REPORT

SOLUTIA

Applied Chemistry, Creative Solutions

Off-Site RCRA Facility Investigation (RFI) Report

Solutia Inc.
Anniston, Alabama

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BBL
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Executive Summary

Purpose and Objectives

This report presents the findings of the Off-Site component of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) program for the Solutia Inc. (Solutia) facility in Anniston, Alabama. The studies, which were performed in accordance with the Off-Site RFI Work Plan (BBL, 1999), assessed the potential presence and significance of polychlorinated biphenyls (PCBs) in the Off-Site area. The Off-Site area is defined as the 100-year floodplain and in-stream portions of both Snow Creek downstream of the 11th Street Ditch, and Choccolocco Creek from the confluence with Snow Creek (including a small upstream backwater area at the confluence) to Lake Logan Martin, as well as the portion of Lake Logan Martin between Choccolocco Creek and Logan Martin Dam. This report focuses only on the in-stream portion of the study area. The floodplain areas will be evaluated separately.

The Off-Site investigation included the collection of sediment, surface water, biota, and habitat assessment data. These data were evaluated to refine the conceptual site model and to evaluate the significance of potential PCB exposure. Although the Off-Site RFI focused on PCBs, a subset of sediment samples was analyzed for 11 metals, and a subset of fish samples was analyzed for mercury.

Consistent with the Off-Site RFI Work Plan, the study addresses these objectives:

- Evaluate the nature and extent of PCBs within the in-stream portions of the study area;
- Predict the fate and transport of PCBs within the downstream portions;
- Assess the significance of potential PCB exposure to human and ecological receptors; and
- Support an assessment of potential corrective measures.

The report describes the nature and extent of PCBs in sediment and fish, as well as the potential movement of sediment-bound PCBs within the Off-Site areas. It evaluates the effects of natural attenuation in reducing the availability of PCBs to the Off-Site area ecosystems, and thereby updates the Off-Site Conceptual Model (OCM). The site-specific action levels developed in the Health and Environmental Assessment (HEA) are presented and evaluated in light of the updated (OCM) and the possible need to collect additional data.

Updated Off-Site Conceptual Model (OCM)

The data collected during the Off-Site RFI were used to update the OCS. This was done to refine our understanding of PCB distribution, exposure pathways, fate and transport within the Off-Site area. The updated OCM demonstrates the role of surficial sediment PCB concentrations in regulating PCB levels in fish and confirms the role of sediment deposition in facilitating natural recovery. These aspects of the conceptual model are further validated by the absence of PCBs in the surface sediments of the lake, the fact that the average PCB concentrations for bass and catfish are below the ADPH advisory level of 2 mg/kg, and the continued decline of PCB concentrations in fish with the passage of time. The fact that fish PCB concentrations in Lake Logan Martin are below this level is important since ingestion of fish is the primary exposure pathway for the lake.

The updated OCM also demonstrates that PCBs in Choccolocco Creek are limited to the upstream reaches and, in particular, the depositional backwater area, upstream of the Snow Creek confluence. Similarly, PCBs in Snow Creek are isolated to the upstream reach and depositional area near the confluence with Choccolocco Creek. The updated OCM also indicates that, while there is still some transport of PCB-containing sediments to Choccolocco Creek and Lake Logan Martin under intermittent high-flow conditions, the net result of this transport is insignificant relative to natural attenuation, and the decline in fish PCB concentrations in Choccolocco Creek and Lake Logan Martin is expected.

Conclusions

The conclusions of the studies described in this report are summarized below and are arranged according to geographic areas.

Lake Logan Martin

- Lake Logan Martin is not affected by PCBs based on the following Off-Site RFI data:

  —The average PCB concentrations in bass and catfish were less than the ADPH advisory level of 2 mg/kg at all sampling stations in the lake.

  —In the vast majority of cases, the average PCB concentrations in fish declined between 1996 and 1999.

  —PCB concentrations in surface sediments were below the analytical quantitation limit (0.06 mg/kg) at all sampling locations in the lake.

  —PCB concentrations in the deeper sediments were all very low (typically less than 1 mg/kg) and were below the quantitation limit in many cases. The highest concentration measured in the deeper sediments was 3.5 mg/kg. However, this sample was obtained at a sediment depth of 3.5 feet in the deepest portion of the channel in water depths in excess of 50 feet. Consequently, it is unlikely that these sediments will be subject to disturbance and re-suspension. Because of the depth of burial and the fact that they are overlain by sediments with markedly lower PCB concentrations, they do not pose an ecological threat.

- Because no unacceptable human or ecological risks were identified in Lake Logan Martin, no corrective measures are necessary and, hence, a CMS is not required.

Choccolocco Creek

- Choccolocco Creek does not present unacceptable risks for a majority of its length between Lake Logan Martin and Snow Creek. Fish tissue concentrations are above the ADPH advisory level of 2 mg/kg. However, conditions in the creek are rapidly improving to acceptable levels through natural attenuation as demonstrated by:

  —Dramatic decreases (up to four-fold) in PCB concentrations in fish tissue from 1996 to 1999; and
  —Average PCB concentrations of less than 1 mg/kg in sediments (both surface and subsurface) downstream of the confluence with Snow Creek.

- The only stretch of the creek that appears to be of potential concern is the backwater area in the upper reach of the creek immediately above the confluence with Snow Creek. However, this section of the creek is not readily accessible and is significantly affected by urban runoff from Snow Creek and upstream agricultural inputs. Consequently, the habitat in this area is subjected to a number of other stressors.

- Because one portion of the creek does present some concern, additional characterization and a CMS will be required to evaluate potential corrective measures for this area.

Snow Creek

- Two areas of potential concern were identified in Snow Creek: the mile of creek immediately below the 11th Street Ditch and the downstream reach of the creek immediately above the confluence with Choccolocco Creek. Because sediments in these two reaches of the creek exceed the risk-based action levels developed in the HEA, corrective measures studies will be required in these two areas. The rest of the creek is not a concern. It is also important to note that Snow Creek is an urban storm water drain and receives inputs from a number of point and nonpoint sources. Consequently, the ecology of the creek is significantly affected by a wide variety of stressors, including on-going urban development and renewal. The impacts of these stressors are reflected in the degraded habitat observed during the ecological assessment.

Recommendations

Based on the findings of this investigation, the following recommendations are made:

- ADPH should evaluate the removal of fish advisories in Lake Logan Martin.

- Conduct a CMS in the following portions of the Off-Site area:

  —The first mile of Snow Creek downstream of the 11th Street Ditch;
  —The lower reach of Snow Creek (from Route 78 to the confluence with Choccolocco Creek); and
  —The backwater area of Choccolocco Creek (upstream of the confluence with Snow Creek).

- Collect additional sediment data from the backwater area of the Choccolocco Creek near its confluence with Snow Creek. The investigation methods will be consistent with the Off-Site RFI Work Plan and include additional sediment sampling transects on approximately 1,000 feet intervals in an upstream direction. The sediment transects will extend along each branch of Choccolocco Creek within the backwater area to a point approximately 1 mile upstream of the point where they rejoin into a single creek. Consistent with the Off-Site RFI, the investigation will be focused on PCBs in sediment. To facilitate field sampling logistics (access and multiple mobilizations) this investigation program may be best implemented in parallel with the floodplain soil sampling identified in the Phase II Off-Site (Floodplain) RFI/CS Investigation Work Plan (BBL, 2000).

- Continue monitoring fish in Choccolocco Creek by collecting and analyzing additional samples. The fish collection program will also include young-of-year (YOY) samples to further document the continued decline of fish tissue concentrations. Additional surface water data is also recommended during high-flow conditions to confirm the conceptual model for particulate PCB transport in Choccolocco Creek.

- Document that the ADPH advisory level is being maintained in Lake Logan Martin by collecting and analyzing fish samples on a periodic basis.

1. Introduction

This report presents the findings of the environmental studies conducted for the Off-Site component of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) program for the Solutia Inc. (Solutia) facility in Anniston, Alabama. The studies were conducted to assess the potential presence and significance of polychlorinated biphenyls (PCBs) in the Off-Site area. The studies were performed in accordance with the requirements of the Post-Closure Permit No. ALD004019048 and the Off-Site RFI Work Plan (BBL, 1999) approved by the Alabama Department of Environmental Management (ADEM) in a letter dated July 26, 1999. A companion investigation for the On-Site portion of the program was completed and the report of that investigation was submitted to ADEM in January 1999.

For the purpose of this report, the Off-Site area is defined as the 100-year floodplain and in-stream portions of both Snow Creek downstream of the 11th Street Ditch, and Choccolocco Creek from the confluence with Snow Creek (including a small upstream backwater area at the confluence) to Lake Logan Martin, as well as the portion of Lake Logan Martin between Choccolocco Creek and Logan Martin Dam. The Off-Site study area is referred to as Area of Concern (AOC) B within the Post-Closure Permit and is highlighted on Figure 1-1. This report focuses on the in-stream portions of AOC B since the floodplain portions are being evaluated under a separate Phase II Off-Site (Floodplain) RFI/CS Investigation Work Plan (BBL, 2000). Similarly, groundwater within AOC B is being evaluated under a Phase II (Groundwater) RFI/CS Investigation Work Plan (Solutia, 2000). Within AOC B, the location and evaluation of dredge spoil pile areas along Snow and Choccolocco creeks were addressed in accordance with the Off-Site Interim Measures Plan, which was approved by ADEM in a letter dated August 14, 1998. Similarly, the 11th Street Ditch, which flows into Snow Creek, was not included in the Off-Site RFI Work Plan scope of study since it is being addressed under a Corrective Measures Study which was submitted to ADEM for review on October 13, 1999

1.1 Objectives

Consistent with the Off-Site RFI Work Plan, the objectives of this study included:

- Evaluating the nature and extent of PCBs within the in-stream portions of AOC B;
- Predicting the fate and transport of PCBs within the downstream systems;
- Assessing the significance of potential PCB exposure to human and ecological receptors;
- Supporting an assessment of potential corrective measures; and

- Preparing and submitting an Off-Site RFI report.

1.2 Technical Approach

The technical approach for completing the Off-Site RFI activities is detailed in the Off-Site RFI Work Plan and included the collection of sediment, surface water, biota, and habitat assessment data. These data were evaluated to refine the conceptual site model and assess the significance of potential PCB exposure. The Off-Site RFI efforts were focused on PCBs, but also included the analysis of a subset of sediment samples for 11 metals. A subset of the fish that were analyzed for the potential presence of PCBs were also analyzed for mercury.

The technical approach also recognizes the direct link between the Off-Site RFI and environmental planning activities in the overall watershed (Figure 1-2). As such, the physical, biological, and chemical data contained in this report can be used by others to assess broader environmental issues using a watershed management approach. This approach is widely accepted within the regulatory community and recognizes the overall driving influence of the 502-square-mile (mi^2) watershed, which drains into the 21 mi^2 of AOC B along Choccolocco and Snow creeks. The hydraulic link and size difference between these two areas is evident in the size and shape of the respective areas, as presented on Figure 1-1. Equally important is the nature of land use within the overall watershed that eventually feeds into Choccolocco and Snow creeks. Uses include a combination of urban areas, industrial plants, agricultural activities, forested areas, and wastewater treatment facilities.

The Off-Site RFI activities were also conducted consistent with the United States Environmental Protection Agency's (USEPA's) RCRA Facility Investigation Guidance (USEPA, 1989a), the guidelines set forth in USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (1988), the USEPA's Contaminated Sediment Management Strategy (1998a), and ADEM's RCRA Facility Investigation Workplan Outline (1997).

1.3 Report Organization

The report has nine sections in addition to this introduction. Section 2 presents background information, including the environmental setting, operational and regulatory history, previous corrective measures, and an overview of the Off-Site Conceptual Model (OCM). The Sediment investigation is presented in Section 3 and includes both the investigation activities and the results. Sections 4, 5, and 6 present the investigation activities and results for the surface water, fish, and habitat assessment components of the Off-Site RFI program, respectively. The updated OCM for in-stream portions of the Off-Site areas is presented in Section 7, followed by the Health and Environmental Assessment (HEA) in Section 8. Conclusions and recommendations are presented in Section 9. References are included in Section 10.

Appendix A contains photographs of the individual sediment cores and the creek banks at each transect. The physical data collected at each of the Choccolocco Creek sampling transects are included in Appendix B. The grain-size distribution analysis for the sediment samples is presented in Appendix C, and surface water modeling results are found in Appendix D. Photographs of the individual fish collected during the fish investigation are included in Appendix E. The habitat assessment scoring sheets for each of the sampling stations are included in Appendix F. The methods used to calculate the Biota Sediment Accumulation Factors (BSAFs) used within the HEA are described in Appendix G.

2. Background Information

This section presents background information for the Off-Site RFI, including the environmental setting, the operational and regulatory history for the facility, previous corrective measures that have been implemented both On- and Off-Site, and a summary of the Off-Site Conceptual Model (OCM) from the Off-Site RFI Work Plan. It is important to note that this section of the Off-Site RFI report presents a description of the OCM that reflects an understanding of the Off-Site areas before the studies described in the Off-Site RFI Work Plan were conducted. An updated OCM which contains revisions based on the findings of these studies is presented in Section 8.

2.1 Environmental Setting

Environmental setting is described below in terms of site location, area climate, regional and local geology, and hydrology. The hydrology section includes discussion of Snow Creek, Choccolocco Creek, and Lake Logan Martin, since all three of these waterbodies are important to the fate and transport of sediments that potentially contain PCBs. These three waterbodies are also important with respect to the introduction of other constituents from the large number of point and non-point sources within the 502 mi^2 Choccolocco Creek watershed illustrated on Figure 1-1. A summary of several dredging projects conducted on Choccolocco Creek during the 1990s is also included since these projects may have mobilized PCB-containing sediment during dredging. These dredging projects also may be responsible for the reversal in the steady decline in fish tissue PCB concentrations observed over the 1970s and 1980s.

2.1.1 Site Location

The Off-Site area is located in the north-central part of Alabama. It includes the in-stream and the 100-year floodplain areas along both Snow Creek and a 37-mile reach of Choccolocco Creek between Lake Logan Martin, an impoundment along the Coosa River. The Off-Site area also includes the portion of Lake Logan Martin between Choccolocco Creek and the dam, as well as a small backwater area and associated 100-year floodplain area just upstream of the confluence of Snow and Choccolocco creeks. The urban areas of this region are shown on Figure 1-1 and include the cities of Anniston and Oxford. Located in Calhoun County, the total combined population for these areas is about 40,000 people, according to 1996 estimates (U.S. Bureau of the Census, 1998). Snow Creek, the primary drainage pathway through these communities, runs a distance of 5 miles southward from 11th Street in Anniston along a residential and commercial corridor through Anniston and Oxford until its confluence with Choccolocco Creek just south of Route 20. Apart from this urbanized corridor, land use in the study area is primarily mixed forest and agricultural.

Downstream of its confluence with Snow Creek, Choccolocco Creek flows through the rural areas of Talladega County until its confluence with the Coosa River in Lake Logan Martin. This area of the county, as indicated by U.S. Geological Survey (USGS) land use maps, primarily consists of mixed forest and crop and pasture lands. Isolated areas of wetlands are spread throughout the county. Commercial areas are found around U.S. Route 78 and State Highway 21. Upstream of the Snow Creek confluence, Choccolocco Creek flows through primarily rural forested areas from its headwaters in Talladega National Forest.

Lake Logan Martin is impounded by a compacted earth dam with a gated concrete spillway section. The dam is located 17 miles downstream from the confluence of Choccolocco Creek and the Coosa River. Depending on the lake stage being maintained, the impoundment on the Coosa River may extend more than 20 miles upstream of Choccolocco Creek. Upstream of the Choccolocco Creek confluence, land use along Lake Logan Martin is predominantly mixed forest. While agricultural land use and mixed forest are approximately equal downstream of the confluence, since the impoundment was established, there has been increasing residential development immediately along the shores of the reservoir.

2.1.2 Area Climate

Calhoun County's climate is characterized as humid subtropical, with hot summers, mild winters, and some precipitation during all months of the year. Precipitation occurs primarily as rainfall and averages about 54 inches per year. The majority of the rainfall occurs in the winter, with the most precipitation in March and the least in October. Droughts are infrequent. The average annual evaporation rate in the area is about 42 inches, and the potential evapotranspiration rate on an average annual basis is about 36 inches. The mean annual temperature is 62 degrees Fahrenheit (°F) and ranges from an average of about 43 °F in January to about 80 °F in July. The occurrence of very low temperatures, although infrequent, effectively prevents the growth of vegetation that is normally indigenous to subtropical climates.

2.1.3 Regional and Local Geology

Approximately 90% of Calhoun County, including the entire Off-Site study area, lies within the Valley and Ridge physiographic province. This area is characterized by complex folding and thrust faulting of the Paleozoic bedrock. The subsequent erosion of the folded and faulted terrain has generated a series of ridges and valleys. The remaining, extreme southeastern portion of Calhoun County lies within the Piedmont physiographic province. The Piedmont province consists of highly dissected uplands developed on metamorphic rocks. Several tributaries in the eastern and southern portions of the basin originate in the Piedmont province. The Talladega-Cartersville Fault, which occurs east of Snow Creek, separates the two physiographic provinces.

The Choccolocco Creek - Lake Logan Martin watershed is underlain by sedimentary and metasedimentary rocks of Cambrian and Ordovician age. The Paleozoic rocks have been extensively folded into northeast-southwest trending synclines and anticlines punctuated by numerous thrust faults (USGS, 1987). The Jacksonville Fault, which trends northeastward from Piedmont to the Coldwater Spring vicinity, is the most prominent thrust in the area. The Talladega-Cartersville Fault is a more minor structural feature that controls the Choccolocco Creek channel upstream of the confluence with Snow Creek.

In the upper basin, Choccolocco Creek's channel bed is composed of fine-grained deposits, reflecting the mudstone, siltstone, and sandstone present in these units. More resistant dolomite and quartzite ridges that occur locally intersect the channel at intervals and control channel grade in these areas. Erosion of these outcrops provides coarse sand and gravels to the stream system.

In the reach from approximately 2.5 to 9 miles upstream of the confluence with Snow Creek, Choccolocco Creek is underlain by a layer of siliceous dolomite. Deep weathering of the formation has generated a clay overburden with embedded gravel and cobbles. Isolated areas with extensive cobbles and boulders provide control over stream grade development in this reach. In the area of its confluence with Snow Creek, Choccolocco Creek is underlain by mudstones and shales interbedded with limestones and siltstones; the channel bed materials are composed of silty sands with intermittent gravel bars. Below the confluence, Choccolocco Creek is underlain by dolomite, mudstone, and shale, with interbedded limestone and siltstone. Bedrock outcrops occur occasionally. After several miles, stream grade increases as the creek intersects a ridge of dolomite and limestone. Farther downstream, Jackson Shoals is formed by an outcrop of quartzose sandstone. Beyond Jackson Shoals, the channel and virtually all of Lake Logan Martin are underlain by dolomite.

At depth, Snow Creek is underlain, from upstream to downstream, by various strata, including layers of sandy dolestone and dolomite limestone, quartzite, sandstone, conglomerated shale, and mudstone, shaley mudstone, and shale. The creek itself flows through recently deposited alluvial soils, and sandstone and quartzite gravel and cobbles up to 8 inches in diameter are common. With increasing elevation, the soil grades to a coarse, stony residuum of sandstone and shale 1 to 2 feet thick over bedrock. In the upper Snow Creek basin, extensive rough mountainous areas are present with many outcrops of sandstone and quartzite bedrock, loose rock fragments, and scattered patches of sandy soil material. Slopes are generally greater than 25% and runoff is rapid. Lake Logan Martin is underlain almost entirely by silicified dolomites.

2.1.4 Hydrology

Snow Creek

Snow Creek is a high-gradient stream, with a slope typically 20 to 30 feet per mile, flowing through an urbanized corridor of Anniston and Oxford. At its confluence with Choccolocco Creek, the drainage area of Snow Creek is 19 mi^2. Because of steeply sloped basins, floodwaters tend to rise and fall quickly in response to brief, intense storms. The average daily flow within Snow Creek increases from approximately 5 cubic feet per second (cfs) at the confluence with the 11^{th} Street Ditch to 28 cfs as it discharges to Choccolocco Creek. The steep basin terrain produces sharp peak flows. The estimated 10-year and 100-year recurrence interval floods for Snow Creek at the point it discharges to Choccolocco Creek are 4,030 cfs and 6,900 cfs, respectively.

HEC-2 water surface profile models used to perform Federal Emergency Management Agency (FEMA) flood insurance studies were combined to provide an evaluation of a 5-mile reach of lower Snow Creek. The results of this modeling were based on a 10-year recurrence interval flood. In-channel velocities were frequently more than 5 feet per second (fps); overbank velocities were found to be usually less than 1 fps.

Choccolocco Creek

Snow Creek discharges to Choccolocco Creek at a point 37 miles upstream from where Choccolocco Creek discharges to the Coosa River. The lower 4 to 5 miles of Choccolocco Creek are affected by the impoundment of Lake Logan Martin. The confluence of Snow Creek and Choccolocco Creek occurs at the midpoint of the Choccolocco watershed (which drains an area of 222 mi^2 at the confluence with Snow Creek, and 502 mi^2 at Lake Logan Martin). Average daily flow increases from 274 cfs at the confluence with Snow Creek to 715 cfs at the confluence with Lake Logan Martin. Other major tributaries in the Choccolocco Creek watershed include Cottagula, Shoal, Jackson, and Hillabee creeks upstream of Snow Creek, and Coldwater, Salt, Eastaboga, and Cheaha creeks downstream of Snow Creek (Figure 1-1).

Flows in Choccolocco Creek are generally greatest during the early spring (the highest average monthly flow of 1,561 cfs near Lincoln occurs in March) and least during the autumn (the lowest average monthly flow, 270 cfs, occurs in October). Flooding occurs along Choccolocco Creek producing overbank flow conditions on average three or four times annually. The Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service [SCS]) estimates that 16,100 acres within the Choccolocco basin are subject to flood damage (SCS, 1989). Flooding along Choccolocco Creek within Calhoun County is most extensive in the low, flat areas near the confluences of Golden Springs Branch, Boiling Springs Branch, and Snow Creek (FEMA, 1993a, 1993b). Flooding extends downstream into

Talladega County for the next 10 to 12 miles. In this reach, a wide floodplain (based on 100-year recurrence interval flood) of ¼ to ½ mile is common. Flooding can increase the water level in Choccolocco Creek by as much as 15 feet above base-flow levels.

During the past 30 years, there have been numerous efforts to reduce the frequency of flooding, including the construction of seven dams or floodwater retardation structures (FRSs) and three multipurpose structures (dams designed for water supply or recreational activities). Before 1990, two channel enlargement projects were undertaken, one several miles upstream of Snow Creek and another along 2 miles of Cheaha Creek. In the 1990s, there have been additional dredging, snagging, and floodway construction efforts by NRCS to increase flow in the Choccolocco Channel in the Oxford area.

Lake Logan Martin

Choccolocco Creek is the largest tributary to Lake Logan Martin and discharges to the lake 17 miles upstream of the Lake Logan Martin Dam. At the dam, the Coosa River basin area is 7,743 mi^2. Lake Logan Martin is one of a series of impoundments along the Coosa River. At the summer pool elevation (464 feet), Lake Logan Martin maintains 273,000 acre-feet of storage and covers a surface area of approximately 15,000 acres (23.5 mi^2). During the autumn, water levels are lowered to the winter pool elevation of 460 feet, with a storage of 205,000 acre-feet and surface area of 17.5 mi^2. Historical minimum and maximum elevations since initial impoundment in 1964 are 452.5 feet (October 1972) and 475.3 feet (April 1977), respectively.

2.1.5 NRCS Channel Projects in the 1990s

The NRCS developed and implemented a plan to modify the Choccolocco Creek channel in the early 1990s, which may have affected the transport of sediments and PCBs in Choccolocco Creek. The Choccolocco Creek channel enhancement project was conducted in three phases during 1990, 1993, and 1994, covering an approximate 15-mile reach centered on its confluence with Snow Creek. Modification of the channel consisted of clearing and snagging to improve capacity, and removing debris that was causing bank erosion; excavating pits in the sediment bed to remove sediment and provide traps to capture bedload sediment; excavating channel cutoffs and floodways to reduce meanders and improve capacity at select locations; installing rock riprap to stabilize probable erosion locations; and following up with additional clean-out of the sediment traps. The intended result of these modifications was to create a channel with essentially the same bank conditions but 1 to 4 feet deeper. The project included the placement of streambed material on land in existing depressions or in spoil piles near the river that were covered with 6 inches of topsoil. Detailed measurements and descriptions, as well as photographs of each dredge spoil area, are provided in the *Dredge Spoil Area Evaluation Report, Snow Creek and Choccolocco Creek, Calhoun and Talladega Counties, Alabama* (Roux Associates, Inc., 1998).

2.2 Facility Operations

The facility is not located within the Off-Site area and is being evaluated separately under the facility Post-Closure Permit as part of the On-Site study area. Operations at the facility began in 1917 with the manufacturing of ferro-manganese, ferro-silicon, and ferro-phosphorous compounds and, later, phosphoric acid by the Southern Manganese Corporation. In 1927, the production of organic chemicals began with the introduction of biphenyl, which remains a major product of the facility. In 1930, Southern Manganese Corporation became Swann Chemical Company; in May 1935, Swann Chemical Company was purchased by Monsanto. Solutia Inc, the present owner, was created as a spin-off of Monsanto in 1997.

A variety of organic and inorganic chemicals have been produced at the facility during its history, including PCBs, parathion, and phosphorus pentasulfide. The facility currently manufactures para-nitrophenol (PNP), which is used in the manufacture of non-aspirin pain relievers, and polyphenyl compounds, which are used in a variety of heat-transfer fluid, plasticizer, and lubricant applications. PCBs were produced at the facility by reacting chlorine and biphenyl. Chlorine was also produced at the facility between the 1950s and 1969 for the sole purpose of supporting PCB manufacturing. Additional historical manufacturing information is presented in the On-Site RFI report (Golder, 1999).

2.3 Regulatory History

The facility is operated in accordance with a variety of permits issued under provisions of the Clean Air Act, Clean Water Act, RCRA, and their state counterparts. The facility previously operated two hazardous waste management areas, or WMAs (WMA I and WMA II). These WMAs were closed in compliance with provisions contained in the facility operating permit issued under the Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) and RCRA. Under provisions of the Hazardous and Solid Waste Amendments of 1984 (HSWA), a RCRA Facility Assessment (RFA) was conducted in 1991 by a USEPA contractor to identify SWMUs that might be subject to potential corrective action. In December 1994, and as amended in July 1995 and May 1996, the facility applied for the reissuance, with modifications, of its AHWMMA Permit. In October 1996, ADEM issued a Draft Hazardous Waste Post-Closure Permit to regulate the facility's post-closure responsibilities for WMA I and WMA II and to address corrective action for SWMUs and potential AOCs located both on and off the facility. This draft permit was finalized and issued on January 7, 1997 (No. ALD004019048).

On April 5, 1995, a Consent Order was entered into with ADEM to develop and implement a sampling plan for soils in the storm water drainage system. The facility collected sediment samples throughout the reach of the drainage ditches and soil samples extending outward on both sides of the ditches on the facility's property and related areas. PCBs were reported at varying concentrations in the sediments of drainage ditches that flow from the area of the South Landfill and from the production area to an area to the east of the manufacturing plant. PCBs were also reported at various concentrations in soil samples outside of the drainage ditches, but within areas potentially flooded by the drainage ditches during heavy rains.

On March 8, 1996, the facility entered into a second Consent Order with ADEM that expanded and defined the scope of the facility's ongoing investigation and remedial activities close to the facility. Under this Consent Order, the facility agreed to sample four additional areas for the presence of PCBs and to identify and sample other areas potentially affected by PCBs.

The facility's obligations under the terms of the March 8, 1996 Consent Order have been completed, and results of these activities have been reported to ADEM. These results confirm that generally PCBs are only detected in areas directly adjacent to drainage ditches or in areas affected by storm water flooding from these ditches. The drainage ditches in which PCBs have been detected ultimately flow toward Snow Creek and join Snow Creek just south of 11th Street. Sediment samples have also been collected from Snow Creek and other drainage ditches and analyzed for the presence of PCBs. The results of these analyses have been reported to ADEM.

2.4 Previous Corrective Measures

Beginning in approximately 1979, the facility initiated several investigations as part of a companywide program to evaluate environmental conditions and to develop information to submit its Part B RCRA Permit application. The following sections describe the substantial corrective measures that have been completed at both the facility and Off-Site areas.

2.4.1 Landfills

There are two landfills at the facility including the South Landfill and the West End Landfill. The South Landfill includes Waste Management Area 1 (WMA-1) and Solid Waste Management Unit 1 (SWMU-1) and consists of 10 individual cells. The South Landfill was operated from 1960 to 1988. The West End Landfill (SWMU-47) consists of one cell and operated from 1930 to 1960. Following hydrogeologic assessments and groundwater sampling, interceptor wells were installed around SWMU-1 in 1982 and 1987-88 to capture affected groundwater. A number of interceptor wells were deactivated in 1998 pursuant to the permit. The two cells used for disposal of hazardous waste were closed with a RCRA-compliant cap in 1989, while the remaining cells in the South Landfill, closed prior to the effective date of RCRA, were covered with clay and a vegetative layer. Additional details of these closure activities are provided in the On-Site RFI/CS report (Golder, 1999).

Interim remedial measures were constructed to prevent transport of affected soils from the South and West End landfills. These measures included the following:

- Construction of a multimedia cap on the West End Landfill and a soil cover on the area immediately around the landfill. The cap included a minimum of 6 inches of compacted clay, a 60-mil-thick high-density-polyethylene (HDPE) liner, a drainage fabric, 18 inches of cover soils, and a vegetative layer.

- Collection of storm water runoff from the West End Landfill and installation of piping for runoff through areas of affected soils. This allowed closure of drainage ditches with affected sediments.

- Upgrade of the cap on a portion of the South Landfill, consisting of a multimedia cap over several closed cells and additional soil cover over adjacent areas.

- Construction of a retention and sedimentation pond to collect storm water runoff from the South Landfill.

- Diversion of storm water runoff from unaffected areas upstream of the South Landfill, and installation of culverts for drainage through areas of affected soils in AOC B. This allowed closure of the ditches containing affected sediments.

All of these measures were constructed in 1997 and 1998, with the exception of the work on the West End Landfill, which was completed in 1996.

2.4.2 Former Production Areas

A number of solid waste management units within the manufacturing facility have been closed. Descriptions of the closed SWMUs and details of these closure measures are provided in the Part B Permit Application (Monsanto, 1996) and in the RFI report summarizing the On-Site portion of the RFI (Golder Associates, 1999). The measures implemented in each of the SWMUs have been accepted as interim corrective measures by ADEM.

2.4.3 On-Site RFI

As noted in Section 1, a companion investigation for the On-Site portion of the RFI has been completed. A draft report summarizing the results of that investigation was submitted to ADEM for review in January 1999 (Golder Associates, 1999).

The investigations described in that report were designed to:

- Characterize the facility's environmental setting;
- Define the source(s) of release(s) to the environment;
- Define the degree and extent of these releases;
- Identify the potential receptors; and
- Support the development and evaluation of any necessary corrective measures.

The results of the investigation satisfied these goals. They demonstrated that the only medium of concern within the facility boundaries is on-site soil. Elevated PCB concentrations were detected in a limited number of near-surface soil samples. Other media which were evaluated (surface water and groundwater) did not present any concern. The air pathway was eliminated from consideration during the formulation of the Site Conceptual Model.

Based on these results, it was concluded that the corrective measures implemented at the facility over the past several years are effective in controlling the potential off-site migration of constituents of potential concern. Thus, the only additional corrective measures considered necessary are capping and/or removal of areas of impacted near-surface soils inside the facility fence and minor upgrades to one of the groundwater corrective action systems. These upgrades are intended to increase the efficiency of the existing system.

2.4.4 On-Site Storm Water Drainage Management

The facility NPDES permit allows the discharge of noncontact cooling water and condensate through the on-site water sewer system. In 1996, all of this process-related water was repiped to discharge to the on-site WWTP. Consequently, only storm water is discharged by the sewer system. Additional sewer system enhancements were constructed in 1997. These included sealing a number of unused collection sewers that had discharged into a trunk main and lining that trunk main with an epoxy resin-impregnated felt liner. The trunk main discharges to one of the designated NPDES monitoring points (DSN 001).

2.4.5 Off-Site Measures

In 1989, the facility removed approximately 1,000 tons of sediment from the 11th Street Ditch and a portion of Snow Creek. In 1995, the facility initiated a program to purchase property in select Off-Site areas close to facility structures. The majority of the purchased properties were demolished, and soil covers were placed over areas with PCB-containing soils. These covers included a geotextile cover layer installed over the existing ground surface and the placement of cover soil. In addition to these measures, spoil piles from the dredging of Snow and Choccolocco creeks have been located, mapped, and characterized for PCBs. As noted in Section 1, a Corrective Measures Study (CMS) report for the 11th Street Ditch was submitted to ADEM in October 1999. Another CMS report was submitted to ADEM in February 2000 for work to be performed in the area of a new bridge over Choccolocco Creek on State Route 21, and Interim Corrective Measures have been constructed at the site of the Quintard Mall in Oxford.

2.5 Off-Site Conceptual Model

As a point of departure for the Off-Site RFI Work Plan, a conceptual model of Off-Site conditions was developed to frame an initial understanding of the primary PCB fate and transport mechanisms and potential exposure pathways. The conceptual model was based on drainage basin information, surface water flow data, and sediment and fish PCB data collected through various studies over the past 15 years. For example, area land use information, results from ongoing and completed corrective measures, and the flow and watershed characteristics of Snow and Choccolocco creeks, the Coosa River, and Lake Logan Martin were compiled and evaluated.

The resulting Off-Site Conceptual Model (OCM) is presented on Figure 2-2 and highlights the complex interrelationships between several variables that ultimately control PCB concentrations in sediment and fish.

2.5.1 Historical Data

This section provides a summary and discussion of historical sediment and fish PCB data. While considerable stream flow data and channel morphology data existed for the waterbodies for the Off-Site area prior to the Off-Site RFI studies, there did not appear to be any historical surface water PCB data.

2.5.1.1 Sediment

Historical PCB concentrations in Off-Site sediments were available for 179 samples. The majority of the existing data are associated with samples from Snow Creek or the 11th Street Ditch tributary to Snow Creek. For 110 of 113 Snow Creek sediment samples, the downstream distance from the facility was categorized as "0 miles." There are 53 samples with PCB analyses for Choccolocco Creek sediments, and a limited number of sediment samples for Lake Logan Martin.

A review of the sediment data found two patterns in the distribution of PCBs: a decrease in PCB concentrations with distance from the facility and a decline in concentrations over time. Exponential rates of decline of approximately 17% per mile or 20% per year, respectively, were indicated when all sediment data not immediately adjacent to the facility were included in the calculations (i.e., when samples with a downstream distance identified as 0 miles are excluded).

Before 1980, 10 sediment samples showed PCB concentrations for Choccolocco Creek downstream of Snow Creek. A maximum concentration of 740 ppm was reported (for a sample near the Snow Creek confluence for 1969). The average for the 10 samples was 80 ppm, although exclusion of the 740 ppm value reduces the average concentration to 6 ppm. For 17 Choccolocco Creek sediment samples collected downstream of Snow Creek during the 1980s, an average PCB concentration of 5.8 ppm and maximum PCB concentration of 19 ppm were reported (average distance approximately 3 miles downstream of Snow Creek). For nine Choccolocco Creek samples collected downstream of Snow Creek during the 1990s, an average of 1.1 ppm with a maximum of 4.3 ppm were reported (average distance 1.1 miles downstream of Snow Creek). Also in the 1990s, 11 sediment samples were collected from Lake Logan Martin, with a maximum concentration of 0.5 ppm and an average concentration of 0.076 ppm.

2.5.1.2 Fish

Historical sampling (pre-1996) and analysis of fish tissue were conducted from 1969 to 1993. A total of 636 samples collected by the facility, ADEM, and the Alabama Department of Agriculture were analyzed during this period. Samples taken by the facility in 1971 and 1972 represent the most extensive historical record, with 214 and 158 samples, respectively. The 1969 through 1974 data are concentrated on Choccolocco Creek, its tributaries, and the feeder streams of the Coosa River. The next sampling of fish tissue for PCB analysis occurred in 1989. The period from 1989 through 1993 produced 128 total samples. These samples came primarily from the Coosa River and Lake Logan Martin near its confluence with Choccolocco Creek. The historical data include a total of 44 samples taken downstream from the confluence of Lake Logan Martin and Choccolocco Creek and upstream of Logan Martin Dam. The fish species present in the historical data sets tend to be shiners, darters, bluegill, longear sunfish, and crappie. These species are typical of the tributaries sampled. Bass and catfish were collected at sites in Lake Logan Martin and the impounded regions of the Coosa River and Choccolocco Creek.

The historical fish data for Choccolocco Creek from the 1970s through 1993 are presented on Figure 2-2 and demonstrate both a decline in PCB concentrations moving in a downstream direction from the Snow Creek confluence and a decline in PCB concentrations with the passage of time. The decline in PCB concentration over time was likely due to natural attenuation associated with the deposition of non-PCB containing sediment in the creek beds and the lake.

A 1996 fish study collected samples from 13 locations (Bayne, 1997a). These sampling locations cover the area from Lake Neely Henry, down the Coosa River, and through Lake Logan Martin. Sampling conducted in 1996 included results for 1,097 fish tissue samples from 14 locations in or near Lake Logan Martin and in Choccolocco Creek. Evaluation of the 1996 PCB data indicates that concentrations varied among species. Sunfish (longear, green), bluegill, and crappie (black, white) displayed the lowest concentrations of PCBs, while channel catfish and spotted bass had the highest. The 1996 data set showed no significant decrease in variability through the use of lipid adjustment of PCB concentrations.

Historical data for Choccolocco Creek fish show that the highest PCB concentrations are in those found at the confluence of Snow Creek and Choccolocco Creek. Concentrations decrease with downstream distance, halving approximately every 6 miles; however, PCB concentrations are higher in the fish just upstream of the Snow Creek confluence. This increase appears to be due to the natural movement of fish species within the creek as the PCB concentration upstream of the confluence tapers off sharply with increasing distance, reaching background levels within 20 miles.

Although the data were limited for trend analyses, where there were fish tissue PCB data for samples collected in the 1970s and again in the 1990s, there were significant overall decreases in average fish PCB concentrations during that time period. Using the fitted curves, the half-life of PCB levels ranged from less than 7 years 1 mile below the Snow Creek confluence to about 16 years 30 miles downstream of the Snow Creek confluence (using sample results from Lake Logan Martin).

2.5.1.3 Habitat

The Off-Site habitats were all assessed by Bayne (1997a, 1997b), who characterized the macroinvertebrate communities in both Snow and Choccolocco creeks as well as the plankton, macroinvertebrates, and fish within portions of Choccolocco Creek and Lake Logan Martin. In his reports, Bayne characterized Snow Creek and Choccolocco Creek as affected by both nonpoint pollution and physical alterations. Choccolocco Creek also showed elevated nutrient levels from the municipal wastewater discharges. Both creeks were also affected by sedimentation.

The biological communities of both creeks had an abundance of macroinvertebrates, but the diversity of these communities was markedly different from those found in reference stations. Taxa from the pollution-intolerant groups such as stoneflies (Plecoptera) and caddis flies (Trichoptera) were dramatically lower, according to Bayne, due to nutrient enrichment and sedimentation. The tolerant groups of chironomids and midges associated with affected conditions were very abundant.

Baynes's study on Lake Logan Martin shows that the lake does not appear to show signs of marked eutrophication as seen in the upstream reservoirs on Lake Neely Henry and Weiss Lake. Chlorophyll levels were in the mesotrophic range (5 to 25 micrograms per liter [µg/L]). Macroinvertebrate community abundance and diversity were typical of those found in southeastern reservoirs. Overall, Lake Logan Martin showed a relatively healthy biological community.

No quantitative data regarding specific terrestrial communities or habitats were available for the area immediately surrounding the Off-Site area. Other than the urban setting surrounding Snow Creek, the terrestrial habitat in the Off-Site area is dominated by mixed forests and agricultural lands (crop and pasture). Even in the agricultural areas, Choccolocco Creek is buffered by a forested strip that provides a canopy around much of the creek. The mixed forest in the floodplain, as well as the forested buffer, may provide habitat for terrestrial species. The flora consists of several species of trees, shrubs, and berries. This area remains largely rural with only the beginnings of residential development encroaching in the areas closest to Oxford and Hobson City. Farther downstream, around the shores of Lake Logan Martin, residential development is much more pervasive.

2.5.2 Preliminary Identification of Constituents of Potential Concern

PCBs have been the focus of almost all of the prior Off-Site investigations, which date back to the 1970s, and are the focus of the OCM. This focus on PCBs is supported by the likely similarity between physical and chemical characteristics of any other constituents which would have remained in the Snow Creek/Choccolocco Creek system and those of PCBs (i.e., low solubility, high adsorption to sediment). Accordingly, those other constituents, if any, would share the same fate and transport mechanisms and exposure pathways with the PCBs. Consequently, any corrective actions needed to address PCBs are expected to be sufficiently robust to address the other constituents as well. In addition, a confirmatory sampling program for the 11 metals was also included in the Off-Site RFI program to establish that PCBs are an appropriate focus of the Off-Site RFI. The confirmation sampling included 11 metals (arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, and vanadium). Approximately 10% of the Choccolocco and Snow creeks sediment samples which were analyzed for PCBs were also analyzed for these metals.

2.5.3 Potential Fate and Transport Mechanisms in Aquatic Environments

The fate and transport of PCBs in the environment are greatly influenced by their low water solubility. This generally limits aqueous-phase concentrations to the low nanograms per liter (ng/L) range or less, unless significant amounts of solvents, oils, or colloids are present (Baker et al., 1986; Dragun, 1989). In general, the adsorption of PCBs to soils and sediments increases with increasing organic content, decreasing particle size, and increasing chlorination (Lyman et al., 1982; Pignatello, 1989).

In general, PCBs are persistent in the environment. However, research shows that PCBs may undergo biotransformation and biodegradation in sediments. Experimental evidence indicates that PCBs are susceptible to biodegradation under both aerobic and anaerobic conditions. In general, the degradability of PCB congeners under aerobic conditions increases as the degree of chlorination decreases. Laboratory research has shown that the lesser chlorinated PCB congeners, such as mono-, di-, and trichlorobiphenyls, are subject to aerobic biodegradation by microorganisms indigenous to soils and sediments. Aerobic biodegradation of PCBs by bacteria generally proceeds toward mineralization through intermediates, including chlorinated catechol and chlorobenzoic acid (Bedard et al., 1987; Hankin and Sawhney, 1984; Fries and Morrow, 1984).

Research has shown that PCBs undergo reductive dechlorination under anaerobic conditions by indigenous microorganisms. Study results indicate that the more highly chlorinated PCBs are transformed to lesser chlorinated congeners (Quensen et al., 1988) and that the lower-chlorinated PCBs subsequently may be degraded in aerobic environments to carbon dioxide, water, and chloride. Analysis of PCB degradation patterns in sediments from sites such as the Hudson River (New York), the Housatonic River (Massachusetts), Waukegan Harbor (Illinois), Sheboygan Harbor (Wisconsin), and New Bedford Harbor (Massachusetts) indicates that anaerobic biodegradation of PCBs occurs in the environment (Brown et al., 1987).

While biodegradation processes can reduce human and environmental exposure to PCBs and the toxicity of environmental mixtures, the importance of these processes varies depending on microbiological and ecosystem factors along with the composition of the PCB mixture. The reduction of human and environmental exposure caused by sedimentary processes tends to be important at aquatic sites with elevated PCB levels. Sediments in low-energy environments tend to be sinks for PCBs. Sedimentary processes of the mixing with and burial under progressively cleaner sediment delivered from the watershed can be the most important natural attenuation process reducing PCB bioaccumulation over time.

The affinity of PCBs for sediments is a function of chemical-specific factors (e.g., degree of chlorination) and site-specific factors (e.g., sediment grain size, organic matter content). Solubility decreases and affinity for sediments increases generally with increasing molecular weight. PCBs generally adsorb more strongly to fine-grained, organic sediment than to coarse sediment with low organic content (Lyman et al., 1982; Pignatello, 1989).

Due to their lipophilic nature (tendency to partition to fats), PCBs bioaccumulate in aquatic organisms. Factors influencing the extent of bioaccumulation include the degree of PCB chlorination and bioavailability, in addition to ecological factors such as trophic relationships and community structure. The tendency of PCBs to partition to sediments in sediment-water systems, as well as to bioaccumulate, correlates with octanol-water partitioning behavior. Octanol-water partitioning constants vary from approximately 100,000 for dichlorobiphenyls to 10,000,000 for a number of hexachlorobiphenyls, heptachlorobiphenyls, and octachlorobiphenyls (Shiu and Mackay, 1986).

PCBs also may be removed from the water column via volatilization to the atmosphere; however, their volatilization rates are generally limited by their tendency to remain adsorbed to sediments and suspended solids. The lesser chlorinated congeners (tetrachlorobiphenyl and lower) have greater potential to volatilize than the more highly chlorinated congeners. PCBs in the atmosphere may be removed by vapor-phase photooxidation, dust fall, and precipitation. Estimated photooxidation half-lives range from approximately 13 days for monochlorobiphenyls to approximately 10 months for hexachlorobiphenyls.

Understanding the hydrology of the Choccolocco Creek watershed and the influence of the Coosa River sediment inputs to Lake Logan Martin is important to understanding sediment transport and PCB transport. Due to their very low solubility, the transport of PCBs in aquatic environments is largely governed by the movement of sediment and other solids and plays an important role in the Off-Site RFI studies.

2.5.4 Potential Exposure Pathways

As part of the OCM, routes of potential human exposure to PCBs were identified on a preliminary basis. This identification was only preliminary as the site-specific land use characteristics were not completely delineated when the Off-Site RFI Work Plan was developed. One of the potential exposure pathways is through consumption of fish from Choccolocco Creek and Lake Logan Martin. A second exposure pathway, consisting of direct contact with the sediment including incidental ingestion, is also of importance. With On-Site PCB discharges controlled, remaining sources of PCBs include creek bed sediments, bank soils, and downstream point or nonpoint sources. The likely release mechanisms of PCBs from these sources can be determined based on standard physical processes, and the routes of exposure can be identified based on a consideration of typical human behavior. The various exposure pathways were reevaluated in the HEA as more site-specific information became available. The following list summarizes the general exposure pathways for the different classes of potential ecological receptors initially identified in the Off-Site RFI Work Plan:

- *Benthic organisms* **-** The exposure pathway was assumed to be pore water.
- *Fish* **-** The exposure pathway was assumed to be a combination of ingestion of sediment, prey items, and absorption across the gill lamellae.
- *Piscivorous birds and mammals* **-** The exposure pathway was assumed to be via the consumption of aquatic organisms that have bioaccumulated PCBs.
- *Terrestrial organisms* **-** The exposure pathways was assumed to be ingestion, inhalation, and dermal absorption of bank soils.

2.5.5 Off-Site Conceptual Model Summary

The significant findings of the OCM prior to the Off-Site RFI study program were:

- PCBs are the COPC in the Off-Site area.
- PCB concentrations in fish and sediment decline with increasing distance downstream.
- The primary route of potential human exposure to PCBs is through fish consumption.
- PCB levels in fish are declining with the passage of time.
- The decline in fish PCB levels is due to natural attenuation processes.
- The primary natural attenuation mechanisms are the mixing and burial of PCB-containing sediment with non-PCB containing sediment delivered from the watershed.
- The relationship between PCB levels in fish and sediment is not understood in a quantitative sense.
- High-flow events from intense rainfall may influence the movement of sediment-bound PCBs.
- Certain areas within the floodplain are likely depositional zones for sediment; however, the significance of potential PCB deposition in the floodplain is currently unknown.
- The effects of recent dredging in Choccolocco Creek on PCB distribution and movement are uncertain.

2.6 Summary of the Off-Site RFI Program

2.6.1 Off-Site Data Collection Activities

As identified by the conceptual model, the key questions to be answered by the Off-Site RFI studies are related to understanding the factors regulating PCB levels in fish and the fate and transport of sediment-based PCBs within the waterways. These factors need to be understood in a quantitative sense so that potential corrective measures to further reduce PCB levels in sediment and fish can be evaluated. When combined with measurements of sediment and PCB transport at key locations within the system, these data efforts will facilitate a more complete understanding of the factors regulating PCB levels in sediment and fish in the Off-Site area.

The Off-Site studies encompassed Snow Creek south of the 11th Street Ditch, a 37-mile reach of Choccolocco Creek, and Lake Logan Martin from the Choccolocco Creek confluence to Lake Logan Martin Dam. The studies included an evaluation of PCB levels in sediment and fish, along with an assessment of potential downstream movement of PCBs within and between these waterbodies. The sediment investigation included a two-phase sediment sampling and analysis program of more than 600 sampling locations, with several samples retained from each location for analyses. The fish sampling program focused on Choccolocco Creek and Lake Logan Martin and included largemouth bass and channel catfish as the species of interest. The transport studies measured the loads of sediment and PCBs at key locations within the Snow Creek, Choccolocco Creek, and Lake Logan Martin system.

Other field studies included a habitat assessment to evaluate the overall ecological character of Snow and Choccolocco creeks and Lake Logan Martin, including the aquatic, wetland, and bottomland areas. As mentioned in Section 1, sampling of the floodplain to both calibrate a general model describing the relationships among flood frequency, distance, hydraulic information and PCB levels, and also to characterize potential human and ecological exposure will be conducted under a separate Phase II Work Plan.

2.6.2 Health and Environmental Assessment

The data gathered during the field investigations were used to complete a Health and Environmental Assessment (HEA) using current methods and guidance from the USEPA. A cornerstone of this assessment was the determination of site-specific PCB levels protective of resident human and wildlife populations. The primary exposure pathways for potential human exposure include fish consumption and, to a lesser extent, direct contact with the sediment. In evaluating these pathways, a number of potential exposure scenarios were considered based on site-specific land-use patterns.

Regarding the fish consumption pathway, the sediment and fish PCB data were evaluated to establish a site-specific relationship between the PCB concentrations in the surface layer of the sediment and PCB levels observed in fish. This evaluation plays a significant role in quantifying the level of reduction in fish PCB concentrations expected to result from a further decline in surficial sediment PCB concentrations. The driving force behind these reductions could be either continued natural attenuation, potential corrective measures, or combinations thereof. This evaluation considered the time to achieve the 2 part per million (ppm) Alabama Department of Public Health (ADPH) advisory level in portions of the Off-Site area where fish PCB concentrations, although declining, appear to be above 2 ppm.

The HEA also evaluated potential ecological receptors, including bottom-dwelling or benthic organisms, fish, birds, and mammals. This assessment was conducted on a site-specific basis using methods and procedures approved by the USEPA and considered the interrelationships between differing levels of the food chain. In performing the assessment, the overall character and quality of the aquatic habitats within the Off-Site areas was considered. This included the incorporation of the site-specific habitat assessment and the relationship between sediment-bound PCBs and corresponding PCB levels in fish and other species.

2.6.3 Off-Site RFI Report

The results of the Off-Site RFI program and HEA are presented in this Off-Site RFI report. The report also includes an updated OCM and conclusions and recommendations for Snow Creek, Choccolocco Creek, and Lake Logan Martin.

3. Sediment Investigation

This section describes the approach, activities, and results of the sediment investigation in Snow and Choccolocco Creeks. Also included are a description of activities and results for Choccolocco Creek top-of-bank sampling, geochronological sampling in Lake Logan Martin, and surface sediment sampling in Choccolocco Creek and Lake Logan Martin. Finally, QA/QC findings are discussed.

3.1 Investigation Approach

As described in the Off-Site RFI Work Plan, the assessment of PCB distribution in the sediment of Choccolocco and Snow creeks was performed using a two-phased, stratified sampling approach.

Phase I consisted of the collection of physical creek data, the identification of sediment textural and geographic strata, and the selection of sediment cores from which samples were submitted for laboratory analyses. The Phase I approaches for Choccolocco Creek and Snow Creek were significantly different: characterization of Choccolocco Creek included measurement and characterization of sediment through probing and the collection of sediment cores at regular intervals; characterization of Snow Creek included continuous mapping and measurement of discernible sediment deposits (because of the creek's small size and shallow depth). Based on the results of the respective Phase I field investigations, a stratified sampling approach was used to select sediment samples for laboratory analysis. The stratified sampling approach is described in the Off-Site RFI Work Plan and consists of the identification and evaluation of geographic strata, or reaches, and sediment textural strata as a basis for random selection and analysis of samples to characterize sediment PCB distribution within the creeks. Following the identification of geographic reaches, land use information and habitat along the creeks were reviewed to ensure the creek segmentation would also support the needs of the HEA.

Phase II activities included the laboratory analysis of sediment core samples and characterization of PCB distributions within the textural and geographic strata of the creeks identified in Phase I.

3.2 Phase I Activities – Choccolocco Creek

Phase I activities in Choccolocco Creek consisted of sediment probing and the attempted collection of at least four cores at 180 of the 186 transects proposed in the Work Plan. At each transect, measurements were made of channel elevation and slope, water depth and channel width, and sediment depth. In addition, water velocity measurements were taken at 45 of the 177 transects downstream of Snow Creek. Sediment textural characteristics were identified at each sampling location.

Approximate transect locations are presented on Figures 3-1 through 3-5. The transects were spaced at approximately 1,000-foot intervals along Choccolocco Creek from just upstream of the Snow Creek confluence, downstream to Lake Logan Martin. No sampling activities were performed at transects C-18, C-19, C-20, C-83, C-143, and C-144. Transects C-18, C-19, and C-20 were located in the former oxbow area of Choccolocco Creek and are to be investigated as part of the Floodplain Investigation. Transect C-83, located midway between Coldwater and Cheaha creeks, was not sampled because access to the property had not been granted. Transects C-143 and C-144, located at Jackson Shoals, were not sampled because of safety concerns related to high water velocities and the general difficulty of gaining access to the creek due to the steep terrain. Three transects upstream of the confluence with Snow Creek (C-U1, C-U2, and C-U3) were also probed and sampled to evaluate the potential backwater effects that may be caused by Snow Creek on sediment characteristics.

At each transect, at least four locations were probed and cores collected where possible (up to seven cores were collected from transects in the wider headwaters of Lake Logan Martin downstream of Jackson Shoals). Locations were spaced evenly across the channel. A total of 541 sediment cores (out of 729 cores attempted) were collected downstream of Snow Creek, and 11 cores (out of 12 attempted) were collected from the three transects upstream of Snow Creek. At 188 probing locations, no cores were recovered because bedrock, cobbles, or boulders were encountered. All recovered cores were described, photographed, and frozen for potential laboratory analyses.

3.3 Phase I Results – Choccolocco Creek

Phase I results for Choccolocco Creek are reported in terms of physical assessments, identification of geographic reaches, identification of textural strata, identification of land use and habitat, and selection of sediment cores for chemical analysis.

3.3.1 Physical Assessments

Assessments of channel bottom elevation and slope, water depth and channel width, sediment thickness, and water velocity are summarized below. Table 3-1 provides a summary of physical characteristics at each transect sampled.

Channel Elevation and Slope

A number of physical characteristics were assessed to support the identification of geographic reaches within Choccolocco Creek. Channel bottom slope was calculated using the measured elevations of the channel bottom and the distance between sampling transects. Slope can be an important determinant of geographic strata because it influences the depositional environment and the textural characteristics of deposited sediment. Typically, creek segments that have low channel slopes (1 to 2 feet per mile) also have low water velocities and are indicative of low-energy zones in which fine-grained sediments can settle from the water column, creating areas in which PCBs are more likely to be present. Creek segments with higher slopes (5 to 6 feet per mile) typically have higher velocities, a factor that reduces the potential for suspended sediments to settle. Figure 3-6 and Table 3-1 show the average bottom elevation at each transect (calculated as the average of the measured bottom elevation for each probing location along a transect). Averages ranged from 447 feet (at transect C-176) to 594 feet (at transect C-U1).

Water Depth and Channel Width

Water depth and channel width are both indicators of channel cross-sectional area, another characteristic considered during the identification of the geographic reaches. Cross-sectional area also influences the characteristics of the sediment bed by affecting water velocity. For a given flow, transects with a lower cross-sectional area will have higher velocities than transects with a larger cross-sectional area. Transects with a large cross-sectional area typically contain sediment deposits that are deeper and contain finer sediment particles than transects with low cross-sectional areas. As is evident on Figures 3-7 and 3-8, water depth and channel width both greatly increase downstream of Jackson Shoals, indicating an area more prone to deeper deposits of fine-grained sediment than areas farther upstream in Choccolocco Creek.

Water depth was assessed using measurements taken at each probing location along a transect. Figure 3-7 and Table 3-1 show the average water depth for each transect. Average water depths ranged from 0.95 feet (at transect C-023) to 17 feet (at transect C-163). Water depths were highest downstream of Jackson Shoals. This area of the creek is affected by the elevation of Lake Logan Martin and is most likely to contain deeper sediment deposits consisting of fine-grained sediments.

Channel width was assessed by measurements taken at each transect. Figure 3-8 and Table 3-1 show the channel width measurements. Channel widths ranged from 46 feet (at transect C-011) to 2,340 feet (at transect C-168). Channel widths remained fairly consistent, between 50 and 150 feet, from the Snow Creek confluence downstream to Cheaha Creek.

Downstream of Cheaha Creek, the creek begins to expand in width until its widest point, at the headwaters of Lake Logan Martin.

Sediment Thickness

Sediment thickness is an indicator of historical sediment deposition. Distinct changes of sediment depth along Choccolocco Creek also guided the identification of geographic reaches. Thick sediment deposits are typically found in low-energy segments of the stream. These deposits often contain the finer-grained sediment particles associated with PCBs. Thick sediments may also be found in areas of the creek that have been altered, such as the NRCS dredge pits. These areas could contain thicker sediments than expected, based upon the stream characteristics found there.

Sediment thickness was assessed by measurements taken at each probing location. Figure 3-9 and Table 3-1 show the average sediment thickness measurements. Average sediment thickness ranged from 0 feet in areas with no recoverable sediment to 3.2 feet (at transect C-167).

Water Velocity

Water velocity was assessed by measurements at 45 transects. Figure 3-10 and Table 3-1 show the water velocity measurements. Water velocities ranged from almost 0 feet per second (fps) in the portion of the creek affected by Lake Logan Martin to more than 1.8 fps (at transect C-036). Higher water velocities were encountered at Jackson Shoals, but due to safety considerations, no measurements were taken. Water velocity was generally highest (ranging from 1.0 to 1.8 fps) between Snow Creek and Coldwater Creek, and lowest in the headwater areas of Lake Logan Martin (always less than 0.2 fps).

3.3.2 Identification of Geographic Reaches

The physical data on channel characteristics collected during Phase I (see Section 3.3.1) were used in conjunction with known geologic and hydraulic features of the creek to define geographic reaches of Choccolocco Creek with relatively consistent physical characteristics (such as creek bed slope, water depth, channel width, sediment thickness, and water velocity) (Table 3-1 and Figures 3-6 through 3-10). The location of the tributaries influences sediment transport and deposition due to increased flow volumes and provides an important source of new sediment. Other geologic factors, such as Jackson Shoals, influence the creek by creating rapids and distinct areas with little to no sediment bed. These data allowed for the delineation of six distinct reaches, or geographic strata, of Choccolocco Creek (Figure 3-11). These reaches are:

- Upstream of Snow Creek (transects C-U1 through C-U3);
- Snow Creek to Coldwater Creek (transects C-1 through C-45);
- Coldwater Creek to Cheaha Creek (transects C-46 through C-118);
- Cheaha Creek to Jackson Shoals (transects C-119 through C-141);
- Jackson Shoals (transects C-142 through C-155); and
- Jackson Shoals to Lake Logan Martin (transects C-156 through C-183).

The physical characteristics described above were used to identify the geographic reaches summarized in Table 3-2. As can be seen in the table, the reach at Jackson Shoals exhibited the highest channel slope, at 7.38 feet per mile, and the second-lowest average sediment thickness, at 0.31 feet. In addition, only 44% of the cores attempted in this reach were recoverable, indicating the channel within this area is composed of mainly cobbles, boulders, and bedrock. Conversely, just downstream of Jackson Shoals in the backwater portions of Lake Logan Martin, the deepest average water depth (11.92 feet), largest average sediment thickness (1.62 feet), and lowest channel slope (0.48 feet per mile) were found. As expected, the thickest sediments contained the majority of the finer-grained sediments found in the creek.

3.3.3 Identification of Textural Strata

The sediment collected in each core was described on a textural basis using the Unified Soil Classification System (USCS) codes. This information was used to divide the sediments into textural classes using the primary particle size within the core (i.e., silt, sand, or gravel). These classifications are useful because PCBs tend to be associated with finer-grained material, which typically has a higher organic carbon content and tends to occur in thicker deposits, where PCBs may have accumulated over time. Table 3-3a presents a summary of the sediment core characteristics by reach, as described by USCS codes. These characteristics were grouped into four textural strata defined as:

- Fine sediments - consisting of organic material, clays, silts, and fine sands;
- Coarse sediments - consisting of well and poorly graded sands;
- Gravel sediments - consisting of well and poorly graded gravels; and
- Boulders and bedrock – consisting of probing locations where no sediment was recoverable.

While it is anticipated that a gravel sediment bed represents a high-energy environment with limited potential for long-term accumulation of PCB-containing sediment, a gravel stratum was nevertheless identified, due to the frequency of the gravel encountered and its widespread geographic distribution. Analysis of the gravel stratum allowed for the evaluation of the potential for PCBs to be associated with the smaller material that may be found in the interstitial areas of sediments classified as gravels.

Table 3-3b shows the distribution of cores from each textural stratum. As indicated, the majority (63%) of fine-sediment cores were found in the 5.5-mile reach of Choccolocco Creek impounded by Lake Logan Martin, while the majority of coarse-sediment cores (44%) were found in the 14.2-mile reach between Coldwater Creek and Cheaha Creek.

Table 3-4 displays the approximate surface area and volume of sediment represented by each of the defined strata. The surface area was calculated as the product of a representative length for each transect, calculated as the sum of one half of the distances to the adjacent upstream and downstream transects, and the measured water width of that transect. Each core on a transect was assigned an equal portion of the total area represented by that transect. Sediment volumes for each core were calculated as the area represented by that core, multiplied by the thickness of sediment recovered for that core. Total surface areas and volumes for each stratum were calculated as the sum of all cores in that stratum.

3.3.4 Identification of Choccolocco Creek Land Use and Habitat

Land use within the Choccolocco Creek floodplain is largely agricultural or forested with a limited number of residential properties. Figure 3-12 presents the floodplain width and land use at approximately 284 locations along Choccolocco Creek including agriculture, forest, residential scrub/shrub, and a wastewater treatment plan (WWTP). This figure was developed using aerial photographs taken in January 1999. There are three additional WWTPs in the watershed that ultimately discharge to Choccolocco Creek. The land use inventory presented on Figure 3-12 is also supported by the information available through USEPA's BASINS database (USEPA, 1999e) as presented on Figure 3-13. USEPA's information identifies the combination of agricultural and forested areas as 84% of the total land use along the Choccolocco Creek. Also consistent with Figure 3-12, USEPA's estimate of residential land use along Choccolocco Creek is low (5%, according to the BASINS database).

The land use and habitat information for Choccolocco Creek was reviewed with respect to the geographic reaches identified in Section 3.3.2 to ensure the Phase II sediment data would support the needs of the HEA. Given the predominance and consistency of agricultural and forested land along the creek, the six geographic reaches presented on Figure 3-11 will support the needs of the HEA. The habitat along Choccolocco Creek is variable and largely a function of the physical characteristics used to segment the geographic reaches of the creek and to evaluate the sediment textural strata (e.g., water depth, velocity, stream width, sediment type). As such, the data collected during the Phase I creek characterization activities were used by the Habitat Assessment team to independently select the habitat sampling stations. The habitat sampling was completed in advance of segmenting the creek into the six geographic reaches for the Phase II characterization (i.e., PCB analyses). To assess the compatibility of the habitat assessment data with the creek segments used to characterize the distribution of PCBs in the sediment, the habitat sampling locations were plotted on a map along with the six geographic segments. The results of this activity indicated that the habitat sampling stations were well distributed throughout the entire creek with one or more habitat sampling stations located in most of the reaches of the creek (Figure 3-11).

The high level of compatibility between the habitat sampling locations and the segmentation of the creek into geographic reaches for characterizing the distribution of PCBs is consistent with the similar, but independent activities, to define the creek based on physical characteristics.

3.3.5 Selection of Sediment Cores for Chemical Analysis

To characterize the distribution of PCBs in Choccolocco Creek sediment, sediment cores from each stratum were selected for analysis. The sample sizes for each stratum were based upon the distribution of cores in each stratum (Table 3-3) and the relative area and volume of sediment represented (Table 3-4).

The Off-Site RFI Work Plan specified that five to 15 cores from each of the fine- and coarse-sediment strata be selected for laboratory analysis from each geographic reach. To provide a high degree of statistical confidence in the sediment PCB data, and to represent the maximum combined total of 30 cores per geographic reach, a combined 30 cores were allotted among textural strata (e.g., 25 fine-grained and five coarse-grained). The only exception was the reach upstream of the confluence with Snow Creek, where a total of 11 cores were collected. In this case, five of the eight fine-grained cores were analyzed. Table 3-5 presents the cores from each stratum selected for laboratory analyses as a ratio of total number collected. Allocation of samples focused on the fine sediments because higher and more variable PCB concentrations were expected to occur in fine sediment, rather than in coarse sediment. Sample sizes were also adjusted to account for the proportion of fine- and coarse-sediment cores in each reach, as well as the calculated volume of sediment represented by that textural stratum. The minimum sample size per stratum was five cores. The overall core allocation included the segmentation and analysis of 71 of the 161 (44%) cores classified as fine-grained, 66 of the 312 (21%) cores classified as coarse-grained, and seven of the 75 cores (9%) described as being primarily gravel.

The cores selected and number of samples from each core for PCBs and select metals are presented in Table 3-6. It is important to note that both the selection of cores for PCB analysis and the cores to be analyzed for select metals were identified at random for each stratum using the approach presented in the approved Off-Site RFI Work Plan. In addition to cores proposed for PCB and select metals analysis, Table 3-6 includes data from eight cores (representing sediments from each reach, excluding Jackson Shoals) selected for wet-sieve analysis. The separated size fractions of solids from these eight cores were analyzed for PCBs and TOC to assess variations in the PCB content among various particle-size classes. These data were used to evaluate the potential importance of differential transport of sediment particles (i.e., winnowing) in this system.

3.4 Phase II Activities – Choccolocco Creek

Phase II activities for Choccolocco Creek consisted of the segmentation of cores identified at random for laboratory analysis. Each core was segmented into a 0- to 2-inch depth interval, a 2- to 12-inch depth interval, and 12-inch depth intervals thereafter, unless a distinct visible horizon was encountered. This included 144 cores from Choccolocco Creek, resulting in a total of 326 sediment samples (including 17 duplicate samples) for PCB and TOC analyses. Of these 326 samples, 144 also were submitted for particle-size analysis. In addition to the 144 cores selected, an additional eight cores (two from each reach downstream of Snow Creek, excluding Jackson Shoals) were analyzed for PCB on a size-fraction basis to evaluate the PCB-particle size relationship.

Ten out of the 144 cores analyzed for PCB and TOC also were analyzed for select metals. To compare the metals concentrations to background values, four additional cores were collected on Choccolocco Creek near Boiling Springs Road.

3.5 Phase II Results – Choccolocco Creek

Phase II results for Choccolocco Creek are described below in terms of PCB and TOC analytical results, and metals analytical results.

3.5.1 Results of PCB and TOC Analyses

The results for the PCB analyses performed on sediment samples from Choccolocco Creek are provided in Table 3-7 and indicate that PCB concentrations ranged from not detected to 170 mg/kg in a sample from the 12- to 24-inch depth interval of a fine-grained core collected from the backwater area upstream of the Snow Creek confluence. TOC concentrations ranged from not detected to 180,000 mg/kg, for a sample at transect 21 just downstream of the former oxbows.

Figures 3-14 and 3-15 show PCB concentrations in surficial and subsurface sediments by distance from the Snow Creek confluence. As shown on the figures, PCB concentrations were highest upstream of the Snow Creek confluence and decreased downstream, with a majority of concentrations well below 1.0 mg/kg. The distribution of PCB concentrations in Choccolocco Creek (Figure 3-16) shows that more than 30% of the samples from both the fine- and coarse-grained sediments were reported as not detected. As seen on the figure, approximately 75% of fine-grained sediments and 90% of coarse-grained sediments were reported as less than 1.0 mg/kg. There were no coarse-grained sediments with PCB concentrations reported higher than 10 mg/kg, and approximately 95% of fine-grained sediments were reported as having PCB concentrations less than 10 mg/kg. PCB concentrations in the reach from Jackson Shoals to Lake Logan Martin, which contains approximately 85% of the total sediment volume, were less than 1 mg/kg in the majority of cases (92%). No sample from Jackson Shoals to Lake Logan Martin contained PCBs concentrations greater than 3 mg/kg.

Table 3-8 provides a summary of average PCB concentrations found in each of the textural and geographic strata identified in Phase I. The gravel stratum encompassed all geographic reaches and had an average PCB concentration of 0.12 mg/kg. To allow for flexibility in the use of these averages, they have been calculated for surficial sediment (0 to 2 inches) and subsurface sediments (deeper than 2 inches) separately. The subsurface concentrations are based on a depth-weighted PCB concentration for each core (excluding the 0- to 2-inch sample).

The average surficial PCB concentration in all strata ranged from 0.12 mg/kg, for gravel throughout the creek, to 24 mg/kg, in fine sediments from the reach upstream of the Snow Creek confluence. Average surficial TOC concentrations ranged from 1,400 mg/kg, for coarse sediments from the reach between Coldwater and Cheaha creeks, to 23,000 mg/kg, for fine sediments between Cheaha Creek and Jackson Shoals.

3.5.2 Distribution of PCB Mass in Choccolocco Creek

The concentration of PCBs in the surficial sediments of the creek are of primary interest as they directly influence potential ecological or human exposure. However, to assist in understanding the potential fate and transport of PCBs in the differing hydraulic characteristics of Choccolocco Creek, estimates of PCB mass within the individual geographic reaches were developed. The estimates of PCB mass were made using the sediment volume estimates calculated for each stratum during the physical characterization of the creek conducted during Phase I (Table 3-4) and the average PCB concentrations for each stratum, in the surface and subsurface, calculated during Phase II (Table 3-8). The volume of the surface layer was calculated using the area of the stratum and a depth of 2 inches. The volume of the subsurface layer was calculated by subtracting the volume of the surface layer from the total volume of the stratum.

The estimated PCB mass for each stratum is shown in Table 3-9 and on Figure 3-17. The backwater area upstream of Snow Creek, which had the highest PCB concentration, was estimated to contain approximately 52% of the total mass of PCBs in Choccolocco Creek. The area between Jackson Shoals and Lake Logan Martin, which had the largest estimated sediment volume (approximately 85% of the total volume) was estimated to contain approximately 34% of the total PCB mass; however, almost all samples from this reach had PCB concentrations less than 1 mg/kg. These two areas represent the low energy, depositional areas of Choccolocco Creek. The remaining 14% of the estimated PCB mass was distributed between the remaining reaches of Choccolocco Creek, with over half of this found in the reach between Snow and Coldwater creeks.

The significant findings of this investigation include:

- A majority of the PCBs are isolated from the environment at depth within the upstream backwater area of the creek. This area is depositional in nature and thus, the PCBs are not expected to be subject to disturbance and re-suspension.

- PCBs in the sediment downstream of Jackson Shoals are not a concern as average concentrations are well below 1 mg/kg (both surficial and at depth). The thickness of the sediment deposits in this reach of the creek indicate that it is depositional in nature and not a potential long term source of PCBs to Lake Logan Martin.

- PCBs in the sediments from Snow Creek to Jackson Shoals reach, while potentially erodible during high-flow conditions, are not present in significant concentration or mass to influence PCB fate and transport trends within the off-site area, such as natural attenuation.

3.5.3 Results of Metals Analyses

The results of the select metals analyses for Choccolocco Creek are presented in Table 3-10 and are summarized below.

Arsenic

Arsenic was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for arsenic ranged from 1.2 mg/kg, for a sample from the 12- to 24-inch depth interval of core C-176-SED-2, located in the reach from Jackson Shoals to Lake Logan Martin, to 22 mg/kg, for a sample from the 12- to 17.5-inch depth interval of core C-U4-SED-4, located near Boiling Springs Road.

Barium

Barium was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for barium ranged from 14 mg/kg, for a sample from the 2- to 6-inch depth interval of core C-165-SED-2, located in the reach between Jackson Shoals and Lake Logan Martin, to 380 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

Beryllium

Beryllium was detected in 48 out of 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for beryllium ranged from not detected to 3.7 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek

Cadmium

Cadmium was detected in 21 out of 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for cadmium ranged from not detected to 2.2 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

Chromium

Chromium was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for chromium ranged from 3.6 mg/kg, for a sample from the 2- to 4-inch depth interval of core C-U4-SED-2, located near Boiling Springs Road, to 82 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

Cobalt

Cobalt was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for cobalt ranged from 2.2 mg/kg, for a sample from the 2- to 4-inch depth interval of core C-U4-SED-2, located near Boiling Springs Road, to 55 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

Lead

Lead was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for lead ranged from 2.0 mg/kg, for a sample from the 2- to 4-inch depth interval of core C-U4-SED-2, located near Boiling Springs Road, to 110 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

Manganese

Manganese was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for manganese ranged from 51 mg/kg, for a sample from the 2- to 8.5-inch depth interval of core C-U4-SED-1, located near Boiling Springs Road, to 3,000 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

Mercury

Mercury was detected in 10 out of 10 samples collected from Choccolocco Creek near Boiling Springs Road. Mercury concentrations in these background samples ranged from 0.0092 mg/kg to 0.087 mg/kg, for a sample from the 12- to 17.5-inch depth interval of core C-U4-SED-2. Sediment samples from cores collected downstream of the Snow Creek confluence exceeded the holding time for mercury while in frozen storage. In lieu of these results, surface sediment samples collected throughout Choccolocco Creek were used. These samples included five samples from each of the three fish sampling locations (ADEM 96, New 99, and Station 35) for a total of 15 samples on Choccolocco Creek. The concentrations for these three locations ranged from 0.034 mg/kg to 1.17 mg/kg, in a sample from Station 35.

Nickel

Nickel was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for nickel ranged from 1.8 mg/kg, for a sample from the 2- to 4-inch depth interval of core C-U4-SED-2, located near Boiling Springs Road, to 64 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

Vanadium

Vanadium was detected in all 54 of the sediment samples analyzed from Choccolocco Creek. Concentrations for vanadium ranged from 3.4 mg/kg, for a sample from the 2- to 4-inch depth interval of core C-U4-SED-2, located near Boiling Springs Road, to 63 mg/kg, for a sample from the 2- to 13-inch depth interval of core C-071-SED-1, located in the reach from Coldwater Creek to Cheaha Creek.

The results of the metal analysis for the sediment samples from Choccolocco Creek are indicative of the industrial areas within the overall watershed. This is supported by the presence of metals at the upstream background sampling locations and the wide range of industries along Snow Creek that ultimately feed into Choccolocco Creek.

3.6 Phase I Activities – Snow Creek

Phase I characterization activities in Snow Creek differed from those in Choccolocco Creek. Whereas Choccolocco Creek's sampling involved the measurement and characterization of the sediment through probing and the collection of cores at regular intervals, the Phase I characterization of Snow Creek involved mapping and measuring of discernible sediment deposits prior to Phase II core collection. Snow Creek's small size and shallow depth allowed for the continuous visual observation and probing of the creek bed from the 11th Street Ditch downstream to the confluence with Choccolocco Creek, excluding the segment of the creek subject to the construction activities at Quintard Mall in Oxford, Alabama, during the sampling period. A short segment of the creek was also not characterized because of access limitations. This reach is located in the vicinity of Sandy Creek Lumber Company, for which no access was granted. Sediment deposits (characterized as those areas penetrable by the probing rod) were identified and characterized by area of the deposit, average thickness of the deposit, predominant sediment types, and the type of depositional environment (e.g., channel deposit, aggrading bar). The locations of identified deposits and creek characteristics are depicted on Figures 3-18 through 3-31 and are listed in Table 3-11. Approximately 100 sediment deposits were identified and characterized in this manner.

3.7 Phase I Results – Snow Creek

Phase I results for Snow Creek are reported in terms of the identification of sediment deposits and geographic strata, the identification of geomorphologic strata, the identification of land use and habitat, and selection of sediment cores for chemical analysis.

3.7.1 Identification of Sediment Deposits and Geographic Strata

Sediment deposits identified during Phase I activities in Snow Creek are summarized in Table 3-11 and shown on Figures 3-18 through 3-31. In the field, Snow Creek was divided into six sections for identification purposes. The area near the Quintard Mall was not characterized during Phase I, since that effort was completed as a part of ongoing construction activities. In addition, the creek in this area following construction will be a concrete-lined channel. Sediment volume estimates in Snow Creek were calculated as the product of the approximate surface area and average sediment thickness and are presented in Table 3-12. The largest deposit, consisting of sediment built up in culvert pipes, had an estimated volume of 1,600 cy (30% of the total sediment volume) and covers an area of approximately 14,400 ft^2. The deposit consists of predominantly fine to very coarse sands and gravel. The remaining deposits, comprising 70% of the sediment volume, ranged from 20 ft^2 to 7,800 ft^2 and from less than 1 cy to 433 cy. These deposits are characterized as aggrading bars, terrace deposits, channel deposits, and bank deposits.

3.7.2 Identification of Geomorphologic Strata

The descriptions of the depositional environment provided in Table 3-11 were categorized as follows:

- Aggrading bars - including deposits characterized as sand bars and islands;
- Channel deposits - including bank wash;
- Terraces - including high and low terraces as well as bank deposits; and
- Other - including a drainage ditch outlet and the exposed sediment built up in culvert pipes.

The majority of deposits characterized contained a heterogeneous mixture of particle sizes. Only 26 deposits were characterized as fine sediment deposits. Fine sediment deposits, identified in Table 3-12 by shading, were considered as those deposits that contained more than trace amounts of silts or clays. These deposits were predominantly found at the upstream and downstream portions of Snow Creek.

3.7.3 Identification of Snow Creek Land Use and Habitat

Land use within the Snow Creek floodplain is variable with small areas of the floodplain often supporting multiple land uses and property ownership. The information was developed based on a review of 1999 aerial photographs. The range of land uses reflects the urbanized nature of Snow Creek and includes heavy industry, manufacturing, residences, light commercial, and public recreation.

Similar to the approach used for Choccolocco Creek, the available land use information was reviewed with respect to the needs of the HEA. Given the multiple range of land uses that typically occurred within each geographic reach, the six segments initially identified during the field sampling phase (Section 3.7.1) were deemed consistent with the needs of the HEA. The habitat sampling station was also located in the downstream reach of Snow Creek.

3.7.4 Selection of Sediment Cores for Chemical Analysis

The selection of deposits in Snow Creek for sediment sampling was based on the distribution of sediment deposits in the geographic and geomorphic strata. Since higher PCB levels were expected to be associated with fine-grained sediment deposits, all 26 of these deposits were selected for core collection. Three sediment cores were allocated to the largest deposit (characterized as exposed sediment built up in culvert pipes) to characterize approximately 30% of the entire sediment volume of Snow Creek in the reaches studied. The remaining 31 cores were allocated between the remaining strata according to the number of deposits and deposit areas. The volume of sediment estimated for each stratum is presented in Table 3-13. The individual deposits selected for core collection are indicated in Table 3-11, and the overall allocation of sediment cores by strata is summarized in Table 3-14.

Field activities for Snow Creek sediment cores included the collection and analysis of 17 cores from 16 of the 53 individual deposits classified as aggrading bar deposits, representing 39.1% of the estimated total sediment volume; 11 cores from 11 of the 22 channel deposits, representing 5.7% of the total sediment volume; and 18 cores from 18 of the 24 terrace deposits, representing 11% of the total sediment volume in Snow Creek. Four samples were collected from two individual deposits that were not classified in the above three strata; these two deposits represented approximately 30% of the total sediment volume observed in Snow Creek.

Including all strata, the 50 cores collected from the 101 observed deposits represented approximately 66% of the total area and 86% of the total volume of sediment deposits in Snow Creek.

3.8 Phase II Results – Snow Creek

Phase II results for Snow Creek are reported below in terms of PCB and TOC analyses, distribution of PCB mass in Snow Creek and metals analyses.

3.8.1 Results of PCB and TOC Analyses

The results for the PCB analyses performed on sediment samples from Snow Creek are provided in Table 3-15 and indicate that PCB concentrations ranged from not detected to 60 mg/kg in a duplicate sample from deposit S-2-06. This sample was of coarse-grained sediment that had been built up in a culvert pipe under Route 202. TOC concentrations are also presented in Table 3-15 and ranged from not detected to 250,000 mg/kg in deposit S-6-07. This sample was of fine-grained sediment from a channel deposit next to the Choccolocco Creek confluence.

PCB concentrations shown by distance from the 11th Street Ditch for all sediment depths are presented on Figure 3-32. As seen on the figure, PCB concentrations are generally higher in the upstream reaches of the creek and lowest throughout the middle portion of the creek (from the railroad bridge to Highway 78). PCB concentrations then increase again as the creek nears its confluence with Choccolocco Creek and the creek becomes more depositional in nature.

The overall distribution of PCB concentrations in Snow Creek (Figure 3-33) shows that approximately 18% of all samples were reported as having PCB concentrations less than 1.0 mg/kg and 73% of samples were reported as less than 10 mg/kg.

Table 3-16 provides a summary of PCB concentrations found in each of the geomorphological strata identified in Snow Creek. Average PCB concentrations found in each stratum ranged from 0.088 mg/kg upstream of the 11th Street Ditch to 33.3 mg/kg in sediment built up in a culvert pipe. Figure 3-34 shows the average PCB concentration in each type of deposit from upstream to downstream by reach.

3.8.2 Distribution of PCB Mass in Snow Creek

Similar to the evaluation conducted for Choccolocco Creek, the mass of sediment-bound PCBs within the geographic reaches of Snow Creek was estimated to assist in understanding the potential fate and transport of these sediments. Estimates of PCB mass were made using the sediment volumes calculated for each stratum during the physical characterization of the creek conducted during Phase I (Table 3-13) and the average PCB concentration for each stratum calculated during Phase II (Table 3-16). The estimated mass of PCB for each stratum is presented in Table 3-17 and on Figure 3-35. The stratum characterized as "other" between 9th Street and the railroad bridge contains approximately 52% of the total PCB mass for the creek. This stratum consists of sediment built up in culvert pipes under the Route 202 bridge and contained approximately 30% of the total sediment volume characterized. The aggrading bar environment between the Highway 78 bridge and the Choccolocco Creek confluence, which contained approximately 23% of the total calculated sediment volume, also contains approximately 20% of the total PCB mass in the creek. The remaining 28% of the total PCB mass is distributed throughout the rest of the creek.

The significant findings of this evaluation include:

- PCBs are generally contained to two reaches of the creek with a majority of PCBs isolated from the environment in culvert pipes and do not appear to be susceptible to erosion or exposure.
- The overall inventory or mass of PCBs in the sediments of Snow Creek is relatively small and will not significantly influence the fate and transport trends within the Off-Site area, such as natural attenuation.

3.8.3 Results of Metals Analyses

The results of the select metals analyses for Snow Creek are presented in Table 3-18 and are summarized below.

Arsenic

Arsenic was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for arsenic ranged from 3.3 mg/kg, for a sample from the 4- to 15-inch depth interval of a core from near 14^{th} Street, to 21 mg/kg, for two samples, one from the 2- to 6.5-inch depth interval of a core from near 16^{th} Street and the other from the 0- to 2-inch depth interval of a core from deposit S-1-04.

Barium

Barium was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for barium ranged from 29 mg/kg, for a sample from the 0- to 2-inch depth interval of a core from near 16^{th} Street, to 380 mg/kg, for a sample from the 2- to 12-inch depth interval of a core from deposit S-6-10.

Beryllium

Beryllium was detected in 14 out of 30 of the sediment samples analyzed from Snow Creek. Concentrations for beryllium ranged from not detected to 3.6 mg/kg, for a sample from the 0- to 3-inch depth interval of a core from deposit S-2-3A.

Cadmium

Cadmium was detected in 16 out of 30 of the sediment samples analyzed from Snow Creek. Concentrations for cadmium ranged from not detected to 3.3 mg/kg, for a sample from the 2- to 8-inch depth interval of a core from near 14^{th} Street.

Chromium

Chromium was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for chromium ranged from 21 mg/kg, for a sample from the 0- to 2-inch depth interval of a core from near 16^{th} Street, to 1,000 mg/kg, for a sample from the 2- to 4-inch depth interval of a core from near 14^{th} Street.

Cobalt

Cobalt was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for cobalt ranged from 3.5 mg/kg, for a sample from the 0- to 2-inch depth interval of a core from near 16th Street, to 110 mg/kg, for a sample from the 0- to 3-inch depth interval of a core from deposit S-2-3A.

Lead

Lead was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for lead ranged from 2.0 mg/kg, for a sample from the 9- to 14-inch depth interval of a core from near 14th Street, to 150 mg/kg, for a sample from the 2- to 8-inch depth interval of a core from deposit S-1-01.

Manganese

Manganese was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for manganese ranged from 110 mg/kg, for a sample from the 4- to 15-inch depth interval of a core from near 14th Street, to 7,500 mg/kg, for a sample from the 2- to 8-inch depth interval of a core from near 16th Street.

Mercury

Mercury was detected in 24 out of 27 of the sediment samples analyzed from Snow Creek. Concentrations for mercury ranged from not detected to 8.6 mg/kg, for a sample from the 2- to 8-inch depth interval of a core from deposit S-1-01.

Nickel

Nickel was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for nickel ranged from 5.8 mg/kg, for a sample from the 0- to 2-inch depth interval of a core from near 16th Street, to 110 mg/kg, for a sample from the 0- to 3-inch depth interval of a core from deposit S-2-3A.

Vanadium

Vanadium was detected in all 30 of the sediment samples analyzed from Snow Creek. Concentrations for vanadium ranged from 16 mg/kg, for a sample from the 0- to 2-inch depth interval of a core from near 14th Street, to 64 mg/kg, for a sample from the 0- to 2-inch depth interval of a core from deposit S-1-01.

The results of the metals analysis conducted for the sediment samples from Snow Creek indicate that a wide range of metals are present, including at the upstream background sampling locations. This is indicative of the wide range of industrial activities within the urbanized Snow Creek watershed area.

3.9 Choccolocco Creek Top-of-Bank Sampling

To assess potential PCB transport in eroded soils, top-of-bank samples were also collected along Choccolocco Creek for PCB analysis as specified in the Off-Site RFI Work Plan.

3.9.1 Top-of-Bank Sampling Activities

Based on field observations of the bank conditions along the creek, 49 transects with potential for significant erosion were identified. Top-of-bank samples were collected from 36 of these locations. At the other 13 locations, access was either not available (12 locations), or access limitations on adjoining properties prevented sampling (one location). This sample information, along with the top-of-bank samples split with ADEM, is presented in Table 3-19. The top-of-bank transect locations identified in Table 3-19 are also presented on Figure 3-36.

As part of the Off-Site RFI studies, top-of-bank soil sampling was conducted at locations along Choccolocco Creek that appeared to have potential for extreme bank erosion. While initially included in the Off-Site RFI to assist in evaluating the creek sediment data, these data are also useful in refining the conceptual model for the floodplain and were used to assist in preparing the Phase II Off-Site (Floodplain) RFI/CS Investigation Work Plan (BBL, 2000).

3.9.2 Top-of-Bank Sampling Results

For each top-of-bank sampling location, Table 3-20 includes the sampling location using the same nomenclature as used to identify the sediment sampling transects (for example, C-034-LB is the left bank of transect 34 facing in an upstream direction) and the associated PCB concentration (mg/kg) for the 0- to 6-inch horizon. The table also identifies locations not sampled because access was not available.

PCB concentrations in top-of-bank samples ranged from not detected to 21 mg/kg, in a sample collected from the left bank of transect 12 (C-012-LB-1). TOC concentrations ranged from 6,700 mg/kg, in sample C-034-RB-1, to 45,000 mg/kg, in sample C-159-LB-1. The mean PCB and TOC concentrations for all top-of-bank samples were 3.6 mg/kg and 18,000 mg/kg, respectively.

The PCB sample results are also graphically presented on Figure 3-36 and illustrate a general decline in PCB concentrations moving in a downstream direction. These data are consistent with the sediment PCB data for the creek discussed in Section 3.5 as well as with historical fish and sediment data.

3.10 Geochronological Sampling

This section presents the sampling activities and results for the two geochronological sampling events conducted in Lake Logan Martin. The first event was conducted in 1999 and was followed by a supplemental sampling event in April 2000. The supplemental sampling was performed at four sampling locations in the deeper-water area of Lake Logan Martin and at one location in Lake Neely Henry (Figure 3-37).

3.10.1 Geochronological Sampling Activities

Geochronological sediment cores were collected from depositional areas in Lake Logan Martin in April 1999. Four cores were collected at each of three locations in the lake: upstream of Choccolocco Creek near Route 20, at the mouth of Choccolocco Creek, and downstream of Choccolocco Creek near Griffitt Bend. Each core was finely sectioned in accordance with methods prescribed in the Off-Site RFI Work Plan and submitted to the laboratory for radionuclide analysis of cesium 137 (Cs^{137}), lead 210 (Pb^{210}), and beryllium 7(Be^{7}). Results of the radionuclide analyses were then evaluated for purposes of characterizing historical and recent sediment transport rates, sediment deposition rates, and surface sediment mixing depths prior to the analysis of any samples for PCBs. Each of the four cores from the three lake locations was analyzed for radionuclides.

The success of the geochronological dating of the cores was mixed. Radionuclide data are graphically presented on Figures 3-38 through 3-40. While some of the cores collected in Lake Logan Martin exhibited Cs^{137} and Pb^{210} profiles consistent with our expectations, the overall level of radioactivities were generally much lower than would be desired for sediment dating purposes. The Cs^{137} profiles exhibited activities well below values that would be expected, and the Pb^{210} profiles, which were expected to decline by several orders of magnitude throughout the depth of the sediment cores, varied by only a factor of two to three in most cores and exhibited a high degree of variability in one-third of the cores analyzed. In summary, the low levels of radionuclides and the variability exhibited by many of the cores limit further use of these samples for establishing a reliable depositional chronology. Only the two cores from Lake Logan Martin downstream of Choccolocco Creek yielded adequate Cs^{137} profiles to perform preliminary sedimentation modeling as described in the Off-Site RFI Work Plan. These results suggest that the surface sediment mixing zone in this area is in the 2- to 5-inch range, which supports the 2-inch depth interval for surficial sediment sampling performed in conjunction with the fish collection.

In accordance with the Off-Site RFI Work Plan, the core exhibiting the best Cs^{137} profile at each location was analyzed for PCBs. Results of PCB analyses are plotted on the depth profiles on Figures 3-38 through 3-40. PCBs were only detected in three of the 12 cores analyzed (Table 3-21). All three of the samples where PCBs were detected had concentrations less than 0.1 mg/kg. The cores collected from Lake Logan Martin upstream of Choccolocco Creek and near the mouth of Choccolocco Creek are inadequate for modeling purposes and suggest inconsistent local depositions, irregular mixing, a transient sediment bed, or disturbance during sampling activities. It is possible that the upper and lower lake sampling stations were at some time not subaqueous, or had very shallow water depths as the lake levels during the early 1970s were quite low. This shallow water environment may have altered the deposition profile due to wind-wave action, degradation of the lead, or physical mixing due to land-based activities. For the samples location at the mouth of Choccolocco Creek, the results of the sediment probing indicated that sediment deposition occurred over a wide area and that the creek channel may have moved from time to time within this general area. As a result, an area of the creek bed that represents a consistent record of deposition may not be present in the mouth of the creek, but would more likely be found further upstream in Choccolocco Creek.

Given the importance of understanding sediment deposition in the lake, an additional round of geochronological sampling was proposed and accepted into the Off-Site RFI Work Plan. As described below, the supplemental sampling was conducted in deeper water areas of the lake that were not influenced by the factors identified above.

3.10.2 Supplemental Geochronological Sampling

Because the initial samples did not provide the expected information and to further evaluate sediment deposition, additional geochronological samples were collected at five locations to obtain more well-defined and usable radionuclide profiles. Sampling efforts focused on deep-water areas of the three general locations identified in the Off-Site RFI Work Plan (Lake Logan Martin upstream of, downstream of, and at the mouth of Choccolocco Creek), as well as two new proposed locations. The two new locations, one each upstream of Logan Martin and Neely Henry dams, are expected to be heavily depositional and are expected to yield acceptable profiles.

The deeper-water areas are expected to yield cores reflecting consistent sediment deposition rates of fine-grained sediment, which offer a better opportunity to meet the criteria for geochronological dating. Given the deeper water, diver-assisted sampling was performed. With the exception of one sampling location, the collection of sediment cores solely targeted areas in the deeper-water near the thalweg of the former Coosa River channel. At the sampling station located at the mouth of Choccolocco Creek, the supplemental sampling efforts were guided by a balance between the thalweg area and the Off-Site RFI Work Plan approach of obtaining a sediment sample at this location, which reflects sediments originating from Choccolocco Creek with little or no contribution from the Coosa River. All sampling methods and analyses were performed in accordance with the Off-Site RFI Work Plan.

Radioisotope data for these samples have not been received from the laboratory. These data will be reported to ADEM upon receipt as an addendum to this report. PCB concentrations in the finely sectioned cores were generally very low with an average concentration well below 1 mg/kg. Sediment PCB concentrations from cores collected just upstream of Logan Martin Dam indicated that PCBs are present in this portion of the reservoir at depth, but not in the top one foot of sediment. The maximum PCB concentration (3.5 mg/kg) reported was from the 40- to 42-inch depth interval of core DLM-GEO-2. The PCB concentration profile (Figure 3-41) indicated that PCB concentrations decreased sharply from the maximum concentration in both directions. Cores collected throughout the rest of Lake Logan Martin were consistent with the initial core samples, with PCB values reported as not detected or PCB concentrations reported as less than 0.2 mg/kg.

PCB samples from cores collected from Choccolocco Creek near transect 167 showed PCB concentrations at the surface of less than 0.2 mg/kg and a maximum PCB concentrations of approximately 1 mg/kg (Figure 3-42). The maximum reported PCB concentration was from the 18- to 20-inch depth interval of core MLM-GEO-7.

3.11 Surface Sediment

This section presents a summary of the surface sediment sampling activities and the results of the PCB, TOC, and mercury analyses conducted on the samples obtained.

3.11.1 Surface Sediment Sampling Activities

Surface sediment samples were collected from each of the seven fish sampling locations identified on Figure 3-43. A total of 10 samples per location were collected from the 0- to 2-inch horizon and shipped to the laboratory for PCB analysis. Five of the 10 samples from each location were also analyzed for total mercury. The samples were collected in accordance with the Off-Site RFI Work Plan. The ADEM Field Operations Group also provided oversight for sample collection activities at one of the seven locations and obtained a split sample from this location.

3.11.2 Surface Sediment Sampling Results

Average surface sediment PCB (Table 3-22) concentrations at each fish sampling location in Choccolocco Creek were less than 1.0 mg/kg. PCBs were not detected at any of the four Lake Logan Martin sampling locations. In Choccolocco Creek, the average surficial PCB concentration at ADEM 96, near Coldwater Creek, was 0.29 mg/kg; at New 99, between Cheaha Creek and Jackson Shoals, was 0.66 mg/kg; and at Station 35, near the mouth of Choccolocco Creek, was 0.84 mg/kg. Although surface sediment PCB concentrations increased in the downstream direction, there was a corresponding increase of TOC, from an average of 3,780 mg/kg near Coldwater Creek to 26,500 mg/kg at the mouth of Choccolocco Creek. When PCB concentrations are adjusted for TOC, the bioavailable PCB concentration in terms of PCB per kilogram TOC actually decreased, from 117 mg/kg TOC to 34 mg/kg TOC to 26 mg/kg TOC in the upstream-to-downstream direction. This trend serves to contrast the coarse low-organic sediment upstream in the high-energy areas of Choccolocco Creek with the fine-grained, high-TOC sediment collected in the lower-energy headwaters to Lake Logan Martin.

Mercury concentrations were higher in Choccolocco Creek surface sediment than in the surface sediment of the Lake Logan Martin sampling locations. In Choccolocco Creek surface sediment, mercury was fairly consistent, with average concentrations of 0.86 mg/kg, 0.85 mg/kg, and 1.1 mg/kg in samples collected from near Coldwater Creek, downstream of Cheaha Creek, and the mouth of Choccolocco Creek, respectively. In Lake Logan Martin surface sediment, mercury concentrations ranged from 0.035 mg/kg at Station 38 near Griffitt Bend to 0.125 mg/kg just upstream of Logan Martin Dam.

3.12 Wet Sieve Sampling Results

To assess the variation in the PCB content among various particle size classes and the potential importance of the differential transport of sediment particles (i.e. winnowing) a wet sieve analysis was performed on sediment from eight cores collected from Choccolocco Creek during Phase I sampling. The cores were sieved according to the procedures outlined in Appendix L of the QA/SAPP and fractionated sediment was submitted for laboratory analysis of PCB and TOC. The results of these analyses are presented on Table 3-23.

As expected, higher PCB concentrations were generally associated with the finer material within each core than the coarser material within each core. This relationship is stronger in the sediment collected upstream in Choccolocco Creek and weakens in the downstream direction, as input of the various size fraction provides dilation of particulate PCB within all size classes. These trends can be seen in Figure 3-44, which show PCB concentrations for each size fraction for all cores where PCB was detected. These data confirm the theory behind the stratified sampling approach, which predicts that higher and more variable PCB concentrations are expected to be found in the finer sediments throughout the system.

3.13 QA/AC

Data from 47 sample delivery groups for samples collected between April 1999 and May 2000 were reviewed for quality assurance/quality control compliance with method guidelines and project specific requirements. Each data package from the laboratory (STL-Savannah) was reviewed as outlined in the Quality Assurance Project Plan. Specifically included were an evaluation of holding times, calibration requirements (initial and continuing), blank contamination, surrogate recovery, matrix spike and duplicate performance, laboratory control sample recovery and analyte identification, as applicable.

The results of the data validation activities indicated that the analytical chemistry data for the sediment samples will support the Off-Site RFI Data Quality Objectives (DQOs). Of the 6330 PCB and metals analyses conducted on the sediment samples, over 98% of these results met the DQOs for this project and were used in preparing this Off-Site RFI report. The specific findings of the data review for the sediment samples are provided below.

3.13.1 Snow Creek Sediment Data

PCB analyses were performed following EPA SW-846 method 8082 for 129 samples. Select metals (arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel and vanadium) analyses were performed following methods 6010 and 7471 for 38 samples. All PCB data were reported on an Aroclor-specific basis.

All QA/QC parameters were found to be within acceptable limits, with the following exceptions:

- Recoveries for both PCB surrogates were below control limits in 3 samples, resulting in the qualification of all Aroclor data for the samples as estimated with a potential low bias. Recoveries for both surrogates were above control limits in one sample, resulting in the qualification of Aroclor data for the sample as estimated.

- Agreement between two dissimilar columns was evaluated and the percent difference was high resulting in the qualification of PCB data for 10 samples. In addition, the laboratory reported the lower of the two column results. All positive results were corrected to reflect the higher of the two column results, in accordance with method specifications.

- Mercury analyses for eight samples were performed outside the specified holding times. Mercury data for four samples were qualified as estimated and mercury data for four samples were rejected based on exceedance of the holding time.

- Beryllium was detected in the method and calibration blanks resulting in qualification of data for 21 samples.

- Serial dilutions were outside control limits resulting in the qualification of beryllium data as estimated for six samples.

- Matrix spike recoveries were outside control limits for barium, chromium, vanadium, lead and cobalt. Data for 24 samples for barium, 26 samples for chromium, 21 samples for vanadium, five samples for lead and three samples for cobalt were qualified as estimated based on matrix spike recoveries.

- Field duplicate results were outside control limits resulting in the qualification of nickel data as estimated in two samples.

3.13.2 Choccolocco Creek Sediment Data

PCB analyses were performed following EPA SW-846 method 8082 for 455 samples. Select metals (arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel and vanadium) analyses were performed following methods 6010 and 7471 for 54 samples and mercury analyses were performed following method 7471 for 40 samples. All PCB data were reported on an Aroclor-specific basis.

All QA/QC parameters were found to be within acceptable limits, with the following exceptions:

- Recoveries for both PCB surrogates were below control limits in five samples, resulting in the qualification of all Aroclor data for the samples as estimated.

- Agreement between two dissimilar columns was evaluated and the percent difference was high resulting in the qualification of PCB data for nine samples. In addition, the laboratory reported the lower of the two column results. All positive results were corrected to reflect the higher of the two column results, in accordance with method specifications.

- Due to extract discrepancies between original and reextracted analyses, eight samples were qualified as estimated.

- 35 samples were extracted and analyzed outside the specified holding time, resulting in the rejection of data for eight samples and the qualification as estimated of data for 27 samples.

- Fifty two samples were analyzed for mercury outside the specified holding times. Mercury data for four samples were qualified as estimated and mercury data for 48 samples were rejected based on exceedance of the holding time. Arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel and vanadium data for nine samples were also qualified as estimated based on holding times.

- Matrix spike recoveries were outside control limits for chromium, vanadium, mercury, manganese and cobalt. Manganese, chromium, mercury and cobalt data for 10 samples and vanadium data for eight samples were qualified as estimated based on the recoveries.

- Several serial dilution results were outside control limits, resulting in the qualification of beryllium data as estimated for 10 samples and nickel data as estimated for four samples.

- Beryllium was detected in the method and calibration blanks resulting in qualification of data for six samples.

3.13.3 Geochronological Sediment Data

PCB analyses were performed following EPA SW-846 method 8082 for 198 samples. Data were reported on an Aroclor-specific basis.

- 26 samples were extracted and analyzed outside the specified holding times. All PCB data for the samples were qualified as estimated.

- Recoveries for both surrogates were below control limits in 11 samples, resulting in the qualification of all Aroclor data for the samples as estimated with a potential low bias.

- Agreement between two dissimilar columns was evaluated and the percent difference was high resulting in the qualification of data for 16 samples.

- False negative results were reported for three samples. Data for these samples were manually calculated and the results were qualified as estimated with presumptive evidence of identification.

3.13.4 Overall QA/QC Summary

With the minor exceptions noted above, the data quality was within acceptable limits and the data are considered acceptable for use within the Off-Site RFI report. While the mercury analyses for many of the sediment cores from Choccolocco Creek exceeded holding times, a significant number of sediment samples were collected at several locations along the creek during the surficial sediment sampling program providing a sufficient data set to complete this component of the Off-Site RFI sediment evaluation.

The high quality of the analytical results for the sediment and soil samples is demonstrated by the fact that 98% of the data meets the DQOs for the project.

3.14 Summary

This section presents a summary of the key findings of the sediment investigation for Snow Creek, Choccolocco Creek, and Lake Logan Martin.

3.14.1 Snow Creek

Snow Creek sediments were predominantly coarse-grained, with only 26% of the deposits characterized as containing more than trace amounts of silt and clay. The frequency of occurrence for sediment deposits was generally higher in the lower portion of the creek when compared to the middle portion and first mile downstream of the 11th Street Ditch.

PCBs are present in a variety of depositional environments throughout Snow Creek, including the portions of the creek upstream of the 11th Street Ditch. Reported PCB concentrations are the highest in the first mile of Snow Creek below the 11th Street Ditch and are the lowest in the middle, channelized portion of the creek. PCB concentrations between Highway 78 and the Choccolocco Creek confluence were generally higher than the middle section of the creek but less than the first mile downstream of the 11th Street Ditch.

Over 50% of estimated PCB mass in the creek is found in sediment in the culvert pipes under Route 202. Aggrading bar deposits between Highway 78 and the Choccolocco Creek confluence contain approximately 20% of the total estimated PCB mass in Snow Creek.

3.14.2 Choccolocco Creek

Choccolocco Creek sediments below Jackson Shoals and upstream of the Snow Creek confluence were generally characterized as fine-grained, while the stretch between Snow Creek and Jackson Shoals was predominantly coarser material. Based upon the textural description of sediment and the thickness of those sediments, three predominantly depositional areas of the creek were delineated. The first area is found upstream of the Snow Creek confluence, the second area is found behind the sill of a former dam located just upstream of Jackson Shoals, and the third area is found in the headwater area of Lake Logan Martin below Jackson Shoals.

Sediments characterized as fine-grained generally exhibited higher PCB concentrations than coarse sediments, indicating that particle size can be used as a general indicator of the presence of PCBs. PCB concentrations are highest in the backwater area upstream of the Snow Creek confluence. They generally decline in the downstream direction until they begin to increase just before Jackson Shoals, although the concentrations very seldom exceed 1 mg/kg in this lower reach of the creek. This general trend is evident in the PCB concentrations from the sediment cores as well as in the top-of-bank samples. Surface sediment samples from the three fish collection areas in the creek showed an increasing trend in dry-weight PCB concentrations, but exhibited a decrease in PCB when the numbers were adjusted for TOC variations.

Over 80% of the estimated PCB mass is sequestered in the deep sediment found in the two low-energy, depositional reaches of the creek (upstream of the Snow Creek confluence and downstream of Jackson Shoals). The remaining 20% of the estimated mass was distributed throughout the creek. Although a significant percentage of the total mass (34%) is held in the sediments downstream of Jackson Shoals, the average concentrations is well below 1 mg/kg in this reach and the large mass is a reflection of the large volume of sediment there. Consequently, the sediments in this area are not a source of concern.

3.14.3 Lake Logan Martin

PCB concentrations in surficial sediments (0- to 2-inch) from the fish collection areas were all reported as not detected, while PCB concentrations within the top 1 foot of sediment cores collected for geochronological analyses were all reported as less than 0.2 mg/kg.

The maximum PCB concentration in Lake Logan Martin was 3.5 mg/kg and was found in a sample from the 40- to 42-inch depth interval of a core collected from the original Coosa River channel near Logan Martin Dam.

Preliminary deposition chronologies indicate sediment deposition rates are on the order of 0.3 inches per year and that the sediment mixing depth ranges from 2 to 5 inches.

4. Surface Water Investigation

This section describes surface water investigation activities conducted in accordance with the Off-Site RFI Work Plan and the results of these investigation activities. Results are provided for base-flow and high-flow (storm-flow) sampling, followed by results of 24-hour sampling at Neely Henry Dam and additional surface water sampling at Jackson Shoals, surface water modeling results, and quality assurance/quality control (QA/QC) findings.

4.1 Investigation Activities

The surface water investigation began in March 1999 with the installation of staff gages at the locations specified in the Off-Site RFI Work Plan. Sampling locations are shown on Figure 4-1. Data were collected during six base-flow events and three high-flow events, although high-flow samples were not collected at all the sampling locations identified on Figure 4-1 for reasons discussed in Section 4.1.2. Samples measured surface water flow rates, total suspended solids (TSS), and PCB concentrations at locations selected in the Off-Site RFI Work Plan.

4.1.1 Base-Flow Sampling

The six base-flow sampling events were conducted on March 23-24, 1999; May 3-4, 1999; May 26-27, 1999; June 14, 1999; September 27-28, 1999; and January 19-20, 2000. These sampling events covered a range of base-flow conditions across an entire year.

4.1.2 High-Flow Sampling

The Off-Site RFI Work Plan called for the sampling of three high-flow sampling events in addition to the base-flow sampling events. For Choccolocco Creek, the goal was to sample when peak flows were expected to exceed 1,500 cubic feet per second (cfs) at Jackson Shoals. As previously communicated to ADEM, obtaining storm-flow measurements that met the 1,500 cfs criterion proved challenging because:

- The period from mid-March 1999 through March 2000 was unusually dry;
- Flows associated with brief precipitation events rise rapidly within the creek; and
- Alabama Power Company (APCO) creek flow reporting equipment for the United States Geological Survey (USGS) gage at Jackson Shoals periodically did not work for long periods of time.

Each of these difficulties is discussed below along with the technical approach to complete the surface water investigation using a continuous monitoring station installed at Jackson Shoals.

4.1.3 Sampling Difficulties and Solutions

Dry Weather – The southeastern part of the county experienced an unusually dry year in 1999 with several areas having near drought conditions. This is reflected in the fact that flow in Choccolocco Creek, as measured at Jackson Shoals, exceeded 1,500 cfs on only three occasions from early March 1999 through March 2000. The 1,500 cfs criterion represents, on a daily average basis, the 10% exceedance flow (the flow that statistically would be expected to be exceeded 10% of the time); it occurs on average approximately five times per year (based on 15 years of USGS data). During the RFI, the first two of three exceedances were in July 1999, when difficulties with the creek flow reporting equipment prevented real-time storm-flow monitoring and prompt deployment of sampling personnel. The third event was in late March 2000 and occurred during an overnight period.

Creek Response – The "flashy" nature of the rise in water levels in the creek following precipitation events made implementation of the Off-Site RFI Work Plan sampling program difficult. Sampling the creek at three points on the hydrograph was difficult because the creek tends to rise so quickly. This tendency has also made it difficult to sample creek flows resulting from storms with intense precipitation over a short time period; it also made it difficult to sample all the locations shown on Figure 4-1 during a high-flow event. This was the case for a storm that occurred during the late evening of March 19, 2000. By the time daylight arrived on March 20, 2000, the peak flow had already occurred. As discussed further below, the continuous monitoring sampling unit installed at Jackson Shoals provided a mechanism to effectively sample multiple points over the course of the hydrograph following these flashy storms.

A systemwide high-flow sampling event occurred on April 1, 1999. Unfortunately, the flow peaked at approximately 1,350 cfs, just short of the 1,500 cfs criterion. In addition, the relatively small size of the storm's hydrograph did not provide sufficient time to obtain the three separate sample intervals identified in the Off-Site RFI Work Plan. These samples included the rising limb of the hydrograph (in terms of amplitude and peak duration), the near-peak flow condition, and the falling limb of the hydrograph.

Reporting of Choccolocco Creek Flow Data – The preliminary 1999 flow data for the gage at Jackson Shoals was recently received from the USGS. Before this, preliminary creek flow information was available through a system operated by APCO. These data were available in two forms: through a dial-in telephone system for real-time estimates of flow and from an electronic file provided monthly by APCO. While we were aware that APCO experienced reporting difficulties with this gage throughout the summer of 1999, we were unaware until we subsequently received the USGS flow data that a series of storms in July 1999 resulted in creek flows exceeding 1,500 cfs. Although we were aware of these storms, there was no practical way of accurately determining creek flow at Jackson Shoals during the storms. In response to this data limitation, Solutia worked with the USGS during the summer of 1999 to have a real-time flow gage installed at Friendship Road. After a period of calibration by the USGS, this gage became operational during the early fall of 1999 and now provides real-time creek flow information over the Internet.

Automatic Sampling at Jackson Shoals – As previously communicated to ADEM, Solutia installed a continuous surface water sampling station on Choccolocco Creek at Jackson Shoals. This sampling station was designed to provide additional surface water data to augment the data being collected as part of the Off-Site RFI. The sampling station was installed in late September 1999 and collected surface water samples once a week for an approximate 8-week period, as well as during high-flow conditions. These data included the eight low-flow sampling events and the first of the three high-flow events identified in the table below. After the initial 8-week period, the sampling unit was operated only in response to storm events. Three such events were sampled and are also identified in the table below. Two of these resulted in peak flows that exceeded the 1,500 cfs criterion (2,561 cfs, on 3/20/00; and 8,216 cfs, on 4/4/00).

Jackson Shoals Continuous Sampling Unit Operational History and Corresponding Gage Data September 1999 through April 2000

Low-Flow Sampling		High-Flow Sampling	
Date(s)	**Average Flow (cfs)**	**Date(s)**	**Peak Flow (cfs)**
9/29/99	158	10/11/99	641
10/4/99	166	11/2/99	517
10/10/99	325	1/23/00	1,250
10/20/99	171	2/14/00	1,393
10/27/99	149	3/20/00	2,561
11/10/99	175	4/4/00	8,216
11/17/99	159		
12/1/99	130		

With the results of the continuous surface water sampling, data are now available from one sampling location for two storm events on Choccolocco Creek with flows exceeding the 1,500 cfs criterion. The data from the continuous surface water sampling also included two events with peak flows near 1,500 cfs (1,250 cfs and 1,393 cfs). The additional surface water data from the April 1, 1999 high-flow event (1,350 cfs) were also used to complete the evaluation of high-flow events.

In summary, the range of flow conditions sampled with the continuous sampling station provided the data to assess PCB and sediment transport along Choccolocco Creek during storm-flow conditions. These data, combined with the surface water data collected during the six base-flow measurement events, provided a complete data set to evaluate PCB and sediment fate and transport in the surface water.

4.2 Base-Flow Sampling Results

In accordance with the Off-Site RFI Work Plan, base-flow sampling targeted steady-state flow conditions occurring during the late winter, then spring, and then early summer of 1999. The Off-Site RFI Work Plan specified sampling six base-flow events at intervals of 2 to 3 weeks, when flow was neither rising nor falling in response to precipitation events. With the exception of the Neely Henry Dam and upper Lake Logan Martin sampling locations, which were not sampled during the June 14, 1999 sampling event, all six base-flow events were successfully sampled between March 23, 1999 and January 18, 2000. Figure 4-2 shows the dates of the sampling events in relation to the flow at the Jackson Shoals USGS gage.

The March 22-23, 1999 base-flow event exhibited the highest flows sampled, while the lowest base-flow sampled occurred on September 27-28, 1999. In Snow Creek, measured flows ranged from 1.6 cfs during the September event to 16 cfs during the March event. Downstream in Choccolocco Creek, at Highway 77, the flows ranged from 116 cfs to 783 cfs during the September and March sampling events, respectively. For Lake Logan Martin, the average daily flows during the September and March sampling events were 4,350 cfs and 9,366 cfs, respectively, based on the hourly flow release data provided by APCO. In addition to the Snow Creek and Choccolocco Creek locations, both Cheaha and Eastaboga creeks were sampled near their mouths. As described in the Off-Site RFI Work Plan, since PCBs were not detected in the initial sample at each location, subsequent samples from these locations included only flow measurements, field parameters, and TSS analysis. Results of all base-flow sampling are presented in Table 4-1.

4.2.1 Total Suspended Solids

TSS concentrations at all locations during base-flow conditions ranged from not detected in each of the Choccolocco Creek tributaries (Snow Creek, Eastaboga Creek, Cheaha Creek) and in Choccolocco Creek at Boiling Springs Road to a high of 30 milligrams per liter (mg/L) observed in Eastaboga Creek during the May 3-4, 1999 sampling event. Individual and average TSS concentrations for each sampling location are presented on Figure 4-3. In Snow Creek, TSS were not detected during four of the six sampling events; TSS were not detected in five out of six events at Cheaha Creek. In Choccolocco Creek, TSS concentrations were highest upstream at Flatbridge Road and lowest at Highway 77 in every event. In conjunction with the tributary data, this suggests that downstream contributions to flow in Choccolocco Creek are low in TSS. Average base-flow TSS concentrations were 15 mg/L and 9.7 mg/L at Flatbridge Road and Highway 77, respectively.

Average base-flow TSS concentrations entering Lake Logan Martin past Neely Henry Dam were higher and more consistent than TSS contributed to the lake by Choccolocco Creek. The average TSS concentration observed at Neely Henry Dam was 12 mg/L. TSS concentrations in Choccolocco Creek were more variable due to flow and seasonal variations, while TSS in the upstream Coosa River were more consistent due to the daily release of water over Neely Henry Dam. Within Lake Logan Martin, a significant increase in TSS concentrations was observed between Neely Henry Dam and the Route 20 bridge, upstream of the mouth of Choccolocco Creek, with the average concentration increasing from 12 mg/L to 21 mg/L. Downstream of Choccolocco Creek, the average TSS concentration was 19 mg/L, but the individual data tended to vary more at the lake sampling location downstream of Choccolocco Creek.

TSS concentrations are directly related to flow in Snow Creek and Choccolocco Creek, as shown on Figure 4-4, which illustrated the differences in responsiveness of TSS to flow at various locations. It should be noted that Figure 4-4 also includes the results of high-flow sampling, which is discussed in subsequent sections of this report. In Snow Creek, TSS responded sharply to increases in flow, while at Highway 77, TSS concentrations tended to be more consistent and increased to a lesser degree in response to flow increases. At Flatbridge Road, the response was intermediate between the upstream response at Snow Creek and the downstream response at Highway 77 locations. In comparison, Figure 4-5 shows the relationship between flow and TSS concentrations at the three Lake Logan Martin locations. Among and between sampling events, TSS concentrations at the lake sampling locations were more consistent and less responsive than in the creek locations. This is in part due to the regulation of flow and the large volume of water, which assimilates incoming contributions of tributaries.

Calculation of TSS loads allows for the adjustment of TSS concentrations to account for the variations of flow between sample locations by converting observed concentrations in the water column to a mass of solids being transported, which can then be directly compared between sampling locations. Calculated TSS loads are included in Table 4-1. Comparison of TSS loads illustrates the relative contributions of Snow Creek to Choccolocco Creek and Choccolocco Creek to Lake Logan Martin. On average, during base-flow conditions, observed TSS loads from Snow Creek accounted for approximately 2.1% of the observed TSS load at Flatbridge Road and 1.8% of the TSS load at Highway 77. The average TSS load at Highway 77 (8,770 kilograms per day [kg/day]) was approximately equal to the sum of the average TSS loads observed at Flatbridge Road, Cheaha Creek, and Eastaboga Creek (9,100 kg/day), but the contribution from the two tributaries varies as a function of season. For example, during the colder winter months (i.e., the March 1999 and January 2000 sampling events), the two creeks together accounted for only 6% of the daily TSS load at Highway 77, while they averaged 35% of the daily load during the other events.

Between Flatbridge Road and Highway 77, the daily TSS load on the days of sampling decreased during two events (May 3-4, 1999, and September 27-28, 1999) and increased during the other four. The increase in TSS load was not entirely accounted for by the contributions of Cheaha and Eastaboga creeks, suggesting other tributaries, biotic material, and/or the sediment bed may play an important role in the overall solids transport mass balance. In the cases of decreasing daily TSS loads, the largest relative decrease occurred during the September 1999 sampling event, which also exhibited the lowest flows and the lowest TSS loads of all the base-flow events.

The base-flow TSS load balance within Lake Logan Martin indicates a substantial increase of TSS mass transport between Neely Henry Dam and the Route 20 bridge upstream of Choccolocco Creek. Between these two locations, the average base-flow daily TSS load increased by a factor of about 2, from approximately 152,000 kg/day to approximately 345,000 kg/day (compared to approximately 7,000 kg/day from Choccolocco Creek). In each case, the TSS load was higher at Neely Henry Dam than at the Route 20 Bridge in Lake Logan Martin, which may merely reflect the trapping effect of Neely Henry Dam, which settles solids out prior to release, or the presence of biotic solids downstream in the main body of the lake. Between the two lake locations upstream and downstream of Choccolocco Creek, daily TSS loads were variable but about equal over all the sampled events. The average daily TSS load observed in Lake Logan Martin downstream of Choccolocco Creek was 295,000 kg/day. It should be noted that flows used in Lake Logan Martin load calculations represent the average daily flow for the day sampled, based on hourly data provided by APCO.

Overall, the base-flow TSS load from Snow Creek was negligible compared with TSS transport observed in Lake Logan Martin, comprising at most 0.2% of the TSS load observed during the March 22-23, 1999 sampling event and averaging 0.06% of the total during all six base-flow events. During the base-flow events sampled, the contribution of daily TSS load from Choccolocco Creek (as measured at Highway 77) to Lake Logan Martin ranged from 0.7 to 7.7% of the TSS load observed in the lake downstream of Choccolocco Creek, with an average of 2.9%.

4.2.2 Particulate-Phase PCB

During each base-flow event, surface water samples from each location were filtered and the recovered solids analyzed for particulate-phase PCB. Results of the PCB analyses are presented on Figure 4-6, and show decreasing particulate-phase PCB concentrations between Snow Creek and Lake Logan Martin. In Snow Creek, particulate-phase PCB concentrations ranged from 0.18 to 16 mg/kg TSS, with an average of 5.2 mg/kg TSS. At Flatbridge Road, particulate-phase PCB concentrations ranged from 0.16 mg/kg TSS to 6.8 mg/kg TSS, with an average of 2.0 mg/kg TSS. At Highway 77, particulate-phase PCB concentrations ranged from 0.11 mg/kg TSS to 2.7 mg/kg TSS, with an average of 1.1 mg/kg TSS.

Sampling at Boiling Springs Road was discontinued in accordance with the Off-Site RFI Work Plan since PCBs were not detected during the initial base-flow sampling event, and Choccolocco Creek upstream of Boiling Springs Road was eliminated as a source of particulate-phase PCB. However, sampling of Snow Creek surface water, performed at the 14th Street and 16th Street bridges (both located upstream of the 11th Street Ditch) on June 21, 1999, revealed sources of particulate-phase PCB upstream in Snow Creek. Although flows were very low at those locations on the date of sampling (0.02 cfs at 14th Street and 1.2 cfs at 16th Street), particulate-phase PCB concentrations of 12 and 0.87 mg/kg TSS were reported for 14th and 16th streets, respectively. Corresponding respective TSS values were 66 and 52 mg/L, indicating the potential for PCB transport from upstream locations into the Off-Site RCRA site.

Particulate-phase PCBs were detected in all samples collected from Lake Logan Martin; all were less than 1.0 mg/kg and all but four were less than 0.1 mg/kg TSS. At each of the three lake locations, the highest concentrations were observed during the March 1999 sampling event, during which the highest daily average flows were also observed. The particulate-phase PCB concentrations generally decreased between Neely Henry Dam and the Route 20 sampling location upstream of Choccolocco Creek and increased between Route 20 and the sampling location downstream of Choccolocco Creek. From upstream to downstream, average particulate-phase PCB concentrations were 0.16, 0.090, and 0.15 mg/kg TSS. However, due to the limited number of samples and the variability of the individual concentrations, none of these averages are statistically significantly different from one another based on the 95% confidence intervals about the respective means.

The relationships between particulate-phase PCB concentrations and flow are not as well-defined as they were for TSS. Figure 4-7 shows the particulate-phase PCB concentrations observed at varying flows for the Snow Creek sampling location and two Choccolocco Creek sampling locations. For each location, although higher flows in general were associated with higher PCB concentrations, a wide range of PCB concentrations was observed for lower flows, prohibiting the development of any significant relationships. Within Lake Logan Martin, particulate-phase PCB concentrations were directly related to flow, as illustrated on Figure 4-8. At each location alone, the data are too limited to formulate significant relationships; however, the data from all locations show statistically significant linear correlation ($r^2 = 61$, $p < 0.002$). The similarity of the data between locations and the significance of the combined data suggest PCB transport mechanisms that are relatively similar at the various locations with no notable impact from Choccolocco Creek during the sampled base-flow events. Figure 4-8 indicates that the variation in PCB concentrations at all three Lake Logan Martin locations may largely be attributed to flow.

Instantaneous particulate-phase PCB loads were calculated from each base-flow sample from each location. These load estimates accounted for the TSS concentrations in the individual samples and the flow rate at which they were observed. The individual and average base-flow particulate-phase PCB fluxes for each location are included in Table 4-1, normalized to an annual rate basis, to make comparisons easier. This is also graphically presented on Figure 4-9. As expected due to the magnitude of flow, Snow Creek exhibited the lowest annual base-flow of particulate-phase PCB transport, at 0.46 kg/yr. In Choccolocco Creek, average annual base-flow particulate-phase PCB loads based on the base-flow monitoring data were 6.7 kg/yr at Flatbridge Road and 5.8 kg/yr at Highway 77. Estimated base-flow loads in Choccolocco Creek were roughly half those estimated for the Lake Logan Martin locations, which were 13 kg/yr at Neely Henry Dam, and 18 kg/yr and 17 kg/yr at Lake Logan Martin upstream and downstream of Choccolocco Creek.

The average of the instantaneous annualized loads was largely driven by the results of the March 22-23, 1999 sampling event, which at most locations combined the highest observed flows with the highest observed particulate-phase PCB concentrations. Although considered base-flow conditions as defined in the Off-Site RFI Work Plan, excluding it from the average load estimate lowered the load estimate dramatically, especially for the Snow Creek and Lake Logan Martin locations. Excluding the March sampling event, the annual particulate-phase PCB load estimates based on base-flow monitoring decreased from 0.46 kg/yr to 0.070 kg/yr in Snow Creek at Snow Street, from 6.2 kg/yr to 3.1 kg/yr in Choccolocco Creek at Flatbridge Road, 5.8 kg/yr to 2.4 kg/yr in Choccolocco Creek at Highway 77, and to 3.9 kg/yr, 2.3 kg/yr, and 3.5 kg/yr from 13 kg/yr, 18kg/yr, and 17 kg/yr at the three Lake Logan Martin locations from upstream to downstream, respectively. Both with and without the March 1999 sampling event data, it appears that Choccolocco Creek does not increase the net particulate-phase PCB transport in and through Lake Logan Martin.

4.3 24-Hour Sampling at Neely Henry Dam

Hourly sampling of the water column was performed over a 24-hour period to assess the temporal fluctuations of TSS, particulate PCB, and water quality parameters in response to controlled water releases from Neely Henry Dam. The variability of hydraulic characteristics within a 24-hour period is important in the evaluation of transport, since water is typically released at the dam only during a small period of the day to support generation of electricity. These short periods of high flow, if sampled, would overestimate load calculations since there is no flow for the rest of the day. Conversely, if sampling occurred when no release was occurring, the corresponding load would be zero. Therefore, for the purposes of the Off-Site RFI the average flow release (based on an average of hourly flow data provided by APCO) for the day of sampling was used in the analysis of TSS and particulate-phase PCB data. This 24-hour intensive water quality survey was performed to assess the impact of regulated flow releases on measured parameters.

Sampling was performed over a 24-hour period during June 1999, just below the Neely Henry Dam. Every hour, water column measurements of turbidity and velocity were made 3 feet from the water surface, 3 feet from the channel bottom, and at mid-depth of the channel. Consistent with the Off-Site RFI Work Plan, sampling was conducted at depth where the highest turbidity was observed; a sample was collected and analyzed for TSS. Every 4 hours, a high-volume sample was collected at the same depth interval and was filtered; the recovered solids were submitted for PCB analysis.

Results are presented in Table 4-2. Results of the 24-hour sampling show minimal impact of short-term flow release on TSS or particulate-phase PCB. As expected, increases in water depth, water velocity, and turbidity were observed corresponding to a period of high flow as the water surged and flowed through. However, as shown on Figure 4-10, TSS concentrations were unrelated to flow and were fairly consistent during the 24-hour period.

Similarly, particulate-phase PCB concentrations are unrelated to flow or TSS concentrations (Figure 4-11), and with the exception of the 6 a.m. sample (0.094 mg/kg), fell into a relatively narrow range as well, especially during the daylight sampling hours. It is not discernible from these data if the sample collected at 6 a.m. represents sample variability or a temporal trend. However, the data indicate that a single TSS and particulate-phase PCB sample can be used in conjunction with average flow data to represent the transport of material downstream of Neely Henry Dam.

It should be noted that the effect of intermittent flow release will be most pronounced at the sampling location just downstream of Neely Henry Dam. The effect of flow release is less detectable as the flow pulses are assimilated as they move downstream. At the other locations, observed fluctuations in water quality parameters are more likely to occur due to daytime biological activity, which would not be expected just below the dam due to daily flushing of the channel by flow release.

4.4 High-Flow Sampling Results

High-flow events were targeted by the Off-Site RFI Work Plan to be sampled for TSS and particulate-phase PCB to complement similar data generated for base-flow conditions. However, implementation difficulties prevented the execution of the high-flow sampling events as described in the Off-Site RFI Work Plan. These difficulties and solutions are described in Section 4.1.3. This subsection describes the results of the high-flow sampling that was completed:

- One sampling event from Choccolocco Creek locations on April 1, 1999; and
- Two samples from Snow Creek at Snow Street during one high-flow event on April 27, 1999.

The April 1, 1999 high-flow event was sampled at Boiling Springs Road, Flatbridge Road, Highway 77, and the mouths of Cheaha and Eastaboga creeks. Due to the rapid response of Snow Creek to relatively short-lived and localized rain, the hydrograph peak at Snow Road was not sampled. At Jackson Shoals, the recorded flow peaked at 1,350 cfs, slightly below the Off-Site RFI Work Plan target of 1,500 cfs. Lake Logan Martin locations were not sampled because the high-flow event was not large enough to cause significant increases in flow in the Coosa River that were not controlled by the dams. Results of the high-flow sampling are included in Table 4-1.

4.4.1 Total Suspended Solids

High-flow TSS concentrations were higher than any observed base-flow concentrations except at Eastaboga Creek. TSS concentrations at Boiling Springs Road were 38 mg/L, increased to 44 mg/L at Flatbridge Road, and then decreased to 26 mg/kg at Highway 77. Eastaboga Creek and Cheaha Creek samples had TSS concentrations of 25 mg/L and 29 mg/L, respectively. Although the TSS concentrations decreased downstream of Flatbridge Road, the daily TSS load increased based on the instantaneous measurements. The estimated daily TSS load at Boiling Springs Road was approximately 50,000 kg/day, increasing to approximately 64,000 kg/day at Flatbridge Road and 80,000 kg/day at Highway 77. The increase of daily TSS load between Flatbridge Road and Highway 77 is of the same relative magnitude as the combined contributions of Cheaha Creek (approximately 18,000 kg/day) and Eastaboga Creek (approximately 4,600 kg/day). The increase of both TSS concentration and load at these locations when compared with concentrations during base-flow conditions is indicative of an event-responsive river, for which relatively infrequent high-flow events account for a significant amount of solids transport on an annual basis.

Snow Creek high-flow data show similar, if not more pronounced, responses to flow increases. Snow Creek high-flow data are included in Table 4-1. Observed TSS concentrations of 230 mg/L and 280 mg/L, corresponding to flows of 205 cfs and 135 cfs, respectively, were more than 10 times the highest base-flow TSS concentration. The high flows, combined with the high TSS concentrations, resulted in a TSS load estimate orders of magnitude higher than observed during base-flow conditions and comparable to TSS loads observed in Lake Logan Martin during base-flow conditions. The TSS loads, on a daily basis, were approximately 115,000 kg/day and 92,500 kg/day for the two samples. However, the daily estimates are an unrealistic estimate due to the short-lived nature of high-flow conditions in Snow Creek. The nature of the Snow Creek watershed would not maintain these flows over a 24-hour period, and therefore the instantaneous data provided an overestimate of daily TSS transport.

4.4.2 Particulate-Phase PCB

Particulate-phase PCB concentrations associated with the high-flow event samples did not show similar increases in response to flow as did TSS. At Boiling Springs Road, no PCBs were detected. At Flatbridge Road and Highway 77, particulate-phase PCB concentrations of 1.6 and 1.0 mg/kg TSS were reported, both within the ranges observed at those locations during base-flow events. Thus, the higher particulate-phase PCB load (based on instantaneous data adjusted to an annual rate) when compared with base-flow conditions, is due to the increase in flow and TSS, not to an increase in particulate PCB concentrations. The estimated particulate-phase PCB loads were 37 kg/yr at Flatbridge Road and 30 kg/yr at Highway 77, both of which are similar in magnitude to the particulate-phase PCB loads observed during the March 1999 base-flow event at the respective locations.

Particulate-phase PCB concentrations in Snow Creek during high-flow conditions, at 3.7 mg/kg TSS and 3.3 mg/kg TSS, were within the range of concentrations observed at Snow Road during base-flow conditions. However, the large TSS load resulted in PCB load estimates that were considerably higher than were observed during base-flow conditions. Instantaneous PCB load estimates for the two samples collected on April 27, 1999, on a daily basis, were 0.43 kg/day and 0.31 kg/day, with an average of 0.37 kg/day. As was the case for TSS load estimates, these values are overestimates of the actual load because the measured conditions cannot be sustained for a 24-hour period. However, both the TSS and PCB data show the importance of high-flow events in the transport of solids and particulate-phase PCB in Snow Creek.

4.5 Additional Surface Water Sampling at Jackson Shoals

To accommodate the need for high-flow event sampling, an automatic sampler was installed to sample surface water from Choccolocco Creek at Jackson Shoals. Results of the surface water sampling at Jackson Shoals are presented in Tables 4-3 and 4-4. The sampling effort is summarized in Section 4.1.3.

Samples included 24-hour composite base-flow samples and several high-flow samples composited over shorter time periods (2-6 hours), representing flows of up to 7,545 cfs. The base-flow and high-flow sampling events in relation to flow recorded at the Jackson Shoals gage are shown on Figure 4-16. A whole-water TSS sample was collected at the beginning and at the end of each particulate-phase PCB composite sample; those concentrations were averaged to approximate the TSS concentration in the composite sample. Similarly, hourly USGS flow data were averaged for the sampling period to represent flow corresponding to the measured particulate PCB concentrations. Between the particulate-phase PCB data, TSS data, and USGS hourly flow data from the gage, there are adequate data to characterize and quantify TSS and particulate-phase PCB transport in Choccolocco Creek.

4.5.1 Total Suspended Solids

TSS concentrations at Jackson Shoals varied considerably in response to flow. Individual TSS concentrations and corresponding flow from the USGS gage are presented in Table 4-3. Instantaneous concentrations ranged from not detected to 820 mg/L and varied widely, particularly during high flows. Individual TSS concentrations are plotted against flow on Figure 4-12, along with comparable data from USGS collected at the gage from 1985 to 1996. Together, these data sets exhibit the relationship between TSS and flow at Jackson Shoals. It is notable that data collected during the RFI comprise the high end of the combined data set, and that the relative variability of the relationship between TSS and flow observed at high flows is difficult to ascertain. Additional data at high flows may be useful in reducing that variability.

TSS concentrations are more variable during high-flow events, even over short periods of time, than during base-flow conditions. Figure 4-13 presents the individual pairs of data associated with each automated sample plotted against one another; deviation from a line with a slope of one indicates differences of TSS concentrations in samples collected at the beginning and at the end of the particulate-phase PCB sample collection. TSS samples collected during base-flow conditions closely follow the line, even though individual samples were collected 24 hours apart. High-flow TSS samples, however, typically collected only 2 hours apart, are considerably less correlated with one another. Thus, there is a high degree of uncertainty in TSS characterization attributable to variations of flow, but also due to the variable nature of TSS concentrations collected at similar flows within a relatively narrow time frame.

Averaging the TSS data pairs to obtain a single TSS concentration per PCB samples reduces the variability somewhat. Average TSS concentrations corresponding to particulate PCB samples ranged from 5.5 mg/L during the October 27, 1999 base-flow event to 437 mg/L during the April 6, 2000 high-flow sampling interval. The average TSS concentration for the 24-hour base-flow composite samples was 11 mg/L, compared to 93 mg/L for the shorter-term (2 to 6 hours) high-flow sample intervals. TSS data from the automatic sampling at Jackson Shoals are presented in Table 4-2. TSS is exponentially related to flow at Jackson Shoals, as is shown on Figure 4-14, suggesting an erosional environment at very high flows. Since the highest TSS concentrations occur at the highest flows, TSS loads increase at a much faster rate than TSS concentrations.

TSS loads corresponding to particulate-phase PCB sampling intervals, adjusted to a daily basis, ranged from 1,980 kg/day to 4,550,000 kg/day. Except for the extreme high-flows, the Jackson Shoals data are consistent with comparable estimates using data from Highway 77, approximately 5 miles downstream. Average TSS load at Jackson Shoals during base-flow conditions was 7,800 kg/day, corresponding to an average flow of 215 cfs, while at Highway 77, base-flow sampling produced an average TSS load of 8,800 kg/day, for an average flow of 348 cfs. Average TSS load for the high-flow composite samples conducted at Jackson Shoals was 1,029,000 kg/day. Rating the calculated TSS load by the annual occurrence frequency of the flow interval during which it occurred shows that at Jackson Shoals approximately 80% of the annual solids transport would be expected to occur during flows that occur only 5% of the time.

The TSS data from Jackson Shoals demonstrate the sensitivity of TSS to changes in flows in Choccolocco Creek as well as the influence of relatively few, short-lived flood events on annual suspended solids transport.

4.5.2 Particulate-Phase PCB

Particulate-phase PCB concentrations did not correlate with flow at Jackson Shoals for either base-flow, high-flow, or combined data. Particulate-phase PCB concentrations are plotted against flow on Figure 4-15, which illustrates the consistency of particulate-phase PCB concentrations over a wide range of flows. Particulate-phase PCB concentrations range from near zero to more than 3.0 mg/kg TSS, regardless of flow. Also well illustrated on Figure 4-16 is the successful sampling of the two largest and four of the largest five high-flow events to occur between October 1, 1999 and April 15, 2000. These data are useful to extrapolate across flows because they were collected across flows.

Particulate-phase PCB loads were calculated for Jackson Shoals. As expected, the relationship between PCB load and flow reflects the well-defined relationship of TSS and flow, and increases rapidly at high flows. The calculated PCB loads for Jackson Shoals are plotted against flow on Figure 4-17. Also shown on Figure 4-17 are the Highway 77 PCB loads, showing excellent agreement with the Jackson Shoals PCB load data. This would suggest that the Jackson Shoals data can be applied to make inferences regarding PCB transport at Highway 77, and the two data sets adequately characterize PCB transport from Choccolocco Creek to Lake Logan Martin.

Flow-stratified load calculations show that approximately 86% of the annual PCB transport at Jackson Shoals occurs during flow events that occur less than 5% of the time, and that during the remaining 95% of time only 14% annual particulate-phase PCB transport occurs. This is shown on Figure 4-18, which compares the cumulative relative frequencies of flow at Jackson Shoals and estimated particulate-phase PCB transport (load). These curves illustrate the high degree of influence that high flow events have on annual PCB transport at Jackson Shoals. The overall estimated annual load based on the RFI surface water data is 125 kg/yr, approximately 18 kg/yr of which is expected to occur at flows less than approximately 2,300 cfs, which is 95% of the time.

4.6 QA/QC

Data from 18 sample delivery groups for samples collected between March 1999 and May 2000 were reviewed for quality assurance/quality control (QA/QC) compliance with method guidelines and project specific requirements. Each data package from the laboratory (STL-Savannah) was reviewed as outlined in the Quality Assurance Project Plan. Specifically included were an evaluation of holding times, calibration requirements (initial and continuing), blank contamination, surrogate recovery, matrix spike and duplicate performance, laboratory control sample recovery and analyte identification, as applicable.

PCB analyses were performed following EPA SW-846 method 8082 for 76 particulate (suspended sediment) samples. Data were reported on an Aroclor-specific basis.

The results of the data validation activities indicated that the analytical chemistry data for the surface water samples will support the Off-Site RFI Data Quality Objectives (DQOs). The high quality of these analytical chemistry data is indicated by the fact that 100% of the results (567 PCB results) were available for use within the Off-Site RFI. The findings of the data review for the surface water samples are provided below.

All QA/QC parameters were found to be within acceptable limits, with the following exceptions:

- Recoveries for both surrogates were below control limits in two samples, resulting in the qualification of all Aroclor data for the samples as estimated.

- Agreement between two dissimilar columns was evaluated and the percent difference was high resulting in the qualification of data as estimated for 13 samples, and data for seven samples were qualified as non-detected. In addition, the laboratory reported the lower of the two column results. All positive results were corrected to reflect the higher of the two column results, in accordance with method specifications.

- The laboratory reported the MDL rather than the PQL for 21 samples. The data were manually corrected to reflect the correct reporting convention.

- Data for 14 samples were qualified as estimated based on calibration excursions.

- One field duplicate percent difference was outside control limits, resulting in the qualification of data for the sample and duplicate pair.

- One laboratory control sample was below control limits, resulting in the qualification of data for 7 samples.

With the exceptions of the deviations noted above, the data quality was within acceptable limits and the data are considered acceptable for use as reported by the laboratory.

4.7 Surface Water Modeling

Floodplain modeling of Choccolocco and Snow creeks was conducted as part of the Off-Site RFI Work Plan. The modeling efforts were used to assist in the preparation of the Phase II Off-Site (Floodplain) RFI/CS Investigation Work Plan (BBL, 2000) and are summarized in Appendix D.

Two scenarios were modeled for each creek: a current-condition scenario and a historical-condition scenario. The current-condition scenario represents the mid-1990s, while the historical-condition scenario represents the early 1950s. The modeling was conducted for the 2-, 10-, 25-, 50-, and 100-year floodplains using U.S. Army Corps of Engineers Hydrologic Engineering Center's River Analysis System (HEC-RAS) software.

For Choccolocco Creek, the current-condition scenario incorporated man-made oxbow cutoffs, overflow cutoffs, the low-flow dam structure at Jackson Shoals, bridges as located and configured in 1999, and Lake Logan Martin. The historical-conditions scenario included the channel in its natural alignment (i.e., no man-made cutoffs), low-flow dam structures at both Jackson Shoals and the former Smith's Mill site, and bridges likely to have been located and configured in the mid-1950s. The historical-condition scenario did not include Lake Logan Martin.

For Snow Creek, the current-condition scenario incorporated bridge, culvert, and development conditions (land use and buildings) of the mid-1990s. The historical-condition scenario included the estimated bridge, culvert, and development status from the mid-1950s.

4.7.1 Input Development

4.7.1.1 FEMA Data

The basic data requirements for floodplain modeling included ground elevation data in the channel bed and overbanks, bridge geometry data, roughness coefficients, and stream flow (discharge) data. Inputs from models used in Federal Emergency Management Agency (FEMA) Flood Insurance Studies (FIS) published from 1980 to 1993 were used as a starting point for the input data development. FEMA data were enhanced and/or updated using various sources as described below.

4.7.1.2 Snow Creek

Elevation data for Snow Creek were taken from the Snow Creek FEMA model. The FEMA elevations were verified at several locations in the creek with field survey data. Bridge data from the FEMA model were refined using photographs and field survey data. While generally consistent, preference was given to field survey data measurements when significant discrepancies between FEMA data and field survey data were found. Both historical and recent aerial photographs were used to assess Manning's roughness coefficients and development conditions. Roughness values were adjusted for estimated differences between current and historical conditions. Development in the immediate vicinity of the creek that could have a potentially significant impact on flooding conditions was represented using options in HEC-RAS for blocked (due to building) and ineffective (due to flow divergence and convergence) flow areas. The locations of blocked and ineffective areas were developed from aerial photographs.

Flow data for the Snow Creek current-condition model were obtained from the FEMA data. The FEMA data included discharges for the 10-, 50-, and 100-year events. Discharges for the 2- and 25-year events were extrapolated and interpolated from the 10-, 50-, and 100-year events. The historical-condition discharges were estimated by reducing the current-condition discharges to reflect the estimated change in land development between the two time periods. The water surface elevations at the downstream end of Snow Creek, which are necessary as a starting point of the model computations, were taken form the modeling results for Choccolocco Creek at the confluence of Choccolocco and Snow creeks.

4.7.1.3 Choccolocco Creek

Elevation data for the Choccolocco Creek model were obtained from several sources. FEMA model data were used for areas in the immediate vicinity of bridges. Away from the bridges, the FEMA data were not used because the FEMA model river stationing could not be verified. The FEMA model elevation data were replaced with data from 1:24,000 scale USGS digital elevation models (DEMs). These DEMs were supplemented with field survey data for the stream bed collected during the supplemental study at over 100 transect locations. Engineering drawings from U.S. Soil Conservation Service (now the National Resource Conservation Service) channel modification projects and aerial photographs were used to ascertain the location and character of oxbow cutoffs constructed during the projects.

Choccolocco Creek bridge data were generally adopted directly from the FEMA model. Field photographs were used to make minor modifications to the FEMA data. The locations and geometries of structures currently not present, or inundated by Lake Logan Martin, were estimated from historical aerial photographs and maps. Aerial photographs were also used to assess Manning's roughness coefficient and development conditions. For Choccolocco creek, development and roughness conditions were judged to not have changed appreciably between the time period represented by the historical and current cases.

Flow data for Choccolocco Creek were taken from published FEMA Flood Insurance Study (FIS) reports. As with the Snow Creek discharges, the 2- and 25-year events were extrapolated and interpolated from the given 10-, 50-, and 100-year events. Flows at intermediate points between FEMA stations were modified to reflect contributing watershed areas when judged necessary for data consistency. The estimated reductions in flow due to existing upland retention structures were also used to adjust historical-condition flows to current-conditions flow.

The current-condition water surface elevations at the downstream end of the creek for all storm events were taken to be normal pool elevation of Lake Logan Martin. For the historical conditions, a stage-discharge curve for the Coosa River representative of conditions prior to the impoundment of Lake Logan Martin was developed from historical-rating curve data at points upstream and downstream of Lake Logan Martin. Water surface elevations for the downstream end of Choccolocco Creek were then taken from this stage-discharge curve.

4.7.1.4 Calibration

Initially computed water surface profiles for Choccolocco creek were compared to rating curves for existing and historical gage stations along the creek to identify adjustments to channel roughness and calibrate the Choccolocco Creek model. A similar comparison was not possible for Snow Creek since stage-discharge measurements stations for the creek do not exist. However, computed water levels were inspected for physical reasonableness. Minor modification of roughness were made to insure physical reasonableness of the results.

4.7.2 Modeling Results

Modeling determined features of flow behavior, including water surface elevation, flood flow widths, and channel and floodplain velocities. Modeling results were used to generate the floodplain maps (Figures B1 – B2) in Appendix D. For Choccolocco Creek, the floodplain maps were produced from the DEMs using water surface elevations generated by HEC-RAS. Geographic information system (GIS) software was used to identify the intersection of the ground surface and the computed water surface elevation.

Inconsistencies between the DEMs and the FEMA-based ground elevation data used in the HEC-RAS model required that a different approach be taken for the Snow Creek floodplain maps. These maps were developed using the floodplain width computed by HEC-RAS. CAD and GIS software were used to generate plots of the floodplains based on the computed floodplain width.

4.7.3 Uncertainty Analysis

The Snow Creek and Choccolocco Creek floodplain maps are based on a variety of data, including both field data obtained during this investigation and previous studies. Data used as input to the analysis were verified wherever possible. Map production techniques were chosen so as to minimize the inconsistencies between different data sources. However, the maps are based on various data sources and the modeling includes estimates of both current and historical conditions. Furthermore, data for calibration of flow conditions in Snow Creek were not available. Thus, the floodplain maps should be used for guidance in defining flood plain limits and not taken to show the precise extent of flooding.

4.8 Conclusions

Based on the results of the surface water sampling, the following conclusions can be made:

- TSS and PCB transport in Snow Creek and Choccolocco Creek are extremely responsive to high-flow events, with a majority of annual transport occurring during relatively few, short-lived, high-flow events. Conversely, Lake Logan Martin exhibits a more tempered relationship between PCB and TSS transport and flow, which is consistent between the three lake sampling locations.

- Choccolocco Creek does not appear to substantially increase the net mass of TSS and particulate-phase PCB transported through Lake Logan Martin. A significant increase in TSS concentration and load occurs between Neely Henry Dam and the Route 20 bridge, upstream of Choccolocco Creek.

- On an annual basis, estimated particulate-phase PCB being transported over Neely Henry Dam exceeds particulate-phase PCB contributed to Lake Logan Martin from Choccolocco Creek under base-flow conditions. Solids and particulate-phase PCB loads from Snow Creek are negligible compared to solids and particulate-phase PCB loads in Lake Logan Martin, both downstream and upstream of Choccolocco Creek, and contributions from Choccolocco Creek do not appear to result in an increase of loads as measured from upstream and downstream of the creek mouth.

5. Fish Investigation

This section presents a summary of the fish investigation activities and the results of the data collected. A discussion of the data collected relative to the target number of samples identified in the Off-Site RFI Work Plan is also included.

5.1 Fish Investigation Activities

Fish investigation activities were initiated in mid-November 1999 and were completed by late December 1999. The sampling program included the collection of adult bass and catfish, and young-of-year (YOY) bass samples. The adult fish were evaluated as skin-off fillets and the YOY samples were evaluated as whole-body composites. The fish collection and processing activities were directly overseen by ADEM's Field Operations Group and included the collection of split samples by ADEM for each of the seven fish sampling locations. The sampling locations are presented on Figure 5-1 and include the two additional stations requested by ADEM (Lake Logan Martin, just upstream of the Logan Martin Dam, and Lake Neely Henry, just upstream of the Neely Henry Dam).

5.1.1 Bass Sampling Activities

All 70 bass samples identified in the Off-Site RFI Work Plan were collected. This included 10 adult fish at each of the seven sampling locations. At each of the sampling locations, the predominant bass species observed (largemouth or spotted) was used as the target species. As a result, all bass samples collected at each location were either largemouth or spotted bass. This included both the adult fish filleted prior to shipment for analysis and the YOY samples submitted for composited whole-body analysis. The approach of using a single bass species at each of the seven sampling locations was agreed to by ADEM during a November 15, 1999 meeting and is consistent with the Off-Site RFI Work Plan. The results of the bass collection activities are presented in Table 5-1.

Consistent with the Off-Site RFI Work Plan, the YOY sampling activities included the collection of five to seven samples at each of the sampling stations identified on Figure 5-1. YOY samples included five individual fish, composited into a single homogenate for analysis. As a result, the sampling activities included the collection of 25 to 35 YOY fish at each of the seven locations.

5.1.2 Catfish Sampling Activities

For the collection of catfish samples, the Off-Site RFI Work Plan identified 10 samples at each location. The number of samples was targeted to minimize the variability often associated with fish samples. To assist in achieving this target of 10 fish, the Off-Site RFI Work Plan identified blue catfish as a substitute species for channel catfish. The results of the fish collection program are presented in Table 5-1.

5.1.3 Variations in the Off-Site RFI Work Plan

Difficulties were encountered in the collection of the target number of catfish within the size ranges specified in the Off-Site RFI Work Plan and the ADEM fish collection procedures. At five of the fish sampling locations, the target number of 10 catfish samples was not achieved due to difficulties encountered in collecting the catfish. At those five locations, a combination of channel and blue catfish was used to maximize the number of fish submitted for analysis. The combination of catfish species at these locations was consistent with the Off-Site RFI Work Plan and was considered appropriate, given the similar nature of these species. Difficulties in fish collection included the tendency of catfish not to float to the surface after being shocked with electro-fishing equipment, combined with the difficulty of collecting shocked fish at depth in surface waters with high turbidity. Alternative collection methods including trap nets, fyke nets, gill nets, and line fishing were used to supplement the electro-fishing efforts. However, these alternative efforts resulted in the collection of large numbers of fish that did not meet the species and/or size requirements identified in the Off-Site RFI Work Plan. These alternative efforts, particularly the use of a gill net, were kept to a minimum due to environmental concerns. For example, the use of a gill net resulted in the collection of only two target fish (correct species within the required size class) and 166 other fish, many of which did not survive the impacts of being netted.

The net result of the efforts to collect catfish included 59 of the 70 fish samples identified in the Off-Site RFI Work Plan. At three of the seven sampling locations, 10 samples were collected. At the other four locations, six to nine samples were collected (six at one location, seven at two locations, and nine at one location). While this is less than the Off-Site RFI Work Plan target of 10 samples at each location, the number of samples collected was considered sufficient to minimize the variability when evaluated in conjunction with the lipid data that was also developed for each fish sample. As a result, the data collected satisfy the data quality objectives defined in the Off-Site RFI Work Plan.

5.2 Fish Investigation Results

The results of the fish investigation are presented in this section and include the adult bass and catfish sample results, the results of the YOY samples, and a discussion of the data validation conducted on the laboratory results of fish analyses. A comparison of the data collected during this investigation with the results of the 1996 sampling conducted by Bayne (Bayne, 1997b) is also included in this section. The results of the surface sediment samples collected at the seven fish sample locations are discussed in Section 3.12.

5.2.1 Lake Neely Henry and Lake Logan Martin

The results of the individual adult bass and catfish samples for the sampling locations in Lake Neely Henry (Station 30) and Lake Logan Martin (Stations 33, 38, and 39) are presented in Table 5-2. This table includes the sample location, type (fillet or whole body), species collected, length, weight, sex, lipid content, and the results of the PCB and mercury analyses (where applicable). As noted above, the sampling station in the lower reaches of Lake Neely Henry is just upstream of the Neely Henry Dam.

The average concentration of PCBs in adult bass for the three Lake Logan Martin sampling locations ranged from 0.41 mg/kg at Station 39 to 1.1 mg/kg at Station 33. In each case, the average PCB concentration was less than the ADPH advisory level of 2 mg/kg. The results of the adult catfish samples for the three Lake Logan Martin sampling locations were similar, with average PCB concentrations ranging from 0.51 mg/kg at Station 39 to 0.94 mg/kg at Station 33. These average concentrations were also less than the ADPH advisory level of 2 mg/kg.

The results of bass and catfish sampling conducted in Lake Neely Henry also demonstrated that PCBs are present in the fish upstream of Lake Logan Martin. Although, measured PCB concentrations in fish from Lake Neely Henry were below the ADPH advisory level of 2 mg/kg, their consistent presence documents both background levels of PCBs in fish on a regional basis, and the likely transport of PCBs into Lake Logan from upstream sources.

5.2.2 Choccolocco Creek

The results of the individual adult bass and catfish samples from Choccolocco Creek locations (ADEM 96, New 99, and Station 35) are also presented in Table 5-2. The PCB concentrations measured in the fish from these three locations ranged from a channel catfish with 0.20 mg/kg at Station 35 to a channel catfish with 34 mg/kg at ADEM 96.

The average PCB concentrations for the adult bass samples from these three locations ranged from 2.3 mg/kg at Station 35 to 5.4 mg/kg at ADEM 96. The average PCB concentrations for the three adult catfish samples ranged from 4.8 mg/kg at Station 35 to 8.8 mg/kg at ADEM 96. The average PCB concentrations at all stations were above the ADPH advisory level of 2 mg/kg.

5.2.3 Comparison with 1996 Sampling Results

The results of the adult bass and catfish samples collected during the Off-Site RFI were compared with the results from the 1996 fish investigation conducted by Bayne. The results for Lake Neely Henry (Station 30) and Lake Logan Martin (Stations 33, 38, and 39) are presented on Figures 5-2 through 5-5. The results are grouped by species and demonstrate a clear and consistent pattern of decline in PCB concentrations with the exception of Station 33. At this station, PCB concentrations do not change significantly with respect to the variability of the data. In all cases, the average PCB concentrations were below the ADPH advisory level of 2 mg/kg.

The results of the adult fish collected at two of the Choccolocco Creek sampling locations (ADEM 96 and Station 35) were also compared with the results obtained during the 1996 Bayne investigation. This comparison is presented on Figures 5-6 and 5-7 and demonstrates a clear and consistent decline in PCB concentrations at both locations. The 1999 results for the New 99 location are presented on Figure 5-9. However, no samples were collected by Bayne at this location, and hence a historical comparison was not made.

5.2.4 Mercury Analysis

Fifty percent of the bass samples were also evaluated for mercury. The individual results for each of the 35 fish analyzed (five at each of the seven sampling locations) are presented in Table 5-2 and summarized in Table 5-4. The measured concentrations of mercury ranged from 0.025 mg/kg at Station 30 to 0.91 mg/kg at New 99. The average concentrations at the seven sample locations ranged from 0.037 mg/kg at Station 30 to 0.73 mg/kg at New 99. All of the samples analyzed were below the ADPH advisory level of 1 mg/kg.

5.2.5 Young-of-Year (YOY) Sampling Results

The results of the individual YOY samples for Lake Neely Henry, Lake Logan Martin, and Choccolocco Creek are presented in Table 5-2 and summarized in Table 5-3. The YOY data for the four fish sample stations in Lake Logan Martin and Lake Neely Henry are presented on Figure 5-9. This figure illustrates that PCB concentrations in Lake Logan

Martin YOY samples do not vary significantly between stations, or among the individual samples. Consistent with the results of adult fish sampling, the YOY samples in Lake Neely Henry indicate that PCB concentrations are all well below 2 mg/kg and are present in the aquatic environment upstream of Lake Logan Martin.

The YOY data for the three Choccolocco Creek sampling location are presented on Figure 5-10. These data are very consistent at two of the sampling locations (New 99 and Station 35). At ADEM 96, the whole-body YOY PCB data are more variable, with concentrations ranging from 6.9 mg/kg to 19 mg/kg, and an average PCB concentration of 12 mg/kg. The YOY PCB concentrations for Choccolocco Creek also markedly decrease in a downstream direction, reflecting both the historical trends in fish and sediment PCB concentrations and the result of the Off-Site RFI sediment investigation presented in Section 3.

5.3 QA/QC

Data from 11 sample delivery groups for samples collected between November 1999 and December 1999 were reviewed for quality assurance/quality control compliance with method guidelines and project specific requirements. Each data package from the laboratory (STL-Savannah) was reviewed as outlined in the Quality Assurance Project Plan. Specifically included were an evaluation of holding times, calibration requirements (initial and continuing), blank contamination, surrogate recovery, matrix spike and duplicate performance, laboratory control sample recovery and analyte identification, as applicable.

PCB analyses were performed following EPA SW-846 method 8082 for 174 samples. Mercury analyses were performed following method 7471 for 35 samples (50% of the bass samples). All PCB data were reported on an Aroclor-specific basis.

The results of the data validation activities indicated that the analytical chemistry data for the fish tissue samples will support the Off-Site RFI Data Quality Objectives (DQOs). All of the 1253 PCB and mercury analyses, 100% of the results were available for use within the Off-Site RFI. The specific findings of the data review for the fish tissue samples are provided below.

All QA/QC parameters were found to be within acceptable limits, with the following exceptions:

- Recovery for one PCB surrogate was below control limits in five samples and above control limits in two samples. No data qualification was warranted based on the excursions.

- Minor deviations were observed for several PCB matrix spike and matrix spike duplicate recoveries and relative percent differences between recoveries. The majority of the excursions were judged to have no impact on the reported data. Data for Aroclor 1260 was, however, qualified as estimated in one sample based on the recoveries.

- Agreement between two dissimilar columns was evaluated and the percent difference was high resulting in the qualification of PCB data for 19 samples. In addition, the laboratory reported the lower of the two column results. All positive results were corrected to reflect the higher of the two column results, in accordance with method specifications.

- Mercury matrix spike and matrix spike duplicate recoveries were below control limits resulting in the qualification of data for 20 samples.

With the minor exceptions of the deviations noted above, the data quality was within acceptable limits and the data are considered acceptable for use as reported by the laboratory.

5.4 Summary

The results of the fish sampling program demonstrate that average PCB concentrations in bass and catfish fillets are below the ADPH advisory level of 2 mg/kg in Lake Logan Martin. The data also demonstrate that PCB concentrations in fish are declining throughout the Off-Site area. Given this declining trend, the fish tissue concentrations in Choccolocco Creek are expected to drop below the ADPH advisory level of 2 mg/kg. In addition, the results of mercury analyses conducted on the fish samples throughout the Off-Site area were all below the ADPH advisory level of 1 mg/kg.

6. Habitat Assessment

This section describes habitat investigation activities conducted for the Off-Site RFI and presents the results of the habitat assessments for Choccolocco Creek, Lake Logan Martin, and three tributaries to Choccolocco Creek: Snow Creek, Eastaboga Creek, and Blue-Eye Creek.

6.1 Habitat Investigation Activities

The field portions of the Habitat Assessment (initial assessment and aquatic community sampling) were conducted during mid-to-late September 1999. The initial assessment included collection of the physical habitat characterization information as described in the Off-Site RFI Work Plan. Information was gathered on physical characteristics (including land use; erosion; watershed non-point-source pollution; width, length, and velocity; dams, channel, and canopy), water quality (including temperature, dissolved oxygen, pH; stream type; odors; oils; and turbidity), and substrate and in-stream cover (including bottom substrate; embeddedness; channel alteration; bottom scouring and deposition; pool/riffle bend/run; bank stability; bank vegetation; and streamside cover). During community sampling efforts, benthic organisms and small fish were collected to develop a species list for use within the HEA.

The habitat sampling stations are presented on Figure 6-1 and include five locations within Choccolocco Creek, four locations within the hydraulic influence of Lake Logan Martin, and three tributary sampling stations, including Snow Creek, Eastaboga Creek, and Blue-Eye Creek. Although Coldwater Creek was identified as a potential tributary sampling location, ongoing construction activities adjacent to and within this creek during the Habitat Assessment precluded sampling. In lieu of this station, a second station was sampled on Blue-Eye Creek.

6.2 Habitat Sampling Station Results

The Habitat Assessment characterized habitats within the study area for physical, water quality, and overall habitat characteristics. The data assessed potential impacts from various environmental stressors within the area, including impacts from developmental, agricultural, and other activities within the overall watershed. The sampling stations provided a basis for developing subsequent ecological comparisons between similar habitat/community types and included:

- Stations within tributary streams to Choccolocco Creek, including Snow Creek;
- Stations along Choccolocco Creek upstream and downstream of the confluence of Snow Creek; and
- Stations within the limnetic zone of Lake Logan Martin.

Quantitative ratings of aquatic habitat at the sampling station locations were developed using the USEPA Rapid Bioassessment Protocols (USEPA, 1999c) guidelines. The habitat scoring system described by USEPA results in a scoring system that ranges from 0 to 150 habitat assessment (HA) points, with 150 points representing the highest habitat quality. Each sampling station represents approximately 330 feet of stream, for which the various factors were scored. As the general habitat quality increases, rating scores also increase. However, when interpreting the raw scores, the absolute score or percentage of the maximum total (150 points) is typically less important than the relative ranking of one station to the others. The field data sheets for each of the habitat sampling stations are included in Appendix F.

The biological assessment was performed to evaluate biological community along Choccolocco Creek and its influent tributaries as to general community condition. In particular, the survey was performed to assess biological comparability between stations and with historical data. It was also performed to identify target community/populations for subsequent HEA calculations.

6.2.1 Choccolocco Creek Sampling Stations

Summaries of results from five Choccolocco Creek sampling stations are presented below.

6.2.1.1 Station CU3

Station CU3 is located approximately 1,800 feet upstream of Snow Creek. Surrounding land use is predominately open fields and pastures with intermittent canopy cover and little bank vegetation. This station was representative of habitat conditions in this backwater portion of Choccolocco Creek. Surface waters were slightly turbid, and flow conditions were relatively slow (0.1 cfs). This station had the lowest habitat score (HA score = 20) of all stations assessed. The station had severe sedimentation problems and the poorest habitat diversity of all stations visited. Habitat in this area was clearly influenced by the backwater nature of this area and the urban runoff from Snow Creek. Bottom substrate and available cover were absent from this location, and embedded cobble was not apparent. As mentioned above, bank vegetation, although present, did not appear to be at sufficient density to prevent erosion. The creek in this area appeared to be channelized, and habitat quality as represented by pools, riffles, and sinuosity (e.g., bends in the creek) was not observed.

Taxa and family for the species identified at Station CU3 are presented in Table 6-1. In summary, benthic macroinvertebrates (BMI) were reasonably abundant in this area, and of the 21 taxa noted at this station most were midges (Chironomidae). Other common taxa included riffle beetles (Elmidae) and backswimmers (Notonectidae). Only a few species of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) were documented in samples.

6.2.1.2 Station CO11

The first Choccolocco Creek station downstream of Snow Creek (Station C011) showed an improved habitat score of 74 but continued to be affected by development activities documented in the upstream watershed. This station was located approximately 2 miles downstream of the Snow Creek confluence and is bordered by mostly field and pasture with some areas of commercial land use as well. The improved habitat score at Station C011, above that observed at Station CU3, was largely due to the presence of improved bottom substrate, in-stream cover, and greater surface water flow compared to upstream locations. Improved quality of pools and riffles was noted in this portion of Choccolocco Creek, and contributed to the increased habitat score. Bank stability and shoreline vegetation provided slightly higher scores for this reach, compared to upstream conditions.

Taxa and family information for the species identified at Station C011 are presented in Table 6-1. In summary, the BMI abundance in this reach of the creek was much greater than in the upstream location. Of the 31 taxa noted at Station C011, mayflies (Ephemeroptera) and midges (Chironomidae) co-dominated the sample. Stoneflies were also abundant. Freshwater clams (Unionidae) and snails (Viviparidae) were also common at this location. Combined, these biological groups indicate that habitat conditions at this location are of higher quality than at upstream locations.

6.2.1.3 Station C058

Station C058 on Choccolocco Creek had the highest habitat scores (HA score = 113) of any station sampled. Station C058 was located approximately 11 miles downstream of the Snow Creek confluence. Land use bordering this section of the creek was predominately agricultural and residential (rural). The 300-foot station section showed a variety of good to excellent habitat types covering the four major stream requisite types (fast, deep and shallow; slow, deep and shallow). Bottom substrate and embeddedness of cobble and larger stones were more abundant and of higher quality in this reach compared to upstream locations. Compared to upstream locations, depositional areas were limited in size and location, indicating that this habitat was favorable to biological organisms that favor clear, running surface waters and coarse substrates.

Taxa and family information for the species identified at Station C058 are presented in Table 6-1. In summary, the BMI community supported the observations of habitat quality in this reach. Of the organisms in this sample, the taxa most common included two species of mayflies (Baetidae and Heptageniidae), and stoneflies (mostly Hydroptilidae). Mayflies and stoneflies are typically abundant in habitats that are nondepositional, and are representative of higher quality. These organisms dominated the sample, although other representative taxa, including riffle beetles (Elmidae), freshwater clams (Unionidae), and snails (Viviparidae) were also present.

6.2.1.4 Station C103

Station C103 was located approximately 20 miles downstream of the Snow Creek confluence in an area of Choccolocco Creek bordered by rural, agricultural land use. Livestock are likely to contribute to the potential sources of runoff in this area. Vegetation and deadfall were observed along the banks of the creek. Velocity of running water at this reach, although higher than the upstream station (CU3), was slightly lower than at C058. Although bottom substrate, cover, and embeddedness were of similar quality to that found in Station C058, other habitat attributes related to flow, greater depositional area, and quality of riffle and pools decreased the overall habitat score (HA score = 83). Although not providing the level of habitat quality observed at Station C058, this reach did provide higher-quality habitat compared to the upstream station (CU3).

Taxa and family information for the species identified at Station C103 are presented in Table 6-1. In summary, the BMI community at this reach was represented by a range of 31 taxa. Freshwater snails (Viviparidae) were most common, although beyond these organisms there were no clear dominance patterns of any particular taxa. This may indicate that the diversity of reasonably good habitat in this location provides suitable conditions for a diverse community of BMI.

6.2.1.5 Station C117

Station C117 was located approximately 22 miles downstream of the Snow Creek confluence. Surface waters were reasonably clear and flowing at velocities similar to those observed in other stations below Snow Creek. Land use bordering this reach of the creek was predominately a mix of open field/pasture and agricultural types. Cow pastures were present along this reach, and in some areas of the creek cow patties were observed. Cotton fields were also noted. Overall, habitat quality was similar to some of the other upstream locations (HA score = 79). Substrate attributes were of reasonably good quality; however, the quality of riffle, pools, and runs were somewhat lower than at other upstream stations (with the exception of Station CU3, which scored the lowest).

Taxa and family identification for the species identified at Station C117 are presented in Table 6-1. The abundance of BMI was similar to that found at the upstream station (CU3). However, the important difference between Stations C117 and CU3 is in the composition of the BMI community. While Station CU3 was dominated by Chironomid midges (typically indicative of poor habitat quality), Station C117 was co-dominated by mayflies (mostly Baetidae), freshwater snails (Viviparidae), and several representatives of stoneflies. The presence of these taxa indicates that the habitat in this area of the creek is of higher quality than that found above Snow Creek (Station CU3).

6.2.2 Tributary Sampling Stations

6.2.2.1 Snow Creek

The Snow Creek sampling station is located between the overpass at Recreation Drive (upstream extent) downstream to Interstate 20 in Anniston. Surrounding land use is almost exclusively commercial, with parks, restaurants, and hotels located along the banks of the creek. Refuse in the form of tires, broken pipe, and rubbish was common in areas of the creek. Surface waters were turbid, but flowing reasonably well, and canopy cover provided some shade to the creek. Most habitat metrics scored “fair” in quality (e.g., bottom substrate, embeddedness, channel alteration). The most highly scored attribute was streamside cover, represented by local species of ornamental shrubs. Snow Creek had an overall habitat assessment score of 60 for this reach.

Taxa and family information for the samples collected at the Snow Creek station are presented in Table 6-2. In summary, the abundance of BMI observed in Snow Creek (and other tributaries) were similar to those observed in Choccolocco Creek. BMI at the Snow Creek station were in abundance and represented by 23 taxa. Midges (Chironomidae) and maylflies (Baetidae and Heptageniidae) were the most common organisms. A diverse group of taxa were also found at lower abundance: dragonflies (Coenagrionidae), dobsonflies (Corydalidae), riffle beetles (Elmidae), water scavenger beetles (Hydrophilidae), stoneflies (mostly Hydroptilidae), and several families of freshwater snails. In addition, sunfish were also noted in this area.

6.2.2.2 Eastaboga Creek

The Habitat Assessment for this tributary to Choccolocco Creek was located upstream from the Talladega Speedway Boulevard bridge, just south of Interstate 20. Land use bordering this section of the tributary is almost exclusively rural. A dense canopy of shrubs and trees provides an extensive amount of shade to a large pool area in this tributary, with only a small open area immediately before the boulevard. Riffle habitat is present near the bridge. The Habitat Assessment score for Eastaboga Creek (HA = 69) was similar to that found in Snow Creek.

Taxa and family information for this station is presented in Table 6-2 and includes 30 BMI taxa. Freshwater snails were the most abundant taxa, comprising more than one half of the sample. Similar to Snow Creek, numerous other groups were represented by several taxa and at a range of abundances. In addition to those already mentioned, flatworms (Planariidae), predaceous diving beetles (Dytisicdae), amphipods (Gammaridae and Talitridae), isopods (Asellidae), and crayfish (Cambaridae) were common.

6.2.2.3 Blue-Eye Creek

Blue-Eye Creek is a tributary to the Coosa River as it flows into Lake Logan Martin. The confluence of Blue-Eye Creek with the Coosa River is approximately 2.5 miles to the north of Choccolocco Creek's confluence with Lake Logan Martin. Agricultural land use supporting various livestock is the predominant land use in this reach. Canopy cover is moderate and provides some shade to the creek. Surface water flow were typically slower than the other tributaries, and bottom substrate available cover and embeddedness of cobble or rock scored lower than at other tributaries. Overall, the Blue-Eye Creek habitat assessment score of 53 was the lowest observed for each of the systems where the RBP approach could be conducted. Habitat conditions at this location were significantly influenced by agricultural practice, including direct watering of livestock within the area of creek bed.

Taxa and family information for this station is presented in Table 6-2. In reviewing the data, it was found that the BMI community does not reflect the lower habitat scores for this creek. There was no indication of dominance or co-dominance by any particular group of taxa. Mayflies (Heptageniidae) and midges (Chironomidae) were present at abundances similar to other taxa, which included damselflies and dragonflies (Coenagrionidae and Cordulegasteridae, respectively), predaceous diving beetles (Dytisicdae), riffle beetles (Elmidae), amphipods (Talitridae), caddisflies (Leptoceridae), freshwater clams (Sphaeridae), and snails (Lymnaeidae).

6.2.3 Lake Logan Martin Sampling Stations

The limnetic stations within Lake Logan Martin and the Choccolocco Creek stations at the lake confluence could not be scored using the same habitat metrics as those used for upstream Choccolocco Creek stations and associated tributaries stations. Stations at the lake confluence are within a wider area of the creek and are more representative of "pool-like" habitat characteristic of lakes. Therefore, stations associated with Lake Logan Martin were evaluated based solely on the

BMI community results. These stations include Station C159 and Station C175 (along Choccolocco Creek and near the confluence with the lake); a mid-pool station in Lake Logan Martin (off Choccolocco Creek), and a limnetic station off Blue-Eye Creek (Blue 02). For each of these stations, two BMI samples were collected. The first sample was taken in the shallow (predominately littoral) areas, with a second sample taken at a deeper location. Taxa and family information for these samples is presented in Table 6-3.

In general, BMI communities in deeper samples of each station were typically lower in abundance than in shallower samples. This is not surprising, since productivity (related to light penetration, submerged vegetation, and food supply) is typically higher in littoral habitats of lakes compared to deeper zones. BMI communities are part of this higher productivity in littoral habitats but can vary significantly in number of taxa and composition of species when compared to creek habitats.

For example, Stations C159 and C175 (along Choccolocco Creek and near the confluence with the lake) were almost exclusively comprised of three taxa: midges (Chironomidae), mayflies (Baetidae), and water mites (Arrenuridae). Similarly, Station Blue 02 also had representatives of taxa found in C159 and C175, along with roundworms (Nematoda) and freshwater snails (Viviparidae).

The mid-pool station at Logan Martin had the most organisms in the Lake Logan Martin system. In the littoral habitat, mayflies (Heptageniidae), midges (Chironomidae), and freshwater snails (Viviparidae) were the most common. The deeper station had mostly midges (Chironomidae), freshwater snails (Lymnaidae and Neritidae), and clams (Unionid).

6.3 Summary

The habitat assessment and BMI community evaluation conducted in this study indicate that no widespread impairment is evident in Choccolocco Creek, associated tributaries, and receiving waters. Overall, habitat quality along Choccolocco Creek is greater in areas downstream of Snow Creek. Habitat attributes such as riparian land use, substrate characteristics, and surface water flow provide quality habitat at locations of Choccolocco Creek below Snow Creek. Above Snow Creek, habitat is limited in many of these attributes, and of those habitats that are present, quality is poor. The dominance of chironomid midges in sediments above Snow Creek supports the lower habitat score observed at this location. Chironomids are tolerant of a wide range of physicochemical conditions. The presence of these organisms (as dominant taxa) may indicate that habitat attributes are not of sufficient quality to support more sensitive taxa (e.g., Ephemeroptera, Plecoptera, and Trichoptera).

Snow Creek and Eastaboga Creek show some similarity in habitat structure to their receiving water (Choccolocco Creek). However, reduced flow, finer-grained substrates, and depositional properties in these slower-moving systems result in lower habitat scores than those observed in the creek. This is also true for Blue-Eye Creek, which had habitat scores even lower than Snow and Eastaboga creeks. Accordingly, BMI communities in these waterbodies are well represented by a mix of sensitive and tolerant invertebrate taxa. Fish were also documented in each creek. Overall, habitat and biological observations in these tributaries indicate a functional ecology that is typical of small, slow- flowing streams.

Finally, observations on BMI associated with Lake Logan Martin indicate a community that is different in abundance and composition from those observed in Choccolocco Creek and the tributaries. The two lower stations (C175 and C159) in Choccolocco Creek have similar structural features to the lake, and therefore cannot be compared directly to upstream creek stations. In fact, BMI communities at Stations C175 and C159 are similar in abundance and composition to communities observed in the lake. At all "lake stations," BMI collected in shallower zones were slightly greater in abundance than BMI collected in deeper zones. This finding is likely due to the higher level of productivity that is typically found in the littoral bones of lakes.

7. Health and Environmental Assessment

This section describes the technical approach, findings, and conclusions of the Health and Environmental Assessment (HEA) performed for the Off-Site RFI.

7.1 Technical Approach

The focus of the Off-Site RFI studies was PCBs in the sediment, surface water, and fish; along with an assessment of habitat quality within the Off-Site area. A confirmatory sampling program was also included in the sediment and fish investigations to confirm PCBs as the COPC for the Off-Site area. The results of the confirmatory sampling demonstrated that PCBs are the appropriate focus of the Off-Site RFI, and that although metals are present, their presence in upstream background sampling locations is indicative of a wide range of potential sources within the 502 mi^2 Choccolocco Creek watershed. Consistent with this approach, the HEA activities were focused on PCBs as the COPC for the Off-Site area. Additional discussions of the distribution of metals within the Off-Site area and PCBs as the COPC is included in the updated OCM (Section 8.2) of this report.

In the RCRA cleanup reforms proposal recently released by USEPA, the agency provided recommendations designed to "achieve faster, more efficient cleanups" at RCRA-permitted sites (USEPA, 1999a) by emphasizing "flexibility and trying new approaches to clean up" sites. This HEA is consistent with these expressed goals and focuses on considerations most important to risk-management decision making. This approach is consistent with RCRA guidance and uses principles from USEPA's Superfund Accelerated Cleanup Model (SACM) to focus the risk analysis on the constituent(s) of concern that may drive any remedial decision (USEPA, 1992a).

The fundamental goal of the RCRA corrective action program is to control or eliminate risks to human health and the environment. According to USEPA (1996a):

> *Risk-based decision making is especially important in the corrective action program, where it should be used to ensure that corrective action activities are fully protective given reasonable exposure assumptions and consistent with the degree of threat to human health and the environment.*

The risk-based decision-making process is initiated with the HEA portion of the RFI. The HEA uses a set of criteria, termed "action levels," to which current environmental conditions are compared. In instances where these action levels are exceeded, a Corrective Measures Study (CMS) may be required (USEPA, 1989a). The concept of developing site-specific action levels was reiterated by USEPA in the *Risk-Based Clean Closure Guidance* (March, 1998a), which provided guidance confirming that protective, risk-based media-specific cleanup levels can be developed to achieve closure of RCRA-regulated units. This approach is also supported within proposed guidance from USEPA acknowledging that action levels can be developed on a facility-specific basis, and that they should be based "on less conservative assumptions and site-specific conditions" (USEPA, 1996a).

In the HEA, risk-based action levels (RBALs) were developed for potential exposure to PCBs through the sediments. Both ecological and human receptors have the potential to be exposed to a varying degree of PCBs associated with the in-stream sediment, either via direct contact, or indirectly through the consumption of aquatic organisms. Given these two primary exposure mechanisms, RBALs were derived to address the different potential exposure pathways and receptors at this location. Specifically, human health protection values (HPVs), which are exposure concentrations protective of human receptors, were calculated for both direct contact with the sediments and consumption of fish collected from the creeks and lake. Likewise, ecological protection values (EPVs) were established that are receptor- and pathway-specific. These receptor protection values are either sediment concentrations or fish tissue concentrations that are related back to a bulk sediment concentration using the biota-sediment accumulation factor (BSAF) model (see Appendix G). Once derived, these site-specific RBALs are used to evaluate current and likely future conditions or to serve as preliminary remedial options for inclusion in the risk-management decision-making process.

7.2 Human Receptors

Consideration of human receptors involved development of a site conceptual exposure model, calculation of the HPV, and application of RBAL results.

7.2.1 Site Conceptual Exposure Model

The fundamental goal of the corrective action program is to control or eliminate risks to human health and the environment, "given reasonable exposure assumptions" (USEPA, 1996a). The first step in developing the exposure assumptions is to identify sources, release mechanisms, exposure pathways, and potential receptors. These components of the site conceptual exposure model are illustrated in Figures 7-1, 7-2, and 7-3. For the in-stream portion of the Off-Site RFI, the source of PCBs is assumed to be the channel sediments. As depicted in the site conceptual exposure model, there are only two reasonable exposure pathways for human receptors with respect to sediment-associated PCBs: direct contact (dermal and incidental ingestion) as a result of wading, and ingestion of fish that have bioaccumulated PCBs originating from sediments.

The most significant factor affecting the potential for exposure is land use. For Choccolocco Creek, the predominance of forested and agricultural land areas along the creek significantly restricts access to the waterbody (Figure 3-12). Large areas along both banks are range lands, which are private property with restricted access to the creek channel.

Those areas not falling under this category are primarily forested, which also limits the ability of the general population to gain access to the creek. In either instance, restricted access reduces the probability of either direct contact with stream channel sediments or recreational fishing activities. The ability to wade in the stream is typically limited to those areas near bridges or, in some instances, boat launches. Access to fishable areas in Choccolocco Creek is primarily restricted to individuals using a boat, or from the sporadic bridge crossings that traverse the stream channel. Despite these apparent limits on accessibility, for the purposes of deriving RBALs for sediments, the potential exposure area (i.e., wading or capturing and consuming fish) is conservatively assumed to be the entire length of Choccolocco Creek.

Conversely, certain areas of Snow Creek, particularly in the more southern areas of the creek, near its confluence with Choccolocco Creek, are very accessible by humans. As such, direct contact with stream sediments by humans is considered a complete exposure pathway. Unlike Choccolocco Creek, the fish found in this stream are not of edible size. Therefore, the fish consumption pathway for human receptors is considered incomplete (Figure 7-2), and will not be used to derive an RBAL for Snow Creek.

For Lake Logan Martin, access was considered relatively unrestricted. The shores of the lake are surrounded by residential property and recreational areas such as public boat launches and numerous public and private docks. Although the lake is a desirable area for fishing and recreational activities (fishing, swimming, and water-skiing), direct contact with sediments is limited to the shore areas by children and adults engaged in wading activities.

7.2.2 Human Protection Value

7.2.2.1 Fish Consumption Exposure Pathway

The human protection value (HPV) for the fish consumption exposure pathway is based on the current guidelines advanced by the ADPH for establishing fish consumption advisories (ADPH, 1998). For PCBs in aquatic organisms, the guideline is founded upon the RBAL developed by the Food and Drug Administration (FDA) in 1984 (FDA, 1984). The FDA limit advises against the consumption of fish when PCB concentrations in the "edible portion" exceed 2 mg/kg on a wet-weight basis. Based on these guidelines, the HPV based on fish consumption for Choccolocco Creek and Lake Logan Martin was set at 2 mg/kg in fish fillets. Given that the HPV for this exposure pathway is based on the current ADPH fish advisory threshold, a site-specific exposure equation is not required. That is, variables typically used to estimate daily intake of PCBs based on the consumption of fish (e.g., fish consumption rates, species preferences) are not needed since the target fish tissue concentration is already established. Thus, the derivation of the HPV is a relatively straightforward calculation. Creek and lake sediment concentrations resulting in fish tissue levels equivalent to the HPV (i.e., 2 mg/kg) were determined based on the BSAF. Based on site-specific data used to develop the BSAF model, a sediment concentration associated with the HPV (the RBAL) was calculated so that fish tissue levels would not exceed 2 mg/kg. The calculation of the site-specific BSAF is described in Appendix G.

7.2.2.2 Direct Contact with Sediments

The derivation of an HPV based on direct contact with creek sediments incorporated the concepts of variability in accessibility outlined in the site conceptual exposure model. The Off-Site RFI Work Plan (BBL, 1999) identified two potential receptors (the resident and visitor/trespasser) that may directly contact sediment. However, a review of available data, including land use information, resulted in the use of only the visitor/trespasser (trespasser) scenario for Snow and Choccolocco creeks and resulted in consideration of this individual as an "aggregate receptor." The aggregate receptor integrates exposure characteristics for a child, adolescent, and adult over a relevant exposure duration. This approach is appropriate for evaluating lifetime cancer risks from a particular compound under circumstances where exposure could occur at any point in an individual's life (USEPA, 1992b). This receptor would not be appropriate under situations where exposure was limited to adults, for example in an industrial setting.

Receptor Selection

For Snow Creek/Choccolocco Creek/Lake Logan Martin, it was assumed for the purposes of HPV determinations that direct contact could occur anytime during an individual's lifetime starting at 4 years of age. This age is conservatively assumed to be about the age that a child might venture off in an unsupervised manner to play in a potentially dangerous setting (i.e., a streambed with flowing water). Thus, the exposure scenario assumed for this site was more of a trespasser rather than a wader or someone drawn to a specific area of the creeks by the presence of a recreational setting (i.e., park). Additionally, it was assumed children and adolescents (ages ranging from 4 to 18) would engage in the majority of this visitor/trespasser activity, with the frequency of contact decreasing with age. Therefore, an aggregate visitor/trespasser scenario was considered for exposure to sediments in the Snow Creek/Choccolocco Creek/Lake Logan Martin area. The following paragraphs detail the assumptions made regarding the accessibility of the individual creeks since this factor significantly affects the various parameters used to quantify exposure. It is important to note that the most conservative of the following three scenarios (Snow Creek) was used in the development of the HPVs.

Choccolocco Creek

The majority of Choccolocco Creek is relatively inaccessible, particularly to small children. As previously described, the inaccessibility is a function of land use; most of the stream bank abuts private range land, or courses through relatively thick vegetation. This would require young children to either travel significant distances over private property or navigate thickly wooded areas. Despite these obvious limitations on exposure, it was assumed that the exposure potential to stream sediments included child, adolescent, and adult trespassers.

Snow Creek

For Snow Creek, however, although the majority of the stream channel courses through urbanized and industrial areas, there is significant potential for direct contact with sediment by young children, adolescents, and to a lesser degree by adults. Given these significant differences in the current and likely future uses of lands adjacent to the stream channel, differences in exposure conditions would be expected for direct contact with sediments from Snow Creek and Choccolocco Creek/Lake Logan Martin. However, the exposure parameters developed for HPV derivations were based on an estimate for Snow Creek (assumed highest potential exposure) and adopted for Choccolocco Creek.

Lake Logan Martin

Similar limitations were assumed for Lake Logan Martin. Since the lake is accessible primarily by boat, both the duration and frequency of exposure to these sediments would be less than for Snow Creek. This is particularly true for the young trespasser. However, exposure conditions developed for Snow Creek were adopted for developing the HPV for Lake Logan Martin. Since the accessibility of lake sediments is much lower than Snow Creek, the adoption of these exposure assumptions likely would overestimate the actual exposure expected for humans contacting sediments of Lake Logan Martin, resulting in a more conservative analysis of potential risk.

Sediment Ingestion Rate

The exposure assumptions used to derive the direct-contact HPV for Snow Creek and Choccolocco Creek/Lake Logan Martin are listed below. The exposure equations used to calculate these values are also listed below (see Section 7.2.3.2). One important assumption used to derive the HPV for direct contact is that the rate of sediment ingestion was the same as for dry soil for both adults and adolescents. A sediment ingestion rate of 200 mg/day was assumed for 4 to 10 years of age, 100 mg/day for the 11- to 18-year-old, and 50 mg/day for the adult (USEPA, 1997a). These assumptions overestimate exposure, partic ularly for the adult, since a substantial portion of the ingested soil is a result of dust, which is not typically generated from submerged sediments. Likewise, children are likely to ingest less sediment while playing in the stream than is typically assumed for surface soil. However, the actual sediment ingestion rate cannot be quantified, and therefore the more conservative soil ingestion rate was adopted.

Dermal Absorption Factor

The current dermal absorption factor for PCBs recommended by USEPA is 6% (USEPA, 1992b). The dermal absorption factor was derived from experimental data using 3,3',4,4'-tetrachlorobiphenyl (TCB) applied to the skin of rats. Based on USEPA's interpretation of the data, the percent of TCB absorbed from soil ranged from 0.63% for high organic soil to 2.1% for low organic soil. However, USEPA did not propose a conservative estimate of dermal absorption based on these data by recommending that the high-end value (2.1%) be used as the default value. Rather, the agency decided upon an almost arbitrary upper-end absorption factor.

> *EPA decided that any final recommendation for percent absorbed should span at least one order of magnitude to reflect the uncertainty [in the database]. Thus, the final recommendation for percent TCB absorbed from soil is 0.6% to 6%. (USEPA, 1992b)*

Since the default value of 6% is actually three times higher than the experimental data provided, the dermal absorption factor used to calculate the HPV for dermal exposure overestimates the actual internalized dose of PCBs from this exposure pathway.

Gastrointestinal Absorption

USEPA has long recognized the significant effect the soil matrix can have on the absorption of PCBs from the gastrointestinal (GI) tract. The GI absorption of PCBs is not 100% even when the pure mixture is administered as an emulsion (80%) or dissolved in corn oil (81%) (ATSDR, 1998). In the agency's *Development of Advisory Levels for Polychlorinated Biphenyls Cleanup* (USEPA, 1986), USEPA recommended that the daily intake of PCBs from soil be determined using a 30% absorption factor. There have been no subsequent recommendations from the USEPA concerning a GI absorption factor. Likewise, as summarized below, a review of the current scientific literature does not provide any additional information suggesting the need to modify this agency recommendation.

Recent reports have described complex desorption kinetics of PCBs from sediment and soil, particularly "historically contaminated" material (Bjorklund et al., 1999; Pilorz et al., 1999; Huang and Weber, 1998; Cornelissen et al., 1998). These reports describe rapidly desorbing and slow desorbing sites within the soil matrix, which, although not specifically evaluated as to their effect on bioavailablity, support the position developed by USEPA that PCBs in soil have lower intestinal bioavailablity than pure compounds. This is particularly true in those instances where PCBs have been associated with soil or sediment material in the environment for prolonged periods of time. Such is the case with PCBs detected in sediments of Choccolocco Creek, Snow Creek, and Lake Logan Martin. Given the fact that these materials may have been in the aquatic environment for more than 25 years, any remaining PCBs are assumed to be tightly bound within the sediment matrix. Unfortunately, there are no published reports that address the bioavailablity of aged PCBs in sediments.

The use of a 30% GI absorption factor recommended by USEPA in 1986 assumes that the matrix effect of aged PCBs reduces the relative absorption by approximately two-thirds. Based on an understanding of desorption kinetics, including a consideration of the equilibrium partitioning occurring in the aqueous environment in the lumen of the gut, this reduction in absorption efficiency is a reasonable and conservative estimate. Use of this factor would provide a reasonable estimate of the internalized dose resulting from the ingestion of PCB-containing soil or sediment.

Soil Adherence Factor/Skin Surface Area

The soil adherence factor (AF) for adults of 0.32 milligrams per square centimeter (mg/cm^2) is recommended for "wet soil" (USEPA, 1998c) and was considered relevant for the types of sediments likely contacted in the assumed exposure conditions. For children (4 to 10 years of age), the AF for "children playing in wet soil" is reported to range from 0.2 mg/cm^2 (USEPA, 1999b) to 1.0 mg/cm^2 (USEPA, 1998c). The USEPA previously suggested that the lower end of the range of AFs may be the best value to represent an average over all exposed skin, since these values historically have been developed from hand measurements only (USEPA, 1992b). In another instance, USEPA adopted an AF of 0.51 mg/cm^2 empirically derived by Hawley (1985) for children 2 to 6 years of age exposed to river sediments (USEPA, 1998b). The USEPA's *Exposures Factors Handbook* (USEPA, 1997a) contains an activity-specific AF that would appear to be relevant to the exposure scenario evaluated in the HPV determination. The "kids-in-mud" exposure scenario has a 50th percentile weighted AF of 22 mg/cm^2. Associated with this value is the qualifying statement: "However, the application of these data to the dermal dose equation in this guidance will result in a significant overestimation of dermal risks. Therefore, it is recommended that these AF values not be used in a quantitative dermal risk assessment." This recommendation was followed within this HEA, as an alternative value was selected for the HPV derivation.

Based on the likely exposure conditions, an AF of 0.51 mg/cm^2 was conservatively assumed to estimate the amount of soil staying attached to the skin of an active child. Likewise, this same AF was used for the adolescent receptor (11- to 18-year-olds). Since we are evaluating creek sediments, contact with these materials would require playing in the stream channel and experiencing a constant washing off, reloading, and washing off of the sediments. Since the explicit assumption in the risk calculation is that all of the exposed skin surface is covered with 0.51 mg/cm^2 of sediment during the entire exposure duration, use of even the "best estimate of the mean" AF for wet soil overestimates the actual or probable exposure conditions.

The exposed skin surface area (SA), or contact surface area, was seasonally adjusted to account for the variation in temperature, and therefore clothing, experienced in north central Alabama. Skin SA was calculated for warm and cold months. For warm months (late spring, summer, and early fall), exposure frequency rates are highest. For warm months, the SA of exposed skin for the child receptor (4 to 10 years of age) and the adolescent receptor (11 to 18 years of age) was assumed to be the head, hands, forearms, lower legs, and feet. The SA of exposed skin for the adult receptor (19 to 33 years of age) during warm months was assumed to be the head, hands, forearms, and lower legs; it was assumed that the adult would wear shoes. The total skin SAs calculated for these age groups during warm months were approximately 3,700 cm^2 (ages 4 to 10), 6,100 cm^2 (ages 11 to 18), and 6,160 cm^2 (ages 19 to 33). During cold months (late fall, winter, and early spring), the feet and lower legs were considered covered. The total skin SAs calculated for the three age groups during cold months were 2,100 cm^2 (ages 4 to 10), 3,100 cm^2 (ages 11 to 18), and

3,600 cm^2 (ages 19 to 33). The annual seasonally adjusted skin SAs, using warm- and cold-month SAs, were 3,160 cm^2 (ages 4 to 10), 5,100 cm^2 (ages 11 to 18), and 4,900 cm^2 (ages 19 to 33).

Exposure Frequency/Exposure Duration

Since there is no specific guidance on this type of activity (i.e., trespassing to a creek), the variables selected for both exposure frequency (EF) and exposure duration (ED) are based on best professional judgment. As previously described, the frequency of excursions to creek beds or the lake is a function of the time of year. During the warmer months, particularly those months when school is not in session, the number of visits to these aquatic environments by young children and adolescents is expected to be the highest of the year. Likewise, in colder months and when most children are in school, the potential for contact with creek and lake sediments is reduced from those of summer months. The exposure frequencies for children, adolescents, and adults that are characterized as trespassers are outlined in the table below. The exposure duration for this particular pathway was assumed to be 30 years, per USEPA guidance for assessing lifetime cancer risks (USEPA, 1989b).

Exposure Conditions Assumed for HPV Calculation

		Exposure Frequency (visits/wk)			
Age Group	**Sediment Ingestion (mg/d)**	**Warm Season**	**Cold Season**	**Adherence Factor (mg/cm^2)**	**Skin Surface Area (cm^2)**
Child (4-10)	200[1]	4	2	0.51[3]	3160
Adolescent (11-18)	100[2]	4	2	0.51[3]	5100
Adult (19-33)	50[1]	2	2	0.32[4]	4900

Notes:
[1] USEPA, 1997
[2] Best Professional Judgment
[3] USEPA, 1998b
[4] USEPA, 1998a

The EF assumptions tend toward overestimating the likely exposure experienced by these receptors. For example, explicit in these EF variables are assumptions:

- That a child visits the creek every other day for the entire 6 months of the “warm season”;
- That 0.51 mg/cm^2 of sediment adheres to all 3,160 cm^2 of skin for the entire excursion to the creek;
- That 200 mg of sediment are incidental-ingested during each event; and
- That these conditions exist every year for 6 years.

Also explicit in these assumptions are that they are "event-driven" and not time-driven. That is, it does not matter how long the child is at the creek (30 minutes or 3 hours), the dermal absorption and incidental ingestion occur at the maximum rate estimated for each day (i.e., 200 mg of soil ingested per day). The probability that any of the residents of this area could be reasonably expected to fulfill these exposure characteristics is extremely low.

7.2.3 Risk-Based Action Level (RBAL) Results

The following section details the results of the development of RBALs for potential human receptors along Choccolocco Creek and Lake Logan Martin. Given the conservative approach in developing the RBALs for direct contact, only one RBAL was calculated.

7.2.3.1 Fish Consumption Exposure Pathway

Sediment concentrations estimated to result in the accumulation of PCBs into fish fillets at concentrations not exceeding 2 mg/kg were estimated using species-specific BSAFs determined for catfish and bass fillets. Consistent with the approach presented in Appendix G, RBALs for the catfish and bass species were calculated for the locations along Choccolocco Creek. These three locations correspond to the three fish sampling stations on the creek (i.e., ADEM96, New 99, and Station 35). To calculate bulk sediment PCB concentration, on a dry weight basis, the BSAF equation was rearranged to the following:

$$\text{Sediment PCB (mg/kg)} = \frac{(PCB_{tissue}) * (\%TOC)}{BSAF * (\%Lipid)} \qquad \text{(Eq. 1)}$$

For the development of a sediment concentration associated with the HPV of 2 mg/kg in fish tissue, the "PCB tissue" variable is held constant and the other three values vary depending upon species and the applicable reach of the creek. The results of this analysis are summarized in the table below.

RBAL Sediment PCB Concentrations

Location	Species	% Lipid	BSAF	Sediment RBAL (mg/kg)
ADEM 96	Channel Catfish	2.5	1.17	0.212
	Spotted Bass	0.47	11.8	0.137
NEW 99	Channel Catfish	1.33	3.95	0.185
	Spotted Bass	0.21	61.8	0.336
Station 35	Channel Catfish	1.31	5.11	0.330
	Largemouth Bass	0.39	30.4	0.487

RBALs for sediment in Lake Logan Martin that result in PCB concentrations less than 2 mg/kg in bass and catfish fillets were not calculated since the PCB concentrations in the surface sediment samples from the lake were not detected. More importantly, the results from this sampling indicate that the lake sediments are well below any of the RBALs determined in the above calculations.

7.2.3.2 Direct Contact with Sediments

Unlike the RBALs developed for the fish consumption exposure pathway, the risk-based sediment concentration associated with the exposure parameters is for all three waterbodies: Snow Creek, Choccolocco Creek, and Lake Logan Martin. The exposure conditions for direct contact with sediment, especially exposure frequency, were conservatively protective for all three systems, and likely overestimated exposure to large portions of the creeks and lake. In developing the direct-contact RBAL, the estimated sediment exposure was calculated for each life exposure period (i.e., childhood, adolescence, and adulthood) of the hypothetical receptor. The same exposure equations were used for each age receptor, with the variables changed to reflect that particular life stage. The general exposure equation for the ingestion of, and dermal exposure to, sediment are provided below:

Sediment Exposure Via Ingestion (kg) = IR x EF x ED x FI x GI x CF (Eq. 2)

Sediment Exposure Via Dermal Contact (kg) = SA x AF x ABS x EF x ED x FI x CF (Eq. 3)

Where:

IR = ingestion rate (mg/day)

EF = exposure frequency (days/year)

ED = exposure duration (years)

FI = site utilization factor (unitless)

GI = gastrointestinal absorption factor (unitless)

CF = conversion factor (1E-6 kg/mg)

SA = surface area (cm^2)

AF = adherence factor (mg/cm^2)

ABS = dermal absorption factor (unitless)

Intake from these two primary routes of exposure was determined to provide an estimated intake for any particular life stage using the following relationship.

$$\text{Total Exposure to Sediments (kg)} = \text{Exposure}_{\text{Ingestion}} + \text{Exposure}_{\text{Dermal}} \quad \text{(Eq. 4)}$$

The total exposure was determined for the child, adolescent, and adult receptor. The estimated total exposures from these three periods were then added to derive an intake for the 30 years of exposure. This total exposure represents the lifetime exposure to PCBs from creek and lake sediments. The lifetime exposure was amortized over 70 years to get the theoretical lifetime average daily dose (in mg/kg/day). The RBAL for this pathway was determined based on hypothetical cancer risks associated with PCB exposure, adopting an acceptable target risk level of 1 in 100,000, which is the midpoint of USEPA's target risk range (USEPA, 1999b). The agency has stated that "cleanup levels determined on a site-specific basis that represent anywhere within the [1 x 10^{-4} to 1 x 10^{-6}] range could be acceptable." The midpoint risk range is considered conservatively protective for the development of an RBAL.

$$\text{RBAL (mg/kg)} = \frac{(TR * BW * AT)}{(CSF * (EXc + EXal + EXad))} \quad \text{(Eq. 5)}$$

Where:

TR = Target risk level (1 in 100,000)

BW = Aggregate body weight (59.4 kg)

AT = Averaging time (25,550 days)

CSF = Cancer slope factor (2.0 kg-d/mg PCB)

EXc = Intake as a child (kg)

EXal = Intake as an adolescent (kg)

EXad = Intake as an adult (kg)

The table below provides the results of the risk calculations and information relative to the two major routes of potential exposure through direct contact: dermal absorption and incidental ingestion of sediment. The RBAL for the direct-contact route is determined from the aggregate exposure and is protective of a 30-year exposure amortized over a 70-year lifetime.

RBAL and Lifetime Average Daily Intake Estimates
Based on Direct Contact with Sediment Exposure Pathways

Pathway	Intake (μg/day)	Percent of Total
Ingestion	0.067	23%
Dermal Contact	0.23	77%
Total	0.298	–
RBAL	**15.5 ppm**	

7.3 Ecological Receptors

RBALs relevant to the protection of ecological receptors were derived using an approach consistent with the ecological risk assessment process and guidelines recommended by USEPA (1997b, 1998d). The USEPA (1996a) recommends the development of facility-specific action levels to account for ecological risk, since generic values applicable for wildlife receptors are not readily available. The USEPA ecological risk assessment process can be used to support the derivation of facility-specific action levels. The steps in this process include problem formulation, analysis of potential exposures and ecological effects, and risk characterization (USEPA, 1998d). The information from the analysis step of this process can be used with factors converting tissue, water, or other media levels to the corresponding sediment concentration to derive sediment RBALs consistent with the identification of potential adverse ecological effects.

7.3.1 Problem Formulation

The purpose of the problem formulation step is to identify stressor characteristics and sources, provide information on the ecosystem that is to be protected, describe the ecological assessment and measurement endpoints, and present a conceptual site exposure model that illustrates the relationship among the source, pathways, and receptors at the site (USEPA, 1997b). The following paragraphs outline the various considerations and processes that were used to identify and select these components of the ecological evaluation.

7.3.1.1 Stressor Characteristics and Source

In the conceptual site exposure model for the Off-Site RFI, sediments were considered the source of the stressor (PCBs) in the Snow Creek/Choccolocco Creek/Lake Logan Martin ecosystem. In aquatic environments, PCBs readily adsorb onto sediments in streams and may potentially be transferred to aquatic organisms and to higher trophic levels. PCBs and lipophilic chemicals are only found in a dissolved state within the water column in very low concentrations. Although present in low concentrations within surface waters, PCBs accumulate in aquatic organisms because of their high lipid solubility and slow rate of metabolism and elimination. Due to bioaccumulation of PCBs in the food chain, PCBs are easily passed on to organisms occupying higher levels in the food web.

The potential exposure of ecological receptors to PCBs is primarily a function of bioaccumulation, rather than direct contact with sediments. While PCBs bioaccumulate in the environment by both bioconcentrating (being absorbed from water and accumulated in tissue to levels greater than those found in surrounding water) and biomagnifying (increasing in tissue concentrations as they go up the food chain through two or more trophic levels), the overall source of PCBs to the ecosystem is controlled by the bioavailable fraction of PCBs within the surficial sediment.

7.3.1.2 Ecosystem Characteristics

The ecosystem evaluated in this assessment is the Snow Creek/Choccolocco Creek/Lake Logan Martin system located in north central Alabama; it is home to various aquatic and semiaquatic organisms. The range of organisms in this system includes benthic invertebrates, fish, piscivorous birds, and mammals. The physical characteristics of the stream channel have been described in Section 3. In-stream habitat quality was quantitatively evaluated using USEPA's Rapid Bioassessment Protocols (USEPA, 1999c). The results of this analysis are described in Section 6.

7.3.1.3 Ecological Assessment Endpoints

Ecological assessment endpoints focus the risk assessment on the components of the ecosystem that could be adversely affected by the stressor. These endpoints can be expressed as individual organisms, populations, communities, or ecosystems. A review of the habitat of the Snow Creek/Choccolocco Creek/Lake Logan Martin ecosystem provided information for the selection of assessment endpoints. Numerous invertebrates, fish, birds, and mammals inhabit or use this ecosystem for foraging. It is impossible to evaluate all the individual organisms of this ecosystem, and the assessment endpoints were therefore selected on a conservative basis and focused on the potential risks to fish and the piscivorous mammalian populations.

The appropriate assessment endpoint for the development of the EPV, and ultimately the RBAL for sediments, focused on reproductive success in piscivorous organisms known to inhabit the Choccolocco Creek watershed (USEPA, 1997b). The available information on PCB-induced reproductive effects was evaluated to select the most appropriate high-trophic-level receptor. In the case of PCBs, mink are generally considered the most sensitive wildlife species. Various toxicity databases containing generic toxicity threshold values were reviewed to facilitate the selection of the receptor population. The scientific material included guidance and reference documents developed specifically for, or used as, screening-level evaluations. These included the *Planar PCB Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review* (USDI, 1996), *Toxicological Benchmarks for Wildlife: 1996 Revision* (Sample, 1996), and *USEPA, Region 4*

Supplemental Guidance to RAGS: Ecological Risk Assessment, Bulletin No. 2 (USEPA, 1999b). Based on a review of these and other toxicological information, reproductive success of the female mink (*Mustela vision*) was determined as the most conservative measurement endpoint for the Choccolocco Creek watershed. This approach is supported by USEPA's recommendations on designing and conducting ecological risk assessments: "Sometimes, individual assessment endpoints are limited to one species (e.g., a species known to be particularly sensitive to a site contaminant)" (USEPA, 1997b).

Given the unique sensitivity of the mink, the EPV derived from this particular receptor will be protective of other less sensitive receptor populations. This is consistent with the recommendation from the USEPA as described in the development of *The Great Lakes Wildlife Criterion for PCBs* (USEPA, 1995):

> *The Great Lakes Wildlife Criterion for polychlorinated biphenyls (PCBs) is determined by the lower of the mammalian wildlife value and the avian wildlife value (WV). The avian WV is approximately 3 times greater that the mammalian WV. Therefore, the Great Lakes Wildlife Criterion for polychlorinated biphenyls (PCBs) is based on the mammalian WV.*

Although avian species are often identified as receptor populations potentially at risk from PCB exposure via the food chain, an EPV derived from the mink will have at least a three-fold safety factor for this particular population. Use of the mink as the surrogate receptor is also appropriate since this measurement endpoint evaluates an ecological receptor whose exposure is through bioaccumulation, while direct exposure to PCBs in sediment is assessed via the benthic EPV.

While mink are deemed appropriate for Choccolocco Creek and Lake Logan Martin, for Snow Creek they are not appropriate due to the high level of urbanization along the creek bank and surrounding floodplain areas. Therefore, in order to evaluate piscivorous mammals, an alternative representative receptor was selected. Reproductive success in another fish-eating mammal, the raccoon (*Procyon lotor*), was determined as the most appropriate assessment endpoint for the Snow Creek area.

7.3.1.4 Ecological Measurement Endpoints

Ecological measurement endpoints are "measurable characteristics" that relate directly to the valued ecological component chosen as the assessment endpoint. In this analysis, ecological measurement endpoints are developed to estimate levels of exposure to PCBs by piscivorous mammals, specifically the wild female mink. Measurement endpoints were selected to support the development of an EPV based on mink reproductive success, survival of sensitive life stages in fish, and lethality in benthic invertebrates. Since the goal of the in-stream HEA is to directly evaluate PCBs in sediment, measurement endpoints usable for deriving the EPV are related to sediments. The measure of direct exposure for female mink is fish tissue concentrations, while tissue burdens in fish were evaluated for resident piscine species. For the benthic community, direct exposure to sediments was considered the primary exposure pathway. A probabilistic approach (i.e., Monte Carlo analysis) was used to estimate the total daily intake (TDI) of PCBs for female mink resulting from consumption of fish from the Choccolocco Creek watershed. Using this approach, the BSAF for YOY fish was used to back-calculate a PCB concentration in whole-body YOY fish corresponding to the EPV (for both mink and fish). Measurement endpoints include sediment PCB concentrations and fish PCB concentrations.

Additionally, a qualitative survey of the benthic community and quantitative in-stream habitat assessment were selected as measurement endpoints since they are key indicators of ecosystem health. These data are vital for the development of a preliminary wildlife exposure model for the central Alabama upland region. The habitat assessment is particularly important since it provides quantitative information on whether factors unrelated to PCBs alter the species composition at the site. This evaluation, which is a component of the HEA, is provided separately in Section 6.

7.3.1.5 Receptors of Concern

As noted above, the wild female mink (*Mustela vision*) was chosen as the receptor of concern for the Choccolocco Creek watershed as a high-trophic-level predator in the food web of many riverine environments. Mink are also good indicators of environmental health because they are especially susceptible to chemical constituents.

Water is a critical habitat feature for mink. Mink inhabit streambanks, lakeshores, and marshes and are commonly found in areas where downfall, debris, and logjams create an area for foraging and shelter. Mink avoid open areas such as pasturelands and certain highly maintained agricultural lands and prefer shrubby, dense thickets. Areas of streambanks that have been degraded by livestock are avoided (BISON, 2000). Mink home ranges tend to approximate the shape of the body of water the mink uses most. The female mink has a smaller average home range than the male mink. Females tend to use a greater proportion of their home range as a core area than males. The average home range for a female in heavily vegetated areas is 19 acres; whereas in sparsely vegetated areas the home range can be as much as 50 acres. Male mink travel extensively. The male mink home range can be as great as 5 miles in diameter and can take approximately 2 weeks to cover. A series of temporary homes is used during this time, the home being occupied for a few days at a time. Individual home ranges rarely overlap except during breeding season when male home ranges overlap those of females (USDA Forest Service, 2000) and sometimes the territories of different males overlap (Texas Parks and Wildlife, 1994). Mink are opportunistic carnivores with a diet consisting primarily of fish. Mink will also consume insects, frogs, freshwater mussels, crayfish, turtles, small mammals, and birds. Approximately 61% of the mink's year-round diet consists of fish (USEPA, 1993), with YOY fish providing an excellent food source.

The raccoon (*Procyon lotor*) was chosen as the receptor of concern for the Snow Creek area because this area does not provide a habitat desirable to mink. Snow Creek is highly channelized with steep banks and areas of urbanization and industrialization. Mink prefer gently sloping stream banks in highly wooded areas with downfall, debris, and logjams. Therefore, mink are not likely to be present in the Snow Creek area. The raccoon is highly adaptable and is therefore more likely to occupy the Snow Creek area than the mink. Raccoons are found primarily along streams and lakes near wooded areas. However, the raccoon is opportunistic and may inhabit urban, residential, and recreational areas. The raccoon is representative of an omnivorous mammal with diet varying from nuts and fruits to crayfish, frogs, rodents, and fish. In most habitats, plants provide a larger percentage of the raccoon's diet than animals do. However, the raccoon has adapted to include trash and other food available in suburban and urban areas in its diet (Univ. of MI Museum of Zoology, 2000). In areas where household trash is found, the raccoon will live primarily on food scraps. The average home range of the raccoon is 504 acres. In suburban areas, home ranges seldom exceed 8 acres (Wittenburg Univ., 2000).

7.3.1.6 Exposure Pathways in the Ecosystem

Ecological receptors may be exposed to PCBs through several pathways. However, the pathway must be complete for any chemical exposure to occur. In the case of the mink, the sole exposure pathway considered in this assessment is the ingestion of aquatic prey items (i.e., fish). Although exposure could theoretically occur via the other pathways illustrated in Figure 7-4, ingestion of fish is the most quantitatively significant, and the pathway that will "drive" the development of an EPV.

7.3.1.7 Ecological Conceptual Site Exposure Model

This section presents a working hypothesis of how the chemical stressor (PCBs) might be released from a source, be transported, and then come into contact with the ecological components of the site. The ecological conceptual site exposure model is graphically presented on Figure 7-4 and is specific to the riverine ecosystem of east central Alabama. The following section provides information on the organisms that may be exposed to PCBs by direct contact of sediment, or by indirect contact through prey consumption.

7.3.1.8 Ecosystem / Food Chain Type

This ecological portion of the HEA is concerned with a riverine ecosystem and includes organisms potentially at risk in the Snow Creek/Choccolocco Creek/Lake Logan Martin area. Many organisms inhabit these waters, including plants, invertebrates, fish, and piscivorous mammals and birds. The relationship of these organisms to one another in terms of food web structure (and potentially PCB transfer) is presented graphically in Figure 7-4.

Primary Producers: Microscopic aquatic plants known as phytoplankton capture solar energy through photosynthesis that convert inorganic compounds (i.e., carbon dioxide and water) into complex organic compounds (i.e., carbohydrates). These aquatic plants float passively in the water column, making them a suitable source of food for other organisms. This process of primary productivity supports the pelagic food chain. The uptake of surface water by these aquatic plants creates an exposure route in which they can potentially accumulate compounds (U.S. Fish and Wildlife Service, 1986).

Detritus: Detritus is composed primarily of decomposing organic debris and small pieces of dead and decomposing plants and animals. Detritus forms the main base of carbon in river sediments. Sediments are the matrix of the benthic environment.

Primary Consumers: Primary consumers are organisms that feed directly on the phytoplankton or detritus within the water column or sediment. These organisms include zooplankton and benthic infauna. Zooplankton are small floating, weakly swimming animals that are transported by water currents.

Benthic Organisms: Benthic organisms were reviewed as possible receptors of concern because they are sensitive to environmental stressors. This is due to their relative immobility and associated susceptibility to localized elevated constituent concentrations. Bioaccumulation of chemicals by benthic organisms is one of the primary steps in the biological transport of hydrophobic pollutants from the sediment to higher trophic levels (Lee, 1992). Benthic organisms, which include plants, invertebrates, and some species of fish, live in, on, or near the bottom sediments. Benthic invertebrates burrow into the bottom, either superficially through fine sediments or deeper in vertical tubes. These consist largely of worms, snails, mussels, and small crustaceans (i.e., crayfish). Many benthic organisms are filter feeders that strain suspended organisms and organic matter from the water column (i.e., mussels feeding on phytoplankton). Some worms feed by ingesting sediments from the bottom and extracting nutrients. Benthic organisms are an important component to the aquatic grazing food chain, fed upon by amphibians, fish, and birds. Benthic organisms can accumulate PCBs through feeding and direct contact with sediments and sediment pore water. The principal exposure routes of these organisms are through the uptake of compounds across respiratory organs such as filaments or gills, direct ingestion of sediment or pore water, direct ingestion of chemical-containing food items, and direct contact with sediment or surface water.

Worms (*oligochaetes*), snails and mussels (*mollusca*), and crayfish (*astacidea*) are common in most freshwater habitats in central Alabama. They are most commonly found in soft sediments rich in organic matter. Most are deposit feeders, subsisting on organic detritus.

Secondary Consumers: Secondary consumers are organisms that feed on primary producers and/or primary consumers. The principal exposure pathways for this group of receptors include ingestion of prey items and contact with sediment or surface water (ingestion and/or respiration). This trophic level includes amphibians (i.e., frogs and salamanders), some reptiles (i.e., turtles), and small bottom-feeding fish (i.e., darter, minnow, and shiner).

Higher Consumers: This trophic level includes the top feeders of the food web. Large predatory fish (i.e., catfish and bass), piscivorous mammals (i.e., mink, raccoon, and river otter), and piscivorous birds (i.e., great blue heron and bald eagle) were reviewed as possible receptors of concern because aquatic organisms (i.e., fish), as the major component of their diet, represent a possible exposure pathway (i.e., fish).

Large Predatory Fish: Fish may be exposed to PCBs in sediment through consumption of benthic invertebrates or other fish species. Bottom-feeding fish are in close contact with sediments. They may be exposed to PCBs via the food web and direct or incidental ingestion of sediments or, to a limited degree, uptake across gill lamellae of dissolved chemicals. Predatory fish primarily ingest PCBs while feeding on smaller fish; bioaccumulation of PCBs may result from the ingestion of smaller fish. The blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), and spotted bass (*Micropterus punctulatus*) are found in streams and rivers of central Alabama. These larger fish species were reviewed as possible receptors of concern because they represent fish species at different trophic levels and are common to ecosystems like the one found in Choccolocco Creek/Lake Logan Martin.

Channel Catfish: The channel catfish is most commonly found in big rivers and streams. It prefers some current and deep water with sand, gravel, or rubble bottoms. It is mostly a bottom feeder, but will also feed at the surface and mid-depth. The diet consists of aquatic organisms such as crayfish, mollusks, crustaceans, and fishes. Channel catfish are also migratory and closely resemble the blue catfish. A study by Dames indicated that channel catfish may travel almost 300 miles over a two-month period. However, the median home range of this species is between 2.5 and 18.6 miles (Dames, 1989). A study conducted at the Saint Johns River in Florida found a channel catfish traveled 62 miles in 22 days (Hale, 1986).

Blue Catfish: Blue catfish are found in big rivers and in the lower reaches of major tributaries. They prefer clearer, swifter water than most other catfish species. Young blue catfish feed on aquatic insects and small fish; larger blue catfish prefer crayfish, mussels, and other fish. Blue catfish are the largest of the catfish species and grow faster and live longer than channel catfish. Maximum life span is probably 20 to 25 years. They may exceed a weight of 100 pounds. Blue catfish travel considerably (approximately 20 to 30 miles) and are quite migratory (Dames, 1989).

Largemouth Bass: Largemouth bass can tolerate a wide range of river water clarities and bottom types. The diet of the largemouth bass changes with its size. Young fish feed on zooplankton and crayfish. An adult’s diet consists of fish, crayfish, frogs, salamanders, turtles, mice, and even birds. Largemouth bass have been known to live approximately 16 years. Largemouth bass have distinct home ranges and are generally found within 5 to 5.6 miles of their preferred range. A 1960 study by Kramer and Smith found that 96% of the largemouth bass remained within 100 yards of their nesting range (Fish and Wildlife Information Exchange, 2000). Other studies indicate that the largemouth bass has a home range of approximately 300 feet upstream and downstream from the tagged location of this species (Miller, 1975). The average length of a study is one year. Once in a while a “stray” has been captured miles from the tagged location. This has generally been the result of flood conditions.

Spotted Bass: Spotted bass are similar in appearance to the largemouth bass but tend to grow more slowly and do not attain as large a size. They prefer slow-moving rivers and streams with gravel or rock bottoms. The principal diet consists of crayfish, fish, and aquatic insects, while fish make up a much smaller percentage of the diet relative to other bass species. Studies indicate that the spotted bass has a normal home range of 200 to 400 feet upstream and downstream from the tagged location (Vogele, 1975). Less than 10% have been captured 1 mile from the tagged location. An individual was captured as far away as 200 miles from the tagged location; however, this is far from the norm (Miller, 1975).

Omnivorous Mammals: The raccoon (*Procyon lotor*) is found in most of the United States. It is omnivorous and opportunistic. In most habitats, plants provide a larger percentage of the raccoon's diet than animals do. Plant foods vary from nuts to fruits. The raccoon has adapted to include trash and other food available in suburban and urban areas in its diet. The raccoon will get into trash cans and live primarily off food scraps. The raccoon is nocturnal and is seldom active during the daytime (Wittenberg Univ., 2000). The raccoon was selected as a representative receptor for the Snow Creek area of the site.

Piscivorous Mammals: The mink (*Mustela vison*) and the river otter (*Lutra canadensis*) are both found in central Alabama and were reviewed as possible receptors of concern. The mink was selected because it is at the top of the aquatic food chain, feeding primarily on fish. It is also known to be especially sensitive to PCBs, and therefore represents an appropriate surrogate species for this class of organisms.

Mink: Mink are considered semiaquatic in their habitat requirements. The basic requirement for mink habitat is permanent water. Mink dwell along banks of streams and rivers in central Alabama. The den is usually a retreat under roots of a tree near the water or a hole in the bank of a stream. Mink travel widely with a home range up to 5 miles in diameter, a characteristic that requires a consideration of a significant spatial variation in feeding areas. Mink prefer a habitat with ample vegetative cover, as opposed to open areas such as pasturelands and certain highly maintained agricultural lands. Mink are opportunistic carnivores. Their diet consists primarily of fish; however; insects, frogs, freshwater mussels, crayfish, turtles, small mammals, and birds are also known prey items.

River Otter: The river otter is also found along banks of streams and rivers in central Alabama. The den of the river otter is usually a hole in the bank of a stream with the entrance below water. The home range for the river otter is 15 miles or more, again resulting in spatial variation of PCB residue in the tissue of its prey. The river otter feeds primarily on fish, frogs, crayfish, and other aquatic invertebrates.

Piscivorous Birds: Numerous species of birds, including piscivorous species may be present in the Snow Creek/Choccolocco Creek area. Piscivorous birds feed largely on fish and other aquatic organisms. Bioaccumulation of PCBs is a potential risk to piscivorous birds in this ecosystem. Reproduction in piscivorous birds is an assessment endpoint of toxicity potential caused from exposure to PCBs. The great blue heron (*Ardea herodias*) and bald eagle

(*Haliaeetus leucocephalus*) were reviewed as possible receptors of concern because their diet consists primarily of fish and aquatic organisms, resulting in a relatively high potential for exposure.

Great Blue Heron: The great blue heron is widespread in the Southeast and its habitats include rivers, lake edges, marshes, swamps, and saltwater shores. It lives and nests in colonies, and it wades, usually feeding in shallow water or long grass. The great blue heron's diet consists of fish, frogs, salamanders, lizards, snakes, crayfish, and many aquatic insects. The adult great blue heron has very few natural predators because of its size and very sharp bill; however, the young great blue heron is preyed upon by red-tailed hawks, raven, bald eagles, and raccoons. However, in about 6 weeks the young are as large as adults. The major influence on this bird is destruction of habitat. It is known as a keystone species or bio-indicator because any major change in its environment will greatly affect its population.

Bald Eagle: The bald eagle, a large raptor, is found throughout North America. It is primarily riparian, associated with coasts, rivers, and lakes, and usually nests near bodies of water where it feeds. The bald eagle is generally a fish eater, but is also an opportunistic predator feeding on small mammals, a variety of birds, and carrion when fish are not available. The home range during hunting varies from 1,700 to 10,000 acres. Home range is smaller when food is abundant. In 1982 there were no bald eagle pairs found in Alabama, but the bald eagle is making a comeback. The latest data from the U.S. Fish and Wildlife Service (1998) show 23 nesting pairs of bald eagles were found in Alabama.

7.3.1.8.1 Summary of Organisms at Each Trophic Level

The following taxonomic groups have been identified in the Snow Creek/Choccolocco Creek/Lake Martin ecosystem:

Primary Consumers

Benthic invertebrates: worms, snails, mussels, and crayfish

Secondary Consumers

Amphibian: salamander

Reptile: turtle

Small bottom-feeding fish: snail darter, spring pygmy sunfish, blue shiner

Higher Consumers

Large predatory fish: blue catfish, channel catfish, largemouth bass, spotted bass

Omnivorous mammals: raccoon

Piscivorous mammals: mink and river otter

Piscivorous birds: great blue heron and bald eagle

7.3.1.8.2 Threatened and Endangered Species

A number of endangered or threatened species of snails and mussels are found in freshwater creeks in Alabama. Approximately one-third of Alabama's mussels are considered threatened, endangered, troubled, or of special concern (ADCNR, 2000). Ninety-seven species of Alabama's gill-breathing snails (65%) are recognized as being either extinct, endangered, threatened, or of special concern. Two of Alabama's threatened snails, the lacy elimia (*Elimia crenatella*) and the painted rocksnail (*Leptoxis taeniata*), are found in Calhoun County (Bama Environmental News 2000). The tulotoma snail (*Tulotoma magnifica*) is an aquatic endangered species found in the Coosa River tributaries of northeastern Alabama. Three fish species, the snail darter (*Percina tanasi*), spring pygmy sunfish (*Elassoma alabamae*), and blue shiner (*Cyprinella caerulea*) are also listed as rare, endangered, or threatened.

7.3.2 Analysis Phase and Risk Characterization

7.3.2.1 Benthic Invertebrates

Benthic invertebrates are organisms that live in direct contact with sediments. A biological community sampling program was initiated to identify the benthic receptors residing in different segments of the Choccolocco Creek environs. The methods used to sample and identify the benthic organisms are provided in Section 6 of the Off-Site RFI Work Plan (BBL, 1999). These resident populations were the focus of the RBAL development. Additionally, the identification of resident populations allows a qualitative evaluation of stream and lake health based on the occurrence of various families at each sampling location. The results of this community survey are provided in Table 6-1 for Choccolocco Creek, Table 6-2 for tributary creeks including Snow Creek, and Table 6-3 for Lake Logan Martin. In concert with these data, a quantitative habitat assessment was performed at each of the biological sampling stations. The importance of the evaluation of abiotic characteristics in an ecosystem was recently expressed by USEPA (1999):

> *An evaluation of habitat quality is critical to any assessment of ecological integrity and should be performed at each site at the time of the biological sampling. In the truest sense, 'habitat' incorporates all aspects of physical and chemical constituents along with the biotic interactions.*

In fact, habitat quality is considered the single most important factor determining biological diversity and health (USEPA, 1989c). The purpose of this evaluation was to develop an understanding of current habitat conditions and also provide information that would allow the assessment of physical and biological stressors that may be affecting community structure. The habitat assessment was performed using the protocols originally published by USEPA in 1989, and were consistent with recently revised methods (see Chapter 5 in USEPA, 1999c). The results of the quantitative habitat assessment are contained in Appendix F.

7.3.2.1.1 Habitat Assessments and BMI Community Evaluation

As detailed in Section 6, an assessment of habitat and an evaluation of benthic macroinvertebrate (BMI) community were conducted of the Snow Creek/Choccolocco Creek/Lake Logan Martin ecosystem. These evaluations were conducted in support of the overall HEA effort. The studies found that no widespread impairment is evident in Choccolocco Creek or its associated tributaries and receiving waters. Overall, habitat quality along Choccolocco Creek is greater in areas downstream of Snow Creek. Habitat attributes such as riparian land use, substrate characteristics, and surface water flow provide quality habitat at locations of Choccolocco Creek below Snow Creek. Above Snow Creek, habitat is limited in many of these attributes, and of those habitats that are present, quality is poor. For additional details on these findings, refer to Section 6 of this report.

7.3.2.1.2 Ecological Protection Value for Benthic Invertebrates

An ecological protection value for benthic organisms ($EPV_{Benthic}$) was developed for the invertebrate community inhabiting the Snow Creek/Choccolocco Creek/Lake Logan Martin watershed. The $EPV_{Benthic}$ is related to the interstitial or pore water concentration of PCBs (µg PCBs/liter of water). Pore water is considered the most biologically relevant exposure medium since it represents the freely dissolved – and biologically available – fraction of PCBs in an aquatic environment where the source of the chemical of concern is the sediments (USEPA, 1989d).

The hypothetical pore water concentration protective of resident benthic organisms was determined using the equilibrium partitioning model (EqP). The scientific rationale for this model is based on the fugacity principle, which can be regarded as the “escaping tendency” of a chemical from one phase to another. Equilibrium is achieved when the escaping tendency from one phase exactly matches that from the other (Mackay and Paterson, 1981). The phases evaluated in the EqP are pore water and the organic matrix of the sediments (normalized to the organic carbon content). Thus, the EqP method is appropriate for quantifying partitioning between two phases (sediment and water) for nonpolar chemicals like PCBs (USEPA, 1989d). The pore water concentration can be estimated knowing the chemical’s lipophilicity (as defined by the organic carbon/water partitioning coefficient [Koc]) and the carbon content of the sediment.

The pore water concentration (µg/L) is defined by the following relationship:

$$\frac{\text{Carbon - Normalized Sediment Concentration } (\mu g/kg_{oc})}{\text{PCBs Koc } (L/kg_{oc})}$$

As with any model, there are a number of factors that influence the partitioning of PCBs from a sediment matrix to water. These factors include particle concentration effects, increased sequestration of the chemical onto the particle with time (i.e., “aging”), and the presence of dissolved organic carbon. All these factors, as well as many others, can affect to some degree partitioning kinetics in an aqueous environment. However, those effects not specifically addressed in the EqP model are likely to be insignificant relative to the overall variability and uncertainty associated with quantifying this parameter. In addition, most of these factors are not easily quantified with standard analysis.

The USEPA recommends that Sediment Quality Criteria for nonionic compounds be established using the final chronic value (FCV) defined in the Ambient Water Quality Criteria as the effect concentration (USEPA, 1996b). A similar approach was used here to develop the EPV for the resident benthic community, with the $EPV_{Benthic}$ assumed to equal the FCV for PCBs. The current AWQC for PCBs does not contain an FCV for freshwater species, and the freshwater criterion of 0.014 µg/L is not an appropriate effects concentration to derive the benthic EPV. Although the criterion was developed "to protect freshwater aquatic life," the final value was based on a dietary intake (i.e., a fish tissue PCB concentration) protective of mink, a terrestrial mammal. Use of published bioconcentration factors allowed the conversion of this fish tissue concentration into a water concentration, and hence the AWQC. Although the final value is unsuitable for this analysis, the *Ambient Water Quality Criteria for Polychlorinated Biphenyls* (USEPA, 1980) does contains relevant information for use in deriving an $EPV_{Benthic}$.

Specifically, results from six chronic tests with three freshwater invertebrate species provide relevant toxicity data to establish a threshold effects concentration. All six tests were performed using flow-through protocols which are superior to static testing methods and are required by the USEPA for developing FCUs (USEPA, 1985). Likewise, all of the identified studies were life-cycle toxicity tests as required for the development of a FCV. The chronic values from these tests were: for *Daphnia magna*, 15 µg/L, 4.3 µg/L and 2.1 µg/L; for the midge (*Tanytarsus dissimilis*) 0.8 µg/L; and for the scud (*Gammarus pseudollmnaeus*) 4.9 µg/L and 3.3 µg/L. The geometric mean of the chronic values, 3.47 µg/L, was adopted as the $EPV_{Benthic}$.

The corresponding RBAL for invertebrates is the sediment concentration that will result in a pore water concentration at or below the $EPV_{Benthic}$. The derivation of the RBAL takes into account site-specific organic carbon content of the sediment, which based on this model is the most important factor determining partitioning from one matrix (sediment) to another (pore water). Unlike the RBAL for other receptors, there is no spatial averaging required in deriving the final value, since invertebrates are generally considered to be relatively immobile.

The RBAL for sediments, on a dry-weight basis (i.e., mass of PCBs per mass of sediment), is derived using the following equation:

$$RBAL = EPV_{Benthic} \times Koc \times CF \times SSTOC \qquad \text{(Eq. 6)}$$

Where:

RBAL = risk-based action level (mg PCB/kg sed)

$EPV_{Benthic}$ = Ecological Protection Value or the Benthic Chronic Value (3.47 µg/L)

K_{oc} = PCB-specific organic carbon/water partitioning coefficient (3.09 E+05 L/kg_{oc})

CF = Conversion factor (1.00E-03 kg_{oc}/g_{oc})

SSTOC = Site-specific total organic carbon content of sediments (g_{oc}/kg sediment).

The table below presents the site-specific benthic RBALs for each segment, or reach, of Choccolocco Creek.

$RBAL_{benthic}$ for Various Segments in Off-Site Ecosystem

Location	SSTOC (g_{oc}/kg_{sed})	$RBAL_{benthic}$ (mg/kg_{sed})
Snow Creek to Coldwater Creek	3.08	3.30
Coldwater Creek to Jackson Shoals	4.86	5.21
Jackson Shoals to Lake Logan Martin	11.0	11.8

7.3.2.2 Ecological Protection Value for Piscine Species

A chemical residue-based assessment technique was used to derive an ecological protection value for feral fish populations (EPV_{Fish}). This method relies on published toxicity data that provide response thresholds as an internal dose (i.e., tissue concentration), rather than as an exposure point concentration (e.g., nominal water concentrations). This effects concentration is sometimes referred to as a critical body residue, and has been advocated by many scientists, including some at the USEPA (USEPA, 1998) as an improvement for predicting toxicity to wildlife populations (Cook et al., 1991; Landrum et al., 1992; McCarty and MacKay, 1993). The correlation of measured tissue concentrations to reported toxic effects (residue-based dose) has a number of advantages over using an "exposure-based approach," including (McCarty and MacKay, 1993):

- bioavailablity is explicitly considered;
- accumulation kinetics are considered, which reduces the confounding effects of exposure duration when interpreting results;
- uptake from all media is implicitly considered; and
- effects of internal processes (metabolism, elimination, etc.) are included.

This method is particularly effective for developing an EPV_{Fish} in those instances where critical body residue data are available both on the receptor of concern and expressed in a manner consistent with the measurement endpoints selected as part of the problem formulation process. In fish species, the early life stages are generally more sensitive to chemical exposure than the adult stage (McKim, 1977), and thus survival of these sensitive receptors represents an appropriate measurement endpoint. For the purposes of developing a piscine EPV toxicity data from studies on these life stages were identified and reviewed for use in the development of a risk-based value. The search was limited to freshwater species and exposure protocols that would reduce the uncertainty in extrapolating these data to the Snow Creek/Choccolocco Creek/Lake Logan Martin ecosystem. Table 7-1 lists the studies that provided the most relevant data on tissue concentrations of toxicants and associated effects in early life stages of fish. Although other studies were identified, they were not included in the evaluation due to limitations in study design or uncertainties in analytical results. For example, several studies evaluated embryo hatching success (e.g., Ankley et al., 1991). However, these eggs were collected from feral populations and co-occurrence of other constituents, and their potential contribution to the observed effect, could not be quantified. Other studies were eliminated since the species used in the investigations were from saltwater or estuarine environments (e.g., Spies et al., 1985) and not a freshwater system.

A report published by Mayer et al. (1977) provided the most relevant information for the piscine EPV for several reasons. First, the focus of this investigation is species indigenous to the Snow Creek/Choccolocco Creek/Lake Logan Martin ecosystem, and specific species collected as part of the Off-Site RFI studies. Second, and equally as important, the investigation by Mayer and co-workers also evaluated a critical life stage, employed a chronic exposure protocol, and selected a toxicological endpoint relevant to the success of a feral population. Mayer and colleagues chronically exposed fingerling channel catfish to PCBs and assessed growth and fry mortality as a function of this exposure. From this study, a critical body residue associated with a no-observable-adverse-effects-level (NOAEL) was estimated at 32 mg/kg body weight; this value was selected as the EPV_{Fish}.

The toxicity threshold reported by these investigators is appropriate for the EPV_f, although it was not the lowest value reported in the literature obtained as part of this analysis. Critical body residue concentrations associated with adverse effects in early life stages in freshwater fish exposed only to PCB mixtures ranged from 1.6 mg/kg in rainbow trout (Hendricks et al., 1981) to 429 mg/kg in female fathead minnows (Nebeker et al., 1974). Thus, the value reported by Mayer et al. is approximately the midrange of the reported critical body residue concentration. Most importantly, this 32 mg/kg value is for a resident species, and an organism for which site-specific tissue data was collected. As a result, there is no need for interspecies extrapolations. This eliminates the need for applying recommended so-called "safety" factors that are typically required to insure the benchmark value is adequately protective (USEPA, 1994).

For example, following the USEPA Region VIII recommendations (USEPA, 1994), an uncertainty factor of 10 is assigned when using a test involving an acute exposure and a factor of 15 when extrapolating from an LC50 to NOAEL. Likewise, an uncertainty factor of 7 is assigned to account for extrapolation of results from a species in a different taxonomic family. The study by Mayer et al. used a chronic exposure regime, reported a NOAEL, and was performed on the same species evaluated in the field studies, and no uncertainty factors are required. Since these safety factors are not required, one can assume that the uncertainty (in particular variability) associated with the EPV is significantly reduced.

7.3.2.2.1 RBAL for Resident Fish Species

To calculate the $RBAL_{fish}$, an exposure concentration or sediment level associated with the critical body residue concentration of 32 mg/kg (the EPV_{Fish}) was developed. The site-specific BSAF model used to estimate a bulk sediment PCB concentration is rearranged to solve for the bulk sediment concentration (Eq. 1, Section 7.2.3.1).

$$Sediment_{PCB} = \frac{Tissue_{PCB}}{\%Lipid} \times \frac{\%TOC}{BSAF} \qquad \text{(Eq. 7)}$$

A sediment PCB concentration is determined for the applicable segments of Choccolocco Creek. Determination of a risk-based concentration for Lake Logan Martin is not necessary because the sediment PCB levels were all below the limits of detection. A risk-based concentration could not be developed for Snow Creek, since no fish were collected to analyze for PCB body burdens.

For the three segments of Choccolocco Creek, the tissue PCB concentration is held constant at the EPV_{Fish} (32 mg/kg). The percent lipid used in the equation was assumed to be equivalent to the lipid values reported for the YOY in bass species collected in Choccolocco Creek. The reported lipid content in the YOY are consistent with data provided by Mac and Seelye (1981), which reported lipid content in fry of 1.9% to 2.5%. Although lipid values from bass and not channel catfish were used in the calculations, the consistency of the reported values with those in the literature suggests that these values provided a correct estimate of lipids in catfish fingerlings. Like the lipid content, the percent TOC and BSAF are a function of the creek segment. The risk-specific sediment PCB concentrations associated with a critical body residue of 32 mg/kg as a function of the specific segment of the ecosystem are summarized in the table below.

Fish-Based RBAL

Location	% Lipid	%TOC	BSAF	$RBAL_{fish}$ (mg/kg_{sed})
Snow Creek to Coldwater Creek	1.76	0.38	5.63	1.23
Coldwater Creek to Jackson Shoals	1.90	2.16	3.86	9.42
Jackson Shoals to Lake Logan Martin	1.41	2.62	11.6	5.13

7.3.2.3 Ecological Protection Value for Piscivorous Mammals

7.3.2.3.1 Characterization of Exposure

Wild female mink and raccoon may be exposed to PCBs via direct contact with sediments, ingestion of sediments, and ingestion of prey tissue containing PCBs. In this risk assessment, ingestion of food was the only pathway considered. The total daily intake (TDI) of PCBs for female mink in the Choccolocco Creek area and for raccoon in the Snow Creek area was developed using a probabilistic assessment approach. A probabilistic approach differs from the traditional deterministic approach in that the probabilistic approach uses a distribution of values for each parameter rather than a single-value or point estimate. The advantage of using the probabilistic approach is that is allows some understanding and expression of the uncertainties associated with the assessment. Just as important, this method also provides an estimate of the assessment endpoint's probability of occurrence or magnitude of a response (Suter, 2000). As recommended by USEPA for PCBs in aquatic systems, the assessment endpoint is reproductive success in piscivorous organisms (see Section 7.4.1.3).

7.3.2.3.2 Methodology

Monte Carlo analysis was performed for the Choccolocco Creek/Snow Creek watershed area using the Crystal Ball Version 4.0 program developed by Decisioneering, Inc. The Monte Carlo analysis was used to derive a cumulative density function (CDF) for the TDI of PCBs by the wild female mink and raccoon. In the Monte Carlo analysis, instead of using a single value for each exposure factor, a distribution for each exposure parameter is used to develop a probability distribution for each exposure factor. Each exposure factor has a range of possible values based on information published in the scientific literature, or developed from knowledge of the site. In a series of multiple calculations, the Monte Carlo analysis randomly selects values from each of the ranges of possible values (distributions) within each exposure factor. This iterative approach provides an estimate of the TDI by the hypothetical mink and raccoon population. The TDI of PCBs was calculated using the following equation:

$$TDI_{PCBs} = (MR/\ GE_{fish}) \text{ x } P_{fish} \text{ x CF x FS} \qquad \text{(Eq. 8)}$$

Where:

TDI_{PCBs} = Total daily intake of PCBs (µg/kg body wt/day)
MR = Metabolic rate (kcal/kg body wt/day)
GE_{fish}= Gross energy of fish (kcal/g)
P_{fish} = Proportion of fish in diet (%)
CF = Concentration of PCBs in fish tissue (mg/kg)
FS = Fraction of source (%)

7.3.2.3.3 TDI for Mink

The Monte Carlo analysis for TDI of PCBs for female mink was conducted using PCB concentrations in fish tissue of 1 mg/kg, 2.5 mg/kg, 5 mg/kg, and 7 mg/kg. Monte Carlo analysis was conducted for each fish tissue concentration for a total of four simulations (Figure 7-5). Each simulation included 10,000 trials and included the input distributions and distribution parameters summarized below.

Metabolic Rate (MR) (kcal/kg body wt/day): Metabolic rate is defined as the rate at which an organism expends energy for the maintenance of respiration, circulation, body temperature, glandular activity, and other functions of the body. For the calculation of TDI of PCBs for mink, the metabolic rate was divided by the gross energy of prey (i.e., fish) to determine the estimated food intake rate. A lognormal distribution was assumed for the metabolic rate of the wild female mink. Lognormal distribution is used in situations where values are positively skewed with a lower limit of zero and no upper limit. This type of distribution is denoted by a mean and standard deviation greater than zero. The values used for this simulation are based on the study by Moore and co-workers regarding the effects of PCBs on female mink (Moore et al., 1999). A mean MR of 256 kcal/kg body wt/day and a standard deviation of 130 were used in the Monte Carlo simulation.

Gross Energy of Fish (GE_{fish}) (kcal/g): The gross energy, or total energy, of a food type is the caloric content of the food type and is a function of the characteristics of the food. A mean GE_{fish} of 1.20 kcal/g and a standard deviation of 0.24 were assumed with a normal distribution (Moore et al., 1999) for this simulation.

Proportion of Fish in Diet (P [%]): The proportion of fish in the mink's diet used for this simulation was also based on the study by Moore et al. (1999). Moore used data from studies chosen by Sample et al., 1996, which are summarized in the *Wildlife Exposure Factors Handbook* (USEPA, 1993) to determine the proportion of fish and other prey in the mink's diet. The means of fish in the mink's diet from these studies, as summarized in the *Wildlife Exposure Factors Handbook* (USEPA, 1993), are as follows: 61% year-round for a stream environment; 85% year-round for a river environment (Alexander, 1977); 4% for a female mink during winter (Sealander, 1943); and 19.9% statewide in Missouri (Korschgen, 1958). These data were fit to a beta distribution using the means from these studies. (Moore et al., 1999). The following values were used: alpha = 5, beta = 4.5, and scale = 1 with a selected range of 0.1 to 1.0. Beta distribution was assumed for this simulation. Beta distribution is a very flexible distribution and is commonly used to represent variability over a fixed range. It is used for variables bounded by zero and one. This assumption is a percentage and is therefore bounded by zero and one.

Concentration of PCBs in Fish Tissue (CF [mg/kg]): A point estimate was assumed for the concentration of PCBs in fish tissue. Values of 1 mg/kg, 2.5 mg/kg, 5 mg/kg, and 7 mg/kg were assumed for the concentration of PCBs in fish tissue.

Fraction of Source (FS [%]): As previously mentioned, mink have certain habitat requirements that affect their utilization of a particular area for foraging. Mink prefer a habitat with ample vegetative cover, as opposed to open areas such as pasturelands and certain highly maintained agricultural lands. Approximately 61% of the land adjacent to Choccolocco Creek streambanks is currently devoted to agricultural concerns, primarily rangeland used for grazing of domesticated animals (cows and horses). Another approximately 10% of the land bordering the creek is dedicated to residential or industrial/commercial activities. As such, a significant portion of the stream is relatively inaccessible or undesirable to mink, particularly given the other areas of more suitable habitat available from the numerous small and large tributaries in the Choccolocco Creek watershed. Given the relative inaccessibility of the stream and availability of other more favorable habitat, a utilization factor was included in the TDI calculation. A normal distribution was assumed for the fraction of the Choccolocco Creek watershed used by the subpopulation of wild female mink. A mean of 0.5 (50%) utilization and a selected range of 0.10 to 1.0 were the values assumed for this parameter.

7.3.2.3.4 Mink TDI Results

The estimated 90th percentile TDI of PCBs by the wild female mink ranged from 53 µg/kg body weight/day (assuming fish tissue concentration of 1 mg/kg), to 375 µg/kg body weight/day (assuming fish tissue concentration of 7 mg/kg) (Figure 7-5). These hypothetical intakes are not meant to represent site conditions. Rather, these calculations were developed to provide dosing information that were used in subsequent steps to develop the EPV_{mink}.

7.3.2.3.5 TDI for Raccoon

The same approach used for the mink was adopted to determine a probabilistic TDI of PCBs by raccoon in the Snow Creek area. Monte Carlo analysis for TDI of PCBs for raccoon was conducted using PCB concentrations in fish tissue of 20 mg/kg, 25 mg/kg, and 30 mg/kg. The fish concentrations were selected in order to provide the data most relevant for the development of TDI estimates within the range of the toxicological benchmark established for mink (Section 7.4.3.1). Monte Carlo analysis was conducted for each fish tissue concentration, for a total of three simulations. The input distributions and distribution parameters used during the Monte Carlo simulations are summarized below.

Metabolic Rate (MR [kcal/kg body wt/day]): Metabolic rate is defined as the rate at which an organism expends energy for the maintenance of respiration, circulation, body temperature, glandular activity, and other functions of the body. For the calculation of TDI of PCBs for raccoon, the metabolic rate was divided by the gross energy of prey (i.e., fish) to determine the estimated food intake rate. Lognormal distribution is used in situations where values are positively skewed with a lower limit of zero and no upper limit. A lognormal distribution was assumed for the metabolic rate of the raccoon. This type of distribution is denoted by a mean and standard deviation greater than zero. The values used for this simulation are based on the *Wildlife Exposure Factors Handbook* (USEPA, 1993). A mean of 187 kcal/kg body wt/day and a standard deviation of 18.7 were used in the Monte Carlo simulation.

Gross Energy of Fish (GE_{fish} [kcal/g]): The gross energy, or total energy, of a food type is the caloric content of the food type and is a function of the characteristics of the food. Normal distribution was assumed for the gross energy of fish with a mean of 1.20 kcal/g and a standard deviation of 0.24 (Moore et al., 1999).

Proportion of Fish in Diet (P [%]): The proportion of fish in the raccoon's diet used for this simulation ranged from 1% (minimum) to 5% (maximum). A maximum value of 5% was chosen because it is unlikely that the amount of fish foraged on by raccoon in the Snow Creek area would exceed this amount. Raccoon are omnivorous and opportunistic and are well adapted to urbanization. Snow Creek is located in an urban and commercial/industrial area. Therefore, it is more likely that in this area the raccoon's diet would consist primarily of food scrapes from trashcans or other similar sources, since "fishing" requires considerably more effort. Uniform distribution was used in this simulation. Uniform distribution is a distribution that provides equal likelihood that all values between the minimum and maximum may occur.

Concentration of PCBs in Fish Tissue (CF [mg/kg]): A point estimate was assumed for the concentration of PCBs in fish tissue. Values of 10 mg/kg, 15 mg/kg, and 20 mg/kg were assumed for the concentration of PCBs in fish tissue.

Fraction of Source (FS [%]): The majority of Snow Creek courses through urbanized and industrial areas. Although the raccoon will forage on fish, fish do not make up the majority of its diet. Raccoon are opportunistic and highly adaptable. In urbanized areas, the raccoon feeds primarily on food scraps from trashcans. Therefore, it is unlikely that Snow Creek would be greatly used by the raccoon for food. A normal distribution was assumed for the fraction of the Snow Creek watershed used by raccoon. A mean of 50% utilization and a selected range of 0.10 to 1.0 were the values assumed for this parameter.

7.3.2.3.6 Raccoon TDI Results

The estimated 90th percentile TDI of PCBs by the raccoon ranged from 39 µg/kg body weight/day (assuming fish tissue concentration of 20 mg/kg) to 60 µg/kg body weight/day (assuming fish tissue concentration of 30 mg/kg). As with the analysis performed on the mink, these are hypothetical PCB exposure concentrations and are not meant to be representative of site conditions. Figure 7-6 illustrates the cumulative density function for the raccoon in Snow Creek.

7.3.3 Effects Assessment

To determine if the exposure to PCBs by mink foraging on fish from Choccolocco Creek and by raccoon foraging on fish from Snow Creek could produce adverse effects, exposure estimates were compared with toxicological benchmark doses.

7.3.3.1 Toxicological Benchmarks

Typically, hazard estimates for either human or ecological receptors are based on the likelihood of a hypothetical exposure resulting in a dose that exceeds a specified toxicity value. For humans, these are usually reference doses; for ecological receptors, the toxicological benchmark is a NOAEL or a lowest-observable-adverse-effects level (LOAEL), with some sort of safety factor applied to "insure protectiveness" (USEPA, 1989). A more appropriate approach, one that is consistent with the concept of risk as "the degree of probability of loss or injury" (Merriam-Webster, 1985), is to estimate probabilities of varying degrees of an effect. Estimated probabilities of different magnitudes of effects would also provide more pertinent information for making risk-management decisions. For this reason, a dose-response curve fitted to data obtained from published toxicity studies, rather than a NOAEL, was used in estimating possible adverse effects in resident mink population (and in the case of Snow Creek, raccoons).

Since our measurement endpoint for the in-stream portion of the HEA was selected as mink fecundity (measured as the number of kits born per whelped female), the data from chronic feeding studies that evaluated the effects of Aroclor mixtures on farm-raised mink were selected for the toxicity database. Specifically, the studies of Aulerich and Ringer (1977), Jensen (1977), and Aulerich et al., (1985), which were identified by USEPA (1997a) as those that "provide a more solid base for causality," were used to derive the dose-response model. These studies looked at the effect on reproductive success in farm-raised mink fed fish containing known concentrations of PCB mixtures.

Fecundity data, expressed as number of kits per female, were plotted as a function of dose using several fish tissue concentrations and appropriate mink fish consumption rates (USEPA, 1995). The data from the two studies were combined into an Excel spreadsheet; the built-in trend analysis function application was used to fit a polynomial to the response data. The following equation was generated by this model:

$$y = -0.0084 * x^3 - 1.6119 * x^2 + 27.464 * x - 5.8526 \qquad \text{(Eq. 9)}$$

Where y is % decline in fecundity and x is the concentration of PCBs in the fish fed to the female mink.

The resulting polynomial was evaluated to ensure that the estimated responses predicted by the line were in agreement with current point estimates of toxicity (e.g., the Great Lakes Wildlife Criteria for PCBs). This evaluation demonstrated that the dose-response model was adequately conservative, since the threshold value for the response (the x-intercept) was approximately 21 µg/kg PCBs in fish (Figure 7-7), which corresponds to a dose in our population of 33 µg/kg/day – a dose equivalent to the Great Lakes Wildlife Criteria for mammals (USEPA, 1995).

7.3.3.2 Risk Characterization

Risk characterization integrated the results of the exposure assessment and the effects assessment to estimate the risks associated with sediment containing PCBs. For the Choccolocco Creek/Snow Creek watershed, exposure estimates and toxicity benchmarks were used to derive an EPV for mink.

7.3.3.3 Methodology

The cumulative density functions (CDFs) developed for the TDI based on various hypothetical fish tissue concentrations were used to estimate probabilities of reproductive effects. The technique for this assessment evaluated effects of varying magnitude based on a dose-response model rather than simply comparing this distribution to a specified single toxicity value (e.g., NOAEL). Data obtained from experimental toxicity tests on mink were used to derive a dose-response model based using the Excel® built-in trend analysis function application. The specifics of this approach are described below. Combining the outputs of these two determinations resulted in estimated probabilities of adverse reproductive effects as a function of the various fish tissue concentrations (Figure 7-8).

The results of these calculations were expressed in another fashion, as a function of a specific effects level (decline in fecundity) based on the relationship illustrated on Figure 7-8. This was accomplished by plotting the intersects of the lines corresponding to the various fish tissue levels at the specific effects level (e.g., the exceedance probability corresponding to the curves generated by a concentration of 1 mg/kg, 2.5 mg/kg, 5 mg/kg, and 7 mg/kg and a 10% effects level). Figure 7-9 depicts the product of this data transformation. Thus, the exceedance probabilities and associated dose were used to plot "effects lines" corresponding to the adverse reproductive response (i.e., percent decrease in fecundity).

The importance of this series of data evaluations is that the output of the final graph (Figure 7-9) allows the determination of a fish tissue PCB concentration (and ultimately sediment concentration) that corresponds to a specific probability of a specific adverse effect level. For the purposes of determining the appropriate effects-related fish tissue level, or EPV_{mink}, the criteria associated with the selection of the assessment endpoints for this site need to be revisited. The purpose of the environmental portion of the HEA was to determine PCB sediment concentrations that are protective of a viable mink population inhabiting the Choccolocco Creek watershed. This is consistent with the goals of an ecological risk assessment as outlined in the USEPA's *Guidelines for Ecological Risk Assessment* (USEPA, 1998d), which recommends that risks be evaluated on a population, community, or landscape scale (unless threatened or endangered species are selected as assessment endpoints). Thus, a consideration of the quantitative importance of this particular habitat – Choccolocco Creek – on the survival and reproduction of the entire population of mink living in the watershed must be incorporated into the determination of an appropriate EPV_{mink}.

The Choccolocco Creek watershed is approximately 502 mi^2 and includes 638 linear miles of stream/creek habitat attributed to first-, second-, and third-order streams. The study area of Choccolocco Creek (from the confluence with Snow Creek to Lake Logan Martin) is only 35 miles, or approximately 5.5% of the total available stream habitat available to mink in the Choccolocco Creek watershed. Additionally, a large percentage of the stream channel in the study area is bordered by disturbed habitat, such as open pastureland, and urban and residential land uses that are not particularly desirable to mink. In fact, of the study area's 21 mi^2 floodplain, approximately 61% is dedicated to agricultural uses while less than 10% is characterized as urban, commercial, and residential. Only 6 square miles of the floodplain, or approximately 1% of the entire Choccolocco Creek watershed, could be considered as providing habitat suitable for mink. Based on the limitation on habitat, only a small sub-population of the mink living in the watershed was assumed to have access to the stream length that constituted the study area. As such, a conservative threshold of a 30% probability that sediment-associated PCBs originating from the study area could potentially impact this sub-population was selected. This probability of an effect to the sub-population provides an adequate level of protection to the entire resident mink population. This 30% probability of experiencing an adverse reproductive effect in the sub-population was used to derive the HPV_{mink}.

Also, there are various habitats of much higher quality in terms of mink requirements within or directly adjacent to the Choccolocco Creek watershed, including, for example, the Talladega National Forest. These areas are more likely preferred by mink, and would constitute a significant portion of the home ranges of the local population. These "habitat patches" with greater relative quality will have an increased probability of receptor occurrence by attracting and holding the target species more strongly and for longer duration than those with minimal habitat quality (ODEQ, 1998).

For the purposes of risk characterization, a 20% decrease in fecundity in a hypothetical mink subpopulation was selected as the appropriate effects endpoint. Although there are no reliable data available on fecundity in feral mink populations, information provided from experimental protocols can be used to estimate expected rates. For example, in the studies used in this assessment for the development of the dose-response relationship (Aulerich and Ringer, 1977; Jensen et al., 1977; Aulerich et al., 1985), in the control animals there was a 30% difference in the number of kits born to whelped females. Similarly, the fecundity of female minks receiving no PCB exposure ranged from a low of 5% to a high of 32%. Thus, a 20% decrease in fecundity appears to be a reasonable estimate of a detectable threshold effects level.

Based on a consideration of the limited desirable habitat and the variability of fertility in unexposed animals, a 30% probability that females in the hypothetical exposed subpopulation would experience a 20% decrease in fecundity was selected as the basis for deriving the EPV_{mink}. This probability effects level is considered adequately protective, given that the potentially affected mink subpopulation was conservatively assumed to use the study area as a source for between 10% and 100% of its fish intake. Since this hypothetical subpopulation would constitute only a minor component of the total mink population in the Choccolocco Creek watershed (given the small percentage of total habitat this study area represents), the impacts at a population level of the HPV_{mink} would be minimal. This is particularly true given the likely significant impact on the population from other environmental stressors present in this ecosystem, especially loss of habitat due to human land development.

7.3.3.4 Results

Mink

The results of the Monte Carlo analysis for mink are illustrated on Figure 7-5. The CDFs for our hypothetical mink population described by the variables outlined in Section 7.4.1.2 were generated assuming a series of fish PCB tissue concentrations ranging from 1 to 7 mg/kg. These concentrations were selected at random and were not intended to necessarily represent conditions found at the site. Rather, the purpose was to develop CDFs that contained the information required for subsequent steps in the analysis. This will become apparent as the remaining steps in the analysis are explained. The resulting CDFs are an expression of the probability that the population will receive a particular dose of PCBs, given the constraints of the exposure conditions.

The CDF outputs data were combined with the dose-response relationship illustrated on Figure 7-7, to develop an exceedance probability as a function of the adverse effect (fecundity) and was plotted for each of the different fish tissue exposure concentrations (Figure 7-8). For example, based on the CDFs, the percentage of the population receiving a particular dose can be predicted. Once these values are determined, a) the response associated with this dose, and b) the percent of the population experiencing this response can be predicted. Thus, if 20% of the population had a particular dose or less, the percent decline in fecundity associated with that dose could be determined from the trend equation developed from the dose-response data. The inverse of the cumulative density value, expressed as the "exceedance probability," was plotted as a function of the response. In other words, if 20% of the population received a dose causing a 10% response, then 80% of the population would have a probability of exceeding the response (Figure 7-8). As the percent response increases (as a function of increasing dose), the probability of exceeding this response decreases.

These data were replotted to express a specific effects level in a percentage of the population as a function of the fish tissue concentration (Figure 7-9). Again, we explain by example: for a 20% mortality, there was approximately a 5% exceedance probability at 2.5 mg/kg in fish, an approximately 38% exceedance probability at 5 mg/kg, and an approximately 58% exceedance probability at 7 mg/kg. From these curves generated for selected response levels (e.g., 10% mortality, 20% mortality), the probability of a selected response and the fish tissue concentration associated with that response was developed.

For the subpopulation of female mink that receives between 10% and 100% of its fish diet from Choccolocco Creek, the selected measurement endpoint of a 30% probability of a 20% kit mortality rate corresponded to a PCB fish tissue concentration of 4.5 mg/kg. Thus, the EPV for piscivorous mammals is 4.5 mg/kg. Based on the site-specific BSAF for YOY fish, the following sediment PCB concentrations, or RBAL, which would result in tissue concentrations listed in the table below are equal to or below the EPV.

Sediment RBAL Based on Mink Reproductive Success

Geographic Reach of Choccolocco Creek	BSAF	RBAL (mg/kg)
Snow Creek to Coldwater Creek	1.17	0.173
Coldwater Creek to Jackson Shoals	3.95	1.325
Jackson Shoals to Lake Logan Martin	5.11	0.798

Raccoon

The results of the Monte Carlo analysis for raccoon are illustrated in Figure 7-6. Since the dose of PCBs from Snow Creek fish would be small based on the exposure conditions assumed for this area, the CDF was simply compared with a point estimate of toxicity rather than developing an analysis similar to the one described above for mink. Assuming that raccoon are equally sensitive to PCBs as mink, an acknowledged overly conservative assumption, the Great Lakes Wildlife Criteria for mammals of 30 µg/kg/day was used as a toxicity benchmark for this population. The 90th percentile of CDF for the various selected fish tissue concentrations reveals that fish in Snow Creek would need to exceed 20 mg/kg before the dose equaled the toxicity benchmark. These results are undoubtedly overestimations of actual risk, since no data suggest that the raccoon is as uniquely sensitive as mink to the effects of PCBs. In addition, the exposure parameters were intentionally selected to reflect conditions that were likely never to occur. For example, the maximum exposure conditions result in a raccoon in an urban environment with 5% of the diet composed of fish, 50% of which comes from Snow Creek. These exposure parameters were maximized simply to estimate high-end, or in some instances worst-case, scenarios to provide some indication of the high concentration of PCB in fish that would be required to suggest any risk.

Since the fish tissue concentrations resulting in doses approaching a toxicity threshold were so high, sediment PCB concentrations required for these levels were not determined. Also, the HPV developed for this portion of the ecosystem is likely to be significantly lower than an ecologically based sediment concentration, and therefore the HPV would "drive" the RBAL determination. Finally, given the significantly disturbed habitat along the entire reach of Snow Creek, there have not been any fish collected or sampled. Thus, a Snow Creek-specific BSAF was not calculated.

7.4 Uncertainty

Uncertainty is always a significant component of any risk analysis and is associated with many factors. This section qualitatively addresses some of the uncertainties associated with the assumptions used in the development of site-specific RBALs. For the ecological portion of the HEA, the major sources of uncertainty are associated with the factors selected to describe habitat utilization and quality, stressor distribution, bioavailability of the stressor, food consumption, and estimates of toxicity. These factors all have a significant role in the derivation of species-specific RBALs, and consequently some caution should be applied before applying these values in a risk-management context. One of the most common tools employed by the regulatory community to deal with this uncertainty is to use conservative estimation for the various values adopted for these variables. This approach was used within this HEA and included the selection of conservative variables to calculate the RBALs. Several of these conservative assumptions are described in more detail below.

With regard to the BSAF, as in any environmental modeling effort, uncertainty and variability are difficult to minimize. In the case of a relatively large ecosystem, quantifying the movement of PCBs from sediment into other exposure matrices (e.g., fish tissue) relies on certain assumptions, both implicit and explicit, that may or may not be true for a particular setting. In the case of the Snow Creek/Choccolocco Creek/Lake Logan Martin ecosystem, one significant assumption that is difficult to evaluate is that we have accurately identified and characterized the environs visited by the different fish species in terms of attributes important for quantifying bioaccumulation. For example, the adult and YOY bass species were assumed to live and feed along only a 200- to 400-foot reach of the creek. This assumption was based on published scientific literature and discussions with a professional fisheries biologist familiar with these systems. Data sufficient to characterize these small areas were collected and analyzed, but the possibility for overestimating or underestimating bioaccumulation certainly exists. For example, ADEM 96 was a sampling location just downstream of the confluence with Coldwater Creek. It was assumed that the fish collected at this location did not venture into Coldwater Creek, an area presumed to have lower sediment PCB concentrations. If this assumption was in fact in error, the actual exposure concentration (i.e., in surficial sediments) experienced by the fish would have been lower and therefore the magnitude of bioaccumulation was underestimated. Conversely, we also assumed that these fish did not venture too far upstream near the confluence with Snow Creek and the reach of stream channel just upstream of this confluence. While this upstream area is quite small in size, the sediment PCB concentrations are typically the highest in Choccolocco Creek. Ignoring this upstream area would tend to underestimate bioaccumulation.

The actual habitat used by mink and raccoon may be only a portion of the area along the Choccolocco Creek/Snow Creek watershed, and usability of the area is certainly varied. The percentage of the watershed mink subpopulation that uses this specific area as a feeding ground for fish may have been over- or underestimated. Only extensive and expensive population sampling of the local mink could reduce the uncertainty associated with the value selected as "the percentage of the exposed population."

In developing the RBAL for the protection of human receptors via direct contact with sediments, exposure frequency and duration present the greatest level of uncertainty. The frequency with which a particular child or adolescent ventures to various areas of the ecosystem was not determined by direct survey, but rather by experience at other similar environments and the overall land use patterns along the creeks as determined by aerial photographs. It is difficult to quantify the uncertainty associated with these assumptions. However, since conservative assumptions were adopted, and the RBAL for this pathway was high, particularly relative to current conditions, there is a certain degree of safety associated with this exposure pathway.

7.5 Summary of Sediment RBALs

As discussed in the sections above, sediment RBALs were developed for both potential human and ecological receptors. For the human receptors, the RBALs included the potential ingestion of fish and direct contact with the sediment. For potential ecological receptors, RBALs were developed for benthic organisms, fish, and mink. Although the RBALs are presented in the table below on a reach-specific basis for Choccolocco Creek, the average of the three RBAL values will be used to compare with the surface-weighted average sediment PCB concentrations along the creek. The use of averaging is appropriate, given that all of the values are within an order of magnitude and given the uncertainties typically associated with the development of such values.

The average RBALs for potential human receptors included 0.22 mg/kg in sediment for the ingestion of fish with less than 2 mg/kg in the fillets and 15.5 mg/kg in the sediment for direct contact, including ingestion. For potential ecological receptors, the average sediment RBALs include 6.77 mg/kg for benthic organisms, 5.26 mg/kg for fish, and 0.76 mg/kg for mink.

The average sediment RBALs developed for Choccolocco Creek were also applied to Snow Creek. Although this results in an overly conservative approach, the quantity of fish data from Choccolocco Creek from which site-specific RBALs were calculated was preferred over the use of a literature-value approach for Snow Creek. It is also important to note that RBALs for Lake Logan Martin were not developed since the sediment PCB concentrations were below the analytical detection limit. In addition, the average fish concentrations in the lake were below the ADPH advisory level.

Choccolocco Creek Sediment RBALs (mg/kg)

Geographic Reaches of Choccolocco Creek	Human Receptors		Ecological Receptors		
	Fish Ingestion[1]	Direct Contact	Benthos	Fish	Mink
Snow Creek to Coldwater Creek	0.137	15.5	3.30	1.23	0.17
Coldwater Creek to Jackson Shoals	0.185	15.5	5.21	9.42	1.32
Jackson Shoals to Lake Logan Martin	0.330	15.5	11.8	5.13	0.80

[1] Minimum values determined for two species (bass and catfish).

7.5.1 Choccolocco Creek

The current sediment conditions in Choccolocco Creek are presented as area-weighted surface average PCB concentrations in the table below. PCB concentrations are included for each of the six geographical reaches used to characterize PCB concentrations along the creek (Figure 7-10). The table also identifies which, if any, of the sediment RBALs are exceeded within the six reaches of the creek.

Within the backwater area upstream of the confluence with Snow Creek, the RBALs are exceeded for both potential human and ecological receptors. In reviewing this information, it is important to note the degraded habitat conditions in this reach that are heavily influenced by urban runoff from the Snow Creek watershed and siltation due to upstream sod farms on Choccolocco Creek. In the upstream portion, the impacts of runoff from the Snow Creek watershed and point sources are the likely stressors to the benthos.

In the Snow Creek to Coldwater Creek reach, the exceedance of the sediment RBAL for mink is quite small (0.86 mg/kg compared with the RBAL of 0.76 mg/kg). While the sediment RBAL for fish ingestion is also exceeded in the reach, the rate of decline in fish PCB concentrations in Choccolocco Creek indicates that attainment of 2 mg/kg in fish tissue will occur within a reasonable time frame.

Downstream of Coldwater Creek, the exceedances are limited to fish ingestion by humans. Similar to the Snow Creek to Coldwater Creek reach, the downward trend in fish tissue concentrations supports attainment of the 2 mg/kg level in fish fillets in a reasonable time frame.

Geographic Reaches of Choccolocco Creek	Current Conditions (SAWA mg/kg)	RBALs Exceedance				
		Human Receptors		Ecological Receptors		
		Fish Ingestion[1]	Direct Contact	Benthos	Fish	Mink
Upstream of Snow Creek	18	x	x	x	x	x
Snow Creek to Coldwater Creek	0.86	x				x
Coldwater Creek to Cheaha Creek	0.13					
Cheaha Creek to Jackson Shoals	0.56	x				
Jackson Shoals	0.08					
Jackson Shoals to Lake Logan Martin	0.39	x				

7.5.2 Snow Creek

The current conditions found in Snow Creek were also compared to the relevant and appropriate receptor- and pathway-specific RBALs. As previously discussed and as illustrated on Figure 7-2, the exposure conditions found in Snow Creek render the fish ingestion pathway an incomplete route of exposure. Thus, for human receptors the RBAL related to direct contact (15.5 mg/kg) was compared with creek sediment concentrations. Sediments in the first mile of Snow Creek downstream from its confluence with the 11th Street Ditch contain PCBs in concentrations exceeding the direct contact RBAL (Figure 3-32). After the railroad bridge, approximately 5,000 feet downstream of the confluence with the 11th Street Ditch, only one sample exceeded the sediment PCB RBAL. Overall, approximately 85% of all of the sediment samples collected within the Snow Creek channel contained PCB concentrations below the RBAL for direct human contact (Figure 3-33).

For ecological receptors, the $RBAL_{fish}$ and $RBAL_{benthic}$ are generally exceeded along the same two reached of Snow Creek. However, other chemical, physical, and biological stressors associated with the urbanization of the surrounding environment likely play a more significant role in determining the health and viability of these receptor groups. The potential role of these other stressors has been described in the Habitat Assessment section (Section 6) and in the site conceptual exposure model section of the HEA (Section 7.4.1.7). Mink reproduction was not considered an appropriate assessment endpoint for this area of the site (see Section 7.4.2.3), and therefore the $RBAL_{mink}$ was not used in the evaluation of Snow Creek.

8. Updated Off-Site Conceptual Model (OCM)

This section provides an update to the OCM using the sediment, surface water, fish, and habitat data collected during the Off-Site RFI studies. The model represents our current understanding of the distribution and potential movement of PCBs within the aquatic systems of Snow Creek, Choccolocco Creek, and Lake Logan Martin. In the process of updating the OCM, the original hypothesis that PCBs are the constituent of potential concern (COPC) was also re-visited using the results of the metals data collected during the Off-Site RFI studies.

8.1 Summary of Initial OCM

Before presenting the updated OCM, it is important to review the initial OCM. The significant findings of the initial OCM prior to conducting the Off-Site RFI studies include;

- PCBs are the COPC in the Off-Site area.
- PCB concentrations in fish and sediment decline with increasing distance downstream.
- The primary route of potential human exposure to PCBs is through fish consumption.
- PCB levels in fish are declining with the passage of time.
- The decline in fish PCB levels is due to natural attenuation processes.
- The primary natural attenuation mechanisms are the mixing and burial of PCB-containing sediment with non-PCB containing sediment delivered from the watershed.
- The relationship between PCB levels in fish and sediment is not understood in a quantitative sense.
- High-flow events from intense rainfall may influence the movement of sediment-bound PCBs.
- Certain areas within the floodplain are likely depositional zones for sediment; however, the significance of potential PCB deposition in the floodplain is currently unknown.
- The effects of recent dredging in Choccolocco Creek on PCB distribution and movement are uncertain.

8.2 Summary of Updated OCM

The updated OCM is presented in this section and includes a discussion of the Off-Site RFI results relative to the initial OCM. Figure 8-1 graphically depicts the updated OCM.

PCBs are the COPC in the Off-Site area.

PCBs were the focus of the Off-Site RFI studies. Confirmatory sampling was also conducted, however, for arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, and vanadium. The confirmatory analyses for these 11 metals were conducted at a frequency of 10% of sediment samples analyzed for PCBs. The confirmational program also included sampling upstream locations on both Snow and Choccolocco creeks and analysis of these sediment samples for the 11 metals. Also, 50% of the adult bass samples from Lake Logan Martin and Choccolocco Creek were analyzed for mercury.

The results of the sediment analysis on Snow Creek indicated the presence of several metals, including arsenic, cadmium, chromium, lead, manganese, nickel, and mercury. The results also indicated the presence of these metals in a reach of Snow Creek upstream of the 11th Street Ditch. The range of constituents present in Snow Creek was consistent with the wide range of industries present in the Snow Creek watershed, including chemical production, foundries, automotive reclamation, and metals plating.

The results of the metals analysis for the Choccolocco Creek sediment indicated the presence of arsenic, cadmium, chromium, lead, manganese, nickel, and mercury. These constituents were either present in Snow Creek (which feeds into Choccolocco Creek) or, in the case of arsenic, manganese, and lead, were present well upstream in Choccolocco Creek (at Boiling Springs Road). The sediment metals data for Choccolocco Creek suggest other potential sources along the creek, since the distribution does not appear to follow the same pattern as for PCBs. This is evidenced by the fact that elevated concentrations of metals are not present in sediments from the backwater area upstream of the confluence with Snow Creek. Rather, the metals appear to be more widely scattered and indicative of potential sources throughout the entire watershed.

The results of the confirmatory analyses conducted on the bass samples indicated all 35 fish exhibited mercury concentrations below the ADPH advisory level of 1 mg/kg for mercury. In addition, the pattern of mercury concentrations in fish along the creek was not consistent with the distribution of PCBs in fish. The highest average mercury concentration was observed at the mid-point of the creek (Station New 99), as opposed to average PCB concentrations that decline with distance along Choccolocco Creek. Again, this supports the role of other potential sources in distributing metals throughout the watershed. However, these potential sources of mercury do not appear to be significant relative to ambient mercury concentrations in fish for this portion of the country, as noted as USEPA's nationwide survey of mercury in fish for the Southeast (USEPA, 1997).

The data collected during the confirmatory sampling program supports the continued focus on PCBs as the sole COPC for the Off-Site area. The rationale for this is the documented presence of the range of metals in the upstream areas of the creeks and the fact that concentrations of mercury in fish are both below the ADPH advisory levels and are consistent with ambient conditions for this area of the country. It is also important to note that the metals in the sediment of Snow Creek are collocated with the areas of elevated PCB concentrations and would also be addressed through corrective measures, if required, due to the presence of PCBs.

PCB concentrations in fish and sediment decline with increasing distance downstream.

The updated OCM for PCB concentrations in fish is consistent with the initial OCM in terms of declining PCB concentrations with increasing distance downstream. This declining trend was evident in both the adult fish fillets (Figure 8-2) and the YOY samples (Figures 5-8 and 5-9).

The updated OCM for Snow Creek sediment is generally consistent with the initial OCM in terms of declining concentrations with increasing distance downstream. The data for the creek, however, indicate that PCB concentrations increase in the last mile, just upstream of the confluence with Choccolocco Creek. This is likely due to a combination of a flattening of the creek bed and the potential backwater effects of Choccolocco Creek during periods of higher flow. The updated OCM for Choccolocco Creek sediment is also generally consistent with the initial OCM in terms of decreasing PCB concentrations with increasing distance downstream. These results were confirmed by the top-of-bank samples, which demonstrate declining PCB concentrations with increasing distance downstream. The sediment PCB data for Choccolocco Creek also indicate that PCBs are present in the backwater area upstream of the Snow Creek confluence. During the Off-Site RFI, three sampling transects were located in this reach of the creek to assess potential backwater effects. The results of the sediment probing indicate that the area is depositional with relatively thick (up to 3 feet) deposits of fine-grained sediment. The PCB analysis conducted on samples from this area also indicate that PCB concentrations increase with depth, further confirming that this area is depositional. While the data indicate that the PCBs are present in this backwater area, additional data are required to further assess the extent of PCBs within this reach of the creek.

The primary route of potential human exposure to PCBs is through fish consumption.

The updated OCM confirms that potential consumption of fish from Choccolocco Creek is the primary human exposure pathway because direct contact with the creek sediment is limited by the forested and agricultural land use as well as the terrain. Moreover, the updated OCM for Lake Logan Martin demonstrates that consumption of fish (bass and catfish), while a potential exposure pathway, is not an exposure pathway of concern since average PCB concentrations in catfish and bass are below the ADPH advisory level of 2 mg/kg. This is further supported by the lack of detectable PCBs in the surface sediment of the lake. It should be noted, however, that the potential for direct contact (including dermal contact and incidental ingestion) was given equal weighting within the HEA, since both represent potential exposure pathways. For Snow Creek, the updated OCM remains consistent with direct contact with the sediment as the primary exposure pathway.

PCB levels in fish are declining with the passage of time.

The updated OCM is consistent with the initial OCM because PCB concentrations in fish are clearly declining over time. This pattern is clear and consistent in both Lake Logan Martin, where average concentrations have declined below the ADPH advisory level, and in Choccolocco Creek, where average concentrations are beginning to approach the 2 mg/kg advisory level.

The decline in fish PCB levels is due to natural attenuation.

The data collected during the Off-Site RFI support natural attenuation as a significant factor in the decline of PCB concentrations in fish. These data found:

- declining fish PCB concentrations;
- the lack of detectable PCBs in the surface sediment of Lake Logan Martin; and
- Lake Logan Martin is depositional based on geochronologic and PCB data.

The primary natural attenuation mechanisms are the mixing and burial of PCB-containing sediment with non-PCB containing sediment delivered from the watershed.

The updated OCM for Lake Logan Martin is consistent with the initial OCM. This also holds true for the backwater area of Choccolocco Creek and the reach of the Choccolocco Creek downstream of Jackson Shoals. For the other areas of the creek, PCBs are well below 1 mg/kg on average and will be subject to a combination of deposition of non-PCB-containing sediment, and the winnowing of sediment from the creek bed during periods of high flow. It is also important to note that sediment PCB concentrations within these potentially erosional areas of Choccolocco Creek are very low and are not present in significant quantities since much of the creek bed is coarse-grained sand, gravel, cobble, and bedrock.

The relationship between PCB levels in fish and sediment is not understood in a quantitative sense.

The OCM has been updated to reflect an understanding of the relationship between the concentrations of PCB in sediment and PCB levels observed in fish. The data clearly indicate the bioavailability of PCBs as a function of PCB sediment concentration normalized for TOC. The ability to quantitate this relationship was limited to Choccolocco Creek because surficial sediment PCB concentrations in Lake Logan Martin are below the analytical quantitation limit.

High-flow events from intense rainfall may influence the movement of sediment-bound PCBs.

The updated OCM remains consistent with the initial OCM in terms of high-flow events playing a significant role in the transport of sediment-bound PCB within Snow and Choccolocco creeks. The data also indicate that concentrations of sediment particles within the surface waters, measured as TSS, increase in a downstream direction. This increase is consistent with both the increase in the size of the drainage basin area (or watershed) and sediment loadings from other tributary creeks.

The data indicate the majority of sediment transport occurs during flow events that occur only 10% of the time. As such, the majority of transport of sediment-bound PCBs also occurs during this period. Although there is transport of PCBs to Lake Logan Martin during periods of high flow, this transport is not significant relative to the effects of natural attenuation, including the desposition of non-PCB-containing sediment within the lake. This is evidenced by the lack of detectable PCBs within the surface sediment of the lake and the continuing decline of PCB levels in fish throughout this Off-Site area.

Certain areas within the floodplain are likely depositional zones for sediment; however, the significance of potential PCB deposition in the floodplain is currently unknown.

The distribution of PCBs within the floodplain was not the focus of the Off-Site RFI and will be evaluated by the investigations described in the Phase II Off-Site (Floodplain) RFI/CS Investigation Work Plan (BBL, 2000). The top-of-bank samples collected along Choccolocco Creek, however, provide some initial insight into the potential presence of PCBs within the Choccolocco Creek floodplain. These data indicate that PCB concentrations in the top-of-bank soil samples decline with increasing distance from Snow Creek and have an overall average PCB concentration of 3.6 mg/kg.

The effects of recent dredging in Choccolocco Creek on PCB distribution and movement are uncertain.

The decline in PCB concentrations for fish in Choccolocco Creek supports the premise in the initial OCM that dredging activities during the early 1990s mobilized PCBs. It is also important to note that sediment PCB concentrations in Lake Logan Martin and Choccolocco Creek downstream of Snow Creek ranged from nondetectable to below 1 mg/kg on average, and thus the impacts of these dredging activities have been overcome by natural attenuation. However, the data clearly indicate the negative environmental impacts associated with dredging and the need to prevent its use within the Off-Site area.

8.3 Summary of Updated OCM

The updated OCM demonstrates the role of surficial sediment PCB concentrations in regulating PCB levels in fish and confirms the role of sediment deposition in facilitating natural recovery. These aspects of the conceptual model are further validated by the absence of PCBs in the surface sediments of the lake, the fact that the average PCB concentrations for bass and catfish are below the ADPH advisory level of 2 mg/kg, and the continued decline of PCB concentrations in fish with the passage of time. The fact that fish PCB concentrations in Lake Logan Martin are below this level is important since ingestion of fish is the primary exposure pathway for the lake.

The updated OCM also demonstrates that PCBs in Choccolocco Creek are limited to the upstream reaches and, in particular, the depositional backwater area, upstream of the Snow Creek confluence. Similarly, PCBs in Snow Creek are isolated to the upstream reach and depositional area near the confluence with Choccolocco Creek. The updated OCM also indicates that, while there is still some transport of PCB-containing sediments to Choccolocco Creek and Lake Logan Martin under intermittent high-flow conditions, the net result of this transport is insignificant relative to natural attenuation, and the decline in fish PCB concentrations in Choccolocco Creek and Lake Logan Martin is expected.

9. Conclusions and Recommendations

This section presents the conclusions of the RFI and recommendations for Lake Logan Martin, Choccolocco Creek, and Snow Creek. The conclusions and recommendations for these portions of the Off-Site area are based on the results of the RFI studies, the updated OCM, and the HEA, and consider both potential human and ecological receptors. Within the conclusions section, the potential need for Corrective Measures Studies (CMS) are identified, where appropriate. Where additional data are required, they are identified and discussed within the recommendations section.

9.1 Conclusions

9.1.1 Lake Logan Martin

- Lake Logan Martin is not affected by PCBs based on the following Off-Site RFI data:

  —The average PCB concentrations in bass and catfish were less than the ADPH advisory level of 2 mg/kg at all sampling stations in the lake.

  —In the vast majority of cases, the average PCB concentrations in fish declined between 1996 and 1999.

  —PCB concentrations in surface sediments were below the analytical quantitation limit (0.06 mg/kg) at all sampling locations in the lake.

  —PCB concentrations in the deeper sediments were all very low (typically less than 1 mg/kg) and were below the quantitation limit in many cases. The highest concentration measured in the deeper sediments was 3.5 mg/kg. However, this sample was obtained at a sediment depth of 3.5 feet in the deepest portion of the channel in water depths in excess of 50 feet. Consequently, it is unlikely that these sediments will be subject to disturbance and re-suspension. Because of the depth of burial and the fact that they are overlain by sediments with markedly lower PCB concentrations, they do not pose an ecological threat.

- Because no unacceptable human or ecological risks were identified in Lake Logan Martin, no corrective measures are necessary and, hence, a CMS is not required.

9.1.2 Choccolocco Creek

- Choccolocco Creek does not present unacceptable risks for a majority of its length between Lake Logan Martin and Snow Creek. Fish tissue concentrations are above the ADPH advisory level of 2 mg/kg. However, conditions in the creek are rapidly improving to acceptable levels through natural attenuation as demonstrated by:

  —Dramatic decreases (up to four-fold) in PCB concentrations in fish tissue from 1996 to 1999; and
  —Average PCB concentrations of less than 1 mg/kg in sediments (both surface and subsurface) downstream of the confluence with Snow Creek.

- The only stretch of the creek that appears to be of potential concern is the backwater area in the upper reach of the creek immediately above the confluence with Snow Creek. However, this section of the creek is not readily accessible and is significantly affected by urban runoff from Snow Creek and upstream agricultural inputs. Consequently, the habitat in this area is subjected to a number of other stressors.

- Because one portion of the creek does present some concern, additional characterization and a CMS will be required to evaluate potential corrective measures for this area.

9.1.3 Snow Creek

- Two areas of potential concern were identified in Snow Creek: the mile of creek immediately below the 11th Street Ditch and the downstream reach of the creek immediately above the confluence with Choccolocco Creek. Because sediments in these two reaches of the creek exceed the risk-based action levels developed in the HEA, collective measures studies will be required in these two areas. The rest of the creek is not a concern. It is also important to note that Snow Creek is an urban storm water drain and receives inputs from a number of point and nonpoint sources. Consequently, the ecology of the creek is significantly affected by a wide variety of stressors, including on-going urban development and renewal. The impacts of these stressors are reflected in the degraded habitat observed during the ecological assessment.

9.2 Recommendations

Based on the findings of this investigation, the following recommendations are made:

- ADPH should evaluate the removal of fish advisories in Lake Logan Martin.

- Conduct a CMS in the following portions of the Off-Site area:

  —The first mile of Snow Creek downstream of the 11th Street Ditch;
  —The lower reach of Snow Creek (from Route 78 to the confluence with Choccolocco Creek); and
  —The backwater area of Choccolocco Creek (upstream of the confluence with Snow Creek).

- Collect additional sediment data from the backwater area of the Choccolocco Creek near its confluence with Snow Creek. The investigation methods will be consistent with the Off-Site RFI Work Plan and include additional sediment sampling transects on approximately 1,000 feet intervals in an upstream direction. The sediment transects will extend along each branch of Choccolocco Creek within the backwater area to a point approximately 1 mile upstream of the point where they rejoin into a single creek. Consistent with the Off-Site RFI, the investigation will be focused on PCBs in sediment. To facilitate field sampling logistics (access and multiple mobilizations) this investigation program may be best implemented in parallel with the floodplain soil sampling identified in the Phase II Off-Site (Floodplain) RFI/CS Investigation Work Plan (BBL, 2000).

- Continue monitoring fish in Choccolocco Creek by collecting and analyzing additional samples. The fish collection program will also include young-of-year (YOY) samples to further document the continued decline of fish tissue concentrations. Additional surface water data will also be collected during high-flow conditions to confirm the conceptual model for particulate PCB transport in Choccolocco Creek.

- Document that the ADPH advisory level is being maintained in Lake Logan Martin by collecting and analyzing fish samples on a periodic basis.

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Tables

Table 3-1

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Physical Characteristics of Choccolocco Creek Transects

Transect	Width (ft)	Average Water Depth (ft)	Average Sediment Thickness (ft)	Average Bottom Elevation (ft)	Velocity (fps)
C-U1	48	4.4	1.1	594.1	
C-U2	49	2.7	2.9	593.0	
C-U3	45	4.7	1.5	591.4	
C-001	55	2.2	1.4	592.6	
C-002	61	2.8	0.7	590.9	
C-003	100	1.2	2.2	591.7	1.40
C-004	58	4.2	1.7	586.4	
C-005	59	2.8	0.6	586.6	
C-006	70	2.2	0.6	586.0	1.40
C-007	62	2.7	0.7	584.2	
C-008	66	2.9	1.9	583.7	
C-009	62	3.3	2.2	583.1	1.10
C-010	70	3.5	2.3	583.0	
C-011	46	3.8	0.7	584.7	
C-012	55	3.1	0.3	579.9	
C-013	63	2.8	1.6	579.6	1.08
C-014	69	3.2	0.7	579.1	
C-015	68	3.0	0.9	579.2	
C-016	55	3.9	1.7	577.3	
C-017	57	3.4	1.3	578.0	1.18
C-021	70	3.2	0.8	578.0	
C-022	60	2.3	1.7	577.8	
C-023	80	1.0	0.8	578.1	
C-024	56	2.2	0.4	575.6	1.59
C-025	62	2.8	1.6	574.7	
C-026	65	2.1	1.2	573.9	
C-027	64	3.2	1.0	573.1	1.22
C-028	60	4.3	0.8	570.7	
C-029	62	2.2	0.4	571.5	
C-030	77	2.5	1.5	570.2	
C-031	64	4.6	1.0	567.5	
C-032	96	1.9	0.6	568.8	1.43
C-033	81	2.4	1.2	567.3	
C-034	68	3.0	0.4	566.5	
C-035	72	2.7	0.9	566.2	
C-036	70	2.5	0.6	566.2	1.81

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Transect	Width (ft)	Average Water Depth (ft)	Average Sediment Thickness (ft)	Average Bottom Elevation (ft)	Velocity (fps)
C-037	73	2.6	0.5	565.4	
C-038	70	2.4	0.4	565.3	
C-039	65	4.7	1.0	562.3	
C-040	78	3.1	1.4	563.9	1.05
C-041	64	3.5	0.7	563.4	
C-042	72	2.6	0.5	562.6	
C-043	58	4.2	0.3	559.7	
C-044	88	1.9	0.2	561.6	1.33
C-045	101	3.0	0.2	559.8	
C-046	132	2.3	0.4	560.0	
C-047	120	1.8	0.4	558.8	
C-048	101	2.2	0.2	557.9	1.39
C-049	116	3.2	0.3	556.0	
C-050	78	2.2	0.1	556.0	
C-051	126	1.6	0.8	554.9	
C-052	126	3.1	0.4	553.2	0.61
C-053	115	2.4	0.2	552.6	
C-054	150	1.0	0.4	552.0	
C-055	114	2.5	0.2	547.8	
C-056	117	7.6	0.4	545.1	0.32
C-057	81	2.5	0.1	544.7	
C-058	93	2.8	0.1	544.5	
C-059	107	3.9	0.5	540.3	
C-060	96	4.4	0.4	539.5	0.57
C-061	105	4.2	0.4	539.8	
C-062	99	6.8	0.2	537.8	
C-063	120	3.9	0.4	539.7	
C-064	94	2.7	0.2	540.9	0.84
C-065	80	3.6	0.4	537.7	
C-066	95	2.0	0.3		
C-067	105	3.3	0.3	535.3	
C-068	118	1.9	0.2	536.2	0.69
C-069	111	2.7	0.3	535.9	
C-070	91	3.4	0.1	528.6	
C-071	109	4.5	0.5	538.1	
C-072	115	4.4	0.6		

Table 3-1

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Anniston, Alabama
Off-Site RFI Report

Physical Characteristics of Choccolocco Creek Transects

Transect	Width (ft)	Average Water Depth (ft)	Average Sediment Thickness (ft)	Average Bottom Elevation (ft)	Velocity (fps)
C-073	100	4.8	0.1	534.4	1.50
C-074	195	2.9	0.3	534.1	
C-075	90	4.2	0.2	529.4	
C-076	126	3.6	0.0	528.2	1.17
C-077	145	4.9	0.1	526.6	
C-078	96	2.8	0.1	525.1	
C-079	90	3.5	0.0	523.8	
C-080	116	5.2	0.4	520.2	0.74
C-081	124	2.6	0.2	521.7	
C-082	107	4.8	0.3	517.7	
C-084	140	2.3	0.2	516.6	1.54
C-085	105	3.5	0.2		
C-086	115	5.3	0.2	510.2	
C-087	75	6.9	0.1	508.9	
C-088	120	2.1	0.3	511.5	1.68
C-089	100	2.3	0.2		
C-090	130	3.2	0.2	508.2	
C-091	111	5.7	0.4	504.8	0.41
C-092	170	1.9	0.2	506.5	
C-093	107	1.8	0.1	502.6	
C-094	60	4.4	0.0	499.3	
C-095	130	3.4	0.3	501.8	
C-096	120	4.4	0.2	498.2	0.51
C-097	124	5.7	0.5	507.9	
C-098	154	2.5	0.3	497.0	
C-099	135	3.4	0.2	495.9	
C-100	70	2.9	0.3	497.6	1.10
C-101	95	1.6	0.6	494.6	
C-102	90	2.2	0.8	493.6	
C-103	90	2.4	0.2	492.9	
C-104	90	2.2	0.4	492.5	1.22
C-105	100	1.5	0.2	492.2	
C-106	67	4.5	0.3	488.1	
C-107	96	5.0	0.1	488.2	
C-108	70	4.7	0.1	486.9	0.69
C-109	100	1.6	0.6	489.5	

Table 3-1

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Anniston, Alabama
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Physical Characteristics of Choccolocco Creek Transects

Transect	Width (ft)	Average Water Depth (ft)	Average Sediment Thickness (ft)	Average Bottom Elevation (ft)	Velocity (fps)
C-110	85	4.9	0.7	484.7	
C-111	100	3.4	0.2	486.0	
C-112	128	2.3	0.4	486.4	0.76
C-113	140	2.2	0.4	486.3	
C-114	95	3.5	0.3	486.0	
C-115	100	4.5	0.1	482.7	
C-116	85	6.4	0.1	482.6	0.47
C-117	120	2.1	0.7	484.4	
C-118	100	5.4	0.3	481.2	
C-119	105	5.8	0.4	481.0	
C-120	130	2.7	0.5	483.8	0.80
C-121	130	5.1	0.6	483.3	
C-122	125	4.6	0.7	481.1	
C-123	125	6.2	0.0	478.7	
C-124	130	5.3	0.1	482.0	0.33
C-125	110	5.9	0.1		
C-126	115	5.1	0.2	480.1	
C-127	120	7.1	0.1	478.5	
C-128	165	5.1	0.5	479.3	0.46
C-129	125	5.8	0.1	479.0	
C-130	155	6.7	0.4	478.2	
C-131	135	7.4	0.4	477.7	
C-132	145	8.3	0.8	477.8	0.27
C-133	151	7.8	0.4	477.9	
C-134	175	5.9	0.6	480.0	
C-135	173	6.9	0.1	478.9	
C-136	142	14.0	0.4	470.0	0.13
C-137	195	9.1	1.1	475.4	
C-138	220	7.7	0.8	476.6	
C-139	158	12.6	0.9	471.8	
C-140	205	8.7	0.5	475.1	0.15
C-141	162	16.5	1.0	469.6	
C-142	231	8.2	0.9	476.6	0.16
C-145	164	3.8	0.2	463.7	0.56
C-146	156	6.9	0.0	459.4	
C-147	183	7.1	0.5		

Table 3-1

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Physical Characteristics of Choccolocco Creek Transects

Transect	Width (ft)	Average Water Depth (ft)	Average Sediment Thickness (ft)	Average Bottom Elevation (ft)	Velocity (fps)
C-148	169	8.8	0.6		
C-149	195	1.8	0.5	464.6	
C-150	180	1.6	0.1	464.8	
C-151	150	5.9	0.5	457.5	
C-152	230	4.6	0.2	458.3	0.19
C-153	310	6.4	0.2	456.9	
C-154	190	11.4	0.1	452.0	
C-155	200	10.4	0.0	453.6	
C-156	230	10.6	0.2	451.3	
C-157	290	10.0	0.7	453.6	0.06
C-158	245	13.6	1.3	450.1	
C-159	245	13.7	1.1	465.0	0.06
C-160	215	14.0	1.4	448.5	
C-161	220	13.9	1.8	445.8	0.01
C-162	360	8.8	0.9	454.1	
C-163	220	17.1	1.5	445.4	0.04
C-164	230	14.5	1.1	445.2	
C-165	230	14.4	0.4	448.3	
C-166	1178	5.7	1.9	456.8	
C-167	875	8.7	3.1	454.2	
C-168	2339	5.8	1.9	457.0	
C-169	1059	6.8	2.3	455.9	
C-170	579	11.1	1.7	451.7	0.07
C-171	521	11.8	1.1	450.8	
C-172	335	16.6	1.3	443.5	
C-173	808	10.2	2.5	452.4	0.00
C-174	876	8.0	2.0	454.5	
C-175	510	14.3	0.6	448.4	
C-176	537	15.5	1.7	447.1	0.08
C-177	1281	8.7	2.1	454.1	
C-178	1022	9.2	2.1	453.6	
C-179	493	14.3	1.8	448.5	
C-180	654	15.1	2.3	447.7	
C-181	741	13.4	1.6	449.5	
C-182	858	13.1	1.8	449.9	
C-183	696	15.3	2.1	449.4	

Table 3-2

Solutia Inc.
Anniston, Alabama
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Physical Characteristics of Choccolocco Creek Reaches

Geographic Strata	Number of Transects	Estimated Distance (mi)	Average Width (ft)	Average Water Depth (ft)	Average Sediment Thickness (ft)	Average Slope (ft/mi)	Average Bottom Elevation (ft)	Average Velocity (fps)
Upstream of Snow Creek	3	0.6	47	3.9	1.7	4.8	592.8	
Snow Creek to Coldwater Creek	42	8.2	68	2.9	1.0	3.8	574.7	1.4
Coldwater Creek to Cheaha Creek	72	14.2	109	3.4	0.3	5.4	518.2	0.9
Cheaha Creek to Jackson Shoals	23	4.5	148	7.4	0.5	1.8	478.0	0.4
Jackson Shoals	12	2.4	197	6.4	0.3	7.4	460.7	0.3 *
Jackson Shoals to Lake Logan Martin	28	5.5	637	11.9	1.6	0.5	451.1	0.0

* Indicates that no velocity measurements were taken in the shoals area because of safety concerns.
The actual average velocity would be much higher.

Table 3-3a

Solutia Inc.
Anniston, Alabama
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Sediment Textural Classifications in Choccolocco Creek by Reach

Geographic Strata	Cores Attempted	Cores Not Recovered	USCS Core Description												
			OL	PT	CH	CL	MH	ML	SC	SM	SP	SW	GM	GP	GW
Upstream of Snow Creek	12	1				2				6			1		2
Snow Creek to Coldwater Creek	168	17	1	1				2	2	7	11	92	2	4	29
Coldwater Creek to Cheaha Creek	288	92	10					1	1	3		155			26
Cheaha Creek to Jackson Shoals	92	33								24		33	1		1
Jackson Shoals	48	27								6	1	5	1	6	2
Jackson Shoals to Lake Logan Martin	133	19	8		3	7	12	45	10	14	5	10			

Table 3-3b

Description of Choccolocco Creek Cores by Strata

Geographic Strata	Cores Attempted	Cores Not Recovered	Core Description					
			Organics	Clays	Silts	Fine Sands	Coarse Sands	Gravels
Upstream of Snow Creek	12	1	**0**	**2**	**0**	**6**	**0**	3
Snow Creek to Coldwater Creek	168	17	**2**	**0**	**2**	**9**	**103**	35
Coldwater Creek to Cheaha Creek	288	92	**10**	**0**	**1**	**4**	**155**	26
Cheaha Creek to Jackson Shoals	92	33	**0**	**0**	**0**	**24**	**33**	2
Jackson Shoals	48	27	**0**	**0**	**0**	**6**	**6**	9
Jackson Shoals to Lake Logan Martin	133	19	**8**	**10**	**57**	**24**	**15**	0

(cyan) Cores grouped in the "fine" class

(magenta) Cores grouped in the "coarse" class

Table 3-4

Solutia Inc.
Anniston, Alabama
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Estimated Choccolocco Creek Sediment Areas and Volumes Areas by Strata

Geographic Strata	Total Area (acres)	Percent Fine Sediments (%)	Percent Coarse Sediments (%)	Percent Gravel (%)	Percent No Recovery (%)	Total Volume (cy)	Percent Fine Sediments (%)	Percent Coarse Sediments (%)	Percent Gravel (%)
Upstream of Snow Creek	4.6	77	0.0	15	8.0	14,158	90	0.0	10
Snow Creek to Coldwater Creek	66	7.1	59	23	11	106,756	13	60	27
Coldwater Creek to Cheaha Creek	185	5.1	56	9.2	30	86,796	13	76	11
Cheaha Creek to Jackson Shoals	74	31	31	1.9	36	62,639	50	49	1.1
Jackson Shoals	55	12	12	20	57	26,776	41	32	26
Jackson Shoals to Lake Logan Martin	419	84	7.4	0.0	8.4	1,667,953	96	4.4	0.0
Total	804	50	25	5.6	19	1,965,078	85	12	2.4

Table 3-5

Solutia Inc.
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Number of Choccolocco Creek Cores Selected for Laboratory Analysis by Strata

Geographic Strata	Textural Strata		
	Fine	Coarse	Gravel
Upstream of Snow Creek	5/8	0/0	7/75
Snow Creek to Coldwater Creek	10/13	20/103	
Coldwater Creek to Cheaha Creek	10/15	20/155	
Cheaha Creek to Jackson Shoals	15/24	15/33	
Jackson Shoals	6/6	6/6	
Jackson Shoals to Lake Logan Martin	25/95	5/15	
Total	71/161	66/312	7/75

Notes:
Numbers displayed include the analyzed number of cores over the total number of cores collected for each stratum.
Fine cores consist of organic material, clays, silts, and fine sands.
Coarse cores consist of coarse sands.

Table 3-6

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Choccolocco Creek Cores Selected for Laboratory Analyses

Reach	Textural Class	Sediment Core	PCB Analysis	Select Metal Analysis	Wet-Sieve Anaysis	ADEM Split	Number of Samples
Upstream of Snow Creek	fine	C-U1-SED-1	yes	no	no	no	2
	fine	C-U2-SED-1	yes	no	no	no	5
	fine	C-U2-SED-2	no	no	yes	no	5
	fine	C-U2-SED-3	yes	no	no	no	4
	fine	C-U2-SED-4	yes	no	no	no	4
	fine	C-U3-SED-4	yes	yes	no	yes	3
Snow Creek to Coldwater Creek	gravel	C-002-SED-3	yes	no	no	no	2
	gravel	C-029-SED-2	yes	no	no	no	1
	coarse	C-005-SED-1	yes	no	no	no	2
	coarse	C-008-SED-2	yes	no	no	no	2
	coarse	C-011-SED-1	no	no	yes	no	5
	coarse	C-013-SED-3	yes	no	no	no	2
	coarse	C-014-SED-1	yes	no	no	no	2
	coarse	C-014-SED-3	yes	no	no	no	2
	coarse	C-015-SED-3	yes	no	no	no	2
	coarse	C-016-SED-3	yes	no	no	no	3
	coarse	C-017-SED-2	yes	no	no	no	3
	coarse	C-021-SED-4	yes	no	no	no	4
	coarse	C-022-SED-3	no	no	yes	no	5
	coarse	C-024-SED-2	yes	no	no	no	1
	coarse	C-026-SED-2	yes	no	no	no	2
	coarse	C-031-SED-1	yes	no	no	no	2
	coarse	C-031-SED-4	yes	no	no	yes	3
	coarse	C-032-SED-3	yes	no	no	no	2
	coarse	C-033-SED-2	yes	no	no	no	2
	coarse	C-036-SED-1	yes	no	no	no	2
	coarse	C-041-SED-3	yes	no	no	no	2
	coarse	C-042-SED-2	yes	no	no	no	1
	coarse	C-043-SED-4	yes	no	no	no	1
	coarse	C-045-SED-4	yes	no	no	no	1
	fine	C-001-SED-4	yes	no	no	no	3
	fine	C-005-SED-2	yes	yes	no	yes	3
	fine	C-008-SED-4	yes	no	no	no	3
	fine	C-009-SED-1	yes	no	no	no	4
	fine	C-010-SED-4	yes	no	no	no	3
	fine	C-011-SED-3	yes	no	no	no	2
	fine	C-011-SED-4	yes	no	no	no	2
	fine	C-013-SED-4	yes	yes	no	yes	3
	fine	C-028-SED-2	yes	no	no	no	3
	fine	C-039-SED-2	yes	no	no	no	2
	gravel	C-049-SED-4	yes	no	no	no	1
	gravel	C-066-SED-2	yes	no	no	no	1
	gravel	C-099-SED-4	yes	no	no	no	1
	coarse	C-048-SED-1	yes	no	no	no	1
	coarse	C-051-SED-4	yes	no	no	no	1
	coarse	C-053-SED-2	yes	no	no	no	1
	coarse	C-054-SED-4	yes	no	no	no	2
	coarse	C-059-SED-3	yes	no	no	no	2
	coarse	C-060-SED-4	yes	no	no	no	2
	coarse	C-063-SED-1	yes	no	no	no	2
	coarse	C-064-SED-1	yes	no	no	no	1
	coarse	C-065-SED-3	yes	no	no	no	2
	coarse	C-068-SED-1	yes	no	no	no	1
	coarse	C-070-SED-4	yes	no	no	no	1
	coarse	C-074-SED-1	yes	no	no	no	1

Table 3-6

Solutia Inc.
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Choccolocco Creek Cores Selected for Laboratory Analyses

Reach	Textural Class	Sediment Core	PCB Analysis	Select Metal Analysis	Wet-Sieve Anaysis	ADEM Split	Number of Samples
Coldwater Creek to Cheaha Creek	coarse	C-082-SED-2	yes	no	no	no	1
	coarse	C-086-SED-3	yes	no	no	no	1
	coarse	C-106-SED-3	yes	no	no	no	2
	coarse	C-100-SED-1	no	no	yes	no	4
	coarse	C-101-SED-4	no	no	yes	no	4
	coarse	C-111-SED-2	yes	no	no	no	2
	coarse	C-112-SED-2	yes	no	no	no	1
	coarse	C-113-SED-3	yes	no	no	no	1
	coarse	C-115-SED-1	yes	no	no	no	2
	coarse	C-115-SED-2	yes	no	no	no	1
	fine	C-056-SED-1	yes	no	no	no	3
	fine	C-060-SED-2	yes	no	no	no	1
	fine	C-062-SED-3	yes	no	no	no	1
	fine	C-071-SED-1	yes	yes	no	yes	2
	fine	C-092-SED-3	yes	no	no	no	2
	fine	C-097-SED-4	yes	no	no	no	2
	fine	C-101-SED-1	yes	no	no	yes	2
	fine	C-102-SED-4	yes	no	no	no	2
	fine	C-114-SED-1	yes	no	no	no	2
	fine	C-118-SED-1	yes	no	no	no	2
Cheaha Creek to Jackson Shoals	coarse	C-119-SED-2	yes	no	no	no	1
	coarse	C-119-SED-4	yes	no	no	no	2
	coarse	C-121-SED-1	yes	no	no	no	2
	coarse	C-121-SED-3	yes	no	no	no	2
	coarse	C-122-SED-1	yes	no	no	no	1
	coarse	C-124-SED-3	yes	no	no	no	2
	coarse	C-128-SED-2	yes	no	no	no	2
	coarse	C-130-SED-3	yes	no	no	no	1
	coarse	C-130-SED-4	yes	no	no	no	2
	coarse	C-132-SED-2	yes	no	no	no	2
	coarse	C-132-SED-3	yes	no	no	no	2
	coarse	C-134-SED-2	yes	no	no	yes	2
	coarse	C-136-SED-2	yes	no	no	no	2
	coarse	C-138-SED-3	yes	no	no	no	2
	coarse	C-138-SED-4	no	no	yes	no	5
	coarse	C-141-SED-4	yes	no	no	no	4
	fine	C-120-SED-1	yes	no	no	yes	3
	fine	C-125-SED-1	yes	no	no	no	1
	fine	C-126-SED-1	yes	no	no	no	2
	fine	C-131-SED-1	yes	no	no	no	2
	fine	C-133-SED-4	yes	no	no	no	1
	fine	C-134-SED-1	no	no	yes	no	5
	fine	C-135-SED-1	yes	no	no	no	1
	fine	C-137-SED-1	yes	no	no	no	2
	fine	C-137-SED-2	yes	no	no	no	2
	fine	C-137-SED-3	yes	no	no	no	3
	fine	C-137-SED-4	yes	no	no	no	3
	fine	C-138-SED-1	yes	no	no	no	2
	fine	C-139-SED-3	yes	no	no	no	4
	fine	C-139-SED-4	yes	no	no	no	2
	fine	C-140-SED-1	yes	no	no	no	2
	fine	C-141-SED-2	yes	no	no	no	3

Table 3-6

Solutia Inc.
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Choccolocco Creek Cores Selected for Laboratory Analyses

Reach	Textural Class	Sediment Core	PCB Analysis	Select Metal Analysis	Wet-Sieve Anaysis	ADEM Split	Number of Samples
Jackson Shoals	gravel	C-150-SED-1	yes	no	no	no	1
	gravel	C-153-SED-4	yes	no	no	no	1
	coarse	C-142-SED-3	yes	no	no	no	2
	coarse	C-145-SED-1	yes	no	no	no	2
	coarse	C-147-SED-1	yes	no	no	no	2
	coarse	C-147-SED-3	yes	no	no	no	2
	coarse	C-151-SED-3	yes	no	no	no	3
	coarse	C-154-SED-1	yes	no	no	no	1
	fine	C-142-SED-4	yes	no	no	no	4
	fine	C-147-SED-2	yes	no	no	no	2
	fine	C-148-SED-2	yes	no	no	no	2
	fine	C-148-SED-3	yes	no	no	no	2
	fine	C-148-SED-4	yes	yes	no	yes	2
	fine	C-153-SED-2	yes	no	no	no	2
Jackson Shoals to Lake Logan Martin	coarse	C-158-SED-3	yes	no	no	no	3
	coarse	C-159-SED-3	yes	no	no	no	1
	coarse	C-160-SED-3	yes	no	no	no	3
	coarse	C-161-SED-1	yes	no	no	no	2
	coarse	C-161-SED-2	yes	no	no	no	2
	fine	C-157-SED-1	yes	no	no	no	2
	fine	C-157-SED-2	yes	no	no	yes	3
	fine	C-162-SED-3	yes	yes	no	no	3
	fine	C-164-SED-1	yes	no	no	no	3
	fine	C-164-SED-4	yes	no	no	no	3
	fine	C-165-SED-2	yes	yes	no	no	2
	fine	C-166-SED-6	yes	yes	no	no	2
	fine	C-168-SED-2	yes	no	no	no	2
	fine	C-169-SED-5	yes	yes	no	yes	4
	fine	C-170-SED-1	yes	no	no	no	4
	fine	C-170-SED-5	yes	no	no	no	3
	fine	C-172-SED-2	yes	yes	no	no	3
	fine	C-173-SED-4	yes	no	no	no	3
	fine	C-174-SED-5	yes	yes	no	no	3
	fine	C-175-SED-1	yes	no	no	no	2
	fine	C-176-SED-2	yes	yes	no	yes	4
	fine	C-176-SED-5	yes	no	no	no	3
	fine	C-177-SED-2	yes	yes	no	no	3
	fine	C-177-SED-3	yes	no	no	no	2
	fine	C-178-SED-3	yes	no	no	no	3
	fine	C-180-SED-2	no	no	yes	no	5
	fine	C-180-SED-4	yes	yes	no	no	4
	fine	C-181-SED-3	yes	no	no	no	3
	fine	C-181-SED-5	yes	no	no	no	3
	fine	C-182-SED-4	yes	yes	no	yes	2
	fine	C-183-SED-5	yes	no	no	no	2

Table 3-7

Solutia Inc.
Anniston, Alabama
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Choccolocco Creek Sediment Data Summary

Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
Upstream of Snow Creek						
C-U1-SED-1	C10072	0	2	fine	19000	ND(0.12)
C-U1-SED-1	C10073	2	13.5	fine	8900	ND(0.083)
C-U2-SED-1	C10090	0	2	fine	7900	1.2
C-U2-SED-1	C10091	2	12	fine	20000	55
C-U2-SED-1	C10092	12	24	fine	28000	49 J
C-U2-SED-1	C10093	24	36	fine	25000	0.45
C-U2-SED-1	C10094	36	45	fine	23000	ND(0.071)
C-U2-SED-3	C10086	0	2	fine	ND(500)	0.12 J
C-U2-SED-3	C10087	2	12	fine	ND(500)	0.69
C-U2-SED-3	C10088	12	24	fine	25000	170
C-U2-SED-3	C10089	24	32	fine	23000	160
C-U2-SED-4	C10077	0	2	fine	28000	95 J
C-U2-SED-4	C10078	2	12	fine	25000	130 J
C-U2-SED-4	C10079	12	24	fine	35000	75 J
C-U2-SED-4	C10080	24	27	fine	31000	0.57
C-U2-SED-4	C10081	12	24	fine	39000	64 J
C-U3-SED-4	C10001	0	2	fine	25000	R
C-U3-SED-4	C10002	2	12	fine	30000	ND(0.11) J
C-U3-SED-4	C10003	12	25	fine	29000	ND(0.12) J
Snow Creek to Coldwater Creek						
C-001-SED-4	C10074	0	2	fine	ND(500)	1.9
C-001-SED-4	C10075	2	12	fine	11000	2.6
C-001-SED-4	C10076	12	22	fine	2800	2.9
C-002-SED-3	C10320	0	2	gravel	ND(500)	0.29
C-002-SED-3	C10321	2	5	gravel	ND(500)	0.050
C-005-SED-1	C10084	0	2	coarse	ND(500)	0.23 J
C-005-SED-1	C10085	2	5.5	coarse	ND(500)	0.022 J
C-005-SED-2	C10007	0	2	fine	7200	R
C-005-SED-2	C10008	2	12	fine	ND(500)	ND(0.092) J
C-005-SED-2	C10009	12	20	fine	ND(500)	ND(0.098) J
C-008-SED-2	C10058	0	2	coarse	15000	0.34
C-008-SED-2	C10059	2	11.5	coarse	5700	0.28

See notes on page 10.

Table 3-7

Solutia Inc.
Anniston, Alabama
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Choccolocco Creek Sediment Data Summary

Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-008-SED-4	C10096	0	2	fine	ND(500)	0.50
C-008-SED-4	C10097	2	12	fine	9100	0.25
C-008-SED-4	C10098	12	20	fine	32000	ND(0.10)
C-008-SED-4	C10099	12	20	fine	28000	ND(0.10)
C-009-SED-1	C10100	0	2	fine	ND(500)	2.1 J
C-009-SED-1	C10101	2	12	fine	ND(500)	0.20 J
C-009-SED-1	C10102	12	24	fine	1300	ND(0.059) J
C-009-SED-1	C10103	24	34	fine	ND(500)	ND(0.060) J
C-010-SED-4	C10104	0	2	fine	ND(500)	0.42 J
C-010-SED-4	C10105	2	12	fine	27000	ND(0.066) J
C-010-SED-4	C10106	12	23	fine	25000	ND(0.081) J
C-011-SED-3	C10107	0	2	fine	26000	23 J
C-011-SED-3	C10108	2	5.5	fine	56000	19 J
C-011-SED-4	C10109	0	2	fine	1700	0.62 J
C-011-SED-4	C10110	2	9	fine	8300	4.3 J
C-013-SED-3	C10082	0	2	coarse	ND(500)	0.16 J
C-013-SED-3	C10083	2	8.5	coarse	ND(500)	0.074 J
C-013-SED-4	C10010	0	2	fine	ND(500)	R
C-013-SED-4	C10011	2	13.5	fine	15000	1.2 J
C-014-SED-1	C10050	0	2	coarse	ND(500)	0.29
C-014-SED-1	C10051	2	5	coarse	ND(500)	0.24
C-014-SED-3	C10052	0	2	coarse	6900	0.64
C-014-SED-3	C10053	2	8.5	coarse	ND(500)	0.65
C-015-SED-3	C10040	0	2	coarse	ND(500)	1.3
C-015-SED-3	C10041	2	8.5	coarse	ND(500)	0.25 J
C-016-SED-3	C10069	0	2	coarse	2600	1.1
C-016-SED-3	C10070	2	12	coarse	ND(500)	0.64
C-016-SED-3	C10071	12	23.5	coarse	ND(500)	0.34
C-017-SED-2	C10042	0	2	coarse	23000	8.9
C-017-SED-2	C10043	2	12	coarse	1200	0.49
C-017-SED-2	C10044	12	18.5	coarse	ND(500)	0.16 J
C-021-SED-4	C10062	0	2	coarse	13000	1.2 J
C-021-SED-4	C10063	2	12	coarse	ND(500)	0.57 J
C-021-SED-4	C10064	12	17	coarse	4900	0.95

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Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-021-SED-4	C10065	17	22	coarse	180000	1.2 J
C-021-SED-4	C10066	17	22	coarse	140000	2.1 J
C-024-SED-2	C10045	0	3	coarse	ND(500)	0.056 J
C-026-SED-2	C10037	0	2	coarse	ND(500)	0.33 J
C-026-SED-2	C10038	2	5.5	coarse	ND(500)	0.30
C-028-SED-2	C10111	0	2	fine	ND(500)	0.13 J
C-028-SED-2	C10112	2	12	fine	ND(500)	ND(0.056) J
C-028-SED-2	C10113	12	18	fine	ND(500)	ND(0.056) J
C-029-SED-2	C10322	0	3	gravel	6900	0.24 J
C-031-SED-1	C10054	0	2	coarse	ND(500)	0.29 J
C-031-SED-1	C10055	2	9	coarse	ND(500)	0.46
C-031-SED-4	C10004	0	2	coarse	19000	R
C-031-SED-4	C10005	2	12	coarse	ND(500)	0.19 J
C-031-SED-4	C10006	12	23.5	coarse	12000	1.9 J
C-032-SED-3	C10047	0	2	coarse	32000	0.24 J
C-032-SED-3	C10048	2	7	coarse	ND(500)	0.094 J
C-032-SED-3	C10049	2	7	coarse	ND(500)	0.18 J
C-033-SED-2	C10056	0	2	coarse	680	0.27 J
C-033-SED-2	C10057	2	8	coarse	4200	0.34
C-036-SED-1	C10067	0	2	coarse	3900	0.61
C-036-SED-1	C10068	2	10	coarse	ND(500)	0.24 J
C-039-SED-2	C10114	0	2	fine	ND(500)	0.31 J
C-039-SED-2	C10115	2	9	fine	32000	1.6 J
C-041-SED-3	C10060	0	2	coarse	ND(500)	0.13 J
C-041-SED-3	C10061	2	8	coarse	9000	0.42
C-042-SED-2	C10039	0	2.5	coarse	ND(500)	0.12 J
C-043-SED-4	C10095	0	2	coarse	6200	1.2
C-045-SED-4	C10046	0	2.5	coarse	40000	0.96
Coldwater Creek to Cheaha Creek						
C-048-SED-1	C10116	0	3	coarse	ND(500)	0.19 J
C-049-SED-4	C10323	0	2.5	gravel	ND(500)	0.076 J
C-051-SED-4	C10117	0	3.5	coarse	ND(500)	0.12 J
C-053-SED-2	C10118	0	3.5	coarse	ND(500)	ND(0.060) J
C-054-SED-4	C10119	0	2	coarse	870	0.078 J

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Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-054-SED-4	C10120	2	4.5	coarse	550	0.083 J
C-056-SED-1	C10144	0	2	fine	3000	0.62 J
C-056-SED-1	C10145	2	12	fine	28000	3.7
C-056-SED-1	C10146	2	12	fine	33000	2.8
C-056-SED-1	C10147	12	18	fine	26000	1.9
C-059-SED-3	C10121	0	2	coarse	ND(500)	0.099 J
C-059-SED-3	C10122	2	4	coarse	ND(500)	ND(0.060)
C-060-SED-2	C10143	0	3	fine	ND(500)	0.10 J
C-060-SED-4	C10123	0	2	coarse	ND(500)	ND(0.057)
C-060-SED-4	C10124	2	8.5	coarse	ND(500)	0.027 J
C-062-SED-3	C10148	0	2	fine	ND(500)	1.1
C-063-SED-1	C10125	0	2	coarse	ND(500)	0.11 J
C-063-SED-1	C10126	2	6.5	coarse	2100	ND(0.055)
C-063-SED-1	C10142	2	6.5	coarse	ND(500)	ND(0.078) J
C-064-SED-1	C10127	0	2	coarse	ND(500)	0.11
C-065-SED-3	C10128	0	2	coarse	ND(500)	0.20 J
C-065-SED-3	C10129	2	7	coarse	ND(500)	ND(0.071)
C-066-SED-2	C10324	0	1.5	gravel	ND(500)	ND(0.056)
C-068-SED-1	C10130	0	3.5	coarse	ND(500)	0.19 J
C-070-SED-4	C10131	0	2.5	coarse	ND(500)	ND(0.060)
C-071-SED-1	C10012	0	2	fine	29000	R
C-071-SED-1	C10013	2	13	fine	12000	0.94 J
C-074-SED-1	C10132	0	3	coarse	ND(500)	0.10 J
C-082-SED-2	C10133	0	1.5	coarse	ND(500)	ND(0.061)
C-086-SED-3	C10134	0	2.5	coarse	ND(500)	0.14
C-092-SED-3	C10149	0	2	fine	15000	1.2
C-092-SED-3	C10150	2	4	fine	18000	8.1 J
C-097-SED-4	C10151	0	2	fine	33000	0.35 J
C-097-SED-4	C10152	2	7.5	fine	31000	0.85
C-099-SED-4	C10325	0	2	gravel	3600	0.088 J
C-101-SED-1	C10014	0	2	fine	21000	R
C-101-SED-1	C10015	2	5.5	fine	14000	0.84 J
C-102-SED-4	C10153	0	2	fine	22000	0.61
C-102-SED-4	C10154	2	11.5	fine	6300	0.058 J

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Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-106-SED-3	C10135	0	2	coarse	3400	ND(0.053)
C-106-SED-3	C10136	2	4.5	coarse	ND(500)	ND(0.053)
C-111-SED-2	C10137	0	2	coarse	ND(500)	ND(0.055)
C-111-SED-2	C10138	2	8.5	coarse	ND(500)	ND(0.083)
C-112-SED-2	C10157	0	2	coarse	ND(500)	ND(0.090) J
C-113-SED-3	C10160	0	2.5	coarse	ND(500)	ND(0.073)
C-114-SED-1	C10155	0	2	fine	5600	4.1
C-114-SED-1	C10156	2	4	fine	ND(500)	0.31 J
C-115-SED-1	C10139	0	2	coarse	19000	0.31
C-115-SED-1	C10140	2	5	coarse	ND(500)	0.031 J
C-115-SED-2	C10141	0	1	coarse	ND(500)	ND(0.085)
C-118-SED-1	C10158	0	2	fine	2400	ND(0.095)
C-118-SED-1	C10159	2	8.5	fine	ND(500)	ND(0.092)
Cheaha Creek to Jackson Shoals						
C-119-SED-2	C10161	0	2	coarse	ND(500)	ND(0.079)
C-119-SED-4	C10162	0	2	coarse	ND(500)	0.052 J
C-119-SED-4	C10163	2	5.5	coarse	8400	0.41 J
C-120-SED-1	C10018	0	2	fine	1100	R
C-120-SED-1	C10019	2	12	fine	ND(500)	ND(0.083) J
C-120-SED-1	C10020	12	22	fine	ND(500)	ND(0.083) J
C-121-SED-1	C10164	0	2	coarse	11000	0.073 J
C-121-SED-1	C10165	2	7.5	coarse	ND(500)	ND(0.088)
C-121-SED-1	C10166	2	7.5	coarse	ND(500)	ND(0.090)
C-121-SED-3	C10167	0	2	coarse	6400	0.027 J
C-121-SED-3	C10168	2	5	coarse	ND(500)	ND(0.084)
C-122-SED-1	C10169	0	2.5	coarse	5800	0.14 J
C-124-SED-3	C10170	0	2	coarse	ND(500)	0.12 J
C-124-SED-3	C10171	2	4	coarse	ND(500)	0.036 J
C-125-SED-1	C10190	0	2.5	fine	18000	2.0
C-126-SED-1	C10191	0	2	fine	43000	1.7
C-126-SED-1	C10192	2	5	fine	8700	1.3
C-128-SED-2	C10172	0	2	coarse	ND(500)	ND(0.083)
C-128-SED-2	C10173	2	4	coarse	ND(500)	ND(0.080)
C-130-SED-3	C10174	0	2.5	coarse	ND(500)	0.21 J

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Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-130-SED-4	C10175	0	2	coarse	ND(500)	0.026 J
C-130-SED-4	C10176	2	6	coarse	ND(500)	ND(0.080)
C-131-SED-1	C10193	0	2	fine	23000	0.95
C-131-SED-1	C10194	2	13.5	fine	2700	0.077 J
C-132-SED-2	C10177	0	2	coarse	35000	1.2 J
C-132-SED-2	C10178	2	12	coarse	ND(500)	ND(0.078)
C-132-SED-3	C10179	0	2	coarse	60000	2.6 J
C-132-SED-3	C10180	2	7	coarse	20000	2.3
C-133-SED-4	C10195	0	3	fine	19000	1.2
C-134-SED-2	C10016	0	2	coarse	ND(500)	R
C-134-SED-2	C10017	2	10	coarse	ND(500)	ND(0.081) J
C-135-SED-1	C10196	0	2	fine	27000	1.2
C-136-SED-2	C10181	0	2	coarse	27000	1.9
C-136-SED-2	C10182	2	8.5	coarse	7500	0.60
C-136-SED-2	C10183	2	8.5	coarse	17000	0.94
C-137-SED-1	C10197	0	2	fine	32000	1.4
C-137-SED-1	C10198	2	8.5	fine	22000	1.5
C-137-SED-2	C10199	0	2	fine	13000	0.76
C-137-SED-2	C10200	2	8	fine	16000	0.18 J
C-137-SED-3	C10201	0	2	fine	29000	0.36 J
C-137-SED-3	C10202	2	12	fine	ND(500) J	ND(0.069)
C-137-SED-3	C10203	12	16.5	fine	10000	ND(0.078)
C-137-SED-3	C10204	2	12	fine	1900	ND(0.071)
C-137-SED-4	C10205	0	2	fine	25000	1.2
C-137-SED-4	C10206	2	12	fine	6600	0.47
C-137-SED-4	C10207	12	16	fine	ND(500) J	ND(0.072)
C-138-SED-1	C10208	0	2	fine	27000	1.6
C-138-SED-1	C10209	2	5.5	fine	25000	1.7
C-138-SED-3	C10184	0	2	coarse	5300	0.29 J
C-138-SED-3	C10185	2	10	coarse	ND(500)	ND(0.056)
C-139-SED-3	C10210	0	2	fine	14000	0.69
C-139-SED-3	C10211	2	12	fine	3000	0.21 J
C-139-SED-3	C10212	12	24	fine	ND(500) J	ND(0.080)
C-139-SED-3	C10213	24	27.5	fine	ND(500) J	ND(0.081)

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Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-139-SED-4	C10214	0	2	fine	22000	2.1
C-139-SED-4	C10215	2	7	fine	30000	1.6
C-140-SED-1	C10216	0	2	fine	25000	1.8
C-140-SED-1	C10217	2	7.5	fine	19000	1.3
C-141-SED-2	C10218	0	2	fine	24000	0.82
C-141-SED-2	C10219	2	13.5	fine	12000	ND(0.10)
C-141-SED-4	C10186	0	2	coarse	31000	0.94
C-141-SED-4	C10187	2	12	coarse	8300	0.34
C-141-SED-4	C10188	12	24	coarse	ND(500)	ND(0.053)
C-141-SED-4	C10189	24	31.5	coarse	ND(500)	ND(0.058)
Jackson Shoals						
C-142-SED-3	C10220	0	2	coarse	14000	0.49 J
C-142-SED-3	C10221	2	12	coarse	11000	ND(0.082)
C-142-SED-3	C10222	2	12	coarse	ND(500) J	0.22 J
C-142-SED-4	C10233	0	2	fine	23000	0.84
C-142-SED-4	C10234	2	12	fine	ND(500) J	0.54 J
C-142-SED-4	C10235	12	24	fine	9000	ND(0.088)
C-142-SED-4	C10236	24	27.5	fine	7400	ND(0.093)
C-145-SED-1	C10223	0	2	coarse	ND(500) J	ND(0.076)
C-145-SED-1	C10224	2	8	coarse	ND(500) J	ND(0.077)
C-147-SED-1	C10225	0	2	coarse	870	0.021 J
C-147-SED-1	C10226	2	4	coarse	ND(500) J	ND(0.074)
C-147-SED-2	C10237	0	2	fine	16000	0.35
C-147-SED-2	C10238	2	6	fine	9300	0.34
C-147-SED-3	C10227	0	2	coarse	ND(500) J	0.14 J
C-147-SED-3	C10228	2	10	coarse	ND(500) J	ND(0.082)
C-148-SED-2	C10239	0	2	fine	ND(500) J	0.10 J
C-148-SED-2	C10240	2	6.5	fine	ND(500)	ND(0.085)
C-148-SED-3	C10241	0	2	fine	4400	ND(0.082)
C-148-SED-3	C10242	2	12.5	fine	ND(500)	ND(0.089)
C-148-SED-3	C10243	2	12.5	fine	ND(500)	ND(0.089)
C-148-SED-4	C10021	0	2	fine	35000	ND(0.13)
C-148-SED-4	C10022	2	6	fine	17000	0.92
C-150-SED-1	C10326	0	2.5	gravel	ND(500)	ND(0.058)

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Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-151-SED-3	C10229	0	2	coarse	1800	0.032 J
C-151-SED-3	C10230	2	12	coarse	ND(500) J	ND(0.098)
C-151-SED-3	C10231	12	21	coarse	ND(500) J	ND(0.11)
C-153-SED-2	C10244	0	2	fine	16000	ND(0.092)
C-153-SED-2	C10245	2	6	fine	13000	ND(0.10)
C-153-SED-4	C10327	0	2.5	gravel	7100	0.16 J
C-154-SED-1	C10232	0	3	coarse	4500	0.048 J
Jackson Shoals to Lake Logan Martin						
C-157-SED-1	C10256	0	2	fine	ND(500)	0.17
C-157-SED-1	C10257	2	6	fine	8400	0.28 J
C-157-SED-2	C10023	0	2	fine	ND(500)	0.087 J
C-157-SED-2	C10024	2	12	fine	ND(500)	0.14 J
C-157-SED-2	C10025	12	24.5	fine	ND(500)	ND(0.078) J
C-157-SED-2	C10026	2	12	fine	ND(500)	0.12 J
C-158-SED-3	C10246	0	2	coarse	26000	0.48 J
C-158-SED-3	C10247	2	12	coarse	ND(500)	ND(0.059)
C-158-SED-3	C10248	12	19	coarse	9600	0.65
C-159-SED-3	C10249	0	3.5	coarse	ND(500)	0.082 J
C-160-SED-3	C10250	0	2	coarse	3000	0.36 J
C-160-SED-3	C10251	2	12	coarse	ND(500)	ND(0.054)
C-160-SED-3	C10252	12	21.5	coarse	ND(500)	ND(0.058)
C-161-SED-1	C10253	0	3.5	coarse	29000	0.64
C-161-SED-2	C10254	0	2	coarse	8300	0.21 J
C-161-SED-2	C10255	2	9.5	coarse	ND(500)	ND(0.060)
C-162-SED-3	C10258	0	2	fine	3100	ND(0.061)
C-162-SED-3	C10259	2	12	fine	4700	ND(0.083)
C-162-SED-3	C10260	12	22.5	fine	6700	ND(0.065)
C-162-SED-3	C10262	12	22.5	fine	5800	ND(0.065)
C-164-SED-1	C10263	0	2	fine	8300	ND(0.071)
C-164-SED-1	C10264	2	12	fine	5000	ND(0.067)
C-164-SED-1	C10265	12	15	fine	5500	ND(0.066)
C-164-SED-4	C10266	0	2	fine	7600	0.14
C-164-SED-4	C10267	2	12	fine	11000	ND(0.067)
C-164-SED-4	C10268	12	18	fine	5500	ND(0.066)

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Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-165-SED-2	C10269	0	2	fine	16000	0.36
C-165-SED-2	C10270	2	6	fine	ND(500)	0.035 J
C-166-SED-6	C10271	0	2	fine	ND(500)	ND(0.083)
C-166-SED-6	C10272	2	6	fine	ND(500)	ND(0.062)
C-168-SED-2	C10273	0	2	fine	960	ND(0.063)
C-168-SED-2	C10274	2	11	fine	ND(500)	ND(0.060)
C-169-SED-5	C10027	0	2	fine	15000	0.60
C-169-SED-5	C10028	2	12	fine	9300	0.25 J
C-169-SED-5	C10029	12	24	fine	3400	ND(0.087)
C-169-SED-5	C10030	24	27	fine	ND(500)	ND(0.084)
C-170-SED-1	C10275	0	2	fine	45000	0.60
C-170-SED-1	C10276	2	12	fine	25000	1.3
C-170-SED-1	C10277	12	24	fine	27000	0.36
C-170-SED-1	C10278	24	36.5	fine	8800	0.23
C-170-SED-5	C10279	0	2	fine	17000	0.12
C-170-SED-5	C10280	2	12	fine	11000	0.084 J
C-170-SED-5	C10281	12	20.5	fine	30000	0.27
C-170-SED-5	C10282	12	20.5	fine	31000	0.47 J
C-172-SED-2	C10283	0	2	fine	26000	0.16
C-172-SED-2	C10284	2	12	fine	24000	0.087 J
C-172-SED-2	C10285	12	15.5	fine	19000	0.14
C-173-SED-4	C10296	0	2	fine	11000	0.55
C-173-SED-4	C10297	2	12	fine	9300	0.042 J
C-173-SED-4	C10298	12	23	fine	ND(500) J	ND(0.082)
C-174-SED-5	C10286	0	2	fine	20000	0.14
C-174-SED-5	C10287	2	12	fine	14000	0.068 J
C-174-SED-5	C10288	12	21	fine	12000	ND(0.083)
C-175-SED-1	C10299	0	2	fine	12000	0.17
C-175-SED-1	C10300	2	12.5	fine	3100	ND(0.080)
C-176-SED-2	C10031	0	2	fine	ND(500)	0.10
C-176-SED-2	C10032	2	12	fine	ND(500)	0.15 J
C-176-SED-2	C10033	12	24	fine	ND(500)	ND(0.080)
C-176-SED-2	C10034	24	28.5	fine	ND(500)	ND(0.079)
C-176-SED-5	C10301	0	2	fine	18000	1.2

See notes on page 10.

Table 3-7

Solutia Inc.
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Choccolocco Creek Sediment Data Summary

Location ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-176-SED-5	C10302	2	12	fine	6400	0.37
C-176-SED-5	C10303	12	17	fine	ND(500) J	ND(0.076)
C-176-SED-5	C10304	12	17	fine	2000	ND(0.078)
C-177-SED-2	C10289	0	2	fine	3800	ND(0.088)
C-177-SED-2	C10290	2	12	fine	1100	ND(0.081) J
C-177-SED-2	C10291	12	19	fine	ND(500)	ND(0.079)
C-177-SED-3	C10305	0	2	fine	ND(500) J	ND(0.084)
C-177-SED-3	C10306	2	11.5	fine	ND(500) J	ND(0.082)
C-178-SED-3	C10307	0	2	fine	20000	1.6
C-178-SED-3	C10308	2	12	fine	7900	0.78
C-178-SED-3	C10309	12	17.5	fine	ND(500) J	ND(0.082)
C-180-SED-4	C10292	0	2	fine	33000	0.16
C-180-SED-4	C10293	2	12	fine	27000	0.27 J
C-180-SED-4	C10294	12	24	fine	16000	0.20 J
C-180-SED-4	C10295	24	30.5	fine	1200	ND(0.081)
C-181-SED-3	C10310	0	2	fine	27000	1.8
C-181-SED-3	C10311	2	12	fine	23000	0.63
C-181-SED-3	C10312	12	22	fine	3200	2.2
C-181-SED-5	C10313	0	2	fine	9200	0.50
C-181-SED-5	C10314	2	12	fine	2400	ND(0.082)
C-181-SED-5	C10315	12	22	fine	ND(500)	ND(0.061)
C-181-SED-5	C10316	2	12	fine	1800	ND(0.081)
C-182-SED-4	C10035	0	2	fine	13000	1.1
C-182-SED-4	C10036	2	6.5	fine	5700	0.57 J
C-183-SED-5	C10317	0	2	fine	16000	1.1
C-183-SED-5	C10318	2	9	fine	2700	0.27
C-183-SED-5	C10319	2	9	fine	3600	0.059

Notes:

J - The compound/analyte was positively identified; however, the associated numerical value is an estin concentration only.
R - The sample results were rejected.
ND (500) - Not detected. Number in parentheses denotes the quantitation limit.

Table 3-8

Solutia Inc.
Anniston, Alabama
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Average PCB concentration by Strata in Choccolocco Creek

Geographic Strata	Fine Surface Sediments (mg/kg))	Fine Sub-Surface Sediments (mg/kg))	Coarse Surface Sediments (mg/kg))	Coarse Sub-Surface Sediments (mg/kg))	Gravel - All Depths (mg/kg)
Upstream of Snow Creek	24	44	NA	NA	0.12
Snow Creek to Coldwater Creek	3.7	2.9	0.96	0.39	
Coldwater Creek to Cheaha Creek	1.0	1.7	0.10	0.038	
Cheaha Creek to Jackson Shoals	1.3	0.76	0.55	0.33	
Jackson Shoals	0.24	0.27	0.13	0.060	
Jackson Shoals to Lake Logan Martin	0.43	0.20	0.35	0.11	

Table 3-9

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Estimated PCB Mass (kg) by Strata in Choccolocco Creek

Reach	Fine Sediments	Coarse Sediments	Gravel	Total
Upstream of Snow Creek	540	NA	0.2	540
Snow Creek to Coldwater Creek	41	34	4	79
Coldwater Creek to Cheaha Creek	17	5	1	23
Cheaha Creek to Jackson Shoals	27	13	0.1	40
Jackson Shoals	3	1	1	5
Jackson Shoals to Lake Logan Martin	340	11	NA	351
Total	968	64	6	1038

NA - No sediment of this texture class was observed.

Table 3-10

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Choccolocco Creek Metal Analysis Data

Location ID	Sample ID	Date	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Vanadium (mg/kg)
C-005-SED-2	C10007	20-Apr-99	0	2	3.1 J	48 J	0.53 J	ND(0.050) J	21 J	11 J	10 J	520 J	R	9.2 J	9.4 J
C-005-SED-2	C10008	20-Apr-99	2	12	9.9 J	99 J	1.9 J	ND(0.055) J	24 J	11 J	26 J	800 J	R	19 J	29 J
C-005-SED-2	C10009	20-Apr-99	12	20	9.5 J	91 J	2.2 J	ND(0.053) J	15 J	7.7 J	24 J	320 J	R	21 J	33 J
C-013-SED-4	C10010	21-Apr-99	0	2	1.5 J	48 J	0.33 J	ND(0.050) J	9.3 J	4.2 J	13 J	180 J	R	4.6 J	6.9 J
C-013-SED-4	C10011	21-Apr-99	2	13.5	1.4 J	36 J	0.30 J	ND(0.045) J	8.7 J	3.3 J	15 J	170 J	R	3.5 J	6.1 J
C-071-SED-1	C10012	25-May-99	0	2	11 J	250 J	2.3 J	0.91 J	55 J	34 J	71 J	1800 J	R	41 J	43 J
C-071-SED-1	C10013	25-May-99	2	13	17 J	380 J	3.7 J	2.2 J	82 J	55 J	110 J	3000 J	R	64 J	63 J
C-148-SED-4	C10021	5-Aug-99	0	2	5.0	89	0.67 B	0.28 B	23	9.3	24	610	R	9.6	16
C-148-SED-4	C10022	5-Aug-99	2	6	3.1	57	0.40 B	0.33 B	15	7.2	15	430	R	6.2	9.8
C-162-SED-3	C10258	14-Sep-99	0	2	4.5	76	0.49 B	ND(0.050)	9.7 J	7.5	13	1100	R	6.8	16
C-162-SED-3	C10261	14-Sep-99	0	2	4.8	75	0.50	ND(0.040)	9.7 J	7.2	13	1000	R	6.6	15
C-162-SED-3	C10259	14-Sep-99	2	12	4.5	85	0.55	ND(0.045)	9.8	7.4	12	1200	R	6.9	17
C-162-SED-3	C10260	14-Sep-99	12	22.5	2.7	110	0.72	ND(0.052)	8.4	5.9	8.5	360	R	6.2	12
C-162-SED-3	C10262	14-Sep-99	12	22.5	2.5	110	0.71	ND(0.052)	8.9	6.1	9.1	350	R	6.5	12
C-165-SED-2	C10269	14-Sep-99	0	2	3.3	39	0.31 B	0.58 B	13 J	5.9	8.2	340	R	4.4 B	7.5
C-165-SED-2	C10270	14-Sep-99	2	6	2.9	14	0.21 B	0.052 B	16	2.9	5.4	140	R	2.7	6.6
C-166-SED-6	C10271	15-Sep-99	0	2	8.7	100	0.85	ND(0.050)	17 J	9.1	14	330	R	11	31
C-166-SED-6	C10272	15-Sep-99	2	6	9.2	110	0.84	ND(0.050)	18	8.0	15	210	R	12	34
C-169-SED-5	C10027	19-Sep-99	0	2	4.8	97	0.61	0.51 B	23	7.2	25	730	R	8.2	16
C-169-SED-5	C10028	19-Sep-99	2	12	12	140	0.68	0.077 B	17	7.8	20	2100	R	10	36
C-169-SED-5	C10029	19-Sep-99	12	24	5.8	160	1.2	ND(0.052)	11	9.6	13	1300	R	9.8	22
C-169-SED-5	C10030	19-Sep-99	24	27	5.2	140	1.1	ND(0.050)	13	14	15	920	R	11	22
C-172-SED-2	C10283	21-Sep-99	0	2	7.3	130	1.0	0.90	41 J	13	36	1100	R	14	26
C-172-SED-2	C10284	21-Sep-99	2	12	8.1	140	1.0	1.6	36	12	43	1000	R	15	26
C-172-SED-2	C10285	21-Sep-99	12	15.5	7.3	200	0.95	2.4	30	11	45	900	R	13	22
C-174-SED-5	C10286	20-Sep-99	0	2	5.9	110	0.76	0.71 B	29 J	9.2	28	650	R	11	19
C-174-SED-5	C10287	20-Sep-99	2	12	6.3	79	0.51 B	0.69	19	7.2	21	670	R	6.7	15
C-174-SED-5	C10288	20-Sep-99	12	21	4.0	77	0.47	ND(0.045)	11	6.3	11	840	R	5.4	20

See notes on page 3.

Table 3-10

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Choccolocco Creek Metal Analysis Data

Location ID	Sample ID	Date	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Vanadium (mg/kg)
C-176-SED-2	C10031	20-Sep-99	0	2	1.8	57	0.39 B	ND(0.050)	7.5	4.5	6.3	190	R	4.0 B	7.9
C-176-SED-2	C10032	20-Sep-99	2	12	1.9	59	0.42 B	ND(0.045)	7.1	4.5	6.6	190	R	4.1 B	8.2
C-176-SED-2	C10033	20-Sep-99	12	24	1.2 B	42	0.36 B	ND(0.048)	4.9	4.0	3.5	88	R	3.0 B	5.6
C-176-SED-2	C10034	20-Sep-99	24	28.5	1.2	42	0.34 B	ND(0.043)	4.5	4.2	4.3	99	R	3.0 B	5.5
C-177-SED-2	C10289	19-Sep-99	0	2	3.7	39	0.30 B	0.40 B	16 J	4.0	10	230	R	3.6 B	8.4
C-177-SED-2	C10290	19-Sep-99	2	12	3.6	80	0.53	ND(0.044)	12	6.8	11	120	R	7.9	22
C-177-SED-2	C10291	19-Sep-99	12	19	5.3	81	0.42 B	ND(0.043)	11	13	16	1000	R	7.7	26
C-180-SED-4	C10292	18-Sep-99	0	2	7.3	130	0.95	0.63 B	33 J	12	35	700	R	13	24
C-180-SED-4	C10293	18-Sep-99	2	12	7.1	140	0.95	1.2	30	12	39	780	R	14	25
C-180-SED-4	C10294	18-Sep-99	12	24	6.7	170	0.79	1.4	40	10	34	1200	R	13	27
C-180-SED-4	C10295	18-Sep-99	24	30.5	4.3	72	0.55	ND(0.044)	10	7.5	11	160	R	6.5	17
C-182-SED-4	C10035	17-Sep-99	0	2	4.8	110	0.68	0.42 B	27	8.1	26	480	R	10	20
C-182-SED-4	C10036	17-Sep-99	2	6.5	3.2	74	0.41 B	0.69	17	5.3	17	210	R	6.4	15
C-U3-SED-4	C10001	14-Apr-99	0	2	4.1 J	110 J	0.62 J	ND(0.070) J	10 J	7.8 J	16 J	740 J	R	6.5 J	14 J
C-U3-SED-4	C10002	14-Apr-99	2	12	3.8 J	96 J	0.59 J	ND(0.062) J	11 J	6.7 J	14 J	290 J	R	7.1 J	18 J
C-U3-SED-4	C10003	14-Apr-99	12	25	2.9 J	82 J	0.55 J	ND(0.065) J	10 J	7.3 J	9.8 J	160 J	R	6.7 J	19 J
C-U4-SED-1	C10328	16-Dec-99	0	2	2.9	23	ND(0.29)	ND(0.032)	5.3 JEN*	2.5 JN	2.5	73 JN*	0.0098 BJN*	2.2 BE	3.6 JN*
C-U4-SED-1	C10329	16-Dec-99	2	8.5	2.0	19	ND(0.30) E	ND(0.034)	9.9 JEN*	2.3 JN	3.0	51 JN*	0.0099 BJN*	2.5 BE	4.0 JN*
C-U4-SED-1	C10337	16-Dec-00	2	8.5	2.2	19	ND(0.36) E	ND(0.036)	10 JEN*	2.4 JN	2.8	56 JN*	ND(0.0060) JN*	2.2 BE	3.9 JN*
C-U4-SED-1	C10337	16-Dec-99	2	8.5	2.2	19	ND(0.36) E	ND(0.036)	10 JEN*	2.4 JN	2.8	56 JN*	ND(0.0060) JN*	2.2 BE	3.9 JN*
C-U4-SED-2	C10330	16-Dec-99	0	2	3.4	32	ND(0.43) E	ND(0.039)	6.3 JEN*	4.1 JN	3.7	260 JN*	0.010 BJN*	3.5 BE	5.2 JN*
C-U4-SED-2	C10331	16-Dec-99	2	4	2.7	17	ND(0.30) E	ND(0.032)	3.6 JEN*	2.2 JN	2.0	110 JN*	0.0092 BJN*	1.8 BE	3.4 JN*
C-U4-SED-3	C10332	16-Dec-99	0	2	3.7	26	ND(0.37) E	ND(0.032)	5.4 JEN*	2.9 JN	3.3	400 JN*	0.012 JN*	2.3 BE	4.7 JN*
C-U4-SED-3	C10333	16-Dec-99	2	12	18	55	2.5 JE	0.16 B	12 JEN*	36 JN	19	87 JN*	0.085 JN*	33 JE	26 JN*
C-U4-SED-3	C10334	16-Dec-99	12	17.5	22	57	2.6 JE	0.081 B	12 JEN*	19 JN	15	64 JN*	0.087 JN*	24 JE	20 JN*
C-U4-SED-4	C10335	16-Dec-99	0	2	16	40	1.9 JE	ND(0.038)	25 JEN*	19 JN	22	610 JN*	0.066 JN*	14 JE	29 JN*
C-U4-SED-4	C10336	16-Dec-99	2	5	10	31	1.5 JE	ND(0.035)	7.6 JEN*	12 JN	12	350 JN*	0.047 JN*	12 JE	13 JN*

See notes on page 3.

Table 3-10

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Choccolocco Creek Metal Analysis Data

Notes:

J - The compound/analyte was positively identified; however, the associated numerical value is an estimated concentration only.
N - The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
B - The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
E - The compound was quantitated above the calibration range.
* - Duplicate analysis not within control limit.
R - The sample results were rejected.
ND (500) - Not detected. Number in parentheses denotes the quantitation limit.

Table 3-11

Solutia Inc.
Anniston, Alabama
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Snow Creek Sediment Deposit Characteristics

General Description	Area[2]	Area Description[3]	Sediment Deposit	Depositional Environment[4]	Approx. Surface Area (ft^2)	Average Depth to Refusal (ft)	Predominant Sediment Type(s) and Field Observations
Snow Creek from confluence of 11th St. Ditch to closed bridge at W. 9th St.	1	Upper stretch has low right banks becoming steep. Left banks are steep throughout with few areas of erosion. Channel deposits consist of tight fine sand and clay in the upper section with fine sand to very coarse sand, gravel, rock over clay below.	1	terrace deposit	1000	1.3	dark brown silt and fine to medium sand, trace coarse sand over gravel, rock/silt along edge of channel, slight oil sheen
			2	low terrace deposit	162	0.3	sand, silt, and railroad bedding gravels washed down by the steep bank
			3	low terrace/ aggrading bar	280	0.8	fine to very coarse sands, gravels, rocks
			4	low terrace deposit	900	0.8	mixture fine to very coarse sand, silts, gravels, rocks; silt and fine sand along edge of channel/terrace
			5	low terrace	180	0.3	silt, fine sand, aquatic plant roots over rock, gravel
			6	channel deposit	48	1.5	brown fine sand, little silt, oil sheen
			7	channel deposit	144	1.5	soft silt over silt and fine sand, heavy oil sheen, strong organic odor behind RR tie in creek
			8	drainage ditch outlet/ 2nd channel during high flow	75	1.0	soft brown silt over fine sand and clay, grey with black staining
			9	aggrading bar	36	0.5	fine sand to very coarse sand, gravel, trace silt, oil sheen, organic odor
			10	low terrace	45	1.5	soft dark brown silt over tan fine sandy clay, oil sheen
			11A	low terrace deposit with secondary channel	120	0.5	brown silt and fine sand over dark brown silt, fine to medium sand, small gravel
			11B	low terrace deposit with secondary channel	600	0.5	brown silt and fine sand over dark brown silt, fine to medium sand, small gravel with some medium size gravel
			12	low terrace/ channel deposit	675	0.5	fine to medium sand, trace coarse sand, orange brown upper part, bottom part fine sand and silt
			13	sand bar deposit	20	1.2	fine sand to very coarse sand, gravel
			14	bank deposit/ high terrace	1000	0.2-0.3	fine sand to very coarse sand, gravel, rocks

See notes on page 6.

Table 3-11

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Snow Creek Sediment Deposit Characteristics

General Description	Area[2]	Area Description[3]	Sediment Deposit	Depositional Environment[4]	Approx. Surface Area (ft^2)	Average Depth to Refusal (ft)	Predominant Sediment Type(s) and Field Observations
	1 (cont'd)		15	channel deposit/ aggrading bar	225	0.6	fine sand to very coarse sand, gravels, small to medium rock
			16	bank deposit/ high terrace	750	0.9	mostly fine sand, some medium to coarse sand, gravels, rock
			17	aggrading bar	192	1.0	medium sand to very coarse sand, gravels, small/medium rock
Snow Creek from closed bridge at W. 9th St. to Railroad bridge at southwest corner of Calhoun Co. Jail	2	Steep right and left banks with few areas of erosion. Channel deposit consists of fine to very coarse sand, gravel, rock, and cobble. Limited deposition.	1	channel deposit	270	1.0	brown medium to very coarse sand, some gravels
			2	exposed channel deposit/ aggrading bar	1000	0.5	dark brown to black silt with fine to medium sand, some coarse sand, gravels
			3A	channel deposit/ aggrading bars	100	0.3	silt, fine to very coarse sand, gravel over rock
			3B	channel deposit/ aggrading bar	150	0.5	fine sand to coarse sand
			4A	aggrading bar	125	0.5	fine sand to medium sand, trace silt
			4B	aggrading bar	150	0.5	fine sand to coarse sand, trace silt over rock
			5	aggrading bar above culvert pipes	2600	2.0 - 3.0	fine sand to very coarse sand, gravel, small to large rocks 1"-4"
			6	exposed sediment built up in culvert pipes	14400	2.0 - 4.0	fine sand to very coarse sand, gravels
			7	channel deposit/ aggrading bar	756	0.3-0.4	fine sand, some silt, medium to coarse sand, gravel
			8	channel deposit/ aggrading bar	4800	1.0	fine sand to very coarse sand, gravels, small rock
			9	bank deposit/ channel deposit	120	0.4	fine sand to coarse sand
			10	low terrace/ bank deposit	60	0.3	fine sand to very coarse sand, gravels
			11	channel deposit	216	0.6	fine sand to very coarse sand
			12	channel deposit/ low terrace	100	0.5	fine sand to very coarse sand, gravels

See notes on page 6.

Table 3-11

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Snow Creek Sediment Deposit Characteristics

General Description	Area[2]	Area Description[3]	Sediment Deposit	Depositional Environment[4]	Approx. Surface Area (ft^2)	Average Depth to Refusal (ft)	Predominant Sediment Type(s) and Field Observations
	2 (cont'd)		13	channel deposit/ aggrading bar	640	0.5	fine sand to medium sand, gravels, rock, some silt
			14	aggrading bar	225	0.5	fine sand to very coarse sand, gravels, rock
			15	aggrading bar/ channel deposit	84	0.6	fine sand to very coarse sand, trace silt, organics
			16	channel deposit	750	2.0-3.0	mostly fine to medium sand, debris, some coarse sand, gravels
Snow Creek from Railroad bridge at southwest corner of Calhoun Co. Jail to end of concrete spillway	3	Snow Creek is channelized in a concrete structure with steep walls with a cobble to concrete slab bottom. Numerous outfall pipes noted. Limited channel deposits consist of medium sand to very coarse sand, gravel.	1	channel deposit	480	0.5	fine sand to coarse sand, some silt, some gravels, little medium size rocks
			2	low terrace deposit	800	1.0	fine sand, some medium to coarse sand, some silt
			3	terrace/channel deposit	225	0.5	fine sand to medium sand, trace coarse sand, gravels
			4	channel deposit	270	0.3	fine to coarse sand, some silt, vegetated along right bank, appears to have been dumped from side of channel
			5	channel deposit/ low terrace	100	1.0	fine sand and silt, trace medium to coarse sand
			6	channel deposit	100	0.5	mostly fine sand, trace medium to coarse sand
			7	aggrading bar	2000	0.5-1.0	mostly fine sand to coarse sand, little silt, some very coarse sand, gravels, small to large stone
Snow Creek from end of concrete spillway to above Sandy Lumber Co. Property	4	Steep right and left banks. Right bank is partially lined with concrete. Limited channel deposits consist of coarse sand to very coarse sand, gravel, rock, cobble, with areas of weathered bedrock bottom.	1	aggrading bar	75	0.4	medium sand to very coarse sand, gravels, rock, cobble, debris
			2	high terrace	192	0.5	fine sand with silt over medium sand to very coarse sand, gravels, rock

See notes on page 6.

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Snow Creek Sediment Deposit Characteristics

General Description	Area[2]	Area Description[3]	Sediment Deposit	Depositional Environment[4]	Approx. Surface Area (ft^2)	Average Depth to Refusal (ft)	Predominant Sediment Type(s) and Field Observations
Snow Creek from below Sandy Lumber Co. Property to Snow Street Bridge	5	Moderate to very steep right banks, few eroded areas with numerous aggrading bars/channel deposits. Left banks steep, mostly channelized. Channel deposits consist of medium sand to very coarse sand, gravels, rocks, small cobbles.	1	high terrace/ bank deposit	960	0.7	fine sand, some medium sand, some very coarse sand, gravels, rock
			2	low terrace	30	0.4	fine sand, silt along left bank over rock, gravels
			3	high terrace/ bank deposit	315	0.8	silt and fine sand over fine sand, trace medium sand
			4	low to high terrace/ channel deposit	2250	2.0-4.0	fine sand to coarse sand up high, medium to very coarse sand, gravels, rock, stone
			5	aggrading bar	2600	1.5	medium sand to very coarse sand, gravels, rock
			6	aggrading bar/ channel deposit	330	0.5	fine sand to very coarse sand, gravels, some silt, organic matter, leaves
			7	aggrading bar/ channel deposit	1920	0.2	mostly gravel, rock over some coarse sand to very coarse sand
			8A	aggrading bar	735	0.6	medium to very coarse sand, gravels, rock
			8B		900	0.4	medium sand to very coarse sand, gravels, rock
			9	aggrading bar	1350	0.5	medium to very coarse sand, gravels, rock 1"-6"
			10	aggrading bar/ low terrace	500	0.7	medium sand to very coarse sand, gravels, rock, cobble
			11A	sand mound	96	4.0	fine sand over coarse sand to very coarse sand, gravels
			11B	sand mound	96	4.0	fine sand over coarse sand to very coarse sand, gravels
			12A	aggrading bar	240	1.0	medium sand to very coarse sand, gravel
			12B	aggrading bar	175	1.0	medium sand to very coarse sand, gravel
			13	aggrading bar/ low terrace	3300	0.9	fine sand to very coarse sand, gravels, rock, few cobbles
			14	aggrading bar/ low terrace	7800	1.5	coarse sand to very coarse sand, gravel; fine sand some medium sand on terrace; medium to very coarse sand, gravels/ rock on aggrading bar

See notes on page 6.

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Snow Creek Sediment Deposit Characteristics

General Description	Area[2]	Area Description[3]	Sediment Deposit	Depositional Environment[4]	Approx. Surface Area (ft^2)	Average Depth to Refusal (ft)	Predominant Sediment Type(s) and Field Observations
	5 (cont'd)		15	aggrading bar/ low terrace	3120	0.5	coarse to very coarse sand, gravels, rock, small cobble; low terrace has fine sand over small cobble
			16	aggrading bar	3750	0.5	fine sand to very coarse sand, gravel, rock
			17	aggrading bar	3000	0.5	coarse sand to very coarse sand, gravel, rock
			18	aggrading bar	3000	0.5	coarse sand to very coarse sand, gravel, rock
			19	aggrading bar	3000	0.8	medium sand to very coarse sand, gravel, rock
			20	aggrading bar	1000	0.6	coarse sand to very coarse sand, gravel, rock
			21	aggrading bar	175	0.9	fine sand to very coarse sand, gravel
			22	aggrading bar	1200	0.8	fine sand to very coarse sand, gravel
			23	aggrading bar	150	1.2	coarse sand to very coarse sand, gravel, rock
			24	channel deposit	240	2.0	medium to very coarse sand, gravel
			25	aggrading bar/ sand bar	150	0.9	fine sand to coarse sand, little gravel
Snow Creek from Highway 78 to confluence of Choccoloco Creek	6	Moderate to steep right and left banks with erosion noted along both banks. Channel deposits are mostly medium sand to very coarse sand, gravel, rock with numerous aggrading bars.	1	aggrading bar	2805	0.5-1.0	fine sand to very coarse sand, gravel, rock
			2	channel deposit	20	1.2	fine sand with silt over coarse sand to very coarse sand, gravel
			3	channel deposit/bank wash	180	1.1	mostly fine sand, little clay, gravel
			4	channel deposit	250	0.5	medium sand to very coarse sand, gravel, rock, little fine sand
			5	high terrace	108	1.5	fine sand and silt over very coarse sand, gravel
			6	aggrading bar	2625	0.5	fine sand to very coarse sand, gravel, rock
			7	channel deposit	180	0.5	fine sand with silt over coarse sand to very coarse sand, gravel
			8	channel deposit	72	1.0	fine sand to very coarse sand, gravel
			9	aggrading bar/ low terrace	660	0.5	fine sand, silt and clay on terrace; coarse sand to very coarse sand, gravel, rock on bar
			10	low to high terrace	1200	0.5	fine sand with silt over coarse sand to very coarse sand, gravel
			11	aggrading bar/ rock shelf/ channel deposit	320	0.4	medium sand to very coarse sand, gravel, rock, bedrock
			12	aggrading bar/ channel deposit	1300	0.3	coarse sand to very coarse sand, gravel, rock
			13	aggrading bar	175	3.0	medium sand to very coarse sand over brown silt, clay with fine sand of fine sand over fine sand

See notes on page 6.

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Snow Creek Sediment Deposit Characteristics

General Description	Area[2]	Area Description[3]	Sediment Deposit	Depositional Environment[4]	Approx. Surface Area (ft^2)	Average Depth to Refusal (ft)	Predominant Sediment Type(s) and Field Observations
			14	aggrading bar/channel deposit	360	0.4	coarse to very coarse sand, gravel
			15	aggrading bar/ low terrace	1800	1.0	fine sand, silt, clay - terrace; medium to very coarse sand, gravel, rock - aggrading bar
			16	aggrading bar/ sand bar	120	0.5	medium to very coarse sand, gravel over rock
			17	island/ aggrading bar	2900	1.0-1.5	medium to very coarse sand, gravel, rock; fine sand in island area
			18	aggrading bar	1200	0.5	medium to very coarse sand, gravel
			19	aggrading bar	900	0.4	medium to very coarse sand, gravel, little fine sand
			20	aggrading bar	450	0.3	medium sand to very coarse sand, gravel, rock
			21	aggrading bar	3750	1.0-2.0	fine to very coarse sand, gravel, rock
			22	aggrading bar	280	0.5	medium sand to very coarse sand, gravel
			23	aggrading bar/ bank deposit	800	0.8	medium sand to very coarse sand, gravel, little fine sand, clay
			24	aggrading bar	192	0.8	fine sand to very coarse sand, gravel
			25	aggrading bar/ low terrace	1980	3.0-3.5	coarse sand to very coarse sand, gravel; mostly fine sand with medium sand up high
			26	bank deposit/ bank wash	500	6.0	red brown clay, little fine sand
			27	aggrading bar/ terrace deposit	2520	3.0-3.5	fine sand to very coarse sand, gravel , small rock
			28	bank deposit/ low terrace	210	1.0	fine sand to very coarse sand, gravel

Notes:

1. The probing/reconnaissance effort of Snow Creek from the confluence of the 11th Street Ditch to Choccoloco Creek was conducted by Blasland & Bouck & Lee, Inc. on September 20-21, 1999 in accordance with the approved Work Plan.
2. Snow Creek was divided into individual areas and illustrated on aerial photographs to facilitate the characterization of the creek.
3. The area descriptions are the main characteristics of the individual areas.
4. The type of depositional environment (channel deposit, terrace deposit, bank slope, aggrading bar, secondary channels and areas of limited deposition) identified in the individual areas.

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Summary of Snow Creek Deposit Characteristics

Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
1	17	medium sand to very coarse sand, gravels, small/medium rock	aggrading bar	192	1.0	7	
1	13	fine sand to very coarse sand, gravel	aggrading bar	20	1.2	1	
1	9	fine sand to very coarse sand, gravel, trace silt, oil sheen, organic odor	aggrading bar	36	0.5	1	
1	15	fine sand to very coarse sand, gravels, small to medium rock	channel	225	0.6	5	
1	7	soft silt over silt and fine sand, heavy oil sheen, strong organic odor behind RR tie in creek	channel	144	1.5	8	1
1	6	brown fine sand, little silt, oil sheen	channel	48	1.5	3	
1	8	soft brown silt over fine sand and clay, grey with black staining	drainage	75	1.0	3	1
1	11B	brown silt and fine sand over dark brown silt, fine to medium sand, small gravel with some medium size gravel	terrace	600	0.5	11	1
1	11A	brown silt and fine sand over dark brown silt, fine to medium sand, small gravel	terrace	120	0.5	2	1
1	16	mostly fine sand, some medium to coarse sand, gravels, rock	terrace	750	0.9	25	1
1	14	fine sand to very coarse sand, gravel, rocks	terrace	1000	0.3	9	
1	12	fine to medium sand, trace coarse sand, orange brown upper part, bottom part fine sand and silt	terrace	675	0.5	13	1
1	10	soft dark brown silt over tan fine sandy clay, oil sheen	terrace	45	1.5	3	1

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Summary of Snow Creek Deposit Characteristics

Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
1	5	silt, fine sand, aquatic plant roots over rock, gravel	terrace	180	0.3	2	1
1	4	mixture fine to very coarse sand, silts, gravels, rocks; silt and fine sand along edge of channel/terrace	terrace	900	0.8	27	1
1	3	fine to very coarse sands, gravels, rocks	terrace	280	0.8	8	
1	2	sand, silt, and railroad bedding gravels washed down by the steep bank	terrace	162	0.3	2	1
1	1	dark brown silt and fine to medium sand, trace coarse sand over gravel, rock/silt along edge of channel, slight oil sheen	terrace	1000	1.3	48	1
2	4B	fine sand to coarse sand, trace silt over rock	aggrading bar	150	0.5	3	
2	4A	fine sand to medium sand, trace silt	aggrading bar	125	0.5	2	
2	15	fine sand to very coarse sand, trace silt, organics	aggrading bar	84	0.6	2	
2	14	fine sand to very coarse sand, gravels, rock	aggrading bar	225	0.5	4	
2	5	fine sand to very coarse sand, gravel, small to large rocks 1"-4"	aggrading bar	2600	2.5	241	1
2	2	dark brown to black silt with fine to medium sand, some coarse sand, gravels	aggrading bar	1000	0.5	19	1

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Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
2	3B	fine sand to coarse sand	channel	150	0.5	3	
2	3A	silt, fine to very coarse sand, gravel over rock	channel	100	0.3	1	1
2	16	mostly fine to medium sand, debris, some coarse sand, gravels	channel	750	2.5	69	1
2	13	fine sand to medium sand, gravels, rock, some silt	channel	640	0.5	12	
2	12	fine sand to very coarse sand, gravels	channel	100	0.5	2	
2	11	fine sand to very coarse sand	channel	216	0.6	5	
2	8	fine sand to very coarse sand, gravels, small rock	channel	4800	1.0	178	1
2	7	fine sand, some silt, medium to coarse sand, gravel	channel	756	0.4	10	
2	1	brown medium to very coarse sand, some gravels	channel	270	1.0	10	
2	6	fine sand to very coarse sand, gravels	exposed sediment in culvert pipes	14400	3.0	1600	3
2	10	fine sand to very coarse sand, gravels	terrace	60	0.3	1	
2	9	fine sand to coarse sand	terrace	120	0.4	2	
3	7	mostly fine sand to coarse sand, little silt, some very coarse sand, gravels, small to large stone	aggrading bar	2000	0.8	56	1
3	6	mostly fine sand, trace medium to coarse sand	channel	100	0.5	2	

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Summary of Snow Creek Deposit Characteristics

Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
3	5	fine sand and silt, trace medium to coarse sand	channel	100	1.0	4	1
3	4	fine to coarse sand, some silt, vegetated along right bank, appears to have been dumped from side of channel	channel	270	0.3	3	
3	1	fine sand to coarse sand, some silt, some gravels, little medium size rocks	channel	480	0.5	9	1
3	3	fine sand to medium sand, trace coarse sand, gravels	terrace	225	0.5	4	
3	2	fine sand, some medium to coarse sand, some silt	terrace	800	1.0	30	1
4	1	medium sand to very coarse sand, gravels, rock, cobble, debris	aggrading bar	75	0.4	1	
4	2	fine sand with silt over medium sand to very coarse sand, gravels, rock	terrace	192	0.5	3	1
5	8B	medium sand to very coarse sand, gravels, rock	aggrading bar	900	0.4	13	
5	8A	medium to very coarse sand, gravels, rock	aggrading bar	735	0.6	16	
5	12B	medium sand to very coarse sand, gravel	aggrading bar	175	1.0	6	
5	12A	medium sand to very coarse sand, gravel	aggrading bar	240	1.0	9	

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Summary of Snow Creek Deposit Characteristics

Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
5	11B	fine sand over coarse sand to very coarse sand, gravels	aggrading bar	96	4.0	14	
5	11A	fine sand over coarse sand to very coarse sand, gravels	aggrading bar	96	4.0	14	
5	25	fine sand to coarse sand, little gravel	aggrading bar	150	0.9	5	
5	23	coarse sand to very coarse sand, gravel, rock	aggrading bar	150	1.2	7	
5	22	fine sand to very coarse sand, gravel	aggrading bar	1200	0.8	36	
5	21	fine sand to very coarse sand, gravel	aggrading bar	175	0.9	6	
5	20	coarse sand to very coarse sand, gravel, rock	aggrading bar	1000	0.6	22	
5	19	medium sand to very coarse sand, gravel, rock	aggrading bar	3000	0.8	89	
5	18	coarse sand to very coarse sand, gravel, rock	aggrading bar	3000	0.5	56	
5	17	coarse sand to very coarse sand, gravel, rock	aggrading bar	3000	0.5	56	
5	16	fine sand to very coarse sand, gravel, rock	aggrading bar	3750	0.5	69	
5	15	coarse to very coarse sand, gravels, rock, small cobble; low terrace has fine sand over small cobble	aggrading bar	3120	0.5	58	
5	14	coarse sand to very coarse sand, gravel; fine sand some medium sand on terrace; medium to very coarse sand, gravels/ rock on aggrading bar	aggrading bar	7800	1.5	433	2
5	13	fine sand to very coarse sand, gravels, rock, few cobbles	aggrading bar	3300	0.9	110	1

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Summary of Snow Creek Deposit Characteristics

Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
5	10	medium sand to very coarse sand, gravels, rock, cobble	aggrading bar	500	0.7	13	
5	9	medium to very coarse sand, gravels, rock 1"-6"	aggrading bar	1350	0.5	25	
5	7	mostly gravel, rock over some coarse sand to very coarse sand	aggrading bar	1920	0.2	14	
5	6	fine sand to very coarse sand, gravels, some silt, organic matter, leaves	aggrading bar	330	0.5	6	1
5	5	medium sand to very coarse sand, gravels, rock	aggrading bar	2600	1.5	144	1
5	24	medium to very coarse sand, gravel	channel	240	2.0	18	1
5	4	fine sand to coarse sand up high, medium to very coarse sand, gravels, rock, stone	terrace	2250	3.0	250	1
5	3	silt and fine sand over fine sand, trace medium sand	terrace	315	0.8	9	1
5	2	fine sand, silt along left bank over rock, gravels	terrace	30	0.4	0	1
5	1	fine sand, some medium sand, some very coarse sand, gravels, rock	terrace	960	0.7	25	1
6	27	fine sand to very coarse sand, gravel , small rock	aggrading bar	2520	3.3	303	1
6	25	coarse sand to very coarse sand, gravel; mostly fine sand with medium sand up high	aggrading bar	1980	3.3	238	1
6	24	fine sand to very coarse sand, gravel	aggrading bar	192	0.8	6	
6	23	medium sand to very coarse sand, gravel, little fine sand, clay	aggrading bar	800	0.8	24	1

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Summary of Snow Creek Deposit Characteristics

Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
6	22	medium sand to very coarse sand, gravel	aggrading bar	280	0.5	5	
6	21	fine to very coarse sand, gravel, rock	aggrading bar	3750	1.5	208	1
6	20	medium sand to very coarse sand, gravel, rock	aggrading bar	450	0.3	5	
6	19	medium to very coarse sand, gravel, little fine sand	aggrading bar	900	0.4	13	
6	18	medium to very coarse sand, gravel	aggrading bar	1200	0.5	22	
6	17	medium to very coarse sand, gravel, rock; fine sand in island area	aggrading bar	2900	1.3	134	1
6	16	medium to very coarse sand, gravel over rock	aggrading bar	120	0.5	2	
6	15	fine sand, silt, clay - terrace; medium to very coarse sand, gravel, rock - aggrading bar	aggrading bar	1800	1.0	67	1
6	14	coarse to very coarse sand, gravel	aggrading bar	360	0.4	5	
6	13	medium sand to very coarse sand over brown silt, clay with fine sand of fine sand over fine sand	aggrading bar	175	3.0	19	1
6	12	coarse sand to very coarse sand, gravel, rock	aggrading bar	1300	0.3	14	
6	11	medium sand to very coarse sand, gravel, rock, bedrock	aggrading bar	320	0.4	5	

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Summary of Snow Creek Deposit Characteristics

Area	Sediment Deposit	Predominant Sediment Type(s)	Depositional Environment	Approximate Surface Area (ft2)	Average Depth to Refusal (ft)	Estimated Volume (cy)	Number of Cores Analyzed
6	9	fine sand, silt and clay on terrace; coarse sand to very coarse sand, gravel, rock on bar	aggrading bar	660	0.5	12	1
6	6	fine sand to very coarse sand, gravel, rock	aggrading bar	2625	0.5	49	
6	1	fine sand to very coarse sand, gravel, rock	aggrading bar	2805	0.8	78	1
6	8	fine sand to very coarse sand, gravel	channel	72	1.0	3	
6	7	fine sand with silt over coarse sand to very coarse sand, gravel	channel	180	0.5	3	1
6	4	medium sand to very coarse sand, gravel, rock, little fine sand	channel	250	0.5	5	1
6	3	mostly fine sand, little clay, gravel	channel	180	1.1	7	1
6	2	fine sand with silt over coarse sand to very coarse sand, gravel	channel	20	1.2	1	1
6	28	fine sand to very coarse sand, gravel	terrace	210	1.0	8	
6	26	red brown clay, little fine sand	terrace	500	6.0	111	1
6	10	fine sand with silt over coarse sand to very coarse sand, gravel	terrace	1200	0.5	22	1
6	5	fine sand and silt over very coarse sand, gravel	terrace	108	1.5	6	1

Table 3-13

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Estimated Sediment Volume (cy) by Strata in Snow Creek

Reach	Depositional Environment				
	Aggrading Bar	Channel	Terrace	Other[1]	Total
11th St Ditch to 9th St Bridge	8.7	16	150	2.8	178
9th St Bridge to RR Bridge	270	289	2.4	1600	2161
RR Bridge to Concrete Spillway	57	17	34		108
Concrete Spillway	1.1		3.2		4.3
Concrete Spillway to Snow St Bridge	1222	18	285		1525
Hwy 78 Bridge to Choccolocco Creek Confluence	1211	19	147		1377
Whole Creek Total	2770	359	622	1603	5353

[1] "Other" represents sediments in culvert pipes and drainageways

Table 3-14

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Distribution of Snow Creek Cores Collected By Sediment Deposit Strata

Geographic Reach	Aggrading Bar Deposits	Channel Deposits	Terrace Deposits	Other Deposits	Totals
11th St Ditch to W. 9th St. Bridge	0/3	1/3	9/11	1/1 [1]	11/18
W. 9th St Bridge to RR Bridge at SW Corner of Calhoun Co. Jail	2/6	3/9	0/2	3/1 [2]	8/18
RR Bridge to End of Concrete Spillway	1/1	2/4	1/2	--	4/7
Concrete Spillway to Above Sandy Lumber Co. Property	0/1	--	1/1	--	1/2
Sandy Lumber Co. Property to Snow Street Bridge	5/23	1/1	4/4	--	10/28
Highway 78 to Choccolocco Creek Confluence	9/19	4/5	3/4	--	16/28
Total	17/53	11/22	18/24	4/2	50/101

Notes:

2/9 would indicate 2 cores were collected from 9 sediment deposits

1 Drainage ditch outlet acting as 2nd channel during high flow.

2 Exposed sediment built up in culvert pipes - 3 cores will be collected form this deposit.

Table 3-15

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Summary of Snow Creek Sediment Data

Field Sample ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Sediment Deposit Strata	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
14-SED-1 (0-2)	S10001	0	2		background	ND(0.0062)		0.40 J
14-SED-1 (2-8)	S10002	2	8		background	0.045		ND(0.081)
14-SED-2 (0-2)	S10003	0	2		background	0.035		0.41
14-SED-2 (2-8)	S10004	2	8		background	0.032		0.45 J
14-SED-2 (8-15)	S10005	8	15		background	0.028		0.064 J
14-SED-3 (0-2)	S10006	0	2		background	ND(0.0054)		0.24
14-SED-3 (2-9)	S10007	2	9		background	0.031		0.11 J
14-SED-3 (9-14)	S10008	9	14		background	0.039		ND(0.082)
14-SED-4 (0-2)	S10009	0	2		background	0.055		0.97
14-SED-4 (2-4)	S10010	2	4		background	0.023		0.14
14-SED-4 (4-15)	S10011	4	15		background	0.03		ND(0.082)
16-SED-1 (0-2)	S10012	0	2		background	0.011 B		ND(0.083)
16-SED-1 (2-7)	S10013	2	7		background	0.029		ND(0.077)
16-SED-2 (0-2)	S10014	0	2		background	0.013 B		ND(0.082)
16-SED-2 (2-8)	S10015	2	8		background	0.020 B		ND(0.079)
16-SED-3 (0-2)	S10016	0	2		background	0.0081 B		0.043 J
16-SED-3 (2-7)	S10017	2	7		background	0.013 B		ND(0.079)
16-SED-4 (0-2)	S10018	0	2		background	0.11		0.24 J
16-SED-4 (2-6.5)	S10019	2	6.5		background	0.017 B		ND(0.078)
S-SED-DUP-1	S10020	2	7		background	0.0083 B		

See notes on page 7.

Table 3-15

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Summary of Snow Creek Sediment Data

Field Sample ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Sediment Deposit Strata	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
S-1-01 (0-2)	S10021	0	2	fine	terrace	ND(0.013)	24000	3.8 J
S-1-01 (2-8)	S10022	2	8	fine	terrace	8.6 J	33000	31 J
S-1-02 (0-2)	S10023	0	2	fine	terrace		17000	8
S-1-04 (0-2)	S10024	0	2	fine	terrace	0.26 N	91000	14
S-1-04 (2-5)	S10025	2	5	fine	terrace	1.3 J	7900	17
S-1-05 (0-2)	S10026	0	2	fine	terrace		36000	11 J
S-1-07 (0-2)	S10027	0	2	fine	channel		59000	16 J
S-1-07 (2-12)	S10028	2	12	fine	channel		3200	1.2 J
S-1-07 (12-23)	S10029	12	23	fine	channel		ND(500)	ND(0.17)
S-1-08 (0-2)	S10030	0	2	fine	other		70000	32 J
S-1-08 (2-12)	S10031	2	12	fine	other		27000	12
S-SED-D1	S10032	2	12	fine	other		28000	4.3
S-1-08 (12-14.5)	S10033	12	14.5	fine	other		57000	37 J
S-1-10 (0-2)	S10034	0	2	fine	terrace		44000	12 J
S-1-10 (2-12)	S10035	2	12	fine	terrace		46000	29 J
S-1-10 (12-16.5)	S10036	12	16.5	fine	terrace		44000	18
S-1-11A (0-2)	S10037	0	2	fine	terrace		6500	2.2
S-1-11A (2-12)	S10038	2	12	fine	terrace		ND(500)	ND(0.20)
S-1-11A (12-24)	S10039	12	24	fine	terrace		2700	0.39 J
S-1-11B (0-2.5)	S10040	0	2.5	coarse	terrace		18000	12

See notes on page 7.

Table 3-15

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of Snow Creek Sediment Data

Field Sample ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Sediment Deposit Strata	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
S-1-12 (0-2)	S10041	0	2	fine	terrace		7600	0.67
S-1-12 (2-5)	S10042	2	5	fine	terrace		ND(500)	2.1
S-1-16 (0-2)	S10043	0	2	coarse	terrace		2700	28
S-1-16 (2-5)	S10044	2	5	coarse	terrace		1200	32
S-2-02 (0-3.5)	S10045	0	3.5	fine	aggrading bar		16000	19
S-2-3A (0-3)	S10046	0	3	fine	channel	3.2 J*	12000	3.8
S-SED-D2	S10047	0	3	fine	channel	1.2 J*		
S-2-05 (0-2)	S10048	0	2	coarse	aggrading bar		ND(500)	5.4
S-2-05 (2-5)	S10049	2	5	coarse	aggrading bar		9600	6.4
S-2-08 (0-2)	S10050	0	2	coarse	channel		18000	20
S-2-08 (2-12)	S10051	2	12	coarse	channel		12000	20
S-2-08 (12-16)	S10052	12	16	coarse	channel		1600	4.0
S-2-06B (0-2)	S10053	0	2	coarse	other		ND(500)	13
S-2-06B (2-12)	S10054	2	12	coarse	other		1800	11
S-2-06B (12-20.5)	S10055	12	20.5	coarse	other		3000	34
S-2-06C (0-2)	S10056	0	2	coarse	other		2200	30
S-2-06C (2-12)	S10057	2	12	coarse	other		5000	14
S-2-06C (12-24)	S10058	12	24	coarse	other		5000	23
S-2-06C (24-27)	S10059	24	27	coarse	other		9600	15
S-2-06A (0-2)	S10060	0	2	coarse	other		12000	22

See notes on page 7.

Table 3-15

Solutia Inc.
Anniston, Alabama
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Summary of Snow Creek Sediment Data

Field Sample ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Sediment Deposit Strata	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
S-2-06A (2-5)	S10061	2	5	coarse	other		2700	8.9
S-2-16 (0-2)	S10062	0	2	coarse	channel		13000	4.0
S-2-16 (2-4)	S10063	2	4	coarse	channel		16000	3.3
S-3-01 (0-2)	S10064	0	2	coarse	channel		12000	3.3
S-3-01 (2-8)	S10065	2	8	coarse	channel		12000	4.8
S-3-02 (0-2)	S10066	0	2	coarse	terrace		22000	8.1
S-3-02 (2-12)	S10067	2	12	coarse	terrace		24000	11
S-3-02 (12-15.5)	S10068	12	15.5	coarse	terrace		32000	17
S-3-05 (0-2)	S10069	0	2	fine	channel		20000	1.4
S-3-05 (2-10.5)	S10070	2	10.5	fine	channel		11000	2.1
S-3-07 (0-2)	S10071	0	2	coarse	aggrading bar		9600	0.66
S-3-07 (2-8)	S10072	2	8	coarse	aggrading bar		18000	0.76
S-4-02 (0-2)	S10073	0	2	fine	terrace		15000	1.1
S-4-02 (2-4)	S10074	2	4	fine	terrace		3000	0.58 J
S-5-01 (0-3.5)	S10075	0	3.5	coarse	terrace		1400	0.65
S-SED-D4	S10076	0	3.5	coarse	terrace		ND(500)	0.76
S-5-02 (0-3.5)	S10077	0	3.5	fine	terrace		8700	4.5
S-5-03 (0-2)	S10078	0	2	fine	terrace		15000	5.8
S-5-03 (2-4)	S10079	2	4	fine	terrace		ND(500) J	1.6
S-5-04 (0-2)	S10080	0	2	coarse	terrace		ND(500) J	1.8

See notes on page 7.

Table 3-15

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of Snow Creek Sediment Data

Field Sample ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Sediment Deposit Strata	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
S-5-04 (2-6)	S10081	2	6	coarse	terrace		2300	1.9
S-5-05 (0-2)	S10082	0	2	coarse	aggrading bar		ND(500)	1.2
S-5-05 (2-4)	S10083	2	4	coarse	aggrading bar		ND(500)	1.9
S-5-06 (0-2)	S10084	0	2	fine	aggrading bar		ND(500)	2.7
S-5-06 (2-5)	S10085	2	5	fine	aggrading bar		ND(500)	2.3
S-5-13 (0-3.5)	S10086	0	3.5	coarse	aggrading bar		ND(500)	1.3
S-5-14A (0-2)	S10087	0	2	coarse	aggrading bar		1200	1.5
S-5-14A (2-5)	S10088	2	5	coarse	aggrading bar		ND(500)	0.92
S-5-14B (0-2)	S10089	0	2	coarse	aggrading bar		ND(500)	1.6
S-5-14B (2-5.5)	S10090	2	5.5	coarse	aggrading bar		ND(500)	1.6
S-5-24 (0-2)	S10091	0	2	coarse	channel		ND(500)	1.2
S-5-24 (2-12)	S10092	2	12	coarse	channel		ND(500)	1.2
S-6-01 (0-2)	S10093	0	2	coarse	aggrading bar		ND(500)	1.3
S-6-01 (2-12)	S10094	2	12	coarse	aggrading bar		ND(500)	4.7
S-6-02 (0-2)	S10095	0	2	fine	channel	0.51 N	4700	5.8
S-6-02 (2-5)	S10096	2	5	fine	channel	R	8300	5.6
S-6-03 (0-2)	S10097	0	2	fine	channel		36000	41 J
S-6-03 (2-12)	S10098	2	12	fine	channel		5600	7.3
S-SED-D5	S10099	2	12	fine	channel		4100	11 J
S-6-05 (0-2)	S10100	0	2	fine	terrace		13000	2.2 J

See notes on page 7.

Table 3-15

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of Snow Creek Sediment Data

Field Sample ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Sediment Deposit Strata	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
S-6-05 (2-6.5)	S10101	2	6.5	fine	terrace		19000	3.9
S-6-07 (0-2)	S10102	0	2	fine	channel		ND(500)	0.43
S-6-07 (2-12)	S10103	2	12	fine	channel		32000	0.077 J
S-6-07 (12-24)	S10104	12	24	fine	channel		32000	ND(0.22)
S-6-07 (24.26.5)	S10105	24	26.5	fine	channel		250000	ND(0.20)
S-6-09 (0-2)	S10106	0	2	fine	aggrading bar		3400	3.3
S-6-09 (2-6.5)	S10107	2	6.5	fine	aggrading bar		11000	2.1
S-6-10 (0-2)	S10108	0	2	fine	terrace	0.58 N	3100	1.5
S-6-10 (2-12)	S10109	2	12	fine	terrace	2.6 J	14000	4.9
S-6-13 (0-2)	S10110	0	2	fine	aggrading bar		5100	3.9
S-6-13 (2-7.5)	S10111	2	7.5	fine	aggrading bar		25000	8.1
S-6-15 (0-2)	S10112	0	2	fine	aggrading bar		ND(500)	1.3
S-6-15 (2-12.5)	S10113	2	12.5	fine	aggrading bar		13000	4.5
S-6-04 (0-3.5)	S10114	0	3.5	coarse	channel		1200	4.4
S-6-17 (0-2)	S10115	0	2	coarse	aggrading bar		8500	9.5
S-6-17 (2-10)	S10116	2	10	coarse	aggrading bar		16000	6.3
S-6-21 (0-2)	S10117	0	2	coarse	aggrading bar		5900	1.7
S-6-21 (2-4.5)	S10118	2	4.5	coarse	aggrading bar		6200	1.8
S-6-23 (0-2)	S10119	0	2	fine	aggrading bar		3600	1.1
S-6-23 (2-7)	S10120	2	7	fine	aggrading bar		9400	1.6

See notes on page 7.

Table 3-15

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of Snow Creek Sediment Data

Field Sample ID	Sample ID	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Textural Class	Sediment Deposit Strata	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
S-6-25 (0-2.5)	S10121	0	2.5	coarse	aggrading bar		5500	4.4
S-6-26 (0-2)	S10122	0	2	fine	terrace		9100	ND(0.17)
S-6-26 (2-12)	S10123	2	12	fine	terrace		10000	ND(0.18)
S-6-26 (12-24)	S10124	12	24	fine	terrace		7000	ND(0.17)
S-6-26 (24-33)	S10125	24	33	fine	terrace		3800	ND(0.17)
S-SED-D6	S10126	2	12	fine	terrace		8100	ND(0.17)
S-6-27 (0-2)	S10127	0	2	coarse	aggrading bar		2400	2.1
S-6-27 (2-12)	S10128	2	12	coarse	aggrading bar		35000	2.8
S-6-27 (12-15.5)	S10129	12	15.5	coarse	aggrading bar		1600	5.6
S-SED-D7	S10130	2	12	coarse	aggrading bar		54000	5.0
S-SED-D3	S10131	12	20.5	coarse	other		8400	60

Notes:

J - The compound/analyte was positively identified; however, the associated numerical value is an estimated concentration only.
N - The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
B - The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
* - Duplicate analysis not within control limit.
R - The sample results were rejected.
ND - Not detected. (Number in parentheses denotes the quantitation limit.

Table 3-16

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Arithmetic Average PCB Concentration (mg/kg) in Snow Creek Strata

	Depositional Environment			
Reach	Aggrading Bar	Channel	Terrace	Other[1]
Upstream of 11th St Ditch		0.088		
11th St Ditch to 9th St Bridge		13.3	15.8	33.3
9th St Bridge to RR Bridge	9.4	9.1		14
RR Bridge to Concrete Spillway	7.3	8.3	18.9	
Concrete Spillway			4.9	
Concrete Spillway to Snow St Bridge	1	0.7	3.2	
Hwy 78 Bridge to Choccolocco Creek Confluence	7.3	21.4	5	

[1] "Other" represents sediments in culvert pipes and drainageways

Table 3-17

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Estimated PCB Mass (kg) in Snow Creek by Strata

Reach	Depositional Environment				
	Aggrading Bar	Channel	Terrace	Other[1]	Total
11th St Ditch to 9th St Bridge	0.14	0.23	2.6	0.10	3.1
9th St Bridge to RR Bridge	2.8	2.9	0.029	25	31
RR Bridge to Concrete Spillway	0.45	0.16	0.70		1.3
Concrete Spillway	0.0060		0.017		0.023
Concrete Spillway to Snow St Bridge	1.4	0.014	1.0		2.4
Hwy 78 Bridge to Choccolocco Creek Confluence	9.7	0.44	0.81		11.0
Total	14.5	3.7	5.2	25	48

[1] "Other" represents sediments in culvert pipes and drainageways

Table 3-18

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Snow Creek Sediment Metal Analysis Data

Location ID	Sample ID	Date Collected	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Vanadium (mg/kg)
S-014	S10001	28-Jun-99	0	2	11	75 JN*	ND(0.52) N*	0.51 B	380 JN	13 *	30	400 *	ND(0.0062)	7.9 J*	40 JN
S-014	S10002	28-Jun-99	2	8	4.6	77 JN*	0.58 JN*	ND(0.062)	36 JN	11 *	18	540 *	0.045	8.7 J*	36 JN
S-014	S10003	28-Jun-99	0	2	10	76 JN*	ND(0.89) N*	0.65	840 JN	6.9 *	71	490 *	0.035	12 J*	23 JN
S-014	S10004	28-Jun-99	2	8	13	100 JN*	ND(0.65) N*	3.3	650 JN	8.8 *	140	760 *	0.032	16 J*	26 JN
S-014	S10005	28-Jun-99	8	15	7.2	76 JN*	ND(0.63) N*	0.098 B	74 JN	9.3 *	16	240 *	0.028	7.4 J*	38 JN
S-014	S10006	28-Jun-99	0	2	11	160 JN*	ND(1.2) N*	1.0	870 JN	9.9 *	100	1500 *	ND(0.0054)	15 J*	31 JN
S-014	S10007	28-Jun-99	2	9	16	110 JN*	ND(0.88) N*	0.39 B	230 JN	6.1 *	41	1400 *	0.031	7.9 J*	44 JN
S-014	S10008	28-Jun-99	9	14	3.8	78 JN*	ND(0.52) N*	ND(0.055)	47 JN	8.0 *	15	460 *	0.039	8.0 J*	27 JN
S-014	S10009	28-Jun-99	0	2	3.8	110 JN*	ND(0.66) N*	0.89	310 JN	4.7 *	78	860 *	0.055	14 J*	16 JN
S-014	S10010	28-Jun-99	2	4	7.5	110 JN*	ND(0.69) N*	0.41 B	1000 JN	5.9 *	110	720 *	0.023	9.1 J*	23 JN
S-014	S10011	28-Jun-99	4	15	3.3	62 JN*	ND(0.57) N*	ND(0.063)	53 JN	4.0 *	21	110 *	0.03	7.3 J*	27 JN
S-016	S10012	28-Jun-99	0	2	7.5	29 JN*	ND(0.54) N*	ND(0.055)	22 JN	4.4 *	18	400 *	0.011 B	5.8 J*	21 JN
S-016	S10013	28-Jun-99	2	7	17	69 JN*	0.96 JN*	ND(0.060)	84 JN	25 *	27	820 *	0.029	17 J*	51 JN
S-016	S10014	28-Jun-99	0	2	9.5	160 JN*	ND(0.79) N*	0.16 B	37 JN	3.5 *	18	610 *	0.013 B	6.2 J*	29 JN
S-016	S10015	28-Jun-99	2	8	20	350 JN*	1.9 JN*	0.74	64 JN	50 *	28	7500 *	0.020 B	29 J*	39 JN
S-016	S10016	28-Jun-99	0	2	12	66 JN*	ND(0.56) N*	0.24 B	21 JN	5.9 *	23	700 *	0.0081 B	11 J*	19 JN
S-016	S10017	28-Jun-99	2	7	5.9	46 JN*	ND(0.55) N*	ND(0.060)	27 JN	4.2 *	21	570 *	0.013 B	6.7 J*	17 JN
S-016	S10018	28-Jun-99	0	2	15	180 JN*	ND(1.2) N*	2.0	76 JN	11 *	77	2500 *	0.11	21 J*	46 JN
S-016	S10019	28-Jun-99	2	6.5	21	47 JN*	0.56 JN*	ND(0.060)	59 JN	6.1 *	21	590 *	0.017 B	14 J*	59 JN
S-016	S10020	28-Jun-99	2	7	12	58 JN*	0.35 BJN*	ND(0.060)	50 JN	9.4 *	36	1300 *	0.0083 B	22 J*	41 JN
S-1-01	S10021	30-Nov-99	0	2	20	190	1.8	0.37 B	670	12	57	1400	ND(0.013)	18	64
S-1-01	S10022	30-Nov-99	2	8	18	410	3.5 EJ	0.74 B	260 JN*	26	150 JN	2400 *	8.6 J	34	46
S-1-04	S10024	30-Nov-99	0	2	21	190	1.5	ND(0.12)	280	18	72	1100	0.26 N	27	54
S-1-04	S10025	30-Nov-99	2	5	17	110	1.6 EJ	ND(0.072)	90 JN*	19	120 JN	860 *	1.3 J	24	61
S-2-3A	S10046	30-Nov-99	0	3	13	270 JN*	2.9 EJ	ND(0.073)	140 JN*	110 JN	66 JN*	5200 *	3.2 J*	110 JN	50 *
S-2-3A	S10047	30-Nov-99	0	3	16	370 JN*	3.6 EJ	ND(0.070)	150 JN*	67 JN	79 JN*	3800 *	1.2 J*	74 JN	57 *
S-6-02	S10095	1-Dec-99	0	2	12	220	2.0	0.13 B	46	21	110	1800	0.51 N	29	52
S-6-02	S10096	1-Dec-99	2	5	11	150	2.0 EJ	ND(0.076)	38	20	68	1200		25	44
S-6-10	S10108	1-Dec-99	0	2	12	160	1.3	ND(0.089)	42	16	57	1400	0.58 N	22	53
S-6-10	S10109	1-Dec-99	2	12	14	380 JN	1.9 EJ	0.14 B	79 JN	96 JN	100	2400		41	50

(See Notes on Page 2)

Table 3-18

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Snow Creek Sediment Metal Analysis Data

<u>Notes:</u>

J - The compound/analyte was positively identified; however, the associated numerical value is an estimated concentration only.
N - The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
B - The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
E - The compound was quantitated above the calibration range.
* - Duplicate analysis not within control limit.
ND (500) - Not detected. Number in parentheses denotes the quantitation limit.

Table 3-19

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Top-of-Bank Samples in Choccolocco Creek

Transect	Side	Property Owner Access Granted	Collected for PCB Analysis	ADEM Split
C-U1	RB	yes	yes	yes
C-005	RB	yes	yes	no
C-008	LB	yes	yes	no
C-012	LB	yes	yes	no
C-023	RB	yes	yes	no
C-023	LB	yes	yes	no
C-025	LB	yes	yes	no
C-026	RB	yes	yes	no
C-027	LB	yes	yes	no
C-030	RB	yes	yes	no
C-034	RB	yes	yes	yes
C-034	LB	yes	yes	no
C-038	LB	yes	yes	no
C-051	RB	yes	yes	no
C-057	RB	no	no	no
C-060	RB	yes	yes	no
C-061	LB	yes	yes	no
C-062	RB	no	no	no
C-063	LB	yes	yes	no
C-063	RB	no	no	no
C-064	LB	yes	yes	no
C-065	LB	yes	yes	no
C-065	RB	no	no	no
C-067	RB	no	no	no
C-068	RB	yes	yes	no
C-070	RB	yes	yes	no
C-070	LB	no	no	no
C-071	RB	yes	yes	yes
C-086	RB	yes	no	no
C-112	LB	yes	yes	no
C-114	LB	yes	yes	no
C-114	RB	no	no	no
C-119	LB	yes	yes	no
C-148	RB	no	no	no
C-156	RB	no	no	no
C-157	RB	no	no	no
C-158	LB	yes	yes	no
C-159	RB	yes	yes	no
C-159	LB	yes	yes	no
C-160	RB	yes	yes	no
C-161	RB	yes	yes	no
C-165	RB	yes	yes	no
C-165	LB	no	no	no
C-166	LB	yes	yes	no
C-166	RB	no	no	no
C-172	RB	yes	yes	no
C-172	LB	yes	yes	no
C-181	RB	yes	yes	no
C-182	RB	yes	yes	no

Note:
All samples collected as 0- to 6- inch depth interval.
RB refers to the right bank of Choccolocco Creek, facing upstream.
LB refers to the left bank of Choccolocco Creek, facing upstream.

Table 3-20

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Top-of-Bank Soil Data Summary

Location ID	Sample ID	Field Sample ID	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-U1-RB-1	C70036	C-U1-RB-1 (0-6)	8900	ND(0.089)
C-005-RB-1	C70037	C-005-RB-1 (0-6)	11000	0.081
C-008-LB-1	C70038	C-008-LB-1 (0-6)	17000	17
C-012-LB-1	C70004	C-012-LB-1 (0-6)	22000	21 J
C-023-LB-1	C70006	C-023-LB-1 (0-6)	16000	11 J
C-023-RB-1	C70005	C-023-RB-1 (0-6)	13000	12
C-025-LB-1	C70007	C-025-LB-1 (0-6)	13000	2.3
C-026-RB-1	C70008	C-026-RB-1 (0-6)	17000	4.1
C-026-RB-1	C70039	C-BANK-D1	17000	2.7
C-027-LB-1	C70009	C-027-LB-1 (0-6)	14000	5.6
C-030-RB-1	C70010	C-030-RB-1 (0-6)	21000	6.7
C-034-LB-1	C70012	C-034-LB-1 (0-6)	12000	1.1 J
C-034-RB-1	C70011	C-034-RB-1 (0-6)	6700	5.4
C-038-LB-1	C70013	C-038-LB-1 (0-6)	30000	0.69
C-051-RB-1	C70014	C-051-RB-1 (0-6)	14000	3.3 J
C-060-RB-1	C70015	C-060-RB-1 (0-6)	16000	2.6
C-061-LB-1	C70016	C-061-LB-1 (0-6)	12000	2.6
C-063-LB-1	C70017	C-063-LB-1 (0-6)	19000	9.4 J
C-064-LB-1	C70018	C-064-LB-1 (0-6)	15000	0.49
C-065-LB-1	C70019	C-065-LB-1 (0-6)	25000	4.1
C-068-RB-1	C70020	C-068-RB-1 (0-6)	20000	3.9 J
C-070-RB-1	C70021	C-070-RB-1 (0-6)	19000	2.8 J
C-071-RB-1	C70022	C-071-RB-1 (0-6)	24000	2.3
C-112-LB-1	C70024	C-112-LB-1 (0-6)	24000	1.6
C-114-LB-1	C70023	C-114-LB-1 (0-6)	18000	2.5
C-119-LB-1	C70025	C-119-LB-1 (0-6)	19000	1.1
C-119-LB-1	C70040	C-BANK-D2	17000	1.4
C-158-LB-1	C70035	C-158-LB-1 (0-6)	16000	0.78
C-159-LB-1	C70034	C-159-LB-1 (0-6)	45000	0.53
C-159-RB-1	C70033	C-159-RB-1 (0-6)	24000	0.63
C-160-RB-1	C70032	C-160-RB-1 (0-6)	29000	0.46 J
C-161-RB-1	C70031	C-161-RB-1 (0-6)	10000	0.31
C-165-RB-1	C70030	C-165-RB-1 (0-6)	13000	0.69

See notes on page 2.

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Solutia Inc.
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Top-of-Bank Soil Data Summary

Location ID	Sample ID	Field Sample ID	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C-166-LB-1	C70029	C-166-LB-1 (0-6)	12000	ND(0.076)
C-172-LB-1	C70028	C-172-LB-1 (0-6)	31000	ND(0.075)
C-172-RB-1	C70027	C-172-RB-1 (0-6)	21000	ND(0.084)
C-182-RB-1	C70026	C-182-RB-1 (0-6)	13000	0.028 J
ML	C70001	ML-BANK-1	19000	4.6
ML	C70002	ML-BANK-2	15000	12
ML	C70003	ML-BANK-3	23000	5.8

Notes:

J - The compound/analyte was positively identified; however, the associated numerical value is an estimated concentration only.

ND (500) - Not detected. Number in parentheses denotes quantitation limit.

Table 3-21

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of PCB Data From Geochronological Cores

Location ID	Sample ID	Date	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Total PCB (mg/kg)
DLM-GEO-2	L10327	05/04/00	0.0	0.5	ND(0.39)
DLM-GEO-2	L10328	05/04/00	0.5	1.0	ND(0.39)
DLM-GEO-2	L10329	05/04/00	1.0	2.0	ND(0.18)
DLM-GEO-2	L10330	05/04/00	2.0	4.0	ND(0.14)
DLM-GEO-2	L10332	05/04/00	6.0	8.0	ND(0.19)
DLM-GEO-2	L10334	05/04/00	10.0	12.0	0.037 J
DLM-GEO-2	L10336	05/04/00	14.0	16.0	0.079
DLM-GEO-2	L10338	05/04/00	18.0	20.0	0.23 J
DLM-GEO-2	L10340	05/04/00	22.0	24.0	0.39
DLM-GEO-2	L10343	05/04/00	26.0	28.0	0.78
DLM-GEO-2	L10342	05/04/00	26.0	28.0	0.57
DLM-GEO-2	L10345	05/04/00	30.0	32.0	1.7
DLM-GEO-2	L10347	05/04/00	34.0	36.0	0.71
DLM-GEO-2	L10349	05/04/00	38.0	40.0	1.9
DLM-GEO-2	L10351	05/04/00	42.0	44.0	3.5
DLM-GEO-2	L10353	05/04/00	46.0	48.0	1.2
DLM-GEO-4	L10355	05/04/00	0.0	0.5	ND(0.35)
DLM-GEO-4	L10356	05/04/00	0.5	1.0	ND(0.30)
DLM-GEO-4	L10357	05/04/00	1.0	2.0	ND(0.26)
DLM-GEO-4	L10358	05/04/00	2.0	4.0	ND(0.23)
DLM-GEO-4	L10361	05/04/00	6.0	8.0	ND(0.18)
DLM-GEO-4	L10360	05/04/00	6.0	8.0	ND(0.20)
DLM-GEO-4	L10363	05/04/00	10.0	12.0	ND(0.19)
DLM-GEO-4	L10365	05/04/00	12.0	16.0	ND(0.16)
DLM-GEO-4	L10365	05/04/00	12.0	16.0	ND(0.16)
DLM-GEO-4	L10367	05/04/00	18.0	20.0	ND(0.14)
DLM-GEO-4	L10367	05/04/00	18.0	20.0	ND(0.14)
DLM-GEO-4	L10369	05/04/00	20.0	24.0	0.22 J
DLM-GEO-4	L10371	05/04/00	26.0	28.0	0.39 J
DLM-GEO-4	L10373	05/04/00	30.0	32.0	ND(0.12)
DLM-GEO-4	L10375	05/04/00	34.0	36.0	0.029 J
DLM-GEO-4	L10375	05/04/00	34.0	36.0	0.39
DLM-GEO-4	L10377	05/04/00	38.0	40.0	0.22 J
DLM-GEO-4	L10377	05/04/00	38.0	40.0	0.52
DLM-GEO-4	L10380	05/04/00	42.0	44.0	0.13 J
DLM-GEO-4	L10380	05/04/00	42.0	44.0	0.4
DLM-GEO-4	L10379	05/04/00	42.0	44.0	0.18 J
DLM-GEO-4	L10382	05/04/00	46.0	48.0	0.037 J

See notes on page 5

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Solutia Inc.
Anniston, Alabama
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Summary of PCB Data From Geochronological Cores

Location ID	Sample ID	Date	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Total PCB (mg/kg)
DLM-GEO-4	L10382	05/04/00	46.0	48.0	0.32
DLM-GEO-4	L10384	05/04/00	50.0	52.0	ND(0.10)
DLM-GEO-4	L10384	05/04/00	50.0	52.0	0.21
LLM-GEO-3	L10165	04/07/99	0.0	0.5	ND(0.14) J
LLM-GEO-3	L10166	04/07/99	0.5	1.0	ND(0.13) J
LLM-GEO-3	L10168	04/07/99	2.0	4.0	ND(0.12) J
LLM-GEO-3	L10170	04/07/99	6.0	8.0	0.041 J
LLM-GEO-3	L10172	04/07/99	10.0	12.0	ND(0.098) J
LLM-GEO-3	L10174	04/07/99	14.0	16.0	ND(0.089) J
LLM-GEO-3	L10176	04/07/99	18.0	20.0	ND(0.094) J
LLM-GEO-3	L10178	04/07/99	22.0	24.0	ND(0.088) J
LLM-GEO-6	L10292	05/03/00	0.0	0.5	ND(0.29)
LLM-GEO-6	L10293	05/03/00	0.5	1.0	ND(0.24)
LLM-GEO-6	L10294	05/03/00	1.0	2.0	ND(0.21)
LLM-GEO-6	L10295	05/03/00	2.0	4.0	ND(0.19)
LLM-GEO-6	L10297	05/03/00	6.0	8.0	ND(0.19)
LLM-GEO-6	L10299	05/03/00	10.0	12.0	ND(0.17)
LLM-GEO-6	L10301	05/03/00	14.0	16.0	ND(0.16)
LLM-GEO-6	L10304	05/03/00	18.0	20.0	ND(0.14)
LLM-GEO-6	L10303	05/03/00	18.0	20.0	ND(0.14)
LLM-GEO-6	L10306	05/03/00	22.0	24.0	0.13 J
LLM-GEO-6	L10308	05/03/00	26.0	28.0	0.33 J
LLM-GEO-8	L10310	05/03/00	0.0	0.5	ND(0.25)
LLM-GEO-8	L10311	05/03/00	0.5	1.0	ND(0.23)
LLM-GEO-8	L10312	05/03/00	1.0	2.0	ND(0.22)
LLM-GEO-8	L10313	05/03/00	2.0	4.0	ND(0.20)
LLM-GEO-8	L10315	05/03/00	6.0	8.0	ND(0.19)
LLM-GEO-8	L10317	05/03/00	10.0	12.0	ND(0.17)
LLM-GEO-8	L10319	05/03/00	14.0	16.0	ND(0.14)
LLM-GEO-8	L10321	05/03/00	18.0	20.0	0.092
LLM-GEO-8	L10323	05/03/00	22.0	24.0	0.078
LLM-GEO-8	L10323	05/03/00	22.0	24.0	ND(0.14)
LLM-GEO-8	L10325	05/03/00	26.0	28.0	0.087 J
LNH-GEO-1	N10000	04/28/00	0.0	0.5	ND(0.12)
LNH-GEO-1	N10001	04/28/00	0.5	1.0	ND(0.10)
LNH-GEO-1	N10002	04/28/00	1.0	2.0	ND(0.10)
LNH-GEO-1	N10003	04/28/00	2.0	4.0	ND(0.097)
LNH-GEO-1	N10005	04/28/00	6.0	8.0	ND(0.097)

See notes on page 5

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Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of PCB Data From Geochronological Cores

Location ID	Sample ID	Date	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Total PCB (mg/kg)
LNH-GEO-1	N10007	04/28/00	10.0	12.0	ND(0.096)
LNH-GEO-1	N10009	04/28/00	14.0	16.0	ND(0.096)
LNH-GEO-1	N10011	04/28/00	18.0	20.0	ND(0.10)
LNH-GEO-1	N10013	04/28/00	22.0	24.0	ND(0.10)
LNH-GEO-1	N10015	04/28/00	26.0	29.0	ND(0.10)
LNH-GEO-3	N10016	05/01/00	0.0	0.5	ND(0.12)
LNH-GEO-3	N10017	05/01/00	0.5	1.0	ND(0.11)
LNH-GEO-3	N10018	05/01/00	1.0	2.0	ND(0.10)
LNH-GEO-3	N10019	05/01/00	2.0	4.0	ND(0.094)
LNH-GEO-3	N10021	05/01/00	6.0	8.0	ND(0.098)
LNH-GEO-3	N10023	05/01/00	10.0	12.0	ND(0.098)
LNH-GEO-3	N10025	05/01/00	14.0	16.0	ND(0.098)
LNH-GEO-3	N10026	05/01/00	14.0	16.0	ND(0.098)
LNH-GEO-3	N10028	05/01/00	18.0	20.0	ND(0.11)
LNH-GEO-3	N10030	05/01/00	22.0	25.0	ND(0.11)
MLM-GEO-4	L10114	04/05/99	0.0	0.5	0.030 J
MLM-GEO-4	L10115	04/05/99	0.5	1.0	ND(0.092) J
MLM-GEO-4	L10117	04/05/99	2.0	4.0	0.028 J
MLM-GEO-4	L10119	04/05/99	6.0	8.0	ND(0.082) J
MLM-GEO-4	L10121	04/05/99	10.0	12.0	ND(0.082) J
MLM-GEO-4	L10123	04/05/99	14.0	16.0	ND(0.088) J
MLM-GEO-4	L10125	04/05/99	18.0	20.0	ND(0.092) J
MLM-GEO-4	L10127	04/05/99	22.0	24.0	ND(0.086) J
MLM-GEO-4	L10129	04/05/99	26.0	28.0	ND(0.083) J
MLM-GEO-4	L10131	04/05/99	30.0	32.0	ND(0.082) J
MLM-GEO-5	L10241	05/02/00	0.0	0.5	0.12 J
MLM-GEO-5	L10242	05/02/00	0.5	1.0	0.13 J
MLM-GEO-5	L10243	05/02/00	1.0	2.0	0.22
MLM-GEO-5	L10244	05/02/00	2.0	4.0	0.26 J
MLM-GEO-5	L10246	05/02/00	6.0	8.0	0.33 J
MLM-GEO-5	L10248	05/02/00	10.0	12.0	0.30 J
MLM-GEO-5	L10250	05/02/00	14.0	16.0	0.56
MLM-GEO-5	L10252	05/02/00	18.0	20.0	0.48
MLM-GEO-5	L10254	05/02/00	22.0	24.0	0.076
MLM-GEO-5	L10256	05/02/00	26.0	28.0	0.14
MLM-GEO-5	L10258	05/02/00	30.0	32.0	ND(0.082)
MLM-GEO-7	L10260	05/03/00	0.0	0.5	0.10 J
MLM-GEO-7	L10261	05/03/00	0.5	1.0	0.14 J

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Solutia Inc.
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Summary of PCB Data From Geochronological Cores

Location ID	Sample ID	Date	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Total PCB (mg/kg)
MLM-GEO-7	L10262	05/03/00	1.0	2.0	0.18
MLM-GEO-7	L10263	05/03/00	2.0	4.0	0.49 J
MLM-GEO-7	L10266	05/03/00	6.0	8.0	0.83
MLM-GEO-7	L10265	05/03/00	6.0	8.0	0.67
MLM-GEO-7	L10268	05/03/00	10.0	12.0	0.77
MLM-GEO-7	L10270	05/03/00	14.0	16.0	0.56 J
MLM-GEO-7	L10272	05/03/00	18.0	20.0	1.1
MLM-GEO-7	L10274	05/03/00	22.0	24.0	0.70
MLM-GEO-7	L10276	05/03/00	26.0	28.0	ND(0.10)
MLM-GEO-7	L10278	05/03/00	30.0	32.0	ND(0.082)
MLM-GEO-7	L10280	05/03/00	34.0	36.0	ND(0.083)
MLM-GEO-7	L10282	05/03/00	38.0	40.0	ND(0.084)
MLM-GEO-7	L10284	05/03/00	42.0	44.0	ND(0.084)
MLM-GEO-7	L10286	05/03/00	46.0	48.0	ND(0.082)
MLM-GEO-7	L10288	05/03/00	50.0	52.0	ND(0.081)
MLM-GEO-7	L10290	05/03/00	54.0	56.0	ND(0.081)
ULM-GEO-1	L10001	03/25/99	0.0	0.5	ND(0.046)
ULM-GEO-1	L10002	03/25/99	0.5	1.0	ND(0.043)
ULM-GEO-2	L10015	03/26/99	0.0	0.5	ND(0.043)
ULM-GEO-2	L10016	03/26/99	0.5	1.0	ND(0.048)
ULM-GEO-4	L10037	04/08/99	0.0	0.5	ND(0.14) J
ULM-GEO-4	L10038	04/08/99	0.5	1.0	ND(0.120) J
ULM-GEO-4	L10040	04/08/99	2.0	4.0	ND(0.11) J
ULM-GEO-4	L10042	04/08/99	6.0	8.0	ND(0.10) J
ULM-GEO-4	L10044	04/08/99	10.0	12.0	ND(0.10) J
ULM-GEO-4	L10046	04/08/99	14.0	16.0	ND(0.10) J
ULM-GEO-4	L10048	04/08/99	18.0	20.0	ND(0.093) J
ULM-GEO-4	L10050	04/08/99	22.0	24.0	ND(0.084) J
ULM-GEO-5	L10198	05/02/00	0.0	0.5	ND(0.23)
ULM-GEO-5	L10199	05/02/00	0.5	1.0	ND(0.14)
ULM-GEO-5	L10199	05/02/00	0.5	1.0	ND(0.28)
ULM-GEO-5	L10200	05/02/00	1.0	2.0	ND(0.093)
ULM-GEO-5	L10200	05/02/00	1.0	2.0	ND(0.094)
ULM-GEO-5	L10201	05/02/00	2.0	4.0	ND(0.093)
ULM-GEO-5	L10201	05/02/00	2.0	4.0	ND(0.093)
ULM-GEO-5	L10203	05/02/00	6.0	8.0	ND(0.098)
ULM-GEO-5	L10203	05/02/00	6.0	8.0	ND(0.098)
ULM-GEO-5	L10205	05/02/00	10.0	12.0	ND(0.095)

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Solutia Inc.
Anniston, Alabama
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Summary of PCB Data From Geochronological Cores

Location ID	Sample ID	Date	Sediment Depth to Top (in)	Sediment Depth to Bottom (in)	Total PCB (mg/kg)
ULM-GEO-5	L10207	05/02/00	14.0	16.0	ND(0.098)
ULM-GEO-5	L10209	05/02/00	18.0	20.0	ND(0.11)
ULM-GEO-5	L10211	05/02/00	22.0	24.0	ND(0.092)
ULM-GEO-5	L10213	05/02/00	26.0	28.0	0.034 J
ULM-GEO-5	L10215	05/02/00	30.0	32.0	ND(0.11)
ULM-GEO-5	L10217	05/02/00	34.0	36.0	ND(0.12)
ULM-GEO-5	L10219	05/02/00	38.0	40.0	ND(0.11)
ULM-GEO-8	L10220	05/02/00	0.0	0.5	ND(0.11)
ULM-GEO-8	L10221	05/02/00	0.5	1.0	ND(0.092)
ULM-GEO-8	L10222	05/02/00	1.0	2.0	ND(0.090)
ULM-GEO-8	L10223	05/02/00	2.0	4.0	ND(0.093)
ULM-GEO-8	L10225	05/02/00	6.0	8.0	ND(0.11)
ULM-GEO-8	L10228	05/02/00	10.0	12.0	ND(0.15)
ULM-GEO-8	L10227	05/02/00	10.0	12.0	ND(0.11)
ULM-GEO-8	L10230	05/02/00	14.0	16.0	ND(0.15)
ULM-GEO-8	L10232	05/02/00	18.0	20.0	ND(0.11)
ULM-GEO-8	L10234	05/02/00	22.0	24.0	0.061 J
ULM-GEO-8	L10236	05/02/00	26.0	28.0	0.036 J
ULM-GEO-8	L10238	05/02/00	30.0	32.0	0.063 J
ULM-GEO-8	L10240	05/02/00	34.0	37.0	ND(0.14)
ULM-GEO-8	L10240	05/02/00	34.0	37.0	ND(0.14)

J - The compound/analyte was positively identified; however, the associated numerical value is an estimated concentration only.
ND (500) - Not detected. Number in parentheses denotes quantitation limit.

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Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Surface Sediment Data Summary

Location ID	Sample ID	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
ADEM96-SS-1	C20011	1.40 J	ND(500)	0.17
ADEM96-SS-10	C20020		21000	1.2
ADEM96-SS-2	C20012		2400	0.48 J
ADEM96-SS-3	C20013		980	0.19 J
ADEM96-SS-4	C20014	1.40 J	ND(500)	ND(0.096)
ADEM96-SS-5	C20016	0.340 J	1400	0.24 J
ADEM96-SS-6	C20015		ND(500)	0.060 J
ADEM96-SS-7	C20017		2400	0.084 J
ADEM96-SS-8	C20018	0.650 J	1900	0.25 J
ADEM96-SS-9	C20019	0.490 J	7300	0.21
NEW99-SS-1	C20001	0.470 J	14000	0.25
NEW99-SS-10	C20010		19000	0.51 J
NEW99-SS-2	C20002		22000	0.22
NEW99-SS-3	C20003		18000	2.7
NEW99-SS-4	C20004	1.30 J	28000	1.1
NEW99-SS-5	C20005	0.270 J	4900	0.066 J
NEW99-SS-6	C20006		12000	0.32
NEW99-SS-7	C20007		10000	0.24
NEW99-SS-8	C20008	1.30 J	58000	0.38
NEW99-SS-9	C20009	0.900 J	30000	0.78
STA-30-SS-1	C20025	0.0420	17000	ND(0.12)
STA-30-SS-10	C20034		21000	ND(0.18)
STA-30-SS-2	C20026		6300	ND(0.10) J
STA-30-SS-3	C20027		18000	ND(0.14)
STA-30-SS-4	C20028	0.0530	13000	ND(0.13)
STA-30-SS-5	C20029		15000	ND(0.11)
STA-30-SS-6	C20030	0.0390	3400	ND(0.10)
STA-30-SS-7	C20031		21000	ND(0.20)
STA-30-SS-8	C20032	0.0760	18000	ND(0.14)
STA-30-SS-9	C20033	0.100	24000	ND(0.22)
STA-33-SS-1	C20035	0.0180 B	2100	ND(0.10)
STA-33-SS-10	C20044		1000	ND(0.095)
STA-33-SS-2	C20036		20000	ND(0.23)

See notes on page 3.

Table 3-22

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Surface Sediment Data Summary

Location ID	Sample ID	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
STA-33-SS-2	C20077		22000	ND(0.15)
STA-33-SS-3	C20037	0.0830	23000	ND(0.24)
STA-33-SS-4	C20038	0.0700	17000	ND(0.16)
STA-33-SS-5	C20039		1800	ND(0.10)
STA-33-SS-6	C20040	0.110	26000	ND(0.24)
STA-33-SS-7	C20041		1600	ND(0.094)
STA-33-SS-8	C20042		7000	ND(0.10) J
STA-33-SS-9	C20043	0.0930	23000	ND(0.20)
STA-35-SS-1	C20065		17000	0.32
STA-35-SS-10	C20074		17000	0.34
STA-35-SS-2	C20066	1.20	28000	0.52
STA-35-SS-2	C20078	1.10	27000	0.59
STA-35-SS-3	C20067	1.70	54000	2.7
STA-35-SS-4	C20068		23000	0.36
STA-35-SS-5	C20069	0.570	16000	0.38
STA-35-SS-6	C20070	0.750	24000	0.42
STA-35-SS-7	C20071		23000	0.54 J
STA-35-SS-8	C20072		36000	1.5
STA-35-SS-9	C20073	0.780	23000	0.75
STA-38-SS-1	C20045		2500	ND(0.088)
STA-38-SS-10	C20054	0.0140 B	2000	ND(0.10)
STA-38-SS-2	C20046	0.0540	13000	ND(0.12)
STA-38-SS-2	C20076	0.0450	12000	ND(0.12)
STA-38-SS-3	C20047	0.0440	7000	ND(0.11)
STA-38-SS-4	C20048		3100	ND(0.092)
STA-38-SS-5	C20049		1600	ND(0.094)
STA-38-SS-6	C20050	0.0180 B	9100	ND(0.10)
STA-38-SS-7	C20051	0.0380	8500	ND(0.11)
STA-38-SS-8	C20052		1500	ND(0.094)
STA-38-SS-9	C20053		5600	ND(0.094)
STA-39-SS-1	C20055		4200	ND(0.093)
STA-39-SS-10	C20064		40000	ND(0.15)
STA-39-SS-2	C20056	0.210	26000	ND(0.26)

See notes on page 3.

Table 3-22

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Surface Sediment Data Summary

Location ID	Sample ID	Mercury (mg/kg)	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
STA-39-SS-3	C20057		22000	ND(0.16)
STA-39-SS-4	C20058	0.100	19000	ND(0.22)
STA-39-SS-5	C20059		3200	ND(0.089)
STA-39-SS-6	C20060	0.0980	20000	ND(0.20)
STA-39-SS-7	C20061		16000	ND(0.13)
STA-39-SS-7	C20075		15000	ND(0.14)
STA-39-SS-8	C20062	0.160	26000	ND(0.26)
STA-39-SS-9	C20063	0.0580	16000	ND(0.15)

Notes:

J - The compound/analyte was positively identified; however, the associated numerica value is an estimated concentration only.

ND (500) - Not detected. Number in parentheses denotes quantitation limit.

Table 3-23

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of Choccolocco Creek Wet-Sieve Analyses

BBLID	FIELD SAMPLE ID	Total Organic Carbon (mg/kg)	Total PCB (mg/kg)
C90001	C-011-SIEVE-1A	940	0.17
C90002	C-011-SIEVE-1B	770	0.48
C90003	C-011-SIEVE-1B	850	0.38 J
C90004	C-011-SIEVE-1C	1200 T	0.58 T
C90005	C-011-SIEVE-1E		0.71 T
C90006	C-022-SIEVE-3A	17000	0.38 J
C90007	C-022-SIEVE-3B	2700	0.90 J
C90008	C-022-SIEVE-3C	2100	0.56
C90009	C-022-SIEVE-3D	15000 T	20 JT
C90010	C-022-SIEVE-3E	25000 T	0.28 T
C90011	C-100-SIEVE-1A	610	ND(0.076)
C90012	C-100-SIEVE-1B	ND(500)	ND(0.086)
C90013	C-100-SIEVE-1B	ND(500)	ND(0.081)
C90014	C-100-SIEVE-1E		ND(0.13) T
C90015	C-101-SIEVE-4A	780	ND(0.069)
C90016	C-101-SIEVE-4B	1800	0.15 J
C90017	C-101-SIEVE-4C	1700	0.79 J
C90018	C-101-SIEVE-4E	16000 T	0.76 T
C90019	C-134-SIEVE-1A	860 T	ND(0.067) T
C90020	C-134-SIEVE-1B	1600	ND(0.080)
C90021	C-134-SIEVE-1C	2700	ND(0.18)
C90022	C-134-SIEVE-1D	26000 T	ND(0.40) T
C90023	C-134-SIEVE-1E	20000	ND(0.18)
C90024	C-138-SIEVE-4A	6800	ND(0.073)
C90025	C-138-SIEVE-4B	790	ND(0.082)
C90026	C-138-SIEVE-4C	2000	ND(0.17)
C90027	C-138-SIEVE-4D		ND(0.50) T
C90028	C-138-SIEVE-4E	24000	0.18
C90029	C-180-SIEVE-2A	52000	0.069 J
C90030	C-180-SIEVE-2B	20000	0.22
C90031	C-180-SIEVE-2C	18000	0.040 J
C90032	C-180-SIEVE-2D	33000	0.52
C90033	C-180-SIEVE-2E	21000	0.17
C90034	C-U2-SIEVE-2A	93000	1.4
C90035	C-U2-SIEVE-2B	15000	0.55
C90036	C-U2-SIEVE-2C	7100	2.0
C90037	C-U2-SIEVE-2D	32000	6.1
C90038	C-U2-SIEVE-2E	18000	8.0

Notes:

A - Indicates sample passed a #10 Sieve
B - Indicates sample passed a #10 Sieve and was retained on a #40 Sieve
C - Indicates sample passed a #40 Sieve and was retained on a #100 Sieve
D - Indicates sample passed a #100 Sieve and was retained on a #200 Sieve
E - Indicates sample passed a #200 Sieve
J - The compound/analyte was positively identified; however, the associated numerical value is an estimated concentration only.
ND (500) - Not detected. Number in parentheses denotes the quantitation limit.
T - Indicates laboratory results presented on a wet-weight basis and were converted to dry weight basis using as assumed solids content of 80%.

Table 4-1

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Surface Water Data Summary

Location No.	Location	Flow Event Type	Event No.	Date	Flow (cfs)	TSS (mg/L)	Particulate Total PCB (mg/kg)	Calculated Particulate Phase Water PCB (ug/L)	TSS Load (kg/day)	Particulate PCB Load (kg/day)	PCB Load (kg/year)	Average Base Flow PCB Load (kg/year)	Average Excluding March 22-23
0	Boiling Springs Road	Base	1	March 22-23	343.46	2.5	0.07	0.00018	2,101	0.00015	0.054		
		High	2	April 1	538.61	38	0.025	0.00095	50,074	0.0013	0.46		
1	Snow Street	Base	1	March 22-23	15.99	17	9.9	0.17	665	0.0066	2.4	0.46	0.07
			4	May 3-4	4.97	20	2.7	0.054	243	0.00066	0.24		
			5	May 26-27	3.39	2.5	0.99	0.0025	21	0.000021	0.0075		
			6	June 14	2.55	2.5	0.91	0.0023	16	0.000014	0.0052		
			7	September 27-28	1.6	2.5	0.18	0.00046	10	0.0000018	0.00066		
			8	January 18	2.93	2.5	16	0.041	18	0.00029	0.11		
		High	3	April 27	204.59	230	3.7	0.85	115,124	0.43	155		
			3	April 27	135.1	280	3.3	0.93	92,548	0.31	112		
2	Flatbridge Road	Base	1	March 22-23	445.56	23	2.7	0.062	25,072	0.067	25	6.72	3.14
			4	May 3-4	159.17	18	1.7	0.031	7,010	0.012	4.4		
			5	May 26-27	119.28	14	0.39	0.0055	4,086	0.0016	0.58		
			6	June 14	91.68	14	0.44	0.0062	3,140	0.0014	0.50		
			7	September 27-28	41.36	8	0.16	0.0013	810	0.00013	0.047		
			8	January 19	111.54	15	6.8	0.10	4,093	0.028	10		
		High	2	April 1	593.85	44	1.6	0.069	63,927	0.10	37		
3	Highway 77	Base	1	March 22-23	783.04	12	2.7	0.033	22,989	0.062	23	5.75	2.36
			4	May 3-4	241.05	16	1.5	0.024	9,436	0.014	5.1		
			5	May 26-27	462.05	7	0.20	0.0014	7,913	0.0016	0.59		
			6	June 14	212.8	4.3	0.11	0.00046	2,239	0.00024	0.087		
			7	September 27-28	116.29	6.5	0.25	0.0016	1,849	0.00045	0.17		
			8	January 19	268.11	12.5	2.0	0.024	8,199	0.016	5.9		
		High	2	April 1	1264	26	1.0	0.027	80,403	0.083	30		
4	Neely Henry Dam	Base	1	March 22-23	8026	12	0.46	0.0055	235,632	0.11	40	12.84	3.93
			4	May 3-4	4415	11	0.24	0.0026	118,817	0.028	10		
			5	May 26-27	5581	10	0.025	0.00025	136,542	0.0034	1.3		
			7	September 27-28	3463	14	0.0053	0.000074	118,614	0.00063	0.23		
			8	January 20		13	0.095	0.0012	0	0.00	0.00		

Table 4-1

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Surface Water Data Summary

Location No.	Location	Flow Event Type	Event No.	Date	Flow (cfs)	TSS (mg/L)	Particulate Total PCB (mg/kg)	Calculated Particulate Phase Water PCB (ug/L)	TSS Load (kg/day)	Particulate PCB Load (kg/day)	PCB Load (kg/year)	Average Base Flow PCB Load (kg/year)	Average Excluding March 22-23
5	Logan Martin Upstream	Base	1	March 24	8696	26	0.32	0.0083	553,156	0.18	64	17.75	2.26
			4	May 3-4	5466.5	20	0.019	0.00039	267,482	0.0052	1.9		
			5	May 26-27	5901	18	0.022	0.00039	259,868	0.0056	2.0		
			7	September 27-28	4694.5	26	0.026	0.00068	298,619	0.0078	2.9		
			8	January 20		16	0.050	0.00079	0	0.00	0.00		
6	Logan Martin Downstream	Base	1	March 22-23	9366	13	0.67	0.0087	297,887	0.20	73	17.33	3.46
			4	May 3-4	6518	29	0.032	0.00092	462,452	0.015	5.4		
			5	May 26-27	6221	22	0.033	0.00073	334,840	0.011	4.1		
			6	June 14	5926	10	0.045	0.00045	144,983	0.0065	2.4		
			7	September 27-28	4350	22	0.024	0.00053	234,135	0.0056	2.1		
			8	January 20		10	0.080	0.00	0	0.00	0.00		
7	Eastaboga Creek	Base	1	March 22-23	37	2.5			226				
			4	May 3-4	18.16	30			1,333				
			5	May 26-27	11.48	12			337				
			6	June 14	11.37	13			362				
			7	September 27-28	5.24	20			256				
			8	January 19	67.93	2.5			415				
		High	2	April 1	74.57	25			4,561				
8	Cheaha Creek	Base	1	March 22-23	186.61	2.5			1,141				
			4	May 3-4	87.34	24			5,128				
			5	May 26-27	81.3	2.5			497				
			6	June 14	68.22	2.5			417				
			7	September 27-28	36.54	2.5			223				
			8	January 19	7.6	2.5			46				
		High	2	April 1	259.6	29			18,419				
	Snow Creek			June 21	0.02	66	12	0.77	3.23	0.000038	0.014		
				June 21	1.23	52	0.87	0.045	156.5	0.00014	0.049		

Table 4-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Results of 24-hour Water Column Sampling at Neely Henry Dam

Date	Time	Sample Depth (ft)	Flow (cfs)	TSS (mg/L)	Particulate PCB (mg/kg)	Surface			Mid-Depth			Bottom			Average	
						Depth (ft)	Turbidity (NTU)	Velocity (ft/s)	Depth (ft)	Turbidity (NTU)	Velocity (ft/s)	Depth (ft)	Turbidity (NTU)	Velocity (ft/s)	Turbidity (NTU)	Velocity (ft/s)
6/22/1999	10:00	13.2	0	10	0.025	3	15	0.060	6.60	17	0.0	10.2	17	0.0	16.3	0.020
	11:00	13.2	0	9.5		3	17	0.020	6.60	16	0.0	10.2	17	0.0	16.7	0.0067
	12:00	13.2	0	16		3	16	0.0	6.60	16	0.0	10.2	19	0.0	17.0	0.0
	13:00	13.2	13014	10		3	17	0.040	6.60	17	0.0	10.2	18	0.0	17.3	0.013
	14:00	16.9	16802	16	0.025	3	24	1.52	8.45	23	1.09	13.9	28	0.94	25.0	1.18
	15:00	16.9	16972	10		3	21	1.23	8.45	22		13.9	22		21.7	1.23
	16:00	16.5	17181	12		3	41	2.69	8.25	20	2.38	13.5	20	1.6	27.0	2.22
	17:00	16.6	13932	9.5		3	234	2.83	8.30	134	2.21	13.6	53	1.44	140.3	2.16
	18:00	16.9	0	9.5	0.025	3	106	1.90	8.45	48	1.77	13.9	34	1.65	62.7	1.77
	19:00	17.9	0	13		3	23	0.34	8.40	23	0.38	14.9	24	0.28	23.3	0.33
	20:00	14.6	0	12		3	23	0.21	7.30	22	0.17	11.6	22	0.11	22.3	0.16
	21:00	13.9	0	20		3	23	0.020	6.80	23	0.040	10.9	22	0.030	22.7	0.030
	22:00	13.9	0	10	0.033	3	21	0.0	6.95	22	0.0	10.9	21	0.0	21.3	0.0
	23:00	14	0	12		3	20	0.0	7.00	22	0.0	11.0	20	0.0	20.7	0.0
6/23/1999	0:00	14.2	0	11		3	20	0.0	7.10	20	0.0	11.2	21	0.0	20.3	0.0
	1:00	14.5	0	7		3	20	0.0	7.25	22	0.0	11.5	21	0.0	21.0	0.0
	2:00	14.5	0	9.5	0.044	3	21	0.030	7.25	21	0.020	11.5	21	0.0	21.0	0.017
	3:00	14.1	0	10		3	20	0.090	7.05	21	0.080	11.1	19	0.0	20.0	0.057
	4:00	14	0	8.5		3	20	0.0	7.00	20	0.0	11.0	21	0.0	20.3	0.0
	5:00	14	0	10		3	20	0.0	7.00	19	0.0	11.0	22	0.0	20.3	0.0
	6:00	14.2	0	12	0.094	3	18	0.0	7.10	19	0.0	11.2	22	0.0	19.7	0.0
	7:00	14.3	0	12		3	18	0.020	7.15	21	0.0	11.3	21	0.0	20.0	0.0067
	8:00		0	9		3										
	9:00	14	0	9.5		3	20	0.010	7.00	21	0.0	11.0	23	0.0	21.3	0.0033
	10:00	13.8	0	11	0.036	3	19	0.010	6.90	20	0.0	10.8	20	0.0	19.7	0.0033

Table 4-3

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Surface Water Data
Collected at Jackson Shoals

Field ID	Date	Time	TSS (mg/L)	Flow (cfs)
JS-SS-1	29-Sep-99	14:05	7.5	163
	30-Sep-99	14:05		180
JS-SS-2-A	04-Oct-99	14:00	16	163
JS-SS-2-B	05-Oct-99	14:00	12	168
JS-SS-3-A	10-Oct-99	10:20	32	249
JS-SS-3-B	11-Oct-99	10:20	28	364
JS-SS-4-A	11-Oct-99	16:00	14	312
JS-SS-4-B	12-Oct-99	16:00	12	288
JS-SS-5-A	20-Oct-99	11:25	7.5	158
JS-SS-5-B	21-Oct-99	11:25	9	155
JS-SS-6-A	27-Oct-99	10:10	2.5	150
JS-SS-6-B	28-Oct-99	9:10	7.5	145
JS-SS-7	02-Nov-99	11:30	24	482
	02-Nov-99	13:30		501
JS-SS-8-A	02-Nov-99	13:45	22	489
JS-SS-8-B	02-Nov-99	15:45	29	441
JS-SS-9-A	02-Nov-99	20:05	24	345
JS-SS-9-B	03-Nov-99	2:05	12	288
JS-SS-10-A	10-Nov-99	9:00	7	168
JS-SS-10-B	11-Nov-99	9:00	6	166
JS-SS-11-A	17-Nov-99	8:45	6	158
JS-SS-11-B	18-Nov-99	8:45	7	153
JS-SS-12-A	01-Dec-99	8:28	10	128
JS-SS-12-B	02-Dec-99	8:28	10	156
JS-SS-13	23-Jan-00	12:30	28	841
	23-Jan-00	14:30		1088
JS-SS-14-A	23-Jan-00	16:58	8	1249
JS-SS-14-B	23-Jan-00	18:58	22	1262
JS-SS-15-A	24-Jan-00	10:23	2.5	885
JS-SS-15-B	24-Jan-00	12:23	45	856
JS-SS-16-A	14-Feb-00	14:14	54	1336
JS-SS-16-B	14-Feb-00	16:34	30	1375

Table 4-3

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Surface Water Data
Collected at Jackson Shoals

Field ID	Date	Time	TSS (mg/L)	Flow (cfs)
JS-SS-17-A	14-Feb-00	16:34	28	1384
JS-SS-17-B	14-Feb-00	18:34	29	1368
JS-SS-18-A	16-Feb-00	9:00	15	696
JS-SS-18-B	16-Feb-00	11:00	24	674
JS-SS-19-A	20-Mar-00	9:09	110	2487
JS-SS-19-B	20-Mar-00	11:09	94	2430
JS-SS-20-A	20-Mar-00	12:53	140	2382
JS-SS-20-B	20-Mar-00	14:53	230	2327
JS-SS-21-A	23-Mar-00	8:50	110	1072
JS-SS-21-B	23-Mar-00	10:50	20	1065
JS-SS-22-A	02-Apr-00	18:03	7.5	1840
JS-SS-22-B	02-Apr-00	20:03	26	2202
JS-SS-23-A	03-Apr-00	10:07	190	3577
JS-SS-23-B	03-Apr-00	12:07	270	3350
JS-SS-24-A	04-Apr-00	8:42	61	7567
JS-SS-24-B	04-Apr-00	10:42	390	7330
JS-SS-25-A	06-Apr-00	8:50	820	4339
JS-SS-25-B	06-Apr-00	10:50	53	4193

Table 4-4

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Summary of Surface Water Data
Collected at Jackson Shoals

Sample ID	Field ID	Date Started	Average USGS Flow (cfs)	Time Started	Time Ended	Duration (hours)	Average TSS (mg/L)	Particulate PCB (mg/kg)
C50018	JS-SS-1	9/29/1999	172	14:05	14:05	24	7.5	0.167
C40019	JS-SS-2 (1-7)	10/4/1999	165	14:00	14:00	24	14	2.0
C40020	JS-SS-3 (1-10)	10/10/1999	438	10:20	10:20	24	30	0.95
C40021	JS-SS-4 (1-10)	10/11/1999	307	16:00	16:00	24	13	0.010
C40022	JS-SS-5 (1-9)	10/20/1999	157	11:25	11:25	24	8.25	2.590
C40023	JS-SS-6 (1-8)	10/27/1999	147	10:10	9:10	23	5.5	2.850
C40024	JS-SS-7 (1-10)	11/2/1999	500	11:30	13:30	2	24	1.1
C40025	JS-SS-8 (1-10)	11/2/1999	464	13:45	15:45	2	26	0.56
C40026	JS-SS-9 (1-10)	11/2/1999	311	20:05	2:05	6	18	1.9
C40027	JS-SS-10 (1-8)	11/10/1999	167	9:00	9:00	24	6.5	1.7
C40028	JS-SS-11 (1-7)	11/17/1999	153	8:45	8:45	24	6.5	2.6
C40029	JS-SS-12 (1-7)	12/1/1999	131	8:28	8:28	24	10	3.2
C40030	JS-SS-13 (1-10)	1/23/2000	1026	12:30	14:30	2	15	1.2
C40031	JS-SS-14 (1-10)	1/23/2000	1256	16:58	18:58	2	28	1.4
C40032	JS-SS-15 (1-10)	1/24/2000	871	10:23	12:23	2	24	2.1
C40036	JS-SS-16 (1-10)	2/14/2000	1360	14:14	16:34	2	42	1.3
C40037	JS-SS-17 (1-10)	2/14/2000	1377	16:34	18:34	2	29	1.7
C40038	JS-SS-18 (1-10)	2/16/2000	683	9:00	11:00	2	20	2.0
C40039	JS-SS-19 (1-10)	3/20/2000	2455	9:09	11:09	2	487	1.8
C40040	JS-SS-20 (1-10)	3/20/2000	2351	12:53	14:53	2	185	2.2
C40041	JS-SS-21 (1-10)	3/23/2000	1067	8:50	10:50	2	65	1.3
C40042	JS-SS-22 (1-10)	4/2/2000	2044	18:03	20:03	2	17	2.6
C40043	JS-SS-23 (1-10)	4/3/2000	3473	10:07	12:07	2	230	0.7
C40044	JS-SS-24 (1-10)	4/4/2000	7545	8:42	10:42	2	226	2.4
C40045	JS-SS-25 (1-10)	4/6/2000	4259	8:50	10:50	2	437	3.3

Note:
Average flow is over sampling period.
Average flow is from samples collected before and after PCB sample collection.

Table 5-1

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin, and Choccolocco Creek
Fish Collection Summary

Location	Station	Number of Fish		
		Bass (Species)	YOY Bass	Catfish (Species)
Lake Neely Henry	30	10 (LMB)	7	6 (Channel) 1 (Blue)
Lake Logan Martin	33	10 (LMB)	7	5 (Channel) 5 (Blue)
	39	10 (SPB)	7	3 (Channel) 4 (Blue)
	38	10 (SPB)	7	6 (Channel) 3 (Blue)
Choccolocco Creek	35	10 (LMB)	7	6 (Channel)
	NEW 99	10 (SPB)	5	10 (Channel)
	ADEM 96	10 (SPB)	5	10 (Channel)

Notes:

LMB = Largemouth Bass
SPB = Spotted Bass
YOY = Young of Year Composite Samples

Table 5-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin and Choccolocco Creek
Fish Data Summary

Location ID	Sample Type	Species	# of Fish Composited	Length (cm)	Total Weight (g)	Sex	Lipid (%)	Mercury (mg/kg)	PCB (mg/kg)
Lake Neely Henry and Lake Logan Martin									
Station 30	FILLET	BLUE CATFISH		33.9	300	F	0.46		ND(0.20)
Station 30	FILLET	BLUE CATFISH		33.6	280	M	0.14		ND(0.20)
Station 30	FILLET	BLUE CATFISH		56.9	1670	M	1.5		0.34
Station 30	FILLET	BLUE CATFISH		44.4	670	F	0.46		ND(0.20)
Station 30	FILLET	BLUE CATFISH		34.7	350	F	0.50		ND(0.20)
Station 30	FILLET	BLUE CATFISH		48.5	1030	M	0.75		0.068 J
Station 30	FILLET	CHANNEL CATFISH		39.5	550	F	1.1		0.21 J
Station 30	FILLET	LARGEMOUTH BASS		40.4	1080	F	1.6	0.043 B	0.25
Station 30	FILLET	LARGEMOUTH BASS		38.5	960	M	2.4	0.025 B	0.26 J
Station 30	FILLET	LARGEMOUTH BASS		36.8	890	F	0.36	0.051 B	ND(0.20)
Station 30	FILLET	LARGEMOUTH BASS		37.3	820	F	1.9	0.040 B	ND(0.20)
Station 30	FILLET	LARGEMOUTH BASS		35.4	760	F	1.2	0.025 B	0.21 J
Station 30	FILLET	LARGEMOUTH BASS		37.8	750	F	0.26		ND(0.20)
Station 30	FILLET	LARGEMOUTH BASS		40.2	1100	F	2.7		0.29
Station 30	FILLET	LARGEMOUTH BASS		39.7	1040	F	0.85		ND(0.20)
Station 30	FILLET	LARGEMOUTH BASS		35.8	650	M	0.090		ND(0.20)
Station 30	FILLET	LARGEMOUTH BASS		36.2	770	F	1.7		0.28
Station 30	WHOLE BODY	LARGEMOUTH BASS	5		39.4		0.54		ND(0.20)
Station 30	WHOLE BODY	LARGEMOUTH BASS	5		43.4		0.52		ND(0.20)
Station 30	WHOLE BODY	LARGEMOUTH BASS	5		59		1.4		0.082 J
Station 30	WHOLE BODY	LARGEMOUTH BASS	5		49.8		0.79		ND(0.20)
Station 30	WHOLE BODY	LARGEMOUTH BASS	5		50.9		0.61		ND(0.20)
Station 30	WHOLE BODY	LARGEMOUTH BASS	5		76.1		1.5		0.14 J
Station 30	WHOLE BODY	LARGEMOUTH BASS	5		66.4		1.1		0.12 J

See notes on page 7.

Table 5-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin and Choccolocco Creek
Fish Data Summary

Location ID	Sample Type	Species	# of Fish Composited	Length (cm)	Total Weight (g)	Sex	Lipid (%)	Mercury (mg/kg)	PCB (mg/kg)
Station 33	FILLET	BLUE CATFISH		50.6	1140	M	0.72		0.41 J
Station 33	FILLET	BLUE CATFISH		32.5	320	F	0.020		ND(0.20)
Station 33	FILLET	BLUE CATFISH		48.9	1090	M	1.2		1.3
Station 33	FILLET	BLUE CATFISH		48.5	1010	F	0.31		0.20 J
Station 33	FILLET	BLUE CATFISH		50.5	1150	F	0.54		0.30 J
Station 33	FILLET	CHANNEL CATFISH		38.6	380	M	1.0		0.42
Station 33	FILLET	CHANNEL CATFISH		36	290	M	0.050		0.86 J
Station 33	FILLET	CHANNEL CATFISH		45.3	920	F	6.5		4.7
Station 33	FILLET	CHANNEL CATFISH		43	700	F	0.76		0.23
Station 33	FILLET	CHANNEL CATFISH		37.2	390	M	0.26		0.73 J
Station 33	FILLET	LARGEMOUTH BASS		35.3	760	M	1.0	0.18 J	5.4
Station 33	FILLET	LARGEMOUTH BASS		34.7	620	M	0.73	0.074 J	0.49
Station 33	FILLET	LARGEMOUTH BASS		41.8	1140	M	1.4	0.070 J	0.98
Station 33	FILLET	LARGEMOUTH BASS		37.8	790	F	0.20	0.076 J	ND(0.20)
Station 33	FILLET	LARGEMOUTH BASS		41.3	1080	F	0.54	0.074 J	0.30
Station 33	FILLET	LARGEMOUTH BASS		38.5	930	M	1.4		0.67
Station 33	FILLET	LARGEMOUTH BASS		34.5	640	M	0.51		0.28
Station 33	FILLET	LARGEMOUTH BASS		41	1210	M	1.2		0.83
Station 33	FILLET	LARGEMOUTH BASS		40.9	1080	M	0.29		0.39
Station 33	FILLET	LARGEMOUTH BASS		41.7	1140	F	1.4		1.4
Station 33	WHOLE BODY	LARGEMOUTH BASS	5		66		1.5		0.23 J
Station 33	WHOLE BODY	LARGEMOUTH BASS	5		115.3		0.54		0.28
Station 33	WHOLE BODY	LARGEMOUTH BASS	5		137.7		2.1		0.49
Station 33	WHOLE BODY	LARGEMOUTH BASS	5		128.5		1.8		0.38
Station 33	WHOLE BODY	LARGEMOUTH BASS	5		142.7		1.9		0.49
Station 33	WHOLE BODY	LARGEMOUTH BASS	5		62.7		0.42		0.067 J
Station 33	WHOLE BODY	LARGEMOUTH BASS	5		61.9		0.83		0.093 J

See notes on page 7.

Table 5-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin and Choccolocco Creek
Fish Data Summary

Location ID	Sample Type	Species	# of Fish Composited	Length (cm)	Total Weight (g)	Sex	Lipid (%)	Mercury (mg/kg)	PCB (mg/kg)
Station 38	FILLET	BLUE CATFISH		41.6	620	F	0.76		0.32
Station 38	FILLET	BLUE CATFISH		51.5	1360	M	0.42		0.22 J
Station 38	FILLET	BLUE CATFISH		60.2	2300	M	1.8		2.6 J
Station 38	FILLET	CHANNEL CATFISH		32.6	260	F	1.6		0.65
Station 38	FILLET	CHANNEL CATFISH		45	890	M	2.1		0.33
Station 38	FILLET	CHANNEL CATFISH		39.2	570	F	0.050		1.5
Station 38	FILLET	CHANNEL CATFISH		32	290	M	0.40		0.16
Station 38	FILLET	CHANNEL CATFISH		31.2	220	F	0.50		ND(0.20)
Station 38	FILLET	CHANNEL CATFISH		37.4	380	M	0.13		0.25
Station 38	FILLET	SPOTTED BASS		37.3	610	M	0.59	0.11	0.20 J
Station 38	FILLET	SPOTTED BASS		40	820	F	1.0	0.083	0.37
Station 38	FILLET	SPOTTED BASS		42.1	1010	M	1.2	0.15	0.54
Station 38	FILLET	SPOTTED BASS		33.1	390	F	0.43	0.064 B	0.33 J
Station 38	FILLET	SPOTTED BASS		45.7	1580	F	1.8	0.10	0.87
Station 38	FILLET	SPOTTED BASS		44.5	1350	M	1.0		0.42
Station 38	FILLET	SPOTTED BASS		44.8	1380	F	0.51		0.83
Station 38	FILLET	SPOTTED BASS		35.5	470	F	0.56		0.30
Station 38	FILLET	SPOTTED BASS		38.1	790	M	1.0		0.34 J
Station 38	FILLET	SPOTTED BASS		35.7	440	F	0.24		0.35
Station 38	WHOLE BODY	SPOTTED BASS	5		54.6		1.2		0.27
Station 38	WHOLE BODY	SPOTTED BASS	5		77.3		0.47		0.43
Station 38	WHOLE BODY	SPOTTED BASS	5		69		1.6		0.26 J
Station 38	WHOLE BODY	SPOTTED BASS	5		55.4		1.2		0.16 J
Station 38	WHOLE BODY	SPOTTED BASS	5		54.1		0.61		0.15 J
Station 38	WHOLE BODY	SPOTTED BASS	5		82.9		1.8		0.25 J
Station 38	WHOLE BODY	SPOTTED BASS	5		76.8		1.7		0.32

See notes on page 7.

Table 5-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin and Choccolocco Creek
Fish Data Summary

Location ID	Sample Type	Species	# of Fish Composited	Length (cm)	Total Weight (g)	Sex	Lipid (%)	Mercury (mg/kg)	PCB (mg/kg)
Station 39	FILLET	BLUE CATFISH		53.5	1900	F	2.4		1.1
Station 39	FILLET	BLUE CATFISH		53.1	1360	F	1.0		0.68
Station 39	FILLET	BLUE CATFISH		34.3	440	F	0.30		ND(0.20)
Station 39	FILLET	CHANNEL CATFISH		44.6	760	M	2.7		0.97
Station 39	FILLET	CHANNEL CATFISH		45	770	M	0.11		0.29 J
Station 39	FILLET	CHANNEL CATFISH		39	550	M	1.3		0.33 J
Station 39	FILLET	CHANNEL CATFISH		36	370	M	0.030		ND(0.20)
Station 39	FILLET	SPOTTED BASS		40.4	920	F	0.32	0.45 J	0.23
Station 39	FILLET	SPOTTED BASS		44.1	1280	M	0.45	0.12 J	0.60 J
Station 39	FILLET	SPOTTED BASS		36.7	630	F	0.38	0.096 J	0.33
Station 39	FILLET	SPOTTED BASS		35.8	600	F	0.26	0.095 J	0.19 J
Station 39	FILLET	SPOTTED BASS		42.1	830	M	2.2	0.14 J	1.2
Station 39	FILLET	SPOTTED BASS		34.2	500	F	0.51		0.29
Station 39	FILLET	SPOTTED BASS		31.7	380	F	0.31		ND(0.20)
Station 39	FILLET	SPOTTED BASS		40.1	780	F	1.4		0.74
Station 39	FILLET	SPOTTED BASS		37.6	670	F	0.65		0.35
Station 39	FILLET	SPOTTED BASS		35.1	480	M	0.54		0.072 J
Station 39	WHOLE BODY	SPOTTED BASS	5		64.5		2.1		0.46
Station 39	WHOLE BODY	SPOTTED BASS	5		52.7		1.6		0.42
Station 39	WHOLE BODY	SPOTTED BASS	5		45.7		2.7		0.31
Station 39	WHOLE BODY	SPOTTED BASS	5		59		0.64		0.36
Station 39	WHOLE BODY	SPOTTED BASS	5		43		1.6		0.38 J
Station 39	WHOLE BODY	SPOTTED BASS	5		62.5		1.9		0.67
Station 39	WHOLE BODY	SPOTTED BASS	5		58.6		0.98		0.44

See notes on page 7.

Table 5-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin and Choccolocco Creek
Fish Data Summary

Location ID	Sample Type	Species	# of Fish Composited	Length (cm)	Total Weight (g)	Sex	Lipid (%)	Mercury (mg/kg)	PCB (mg/kg)
Choccolocco Creek									
NEW 99	FILLET	CHANNEL CATFISH		43.9	690	F	1.4		6.3
NEW 99	FILLET	CHANNEL CATFISH		43.1	550	M	0.61		8.6
NEW 99	FILLET	CHANNEL CATFISH		47.3	700	M	0.50		10
NEW 99	FILLET	CHANNEL CATFISH		50	940	M	3.5		13
NEW 99	FILLET	CHANNEL CATFISH		48.1	880	M	0.58		2.5
NEW 99	FILLET	CHANNEL CATFISH		41.8	520	F	0.93		13
NEW 99	FILLET	CHANNEL CATFISH		39.6	480	F	1.2		4.5
NEW 99	FILLET	CHANNEL CATFISH		47.6	780	F	0.37		3.6
NEW 99	FILLET	CHANNEL CATFISH		40	540	F	3.8		3.7
NEW 99	FILLET	CHANNEL CATFISH		42.9	640	M	0.40		6.1
NEW 99	FILLET	SPOTTED BASS		43.4	980	F	0.42	0.75 J	3.5
NEW 99	FILLET	SPOTTED BASS		35.4	520	M	0.20	0.57 J	3.2
NEW 99	FILLET	SPOTTED BASS		39.8	710	F	0.22	0.60 J	0.87
NEW 99	FILLET	SPOTTED BASS		39.2	710	F	0.17	0.81 J	2.3
NEW 99	FILLET	SPOTTED BASS		41.5	880	M	0.040	0.91 J	1.6
NEW 99	FILLET	SPOTTED BASS		45.1	1130	M	0.17		5.8
NEW 99	FILLET	SPOTTED BASS		35.6	500	F	0.40		0.92
NEW 99	FILLET	SPOTTED BASS		36.6	600	F	0.12		2.7
NEW 99	FILLET	SPOTTED BASS		38.8	700	M	0.050		2.6
NEW 99	FILLET	SPOTTED BASS		37.8	750	M	0.29		5.4
NEW 99	WHOLE BODY	SPOTTED BASS	5		112.8		2.3		8.9
NEW 99	WHOLE BODY	SPOTTED BASS	5		117		1.3		5.9
NEW 99	WHOLE BODY	SPOTTED BASS	5		110.6		1.6		5.7
NEW 99	WHOLE BODY	SPOTTED BASS	5		112.5		2.7		7.2
NEW 99	WHOLE BODY	SPOTTED BASS	5		112.9		1.6		8.2

See notes on page 7.

Table 5-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin and Choccolocco Creek
Fish Data Summary

Location ID	Sample Type	Species	# of Fish Composited	Length (cm)	Total Weight (g)	Sex	Lipid (%)	Mercury (mg/kg)	PCB (mg/kg)
ADEM 96	FILLET	CHANNEL CATFISH		49.2	1180	F	2.0		34
ADEM 96	FILLET	CHANNEL CATFISH		57.2	2200	M	1.5		12 J
ADEM 96	FILLET	CHANNEL CATFISH		48.2	1090	M	1.7		8.3
ADEM 96	FILLET	CHANNEL CATFISH		55	1540	F	0.52		3.3
ADEM 96	FILLET	CHANNEL CATFISH		46	880	F	3.7		8.6
ADEM 96	FILLET	CHANNEL CATFISH		44.1	770	F	2.0		2.6
ADEM 96	FILLET	CHANNEL CATFISH		46.2	940	M	3.0		5.3
ADEM 96	FILLET	CHANNEL CATFISH		46	890	M	2.2		1.9
ADEM 96	FILLET	CHANNEL CATFISH		43.4	800	F	1.8		1.6
ADEM 96	FILLET	CHANNEL CATFISH		47.6	1010	F	6.4		10
ADEM 96	FILLET	SPOTTED BASS		39.9	760	F	0.57	0.35	3.3
ADEM 96	FILLET	SPOTTED BASS		37.5	720	F	0.23	0.60	1.4 J
ADEM 96	FILLET	SPOTTED BASS		40.6	860	F	0.18	0.64	2.6
ADEM 96	FILLET	SPOTTED BASS		42.8	1050	F	0.67	0.50	4.1 J
ADEM 96	FILLET	SPOTTED BASS		40.6	990	F	0.39		2.3
ADEM 96	FILLET	SPOTTED BASS		33.2	390	M	0.14	0.59	3.6
ADEM 96	FILLET	SPOTTED BASS		41.1	940	F	0.64		2.8
ADEM 96	FILLET	SPOTTED BASS		35.2	620	M	0.85		12
ADEM 96	FILLET	SPOTTED BASS		41.8	940	M	0.96		21
ADEM 96	FILLET	SPOTTED BASS		33.9	450	F	0.050		1.7
ADEM 96	WHOLE BODY	SPOTTED BASS	5		93.7		1.3		6.9
ADEM 96	WHOLE BODY	SPOTTED BASS	5		89.7		2.2		11
ADEM 96	WHOLE BODY	SPOTTED BASS	5		94.9		2.2		19
ADEM 96	WHOLE BODY	SPOTTED BASS	5		95.7		1.6		14
ADEM 96	WHOLE BODY	SPOTTED BASS	5		79.9		1.5		8.5

See notes on page 7.

Table 5-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin and Choccolocco Creek
Fish Data Summary

Location ID	Sample Type	Species	# of Fish Composited	Length (cm)	Total Weight (g)	Sex	Lipid (%)	Mercury (mg/kg)	PCB (mg/kg)
Station 35	FILLET	CHANNEL CATFISH		42.2	800	M	3.4		23 J
Station 35	FILLET	CHANNEL CATFISH		38.1	470	M	0.070		0.81
Station 35	FILLET	CHANNEL CATFISH		39.1	440	M	0.50		2.3
Station 35	FILLET	CHANNEL CATFISH		38.8	450	F	3.1		0.20 J
Station 35	FILLET	CHANNEL CATFISH		43.9	495	M	0.21		1.6
Station 35	FILLET	CHANNEL CATFISH		41.1	530	F	0.55		0.93
Station 35	FILLET	LARGEMOUTH BASS		44.5	1460	F	0.46	0.46 J	3.1
Station 35	FILLET	LARGEMOUTH BASS		43.6	1540	M	0.21	0.73 J	3.1
Station 35	FILLET	LARGEMOUTH BASS		33	600	M	0.29	0.26 J	1.4
Station 35	FILLET	LARGEMOUTH BASS		35.6	770	F	0.060	0.21 J	0.86
Station 35	FILLET	LARGEMOUTH BASS		34.9	700	F	0.17	0.21 J	2.3
Station 35	FILLET	LARGEMOUTH BASS		43.9	1680	M	0.62		3.9
Station 35	FILLET	LARGEMOUTH BASS		35.4	680	M	0.090		0.73
Station 35	FILLET	LARGEMOUTH BASS		40	1090	F	0.43		1.7
Station 35	FILLET	LARGEMOUTH BASS		39.8	1080	F	0.64		2.5
Station 35	FILLET	LARGEMOUTH BASS		33.8	630	M	0.92		2.9
Station 35	WHOLE BODY	LARGEMOUTH BASS	5		62.3		0.94		3.9
Station 35	WHOLE BODY	LARGEMOUTH BASS	5		74.1		1.1		4.3
Station 35	WHOLE BODY	LARGEMOUTH BASS	5		70.2		1.3		4.2
Station 35	WHOLE BODY	LARGEMOUTH BASS	5		69.8		2.0		3.1
Station 35	WHOLE BODY	LARGEMOUTH BASS	5		71.5		1.7		4.7
Station 35	WHOLE BODY	LARGEMOUTH BASS	5		64.5		1.1		3.7
Station 35	WHOLE BODY	LARGEMOUTH BASS	5		70.5		1.7		4.1

Notes:
J - The compound/analyte was positively identified; however, the associated numerical value is an estimated concentration only.
B - The reported value was obtained from a reading less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
R - The sample results were rejected.
ND (500) - Not detected. Number in parentheses denotes quantitation limit.
F - Female.
M - Male.

Table 5-3

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin, and Choccolocco Creek
Summary of Fish Tissue PCB Data

Station ID	Location	Species	Sample Type	Count	Minimum PCB (mg/kg)	Maximum PCB (mg/kg)	Average PCB (mg/kg)	Stationndard Deviation
Station 30	Lake Neely Henry	CATFISH	FILLET	7	0.068	0.34	0.15	0.097
Station 30	Lake Neely Henry	LARGEMOUTH BASS	FILLET	10	0.10	0.29	0.18	0.086
Station 30	Lake Neely Henry	LARGEMOUTH BASS	WHOLE BODY	7	0.082	0.14	0.11	0.018
Station 33	Lake Logan Martin	CATFISH	FILLET	10	0.10	4.7	0.93	1.4
Station 33	Lake Logan Martin	LARGEMOUTH BASS	FILLET	10	0.10	5.4	1.1	1.6
Station 33	Lake Logan Martin	LARGEMOUTH BASS	WHOLE BODY	7	0.067	0.49	0.29	0.17
Station 38	Lake Logan Martin	CATFISH	FILLET	9	0.10	2.6	0.68	0.84
Station 38	Lake Logan Martin	SPOTTED BASS	FILLET	10	0.20	0.87	0.45	0.23
Station 38	Lake Logan Martin	SPOTTED BASS	WHOLE BODY	7	0.15	0.43	0.26	0.095
Station 39	Lake Logan Martin	CATFISH	FILLET	7	0.10	1.1	0.51	0.41
Station 39	Lake Logan Martin	SPOTTED BASS	FILLET	10	0.072	1.2	0.41	0.35
Station 39	Lake Logan Martin	SPOTTED BASS	WHOLE BODY	7	0.31	0.67	0.43	0.12
ADEM 96	Choccolocco Creek	CHANNEL CATFISH	FILLET	10	1.6	34	8.8	9.7
ADEM 96	Choccolocco Creek	SPOTTED BASS	FILLET	10	1.4	21	5.4	6.1
ADEM 96	Choccolocco Creek	SPOTTED BASS	WHOLE BODY	5	6.9	19	12	4.6
NEW 99	Choccolocco Creek	CHANNEL CATFISH	FILLET	10	2.5	13	7.1	3.8
NEW 99	Choccolocco Creek	SPOTTED BASS	FILLET	10	0.87	5.8	2.9	1.7
NEW 99	Choccolocco Creek	SPOTTED BASS	WHOLE BODY	5	5.7	8.9	7.2	1.4
Station 35	Choccolocco Creek	CHANNEL CATFISH	FILLET	6	0.20	23	4.8	8.9
Station 35	Choccolocco Creek	LARGEMOUTH BASS	FILLET	10	0.73	3.9	2.3	1.1
Station 35	Choccolocco Creek	LARGEMOUTH BASS	WHOLE BODY	7	3.1	4.7	4.0	0.50

Table 5-4

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Neely Henry, Lake Logan Martin, and Choccolocco Creek
Summary of Fish Tissue Mercury Data

Station ID	Location	Species	Sample Type	Count	Minimum Mercury (mg/kg)	Maximum Mercury (mg/kg)	Average Mercury (mg/kg)	Stationndard Deviation
Station 30	Lake Neely Henry	LARGEMOUTH BASS	FILLET	5	0.025	0.051	0.037	0.011
Station 33	Lake Logan Martin	LARGEMOUTH BASS	FILLET	5	0.070	0.18	0.095	0.048
Station 38	Lake Logan Martin	SPOTTED BASS	FILLET	5	0.064	0.15	0.10	0.032
Station 39	Lake Logan Martin	SPOTTED BASS	FILLET	5	0.095	0.45	0.18	0.15
ADEM 96	Choccolocco Creek	SPOTTED BASS	FILLET	5	0.35	0.64	0.54	0.12
NEW 99	Choccolocco Creek	SPOTTED BASS	FILLET	5	0.57	0.91	0.73	0.14
Station 35	Choccolocco Creek	LARGEMOUTH BASS	FILLET	5	0.21	0.73	0.37	0.22

Table 6-1

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Choccolocco Creek Habitat Summary

TAXON	FAMILY	Sampling Station				
		CU3	C011	C058	C103	C117
Nemata	Unidentified (LPIL)		yes	yes	yes	
Turbellaria	Planariidae		yes			
Tanaidacae	Paratanaidae	yes				
Isopoda	Sphaeromidae				yes	yes
Decapoda	Cambaridae			yes	yes	yes
	Damaged (LPIL)		yes			
Acari: Parasitengona	Arrenuridae	yes	yes	yes	yes	
	Damaged (LPIL)		yes			
Plecoptera	Chloroperlidae	yes				
Ephemeroptera	Baetidae		yes	yes	yes	yes
	Heptageniidae	yes	yes	yes	yes	yes
	Unidentified pupae (LPIL)		yes			
Odonata	Coenagrionidae	yes	yes	yes	yes	yes
	Cordulegasteridae	yes	yes	yes	yes	yes
Hemiptera	Gerridae	yes	yes		yes	
	Notonectidae	yes	yes			
	Damaged (LPIL)			yes		
Megaloptera	Corydalidae		yes		yes	yes
Coleoptera	Dryopidae		yes	yes	yes	
	Dytiscidae			yes		yes
	Dytiscidae adult				yes	yes
	Elmidae	yes	yes		yes	
	Elmidae adult	yes	yes	yes	yes	yes
	Elmidae larvae (LPIL)			yes	yes	
	Haliplidae	yes			yes	
	Hydrophilidae		yes	yes		yes
	Hydrophilidae pupae (LPIL)		yes			
	Limnephilidae		yes			
	Noteridae				yes	
	Psephenidae		yes		yes	
	Unidentified pupae (LPIL)	yes			yes	
Trichoptera	Helicopsychidae		yes	yes	yes	yes
	Hydroptilidae		yes	yes	yes	yes
	Hydroptilidae pupae (LPIL)					yes
	Leptoceridae	yes	yes	yes	yes	yes
	Leptoceridae pupae			yes		yes
	Unidentified pupae (LPIL)		yes	yes	yes	yes
	Unidentified damaged (LPIL)			yes		yes
Diptera	Ceratopogonidae	yes			yes	yes

Table 6-1

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Choccolocco Creek Habitat Summary

TAXON	FAMILY	Sampling Station				
		CU3	C011	C058	C103	C117
Diptera : Tendipedidae	Chironomidae	yes	yes	yes	yes	yes
	Chironomidae pupae (LPIL)	yes				
	Simuliidae				yes	
Lepidoptera	Pryalididae		yes	yes	yes	yes
Pelecypoda	Unionidae	yes	yes	yes	yes	yes
Gastropoda	Ancylidae		yes			
	Lymnaeidae		yes	yes		yes
	Neritidae			yes		
	Planorbidae	yes	yes	yes		
	Viviparidae	yes	yes	yes	yes	yes
Ostheichthyes	Cyprinidae	yes		yes	yes	yes
	Percidae / Etheostominae	yes			yes	

Table 6-2

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Tributaries Habitat Summary

TAXON	FAMILY	Sampling Station		
		Blue Eye	Eastaboga	Snow Creek
Nemata	Unidentified (LPIL)		yes	yes
Turbellaria	Planariidae		yes	
Amphipoda	Gammaridae		yes	
	Talitridae	yes	yes	
Isopoda	Asellidae	yes	yes	
Decapoda	Cambaridae		yes	yes
Acari: Parasitengona	Arrenuridae	yes	yes	yes
Ephemeroptera	Baetidae		yes	yes
	Heptageniidae	yes	yes	yes
	Unidentified pupae (LPIL)			yes
Odonata	Coenagrionidae	yes	yes	yes
	Cordulegasteridae	yes	yes	
Hemiptera	Gerridae	yes		
Megaloptera	Corydalidae		yes	yes
Coleoptera	Dryopidae			
	Dytiscidae	yes	yes	
	Elmidae	yes	yes	
	Elmidae adult		yes	yes
	Elmidae larvae (LPIL)	yes		yes
	Haliplidae	yes	yes	
	Hydrophilidae	yes	yes	yes
	Hydrophilidae pupae (LPIL)	yes		
	Hydrophilidae egg casing	yes		
	Limnephilidae	yes		
	Psephenidae		yes	
Trichoptera	Helicopsychidae			yes
	Hydroptilidae		yes	yes
	Hydroptilidae pupae (LPIL)			yes
	Leptoceridae	yes	yes	
	Unidentified pupae (LPIL)	yes		
Diptera	Ceratopogonidae			yes
Diptera : Tendipedidae	Chironomidae	yes	yes	yes
	Chironomidae pupae (LPIL)	yes	yes	yes
	Chironomidae larvae (LPIL)			
	Simuliidae		yes	
Pelecypoda	Sphaeriidae	yes		
	Unionidae		yes	yes
Gastropoda	Ancylidae		yes	
	Lymnaeidae	yes	yes	yes
	Neritidae		yes	yes
	Viviparidae	yes	yes	yes
Ostheichthyes	Cyprinidae	yes	yes	yes
	Percidae / Etheostominae		yes	
	Eggs			yes

Table 6-3

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Lake Logan Martin Habitat Summary

TAXON	FAMILY	Sampling Station							
		C159 Deep	C159 Littoral	C175 Deep	C175 Littoral	Blue Eye 02 Deep	Blue Eye 02 Littoral	Loagn Martin Midpool Deep	Loagn Martin Midpool Littoral
Nemata	Unidentified (LPIL)	yes	yes		yes	yes	yes	yes	
Turbellaria	Planariidae		yes						
Oligochaeta	Naididae					yes			
Amphipoda	Gammaridae						yes		
Acari: Parasitengona	Arrenuridae		yes		yes	yes	yes	yes	
Ephemeroptera	Baetidae	yes	yes	yes	yes				
	Heptageniidae					yes			yes
Hemiptera	Gerridae						yes		
Coleoptera	Dytiscidae						yes		
	Elmidae							yes	
Trichoptera	Hydroptilidae	yes		yes					
	Leptoceridae		yes						yes
	Unidentified pupae (LPIL)				yes				
Diptera	Ceratopogonidae			yes					
Diptera : Tendipedidae	Chironomidae	yes	yes	yes	yes	yes	yes	yes	yes
	Chironomidae pupae (LPIL)							yes	yes
Lepidoptera	Pryalididae					yes			
Pelecypoda	Unionidae	yes		yes				yes	yes
Gastropoda	Ancylidae								yes
	Lymnaeidae							yes	
	Neritidae							yes	
	Planorbidae	yes							
	Viviparidae					yes	yes		yes
Ostheichthyes	Cyprinidae								yes

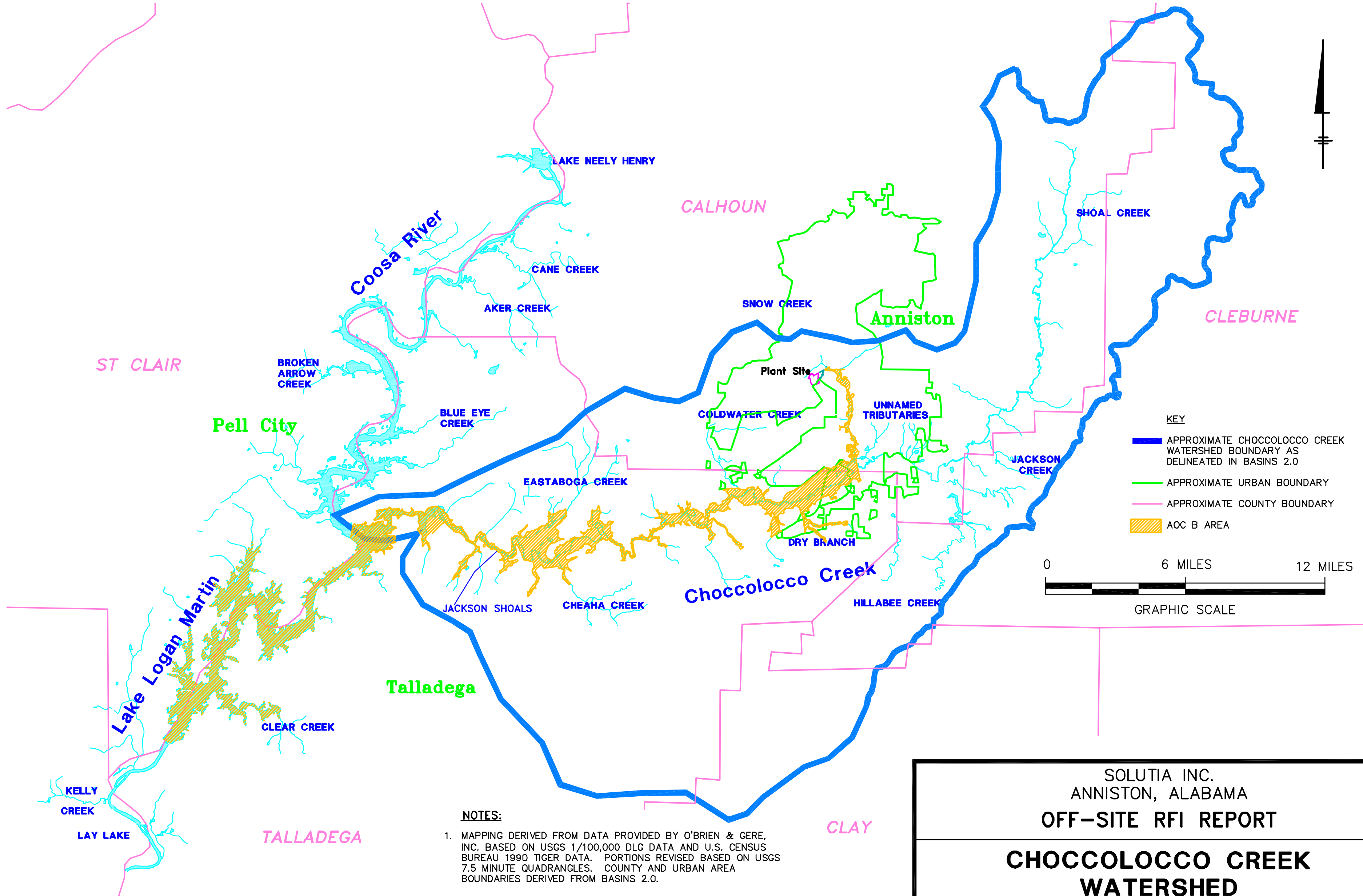
Table 7-1

Solutia Inc.
Anniston, Alabama
Off-Site RFI Report

Health and Environment Assessment Summary

SPECIES	TISSUE	PCB TYPE	STUDY CONDITIONS	EFFECTS CONC. (mg/kg ww)	EFFECTS ENDPOINT	REFERENCE
Rainbow trout	eggs	Aroclor 1254	Gravid females fed 200 mg/kg for 60 days	1.6	Reduced growth of fry relative to control (*p* >0.001)	Hendricks et al. 1981
Rainbow trout	eggs	Aroclor 1242	Observation of contaminated hatchery fish eggs	2.7	Larval mortality and abnormality	Hogan and Brauhn 1975
Sheepshead minnow	eggs	Aroclor 1254	Water exposure in lab	5.1	Decreased fry survival in the first week after hatch	Hansen et al. 1974
Adult fathead minnow	whole body	Aroclor 1254	Exposed to PCBs in sediment for 16 weeks	13.7	Reduced fecundity and frequency of reproduction	ACOE 1988
Fingerling channel catfish	whole body	4 Aroclors	Fed 2.4-24 mg/kg in diet for 193 days	32 (NOAEL)	Growth or mortality	Mayer, et al. 1977
Brook trout	muscle and eggs	Aroclor 1254	Water exposure of 0.2 mg/L for 21 days	32.8 (77.9 in eggs)	78% egg hatch compared to 100% in control	Freeman and Idler 1975
Brook trout	dead fry	Aroclor 1254	Water exposure of eggs to 33-13ug/L for 10 days prior to hatch and 118 days after	125	Fry mortality; 21-100 percent mortality	Mauck et al. 1978
Cyprinid minnow	whole body	Clophen A50	Baltic Sea fish fed PCB contaminated food for 40 days	170	Decreased number and hatchability of ova; delayed spawning; premature hatching	Bengtsson 1980
Sheepshead	fry whole body	Aroclor 1016	Exposed to 32 ug/L in intermittent-flow bioassay	200	Significantly reduced fry survival	Hansen et al. 1975
3-spined stickleback	carcass	Clophen A50	Fed PCB-containing chlronomids for 3.5 months	289 (after spawning)	Reduced spawning success(25% vs. 80% in control, not statistically significant)	Holm et al. 1993
Fathead minnow	whole body	Aroclor 1254	PCB exposure in continuous flow aquaria water	429 (females) (mean)	Reduced spawning, but egg hatchability and fry survival were not affected	Nebeker et al. 1974

Figures



NOTES:

1. MAPPING DERIVED FROM DATA PROVIDED BY O'BRIEN & GERE, INC. BASED ON USGS 1/100,000 DLG DATA AND U.S. CENSUS BUREAU 1990 TIGER DATA. PORTIONS REVISED BASED ON USGS 7.5 MINUTE QUADRANGLES. COUNTY AND URBAN AREA BOUNDARIES DERIVED FROM BASINS 2.0.

2. THE DOWNSTREAM EXTENT OF AOC B IS DEFINED AS SNOW CREEK DOWNSTREAM OF THE 11TH ST. DITCH INCLUDING THE ASSOCIATED AREAS OF THE 100-YEAR FLOODPLAIN AS DERIVED FROM FEMA DATA; CHOCCOLOCCO CREEK FROM THE CONFLUENCE WITH SNOW CREEK DOWNSTREAM TO LAKE LOGAN MARTIN INCLUDING THE ASSOCIATED AREAS OF THE 100-YEAR FLOODPLAIN DERIVED FROM FEMA DATA; AND, LAKE LOGAN MARTIN FROM THE CONFLUENCE WITH CHOCCOLOCCO CREEK DOWNSTREAM TO THE LOGAN MARTIN DAM.

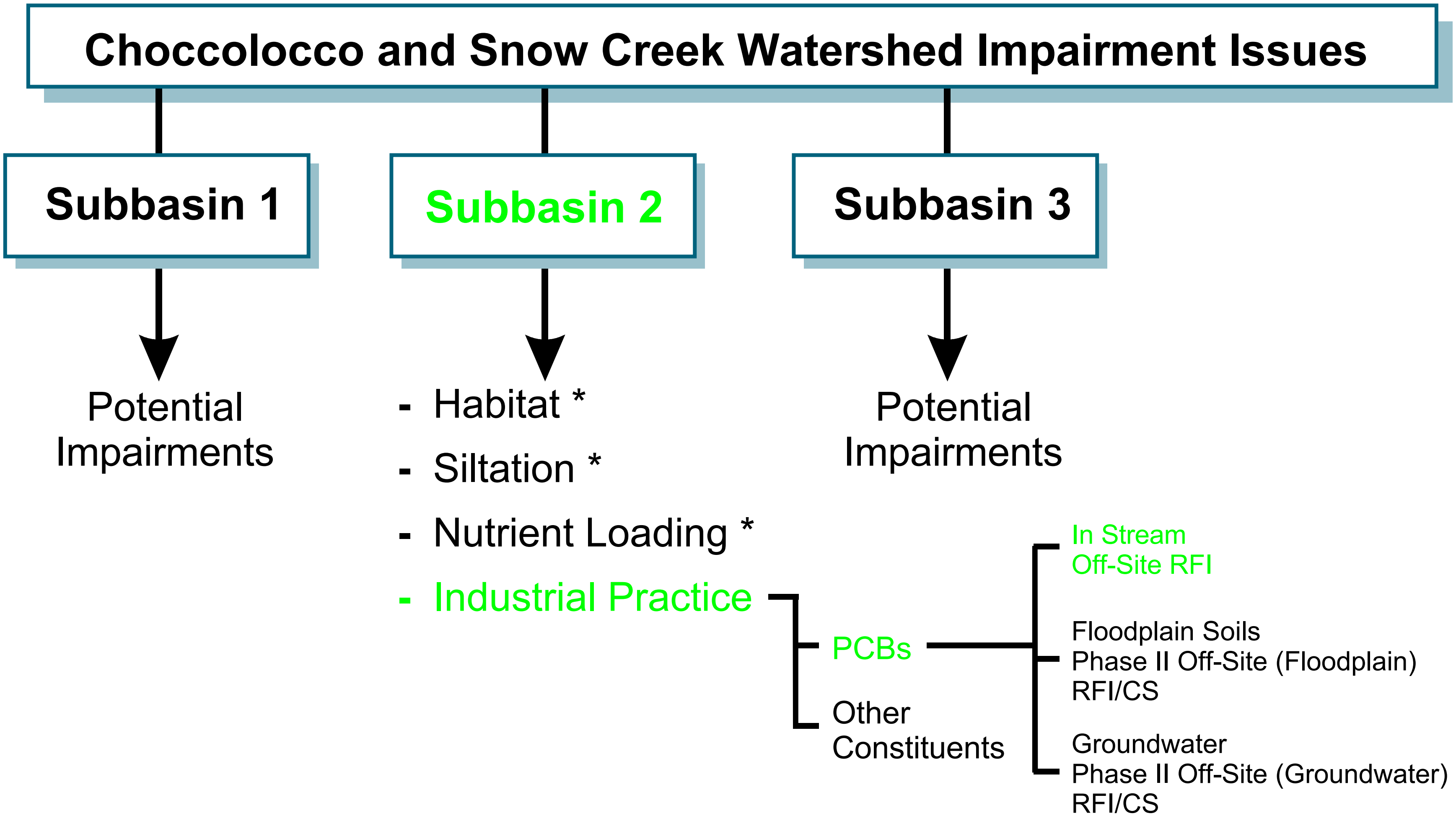
X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A1*,*STREAM*
P: FRY700AL
5/24/00 SYR-54-KMD
10209051/RFI/10209B01.DWG

SOLUTIA INC.
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK WATERSHED

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
1-1



NOTES:
* To be addressed by others (Steering Committee).
Elements in green are the focus of this Off-Site RFI

05/00 SYR D54-DJH LAS
10209051/10209g03.CDR

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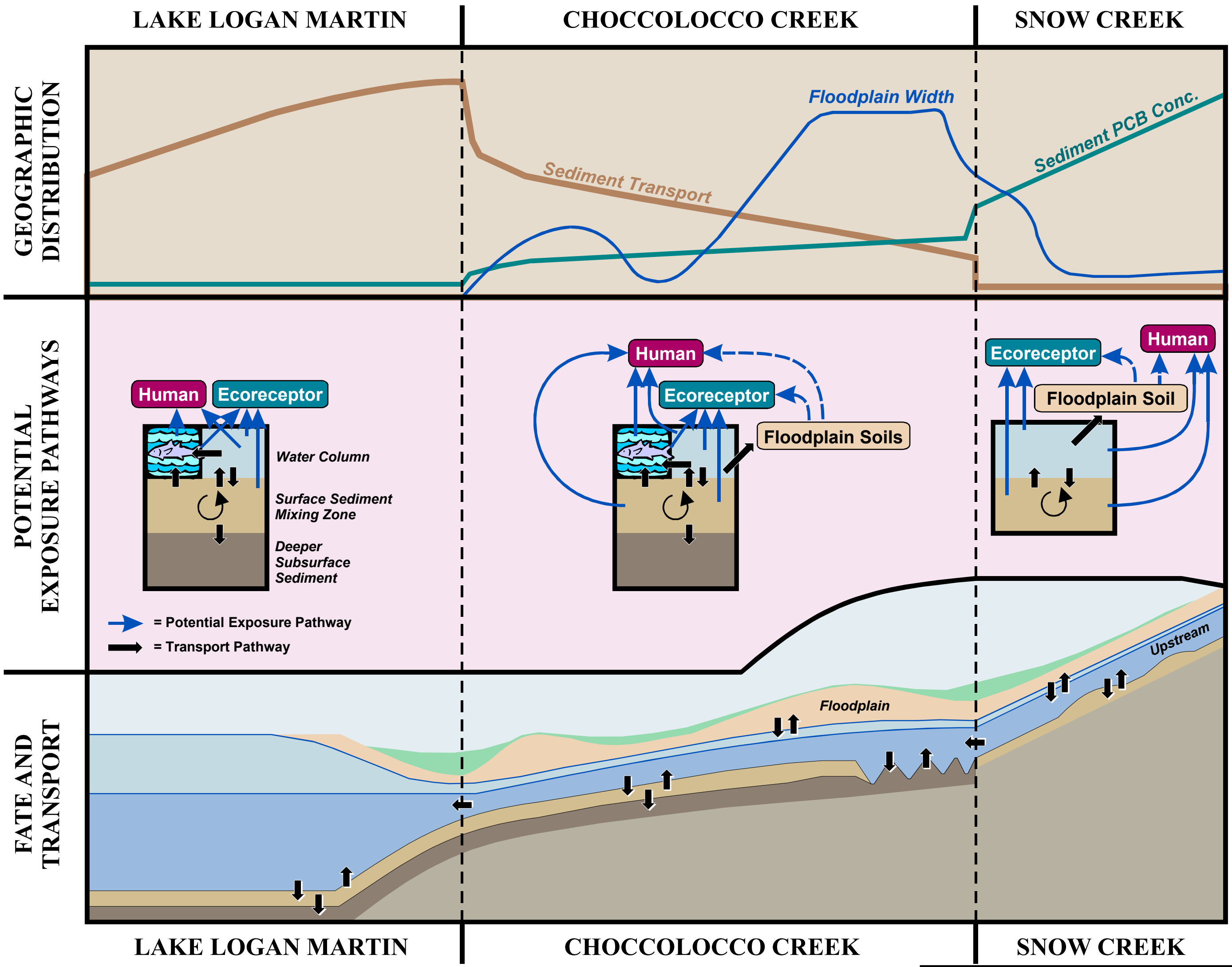
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK WATERSHED MANAGEMENT APPROACH

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1-2



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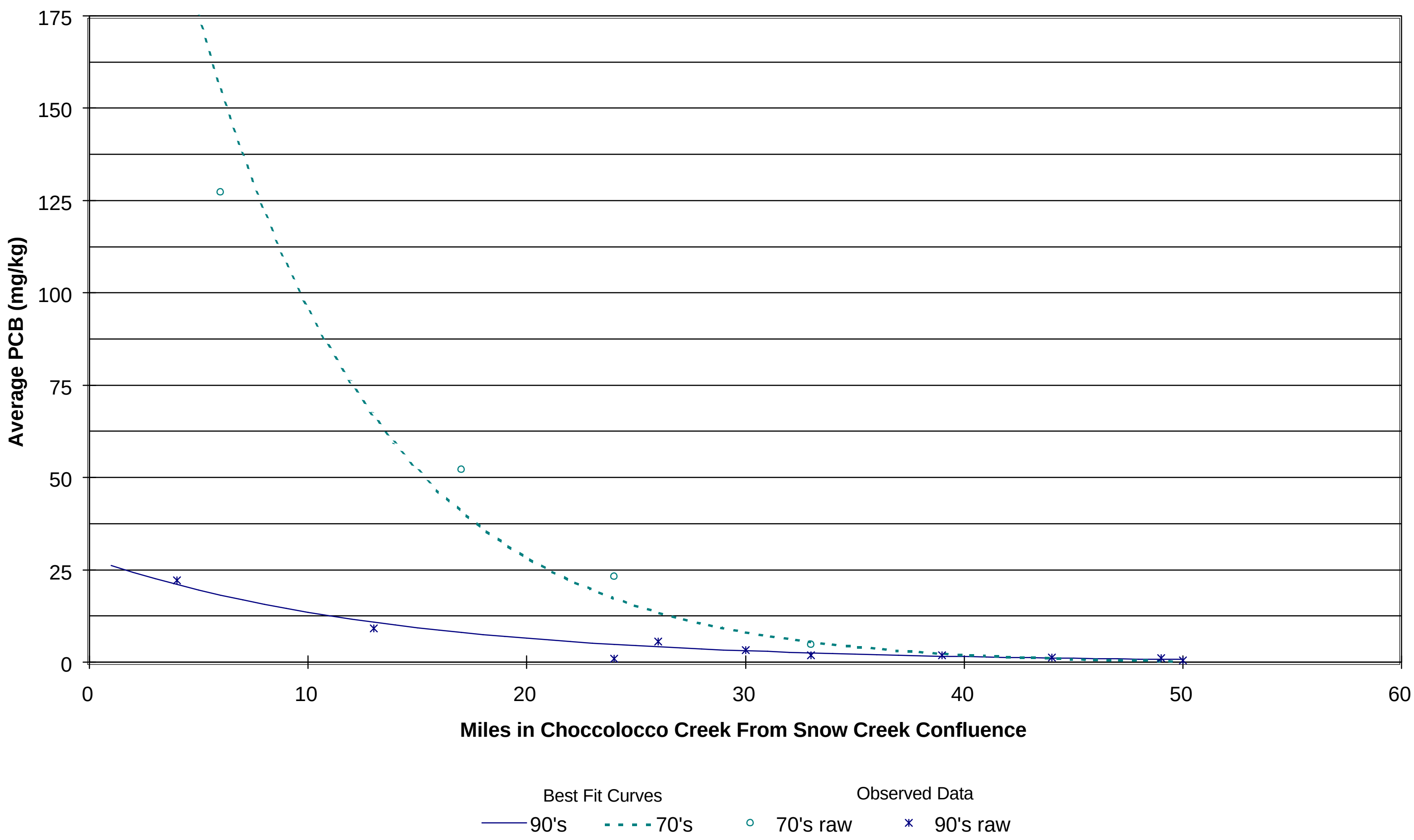
OFF-SITE RFI REPORT

INITIAL OFF-SITE CONCEPTUAL MODEL

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2-1

05/00 SYR D54-DJH LAS
10209051/10209g04.CDR



NOTES:
1) Curves shown are visually fit based on averages with more than 11 samples
2) Fish data from the Off-Site RFI Work Plan (BBL, 1999)

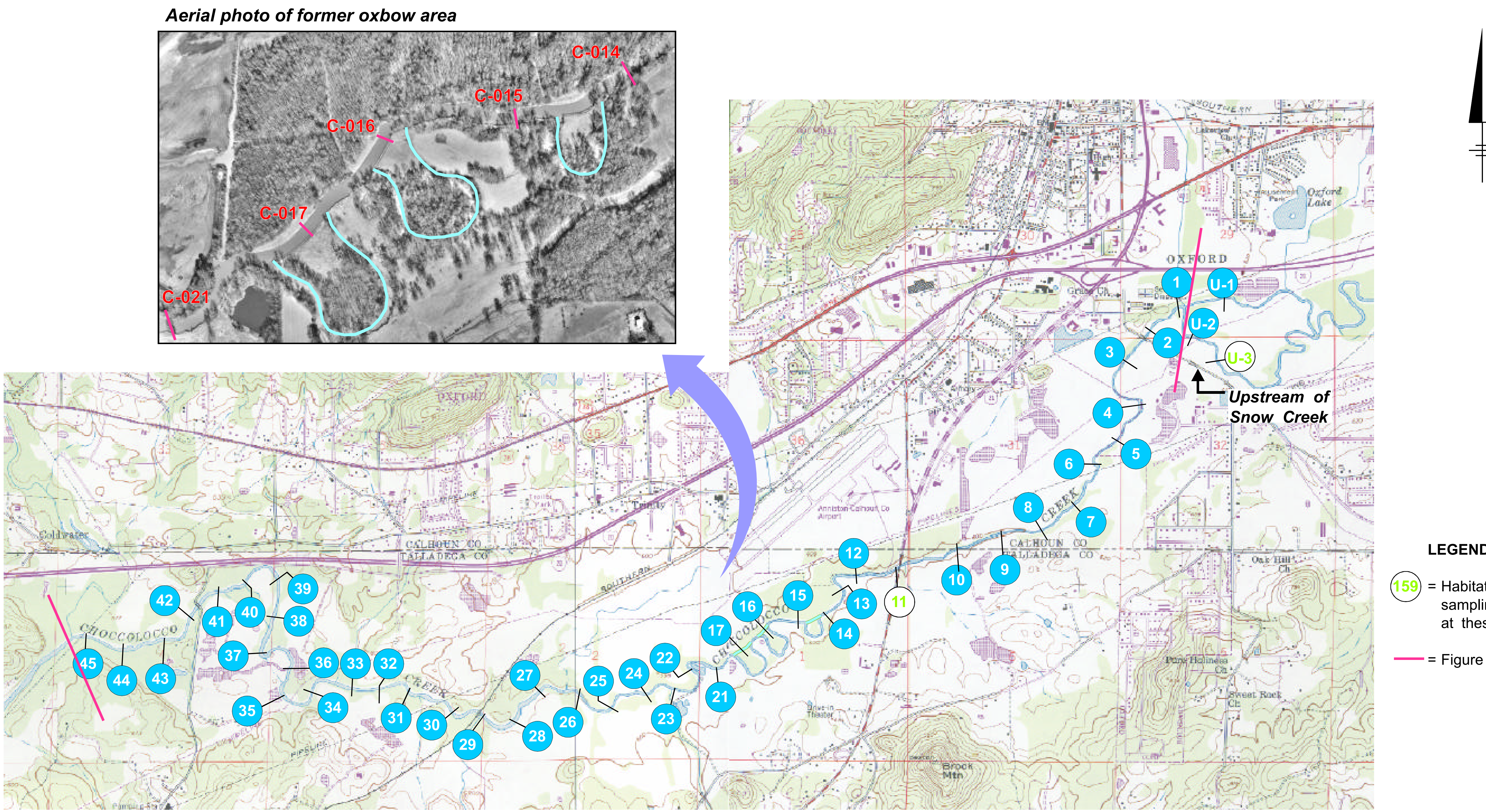
ms_floodfig.xls_2-2_2/28/2003

SOLUTIA INC.
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

AVERAGE FISH PCB CONCENTRATION IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2-2



LEGEND

159 = Habitat assessment sampling also performed at these transects

= Figure match line

NOTES:

1. Initial transect locations included 3 transects in the former oxbows that were not sampled as part of the creek characterization. To preserve the initial transect spacing and numbering scheme up stream and downstream of the reach transects 18, 19, 20 are not shown.
2. Base map source U.S.G.S. 7.5 Minute Quad. Series Oxford, Alabama, 1956 (Photorevised 1983), and Munford, Alabama, 1956 (Photorevised 1983).

05/00 SYR-D54-DJH LAS
10209051/10209g07.cdr

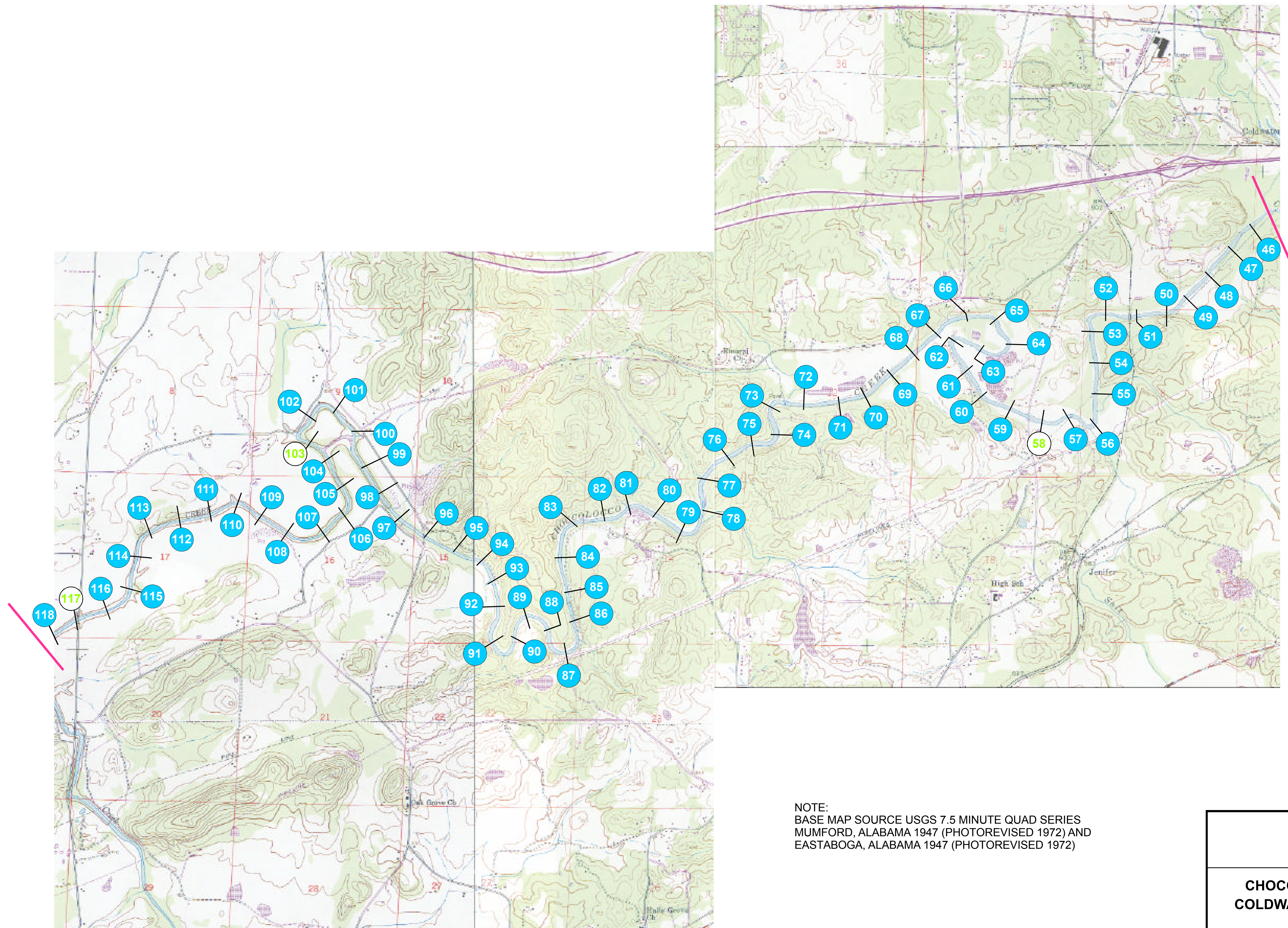
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK TRANSECTS - SNOW CREEK CONFLUENCE TO COLDWATER CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-1



LEGEND

159 = Habitat assessment sampling also performed at these transects

= Figure match line

NOTE:
BASE MAP SOURCE USGS 7.5 MINUTE QUAD SERIES MUMFORD, ALABAMA 1947 (PHOTOREVISED 1972) AND EASTABOGA, ALABAMA 1947 (PHOTOREVISED 1972)

SOLUTIA INC.
ANNISTON, ALABAMA

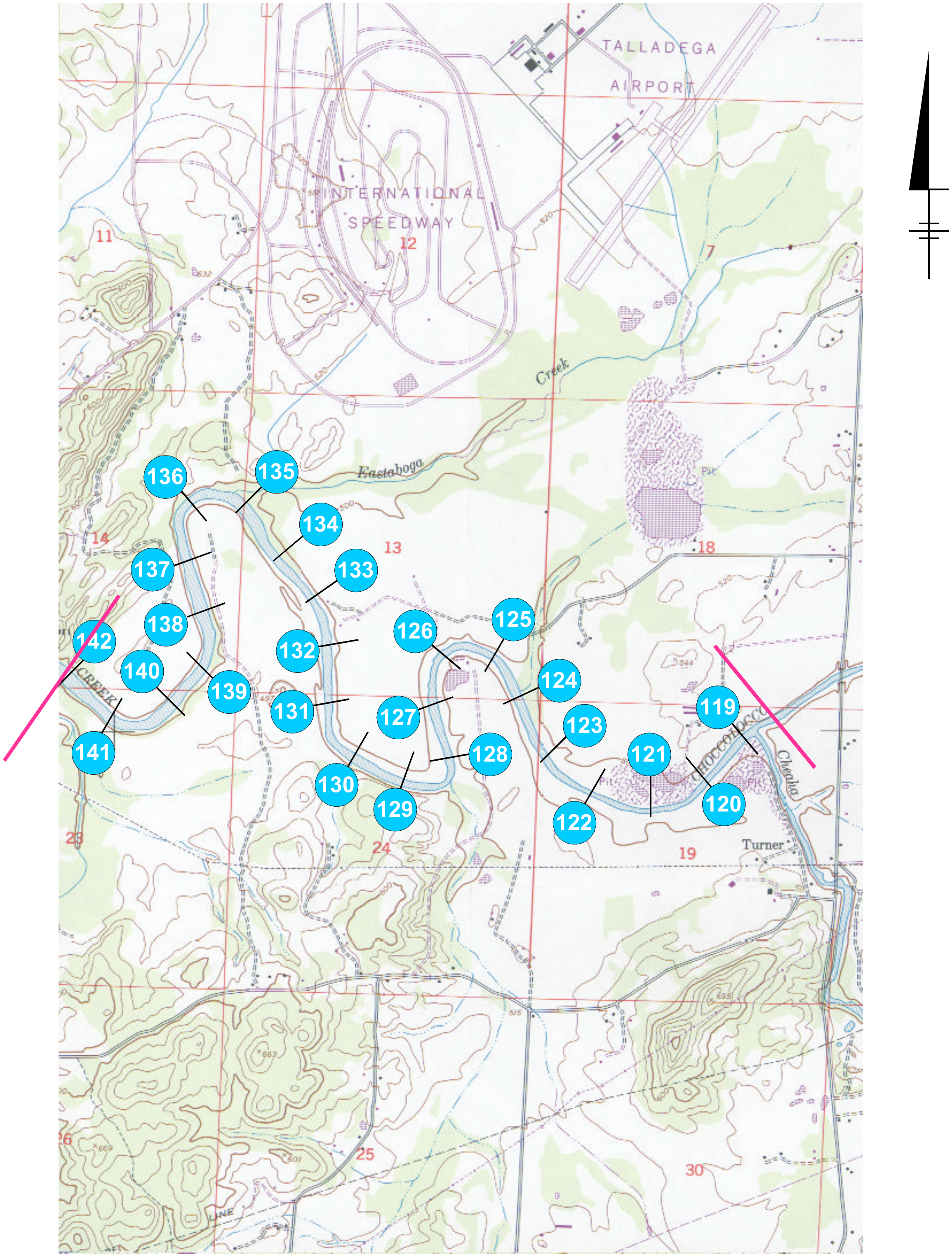
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK TRANSECTS - COLDWATER CREEK TO CHEAHA CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-2

05/00 SYR-D54-DJH LAS
10209051/10209g06.cdr



LEGEND

= Figure match line

NOTE:
BASE MAP SOURCE USGS 7.5 MINUTE QUAD SERIES EASTABOGA, ALABAMA 1947 (PHOTOREVISED 1972)

05/00 SYR-D54-DJH LAS
10209051/10209g08.cdr

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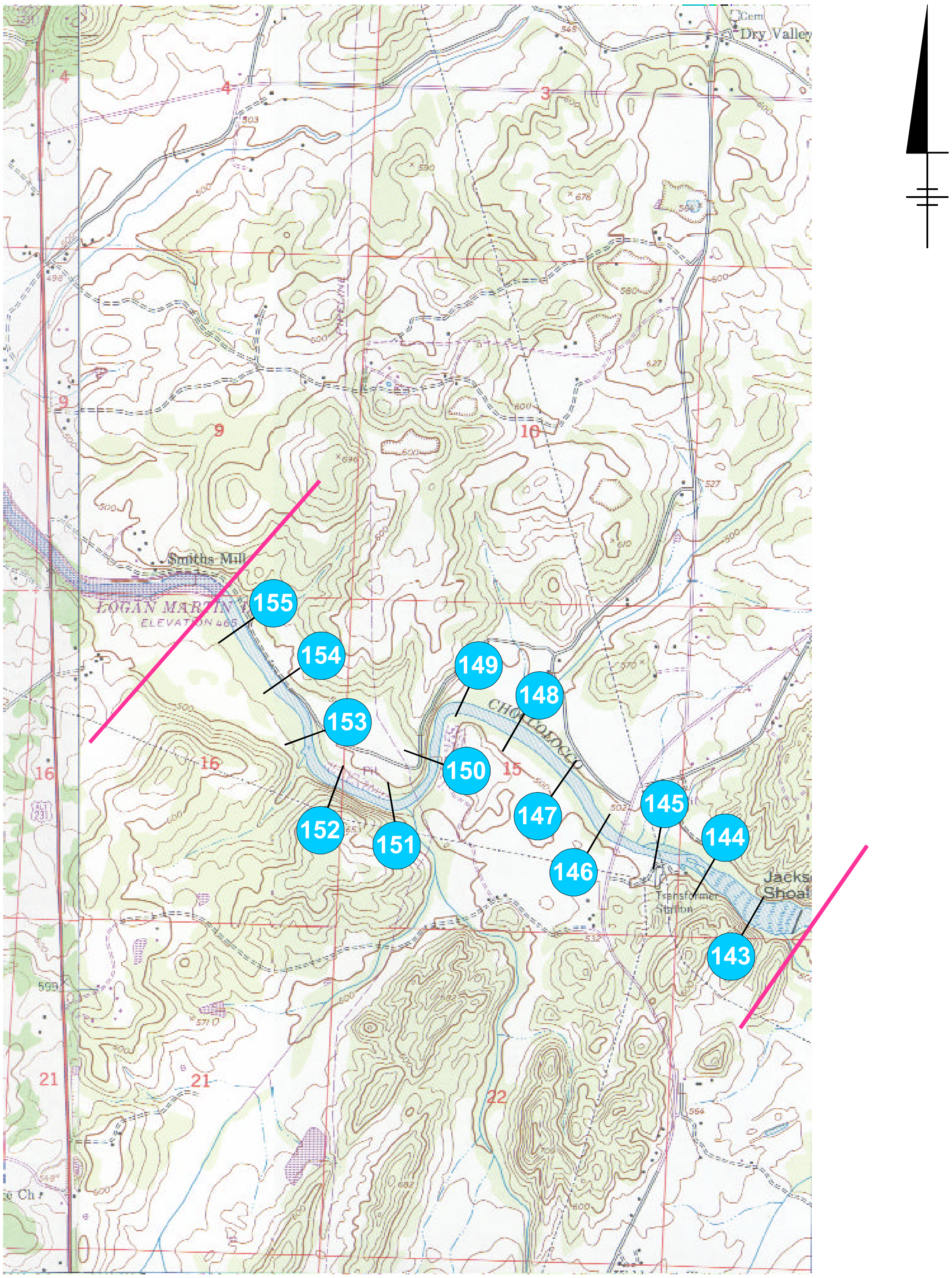
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK TRANSECTS - CHEAHA CREEK TO JACKSON SHOALS

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 3-3



LEGEND

= Figure match line

NOTE:
BASE MAP SOURCE USGS 7.5 MINUTE QUAD SERIES EASTABOGA, ALABAMA 1947 (PHOTOREVISED 1972)

05/00 SYR-D54-DJH LAS
10209051/10209g02.cdr

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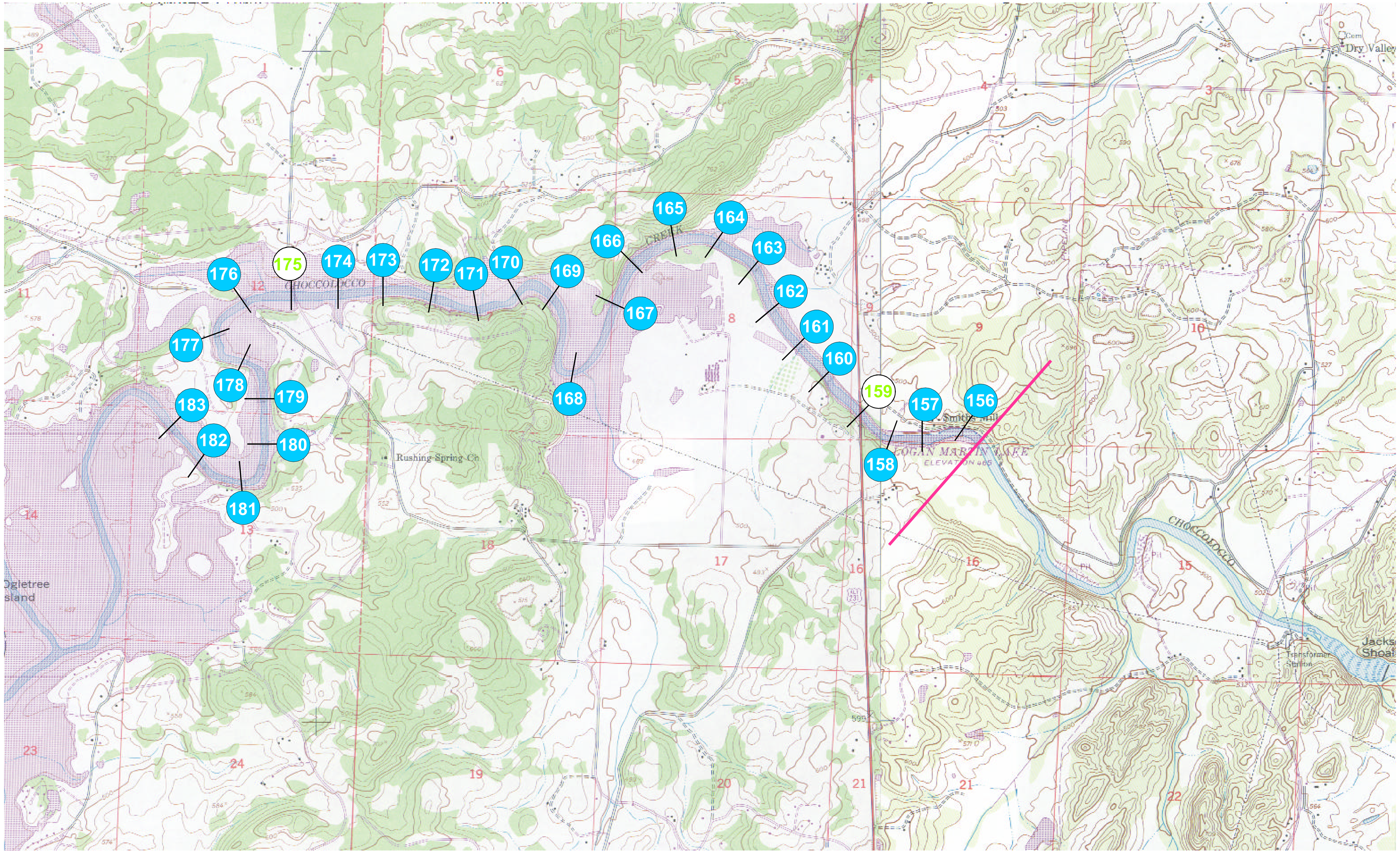
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK TRANSECTS - JACKSON SHOALS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-4



LEGEND

159 = Habitat assessment sampling also performed at these transects

= Figure match line

NOTE:
BASE MAP SOURCE USGS 7.5 MINUTE QUAD SERIES EASTABOGA, ALABAMA 1947 (PHOTOREVISED 1972) AND RIVERSIDE, ALABAMA 1947 (PHOTOREVISED 1972)

SOLUTIA INC.
ANNISTON, ALABAMA

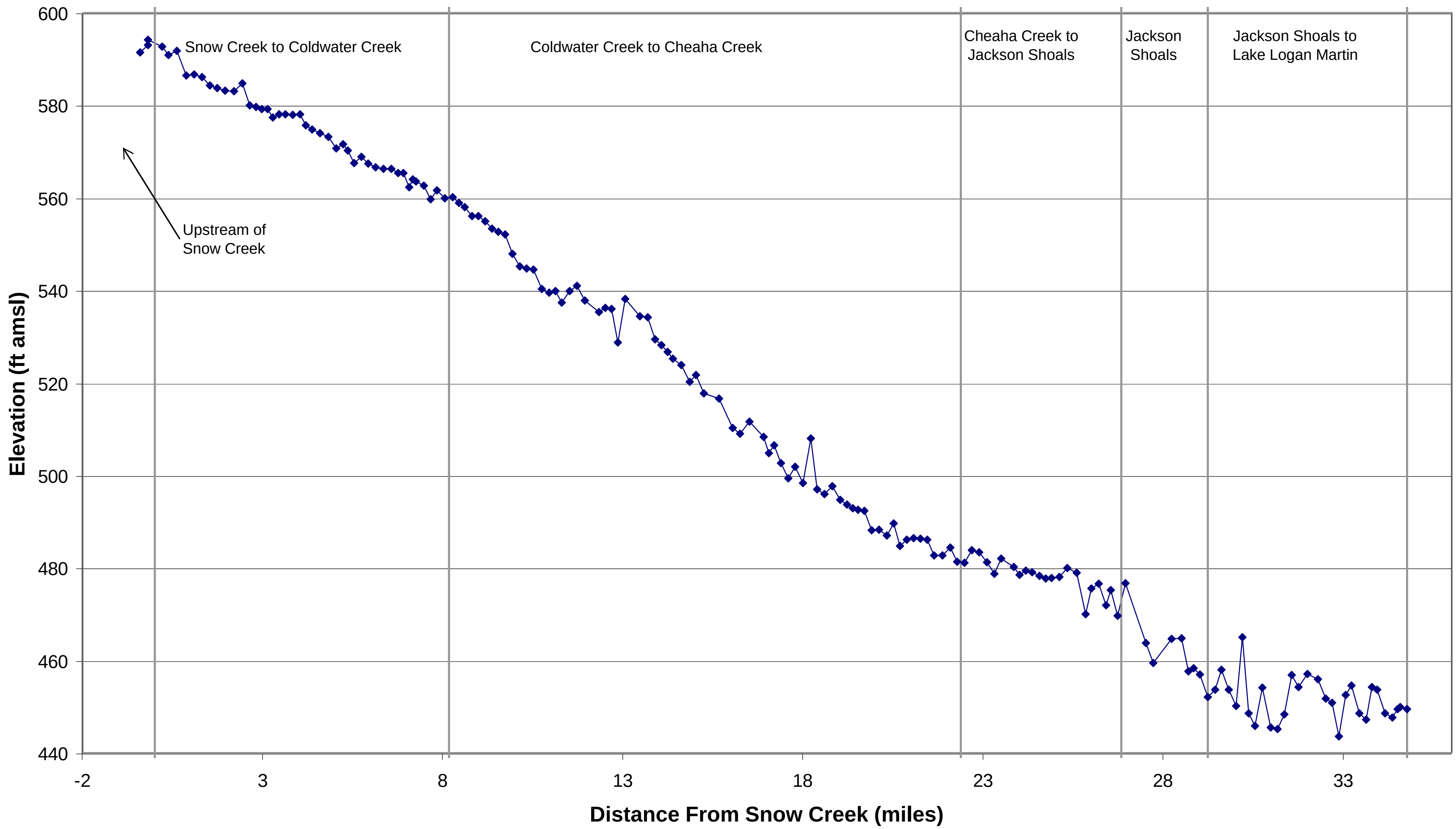
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK TRANSECTS - JACKSON SHOALS TO LAKE LOGAN MARTIN

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 3-5

05/00 SYR-D54-DJH LAS
10209051/10209g01.cdr



NOTE:
AMSL - Above mean sea level.

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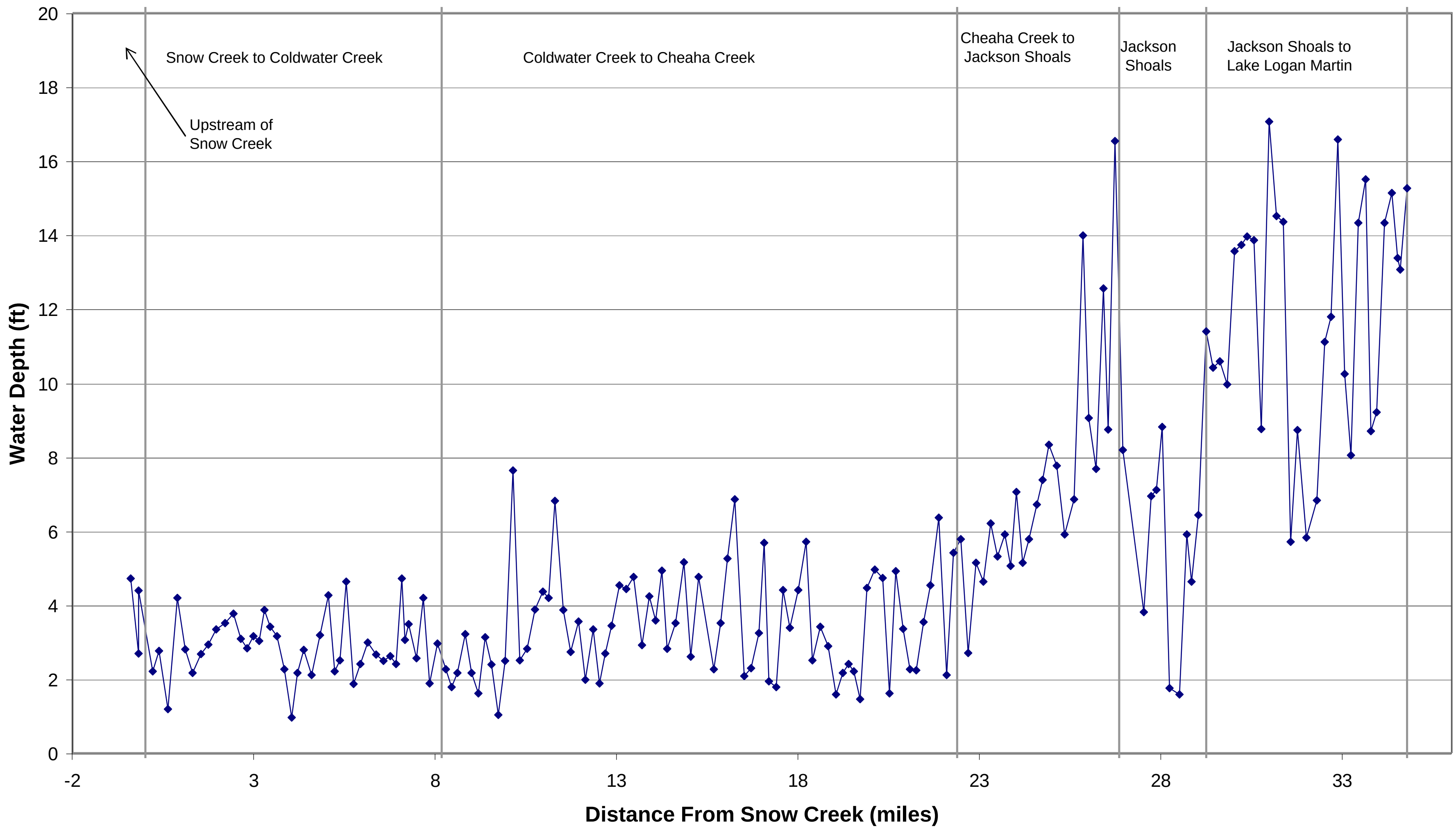
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

AVERAGE BOTTOM ELEVATION BY DISTANCE IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-6



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ANNISTON, ALABAMA

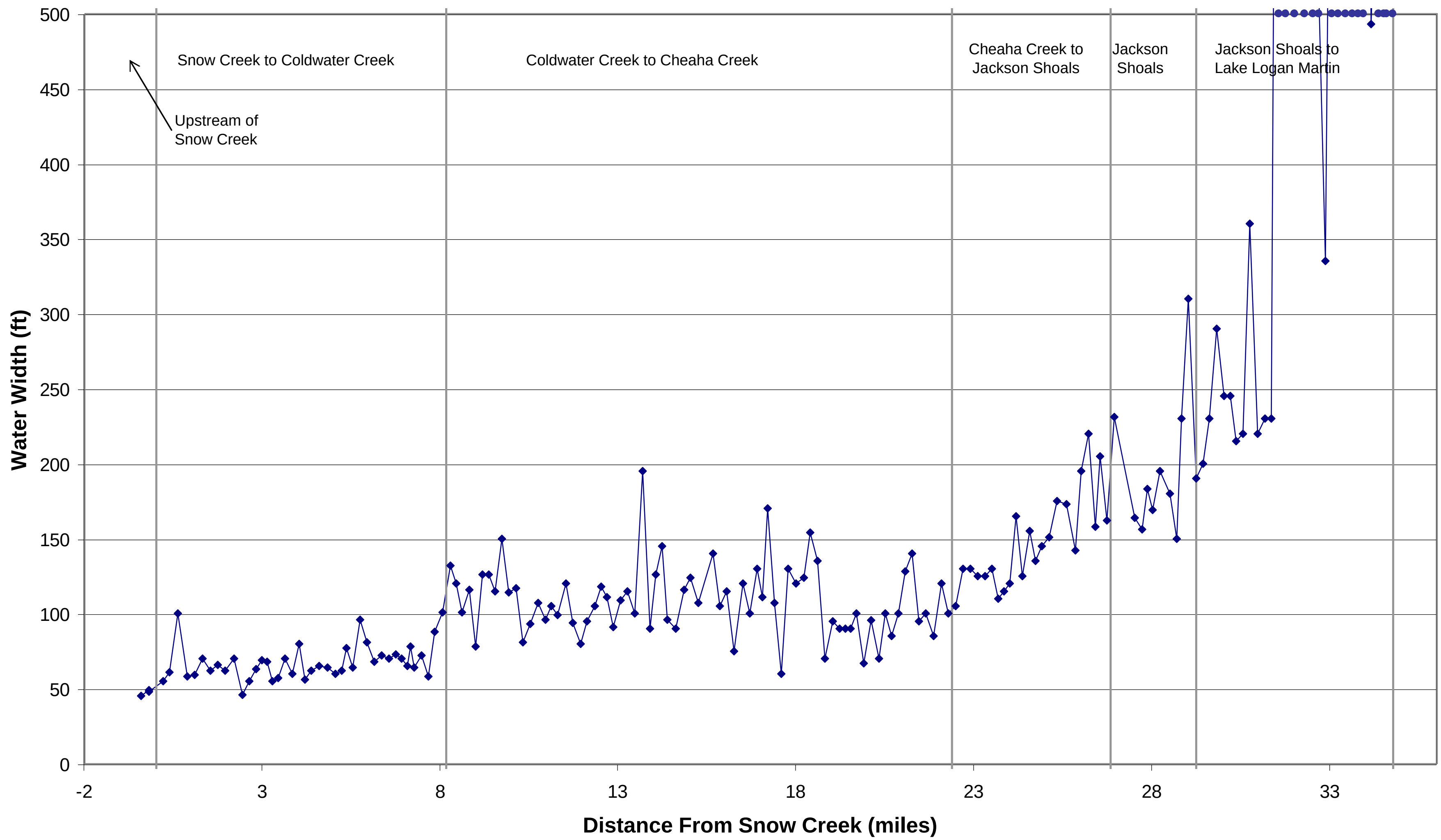
OFF-SITE RFI REPORT

AVERAGE DEPTH OF WATER BY DISTANCE IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-7

ms_transects.xls_WATER DEPTH_2/28/2003



LEGEND

● Width greater than 500 ft, maximum width 2339 ft.

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ANNISTON, ALABAMA

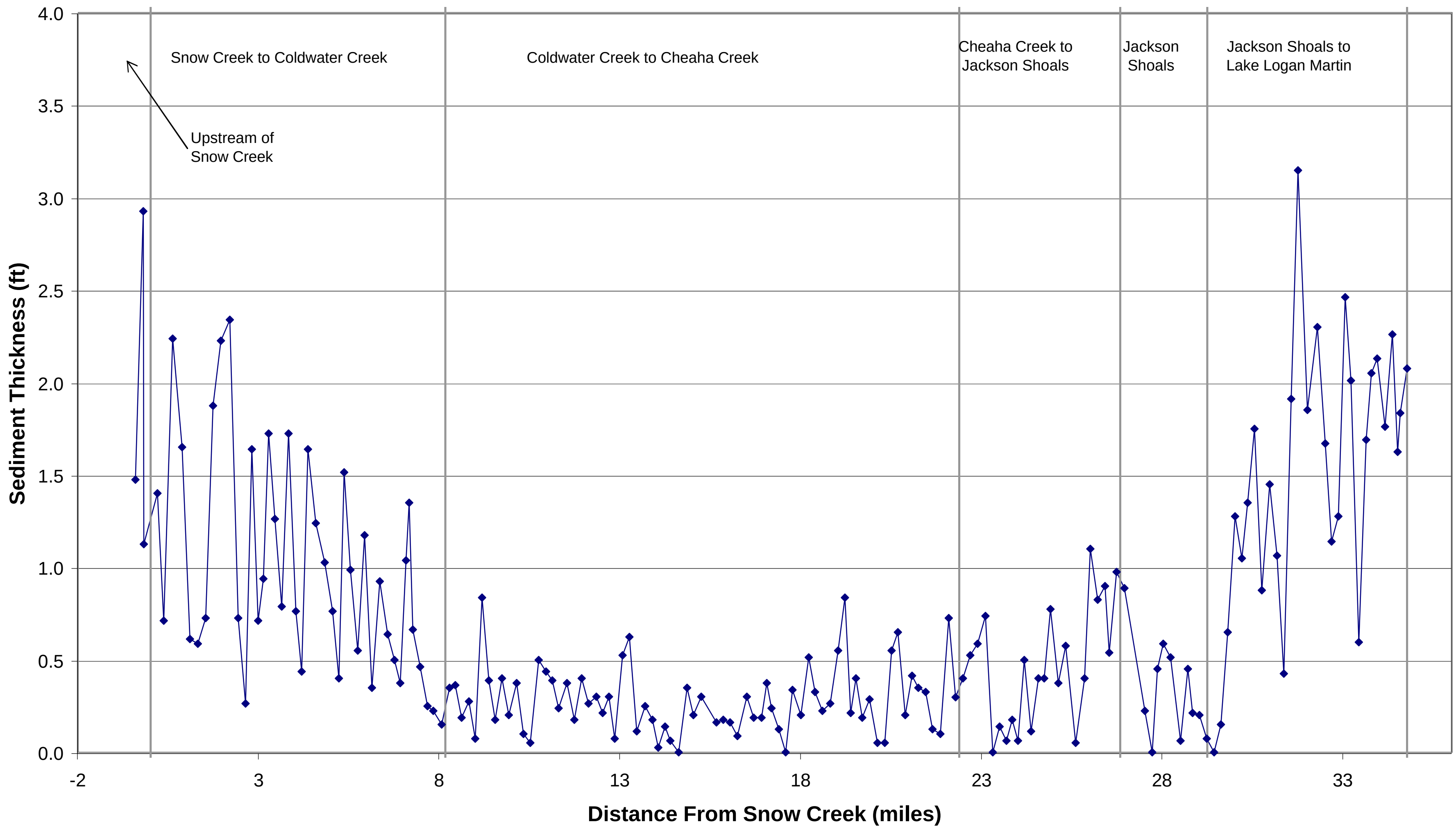
OFF-SITE RFI REPORT

AVERAGE WIDTH OF WATER BY DISTANCE IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-8

ms_transects.xls_3-8_2/28/2003



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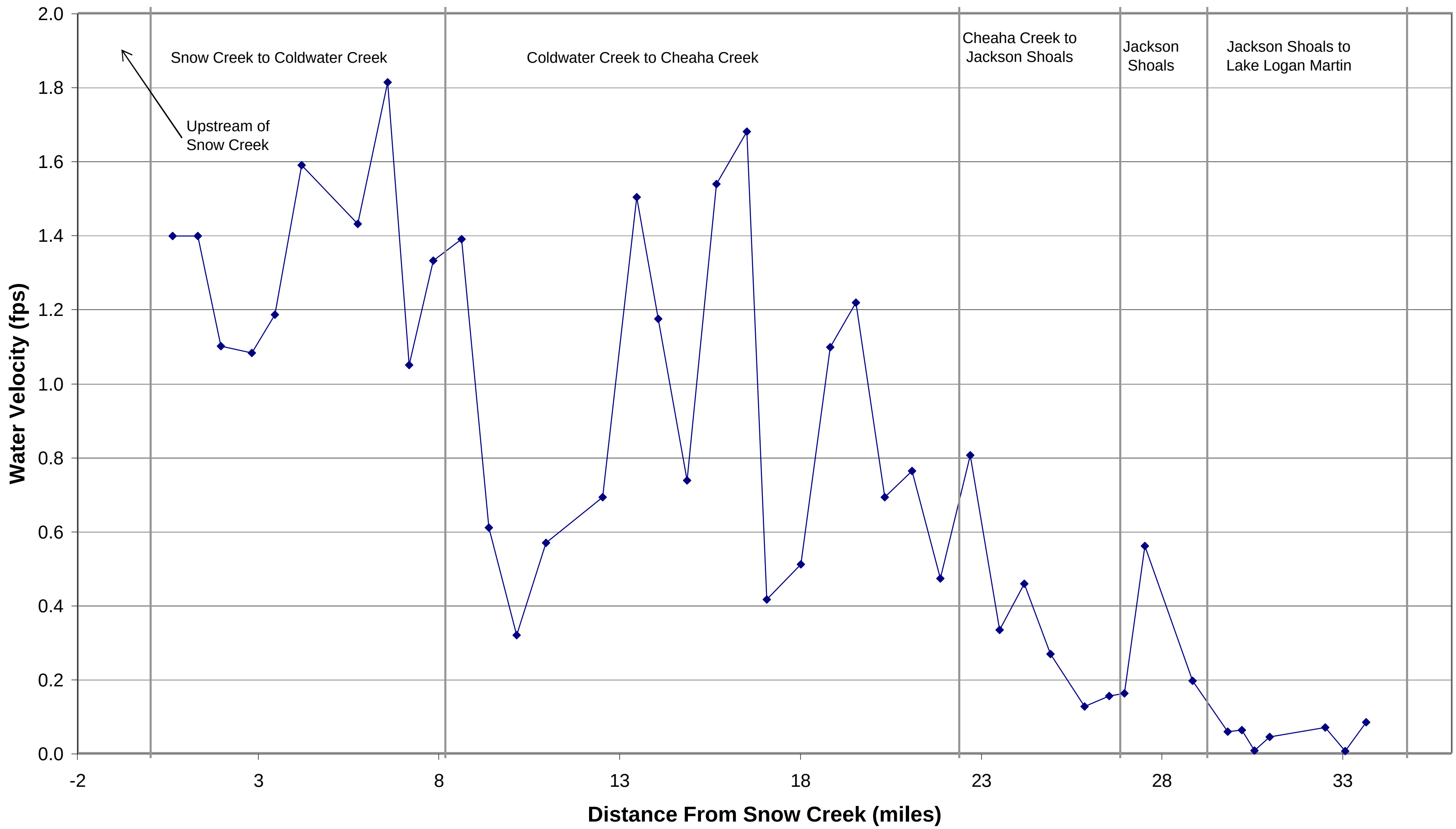
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

AVERAGE THICKNESS OF SEDIMENT BY DISTANCE IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-9



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ANNISTON, ALABAMA

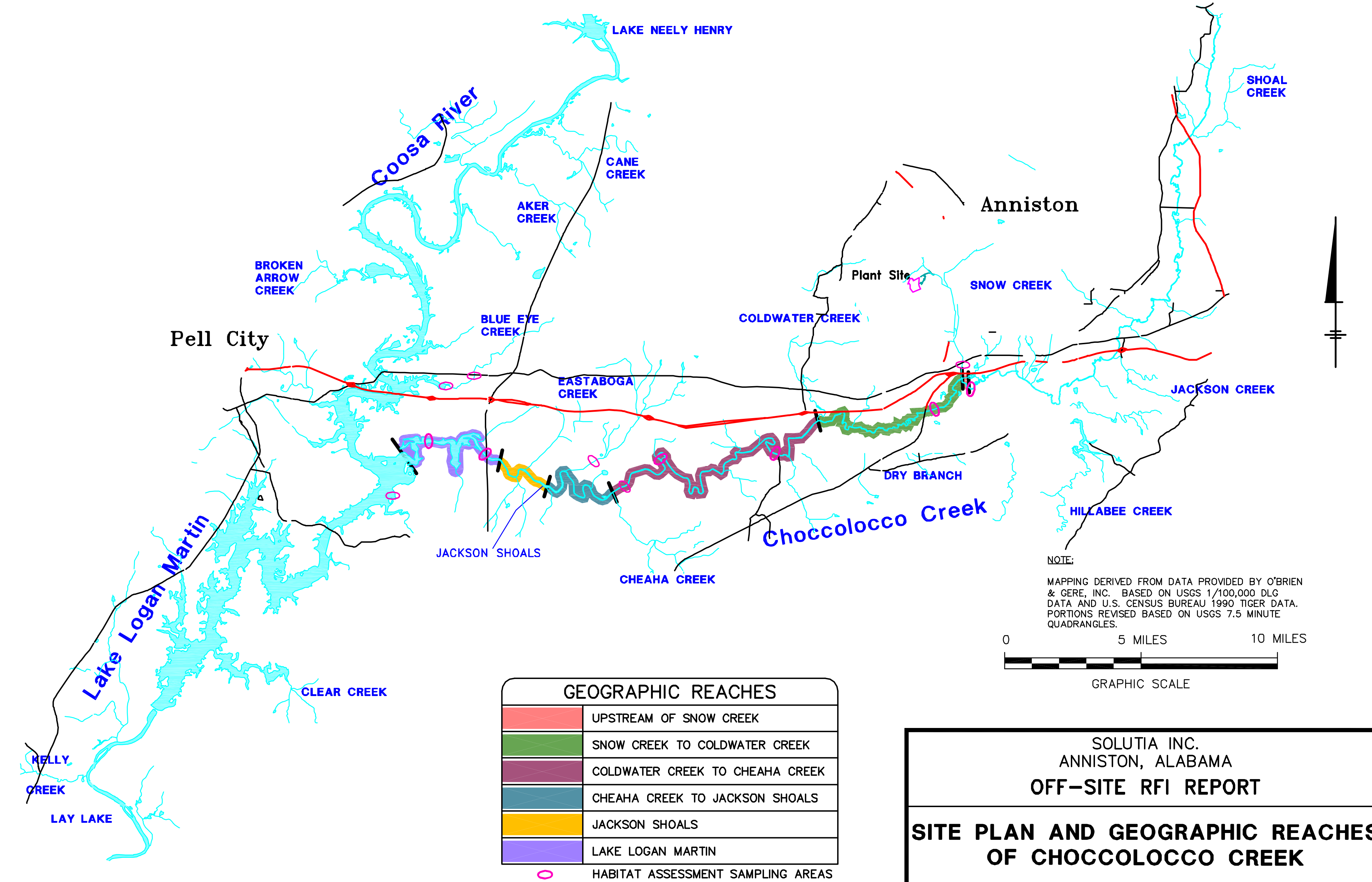
OFF-SITE RFI REPORT

AVERAGE STREAM VELOCITY BY DISTANCE IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-10

ms_transects.xls_WATER VELOCITY_2/28/2003



X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: ALPDF.PCP
6/27/00 SYR-54-KMD NES
10209051/RFI/10209B02.DWG

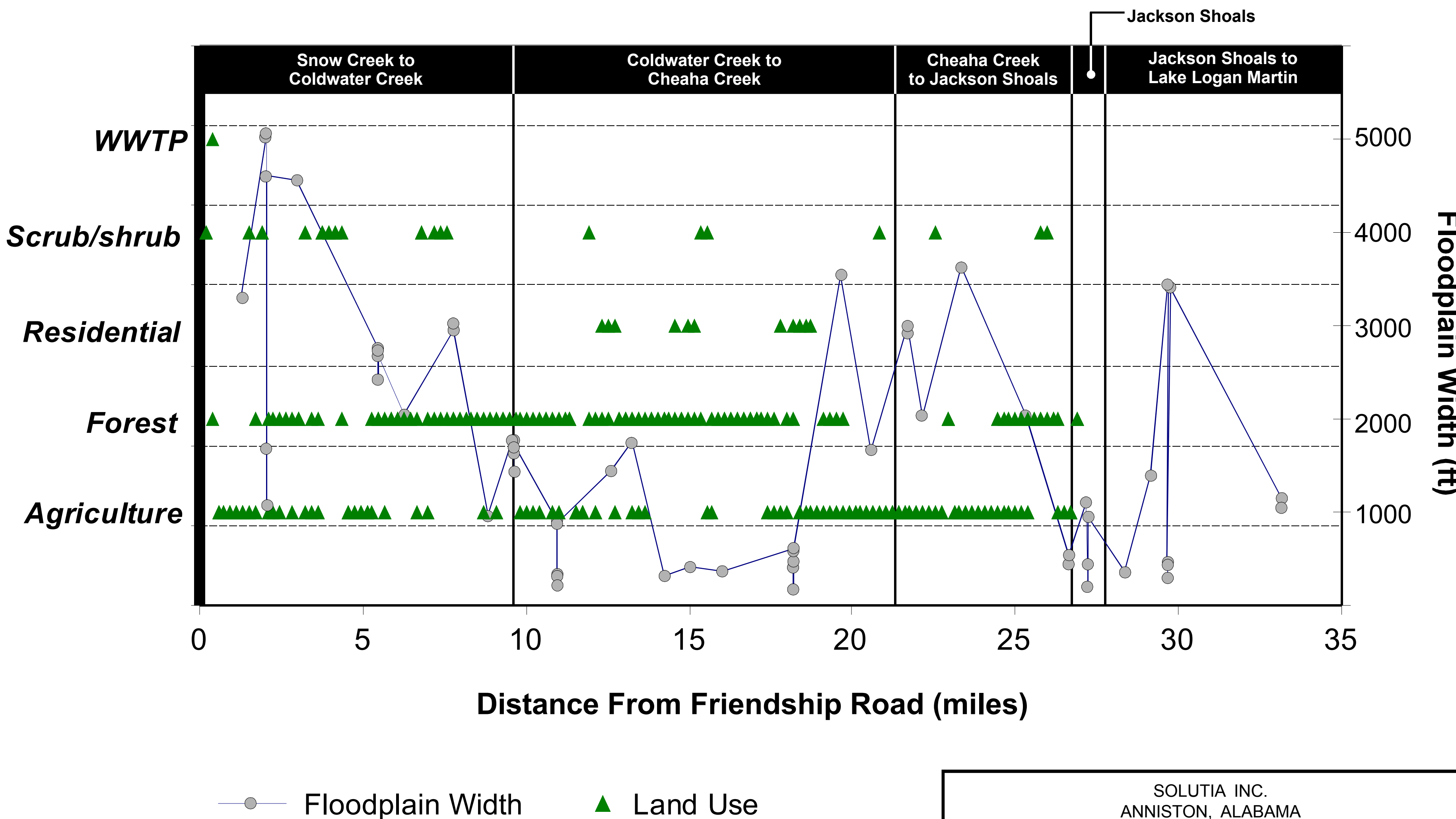
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

SITE PLAN AND GEOGRAPHIC REACHES OF CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-11**



NOTES:

Land use designations based on aerial photographs.

100-year floodplain width based on HEC Modeling (BBL 1999).

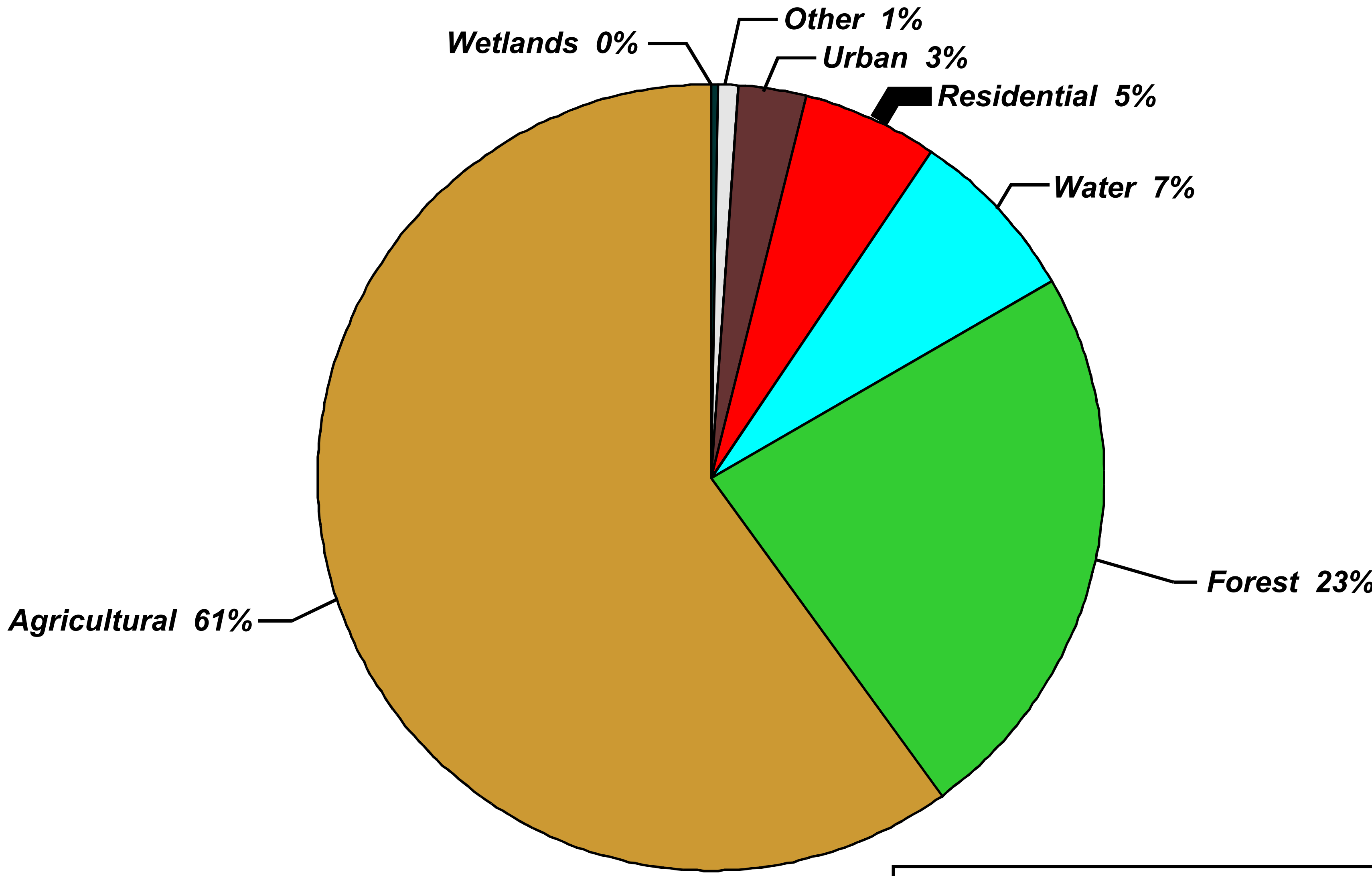
SOLUTIA INC.
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK LAND USE

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE **3-12**

05/00 SYR D54-DJH LAS
10209051/10209g12.CDR



NOTE:
Percentages are on an area basis.
Data from USEPA's BASINS database.

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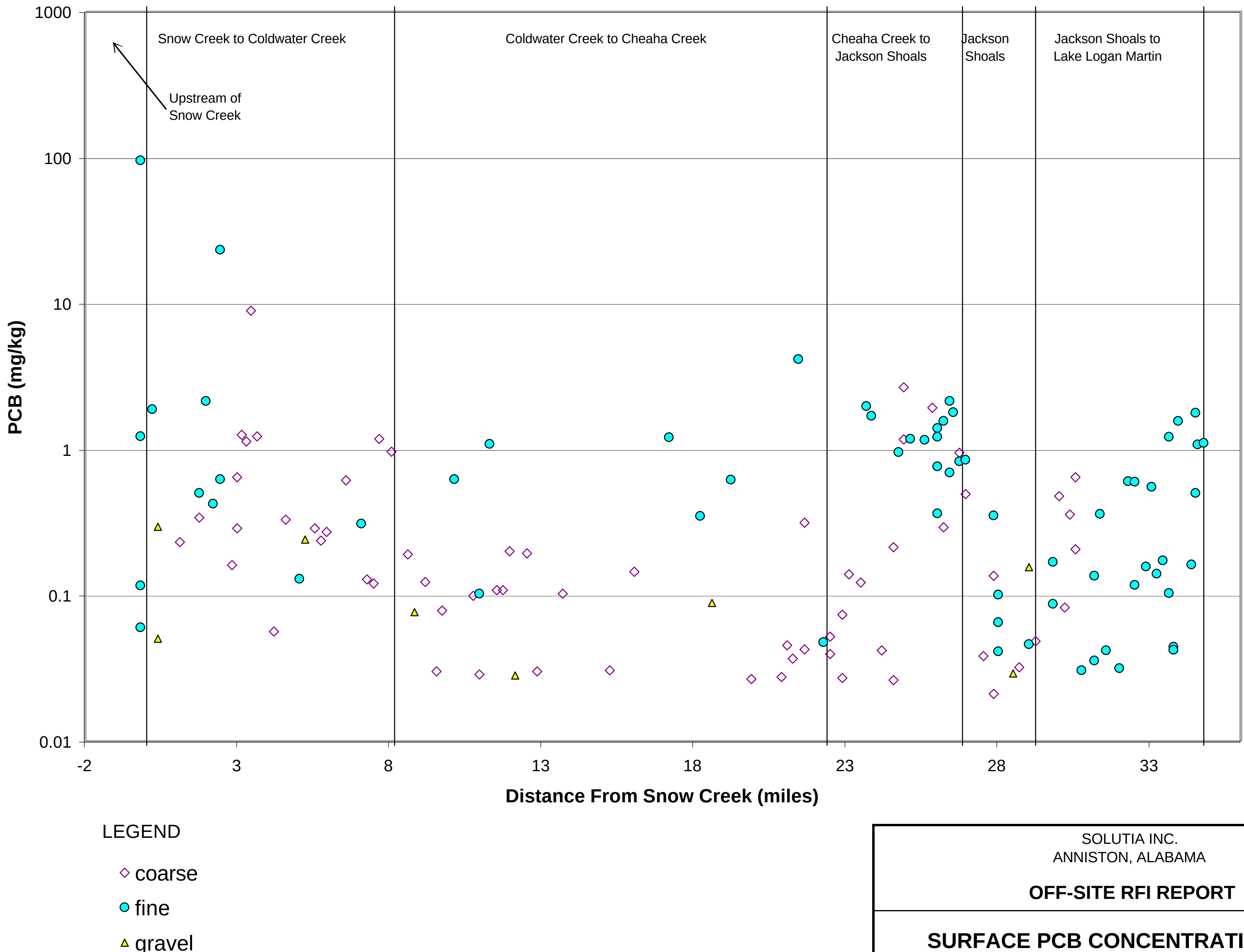
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

LAND USE ALONG CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE **3-13**

05/00 SYR D54-DJH LAS
10209051/10209g15.CDR



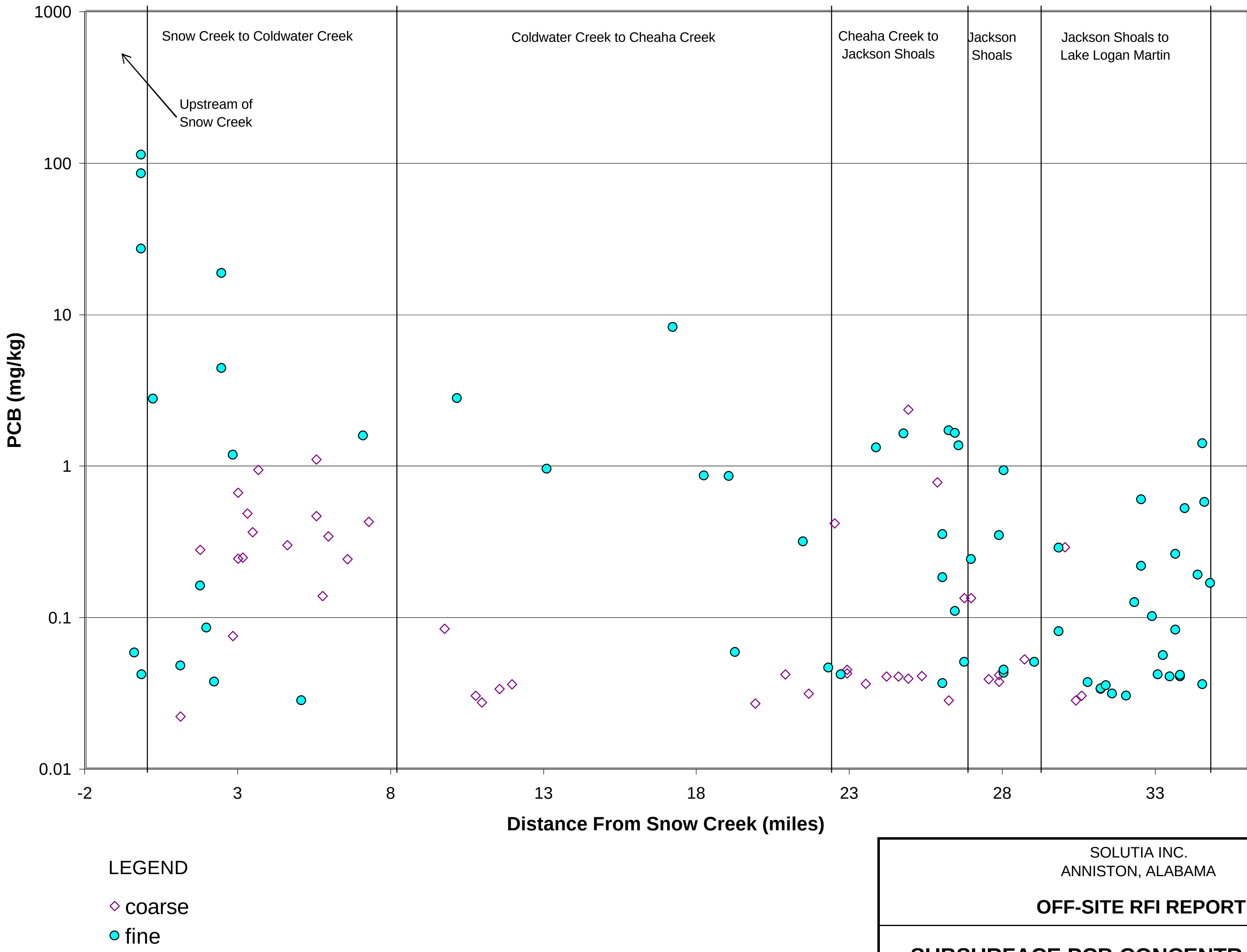
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

SURFACE PCB CONCENTRATIONS BY DISTANCE IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-14



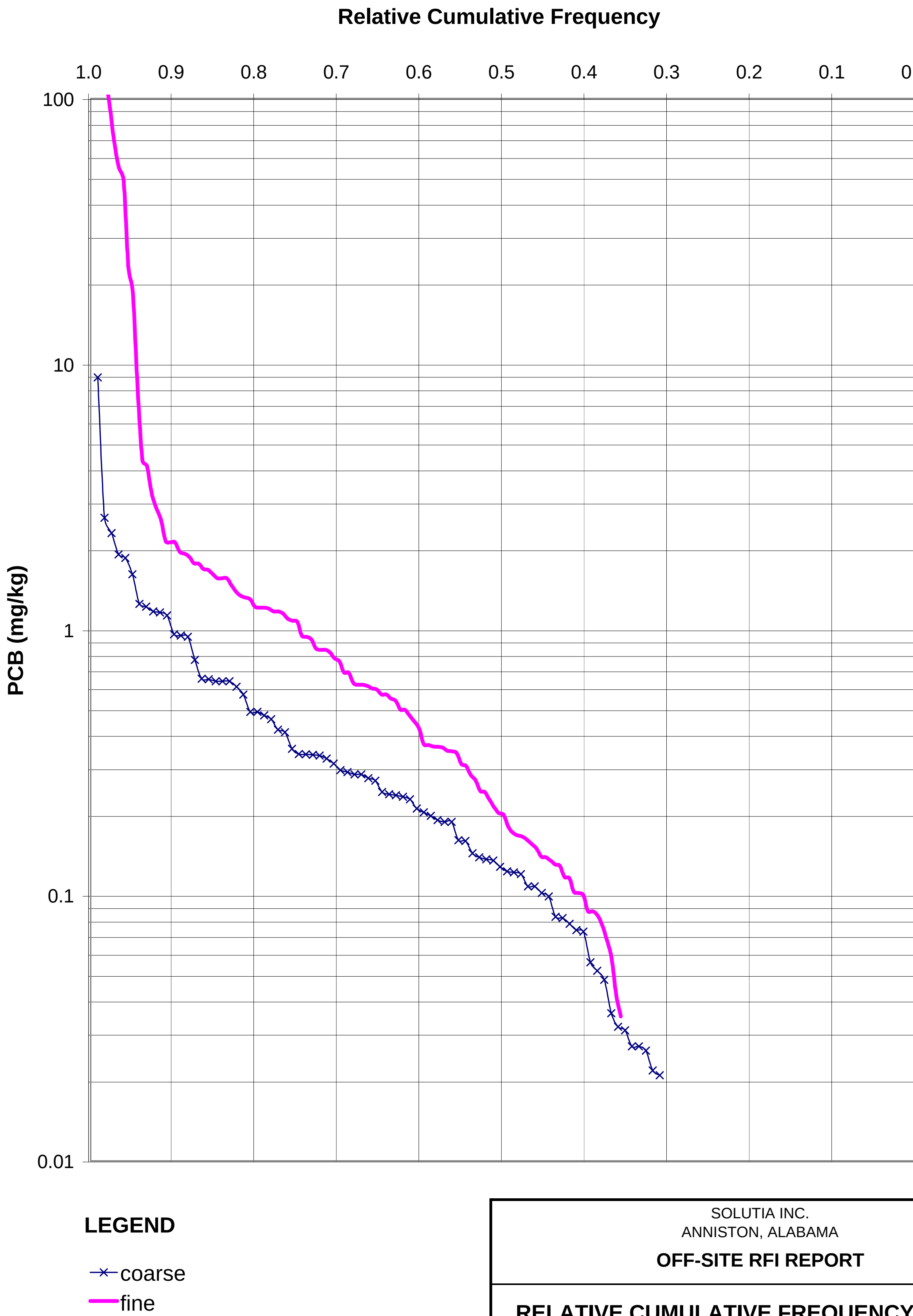
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

SUBSURFACE PCB CONCENTRATIONS BY DISTANCE IN CHOCCOLOCCO CREEK

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 3-15



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ANNISTON, ALABAMA

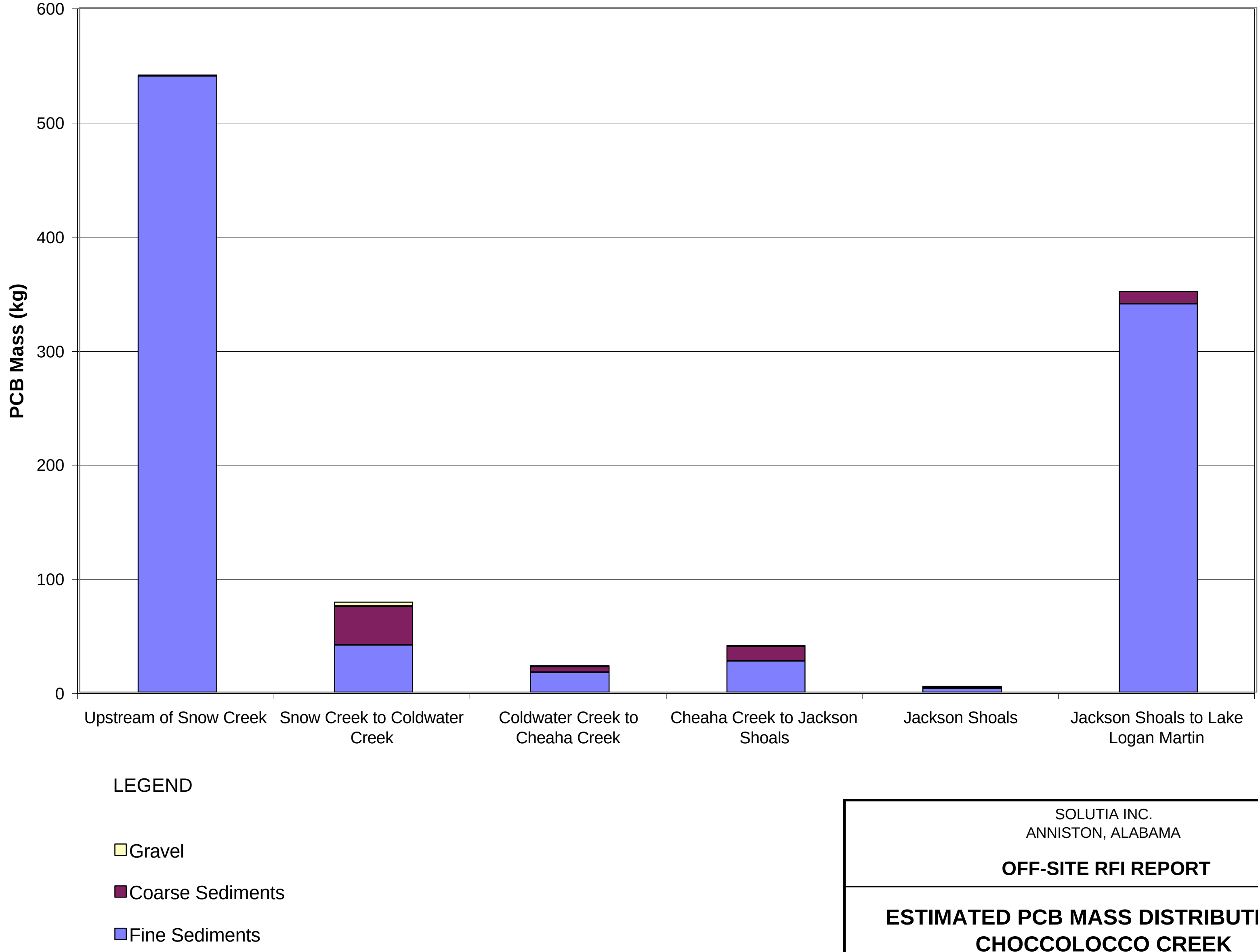
OFF-SITE RFI REPORT

RELATIVE CUMULATIVE FREQUENCY OF PCB IN CHOCCOLOCCO CREEK SEDIMENT

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE
3-16

ms_chocfigs.xls_3-16port_2/28/2003



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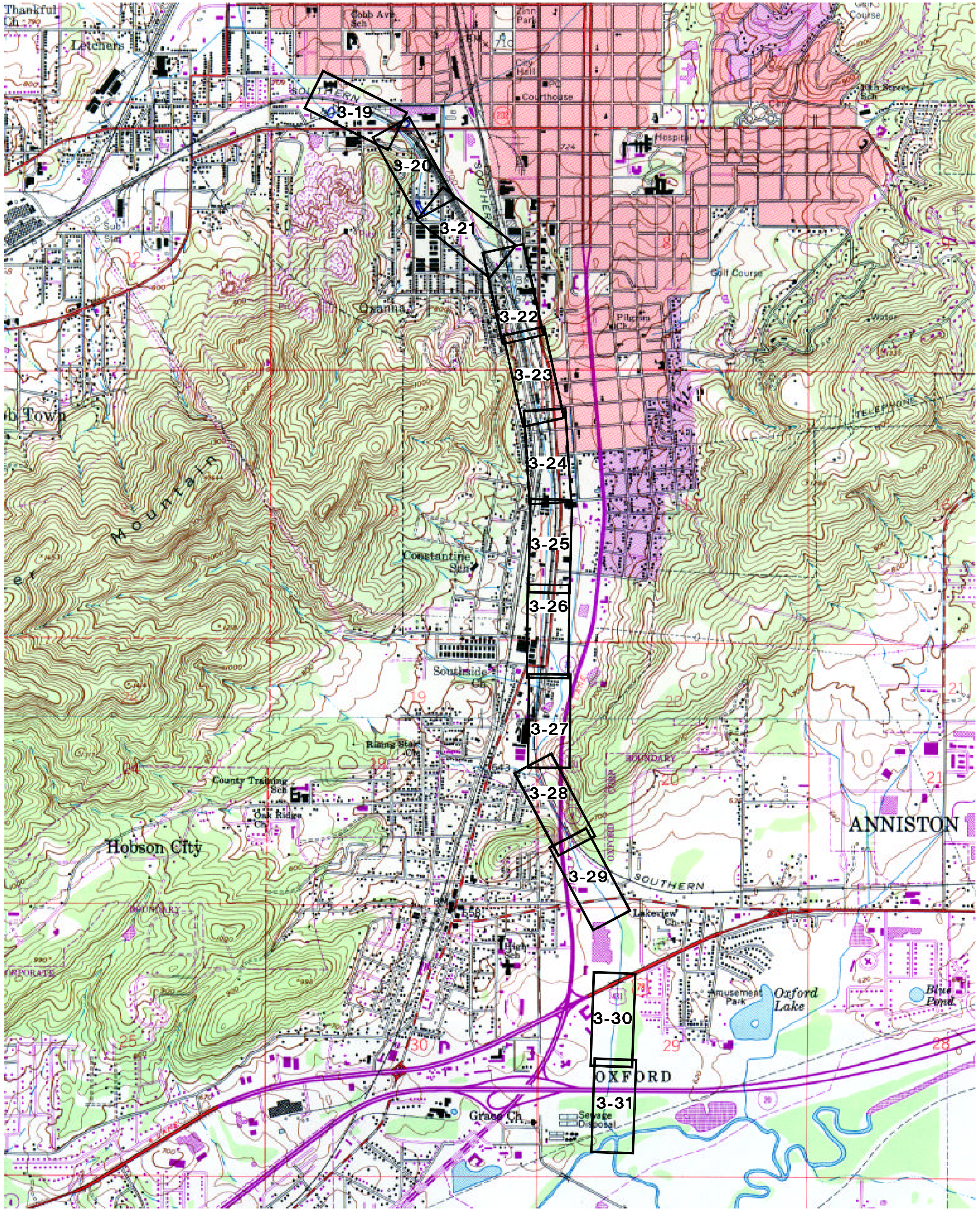
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

ESTIMATED PCB MASS DISTRIBUTION IN CHOCCOLOCCO CREEK

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 3-17



NOTE:

BASE MAP SOURCE USGS 7.5 MINUTE QUAD SERIES OXFORD, ALABAMA 1956 PHOTOREVISED 1983, AND ANNISTON, ALABAMA 1956 PHOTO REVISED 1972

0 1200' 2400'
APPROXIMATE GRAPHIC SCALE

SOLUTIA INC.
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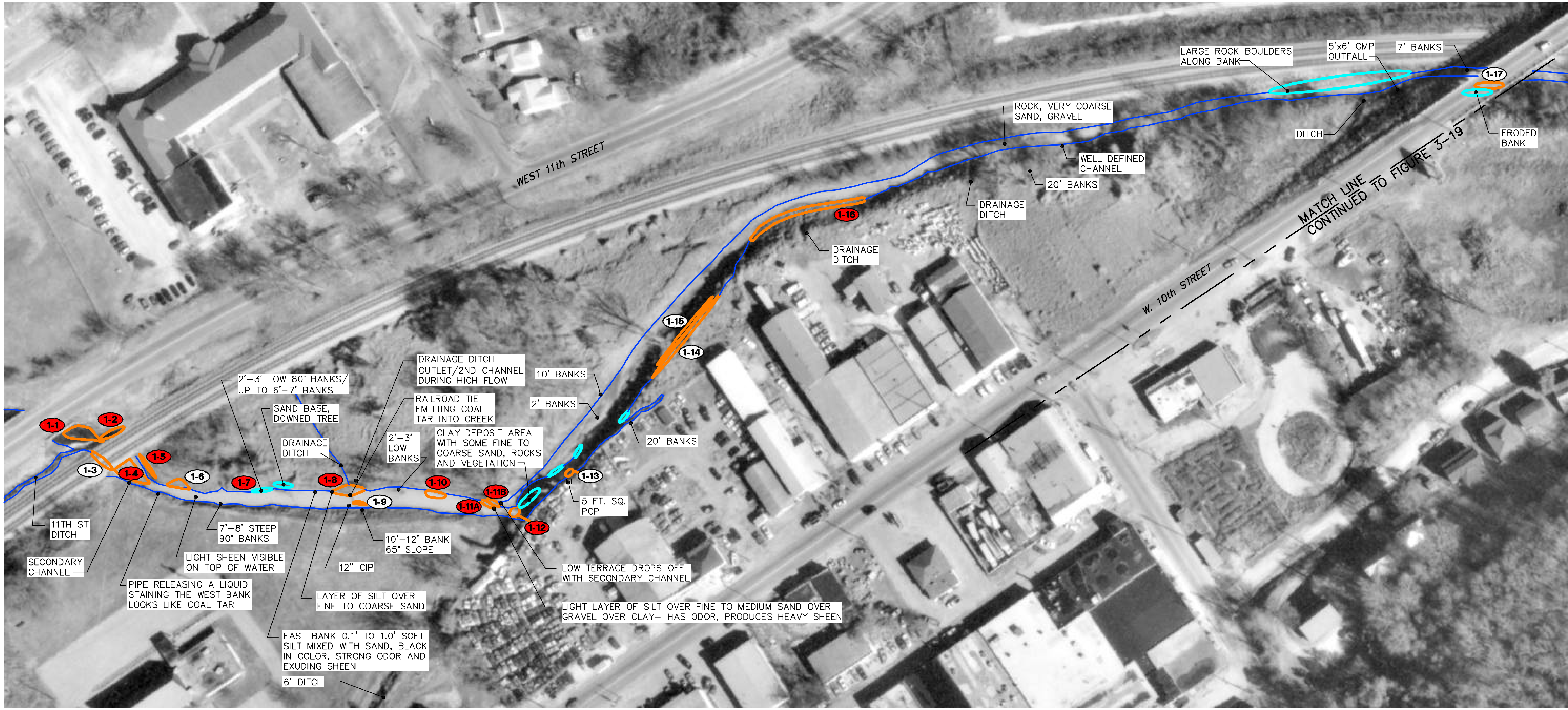
OFF-SITE RFI REPORT

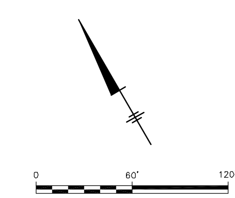
INDEX TO FIGURES

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
3-18

X: 10209X14.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G14.DWG





LEGEND

(1-1) orange outline	SEDIMENT DEPOSIT
cyan outline	OTHER CREEK FEATURE
(1-1) red fill	SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

CMP	CORRUGATED METAL PIPE
PCP	PRESSURE STRESSED CONCRETE PIPE
CIP	CAST IRON PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

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ANNISTON, ALABAMA

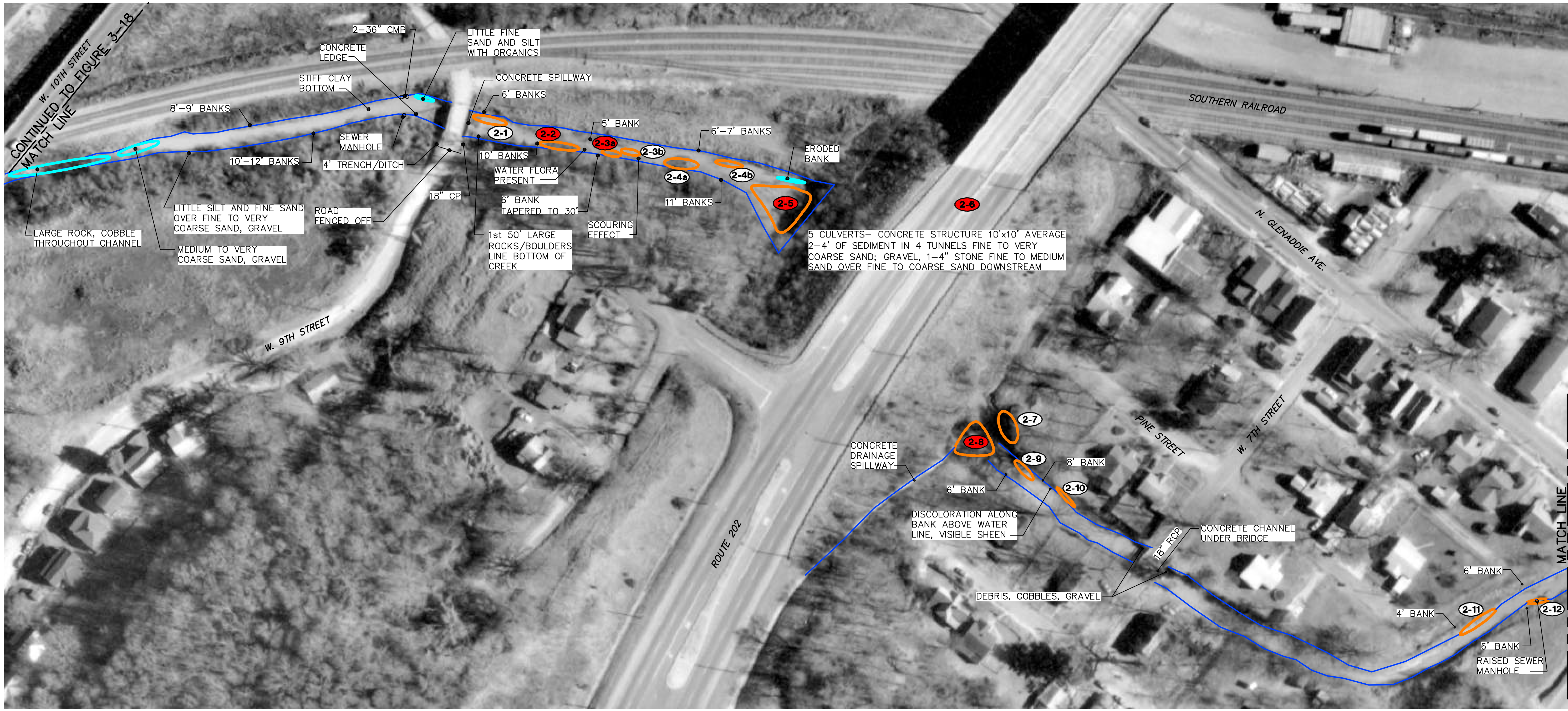
OFF-SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE
3-19

X: 10209X03.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G03.DWG



0 60' 120'
APPROXIMATE GRAPHIC SCALE

LEGEND

- (1-1) SEDIMENT DEPOSIT
- OTHER CREEK FEATURE
- (1-1) SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

RCP	REINFORCED CONCRETE PIPE
CP	CONCRETE PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

X: 10209X04.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G04.DWG

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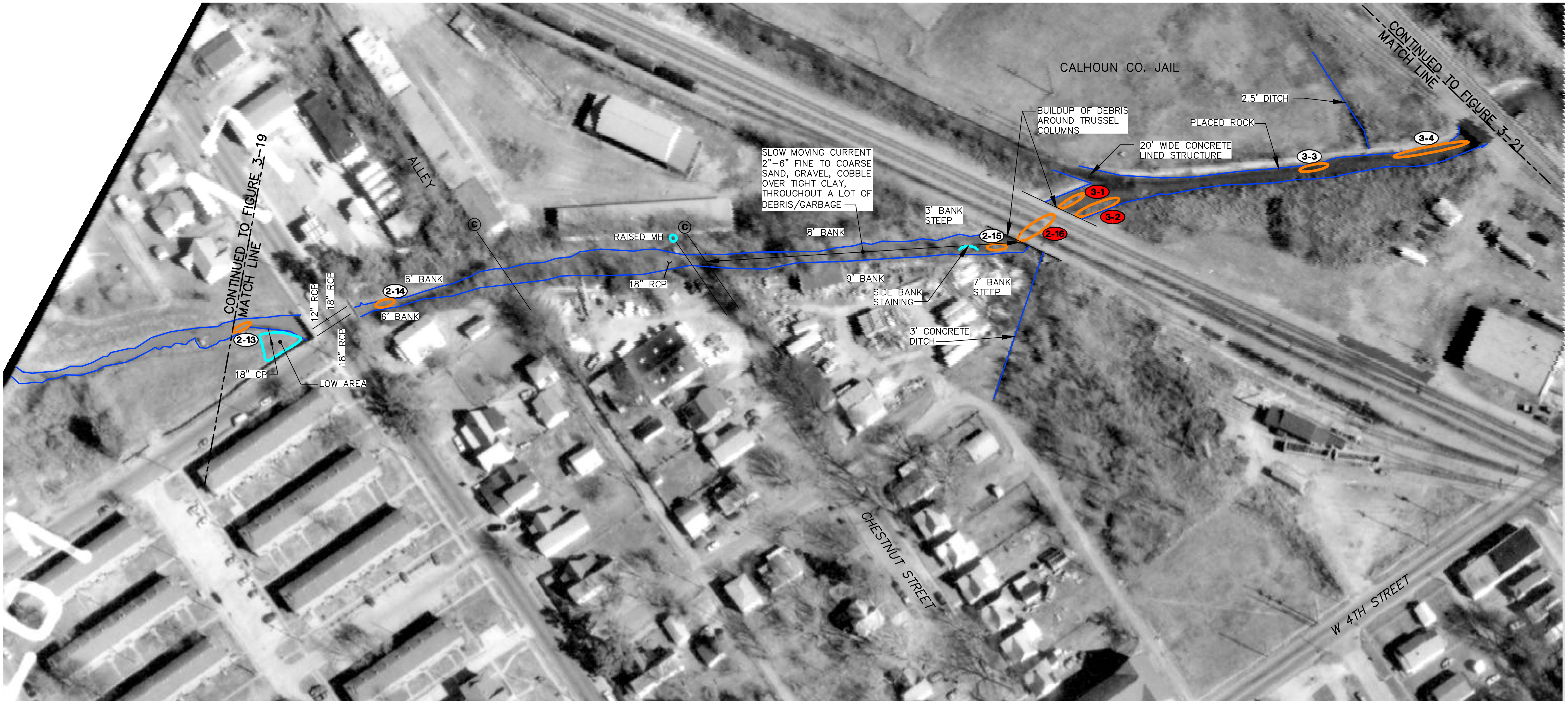
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-20**



LEGEND

1-1 (orange oval)	SEDIMENT DEPOSIT
(cyan oval)	OTHER CREEK FEATURE
1-1 (red)	SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

RCP	REINFORCED CONCRETE PIPE
CP	CONCRETE PIPE
MH	MANHOLE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL.

0 60' 120'
APPROXIMATE GRAPHIC SCALE

X: 10209X05.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G05.DWG

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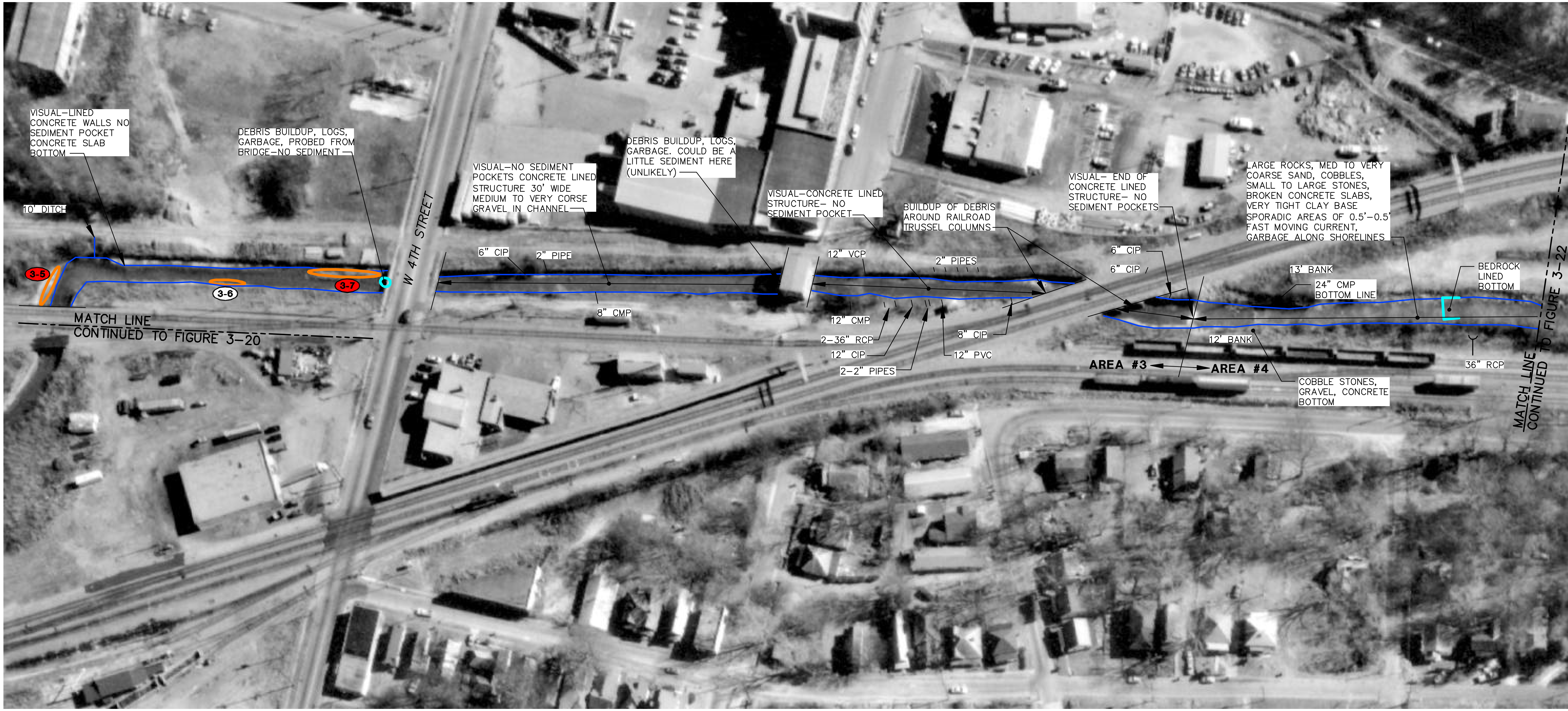
OFF-SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-21**



0 60' 120'
APPROXIMATE GRAPHIC SCALE

LEGEND

1-1 SEDIMENT DEPOSIT
OTHER CREEK FEATURE
1-1 SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

RCP	REINFORCED CONCRETE PIPE
CMP	CORRUGATED METAL PIPE
CIP	CAST IRON PIPE
PVC	POLYVINYL CHLORIDE PIPE
VCP	VITRIFIED CLAY PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

X: 10209X06.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G06.DWG

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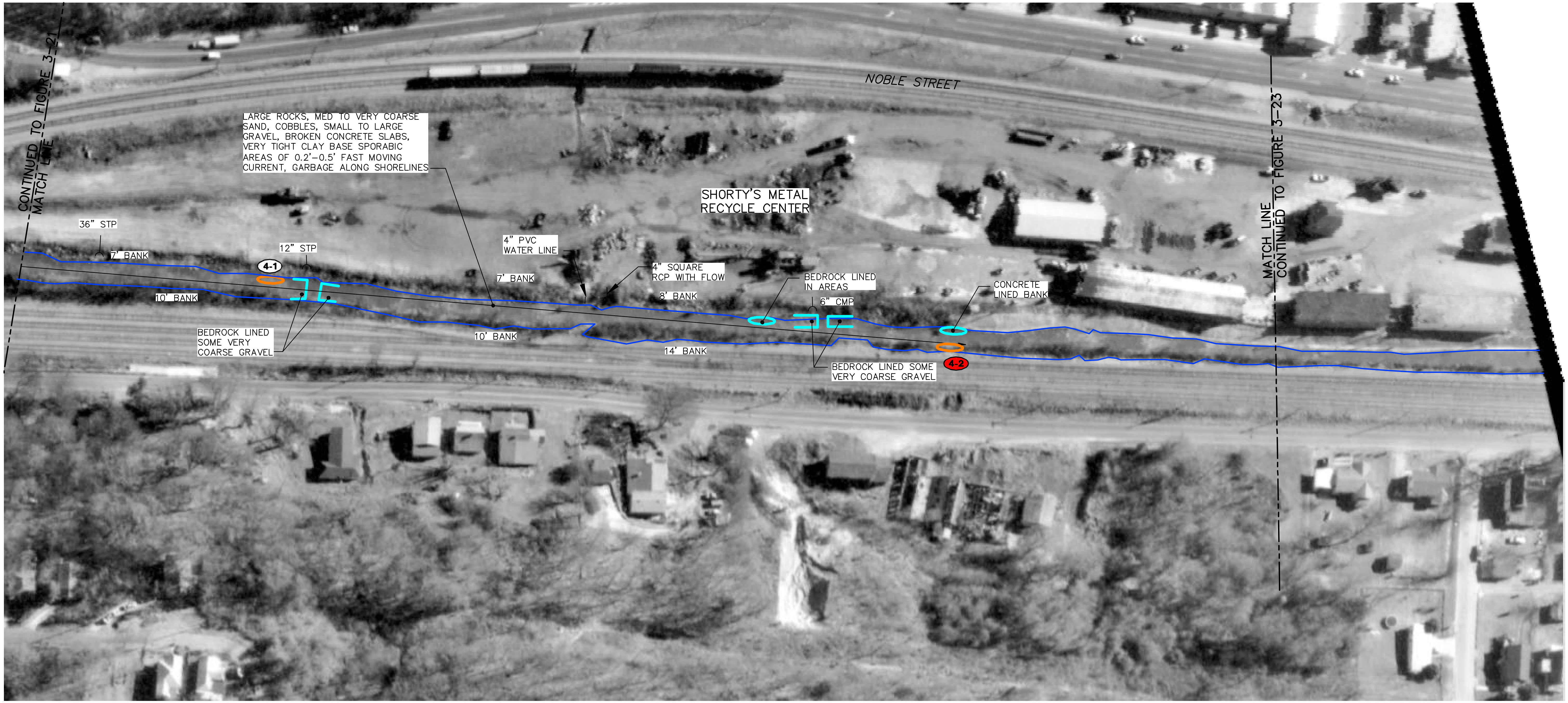
ANNISTON, ALABAMA

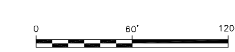
OFF–SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-22**





LEGEND

1-1 (orange)	SEDIMENT DEPOSIT
(cyan)	OTHER CREEK FEATURE
1-1 (red)	SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

RCP	REINFORCED CONCRETE PIPE
CMP	CORRUGATED METAL PIPE
PVC	POLYVINYL CHLORIDE PIPE
STP	STEEL PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

X: 10209X07.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G07.DWG

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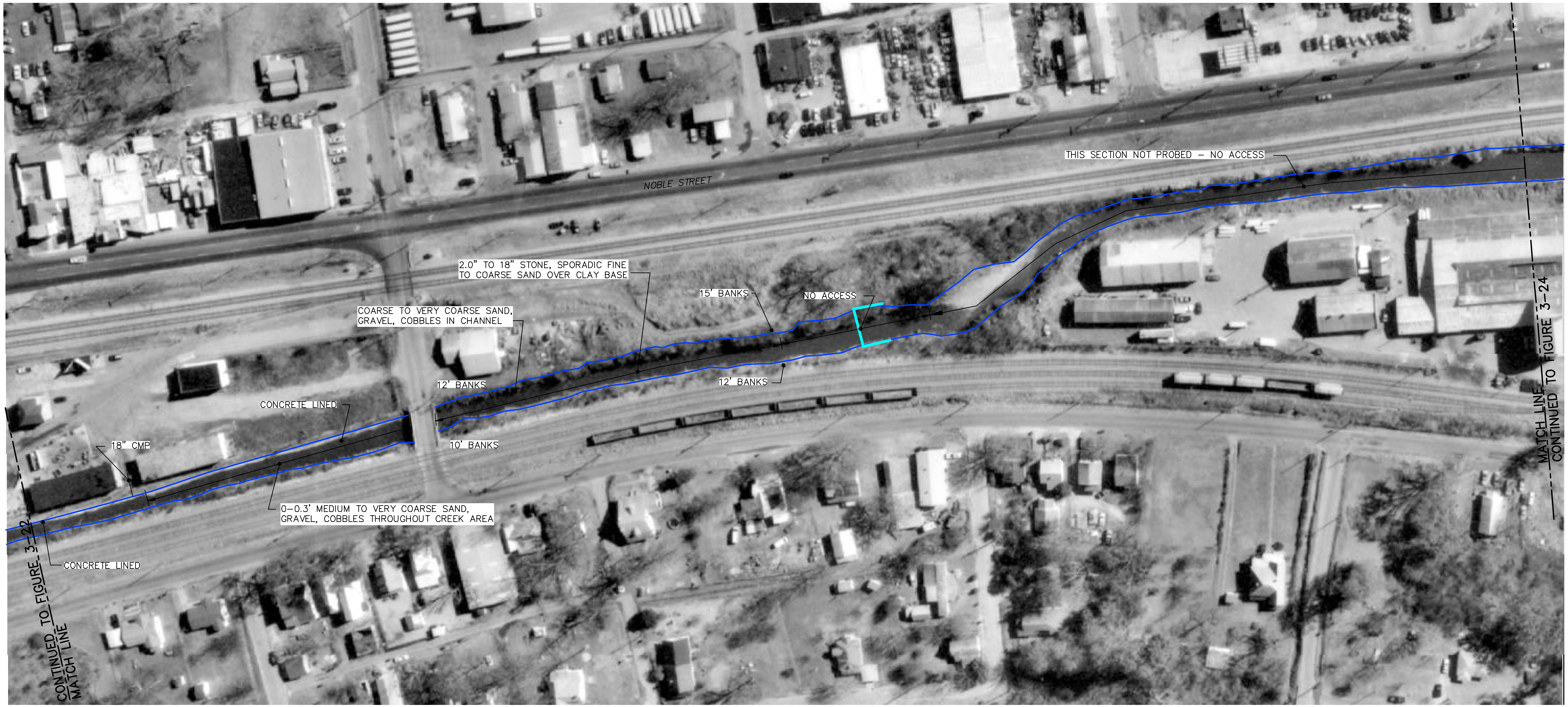
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE **3-23**



LEGEND

SEDIMENT DEPOSIT

OTHER CREEK FEATURE

ABBREVIATIONS:

CMP CORRUGATED METAL PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

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OFF–SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-24**

X: 10209X08.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G08.DWG

0 60' 120'
APPROXIMATE GRAPHIC SCALE

LEGEND

- (1-1) SEDIMENT DEPOSIT
- OTHER CREEK FEATURE
- (1-1) SAMPLED SEDIMENT DEPOSIT

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

X: 10209X09.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G09.DWG

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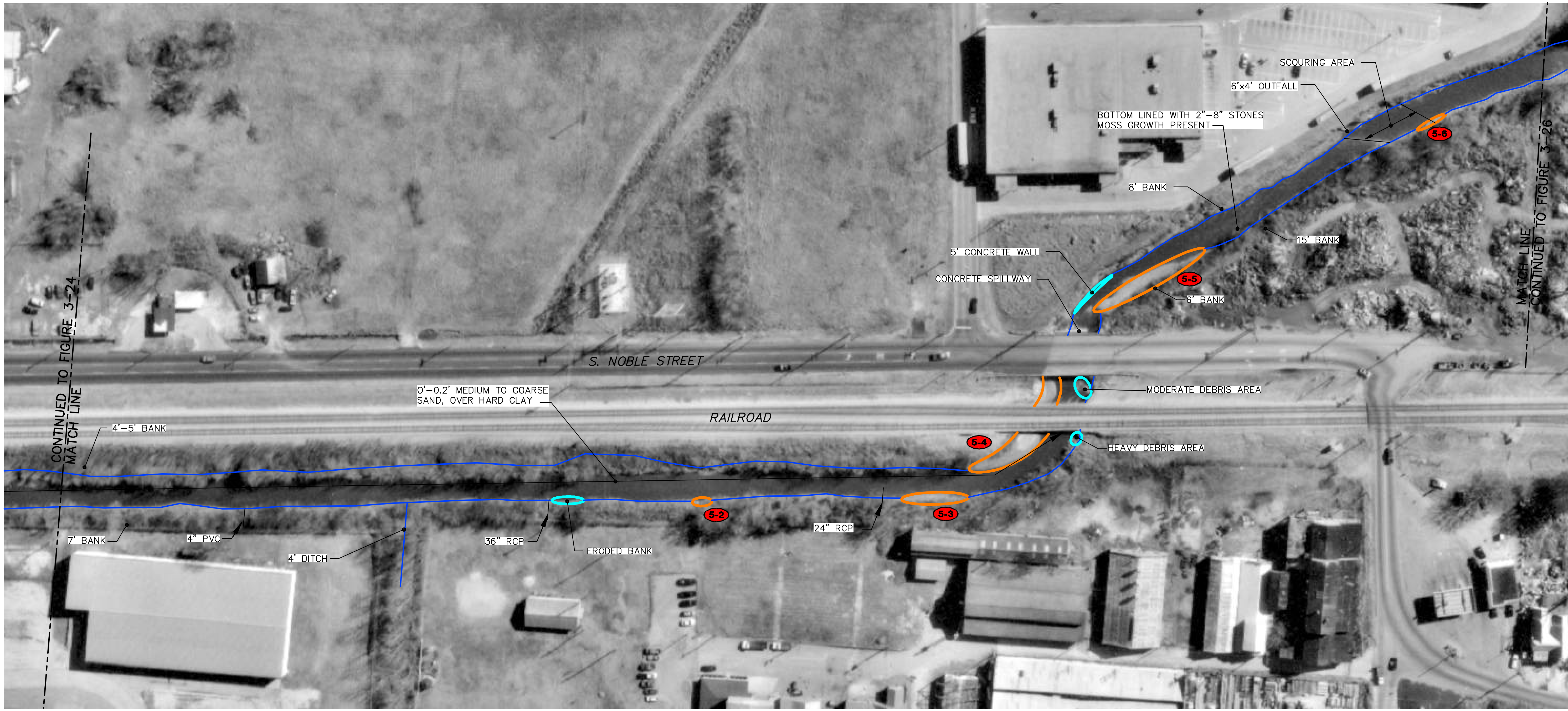
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
3-25



LEGEND

1-1 (orange ellipse)	SEDIMENT DEPOSIT
(cyan ellipse)	OTHER CREEK FEATURE
1-1 (red)	SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

RCP REINFORCED CONCRETE PIPE
PVC POLYVINYL CHLORIDE PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

0 60' 120'
APPROXIMATE GRAPHIC SCALE

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ANNISTON, ALABAMA

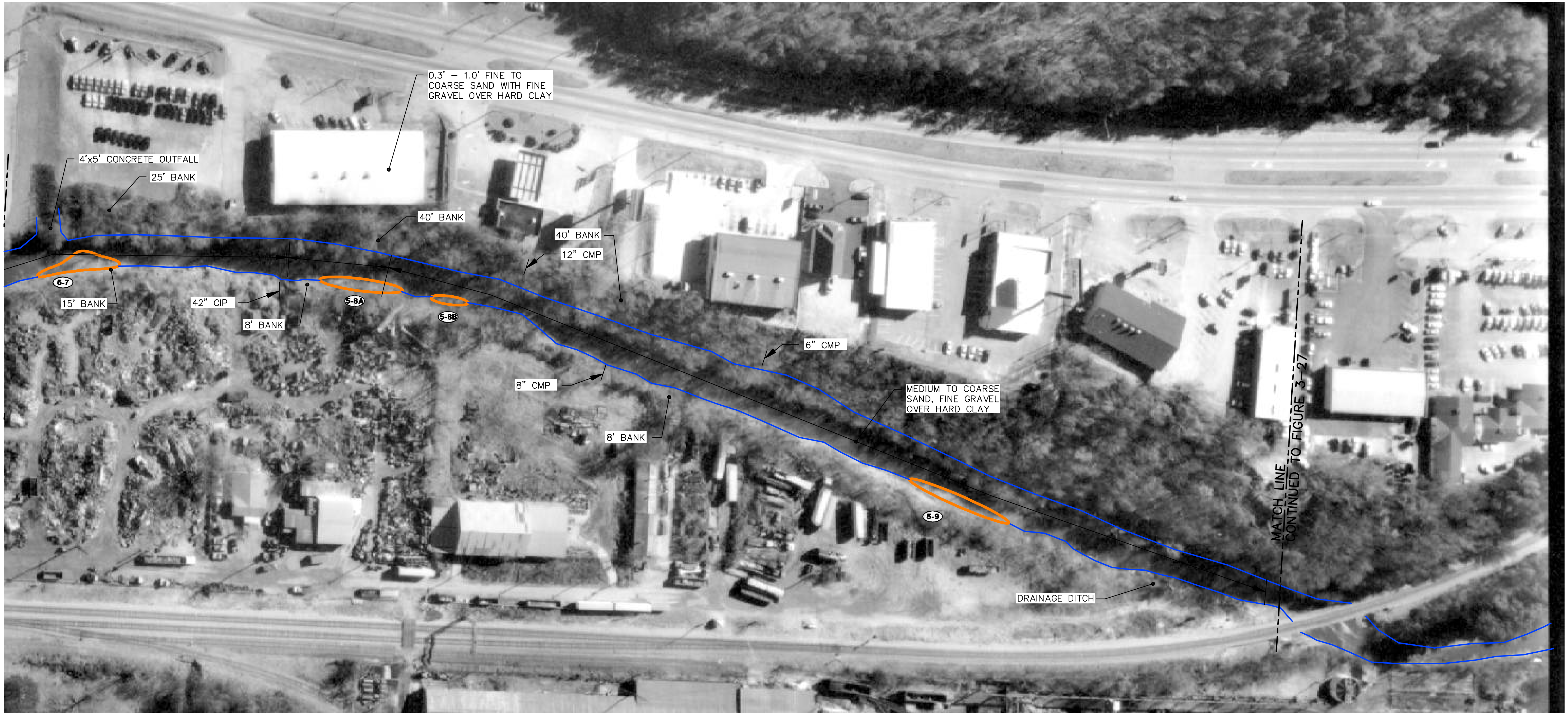
OFF–SITE RFI REPORT

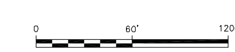
SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-26

X: 10209X10.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G10.DWG





LEGEND

1-1 (orange)	SEDIMENT DEPOSIT
(cyan)	OTHER CREEK FEATURE

ABBREVIATIONS:

CMP	CORRUGATED METAL PIPE
CIP	CAST IRON PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

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SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-27**

X: 10209X11.TIF
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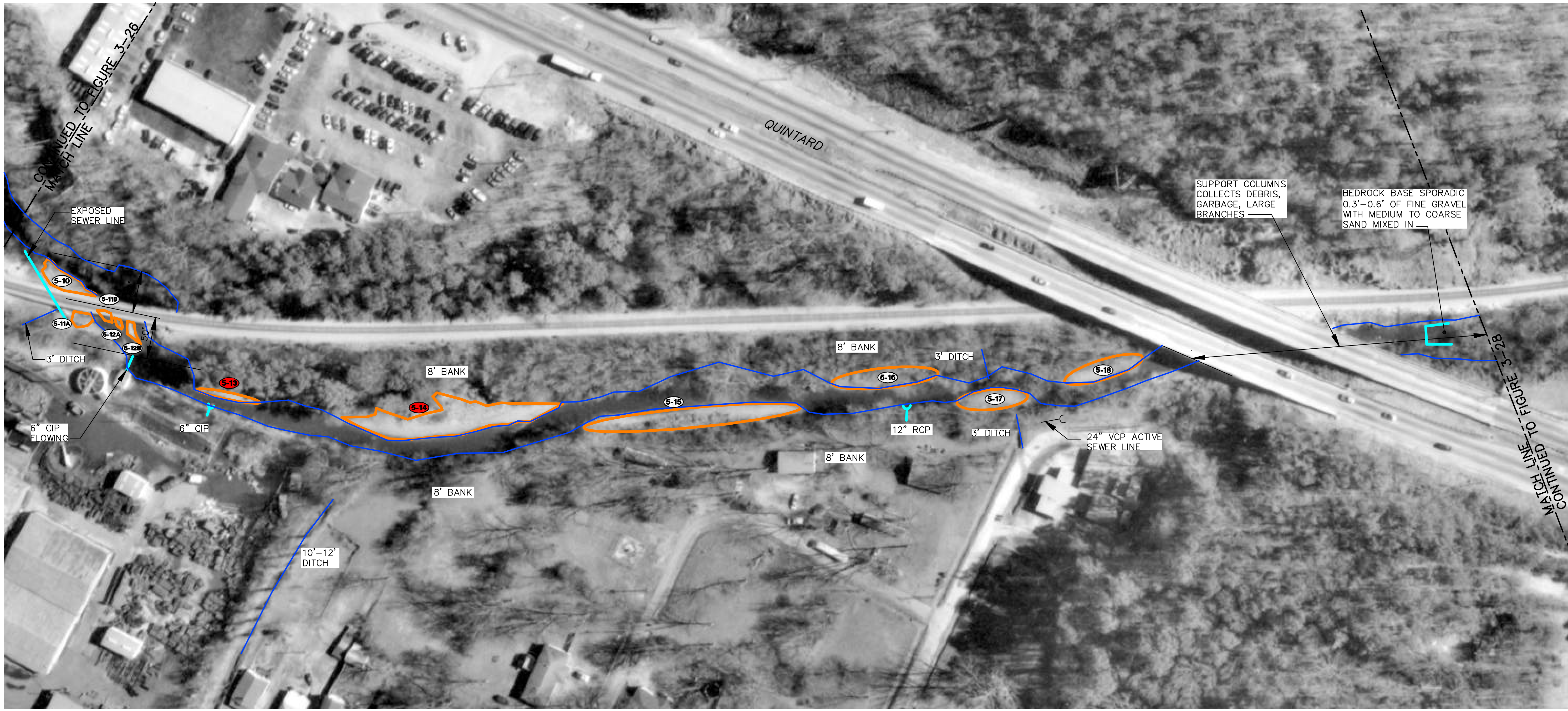
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G11.DWG



LEGEND

- (1-1) SEDIMENT DEPOSIT
- OTHER CREEK FEATURE
- (1-1) SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

RCP	REINFORCED CONCRETE PIPE
CIP	CAST IRON PIPE
VCP	VITRIFIED CLAY PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

0 60' 120'
APPROXIMATE GRAPHIC SCALE

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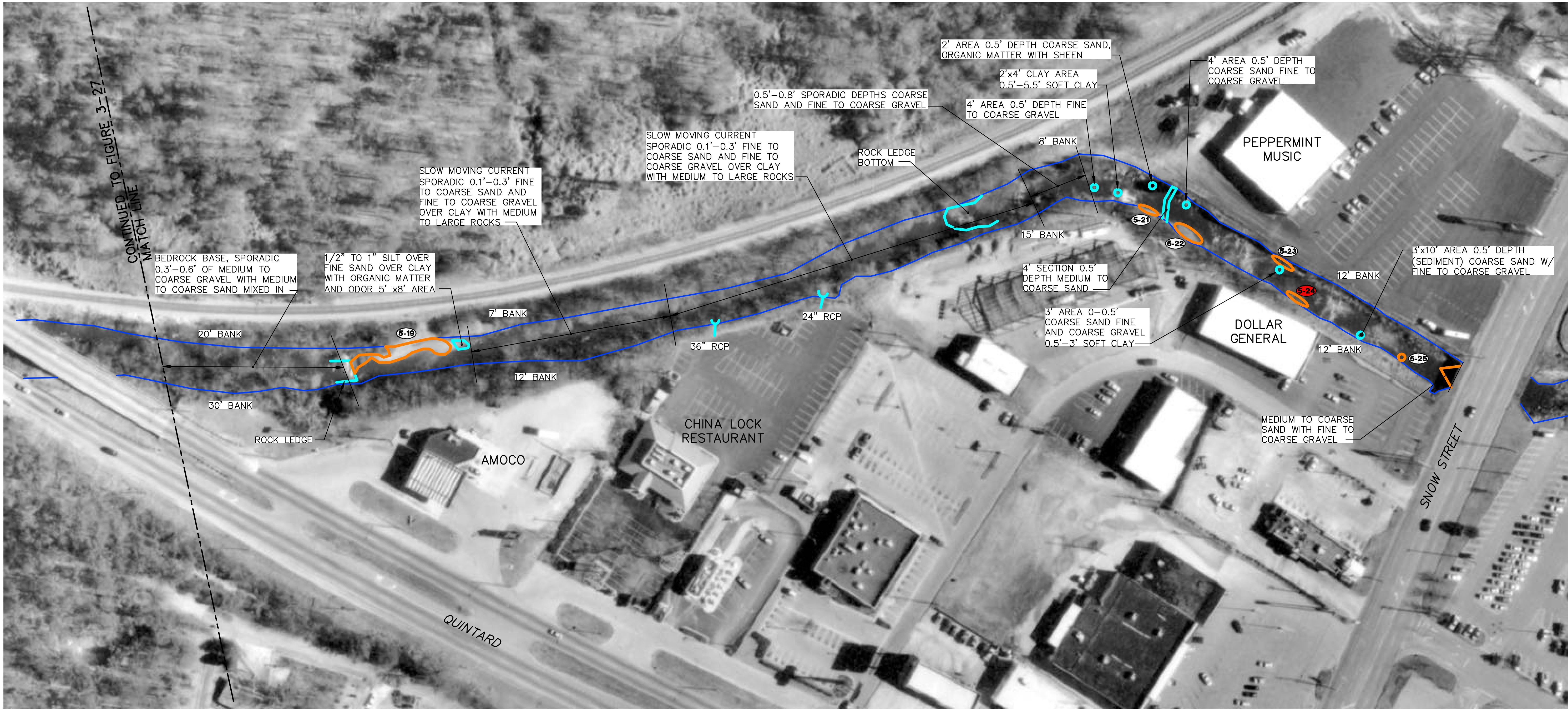
OFF-SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-28**

X: 10209X12.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G12.DWG



LEGEND

- (1-1) SEDIMENT DEPOSIT
- OTHER CREEK FEATURE
- (1-1) SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

RCP REINFORCED CONCRETE PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

0 60' 120'
APPROXIMATE GRAPHIC SCALE

X: 10209X13.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G13.DWG

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SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE **3-29**

0 60' 120'
APPROXIMATE GRAPHIC SCALE

LEGEND

- 1-1 (orange outline): SEDIMENT DEPOSIT
- (cyan outline): OTHER CREEK FEATURE
- 1-1 (red): SAMPLED SEDIMENT DEPOSIT

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

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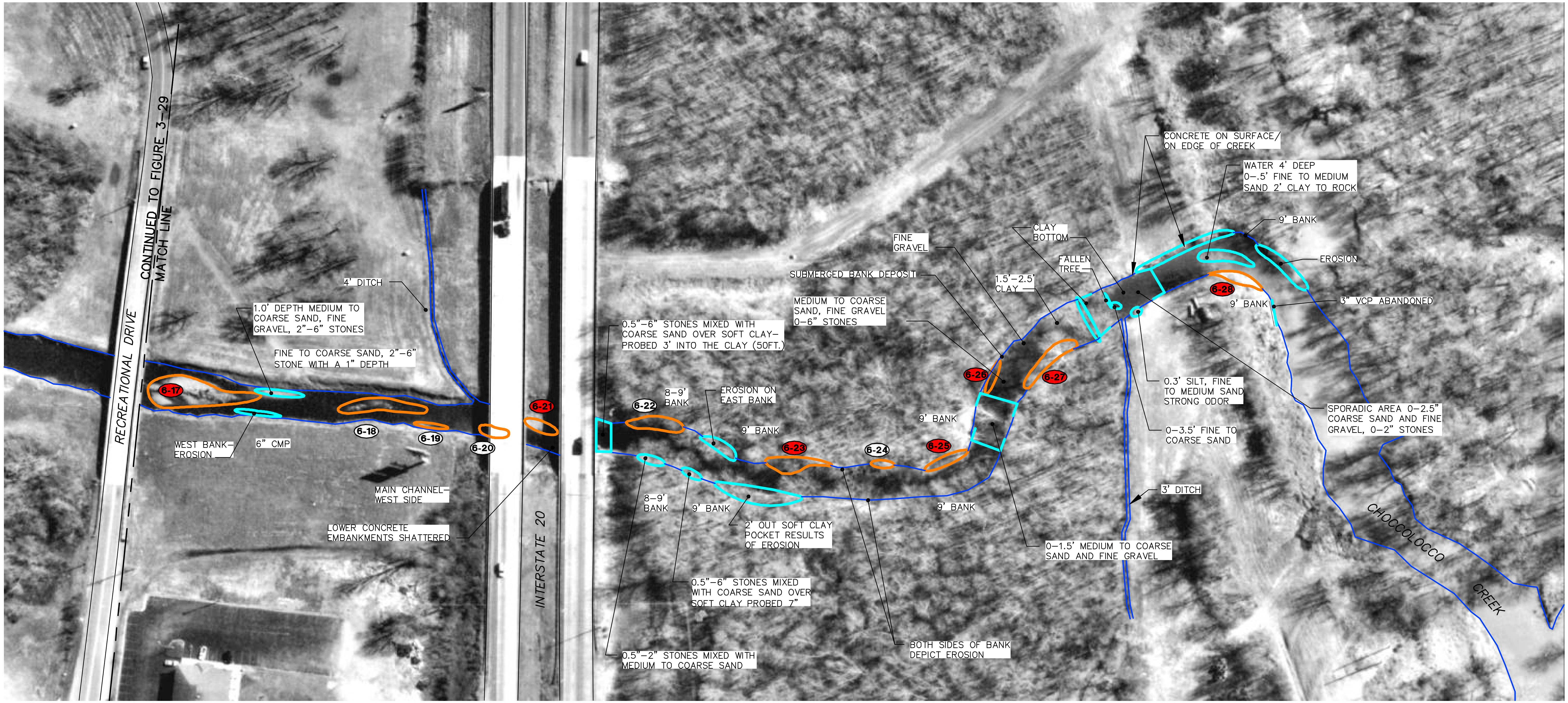
OFF–SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **3-30**

X: 10209X02.TIF
L: ON=*, OFF=REF
P: D2BSPEC
6/27/00 SYR–54–GMS NES
10209051/10209G02.DWG



LEGEND

- 1-4 SEDIMENT DEPOSIT
- OTHER CREEK FEATURE
- 1-1 SAMPLED SEDIMENT DEPOSIT

ABBREVIATIONS:

CMP	CORRUGATED METAL PIPE
VCP	VITRIFIED CLAY PIPE

NOTES:

1. BASE AERIAL PHOTOGRAPHY FLOWN BY LOCKWOOD MAPPING IN 1999.
2. LABELS ARE OBSERVATIONS MADE BY FIELD PERSONNEL

0 60' 120'
APPROXIMATE GRAPHIC SCALE

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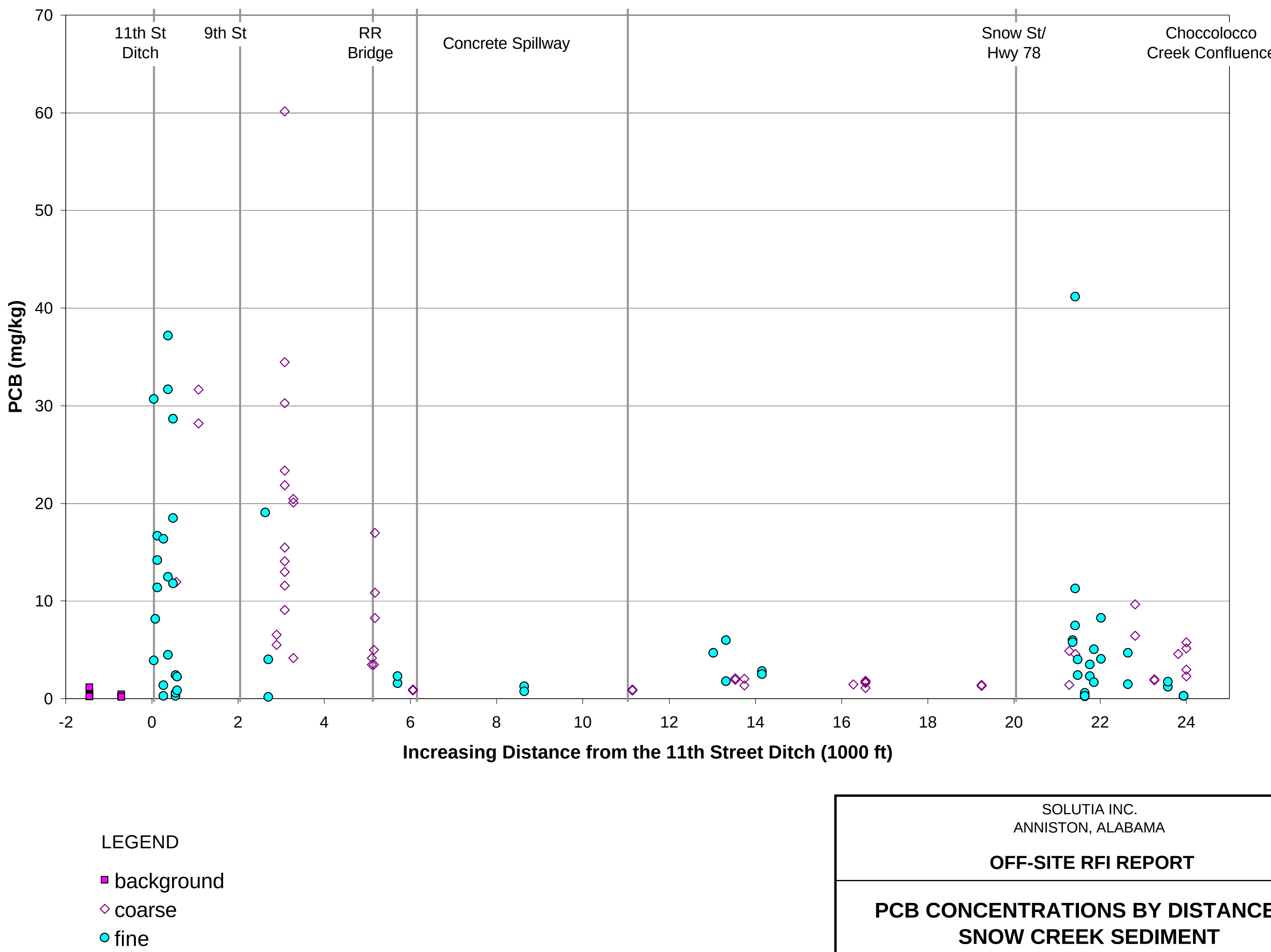
OFF-SITE RFI REPORT

SNOW CREEK - SEDIMENT DEPOSIT LOCATIONS AND CREEK CHARACTERIZATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 3-31

X: 10209X01.TIF
L: ON=* OFF=*REF*
P: D2BSPEC.PCP
6/27/00 SYR-54-GMS NES
10209051/10209G01.DWG



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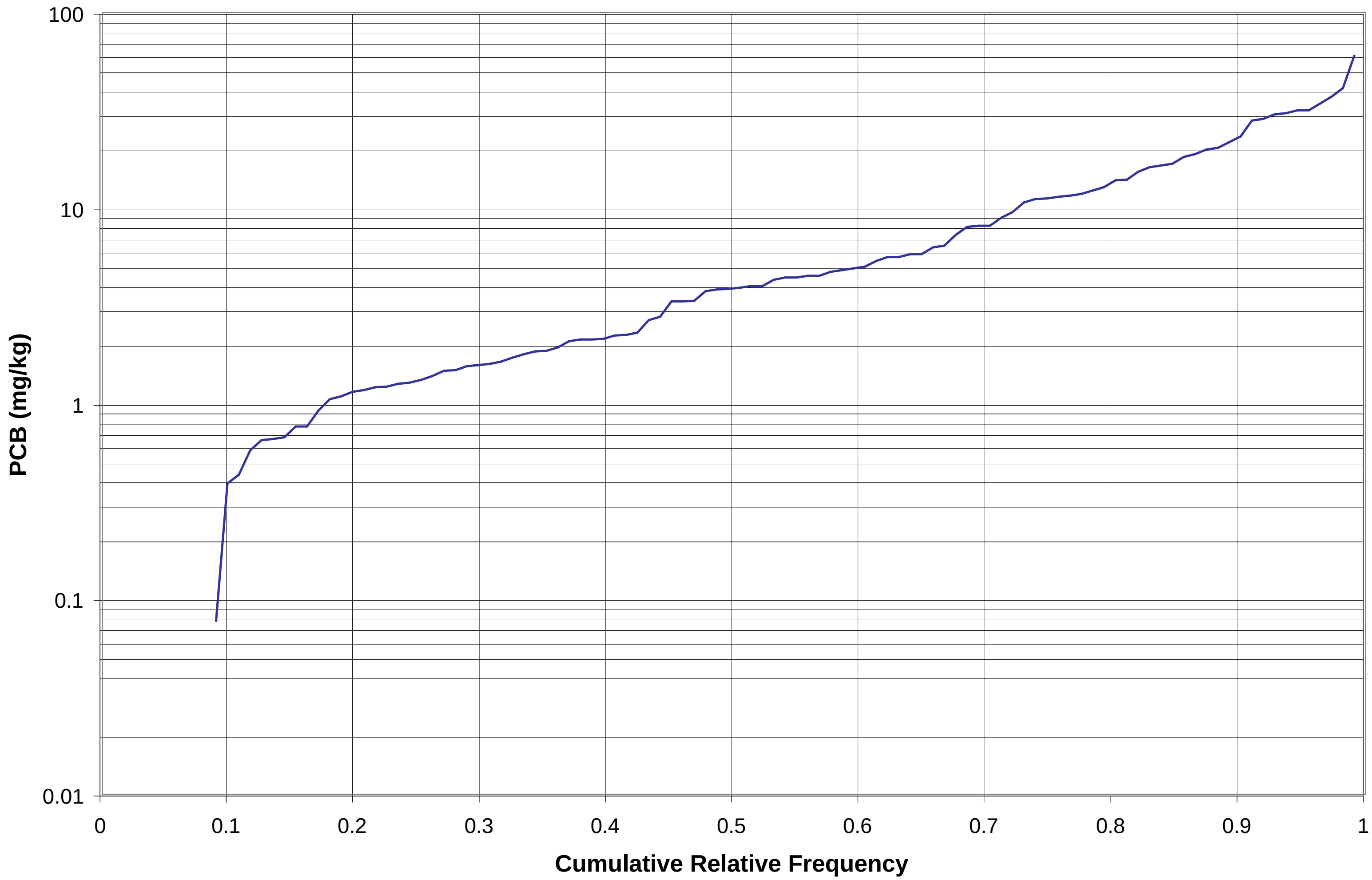
OFF-SITE RFI REPORT

PCB CONCENTRATIONS BY DISTANCE IN SNOW CREEK SEDIMENT

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-32

ms_snowfigs.xls_3-32_2/28/2003



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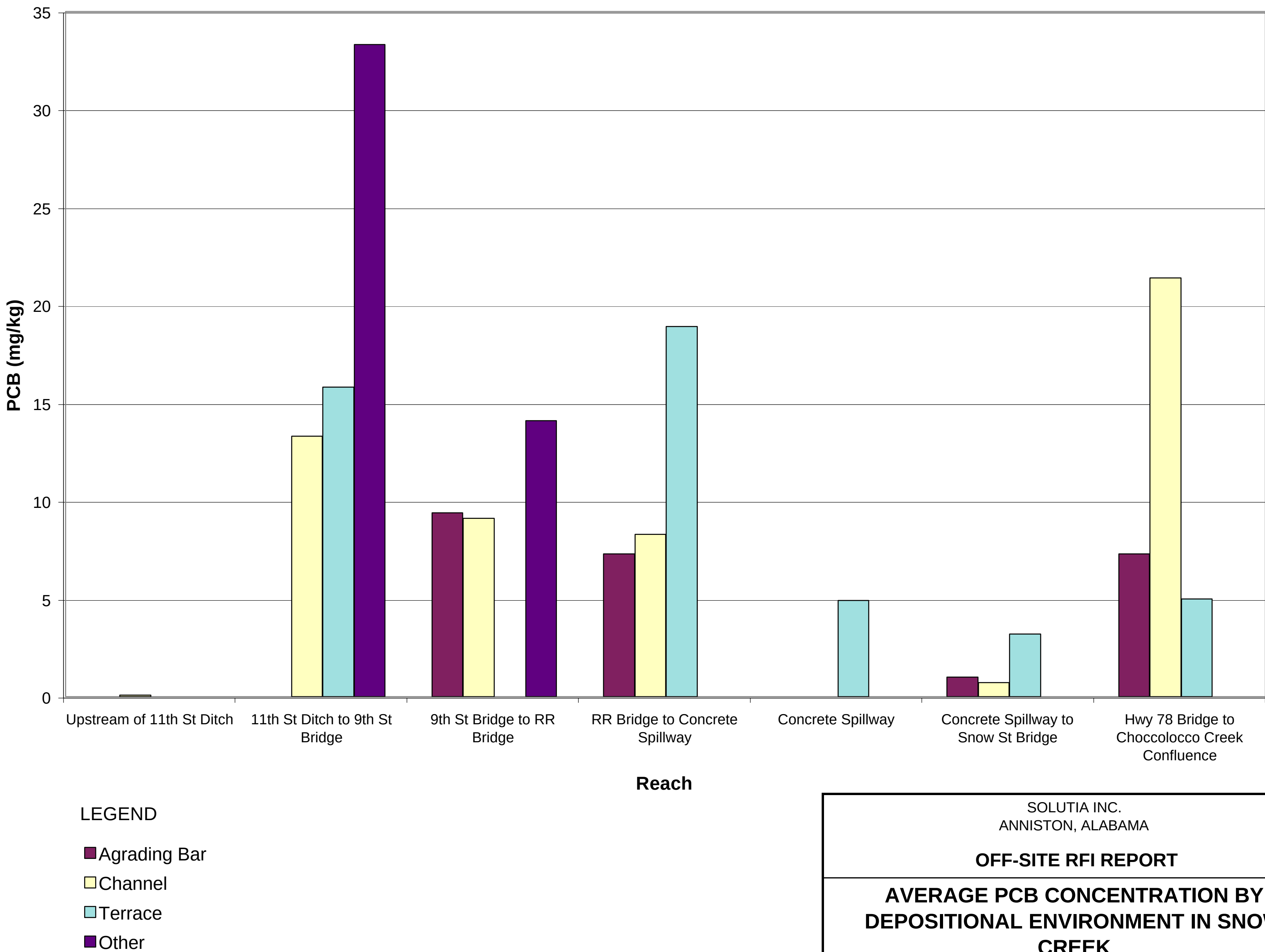
OFF-SITE RFI REPORT

RELATIVE CUMULATIVE FREQUENCY OF PCB CONCENTRATION IN SNOW CREEK SEDIMENT

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-33

ms_snowfigs.xls_3-33_2/28/2003



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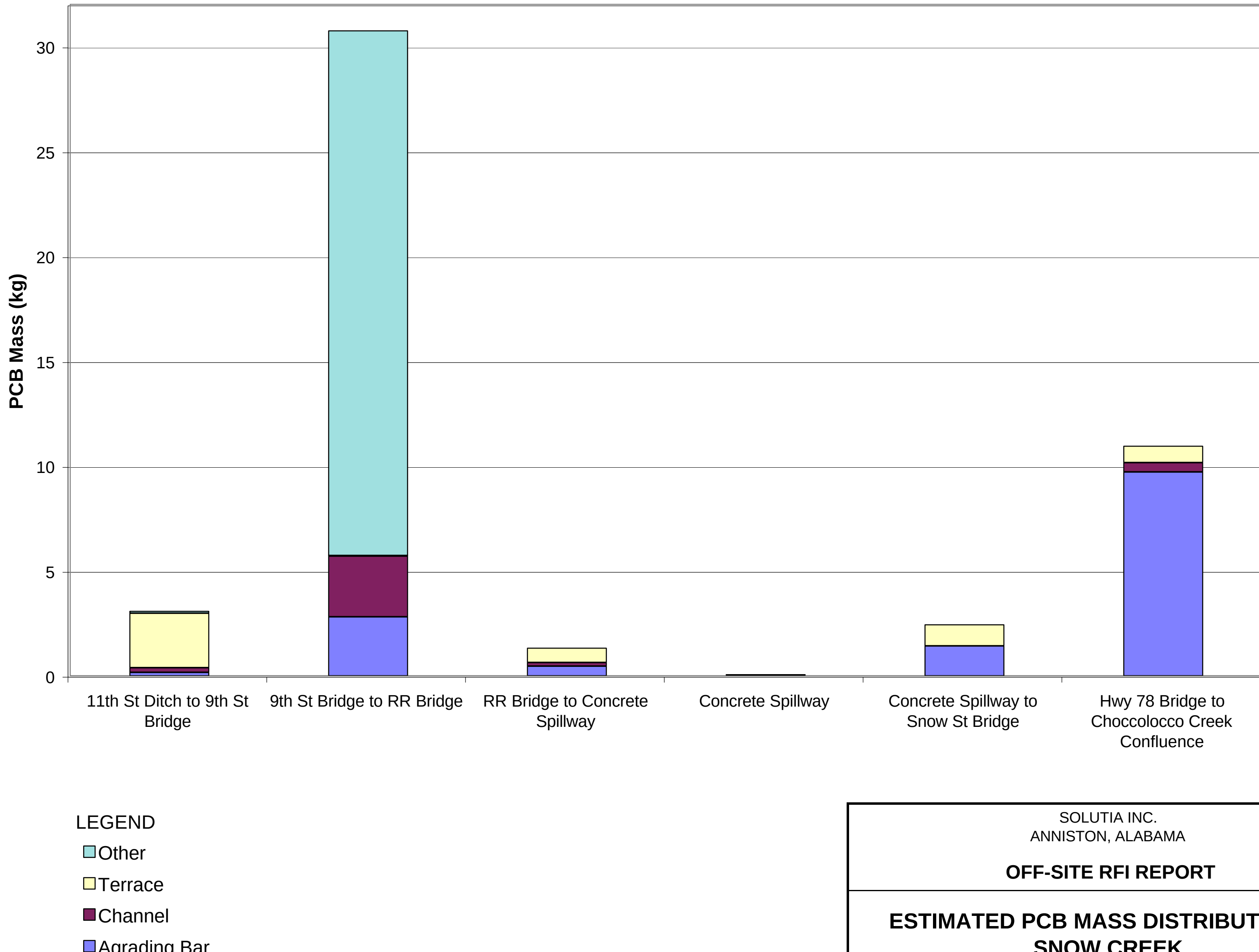
OFF-SITE RFI REPORT

AVERAGE PCB CONCENTRATION BY DEPOSITIONAL ENVIRONMENT IN SNOW CREEK

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
3-34

ms_snowfigs.xls_3-34_2/28/2003



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ANNISTON, ALABAMA

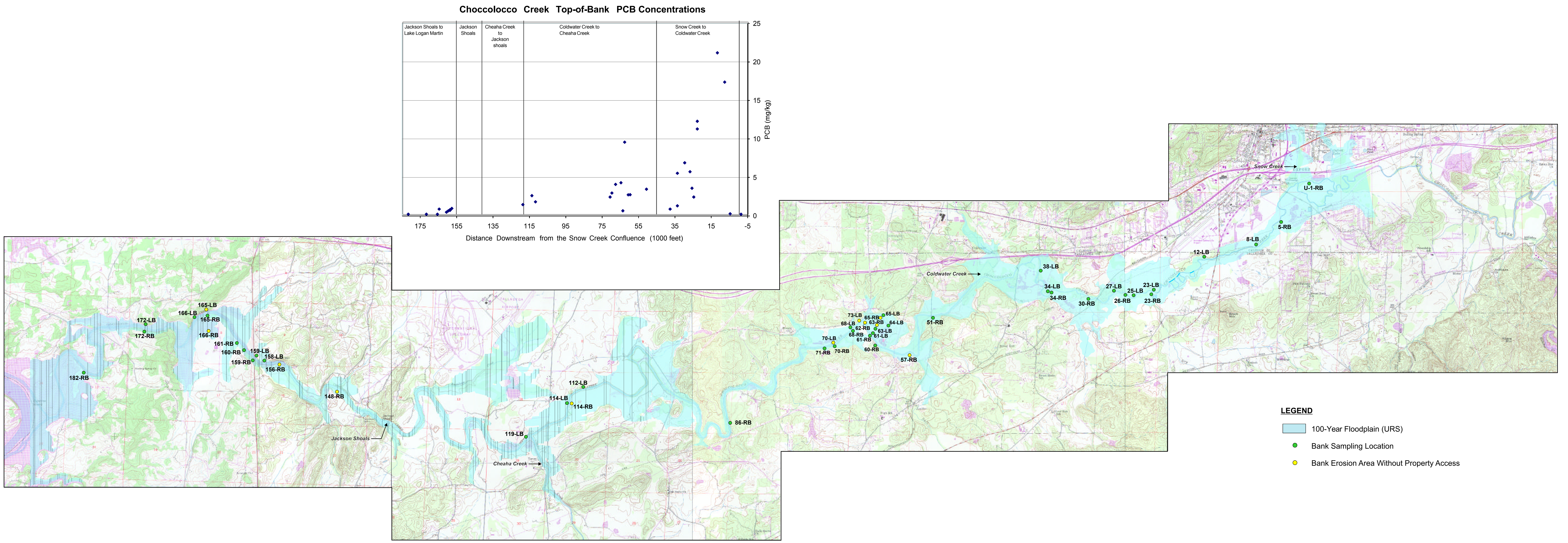
OFF-SITE RFI REPORT

ESTIMATED PCB MASS DISTRIBUTION IN SNOW CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-35

ms_snomass.xls_3-35_2/28/2003



05/00 SYR-D54-DJH LBR YCC LAS
10209051/10209n04.cdr
DJ4-24"x84"-200%

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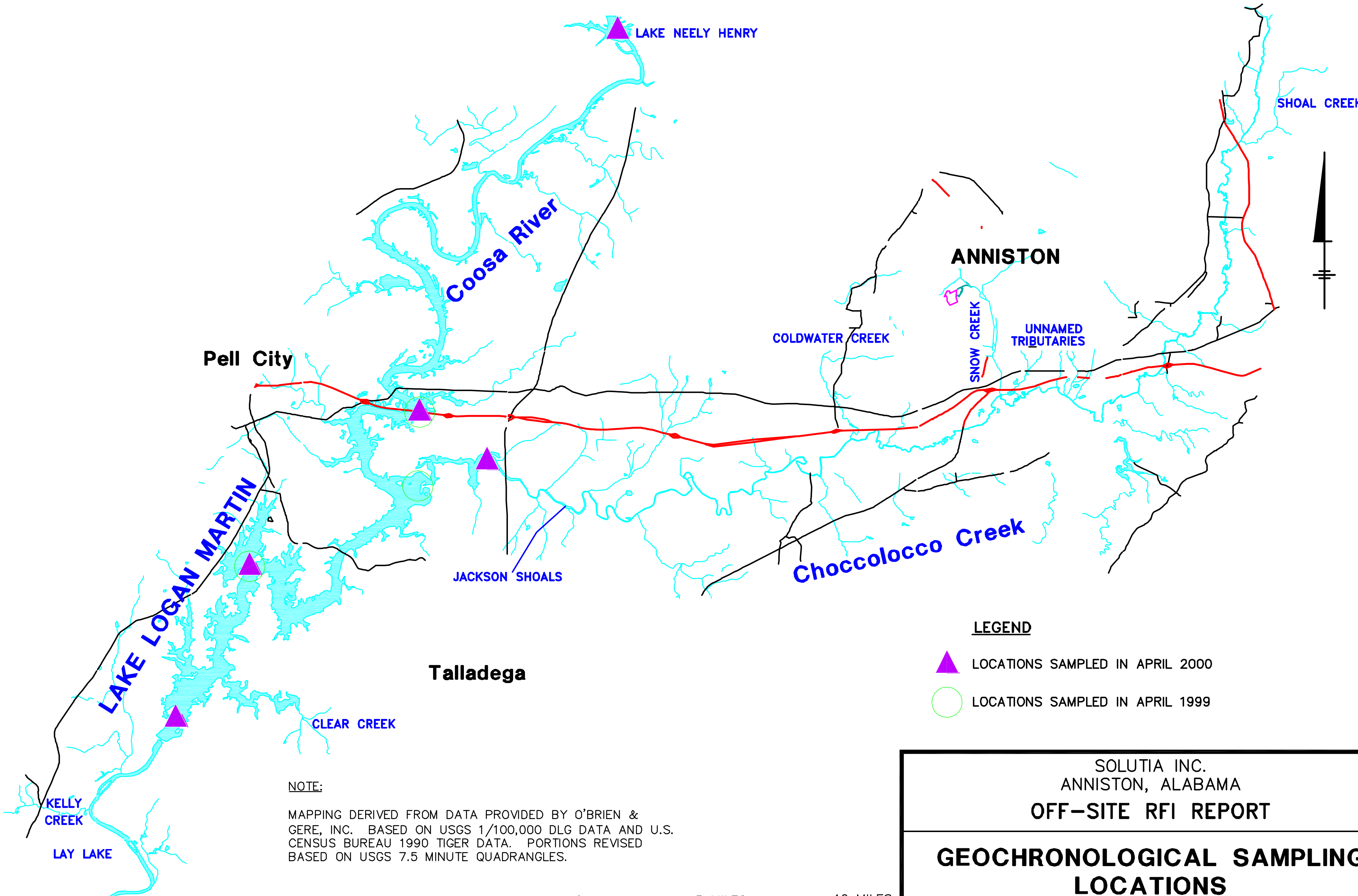
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK
TOP-OF-BANK SAMPLING LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
3-36



NOTE:

MAPPING DERIVED FROM DATA PROVIDED BY O'BRIEN & GERE, INC. BASED ON USGS 1/100,000 DLG DATA AND U.S. CENSUS BUREAU 1990 TIGER DATA. PORTIONS REVISED BASED ON USGS 7.5 MINUTE QUADRANGLES.

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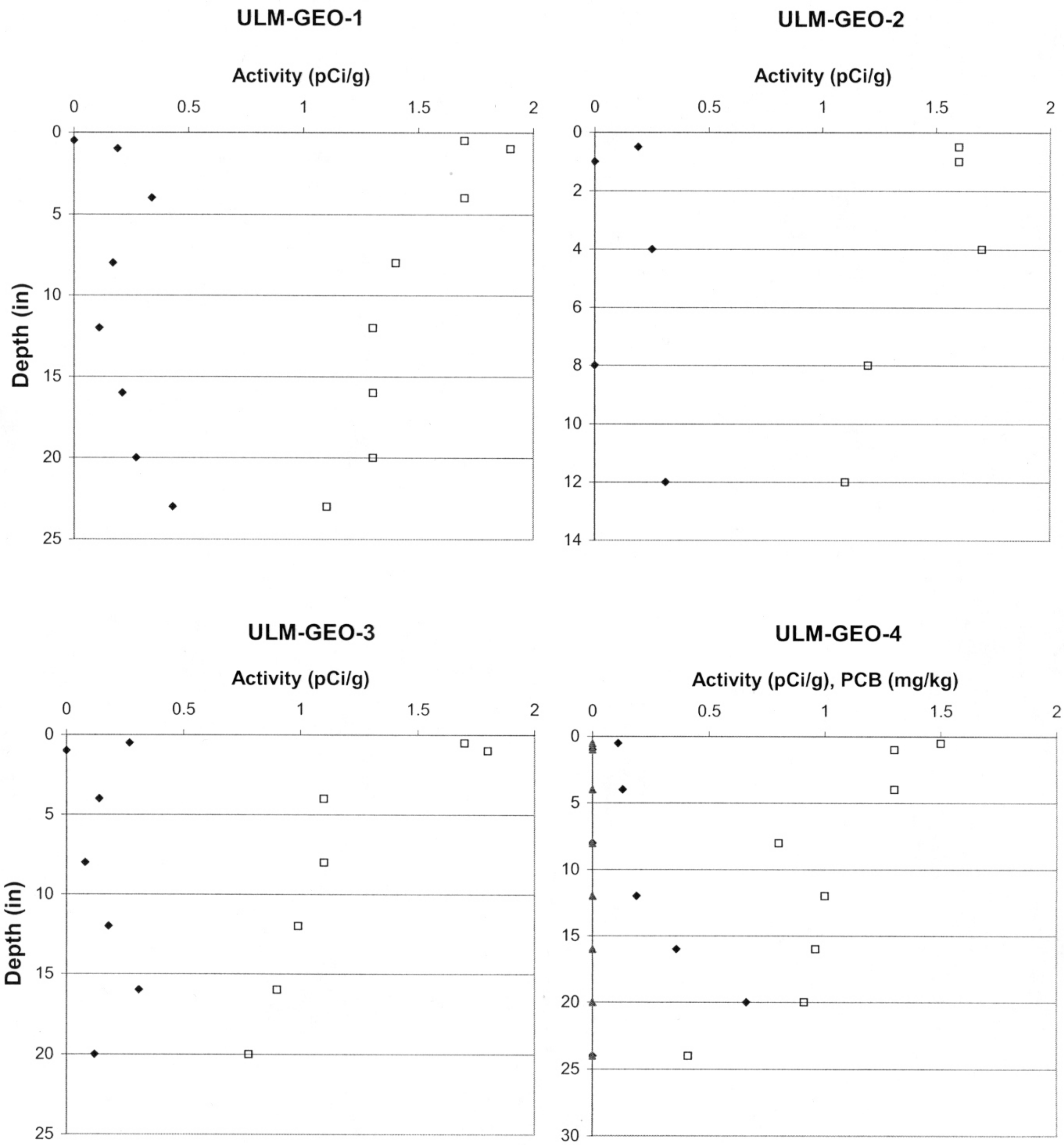
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

GEOCHRONOLOGICAL SAMPLING LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-37

X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: ALPDF.PCP
6/27/00 SYR-54-KMD NES
10209051/RFI/10209B03.DWG



LEGEND

- ◆ Cesium-137
- □ Lead-210
- ▲ PCB

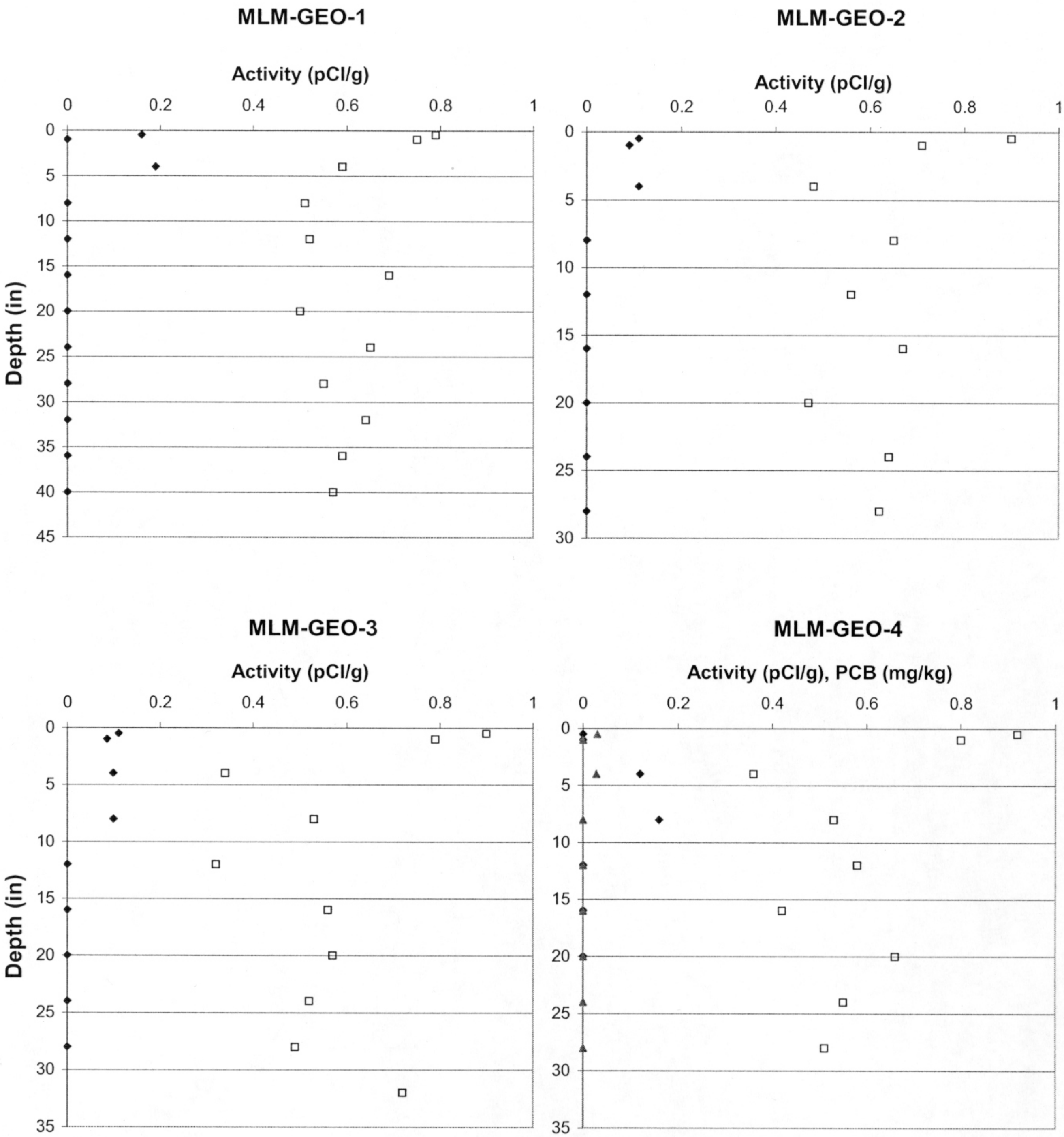
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

GEOCHRONOLOGIC DATA FOR SEDIMENT FROM LAKE LOGAN MARTIN UPSTREAM OF CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 3-38



LEGEND

- ◆ Cesium-137
- □ Lead-210
- ▲ PCB

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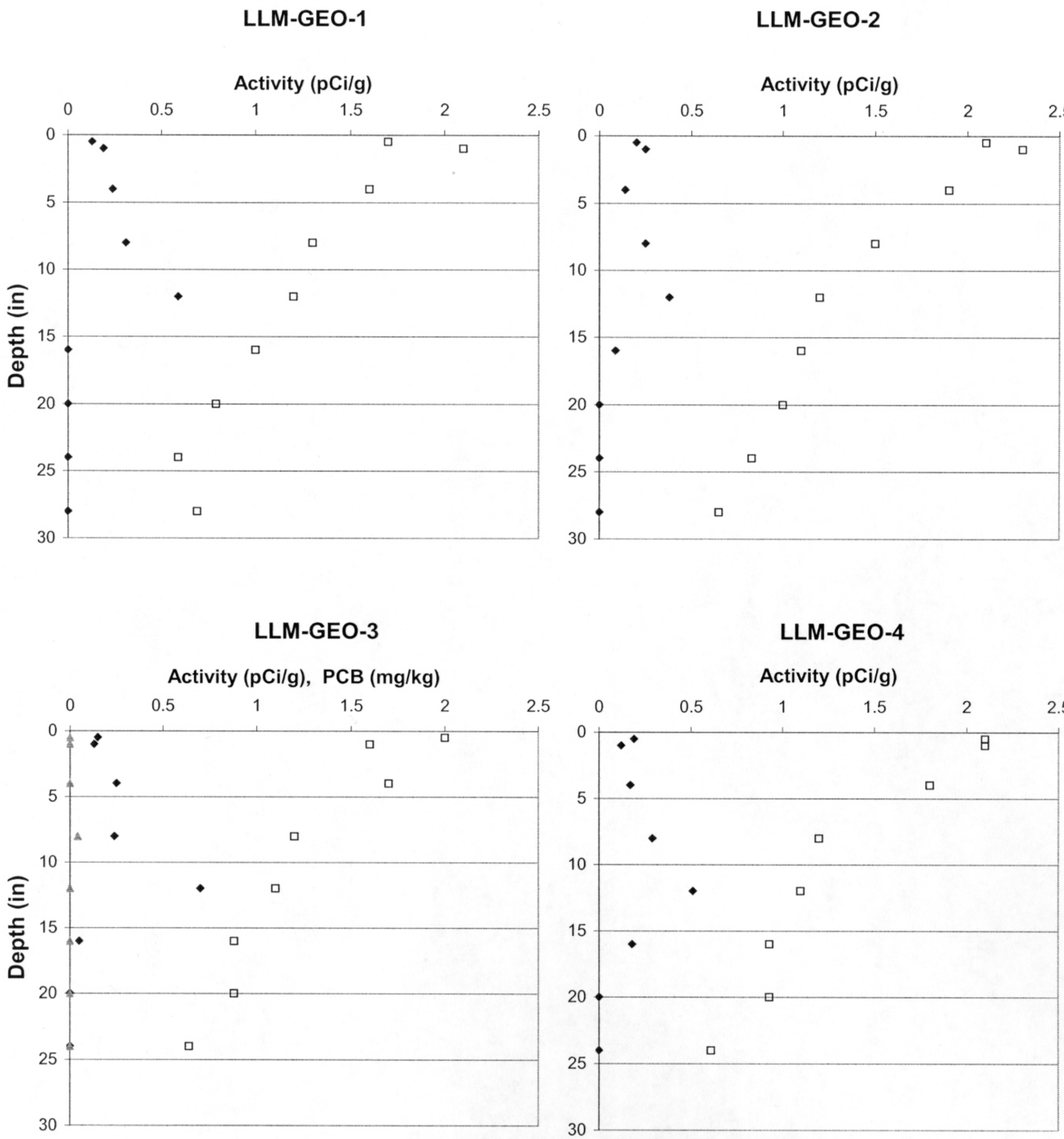
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

GEOCHRONOLOGIC DATA FOR SEDIMENT FROM THE MIDDLE OF LAKE LOGAN MARTIN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-39



LEGEND

- ◆ Cesium-137
- □ Lead-210
- ▲ PCB

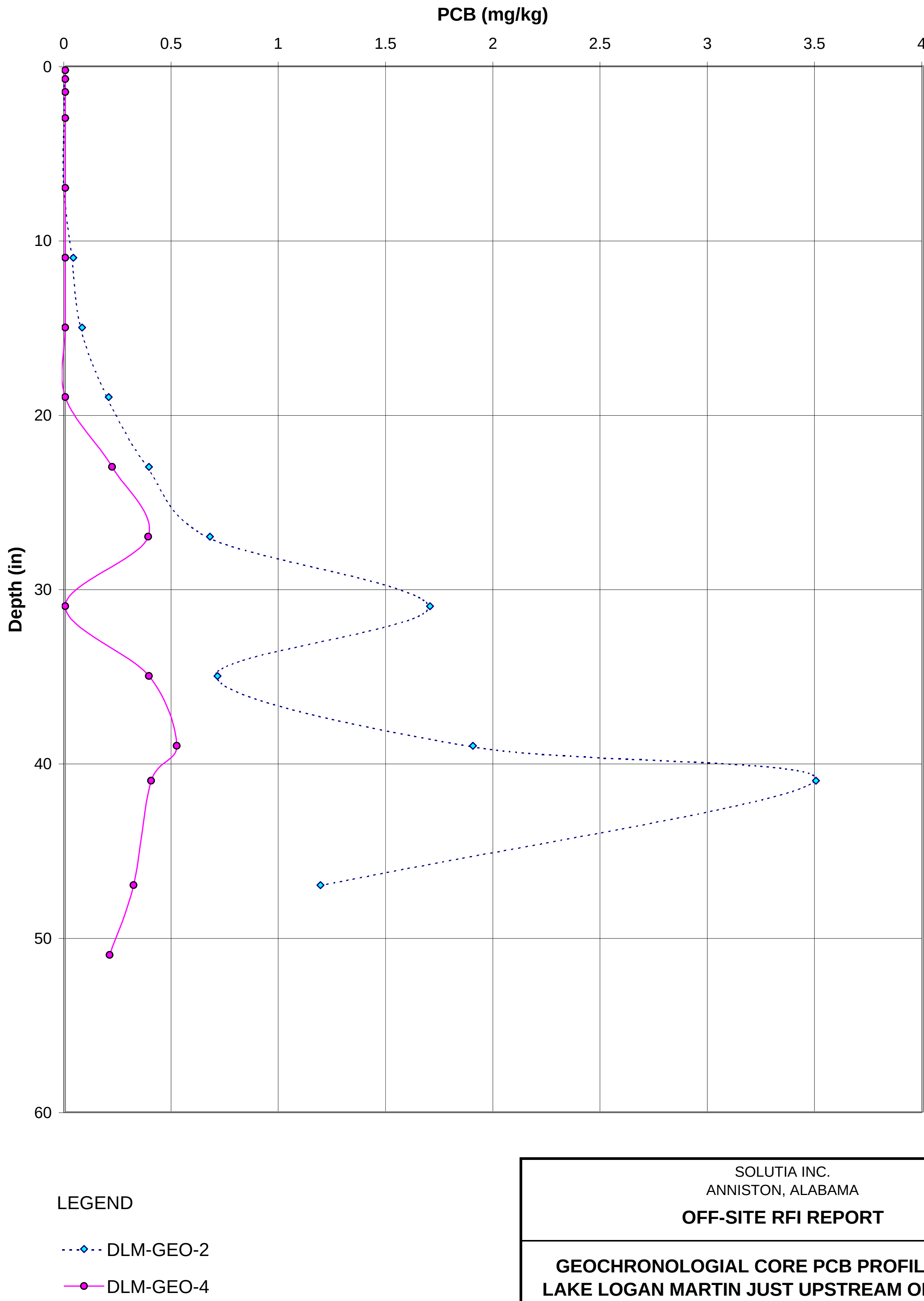
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

GEOCHRONOLOGIC DATA FOR SEDIMENT FROM LAKE LOGAN MARTIN DOWNSTREAM OF CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-40



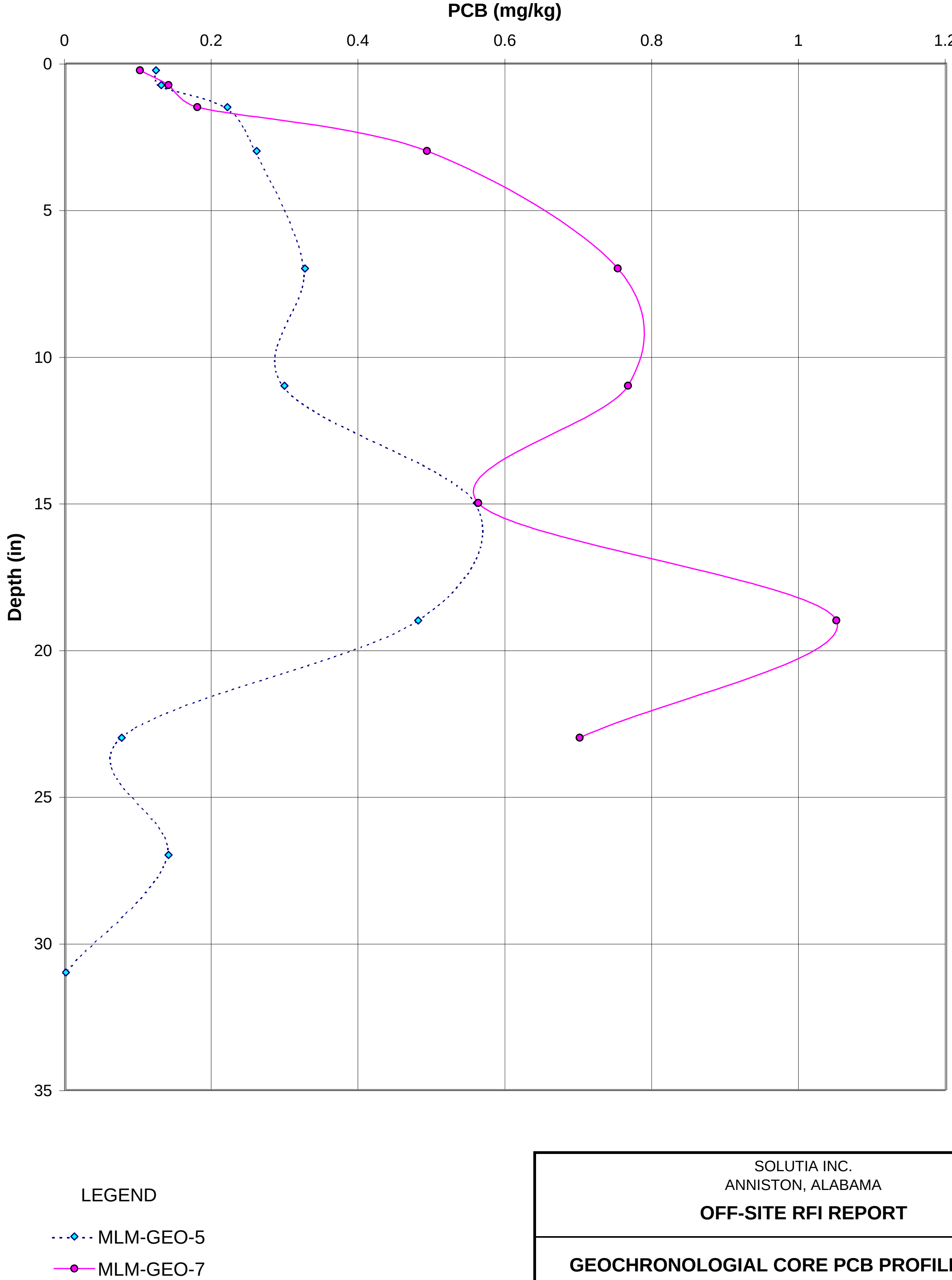
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

GEOCHRONOLOGIAL CORE PCB PROFILES FROM LAKE LOGAN MARTIN JUST UPSTREAM OF THE DAM

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-41



SOLUTIA INC.
ANNISTON, ALABAMA

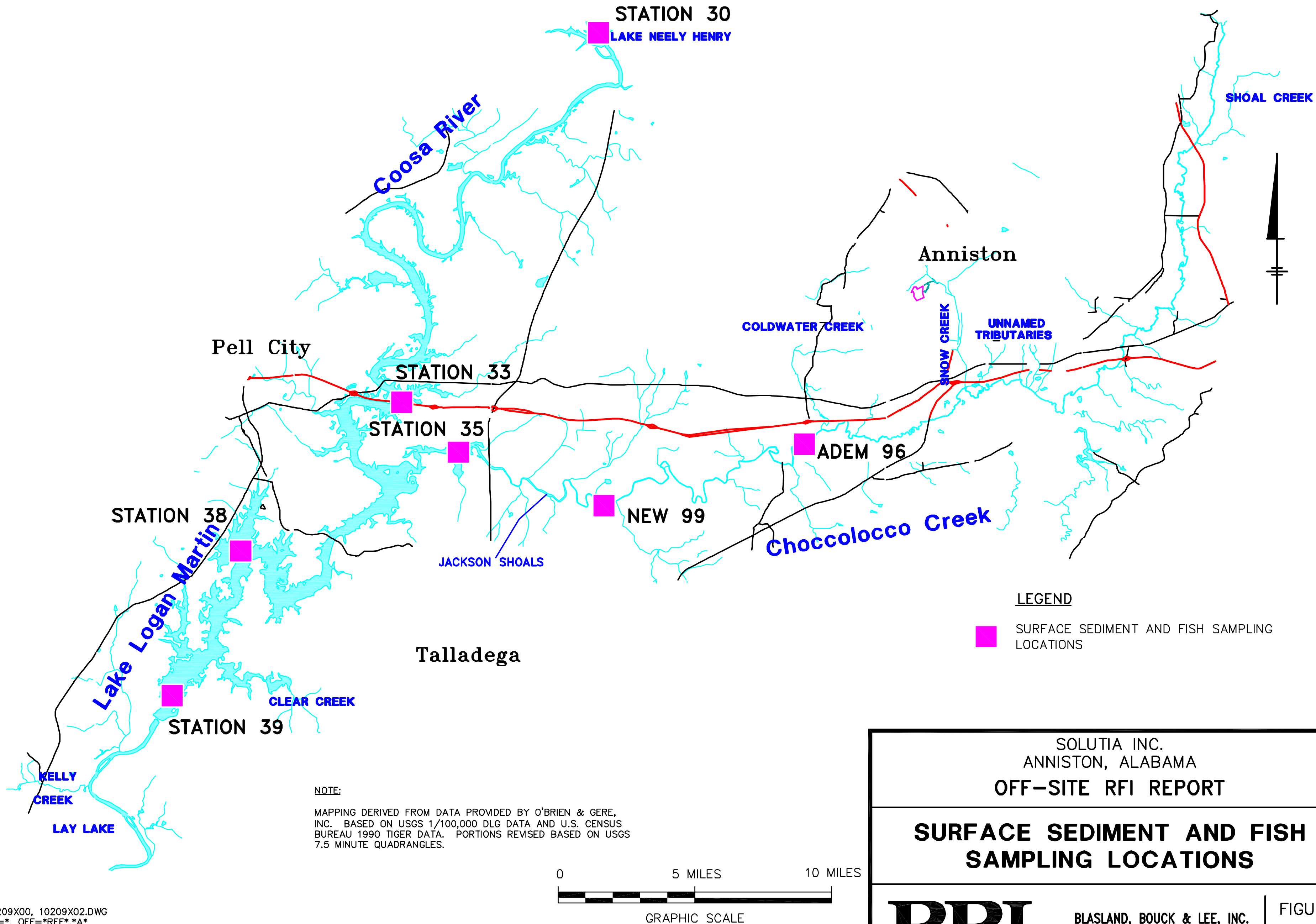
OFF-SITE RFI REPORT

GEOCHRONOLOGIAL CORE PCB PROFILES FROM CHOCCOLOCCO CREEK NEAR TRANSECT C-167

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-42

ms_annnewgeo.xls_3-42_2/28/2003



NOTE:

MAPPING DERIVED FROM DATA PROVIDED BY O'BRIEN & GERE, INC. BASED ON USGS 1/100,000 DLG DATA AND U.S. CENSUS BUREAU 1990 TIGER DATA. PORTIONS REVISED BASED ON USGS 7.5 MINUTE QUADRANGLES.

SOLUTIA INC.
ANNISTON, ALABAMA

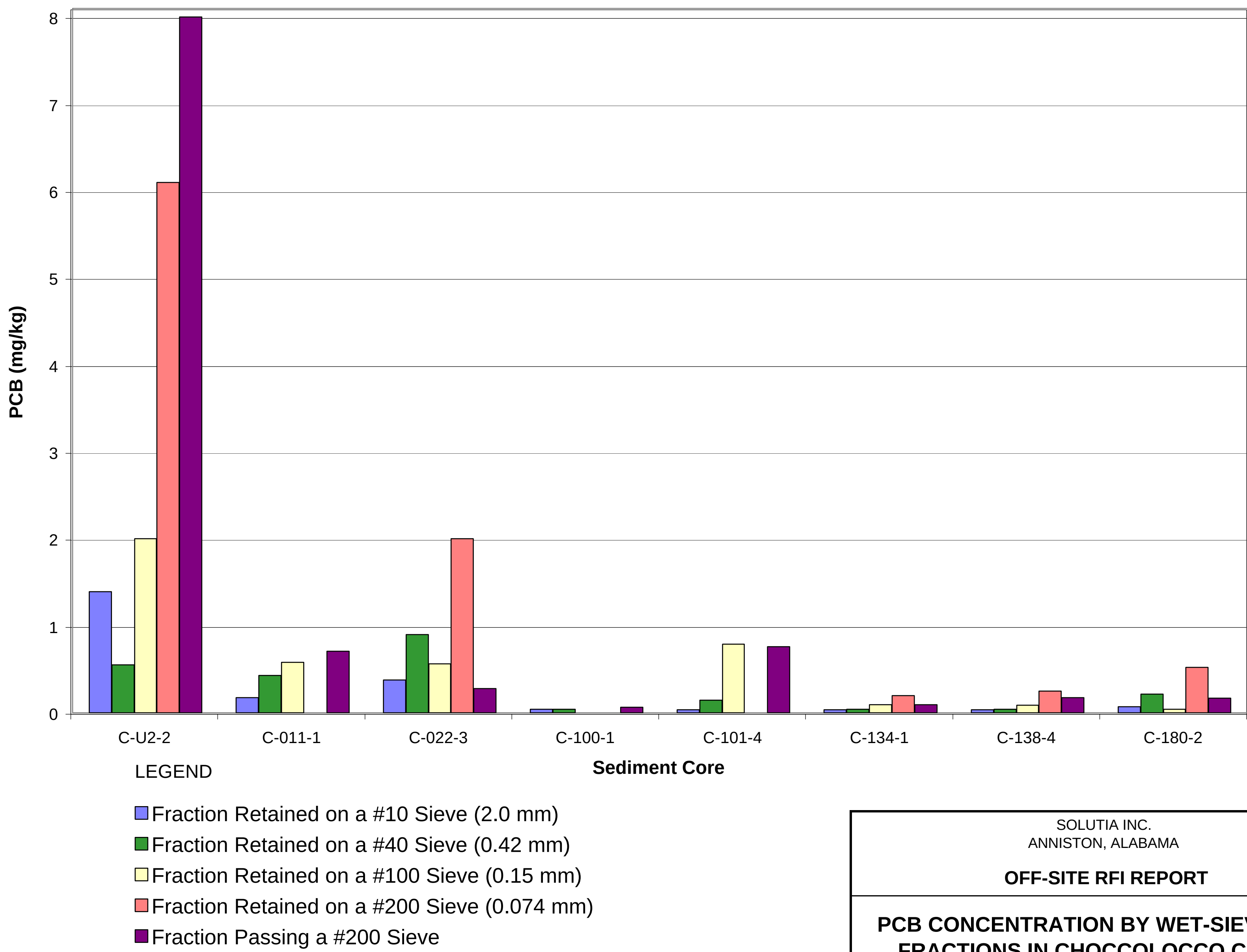
OFF-SITE RFI REPORT

SURFACE SEDIMENT AND FISH SAMPLING LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE **3-43**

X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: FRY700AL.PCP
6/27/00 SYR-54-KMD NES
10209051/RFI/10209B04.DWG



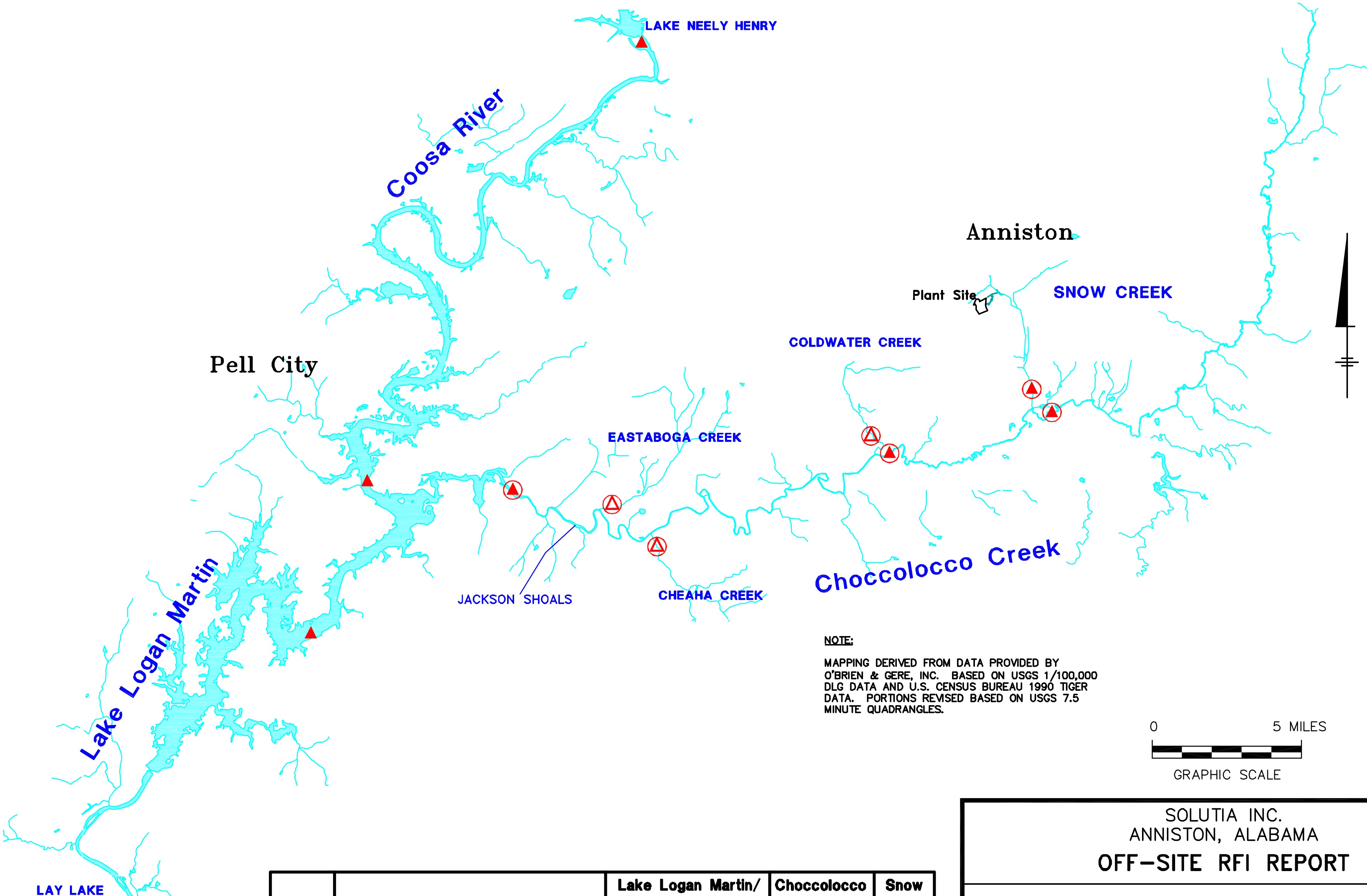
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

PCB CONCENTRATION BY WET-SIEVE SIZE FRACTIONS IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 3-44



NOTE:

MAPPING DERIVED FROM DATA PROVIDED BY O'BRIEN & GERE, INC. BASED ON USGS 1/100,000 DLG DATA AND U.S. CENSUS BUREAU 1990 TIGER DATA. PORTIONS REVISED BASED ON USGS 7.5 MINUTE QUADRANGLES.

Symbol	Off-Site RFI Activity	Lake Logan Martin/ Coosa River	Choccolocco Creek	Snow Creek
△	Suspended Sediment Sampling	X	X	X
▲	Suspended Sediment PCB Sampling	X	X	X
○	Flow Measurement		X	X

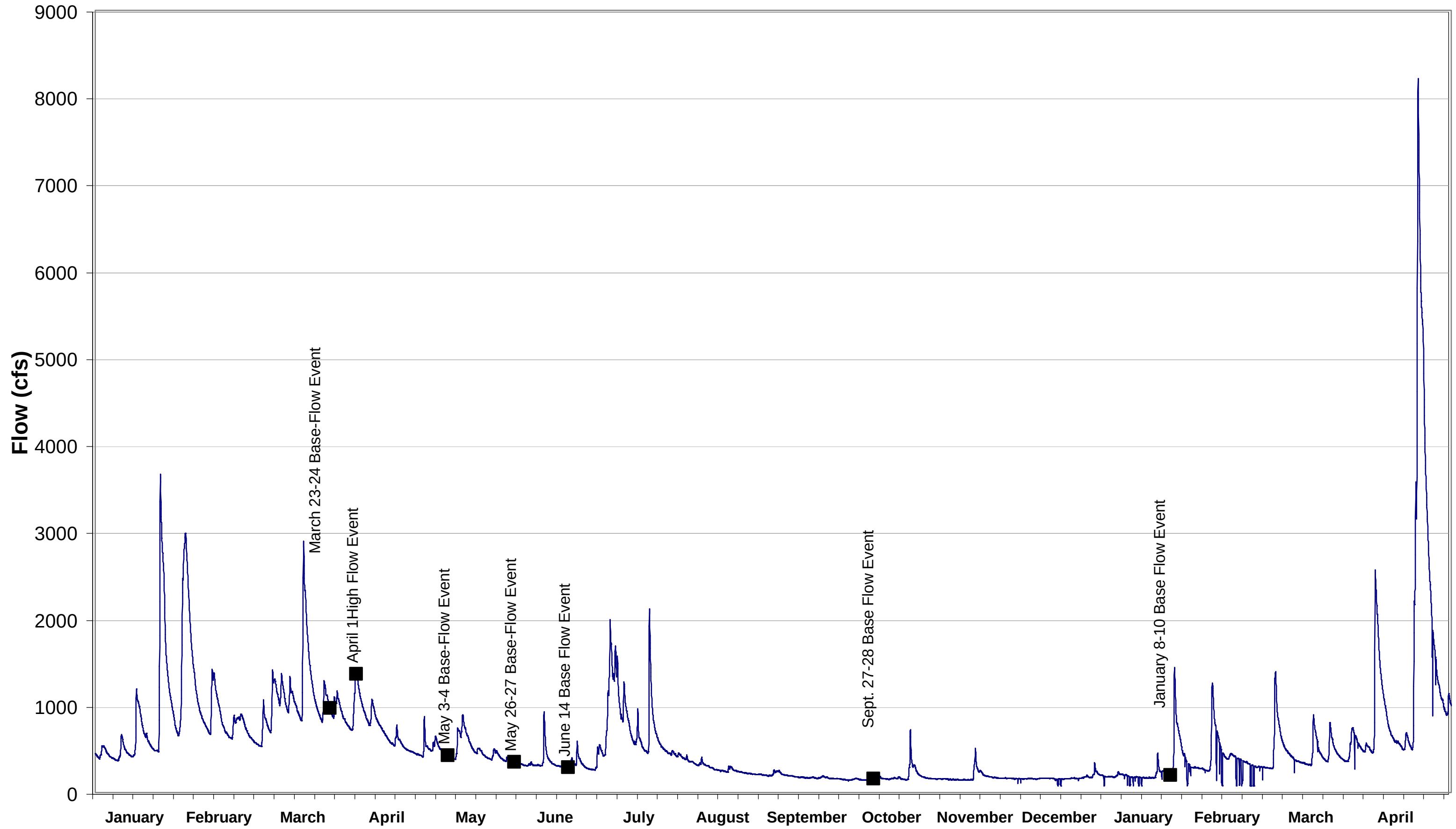
X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: ALPDF.PCP
6/2/00 SYR-54-KMD NES
10209051/RFI/10209B06.DWG

SOLUTIA INC.
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

SURFACE WATER SAMPLING PROGRAM

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 4-1



NOTE:

FLOW DATA FROM USGS GAGE AT JACKSON SHOALS

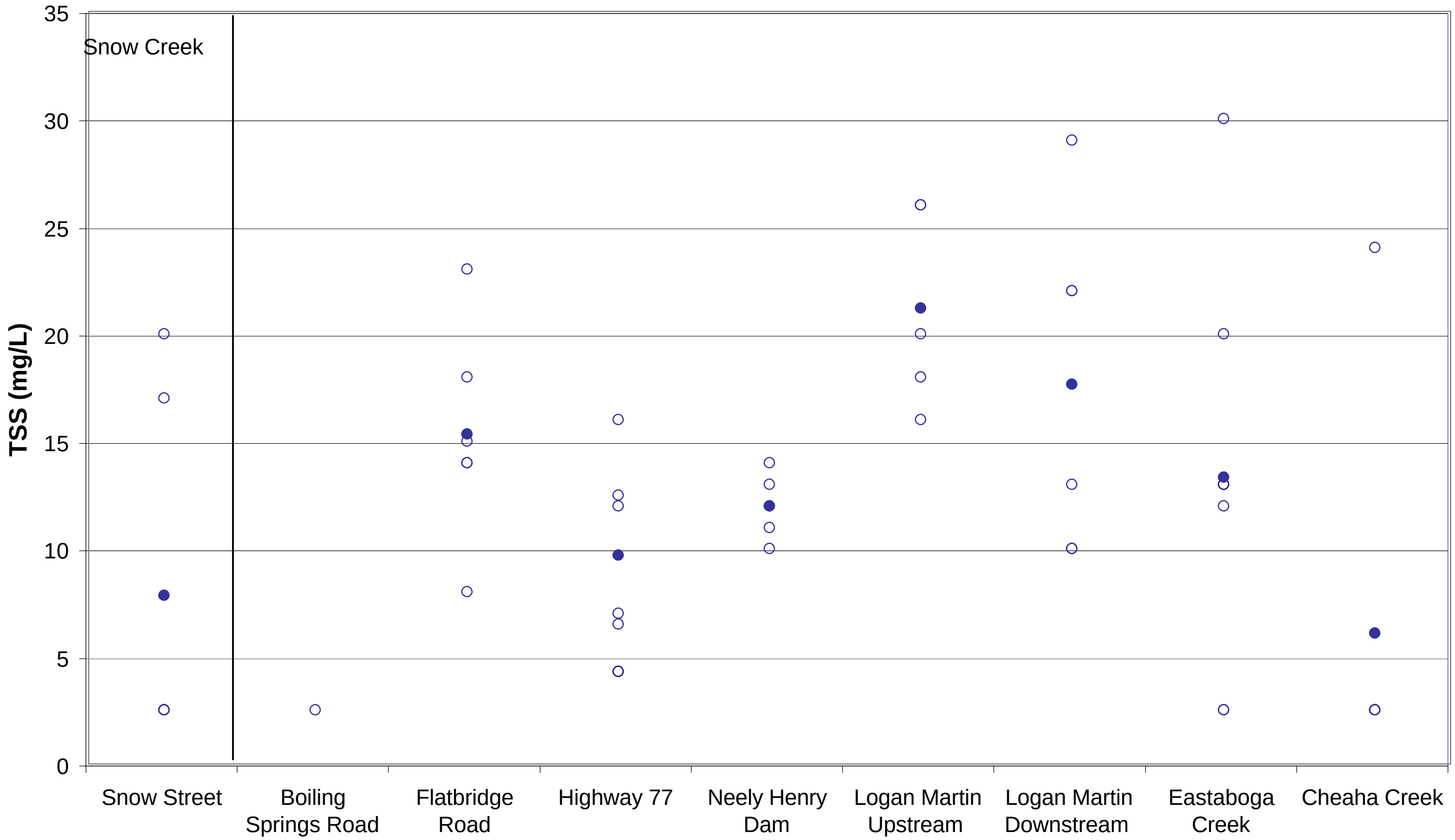
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

BASE AND HIGH FLOW SAMPLING EVENTS
JANUARY 1, 1999 - APRIL 15, 2000

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
4-2



LEGEND

○ **Observations**

● **Average TSS**

NOTE:
One-half the detection limit (2.5 mg/L) is used as a proxy TSS concentration for non-detects.

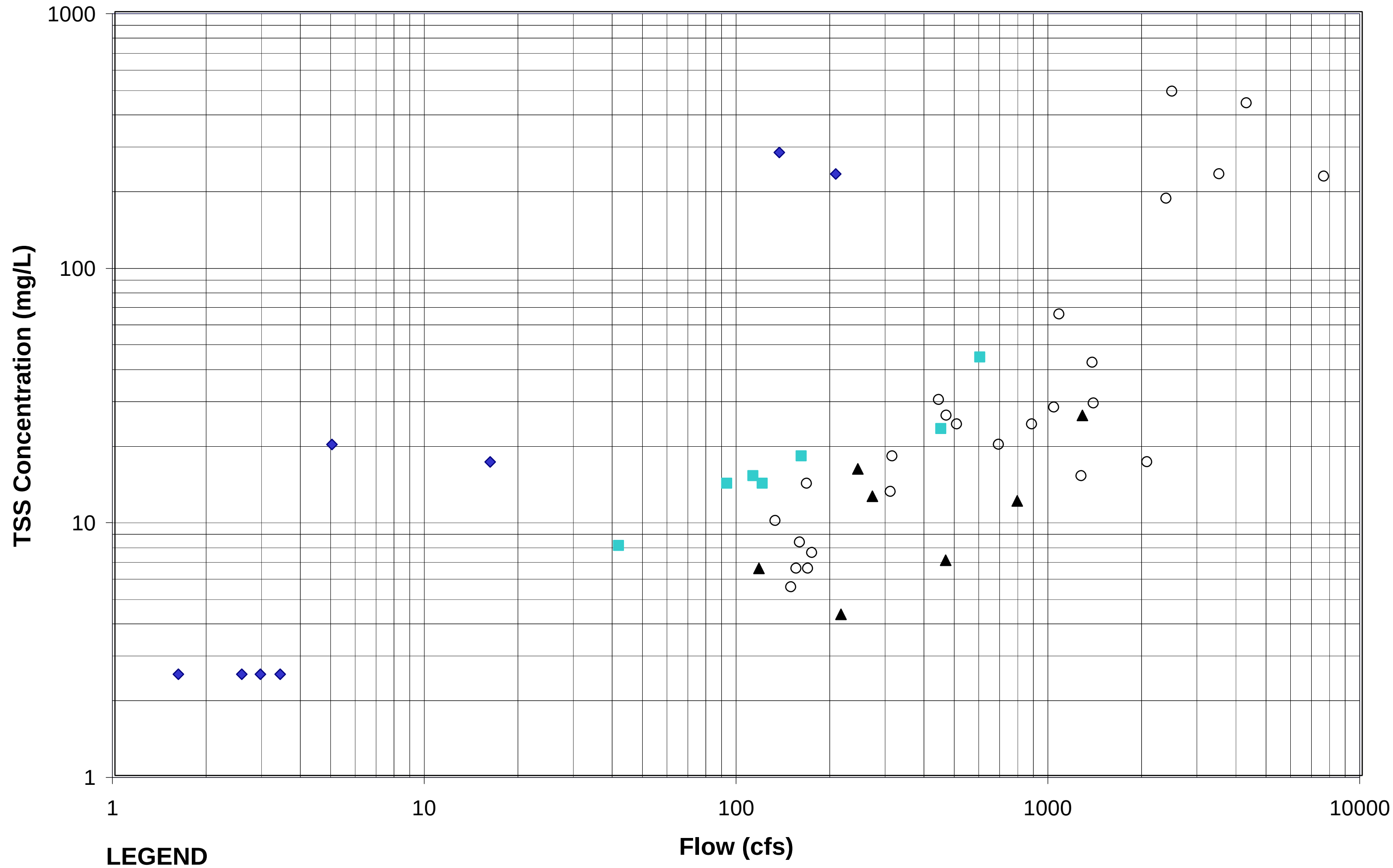
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

BASE-FLOW WATER COLUMN SAMPLING TSS RESULTS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-3



LEGEND

◆ Snow Creek at Snow Street

■ Choccolocco Creek at Flatbridge Road

▲ Choccolocco Creek at Highway 77

○ Choccolocco Creek at Jackson Shoals

NOTE:
One-half the detection limit (2.5 mg/L) is used as a proxy TSS concentration for non-detects.

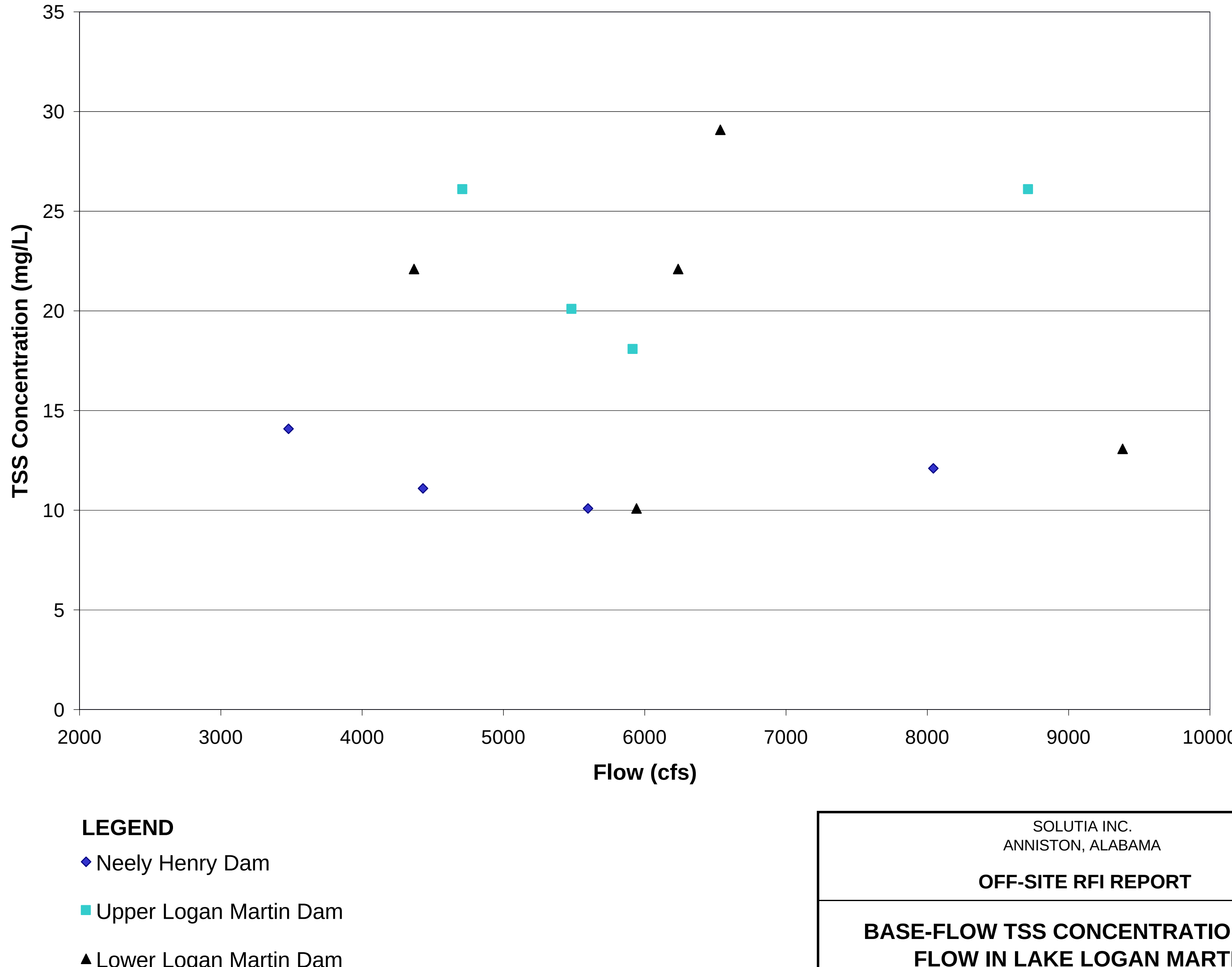
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

TSS CONCENTRATION AND FLOW IN CHOCCOLOCCO AND SNOW CREEKS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-4



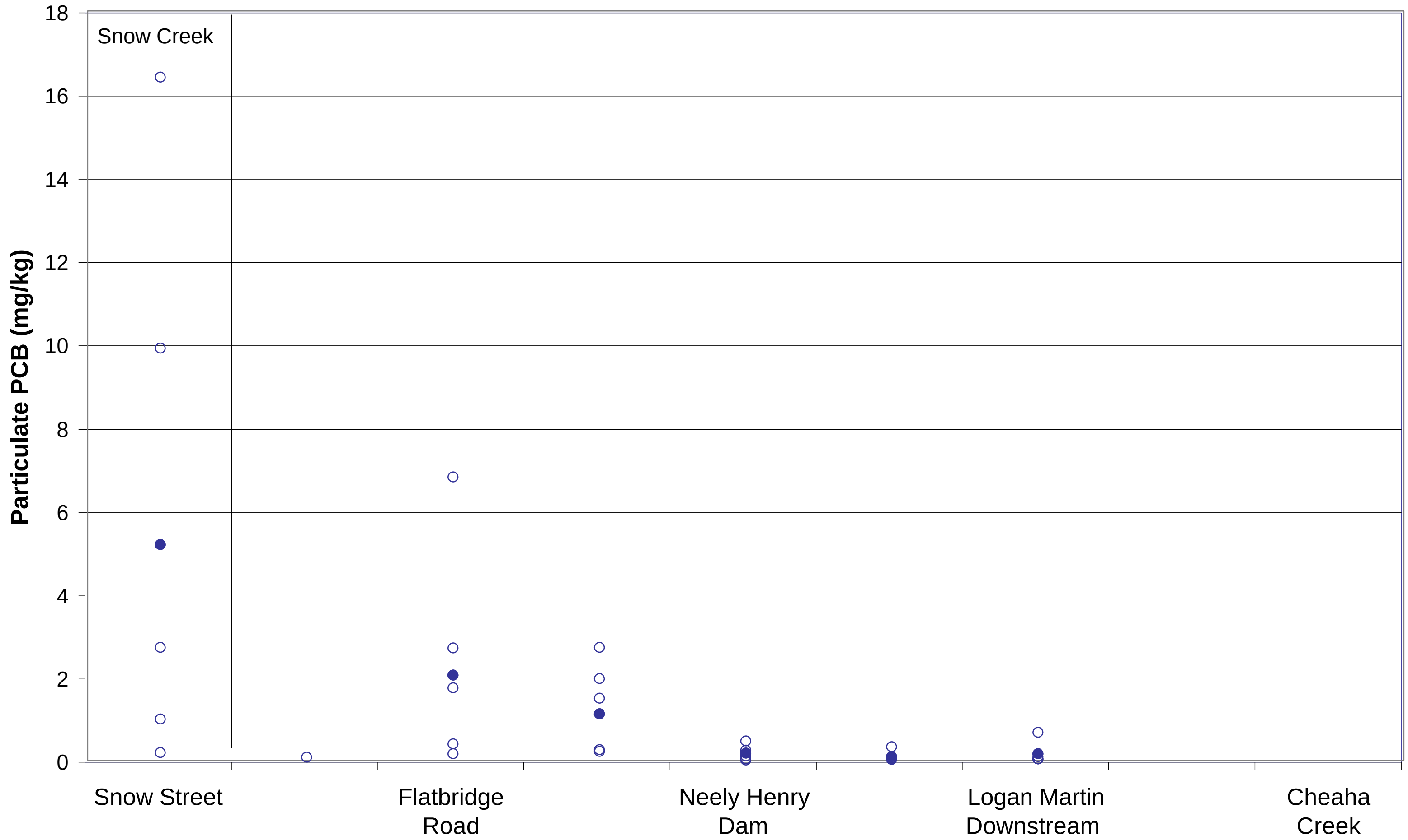
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

BASE-FLOW TSS CONCENTRATION AND FLOW IN LAKE LOGAN MARTIN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-5



LEGEND

Observations

Average PCB

SOLUTIA INC.
ANNISTON, ALABAMA

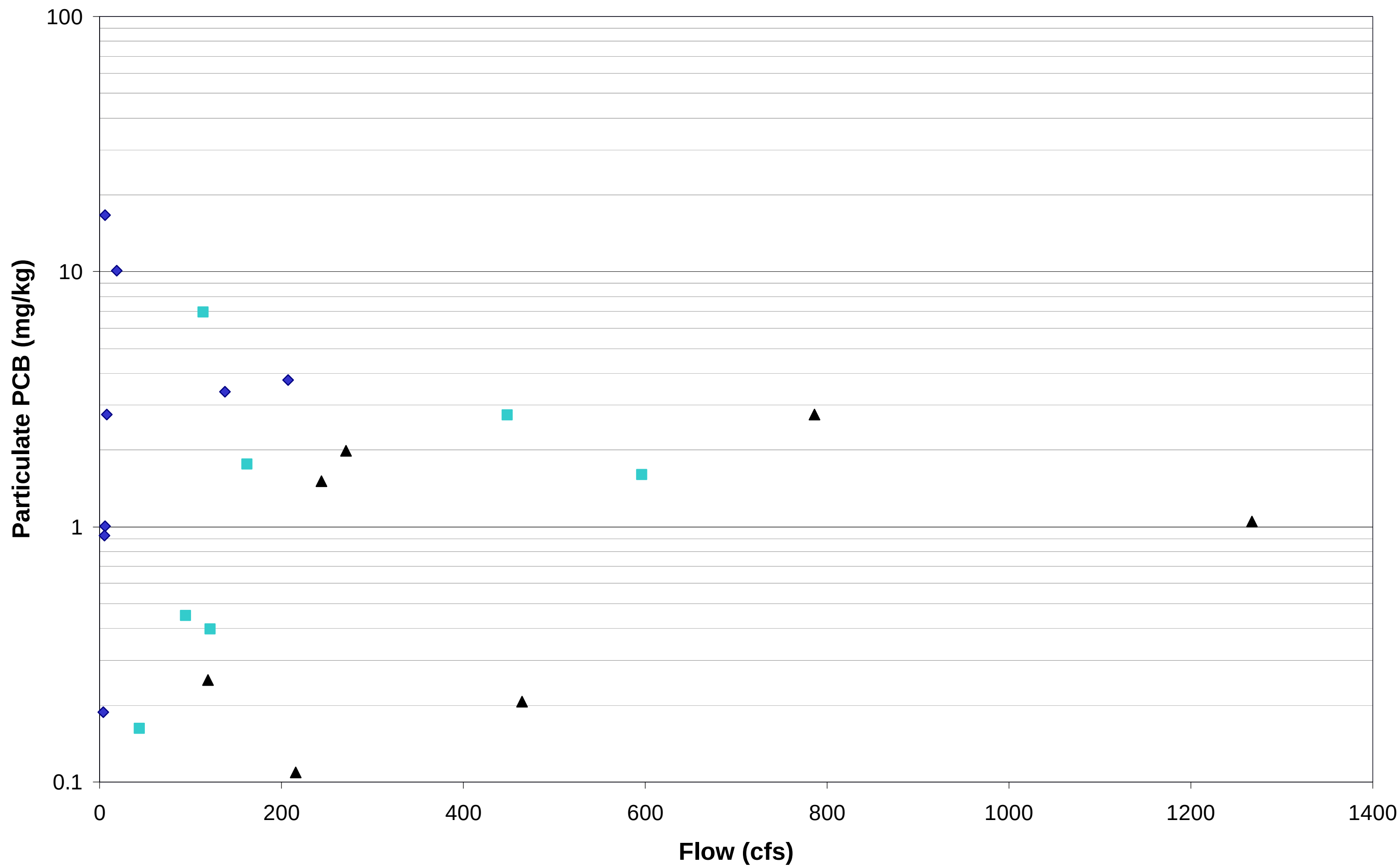
OFF-SITE RFI REPORT

BASE-FLOW WATER COLUMN SAMPLING PCB RESULTS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-6

ms_SWFigs6-27-00.xls_4-62/28/2003



LEGEND

◆ Snow Creek at Snow Street

■ Choccolocco Creek at Flatbridge Road

▲ Choccolocco Creek at Highway 77

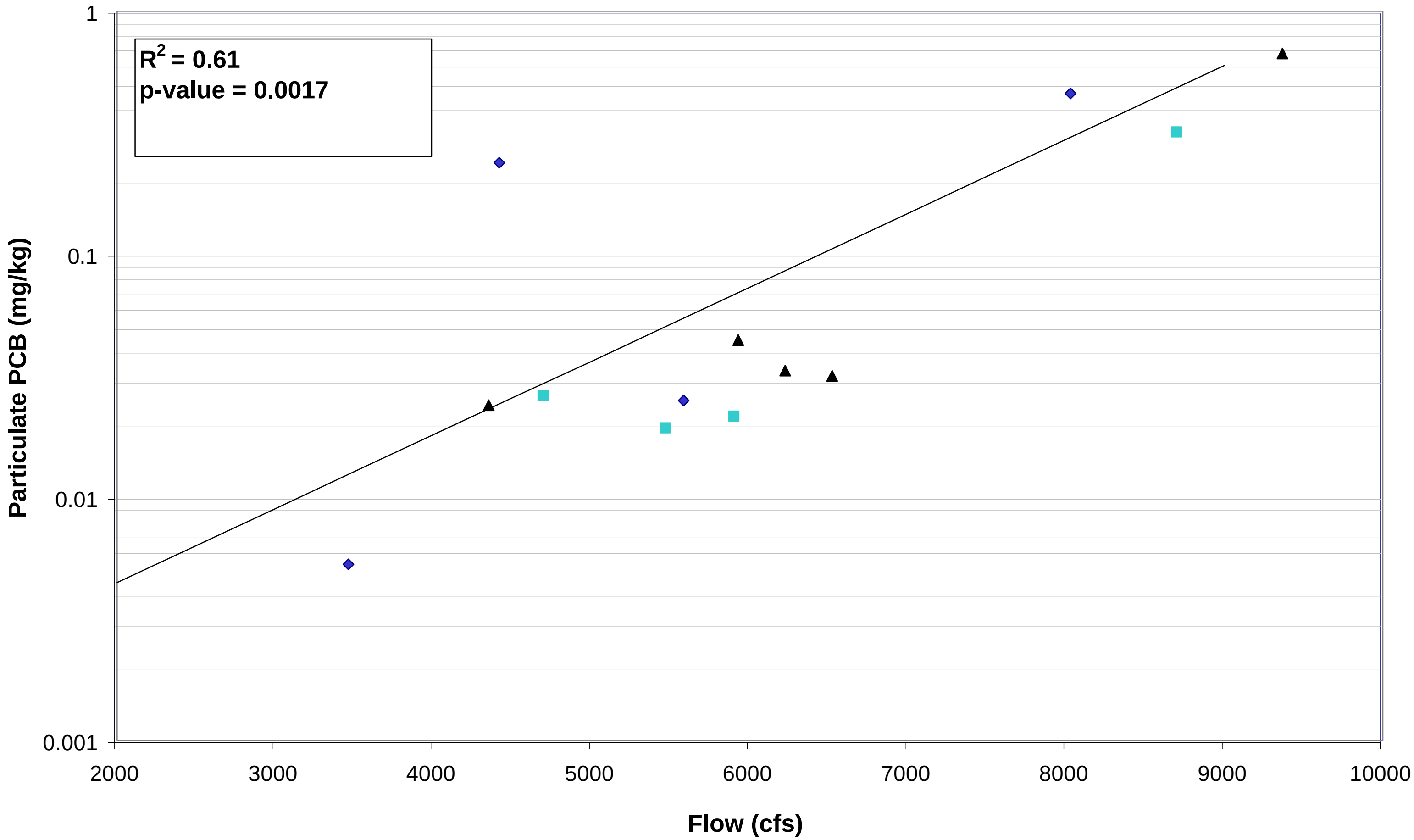
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

PARTICULATE PCB CONCENTRATION AND FLOW IN CHOCCOLOCCO AND SNOW CREEKS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-7



LEGEND

- Neely Henry Dam
- Upper Logan Martin Dam
- Lower Logan Martin Dam
- Regression Line

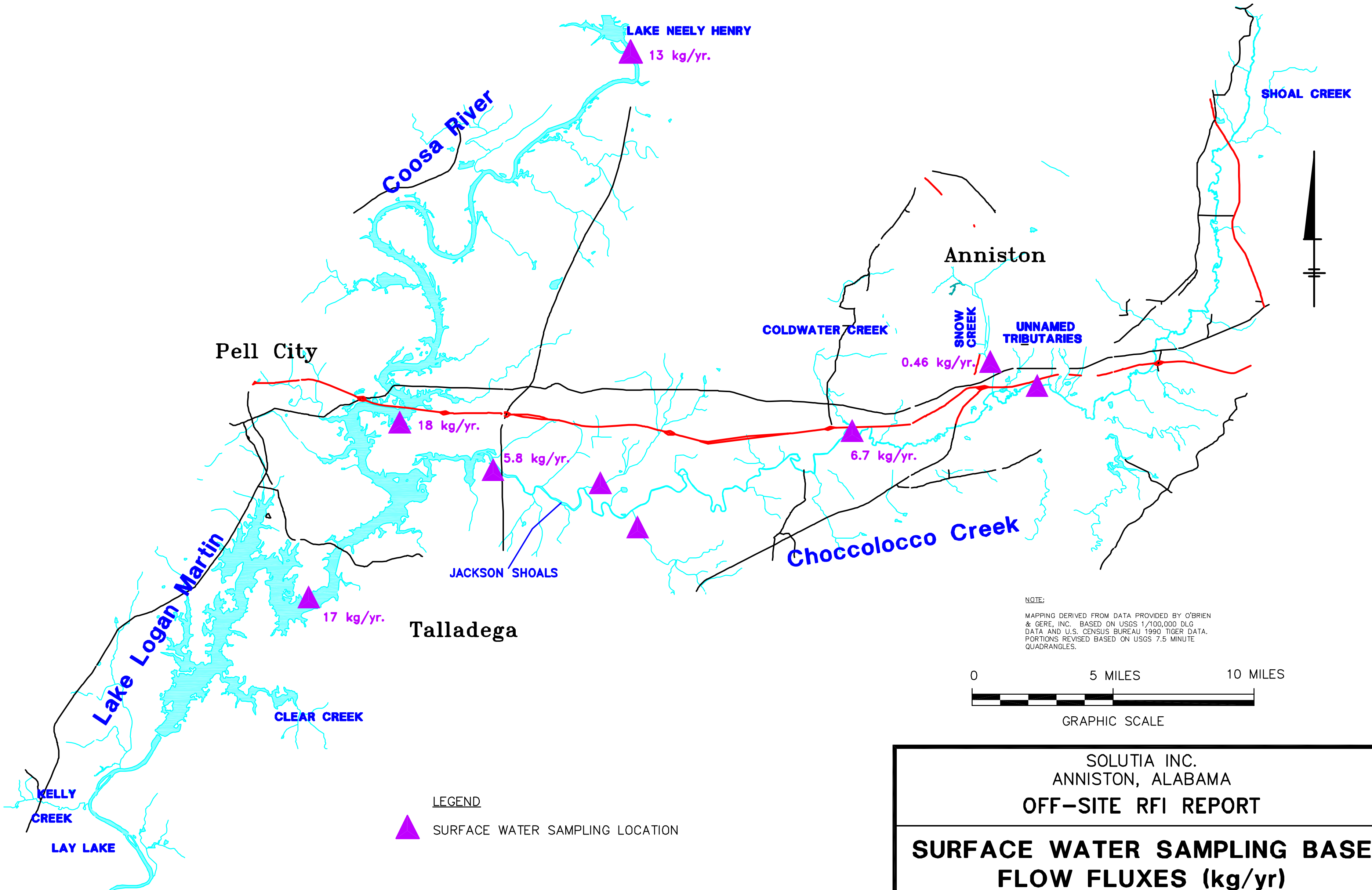
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

BASE-FLOW PARTICULATE PCB CONCENTRATION AND FLOW IN LAKE LOGAN MARTIN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-8



SOLUTIA INC.
ANNISTON, ALABAMA

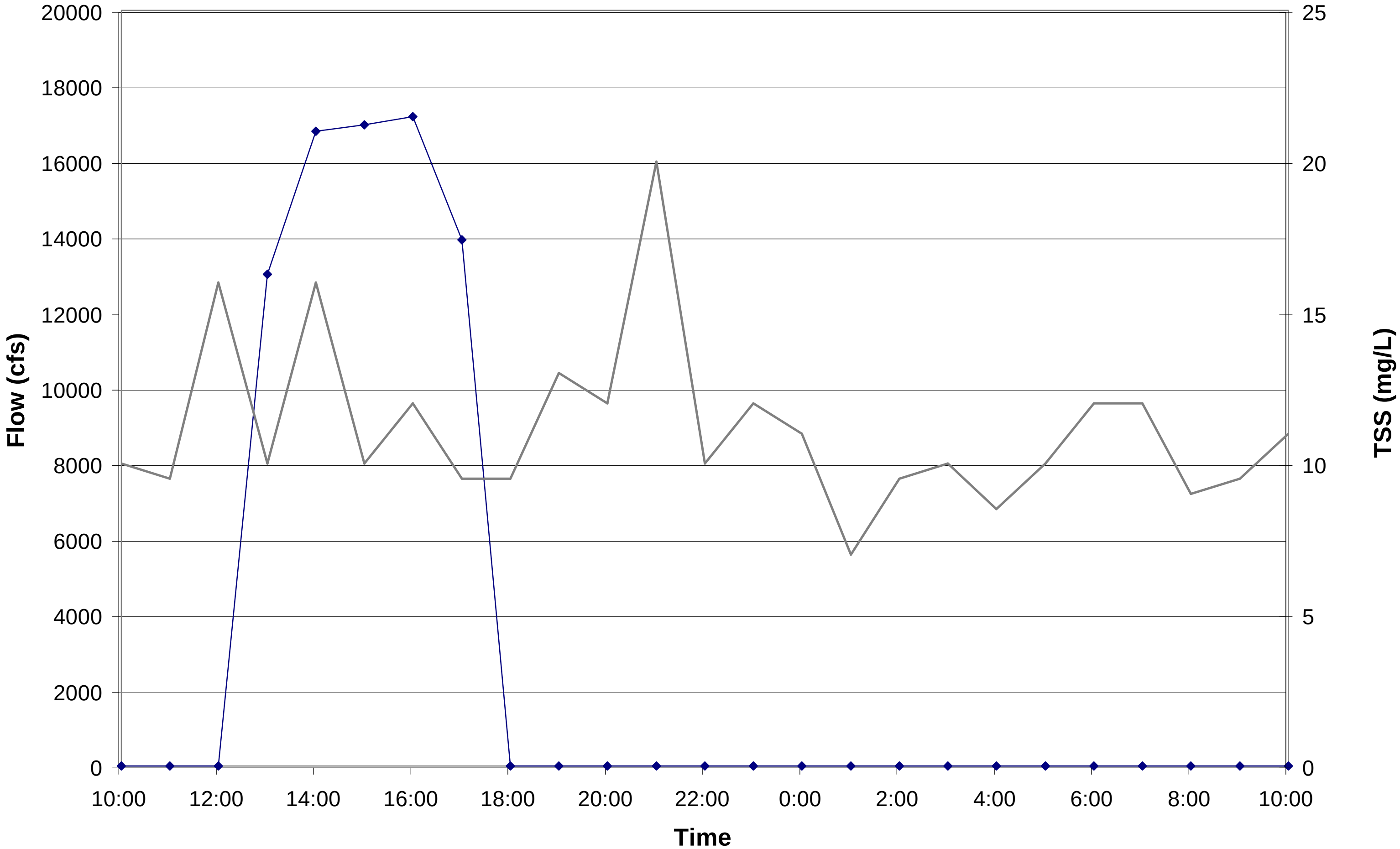
OFF-SITE RFI REPORT

SURFACE WATER SAMPLING BASE FLOW FLUXES (kg/yr)

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
4-9

X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: ALPDF.PCP
6/15/00 SYR-54-KMD NES KMD
10209051/RFI/10209B05.DWG



LEGEND

Flow at Dam

TSS Concentration

NOTE:
Samples were collected on 6/22/99 - 6/23/99.

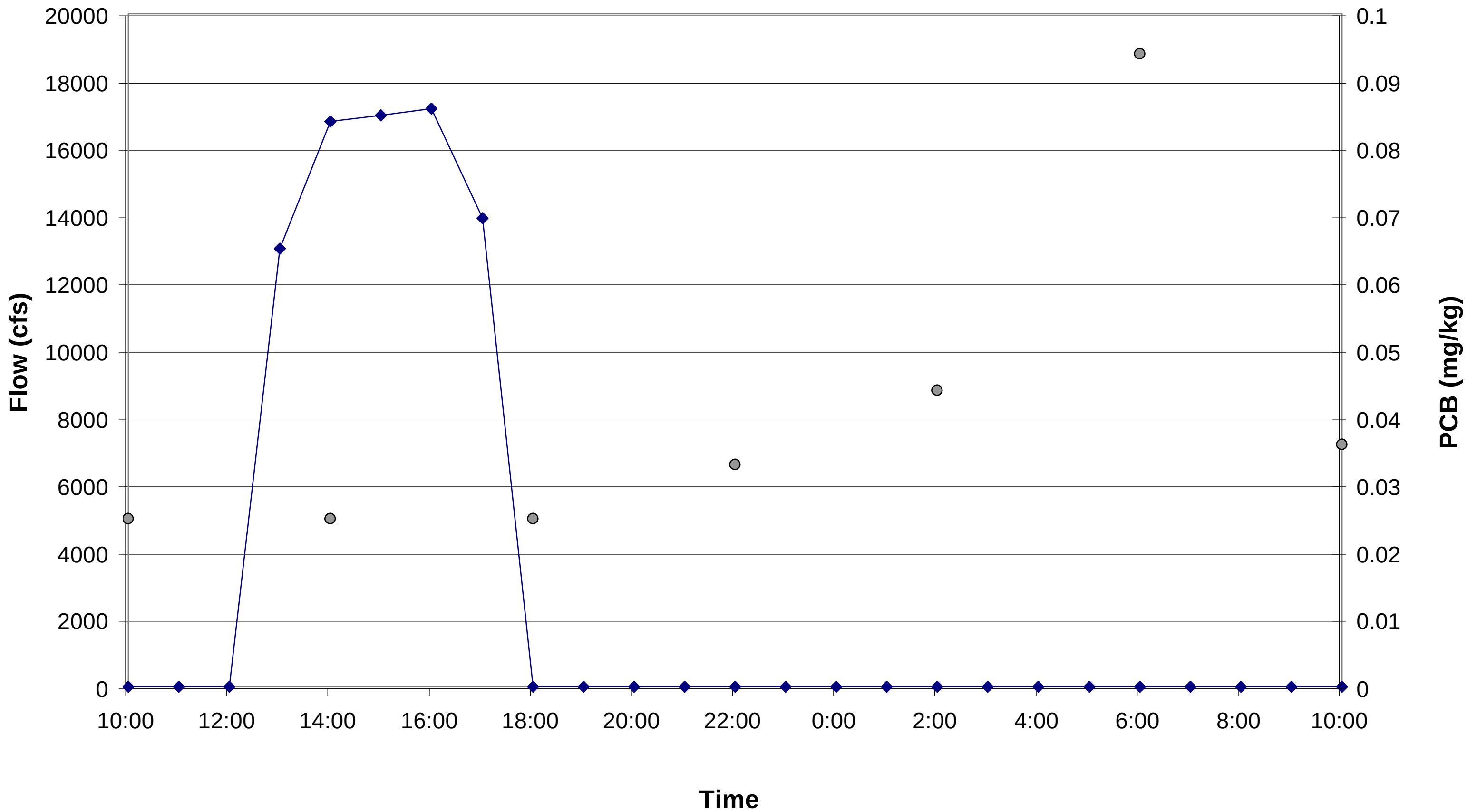
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

FLOW AND TSS DURING A 24-HOUR SAMPLING EVENT BELOW NEELY HENRY DAM

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-10



LEGEND

Flow at Dam

Particulate PCB

NOTE:
Samples were collected on 6/22/99 - 6/23/99.

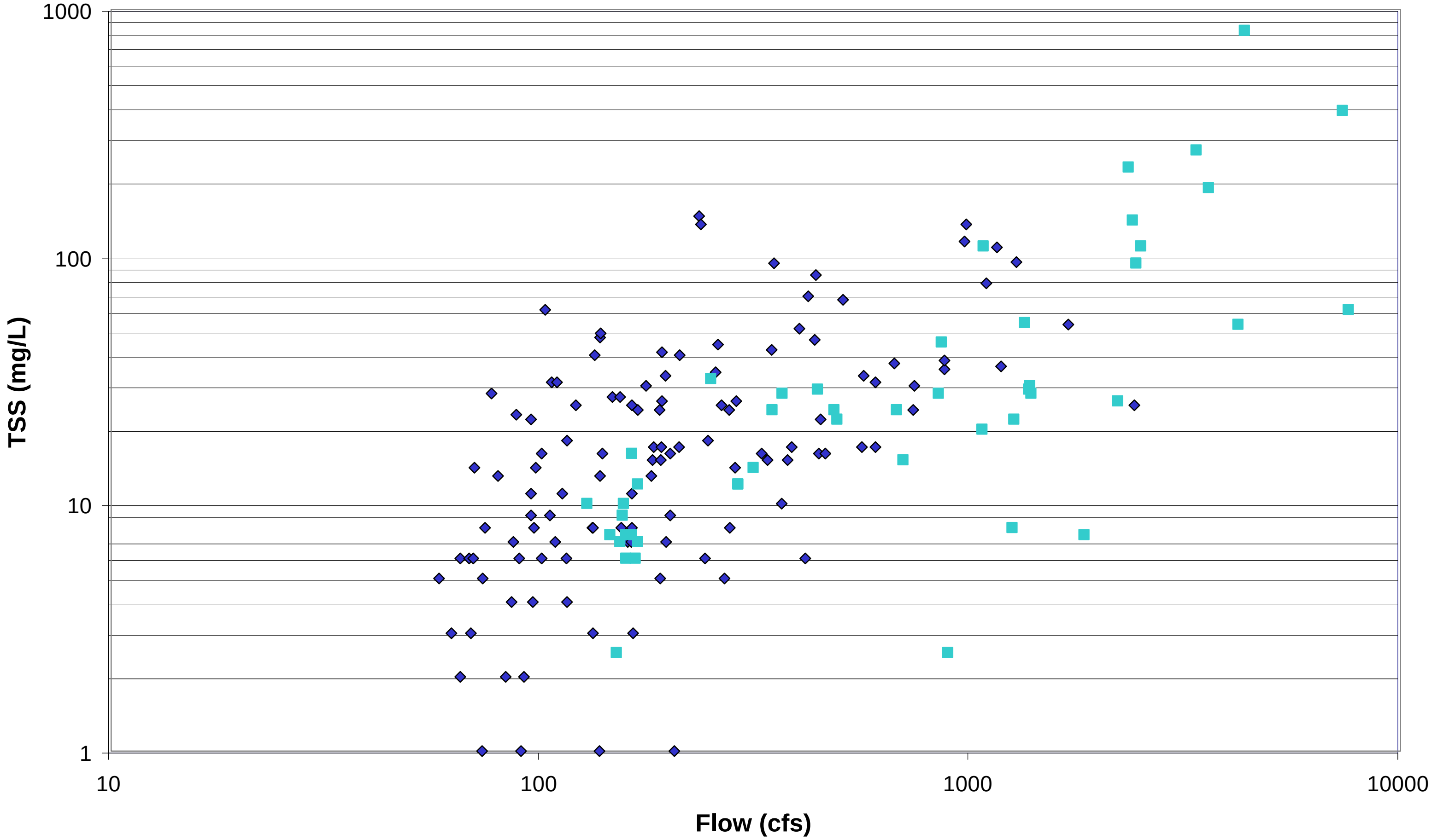
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

FLOW AND PARTICULATE PCB DURING A 24-HOUR SAMPLING EVENT BELOW NEELY HENRY DAM

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-11



LEGEND

◆ USGS Data

■ RFI Data

NOTE:
USGS data collected from 1985 to 1996.

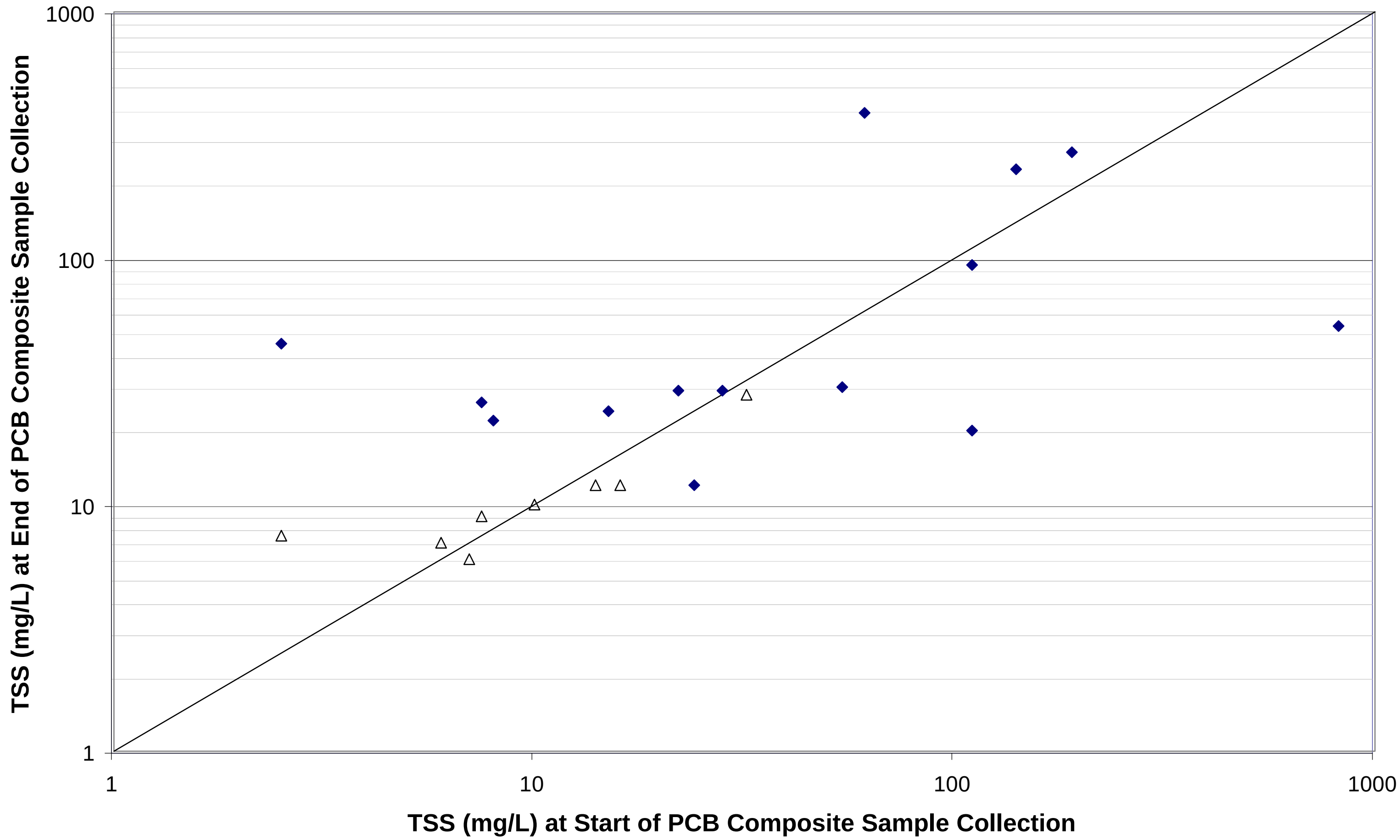
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

COMPARISON OF RFI DATA AND HISTORIC USGS DATA - TSS CONCENTRATION AND FLOW AT JACKSON SHOALS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-12



LEGEND

◆ High Flow Sampling

△ Baseflow Sampling

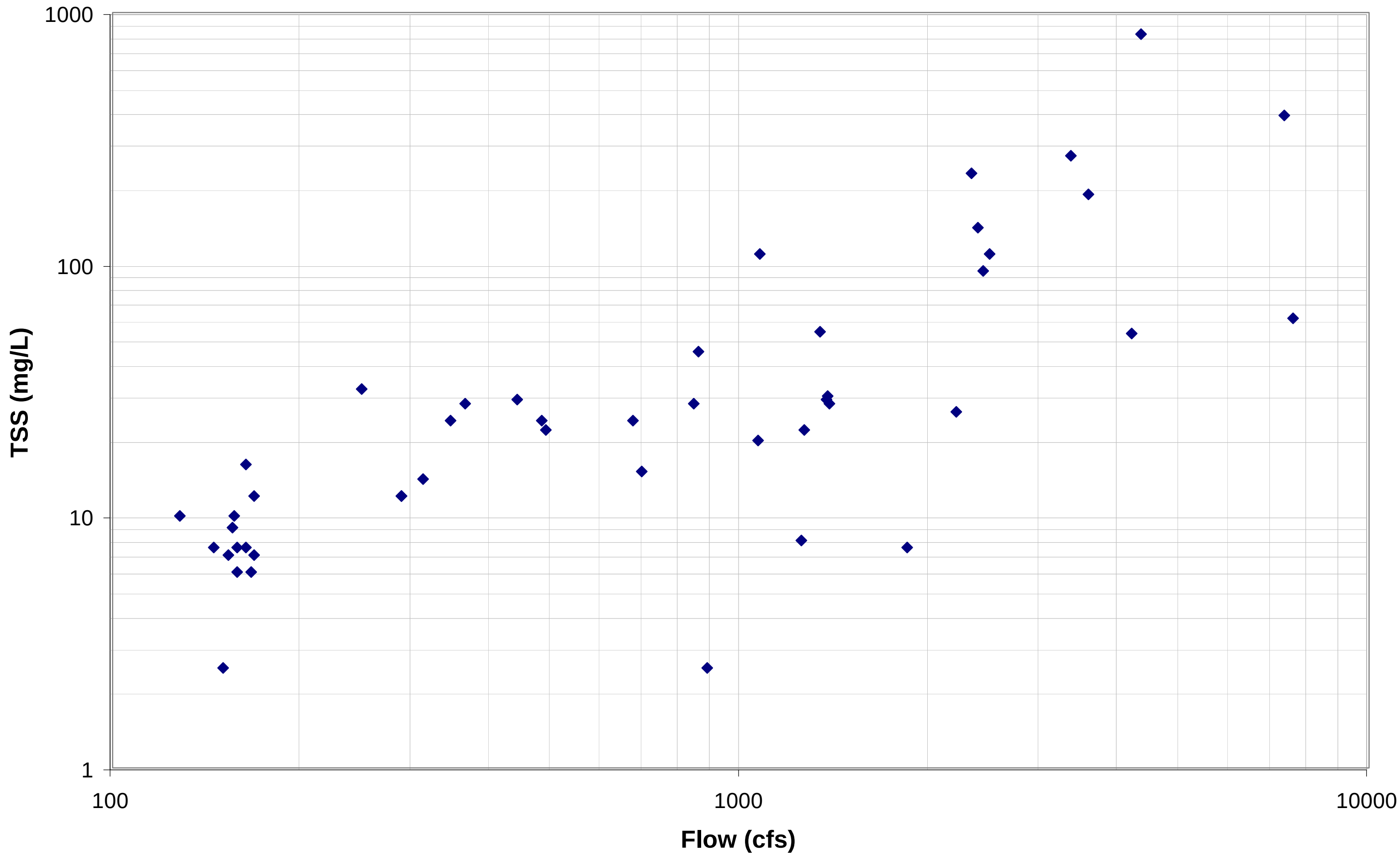
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

COMPARISON OF BASE-FLOW AND HIGH FLOW SAMPLING OF TSS AT JACKSON SHOALS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-13



NOTE:
One-half the detection limit (2.5 mg/L) is used as a proxy TSS concentration for non-detects.

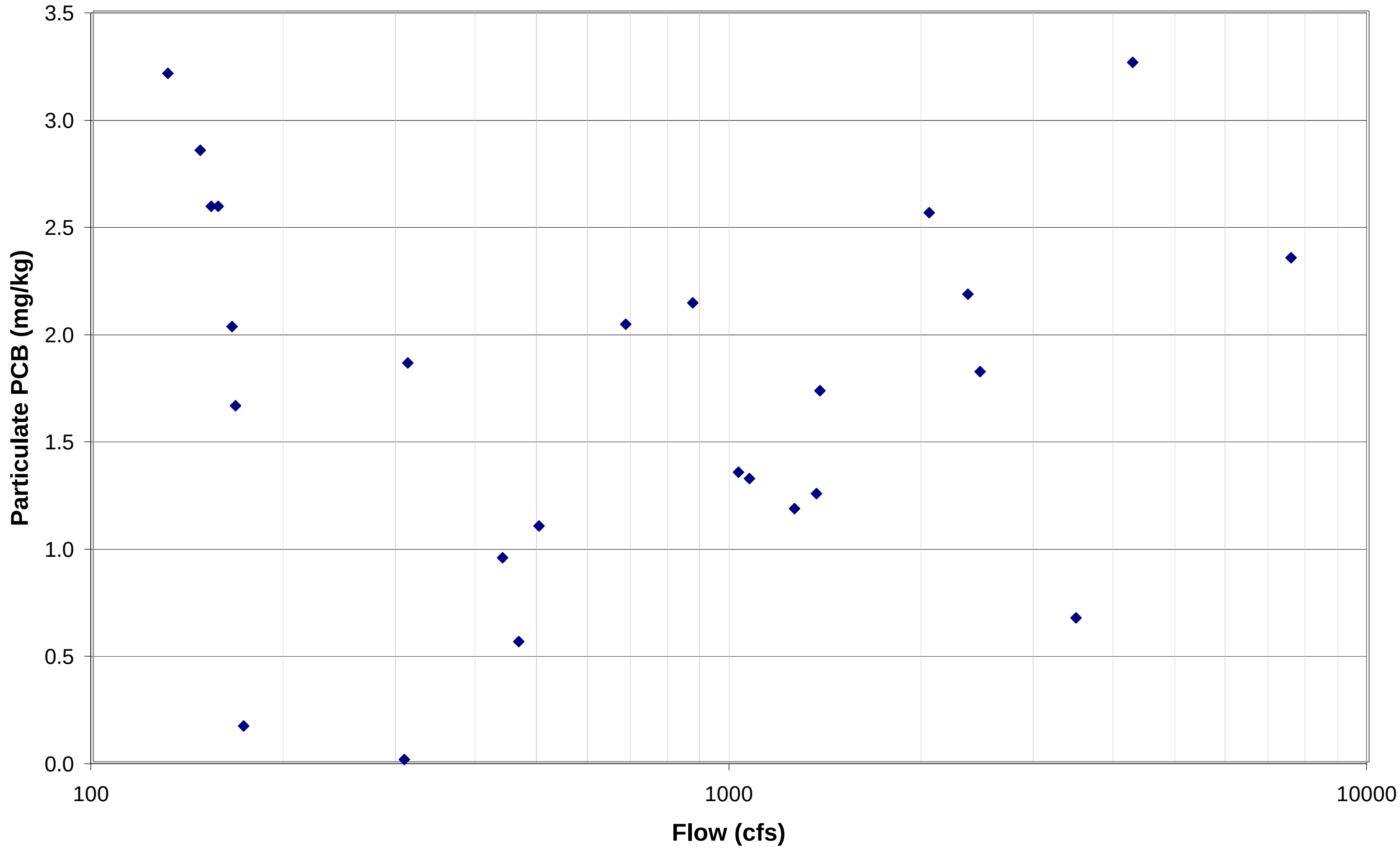
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

RELATIONSHIP BETWEEN TSS CONCENTRATION AND FLOW AT JACKSON SHOALS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-14



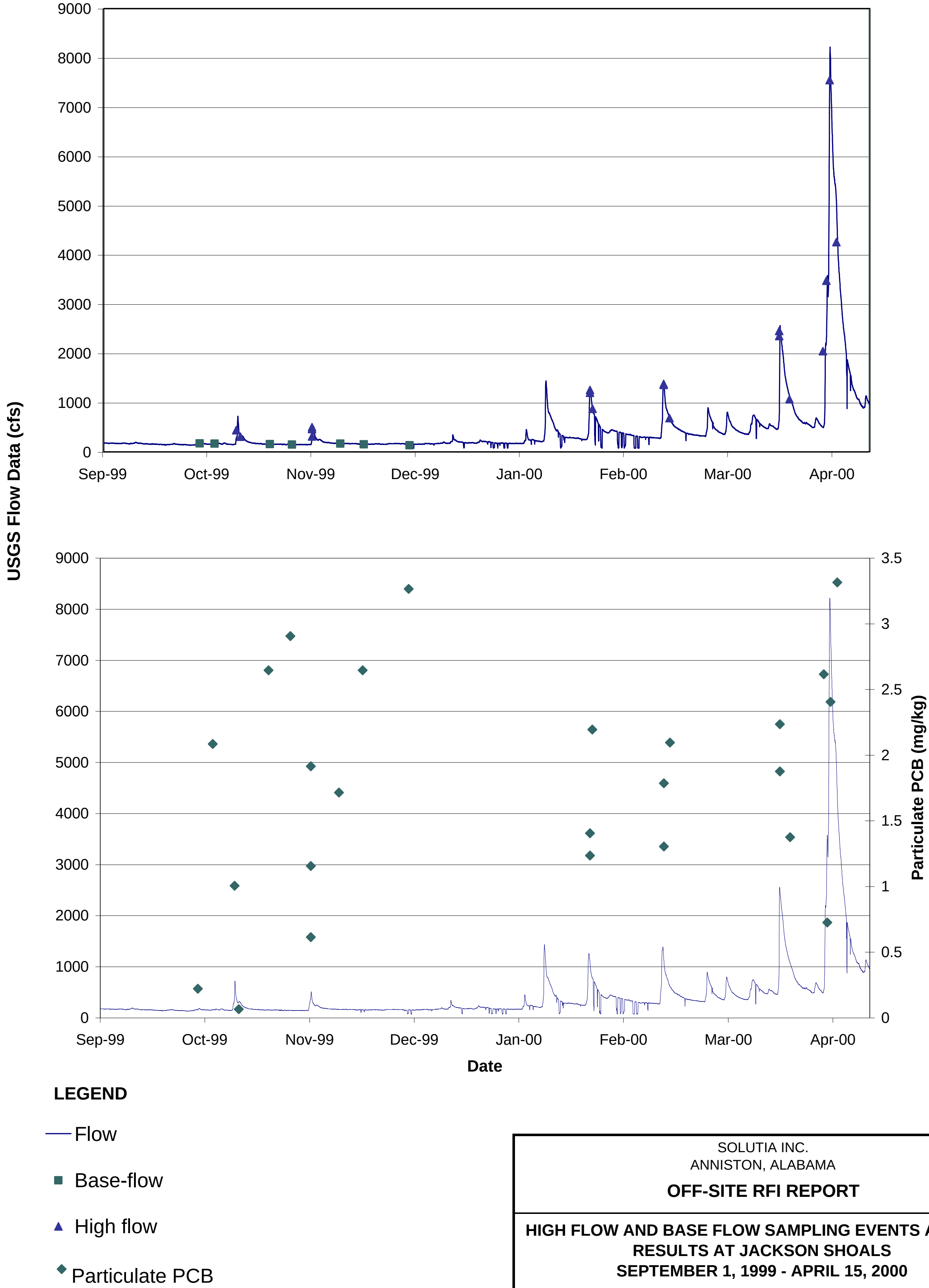
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

RELATIONSHIP BETWEEN PARTICULATE PCB CONCENTRATION AND FLOW AT JACKSON SHOALS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-15



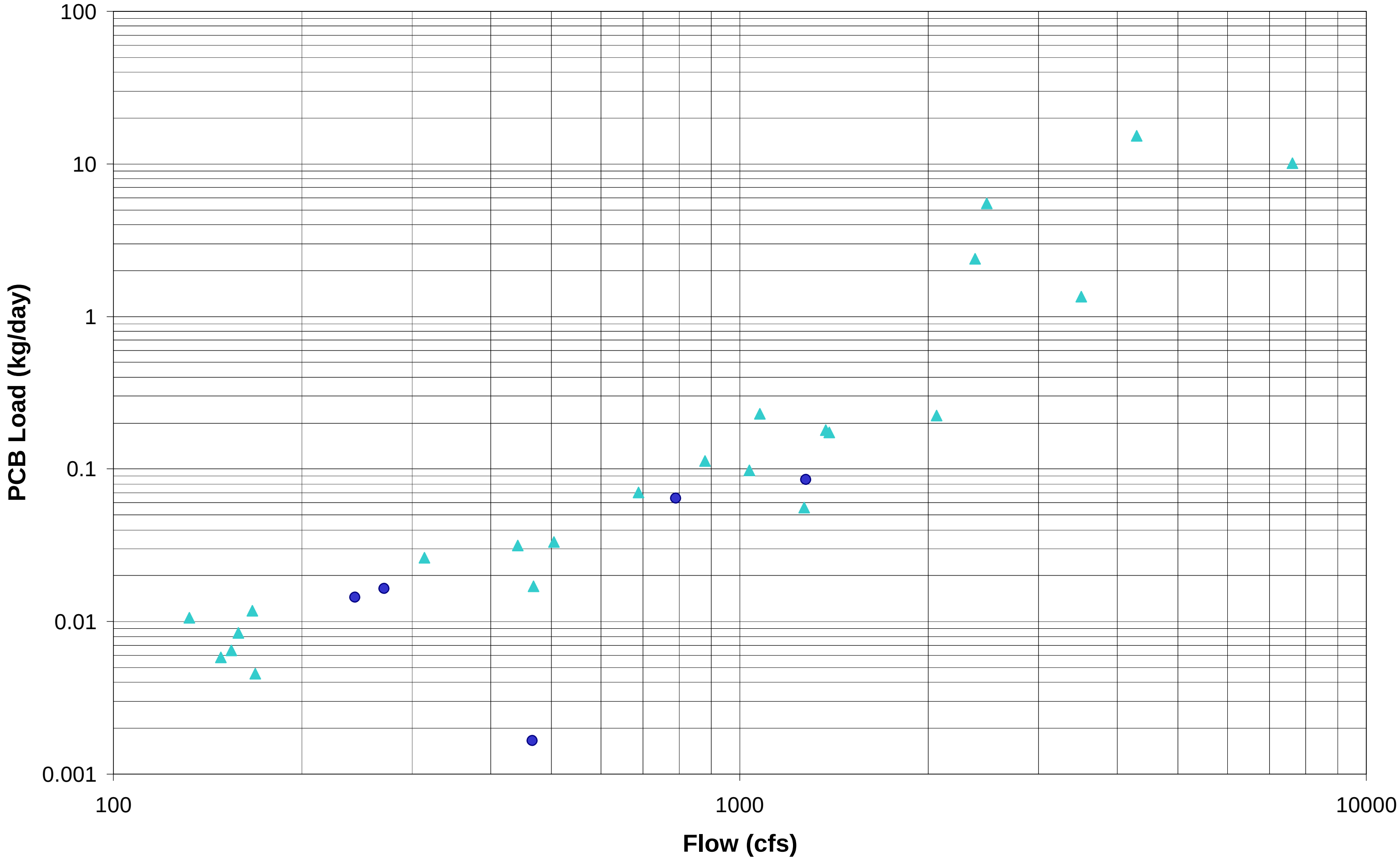
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

HIGH FLOW AND BASE FLOW SAMPLING EVENTS AND PCB RESULTS AT JACKSON SHOALS
SEPTEMBER 1, 1999 - APRIL 15, 2000

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-16



LEGEND

● Choccolocco Creek at Highway 77

▲ Choccolocco Creek at Jackson Shoals

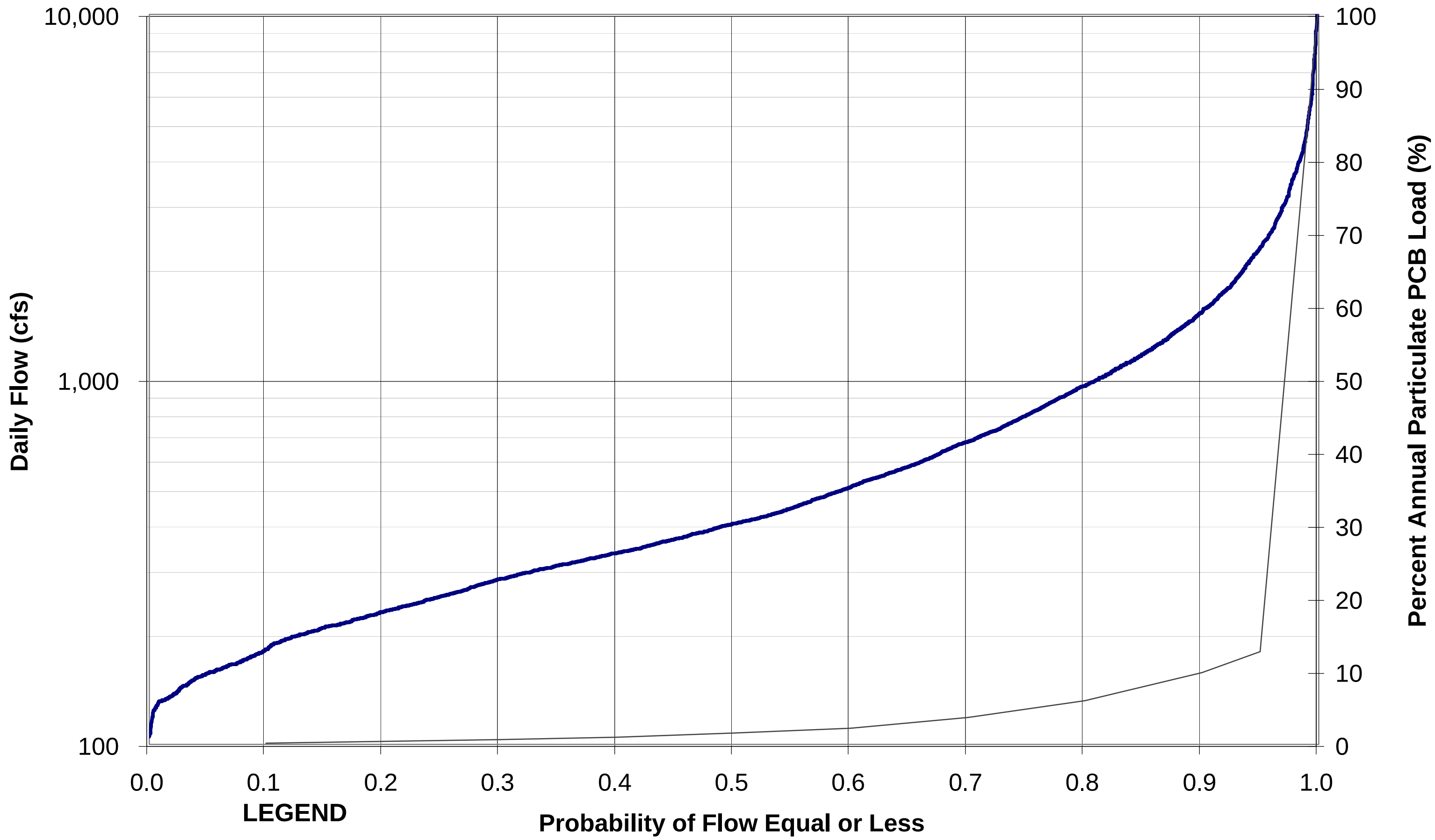
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

RELATIONSHIP BETWEEN DAILY PCB LOAD AND FLOW AT JACKSON SHOALS AND HIGHWAY 77

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-17



LEGEND

Flow

Particulate PCB

NOTE:
Flow data obtained from USGS gaging station 02404400 for the period of record 10/01/84 - 9/30/98.

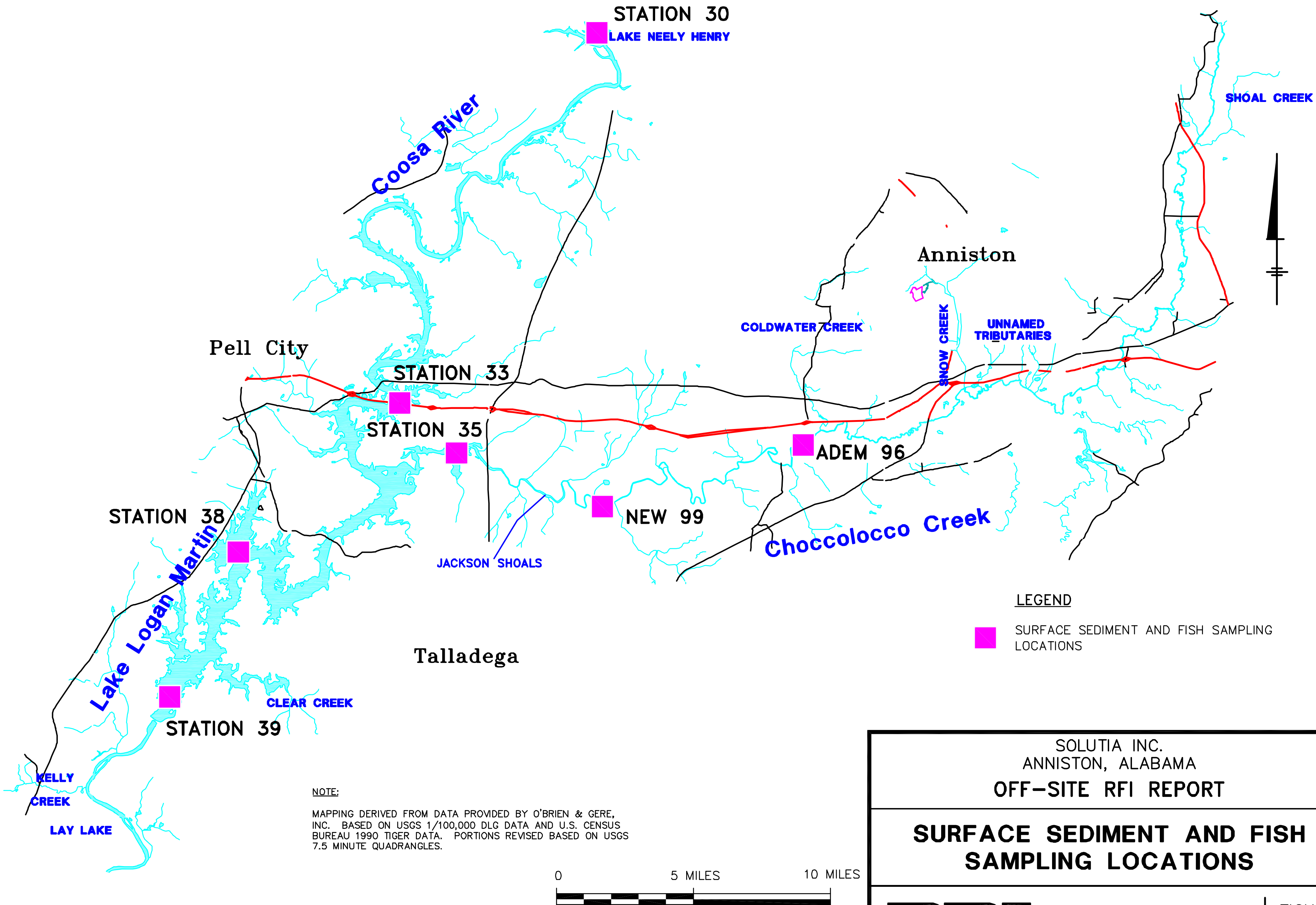
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

CUMULATIVE RELATIVE FREQUENCY OF DAILY FLOW AND PARTICULATE PCB AT JACKSON SHOALS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4-18



LEGEND

SURFACE SEDIMENT AND FISH SAMPLING LOCATIONS

NOTE:

MAPPING DERIVED FROM DATA PROVIDED BY O'BRIEN & GERE, INC. BASED ON USGS 1/100,000 DLG DATA AND U.S. CENSUS BUREAU 1990 TIGER DATA. PORTIONS REVISED BASED ON USGS 7.5 MINUTE QUADRANGLES.

X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: FRY700AL.PCP
6/27/00 SYR-54-KMD NES
10209051/RFI/10209B11.DWG

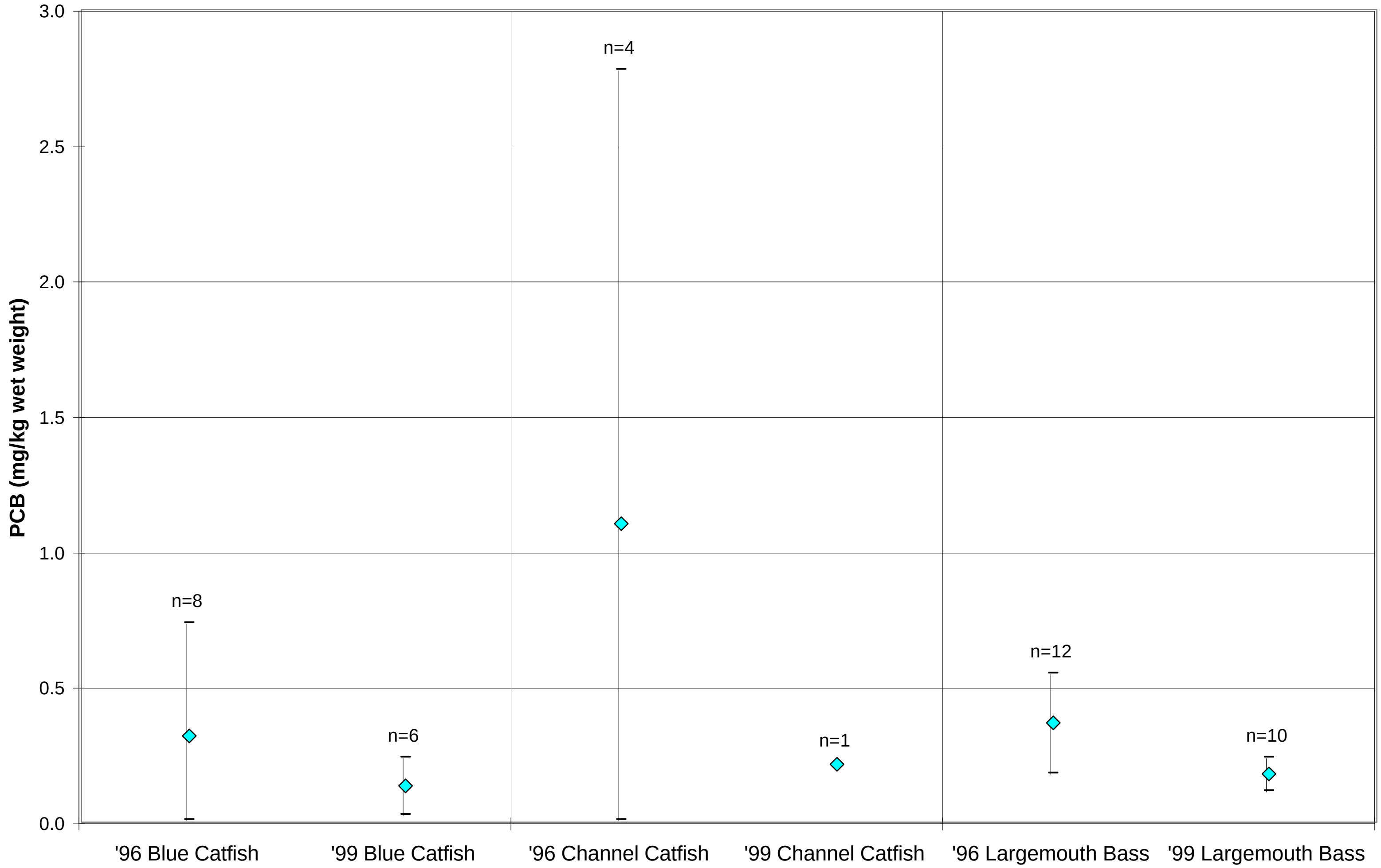
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

SURFACE SEDIMENT AND FISH SAMPLING LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
5-1



SOLUTIA INC.
ANNISTON, ALABAMA

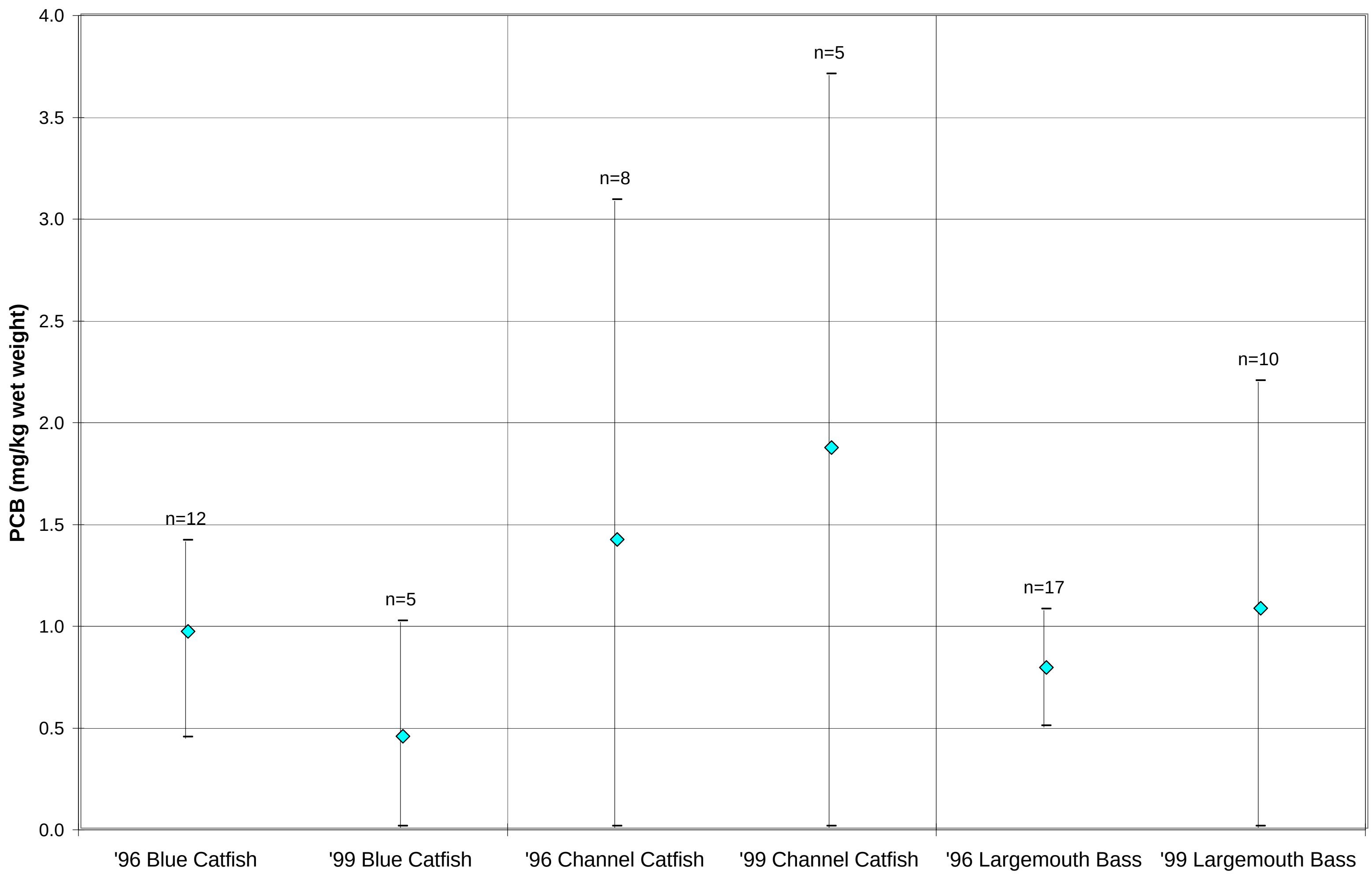
OFF-SITE RFI REPORT

LAKE NEELY HENRY (STATION 30) - MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR BASS AND CATFISH

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-2

ms_fishfigs.xls_st 30_2/28/2003



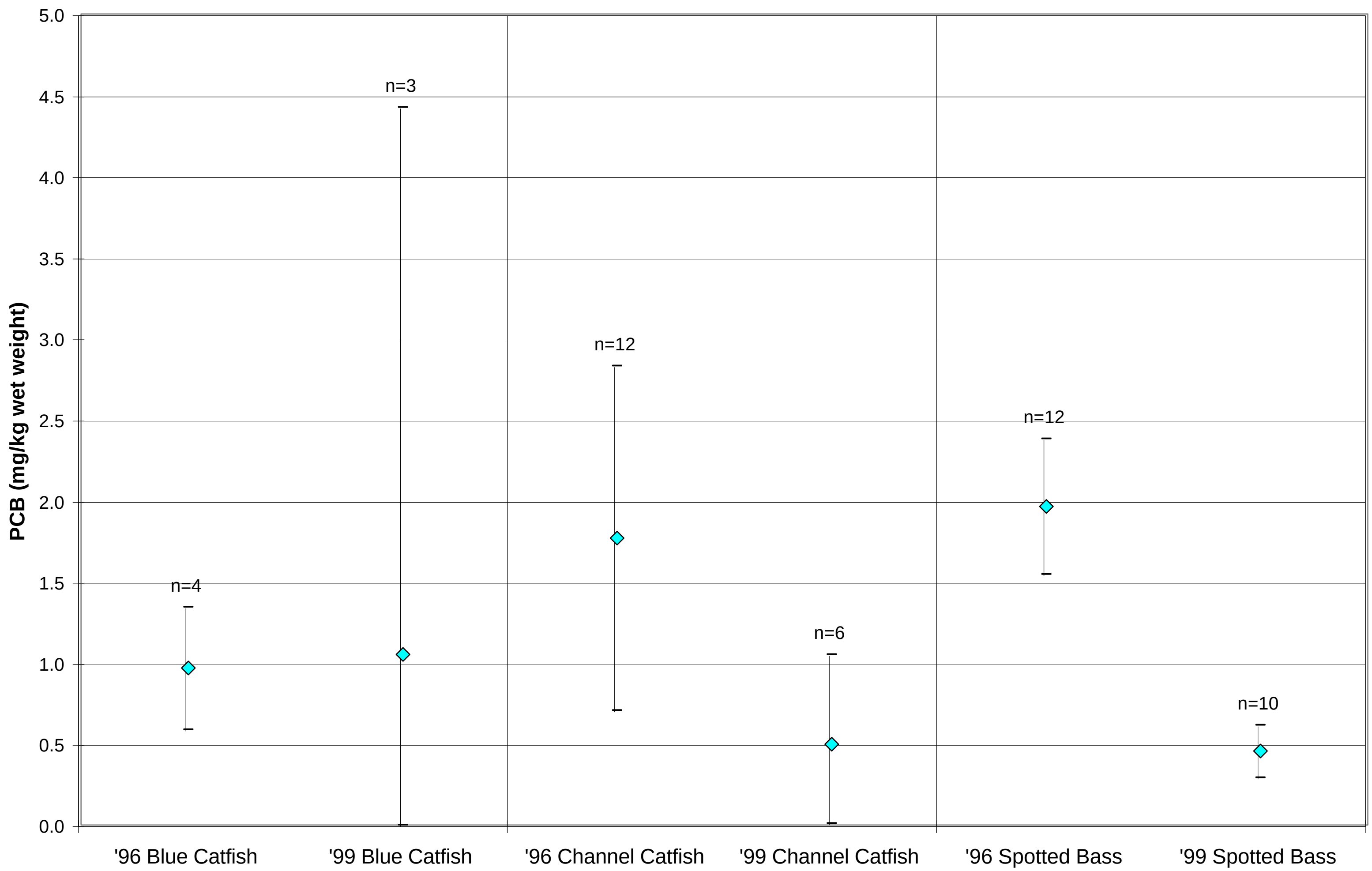
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

LAKE LOGAN MARTIN (STATION 33) - MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR BASS AND CATFISH

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-3



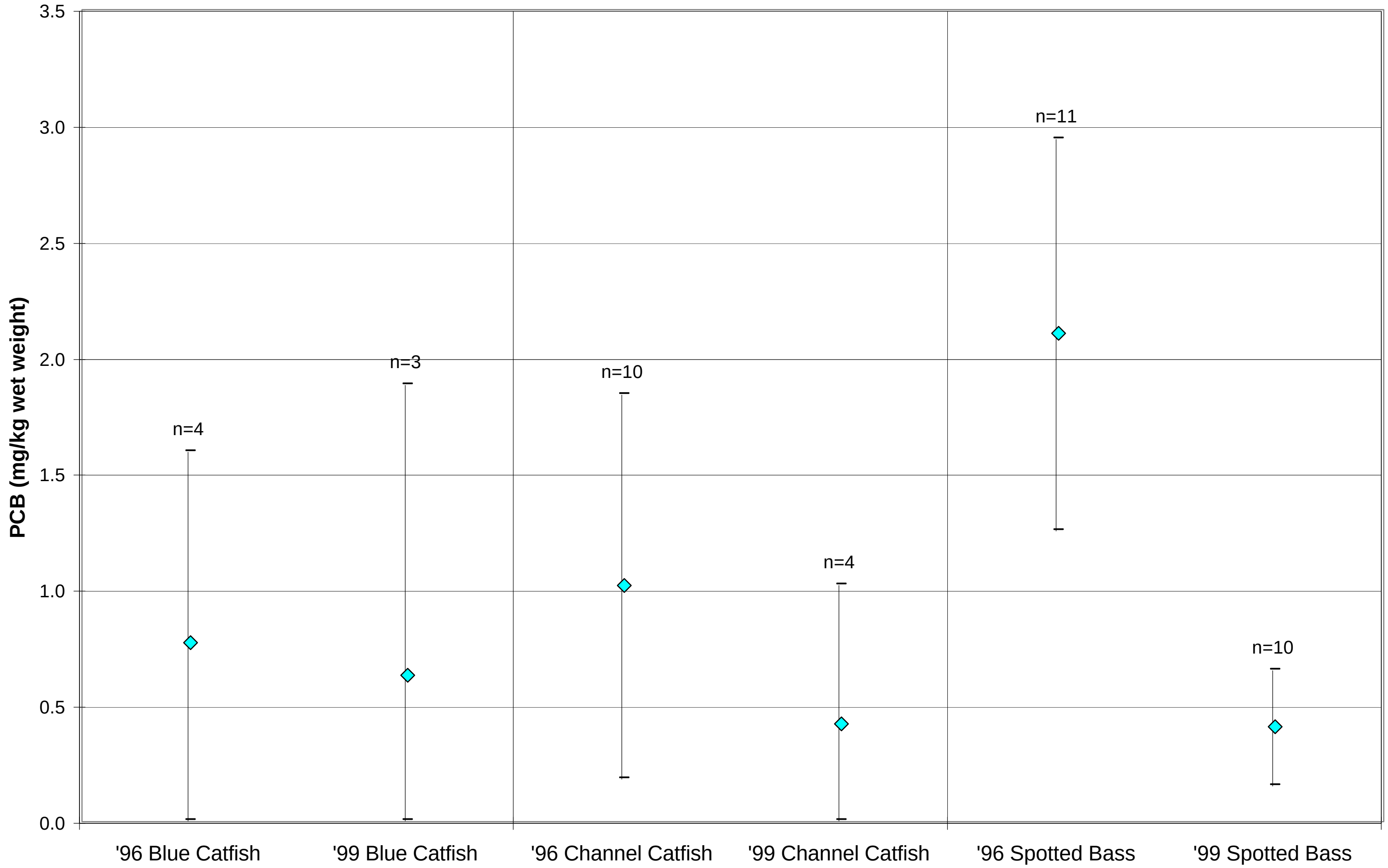
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

LAKE LOGAN MARTIN (STATION 38) - MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR BASS AND CATFISH

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-4



SOLUTIA INC.
ANNISTON, ALABAMA

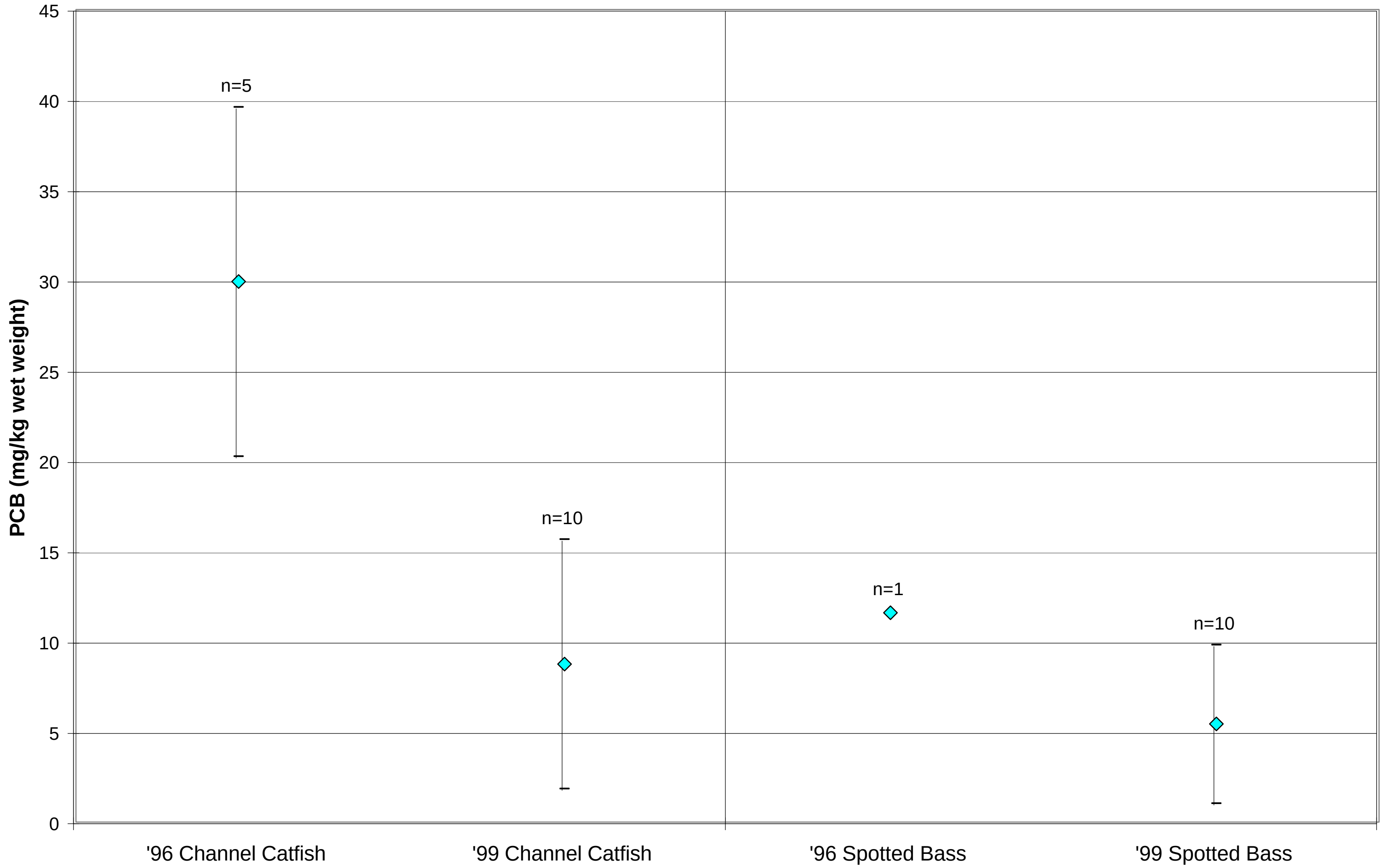
OFF-SITE RFI REPORT

LAKE LOGAN MARTIN (STATION 39) - MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR BASS AND CATFISH

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-5

ms_fishfigs.xls_st 39_2/28/2003



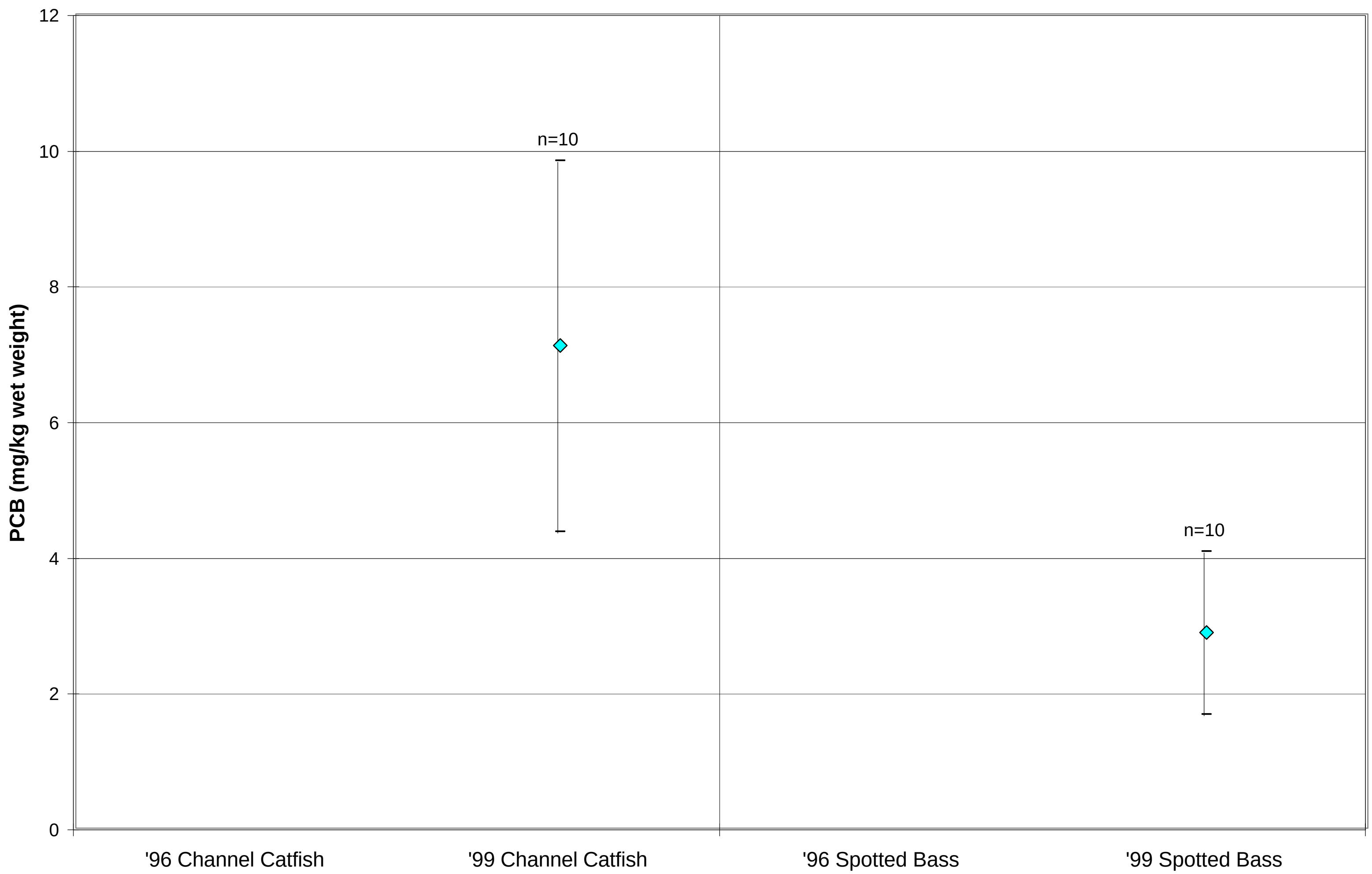
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK (ADEM 96) - MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR BASS AND CATFISH

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 5-6



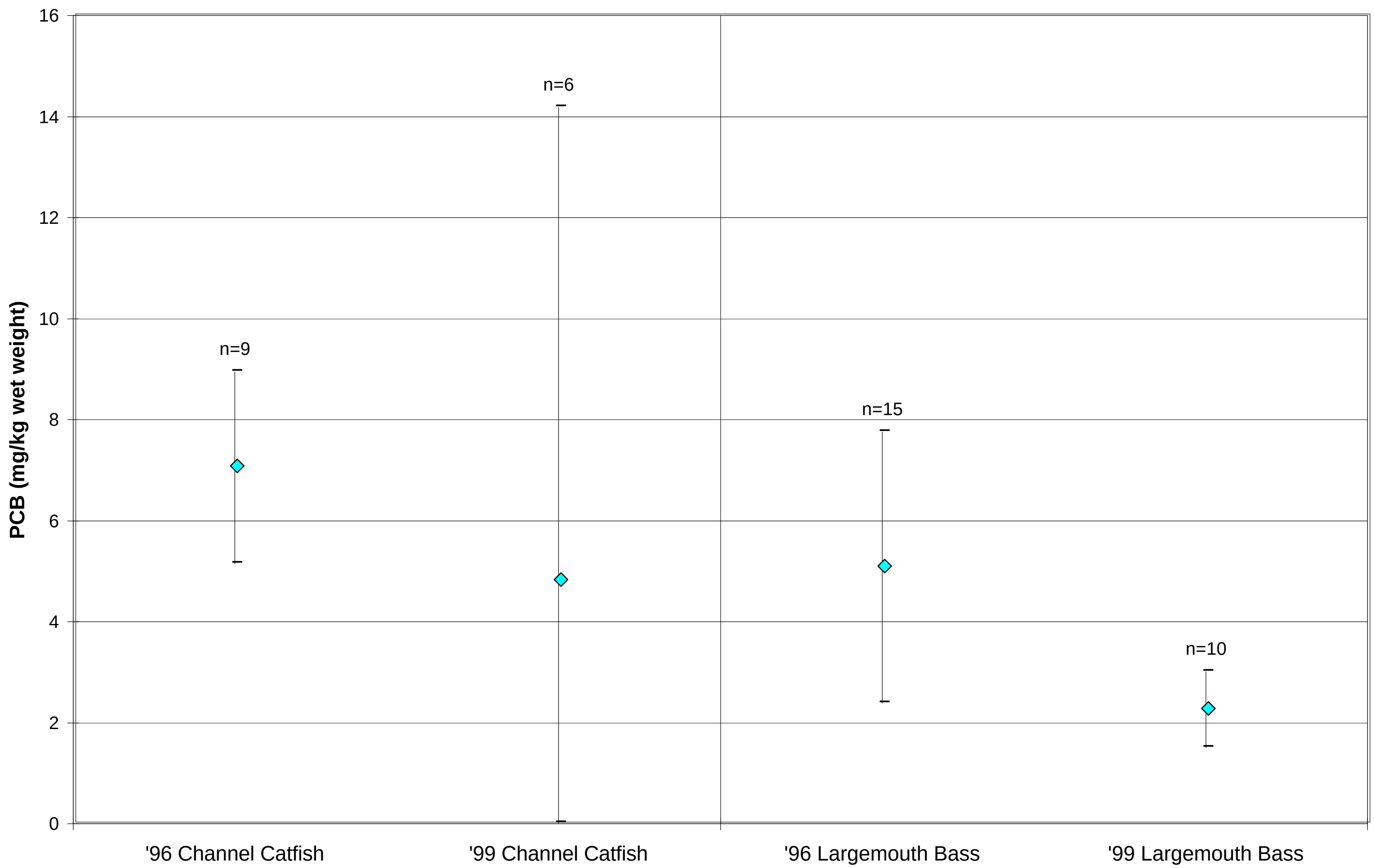
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK (NEW 99) - MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR BASS AND CATFISH

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
5-7



SOLUTIA INC.
ANNISTON, ALABAMA

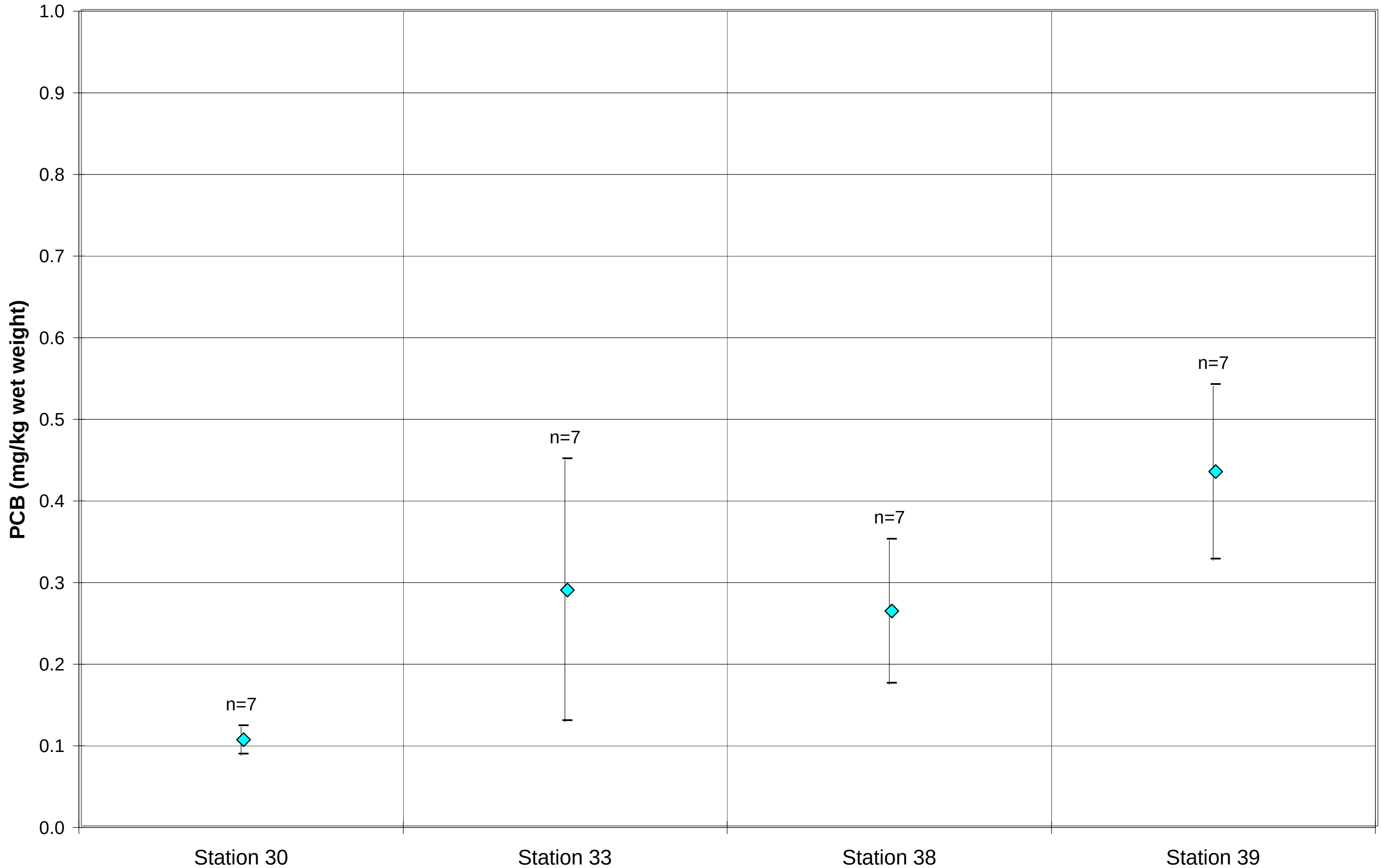
OFF-SITE RFI REPORT

CHOCCOLOCCO CREEK (STATION 35) - MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR BASS AND CATFISH

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-8

ms_fishfigs.xls_st 35_2/28/2003



NOTE:

Sampling Station 30 is located in the lower reaches of Lake Neely Henry

SOLUTIA INC.
ANNISTON, ALABAMA

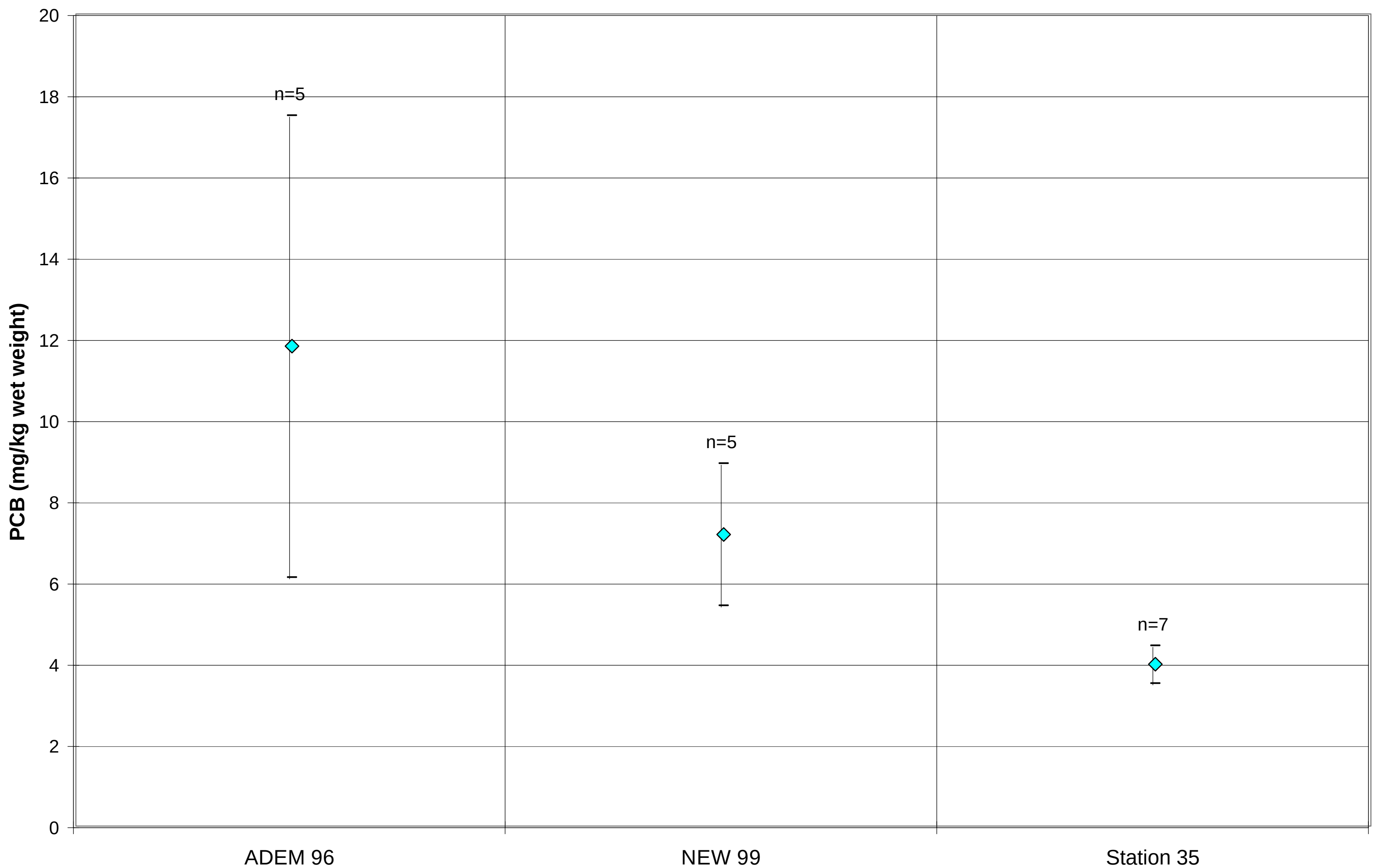
OFF-SITE RFI REPORT

MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR LAKE LOGAN MARTIN AND LAKE NEELY HENRY YOUNG OF YEAR BASS COMPOSITES

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-9

ms_fishfigs.xls_llm yoy_2/28/2003



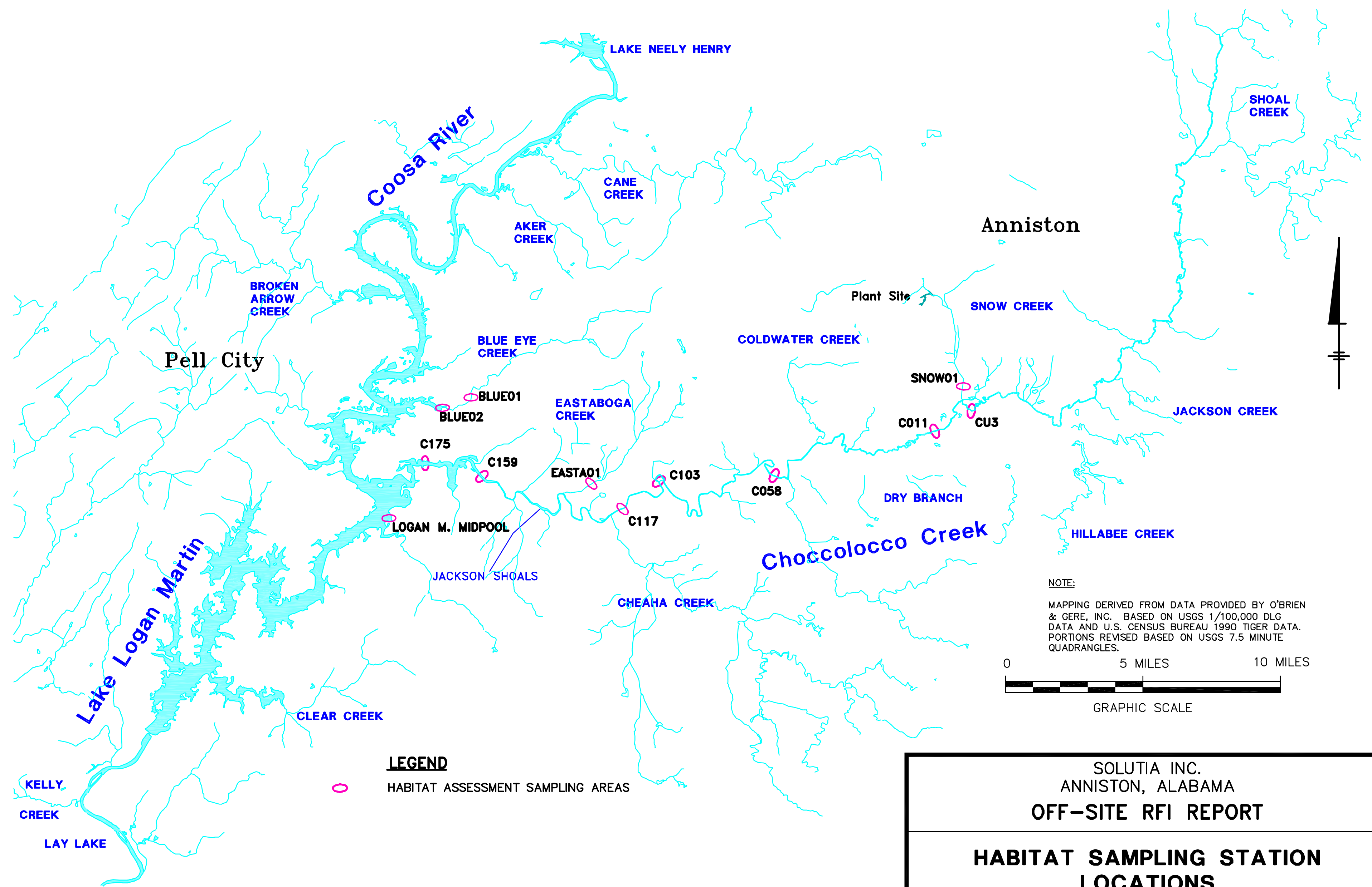
SOLUTIA INC.
ANNISTON, ALABAMA

OFF-SITE RFI REPORT

MEAN PCB CONCENTRATION AND 95% CONFIDENCE INTERVAL FOR CHOCCOLOCCO CREEK YOUNG OF YEAR BASS COMPOSITES

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5-10



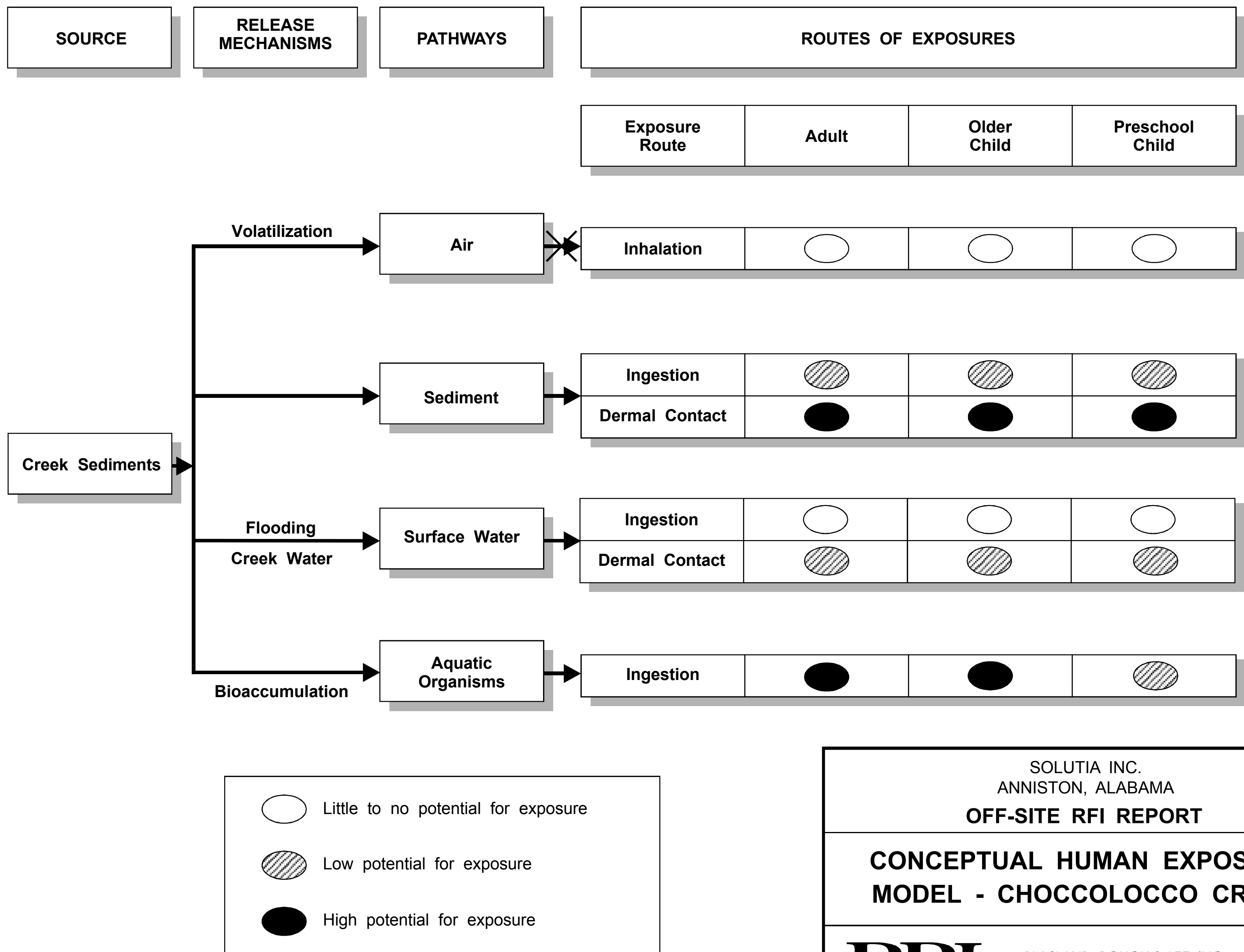
X: 10209X00, 10209X01.DWG
L: ON=*, OFF=*REF*,*A*
P: ALPDF.PCP
6/27/00 SYR-54-KMD NES
10209051/RFI/10209B07.DWG

SOLUTIA INC.
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

HABITAT SAMPLING STATION LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
6-1



SOLUTIA INC.
ANNISTON, ALABAMA

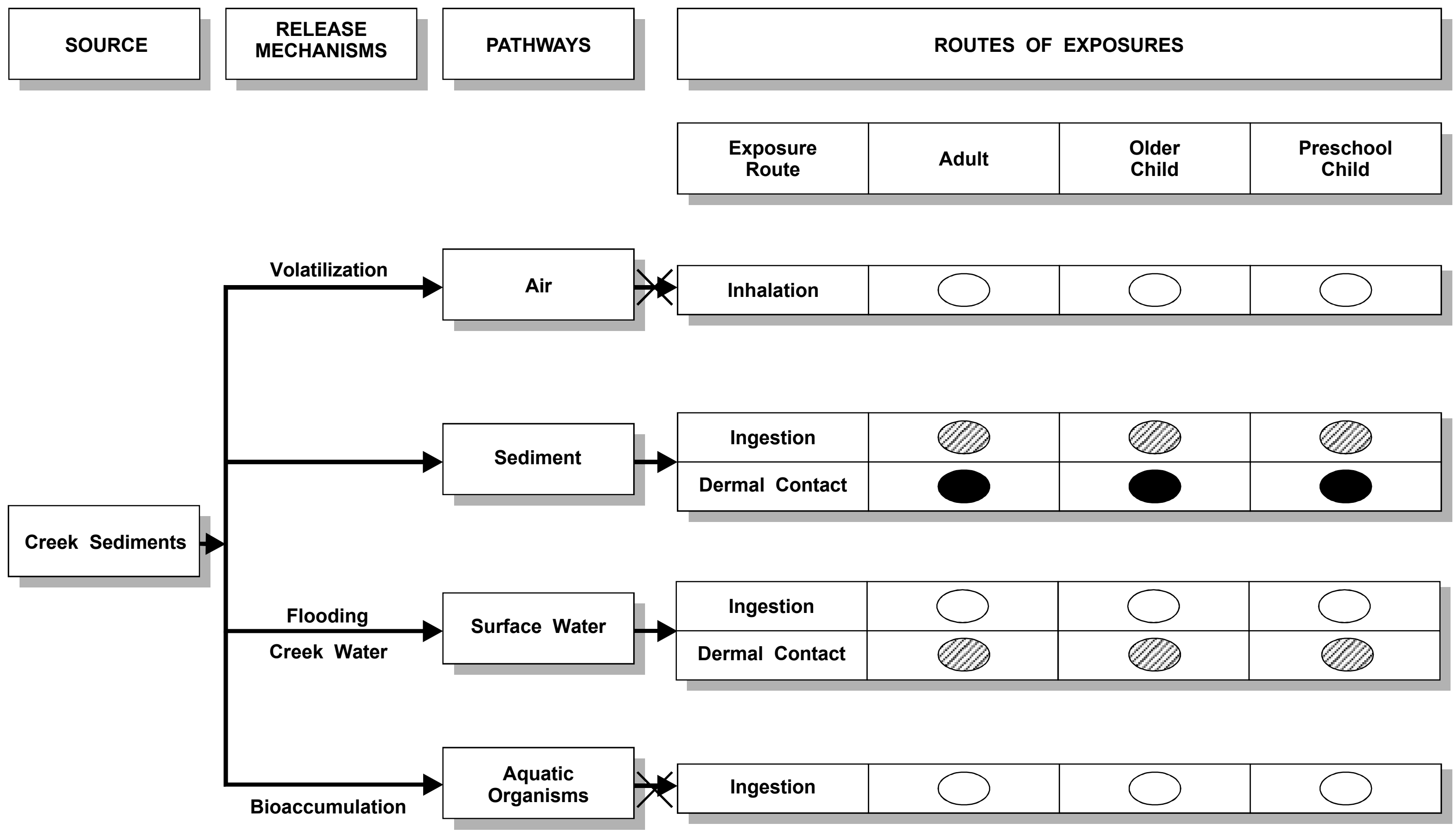
OFF-SITE RFI REPORT

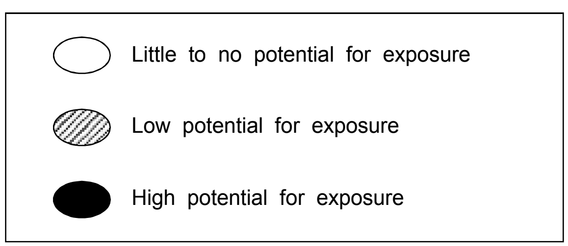
CONCEPTUAL HUMAN EXPOSURE MODEL - CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 7-1

05/00 SYR D54-DJH LAS
10209051/10209g09.CDR





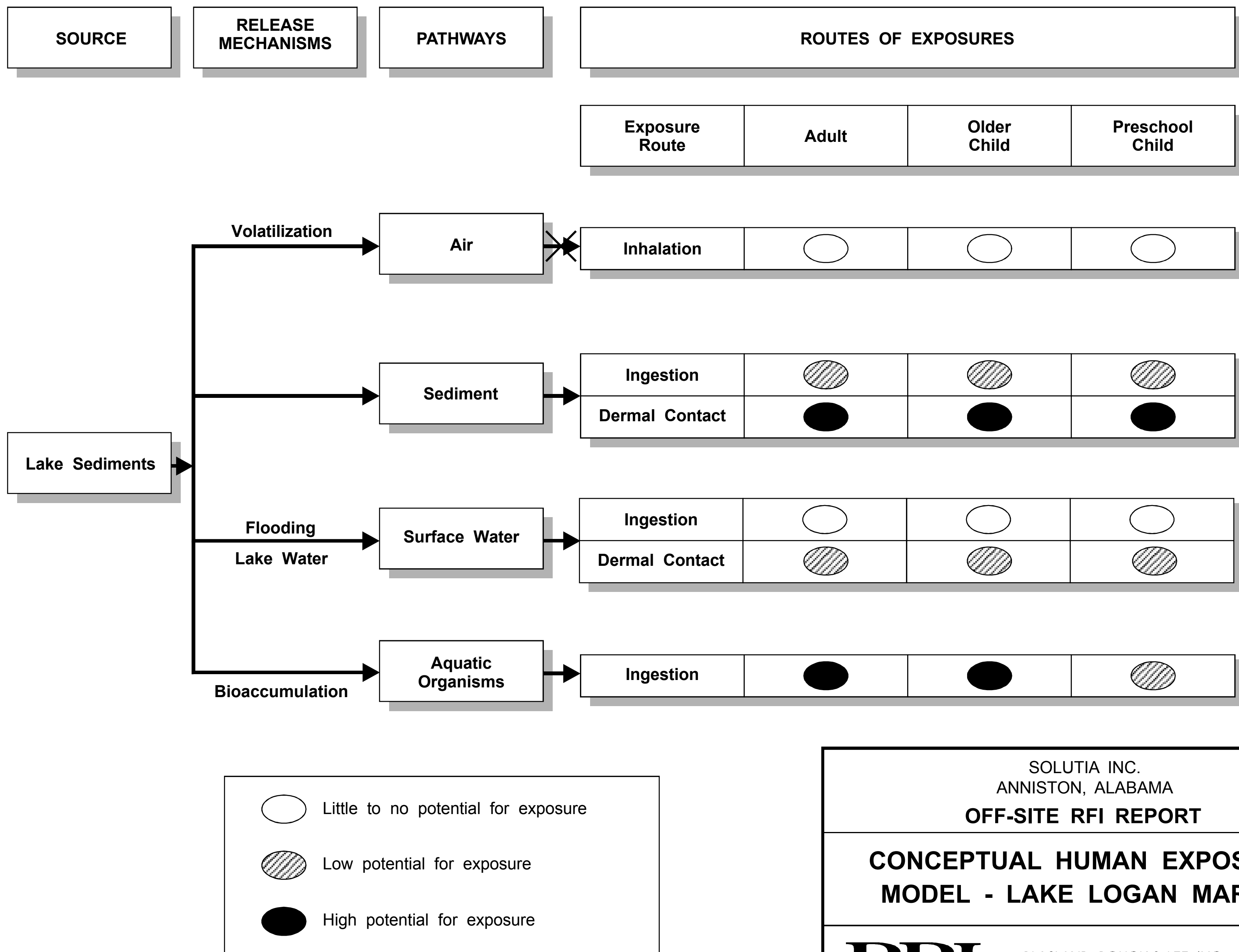
05/00 SYR D54-DJH LAS
10209051/10209g10.CDR

SOLUTIA INC.
ANNISTON, ALABAMA
OFF-SITE RFI REPORT

CONCEPTUAL HUMAN EXPOSURE MODEL - SNOW CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE **7-2**



SOLUTIA INC.
ANNISTON, ALABAMA

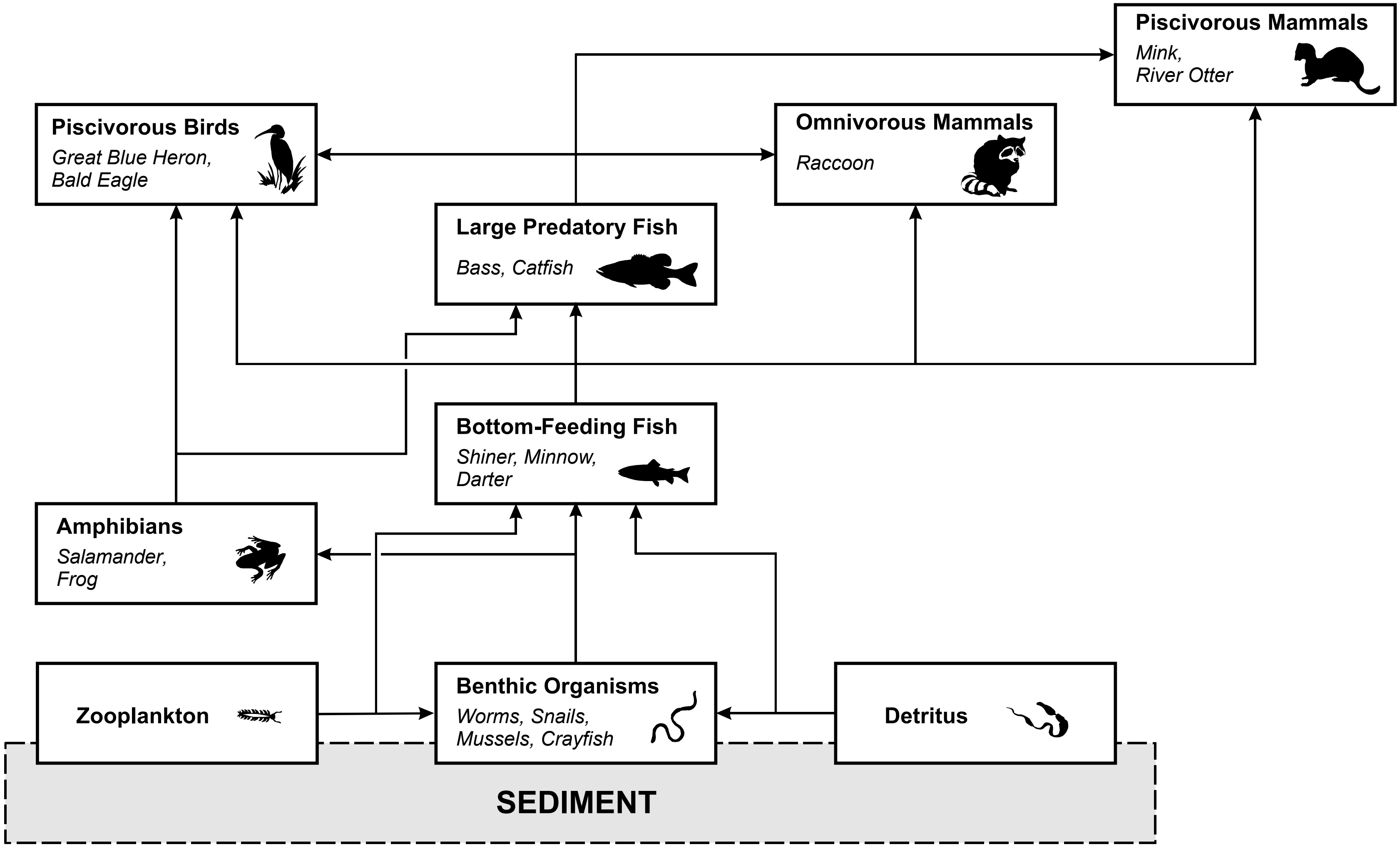
OFF-SITE RFI REPORT

CONCEPTUAL HUMAN EXPOSURE MODEL - LAKE LOGAN MARTIN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 7-3

05/00 SYR D54-DJH LAS
10209051/10209g11.CDR



SOLUTIA INC.
ANNISTON, ALABAMA

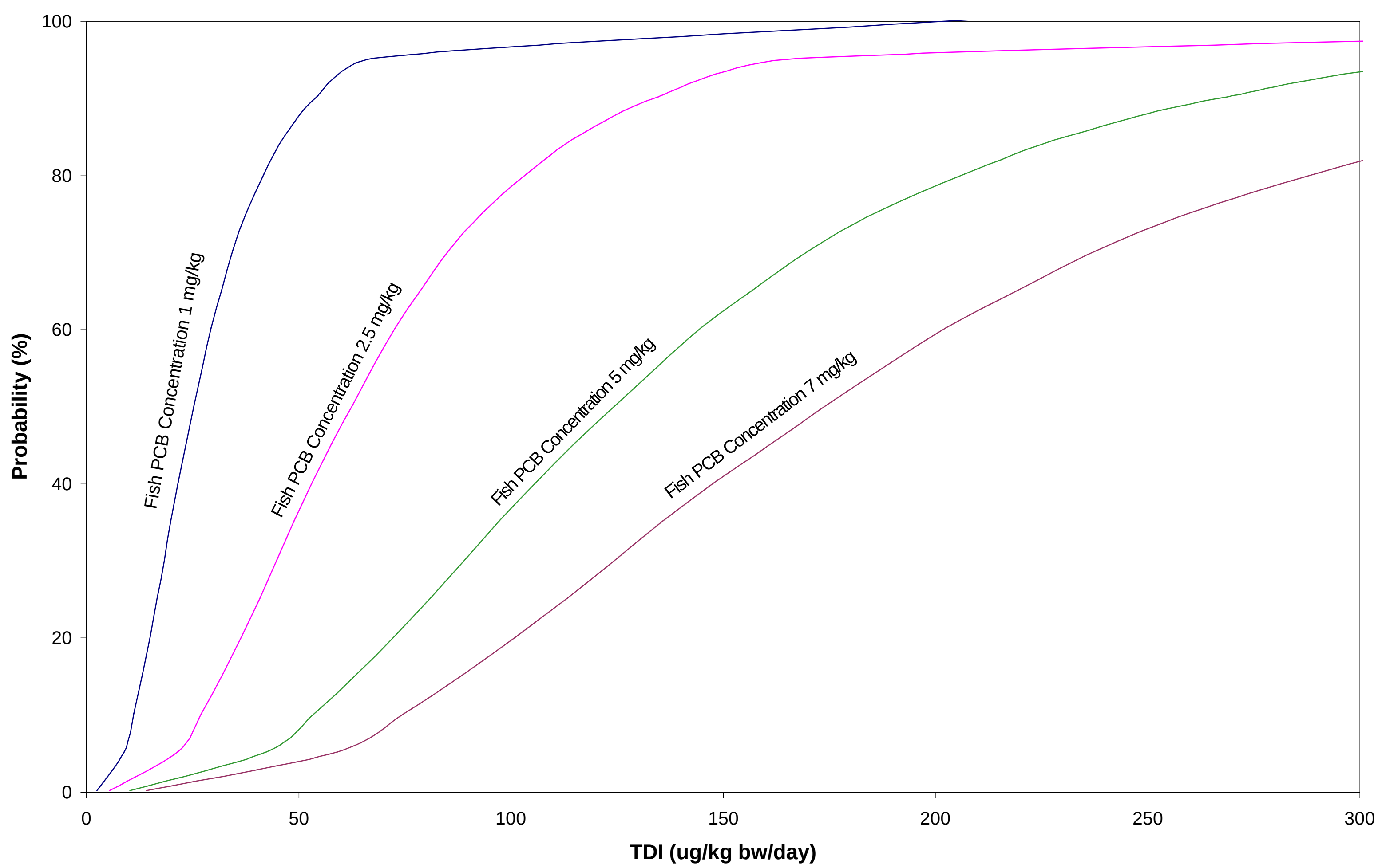
OFF-SITE RFI REPORT

WILDLIFE EXPOSURE MODEL
CHOCCOLOCCO CREEK/SNOW CREEK

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 7-4

05/00 SYR D54-DJH
10209051/10209g14.CDR



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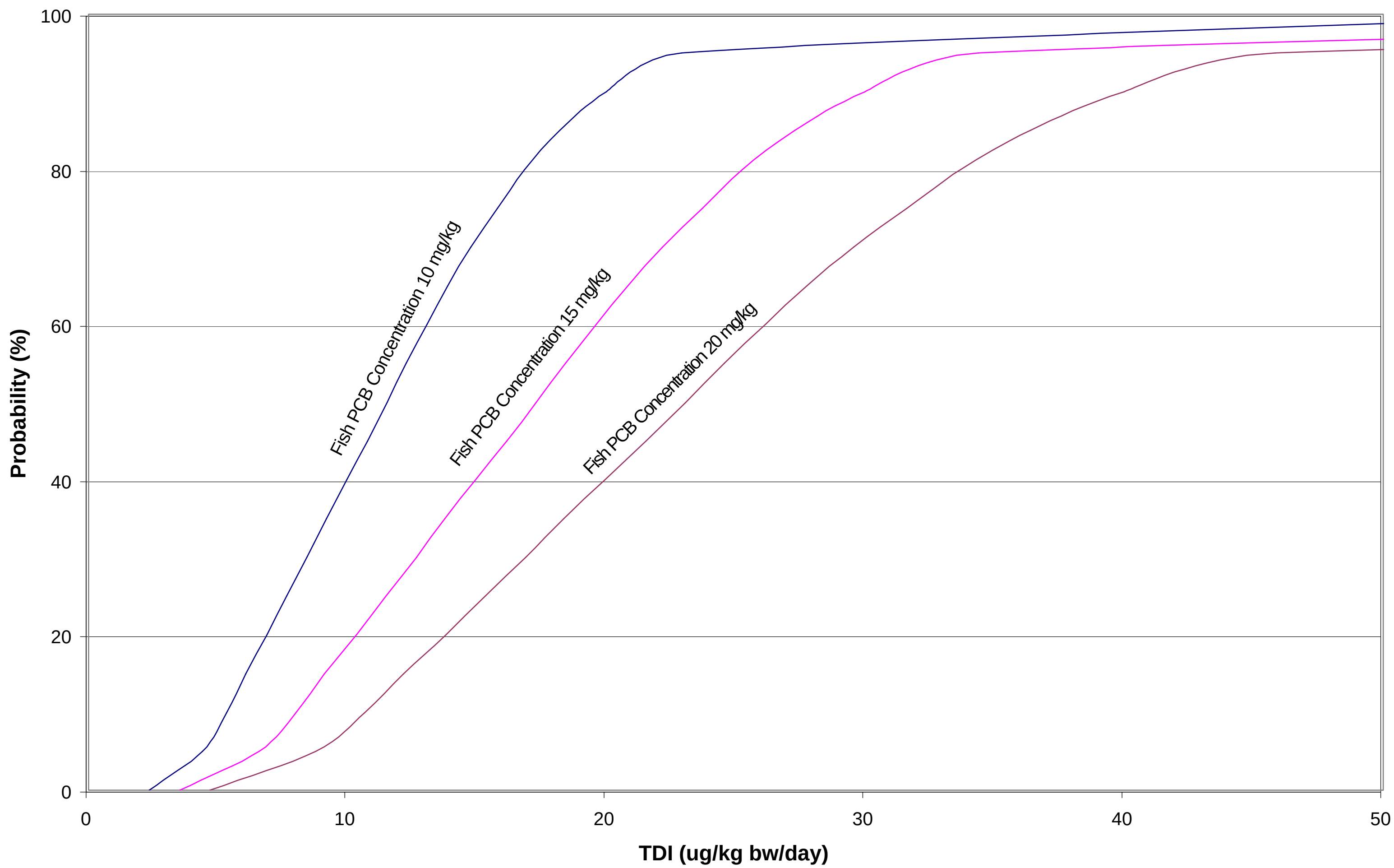
OFF-SITE RFI REPORT

CUMULATIVE DENSITY FUNCTION FOR MINK IN CHOCCOLOCCO CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 7-5



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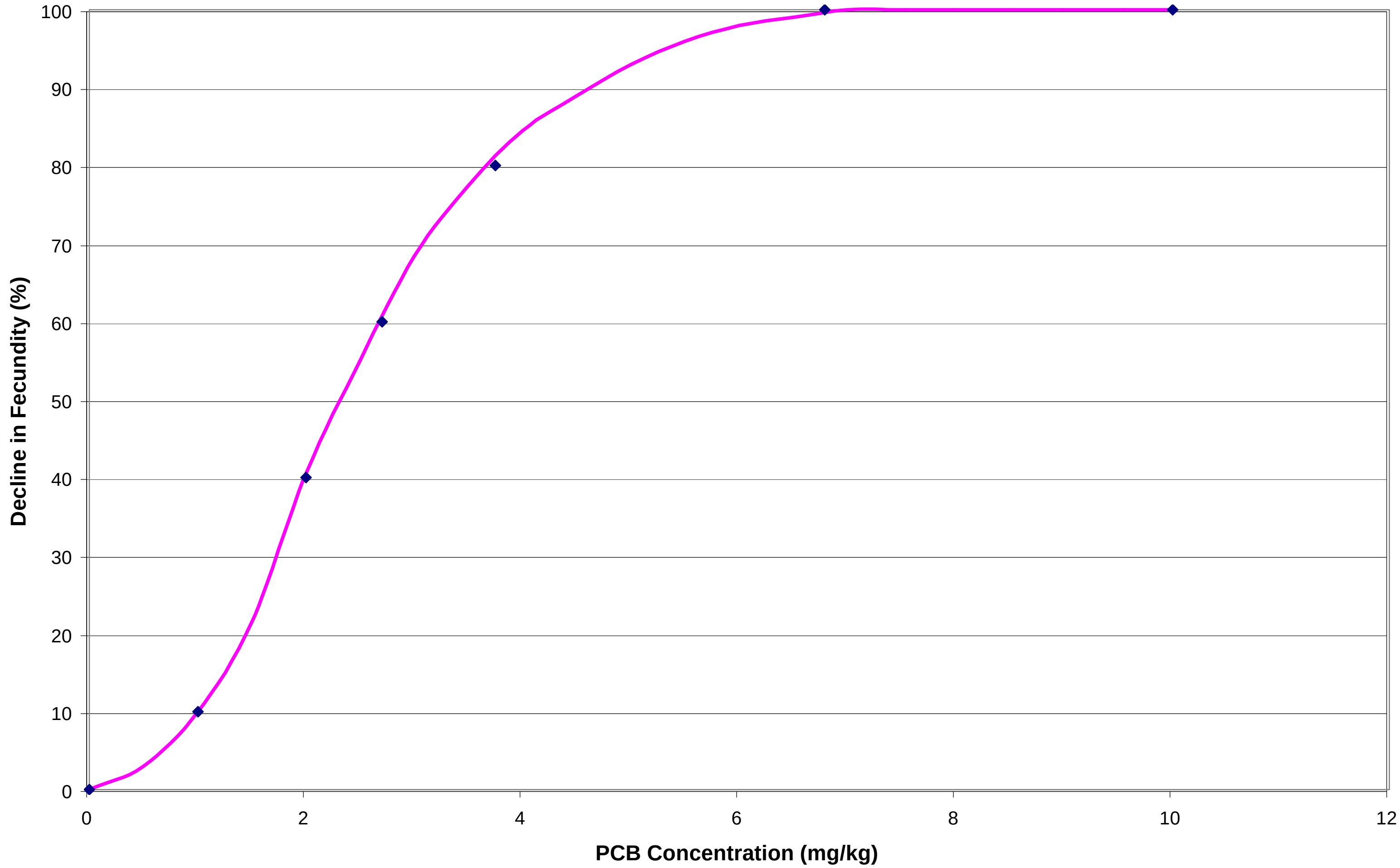
OFF-SITE RFI REPORT

CUMULATIVE DENSITY FUNCTION FOR RACCOON IN SNOW CREEK

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 7-6

ms_JSchell1.xls_fig7-6_2/28/2003



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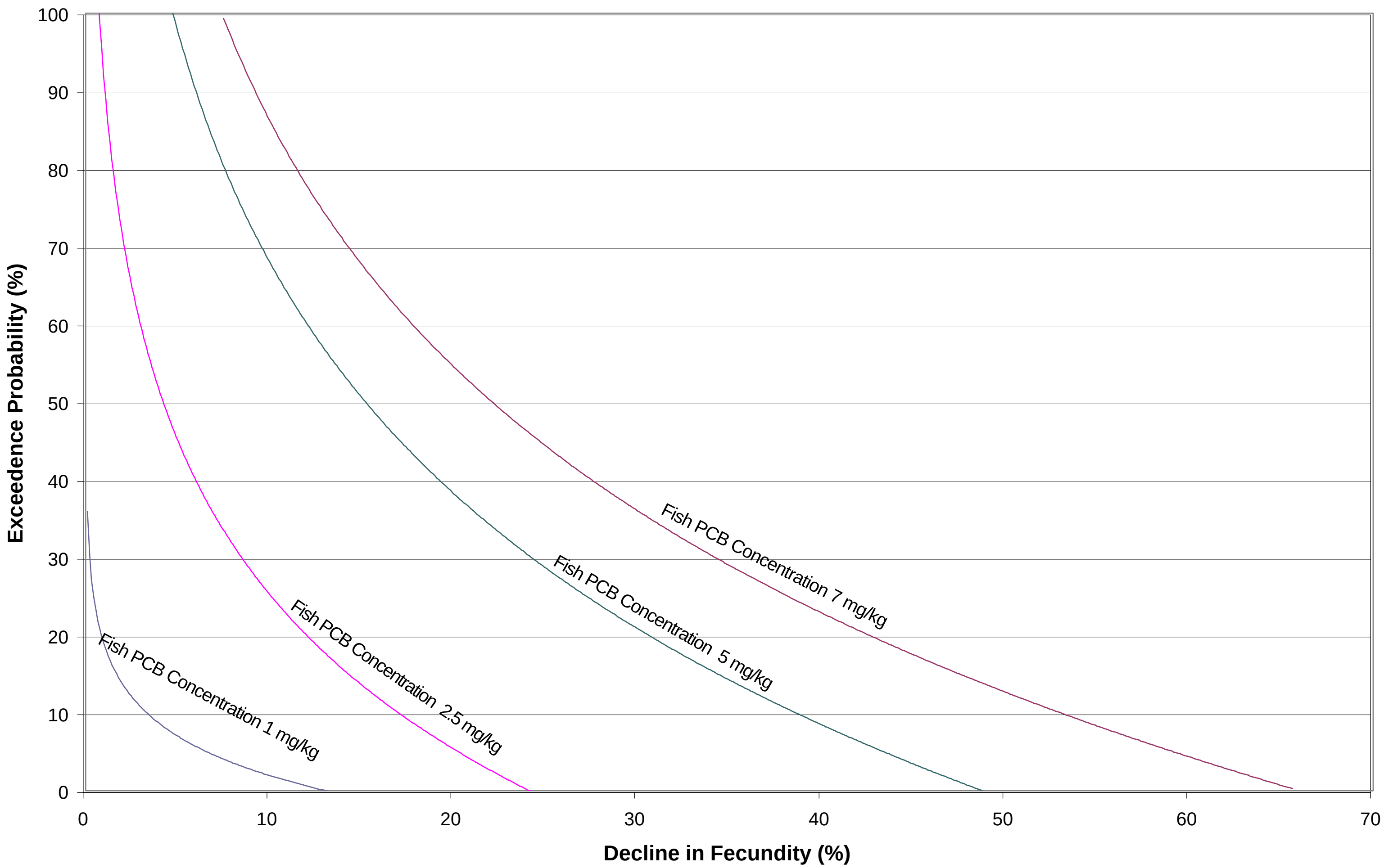
DOSE REPONSE: MINK FECUNDITY

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 7-7



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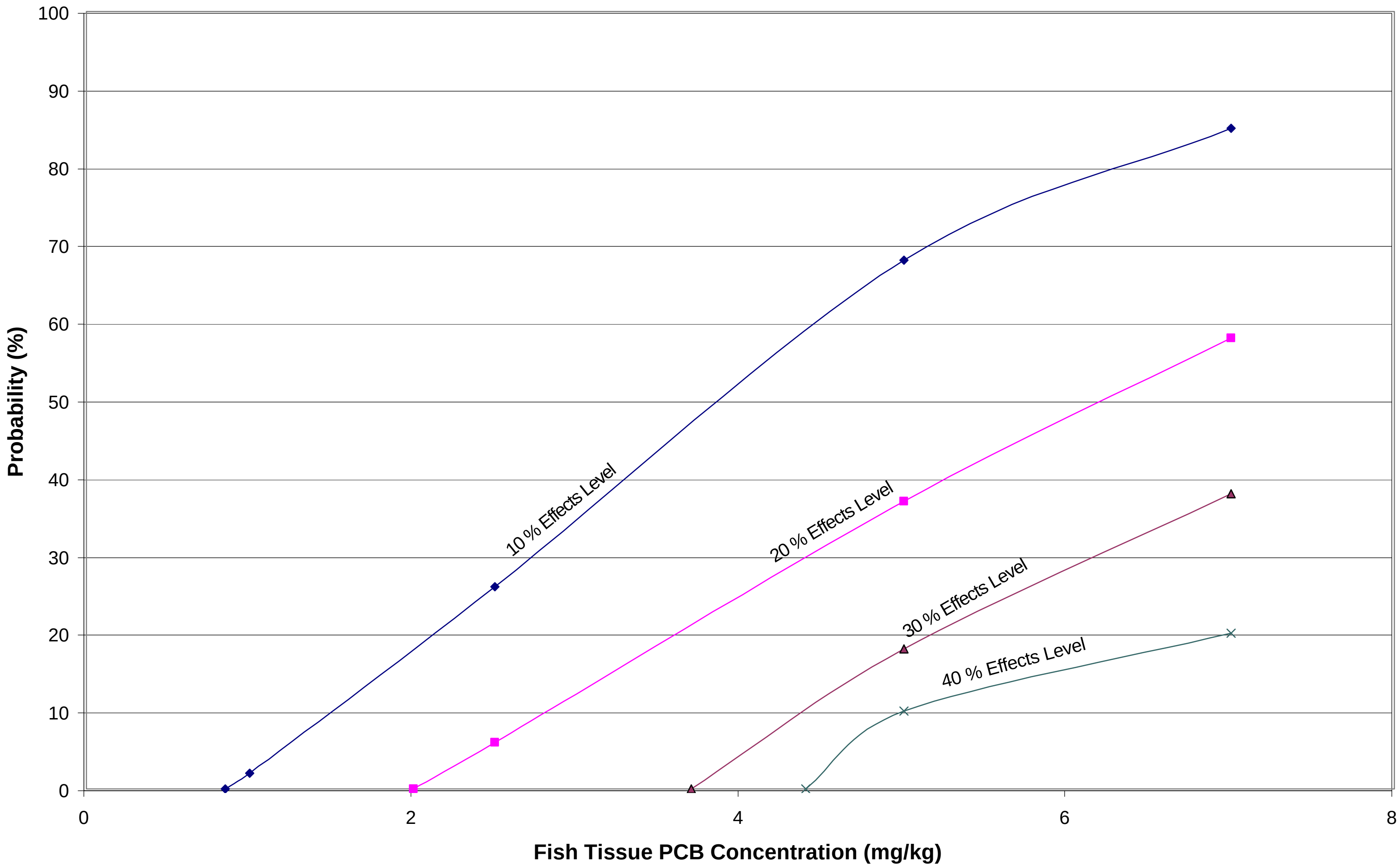
OFF-SITE RFI REPORT

MINK REPRODUCTIVE RISK AS A FUNCTION OF FISH TISSUE PCB CONCENTRATION

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 7-8



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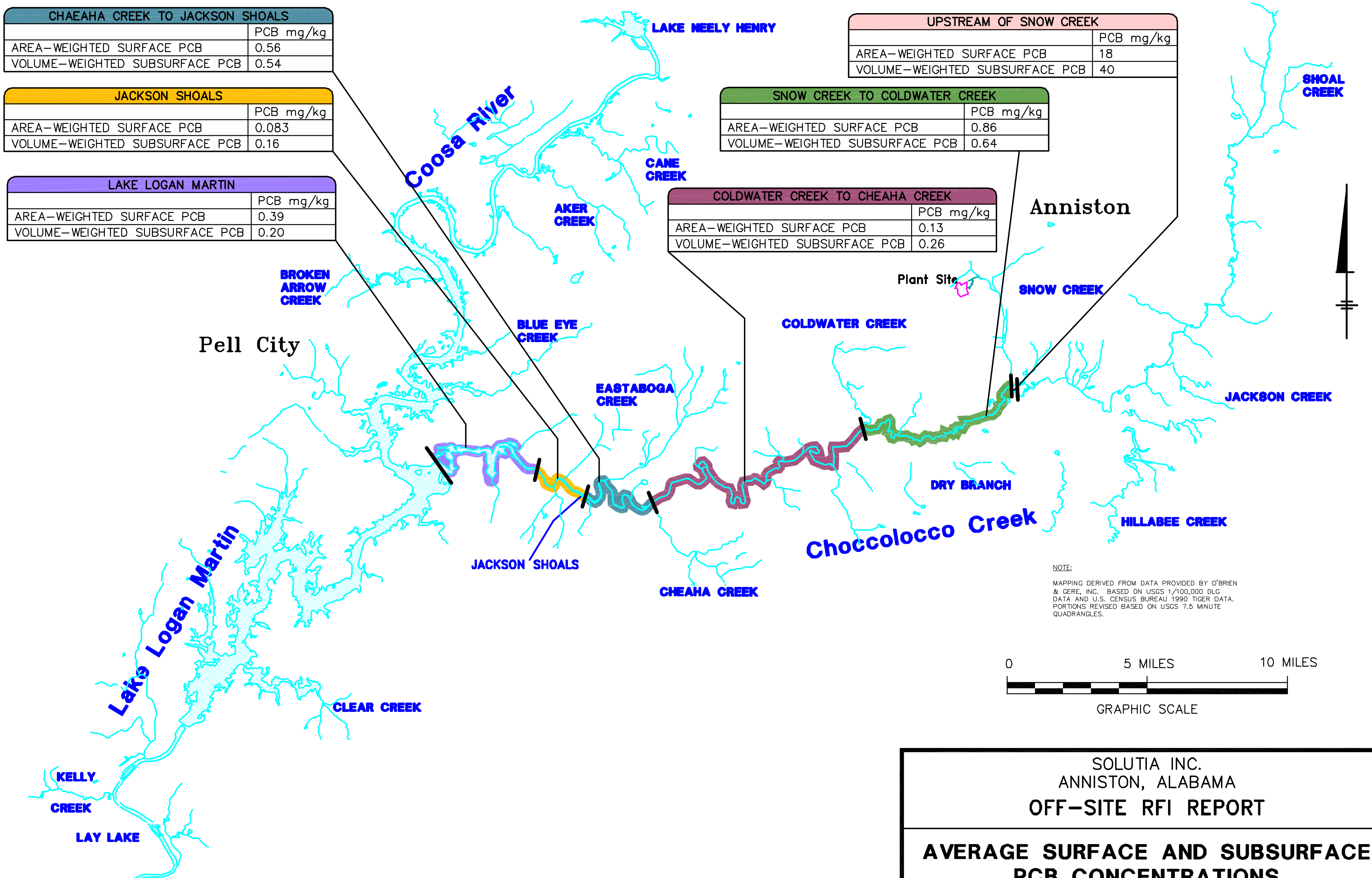
OFF-SITE RFI REPORT

PROBABILITY OF EFFECTS IN MINK AS A FUNCTION OF FISH TISSUE PCB CONCENTRATION

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 7-9



CHAEAHA CREEK TO JACKSON SHOALS	
	PCB mg/kg
AREA–WEIGHTED SURFACE PCB	0.56
VOLUME–WEIGHTED SUBSURFACE PCB	0.54

JACKSON SHOALS	
	PCB mg/kg
AREA–WEIGHTED SURFACE PCB	0.083
VOLUME–WEIGHTED SUBSURFACE PCB	0.16

LAKE LOGAN MARTIN	
	PCB mg/kg
AREA–WEIGHTED SURFACE PCB	0.39
VOLUME–WEIGHTED SUBSURFACE PCB	0.20

UPSTREAM OF SNOW CREEK	
	PCB mg/kg
AREA–WEIGHTED SURFACE PCB	18
VOLUME–WEIGHTED SUBSURFACE PCB	40

SNOW CREEK TO COLDWATER CREEK	
	PCB mg/kg
AREA–WEIGHTED SURFACE PCB	0.86
VOLUME–WEIGHTED SUBSURFACE PCB	0.64

COLDWATER CREEK TO CHEAHA CREEK	
	PCB mg/kg
AREA–WEIGHTED SURFACE PCB	0.13
VOLUME–WEIGHTED SUBSURFACE PCB	0.26

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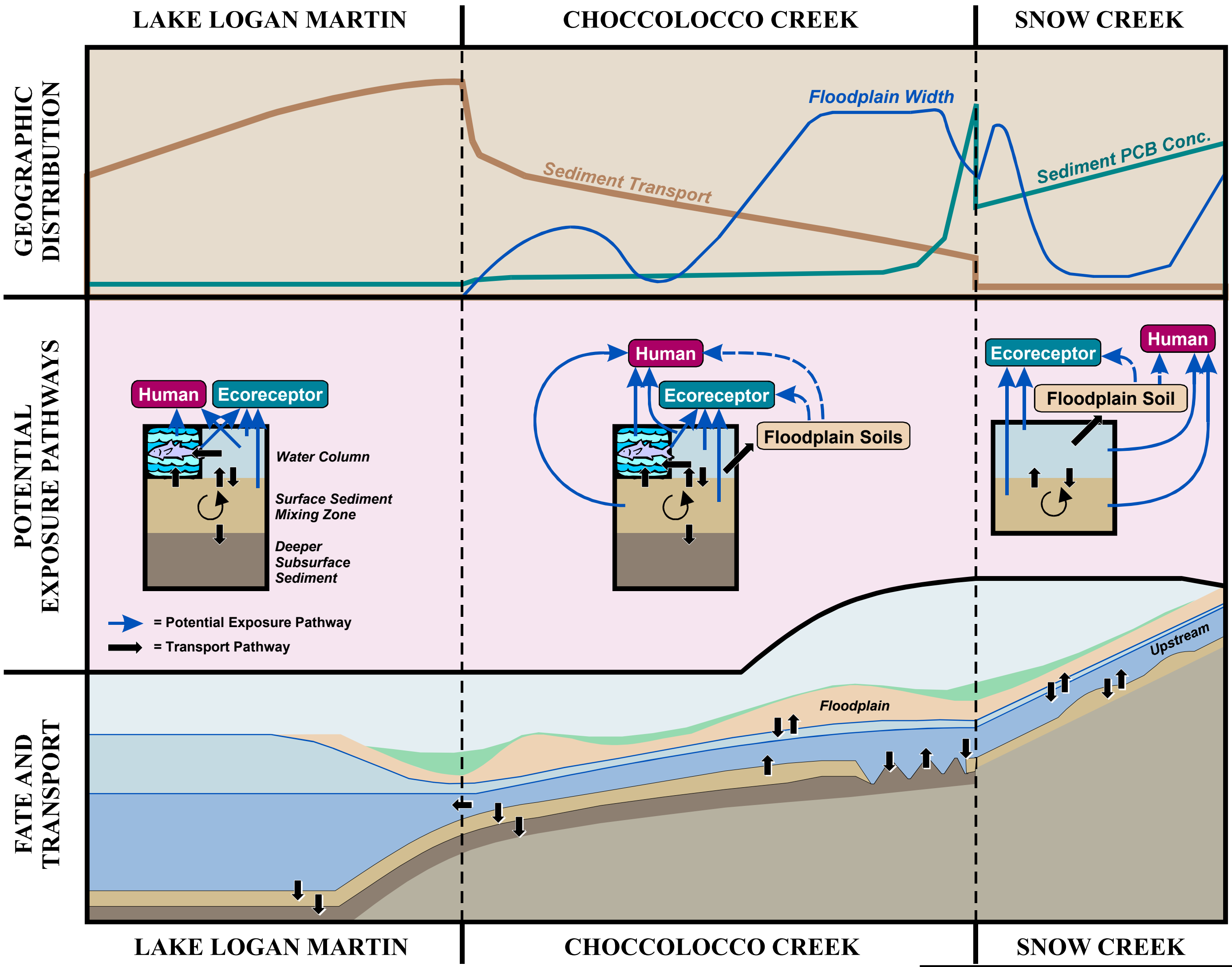
OFF–SITE RFI REPORT

AVERAGE SURFACE AND SUBSURFACE PCB CONCENTRATIONS

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **7-10**

X: 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: ALPDF.PCP
6/29/00 SYR-54-GMS NES
10209051/10209C04.DWG



06/00 SYR D54-DJH LAS LBR
10209051/10209g16.CDR

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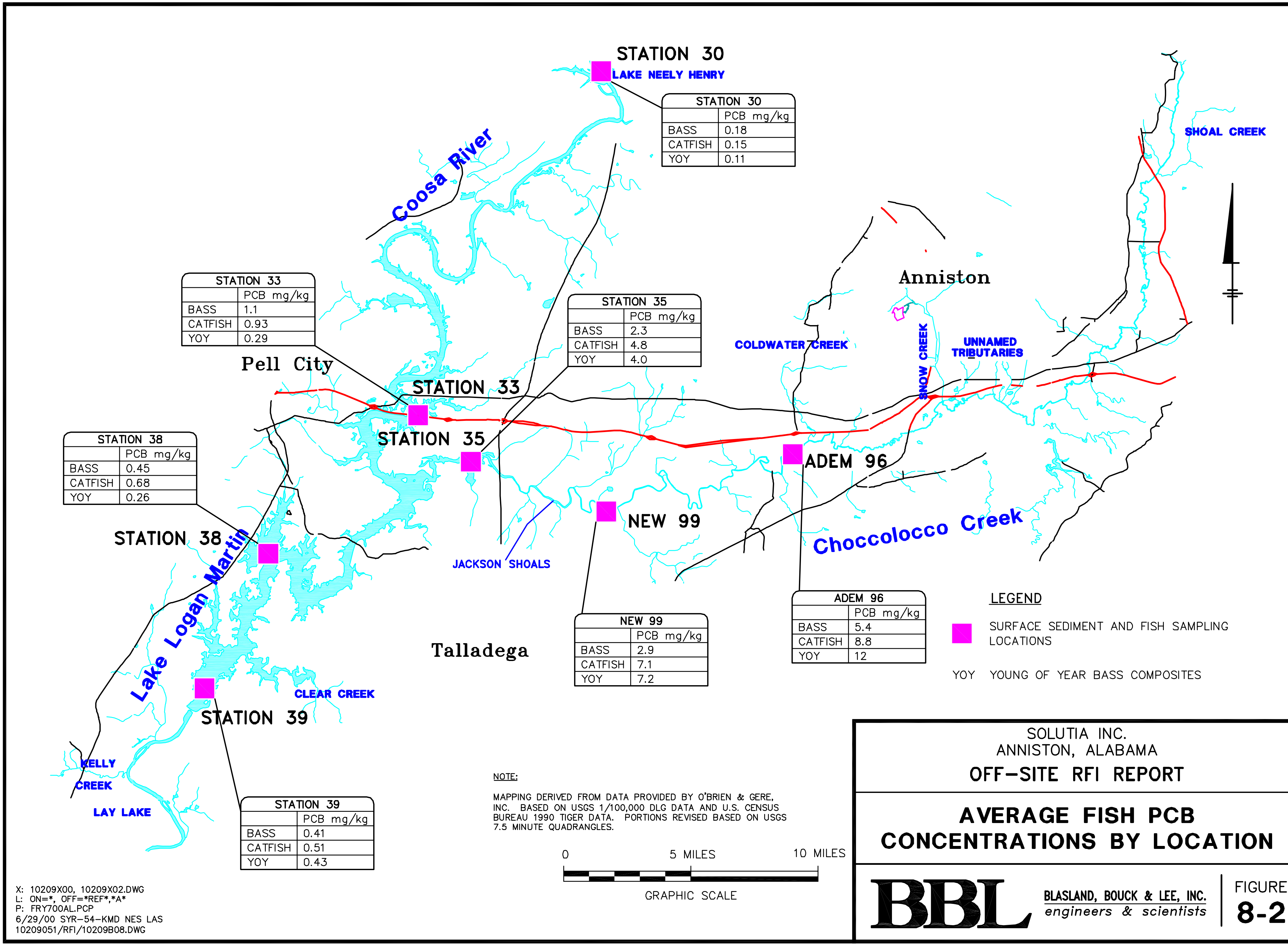
OFF-SITE RFI REPORT

UPDATED OFF-SITE CONCEPTUAL MODEL

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
8-1



STATION 30	PCB mg/kg
BASS	0.18
CATFISH	0.15
YOY	0.11

STATION 33	PCB mg/kg
BASS	1.1
CATFISH	0.93
YOY	0.29

STATION 35	PCB mg/kg
BASS	2.3
CATFISH	4.8
YOY	4.0

STATION 38	PCB mg/kg
BASS	0.45
CATFISH	0.68
YOY	0.26

NEW 99	PCB mg/kg
BASS	2.9
CATFISH	7.1
YOY	7.2

ADEM 96	PCB mg/kg
BASS	5.4
CATFISH	8.8
YOY	12

STATION 39	PCB mg/kg
BASS	0.41
CATFISH	0.51
YOY	0.43

LEGEND

SURFACE SEDIMENT AND FISH SAMPLING LOCATIONS

YOY YOUNG OF YEAR BASS COMPOSITES

NOTE:

MAPPING DERIVED FROM DATA PROVIDED BY O'BRIEN & GERE, INC. BASED ON USGS 1/100,000 DLG DATA AND U.S. CENSUS BUREAU 1990 TIGER DATA. PORTIONS REVISED BASED ON USGS 7.5 MINUTE QUADRANGLES.

X: 10209X00, 10209X02.DWG
L: ON=*, OFF=*REF*,*A*
P: FRY700AL.PCP
6/29/00 SYR-54-KMD NES LAS
10209051/RFI/10209B08.DWG

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OFF-SITE RFI REPORT

AVERAGE FISH PCB CONCENTRATIONS BY LOCATION

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 8-2

Appendices

Volume 1 of 4

A Photographs of the individual sediment cores and the creek banks at each transect.

Volume 2 of 4

A Photographs of the individual sediment cores and the creek banks at each transect.

Volume 3 of 4

B Physical data collected at each of the Choccolocco Creek sampling transects.
C Grain-size distribution analysis for the sediment samples.
D Surface water modeling results are found.

Volume 4 of 4

E Photographs of the individual fish collected during the fish investigation.
F Habitat assessment scoring sheets for each of the sampling stations.
G Development of Biota Sediment Accumulation Factors.

Volume 2 of 4 - Appendix A, Part 2

Please refer to CD #2

Volume 3 of 4 - Appendices B, C, D

Volume 4 of 4 - Appendices E, F, G

Please refer to CD #3