# CITY OF TUSCALOOSA
# STORM-WATER ASSESSMENT

**GEOLOGICAL SURVEY OF ALABAMA**

Berry H. (Nick) Tew, Jr.
State Geologist

# CITY OF TUSCALOOSA STORM-WATER ASSESSMENT

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A REPORT TO THE

CITY OF TUSCALOOSA

FINAL REPORT

By
Marlon R. Cook
Wiley Phillip Henderson, Jr.
Neil E. Moss
and
Robert M. Baker

Submitted in partial fulfillment of contract with the City of Tuscaloosa.

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# CITY OF TUSCALOOSA STORM-WATER ASSESSMENT

by
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## INTRODUCTION

This document is the final report for work completed on the City of Tuscaloosa Storm-Water Assessment as provided for under terms of a 2004 agreement between the Geological Survey of Alabama (GSA) and the City of Tuscaloosa. The report presents information concerning storm water runoff in 20 subwatersheds that drain stormwater from the City of Tuscaloosa in the Black Warrior River watershed in Tuscaloosa County, Alabama. The analytical data included in this report were compiled during the period April 2004 to May 2005.

The City of Tuscaloosa is in a unique hydrologic setting, which is determined by the underlying geology of the area. Tuscaloosa lies along the Fall Line, the boundary between hard rocks of Paleozoic Age underlying the northern portion of the city and unconsolidated Coastal Plain sediments that underlie the southern portion of the city. Geologic structures in the Pottsville Formation and the Valley and Ridge Physiographic Province southeastward from the city influence the flow of the Black Warrior River and its tributaries. Most of the ground and surface water in the city south of the Black Warrior River flows southwestward into Moody Swamp before draining into the river. A relatively small amount of water drains northward directly into the river and eastward into Hurricane Creek. Water in the city north of the river drains southward into the river.

Urban stormwater has two primary characteristics that differ from rural runoff: 1) increased volume and velocity of runoff, and 2) large concentrations of contaminants. Both characteristics are directly related to development in urban and urbanizing areas. Together, these characteristics cause changes in hydrology and water quality that result in a variety of problems including habitat loss, increased flooding, decreased aquatic biological diversity, and increased sedimentation and erosion. The general decline in water quality in the urban environment may also adversely affect the quality of shallow groundwater and downstream surface water. This may adversely affect the future quality of public water supply sources.

Urban runoff pollutants are many and varied depending on the land uses and pollutant sources present in an urban area. Typically, loadings of urban pollutants are greatest from industrial and commercial areas, roads and freeways, and higher density residential areas. Although sources of specific pollutants may vary widely in urban areas, motor vehicles are recognized to be a major source of pollutants, contributing oils, greases, hydrocarbons, and toxic metals.

Major categories of urban pollutants include sediments, nutrients, microbes, and toxic metals and organics. Sediment concentrations in urban runoff are particularly problematic because of their ubiquitous nature, and the fact that many other pollutants occur in association with sediment particles. Sediment loadings occur primarily from soil erosion and runoff from construction sites in urban areas.

Sources of nutrients, such as nitrates and phosphates, include chemical fertilizers applied to landscaped areas, lawns, and gardens, failed septic systems, soil erosion, and atmospheric deposition. Excessive nutrients in urban runoff can stimulate algal growth and cause nuisance algal blooms. Urban runoff may also contain high levels of organic matter that can lead to depleted oxygen levels in water and sediment when it decomposes.

Microbes include hundreds of different kinds of bacteria, protozoa, and viruses that are ubiquitous in the natural environment. Many are beneficial, while others can cause diseases in aquatic biota and illness or even death in humans. Some types of microbes are pathogenic (e.g., *Giardia* spp.), while others indicate a potential risk for water contamination (e.g., fecal coliform bacteria). Microbes are almost always found in high concentrations in urban stormwater, but are highly variable in nature and very difficult to eliminate. Primary sources of microbes include failed sewer or septic systems and waste products from pets, birds, and wild mammals commonly found in urban areas.

Toxic pollutants commonly found in urban runoff include trace metals such as lead, copper, zinc, and organic compounds including oils, grease, phthalates, and chlorinated hydrocarbons. Sources of toxins include the breakdown of metal products, vehicle fuels and fluids, vehicle wear, industrial processes, and the use of industrial and household chemicals such as paints, preservatives, and pesticides. Trace metals and organic compounds may be highly toxic to aquatic organisms and can bioaccumulate in fish and shellfish.

The stormwater assessment presented in this report was designed as an initial investigation into the physical and geochemical character of stormwater in the city of Tuscaloosa. The assessment consists of comprehensive geochemical analyses of a single, high-flow water sample collected from each of 10 key watersheds that drain stormwater from the city. The assessment also contains sedimentation data (including annual sediment loads) for 20 watersheds that drain the majority of stormwater from the city.


## ACKNOWLEDGMENTS

The Geological Survey of Alabama acknowledges those individuals whose participation and cooperation made this project possible: The Honorable Al DuPont, Mayor of the City of Tuscaloosa; Mr. Joe Robinson, City Engineer and Director of the Tuscaloosa Department of Transportation; and Mr. Chad Christian, City Stormwater Engineer, whose counsel and guidance were essential for the design and completion of the project.


# MONITORED WATERSHEDS

The City of Tuscaloosa Storm Water Assessment project area is approximately 38 square miles. Twenty monitoring sites were established in 16 subwatersheds, varying in size from approximately 0.3 to 6.2 square miles ($mi^2$) (table 1). The project area and monitored watersheds are shown on plate 1. The monitoring sites were on three tributaries to Hurricane Creek in the eastern area of the city, five tributaries that flow directly into the Black Warrior River, two sites on Cribbs Mill Creek, a tributary of Moody Swamp, and ten additional sites on tributaries of Moody Swamp. Names of monitored streams and site numbers are given in table 1. Monitoring site locations are shown on plate 1.

## LAND USE AND IMPERVIOUS SURFACES

Land use has a strong influence on water quality which is important not only to protect the public health but also to provide an environment that supports ecosystems.

Table 1.—Measured area in square miles for the Tuscaloosa stormwater assessment sites.

| Monitoring site numbers | Monitored stream name and site location | Monitored watershed area ( $mi^2$) |
|---|---|---|
| 1 | Unnamed tributary to the Black Warrior River at Jack Warner Parkway (U.S. Army Corps of Engineers facility) | 0.384 |
| 2 | Unnamed tributary to Moody Swamp at 29th Street | 0.882 |
| 3 | Unnamed tributary to Moody Swamp at MLK Drive | 2.221 |
| 4 | Cribbs Mill Creek at Kauloosa Avenue | 1.854 |
| 5 | Cypress Creek at Highway 69 | 0.867 |
| 6 | Unnamed tributary to Cottondale Creek at JVC Road | 4.559 |
| 7 | Unnamed tributary to Hurricane Creek at Keenes Mill Road | 1.759 |
| 8 | Unnamed tributary to Hurricane Creek near Summerfield subdivision | 1.239 |
| 9 | Unnamed tributary to the Black Warrior River near Campus Drive | 0.434 |
| 10 | Unnamed tributary to the Black Warrior River near Indian Hills Country Club | 1.015 |
| 11 | Unnamed tributary to Moody Swamp at Fosters Ferry Road | 0.617 |
| 12 | Rum Creek at Highway 69 | 6.204 |
| 13 | Cypress Creek at Highway 82 | 0.970 |
| 14 | Cypress Creek at Cypress Creek Ave | 1.491 |
| 15 | Cypress Creek at Diamond Ridge Lane near Spring Hill Lake | 0.842 |
| 16 | Unnamed tributary to Cribbs Mill Creek at 2nd Avenue East | 3.337 |
| 17 | Cribbs Mill Creek at 2nd Avenue East | 2.981 |
| 18 | Unnamed tributary to Cribbs Mill Creek at Hargrove Road | 1.935 |
| 19 | Unnamed tributary to the Black Warrior River at Rice Mine Road | 1.136 |
| 20 | Unnamed tributary to the Black Warrior River at Rice Mine Road | 3.308 |

Subwatersheds within this project area are dominated by developed urban settings characterized by impervious surfaces that increase runoff. Impervious surfaces are defined as all hard surfaces of the watersheds that are impermeable to rainfall infiltrating the groundwater (USEPA). Examples include parking lots, streets, sidewalks, driveways, rooftops, and other surfaces. Land use and impervious surfaces within the watershed were calculated from the Multi-Resolution Land Characteristics 2001 (MRLC 2001) consortium of Landsat 7 ETM imagery primarily acquired in 2000. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov) consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS),

the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the

Table 2.—Land use data for the Tuscaloosa stormwater assessment sites.

| Monitoring site | Open water % | Developed % | Forested % | Grassland/shrub/ scrub% | Agriculture % | Wetlands % |
|---|---|---|---|---|---|---|
| 1 | 0 | 97.8 | 2.2 | 0 | 0 | 0 |
| 2 | 0 | 95.4 | 3.7 | 0 | 0. 7 | 0.2 |
| 3 | 0 | 90 | 3.7 | 0.3 | 0.6 | 5.4 |
| 4 | 0.1 | 91.5 | 5.3 | 0.6 | 1.1 | 1.4 |
| 5 | 0 | 92.9 | 6.6 | 0.1 | 0.5 | 0 |
| 6 | 0.5 | 33.9 | 45.1 | 9.9 | 5 | 4. 9 |
| 7 | 0.2 | 45.4 | 32.7 | 11.3 | 8. 7 | 1.8 |
| 8 | 0.2 | 39.2 | 53.3 | 5.3 | 1.1 | 1 |
| 9 | 0 | 91.5 | 4.1 | 1.4 | 1.1 | 1.8 |
| 10 | 0 | 82.7 | 14.1 | 0.8 | 1.7 | 0.8 |
| 11 | 0 | 76.4 | 5.5 | 1.4 | 12.3 | 4.3 |
| 12 | 0.2 | 34.2 | 44 | 9.2 | 11.5 | 1 |
| 13 | 0.1 | 68.7 | 21 | 7.5 | 2.5 | 0.3 |
| 14 | 0.4 | 32.9 | 48.9 | 11.7 | 4.9 | 1.3 |
| 15 | 7.1 | 24 | 46.6 | 16 | 3.2 | 3.2 |
| 16 | 0.4 | 57 | 32.7 | 4.5 | 4.5 | 1 |
| 17 | 0.1 | 74.4 | 22 | 1 | 0.8 | 1.8 |
| 18 | 1.0 | 95.3 | 2.6 | 0.3 | 0.3 | 0.5 |
| 19 | 1.4 | 33.3 | 43.4 | 7.8 | 9.9 | 4.2 |
| 20 | 0 | 17 | 57.4 | 7 | 14.5 | 4.2 |

USDA Natural Resources Conservation Service (NRCS). Land use in the project area was subdivided into six classified groups defined as developed, forested, agricultural, grassland/scrub/shrub, wetlands, and open water (table 2). USEPA defines developed areas by high percentages (30 percent or greater) of constructed materials (e.g. asphalt, concrete, buildings, etc.). Developed areas were divided into four categories: developed-open space, developed-low intensity, developed-medium intensity, and developed-high intensity. Developed-open space includes a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of this land-use category. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes. Developed-low intensity includes a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of this category. These areas are composed of mostly single-family housing units. Developed-medium intensity includes areas with a mixture of constructed

materials and vegetation. Impervious surfaces account for 50 to 79 percent of this category. These areas include mostly single-family housing units. Developed-high intensity includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial facilities. Impervious surfaces account for 80 to 100 percent of this category (table 3).

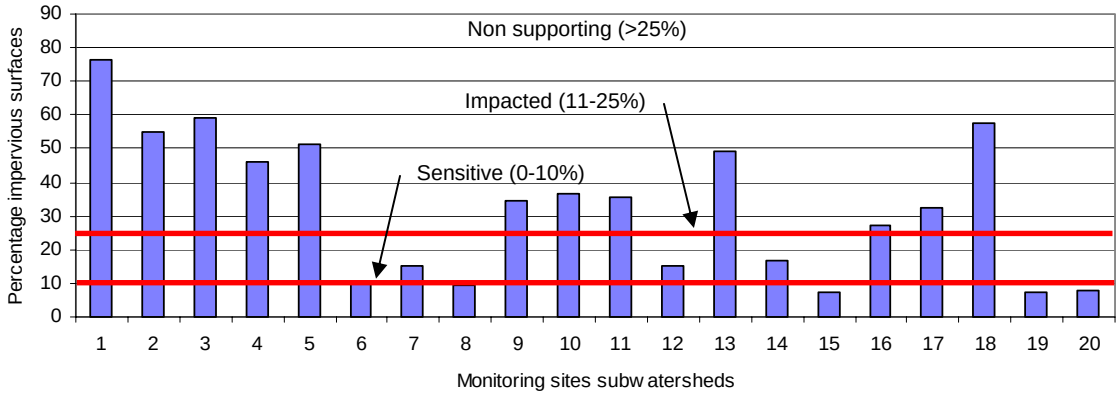
Table 3.—Developed areas for the Tuscaloosa stormwater assessment sites

| Monitoring site | Developed open space % | Developed low intensity % | Developed medium intensity % | Developed high intensity % | Developed total % |
|---|---|---|---|---|---|
| 1 | 13.4 | 26.4 | 30.6 | 27.5 | 97.9 |
| 2 | 28.0 | 50.8 | 12.9 | 3.6 | 95.3 |
| 3 | 23.5 | 34.9 | 22.4 | 9.2 | 90 |
| 4 | 36.8 | 32.8 | 16.8 | 5.1 | 91.5 |
| 5 | 33.3 | 29.0 | 19.9 | 10.6 | 92.8 |
| 6 | 19.1 | 10.8 | 3.9 | 0.1 | 33.9 |
| 7 | 26.5 | 10.7 | 5.5 | 2.7 | 45.4 |
| 8 | 26.5 | 8.4 | 3.2 | 1.1 | 39.2 |
| 9 | 50.1 | 24.3 | 15.7 | 1.4 | 91.5 |
| 10 | 39.1 | 31.7 | 10.1 | 1.7 | 82.7 |
| 11 | 32.2 | 36.1 | 6.4 | 1.8 | 76.4 |
| 12 | 15.8 | 11.2 | 5.9 | 1.4 | 34.2 |
| 13 | 15.7 | 18 | 21.2 | 13.9 | 68.7 |
| 14 | 12.1 | 14 | 5.1 | 1.6 | 32.9 |
| 15 | 16.1 | 5.6 | 2.3 | 0 | 24 |
| 16 | 24.7 | 16.4 | 11.6 | 4.4 | 57 |
| 17 | 37.2 | 21.3 | 10.4 | 5.5 | 74.4 |
| 18 | 31.2 | 29.0 | 22.2 | 12.9 | 95.3 |
| 19 | 23.5 | 8.1 | 1.5 | 0.1 | 33.3 |
| 20 | 7.7 | 5.6 | 3.1 | 0.7 | 17 |

Impervious surfaces data were developed by the MRLC consortium based upon the NLCD 2001 database. This dataset is the same one used to create the land-use/land-cover information. Impervious surfaces directly impact water quality and quantity due primarily to increases in runoff. Subwatersheds can be classified by the amount of impervious surfaces they include. A classification developed by T. Schueler in 1994 relates impervious cover to stream quality by establishing three categories that describe this correlation (table 4). The sensitive category represents 10% impervious cover and is potentially capable of supporting stable channels and good to excellent biodiviersity

(USEPA, 2002). The next category, impacted, describes 11% to 25% impervious cover. At this level urbanization has led to some impacts on stream quality. The last category, non-supporting, contains impervious cover greater than 25%. Usually streams in this category could benefit from restoration to reduce excessive erosion and siltation. Of the 20 monitoring sites in the project area, 12 are in the non-supporting category, 4 in the impacted, and 4 in the sensitive group (fig. 1 and table 4).

Figure1.--Impervious surfaces percentages for Tuscaloosa stormwater assessment sites.




# WATER QUALITY MONITORING

## CHEMICAL AND PHYSICAL PARAMETERS

### STREAM DISCHARGE

Discharge is a primary physical parameter that influences or affects surface-water quality in the project area. Ionic concentrations, specific conductance, dissolved oxygen (DO), biochemical oxygen demand (BOD), suspended and bedload sediment transport, and bacterial concentrations are all influenced by the volume and velocity of stream discharge.

The project subwatersheds have relatively small areal extents. However, the observed effects of urbanization, including flashy flow, large peak flow discharge, high flow velocities, and low base flow, are apparent when compared to streams in similar-sized watersheds with no urban development.

Table 4.—Impervious surface data for the Tuscaloosa stormwater assessment sites

| Monitoring site | Sensitive (0-10%) | Impacted (11-25%) | Non-supporting (>25%) |
|---|---|---|---|
| 1 | 12.2 | 11.4 | 76.4 |
| 2 | 21.7 | 23.1 | 55.2 |
| 3 | 23.4 | 17.6 | 59.0 |
| 4 | 32.4 | 21.6 | 46.0 |
| 5 | 30.1 | 18.5 | 51.4 |
| 6 | 83.5 | 6.2 | 10.3 |
| 7 | 74.7 | 10.4 | 15.0 |
| 8 | 81.5 | 9.0 | 9.4 |
| 9 | 47.8 | 17.5 | 34.6 |
| 10 | 46.6 | 17.0 | 36.4 |
| 11 | 44.6 | 19.7 | 35.8 |
| 12 | 76.2 | 8.6 | 15.2 |
| 13 | 41.8 | 8.7 | 49.4 |
| 14 | 75.4 | 7.9 | 16.6 |
| 15 | 86.8 | 6.1 | 7.1 |
| 16 | 61.8 | 11.1 | 27.0 |
| 17 | 52.0 | 15.7 | 32.3 |
| 18 | 25.4 | 17.1 | 57.5 |
| 19 | 87.6 | 4.8 | 7.5 |
| 20 | 88.4 | 3.7 | 7.9 |

The effect of impervious surfaces on the volume of stormwater runoff can be dramatic. For example, 1 inch of rainfall on 1 acre of naturally vegetated land would typically produce 218 cubic feet of runoff. The same storm over a 1-acre paved parking lot would produce 3,450 cubic feet of runoff, nearly 16 times more than the natural landscape (Schueler, 1995).

Impacts associated with development typically go well beyond flooding and water quality. The greater volume and intensity of runoff leads to increased erosion from construction sites, downstream areas, and stream banks. Because a stream's shape evolves over time in response to the water and sediment loads that it receives, development-impacted runoff and sediment cause significant changes in stream form.

To facilitate increased flow, streams in urbanized areas tend to become deeper and straighter than wooded streams, and as they become clogged with eroded sediment,

the ecologically important "pool and riffle" pattern of the streambed is usually destroyed (figure 2).

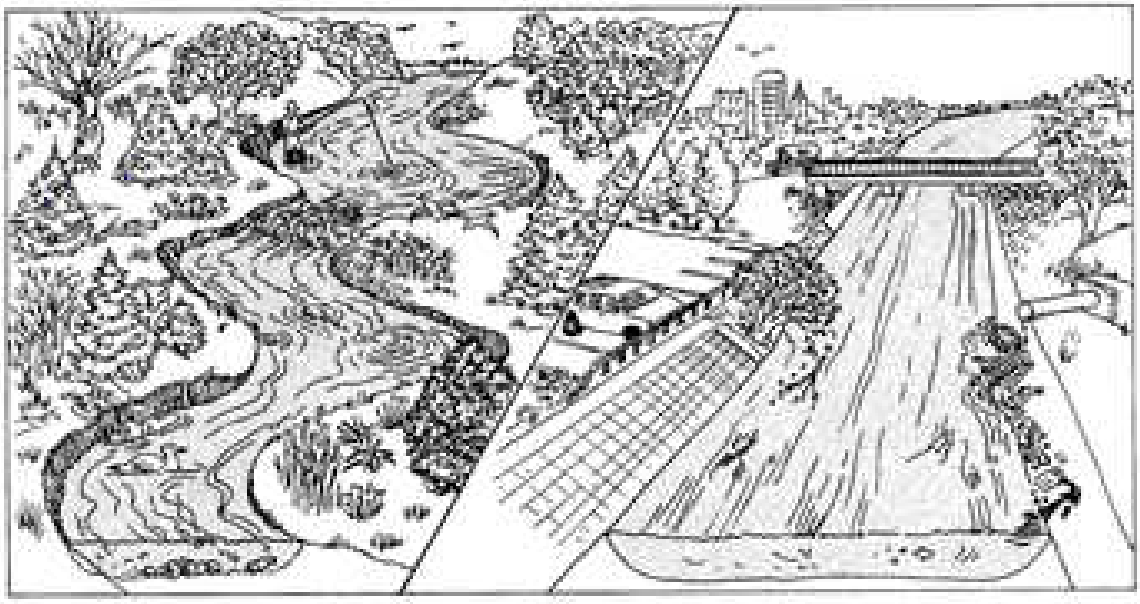


Figure 2.—Changes in stream form associated with urbanization.

These physical changes damage the ecological function of the stream. Bank erosion and severe flooding destroy valuable streamside, or riparian, habitat. Loss of tree cover leads to greater water temperature fluctuations, making the water warmer in the summer and colder in the winter. Most importantly, loss of aquatic habitat is substantial, as the natural streambed composed of pebbles, rock ledges, riffles, and deep pools is covered by a uniform blanket of eroded sand and silt.

As urbanization increases, physical alterations including stream diversion, channelization, damming, and piping become common. As these disturbances increase, so do the ecological impacts. The result may be a biologically sterile stream completely encased in underground concrete pipes. In addition, related habitats like ponds and wetlands may be damaged or eliminated by grading and filling activities as green areas are converted to buildings, streets, and parking lots (fig. 3).

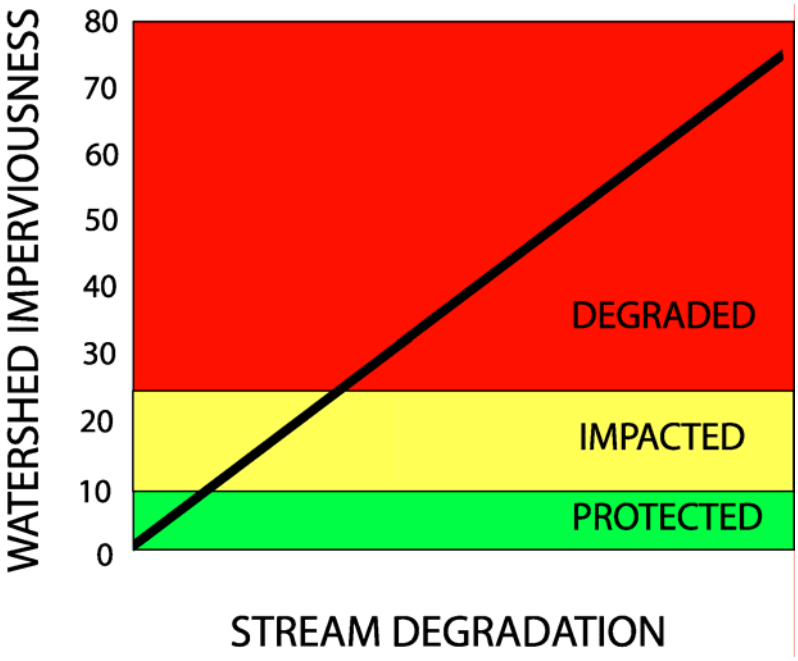



Figure 3.—Stylized relationship between percentage of imperviousness and receiving stream impact (adapted from Schueler, 1992).

## STREAM TEMPERATURE

Water temperature is an important factor that affects the physical and geochemical characteristics of a stream. Dissolved oxygen, biological activity and equilibrium reactions are significantly influenced by water temperature. The standard for maximum temperature established by the Alabama Department of Environmental Management (ADEM, 1992) for surface water classified as Fish and Wildlife is 32.3º C. The maximum temperature standard was not exceeded in any monitored site during the project period (table 5).

## SPECIFIC CONDUCTANCE

Surface water in each project watershed is characterized by a unique specific conductance (microseimens/centimeter (µS/cm)) profile based on physical and chemical properties. The variability of conductivity is influenced by differences in stream temperature, discharge, total dissolved solids, local geology and soil conditions, and ionic influxes from nonpoint sources of pollution characteristic of urban runoff. Effects of the urban environment on conductivity can be observed in table 6. Monitoring sites downstream from densely developed areas (sites 1, 3, 11, and 18) exhibit higher

conductivity than other sites. The effects of discharge on conductivity are shown on figures 4 and 5.

Table 5.—Measured temperature values for Tuscaloosa stormwater assessment sites

| Monitoring site | Maximum temperature (º C) | Minimum temperature (º C) | Average temperature (º C) |
|---|---|---|---|
| 1 | 26.5 | 9.5 | 18.5 |
| 2 | 26.4 | 14.9 | 19.5 |
| 3 | 25 | 7 | 16.5 |
| 4 | 25.9 | 7.4 | 18.4 |
| 5 | 25.8 | 7.6 | 17.5 |
| 6 | 23.6 | 6.1 | 14.2 |
| 7 | 24.1 | 6.5 | 14.4 |
| 8 | 21.3 | 8.4 | 14.4 |
| 9 | 26 | 10.6 | 19 |
| 10 | 27.8 | 8.2 | 18.5 |
| 11 | 25.7 | 7.4 | 16.6 |
| 12 | 23.1 | 7.2 | 14.6 |
| 13 | 25.2 | 6.1 | 16.6 |
| 14 | 27 | 6.5 | 15 |
| 15 | 26 | 7.2 | 15.1 |
| 16 | 24.5 | 8.3 | 16.8 |
| 17 | 25.6 | 11.6 | 17.1 |
| 18 | 23.7 | 12.2 | 16.8 |
| 19 | 17.6 | 8.2 | 13.6 |
| 20 | 17 | 8.2 | 13.5 |

Figure 4.--Measured specific conductance and discharge values for monitoring site 3.

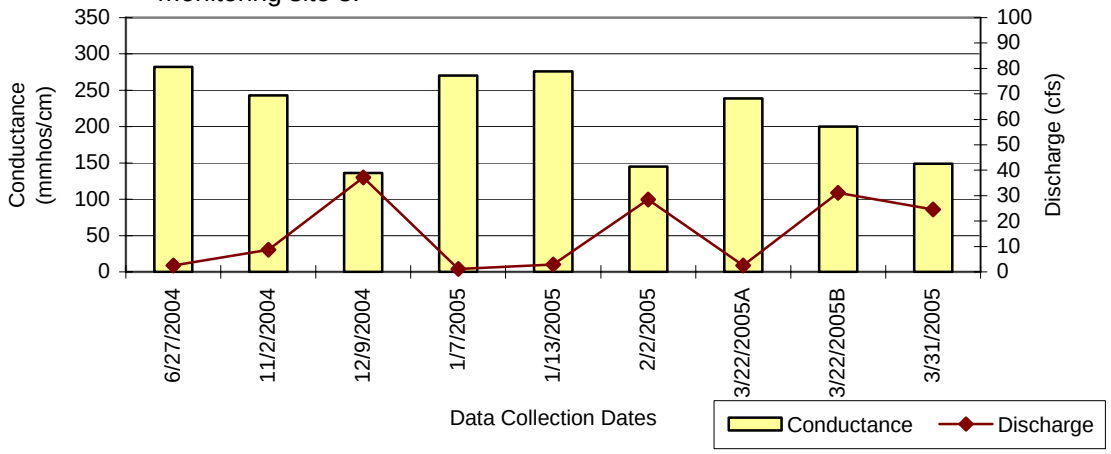


Figure 5.-- Measured specific conductance and discharge values for monitoring site 9.

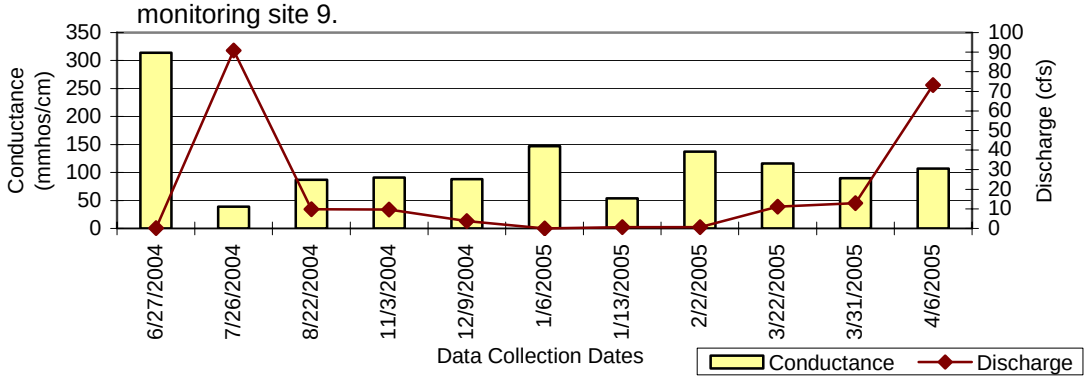



Table 6.—Measured specific conductance values for the Tuscaloosa stormwater assessment sites.

| Monitoring site | Maximum conductivity (µS/cm) | Minimum conductivity (µS/cm) | Average conductivity (µS/cm) |
|---|---|---|---|
| 1 | 256 | 20 | 103 |
| 2 | 134 | 44 | 87 |
| 3 | 282 | 136 | 216 |
| 4 | 130 | 52 | 81 |
| 5 | 138 | 52 | 81 |
| 6 | 115 | 43 | 68 |
| 7 | 103 | 42 | 73 |
| 8 | 305 | 31 | 86 |
| 9 | 314 | 39 | 116 |
| 10 | 140 | 33 | 73 |
| 11 | 305 | 59 | 127 |
| 12 | 97 | 52 | 74 |
| 13 | 140 | 46 | 78 |
| 14 | 92 | 35 | 65 |
| 15 | 150 | 52 | 78 |
| 16 | 136 | 35 | 78 |
| 17 | 126 | 36 | 76 |
| 18 | 173 | 70 | 123 |
| 19 | 65 | 36 | 56 |
| 20 | 82 | 60 | 74 |

## pH

The concentration of hydrogen ions (H+) is a critical water quality parameter in natural and treated waters. Concentrations of hydrogen ions control speciation of other constituents, influence dissolution and precipitation of chemical elements, and determine

whether the water will support aquatic life. Aquatic organisms are sensitive to pH change and require a pH of 6 to 9. Water treatment with specific types of chemicals, including disinfectants requires stringent pH control.

Hydrogen ion activity, or pH, is controlled by interrelated chemical reactions that produce or consume hydrogen ions (Hem, 1985). Therefore, pH is an important indicator of the status of equilibrium reactions that determine the ionic composition of water that flows through the project watersheds. Highly variable pH observed in project streams probably indicates influxes of contaminants related to urban runoff (table 7). Site 2 exceeded the standard and sites 7 and 8 were below the minimum required for aquatic organisms (table 7, figures 6, 7, 8).

Table 7.—Measured pH values for Tuscaloosa stormwater assessment sites.

| Monitoring Site | Maximum pH | Minimum pH | Average pH |
|---|---|---|---|
| 1 | 7.6 | 6 | 6.7 |
| 2 | 10.2 | 6.4 | 7.6 |
| 3 | 7.1 | 6.2 | 6.7 |
| 4 | 7.9 | 5.5 | 6.9 |
| 5 | 7.9 | 6.2 | 7 |
| 6 | 7.6 | 6 | 6.5 |
| 7 | 7.4 | 4.6 | 6.3 |
| 8 | 7.4 | 4.9 | 6.5 |
| 9 | 8.3 | 5.1 | 6.7 |
| 10 | 7.6 | 5.5 | 6.4 |
| 11 | 7.2 | 5.9 | 6.4 |
| 12 | 7.1 | 5.8 | 6.5 |
| 13 | 7.9 | 6.4 | 7.1 |
| 14 | 7 | 5.8 | 6.6 |
| 15 | 7.4 | 5.1 | 6.5 |
| 16 | 7.4 | 6.6 | 7 |
| 17 | 7.5 | 6.2 | 6.8 |
| 18 | 7.3 | 6 | 6.9 |
| 19 | 7.1 | 5.6 | 6.5 |
| 20 | 6.9 | 5.4 | 6.2 |

Figure 6.--Measured pH values for monitoring site 2.

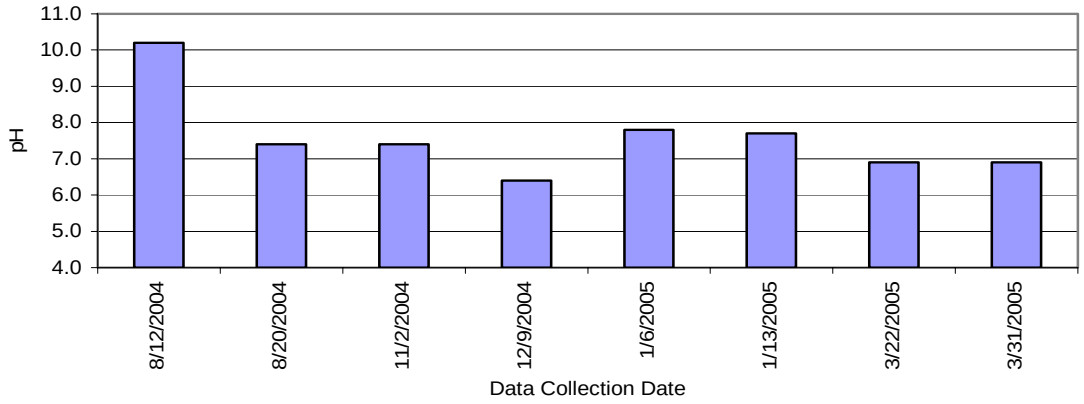



Figure 7.--Measured pH values for monitoring site 7.

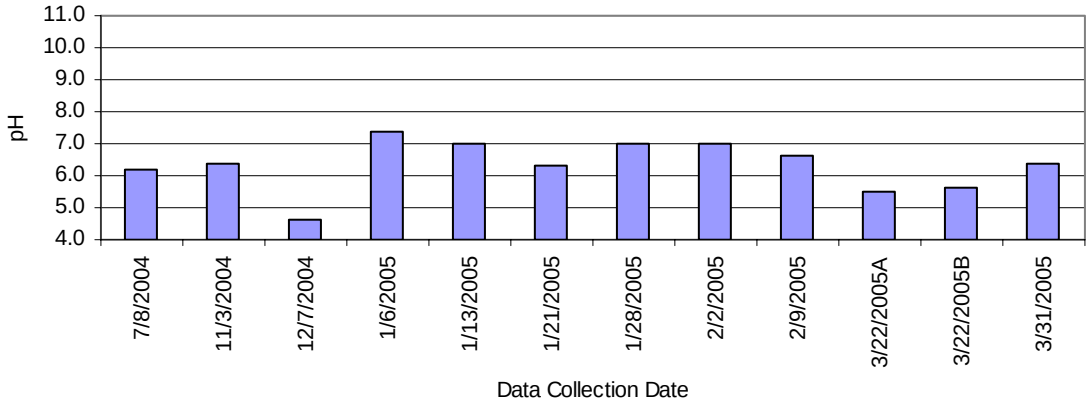
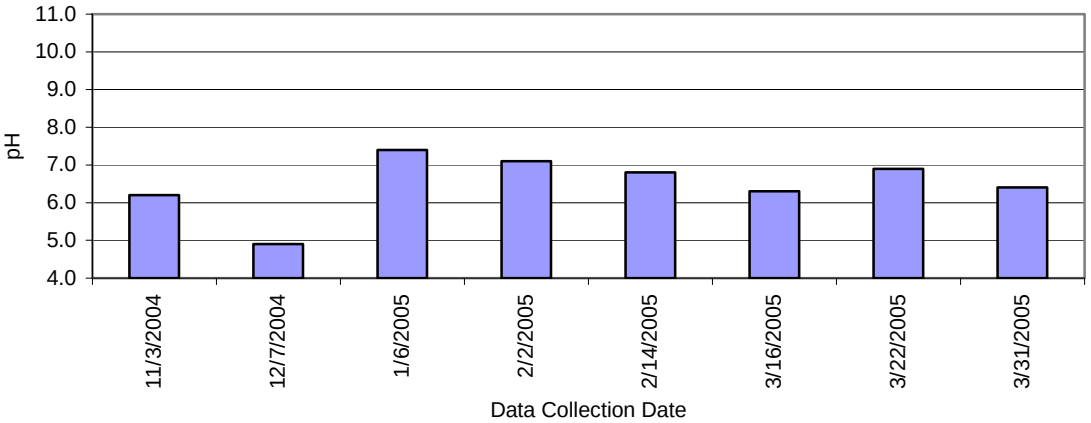



Figure 8.--Measured pH values for monitoring site 8.



## DISSOLVED OXYGEN

Dissolved oxygen (DO) concentration is critical to the biological health and the hydrochemical composition of surface waters. The ADEM standard for DO in surface water classified as Fish and Wildlife is 5.0 milligrams per liter (mg/L) except under extreme conditions, where it may be as low as 4.0 mg/L.

The equilibrium concentration of DO in water that is in contact with air is primarily related to water temperature and barometric pressure and secondarily related to concentrations of other solutes (Hem, 1985). Equilibrium DO in water at 10 ºC and 25ºC is 11.27 mg/L and 8.24 mg/L, respectively. DO concentrations in the project watersheds are significantly affected by water temperature, stream discharge, and concentrations of organic material in the water. However, the standard was violated in only two samples collected at sites 3 and 11 (table 8).

Table 8.—Measured dissolved oxygen (DO) for the Tuscaloosa storm-water assessment sites.

| Monitoring site | Maximum DO (mg/L) | Minimum DO (mg/L) | Average DO (mg/L) |
|---|---|---|---|
| 1 | 9.6 | 6.5 | 8.0 |
| 2 | 9.4 | 6.4 | 8.4 |
| 3 | 7.3 | 3.5 | 5.0 |
| 4 | 9.5 | 6.9 | 8.4 |
| 5 | 10.1 | 7.0 | 8.5 |
| 6 | 11.8 | 7.3 | 9.3 |
| 7 | 12.0 | 7.8 | 9.8 |
| 8 | 10.4 | 8.5 | 9.4 |
| 9 | 9.3 | 7.9 | 8.4 |
| 10 | 10.7 | 7.0 | 8.5 |
| 11 | 7.8 | 3.2 | 5.5 |
| 12 | 10.5 | 7.4 | 9.2 |
| 13 | 11.5 | 7.0 | 9.4 |
| 14 | 11.1 | 6.2 | 9.8 |
| 15 | 11.2 | 7.0 | 9.7 |
| 16 | 10.8 | 7.7 | 9.1 |
| 17 | 11.1 | 7.1 | 9.0 |
| 18 | 10.9 | 8.7 | 9.6 |
| 19 | 11.5 | 9.9 | 10.8 |
| 20 | 11.4 | 9.5 | 10.4 |

## BIOCHEMICAL OXYGEN DEMAND

The biochemical oxygen demand (BOD) is an empirical measure of the amount of oxygen used for the biochemical oxidation of organic matter by the microbial population of a water body. This parameter may be used to indicate the presence and magnitude of organic pollutants. It is often used to determine the effect of waste discharges on the oxygen resources of receiving waters. BOD limitations for effluent established by the USEPA for biologically treated municipal wastewater is 30 mg/L. Standards established by some states for water-quality sensitive surface-water bodies may be as low as 5 mg/L (Mays, 1996). BOD values for the monitoring sites are shown in table 9. Observations from numerous streams monitored by the GSA throughout Alabama indicate that typical BOD values for streams with little or no urban influence vary from 0.5 to 4.0 mg/L.

Table 9.—Measured biochemical oxygen demand (BOD) for sites 1-10.

| Monitoring sites | Biochemical oxygen demand (mg/L) |
|---|---|
| 1 | 7.5 |
| 2 | 5.5 |
| 3 | 4.9 |
| 4 | 5.8 |
| 5 | 5 |
| 6 | 4.4 |
| 7 | 5.2 |
| 8 | 5.8 |
| 9 | 3.6 |
| 10 | 5.7 |

## CHEMICAL OXYGEN DEMAND

The chemical oxygen demand (COD) test is a relatively quick method of determining pollution or oxidizable material load in surface water. The test yields an oxygen equivalent by the use of chemical oxidizer. A range of COD levels of <2 mg/L to 100 mg/L generally is observed for natural streams and rivers (Mays, 1996). The effects of urban runoff on streams in the City of Tuscaloosa may be observed from COD values given in table 10.

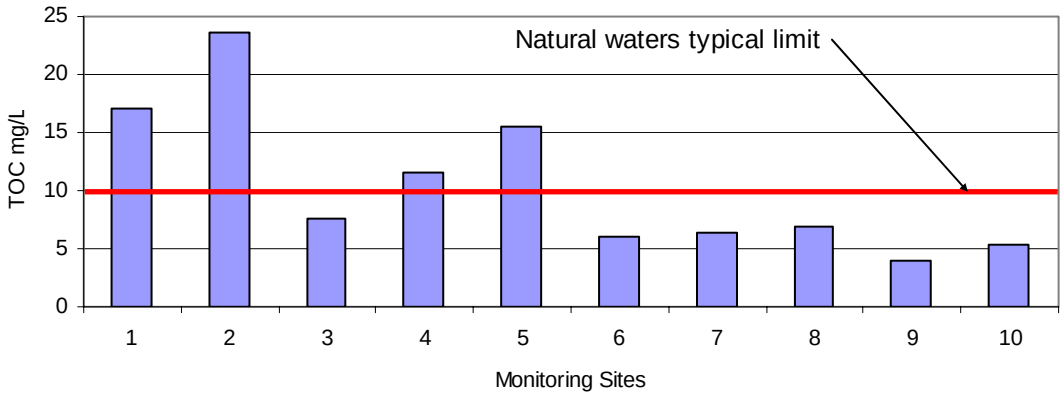
Table 10.—Measured chemical oxygen demand (COD) for sites 1-10.

| Monitoring sites | Chemical oxygen demand (mg/L) |
|---|---|
| 1 | 371 |
| 2 | 554 |
| 3 | 580 |
| 4 | 408 |
| 5 | 602 |
| 6 | 519 |
| 7 | 581 |
| 8 | 375 |
| 9 | 219 |
| 10 | 283 |

## TOTAL ORGANIC CARBON

Total organic carbon (TOC) analysis is a well-defined and commonly used methodology that measures the carbon content of dissolved and particulate organic matter present in water. Many water utilities monitor TOC to determine raw water quality or to evaluate the effectiveness of processes designed to remove organic carbon. Some wastewater utilities also employ TOC analysis to monitor the efficiency of the treatment process. In addition to these uses for TOC monitoring, measuring changes in TOC concentrations can be an effective "surrogate" for detecting contamination from organic compounds (e.g., petrochemicals, solvents, pesticides). Thus, while TOC analysis does not give specific information about the nature of the threat, identifying changes in TOC can be a good indicator of potential threats to a system (USEPA, 2005). Typical TOC values for natural waters vary from 1 to 10 mg/L (Mays, 1996). TOC values for monitoring sites 1-10 are shown in figure 9. Sites 1, 2, 4, and 5 drain densely developed urban areas of the city and have TOC concentrations well above the typical range.

Figure 9.-- Measured TOC values for monitoring sites 1-10.




Natural water has suspended particles with a wide range of sizes that may, under favorable conditions, remain in suspension indefinitely. The smaller colloidal particles are considered to be in the dissolved state. Total dissolved solids (TDS) is a measure of these dissolved particles that remain in the water after larger suspended solids have been removed by filtering. TDS may be an indicator of water quality, especially in areas with land-use practices such as agriculture. In drinking water, an upper limit of 500 mg/L is desirable. The upper limit was not exceeded at any site (table 11).

Table 11.—Measured total dissolved solids (TDS) for sites 1-20

| Monitoring site | Maximum TDS (mg/L) | Minimum TDS (mg/L) | Average TDS (mg/L) |
|---|---|---|---|
| 1 | 166 | 9 | 68 |
| 2 | 106 | 29 | 60 |
| 3 | 183 | 88 | 143 |
| 4 | 85 | 31 | 55 |
| 5 | 90 | 38 | 57 |
| 6 | 75 | 34 | 48 |
| 7 | 91 | 29 | 54 |
| 8 | 198 | 32 | 66 |
| 9 | 204 | 25 | 78 |
| 10 | 103 | 30 | 54 |
| 11 | 198 | 38 | 87 |
| 12 | 63 | 39 | 50 |
| 13 | 74 | 30 | 48 |
| 14 | 60 | 23 | 43 |
| 15 | 98 | 34 | 51 |

Table 11.—Measured total dissolved solids (TDS) for sites 1-20

| Monitoring site | Maximum TDS (mg/L) | Minimum TDS (mg/L) | Average TDS (mg/L) |
|---|---|---|---|
| 16 | 88 | 23 | 52 |
| 17 | 82 | 32 | 60 |
| 18 | 112 | 46 | 82 |
| 19 | 42 | 23 | 37 |
| 20 | 60 | 39 | 49 |

## TURBIDITY

Turbidity in water is caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms (Eaton, 1995). Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted with no change in direction or flux level through the stream (Eaton, 1995). Turbidity values measured from water samples may be utilized to formulate a rough estimate of long-term trends of total suspended solids (TSS). Turbidity data may also be used to evaluate the type of treatment necessary to remove sediment from water. However, turbidity data collected for the City of Tuscaloosa stormwater assessment is used to compare monitored streams suspended sediment content (table 12). Typical turbidity values and corresponding stream discharge are given in figures 10-13. The highest average turbidity values were measured at sites 5, 7, 9, and 13. The lowest values were measured at sites 1, 3, 18, and 19. Sites 5 and 13 are on Cypress Creek downstream from several major construction sites (table 12). Turbidity values and corresponding measured discharge for site 13 are given in figure 14. Site 7 is downstream from large excavated areas in the eastern portion of the city and site 9 is downstream form major University of Alabama construction sites between Campus Drive and University Boulevard.

Table 12.—Measured turbidity in nephelometric turbidity units (NTU) for sites 1-20

| Monitoring site | Maximum turbidity Nephelometric Turbidity Units (NTU) | Minimum turbidity NTU | Average turbidity NTU |
|---|---|---|---|
| 1 | 190 | 1 | 63 |
| 2 | 405 | 1 | 124 |
| 3 | 202 | 7 | 90 |
| 4 | 850 | 0 | 241 |
| 5 | 1000 | 1 | 589 |
| 6 | 1380 | 25 | 340 |
| 7 | 1990 | 11 | 790 |
| 8 | 1240 | 9 | 358 |
| 9 | 1000 | 26 | 452 |
| 10 | 971 | 2 | 228 |
| 11 | 1000 | 15 | 383 |
| 12 | 1000 | 3 | 385 |
| 13 | 2320 | 3 | 618 |
| 14 | 1610 | 4 | 384 |
| 15 | 1000 | 3 | 181 |
| 16 | 1000 | 3 | 233 |
| 17 | 380 | 1 | 170 |
| 18 | 120 | 1 | 40 |
| 19 | 196 | 1 | 50 |
| 20 | 576 | 8 | 190 |

Figure 10.--Measured turbidity and discharge for monitoring site 4.

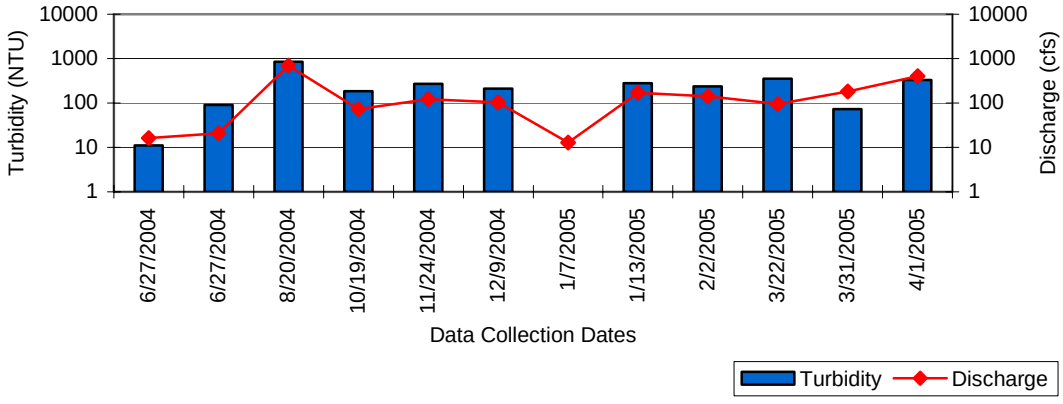


Figure 11.--Measured turbidity and discharge for monitoring site 6.

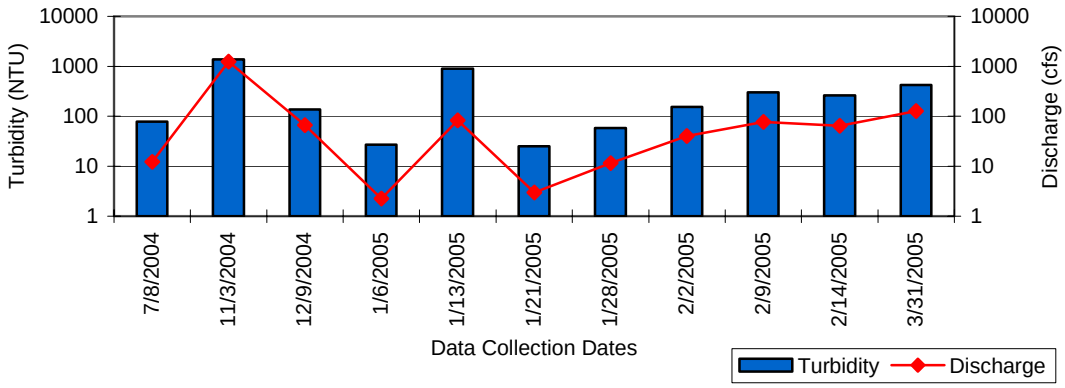



Figure 12.--Measured turbidity and discharge for monitoring site 11.

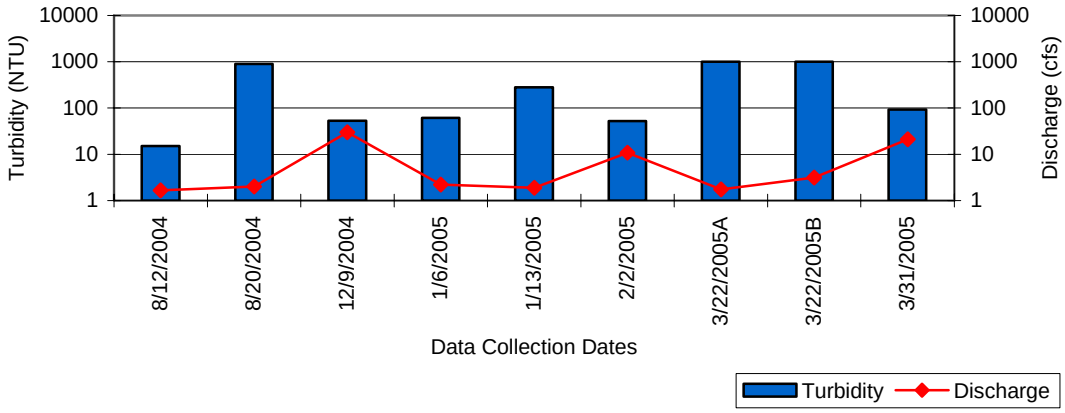



Figure 13.--Measured turbidity and discharge for monitoring site 12.

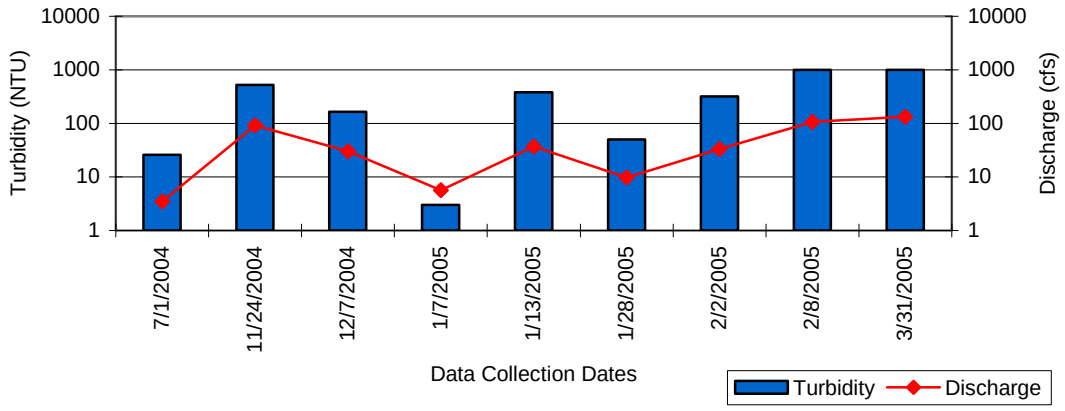
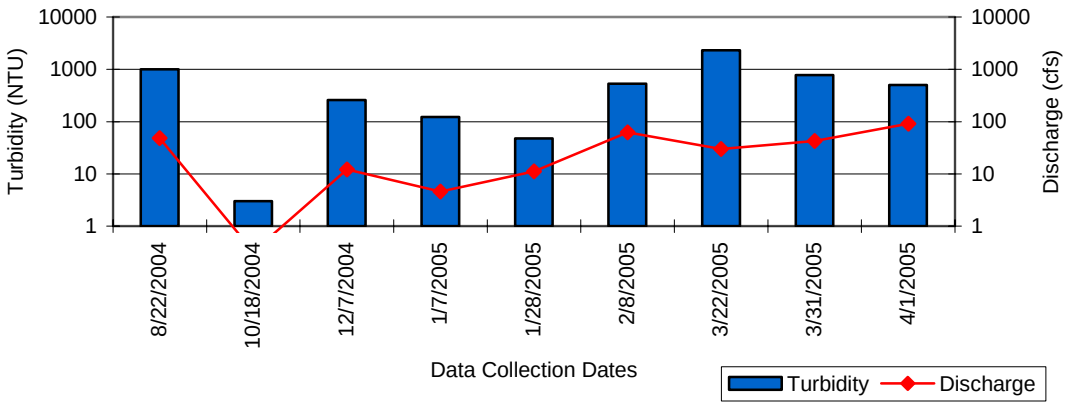


Figure 14.--Measured turbidity and discharge values for monitoring site 13.




# CONSTITUENT CONCENTRATIONS AND LOADING IN PROJECT STREAMS

## NUTRIENTS IN PROJECT STREAMS

A typical aquatic ecosystem includes plants and animals composed of carbon, hydrogen, oxygen, nitrogen, phosphorus, and sulfur. These carbonaceous, nitrogenous, phosphorous, and sulfurous substances decompose upon death of plants and animals and serve as nutrients for development of new organisms. However, excessive concentrations of these substances in the aquatic environment may lead to increased biological activity, decreased dissolved oxygen concentrations, and decreased numbers of species (Mays, 1996). This process is called eutrophication. Concentrations of nitrogen and phosphorus are of primary importance for the health of surface-water bodies. Organic matter contains organic nitrogen, which degrades to ammonia in the first step of the nitrification process. Ammonia is then oxidized to form nitrite. Continued oxidation of nitrite forms nitrate. The largest concentrations of ammonia, nitrate, and phosphorus were measured at site 2. This indicates the presence of one or more major sources of water contamination in the watershed.

## AMMONIA

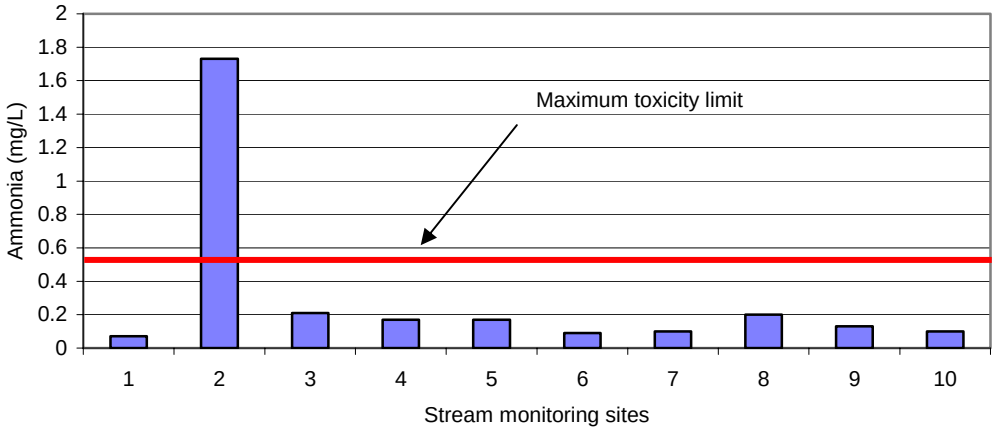
Concentrations of ammonia ($NH_3$-N) in uncontaminated streams may be as low as 0.01 mg/L. Concentrations of ammonia in contaminated streams and in streams downstream from wastewater discharges are generally from 0.5 to 3.0 mg/L.

Concentrations higher than 0.5 mg/L may cause significant ammonia toxicity to fish and other organisms (Maidment, 1993). The toxicity limit (0.5 mg/L) was exceeded at monitoring site 2, which may indicate the presence of introduced contaminants such as industrial discharge or sewage (fig. 15, table 13).

Table 13.—Measured concentrations of ammonia ($NH_3$ as N) for sites 1-10

| Monitoring site | Ammonia ($NH_3$ as N) (mg/L) |
|---|---|
| 1 | 0.07 |
| 2 | 1.73 |
| 3 | 0.21 |
| 4 | 0.17 |
| 5 | 0.17 |
| 6 | 0.09 |
| 7 | 0.1 |
| 8 | 0.2 |
| 9 | 0.13 |
| 10 | 0.1 |

Figure 15.--Measured concentrations of ammonia ($NH_3$ as N) for sites 1-10.



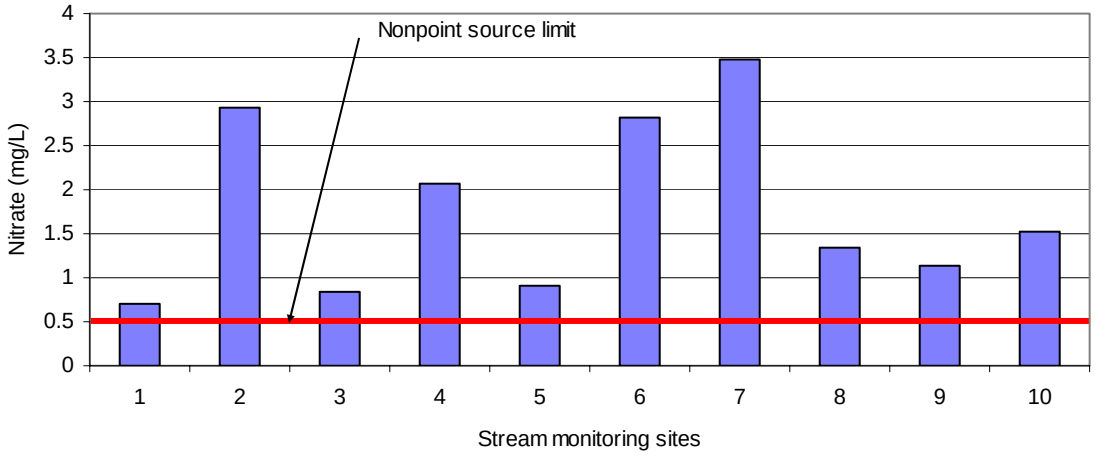
## NITRATE

The USEPA maximum contaminant level (MCL) for nitrate in drinking water is 10 mg/L. Typical nitrate ($NO_3$ as N) concentrations in streams vary from 0.5 to 3.0 mg/L. Concentrations of nitrate in streams without significant nonpoint sources of pollution vary from 0.1 to 0.5 mg/L. Streams fed by shallow ground water draining agricultural areas may approach 10 mg/L (Maidment, 1993). Water samples collected at sites 2, 6 and 7 contained the largest concentrations of nitrate during the sampling period (table 14, figure 31). Site 1 had the smallest nitrate concentration. The nitrate standard for streams without significant nonpoint sources of pollution (0.5 mg/L) was exceeded by all samples collected (table 14, fig.16, pl. 2).

Table 14.—Measured concentrations of nitrate ($NO_3$ as N) for sites 1-10

| Monitoring site | Nitrate ($NO_3$ as N) (mg/L) |
|---|---|
| 1 | 0.7 |
| 2 | 2.9 |
| 3 | 0.8 |
| 4 | 2.1 |
| 5 | 0.9 |
| 6 | 2.8 |
| 7 | 3.5 |
| 8 | 1.3 |
| 9 | 1.1 |
| 10 | 1.5 |

Figure 16.--Measured concentrations of nitrate ($NO_3$ as N) for sites 1-10.



## PHOSPHORUS

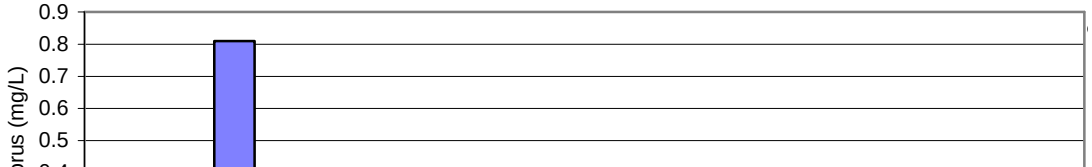
Natural background concentration of total dissolved phosphorus is approximately 0.025 mg/L (Maidment, 1993). Phosphorus concentrations as low as 0.01 to 0.005 mg/L may cause excessive algae growth, but the critical level of phosphorus necessary for excessive algae is around 0.05 mg/L (Maidment, 1993). In many streams phosphorus is the primary nutrient that influences excessive biological activity (Maidment, 1993).

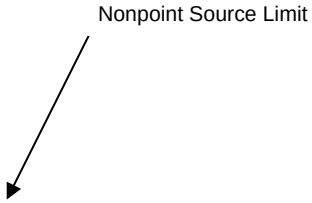
Phosphorus concentrations in monitored streams varied significantly during the sampling period (table 15). Concentrations of phosphorus necessary for excessive algae growth were measured at sites 1, 2, and 7-10. Site 2 exhibited the largest concentrations of total phosphorus (table 15, fig. 17, and pl. 3). Most concentrations of phosphorus in natural and waste waters occur as phosphates. These phosphates arise from a variety of sources such as laundering or cleaning solutions and agricultural or residential fertilizers. Organic phosphates are formed primarily by biological processes and they contribute to sewage by body waste and food residues (Eaton and others, 1995).

Table 15.—Measured concentrations of total phosphorus for sites 1-10

| Monitoring site | Total phosphorus (mg/L) |
|---|---|
| 1 | 0.09 |
| 2 | 0.81 |
| 3 | 0.04 |
| 4 | 0.03 |
| 5 | 0.04 |
| 6 | 0.03 |
| 7 | 0.06 |
| 8 | 0.17 |
| 9 | 0.1 |
| 10 | 0.07 |

Figure 17.--Measured concentrations of total phosphorus for sites 1-10.






## BACTERIA

Microorganisms are present in all surface waters and include viruses, bacteria, fungi, algae, and protozoa. Analyses of bacteria levels may be used to assess the quality of water and to indicate the presence of human and animal waste in surface and ground water. Fecal coliform and fecal streptococcus groups of bacteria are used as the primary indicator organisms of this type of water pollution. The membrane filter procedure as described in the *19th Edition of Standard Methods for the Examination of Water and Wastewater* (Eaton and others, 1995) was used for determining fecal coliform bacteria counts for water samples.

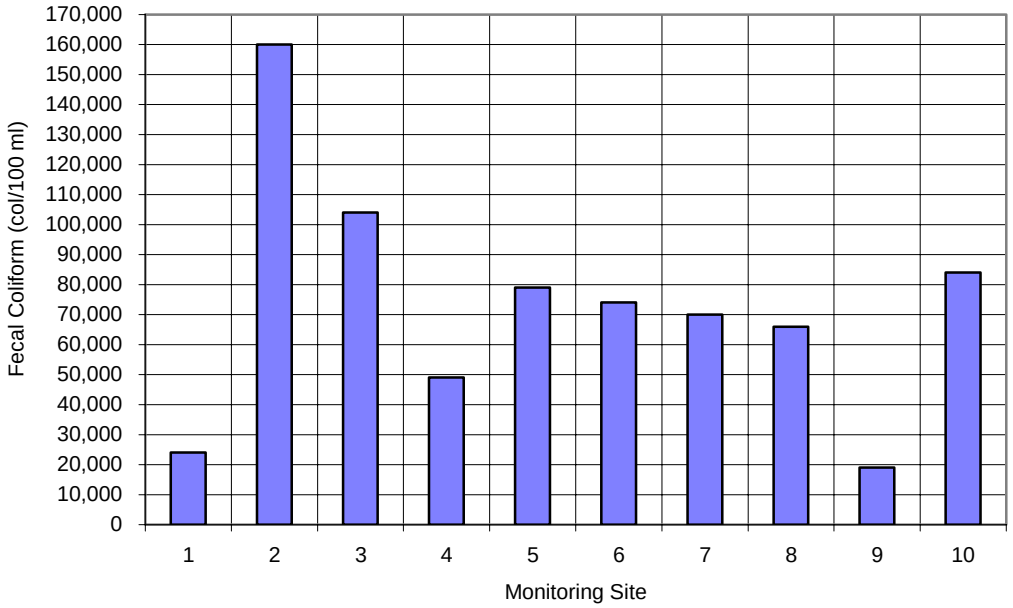
The flushing action of stormwater runoff causes increased concentrations of nonpoint-source pollutants in receiving streams. Previous studies performed by the GSA have demonstrated excellent correlations between increased stream discharge and increased concentrations of in-stream bacteria. Possible sources of fecal contamination to surface waters include wastewater treatment plants, on-site septic systems, domestic and wild animal manure, and storm runoff (USEPA, 2004).

The limit for fecal coliform bacteria, established for surface waters classified as Fish and Wildlife is 2,000 colonies per 100 milliliter sample for single samples (ADEM, 1992). Sampling results indicate that the single limit was exceeded at all collected sites (table 16, fig.18). The fecal coliform counts determined for project streams are extremely large but are not uncommon from streams in urban environments. The high count at site 2 combined with high levels of ammonia, nitrate, and phosphorus indicate the possibility of sewer leakage or some other large contaminant source.

Table 16.—Measured concentrations of fecal coliform for sites 1-10

| Monitoring site | Fecal coliform (col./100ml) |
|---|---|
| 1 | 24,000 |
| 2 | 160,000 |
| 3 | 104,000 |
| 4 | 49,000 |
| 5 | 79,000 |
| 6 | 74,000 |
| 7 | 70,000 |
| 8 | 66,000 |
| 9 | 19,000 |
| 10 | 84,000 |

Figure 18.--Measured concentrations of fecal coliform* for sites 1-10.




*Standard for streams classified as "Fish and Wildlife" is 2000 col/100 mL

## METALLIC CONSTITUENTS

Water samples collected from monitoring sites 1-10 were analyzed for selected metallic constituents. Tables 17 and 18 contain the concentrations for metallic constituents. Although these streams will probably never be used for drinking water supplies, there are currently no nonpoint-source water-quality standards for metallic

concentrations. Therefore, the USEPA primary or secondary drinking water standards have been used for this project as a comparative standard for analytical results. Concentrations highlighted in yellow exceed the USEPA standards.

Table 17.—Measured concentrations of metallic constituents detected in water samples for Tuscaloosa stormwater assessment sites 1-5

| Metallic constituent (mg/L) | Monitoring site 1 | Monitoring site 2 | Monitoring site 3 | Monitoring site 4 | Monitoring site 5 |
|---|---|---|---|---|---|
| Aluminum | BDL* | BDL | BDL | BDL | 0.138 |
| Antimony | BDL | BDL | BDL | BDL | BDL |
| Arsenic | BDL | 0.0024 | BDL | BDL | BDL |
| Barium | 0.242 | 0.137 | 0.362 | 0.242 | 0.198 |
| Beryllium | BDL | BDL | BDL | BDL | BDL |
| Cadmium | BDL | BDL | BDL | BDL | BDL |
| Calcium | 12.4 | 17.2 | 26.6 | 12.4 | 16.3 |
| Chromium | BDL | BDL | BDL | BDL | BDL |
| Copper | BDL | BDL | BDL | BDL | BDL |
| Iron | 0.07 | 0.122 | 0.695 | 0.07 | 0.17 |
| Lead | 0.0127 | 0.0033 | 0.0051 | 0.0127 | 0.0036 |
| Lithium | BDL | BDL | BDL | BDL | BDL |
| Magnesium | 1.45 | 1.38 | 4.72 | 1.45 | 1.75 |
| Manganese | 0.0202 | 0.0189 | 0.214 | 0.0202 | 0.0674 |
| Mercury | BDL | BDL | BDL | BDL | BDL |
| Molybdenum | BDL | BDL | BDL | BDL | BDL |
| Nickel | 0.014 | BDL | 0.015 | 0.014 | 0.015 |
| Potassium | 1.8 | 3.63 | 7.35 | 1.8 | 1.59 |
| Selenium | BDL | BDL | BDL | BDL | BDL |
| Silver | BDL | BDL | BDL | BDL | BDL |
| Sodium | 3.06 | 6.27 | 10.4 | 3.06 | 2.76 |
| Strontium | 0.0251 | 0.0581 | 0.0929 | 0.0251 | 0.0253 |
| Thallium | BDL | BDL | BDL | BDL | BDL |
| Tin | BDL | BDL | BDL | BDL | BDL |
| Vanadium | BDL | BDL | BDL | BDL | BDL |
| Zinc | 0.127 | 0.0753 | 0.153 | 0.127 | 0.118 |

*BDL = Below detectable limit

Table 18.—Measured concentrations of metallic constituents detected in water samples for Tuscaloosa stormwater assessment sites 6-10

| Metallic constituent (mg/L) | Monitoring site 6 | Monitoring site 7 | Monitoring site 8 | Monitoring site 9 | Monitoring site 10 |
|---|---|---|---|---|---|
| Aluminum | 0.814 | 4.12 | 1.09 | 0.682 | 0.785 |
| Antimony | BDL* | BDL | BDL | BDL | BDL |
| Arsenic | BDL | BDL | BDL | BDL | BDL |
| Barium | 1.36 | 1.08 | 1.11 | 0.408 | 0.554 |
| Beryllium | BDL | BDL | BDL | BDL | BDL |
| Cadmium | BDL | BDL | BDL | BDL | BDL |
| Calcium | 4.07 | 5.85 | 4.29 | 11.2 | 4.87 |
| Chromium | BDL | BDL | BDL | BDL | BDL |
| Copper | BDL | BDL | BDL | BDL | BDL |
| Iron | 0.436 | 0.851 | 0.455 | 0.17 | 0.321 |
| Lead | 0.0041 | 0.0119 | 0.0073 | 0.0177 | 0.0036 |
| Lithium | BDL | BDL | BDL | BDL | BDL |
| Magnesium | 1.46 | 1.17 | 0.76 | 1.29 | 0.78 |
| Manganese | 0.251 | 0.0612 | 0.0505 | 0.0112 | 0.0174 |
| Mercury | BDL | BDL | BDL | BDL | BDL |
| Molybdenum | BDL | BDL | BDL | BDL | BDL |
| Nickel | 0.012 | BDL | BDL | BDL | BDL |
| Potassium | 2.63 | 1.84 | 2.8 | 2.78 | 2.21 |
| Selenium | BDL | BDL | BDL | BDL | BDL |
| Silver | BDL | BDL | BDL | BDL | BDL |
| Sodium | 5.46 | 4.37 | 4.21 | 2.76 | 2.6 |
| Strontium | 0.0145 | 0.0162 | 0.0135 | 0.032 | 0.0128 |
| Thallium | BDL | BDL | BDL | BDL | BDL |
| Tin | BDL | BDL | BDL | BDL | BDL |
| Vanadium | BDL | BDL | BDL | BDL | BDL |
| Zinc | 0.82 | 0.633 | 0.676 | 0.241 | 0.33 |

*BDL = Below detectable limit.

Many constituents observed in surface water are naturally occurring and originate from the dissolution or erosion of rocks or sediments. In most cases, these constituents occur in relatively small concentrations and have no detrimental effects on the environment or human health. Barium, calcium, potassium, sodium, and strontium are very common in many rock types (Hem, 1985) and are common in aquatic environments. All samples collected during the project contained these constituents in relatively small concentrations.

Arsenic, nickel, and zinc also occur naturally in metamorphic and igneous rocks and are present in some waters (Hem, 1985) but are much less common than barium, calcium, potassium, sodium, and strontium. Arsenic is used in pesticides and industrial processes. Nickel and zinc are used in metallurgical processes, and zinc is used as a white pigment in paint and rubber. Detections of arsenic, nickel, and zinc were all below drinking water standards. However, when observed with other contaminants, their presence may indicate an anthropogenic source. Arsenic was detected at site 2 (0.0024 mg/L), nickel was detected at sites 1, 3, 4, 5, and 6, and zinc was detected at all sites.

Lead, usually in small concentrations, is pervasive in the environment. The sources of lead are varied and include industrial waste and atmospheric transport from regional or intercontinental sources. EPA primary drinking water standards have established a maximum contaminant level for lead at 0.015 mg/L. Lead was detected in all sampled watersheds. However, site 9 had the only concentration that exceeded the MCL (0.0177 mg/L). The source of lead in this watershed is unknown.

The secondary drinking water standard for aluminum (0.05-0.3 mg/L) was exceeded by water samples collected during the project period at sites 5-10. Site 7 had the highest concentration at 4.12 mg/L. The secondary standard for iron (0.3 mg/L) was exceeded at sites 3, 6, 7, 8, and 10. Site 7 had the highest concentration at 0.851 mg/L. The secondary standard for manganese (0.05 mg/L) was also exceeded at sites 3, 5, 6, 7, and 8. Site 5 had the highest concentration (0.0674 mg/L). Shale in the Pottsville Formation and clay in the Tuscaloosa Group have large, naturally occurring concentrations of iron, aluminum, and manganese. All monitoring sites with high concentrations of these constituents have significant amounts of shale and clay exposed and disturbed due to excavation associated with construction activities or eroded from stream banks and beds. It is probable that high concentrations of these constituents are related to construction activities and erosion in the watersheds.

## INORGANIC NONMETALLIC CONSTITUENTS

Water samples were analyzed for selected inorganic nonmetallic constituents. Tables 19 and 20 contain the concentrations of inorganic nonmetallic constituents. Although no drinking water standard currently exists for Boron, concentrations as small

as 1 mg/L may be toxic to plant life (Hem, 1985). Boron is occasionally detected in the surface waters of Alabama. Boron is naturally associated with igneous rocks and is present in active volcanic areas. In areas without a natural source, it may originate from cleaning wastes and may be present in sewage and industrial wastes (Hem, 1985). Boron was detected at all monitored sites, although concentrations were relatively small (tables 19, 20).

Chloride, fluoride, silica, and sulfate were detected at each monitored site. These constituents are common in surface water and usually originate, in the observed range of concentrations, from sediments that underlie the monitored watersheds.

Table 19.—Measured concentrations of inorganic nonmetallic constituents detected for the Tuscaloosa stormwater assessment sites 1-5

| Inorganic nonmetallic constituent (mg/L) | Monitoring site 1 | Monitoring site 2 | Monitoring site 3 | Monitoring site 4 | Monitoring sites 5 |
|---|---|---|---|---|---|
| Boron | 0.035 | 0.034 | 0.053 | 0.035 | 0.019 |
| Bromide | BDL | BDL | BDL | BDL | BDL |
| Cyanide | BDL | BDL | BDL | BDL | BDL |
| Chloride | 3.47 | 8.1 | 15.1 | 3.47 | 3.41 |
| Fluoride | 0.05 | 0.15 | 0.07 | 0.05 | 0.02 |
| Silica | 2.84 | 3.75 | 9.93 | 2.84 | 3.88 |
| Sulfate | 6.53 | 9.2 | 11.8 | 5.85 | 7.65 |

Table 20.—Measured concentrations of inorganic nonmetallic constituents detected for the Tuscaloosa stormwater assessment sites 6-10

| Inorganic nonmetallic constituent (mg/L) | Monitoring site 6 | Monitoring site 7 | Monitoring site 8 | Monitoring site 9 | Monitoring sites 10 |
|---|---|---|---|---|---|
| Boron | 0.083 | 0.073 | 0.076 | 0.046 | 0.043 |
| Bromide | BDL | BDL | BDL | BDL | BDL |
| Cyanide | BDL | BDL | BDL | BDL | BDL |
| Chloride | 3.52 | 2.29 | 1.96 | 2.61 | 1.57 |
| Fluoride | 0.09 | 0.03 | 0.07 | 0.12 | 0.05 |
| Silica | 6.26 | 11.2 | 4.58 | 3.78 | 3.62 |
| Sulfate | 5.16 | 3.89 | 2.56 | 11.4 | 2.68 |

## ORGANIC CONSTITUENTS

Organic compounds are commonly used in our society today. Frequently, these compounds appear in streams and ground-water aquifers. Many of these compounds are harmful to human health and to the health of the aquatic environment. More than 150

organic constituents and compounds were analyzed in water samples collected from sites 1-10 (comprehensive analytical monitoring sites). They include TOC (discussed previously) phenol, oil and grease, volatiles, semi-volatiles, herbicides, pesticides, and PCBs.

Phenols are used in the production of phenolic resins, germicides, herbicides, fungicides, pharmaceuticals, dyes, plastics, and explosives (USGS, 1992-96). They may occur in domestic and industrial wastewaters, natural waters, and potable water supplies. They generally are traceable to industrial effluents or landfills (Eaton and others, 1995). The EPA states that phenol should be limited to 0.3 *u*g/L (micrograms per liter) in lakes and streams to protect humans from the possible harmful effects of exposure. Phenols cause acute and chronic toxicity to freshwater aquatic life. Phenol concentrations were well above recommended levels in all monitored streams. This indicates the ubiquitous nature of this compound in urban environments (table 21, fig.19).

Table 21.—Measured concentrations of phenol for sites 1-10

| Monitoring site | Phenol *u*g/L |
|---|---|
| 1 | 20.1 |
| 2 | 26.5 |
| 3 | 11.1 |
| 4 | 23.2 |
| 5 | 24.1 |
| 6 | 10.7 |
| 7 | 8.6 |
| 8 | 8.1 |
| 9 | 7.0 |
| 10 | 5.2 |

Concentrations of oil and grease were determined for water samples collected from sites 1-10. Oil and grease includes fatty matter from animal and vegetable sources and from hydrocarbons of petroleum origin. The results of analysis primarily indicate relative contributions of contaminant runoff from automobiles in the city for each monitored watershed. The results show that sites 1, 2, 4, and 5 receive much of the contaminants contributed by automobiles in the city (table 22).

Figure 19.--Measured concentrations of phenol for sites 1-10.

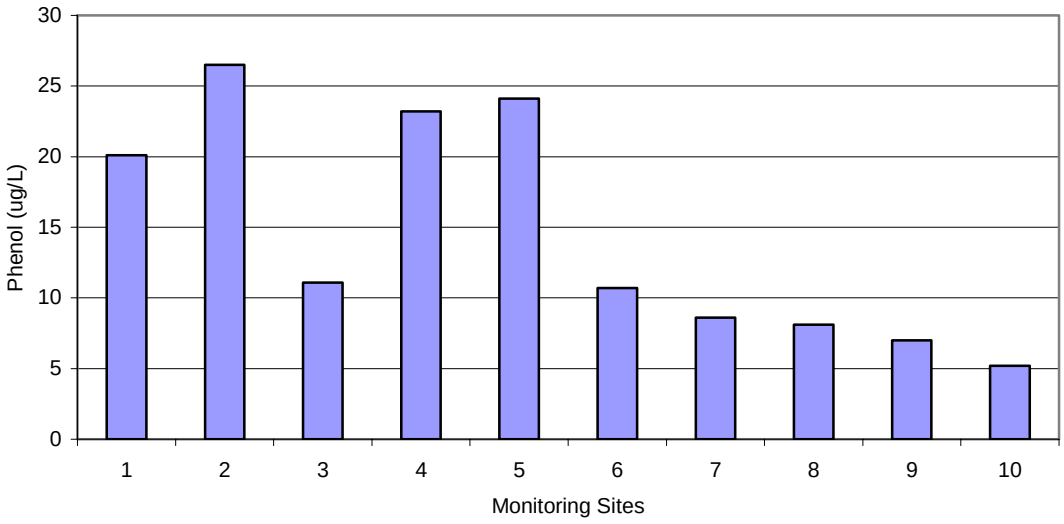



Table 22.—Measured concentrations of oil and grease for sites 1-10

| Monitoring site | Oil and grease mg/L |
|---|---|
| 1 | 2.11 |
| 2 | 4.97 |
| 3 | 0.51 |
| 4 | 1.73 |
| 5 | 3.11 |
| 6 | 0.38 |
| 7 | 0.42 |
| 8 | 0.53 |
| 9 | 0.61 |
| 10 | 0.29 |

Volatiles, semi-volatiles, herbicides, pesticides, and PCBs were analyzed for each water sample collected at the comprehensive monitoring sites. None of these compounds were detected in the samples. These analytical results are included in the appendix.

## SEDIMENTATION

Sedimentation is a process by which eroded particles of rock are transported primarily by moving water from areas of relatively high elevation to areas of relatively low elevation, where the particles are deposited. Upland sediment transport is primarily accomplished by overland flow and rill and gully development. Lowland or floodplain transport occurs in streams of varying order, where upland sediment joins sediment eroded from floodplains, stream banks, and streambeds. Erosion rates are accelerated by human activity related to agriculture, construction and urban development, timber harvesting, unimproved roadways, or any activity where soils or geologic units are exposed or disturbed. Excessive sedimentation is detrimental to water quality, destroys biological habitat, reduces storage volume of water impoundments, impedes the usability of aquatic recreational areas, and causes damage to structures. Sediment loads in streams are primarily composed of relatively small particles suspended in the water column (suspended solids) and larger particles that move on or periodically near the streambed (bedload).

Twenty monitoring sites were established throughout the City of Tuscaloosa to measure sediment loads, flow conditions, and field water-quality parameters. In addition, a limited number of bank pins were installed in Cypress and Cribbs Mill Creeks to measure stream bank erosion (fig. 20).

### Sediment Loads Transported by Project Streams

The rate of sediment transport is a complex process controlled by a number of factors including land use, precipitation runoff, erosion, stream discharge and flow velocity, stream base level, and physical properties of the stream and sediment. All of these factors influence sediment transport rates observed in the Tuscaloosa streams. Most urban areas are defined by constant, large-scale human activity involving modification of the natural environment. The City of Tuscaloosa is no exception. At any time, numerous construction projects are ongoing in the city that involve removal of natural vegetation, disturbance of soils, and construction of impervious surfaces. All of these factors contribute to the sediment loads transported by streams.

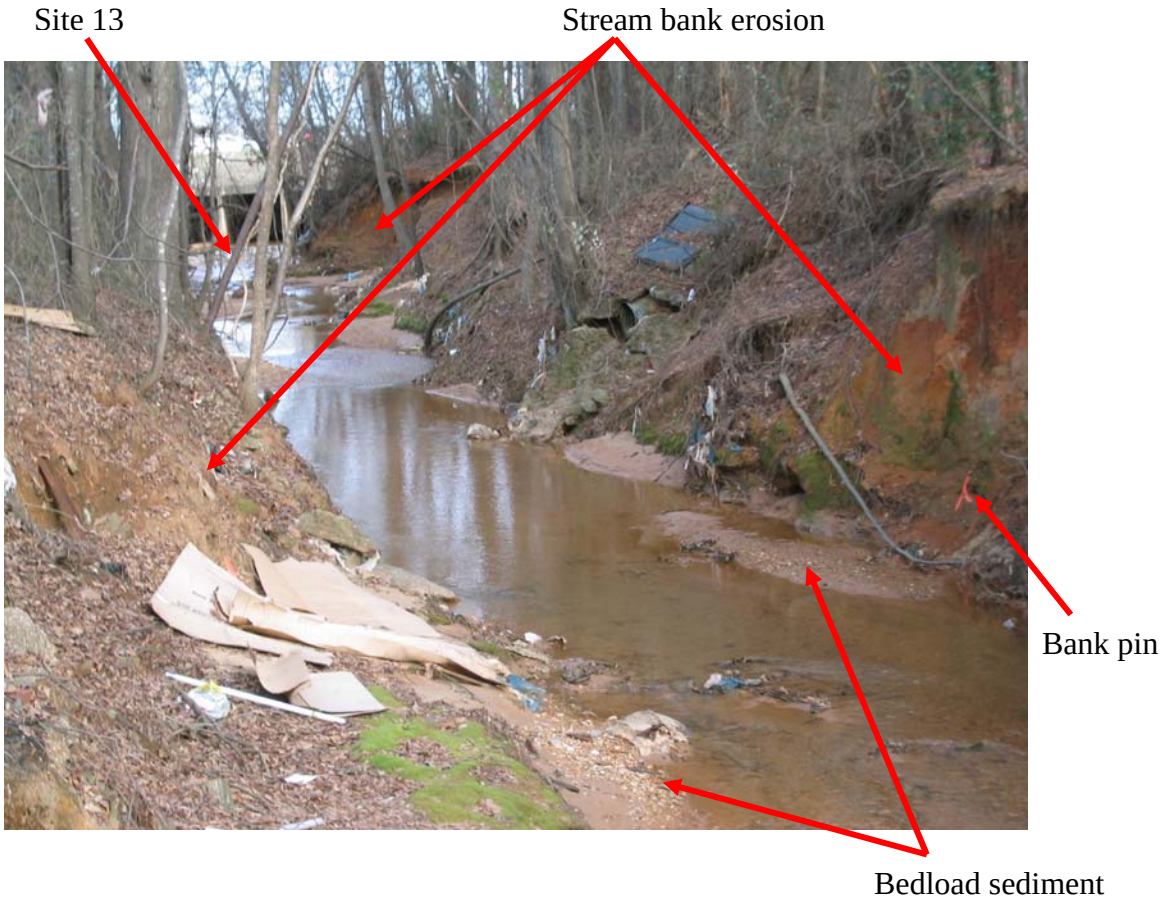



Figure 20.—Stream conditions downstream from site 13.

Sediment is supplied to streams from two primary sources. The first is from erosion of natural geologic materials that form stream channels and banks and underlie the project area. The second is from fill material transported to construction sites in the city. Due to the nature of available fill material and the character of bedload observed in project streams, it is assumed that this material is obtained locally. The Fall Line (updip limit of unconsolidated coastal plain sediments) bisects the City of Tuscaloosa (figure 21). The eastern and northern portions of the city are underlain by sandstone and shale of the upper part of the Pottsville Formation. The Pottsville may be observed in valley floors and in stream channels and floodplains. The ridges in this area consist of sand, gravel, and clay of the high terrace deposits associated with the ancestral Black Warrior River and of the Coker Formation. The southern and western portion of the city are underlain by sand, gravel, and clay of alluvial, coastal, and low terrace deposits and by the Coker Formation (Osborne and others, 1988). The Pottsville and Coker Formations

are relatively resistant to erosion. However, the increased volume and velocity of runoff related to urban storm water drainage erodes these materials and causes them to be significant sources of sediment.

Excessive sedimentation causes changes in base level elevation of streams and triggers downstream movement of the material as streams attempt to regain base level equilibrium. The movement of this material is accelerated by periodic extreme precipitation events that cause increased stream flow and stream flow velocity.

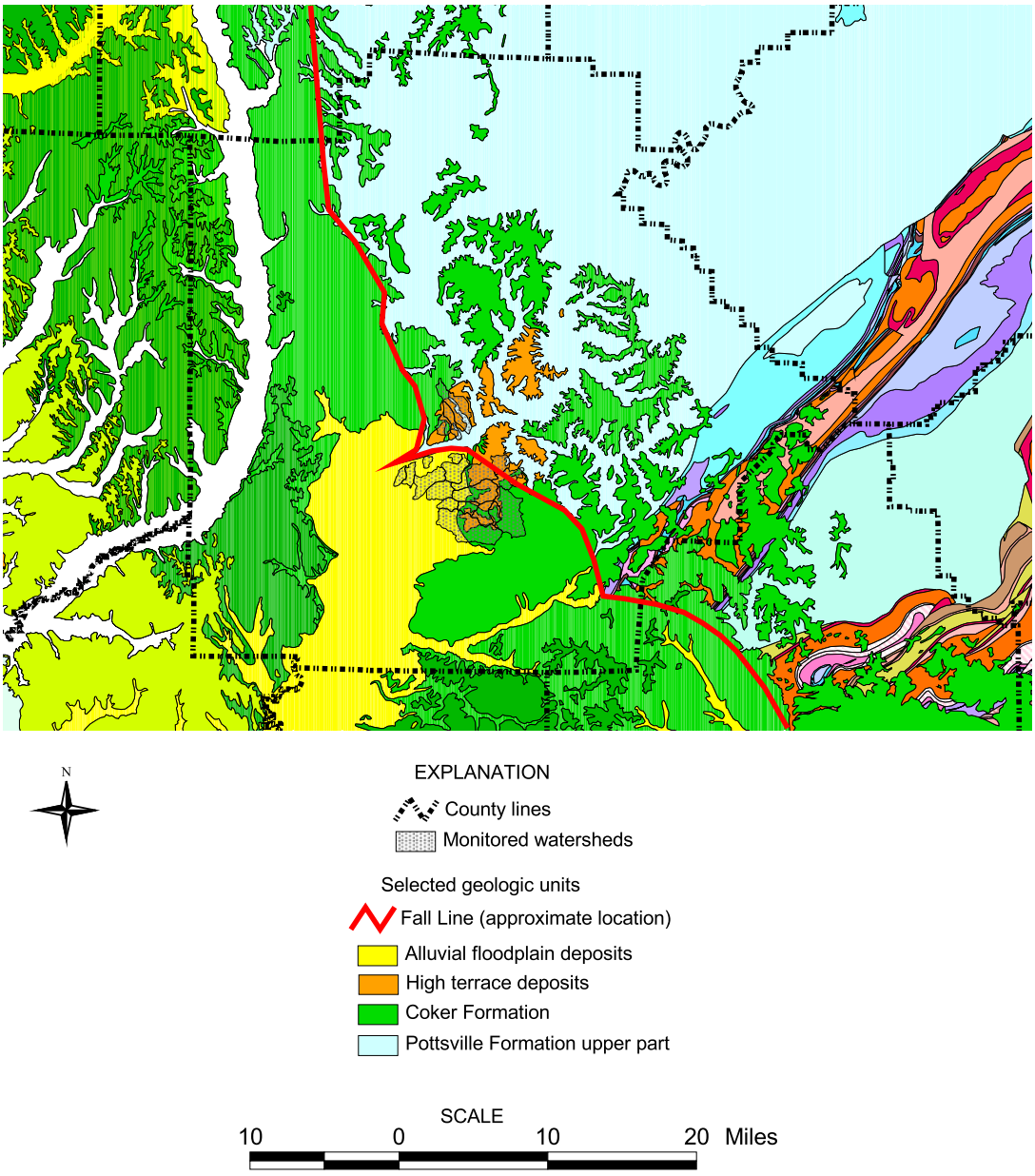



Figure 21.—Geologic map of Tuscaloosa County showing Fall Line (modified from Osborne and others, 1989).

Due to the grain size distribution of sediment in Tuscaloosa watersheds, movement of the material is controlled primarily by stream flow velocity. Large amounts of clay and silt may be suspended in the water column and transported at relatively low velocities in some streams during any discharge event greater than base flow. However, much of the bedload material in the project area consists of coarse sand and gravel eroded from unconsolidated sediments and silt, sand, and cobbles eroded from the Pottsville Formation. In order for the bedload material to be transported, a critical flow velocity threshold must be exceeded. This occurs during significant precipitation events. The duration of each pulse of bedload migration is dependent on the magnitude and duration of the discharge event. Once the streambed material is mobilized, the level of energy required to keep the material moving on the falling limb of the hydrograph is much less. Therefore, large amounts of bedload will continue to be transported even as streams approach base flow conditions. Examples of critical velocities for bedload movement in project streams are shown in figures 22 and 23.

Figure 22.--Critical stream flow velocity determined from measured velocities at site 12, Rum Creek at Highway 69.

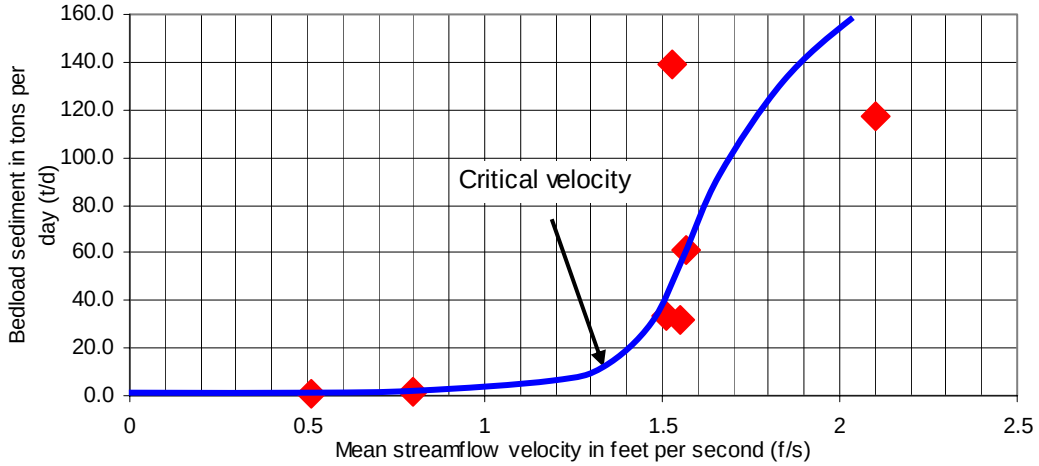
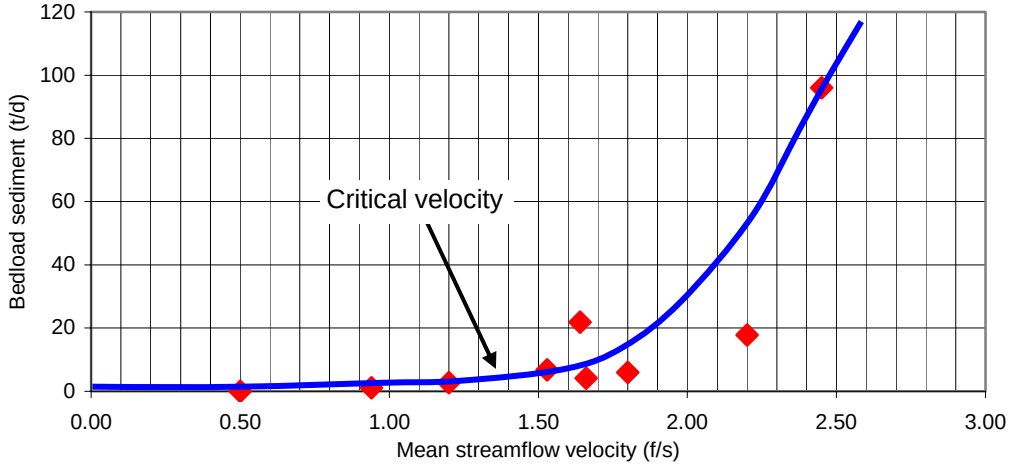


Figure 23.--Critical stream flow velocity determined from measured velocities at site 5, Cypress Creek at Highway 69.




## Stream Flow Conditions

Sediment transport conditions in watersheds in the City of Tuscaloosa are segregated by particular stream segments based on instream conditions, urban development, and current land use activities. Instream conditions in this urban environment include channel width, stream bank shape and composition, streambed composition, and stream gradient. Stream flow within the City of Tuscaloosa is characterized by modifications to stream channels to accommodate urban development and to accelerate movement of storm water runoff out of the city. All monitored streams were modified by some type of channelization including concrete flume, limestone boulder armoring, or natural geologic material. Individual streams may include two or possibly all three stream channel types.

Urban discharge is characterized by extremely high and low flows when compared to streams in rural areas. Most precipitation events cause rapid increases in discharge but most events are of relatively short duration.

Monitoring periods were chosen to collect samples and instream data from well-distributed discharge events varying from base flow to flood. Each stream was monitored at least 10 times. Examples of the distribution of monitored discharge events are given in figures 24 through 27. Summary data for stream discharge are listed in table 23.

Figure 24.--Measured discharge at site 19, unnamed tributary to the Black Warrior River at Rice Mine Road.

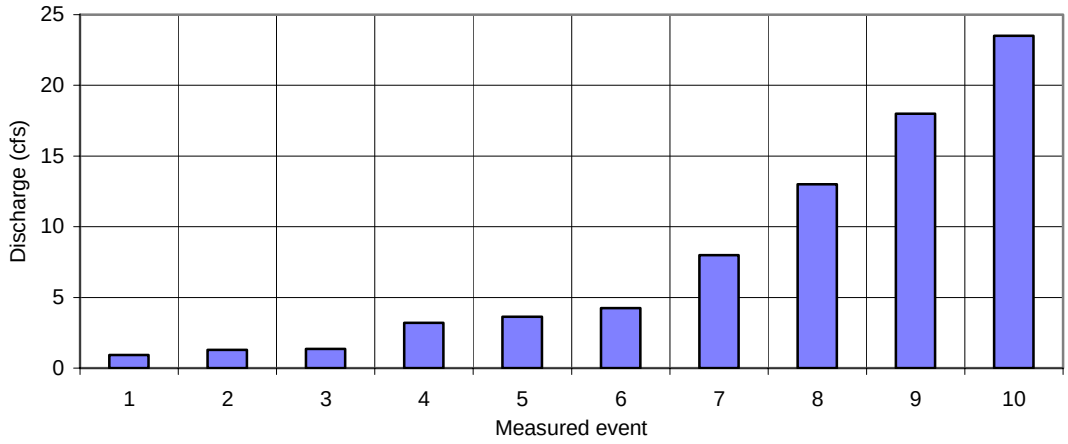



Figure 25.--Measured discharge at site 13, Cypress Creek at Highway 82.

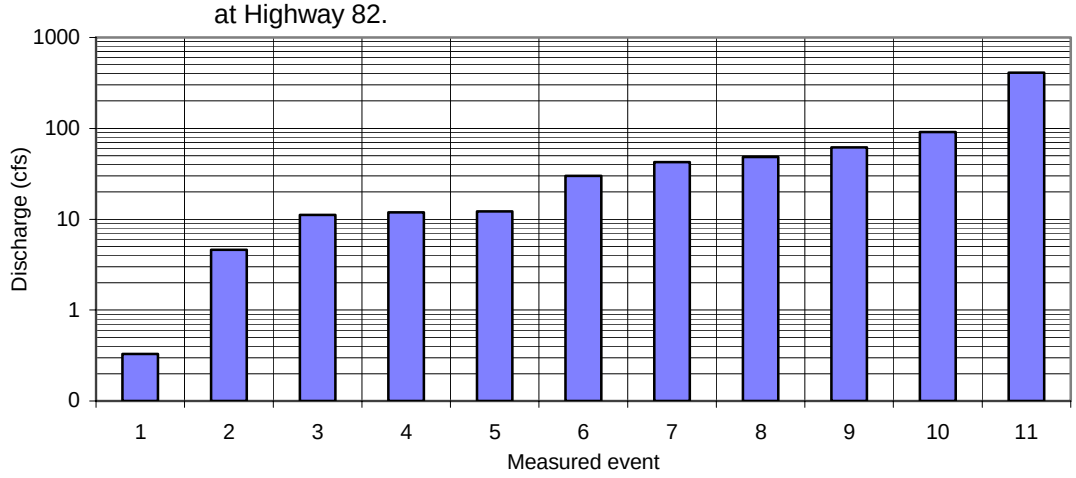



Figure 26.--Measured discharge at Site 4, Cribbs Mill Creek at Kauloosa Avenue.

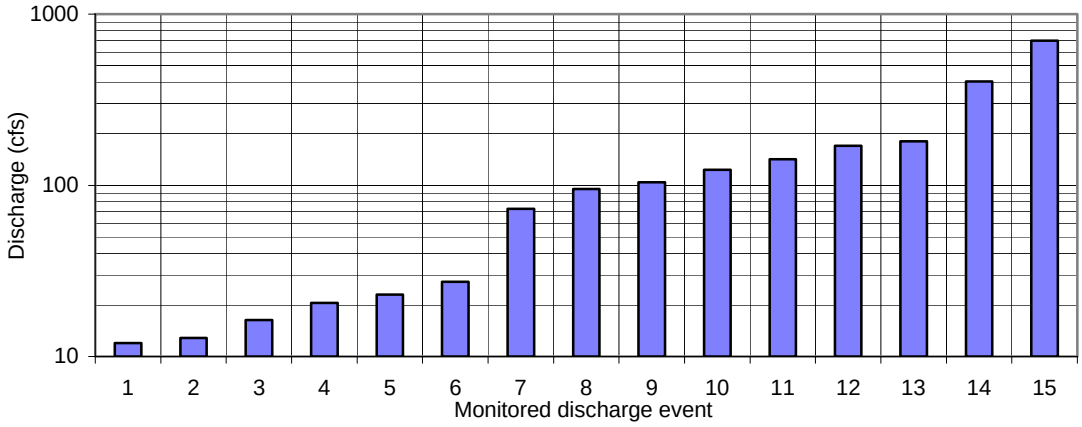


Figure 27.--Measured discharge at site 6, unnamed tributary to Cottondale Creek at JVC Road.

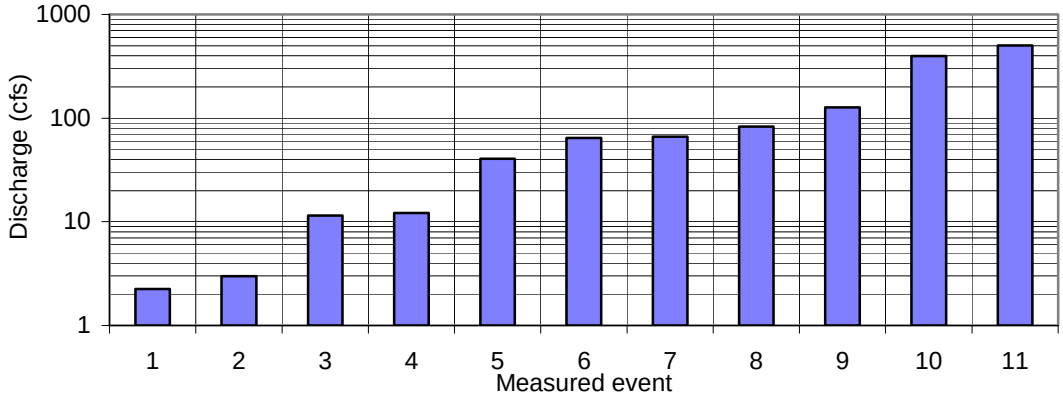



Table 23.--Summary data for stream discharge from project watersheds

| Site | Area (acres) | Measured mean stream flow velocity (f/s) | Measured mean discharge (cubic feet per second) (cfs) | Measured base flow discharge (cfs/acre) | Measured high flow discharge (cfs/acre) |
|---|---|---|---|---|---|
| 1 | 246 | 1.4 | 10.2 | 0.003 | 0.2 |
| 2 | 565 | 4.2 | 17.8 | 0.00004 | 0.1 |
| 3 | 1,421 | 0.9 | 15.6 | 0.0008 | 0.03 |
| 4 | 1,187 | 2.2 | 140.0 | 0.59 | 0.01 |
| 5 | 555 | 1.6 | 28.8 | 0.003 | 0.14 |
| 6 | 3,544 | 3.9 | 90.0 | 0.0006 | 0.14 |
| 7 | 1,126 | 1.5 | 14.3 | 0.0006 | 0.11 |
| 8 | 793 | 1.5 | 2.9 | 0.002 | 0.21 |
| 9 | 278 | 1.4 | 19.4 | 0.00004 | 0.33 |
| 10 | 650 | 1.9 | 18.5 | 0.0009 | 0.09 |
| 11 | 395 | 1.6 | 8.9 | 0.004 | 0.08 |
| 12 | 3,971 | 1.6 | 7.4 | 0.0009 | 0.03 |
| 13 | 1,187 | 1.6 | 32.0 | 0.0003 | 0.35 |
| 14 | 954 | 1.2 | 13.5 | 0.0003 | 0.04 |
| 15 | 538 | 0.9 | 6.4 | 0.001 | 0.04 |
| 16 | 2,136 | 2.3 | 36.0 | 0.0003 | 0.07 |
| 17 | 1,907 | 1.4 | 45.0 | 0.001 | 0.11 |
| 18 | 1,242 | 1.4 | 76.0 | 0.002 | 0.40 |
| 19 | 727 | 1.2 | 7.7 | 0.0007 | 0.03 |
| 20 | 2,117 | 0.8 | 25.4 | 0.0005 | 0.04 |

## Suspended Sediment

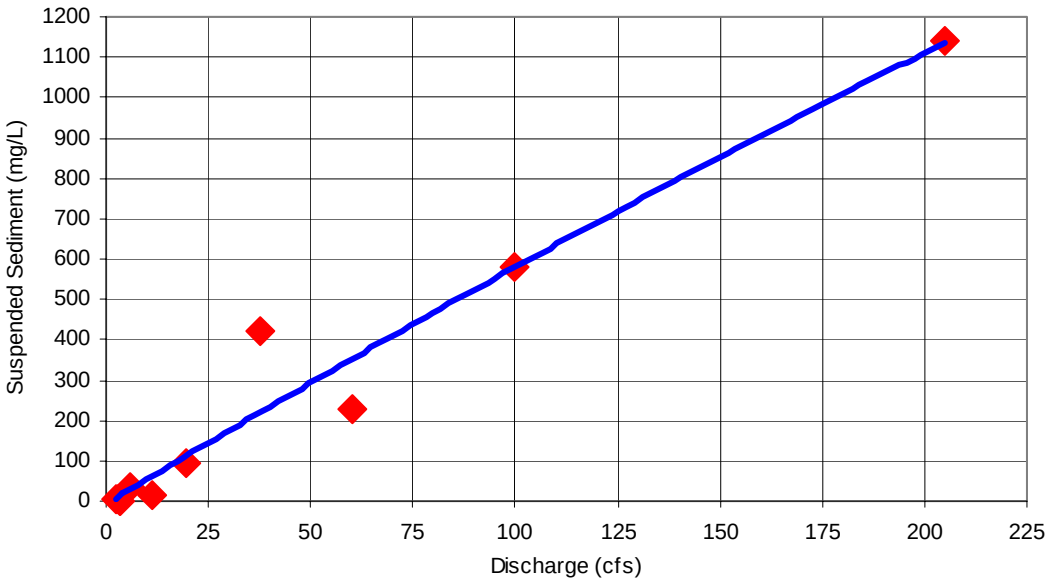
The basic concept of constituent loads in a river or stream is simple. However, the mathematics of determining a constituent load may be quite complex. The constituent load is the mass or weight of a constituent that passes a cross-section of a stream in a specific amount of time. Loads are expressed in mass units (*e.g*., tons, kilograms) and are considered for time intervals that are relative to the type of pollutant and the watershed area for which the loads are calculated. Loads are calculated from concentrations of constituents obtained from analyses of water samples and stream discharge, which is the volume of water that passes a cross-section of the river in a specific amount of time.

The computer model Regr_Cntr.xls (*Regression with Centering*) was selected to calculate suspended sediment loads for this project. The program is an Excel adaptation of the USGS seven-parameter regression model for load estimation (Cohn and others, 1992). It estimates loads in a manner very similar to that used most often by the Estimatr.exe (*USGS Estimator*) program. The Regr_Cntr.xls program was adapted by R. Peter Richards at the Water Quality Laboratory at Heidelberg College (Richards, 1999). The program establishes a regression model using a calibration set of data composed of concentrations of the constituent of interest and discharge values measured at the time of water sampling. These data are applied to mean annual daily discharge to obtain mean daily loads. The mean daily values are summed to obtain an annual load. Constituent loads can be estimated for any year for which mean daily discharge data are provided. Mean daily discharge was determined by calculating a ratio between measured discharge for each monitored site and discharge for the same time period obtained from the USGS real time discharge gauge located on Cribbs Mill Creek near Kauloosa Avenue. The ratio established for each monitored site was then applied to mean daily discharge from the USGS gauge to obtain mean daily discharge for each site.

Suspended sediment is defined as that portion of a water sample that is separated from the water by filtering. This solid material may be composed of organic and inorganic material that includes algae, industrial and municipal wastes, urban and agricultural runoff, and eroded material from geologic formations. These materials are transported to stream channels by overland flow related to storm-water runoff.

The concentrations of suspended sediment in mg/L were determined by laboratory analysis of at least ten water samples collected at each monitoring site over one year at variable stream discharge rates. Suspended sediment loads for each stream during the monitoring period were determined using measured total suspended solids (TSS) concentrations, and estimated mean daily discharge values were entered into the regression model. The relationship between discharge and TSS may be graphically represented by a regression curve that may be used to describe the movement of suspended sediment through a stream system. Figure 28 shows the linear relationship between TSS and discharge at site 17. In this case there is a unit increase in TSS per unit increase in discharge.

Figure 28-- Linear relationship between suspended sediment and stream discharge at site 17, Cribbs Mill Creek at 2nd Avenue East.




A much different system of suspended sediment movement is represented by site 10 where an exponential increase in suspended sediment transport occurs relative to increased discharge (fig. 29, 30). A third type of transport system is represented by site 8 where the rate of increase in TSS decreases as discharge rises beyond a critical threshold. This may be caused by slowing of the rate of velocity increase as the water level in the stream rises (backwater affect) or the stream is approaching its maximum suspended sediment transport capacity. A fourth type of suspended sediment transport is represented at site 11 (fig. 31). Periodically, TSS in this stream increases significantly although the

stream remains at or near base flow. Conversely, at times of increased discharge, TSS concentrations remain relatively small (less than 25 mg/L). Most likely, the suspended material is not sediment, but may be the result of upstream dumping of some type of contaminant in the stream that is concentrated during low flow and diluted during increased flow conditions.

Figure 29.--Exponential increase in suspended sediment transport relative to discharge at site 10, unnamed tributary to the Black Warrior River at Indian Hills Country Club.

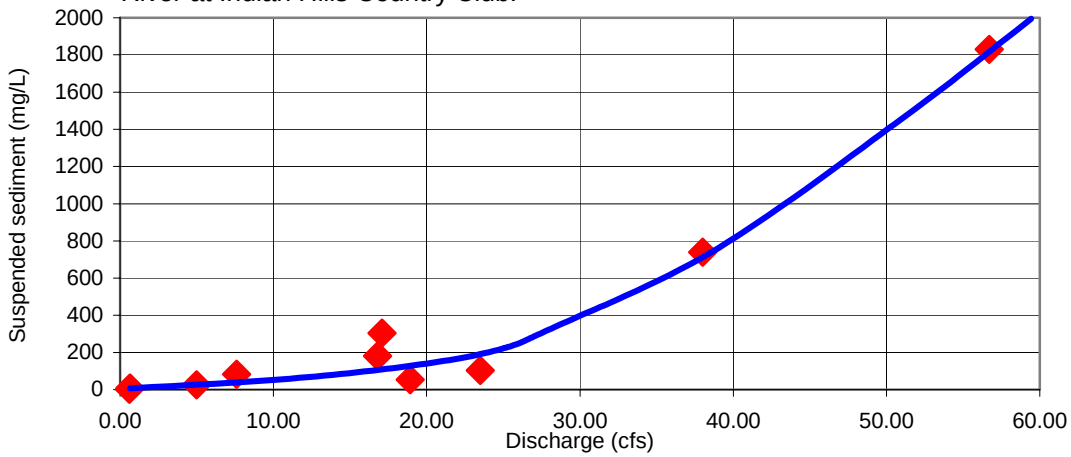



Figure 30.--Decreasing rate of suspended sediment transport relative to increasing discharge at site 8, unnamed tributary to Hurricane Creek at Summerfield Subdivision.

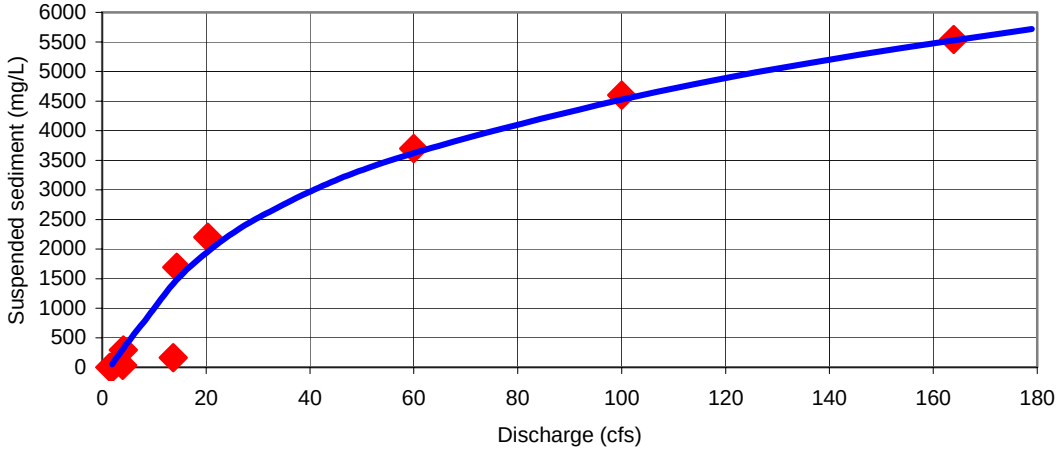
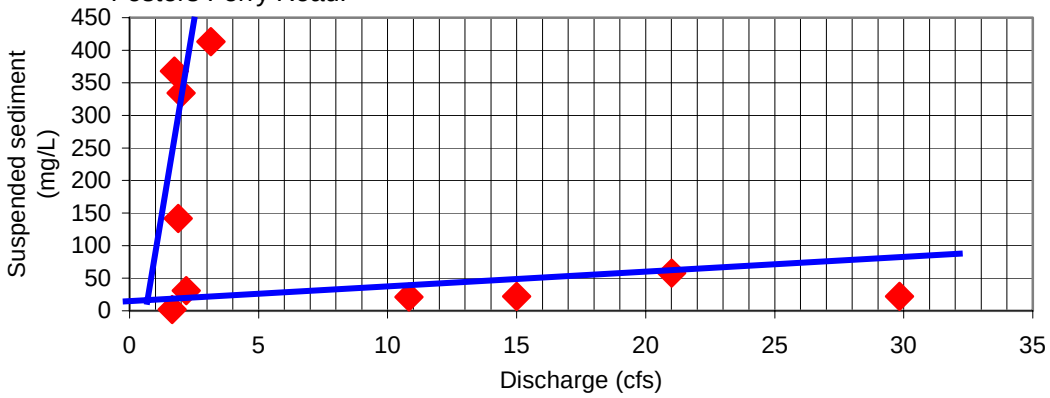


Figure 31.--Contrasting rates of suspended sediment transport relative to discharge at site 11, unnamed tributary to Moody Swamp at Fosters Ferry Road.




Suspended sediment typically composes more than 50 percent of the total sediment loads. In urban environments where stream banks and beds may be armored with concrete or limestone boulders almost all sediment will be suspended during storm events. Total sediment loads determined for nine of twenty project sites were assumed to be composed of suspended sediment. Annual suspended sediment loads are given as total load in tons per year (t/yr) and normalized load with respect to unit area ($t/mi^2/yr$). Estimated sediment load data represent land uses occurring in the watersheds at the time of sampling. The largest suspended load was estimated at Cypress Creek site 13 (18,932 t/yr). A large amount of construction occurred upstream from this site during the project period. The second largest load was estimated at site 6 (15,479 t/yr). Large amounts of residential and commercial construction, including a large excavation project, was ongoing upstream from this site. The smallest load was estimated at site 1 (60 t/yr). Site 1 includes the downtown area and has the largest amount of impervious surface and the smallest amount of construction and erosion. Normalization of the data with respect to unit watershed area indicates that Cypress Creek sites 13 and 14 have the largest suspended loads (5,737 and 4,945 $t/mi^2/yr$, respectively). Site 3 has the smallest load (56 $t/mi^2/yr$). Estimated suspended sediment loads are shown in figures 32 and 33. Loading at site 11 could not be estimated due to the absence of a single TSS trend (discussed previously in this section).

Figure 32.--Estimated annual suspended sediment loads for sites in the Tuscaloosa stormwater assessment.

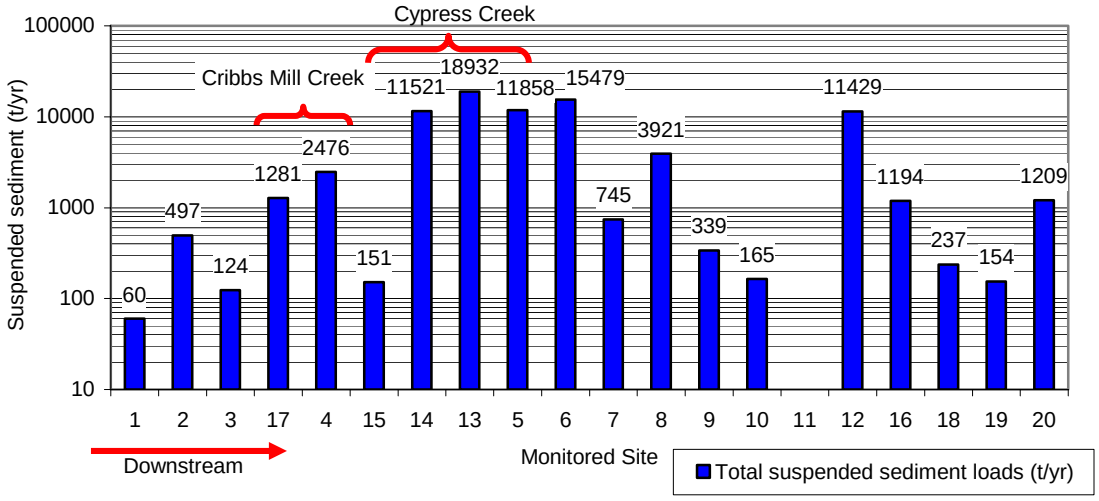
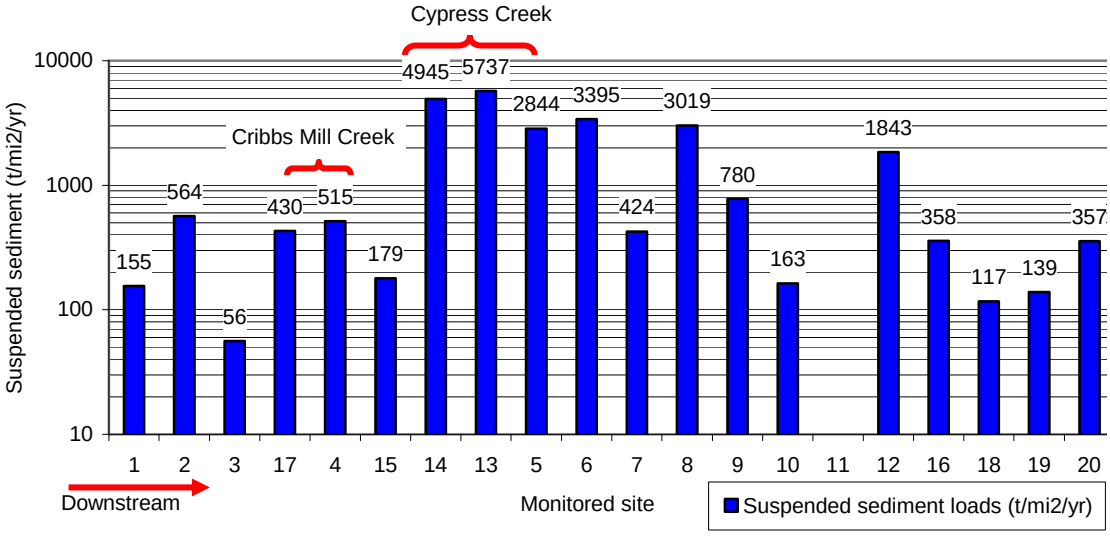



Figure 33.--Estimated normalized annual suspended sediment loads for sites in the Tuscaloosa stormwater assessment.




## Bedload Sediment

Transport of streambed material is controlled by a number of factors primarily related to stream discharge and flow velocity, erosion and sediment supply, stream base level, and physical properties of the streambed material. Most streambeds are in a state of constant flux in order to maintain a stable base level elevation. The energy of flowing water in a stream is constantly changing to supply the required power for erosion or deposition of bedload to maintain equilibrium with the local water table and regional or

global sea level. Stream base level may be affected by regional or global events including fluctuations of sea level or tectonic movement. Local factors affecting base level include fluctuations in the water table elevation, changes in the supply of sediment to the stream caused by changing precipitation rates, and /or land use practices that promote excessive erosion in the floodplain or upland areas of the watershed.

Bedload sediment is composed of particles that are too large or too dense to be carried in suspension by streamflow. These particles roll, tumble, or are periodically suspended as they move downstream. Traditionally, bedload sediment has been difficult to quantify due to deficiencies in monitoring methodology or inaccuracies of estimating volumes of sediment being transported along the streambed. This is particularly true in streams that flow at high velocity or in streams with excessive sediment loads.
Staff of the Geological Survey of Alabama developed a portable bedload sedimentation rate-monitoring device designed to accurately measure bedload sediment in shallow sand or gravel bed streams. This device was utilized in the City of Tuscaloosa project watersheds, where bedload was measured periodically during the project period to obtain a well-distributed data set with respect to stream discharge and velocity. These data were used to create a regression model to determine mean daily bedload volumes. The bedload regression was applied to mean annual daily discharge for each monitored stream. Values of mean daily bedload mass were calculated from these data. Measured bedload values utilized in the regression model and associated stream flow velocities for three sites are depicted in figures 34 through 36.

Figure 34.--Critical stream flow velocity determined from measured velocities and bedload at site 5, Cypress Creek at Highway 69.

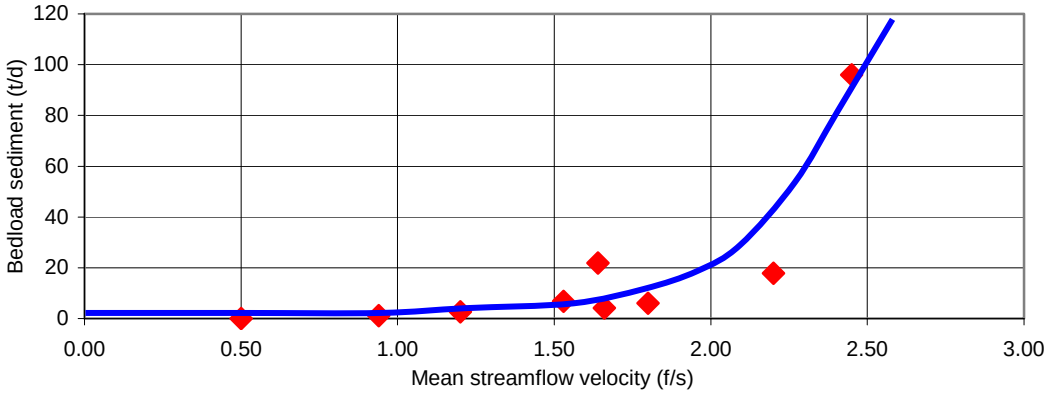



Figure 35.--Measured stream flow velocity and bedload transport rates at site 14, Cypress Creek at Cypress Creek Avenue.

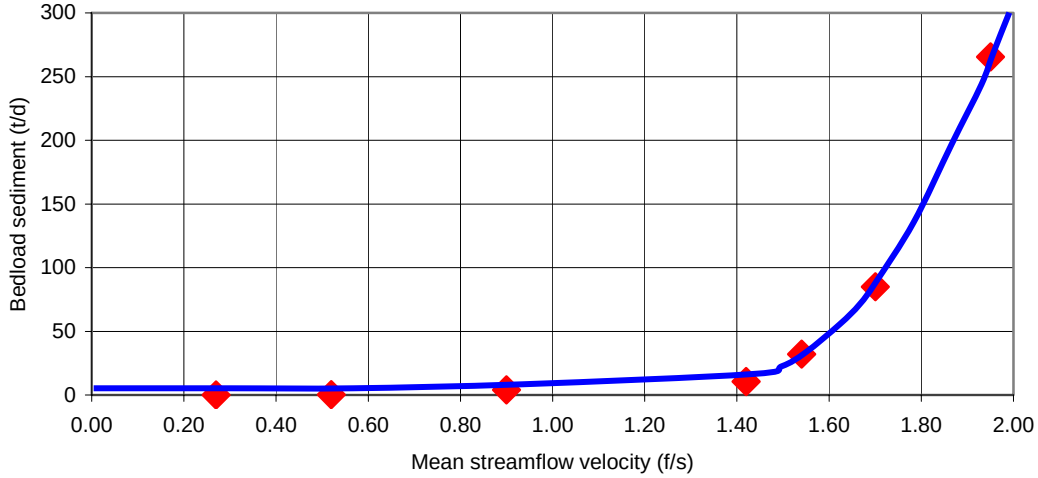
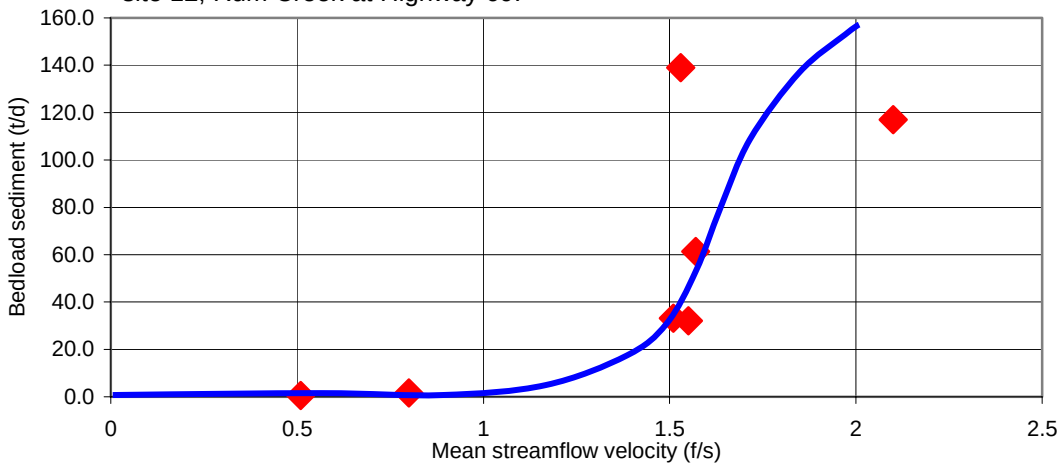
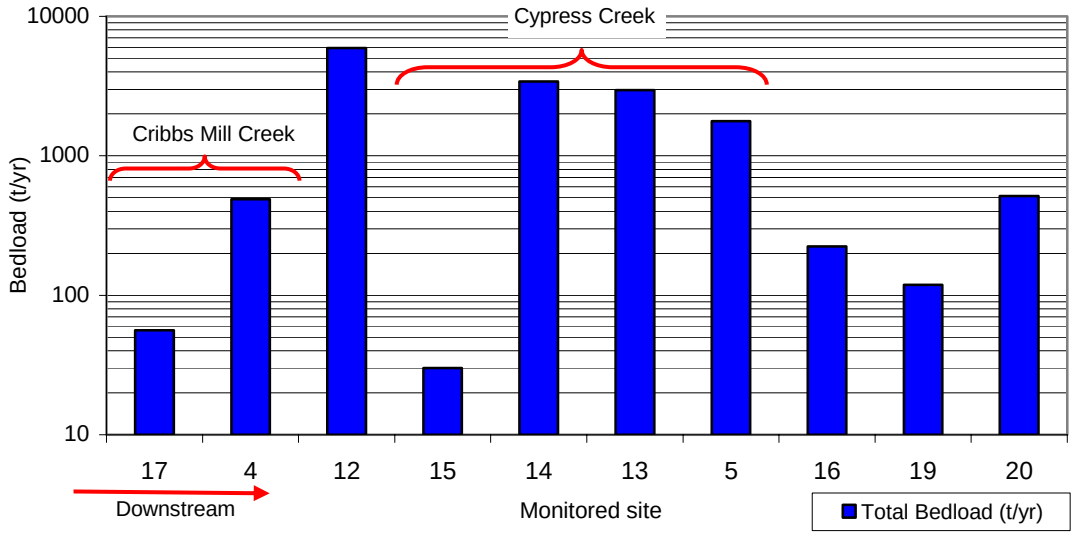



Figure 36.--Measured stream flow velocity and bedload transport rates at site 12, Rum Creek at Highway 69.



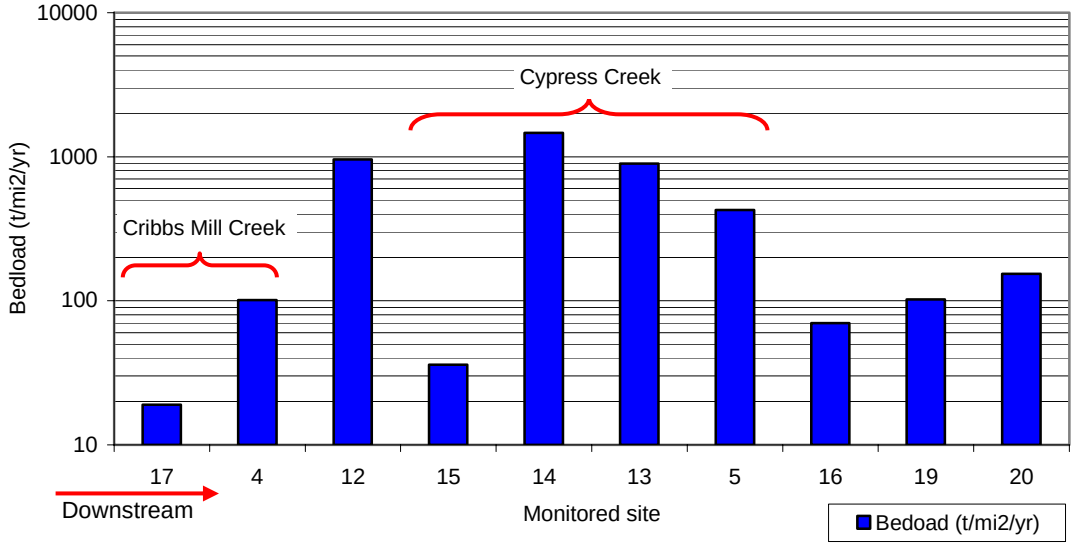
Bedload was measured at ten of the twenty projects sites. The largest bedload transport rate was estimated at 5,935 t/yr at Rum Creek, site 12. The headwaters of Rum Creek are 2.6 miles south of Tuscaloosa. The upper portion of the stream flows northwestward through residential and rural areas along Highway 82. Approximately 0.5 mile south of the city, the stream flows through an area of commercial development before its confluence with Cypress Creek near Kauloosa Avenue. The second, third, and fourth largest bedload rates were estimated for Cypress Creek sites 14 (3,410 t/yr), 13 (2,962 t/yr), and 5 (1,777 t/yr), respectively. As discussed previously, several large construction projects, ongoing during the project period, contributed large amounts of sediment to Cypress Creek. Also, severe stream bank erosion was observed along much of the creek. Bank pins were installed at numerous locations along the stream to quantify the rates of stream bank erosion. Bedload transport rates at all other sites were much less, including the largest project watershed (site 4, Cribbs Mill Creek at Kauloosa Avenue) (489 t/yr). The smallest bedload rate was estimated at Cribbs Mill Creek site 17 (56 t/yr). This upstream portion of Cribbs Mill Creek drains the southeastern portion of the city. Land use in the watershed is characterized by older residential developments and established commercial property with only minor construction or land disturbance. Figure 37 portrays the bedload transport rates for project sites.

Figure 37.-- Estimated total annual bedload transport rates for Tuscaloosa stormwater assessment sites.



Where total annual bedload transport rates indicate the mass of bedload sediment moving through a watershed or portion of a watershed, normalized (unit load per unit area, t/mi$^2$/yr) loads permit comparisons of one watershed to another irrespective of differences in area. Normalization of the bedload data for the Tuscaloosa stormwater assessment indicates that Cypress Creek site 14 had the largest bedload per square mile of drainage area (1,462 t/mi$^2$/yr). Rum Creek site 12 had the second largest load (960 t/mi$^2$/yr). Cribbs Mill Creek site 17 had the smallest load (19 t/mi$^2$/yr). Normalized loads for all sites are shown in figure 38.

Figure 38.-- Estimated normalized annual bedload transport rates for Tuscaloosa stormwater assessment sites.



## Total Sediment Loads

The total sediment load transported by a stream is composed of its suspended load and bed load. For streams with sand or gravel beds, the suspended and bed loads were estimated separately and combined. For streams with beds composed of rock or stream beds composed of concrete or limestone boulders, sediment loads are almost totally suspended. In these cases, water samples were collected near the stream bed and were assumed to contain representative volumes of the total sediment load. The suspended sediment loads determined for these sites were considered to be the total sediment loads. On average, bedload composes approximately 19 percent of the total sediment load for project sites. The largest percentage (77%) occurs at site 19 and the smallest (4%) at site 17. Suspended and bedload contributions to total sediment loads are portrayed in figures 39 and 40.

Figure 39.--Estimated suspended and bed sediment loads for Tuscaloosa stormwater assessment sites.

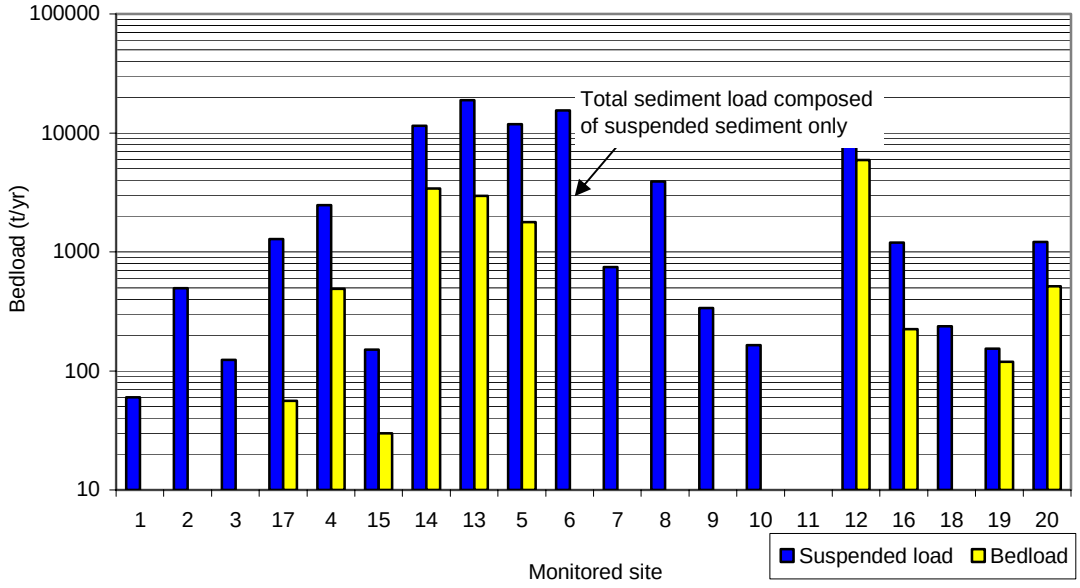
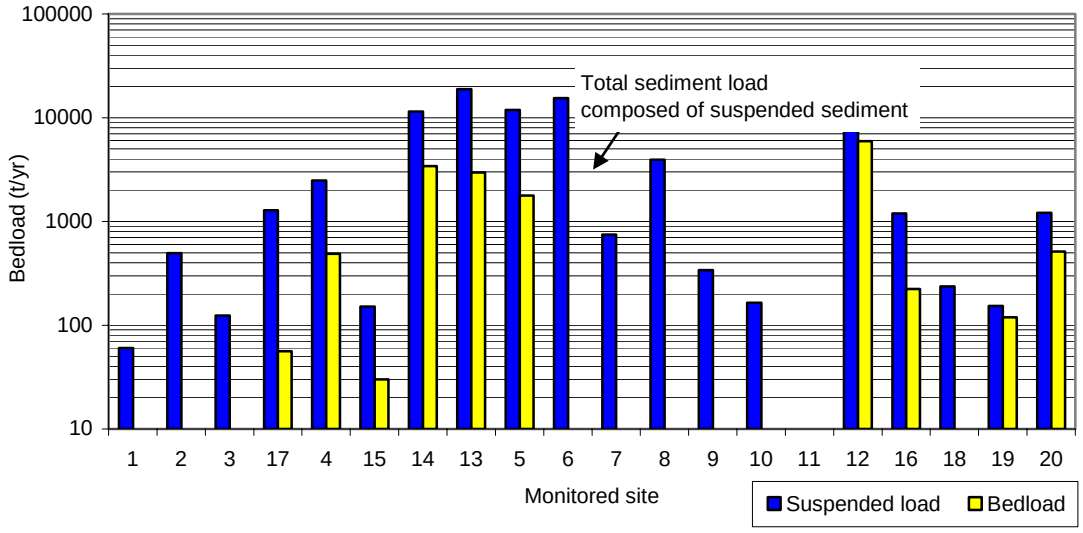


Figure 40.--Estimated normalized suspended and bed sediment loads for Tuscaloosa stormwater assessment sites.




All sediment transported by project streams is deposited in the Black Warrior River, Moody Swamp, or Hurricane Creek. Approximately 2,560 t/yr (1,580 cubic yards) are deposited directly into the Black Warrior River, 42,850 t/yr (26,450 cubic yards) are deposited into Moody Swamp, and 20,150 t/yr (12,440 cubic yards) are deposited into Hurricane Creek. Total and normalized total sediment loads are depicted in figures 41 and 42. Table 24 gives detailed statistics for total sediment loads for all project sites.

Figure 41.--Estimated total annual sediment loads for sites in the Tuscaloosa stormwater assessment.

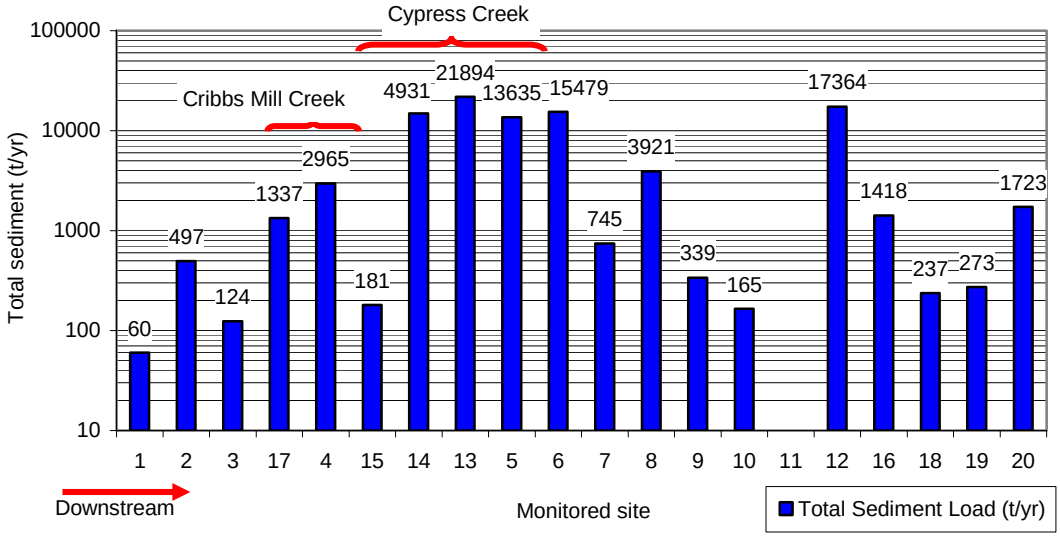


Figure 42.--Estimated normalized total annual sediment loads for sites in the Tuscaloosa stormwater assessment.

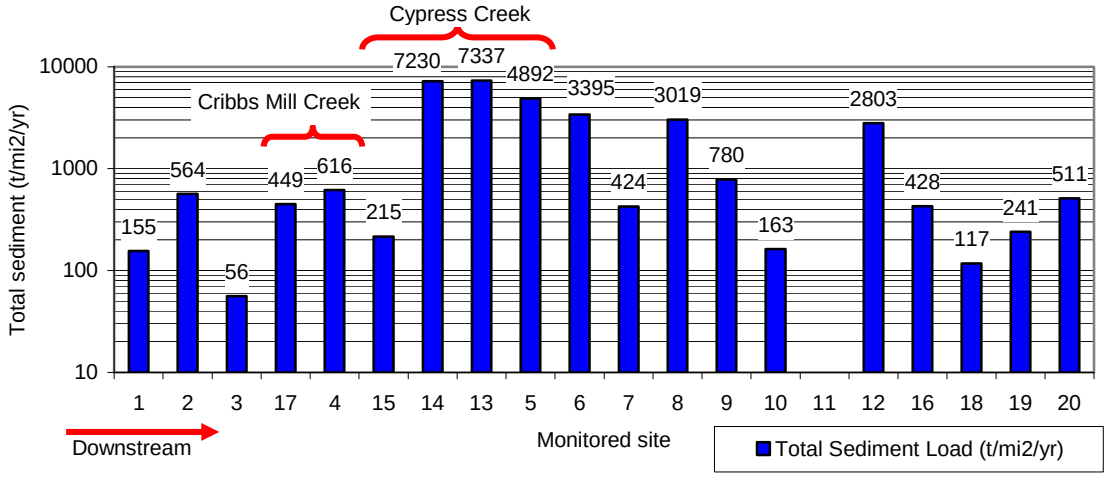


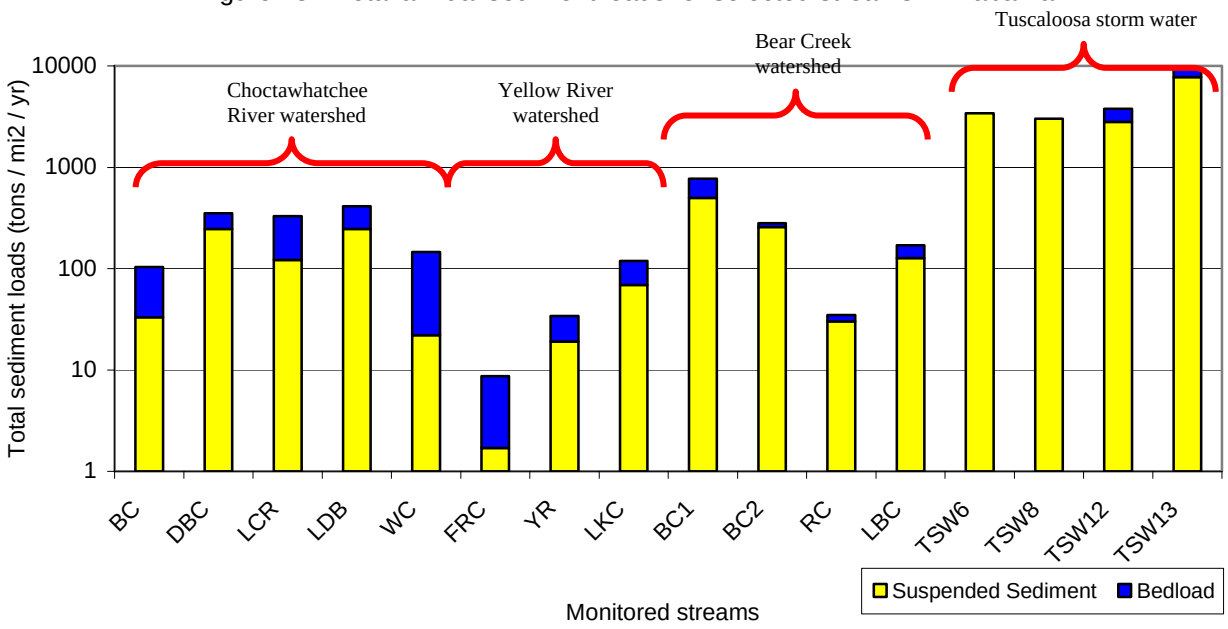

Table 24.—Summary statistical data for sediment loads estimated for the Tuscaloosa stormwater assessment

| Site | Total sediment loads | | | | |
|---|---|---|---|---|---|
| | Tons/year | Tons/mi$^2$/year | Pounds/acre/year | Cubic yards /year | Cubic yards/mi$^2$/year |
| 1 | 60 | 155 | 488 | 37 | 96 |
| 2 | 497 | 564 | 1,761 | 307 | 348 |
| 3 | 124 | 56 | 175 | 77 | 35 |
| 4 | 2,965 | 616 | 4,996 | 1,830 | 989 |
| 5 | 13,635 | 4,892 | 49,146 | 8,417 | 9,708 |
| 6 | 15,479 | 3,395 | 8,735 | 9,555 | 1,725 |
| 7 | 745 | 424 | 1,324 | 460 | 262 |
| 8 | 3,921 | 3,019 | 9,890 | 2,420 | 1,953 |
| 9 | 339 | 780 | 2,441 | 209 | 482 |
| 10 | 165 | 163 | 508 | 102 | 101 |
| 11 | No loads estimated | | | | |
| 12 | 17,364 | 2,803 | 8,746 | 10,719 | 1,728 |
| 13 | 21,894 | 7,337 | 70,535 | 13,515 | 13,933 |
| 14 | 14,931 | 7,230 | 31,302 | 9,217 | 6,182 |
| 15 | 181 | 215 | 672 | 112 | 133 |
| 16 | 1,418 | 428 | 1,328 | 875 | 262 |
| 17 | 1,337 | 449 | 1,402 | 825 | 277 |
| 18 | 237 | 117 | 383 | 146 | 76 |
| 19 | 273 | 241 | 751 | 169 | 149 |
| 20 | 1,723 | 511 | 1,628 | 1,064 | 322 |

Sediment loads have been estimated by the Geological Survey of Alabama for a number of primarily rural streams throughout Alabama. These data are presented in figure 43 along with Tuscaloosa storm water assessment sites 6, 8, 12, and 13. These data

indicate that sediment loads from the urban runoff in Tuscaloosa are significantly greater than sediment loads in other assessed streams.

Figure 43.--Total annual sediment loads for selected streams in Alabama.




## SUMMARY AND CONCLUSIONS

The City of Tuscaloosa stormwater assessment consists of comprehensive physical and chemical analyses of water quality in 10 watersheds and analyses of physical characteristics and sedimentation at 10 additional sites that receive stormwater drainage from the city. More than 225 samples were collected from the monitoring sites and more than 4,000 water water-quality parameters were measured during the project.

The primary physical parameters of concern for stormwater runoff are water temperature, DO concentrations, turbidity, sediment loads, stream discharge and stream flow velocity. Measurements in project streams indicate that water temperature and dissolved oxygen concentrations are above minimum standards during the entire year. The exception to this is periodic low DO measurements at site 3. This site is downstream from a large wetland where water movement is slow and large concentrations of organic material caused depletion of oxygen, which may be the primary cause of low DO, particularly during summer months.

Turbidity is an indication of the amount of sediment being transported by streams. Turbidities were chronically high at sites 5, 7, 9, and 13. Turbidities were high periodically at sites 4, 6, 8, 10, 11, 12, 14, 15, 16, and 20. The largest total sediment loads were estimated for Cypress Creek, the unnamed tributary to Cottondale Creek at JVC Road, the unnamed tributary to Hurricane Creek near Summerfield subdivision, and Rum Creek at Highway 69. The smallest loads were estimated for the unnamed tributary to the Black Warrior River at Jack Warner Parkway (U S Army Corps of Engineers facility), the unnamed tributary to Moody Swamp at MLK Drive, and the unnamed tributary to the Black Warrior River at Indian Hills Country Club. Common characteristics of streams with large sediment loads are large construction and or excavation projects that contribute large amounts of sediment to streams during rainfall events.

Sites 1, 2, 5, 6, 7, 8, 9, 13, 17, and 18 have high discharges that vary from 2 to 10 times higher than streams that flow through rural environments. Mean stream flow velocities vary from 0.8 to 4.2 feet per second. These streams all have some form of channel and flood-plain modification including channelization, concrete or limestone boulder channel lining, and/or large amounts of impervious surface.

The primary chemical parameters of concern for water quality are nutrients, metals, nonmetallic inorganic constituents, and organic compounds. The results of monitoring and analyses indicate that nutrients and a small number of metals and nonmetallic inorganic constituents have high concentrations in many of the project streams. Maximum nonpoint-source contaminant limits for ammonia, nitrate, and phosphorus were exceeded at site 2. The location of the watershed monitored at site 2 and amounts of nutrients measured in the stream indicate a source that may be related to industry or wastewater. Maximum limits for nitrate and phosphorus were exceeded at sites 1, 7, 8, 9, and 10. Site 1 receives most of the downtown stormwater drainage. Sites 7, 8, and 10 are downstream from large residential areas, and site 9 is downstream from the University of Alabama recreational fields. These watersheds receive large amounts of commercial fertilizer, especially during non-winter months.

A number of metallic elements were detected throughout the project area. However, most of these occur naturally in the Pottsville Formation and the Coker Formation. The secondary drinking water standard for aluminum was exceeded at sites 5-

10, but these are probably naturally occurring concentrations originating from clays eroded from natural soils or fill material. Arsenic was detected at site 2, nickel was detected at sites 1, 3, 4, 5, and 6, and zinc was detected at all sites. These metals are common in urban settings and may represent contaminants originating from a long history of industrial activities in these watersheds. Lead, usually in small concentrations, is pervasive in the environment. The sources of lead are varied and include industrial waste, and atmospheric transport from regional or intercontinental sources. Lead was detected in all sampled watersheds. However, site 9 had the only concentration that exceeded the drinking water maximum contaminant level set by USEPA. The source of lead in this watershed is unknown.

Seven inorganic nonmetallic constituents were analyzed from water samples collected at the comprehensive monitoring sites. Chloride, fluoride, silica, and sulfate were detected at each monitored site. These constituents are common in surface water and probably originate from sediments that underlie the monitored watersheds. Boron was detected at all monitored sites, although concentrations were relatively small. Boron may originate from cleaning wastes and may be present in sewage and industrial wastes.

Organic constituents and compounds including TOC, oil and grease, phenols, volatiles, semi-volatiles, herbicides, pesticides, and PCBs were analyzed in water samples collected at the comprehensive monitoring sites. Total organic carbon analysis measures the carbon content of dissolved and particulate organic matter present in water. Typical TOC values for natural waters vary from 1 to 10 mg/L. Sites 1, 2, 4, and 5 drain densely developed urban areas of the city and have TOC concentrations that vary from 12 to 24 mg/L. Phenols are common in today's environment and are used in a wide variety of products including phenolic resins, germicides, herbicides, fungicides, pharmaceuticals, dyes, plastics, and explosives. The EPA states that phenol should be limited to 0.3 mg/l in lakes and streams to protect human health from the possible harmful effects of exposure. Phenols were found in relatively large concentrations (5.2 to 26.5 mg/L) in all monitored streams. This indicates the ubiquitous nature of this compound in urban environments. The results of analysis for oil and grease primarily indicates relative contributions of contaminant runoff from automobiles in the city for each monitored watershed. The results show that sites 1, 2, 4, and 5 receive much of the

contaminants contributed by automobiles in the city. These sites receive runoff from areas with large percentages of impervious surfaces where automobile wastes are concentrated.

More than 150 volatiles, semi-volatiles, herbicides, pesticides, and PCBs were analyzed for each water sample collected at the comprehensive monitoring sites. None of these compounds were detected in the samples.

Collection of adequate amounts of comprehensive data is the first step to understanding any hydrogeochemical system. Data collected during the City of Tuscaloosa stormwater assessment answered a number of questions related to the physical and chemical character of stormwater runoff and the effects of this runoff on the urban hydrologic environment in the monitored watersheds. However, a number of watersheds were not evaluated during the project, and additional data are needed to answer questions concerning several of the monitored streams.

Streams not included in this assessment should be evaluated (more than 10 streams inside the city limits). Also, additional data should be collected to determine annual loads of ammonia, nitrate, phosphorus, and selected metals for all monitored streams. Additional bank pins should be installed for long-term monitoring of stream bank erosion in Cypress Creek, Rum Creek, Cribbs Mill Creek upstream from 2$^{nd}$ Avenue East, the unnamed tributary to Cribbs Mill Creek at 2$^{nd}$ Avenue East, and possibly other streams that have not been evaluated. The unnamed tributary to Moody Swamp at 29th Street (upstream from site 2) should be investigated to determine the source or sources of high concentrations of ammonia, nitrate, and phosphorus detected during the monitoring of site 2. The unnamed tributary to Moody Swamp at Fosters Ferry Road (upstream from site 11) should be investigated to determine the source of high concentrations of suspended solids detected during periods of low flow. Collection of an initial data set from Moody Swamp should be conducted to assess the current quality of water and to establish a base-line data set to evaluate future changes of water quality in this very important wetland.

Erosion and sedimentation are major problems in the city. Steps must be taken to enforce regulations related to control of erosion and runoff from construction sites. Runoff from impervious surfaces should be detained to the fullest extent possible to

reduce the amount of discharge in urban streams during storm events. Stream channels should be restored to their natural configuration wherever possible, and if stream restoration is not possible, unprotected stream banks should be armored to prevent stream bank erosion. This is especially critical upstream from sites 5, 6, 7, 12, 16, 17, and 20.

Excessive concentrations of nutrients appear to be a problem in many areas of the city. An educational program designed to reduce the use of commercial fertilizers should be implemented. Discussions with the University of Alabama may also be helpful.

Garbage and debris in streams in the city is a major problem. A program of education and resident involvement to clean up stream channels and flood plains is needed.

An evaluation and interpretation of existing satellite imagery is needed to determine the effects of land use on runoff and environmental quality in the city. These data will indicate patterns of development and amounts of impervious surface that may be a valuable tool for future planning and development in Tuscaloosa.

Additional evaluation of the stormwater runoff and land use in the City of Tuscaloosa is needed to develop a comprehensive understanding of this urban hydrologic system. However, it is essential that the findings from this and future scientific assessments should be utilized to develop and implement best management practices (BMPs) to improve water quality and the overall quality of the urban environment in Tuscaloosa.

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# Appendix

Analytical results for organic parameters

Construction Materials Engineering and Testing ■
Environmental Engineering and Consulting ■
Geotechnical Engineering ■
Analytical Services ■

November 29, 2004

Mr. Marlon Cook
Geological Survey of Alabama
P.O. Box 869999
Tuscaloosa, AL 35486-6999

RE: City of Tuscaloosa
Work Order Number: **041021035**

Dear Client:

TTL, Inc. received sample(s) on Thursday, October 21, 2004 for the analyses presented in the attached report.

If you should have any questions regarding these analyses, please feel free to call. The work order number shown above will assist us in accessing your data more efficiently.

Thank you for the opportunity to provide these services.

Sincerely,
TTL, Inc.

Steve Martin
Chemist

Attachments

3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

Construction Materials Engineering and Testing ■
Environmental Engineering and Consulting ■
Geotechnical Engineering ■
Analytical Services ■

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

## CASE NARRATIVE

The samples were analyzed in accordance with the following:

Method 8081 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.

Method 8151 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.

Method 8260 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.

Method 8270 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

Technology and Tradition

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

**Lab ID:** 041021035-001
**Client Sample ID:** #5
**Collection Date:** 10/19/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 10/25/2004 10:17 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 10/25/2004 10:15 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-D | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-DB | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dicamba | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dichlorprop | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dinoseb | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| MCPA | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| MCPP | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 10/25/2004 10:16 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0835

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 10/25/2004 9:10 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 16:37 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 16:37 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 16:37 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 16:37 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 16:37 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 16:37 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |



3516 Greensboro Avenue [35401] ■ Drawer 1128 [35403] ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 10/25/2004 9:10 | Analyst: VJB |
|---|---|---|---|---|---|
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 16:37 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 16:37 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 16:37 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | Analyst: VJB |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:04 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:04 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:04 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:04 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:04 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:04 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:04 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:04 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:04 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:04 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:04 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:04 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:04 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:04 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 10/31/2004 1:04 |



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**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

**Lab ID:** 041021035-002
**Client Sample ID:** #4
**Collection Date:** 10/19/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 10/25/2004 10:17 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Dieldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 10/25/2004 10:15 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-D | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-DB | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dicamba | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dichlorprop | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dinoseb | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| MCPA | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| MCPP | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 10/25/2004 10:16 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 10/28/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| | | | | | |
|---|---|---|---|---|---|
| **SEMIVOLATILE ORGANICS** | | **SW8270C** | Prep:(SW3510) | 10/25/2004 9:10 | Analyst: VJB |
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 17:26 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 17:26 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 17:26 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | Analyst: VJB |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:07 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:07 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:07 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:07 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:07 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:07 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:07 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:07 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 1:07 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:07 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:07 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:07 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:07 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 10/31/2004 1:07 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 1:07 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 1:07 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 1:07 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 10/31/2004 1:07 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

**Lab ID:** 041021035-003
**Client Sample ID:** Trip Blank
**Collection Date:** 10/19/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | Analyst: **VJB** |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 2:11 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 2:11 |
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 2:11 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 2:11 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 2:11 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 2:11 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 2:11 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 2:11 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 10/31/2004 2:11 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0835

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041021035

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 2:11 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 2:11 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 10/31/2004 2:11 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 10/31/2004 2:11 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 10/31/2004 2:11 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 10/31/2004 2:11 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0835

Construction Materials Engineering and Testing ■
Environmental Engineering and Consulting ■
Geotechnical Engineering ■
Analytical Services ■

November 29, 2004

Mr. Marlon Cook
Geological Survey of Alabama
P.O. Box 869999
Tuscaloosa, AL 35486-6999

RE: City of Tuscaloosa
Work Order Number: **041104019**

Dear Client:

TTL, Inc. received sample(s) on Thursday, November 04, 2004 for the analyses presented in the attached report.

If you should have any questions regarding these analyses, please feel free to call. The work order number shown above will assist us in accessing your data more efficiently.

Thank you for the opportunity to provide these services.

Sincerely,
TTL, Inc.

Steve Martin
Chemist

Attachments

3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

TTL
Technology and Tradition

*Construction Materials Engineering and Testing* ■
*Environmental Engineering and Consulting* ■
*Geotechnical Engineering* ■
*Analytical Services* ■

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

# CASE NARRATIVE

The samples were analyzed in accordance with the following:

Method 8081 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.

Method 8151 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.

Method 8260 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.

Method 8270 outlined in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", EPA, SW-846.



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

**Lab ID:** 041104019-001
**Client Sample ID:** #1
**Collection Date:** 11/02/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/06/2004 9:12 | | **Analyst: RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/06/2004 10:09 | | **Analyst: RBW** |
| 2,4,5-T | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-D | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-DB | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dicamba | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dichlorprop | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dinoseb | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| MCPA | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| MCPP | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/06/2004 9:11 | | **Analyst: RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 18:15 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 18:15 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 18:15 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 18:15 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 18:15 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 18:15 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

Date: 29-Nov-04

**CLIENT:** Geological Survey of Alabama **Lab Order:** 041104019
**Project:** City of Tuscaloosa

| | | | | | |
|---|---|---|---|---|---|
| **SEMIVOLATILE ORGANICS** | | **SW8270C** | Prep:(SW3510) | 11/08/2004 6:15 | Analyst: VJB |
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 18:15 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 18:15 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 18:15 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | Analyst: VJB |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 14:14 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 14:14 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 14:14 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 14:14 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 14:14 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 14:14 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 14:14 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 14:14 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 14:14 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 14:14 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 14:14 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 14:14 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 14:14 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 14:14 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 14:14 |



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Date: 29-Nov-04

**CLIENT:** Geological Survey of Alabama **Lab Order:** 041104019
**Project:** City of Tuscaloosa

**Lab ID:** 041104019-002 **Collection Date:** 11/02/2004 0:00
**Client Sample ID:** #2 **Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/06/2004 9:12 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Dieldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/06/2004 10:09 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0050 | 0.0050 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-D | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| 2,4-DB | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dicamba | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dichlorprop | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| Dinoseb | < 0.0300 | 0.0300 | mg/L | 10 | 11/18/2004 0:00 |
| MCPA | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| MCPP | < 10.00 | 10.00 | mg/L | 10 | 11/18/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/06/2004 9:11 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:03 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:03 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 19:03 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:03 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:03 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:03 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 19:03 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:03 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 19:03 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | Analyst: VJB |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 15:10 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 15:10 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 15:10 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 15:10 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 15:10 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 15:10 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 15:10 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 15:10 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 15:10 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 15:10 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 15:10 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 15:10 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 15:10 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 15:10 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 15:10 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

Date: 29-Nov-04

**CLIENT:** Geological Survey of Alabama **Lab Order:** 041104019
**Project:** City of Tuscaloosa

**Lab ID:** 041104019-003 **Collection Date:** 11/03/2004 0:00
**Client Sample ID:** #3 **Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/06/2004 9:12 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Dieldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/06/2004 10:09 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0005 | 0.0005 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0005 | 0.0005 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4-D | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4-DB | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dicamba | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dichlorprop | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dinoseb | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| MCPA | < 1.000 | 1.000 | mg/L | 1 | 11/18/2004 0:00 |
| MCPP | < 1.000 | 1.000 | mg/L | 1 | 11/18/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/06/2004 9:11 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:52 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:52 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 19:52 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:52 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:52 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 19:52 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| | | | | | |
|---|---|---|---|---|---|
| **SEMIVOLATILE ORGANICS** | | **SW8270C** | Prep:(SW3510) | 11/06/2004 6:15 | **Analyst: VJB** |
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 19:52 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 19:52 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 19:52 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | **Analyst: VJB** |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 16:06 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 16:06 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 16:06 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 16:06 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 16:06 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 16:06 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 16:06 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 16:06 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 16:06 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 16:06 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 16:06 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 16:06 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 16:06 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 16:06 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 16:06 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

**Lab ID:** 041104019-004
**Client Sample ID:** #6
**Collection Date:** 11/03/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/06/2004 9:12 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Dieldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/06/2004 10:09 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0005 | 0.0005 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0005 | 0.0005 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4-D | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4-DB | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dicamba | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dichlorprop | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dinoseb | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| MCPA | < 1.000 | 1.000 | mg/L | 1 | 11/18/2004 0:00 |
| MCPP | < 1.000 | 1.000 | mg/L | 1 | 11/18/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/06/2004 9:11 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 20:41 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 20:41 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 20:41 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 20:41 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 20:41 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 20:41 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| | | | | | |
|---|---|---|---|---|---|
| **SEMIVOLATILE ORGANICS** | | **SW8270C** | Prep:(SW3510) | 11/06/2004 6:15 | **Analyst: VJB** |
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 20:41 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 20:41 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 20:41 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | **Analyst: VJB** |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:00 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0835

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa

**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:00 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:00 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:00 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:00 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:00 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:00 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:00 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:00 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:00 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:00 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:00 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:00 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 17:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

Date: 29-Nov-04

**CLIENT:** Geological Survey of Alabama **Lab Order:** 041104019
**Project:** City of Tuscaloosa

**Lab ID:** 041104019-005 **Collection Date:** 11/03/2004 0:00
**Client Sample ID:** #7 **Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/08/2004 9:12 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/08/2004 10:09 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0005 | 0.0005 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0005 | 0.0005 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4-D | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| 2,4-DB | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dicamba | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dichlorprop | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| Dinoseb | < 0.0030 | 0.0030 | mg/L | 1 | 11/18/2004 0:00 |
| MCPA | < 1.000 | 1.000 | mg/L | 1 | 11/18/2004 0:00 |
| MCPP | < 1.000 | 1.000 | mg/L | 1 | 11/18/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/08/2004 9:11 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0835

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 21:31 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 21:31 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 21:31 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 21:31 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 21:31 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 21:31 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 21:31 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 21:31 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 21:31 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | Analyst: VJB |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:55 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:55 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:55 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:55 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:55 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:55 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:55 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:55 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 17:55 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:55 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:55 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 17:55 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 17:55 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 17:55 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 17:55 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

**Lab ID:** 041104019-006
**Client Sample ID:** #8
**Collection Date:** 11/03/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/06/2004 9:12 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Dieldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/06/2004 10:09 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0005 | 0.0005 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0005 | 0.0005 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4-D | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4-DB | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dicamba | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dichlorprop | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dinoseb | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| MCPA | < 1.000 | 1.000 | mg/L | 1 | 11/19/2004 0:00 |
| MCPP | < 1.000 | 1.000 | mg/L | 1 | 11/19/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/06/2004 9:11 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 22:20 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 22:20 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 22:20 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 22:20 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 22:20 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 22:20 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| | | | | | |
|---|---|---|---|---|---|
| **SEMIVOLATILE ORGANICS** | | **SW8270C** | Prep:(SW3510) | 11/08/2004 6:15 | **Analyst: VJB** |
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 22:20 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 22:20 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 22:20 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | **Analyst: VJB** |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 18:51 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 18:51 |



3516 Greensboro Avenue [35401] ■ Drawer 1128 [35403] ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 18:51 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 18:51 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 18:51 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 18:51 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 18:51 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 18:51 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 18:51 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 18:51 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 18:51 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 18:51 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 18:51 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 18:51 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 18:51 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

**Lab ID:** 041104019-007
**Client Sample ID:** #9
**Collection Date:** 11/03/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/06/2004 9:12 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Dieldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/08/2004 10:09 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0005 | 0.0005 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0005 | 0.0005 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4-D | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4-DB | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dicamba | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dichlorprop | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dinoseb | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| MCPA | < 1.000 | 1.000 | mg/L | 1 | 11/19/2004 0:00 |
| MCPP | < 1.000 | 1.000 | mg/L | 1 | 11/19/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/06/2004 9:11 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:09 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:09 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 23:09 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:09 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:09 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:09 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| | | | | | |
|---|---|---|---|---|---|
| **SEMIVOLATILE ORGANICS** | | **SW8270C** | Prep:(SW3510) | 11/06/2004 6:15 | **Analyst: VJB** |
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 23:09 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:09 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 23:09 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | **Analyst: VJB** |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 19:48 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 19:48 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 19:48 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 19:48 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 19:48 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 19:48 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 19:48 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 19:48 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 19:48 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 19:48 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 19:48 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 19:48 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 19:48 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 19:48 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 19:48 |



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**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

**Lab ID:** 041104019-008
**Client Sample ID:** #10
**Collection Date:** 11/03/2004 0:00
**Matrix:** Aqueous

| Analyses | Result | Limit | Units | DF | Date Analyzed |
|---|---|---|---|---|---|
| **ORGANOCHLORINE PESTICIDES** | | **SW8081A** | Prep:(SW3510B) 11/06/2004 9:12 | | Analyst: **RBW** |
| 4,4'-DDD | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDE | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| 4,4'-DDT | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Aldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| alpha-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| beta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Chlordane | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| delta-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Dieldrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan I | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan II | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endosulfan sulfate | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin aldehyde | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Endrin ketone | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| gamma-BHC | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Heptachlor epoxide | < 0.0001 | 0.0001 | mg/L | 1 | 11/11/2004 0:00 |
| Methoxychlor | < 0.0005 | 0.0005 | mg/L | 1 | 11/11/2004 0:00 |
| Toxaphene | < 0.0020 | 0.0020 | mg/L | 1 | 11/11/2004 0:00 |
| **CHLORINATED HERBICIDES** | | **SW8151A** | Prep:(SW8150B) 11/06/2004 10:09 | | Analyst: **RBW** |
| 2,4,5-T | < 0.0005 | 0.0005 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4,5-TP (Silvex) | < 0.0005 | 0.0005 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4-D | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| 2,4-DB | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dicamba | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dichlorprop | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| Dinoseb | < 0.0030 | 0.0030 | mg/L | 1 | 11/19/2004 0:00 |
| MCPA | < 1.000 | 1.000 | mg/L | 1 | 11/19/2004 0:00 |
| MCPP | < 1.000 | 1.000 | mg/L | 1 | 11/19/2004 0:00 |
| **PCBS BY METHOD 608** | | **SW8082** | Prep:(SW8082) 11/06/2004 9:11 | | Analyst: **RBW** |
| Aroclor 1016 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1221 | < 0.002 | 0.002 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1232 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1242 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1248 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1254 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |
| Aroclor 1260 | < 0.001 | 0.001 | mg/L | 1 | 11/13/2004 0:00 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| SEMIVOLATILE ORGANICS | | SW8270C | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: VJB |
|---|---|---|---|---|---|
| 1,2,4-Trichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 1,2-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 1,2-Diphenylhydrazine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:59 |
| 1,3-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 1,4-Dichlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2,4,5-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2,4,6-Trichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2,4-Dichlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2,4-Dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2,4-Dinitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:59 |
| 2,4-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2,6-Dinitrotoluene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2-Chloronaphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2-Chlorophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 2-Nitrophenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 3,3'-Dichlorobenzidine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 23:59 |
| 3,4-dimethylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 4,6-Dinitro-2-methylphenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:59 |
| 4-Bromophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 4-Chloro-3-methylphenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 4-Chlorophenyl phenyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| 4-Nitrophenol | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:59 |
| Acenaphthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Acenaphthylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Aniline | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Benz(a)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Benzidine | < 0.050 | 0.050 | mg/L | 1 | 11/17/2004 23:59 |
| Benzo(a)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Benzo(b)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Benzo(g,h,i)perylene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Benzo(k)fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Bis(2-chloroethoxy)methane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Bis(2-chloroethyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Bis(2-chloroisopropyl)ether | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Bis(2-ethylhexyl)phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Butyl benzyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Chrysene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Dibenz(a,h)anthracene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Diethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Dimethyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Di-n-butyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Di-n-octyl phthalate | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Fluoranthene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |



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**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| | | | | | |
|---|---|---|---|---|---|
| **SEMIVOLATILE ORGANICS** | | **SW8270C** | Prep:(SW3510) | 11/06/2004 6:15 | Analyst: **VJB** |
| Fluorene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Hexachlorobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Hexachlorobutadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Hexachlorocyclopentadiene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Hexachloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Indeno(1,2,3-cd)pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Isophorone | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| m,p-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Naphthalene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Nitrobenzene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| N-Nitrosodimethylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| N-Nitrosodi-n-propylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| N-Nitrosodiphenylamine | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| o-cresol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Pentachlorophenol | < 0.025 | 0.025 | mg/L | 1 | 11/17/2004 23:59 |
| Phenanthrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Phenol | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Pyrene | < 0.010 | 0.010 | mg/L | 1 | 11/17/2004 23:59 |
| Pyridine | < 0.020 | 0.020 | mg/L | 1 | 11/17/2004 23:59 |
| **VOLATILES BY GC/MS** | | **SW8260B** | Prep: | | Analyst: **VJB** |
| 1,1,1,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,1,1-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,1,2,2-Tetrachloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,1,2-Trichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,1-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,1-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,1-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2,3-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2,3-Trichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2,4-Trichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2,4-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2-Dibromo-3-chloropropane | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2-Dibromoethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2-Dichloroethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,3,5-Trimethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,3-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,3-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 1,4-Dichlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 2,2-Dichloropropane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 2-Butanone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 20:40 |
| 2-Chloroethyl vinyl ether | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 20:40 |



3516 Greensboro Avenue (35401) ■ Drawer 1128 (35403) ■ Tuscaloosa, Alabama ■ 205.345.0816 ■ Fax 205.343.0635

**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| 2-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 2-Hexanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 20:40 |
| 4-Chlorotoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 4-Isopropyltoluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| 4-Methyl-2-pentanone | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 20:40 |
| Acetone | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 20:40 |
| Acrolein | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 20:40 |
| Acrylonitrile | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 20:40 |
| Benzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Bromobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Bromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Bromodichloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Bromoform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Bromomethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 20:40 |
| Carbon disulfide | < 0.100 | 0.100 | mg/L | 1 | 11/12/2004 20:40 |
| Carbon tetrachloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Chlorobenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Chloroethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 20:40 |
| Chloroform | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Chloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| cis-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| cis-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| cis-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Dibromochloromethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Dibromomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Dichlorodifluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 20:40 |
| Ethylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Hexachlorobutadiene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Iodomethane | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Isopropylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| m,p-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Methyl Tertiary Butyl Ether | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Methylene chloride | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| n-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| n-Propylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| o-Xylene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| sec-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Styrene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| tert-Butylbenzene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Tetrachloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Toluene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| trans-1,2-Dichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| trans-1,3-Dichloropropene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| trans-1,4-Dichloro-2-butene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |



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**Date:** 29-Nov-04

**CLIENT:** Geological Survey of Alabama
**Project:** City of Tuscaloosa
**Lab Order:** 041104019

| VOLATILES BY GC/MS | | SW8260B | Prep: | | Analyst: VJB |
|---|---|---|---|---|---|
| Trichloroethene | < 0.005 | 0.005 | mg/L | 1 | 11/12/2004 20:40 |
| Trichlorofluoromethane | < 0.010 | 0.010 | mg/L | 1 | 11/12/2004 20:40 |
| Vinyl acetate | < 0.050 | 0.050 | mg/L | 1 | 11/12/2004 20:40 |
| Vinyl chloride | < 0.002 | 0.002 | mg/L | 1 | 11/12/2004 20:40 |



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