-2001): Removal of contaminated sediments; backfilled and fenced.	Yes	--	Yes	Yes	Yes	Yes
Site I	Site I was historically operated as a landfill (together with Site H) and occupies 19 acres. It is partially covered by gravel and used for equipment parking.	Part of Site I was connected to the Site H landfill and received industrial wastes from the 1930s until the 1950s. It also received contaminated dredged sediments from CS-A. Part of the site received construction debris.	Hazardous substances documented in resources at Site I include VOCs, SVOCs, PCBs, and metals.	None.	Yes	--	Yes	Yes	Yes	Yes

SITE	DESCRIPTION	RELEASE	WASTE TYPE	REMEDY	PATHWAYS OF EXPOSURE [1]					
					SURFACE WATER	SEDIMENT	SOIL	GROUND-WATER	AIR	BIOTA
Site L	Site L was historically used to dispose of waste water and occupies oneacre. It consists of two closed impoundments, and is covered with cinders and used for equipment storage.	Site L received wash water from cleaning operations from the decontamination of trucks used to transport hazardous wastes.	Hazardous substances documented in natural resources at Site L include VOCs, SVOCs, PCBs, and metals.	None.	Yes	--	Yes	Yes	--	Yes
Site M	Site M was previously used as a sand and gravel borrow pit, and occupies less than two acres. In 2001, it was backfilled as a post-remedial action.	Site M received contaminated surface waters and sediments from Dead Creek.	Hazardous substances documented in resources at Site M include VOCs, SVOCs, PCBs, pesticides, and metals.	None.	Yes	Yes	Yes	--	--	Yes
Site N	Site N was previously used as a sand and gravel borrow pit and later a dumping ground. It occupies between four and five acres.	Buried waste drums, chemical wastes, construction debris, and industrial wastes have been documented.	Hazardous substances documented in resources at Site N include VOCs, pesticides, SVOCs (PAHs), and metals.	None.	Yes	--	Yes	--	--	Yes

SITE	DESCRIPTION	RELEASE	WASTE TYPE	REMEDY	PATHWAYS OF EXPOSURE [1]					
					SURFACE WATER	SEDIMENT	SOIL	GROUND-WATER	AIR	BIOTA
Site O	Site O was used for dewatering sewage sludge as part of wastewater treatment operations for the Village of Sauget. It occupies approximately 28 acres. When the lagoons were closed in 1980, a clay cap was installed. It is currently vegetated.	Site O received waste as part of wastewater treatment operations in the 1960s and 1970s.	Hazardous substances documented in resources at Site O include VOCs, SVOCs, PCBs, dioxins, and metals (including zinc).	None.	Yes	--	Yes	Yes	--	Yes
Site P	Site P was operated as a landfill and occupies 20 acres. It is partially covered by an asphalt parking lot.	Site P received municipal and industrial waste, and construction debris, from the 1970s to the 1980s.	Hazardous substances documented in resources at Site P include VOCs, SVOCs, PCBs, dioxins, and metals.	None.	Yes	--	Yes	Yes	--	Yes

SITE	DESCRIPTION	RELEASE	WASTE TYPE	REMEDY	PATHWAYS OF EXPOSURE [1]					
					SURFACE WATER	SEDIMENT	SOIL	GROUND-WATER	AIR	BIOTA
Site Q	Site Q was operated as a landfill and occupies 219 acres. Part of the site is covered in gravel and cinders and asphalt; with remaining portions covered by vegetation and transient water. Intermittent ephemeral ponds are present at this site.	Site Q received industrial and chemical wastes and drums during its time as a landfill. It also served as a liquid waste holding pit. Waste were documented as being mobilized during flooding events.	Hazardous substances documented in resources at Site P include VOCs, SVOCs, PCBs, dioxins and furans, and metals.	(1990s): Removal of un-earthed hazardous waste barrels; removal of contaminated sediments at Site Q Central. (1999-2000): Removal of wastes, contaminated soils, and drums at Site Q South.	Yes	Yes	Yes	Yes	Yes	Yes

SITE	DESCRIPTION	RELEASE	WASTE TYPE	REMEDY	PATHWAYS OF EXPOSURE [1]					
					SURFACE WATER	SEDIMENT	SOIL	GROUND-WATER	AIR	BIOTA
Site R	Site R was operated as a landfill and occupies 35 acres. A clay cap was installed to cover the waste.	Site R received industrial and chemical waste and construction debris when it was operated by Monsanto from the 1950s to the 1970s.	Hazardous substances documented in resources at Site R include VOCs, SVOCs, PCBs, pesticides, herbicides, dioxins, and metals.	(1979): Installation of a clay cap. (1985): Installation of a rock wall along the western edge bordering the Mississippi River, downgradient of Site R. (2000-2013): Remedial investigations led to the installation of a Groundwater Migration Control System to control groundwater contamination, principally from Area 2, and subsequent infiltration to the Mississippi River.	Yes	--	Yes	Yes	--	Yes
Site S	Site S was operated as a disposal site for Clayton Chemical Company and occupies less than one acre. It is covered with crushed rock and grass.	Site S received industrial waste, waste drums, and fill soil when it was operated as a disposal site in the 1960s.	Hazardous substances documented in resources at Site R include VOCs, SVOCs, PCBs, and metals.	None.	Yes	--	Yes	Yes	--	Yes

[1] Pathways of exposure may include pathways that persist to the present, as well as pathways that occurred in the past and may have diminished over time. All such pathways are relevant to the natural resource damage assessment.

[--] Indicates that a pathway could exist, but has not been documented.

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