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Revised Biological Investigation Work Plan

Lake Chautauqua
Crystal Springs, Mississippi

15 April 2010

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Revised Biological Investigation Work Plan

Lake Chautauqua
Crystal Springs, Mississippi

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1. Introduction

The objective of this revised work plan for the collection/analysis of surface water, sediment, soil, and biota from Lake Chautauqua in Crystal Springs, Mississippi (Figures 1 and 2), is to evaluate ecological and human health risks and to verify data from previous biological investigations conducted by the Mississippi Department of Environmental Quality (MDEQ) and Martin & Slagle. These activities are designed to evaluate the hypothetical risks to humans that may consume aquatic organisms caught in the lake and to assess ecological risks to fish and other ecological receptors exposed to surface water and sediments potentially impacted with polychlorinated biphenyls (PCBs).

The data resulting from this investigation will be used in a Screening Level Ecological Risk Assessment (SLERA) consistent with U.S. Environmental Protection Agency (USEPA; 1997) and MDEQ (2002) guidance. Depending on the results of this assessment, additional investigation may be needed.

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2. Site Background

2.1 Site Location and History

Lake Chautauqua is located in Copiah County, within the city limits of Crystal Springs, Mississippi (Latitude 31°59'53.095" N, Longitude 90°21'54.855" W). The lake is approximately 32 acres in size and is generally bounded by U.S. Highway 51 to the east, Interstate 55 to the west, Chautauqua Drive and private property owners to the north, and Morgan Lane and private property owners to the south (Figure 1).

Previous investigations have evaluated the occurrence and distribution of PCBs in Crystal Springs, Mississippi. A drainage area that carries storm water from the Kuhlman Electric Corporation plant flows northwest to Lake Chautauqua. MDEQ has required remediation at locations within this drainage area.

Figure 3 shows the elevation contours in the vicinity of Lake Chautauqua. Figure 4 depicts the location and extent of terrestrial, wetland, and aquatic habitats within the Site environs. The primary aquatic habitat of Lake Chautauqua is classified by the National Wetlands Inventory as palustrine open water semi-permanently flooded diked/impounded (POWFh). A bathymetric survey of Lake Chautauqua is provided in Appendix A.

2.2 Summary of Previous Investigations

Previous investigations have included sampling and analyses of surface water, sediments, and fishes.

2.2.1 Surface Water/Sediment Sampling

Previous investigations have indicated that surface water is not a medium of concern. However, surface water will be evaluated during this investigation to verify previous data. The available sediment analytical data from Lake Chautauqua were reviewed for the purpose of selecting the constituents of potential concern (COPCs) for the biota sampling plan. Analytical results from 25 sediment analyses indicated Aroclor 1260 concentrations ranged from 0.22 milligram per kilogram (mg/kg) to 1.6 mg/kg (Appendix B). PCBs have been identified for the assessment of hypothetical risks to human and ecological receptor consumers of fish from Lake Chautauqua because they were consistently detected in sediment samples and have the potential to bioaccumulate through the food web.

2.2.2 Biological Sampling

In 2000, MDEQ collected eight largemouth bass (*Micropterus salmoides*) and one bluegill (*Lepomis macrochirus*) from Lake Chautauqua. Analytical results from tissue analysis of fishes indicated Aroclor 1260 concentrations ranged from not detected to 0.420 mg/kg. Based on these fish samples, a precautionary fish advisory for Lake Chautauqua was issued by MDEQ on June 16, 2000. Subsequently, in June 2001, MDEQ resampled the fishes in Lake Chautauqua and determined that eating fish from the lake did not pose a significant health risk (Appendix C). Although MDEQ lifted the precautionary advisory, signs placed at the lake by the city in 2000 that state "Sports Fishing Only, Not for Consumption" remain.

2.2.3 Preliminary Conceptual Site Model

Figure 5 depicts the preliminary conceptual site model. Historical releases to the drainage area and resulting storm water flow are shown as the primary source and transport mechanism for PCBs to enter Lake Chautauqua. As depicted on Figure 3, the topography surrounding the drainage area and Lake Chautauqua is elevated, which likely resulted in the preferential flow and transport of PCBs via depressional areas (e.g., drainage area). Therefore, the aquatic environment is the primary exposure route for biota associated with the lake and is the focus of this biological investigation. Water column organisms (such as fishes, phytoplankton, and zooplankton) and benthic macroinvertebrates may be exposed to COPCs through direct contact with sediment, direct or ancillary ingestion of sediment, or indirectly through ingestion of prey. Constituents buried in sediments can potentially be released to the water column during resuspension and redistribution of sediments. The primary exposure pathway for aquatic biota is expected to be respiratory uptake of constituents from sediment, although they may be exposed to impacted sediment through absorption and/or consumption of prey. Plants may be exposed to COPCs directly through uptake of constituents from their growth medium (sediment and/or surface water). Aquatic biota, in turn, may be consumed by birds and mammals. Semi-aquatic biota may also be exposed to constituents through ingestion of dietary items such as vegetative matter and aquatic organisms and/or ingestion of sediment.

3. Biological Investigation Work Plan

The overall objective of this investigation is to evaluate the hypothetical risks to humans that may consume aquatic organisms caught from the lake and to assess ecological risks to fishes and other ecological receptors exposed to surface water, sediments, and prey items impacted with PCBs. The data resulting from this investigation will be used in a SLERA of the benthic invertebrates, fishes, birds, and mammals that may use Lake Chautaqua. The objectives of this biological investigation work plan will be accomplished by the following three tasks:

- Collection and analysis of fish tissue samples;
- Collection and analysis of surface water and sediment samples; and
- Field assessment of habitat quality and relative value of wetland habitats.

3.1 Constituents of Potential Concern

The sediment and fish analytical data from the Site were evaluated for the purpose of selecting COPCs for biota sampling (Section 2.2).

COPCs for the lake surface water, sediment, and biota sampling are:

- PCBs

3.2 Habitat Characterization and Biological Survey

A habitat characterization and biological survey will be conducted concurrently with the biota and sediment sampling events to document and characterize the location and extent of available terrestrial, wetland, and aquatic habitats within the immediate vicinity of Lake Chautauqua. A pedestrian and boat survey of the Site and surrounding areas will be conducted to evaluate ecological characteristics of the Site. An observational survey of ecological receptors that use the lake will also be conducted.

The objectives of the survey will be to gather qualitative and semi-quantitative information on the ecological communities present or potentially occurring at the Site, describe the pathways by which biological receptors could potentially be exposed to media containing Site-related constituents, and document readily apparent evidence of stress on ecological receptors at the Site. The results of this survey will be documented in the Checklist for Ecological Assessment/Sampling (USEPA 1997) and the Ecological Checklist (MDEQ 2002) included as Appendix D. The objectives of this task are to:

- Document, quantify, and characterize the location and extent of available terrestrial, wetland, and aquatic habitats within the Site; and
- Conduct an observational survey of ecological receptors that utilize the Site.

Prior to conducting the surveys, a literature review will be conducted to gather information on the habitats and biological communities that occur within the vicinity of the Site. The result of this survey will be used to help refine target species in biological sampling and identify potential receptors for the ecological risk assessment.

3.3 Fish Tissue Sampling

The biological tissue sampling program will evaluate the concentrations of PCBs present in selected tissues and whole body of target aquatic organisms collected from the Site. This biological tissue sampling program is designed to provide data for the human health and ecological risk assessment to evaluate the hypothetical risks to human and ecological receptors that may consume aquatic organisms which have potentially accumulated chemicals from sediment. Tissue data will provide a direct measure of exposure of aquatic organisms and humans to COPCs from the sediment and biota in the Site.

3.3.1 Tissue Sampling for Human Health Risk Assessment

3.3.1.1 Sampling Locations

Although termed sample locations, fishes will be collected from an area within a designated sampling zone due to their biological characteristics (e.g., mobility) and practicality of sampling. Sample locations were selected based upon available sediment analytical data for the Site to evaluate the potential for bioaccumulation in biota at the lake and to compare with the baseline conditions (i.e., reference locations). Three sampling locations are proposed to collect fishes in the lake (Figure 6). Sample locations were selected based on previous sediment and fish tissue analytical data and the biological characteristics of selected target species. The same fish species will also be targeted for collection and analysis from a reference lake. Samples from a lake at some distance from Crystal Springs will provide an indication of unaffected or background conditions in similar sediment and biota.

Lake Copiah (Figure 2) is being considered as a reference location. The final selection of the reference location will be dependent upon access from landowners and field observations. The same target species selected for Lake Chautauqua will be collected from Lake Copiah.

The coordinates of the boundaries of each biota sampling zone will be determined using a Global Positioning System (GPS) device and will be recorded in a field notebook.

3.3.1.2 Target Species

Three fish species will be collected for tissue analysis due to their abundance in the Site and representation of different trophic levels, as well as their recreational and socioeconomic importance as edible species for humans:

- Largemouth bass (*Micropterus salmoides*);
- Bluegill (*Lepomis macrochirus*) or other Centrarchid sunfish; and
- Catfish (*Ictalurus* spp.).

If bluegills are not available in sufficient abundance, crappie (*Pomoxis* spp.) will be considered as an alternative species.

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The species selected in this study are consistent with USEPA recommended target species for Inland Fresh Waters (USEPA 2000; Appendix E). Preference will be given to catfish samples because they are often bottom feeders and more likely to have extended contact with sediment. At each designated sampling zone, two samples of each target species will be collected. If a target species is not present at a particular sampling location, an alternative species that is present in sufficient abundance will be collected. For example, if bluegill are not available in sufficient abundance, crappie (*Pomoxis* spp.) or other Centrarchid species will be considered as an alternative species due to similarity in trophic level and recreational importance. The edible portion of fish samples will be analyzed. Fish fillets will be obtained and analyzed individually.

Electric shocking, catfish traps/hoop nets, or trammel nets set overnight will be used for fish collection. Additional methods may include hook and line, trot line, and jug line. The necessary scientific collecting permit(s) will be obtained from the State of Mississippi for collecting aquatic organisms from the lake. If one or more of the collecting procedures described in this plan are prohibited by the scientific collecting permit(s), then the plan may be modified.

The fish will be retrieved from the water utilizing a dip net and then placed in a pre-cleaned galvanized metal washtub containing wet ice for field processing. The washtub will be pre-cleaned using standard field equipment decontamination procedures including Liquinox™ detergent wash and deionized water rinse (no solvents will be used). Species name, weight, sex (if discernible), total length, and visual observations of the condition of the organism will be recorded on Fish Collection Field Data Sheets. Specimens retained for analysis will be photographed. The fishes will be rinsed with deionized water to remove sediment and debris.

Representative samples of each of the species of fish will be prepared for Lake Chautauqua and the reference lake. If individual fish provide sufficient tissue mass, they will be analyzed as discrete samples. For small forage fish species, composite samples will be analyzed.

All fish representing an individual species will be wrapped in aluminum foil and placed into a zip lock plastic bag. A label indicating collection location, date and time of collection, and collector's initials will be applied to the exterior of the plastic bag. This bag will then be placed into another plastic bag. A custody seal will be placed across the bag opening of all samples and signed by the sample processor. The samples will then be placed on ice in a cooler for transfer to the analytical laboratory for analysis. Fish fillets will be processed in the laboratory. Laboratory personnel will remove the

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fillet samples from the fish to generate representative samples of tissue material that would potentially be ingested should similar fish be caught for human consumption. Stainless steel equipment will be employed at the laboratory to minimize the potential for introduction of external contaminants. Standard laboratory practices will be used in preparation of all samples. Tissues will be aliquoted directly from the fish fillet into sample containers. The fillets of a particular species at a single sample location or, in the case of forage fish, the whole fish sample will later be placed into a blender. The tissue will be thoroughly blended and then aliquoted into glass sample containers. Analyses of the samples will be conducted in accordance with standard analytical procedures. Excess tissue will be frozen and retained for use in the event additional tissue is needed.

Field quality assurance/quality control (QA/QC) samples will include matrix spikes and matrix spike duplicates and field duplicates These QA/QC samples will be collected at a frequency of 1 per 20 field samples.

3.3.2 Tissue Sampling for Ecological Risk Assessment

3.3.2.1 Sampling Locations

The sampling zones selected for ecological risk assessment purposes are the same locations proposed for the human health risk assessment sampling. Three locations are selected for fish sampling based on sediment analytical data and the biological characteristics of selected target species. One sampling location in a reference area will be selected.

3.3.2.2 Target Species

A small forage species (topminnows, juvenile sunfish, or shad) will be collected from each of the three sampling zones. The specific species selected will be dependent on abundance and size for tissue analysis. Various species of small forage species are a dominant food item for predatory fishes and birds. Because of a close association with sediments, and ingestion of primarily sediment-associated benthic invertebrates, small forage species potentially represent a substantial pathway for trophic transfer of chemicals from sediments to higher organisms.

A single composite whole body sample of small forage species will be collected from each of the three sampling zones in Lake Chautauqua (Figure 6). Two composite whole body samples of small forage species will be collected from the reference lake. If forage species are large enough, discrete samples will be collected. Each composite

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sample will consist of three individual samples because predators usually ingest large numbers of whole fish when foraging on small minnow species. If enough individuals cannot be collected to meet the specification for compositing (one species, same sex, same size class), only then will compositing across sexes and sizes be performed. Small forage species composite samples will be collected using dip nets, baited minnow traps, cast nets, or seine.

Depending on availability and abundance, a whole body sample of a representative long-lived benthic invertebrates species such as crawfish (*Procambarus* spp.) will be collected from each of the three sampling zones in Lake Chautauqua (Figure 6). Two composite whole body samples of the same benthic invertebrate species will be collected from the reference lake. These samples will be collected using dip nets, baited minnow traps, cast nets, or seine.

3.4 Benthic Macroinvertebrate Community Sampling

Benthic invertebrates are the primary consumer level of the food web in Lake Chautauqua. They comprise a substantial fraction of the diets of higher organisms, including forage fish. Because of their close association with the sediments, benthic invertebrates are directly affected by chemicals associated with sediments and represent a substantial exposure pathway for higher organisms. Thus, evaluation of the richness and abundance of the benthic community is an important indicator of sediment toxicity.

A benthic macroinvertebrate community study will be conducted at each of the three sampling zones in Lake Chautauqua (Figure 6) and at two locations in the reference lake. Sampling stations within Lake Chautauqua will be SED-02, SED-04, and SED-07; two sampling stations in the reference lake will be located during the field investigation based on similarity to sediment type observed at Lake Chautauqua. Three sediment grab samples will be collected from the central location at each sampling station. Surface sediment samples will be collected using a petite ponar, Ekman dredge, or equivalent sampler. Sediment samples for the benthic macroinvertebrate community structure will be sampled using approved sampling techniques.

Each cataloged sample will be processed individually in the laboratory. All macroinvertebrates will be sorted under a dissecting microscope, identified to lowest possible taxon, and counted. The results of benthic invertebrate surveys will be quantitatively evaluated for species richness (total number of taxa), abundance (total

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number of organisms), and diversity. The values calculated for each sampling station will be compared to each other, as well as to the reference lake.

3.5 Surface Water Sampling

Surface water samples will be collected at the same locations proposed for the collection of sediment samples. Upon arriving at a sample location, a surface water sample will be collected first, before disturbing the sediment, to minimize turbidity of the samples. A total of ten surface water sampling locations (SW-1 through SW-10) are depicted on Figure 6. One reference location (SWREF-1) in Lake Copiah will also be selected.

The coordinates of each sampling station for the sediment sampling will be determined using a GPS device and will be recorded in a field notebook.

Surface water samples for the Site will be collected using an open-ended disposable bailer or a polyethylene dipper. All sampling equipment will be properly decontaminated prior to initiating sampling at each location.

In addition to the analytical samples, sampling personnel will record field measurements of pH, dissolved oxygen, temperature, turbidity, salinity, and specific conductivity as each surface water sample is collected.

3.6 Soil Sampling

Surficial soil samples (0 to 6 inches) will be collected using a hand auger from five locations around the lake representative of an apparent elevation that has not been influenced by the water level of Lake Chautauqua. Proposed soil sampling locations are shown on Figure 6. The soil samples are intended to be representative of terrestrial habitats, and analytical results will be used to determine if there is a complete exposure pathway for terrestrial receptors.

3.7 Sediment Sampling

The sediment sampling design was based on previous sediment analytical data and on the bathymetry of Lake Chautauqua (Appendices A and B). A reference location in Lake Copiah will also be selected for sampling (dependent on field observations). A total of ten sediment sampling locations (SED-1 through SED-10) are depicted on Figure 6. One reference location (SEDREF-1) will also be selected.

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The coordinates of each sampling station for the sediment sampling will be determined using a GPS device and will be recorded in a field notebook.

Because aquatic organisms are only exposed to surficial sediment, samples will be collected only from the biologically active zone (0 to 6 inches in depth). Surface sediment samples will be collected using a petite ponar, Ekman dredge, or equivalent sampler.

Each of the sediment analyses will provide information on the Site-specific bioavailability and potential toxicity of COPCs. Sediment samples will be analyzed for PCBs based on the results of previous investigations. Total organic carbon and grain size will also be analyzed to estimate bioavailability.

PCBs: PCBs are the primary constituents of concern in sediment based on previous Site investigations.

Total Organic Carbon (TOC): TOC is required to estimate the bioavailability of PCBs.

For organic chemicals, the equilibrium partitioning approach (Di Toro et al. 1991; Fuchsman 2003; Fuchsman et al. 2006; USEPA 2003a, 2003b, 2005) provides an important method for screening evaluations of sediment quality. This approach to developing sediment quality benchmarks for benthic organisms is based on cause-effect, concentration-response data and accounts for Site-specific factors that affect chemical bioavailability. The equilibrium partitioning approach has been extensively validated in field and laboratory studies (USEPA 2003a, 2003b, 2005). As described by Di Toro et al. (1991), this approach uses the mass fraction of organic carbon in sediment (f_{oc}) and the chemical-specific partition coefficient between water and organic carbon (K_{oc}) to calculate sediment quality benchmarks as follows:

$$\textit{Sediment quality benchmark} = \textit{Water quality benchmark} \times K_{oc} \times f_{oc}$$

For screening purposes, the total PCB water quality benchmarks (based on benthic invertebrate toxicity) that will be used for the evaluation are 0.14 microgram per liter (μg/L) (Suter and Tsao 1996) and 0.54 μg/L (Fuchsman et al. 2006).

3.8 Summary of Sampling Program

At a given sample location surface water samples will be collected first, then sediment samples, followed by the benthic invertebrate sampling. Other biological sampling will take place concurrently at locations removed from those described above.

A summary of the target organisms/matrix and target number of samples is provided below.

Organisms/Matrix	Target Number of Samples*
Largemouth Bass (edible fillet)	8
Bluegill (edible fillet)	8
Catfish (edible fillet)	8
Forage Fish (whole body)	5
Benthic Invertebrate (whole body)	5
Benthic Invertebrate Community	5
Surface Sediment Chemistry	11
Surface Water Chemistry	11
Surface Soil	5

* If the target number of samples or tissue types cannot be obtained due to limitations on the number of organisms that can be captured in a reasonable amount of time, then the scope of this task may be modified.

Sediment, surface water, soil, fish, and invertebrate tissue samples will be transported to a subcontract analytical laboratory with appropriate certifications in the State of Mississippi and analyzed for PCBs using USEPA Method 8082. A 10 percent subset of samples will also be analyzed for PCBs using USEPA Method 1668. Percent lipids and percent moisture will also be analyzed for each biota sample. Total organic carbon (USEPA Method 9060M) and grain size will also be analyzed for sediment samples. Benthic invertebrate community samples will be transported to a subcontract taxonomic laboratory with appropriate certifications in the State of Mississippi.

4. Data Evaluation and Reporting

Data resulting from this biological investigation will be evaluated and included in a human health and ecological risk assessment prepared using relevant USEPA risk assessment guidance and consistent with MDEQ requirements. The risk assessment report will be submitted to MDEQ.

5. Human Health Risk Evaluation

To evaluate human health risks for the ingestion of fish from Lake Chautauqua, the intake equation (USEPA 1989a) below will be used.

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$$\text{Intake} = \frac{CF \times IR \times FI \times EF \times ED}{BW \times AT}$$

where:

CF	=	Average contaminant concentration in fish tissue (mg/kg);
IR	=	Ingestion rate (6.5 g/day);
FI	=	Fraction ingested from contaminated source (unitless);
EF	=	Exposure frequency (365 days/year);
ED	=	Exposure duration (30 years);
BW	=	Body weight (70 kg); and
AT	=	Averaging time (ED x 365 days/year for noncancer effects; 70 years x 365 days/year for cancer effects).

Cancer Risk = Intake x CSF

Noncancer Risk = Intake/RfD

For fish tissue, the average concentrations will be used as the exposure point concentration (EPC) (USEPA 2000, page 9-4; USEPA 1992a, page 147). The MDEQ exposure assumption for fish ingestion (0.0065 kilogram per day [kg/d]) will be used.

PCB risks will be evaluated based on total PCB concentrations. Total PCBs will be determined as the sum of congeners or Aroclors. The noncancer reference dose (RfD) will be based on Aroclor 1254 and should be applied to total PCBs. The cancer slope factor (CSF) is based on a carcinogenicity assessment of Aroclors 1260, 1254, 1242, and 1016. The CSF (2.0 mg/kg-day^{-1}) that will be used is the upperbound slope factor for food chain exposure (USEPA 2010).

When evaluating potential individual cancer risks, USEPA has established an acceptable risk range of 1 in 1,000,000 (1 x 10^{-6}) to 1 in 10,000 (1 x 10^{-4}) (USEPA 1990). In establishing this range, USEPA accepted the policy that a risk range, rather than a single risk value, adequately protects public health. When evaluating human

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health risk from ingestion of contaminated fish, target risk of 1 in 100,000 (1×10^{-5}) is applied in most risk-based concentrations based upon fish consumption. For non-carcinogenic effects, a hazard index less or equal to 1.0 is considered acceptable.

Additional comparative criteria for the evaluation of fish tissue concentrations include:

- Background PCB concentrations detected in fish from the reference lake and fish from the rest of the country (ATSDR 2000; USEPA National Lake Fish Tissue Study 2000-2003).
- The Food and Drug Administration tolerance level of 2 parts per million for PCBs in fish and shellfish as reported in the Toxicological Profile for Polychlorinated Biphenyls (ATSDR 2000).

Additionally, recreational wader exposure to sediment will be considered.

6. Ecological Risk Assessment

The objective of the ecological risk assessment (ERA) will be to evaluate risks to benthic invertebrates, fish, mammals, and birds relative to exposures to PCBs—the Site-related COPCs—from surface sediments, water, and food sources. The ERA will follow technical guidance in USEPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final* (USEPA 1997). Other technical guidance used included USEPA's Region 4 Ecological Risk Assessment Bulletins--*Supplemental Guidance to RAGS* (USEPA 2001); the *Framework for Ecological Risk Assessment* (USEPA 1992b); and *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (USEPA 1989b).

The analysis will represent a baseline ERA (i.e., under an assumption of no future remedial action). It will also provide information to determine whether or not remedial action is necessary based on potential risk to ecological receptors. In accordance with the USEPA (1997) guidance document, the ERA will be organized into four principal sections: (1) Problem Formulation; (2) Characterization of Exposure; (3) Characterization of Ecological Effects; and (4) Risk Characterization. Additionally, a Summary and Conclusions section will be provided in which the risk findings and perspectives will be summarized.

Selection criteria for ecological receptors of interest (ROIs) include potential sensitivity to COPCs, exposure potential, likely presence at the Site, ecological relevance, trophic level, feeding habits, and the availability of life history information. Each of the wildlife ROIs that will be considered for this ERA are included in the USEPA's (1993) compilation of wildlife exposure factors. Collectively, the groups of aquatic receptors and individual wildlife species selected for evaluation in the ERA are expected to give a representative and realistic assessment of the potential risk for adverse ecological effects of PCBs at the Site. The rationale for selecting each ROI is discussed below.

Benthic Invertebrates. The benthic invertebrate community lives in constant and direct contact with sediment and, therefore, may be directly impacted by COPCs. Benthic invertebrates have vital functions within the ecosystem, including serving as a prey base for higher trophic level organisms and cycling of nutrients.

Fishes. The fish community lives in constant and direct contact with surface water that may be impacted by COPCs. Indirect exposures are also possible via sediment and the food chain. The fish community dominates the aquatic ecosystem, in terms of biomass, and small- to medium-sized fish serve as a prey base for aquatic-feeding wildlife.

Great Blue Heron (Ardea herodias). Great blue herons will be evaluated in the ERA as a representative of the feeding guild of piscivorous birds. Because they may ingest fish and invertebrates from the aquatic habitats at the Site, they are exposed to COPCs through the food chain. This makes this feeding guild an appropriate and representative group for risk evaluation.

Raccoon (Procyon lotor). Raccoons will represent the feeding guild of omnivorous mammals. The raccoon has been reported to be the most abundant and widespread medium-sized omnivore in North America (USEPA 1993). Raccoons also tend to be more closely associated with aquatic systems than other mammalian omnivores, although they feed opportunistically from both aquatic and terrestrial sources. Exposures to raccoons are enhanced by relatively small territory sizes, as well as their potential to ingest sediment that may be attached to invertebrate prey.

Mink (*Mustela vison*). Mink will represent the feeding guild of piscivorous mammals. Mink is a species often used for ERA because information is readily available for this species (USEPA 1993; Whitaker 1994). The basic requirement for mink habitat is permanent water. Landform characteristics preferred by mink include irregular shorelines with brushy or wooded cover, as opposed to open, exposed banks (Allen 1986). The mink represents a very conservative species to use for ERA because this species is sensitive to chemical contamination and consumes a high percentage of fish in its diet compared to other mammalian species. However, exposure potential is mitigated by their opportunistic feeding habits and large territory sizes, both of which tend to limit the proportion of diet that is derived from the study area. If risks are not predicted for this species, then risks should not be expected for species with lesser exposures to bioaccumulative constituents (e.g., omnivorous mammals).

Assessment endpoints are explicit expressions of the environmental value that is to be protected, operationally defined by an ecological entity (e.g., fish, birds, mammals) and its attributes (e.g., community structure, survival, growth, reproduction). Assessment endpoints are selected based on ecological relevance, susceptibility (which is a combination of toxicological sensitivity and potential for exposure), and relevance to management goals.

A measurement endpoint is defined as a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint and is a measure of biological effects. In some cases, it is possible to directly measure the assessment endpoints selected for evaluation (e.g., surveys of biological community quality).

Direct measurement of assessment endpoints minimizes the need to extrapolate between the measurement and the goal. Comparisons of estimated exposures with toxicological information for each COPC facilitate the interpretation of biological community data and serve as the primary measurement endpoint where biological community data are not available. Thus, more than one measurement endpoint may be selected for a given assessment endpoint.

The selected assessment endpoints for the ERA will be:

- Benthic invertebrate community structure and function;
- Survival and reproduction of fish populations;
- Survival and reproduction of bird populations; and
- Survival and reproduction of mammal populations.

"Community structure and function" refer to the types and diversity of species present and their ecological roles (e.g., serving as prey for wildlife). Community structure and function generally do not depend on the presence or absence of any single species. "Population" refers to a group of interbreeding individuals of a single species occurring within a geographic area.

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The measurement endpoints corresponding to the ERA's assessment endpoints will be:

- Comparison of benthic invertebrate community values for the Site to reference locations;
- Comparison of COPC concentrations in surface sediment to concentrations associated with adverse effects on macroinvertebrates;
- Comparison of COPC concentrations in benthic invertebrate tissue to concentrations associated with adverse effects on invertebrates;
- Comparison of COPC concentrations in surface water to appropriate water quality standards for the protection of aquatic life;
- Comparison of COPC concentrations in fish tissue to concentrations associated with adverse effects on fish; and
- Comparison of the predicted intake of COPCs in food, sediment, and surface water to toxicological benchmarks for the bird and mammal ROI.

In cases where multiple measurement endpoints are evaluated for one assessment endpoint (i.e., benthic invertebrates and fish), a weight-of-evidence approach is employed. For instance, the comparison of measured COPC concentrations to toxicological effect concentrations is used in distinguishing habitat-related effects on the community parameters from potential effects related to COPCs

6.1 Exposure Characterization for Wildlife

Exposure of wildlife receptors will be evaluated in the ERA by calculating the average daily intake of COPCs, generally based on the methodology described by USEPA (1993) in the *Wildlife Exposure Factors Handbook*. Daily intake calculations are required because wildlife are exposed via multiple pathways, including diet, surface water consumption, and incidental sediment ingestion. The equations used to calculate daily intakes for avian and mammalian receptors are provided below.

6.1.1 Wildlife Exposure Model

Potential exposure pathways for wildlife receptors at the Site include ingestion of food (fish or plants), incidental ingestion of sediment, and ingestion of surface water.

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Inhalation of contaminated air or particles also is a potential pathway; however, PCBs are not expected to significantly volatilize from sediment and surface water. Therefore, the inhalation pathway was not evaluated. The daily intake of COPCs for the potential receptors will be estimated by the following equation (USEPA 1993):

$$ADD = \frac{[(C_{food} \times IR_{food}) + (C_{sed} \times IR_{sed}) + (C_{water} \times IR_{water})] \times AUF}{BW}$$

where:

ADD	=	Average daily dose of constituent (milligram per kilogram per day [mg/kg/day]);
C_{food}	=	Concentration of constituent in food (mg/kg);
IR_{food}	=	Ingestion rate of food (kg/day);
C_{sed}	=	Constituent concentration in sediment (mg/kg);
IR_{sed}	=	Ingestion rate of sediment (kg/day);
C_{water}	=	Constituent concentration in surface water (milligram per liter [mg/L]);
IR_{water}	=	Ingestion rate of surface water (liter per day [L/day]);
AUF	=	Area use factor (home range/area of concern) (unitless); and
BW	=	Body weight (kg).

Receptor-specific information is summarized in Table 1. Food ingestion rates will be derived using the allometric equations of Nagy (1987). These equations are used to estimate dry-weight-based food ingestion rates for birds and mammals based on body mass. However, wildlife do not consume dry food and these estimates must be adjusted to account for the water content of food. Therefore, food ingestion rates were derived with the following equations:

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For birds:

$$IR_{food} = \frac{0.0582 \times BW^{0.651}}{0.2}$$

where:

IR_{food}	=	Ingestion rate of food (kg food wet weight ingested per day);
0.0582	=	Mathematical constant derived by Nagy (1987);
BW	=	Body weight of the indicator species (kg);
0.651	=	Mathematical constant derived by Nagy (1987); and
0.2	=	Dry weight to wet weight conversion factor (0.2 kg food dry weight per kg food wet weight).

For mammals:

$$IR_{food} = \frac{0.0687 \times BW^{0.822}}{0.2}$$

where:

IR_{food}	=	Ingestion rate of food (kg food wet weight ingested per day);
0.0687	=	Mathematical constant derived by Nagy (1987);
BW	=	Body weight of the indicator species (kg);
0.822	=	Mathematical constant derived by Nagy (1987); and
0.2	=	Dry weight to wet weight conversion factor (0.2 kg food dry weight per kg food wet weight).

Beyer et al. (1994) provided data for incidental ingestion of soil and sediment from all sources (e.g., consumed with prey, consumed in prey, from preening, from excavation of burrows, and during other activities) for several bird and mammal species. For the ERA, it will be conservatively assumed that the rates of sediment ingestion are equal to

F I N A L

the rates reported by Beyer et al. (1994) for soil plus sediment. Beyer et al. (1994) expressed soil and sediment ingestion as a percentage of the intake of dry matter in the diet. However, wildlife do not ingest dry sediment and these estimates must be adjusted to account for the water content of sediment. Therefore, sediment ingestion rates were derived with the following equation:

$$IR_{sediment} = IR_{food} \times 0.2 \times I_{sediment}$$

where:

$IR_{sediment}$ = Ingestion rate of sediment (kg sediment wet weight ingested per day);

IR_{food} = Ingestion rate of food (kg food wet weight ingested per day);

0.2 = Dry weight to wet weight conversion factor for food (kg food dry weight per kg food wet weight); and

$I_{sediment}$ = Ingestion of sediment, expressed as a percentage of food intake (kg sediment dry weight per kg food dry weight; Beyer et al. 1994).

Site-specific PCB tissue concentrations will be used as exposure inputs for the wildlife model. Dietary intake will be calculated based on average concentrations of whole body samples of forage fish.

For this ERA, it will be assumed that 100 percent of the measured body burden will be bioavailable to wildlife species. For screening purposes, it will also be assumed that these species obtain 100 percent of their diet from the most contaminated areas. These are very conservative assumptions that help to ensure that the resulting risk estimates are protective of these wildlife species. Estimates of body weights and food and water consumption rates for each receptor were derived from the available literature (Table 1).

The effects characterization for wildlife focuses on the selection of toxicological benchmarks for PCBs. Toxicological benchmarks are based on the estimated concentration of a chemical in a specific medium that is unlikely to result in adverse effects to the population. For terrestrial receptors, chronic toxicity criteria similar to that used in the development of human reference doses will be developed. A toxicological benchmark is an estimate of the dose of a constituent at which no adverse effects are likely to occur. Benchmarks will be based on literature-derived No Observed Adverse Effect Levels (NOAELs) in the selected receptor species or in a phylogenetically related species. Due to differences in avian and mammalian physiology, separate toxicity benchmarks will be developed for each class of vertebrate. Wildlife toxicological benchmarks were extrapolated from other mammalian studies (mouse and rat) or avian studies.

The body weights of the test species and indicator species were taken from Sample et al. (1996), USEPA (1993), and the published scientific literature. PCB wildlife toxicological benchmarks are presented in Table 2.

The first element of risk characterization is the comparison of exposure and effects estimates (risk estimation). If the initial risk estimation identifies a potential risk, the magnitude and nature of the risk is discussed in light of Site observations and key uncertainties or biases in the exposure and effects characterizations. The general approach to risk characterization for benthic invertebrates, fish, birds, and mammals is summarized below.

6.2 Risk Characterization for Benthic Invertebrates

Risks to benthic invertebrate community structure and function will be evaluated based on multiple lines of evidence, including the toxicological assessment of chemistry data for sediment and invertebrate tissue (Table 2), and biological survey data. An equilibrium partitioning approach (Fuchsman et al. 2006) will be utilized for screening evaluations of sediment quality.

6.3 Risk Characterization for Fishes

Risks to fish populations will be evaluated based on the toxicological assessment of surface water and tissue chemistry data (Table 2) and biological survey data.

6.4 Risk Characterization for Wildlife

To estimate ecological risks to mammalian and avian ROIs, hazard quotients (HQs) are calculated for each ROI and each COPC. An HQ is the ratio of the measure of exposure (e.g., measured concentration or modeled dose) to a literature-based value (with comparable units) that is associated with no adverse effects (NOAEL benchmark):

F I N A L

$$HQ = \frac{\text{Exposure Dose (mg/kg-day)}}{\text{Benchmark (mg/kg-day)}}$$

where:

HQ	=	Hazard quotient (unitless);
Exposure Dose	=	Average daily dose (mg COPC/kg body weight-day); and
Benchmark	=	Toxicological benchmark value (mg COPC/kg body weight-day)

In general, NOAEL HQ values less than or equal to 1 indicate that there is no ecological risk. Although HQ values much greater than 1 can be assumed to describe risks that are more severe than those associated with HQs that slightly exceed 1, HQ values should not be interpreted literally or as probabilities. For example, an HQ of 0.5 does not reflect a 50 percent probability of adverse effects and an HQ of 4 does not necessarily indicate adverse effects twice as bad as those associated with an HQ of 2.

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Table 1. Ecological Receptor-Specific Exposure Parameters, Lake Chautauqua, Crystal Springs, Mississippi.

Functional Group/ Common Name	Body Weight (kg)	IR_{FOOD} (kg/day)	IR_W (L/day)	IR_{SED} (kg/day)	Composition		
					Vegetation	Invertebrates (percent)	Fish
Avian Aquatic Piscivore							
Great Blue Heron	2.20	0.49	0.100	0	0	0	100
Mammalian Aquatic Omnivore							
Raccoon	4.00	1.10	0.34	0.02	40*	0	60*
Mammalian Aquatic Piscivore							
Mink	0.896	0.310	0.10	0	0	0	100

Reference: USEPA (1993) and Nagy (1987).

IR_{FOOD} Ingestion rate of food (kg wet weight ingested per day).
IR_{SED} Ingestion rate of sediment (kg sediment wet weight ingested per day).
IR_W Ingestion rate of water (L water ingested per day).

kg Kilogram.
L Liter.
* Raccoon diet conservatively assumed to be composed of 100 percent aquatic organisms for the purposes of this screening assessment.

IRsed(kg sediment wet weight/day) = IRfood x 0.2 x % of dry matter intake,
where: 0.2 = dry-weight to wet-weight conversion factor for food (0.2 kg food dry weight / kg food wet weight)

Table 2. Ecotoxicological Screening Benchmarks, Lake Chautauqua, Crystal Springs, Mississippi.

Assessment	Total PCBs NOAEL TRV (mg/kg/day)	Total PCBs LOAEL TRV (mg/kg/day)	References
Fish tissue*	5.1	26.3	Berlin et al. 1981
Invertebrate tissue*	5	27	Nimmo et al. 1974
Birds	0.6	1.8	Dalhgren et al. 1972
Mammals	0.36	1.28	BTAG
Mink	0.11	0.23	Halbrook et al. 1999

LOAEL Lowest Observed Adverse Effect Level.
mg/kg/day Milligrams per kilogram per day.
NOAEL No Observed Adverse Effect Level.
PCB Polychlorinated Biphenyl.
TRV Toxicity Reference Value.
* TRV values for tissues are in milligrams per kilogram (mg/kg).

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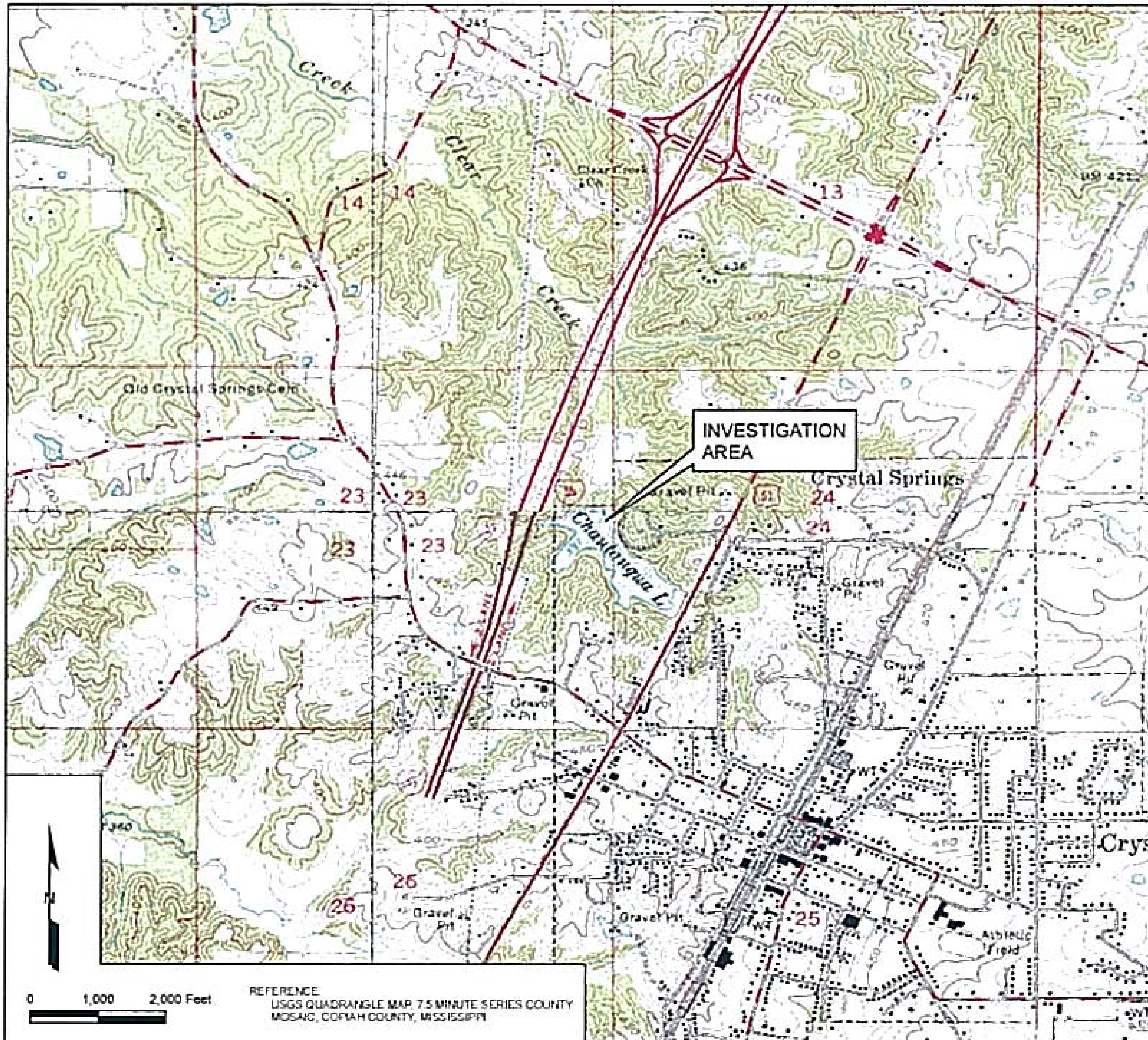

SITE LOCATION MAP

INVESTIGATION AREA
LAKE CHAUTAUQUA
CRYSTAL SPRINGS, MS

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BATON ROUGE, LA 70816
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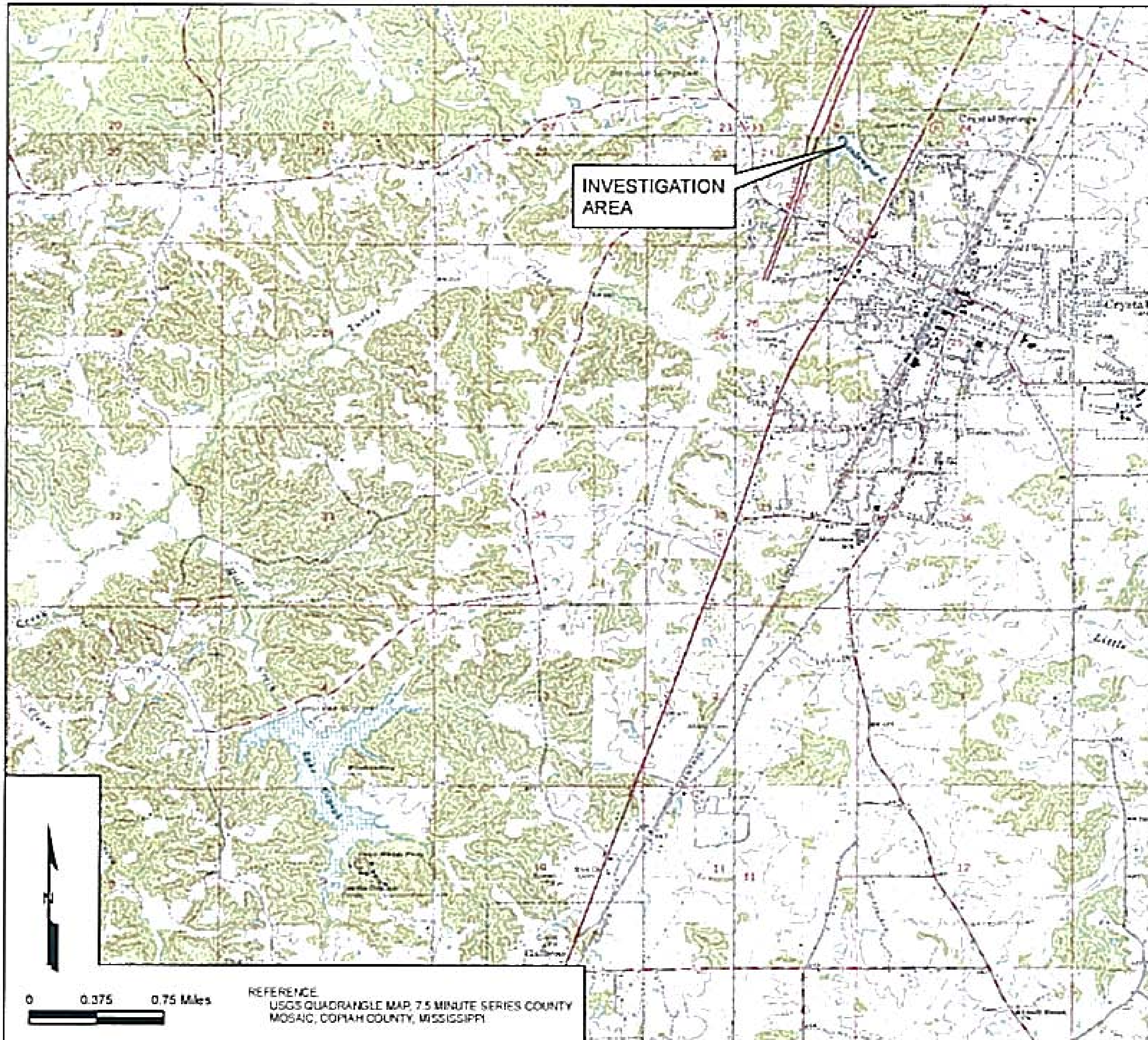
PROJECT MANAGER: GHG	CHECKED BY: LF
DRAWING FILE:	GIS FILE:
DRAWING BY: JEC	DATE: 10/30/2009
PROJECT NUMBER: LA002889.0001	FIGURE NUMBER: 1



REFERENCE:
USGS QUADRANGLE MAP, 7.5 MINUTE SERIES COUNTY MOSAIC, COPIAH COUNTY, MISSISSIPPI

VICINITY LOCATION MAP

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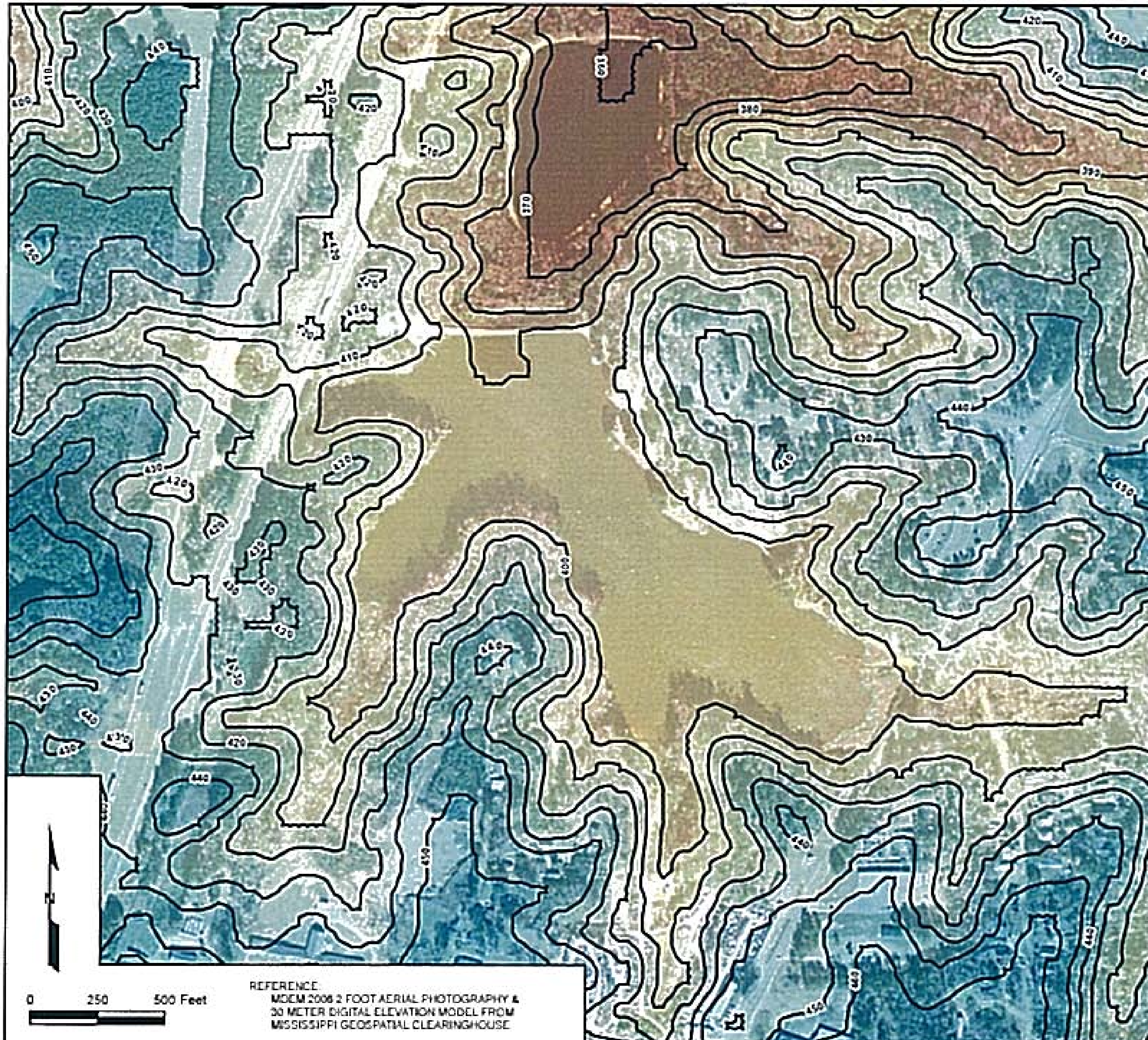

REFERENCE:
MDEM 2006 2 FOOT AERIAL PHOTOGRAPHY &
30 METER DIGITAL ELEVATION MODEL FROM
MISSISSIPPI GEOSPATIAL CLEARINGHOUSE

2006 AERIAL PHOTOGRAPHY & ELEVATIONS

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DRAWING BY: JEG	DATE: 10/30/2009
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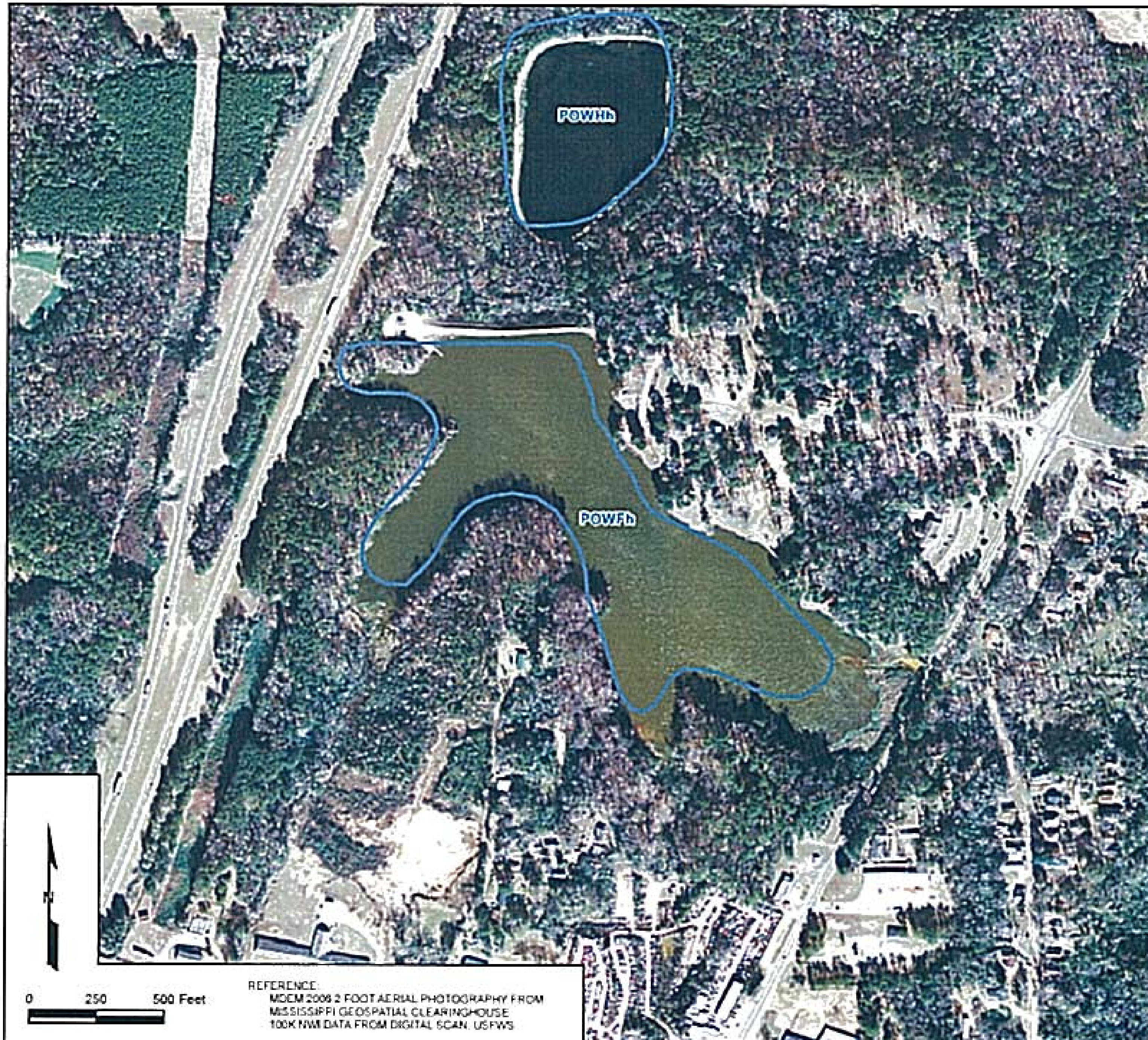

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MISSISSIPPI GEOSPATIAL CLEARINGHOUSE
100K NWI DATA FROM DIGITAL SCAN, USFWS

NATIONAL WETLANDS INVENTORY

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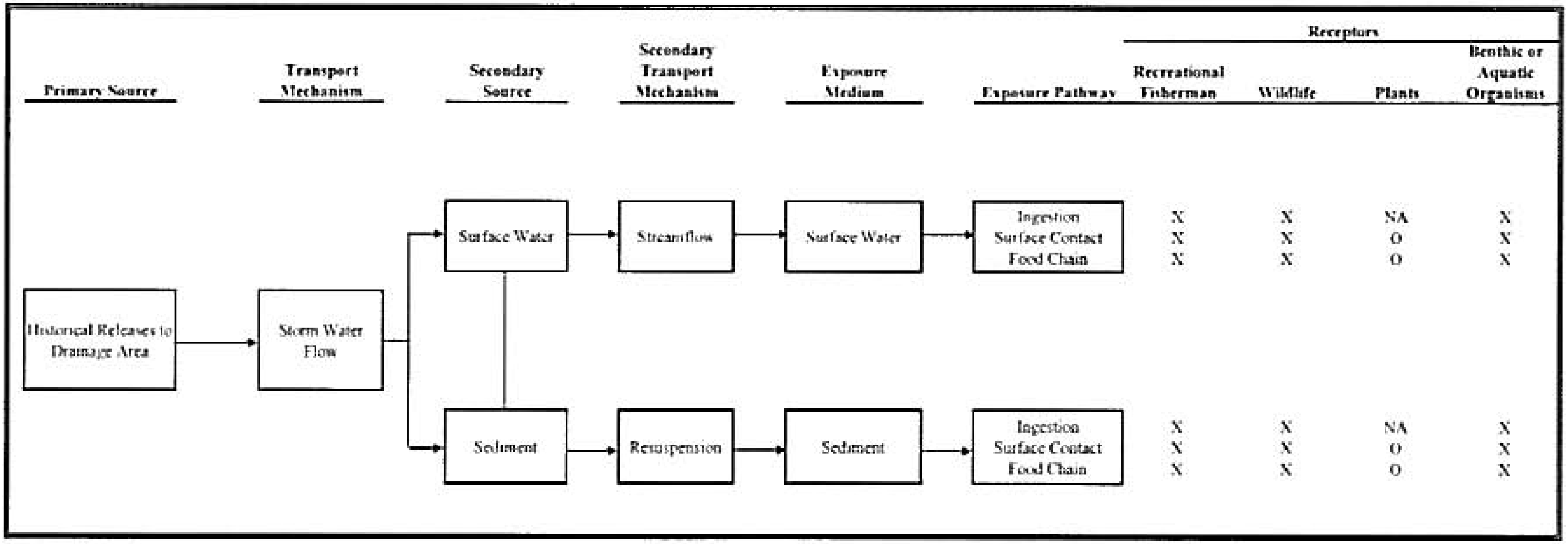
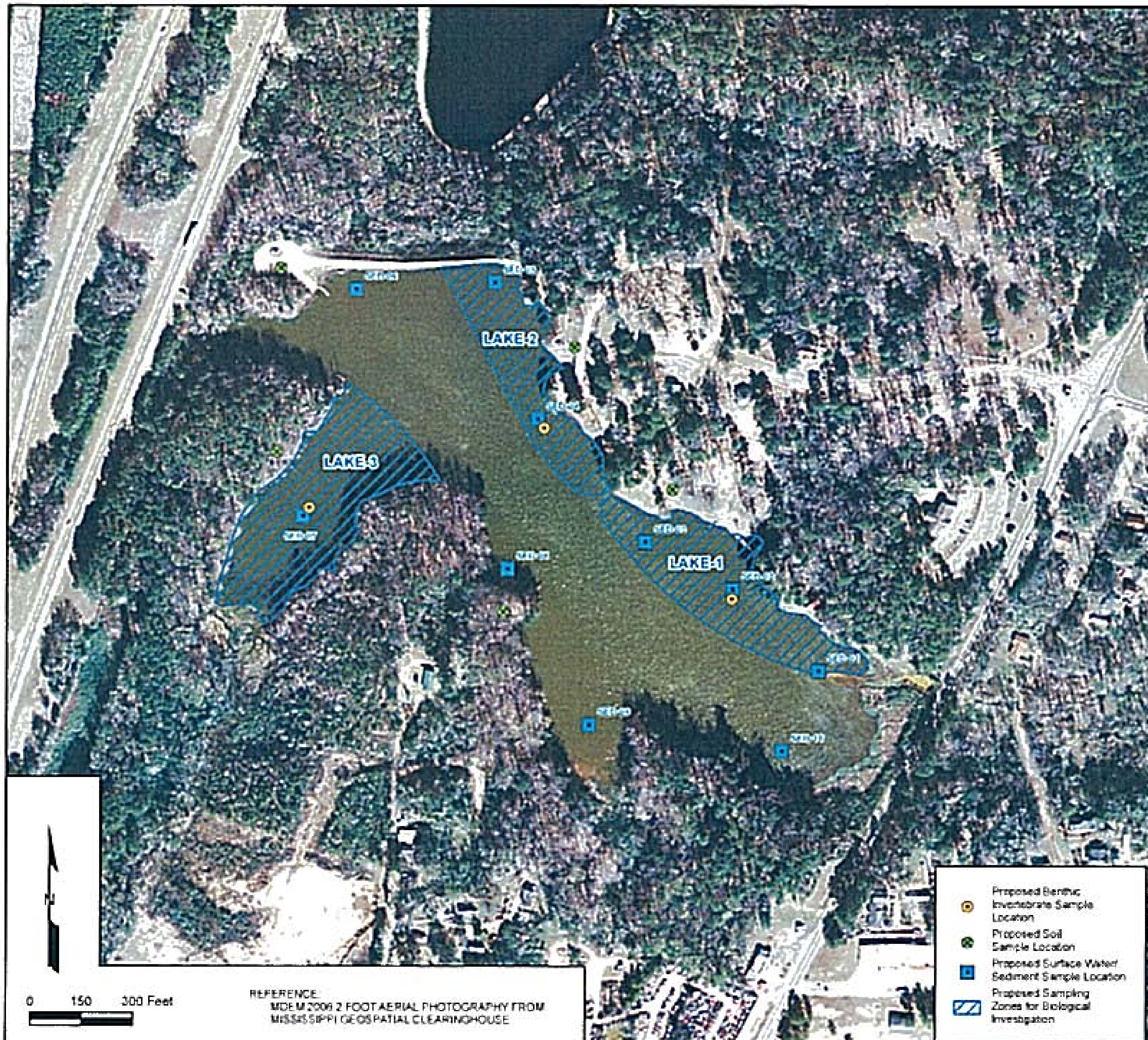
Figure 5
Preliminary Conceptual Site Model
Lake Chautauqua
Crystal Springs, Mississippi



Notes:
NA = Not applicable
X = Potentially complete exposure pathway
O = Pathway expected to be insignificant contributor to exposure



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PROPOSED SAMPLE LOCATIONS

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CRYSTAL SPRINGS, MS

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DRAWING BY: JEC	DATE: 10/30/2009
PROJECT NUMBER: LA002889.0001	FIGURE NUMBER: 6

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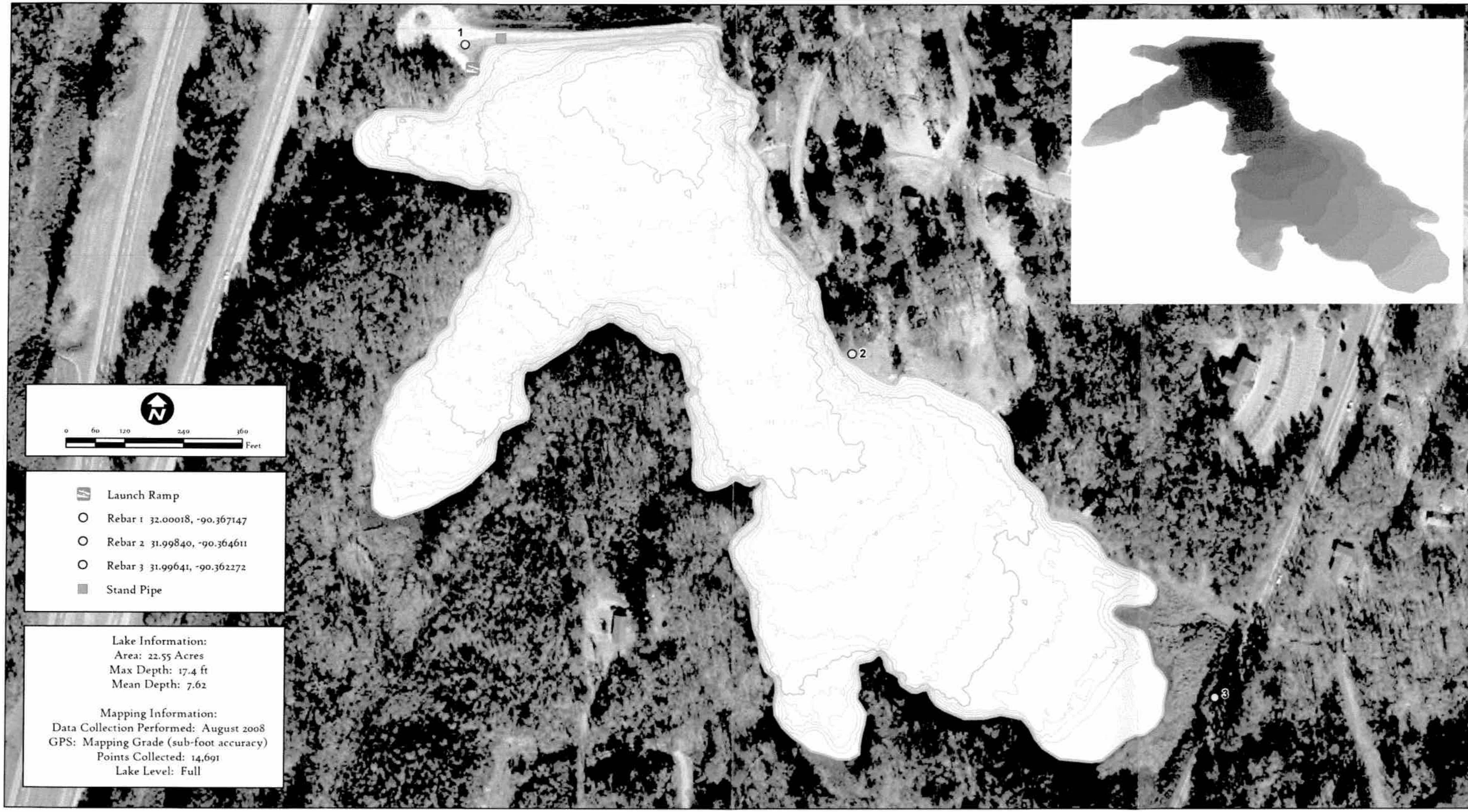
Appendix A

Bathymetry Map for Lake Chautauqua



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Appendix B

Lake Chautauqua Sediment Sample Results and Location Map, October 2008

Lake Chautauqua Sediment Sampling
Crystal Springs, Mississippi
On-Site Laboratory Analytical Results
October 2008

Sample ID Number	Duplicate	Split[1]	Date Collected	Time Collected	Date Analyzed	PCB (Aroclor1260) Concentration (mg/Kg)
LCP-SED-001		YES	15-Oct-08	09:00	15-Oct-08	0.22
LCP-Duplicate	LCP-SED-001	YES	15-Oct-08	-	15-Oct-08	0.45
LCP-SED-002		NO	15-Oct-08	09:05	15-Oct-08	1.4
LCP-SED-003		NO	15-Oct-08	09:12	15-Oct-08	1.1
LCP-SED-004		NO	15-Oct-08	09:17	15-Oct-08	1.1
LCP-SED-005		NO	15-Oct-08	09:30	15-Oct-08	1.2
LCP-SED-006		NO	15-Oct-08	09:42	15-Oct-08	0.80
LCP-SED-007		NO	15-Oct-08	09:50	15-Oct-08	1.6
LCP-SED-008		NO	15-Oct-08	09:55	15-Oct-08	0.71
LCP-SED-009		NO	15-Oct-08	10:05	15-Oct-08	1.1
LCP-SED-010		NO	15-Oct-08	10:18	15-Oct-08	1.3
LCP-SED-011		NO	15-Oct-08	10:33	15-Oct-08	0.55
LCP-SED-012		NO	15-Oct-08	12:28	15-Oct-08	1.3
LCP-SED-013		YES	15-Oct-08	12:50	15-Oct-08	1.3
LCP-SED-014		NO	15-Oct-08	13:00	16-Oct-08	1.1
LCP-SED-015		NO	15-Oct-08	13:12	16-Oct-08	1.0
LCP-SED-016		NO	15-Oct-08	13:22	16-Oct-08	1.2
LCP-SED-017		NO	15-Oct-08	13:30	16-Oct-08	0.91
LCP-SED-018		NO	15-Oct-08	13:38	16-Oct-08	0.71
LCP-SED-019		NO	15-Oct-08	13:47	16-Oct-08	0.71
LCP-SED-020		NO	15-Oct-08	13:58	16-Oct-08	0.86
LCP-SED-021		NO	15-Oct-08	14:05	16-Oct-08	0.70
LCP-SED-022		NO	15-Oct-08	16:32	16-Oct-08	0.75
LCP-SED-023		NO	15-Oct-08	16:45	16-Oct-08	0.72
LCP-SED-024		NO	15-Oct-08	17:05	16-Oct-08	0.23
LCP-SED-025		Yes	15-Oct-08	17:15	16-Oct-08	0.48

Note:
1. "Yes" indicates that this sample was split and the split sample analyzed by the off-site laboratory.

Comparison of On-Site and Off-Site Laboratory Split Sample Analyses
Lake Chautauqua
Crystal Springs, Mississippi
October 2008

Sample Name	Sample Date	On-Site Laboratory Result (mg/Kg)		Off-Site Laboratory Result (mg/Kg)	
LCP-SED-001	15-Oct-08	0.22		0.30	
LCP-Duplicate	15-Oct-08	0.45		0.30	
LCP-SED-013	15-Oct-08	1.30		3.20	
LCP-SED-025	15-Oct-08	0.48		1.70	


LEGEND
DRAWING NAME
LAKE CHAUTAUQUA
SEDIMENT SAMPLE
LOCATION MAP

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Appendix C

Fish Analytical Results and Advisories from Lake Chautauqua

Lako Chautauqua At Crystal Springs.00.

04/21/00 Chautauqua00

OPC #	Species	# Samples	Min Wt(g)	Max Wt(g)	Avg Wt(g)	Aroclor 1016(ppm)	Aroclor 1221(ppm)	Aroclor 1232(ppm)	Aroclor 1242(ppm)	Aroclor 1248(ppm)	Aroclor 1254(ppm)	Aroclor 1260
SF00009	Bluegill	5	153	186	165	ND	ND	ND	ND	ND	ND	0.149
SF00010	Largemouth Bass	3	1356	1528	1450	ND	ND	ND	ND	ND	ND	0.282
SF00011	Largemouth Bass	3	1011	1309	1118	ND	ND	ND	ND	ND	ND	0.420
SF00012	Largemouth Bass	3	195	228	214	ND	ND	ND	ND	ND	ND	ND
SF00013	Largemouth Bass	1	1753	1753	1753	ND	ND	ND	ND	ND	ND	ND
SF00014	Largemouth Bass	2	1133	1373	1253	ND	ND	ND	ND	ND	ND	0.072
SF00015	Largemouth Bass	3	504	716	620	ND	ND	ND	ND	ND	ND	0.074
SF00016	Largemouth Bass	2	348	371	360	ND	ND	ND	ND	ND	ND	ND
SF00017	Largemouth Bass	5	218	267	247	ND	ND	ND	ND	ND	ND	0.069

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name 5413
Misc Info SF00013 Lake Chautauqua @ Crystal Springs
Date Acquired 06/23/00
Operator DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	* Trace (64.0 ppb)	67.0

Surrogates	% Recovery	Limits
TCMX	64	(38-134)
DCB	67	(31-132)

Comments: * Below MQL

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name	5414
Misc Info	SF00014 Lake Chautauqua @ Crystal Springs
Date Acquired	06/23/00
Operator	DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	72.0 ppb	67.0

Surrogates	% Recovery	Limits
TCMX	79	(38-134)
DCB	83	(31-132)

Comments:

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name	5415
Misc Info	SF00015 Lake Chautauqua @ Crystal Springs
Date Acquired	06/23/00
Operator	DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	73.6 ppb	67.0

Surrogates	% Recovery	Limits
TCMX	54	(38-134)
DCB	58	(31-132)

Comments:

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name	5416
Misc Info	SF00016 Lake Chautauqua @ Crystal Springs
Date Acquired	06/23/00
Operator	DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	* Trace (40.0 ppb)	67.0

Surrogates	% Recovery	Limits
TCMX	72	(38-134)
DCB	76	(31-132)

Comments: * Below MQL

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name	5417
Misc Info	SF00017 Lake Chautauqua @ Crystal Springs
Date Acquired	06/23/00
Operator	DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	69.0 ppb	67.0

Surrogates	% Recovery	Limits
TCMX	50	(38-134)
DCB	55	(31-132)

Comments:

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name	5315
Misc Info	SF00009 Chautauqua Lake @ Crystal Springs
Date Acquired	06/12/00
Operator	DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	149 ppb	134

Surrogates	% Recovery	Limits
TCMX	59	(38-134)
DCB	57	(31-132)

Comments:

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name	5316
Misc Info	SF00010 Chautauqua Lake @ Crystal Springs
Date Acquired	06/12/00
Operator	DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	262 ppb	134

Surrogates	% Recovery	Limits
TCMX	78	(38-134)
DCB	78	(31-132)

Comments:____

Mississippi Department of Environmental Quality
Office of Pollution Control Laboratory
1542 Old Whitfield Road
Pearl, MS 39208

PCBs in Soil/Fish

Sample Name	5317
Misc Info	SF00011 Chautauqua Lake @ Crystal Springs
Date Acquired	06/12/00
Operator	DS

Name	Amount (ppb)	MQL
Arochlor 1016	Not Detected	34.0
Arochlor 1221	Not Detected	670
Arochlor 1232	Not Detected	34.0
Arochlor 1242	Not Detected	34.0
Arochlor 1248	Not Detected	34.0
Arochlor 1254	Not Detected	67.0
Arochlor 1260	420 ppb	335

Surrogates	% Recovery	Limits
TCMX	68	(38-134)
DCB	81	(31-132)

Comments:

FAX

To: Anastasia Hamel	From: Gretchen Zmitrovich
	Mississippi Department of Environmental Quality — Office of Pollution Control
	P.O. Box 10385
	Jackson, MS 39289-0385
Phone: 810-497-4503	Phone: 601-961-5240
Fax: 810-497-4441	Fax: 601-961-5300

Date: August 25, 2000		Routine		Priority
Number of pages, including this one: 2				
Message: Here are the fish results that I told you I would fax. If you have any questions about the samples, please call Henry Folmar at 601-~~961~~-3910.				

964

(C)

Lake Chautauqua At Crystal Springs.00.

06/27/00

DFC #	Species	# in Sample	Min Weight(gm)	Max Weight(gm)	Avg Weight(gm)	Aroclor 1016(ppm)	Aroclor 1221(ppm)	Aroclor 1232(ppm)	Aroclor 1242(ppm)	Aroclor 1248(ppm)	Aroclor 1254(ppm)	Aroclor 1260
SF00003	Bluegill	5	153	168	165	ND	ND	ND	ND	ND	ND	0.149
SF00010	Largemouth Bass	3	1385	1528	1450	ND	ND	ND	ND	ND	ND	0.782
SF00011	Largemouth Bass	3	1011	1303	1118	ND	ND	ND	ND	ND	ND	0.420
SF00012	Largemouth Bass	3	195	226	214	ND	ND	ND	ND	ND	ND	ND
SF00013	Largemouth Bass	1	1763	1763	1763	ND	ND	ND	ND	ND	ND	ND
SF00014	Largemouth Bass	2	1130	1373	1253	ND	ND	ND	ND	ND	ND	0.072
SF00015	Largemouth Bass	3	504	716	620	ND	ND	ND	ND	ND	ND	0.074
SF00016	Largemouth Bass	2	348	371	360	ND	ND	ND	ND	ND	ND	ND
SF00017	Largemouth Bass	5	218	267	247	ND	ND	ND	ND	ND	ND	0.069

STATE OF MISSISSIPPI
DAVID RONALD MUSGROVE, GOVERNOR
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
CHARLES H. CHISOLM, EXECUTIVE DIRECTOR

June 16, 2000

FOR IMMEDIATE RELEASE

Contact: Jennifer Griffin
(601) 961-5726

Lake Chautauqua Water Clean
Limited Consumption of Fish Advised

The Mississippi Department of Environmental Quality (MDEQ) has completed analysis of water and fish samples from Lake Chautauqua at Crystal Springs and the preliminary results indicate no contamination in the lake water. However, three of the four fish samples contained measurable levels of polychlorinated biphenyl's (PCBs). MDEQ is advising that the consumption of fish from Lake Chautauqua at Crystal Springs be limited until more definitive results are available.

PCBs accumulate in the fatty tissue of fish and are usually higher in the larger to older fish. Because of this MDEQ is concerned more with the consumption of larger fish in the lake. MDEQ will be conducting additional sampling and analysis of fish from Lake Chautauqua at Crystal Springs and will share results with residents as they become available.

PCBs are a group of organic chemicals in various mixtures that were used primarily as cooling agents in electrical transformers and other electrical devices. The use of PCBs was banned in 1977.

Additionally, the MDEQ has completed offsite sampling and analysis of water at the City of Crystal Springs swimming pool and has determined that there is no contamination in the water at the swimming pool. The MDEQ has adviced the City that they may open the swimming pool. Test results taken from the Crystal Springs water supply also indicate no contamination.

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STATE OF MISSISSIPPI
DAVID RONALD MUSGROVE, GOVERNOR
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
CHARLES H. CHISOLM, EXECUTIVE DIRECTOR

June 13, 2001

Ms. Linda Caston
City Clerk
City of Crystal Springs
Post Office Box 473
Crystal Springs, MS 39059

Dear Ms. Caston:

As you and Gretchen Zmitrovich discussed on the phone on June 7, 2001, the Mississippi Department of Environmental Quality (MDEQ) and the Mississippi Department of Health (MDH) are lifting the precautionary fish consumption advisory on Lake Chautauqua. This precautionary advisory was placed on the Lake after fish samples collected and analyzed by MDEQ showed that the fish had low levels of PCB contamination. At that time, the Mississippi Fish Advisory Task Force, composed of representatives from MDEQ, MDH, and the Mississippi Department of Wildlife, Fisheries, and Parks, started a review of the data collected from the fish and the health risks involved with the consumption of those fish. While the Task Force was conducting its review, the City of Crystal Springs voluntarily chose to put a ban on all fishing at the Lake.

The Task Force has finished its review and has concluded that eating fish from the Lake does not pose a significant health risk. MDEQ will be issuing a news release next week advising the public that the precautionary fish consumption advisory has been lifted. One of the goals the City set for this project was to return the Lake to full use by the City's citizens; MDEQ continues to work with all parties in this matter to assure that goal is accomplished.

We would like to thank you for your continued cooperation with this matter. If you have any questions, please contact Henry Folmar at 601-664-3910 or Ms. Zmitrovich at 601-961-5240.

Sincerely,

TR Russell

Tony Russell, Chief
Uncontrolled Sites Section

Kuhlman-Letter to Caston-removal of fish advisory_6-13-01 (gz)

OFFICE OF POLLUTION CONTROL
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For Immediate Release CONTACT: Linda Vaught
601.961.5053
Phil Bass
601.961.5100

Majority of Mississippi Waters Free From DDT

Be Aware, Not Alarmed is Message of MDEQ Fish Safety Study

Agency Posts Two Advisories, Lifts Two

JACKSON, Miss., June 26, 2001 -- According to recent intensive studies, fish across most of the state have been found free from harmful levels of DDT and Toxaphene, said Charles Chisolm, executive director of the MDEQ. Farm-raised catfish were shown to continue to be safe.

"Our study identifies certain areas where people should be aware and limit their consumption of a few kinds of fish but show no reason for alarm," said Chisolm.

Field work for a Delta-fish study began in May 2000 and was made possible by a grant from the Environmental Protection Agency. Over the past few years, MDEQ has conducted ambient and comprehensive studies on fish tissue across the state. Previous studies paved the way for MDEQ's Fish Advisory Task Force to adopt advisory standards for other specific contaminants including dioxin, polychlorinated biphenyls (PCBs) and mercury.

Two-Thirds of State Not Affected by DDT

The study found that DDT and Toxaphene contamination are not an issue for more than two-thirds of the state. Today and historically, average results of repeated studies of these substances found in Mississippi fish tissue have fallen below the federal Food and Drug Administration's allowable standards. Only a few species of fish in the Delta, where the use of these chemicals was most prevalent, exceed Mississippi's newly developed, more stringent standard

"We strengthened our criteria to make certain the people of Mississippi are protected. Mississippians should be able to consume wild caught fish and not be exposed to unacceptable or unsafe levels of these substances," said Bruce Brackin, Deputy State Epidemiologist. "Our conservative approach is based on the best available science, and recent intensive fish tissue data. There is reason for caution, but not great concern."

-more-

ADD ONE/MDEQ ISSUES/LIFTS FISH ADVISORIES

Farm-Raised Catfish Safe

"We want to make it clear that there is absolutely no reason to be concerned about farm-raised catfish," said Chisolm. "Catfish farms are professional operations, with ongoing testing and the fish have grain-fed diets. They have been shown in repeated tests, including our own, to be free of significant levels of pesticides."

Fish Advisory Posted For Large Portions of Delta

The study's findings show that elevated levels of DDT and Toxaphene are confined to only certain types of fish in the Delta region concentrated east of the Mississippi River levee and west of the bluff hills area. **MDEQ today imposed a fish advisory for a large portion of the Delta, recommending consumption of no more than two meals per month of buffalo, carp and gar and to not eat more than two meals per month of catfish larger than 22 inches.** Further, MDEQ recommends people not consume any size buffalo fish from Roebuck Lake. Delta lakes, located west of the Mississippi River levee, where fish were found to be free of elevated levels of DDT and Toxaphene are NOT covered by the advisory. These lakes include Horn, Tunica, DeSoto, Beulah, Whittington, Ferguson, Lee, Albermarle and Chotard.

Editors Note: See fact sheet for detailed list of unaffected waterways.

Most Fish Not Affected

Most popular game fish throughout the Delta: bream, crappie, bass, fresh water drum and small- to moderate-sized catfish are NOT affected by the advisory. "Fish in those Delta lakes located west of the Mississippi River levee are in great shape," said Phil Bass, director of MDEQ Pollution Control.

Mercury Advisory Posted

The MDEQ study found elevated levels of mercury in Grenada Lake and the Yalobusha River, affecting largemouth and spotted bass and catfish larger than 27 inches. A fish consumption advisory has been issued for women of childbearing age and children under seven to eat not more than one meal of bass or large catfish from these waters every two months. Everyone else is advised to limit consumption to no more than one meal every two weeks. **This advisory extends from Highway 9 on the upper end of Grenada Lake downstream to Highway 8 near Holcomb.** It includes the entire lake and the tailwaters below the dam.

-more-

ADD TWO/MDEQ ISSUES/LIFTS FISH ADVISORIES

Overall Good News

"From a statewide perspective, we believe we have a better understanding and comfort level of what substances are where," said Bass. "We're extremely pleased to find that DDT and Toxaphene contamination is not a problem on the Mississippi River side of the levee which is an area widely used for recreation and fishing. Farm-raised catfish have once again been to shown to be free of environmental contaminants. Most gamefish in the Delta as well as the rest of the state are unaffected and safe to eat," said Bass.

"Fishermen who follow this guidance can safely consume fish statewide.

Advisories Lifted in Other Parts of Mississippi

MDEQ and the Department of Health also today lifted consumption advisories on fish from lakes in Crystal Springs and Hattiesburg.

An August 2000 precautionary advisory for PCBs in Lake Chautauqua in Crystal Springs has been removed. This action is based on results of fish tissue samples collected and tested by the Department of Environmental Quality and reviewed by the Mississippi Fish Advisory Task Force. MDEQ has tested fish from the lake on two different occasions, and the results show that fish from the lake do not pose a health risk.

State officials also lifted an advisory for Country Club Lake in Hattiesburg. This advisory has been in place since 1987, when the lake was contaminated by the release of wood treating chemicals. The wood treating facility has been closed, and remediation efforts at the site are in progress. Pentachlorophenol (PCP) was used in the 1970s and 1980s for pressure treating lumber. Dioxin was an unintentional byproduct and contaminant created by the manufacturing process of PCP and other chemicals. After years of testing, results show that concentrations of these contaminants have declined to the point that they are no longer a human health risk.

MDEQ will work in partnership with the Departments of Health and Wildlife, Fisheries & Parks to get the word out in areas affected by the advisories. Repeated briefings, fliers and public service announcements will be a part of the outreach program.

#####

Editors Note: Please visit the Mississippi Department of Environmental Quality's website, www.deq.state.ms.us and click on News to download reproducible maps showing the affected locations.

ARCADIS

Appendix D

Checklist for Ecological Assessment/Sampling

Checklist for Ecological Assessment/Sampling

I. SITE DESCRIPTION

1. Site Name: ______________________________

   Location: ______________________________

   ____

   County: ______________ City: ______________ State: ______________

2. Latitude: ______________ Longitude: ______________

3. What is the approximate area of the site? ______________________________

4. Is this the first site visit? ☐ yes ☐ no If no, attach trip report of previous site visit(s), if available.

   Date(s) of previous site visit(s): ______________________________.

5. Please attach to the checklist USGS topographic map(s) of the site, if available.

6. Are aerial or other site photographs available? ☐ yes ☐ no If yes, please attach any available photo(s) to the site map at the conclusion of this section.

7. The land use on the site is:

____% Urban

____% Rural

____% Residential

____% Industrial (☐ light ☐ heavy)

____% Agricultural

(Crops:____________________)

____% Recreational

(Describe; note if it is a park, etc.)

____

____

____% Undisturbed

____% Other

The area surrounding the site is:
________________ mile radius

____% Urban

____% Rural

____% Residential

____% Industrial (☐ light ☐ heavy)

____% Agricultural

(Crops:____________________)

____% Recreational

(Describe; note if it is a park, etc.)

____

____

____% Undisturbed

____% Other

8. Has any movement of soil taken place at the site? ☐ yes ☐ no. If yes, please identify the most likely cause of this disturbance:

____ Agricultural Use	____ Heavy Equipment	____ Mining
____ Natural Events	____ Erosion	____ Other

Please describe:

9. Do any potentially sensitive environmental areas exist adjacent to or in proximity to the site, e.g., Federal and State parks, National and State monuments, wetlands, prairie potholes? *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information.*

Please provide the source(s) of information used to identify these sensitive areas, and indicate their general location on the site map.

10. What type of facility is located at the site?

☐ Chemical ☐ Manufacturing ☐ Mixing ☐ Waste disposal

☐ Other (specify)________________________________

11. What are the suspected contaminants of concern at the site? If known, what are the maximum concentration levels?

12. Check any potential routes of off-site migration of contaminants observed at the site:

☐ Swales ☐ Depressions ☐ Drainage ditches

☐ Runoff ☐ Windblown particulates ☐ Vehicular traffic

☐ Other (specify)________________________________

13. If known, what is the approximate depth to the water table?____________________

14. Is the direction of surface runoff apparent from site observations? ☐ yes ☐ no If yes, to which of the following does the surface runoff discharge? Indicate all that apply.

☐ Surface water ☐ Groundwater ☐ Sewer ☐ Collection impoundment

15. Is there a navigable waterbody or tributary to a navigable waterbody? ☐ yes ☐ no

IA. SUMMARY OF OBSERVATIONS AND SITE SETTING

Completed by____ Affiliation________________

Additional Preparers____

Site Manager____

Date____________________

II. TERRESTRIAL HABITAT CHECKLIST

IIA. WOODED

1. Are there any wooded areas at the site? ☐ yes ☐ no If no, go to Section IIB: Shrub/Scrub.

2. What percentage or area of the site is wooded? (_____% _____ acres). Indicate the wooded area on the site map which is attached to a copy of this checklist. Please identify what information was used to determine the wooded area of the site.

3. What is the dominant type of vegetation in the wooded area? (Circle one: Evergreen/Deciduous/ Mixed) Provide a photograph, if available.

   Dominant plant, if known:____________________________________

4. What is the predominant size of the trees at the site? Use diameter at breast height.

   ☐ 0-6 in. ☐ 6-12 in. ☐ > 12 in.

5. Specify type of understory present, if known. Provide a photograph, if available.

IIB. SHRUB/SCRUB

1. Is shrub/scrub vegetation present at the site? ☐ yes ☐ no If no, go to Section IIC: Open Field.

2. What percentage of the site is covered by scrub/shrub vegetation? (_____% _____ acres). Indicate the areas of shrub/scrub on the site map. Please identify what information was used to determine this area.

3. What is the dominant type of scrub/shrub vegetation, if known? Provide a photograph, if available.

4. What is the approximate average height of the scrub/shrub vegetation?

   ☐ 0-2 ft. ☐ 2-5 ft. ☐ > 5 ft.

5. Based on site observations, how dense is the scrub/shrub vegetation?

☐ Dense ☐ Patchy ☐ Sparse

IIC. OPEN FIELD

1. Are there open (bare, barren) field areas present at the site? ☐ yes ☐ no If yes, please indicate the type below:

☐ Prairie/plains ☐ Savannah ☐ Old field ☐ Other (specify)________________

2. What percentage of the site is open field? (_____% _____ acres). Indicate the open fields on the site map.

3. What is/are the dominant plant(s)? Provide a photograph, if available.

4. What is the approximate average height of the dominant plant?________________

5. Describe the vegetation cover: ☐ Dense ☐ Sparse ☐ Patchy

IID. MISCELLANEOUS

1. Are other types of terrestrial habitats present at the site, other than woods, scrub/shrub, and open field? ☐ yes ☐ no If yes, identify and describe them below.

2. Describe the terrestrial miscellaneous habitat(s) and identify these area(s) on the site map.

3. What observations, if any, were made at the site regarding the presence and/or absence of insects, fish, birds, mammals, etc.?

4. Review the questions in Section I to determine if any additional habitat checklists should be completed for this site.

III. AQUATIC HABITAT CHECKLIST – NON-FLOWING SYSTEMS

Note: *Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.*

1. What type of open-water, non-flowing system is present at the site?

   ☐ Natural (pond, lake)
   ☐ Artificially created (lagoon, reservoir, canal, impoundment)

2. If known, what is the name(s) of the waterbody(ies) on or adjacent to the site?

   ____

3. If a waterbody is present, what are its known uses (e.g.: recreation, navigation, etc.)?

4. What is the approximate size of the waterbody(ies)? __________ acre(s).

5. Is any aquatic vegetation present? ☐ yes ☐ no If yes, please identify the type of vegetation present if known.

   ☐ Emergent ☐ Submergent ☐ Floating

6. If known, what is the depth of the water? ______________________________

7. What is the general composition of the substrate? Check all that apply.

☐ Bedrock	☐ Sand (coarse)	☐ Muck (fine/black)
☐ Boulder (>10 in.)	☐ Silt (fine)	☐ Debris
☐ Cobble (2.5-10 in.)	☐ Marl (shells)	☐ Detritus
☐ Gravel (0.1-2.5 in.)	☐ Clay (slick)	☐ Concrete

   ☐ Other (specify)______________________________

8. What is the source of water in the waterbody?

☐ River/Stream/Creek	☐ Groundwater	☐ Other (specify)__________
☐ Industrial discharge	☐ Surface runoff	

9. Is there a discharge from the site to the waterbody? ☐ yes ☐ no If yes, please describe this discharge and its path.

10. Is there a discharge from the waterbody? ☐ yes ☐ no If yes, and the information is available, identify from the list below the environment into which the waterbody discharges.

☐ River/Stream/Creek	☐ onsite	☐ offsite	Distance ______
☐ Groundwater	☐ onsite	☐ offsite	
☐ Wetland	☐ onsite	☐ offsite	Distance ______
☐ Impoundment	☐ onsite	☐ offsite	

11. Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected provide the measurement and the units of measure below:

______ Area

______ Depth (average)

______ Temperature (depth of the water at which the reading was taken) ______

______ pH

______ Dissolved oxygen

______ Salinity

______ Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth ______)

______ Other (specify)

12. Describe observed color and area of coloration.

13. Mark the open-water, non-flowing system on the site map attached to this checklist.

14. What observations, if any, were made at the waterbody regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.?

IV. AQUATIC HABITAT CHECKLIST – FLOWING SYSTEMS

Note: *Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.*

1. What type(s) of flowing water system(s) is (are) present at the site?

☐ River	☐ Stream	☐ Creek
☐ Dry wash	☐ Arroyo	☐ Brook
☐ Artificially created (ditch, etc.)	☐ Intermittent Stream	☐ Channeling
	☐ Other (specify)________________	

2. If known, what is the name of the waterbody?______________________________

3. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)?
☐ yes ☐ no If yes, please describe indicators that were observed.

4. What is the general composition of the substrate? Check all that apply.

☐ Bedrock	☐ Sand (coarse)	☐ Muck (fine/black)
☐ Boulder (>10 in.)	☐ Silt (fine)	☐ Debris
☐ Cobble (2.5-10 in.)	☐ Marl (shells)	☐ Detritus
☐ Gravel (0.1-2.5 in.)	☐ Clay (slick)	☐ Concrete
☐ Other (specify)________________		

5. What is the condition of the bank (e.g., height, slope, extent of vegetative cover)?

6. Is the system influenced by tides? ☐ yes ☐ no What information was used to make this determination?

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Appendix E

USEPA-Recommended Target Species for Inland Fresh Waters

Table 3-1. Recommended Target Species for Inland Fresh Waters

Family name	Common name	Scientific name
Percichthyidae	White bass	*Morone chrysops*
Centrarchidae	Largemouth bass	*Micropterus salmoides*
	Smallmouth bass	*Micropterus dolomieui*
	Black crappie	*Pomoxis nigromaculatus*
	White crappie	*Pomoxis annularis*
Percidae	Walleye	*Stizostedion vitreum*
	Yellow perch	*Perca flavescens*
Cyprinidae	Common carp	*Cyprinus carpio*
Catostomidae	White sucker	*Catostomus commersoni*
Ictaluridae	Channel catfish	*Ictalurus punctatus*
	Flathead catfish	*Pylodictis olivaris*
Esocidae	Northern pike	*Esox lucius*
Salmonidae	Lake trout	*Salvelinus namaycush*
	Brown trout	*Salmo trutta*
	Rainbow trout	*Oncorhynchus mykiss*[a]

[a]Formerly *Salmo gairdneri*.

Table 3-2. Recommended Target Species for Great Lakes Waters

Family name	Common name	Scientific name
Percichthyidae	White bass	*Morone chrysops*
Centrarchidae	Smallmouth bass	*Micropterus dolomieui*
Percidae	Walleye	*Stizostedion vitreum*
Cyprinidae	Common carp	*Cyprinus carpio*
Catostomidae	White sucker	*Catostomus commersoni*
Ictaluridae	Channel catfish	*Ictalurus punctatus*
Esocidae	Muskellunge	*Esox masquinongy*
Salmonidae	Chinook salmon	*Oncorhynchus tschawytscha*
	Lake trout	*Salvelinus namaycush*
	Brown trout	*Salmo trutta*
	Rainbow trout	*Oncorhynchus mykiss*[a]

[a]Formerly *Salmo gairdneri*.