Anniston PCB Site
Stage I Assessment Plan

Prepared by The Anniston PCB Site Trustee Council

State of Alabama
Alabama Department of Conservation and Natural Resources
Geological Survey of Alabama
&
U.S. Department of the Interior
U.S. Fish and Wildlife Service

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Acronyms and Abbreviations

ADCNR	Alabama Department of Conservation and Natural Resources
ADEM	Alabama Department of Environmental Management
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
BBL	Blasland, Bouck & Lee
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
CWA	Clean Water Act
DL	detection limit
DOI	United States Department of the Interior
DW	dry weight
EEC	extreme effect concentration
EPA	United States Environmental Protection Agency
FCA	Fish Consumption Advisory
FDA	United States Food and Drug Administration
FWS	United States Fish and Wildlife Service
GSA	Geological Survey of Alabama
kg	kilogram
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MEC	mid-range effect concentration
n	number of samples
NAS	National Academy of Sciences
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	non-detect
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
OU	Operable Unit
PCB	Polychlorinated biphenyl
ppb	part per billion
ppm	part per million
PRP	potential responsible party
QA/QC	quality assurance/quality control
RI/FS	remedial investigation/feasibility study
SDWA	Safe Drinking Water Act
SEC	sediment effect concentration
Site	Anniston PCB Site
SWDA	Solid Waste Disposal Act
TEL	threshold effect level
TSCA	Toxic Substances Control Act
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WW	wet weight

1. Introduction

The State of Alabama, acting through the Department of Conservation and Natural Resources (ADCNR) and the Geological Survey of Alabama (GSA), and the Secretary of the Interior, as represented by the Regional Director of the Southeast Region of the U.S. Fish and Wildlife Service (FWS; collectively referred to as the Natural Resources Trustees or Trustees), are in the process of assessing injuries to, loss of, or destruction of natural resources from releases of hazardous substances from the Anniston PCB Site (Site). For the purposes of this plan, the Site is defined as the 11th Street ditch, Snow Creek, Choccolocco Creek, Coosa River (including, but not limited to, Lay Lake and Lake Logan Martin), and associated floodplains. Sometimes the Site is also referred to in this document as the Site Assessment Area. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. § 9601 et. seq., (CERCLA) and the Clean Water Act, 33 U.S.C. §§ 1251-1376 (Federal Water Pollution Control Act or CWA), provide authority to the Trustees to seek damages for injuries to natural resources within their trusteehip [42 U.S.C. §§ 9607(a) and (f); 33 U.S.C. § 1321]. Trustees must use recovered funds to restore, replace, rehabilitate, or acquire the equivalent of, the injured natural resources, or may elect to allow the responsible parties to directly implement restoration activities under Trustee oversight.

This document presents the Stage I Assessment Plan for the natural resource damage assessment (NRDA) being conducted by the Trustees. The Stage I Assessment Plan, which describes the approach and methods that the Trustees intend to use in conducting the Stage I assessment, is the second step in the NRDA process and follows the Site Preassessment Screen prepared by the Trustees in February 2005.[1] The Stage I Assessment Plan was prepared in accordance with the U.S. Department of the Interior (DOI) NRDA regulations, as set forth at 43 C.F.R. Part 11(DOI regulations).

1.1 The Natural Resource Damage Assessment Process

The DOI Regulations define several relevant NRDA terms, including

Injury A measurable adverse change, either long or short term, in the chemical or physical quality or the viability of a natural resource resulting from the release of a hazardous substance [43 C.F.R. § 11.14(v)].

Service The physical and biological functions performed by a natural resource, including human uses of those functions [43 C.F.R. § 11.14(nn)]. Services may include such features as wildlife habitat, recreation, erosion control, and subsistence.

[1] These steps are set forth in the Department of the Interior's Natural Resource Damages regulations ("DOI Regulations"), 43 C.F.R. Part 11. If the Trustees choose to follow these regulations to conduct a damage assessment, they may be entitled to a rebuttable presumption of correctness regarding their determination of damages [42 U.S.C. §9607(f)(2)(C)].

Damages The amount of money sought by the Trustees as compensation for injury, destruction, and loss of natural resources [43 C.F.R. § 11.14(i)]. All recovered damages must be put toward environmental restoration by the Trustees. The Trustees may also accept restoration activities in lieu of damages.

The DOI regulations for conducting a NRDA involve four major components (Figure 1). The first is the development of a **Preassessment Screen,** used to determine whether a discharge of oil or a release of hazardous substances warrants a NRDA. Preparation of an **Assessment Plan** represents the second phase. The assessment plan sets forth the manner in which the Trustees will conduct the damage assessment. Trustees are required to provide an opportunity for public review of, and comment on, the assessment plan. The third component involves conducting the **Assessment,** which may include performing studies to determine whether injury has occurred, to quantify the injuries and associated service losses, and to determine the appropriate restoration actions and compensation for the injuries. The fourth component consists of the **Report of Assessment**. At this stage, a report that presents the results of the assessment is prepared and made available to the public.

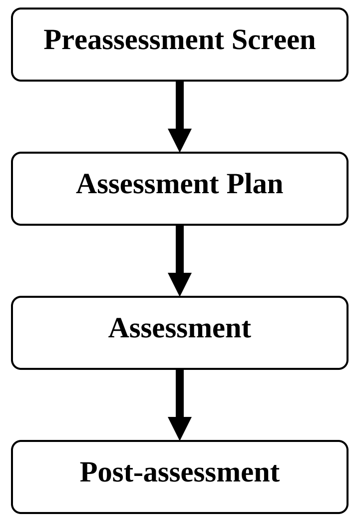

Figure 1. Simplified NRDA process

Potentially responsible parties (PRPs) may be involved in the assessment planning, assessment implementation, or implementation of restoration at any time, at the discretion of the Trustees. If the Trustees conduct the assessment, the DOI Regulations provide that a demand be presented to the PRPs at the end of that process. At that stage, restoration plans will be developed and published for public review and comment. Restoration may be implemented by the Trustees, often in cooperation with the PRPs.

1.2 The Anniston PCB Site Preassessment Screen

The Trustees finalized a Preassessment Screen for the Site in June 2005. In the Preassessment Screen, the Trustees determined that there was a reasonable probability of making a successful claim for natural resource damages and that the Trustees would proceed to the next step of the NRDA process, preparing an Assessment Plan. Specifically, the Preassessment Screen for the Site concluded the following:

1. *Releases of hazardous substances have occurred at and from the Anniston PCB Site* [43 C.F.R. § 11.23(e)(1)].

PCBs were produced at a production facility in Anniston, Alabama, operated by Monsanto Company,(Facility) between 1935 and the early 1970's. Facility records document that PCBs were released from the Facility during production. Releases occurred in the form of wastewater discharges, leakage from Facility landfills, equipment washing runoff, accidental spills, atmospheric releases, storm water runoff, and miscellaneous releases from operational components. The total mass of PCBs released to the environment over the 35 years that PCBs were produced at the Facility is uncertain. However, based on Facility records, more than 45 tons of PCBs may have been discharged in process wastewater alone during a single year of production. Storm water monitoring data indicate that the release of PCBs from the Facility continued through 2001.

2. *Natural resources for which the Trustees can assert trusteeship have been, or are likely to be, adversely affected by the release of hazardous substances* [43 C.F.R. **§** 11.23(e)(2)].

A variety of threatened and endangered species and migratory birds occur in areas contaminated by PCBs released from the Site. PCB concentrations in water and sediment exceed levels known to adversely affect aquatic and terrestrial organisms. Biological monitoring demonstrates that fish and birds in the Site have been exposed to PCBs and have accumulated PCBs in their tissues. Concentrations of PCBs in fish (which ranged as high as 37 ppm in catfish fillets and 38 ppm in bass fillets) exceed levels associated with adverse effects to fish and fish-eating wildlife. Concentrations in bird eggs (which ranged as high as 4.0 ppm in starling eggs) also exceed levels that have been associated with adverse effects on avian receptors. Overall, the available data indicate that PCBs and/or other hazardous substances released at or from the Site (see Section 2.2.2 below) have, or are likely to have, adversely affected surface water, soils and sediments, invertebrates, fish, amphibians, reptiles, birds, and/or mammals utilizing habitats in the Anniston PCB Site.

3. *The quantity and concentration of the released substances are sufficient to potentially cause injury to natural resources* [43 C.F.R. **§** 11.23(e)(3)].

The mass of PCBs released at the Site is uncertain. However, PCBs are distributed over at least 60 miles of stream and river habitat including associated floodplains. Concentrations in water, sediment, and biota throughout this reach exceed the levels that are known to adversely affect aquatic organisms and/or aquatic-dependent wildlife. Soils in urban areas near the Facility and floodplain soils located in certain downstream areas are also contaminated with PCBs.

4. *Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost* [43 C.F.R. **§** 11.23(e)(4)].

A review of readily available information documents that PCBs have been released to soils, surface waters, and the atmosphere on and around the Facility.

The Trustees will evaluate these data, together with the information that will be collected under the Remedial Investigation (see Section 2.3 below), to determine what, if any, additional studies and/or data will be necessary for an injury assessment.

5. *Response actions carried out or planned will not sufficiently remedy the injury to natural resources without further action* [43 C.F.R. **§** 11.23(e)(5)].

   At this time, the extent and nature of any remedial activities are uncertain. However, PCB contamination is distributed in stream and river sediment over a distance of at least 60 miles. Concentrations over the majority of this distance exceed potentially toxic levels (i.e., ranging as high as 60 ppm in Snow Creek and 170 ppm in Choccolocco Creek). Removal or other forms of contaminated sediment remediation over the entire range of contamination appears unlikely. Furthermore, the full extent and magnitude of contamination of floodplain soils is uncertain at this time and removal over the entire possible geographic range seems unlikely. The Trustees will continue to monitor and evaluate planned and ongoing response activities to determine the extent of any residual contamination.

1.3 The Stage I Assessment Plan

The Trustees have decided to conduct the NRDA for the Site in stages. During Stage I, existing data will be used to determine the types and magnitudes of injury and associated damages resulting from hazardous substance releases at and from the Site. If practicable, preliminary restoration alternatives to address those injuries and damages will also be developed. If necessary, the results of the Stage I Assessment will be used by the Trustees to help identify any data gaps that need to be addressed during subsequent stages.

This Stage I Assessment Plan describes the conceptual approach and methods to be used in the Stage I Assessment. The purpose of the Assessment Plan is to ensure that the assessment is performed in a planned and systematic manner, and that the methodologies selected for use in the assessment can be conducted at a reasonable cost [43 C.F.R. **§** 11.30(b)]. This Stage I Assessment Plan includes:

- Descriptions of the geographic areas and natural resources involved [43 C.F.R. **§** 11.31(a)(2)];
- A statement of the authority for asserting trusteeship, or co-trusteeship, for those natural resources considered within the Stage I Assessment Plan [43 C.F.R. **§** 11.31(a)(2)];
- Information sufficient to demonstrate coordination with remedial investigation and feasibility studies (RI/FS) [43 C.F.R. **§** 11.31(a)(3)];
- Procedures and schedules for sharing data, split samples, and results of analyses with PRPs and other interested parties [43 C.F.R. **§** 11.31(a)(4)];

- Explanation of the decision to proceed with a type B assessment [43 C.F.R. § 11.31(b)]; and,
- Results of confirmation of exposure of natural resources to hazardous substances [43 C.F.R. § 11.31(c)(1)].

The Trustees will use the existing data and the data that will be collected as part of the remedial investigation/feasibility study (RI/FS), if applicable, in assessing injuries to natural resources. The Trustees may expand upon RI/FS data collection activities to enable the most effective use of these data for injury assessment purposes. Also, as deemed necessary by the Trustees, during or following the Stage I Assessment, a more detailed assessment may be conducted. This second stage (the Stage II Assessment) would include focused NRDA studies undertaken to address uncertainties and gaps in the Stage I Assessment. Notwithstanding the Stage II Assessment, if the opportunity arises during the Stage I Assessment and the Trustees deem it appropriate, studies may be undertaken to take advantage of the remedial investigation process. This Plan will be modified in such case, if deemed necessary by the Trustees.

1.4 Organization of the Stage I Assessment Plan

Chapter 2 presents an overview of the assessment area and a brief description of PCB releases at the Site. Chapter 3 describes the authority of the Trustees to proceed with the assessment, describes the Trustees' rationale for the selected assessment approach, and identifies the natural resources that will be considered in the assessment. Chapter 4 describes the coordination and previous actions of the Trustees. Chapter 5 provides confirmation that these natural resources have been exposed to PCBs and presents a preliminary estimate of the natural recovery period. Chapter 6 describes the conceptual approach and methods to be employed by the Trustees in the injury assessment. Finally, Chapter 7 describes the Stage I damage determination process, including both restoration planning and compensable value determination.

1.5 Public Review and Comment

The DOI regulations provide that an assessment plan be made available for review and comment by PRPs, other natural resource trustees, other affected Federal, State, or tribal agencies, and any other interested members of the public for a period of at least 30 calendar days, with reasonable extensions granted as appropriate. The Trustees held three public meetings and provided 60 calendar days for public comment, from November 1, 2009, through January 31, 2010. No comments were received.

2. Background Information on the Assessment Area

2.1 Description of the Assessment Area

The Facility is located approximately one mile west of downtown Anniston, Calhoun County, Alabama. It encompasses approximately 70 acres of land in the Snow Creek watershed. Drainage from the Facility travels through a small stream (11th Street Ditch) to Snow Creek. From this confluence, Snow Creek extends about five river miles to Choccolocco Creek. Choccolocco Creek extends 35.4 river miles from the confluence with Snow Creek to Lake Logan Martin on the Coosa River. Lake Logan Martin was formed in 1964 following the construction of Logan Martin Dam on the main stem of the Coosa River. Logan Martin Dam is about 17 miles downstream of the Coosa River-Choccolocco Creek confluence.

The 11th Street Ditch and Snow Creek largely flow through urban areas within Anniston. However, a riparian area has become established along portions of the 11th Street Ditch following the removal of structures and construction of fences along much of the stream course. Similarly, a riparian corridor borders much of Snow Creek. The mean stream flow of Snow Creek at the confluence of Choccolocco Creek is 28 cubic feet per second (cfs; Blasland, Bouck, and Lee, Inc. [BBL] 2000). The 10-year recurrence interval flood at this point is 4,030 cfs.

Choccolocco Creek downstream of Snow Creek is a broad, low-gradient stream. Mean monthly flows near the Snow Creek confluence range from 53 cfs in October to 764 cfs in March (Pearman *et al*. 2002). Downstream flows near the confluence with the Coosa River range from a monthly mean of 298 cfs in September to 1,605 in March. Peak flows at this station range up to 36,900 cfs. Flooding occurs, on average, three to four times per year (BBL 2000). The broad floodplain bordering much of lower Choccolocco Creek consists of bottomland hardwood forests, open water and emergent wetlands, and agricultural lands (crop and pasture).

Choccolocco Creek discharges to Lake Logan Martin. Lake Logan Martin was created by the completion of Logan Martin Dam on the Coosa River in 1964. The Alabama Power Company constructed and operates the dam. Lake Logan Martin is 48 miles long, has a surface area of 15,263 acres, and has 275 miles of shoreline. The current maximum depth of the lake is 69 feet. Lake Logan Martin provides a variety of fish and wildlife habitats, and supports extensive water-oriented recreational activities.

Lay Dam is located approximately 50 miles downstream of Logan Martin Dam. Lay Dam, constructed in 1914, may have trapped PCB-contaminated sediments in the Coosa River.

The severity and extent of contamination at the Site has not been fully characterized and the boundaries of the assessment area remain uncertain. The U.S. Environmental Protection Agency (EPA) has defined the Site as consisting of the area where hazardous substances, including PCBs (associated with the historical and ongoing operations at the Facility) have come to be located. Based on information available to the Trustees, the boundaries will likely encompass at least the uplands in the vicinity of the Facility and aquatic and riparian areas associated with portions of Snow Creek, Choccolocco Creek, and the Coosa River (Figure 2). At this time, it is uncertain if significant levels of contamination persist in rivers and other surface waters downstream of the Coosa River, including the Alabama River, Mobile River, Mobile-Tensaw River Delta, and Mobile Bay. The nature and extent of contamination of terrestrial wildlife habitat is also uncertain at present. Descriptions of the specific resources being addressed in the Stage I Assessment are included in Chapter 4.

2.1.1 Site History and Relevant Operations

PCBs and other hazardous substances were released into the 11^{th} Street ditch, Snow Creek, Choccolocco Creek, and the Coosa River from the Facility. The Trustees have informed Solutia, Inc. (Solutia) and Pharmacia Corporation (Pharmacia, formerly known as Monsanto Company [Monsanto]) that they have been identified as the PRPs for the PCBs and other hazardous substances released into the environment. Other PRPs may be named at a later date, as information becomes available.

Operations at the Facility began in 1917 with the production of ferro-manganese, ferro-silicon, and ferro-phosphorous compounds by the Southern Manganese Corporation (BBL 2000). The Southern Manganese Corporation began production of organic compounds, including biphenyls, in 1927. In 1927, the Southern Manganese Corporation became the Swann Chemical Company. In the same year, Swann Chemical Company initiated biphenyl production at the Facility. However, information available at this time does not indicate whether the biphenyls were chlorinated to form PCBs.

Monsanto purchased the Swann Chemical Company in 1935. Following the acquisition, Monsanto produced PCBs, parathion, phosphorous pentasulfide, paranitrophenol, and polyphenyl. PCB production continued until the early 1970's (EPA 2001). Production of parathion and phosphorous pentasulfide ceased in the mid-1980's. Monsanto spun off its chemical division into a new corporation named Solutia, Inc., in 1997 (EPA 2001). Solutia currently produces para-nitrophenol and polyphenyl compounds at the Facility.

2.2.2 Hazardous Substances Released

The primary chemicals of potential concern (COPCs) at the Site are PCBs. PCBs include a group of synthetic chlorinated aromatic compounds that are chemically stable and persistent in the environment (Hoffman *et al*. 1996). A number of PCB formulations were manufactured in the United States and were sold under the trade name Aroclor, with various amounts of chlorine used in the formulation depending on the intended uses (the last two numbers in the name indicate the amount of chlorine contained in the formulation; i.e., Aroclor 1242 contains 42% chlorine). All of these commercial formulations were comprised of up to 209 individual PCB compounds, (termed congeners), which contain one to ten chlorine atoms. PCBs are listed as hazardous substances in Table 302.4, List of Hazardous Substances and Reportable Quantities under CERCLA [40 C.F.R. § 302.4(a)] and as toxic pollutants pursuant to 40 C.F.R. § 401.15.

The EPA has also identified lead as a COPC at the Site. Mercury-containing wastes were generated at, and reportedly discharged from, the Facility. Both lead and mercury are listed as a hazardous substance in Table 302.4, List of Hazardous Substances and Reportable Quantities under CERCLA (40 CFR §302.4(a)) and as toxic pollutants pursuant to 40 CFR §401.15. Both of these metals are persistent in the environment

In addition to PCBs, lead, and mercury, the EPA has identified 25 other hazardous substances as COPCs at the Facility. The volumes released and the persistence of each of these substances are uncertain at this time. A list of the chemicals of potential concern, which may be evaluated during the assessment, is found at Appendix B.

2.2.3 Duration and Quantity of Release[2]

Monsanto produced PCBs at the Facility between 1935 and the early 1970's. (Prior to that, the previous owner, Swann Chemical, produced PCBs at the plant beginning in 1929.) Monsanto's records indicate that approximately 680,000,000 pounds of PCBs were manufactured at the Facility.

During its operational history, Monsanto's historic corporate documents indicate that the Facility released tens of millions of pounds of PCB wastes into the environment through various pathways, including two large dump sites located adjacent to the plant, now known as the West End Landfill and the South End Landfill. The pathways also include direct discharges by Monsanto to ditches and streams and other waterways, dumping of PCB wastes into sewers, and the release of PCB wastes into unlined, uncapped dumps from which further uncontrolled releases of PCBs occurred through wind-blown dust, run-off during rain events, open burning, and volatilization into the air. Additionally, PCBs were spread by a mechanical pathway into Anniston through the dredging of

[2]Information summarized in this section is taken from EPA's January 13, 2006, Response to Public Comments to Section 122 Administrative Settlement Agreement and Order on Consent for Removal Action between EPA and eleven corporate entities (EPA 2006) and a draft report entitled "PCB Source, Transport and Fate in the Anniston Area," attached to the Response to Comments (Medine *et al*., 2005).

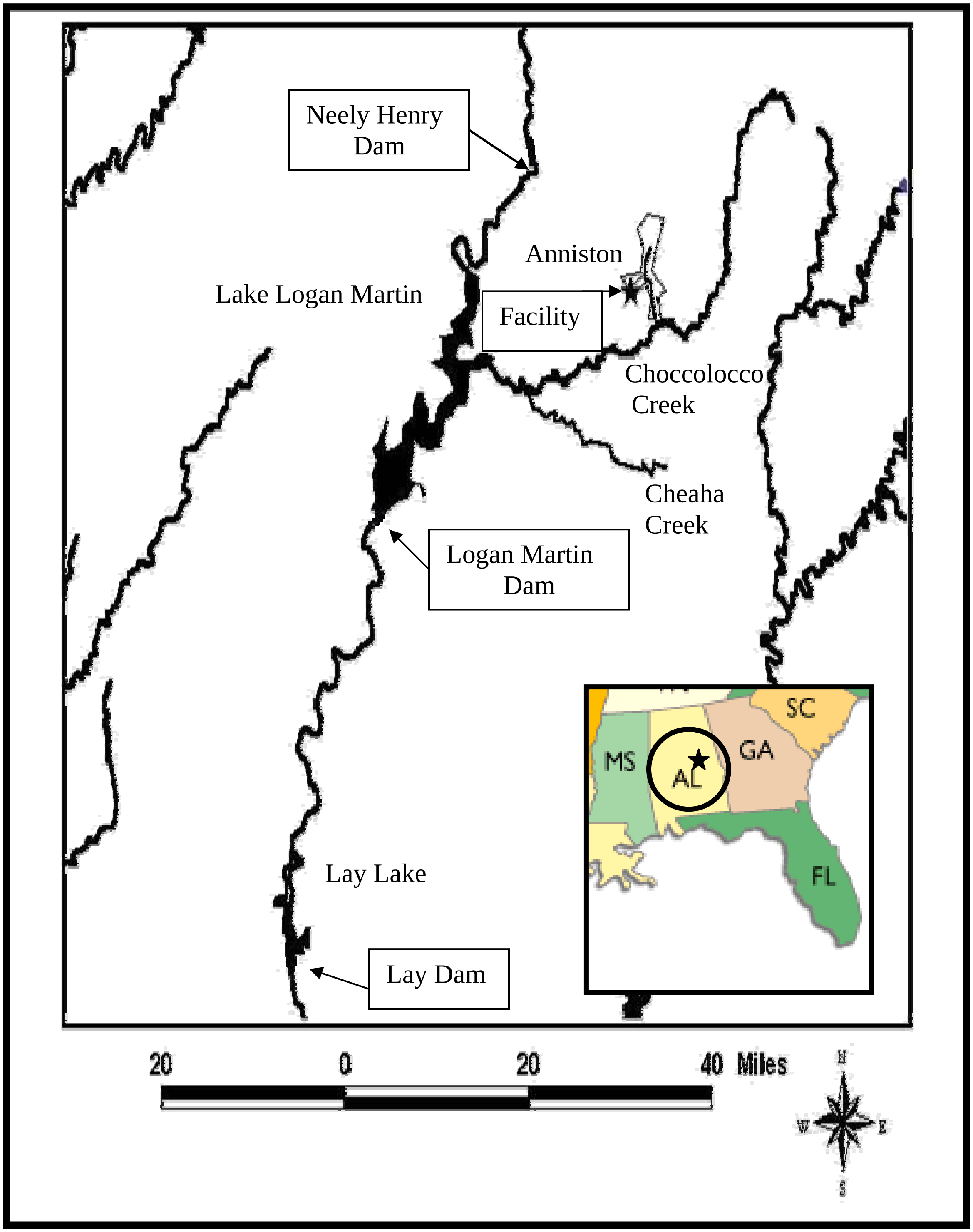

Figure 2. Anniston PCB Site environment: Coosa River and tributaries

previously contaminated waterways and the subsequent use of dredge spoils as fill material and also Monsanto's use of sand and dirt to clean up PCB spills during their production process and the subsequent use of that material as fill.

The six-acre West End Landfill, located on the southeast side of the plant, received wastes from the mid-1930's until 1961. Disposal of production wastes in the South End Landfill, located southeast of the plant across U.S. Highway 202, began in 1961 and continued until 1988. Approximately 10 percent of total Aroclor production was discharged to these landfills. Air emissions were estimated to include 60,000 pounds of PCBs, wastewater discharges were estimated to include about 1.8 million pounds of PCBs, and solid waste was estimated to total at least 87 million pounds of PCB-containing waste. In one of the legal proceedings, evidence was submitted reflecting overall losses of PCBs to the environment estimated for the Anniston plant during 1953-1969, including 39,959 pounds to the air, 1,232,952 to water, and 54,943,434 to dumps, or abut 12 percent of all Aroclors produced. From 1970-1972, approximately 9,400,000 pounds of PCBs were sent to the landfills.

After negotiations with the Alabama Attorney General, Monsanto dredged 1,000 tons of heavily contaminated PCB wastes from the 11th Street ditch and from100 feet of Snow Creek immediately downstream of Monsanto's waste and storm run-off points. During the mid-1990s, Alabama became aware that PCB contamination at the Facility was continuing to be a source of significant levels of PCB migration via various pathways into the Anniston environment. The State required Solutia to undertake a massive engineering program to address the fact that PCBs were continuing to migrate from the Facility into the City and the environment.

Sampling by EPA, Solutia, Inc, ADEM (Alabama Department of Environmental Management), and other parties has indicated that sediments in drainage ditches leading from the Facility, Snow Creek, and Choccolocco Creek, and areas downstream in the Coosa River Valley, including Lake Logan Martin and Lay Lake, as well as sedimentary material in floodplains of these waterways, contain various levels of PCBs and other contaminants above those typically found in similar urban areas. In total, over 7,000 PCB samples are known to have been taken over the years by EPA and other parties in the Anniston area. The data generally indicates that throughout these areas relatively uniform levels of PCB contamination exist. For example, the vast majority of the samples indicate levels of PCBs between non-detect and 10 parts per million. However, a small percentage of samples do indicate specific locations with higher levels of PCBs.

Storm water runoff from the Facility is known to contain PCBs, based on monitoring data provided with the application for re-issuance of a National Pollutant Discharge Elimination System (NPDES) permit in 2001. In addition, BBL (2003) indicated that, in recent years, concentrations in storm water ranged up to almost 22 parts per billion (ppb).

The results of recent air quality monitoring conducted by the Agency for Toxic Substances and Disease Registry (ATSDR) demonstrated that Anniston residents are exposed to atmospheric PCBs via inhalation (ATSDR 2004).

Mercury is believed to have been released to local surface water in chlorine production wastes from the Anniston Facility. Chlorine was produced during Monsanto's operations at the Facility during the 1950's and 1960's. The Anniston Star (2001) estimated that between 40 to 50 tons of mercury were released from the Facility during this time period.

EPA has determined that Monsanto was responsible for lead contamination. For decades, Monsanto used hundreds of tons of lead, which was melted down during the PCB manufacturing process. EPA's National Enforcement Investigation Center analyzed Monsanto's lead-pot process used in the production of biphenyls and determined that lead was released into the air during this process. (Monsanto used the lead-pot process from 1928 to 1964.) EPA also determined that lead was released into the environment from Monsanto's previous ferroalloy production, as well as from the company's shipping and processing of lead as a raw material for use in its PCB manufacturing process. Additionally, Monsanto's records indicate that lead formed a portion of the products they manufactured; therefore, their waste streams, which they released into the environment, were contaminated with lead.

2.3 Remedial Investigation/Feasibility Study Activities

In August 2003, the United States Federal District Court for the Northern District of Alabama approved a Partial Consent Decree (CD or Consent Decree) between the EPA and Pharmacia and Solutia to initiate remedial activities at the Site. Among other things, the Consent Decree required implementation of a typical CERCLA remedial process, including the completion of a RI/FS.

A RI/FS, pursuant to CERCLA, is being conducted for the Site by the EPA and the PRPs. The purpose of the RI/FS is to determine the nature and extent of contamination at the Site, characterize human health and ecological risks resulting from Site contamination, evaluate various alternatives for remediating the Site, and select the Site remedy or remedies to address the risks. The RI/FS process and the Site remedy are distinct from the Site NRDA being conducted by the Trustees. However, the results of the RI/FS influence the NRDA in that, the more extensive the PCB and hazardous substances cleanup remedy conducted, the less NRDA restoration may be required to account for future losses. In addition, data collected to support the RI may be relevant to the NRDA. The relationship between RI/FS and NRDA is described in more detail in Section 7.4.

Remedial activities at the Site have thus far focused largely on the removal of contaminated residential soil and the excavation, backfill, geocomposite liner placement, and shotcrete application in the 11th Street ditch adjacent to the Facility. Remedial investigations for the Site are currently being designed.

2.3.1 RI/FS Description of the Site

Under the Consent Decree, the Anniston PCB Site is defined to include the areas where COPCs from the Facility have come to be located. To facilitate the RI, currently the Site has been separated into three geographical areas known as operable units (OUs; Figure 3). The descriptions for the OUs are as follows:

OU-1/OU-2 Consists of both residential and non-residential properties within the Site upstream of Highway 78, up to, and surrounding, the on-facility area (OU-3), including residential properties located in the Oxford Lakes Neighborhood Zone. This area also includes the non-residential properties located immediately north and east of OU-3, including the 11th Street and West 9th Street ditches. The lateral bounds of the non-residential properties, including both floodplain and non-floodplain properties, may also be included in this area.

OU-3 Consists of the Facility itself, including the plant site, the South Landfill, and the West End Landfill.

OU-4 Consists of Choccolocco Creek and its floodplain downstream to Lake Logan Martin. It also includes the lower end of Snow Creek and its floodplain downstream of Highway 78 to the confluence of Snow and Choccolocco Creeks. The backwater area of Choccolocco Creek upstream of the Snow Creek confluence is also included in this OU.

The spatial extent of the RI/FS investigation may be expanded to include downstream areas, based on the results of the RI of OU-4. Currently, the NRDA assessment area includes all of the areas from the Facility to the downstream limit of the Coosa River.

3. Authority of Trustees and Decision to Proceed with a Type B Assessment

3.1 Authority

Under Section 107 (f) of CERCLA and Section 311 of the Clean Water Act, the Trustees are authorized to recover damages for injury to, destruction of, and loss of natural resources resulting from a release of hazardous substances from the Facility. The Trustees intend to coordinate and cooperate in carrying out their trustee responsibilities in this case. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) provides that “where there are multiple trustees, because of coexisting or contiguous natural resources or concurrent jurisdictions, they should coordinate and cooperate in carrying out their trustee responsibilities.” [40 C.F.R. § 300.615].

A general description of the authorities over natural resources asserted by the Trustees in this case is given below. These descriptions are not meant to be an exhaustive and all-inclusive listing of each Trustee's authorities. In this case, the State and Federal governments share authority over most natural resources.

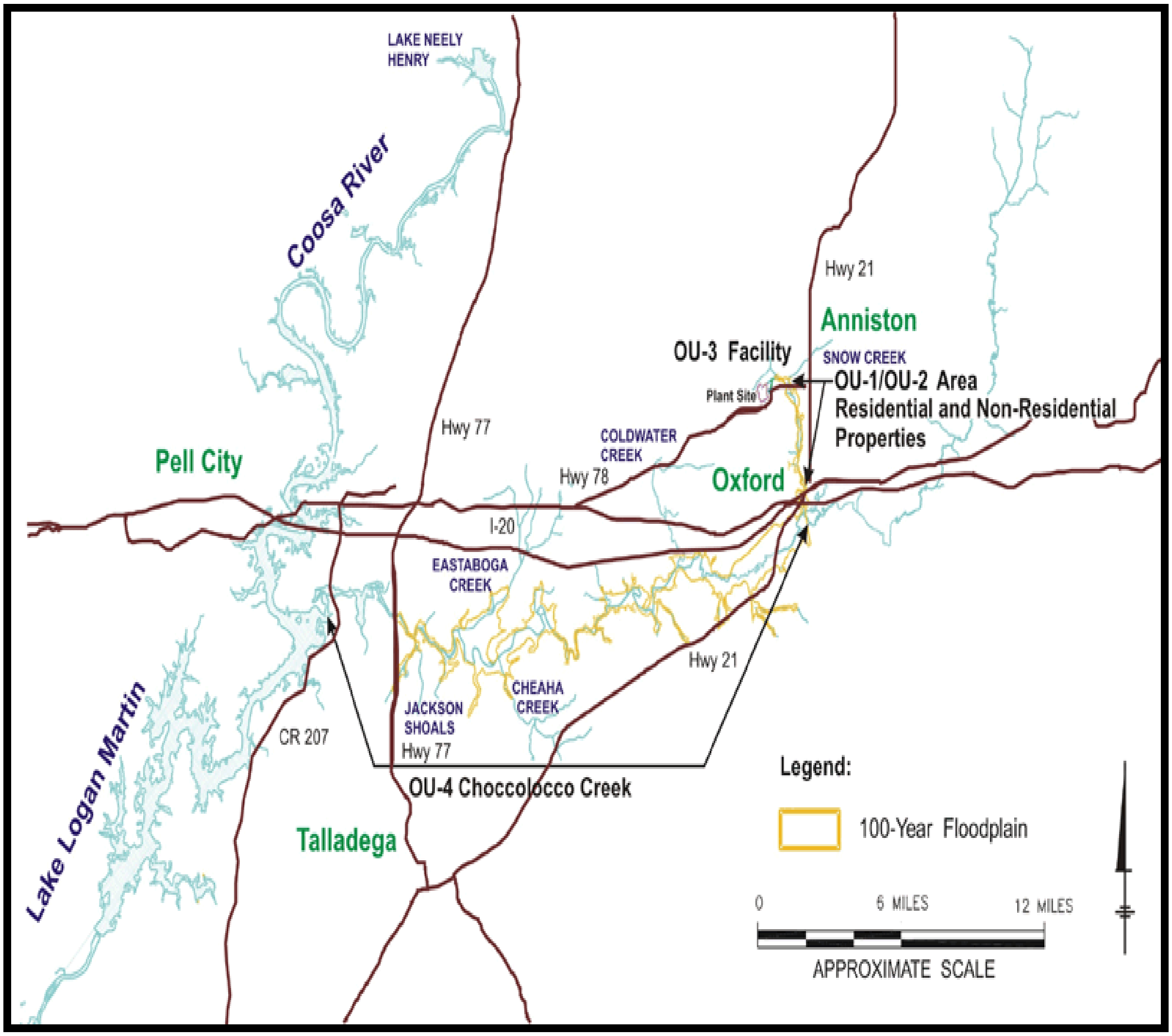

Figure 3. Anniston PCB Site operable units (BBL 2004)

3.1.1 Alabama Department of Conservation and Natural Resources and the Geological Survey of Alabama Natural Resource Trusteeship Authority

The Commissioner of ADCNR and the State Geologist of GSA have been designated by the governor of Alabama as lead State Trustee and Co-Trustee, respectively, for State natural resources pursuant to Section 107(f)(2)(B) of and Section 311 of the CWA. Specifically, the State's authority to assert trusteeship over resources that are the subject of this assessment derives from the following sections of the Code of Alabama and related regulations: 9-2-1 *et seq.* (creation of Department of Conservation), 9-4-1 *et seq.* (creation of Geological Survey), 22-22-1 *et seq.* (Alabama Water Pollution Control Act), 22-22A-1 *et seq.* (Alabama Environmental Management Act), 22-30-1 *et seq.* (Hazardous Wastes Management and Minimization Act) and 22-30A-1 *et seq.* (creating Alabama Hazardous Sites Cleanup Fund).

3.1.2 U.S. Department of the Interior Natural Resource Trusteeship Authority

The Secretary of the Interior acts as Trustee for natural resources managed or controlled by the DOI, including their supporting ecosystems [40 C.F.R. § 300.600(b), (b)(2), and (b)(3)]. The statutory bases for DOI's trusteeship include, but are not limited to, the Migratory Bird Treaty Act (16 U.S.C. § 703 *et seq.*), the Bald and Golden Eagle Protection Act (16 U.S.C. § 668 *et seq.*), the Fish and Wildlife Coordination Act (16 U.S.C. § 661 *et seq.*), and the Endangered Species Act (16 U.S.C. § 1531 *et seq.*).

3.2 Decision to Perform a Type B Assessment

The DOI Regulations set forth two alternate procedures to conduct NRDAs [43 C.F.R. § 11.33], or a combination of these types under certain circumstances [43 C.F.R. § 11.36]. Type A procedures are simplified procedures that require minimal field observation [43 C.F.R. § 11.33(a)]. A Type B assessment provides alternative methodologies for conducting NRDAs and consists of three phases: injury determination, injury quantification, and damage determination [43 C.F.R. § 11.60(b)].

Hazardous substances have been released in the assessment area for over 30 years and transmitted through the food chain, affecting many different trophic levels. Consequently, the releases cannot be considered of a short duration, minor, or resulting from a single event. Furthermore, the spatial and temporal extent and the heterogeneity of exposure conditions and potentially affected resources are not suitable for application of the simplifying assumptions and averaged data and conditions contained in Type A procedures. Therefore, simplified Type A assessment methodologies are not appropriate for this NRDA.

The Trustees have determined that: (1) the Type A assessment is inappropriate for the long-term, spatially and temporally complex releases and exposures to hazardous substances characteristic of the Site Assessment Area; (2) the existing data and those collected under the RI may support a Stage I assessment; and, (3) additional site-specific data, if needed, can be collected at reasonable cost to support a Stage II assessment. Therefore, the Trustees have concluded that the use of Type B procedures is justified for the NRDA of the Anniston PCB Site.

3.3 Natural Resources Considered in this Assessment

Natural resources subject to State and Federal trusteeship, which have been, or are likely to have been, adversely affected by the releases of hazardous substances, include surface water, sediments, groundwater, soils, and biological resources. Each of these natural resources is briefly described below.

Surface water resources are defined in the DOI regulations as including both surface water and sediments suspended in water or lying on the bank, bed, or shoreline. 43 C.F.R. § 11.14(pp). Surface water resources in the vicinity of the Site include water, bed sediment, shoreline sediment, and bank sediment within the Snow Creek, Choccolocco Creek, and Coosa River watersheds.

Groundwater resources are defined in the DOI regulations 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." 43 C.F.R. § 11.14(t). These resources include ground waters that meet the state definition of drinking water supplies. Groundwater resources in the vicinity of the Site include groundwater within the Snow Creek, Choccolocco Creek, and Coosa River watersheds.

Geologic resources are defined in the DOI regulations as "those elements of the Earth's crust such as soils, sediments, rocks, and minerals . . . that are not included in the definitions of groundwater and surface water resources." 43 C.F.R. § 11.14(s). The geologic resources of the Site include the extensive floodplain soils along Snow and Choccolocco Creeks and the Coosa River.

Biological resources are defined in the DOI regulations as "those natural resources referred to in section 101(16) of CERCLA as fish and wildlife and other biota. Fish and wildlife include marine and freshwater aquatic and terrestrial species; game, non-game, and commercial species; and threatened, endangered, and State sensitive species (*see Appendix A for list of federally protected species identified at the Site*). Other biota encompass shellfish, terrestrial and aquatic plants, and other living organisms." 43 C.F.R. § 11.14(f). Biological resources in the vicinity of the Site include aquatic and riparian plants, aquatic and terrestrial invertebrates, fresh water mussels, fish, amphibians, reptiles, birds, and mammals utilizing habitats in the Snow Creek, Choccolocco Creek and Coosa River watersheds.

4. Coordination and Previous Actions of Trustees

On February 12, 2005, the DOI finalized a preassessment screen and determination for the site. In accordance with 43 C.F.R. § 11.32(a)(2)(iii)(A), the DOI invited the PRPs to participate in the development and performance of the assessment. The PRPs have expressed their commitment to continued cooperation with the Trustees and all other stakeholders in the assessment process.

5. Confirmation of Exposure to Natural Resources and Preliminary Determination of Recovery Period

The DOI NRDA regulations state that an assessment plan should confirm that at least one of the natural resources identified as potentially injured in the preassessment screen has in fact been exposed to the . . . hazardous substance." 43 C.F.R. § 11.37(a). A natural resource has been exposed to a hazardous substance if "all or part of [it] is, or has been, in physical contact with . . . a hazardous substance, or with media containing the . . . hazardous substance." 43 C.F.R. § 11.14(q). The DOI regulations also state that "whenever possible, exposure shall be confirmed using existing data" from previous studies of the assessment area. 43 C.F.R. § 11.37(b). The following sections provide confirmation, based on a review of existing data, that a number of natural resources within the Site have been exposed to hazardous substances, including, but not limited to, PCBs. These resources include:

- Surface water resources, including surface water and sediments;
- Groundwater resources;
- Geologic resources; and,
- Biological resources.

The following discussion is not a complete review of existing information regarding Site resource exposure to hazardous substances, but confirms exposure of various resources to PCBs. A preliminary determination of the recovery period for the Site's natural resources is also presented in this chapter.

5.1 Surface Water Resources

Surface water resources in the vicinity of the Site include water, bed sediment, shoreline sediment, and bank sediment within the Snow Creek, Choccolocco Creek, and Coosa River watersheds. Available data on PCB concentrations in surface water and sediment show that these resources have been exposed to PCBs. Internal Monsanto memoranda document the presence of high PCB concentrations in surface waters downstream of the Facility during PCB production operations. A May 12, 1969, Monsanto memorandum reports visible evidence of PCB contamination (e.g., "free globules" of Aroclors) in Snow Creek. A July 21, 1970, Monsanto memorandum documents PCB concentrations of up to 20,300 ppb (20.3 parts per million) in water from Snow Creek and up to 58 ppb in water from Choccolocco Creek.

More recent data generated by Monsanto on PCB contamination outside of the Facility boundaries indicate that the transport of significant PCB loads downstream of the Facility continues (BBL 2000). Maximum PCB concentrations and loads in Snow Creek approached 1 ppb and 1 pound per day, respectively. BBL also estimated an annual load of 125 kg (275 pounds per year) in Choccolocco Creek near the confluence with Lake Logan Martin (e.g., Jackson Shoals).

Storm water runoff from the Facility in November 2003 contained 22 ppb of PCBs. Concentrations of Aroclor 1232 (11 ppb) and Aroclor 1248 (10 ppb) exceeded Alabama water quality standards (0.014 ppb) (BBL 2003).

Low concentrations of PCBs in water have been associated with harmful effects to fish and wildlife. The EPA (2002) recommends that total PCB concentrations should not exceed 14 parts per trillion (equivalent to 0.000014 ppm). EPA water quality criteria for PCBs are designed to protect against bioaccumulation of PCBs in aquatic organisms to levels that would adversely affect aquatic-dependent wildlife species. The State of Alabama has adopted the 0.014 ppb criterion as the water quality standard for each of seven specific PCB mixtures, but has not adopted a water quality standard for total PCBs (ADEM 2008).

Internal Monsanto memoranda document the presence of high PCB concentrations in aquatic sediment collected from streams affected by Facility discharges. For example, a July 21, 1970, Monsanto memorandum reveals that Monsanto measured PCB concentrations of up to 23,600 ppm (2.36 percent) in sediment from Snow Creek and up to 738 ppm in sediment from Choccolocco Creek. Data presented in the memorandum indicate that PCBs also contaminated sediments in Choccolocco Creek and the Coosa River, where a PCB concentration in sediment of 3.24 ppm was reported.

More recent sampling efforts indicate that elevated PCB concentrations persist in aquatic systems downstream of the Facility (Figure 4). BBL (2000) reported that PCB concentrations in sediment ranged up to 60 ppm in Snow Creek and up to 170 ppm in Choccolocco Creek (Figure 4). BBL (2000) further reported elevated PCB concentrations in Lake Logan Martin sediment. The highest PCB concentration (3.5 ppm) was found in deeper sediment near Logan Martin Dam.

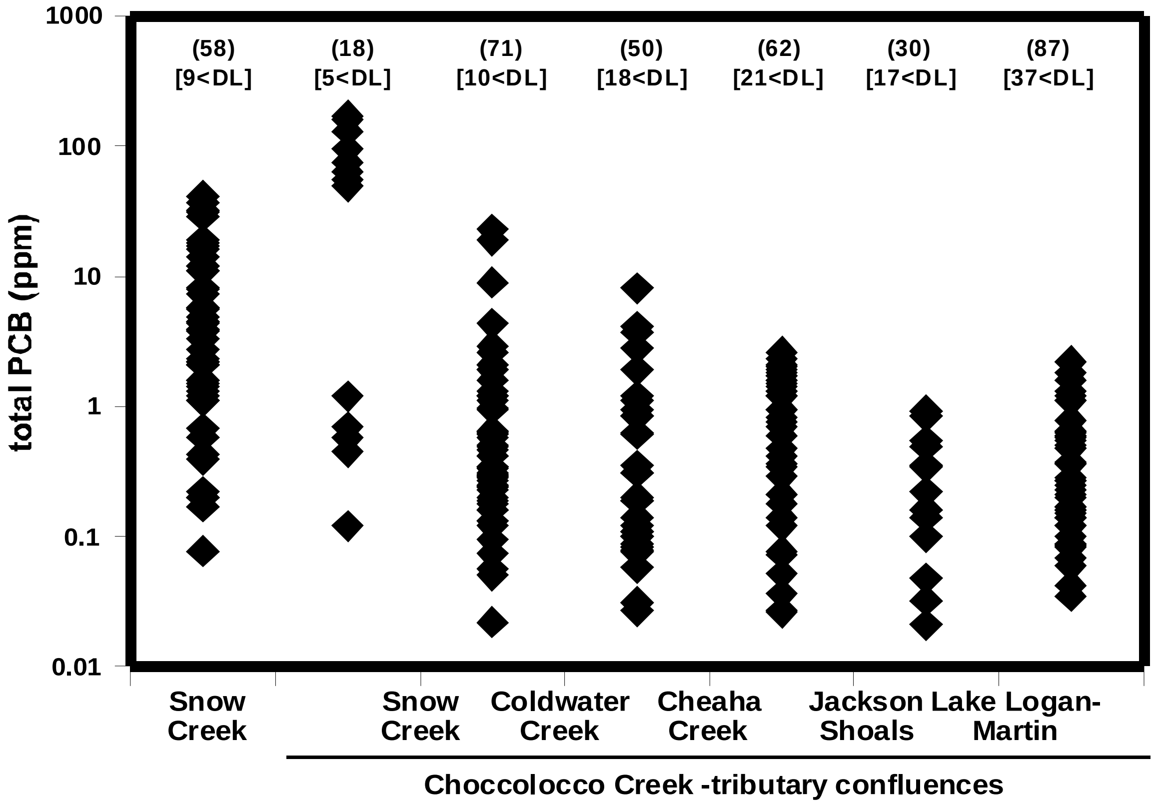

Figure 4. Total PCB concentrations in Snow Creek and Choccolocco Creek sediment [BBL 2000; the total number of samples (n) and the number less than the analytical detection limit (<DL) are given at the top of the figure].

The concentrations of PCBs that are associated with adverse effects on sediment-dwelling organisms have been established based on the results of spiked-sediment toxicity tests and evaluations of the results of field studies. MacDonald *et al.* (2000a) compiled sediment quality guidelines (SQGs) for PCBs from multiple sources and used these SQGs to determine threshold effect, mid-range effect, and extreme effect concentrations of PCBs. The consensus-based threshold effect concentration for invertebrates in freshwater sediment is 0.04 ppm dry weight (MacDonald *et al.* 2000a). The mid-range effect concentration, or that level at which adverse effects frequently occur, is 0.676 ppm (MacDonald *et al*. 2000b) and the severe-effect concentration, or that level at which adverse effects usually or always occur is 1.7 ppm dry weight (MacDonald *et al.* 2000a).

Whole-sediment chemistry data collected downstream of the Facility demonstrate that sediment-dwelling organisms have been exposed to elevated levels of PCBs. Of 110 sediment samples from Snow Creek downstream of the 11th Street Ditch reported in BBL (2000), total PCBs in 100 samples (91%) exceeded the mid-range effect concentration (0.68 ppm DW) and 79 samples (72%) exceeded the extreme effect concentration (1.7 ppm DW). In Choccolocco Creek, the mean PCB concentration in fine surficial sediment collected down to the confluence of Cheaha Creek exceeded the extreme effect concentration (BBL 2000). The mean PCB concentration in surficial sediment in the lowest reach of Choccolocco Creek exceeded the mid-range effect level (MacDonald *et al*. 2000b).

In summary, elevated PCB concentrations have been measured in surface waters and sediment of the Site Assessment Area. These data confirm that surface water resources in the Site have been exposed to PCBs.

5.2 Groundwater Resources

The results of previous sampling showed that levels of PCBs in groundwater underlying the Facility near the 11th Street Ditch and Snow Creek ranged from non-detect (ND) to 7400 µg/L (Solutia, Inc. and Pharmacia Corporation 2005). By comparison, a maximum contaminant level of 0.5 ppm is specified under the National Primary Drinking Water Regulations (43 CFR §141.61(c)) . These data show that groundwater in the Site Assessment Area has been exposed to PCBs.

5.3 Geologic Resources

Geologic resources within the Site include the extensive floodplain soils along Snow and Choccolocco Creeks and the Coosa River. PCB concentrations ranging from ND to 97 mg/kg have been measured in Choccolocco Creek floodplain soils (BBL 2003). PCB concentrations in Facility soils ranged from ND to 16,620 mg/kg (BBL 2005). These data provide evidence that the soils of the Site have been exposed to elevated concentrations of PCBs.

5.4 Biological Resources

Biological resources of the Site include aquatic and riparian plants, aquatic and terrestrial invertebrates, fish, amphibians, reptiles, birds, and mammals and their supporting habitats in the Snow Creek, Choccolocco Creek and Coosa River watersheds. Data confirming the exposure of biological resources to PCBs are available for fish and birds.

5.4.1 Fish

Available data show that fish in the affected areas have been exposed to PCBs. Recent data are provided in BBL (2005). The highest PCB concentrations were found in catfish fillets from Choccolocco Creek, with PCB concentrations ranging up to 37.1 ppm wet weight (WW; Figure 5). Concentrations in bass fillets ranged up to 38.4 ppm WW. Concentrations of PCBs in catfish and bass fillets collected from Choccolocco Creek near the confluence with Lake Logan Martin ranged up to 48.56 and 35.2 ppm WW, respectively. PCB concentrations in catfish and bass fillets collected from Lake Logan Martin ranged up to 4.7 and 5.4 ppm WW, respectively. By comparison, adverse effects on fish reproduction have been observed at concentrations ranging from 0.56 to 1.1 ppm

(Sparks *et al.* 2005; Orn *et al*. 1998). These data confirm that fish in the Site Assessment Area have been, and continue to be, exposed to potentially harmful levels of PCBs.

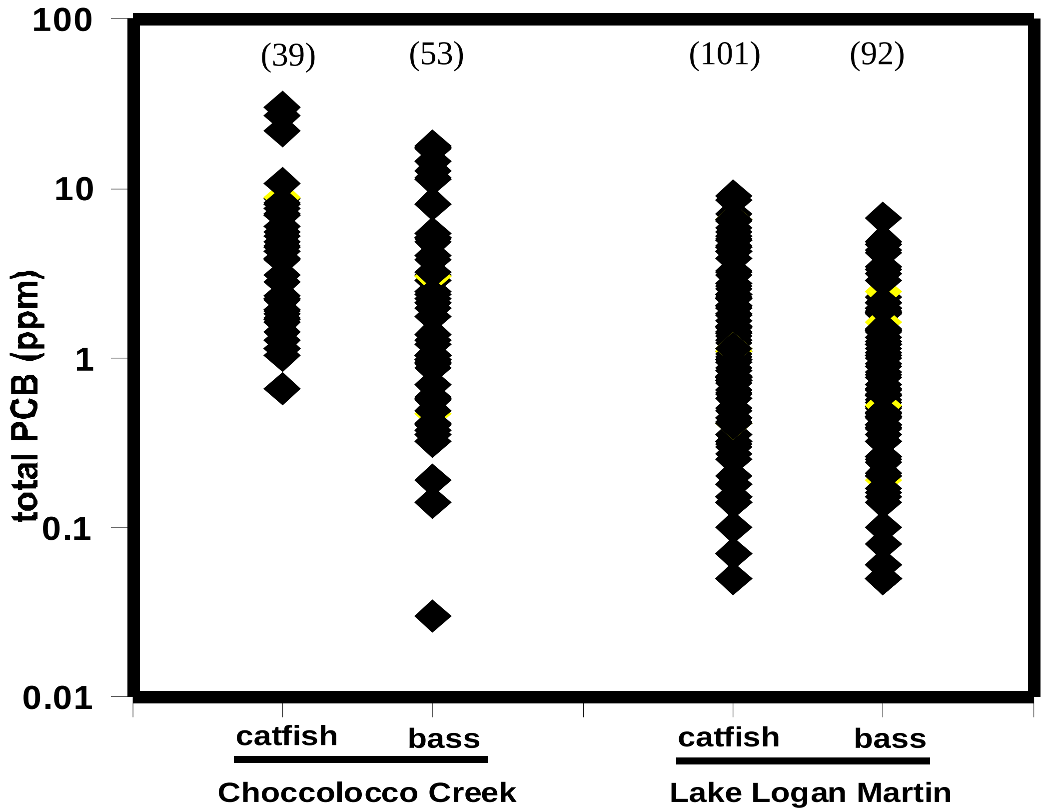

Figure 5. PCB concentrations in Choccolocco Creek and Lake Logan Martin catfish and bass fillets [BBL 2003; the total number of samples (n) are given at the top of the figure].

The Alabama Department of Public Health issued consumption advisories based on the Food and Drug Administrations (FDA) recommendation that fish fillets containing greater than 2 ppm PCBs wet weight (WW) should not be ingested (ADPH 2005). The EPA recommends limited consumption for chronic health endpoint at concentrations as low as 0.006 ppm PCB and no consumption at levels as low as 0.2 ppm (EPA 1997). EPA consumption advisories based on cancer risk are substantially lower, with limited consumption recommended at PCB concentrations as low as 0.00004 ppm and no consumption at levels as low as 0.002 ppm.

Elevated PCB concentrations in fish prompted the Alabama Department of Public Health to issue fish consumption advisories for affected reaches of Choccolocco Creek and the Coosa River between 1993 and 1996. A “No Consumption” advisory was issued for all fish species in Choccolocco Creek downstream of the city of Oxford. “No Consumption” advisories have also been issued for spotted bass, striped bass, crappie, blue catfish, and/or channel catfish in four reaches of the Coosa River, encompassing an area including Lake Logan Martin Reservoir, Lay Lake (downstream of Lake Logan Martin), and the Coosa River between these lakes. All of these reaches are potentially affected by PCBs released at or from the Facility. “Limited Consumption” advisories have also been issued for catfish collected from three reaches of the Coosa River upstream of the Choccolocco Creek confluence, although PCBs in the two reaches that occur upstream of Neely Henry Dam are not likely to have been released at or from the Facility.

5.4.2 Birds

Available data on exposure of birds to PCBs is more limited. Between 1974 and 1985, the National Contaminants Biomonitoring Program (NCBP) examined contaminant concentrations in 618 European starling (*Sturnus vulgaris*) eggs from 134 sites nationwide, including 5 eggs from Anniston, Alabama. The highest PCB concentrations found nationwide (3.8 and 4.0 ppm) were found at the Site (Figure 6). Additionally, all five of the Anniston eggs were among the 10 eggs with the highest PCB concentrations nationwide (NCBP Starling Residue Data at www.cerc.usgs/data/ ncbp/starling/starling.html). Adverse effects on birds have been observed at whole egg concentrations in excess of 1.3 ppm (Chapman 2003).

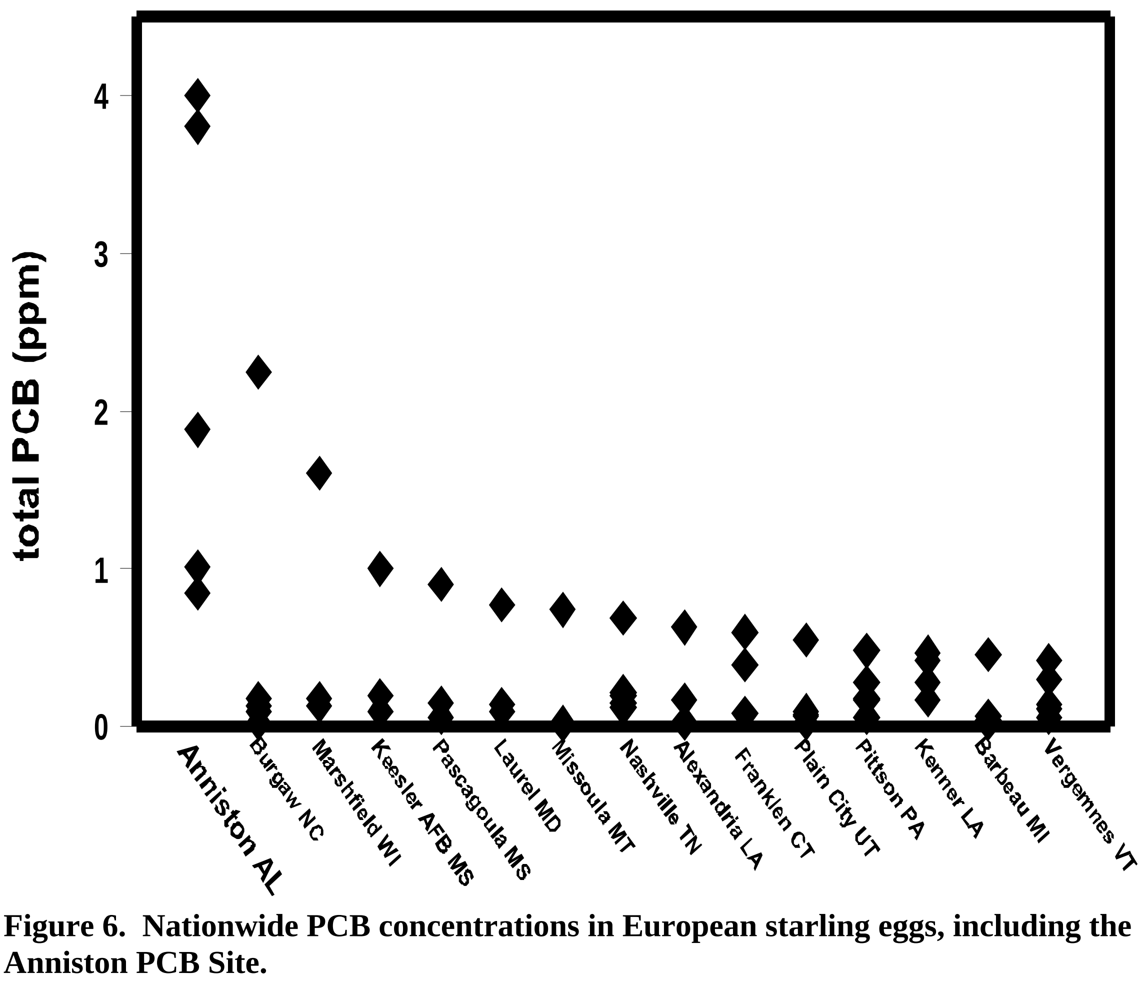

Figure 6. Nationwide PCB concentrations in European starling eggs, including the Anniston PCB Site.

In summary, elevated PCB concentrations have been measured in biological resources, including fish and birds in the Site Assessment Area. In addition, the levels of PCBs in biological tissue exceed toxicity thresholds that have been reported in scientific literature.

5.5 Recovery Period

This section provides a preliminary discussion of the recovery period for the exposed natural resources of the Site Assessment Area.

A recovery period is defined as either (1) the longest length of time required to return the services of the injured resource to their "baseline condition," which is the condition that would have existed had the hazardous substance release(s) not occurred [43 C.F.R. §11.14(e)], or (2) a lesser period of time selected by the Trustees and documented in the Assessment Plan [43 C.F.R. **§** 11.14(gg)]. Services are defined in Section 1.1, above. The following factors should be considered in estimating recovery times:

- Ecological succession patterns in the area;
- Growth or reproductive patterns, life cycles, and ecological requirements of biological species involved, including their reaction or tolerance to the hazardous substance involved;
- Bioaccumulation and extent of hazardous substances in the food chain; and,
- Chemical, physical, and biological removal rates of the hazardous substance from the media involved [43 C.F.R. **§** 11.73(c)(2)].

This preliminary determination of recovery period focuses on natural processes. Natural resources will remain exposed to PCBs as long as environmental media such as soils, sediments, groundwater, and surface water continue to operate as exposure pathways to biological resources. This Stage I Assessment Plan considers the recovery period to be the longest length of time required to return the services of the injured resources to baseline [43 C.F.R. **§** 11.14(gg)].

PCBs are highly persistent compounds and degrade very slowly (Eisler 1986; Erickson 1997). In fact, their resistance to most chemical degradation processes is one of the key features that led to their widespread use (Erickson 1997). While both aerobic degradation and anaerobic dechlorination have been documented in sediments from PCB-contaminated aquatic systems (e.g., Brown and Wagner 1990; Flanagan and May 1993), these processes are much slower for PCBs than for other compounds (Erickson 1997).

Other natural processes related to the fate of PCBs include volatilization and desorption into the water column (from the sediment) and migration downstream. However, both of these processes typically are slow relative to the mass of PCBs in the sediment because of the very low vapor pressure and hydrophobicity of PCB molecules (Erickson 1997).

Because of the persistence of PCBs in the environment, natural recovery of PCB contamination will proceed very slowly in the Site. Sediment burial and downstream particulate transport are typically the primary loss mechanism for PCBs in riverine systems (e.g., Velleux and Endicott 1994). However, PCBs buried in deeper sediment can be re-exposed through anthropogenic activities (e.g., dredging, boating) or through high-flow events. The Trustees are unable to quantify an expected natural recovery period for the Site at this time. Nonetheless, the chemical nature of PCBs and what is known regarding loss of PCBs from environmental systems are consistent with a very long natural recovery period, at least on the order of many decades.

6. Stage I Injury Assessment

Chapter 5 provided information confirming that natural resources at the Site, including surface water, sediments, soils, and biological resources, have been exposed to PCBs. To evaluate the nature, extent, and degree of injury to exposed natural resources, the Trustees will conduct a Stage I injury assessment. The purpose of the injury assessment is to determine whether natural resources have been injured [43 C.F.R. § 11.61], to identify the environmental pathways through which injured resources have been exposed to hazardous substances [43 C.F.R. § 11.63], and to quantify the degree and extent (spatial and temporal) of injury [43 C.F.R. § 11.71].

As discussed in Chapter 1, the Trustees will conduct the Site NRDA in stages. The Stage I Assessment will be conducted using existing information and information being developed in the RI/FS process. Where data gaps are identified or additional data is required, it will be collected. The Stage II Assessment, if necessary, will include new investigations where required. The Trustees will prepare, and make public, specific sampling and analysis plans, either as appendices or supplements to the final Stage II Assessment Plan.

6.1 Injury Assessment Approach

Injury is defined in the DOI regulations as a "... measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a ... release of a hazardous substance, or exposure to a product of reactions resulting from the ... release of a hazardous substance." The definition of "injury" encompasses the concepts of "injury," "destruction," and "loss." 43 C.F.R. § 11.14(v). The injury assessment will involve two basic steps, injury determination and injury quantification, as indicated below:

1. ***Injury determination.*** The Trustees will determine whether an injury to one or more natural resources has occurred as a result of releases of hazardous substances [43 C.F.R. § 11.62]; and,

2. ***Injury quantification.*** The injuries determined by the Trustees will be quantified in terms of changes from "baseline conditions" [43 C.F.R. § 11.71(b)(2)].

> Quantification will address both the spatial and temporal extent of injury, as well as evaluation of the degree of injury. Quantification will be conducted primarily to provide information that is relevant to the damage determination and to restoration planning.

Natural resources under the trusteeship of the Trustees that have been potentially injured by releases of PCBs at and from the Facility include, but are not necessarily limited to: freshwater fish; freshwater mussels; mammals, amphibians, and reptiles; migratory birds, including waterfowl, raptors, and others; threatened and/or endangered species; lands, including wetlands, floodplain, and in-stream soils and sediments; aquatic and terrestrial plants, invertebrates, and microorganisms; surface waters, including sediment and pore water; and, groundwater. The Stage I Assessment will address all or a subset of these natural resources, depending on the availability of requisite data and information. If the evaluation of existing data indicates that additional natural resources are injured, these injuries may also be addressed in the injury assessment.

Natural resources and the ecological services they provide are interdependent. For example, surface water, bed, bank, and suspended sediments, floodplain soils, and riparian vegetation together provide habitat (including lateral and longitudinal connectivity between habitats) for aquatic biota, semi-aquatic biota, and upland biota dependent on access to the river or riparian zone. Hence, injuries to individual natural resources may cause ecosystem-level service reductions. Overall, it is the entire Site ecosystem and associated ecosystem services that may be injured as a result of the releases of hazardous substances. While this Stage I Assessment will be conducted on a resource-by-resource basis, the evaluation of injury, and service losses, and the associated damages, must include an evaluation of ecosystem-wide effects (see Chapter 7 for further information).

6.2 Data Sources

This Section describes the sources of data and information that may be used in the Stage I injury assessment.

6.2.1 Available Data

The Trustees will gather and analyze available data and information relevant to assessing injuries resulting from PCB and other COPCs released at and from the Site. Data sources that will be evaluated in the Stage I Injury Assessment include:

- Articles published in the peer-reviewed literature;
- State and federal government data and reports; and,
- Industry data and reports.

Ongoing studies or soon-to-be-initiated studies may also produce data relevant to the Stage I Assessment. For example, in a reconnaissance study, the U.S.Geological Survey Columbia Environmental Research Center (USGS-CERC) defined similar patterns of PCB congeners in sediment samples collected at locations from the 11th Street ditch downstream to Lay Lake (Echols and Orazio 2005), suggesting that PCBs from the Anniston PCB manufacturing site have moved downstream at least as far as Lay Lake. The Trustees will monitor relevant studies being conducted by these and other researchers and, if appropriate, participate in the studies to the extent necessary to ensure the data can be used for the NRDA injury assessment.

Data sources will be screened to verify that supporting documentation is available and sufficient to allow for an evaluation of the reliability of the information. Data sources will be evaluated for the following types of supporting documentation:

- Sampling methodology, including information on sample location, environmental media sampled, and measurement units;
- Chemical analysis, including information on specific analytes, detection limits, and analytical methodology;
- Raw data or data tabulations (e.g., rather than data summaries or figures only); and,
- Accompanying quality assurance/quality control (QA/QC) data, separate QA/QC reports, or summaries of QA/QC results (i.e., to support evaluations of accuracy and precision).

This supporting documentation will be evaluated for each potential data source, and data considered acceptable for the Stage I Assessment will be compiled for analysis. The development of databases (i.e., data entry and validation) and subsequent data analysis (statistical analysis, generation of figures) will be conducted following QA/QC protocols. Steps to ensure data quality will include verification of all data entered into the databases (to eliminate data entry errors; i.e., 100% data verification), review of all calculations performed on the data (including verification of all mathematical equations), and compilation and review of computer logs to track database changes and modifications. Database auditing will also be conducted to identify potentially erroneous values and verify data.

6.2.2 Data Collected Under the Remedial Investigation

As indicated in Section 2.3, a remedial investigation is currently being conducted at the Anniston PCB Site. The Trustees are participating in the RI, including evaluating data quality in the design and implementation of associated investigations. It is anticipated that much of the information collected during the RI will also support the NRDA.

6.3 Pathway Evaluation

As part of the injury determination phase of the Stage I Assessment, a pathway evaluation will be conducted [43 CFR § 11.63]. Natural resources, either singly or in combination with other media, can serve as exposure pathways. For example, the re-suspension of PCB-contaminated sediment can result in exposure of surface water resources, floodplain soil resources, sediment resources, and biota in downstream areas. According to DOI regulations, "the pathway may be determined by either demonstrating the presence of the . . . hazardous substances in sufficient concentrations in the pathway resource or by using a model that demonstrates that the conditions existed . . . such that the route served as a pathway" [43 CFR § 11.63(a)(2)].

The Stage I pathway evaluation will focus on evaluating the extent to which various natural resources are a route of exposure to hazardous substances for other natural resources within the Site. This evaluation will be based on:

- Available information on releases of hazardous substances in the Site, including from PRP facilities and from other sources;
- Spatial and temporal trends of hazardous substance concentrations in natural resources, including surface water and sediment, groundwater, floodplain soils, and biota;
- PCB congener patterns in water, sediment, floodplain soils; and biological tissues;
- PCB fate and transport models (if available); and,
- The distribution of biological resources in the vicinity of the Site.

The Trustees will also evaluate the baseline problem formulation and associated conceptual site model that are being prepared as part of the RI for information useful to the pathway evaluation.

6.4 Injury Determination and Quantification

6.4.1 Surface Water Resources

6.4.1.1 Surface Water

Surface water resources are defined in the DOI Regulations as including both surface water and sediment suspended in water or lying on the bank, bed, or shoreline [43 C.F.R. § 11.14(pp)]. Surface water and sediment are discussed separately here.

Ecosystem services provided by surface water include habitat for migratory birds, fish, macroinvertebrates, and other aquatic, semi-aquatic, and amphibious animals; water, nutrients, and sediment transport to riparian vegetation; nutrient cycling; geochemical exchange processes; primary and secondary productivity and transport of energy (food) to downstream and down-gradient organisms; growth media for aquatic and wetland plants; and, migration corridors.

Human use services provided by surface water include drinking water; swimming; boating; industrial water supply; other water-based recreation; and, assimilative capacity (i.e., the ability of a resource to absorb low levels of contaminants without exceeding standards or without effects).

Surface Water Injury in the DOI Regulations

The DOI Regulations define injury to surface water resources in a number of ways:

- Concentrations and duration of substances in excess of drinking water standards as established by Sections 1411-1416 of the Safe Drinking Water Act (SDWA), or by other federal or state laws or regulations that establish such standards for drinking water, in surface water that was potable before the release [43 C.F.R. § 11.62(b)(1)(i)];

- Concentrations and duration of substances in excess of applicable water quality criteria established by Section 304(a)(1) of the CWA, or by other federal or state laws or regulations that establish such criteria, in surface water that, before the release, met the criteria and is a committed use as habitat for aquatic life, water supply, or recreation [43 C.F.R. § 11.62(b)(1)(iii)]; and,

- Concentrations and duration of substances sufficient to have caused injury to groundwater, air, geologic, or biological resources, when exposed to surface water; suspended sediments; or bed, bank, or shoreline sediments [43 C.F.R. § 11.62(b)(1)(v)].

Surface Water Injury Determination Approach

Table 1 provides examples of specific regulatory criteria and standards for PCBs that may be used to evaluate injury to surface waters, as defined in 43 C.F.R. § 11.62(b)(1)(i), (iii) and (v). Criteria include levels of PCB concentrations established to protect drinking water supplies, aquatic life, wildlife, and human health. For example, the Safe Drinking Water Act provides criteria for allowable concentrations of hazardous substances in drinking water (Table 1). These and other relevant threshold concentrations may be compared to measurements of hazardous substances in surface water and used to evaluate injury. Water quality criteria for other COPCs may also be compiled as part of the Stage I Assessment.

Each of the criteria for determining injury to surface water resources consists of several components. Table 2 summarizes the components of each definition and the conceptual approach proposed by the Trustees to assess each component.

Table 1
Surface water quality standards or criteria (ppb) established for total PCBs ([a]EPA 1995; [b]EPA 1999; and, [c]ADEM 2005).

Source	Standard or Criterion (ppb)
Safe Drinking Water Act Maximum Contaminant Level [40 C.F.R. § 141]	0.5
Safe Drinking Water Act Maximum Contaminant Level Goal[a]	0
EPA Ambient Water Quality Criterion	0.014
National Toxics Rule [40 C.F.R. § 131]	0.00017 (Human Cancer Risk) 0.014 (Aquatic Life)
Alabama Water Quality Criteria [335-6-10[c]]	0.014

Table 2
Components of relevant surface water injury definitions.

Injury definition	Definition components	Evaluation approach
Water quality exceedences [43 C.F.R. § 11.62(b)(1)(iii)]	Surface waters are a committed use as aquatic life habitat, water supply, or recreation.	Determine whether assessment area water bodies have committed uses.
	Concentrations and duration of hazardous substances are in excess of applicable water quality criteria.	Perform temporal and spatial comparisons of surface water concentrations to State and Federal water quality criteria/standards.
	Criteria were not exceeded before release	Identify pre-release conditions, as available. Data from a suitable reference site will be used in the assessment if historic data for the Site are not available.
Drinking water standards exceedences [43 CPR § 11.62 (b)(1)(i)]	Concentrations and duration of hazardous substances are in excess of applicable drinking water standards.	Perform temporal and spatial comparisons of surface water concentrations to State and Federal standards.
	Water was potable before release.	Identify pre-release conditions.
Biological resources injured when exposed to surface Water and/or sediment [43 C.F.R. § 11.62(b)(1)(v)]	Biological resources are injured when exposed to surface water and/or sediment.	Determine whether biological resources have been injured as a result of exposure to surface water and/or sediment. COPCs in surface water will also be compared to chromic toxicity thresholds for fish and other aquatic organisms.

6.4.1.2 Sediment

Ecosystem services provided by sediment include habitat for benthic, epibenthic and other biological resources dependent on the aquatic habitats in the Assessment Area. In addition, sediment contributes to services provided by surface water, including suspended sediment transport processes, cover for fish and their supporting ecosystems, primary and secondary productivity, geochemical exchange processes, and nutrient cycling and transport.

Sediment Injury in the DOI Regulations

The DOI Regulations that define injuries to sediment resources include the following:

- Concentrations of hazardous substances sufficient to cause injury to biological or surface water resources that are exposed to sediment [43 C.F.R. § 11.62(b)(1)(v); 11.62(e)(11)].

Sediment Injury Determination Approach

Hazardous substances in sediment can cause injury to biological resources through direct toxicity to sediment-dwelling benthic macroinvertebrates or sediment-dwelling fish and through indirect effects such as food-chain bioaccumulation to higher trophic level organisms. Hazardous substances in sediment can also cause injury to surface water resources exposed to the sediment. Table 3 summarizes the components of each definition and the approach that will be evaluated by the Trustees to assess injuries to sediments.

Sediment Injury to Benthic Macroinvertebrates

To evaluate the potential for hazardous substances in sediment to cause toxicity to benthic macroinvertebrates, several different regulatory agencies or research groups have developed sediment effects concentrations (SECs). SECs provide a means of evaluating the potential for contaminated sediment to cause toxicity to sediment-dwelling aquatic biota. Among others, SECs have been developed by the Ontario Ministry of the Environment Guidelines for the Protection and Management of Aquatic Sediment (Persaud *et al*. 1993); EPA ARCS Program Sediment Effects Concentrations (Ingersoll *et al*. 1996; EPA 1996); NOAA Effects Ranges (Long and Morgan 1991); Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (Smith *et al*. 1996); and, Interim Criteria for Quality Assessment of St. Lawrence River sediment (Environment Canada 1992).

These SECs are empirically based, relying on levels of sediment contamination and effects to invertebrates. However, the SECs differ in the underlying databases used, the statistical approaches employed to derive SECs from the databases, and the interpretations of the results of the statistical approaches.

MacDonald *et al.* (2000a; 2000b) developed "consensus-based" SECs for PCBs based on existing SECs developed by the different agencies and researchers. The consensus-based SECs were derived by estimating the central tendency of existing SECs, thereby "reconciling sediment-quality guidelines that have been developed using the various empirically based approaches" (MacDonald *et al*. 2000a; 2000b). MacDonald *et al*. (2000a; 2000b) developed three different levels of SECs for PCBs: a threshold effect concentration (TEC) of 0.04 ppm, the concentration below which adverse effects are unlikely; a mid-range effect (MEC) concentration of 0.676 ppm, the concentration above which adverse effects are frequently observed; and a probable effect concentration (PEC) of 1.7 ppm, the concentration above which adverse effects are usually or always observed. Consensus-based SECs have also been derived for other COPCs that may occur in sediments at the Site. The Trustees will also consider the presence of COPC concentrations in excess of selected toxicity thresholds in the determination of injury to sediment-dwelling organisms.

Sediment Injury to Higher Trophic Level Organisms

In addition to causing injury to benthic and epibenthic macroinvertebrates, hazardous substances in sediment can also cause injury to higher trophic level organisms through bioaccumulation in the food chain. No sediment quality guidelines are available for predicting injuries through the food chain exposure route. However, sediment effect thresholds for PCBs have been developed based on various models, including biota sediment accumulation factors, thermodynamic equilibrium models, bioconcentration models, and food chain multiplier models (Wisconsin Department of Natural Resources (DNR) 1993). For example, sediment PCB threshold concentrations sufficient to cause PCB concentrations in whole fish that could result in injury to piscivorous birds and mammals have been modeled to range from 0.0009 to 0.082 ppm (Wisconsin DNR 1993). New York State Department of Environmental Conservation (NYSDEC) (1999) recommended a sediment quality criterion of 1.4 mg/kg Organic Carbon (OC) to protect piscivorous wildlife.

Models that predict exposure to higher trophic levels based on sediment hazardous substance concentrations may be evaluated to determine the potential injury to higher trophic level organisms. In general, PCB food chain effects are predicted to occur at sediment concentrations lower than those causing direct toxicity to benthic macroinvertebrates (Wisconsin DNR 1993). Thus, measured concentrations of PCBs and other COPCs will also be compared to published sediment quality guidelines or criteria to assess sediment injury.

Sediment Injury to Surface Water Resources

Surface water may also be injured based on exposure to contaminated sediment, as contaminants can migrate from sediment to surface water. Injury to surface water occurs when sediment concentrations are sufficient to cause exceedances of relevant surface water quality criteria. For example, based on equilibrium partitioning models, a threshold sediment concentration of between 0.070 and 0.554 ppm is predicted to cause surface water PCB concentrations to exceed the 0.014 ppb EPA chronic Ambient Water Quality Criteria (AWQC; Wisconsin DNR 1993). Another possible modeling approach is to develop and use measured site-specific sediment-to-water concentration ratios. Depending on the quality and quantity of the existing sediment and surface water data, this approach may be pursued.

Table 3
Components of relevant sediment injury definitions.

Injury definition	Definition components	Evaluation approach
Biological resources injured when exposed to sediment [43 C.F.R. § 11.62(b)(1)(v) and 11.62(e)(11)]].	Biological resources are injured when exposed to sediment.	Compare sediment concentrations to consensus-based sediment-effect concentrations developed by MacDonald *et al*. (2000a; 2000b).
	Higher trophic level organisms are injured when exposed to sediment based on bioaccumulation from the food chain.	Compare sediment concentrations to thresholds for causing injury via Bioaccumulation (e.g., NYSDEC 1999).
Surface water resources injured when exposed to sediment [43 C.F.R. § 11.62(b)(1)(v) and 11.62(e)(11)]].	Surface water resources are injured when exposed to sediment.	Compare sediment concentrations to thresholds for causing exceedences of surface water quality standards or criteria.

6.4.2 Groundwater Resources

Ecosystem services provided by groundwater include supporting habitat for terrestrial and aquatic vegetation and recharge services for surface water resources and their supporting ecosystems. Human use services include drinking water and assimilative capacity.

Groundwater Injury in the DOI Regulations

The DOI Regulations define injury to groundwater resources to include the following:

- Exceedences of drinking water standards, established by sections 1411-1416 of the SDWA, or by other Federal or State laws or regulations that establish such standards for drinking water, in groundwater that was potable before the release [43 C.F.R. § 11.62(c)(i)];

- Exceedences of Applicable Water Quality Criteria (AWQC) established by section 304(a)(1) of the CWA, or by other Federal or State laws or regulations that establish such criteria for domestic water supplies, in groundwater that before the release met the criteria and is a committed use as a domestic water supply [43 C.F.R. § 11.62(c)(iii)]; and,

- Concentrations of hazardous substances in groundwater sufficient to have caused injury to surface water, air, geologic, or biological resources, when exposed to groundwater [43 C.F.R. § 11.62(c)(iv)].

Groundwater Injury Determination Approach

Groundwater injury will be evaluated by comparing hazardous substance concentrations to appropriate criteria or standards. For example, the Maximum Contaminant Level (MCL) established under Section 1416 of the Safe Drinking Water Act (SDWA) for PCBs in drinking water is 0.5 ppb (http://www.epa.gov/safewater/contaminants/basicinformation/polychlorinated-biphenyls.html). In addition, the EPA (1995) lists PCBs as a class B2 probable carcinogen and has established a Maximum Contaminant Level Goal (MCLG) of 0 ppb for PCBs in groundwater. The State of Alabama has also set a 0.014 ppb for PCB water quality for each of seven specific PCB mixtures but has not adopted a water quality criterion for total PCBs (ADEM 2008).

Groundwater injuries will be evaluated using an approach similar to that described for surface water resources. The evaluation may include identification of committed uses and potability of groundwater resources, examination of concentrations and duration of hazardous substances in groundwater, and identification of exceedances of State or Federal drinking water standards and criteria. Depending on the quality and quantity of data available, concentrations of hazardous substance in groundwater will also be evaluated to determine the spatial extent of injuries, delineate vertical and horizontal distribution and movements of contaminant plumes, and determine if groundwater is or will be a significant pathway of exposure to other natural resources.

6.4.3 Geologic Resources

Geologic resources are defined in the DOI regulations 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” [43 C.F.R. § 11.14(s)]. Geological resources in the Site include floodplain and terrestrial soils.

Ecosystem services provided by floodplain soils include habitat for all biological resources that are dependent on riparian or floodplain wetland habitats in the basin. More specifically, floodplain soils provide habitat for migratory birds and mammals; habitat for soil biota; growth media and nutrients for plants; carbon storage, nitrogen fixation, decomposition, and nutrient cycling; soil organic matter and allocthonous energy to streams; hydrograph moderation; and geochemical exchange processes. Human use services include recreation (hiking, picnicking) and access corridors.

Geologic Injury in the DOI Regulations

The DOI Regulations define injury to geologic resources to include the following:

- Concentrations sufficient to injure other resources, including terrestrial organisms and vegetation (via toxicity), groundwater, and wildlife [43 C.F.R. 11.62(e)].

Geological Resource Injury Determination Approach

There are no specific numeric criteria for determining when soil hazardous substance concentrations are sufficient to cause injury to exposed biological resources. The uptake, assimilation, transfer, and toxicity of soil contaminants can vary greatly from system to system. As part of the RI/FS ecological risk assessment for the Kalamazoo River Environment, a site-specific PCB soil uptake and bioaccumulation model was developed based on estimated species-specific dietary PCB no-observed-adverse-effect concentrations for songbirds, small terrestrial mammals, carnivorous mammals, and carnivorous birds (CDM 2003). If developed for the Anniston PCB Site, this model, as well as any alternative models potentially available during the course of the Stage I Assessment, may be used to estimate soil PCB concentrations sufficient to cause injury to biota exposed to the soil.

In addition, the DOI (as cited in EPA 1990) has recommended that soil levels of PCBs not exceed 1.0 ppm for the protection of wildlife (Table 4). While not specified in the DOI regulations for conducting NRDAs, the 1.0 ppm DOI guideline may be used to evaluate potential injuries and the potential for floodplain soils to act as a pathway for injury to biota.

A preliminary remediation goal (PRG) for soil of 0.371 ppm PCBs has been established for protection of wildlife for use in risk assessments and decision-making at CERCLA sites (Table 4; Efroymson *et al*. 1997). The preliminary remediation goal of 0.371 ppm may also be used to evaluate potential injuries and the potential for floodplain soils to act as a pathway for injury to biota.

Table 4
Toxicological benchmarks: PCB soil threshold concentrations for protection of wildlife.

Soil PCB concentration	Protection endpoint	Reference
0.371 ppm	Lowest value of PRGs developed for wildlife, plants, and soil.	Efroymson *et aI*. 1997
1.0 ppm	Protection of wildlife	DOl (as cited in EPA 1990)
8.1 ppm	Protection of songbirds (robin)	CDM 2003
8.3 ppm	Protection of non-piscivorous raptors (owl)	CDM 2003
29.5 ppm	Protection of carnivorous mammals (fox)	CDM 2003
63 ppm	Protection of small terrestrial mammals (mouse)	CDM 2003

6.4.4 Biological Resources

Biological resources are defined in the DOI regulations as “those natural resources referred to in section 101(16) of CERCLA as fish and wildlife and other biota. Fish and wildlife include marine and freshwater aquatic and terrestrial species; game, non-game, 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” [43 C.F.R. § 11.14(f)].

The Coosa River System and its tributaries support a diverse warm water fishery. The fisheries resources below Logan Martin Dam to Lay Dam include the coldwater darter (*Etheostoma ditrema*), river redhorse (*Moxostoma carinatum*), southern walleye (*Stizostedium vitreum)*, smallmouth buffalo (*Ictiobus bubalus*), and freshwater drum (*Aplodinotus grunniens*), and striped bass (*Morone saxatilis*; Mettee *et al*. 1996; Boschung and Mayden 2004). Other fish species that occur in the assessment area include black basses, crappie, catfish, and sunfishes (Dan Catchings, ADCNR pers. comm..). The fisheries resources above Logan Martin Dam include the coldwater darter, holiday darter (*Etheostoma brevirostrum*), pygmy sculpin (C*ottus paulus*), southern walleye (*Stizostedium vitreum*), smallmouth buffalo, freshwater drum, blue shiner (C*yprinella caerulea*), and striped bass (Mettee *et al*. 1996; Boschung and Mayden 2004; Pierson 1998). Other freshwater species of sportfishing interest that inhabit this reach include black bass, crappie, catfish, and sunfishes (ADCNR, pers. comm.). Since the 1970’s, ADCNR has regularly stocked hybrid, striped, and Florida bass (*Micropterus* *salmoides floridanus)* in Logan Martin Lake to enhance recreational fishing. A commercial catfish fishery also exists on Lake Logan Martin.

The majority of the Coosa River System downstream of the City of Anniston is relatively undeveloped. Riparian wetlands and floodplains are abundant and provide ample wildlife habitat for numerous wildlife species. Sections of the Coosa River System and its tributaries, including the St. Claire Community Wildlife Management Area, the Talladega National Forest, and the Mountain Longleaf National Refuge are reserved and managed specifically for wildlife resources. Wildlife known to inhabit the area include a variety of mammalian and avian species. Mammals such as red fox (*Vulpes fulva*), raccoon (*Procyon lotor*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), white-tailed deer (*Odocoileus virginianus*), river otter (*Lutra canadensis*), rabbit (*Sylvilagus floridanus*), house mice (*Mus musculus*), fox squirrel (*Sciurus niger*), and gray squirrel (*S. carolinsis*) can be found in the area. Resident and migratory birds utilizing habitats in this area include bald eagle (*Haliaeetus leucocephalus*), great blue heron (*Ardea herodias*), great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), American robin (*Turdus migratorius*), American woodcock (*Scolopax minor*), and ducks (Imhof 1976; Mount 1984).

Ecosystem services provided by fish and aquatic organisms, birds, and wildlife include prey for fish, carnivorous and omnivorous wildlife, and nutrient and energy cycling. Human use services provided by biological resources include various types of recreation (fishing, hunting, bird watching) and food.

Biological Resources Injury in the DOI Regulations

The DOI Regulations define injury to biological resources to include the following:

- Concentrations of a hazardous substance sufficient to exceed action or tolerance levels established under section 402 of the Food, Drug and Cosmetic Act, 21 U.S.C. 342, in edible portions of organisms [43 C.F.R. § 11.62(f)(1)(ii)];

- Concentrations of a hazardous substance sufficient to exceed levels for which an appropriate State health agency has issued directives to limit or ban consumption of such organism [43 C.F.R. § 11.62(f)(1)(iii)]; and,

- Concentrations of a hazardous substance sufficient to cause the biological resource or its offspring to have undergone at least one of the following adverse changes in viability: death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations [43 C.F.R. § 11.62(f)(1)(i)].

An injury to biological resources can be demonstrated, per the DOI Regulations, if an adverse biological response meets the following acceptance criteria [43 C.F.R. § 11.62 (f)(2)(i-iv)]:

- The biological response is often the result of exposure to . . . [the] hazardous substances;
- Exposure to . . . [the] hazardous substances is known to cause this biological response in free-ranging organisms;
- Exposure to . . . [the] hazardous substances is known to cause this biological response in controlled experiments; and,
- The biological response measurement is practical to perform and produces scientifically valid results.

Biological Resources Injury Determination Approach

The injury definitions identified for biological resources consist of several components. Table 5 summarizes the components of each definition and the conceptual approaches that will be used by the Trustees in assessing each component.

Approaches for evaluating exceedences of action or tolerance levels, state consumption advisories, and biological injuries to fish and wildlife are described below.

Table 5. Components of relevant biological resources injury definitions.

Injury definition	Definition components	Evaluation approach
Food, Drug, and Cosmetic Act exceedences [43 CPR § 11.62(f)(1)(ii)]	Tissue concentrations of a hazardous substance in edible portions of organisms exceed applicable standards.	Compare organism tissue concentrations to applicable Food and Drug Administration (FDA) tolerances.
Consumption advisory exceedences [43 CPR § 11.62(f)(1)(iii)]	Tissue concentrations of a hazardous substance exceed levels for which a state has issued directives to limit or ban consumption.	Compile fish and bird consumption advisories and relate to concentrations of hazardous substances.
Adverse changes in viability [43 CPR § 11.62(f)(1)(i)]	The biological resource or its offspring has undergone adverse changes in viability.	Review site-specific field and laboratory studies on adverse effects; compare Site exposure data to toxicological data; evaluate causality.

Exceedences of Action or Tolerance Levels

Regulations promulgated pursuant to the federal Food, Drug, and Cosmetics Act (Section 402, 21 U.S.C. 342) and fish consumption guidelines established by the Alabama Department of Public Health, set an action or tolerance level of 2 ppm total PCBs in edible portions of fish tissue. The EPA recommends limited consumption for chronic health endpoint at concentrations as low as 0.006 ppm PCB and no consumption at levels as low as 0.2 ppm (EPA 1997). EPA consumption advisories based on cancer risk are substantially lower with limited consumption recommended at PCB concentrations as low as 0.00004 ppm and no consumption at levels as low as 0.002 ppm. Such consumption guidelines have also been promulgated for certain other COPCs that may be included in the NRDA.

To evaluate the potential injury to fish and wildlife in the Site based on exceedences of action or tolerance levels, the Trustees will compare the appropriate federal and state action or tolerance level to fish fillets of recreational fish species and to edible portions of wildlife hunted recreationally.

Consumption Advisories

The State of Alabama has issued fish consumption advisories for Choccolocco Creek and the Coosa River. These fish consumption advisories either limit consumption or recommend no consumption for specific species of fish found in sections of the creek or river. The limited consumption advisory is more restrictive for women of childbearing age and children under 15 and recommends two meals per month of the particular species for the general population. To evaluate consumption advisories for fish in the Site, the Trustees will gather and analyze available information on consumption advisories for all relevant time periods, and evaluate the State's procedures for establishing the advisories.

Biological Injuries

Biological injuries include those injuries that adversely affect the viability of aquatic and terrestrial biota [43 C.F.R. § 11.62(f)(1)(i)]. Biological injuries to aquatic biota may be assessed in aquatic invertebrates, fish, reptiles, amphibians, waterfowl, and aquatic or semi-aquatic mammals. The following injury categories may be assessed by the Trustees: death, disease, cancer, physiological malfunctions (including reproduction), developmental effects (reduced growth), and physical deformities. PCBs have been documented to cause these types of adverse effects in fish and wildlife (e.g., Eisler 1986; Peterson *et al*.; 1993; Safe 1994). Exposure to other COPCs have also been shown to cause these types of adverse effects (MacDonald *et al*. 2002).

Site-specific data on adverse effects to biological resources will be compiled and reviewed. In addition, Site data (or models, if appropriate) on the exposure of biota to PCBs will be compared to toxicity reference values obtained from the literature.

Table 6 provides an overview of the lines of evidence that will be used to assess injury to surface water and biological resources.

Table 6. Summary of lines of evidence that will be used to assess injury to natural resources.

Natural Resource/Receptor	Surface Water				Biological Resources			
Line of Evidence	**Benthos**	**Fish**	**Birds**	**Mammals**	**Benthos**	**Fish**	**Birds**	**Mammals**
Surface-water chemistry	x	x	x	x				
Whole-sediment chemistry	x	x	x	x	x			
Whole-sediment toxicity	X				x			
Invertebrate-tissue chemistry					x		x	x
Fish-tissue chemistry						x	x	x
Bird-Egg Chemistry							x	

6.5 Procedures for Sharing Data

The DOI Regulations state that an assessment plan should include procedures and schedules for sharing data, split samples, and results of analyses, when requested, with any identified potentially responsible parties and other natural resource Trustees [43 C.F.R. § 11.31(a)(4)].

To facilitate the data-sharing process, PRPs and other state or federal agencies will be provided with an opportunity, as deemed appropriate, to obtain a copy of the data collected, analyzed, and used in the Stage I Assessment. If PRPs or state or federal agencies wish to receive such data, a written request identifying the data desired should be submitted to:

U.S. Fish and Wildlife Service
Attn: Karen Marlowe
Propst Hall, Room 229
800 Lakeshore Drive
Birmingham, AL 35229-2234

The Trustees will provide the data to the PRPs and any other interested parties once the data have been validated and deemed suitable for distribution. In addition, the Trustees will explore opportunities to split samples with the PRPs in order to assure data quality and/or enhance data usability.

7. Stage I Damage Determination

This chapter describes the Trustees' approach for conducting the Stage I damage determination. Section 7.1 provides an overview of the approach to be used by the Trustees in the Stage I Assessment. Section 7.2 describes the approach for the Stage I restoration planning and costing, and Section 7.3 describes the approach for the Stage I determination of compensable values. Section 7.4 describes the relationship between the NRDA damage determination and the response actions being conducted as part of the ongoing RI/FS.

7.1 Overview of Approach to Damage Determination

The purpose of a damage determination is to "establish the amount of money to be sought in compensation for injuries to natural resources resulting from a . . . release of a hazardous substance" [43 C.F.R. § 11.80(b)]. The DOI regulations define the measure of damages as *restoration costs* plus *compensable values for interim losses* [43 C.F.R. § 11.80(b)]. Restoration costs are the costs of restoration actions that restore the injured resources and services to baseline, which is the condition that would have existed had the hazardous substance release(s) not occurred [43 C.F.R. §11.14(e)].

Natural resource services are defined as the "physical and biological functions performed by the resource, including the human uses of those functions" [43 C.F.R. § 11.14(nn)]. Restoration actions include actions to restore, rehabilitate, replace, or acquire the equivalent of the injured resources and services they provide. Compensable values for interim losses include both past losses and losses that will occur until the injured resources and services are returned to baseline. Thus, the total amount of NRDA damages includes both the cost of restoration to baseline and the compensable values for interim losses. All recovered damages will be used by the Trustees for restoration of natural resources and natural resource services.

7.2 Restoration Planning

As discussed above, EPA is currently conducting an RI/FS at various parts of the Site. During that process, data will be gathered and analyzed that will help define the type, scope, and location of contamination throughout the Assessment Area. Until those efforts – together with any additional data-gathering or studies by the Trustees – have been completed, it will not be possible to develop a comprehensive strategy to restore the natural resources that have been injured. Nonetheless, this Stage I restoration planning effort will help identify the types and amount of preferred restoration actions and to estimate the costs of their implementation. Currently, the Trustees anticipate considering two general types of restoration actions: sediment/soil restoration and ecosystem-based restoration.

- ***Sediment/soil restoration***. To the extent that on-site actions, including extraction or containment of contaminated sediment and soils, are necessary to accelerate the return of injured resources and services to baseline, the Trustees will evaluate such actions as potential restoration actions; and,
- ***Ecosystem-based restoration***. Ecosystem-based restoration actions can restore resources and/or services that are similar to, but not the same as, those that are injured. Examples of such restoration actions could include habitat restoration or enhancement, stocking programs, species management programs, or improvements in the public's ability to use or enjoy resources.

The Stage I restoration planning effort will identify specific types of potential restoration actions (within the two general types listed above) and estimate the costs of their implementation.

7.2.1 Sediment/Soil Restoration

To the extent that PCBs are causing injuries to natural resources, eliminating or reducing exposure of the injured resources to PCBs will be considered by the Trustees, where appropriate, as part of the restoration plan. Actions to extract or contain contamination, such as sediment dredging or capping, soil removal or capping, or riverbank stabilization, will be evaluated by the Trustees as a part of the overall restoration approach.

7.2.2 Ecosystem-Based Restoration

A second type of restoration action that the Trustees will consider is ecosystem-based restoration. The DOI's NRDA regulations emphasize the restoration of natural resources to baseline, as measured by their services. Services are defined as:

> The physical and biological functions performed by the resource. . . . These services are the result of the physical, chemical, or biological quality of the resource [43 C.F.R. §11.14(nn)].

The DOI regulations also state that:

> Services include provision of habitat, food and other needs of biological resources . . . flood control, ground water recharge, waste assimilation, and other such functions that may be provided by natural resources [43 C.F.R. §11.71(e)].

At the Site, the services provided by different components of the ecosystem are inextricably linked to each other. For example, floodplain soils, floodplain vegetation, and river geomorphology interact to:

- Stabilize streambanks through anchoring of the soil by plant root structures, dissipate erosive stream energy, and maintain channel geometry;

- Control surface water/groundwater exchange rates and influence areas of groundwater discharge or recharge;
- Control sediment delivery rates to downstream aquatic and riparian resources;
- Serve as an important carbon source for the river ecosystem and provide a growth medium for plants and substrate for nutrient cycling and decomposition; and,
- Provide key habitat for vegetation, fish, amphibians, reptiles, and also resident birds and mammals;
- Provide cover and food for fish and benthic invertebrates, shade the water from solar radiation, contribute to aquatic physical habitat complexity through addition of large woody debris and root masses, and regulate the supply of nutrients to the aquatic ecosystem; and/or,
- Provide critical connectivity among upland and aquatic habitats and a corridor for upstream and downstream dispersal for plant and animal species.

Because the various natural resources are so intimately linked, an ecosystem-based approach toward restoration planning is necessary to accomplish full restoration. Further, considering these interdependencies will allow restoration actions to fully compensate the Trustees for the lost resource services in a cost-effective manner.

An ecosystem-based approach to restoration at the Site has several implications for the restoration planning process. First, the approach requires consideration of multiple types of restoration actions to address services lost as a result of the injury, loss, or destruction of natural resources. Hazardous substances released into the Site are one of several ecological stressors on the system. Other stressors, such as habitat loss or degradation, alterations in natural hydrologic processes, and non-point source pollution can also result in loss of resources or services similar to the losses caused by hazardous substance releases. Therefore, options to restore Site resources and services injured by hazardous substances may include restoration activities that address these other stressors. Such restoration activities could include preserving and/or restoring floodplain, wetland, or riverine habitat, restoring the natural river/creek flow patterns, or implementing best management practices in the Site Assessment Area to control non-point source runoff. Regardless of whether these conditions are a result of the release of hazardous substances, restoration actions of this type can provide an effective means to compensate the Trustees for services lost or impaired by the hazardous substance releases for which the PRPs are responsible.

Second, an ecosystem-based approach to restoration planning also necessitates evaluating the ecological service losses associated with remedial response actions. Some response actions may incur "collateral" injuries on ecological resources in the Site. To the extent possible, the Stage I restoration planning phase will evaluate and consider potential long-term ecological impacts of the response actions when determining the type and amount of restoration needed.

7.2.3 Restoration Planning Activities

Figure 7 depicts the Stage I restoration planning activities for the Site. First, the Trustees will develop restoration goals for the Site. Then, the Trustees will develop a list of potential restoration actions with input from the public and resource management agencies. The list will include a variety of types of projects that have the potential to restore the range of the Site resources and services. The Trustees will then develop criteria to evaluate the list of potential projects relative to their potential to contribute to achieving the restoration goals that are established. The criteria will be based on factors identified in the DOI NRDA regulations [43 C.F.R. § 11.82(d)], on Trustee agency priorities and mandates, and on an ecosystem-based perspective, as described above. The criteria include such factors as:

- ***Project acceptability:*** A project must comply with applicable laws and relevant policies;
- ***Project focus.*** The degree to which a project meets the goals and objectives of the Trustees for restoration of the Site is an important factor;
- ***Project feasibility.*** A project must be technically and administratively feasible and cost effective; and,
- ***Project benefits.*** The types, timing, and permanence of benefits provided by a project will be considered by the Trustees in the context of the types and timing of the resources and services lost and the ecosystem perspective toward restoration.

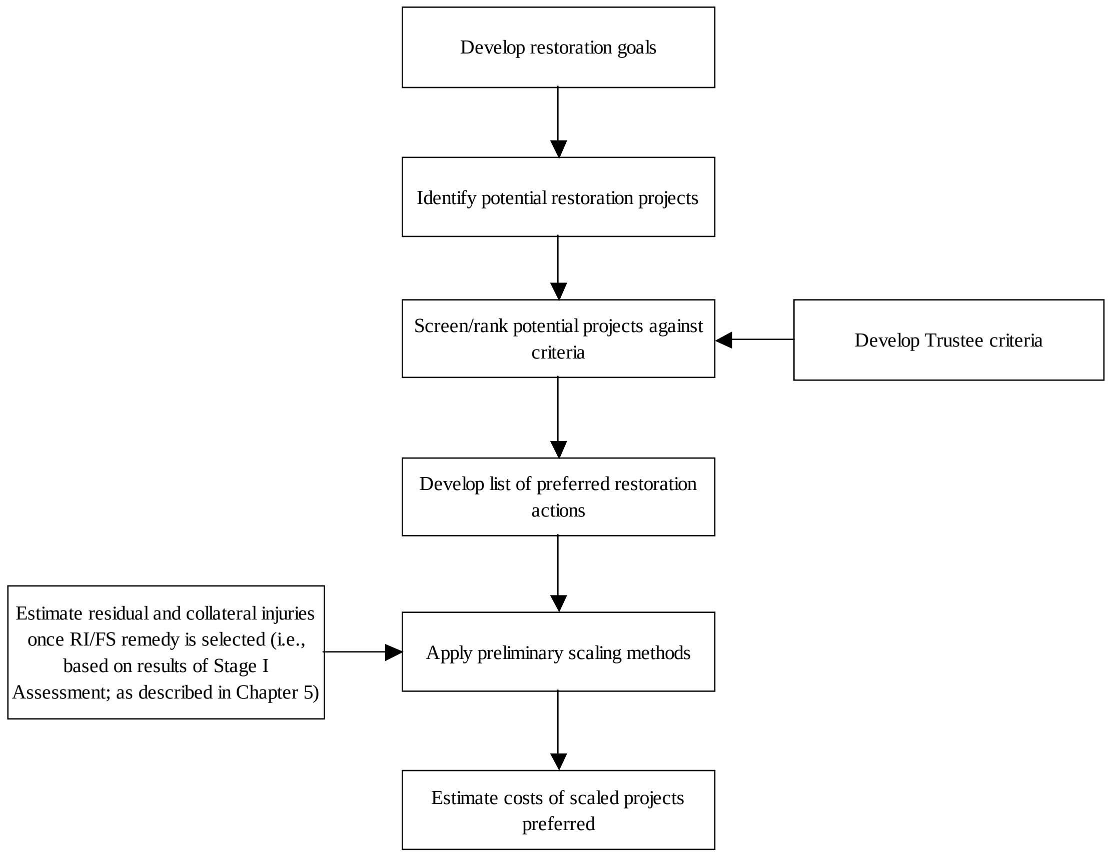

Figure 7. Process for identifying, selecting, and costing preferred restoration alternatives.

Without developing additional data on the extent and nature of contamination, it may be neither feasible nor practicable to create a short list of preferred restoration alternatives or classes of alternatives. Nonetheless, based on the available information, the Trustees anticipate developing a range of alternatives [43 C.F.R. § 11.82(c)] that may include actions such as habitat restoration or enhancement, resource acquisition, species management programs, or enhancements to human use or enjoyment of resources.

If appropriate, the range of preferred restoration alternatives will then be scaled using preliminary scaling techniques. Scaling is the process of determining the appropriate amount of restoration required. Since the appropriate methods for scaling depend on several factors, including the types and magnitude of injuries and service losses and the types of restoration projects being considered, the Trustees cannot at this time specify the scaling methods to be used in the Stage I Assessment. However, the methods (or combinations thereof) used for restoration project scaling will estimate the baseline level of services and the level of services generated by potential restoration actions.

As part of the Stage I restoration planning effort, the Trustees may conduct limited on-site interviews/meetings to obtain insight on public opinions about restoration strategies. The intent of these interviews/meetings will be to provide information for determining subsequent restoration directions. Interview/meeting responses will contain information about public preferences regarding different restoration options.

If adequate information is available for any of the restoration alternatives being considered, the Trustees may also develop cost estimates for implementing the preferred restoration projects. Cost estimates will include both direct and indirect costs of implementing the preferred alternatives [43 C.F.R. § 11.83(b)(1)]. Direct costs are those directly associated with the implementation of the restoration alternative, such as compensation of employees, cost of materials acquired, consumed, or expended specifically for the purpose of the action, equipment and other capital expenditures, and other items of expense expected to be incurred [43 C.F.R. § 11.83(b)(1)(i)]. Indirect costs include costs such as overhead [43 C.F.R. § 11.83(b)(1)(ii)]. The exact methods to be used to estimate costs depend on the nature of the preferred restoration alternatives [43 C.F.R. § 11.83(b)(2)]. The cost estimates will be used in the overall Stage I quantification of damages.

7.3 Compensable Value Determination

Compensable value is the amount of money required to compensate the public for loss in services provided by injured resources between the time of the release of the hazardous substance(s) and the time that resources are restored or replaced. Compensable value can be determined as an economic value or by utilizing a restoration cost approach [43.C.F.R. § 11.83(c)]. Where practicable, the Trustees will use existing information, supplemented by new site-specific data collection efforts, to assess compensable values for interim losses. If more technical and comprehensive analyses are required in order to make an accurate compensable value determination, the Trustees may choose to develop and consider those in the Stage II Assessment plan.

The Trustees will identify the types of service losses due to releases at or from the Site (e.g., recreational fishing, wildlife viewing or dredging). The Trustees will consider measuring service losses using a variety of methodologies, including unit value methodology. Unit value methodology involves estimating damages for the Site and its circumstances by using values derived from the application of primary economic research methods in other studies at the same or similar sites for the same or similar circumstances [43 C.F.R. § 11.83(c)(2)(vi)]. Using existing data for similar areas and similar types of services and resource injuries results in a cost-effective, first order estimate of damages.

In order to determine which, if any valuation studies would be useful, the Stage I Assessment will focus on results from studies in and around the Site and from studies investigating fish consumption advisories (FCAs). An extensive body of literature exists that estimates the value of services lost because of FCAs. This literature reports attitudes toward, and behavioral changes as a result of, FCAs.

The use of travel cost methods identified in the NRDA regulations, [43 C.F.R. § 11.83(c)(2)(iv)], may also be appropriate. Regional values produced by a travel cost model may be relevant in analyzing the results of other studies.

Finally, the Trustees will likely conduct interviews with residents who use, or choose not to use, the resources at the Site. The Trustees will gather a variety of information, including recreational trip records and avidity levels, substitution patterns, socioeconomic characteristics, awareness of and attitudes toward FCAs, preferences over different sites, and opinions about the water bodies of the Site.

If adequate data are available, sensitivity analysis may be used to address uncertainties in the benefits transfer assumptions [43 C.F.R. § 11.84(d)]. The quality and quantity of substitute sites will be given consideration [43 C.F.R. § 11.84(f)]. Measures to guard against double counting and recovery will be incorporated in combining different methods and approaches to estimate value [43 C.F.R. § 11.84(c)]. Finally, annual losses will be compounded and discounted to aggregate damages following the guidance in the regulations [43 C.F.R. § 11.84(e)].

7.4 Relationship to the RI/FS Process

A key feature of the relationship between the RI/FS process that leads to the selection of a clean-up remedy and the NRDA is that the NRDA damages are related to the timing, type, and amount of remediation selected. For example, if a no-action or a minimal remedy is selected, then the total amount of lost natural resource services that requires restoration actions will be larger, and the compensable value losses may be larger. Also, if the remedy itself results in a loss of resources or services, then additional restoration may be required to compensate the public for these losses.

Because of this relationship, information generated during the NRDA can be beneficial to the RI/FS, and vice versa. The Stage I Assessment is being timed to provide useful information to the remedial action decision-makers by evaluating both potential residual injuries (PCB-caused injuries remaining after the selected remedy is implemented) and collateral injuries (injuries resulting from the remedy itself) under different remedial alternatives. This information may help the decision-makers evaluate the overall protection of human health and the environment and the long-term effectiveness of different remedial alternatives. At the same time, the Stage I damage determination cannot be concluded without knowledge of, or at least accurate assumptions about, the remedy, since the type and magnitude of the remedy affects the type and magnitude of restoration that is required to make the public whole. Therefore, information generated during the RI/FS process will be useful to the Stage I Assessment. This exchange of information will help ensure meaningful and useful coordination between the RI/FS and the NRDA processes that will, it is hoped, result in a global resolution of remediation and restoration/compensation needs.

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Appendix A

Threatened and Endangered Species in the Anniston PCB Site

Mollusks[1] (snails and mussels)		
Lacy elimia snail	*Elimia crenatella*	Threatened
Painted rocksnail	*Leptoxis taeniata*	Endangered
Tulotoma snail	*Tulotoma magnifica*	Endangered
Coosa moccasinshell	*Medionidus parvulus*	Endangered
Southern pigtoe	*Pleurobema georgianum*	Endangered
Triangular kidneyshell	*Ptychobranchus greenii*	Endangered
Fine-lined pocketbook	*Hamiota (=Lampsilis) altilis*	Threatened
Fish[1]		
Blue shiner	*Cyprinella caerulea*	Threatened
Pygmy sculpin	*Cottus paulus*	Threatened
Birds		
Red-cockaded woodpecker	*Picoides borealis*	Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Threatened
Mammals		
Gray bat	*Myotis grisescens*	Endangered
Plants		
Tennessee yellow-eyed grass	*Xyris tennesseensis*	Endangered

[1]Fish and mollusk names follow nomenclature in Nelson *et al*. 2004 and Turgeon *et al.* 1998.

Appendix B

List of Chemicals of Potential Concern in the Site Assessment Area

Chemicals of Potential Concern in the Site Assessment Area (BBL 2003)

- Orthophosphate (OP) Pesticides
  - parathion;
  - methyl parathion;
  - tetraethyldithiopyrophosphate (Sulfotep)

- Volatile Organic Compounds (VOCs)
  - 1,2-dichlorobenzene
  - 1,4-dichlorobenzene
  - 2,4-dichlorophenol
  - 4-nitrophenol (PNP)
  - PCBs (Aroclors)
  - phenol
  - pentachlorophenol (PCP)
  - 2,4,5-trichlorophenol
  - 2,4,6-trichlorophenol
  - o,o,o-triethylphosphorothioate

- Metals
  - arsenic (As)
  - barium (Ba)
  - beryllium (Be)
  - cadmium (Cd)
  - chromium (Cr)
  - cobalt (Co)
  - lead (Pb)
  - manganese (Mn)
  - mercury (Hg)
  - nickel (Ni)
  - vanadium (V)