ERDC/EL TR-07-7

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Interagency Performance Evaluation Task Force (IPET)

Environmental Consequences of the Failure of the New Orleans Levee System During Hurricane Katrina

Microbiological Analysis

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Final report

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Prepared for U.S. Army Corps of Engineers
Washington, DC 20314-1000

Abstract: Multiple failures of the levee system protection for the City of New Orleans in the aftermath of Hurricane Katrina in August 2005 led to the flooding of the metropolitan area. The floodwaters and sediments contained some dissolved and entrained chemical and microbial contaminants. Subsequent pumping of floodwater from the city to the adjacent environment and the ongoing removal of sediment and sediment-coated debris are potential mechanisms to distribute these contaminants to the local environment. The recalcitrant hydrocarbon benzo[a]pyrene (BaP) was used as an indicator of hydrophobic organic contaminants and microbial and sterol indicators of fecal material to assess sources and sinks of these classes of contaminants. These data provided a basis for contaminant transport and fate models. Additionally, this report specifically focuses on the Violet Marsh area outside the levee from the Lower Ninth Ward of New Orleans and on the Chalmette area of St. Bernard Parish, looking at potential environmental impacts.

Water fecal coliform counts (colony forming units (cfu) per 100 mL of water) ranged from 100 to 490,000 (mean=21,381, standard deviation =74,541, median=2,200) in New Orleans proper, 10 to 30,000 (mean =3,308, SD=8,093, median=200) in New Orleans East, and 17 to 25,000 (mean=1,287, SD=4,381, median= 100) in St. Bernard Parish and the Lower Ninth Ward polders. The LADEQ primary contact recreational water quality criterion for fecal coliforms is 400 cfu/100 mL. Floodwater in all three polders frequently exceeded this standard, and no trend (increasing or decreasing cfu/100 mL) was evident with time as the water was pumped out. BaP levels in water (µg/L) were all non-detect except one data point at 0.42 µg/L in New Orleans proper. BaP is a hydrophobic organic contaminant that would tend to sorb to sediment particles and settle from the water standing in the city.

Comparison of the levels of indicators in the surface of sediment cores to those in the bottoms of the cores shows that Violet Marsh has had a history of fecal and BaP contamination, much presumably coming primarily from the sewage treatment plant that drains into Bayou Bienvenue. The flooding of New Orleans and the subsequent pumpout resulted in higher levels of fecal material and BaP in the surface sediments of the marsh and a wider distribution of these contaminants throughout the marsh.

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Summary

Multiple failures of the levee system protection for the City of New Orleans in the aftermath of Hurricane Katrina in August 2005 led to the flooding of the metropolitan area. The floodwaters and sediments contained some dissolved and entrained chemical and microbial contaminants. Subsequent pumping of floodwater from the city to the adjacent environment and the ongoing removal of sediment and sediment-coated debris are potential mechanisms to distribute these contaminants to the local environment. This report focuses on the analysis of several specific contaminants that, due to the frequency and levels that they were reported to be present in the flooded city and their ability to cause environmental harm, provided the opportunity to evaluate the environmental distribution of contaminants that resulted from the failure of the New Orleans levee systems.

Data on the recalcitrant hydrocarbon benzo[a]pyrene (BaP) and indicators of potentially infectious sewage waste were gathered and analyzed. First, the levels of these contaminants in three different drainage areas (polders) in the flooded city and the trends in changes in their levels were determined as the city was pumped out. The reduced data were provided to the U.S. Army Engineer Research and Development Center (ERDC) environmental modeling group for use as source terms in their corresponding analyses of the distributions and potential impacts of these contaminants of the environment surrounding New Orleans. This environmental modeling information is presented in a separate report (Dortch et al. 2006). Further analyses of the chemical contaminants are presented in a separate chemical analyses report (Bowley et al. 2006). This report also presents data on these contaminants produced from the authors' sampling and analysis of the Violet Marsh outside the levee from the Lower Ninth Ward of New Orleans and from the Chalmette area of St. Bernard Parish, and discusses potential environmental impacts.

Due to the strategy used to pump out the flooded city and the hydraulic flows resulting from this operation and the levee systems, the flooded city of New Orleans was divided into three separate drainage areas or polders: New Orleans proper, New Orleans East, and St. Bernard Parish and the Lower Ninth Ward. The unified Katrina database of the

U.S. Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LADEQ) database was used to determine the levels of fecal coliforms and BaP in the waters and sediments in each of these three polders, and changes in their levels as the city was pumped dry. Water fecal coliform counts (colony forming units (cfu) per 100 mL of water) ranged from 100 to 490,000 (mean=21,381, standard deviation=74,541, median=2,200) in New Orleans proper, 10 to 30,000 (mean=3,308, SD=8,093, median=200) in New Orleans East, and 17 to 25,000 (mean=1,287, SD=4,381, median= 100) in St. Bernard Parish and the Lower Ninth Ward polders. The LADEQ primary contact recreational water quality criterion for fecal coliforms is 400 cfu/100 mL. The floodwater in all three polders frequently exceeded this standard, and no trend (increasing or decreasing cfu/100 mL) was evident with time as the water was pumped out.

Health advisories were issued during the flood and effects were seen. Of the 10,047 New Orleans patient visits during and immediately after the flooding for which information was available to the Center for Disease Control and Prevention, the most common were due to gastrointestinal, acute respiratory, and skin infections. Analysis of the EPA/LADEQ database showed BaP levels in water (µg/L) were all non-detect except one data point at 0.42 µg/L in New Orleans proper. BaP is a hydrophobic organic contaminant that would tend to sorb to sediment particles and settle from the water standing in the city. The EPA Region 6 water quality criterion MCL for BaP is 0.20, which was exceeded by one sample. Analyses of the EPA/DEQ data resulted in medians and protective 95-percent upper confidence level values of 70,000, 33,000 and 1,700 cfu/100 mL for the environmental modelers to use as source term load values for water pumped from New Orleans proper, New Orleans East, and St. Bernard Parish and the Lower Ninth Ward polders, respectively, and non-detects for the medians and 95-percent upper confidence levels of BaP in each polder.

In order to assess the potential impacts of pumping contaminated water and sediment from the city on local ecosystems, ERDC collected sediment core samples from Violet Marsh, analyzed them for markers of infectious waste and BaP, and attempted to identify sources of these contaminants in the Lower Ninth Ward and the Chalmette area. Undisturbed sediment cores were collected from ditches draining the Murphy Oil Corporation property in Chalmette and the outfall of the New Orleans metropolitan sewage treatment plant over the levee from the Lower Ninth Ward to profile these two potential contaminant sources. Core samples were collected from both the immediate influent and immediate effluent of the pumps that could have transported contaminants from these two sources into Violet Marsh. Sediment core samples were also collected at various distances from these pumps out into Violet Marsh to determine the range of transport of these contaminants into the Marsh. Contaminants in sediments in the top of the cores were used to indicate the most recently deposited contaminants. Sediments in the bottom of the cores were used to indicate contaminants deposited before the failure of the levees.

BaP levels (µg/gm dry weight) in sediments taken from the bottoms of the sediment cores ranged from non-detectable to 11.8 (mean=1.5, SD=3.6, median=0.0). Nine of the 18 sediments from the bottom of the cores exceed the EPA sediment quality criterion (0.062 µg/gdw), and six of these 18 exceeded the LADEQ criterion (0.33). BaP levels in top sediments ranged from non-detect to 31.2 (mean=2.8, SD=7.1, median=1.1). The most recently deposited sediment exceeds the EPA criterion in 16 of the 18 sediment samples and the DEQ criterion in 14 of the 18 sediment samples. Violet Marsh apparently has had a history of BaP contamination that could have been made worse by the failure of the levees. This BaP contamination appeared to have entered Violet Marsh through Bayou Bienvenue and not through the pumps (e.g., pump #6) that would have removed water contaminated by the Murphy Oil spill.

The potential for the presence of infectious waste was indicated using two different approaches, viable indicator bacteria (total coliform, fecal coliform and fecal streptococci) and fecal sterols. Fecal streptococci exceed the detection limits in only one surface sediment sample (Murphy Oil). All the Bayou Bienvenue surface sediment samples were below the detection levels for all viable bacterial indicators measured. Total coliform and fecal coliform measurements indicated a current input of potentially infectious waste from Chalmette into Violet Marsh. None of the five surface sediment samples from Bayou Bienvenue exceeded the 40 CFR 503 Biosolids criterion of 1,000 cfu fecal coliform/gdw. All 12 of the remaining surface sediment samples from the Violet Marsh and Chalmette exceeded this 1,000-cfu fecal coliform criterion.

Fecal sterols provided an alternative means of assessing the impacts of infectious waste derived from fecal material. Coprostanol is formed from cholesterol in the human gut track and is the most abundant sterol (40-60 percent) in human feces (averaging 3,430 μg/gdw). Environmental scientists have suggested environmental quality criteria ranging from 0.1-1.0 nmole coprostanol/gdw. The sedimentary coprostanol levels measured in this study were comparable to those of other sewage-impacted wetlands. The coprostanol levels in sediments from the bottom of the cores ranged from non-detect to 61.2 nmol/gdw (mean= 16.9, SD= 23.1, median= 8.0). Fifteen of the 18 sediment samples from the bottom of the cores were greater than the most lenient criterion suggested as 1.0 nmol/dgw. Historically, the Bayou Bienvenue (sewage treatment plant) has been the major contributor of fecal material to the marsh, with the Chalmette pump stations playing a lesser role. The coprostanol levels in sediments from the tops of the cores ranged from 3.0 to 61.3 nmol/gdw (mean= 20.2, SD= 14.4, median= 20.7). All 18 sediment samples from the top of the cores were greater than that of the suggested criterion of 1.0 nmol/gdw. The coprostanol levels in the upper sediment indicated that the operating pumps may have recently contributed relatively more fecal material to the marsh.

The work presented here begins to provide an objective framework and first impression of some of the most obvious environmental consequences of the failure of the levee system around New Orleans and the subsequent pump-out operations. Although the levels of fecal coliform bacteria were frequently high above the regulatory concern level for recreational use, these levels are expected to abate with distance and time. However, fecal coliform bacteria are not a good predictor of human disease in estuarine water, and we are only beginning to understand the environmental parts of the life cycles of microbial pathogens of humans. The absence of environmental impacts shown from the fecal coliform bacteria data should not be interpreted as an absence of environmental impact. This report shows that Violet Marsh has had a history of fecal and BaP contamination, much presumably coming primarily from the sewage treatment plant that drains into Bayou Bienvenue. The flooding of New Orleans and the subsequent pump-out resulted in higher levels of fecal material and BaP in the surface sediments of the marsh and a wider distribution of these contaminants throughout the marsh. While the data supported these general conclusions, time and financial constraints required the authors to make major assumptions, precluded sufficient replicate analyses, and minimized the number of Violet Marsh locations sampled and the number of different analyses performed on each sample. Inclusion of analyses of recalcitrant hydrophobic compounds in addition to BaP would enable more accurate sediment source tracking. Additional analyses are required to remove the uncertainty due to assumptions made and the minimal statistical design of the Violet Marsh survey, and to better quantify these impacts.

Preface

This report provides an analysis of pathogen indicator data collected in New Orleans and vicinity by various government agencies before, during, and after Hurricanes Katrina and Rita. It also presents and interprets data collected by the U.S. Army Engineer Research and Development Center's Environmental Laboratory (ERDC-EL) on chemical and microbiological impacts to Violet Marsh as a result of the dewatering of New Orleans. These studies were designed to help understand the environmental consequences of the flooding and subsequent dewatering of New Orleans.

This study was conducted as part of the Interagency Performance Evaluation Task Force (IPET) performance evaluation of the New Orleans and Southeast Louisiana hurricane protection system. This study fell under Task 9, Consequences Analysis, which dealt with environmental, economic, human health and safety, social, cultural, and historic consequences of the event. The U.S. Army Corps of Engineers was responsible for executing the IPET, and the Corps' Institute for Water Resources (IWR) was responsible for Task 9. The study was funded by IWR.

This study was conducted by Dr. Herbert Fredrickson of the Environmental Processes Branch (EPB), Environmental Processes and Engineering Division (EPED), ERDC-EL. The work was conducted under the general supervision of Dr. Terry Sobecki, Chief, EPB; Dr. Richard E. Price, Chief, EPED; and Dr. Beth Fleming, Director, EL. Dr. Barbara Kleiss of the Wetlands and Coastal Ecology Branch, Ecosystem Evaluation and Engineering Division, EL, was the ERDC point of contact for the environmental consequences work of IPET Task 9. This report was prepared by Dr. Herbert Fredrickson, Mr. John Furey, and Mr. Chris Foote. The report was reviewed by Dr. Terry Sobecki.

COL Richard B. Jenkins was Commander and Executive Director of ERDC. Dr. James R. Houston was Director.

1 Introduction

IPET relevance

During the period when New Orleans was flooded and during the period when the floodwaters were being pumped out, the U.S. Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LADEQ) collected hundreds of samples of water and sediment and analyzed these samples for a long list of potential contaminants. The flooded area under consideration is the urbanized area on the east side of the Mississippi River, seen north of the river in Figure 1.

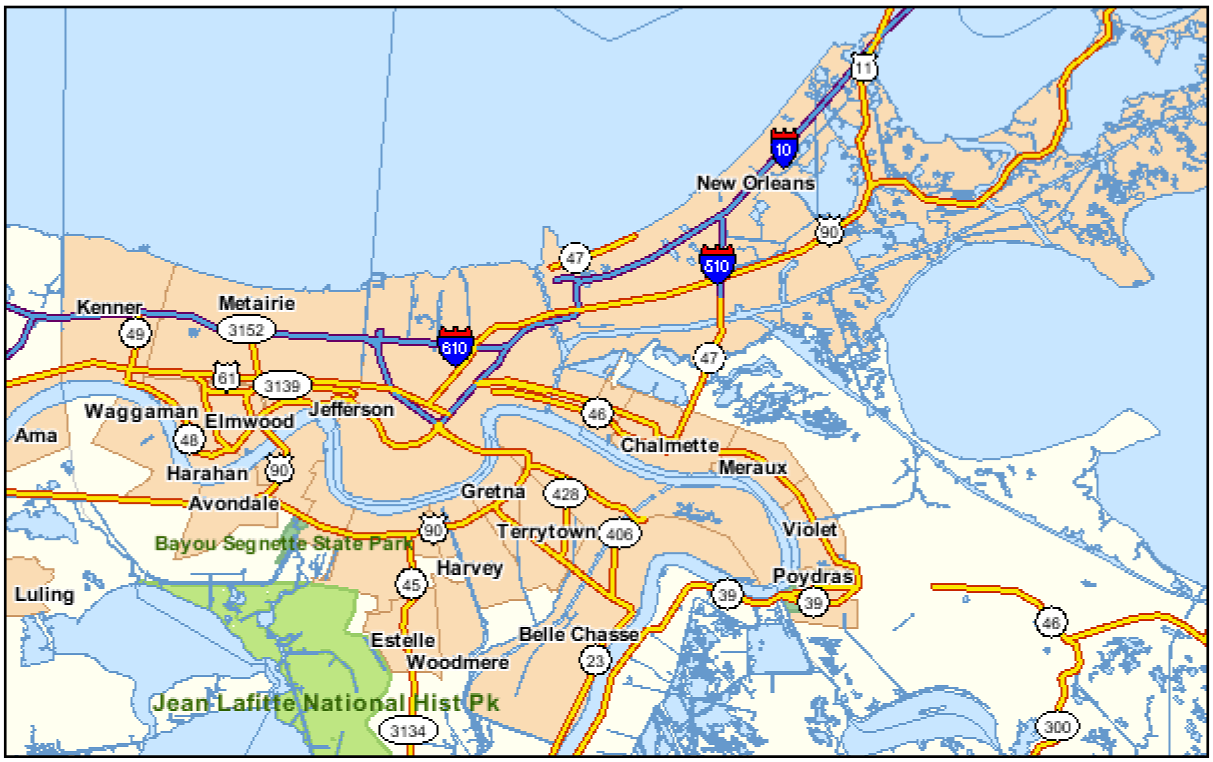

Figure 1. Map showing the New Orleans area.

Of all the water quality parameters measured, only a few stood out as a cause for concern for people coming into contact with water and sediment in the city, or to areas receiving the water as it was pumped out of the city. Elevated levels of bacterial indicators of pathogens derived from sewage were well above the concern levels in many areas of the city, which resulted in special warnings from the EPA that were posted on EPA's Katrina website. Petroleum hydrocarbons were also frequently detected.

Benzo[a]pyrene (BaP) is a particularly mutagenic polycyclic hydrocarbon (PAH) that was frequently detected in these samples. A major oil spill occurred at the Murphy Oil Corporation in Chalmette when a storage tank slid from its foundation during the flood.

To address the charge of determining the environmental effects of the failure of the New Orleans levee system, the authors focused on several indicators of infectious waste derived from sewage and BaP. These contaminants were chosen because 1) they were frequently detected above regulatory concern levels in flooded New Orleans; 2) some of these analytes were targeted by EPA and LADEQ in their water and sediment analyses so the data coverage with respect to space (inner regions, near regions and far regions) and time (pre-Katrina and after Katrina) were some of the best available; 3) some of the analytes retain fingerprint-type identifying information on sources and processes; and 4) they are contaminants that affect both human and environmental health.

Scope and structure of report

The microbiology portion of the IPET Task 9 Consequences Assessment was included in the Section 3.4 Environmental Subtask. Indicators of changes and levels of selected pathogens and other contaminants in sediment were identified. Existing data were consolidated. Suggested values and statistics were provided to environmental modelers, and corroborative data were collected to help determine the potential for impacts indicated by microbiological considerations in the environmental consequences of levee failure.

The most urbanized portions of the metropolitan area of New Orleans are protected within the innermost confines of a complex system of levees. As indicated in Figure 2, the levees radiating from the turning basin in the Inner Harbor Navigation Canal (IHNC) provided a consistent basis to consider the urbanized portions divided into three main polders. This inner ecosystem has historically high levels of urban soil contamination, including metals and PAHs (Mielke et al. 2004). New Orleans proper is considered to be that portion of Orleans Parish west of the IHNC, while New Orleans East is the urbanized area of Orleans Parish east of the IHNC and north of the Intracoastal Waterway leading to the Mississippi River Gulf Outlet (MRGO). The urbanized areas east of the IHNC and south of the Intracoastal Waterway are primarily the Lower Ninth Ward of Orleans Parish and the Chalmette area of St. Bernard Parish. Many of the normal pumps that operate to drain the New Orleans area failed due to the effects of Katrina and the aftermath. The normal operating pumps and the emergency pumps that pumped out flooded New Orleans proper and New Orleans East drain into Lake Pontchartrain. This nearby ecosystem was impacted as discussed in the environmental modeling report (Dortch et al. 2006).

Figure 2. Map illustrating the drainage areas.

Only Pump Stations #3 and #6 operated in the aftermath to drain the flood from the Lower Ninth Ward and Chalmette polder, pumping over the levee into the marsh beyond. Bayou Bienvenue winds through the marsh from the north near the municipal sewage treatment plant. The marshy area east of the levee and west of the MRGO is often accessed primarily by the Violet Canal to the south, and is referred to uniformly as the Violet Marsh in this report. This nearby ecosystem was impacted as discussed in the environmental modeling report (Dortch et al. 2006).

Several further outlying areas, including the Mississippi Sound and the Mississippi River Delta, are likely to have environmental impacts from the levee failures that are more dilute than the nearby ecosystems. These more remote ecosystems are not modeled in this report, and samples were not collected from the remote areas.

Conditions to be considered by task

The Task 9 Consequences Assessment Team envisioned three conditions: pre-Katrina conditions, actual Katrina conditions with levee failure, and hypothetical Katrina conditions without levee failure. However, this subtask only has data to analyze from pre-Katrina conditions and actual Katrina conditions. Modeling may predict some of the hypothetical conditions without levee failure.

Regarding the pre-Katrina conditions, the soil of the inner ecosystems has been well studied, particularly in a series of studies by Prof. Howard Mielke of Tulane University. The surface waters in the inner ecosystems have been less reported, although the measured concentrations in the Katrina storm water pump-out were reported to be similar to normal rainfall pump-out (Pardue et al. 2005). The Lake Pontchartrain Basin Foundation provided historical water quality data to validate the environmental modeling that established pre-Katrina conditions in Lake Pontchartrain (Lake Pontchartrain Basin Foundation 2006). There was a lack of corresponding published data from Violet Marsh. The sediment data collected for this report were intended to provide a partial remedy for that void. The topmost portion of the collected sediment cores was expected to be the most recently deposited. Sediments in the bottom of the cores were used to indicate levels of contaminants that may have been historically deposited before the failure of the levees. However, to this point the collection and analyses of these sediments have been limited by constraints in funding and reporting time. The data interpretations in this report serve mainly to develop hypotheses which, when warranted, should be tested with more detailed studies using appropriate experimental and statistical designs.

Bacterial indicators of infectious wastes

Prior to 1986 EPA recommended the use of fecal coliform as a water quality indicator to help prevent bathers from contracting gastrointestinal illness from recreational waters. These bacteria often did not cause illness directly, but demonstrated characteristics that made them useful as indicators of the presence of microorganisms that did cause these illnesses. In 1986 EPA published “Ambient Water Quality Criteria for Bacteria” where they revised their recommendations of indicator bacteria. In this document EPA recommended the use of *Escherichia coil* as an indicator in fresh water and enterococci for both fresh and marine recreational waters.

These revisions were based on epidemiological studies conducted by EPA, which evaluated the use of several indicator microorganisms. Accidental ingestion of recreational water was the most prevalent exposure pathway. The most common bacterial infections contracted in this way included cholera, salmonellosis, shigellosis, and gastroenteritis. Common viral infections included infectious hepatitis, gastroenteritis, and intestinal disease caused by enterovirus. Protozoan infections included cryptosporidiosis, amoebic dysentery, and giardiasis.

Many federal, state, local and tribal organizations were slow to adopt EPA's 1986 guidance so in 2002 EPA published "Implementation Guidance for Ambient Water Quality Criteria for Bacteria" (USEPA 2002) to assist these organizations in implementing the 1986 recommendations. The amendment to the Clean Water Act known as the Beaches Environment Assessment and Coastal Health (BEACH) Act required coastal and Great Lakes states to have adopted EPA-recommended water quality criteria by April 2004. The National Academy of Science's National Research Council (NRC 2004) recommended that the current use of indicator microorganisms be supplemented with the use of a tool box of microbiological, molecular biology and analytical chemistry techniques to better enable the protection of public health as mandated by the Clean Water Act and the Safe Drinking Water Act. Regulatory criteria are expected to transition from earlier indicator-based measurement to more direct and defensible criteria. This shift is reflected in the EPA document "Standardized Analytical Methods for use During Homeland Security Events" (USEPA 2004a) where microbial indicators are used in the early stages (triage and screening) of a response, and methods that can provide more quantitative information with respect to microbial risk assessment (International Life Science Institute (ILSI) 2000) are to be used in the determination stage of the response.

Use of fecal sterols as indicators

In many circumstances microbial indicators are not suitable for determining fecal pollution. The use of fecal coliform as indicators in tropical waters was shown to be particularly problematic because some indicators may grow in such waters (Isobe et al. 2004). Studies of runoff from New Orleans into Lake Pontchartrain have shown that many indicator bacteria are associated with particles in the water column and quickly settle to the sediment where resuspension of the shallow waters serves as a secondary source (Jin et al. 2004). Logistical constraints are imposed by the fact that samples cannot be stored for long periods of time before culture and analysis. Live bacterial indicators do not persist over long periods of time in the environment so it is not possible to reconstruct historic records of previous impact using this approach. Because humans as well as many animals produce fecal bacterial markers and contribute them to the environment, it can be difficult to distinguish different sources of environmental fecal contamination using these markers.

Biochemical markers such as fecal sterols offer important advantages in selected applications. The average human excretes 0.2–1.0 g coprostanol per day (Walker et al. 1982). Coprostanol comprises 4–60 percent of excreted fecal sterols and averages 3.43 mg/gram dry weight of feces (Nichols et al. 1996). Coprostanol is produced from the hydrogenation of cholesterol by bacteria in the digestive system (Eneroth et al. 1964, Murtaugh and Bunch 1967). In aerobic water columns coprostanol is microbially degraded and half-lives of <10 days at 20^{o} C have been reported (Isobe et al. 2004). However, coprostanol, like other fecal sterols, is hydrophobic and associated with particulate matter in sewage and water columns (Takada et al. 1994). Coprostanol is readily incorporated into bottom sediments, where it has been shown to persist under anaerobic conditions without significant degradation for over 450 days at 15^{o} C (Nishimura and Koyama 1983). Coprostanol can serve as a useful biochemical marker for determining current and long-term inputs of fecal matter to aquatic systems (Arscott et al. 2004). Based on surveys of rivers in the United States and Canada, environmental scientists have recommended three different environmental quality criteria for coprostanol; 40 ppb (1.0 nmol/gdw, Kirchmer 1971); 20 ppb (0.52 nmol/gdw, Murtaugh and Bunch 1967); and 0.5 ppb (0.13 nmol/gdw, Dutka et al. 1974).

The same GC/MS analysis used to determine levels of coprostanol can produce data on other fecal sterols and non-fecal sterols. The resulting sterol profile can provide additional useful information on the nature of the fecal pollution (Nichols et al. 1996). Ratios of coprostanol to cholesterol that are greater than one have been used as an indicator of fecal contamination in aquatic systems. Figure 3 illustrates the formation processes and transformations of several fecal sterols. The formation of epicoprostanol is favored in sewage treatment plants and the ratio of epicoprostanol to coprostanol has been suggested for use as an indicator of input of treated sewage relative to untreated sewage. Although coprostanol is directly formed in the human gut by the bacterial reduction of cholesterol, it can also be formed under environmental conditions in a multi-step process where cholestenone is an intermediate. The 5β/(5β+5α) cholestan-3-one ratio has been recommended for use in highly productive aquatic systems with relatively low levels of coprostanol (Grimalt et al. 1990).

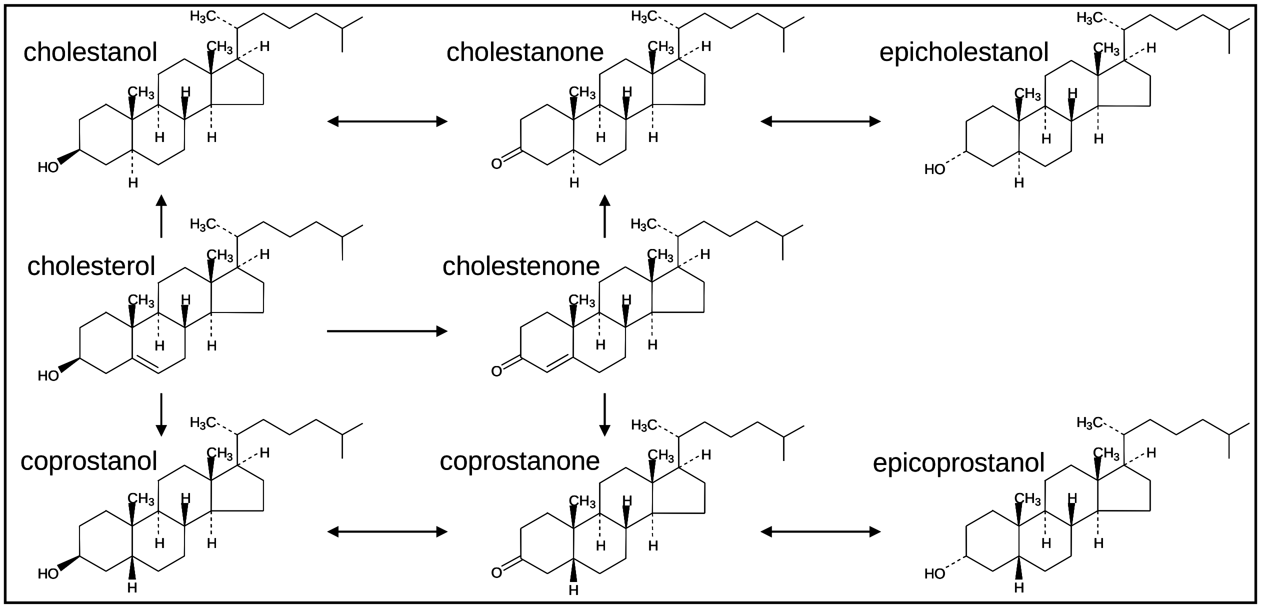

Figure 3. Structures and transformation pathways of some fecal sterols.

Benzo[a]pyrene as hydrocarbon tracer

BaP is one of the 16 EPA designated priority pollutant polycyclic aromatic hydrocarbons (PAH; EPA Method 8310). It is a 5-ring PAH with a molecular weight of 252 u. and, due to transformation products formed during liver metabolism, it is the most carcinogenic known of the 16 (Irwin et al. 1997). Depending on the relative levels, much of the regulatory concern from total PAH contamination often devolves upon the BaP. Usually the other PAHs are assigned BaP equivalency factors for the purposes of toxicity assessments. Over 100 PAHs are commonly found in environmental samples. These PAHs are all hydrophobic and recalcitrant, with heavier PAHs being more hydrophobic and recalcitrant.

Many other hydrocarbons are found along with PAHs. Usually the most common petroleum hydrocarbons are gasoline range alkanes with 6 to 12 carbons, diesel range alkanes with 12 - 28 carbons, and lubrication oil range with 28 - 36 carbons. Many of the lower molecular weight alkanes are volatile, and most are amenable to microbial degradation in various environmental media. Thus, recalcitrant hydrocarbons such as PAHs can serve as longer-term indicators of petroleum hydrocarbons, or more generally, industrial activity.

BaP occurs with several other 5-ring PAHs with a molecular weight of 252. Figure 4 shows a portion of the raw GC/MS data, selected ion 252, from a Violet Marsh sediment sample with a relatively low BaP value of 0.76 μg/gdw. Of the six 5-ring PAHs with molecular weight 252 shown, BaP is the fifth one, near retention time 33.1 minutes. These PAHs all have simple mass spectra with strong molecular weight base peaks.

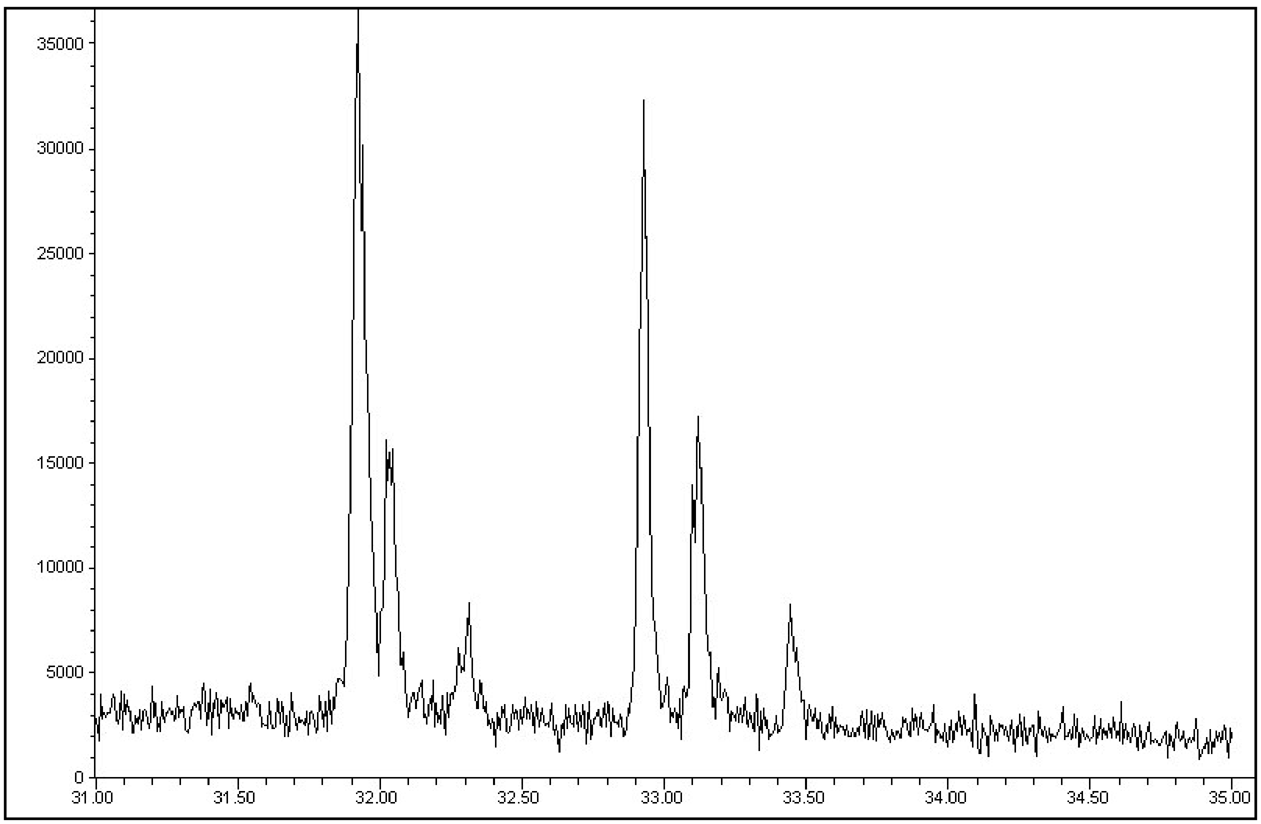

Figure 4. Selected ion (m/z=252) chromatogram of Violet Marsh sediment extract.

The proper aromatic Simplified Molecular Input Line Entry System (SMILES) description of the linked BaP molecule is c1\cc2\cc/cc3ccc4cc5ccccc5c1c4c23. The BaP structure is shown in Figure 5. The environmental recalcitrance and the lack of daughter ions in the mass spectra are due to the visibly highly aromatic structure.

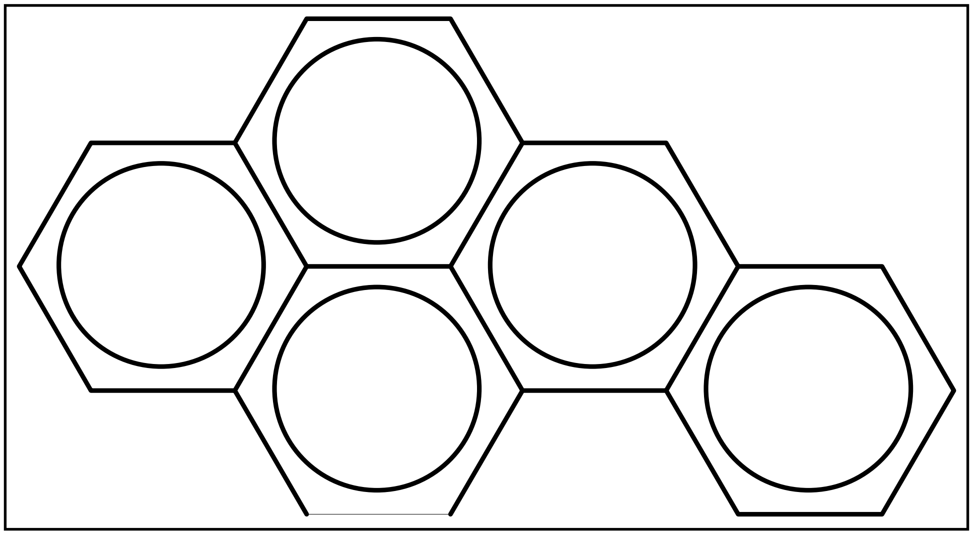

Figure 5. Aromatic structure of benzo[a]pyrene.

Like all PAHs, BaP is seldom of concern for acute exposure. The toxicological problem consists of the chronic effects of long-term exposure to metabolic products. Specifically, the cytochrome P450 system produces the ultimate carcinogen (+)-7R,8S-dihydroxy-9S,10R-epoxy-7,8,9,10-tetrahydro-benzo[a]pyrene (Chang et al. 2006). This product intercalates with DNA and causes errors in transcription (Kang and Lee 2005).

Due to the hydrophobicity of BaP (log $K_{OW} > 6$), very little is ever present in water. The EPA Region 6 water quality criterion MCL for BaP is 0.20 μg/L. BaP preferentially binds to the organic carbon in solids such as sediments. The EPA Region 6 residential soil screening level for BaP is 62 μg/kg. The applicable LADEQ criterion is 0.33 μg/g.

BaP New Orleans data

Mielke et al. (2001) found that pre-Katrina levels of BaP in New Orleans city soil ranged from 52 to 6102 μg/kg, and found, in agreement with other studies, that PAHs in runoff sediments were higher than in the soils. In this context the flooded city of New Orleans acted as a BaP source to the local environment as the water was pumped out of the city.

Because the levees failed in multiple areas, all three polders were deeply flooded at about the same time with brackish storm surge water, Lake Pontchartrain water, and Mississippi River water. The depth of flooding can be envisioned from the U.S. Army Corps of Engineers map from the New Orleans District (Figure 6) and was up to 20 ft in isolated spots. The floodwater remained for weeks. The three polders behind their levees, after they were patched, became three separate contaminant sources for nearby ecosystems. New Orleans proper and New Orleans East were pumped into Lake Pontchartrain, and the Lower Ninth Ward and Chalmette area were pumped into Violet Marsh. Some of the sediment was entrained and pumped out with the water, and more was flushed out with other runoff.

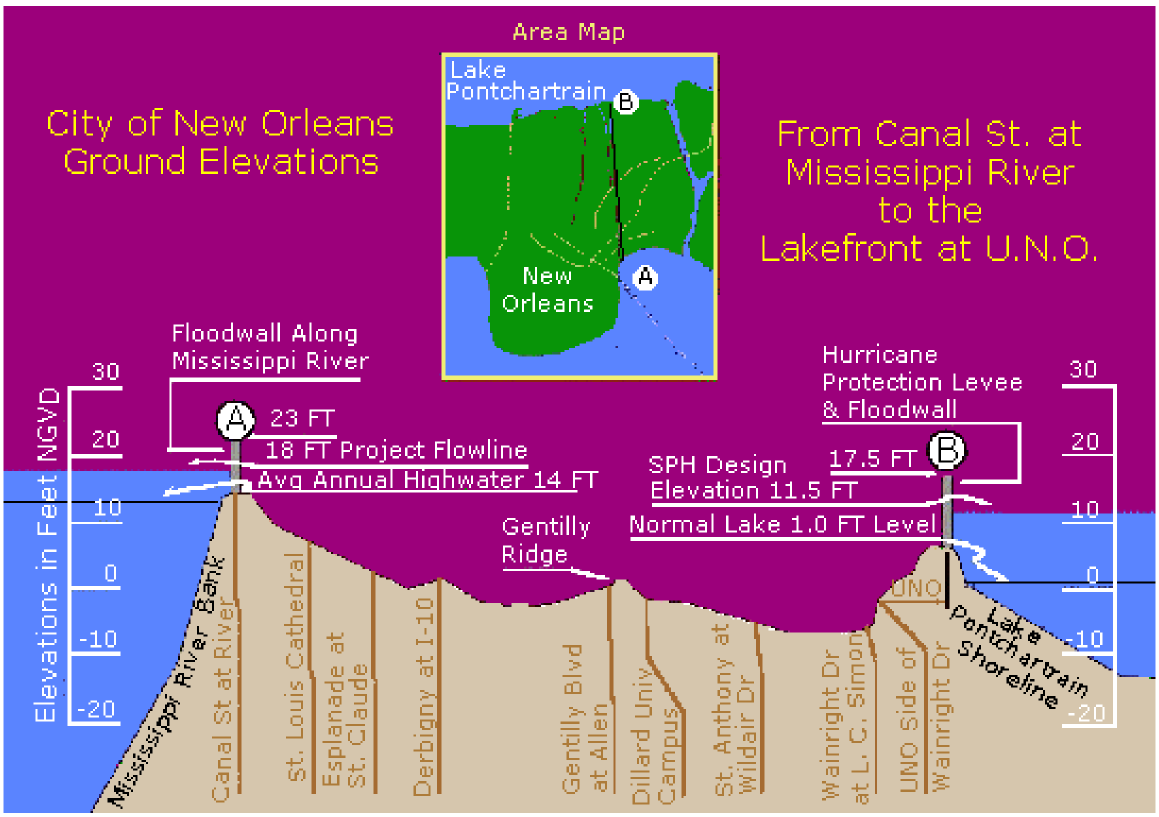

Figure 6. Cross section of New Orleans proper showing elevations.

It is thought the storm surge up the Mississippi River Gulf Outlet (MRGO) and the elevated lake levels provided the hydrological force for most of the levee breaches. The subsided New Orleans area quickly flooded. Many of the details of the flooding and flows have been modeled in Corps of Engineers reports.

Some of the major sources of contamination in New Orleans proper included the contaminated urban soil and structures (Mielke et al. 2004). The flooded New Orleans East area is heavily industrialized. In Chalmette at least one entire oil storage tank at the Murphy Oil Corporation site was breached and completely failed, and the entire site was flooded. Near the

Lower Ninth Ward, over the Bayou Bienvenue levee, the main New Orleans area sewage treatment plant was flooded, damaged, and inoperable for weeks. The Corps of Engineers began to pump out the floodwater, and the final floodwater was declared pumped out on October 11, 2005. This floodwater provided a nearly steady-state source of contamination to nearby ecosystems. The hydrological flows and transport processes of the pumping out are treated in detail in Dortch et al. (2006).

The EPA and the LADEQ conducted extensive measurement operations throughout the flooded urbanized New Orleans area from September through December 2005. Louisiana State University (Pardue et al. 2005) and Texas Tech University (Presley et al. 2006) led independent sampling expeditions in flooded New Orleans, principally in limited parts of New Orleans proper. They reported on a greater variety of contaminants over a more limited area than the EPA data. The data sources used in this report are summarized in Table 1.

Table 1. Sources of information used for chemical microbiological analyses.

	Pre-Katrina	Actual Post-Katrina
Urban Region (Inner)		
Infectious	Inferred and anecdotal Fecal sterols–core bottoms	EPA database Tot. Colif.–core tops Fec. Colif.–core tops Fec. Strep.–core tops Fecal sterols–core tops
Chemical	Mielke 1999 BaP from core bottoms	EPA database BaP–core tops
Violet Marsh Region (Nearby)		
Infectious	Fecal sterols–core bottoms	Tot. Colif.–core tops Fec. Colif.–core tops Fec. Strep.–core tops Fecal sterols–core tops
Chemical	BaP from core bottoms	BaP–core tops
Lake Pontchartrain Region (Nearby)		
Infectious	LPBF–coliform	LPBF–coliform
Chemical	LPBF–WQ data	LPBF–WQ data

2 Experimental Methods

ERDC sediment sampling

As part of the Environmental Subtask, the ERDC conducted a sampling trip 14-16 February 2006 to Violet Marsh outside the polder of the Lower Ninth Ward and the Chalmette area, using an airboat to access the marsh. The ERDC metals fabrication shop modified a commercially available stainless steel (SS) soil coring device for the purpose of retrieving undisturbed sediment cores from wetlands (Figure 7). The SS coring device consisted of three SS parts: the main part was the cylindrical coring tube with dimensions of 4.25 in. outside diameter (o.d.) and 4.00 in. inside diameter (i.d.), and 11.625 in. length. Attached to the bottom of the coring tube was a fitted, lock-in-place, stainless steel ring with protruding cutting teeth with dimensions of 4.25 in. o.d., 4.00 in. i.d., and 1.5 in. length. This piece acted both as the cutting part of the tube and as the securing ring for holding an autoclaved acrylic coring sleeve in place within the SS coring tube. The third component of the coring tube was an SS disk that measured 0.35 in. in thickness and 3.87 in. in diameter and rested on top of the acrylic core sleeve within the coring tube. This disk was held in place by two screws set into the rim of the top of the coring tube that protruded approx 0.125 in. into the interior of the coring tube.

Figure 7. Sediment coring device.

The coring tube was gently pushed down into the sediment over the course of a minute using the ratcheting “T-bar” handle. The teeth cut in the direction of ratcheting. The coring continued until the sediment reached the disk, and then the coring tube was brought up into the airboat, or up onto dry land where the cutting ring was removed and the acrylic core containing the sample was allowed to slide partway out of the coring tube (Figure 8). Immediately a plastic cap was secured onto the bottom of the acrylic core sleeve to cover and protect the core sample material inside. Once the bottom cap was secure, the acrylic core sleeve was allowed to slide fully out of the SS coring tube and was set upright on a flat surface. The SS disk was then removed from the top of the acrylic core sleeve where it had acted as a temporary cap to prevent the loss of material, and a second plastic cap was placed on top of the core sleeve to enclose the sediment sample. The secured sample was then placed on ice in a cooler and transported to ERDC after all samples had been collected.

Figure 8. ERDC team in Violet Marsh.

The coring tube, cutting ring, and SS disk were then scrubbed in water with a brush to free them of any remaining sediment, and the insides and outsides were sprayed with a 99 percent Isopropyl alcohol solution for disinfection and allowed to air dry for a minute after there was no visible liquid alcohol residue. Then a fresh autoclaved acrylic sleeve was placed into the interior of the coring tube, the SS disk was positioned on top of the sleeve within the inside of the coring tube, and the cutting ring was secured to the bottom of the coring tube in preparation for the next core sample to be taken.

In the ERDC Environmental Microbiology laboratory, ice-cold cores were placed in chemical fume hoods and the top caps were removed from the acrylic cores. The first 5 cm were aseptically removed from the top of each core (Figure 9) and thoroughly mixed with a sterile spatula. Separately the lowest 5 cm were aseptically removed from the bottom of each core and mixed. Portions of this homogenized sediment were frozen and aliquots set aside for the various physical, chemical and microbiological analyses. Dry weights were determined by drying an aliquot in the hood in ambient air for a day.

Figure 9. Removing and weighing sediment.

Bacterial indicators of pathogens in sewage

Microbiological analyses for total coliform (SM 9222-D), fecal coliform (SM 9222-D) and fecal streptococci (SM 9230-C) were performed on sediment samples using standard microbiological methods (Standard Methods for the Examination of Water and Wastewater 2005).

Benzo[a]pyrene and fecal sterol analyses

Fecal sterols and polycyclic aromatic hydrocarbons were extracted from sediment samples using the methods described in Ringelberg et al. (2001). All glassware was solvent washed and treated in a muffle furnace before use. Sterol standards were purchased from Sigma-Aldrich Corporation (coprostanol, 5ß-cholestan-3ß-ol; epicoprostanol, 5ß-cholestan-3α-ol; ß-sitosterol, 24-ethylcholest-5-en-3ß-ol; stigmastanol, 24-ethyl-5α-cholestan-3ß-ol) and Applied Science Labs, State College, PA (coprostanone, 5ß-cholestanone; cholesterol, cholest-5-en-3ß-ol; campesterol, 24-methylcholest-5-en-3ß-ol). An 11-g aliquot (wet weight) of sediment was weighed out, and a known amount of deuterated pyrene was mixed into the wet sediment to serve as a recovery standard. A mixture of dichloromethane:methanol:water (1:2:0.8, v:v:v) was added to the sample. The sediment sample was then extracted for 1 hr in an ultrasonic water bath at 10 °C, and then allowed to stand overnight. Equal volumes of dichloromethane (DCM) and water were added to break the liquid phases and the entire volume was centrifuged at 5000 rpm for 10 minutes. The

DCM phase containing the total extractable lipids was recovered using a glass pipette. The DCM was reduced in volume under a stream of dry nitrogen to approximately 100 μL and then brought to a final volume of 2 mL with clean DCM. A subsample (100 μL) of this total lipid extract was derivatized using trimethylchlorosilane for fecal sterol analysis.

Fecal sterols and BaP by GC/MS were determined using slight modifications to the standard method proposed by the Florida Department of Natural Resource Protection (1998). After TMS derivatization, fecal sterol samples were analyzed using a gas chromatograph equipped with a 60 m × 0.25 mm (ID) DB-5MS capillary column (0.1 μm film thickness, J&W Scientific, Folsom, CA) and a Mass Selective Detector (Hewlett Packard GC6890-5973). Peak identities were confirmed by comparing retention times and fragment ion masses (with electron impact ionization at 70 eV) to standards and the NIST MS database. Areas under the peaks were converted to concentrations, corrected to the efficiency of recovery of the deuterated pyrene and then normalized to the gram dry weight of the wet aliquot extracted. Ion mass patterns were used to confirm the identities of the benzo[a]pyrene and sterol GC peaks.

The recovery efficiency of the deuterated pyrene was very consistent and low (~30 percent). All BaP and fecal sterols levels were corrected to each sample's deuterated pyrene recovery. The lower limit for quantization (LLQ) of BaP was determined by adding an extra 0.1 μg/gdw of BaP to three different sediment samples. The LLQ was measured as three times the standard deviation of these matrix spikes. The lower limit of detection (LLD) was determined as three times the standard deviation of the noise in blanks. The BaP LLQ for these samples and this analysis system was 0.067 μg/gdw and the LLD was 0.009 μg/gdw. Both the LLQ and LLD for the fecal sterols were 0.1 nmol/gdw.

3 Results

Mining the EPA/LADEQ data

The microbiological raw data downloaded from EPA's STORET Katrina Central Data Warehouse (http://oaspub.epa.gov/storetkp/dw) for Orleans and St. Bernard Parishes are summarized in Appendix A. These data included 139 water and 569 sediment sampling results in Orleans and St. Bernard Parishes, with sampling dates from 10 September 2005 to 20 November 2005. Some of the samples were taken outside the polder areas. Values were reported as non-detects or present non-quantitated for 19 water and 406 sediment samples in the polders. Several analytical procedures were reportedly used. The sample quantitation limits (SQL) were not reported. The sediment fecal coliform units were erroneously reported in cfu per 100 mL, as for water, instead of the correct cfu/g (USEPA 2004b).

All of the EPA/LADEQ Katrina floodwater and sediment sampling sites in Orleans and St. Bernard Parishes are marked in Figure 10 by green stars. This figure was produced by EPA's EnviroMapper utility.

These sampling points were distributed among three main drainage areas or polders, as defined by the system of levees radiating from the turning basin in the Inner Harbor Navigation Canal, illustrated in Figure 11. New Orleans proper was considered to be that portion of Orleans Parish west of the IHNC, while New Orleans East was the urbanized area of Orleans Parish east of the IHNC and north of the Intracoastal Waterway leading to the Mississippi River Gulf Outlet. The urbanized areas east of the IHNC and south of the Intracoastal Waterway were primarily the Lower Ninth Ward of Orleans Parish and the Chalmette area of St. Bernard Parish. The EPA/LADEQ sampling points that correspond to each polder are given in Appendix B.

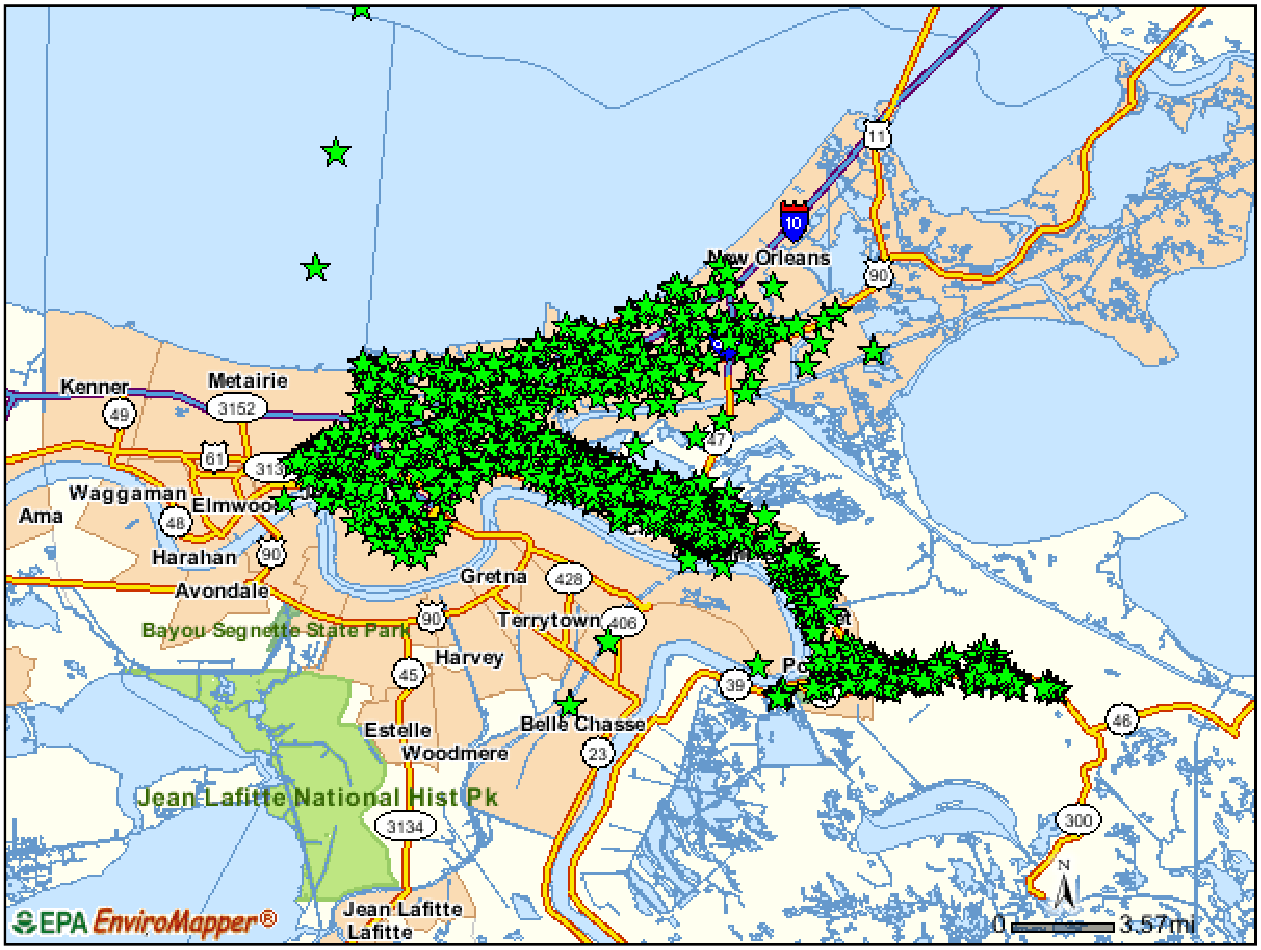

Figure 10. Locations of EPA samples in Orleans and St. Bernard Parishes.

EPA/LADEQ summary statistics

EPA/LADEQ water fecal coliform counts (colony forming units per 100 mL of water) ranged from non-detect to 490,000 (mean 21,381, median 2,200, standard deviation 74,541) in New Orleans proper, non-detect to 30,000 (mean 3,308, median 200, SD 8,093) in New Orleans East, and non-detect to 25,000 (mean 1,287, median 100, SD 4,381) in St. Bernard and the Lower Ninth Ward polders. EPA/LADEQ sediment fecal coliform (cfu per gram dry weight of sediment) ranged from non-detect to 996,260 (mean 31,645, median non-detect, SD 116,783) in New Orleans proper, non-detect to 416,250 (mean 9,980, median non-detect, SD 47,327) in New Orleans East, and non-detect to 1,115,800 (mean 30,196, median non-detect, SD 119,808) in St. Bernard and the Lower Ninth Ward polders. Different values in the polders could be described statistically.

EPA's STORET Katrina Central Data Warehouse yielded 295 floodwater measurements of BaP, with 294 non-detects. The sole detect was 0.42 µg/L. The 1,110 sediment samples tested for BaP ranged from non-detect to 35,500 µg/kg, with 894 non-detects (152 samples exceed the EPA screening standard). The flood sediment in all three polders frequently exceeded the standard. Further analyses of the chemical contaminants in the EPA/LADEQ database are presented in Bowley et al. (2006).

Statistical distribution parameter estimation

For randomly diluted samples a lognormal distribution was expected, in the same way that a normal distribution was expected for randomly additive samples. To develop a lognormal fit to the data, the natural logarithm of each data point, plus an irrelevant small constant offset if there were to be zero or negative data, was calculated and these logarithms were binned. The size of the bins was judiciously chosen to have sufficient data points as well as sufficient resolution. The resulting histogram of the logarithms was then fit by a Gaussian curve. The parameters for curve height, width, and location (and offset) were chosen by a global least squares minimization for goodness of fit.

As illustrated in Figure 11 for sediments, the data without the non-detects was indeed roughly lognormal ($r^2 = 0.70$). For a lognormal distribution, the 95-percent UCL is defined (EPA 1992) as

$$\text{95-percent UCL} \equiv e^{\left(\frac{s^2}{2}+l+\frac{h \cdot s}{\sqrt{n-1}}\right)}$$

where n is the number of data points, *l* is the average of the logarithms of the data (with offset), s is the standard deviation of the logarithms, and h is Land's h statistic. Tables of the h statistic have been compiled (Gilbert 1987) and values are also available through commercial software packages.

For further analyses and inclusion into a lognormal distribution, the non-detects cannot be taken to be zero, and in practice were assumed to be, on average, half the SQL (USEPA 1992). As seen in Figure 11 for the sediments, the large number of non-detects cause another histogram peak at half the SQL. This bimodal distribution could not in general be well fit by any unimodal distribution such as the lognormal, and thus the calculations of distribution-based parameters such as the 95 percent UCL were much less meaningful for the bimodality reflected in the data. Even simpler parameters such as mode, standard deviation, and median are much less useful in describing nonunimodal distributions.

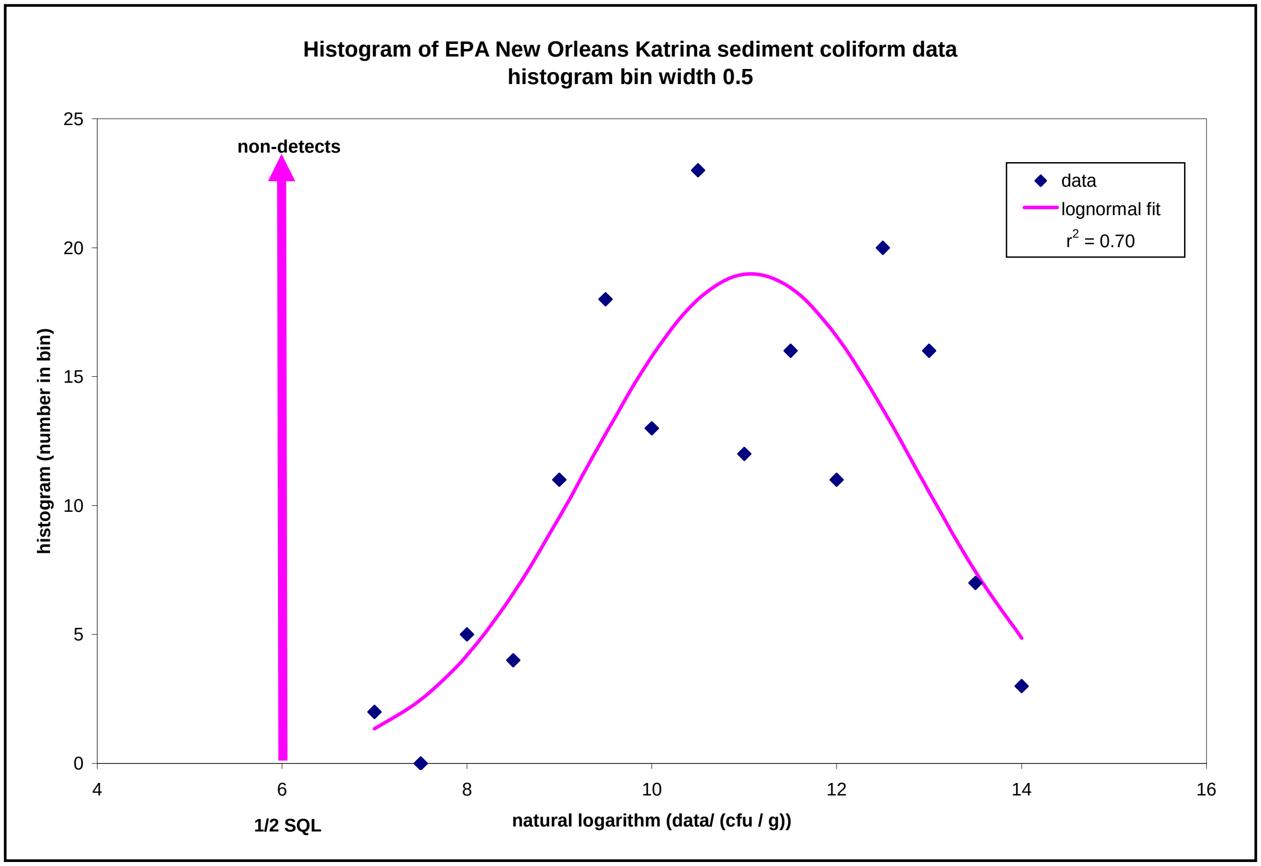

Figure 11. Bimodal histogram of EPA Katrina sediment data.

Temporal trend analyses

No trend (neither increasing nor decreasing) was evident with time for the EPA/LADEQ microbiological water data as the floodwater was pumped out and then after flood pumping ceased on October 11. As seen in Figure 12, the fecal coliform data were uncorrelated (r^2 = 0.012) with time. The data in neither of the other polders were correlated with time. In particular they did not decrease.

The half lives of fecal coliform in New Orleans surface waters are of the order of a couple of days at most (Davies et al. 1995). Thus, no decrease in fecal coliform suggested that the post-flood sewage system was not properly operational throughout the time the data were collected. Many of the data frequently exceeded the primary recreational water standard of 400 cfu/100 mL; 53 of the 139 data points exceeded the standard.

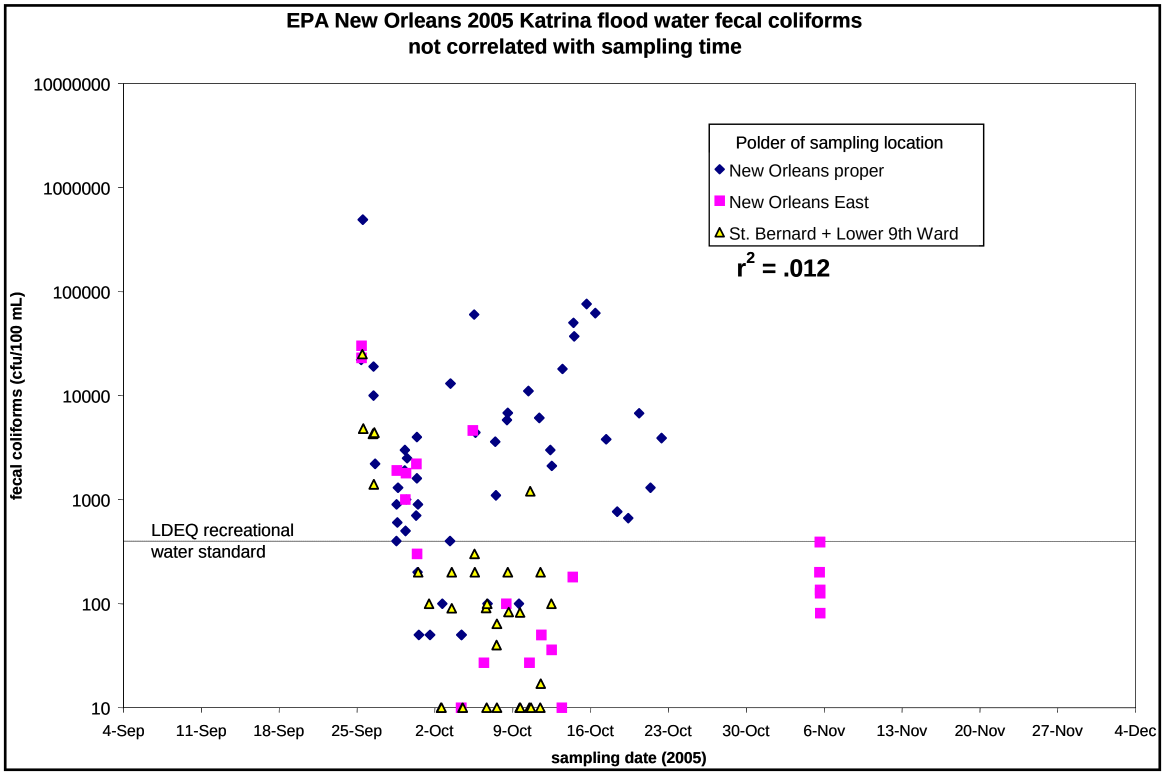

Figure 12. EPA New Orleans 2005 Katrina floodwater fecal coliforms vs sampling time.

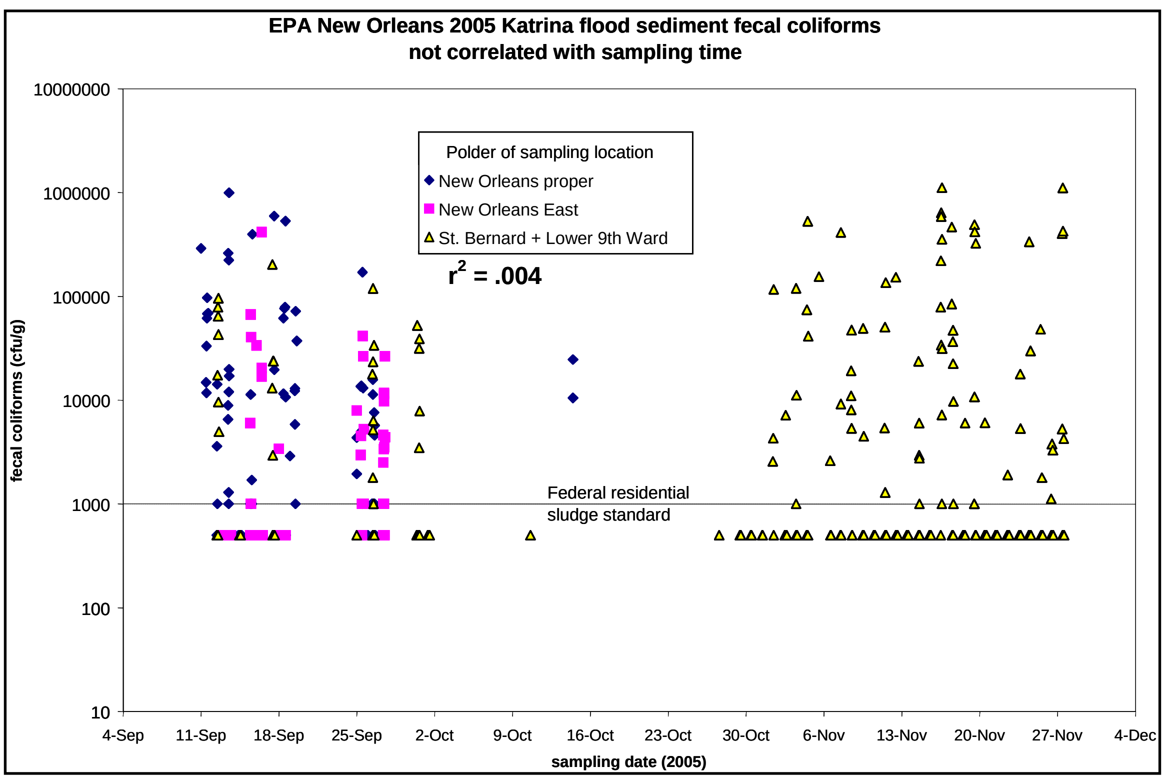

Figure 13. EPA New Orleans 2005 Katrina sediment fecal coliforms vs sampling time.

Similarly, no trend (neither increasing nor decreasing) was evident with time for the EPA/LADEQ microbiological sediment data as the floodwater was pumped out and then after flood pumping ceased on October 11. As seen in Figure 13, the fecal coliform data were uncorrelated ($r^2 = 0.004$) with time. The data in neither of the other polders were correlated with time. In particular they did not decrease.

The half lives of fecal coliform in New Orleans surface sediments are of the order of a couple of weeks at most (Burton et al. 1987). Thus, no decrease in fecal coliform suggests that the post-flood sewage system was not properly operational throughout the time the data were collected. Many of the data again frequently exceeded the federal residential biosolids standard of 1000 cfu/g; this standard was exceeded by 162 of the 569 EPA Katrina sediment samples from Orleans and St. Bernard Parishes.

Data reduction for environmental modeling

As part of the microbiological data mining products, suggested values and statistics were provided to the environmental modeling team. The lack of a temporal trend meant that single characteristic values could be used for the entire modeled time. The selected statistics were the medians and the 95 percent UCL as presented in Table 2.

Table 2. Microbiological values for environmental modeling.

All values in cfu/100 mL	New Orleans Proper	New Orleans East	St. Bernard + Lower 9th Ward
Sediment median, neglecting nondetects	14,200	9,700	23,800
Sediment median, 1/2 SQL = 500	500	500	500
Sediment 95% UCL, neglecting nondetects	164,000	55,000	244,000
Sediment 95% UCL, 1/2 SQL = 500	87,000	7,200	334,000
Water median, neglecting nondetects	3,600	200	200
Water median, 1/2 SQL = 50	2,200	200	100
Water 95% UCL, neglecting nondetects	41,000	43,000	7,200
Water 95% UCL, 1/2 SQL = 50	70,000	33,000	1,700

ERDC sediment core locations

Sediment core sample locations were selected to capture potentially major primary contaminant sources located at Murphy Oil Corporation, and the municipal sewage treatment plant. Some samples were collected as close to these sources as possible. Canals drain the Murphy Oil property and conduct water to the large stationary pumps that pumped the water over the levees. Core samples were collected from both the immediate influent and immediate effluent of the pumps that could have transported contaminants from these two sources into Violet Marsh. Sediment core samples were also collected at various distances from these pumps out into Violet Marsh to determine the range of transport of these contaminants into the marsh. All locations from which ERDC collected core samples are shown as yellow circles in Figures 14 and 15 and the GPS coordinates of these sites are given in Table 3. Almost all of the ERDC sites are outside the inner urban levees. A few of the nearby EPA sampling sites are shown in red circles for visual comparison. Almost all the EPA sites are inside of the inner urban levees.

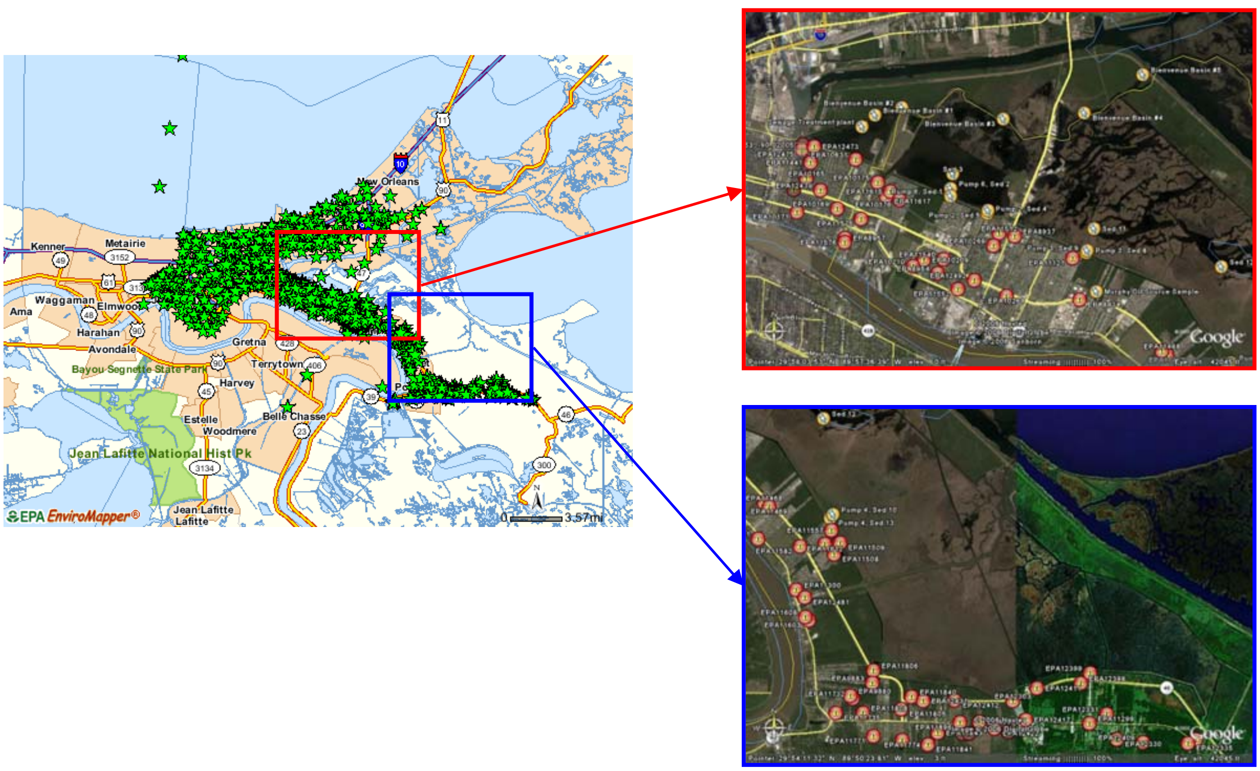

Figure 14. Locations of ERDC core samples and relation to EPA samples.

Figure 15. ERDC locations at a higher resolution.

Table 3. ERDC sampling locations descriptions.

Sample Name	Latitude	Longitude	Description
Sewage Plant	29.984166	-90.001866	Northwest of treatment plant in marsh
Murphy Oil Site	29.940866	-89.931083	Munster Ln, North of Judge Perez, intersection of drainage canal running N.W.
Pump 2 Sed 4	29.961400	-89.963983	Before pump #2
Pump 2 Sed 5	29.962183	-89.963783	After pump #2
Pump 3 Sed 8	29.951633	-89.933833	After pump #3
Pump 3 Sed 9	29.951050	-89.934100	Before pump #3
Pump 4 Sed 10	29.922100	-89.890416	After pump #4
Pump 4 Sed 13	29.921133	-89.891266	Before pump #4
Pump 6 Sed 1	29.965925	-89.975072	Before pump #6
Pump 6 Sed 2	29.967916	-89.975088	After pump #6
Sed 3	29.971766	-89.974433	Due north of pump #6, middle of marsh
Sed 11	29.957350	-89.931783	NNE of pump #3, middle of marsh
Sed 12	29.947333	-89.893266	Due north of pump #4 middle of marsh
Bienvenue Basin 1	29.987200	-89.997950	adjacent to treatment plant areator within discharge canal
Bienvenue Basin 2	29.989166	-89.989816	beginning of treatment plant discharge canal
Bienvenue Basin 3	29.986166	-89.959183	towards the end of treatment plant discharge canal
Bienvenue Basin 4	29.987733	-89.934683	north shore of marsh between discharge canal and intracoastal waterway lock
Bienvenue Basin 5	29.997783	-89.917000	adjacent to intracoastal waterway canal lock

Fecal bacteria indicator culture data

Sediment cores were transported back to the Vicksburg laboratory on ice and samples were taken from the top 5 cm of each core as previously described. Samples were analyzed using the Standard Methods Most Probable Number Analyses for total coliform, fecal coliform and fecal streptococci (Table 4). Samples from the bottoms of these cores were not analyzed because these fecal bacteria were not thought to be able to survive for extended periods of time in sediments. Fecal streptococci are the indicators currently recommended by the EPA for estuarine and marine systems, but no sediment quality standards were currently recommended. Only one fecal strep sample from the top of the Murphy Oil drainage canal produced a reading that was above the lower detection limit of the analysis. In contrast, all the total coliform analyses except those from the two outermost samples of Bayou Bienvenue produced moderate to high counts. The highest coliform values were not at the sewage treatment plant outfall but from the Murphy Oil drainage canal and locations indicating input from Chalmette into Violet Marsh. Fecal coliform counts exceeded the standard for biosolids set by 40 CFR 503 (1000 cfu/gdw) for all sample locations except the sewage treatment plant and all samples from the Bayou Bienvenue. The reason for relatively low total and fecal coliform bacteria in these locations was not clear but may be biological (i.e. not just due to housing location or dilution) via inhibition of bacterial growth by co-occurring chemical contaminants and/or active coliphage (not measured) activity in these chronically polluted areas.

Fecal sterol data

Coprostanol levels in the tops and bottoms of almost all cores collected indicated significant historic and recent fecal impacts on Violet Marsh (Table 5). These levels are comparable to those in heavily sewage-impacted marshes in Barcelona, Spain and Havana, Cuba (Table 6). Analysis of the sterol content from the bottom of the cores provided some insights into the input of fecal matter into Violet Marsh before Katrina struck (Table 5). In these earlier deposited sediments, the levels of coprostanol were highest in the two most western sampling stations in the Bayou Bienvenue; BB1 (61.2 nmol/gdw) and BB2 (87.8 nmol/gdw). Coprostanol levels rapidly decreased with distance to the east (BB3-5; 3.4-6.0 nmol/gdw). Together, these data suggested the sewage treatment plant (or other source in this area) constituted a major long-term source of fecal contamination but the distribution of this fecal material into Violet Marsh was rather limited. High to moderate levels of coprostanol were found in the bottom of the core taken closest to the sewage plant outfall (20.3 nmol/gdw) and pump stations #2 (32.8 nmol/gdw), #3 (12.6 nmol/gdw) and #6 (8.0 nmol/gdw), indicating a long-term source of fecal contamination from these sources. It is important to note that almost all of the sediments analyzed exceeded the most lenient coprostanol sediment quality standard suggested (1 nmol/gdw), indicating that Violet Marsh has been chronically impacted by fecal material.

Table 4. Fecal indicator bacteria levels in Violet Marsh sediments.

Table	Plate count results from Top of Soil Core				
		Total	Fecal	Fecal	40 CFR 503
Sample		Coliforms	Coliforms	Streptococci	BioSolid Res Std FecColif
Location		CFU/gm	CFU/gm	CFU/gm	1000
Bienvenue Basin 1	TOP	17,000	< 1,000	<1,000	–
Bienvenue Basin 2	TOP	12,000	< 1,000	<1,000	–
Bienvenue Basin 3	TOP	<1000	< 1,000	<1,000	–
Bienvenue Basin 4	TOP	<1000	< 1,000	<1,000	–
Bienvenue Basin 5	TOP	3,000	< 1,000	<1,000	–
Sewage Plant	TOP	10,000	< 1,000	<1,000	–
Murphy Oil Site	TOP	1,600,000	630,000	100	>
Pump 2 Sed 4	TOP	57,000	14,000	<100	>
Pump 2 Sed 5	TOP	133,000	25,000	<100	>
Pump 3 Sed 8	TOP	84,000	5,000	<100	>
Pump 3 Sed 9	TOP	630,000	70,000	<100	>
Pump 4 Sed 10	TOP	77,000	10,000	<100	>
Pump 4 Sed 13	TOP	128,000	15,000	<100	>
Pump 6 Sed 1	TOP	30,000	8,000	<100	>
Pump 6 Sed 2	TOP	65,000	2,000	<100	>
Sed 11	TOP	33,000	3,000	<100	>
Sed 12	TOP	>200000	4,000	<1,000	>
Sed 3	TOP	2,100	3,000	<100	>
Mean		192,073	65,750		
Standard Deviation		419,233	178,681		
Median		57,000	9,000		

The coprostanol levels in sediment from the top of the cores also showed significant impacts from fecal contamination (Table 5). The average level of coprostanol in the most recent sediment was higher (20.2 nmol/gdw) than that of the bottom sediment (16.9 nmol/gdw), which suggested increasing fecal input. Additionally, the relative coprostanol distribution pattern in the most recent sediments was different from that observed from the analysis of core bottoms. The levels of coprostanol in the surface sediments of the eastern location in the Bayou Bienvenue (BB1= 28.3 nmol/gdw; BB2=28.5 nmol/gdw) were approximately half of those found in the sediments of the bottoms of these cores. This may reflect the lack of input due to the failure of the sewage treatment system that resulted from the flooding. In contrast, the surface sediments associated with pump stations #2, #3, #4 and #6 all contained higher levels of coprostanol than their respective core bottoms. This suggested that the flooding resulted in a greater fecal load to Violet Marsh than originated from Chalmette along the northern levee.

Table 5. Fecal sterol levels in Violet Marsh sediments.

Table X. Fecal sterol content of sediment from the tops and bottoms of cores.									
		A	B	C	D	Ratio	Ratio	Ratio	Ratio
Sample		coprostanol	epicoprostanol	cholesterol	cholestanol	A/D	B/A	A/C	A/A+D
Location		nmol/gm dw	nmol/gm dw	nmol/gm dw	nmol/gm dw				
Bienvenue Basin 1	Top	28.3	1.6	43.5	3.8	7.37	0.06	0.65	0.88
Bienvenue Basin 2	Top	28.5	41.4	355.2	41.0	0.70	1.45	0.08	0.41
Bienvenue Basin 3	Top	9.2	0.8	43.6	7.9	1.16	0.08	0.21	0.54
Bienvenue Basin 4	Top	9.1	2.6	42.7	5.0	1.81	0.29	0.21	0.64
Bienvenue Basin 5	Top	4.2	0.4	110.9	5.1	0.82	0.10	0.04	0.45
Sewage Plant	Top	27.3	18.1	29.2	6.5	4.20	0.66	0.93	0.81
Murphy Oil Site	Top	20.8	0.6	17.2	1.3	15.58	0.03	1.21	0.94
Pump 2 Sed 4	Top	3.0	3.7	67.7	3.8	0.79	1.24	0.04	0.44
Pump 2 Sed 5	Top	61.3	4.6	344.7	30.3	2.02	0.07	0.18	0.67
Pump 3 Sed 8	Top	20.6	1.8	145.8	10.0	2.06	0.09	0.14	0.67
Pump 3 Sed 9	Top	39.1	2.2	90.0	9.1	4.31	0.06	0.44	0.81
Pump 4 Sed 10	Top	28.1	2.0	32.4	5.9	4.72	0.07	0.87	0.83
Pump 4 Sed 13	Top	13.4	1.0	68.6	6.3	2.11	0.08	0.20	0.68
Pump 6 Sed 1	Top	22.0	1.7	117.4	10.5	2.09	0.08	0.19	0.68
Pump 6 Sed 2	Top	9.5	0.8	44.3	6.8	1.39	0.08	0.21	0.58
Sed 11	Top	21.5	6.0	90.3	7.0	3.06	0.28	0.24	0.75
Sed 12	Top	4.3	0.7	40.6	7.3	0.58	0.17	0.10	0.37
Sed 3	Top	14.3	1.1	67.5	11.0	1.31	0.07	0.21	0.57
Mean		20.2	5.1	97.3	9.9	3.1	0.3	0.3	0.7
Standard Deviation		14.4	10.0	98.0	9.8	3.6	0.4	0.3	0.2
Median		20.7	1.8	67.6	6.9	2.0	0.1	0.2	0.7
Bienvenue Basin 1	Bottom	61.2	2.5	80.2	6.5	9.38	0.04	0.76	0.90
Bienvenue Basin 2	Bottom	87.8	4.6	115.4	11.3	7.78	0.05	0.76	0.89
Bienvenue Basin 3	Bottom	3.4	0.5	23.4	3.0	1.15	0.14	0.15	0.53
Bienvenue Basin 4	Bottom	6.0	0.5	33.2	7.0	0.86	0.09	0.18	0.46
Bienvenue Basin 5	Bottom	3.4	0.5	22.0	5.0	0.68	0.14	0.15	0.40
Sewage Plant	Bottom	20.3	2.7	91.8	19.8	1.02	0.13	0.22	0.51
Murphy Oil Site	Bottom	23.9	1.2	15.3	4.6	5.18	0.05	1.56	0.84
Pump 2 Sed 4	Bottom	8.1	0.7	84.5	4.8	1.67	0.09	0.10	0.63
Pump 2 Sed 5	Bottom	32.8	3.2	99.2	19.1	1.72	0.10	0.33	0.63
Pump 3 Sed 8	Bottom	0.9	0.1	4.9	0.4	2.16	0.08	0.19	0.68
Pump 3 Sed 9	Bottom	12.6	0.5	20.3	5.1	2.50	0.04	0.62	0.71
Pump 4 Sed 10	Bottom	0.0	0.0	2.7	0.9	0.00	-	0.00	0.00
Pump 4 Sed 13	Bottom	0.0	0.0	2.1	0.4	0.00	-	0.00	0.00
Pump 6 Sed 1	Bottom	5.0	0.5	24.0	3.5	1.41	0.10	0.21	0.59
Pump 6 Sed 2	Bottom	8.0	1.1	56.5	10.0	0.79	0.13	0.14	0.44
Sed 11	Bottom	14.2	1.4	84.5	12.3	1.15	0.10	0.17	0.54
Sed 12	Bottom	6.0	1.3	55.6	9.8	0.61	0.22	0.11	0.38
Sed 3	Bottom	11.2	1.1	63.3	18.4	0.61	0.10	0.18	0.38
Mean		16.9	1.2	48.8	7.9	2.1	0.1	0.3	0.5
Standard Deviation		23.1	1.2	36.8	6.2	2.6	0.0	0.4	0.3
Median		8.0	0.9	44.4	5.8	1.2	0.1	0.2	0.5

Ratios of the levels of various other sterols recovered from wetland sediment cores have been used as aids to data interpretation, particularly in highly productive systems where coprostanol levels were below 2 nmol/gdw and other sources of sterols had become significant. None of these sterol ratios were found particularly helpful in the context of gaining additional information from the data collected (Table 6). The ratio of coprostanol / coprostanol+cholestanol did not change much with location or sediment depth suggesting the relative importance of the different cholesterol reduction pathways did not change very much with time or location in the marsh. The ratio of epicoprostanol (formed from coprostanol in activated sludge) to coprostanol has been used as an indication of treated *vs* non-treated sewage. Although this ratio fluctuated, it was difficult to rationalize these differences in terms of extent of sewage treatment.

Table 6. Comparison of fecal sterols in other tropical wetlands.

Sample	A Coprostanol nmoles/gdw	B Epicoprostanol nmoles/gdw	C Cholesterol nmoles/gdw	D Cholestanol nmoles/gdw	A/D	B/A	A/C	A/A+D
Human feces[1]	8,824.29		746.08				11.83	
Barcelona S1[2]	1,003.34	12.86	205.81	41.16	24.38	0.01	4.88	0.96
Barcelona S2[2]	115.77	5.15	25.73	18.01	6.43	0.04	4.50	0.87
Barcelona S3[2]	87.47	3.86	23.15	10.29	8.50	0.04	3.78	0.89
Barcelona S4[2]	61.74	2.57	51.45	7.72	8.00	0.04	1.20	0.89
Barcelona S5[2]	38.59	1.29	30.87	7.72	5.00	0.03	1.25	0.83
Barcelona S7[2]	3.34	0.26	2.57	1.03	3.25	0.08	1.30	0.76
Barcelona S7[2]	2.57	0.21	1.29	0.64	4.00	0.08	2.00	0.80
Havana, Cuba S8[2]	2.83	0.26	8.23	1.75	1.62	0.09	0.34	0.62
Havana, Cuba S9[2]	1.05	0.10	2.57	1.41	0.75	0.10	0.41	0.43
Kirchmer criterion[3]	1.03							
Murtaugh criterion[4]	0.51							
Dutka criterion[5]	0.13							

[1]Nichols et al., 1996
[2]Grimalt et al., 1990
[3]Kirchmer, 1971
[4]Murtaugh and Bunch, 1967
[5]Dutka et al., 1974

Benzo[a]pyrene data

The Violet Marsh has had a history of BaP contamination and the recent flooding has made this contamination more pervasive through the marsh. BaP levels in the bottom sediments from 9 of the 18 core samples collected exceeded the EPA sediment criterion of 0.062 µg/gdw (Table 7). The sediments that chronically exceeded this criterion came from Bayou Bienvenue, the sewage treatment plant, and around pump stations #2 and #3. This historic BaP contamination did not extend far into the marsh (e.g., sediment 12 = 0.0 µg/gdw). When considering the most recently deposited sediments, the number of cores showing measurable BaP levels and the levels of BaP in these sediments indicated that the flooding resulted in the addition of BaP to the marsh in excess of the historically deposited levels. The EPA BaP sediment criterion was exceeded in the sediments most recently deposited in 16 of the 18 cores collected. The average level of BaP in the most recent sediments was 2.8 µg/gdw compared to 1.5 µg/gdw in the historic sediments. The highest levels in both the top and bottom sediments were detected in the eastern Bayou Bienvenue.

Table 7. Benzo[a]pyrene levels in Violet Marsh sediments.

Table Concentration of Benzo(A)Pyrene in Top and Bottom of Cores				
Sample		BaP ug/g *dw*	EPA criteria	LDEQ criteria
Location			0.062	0.33
Bienvenue Basin 1	TOP	31.2	>	>
Bienvenue Basin 2	TOP	2.8	>	>
Bienvenue Basin 3	TOP	1.0	>	>
Bienvenue Basin 4	TOP	0.0	-	-
Bienvenue Basin 5	TOP	0.4	>	>
Sewage Plant	TOP	3.1	>	>
Murphy Oil Site	TOP	1.6	>	>
Pump 2 Sed 4	TOP	1.4	>	>
Pump 2 Sed 5	TOP	1.4	>	>
Pump 3 Sed 8	TOP	0.9	>	>
Pump 3 Sed 9	TOP	1.3	>	>
Pump 4 Sed 10	TOP	1.5	>	>
Pump 4 Sed 13	TOP	0.2	>	-
Pump 6 Sed 1	TOP	1.1	>	>
Pump 6 Sed 2	TOP	1.2	>	>
Sed 11	TOP	0.0	-	-
Sed 12	TOP	0.1	>	-
Sed 3	TOP	1.1	>	>
Mean		2.8		
Standard Deviation		7.1		
Median		1.1		
Bienvenue Basin 1	Bottom	11.8	>	>
Bienvenue Basin 2	Bottom	11.0	>	>
Bienvenue Basin 3	Bottom	0.1	>	-
Bienvenue Basin 4	Bottom	0.0	-	-
Bienvenue Basin 5	Bottom	0.1	>	-
Sewage Plant	Bottom	0.5	>	>
Murphy Oil Site	Bottom	0.8	>	>
Pump 2 Sed 4	Bottom	0.8	>	>
Pump 2 Sed 5	Bottom	2.5	>	>
Pump 3 Sed 8	Bottom	0.0	-	-
Pump 3 Sed 9	Bottom	0.3	>	-
Pump 4 Sed 10	Bottom	0.0	-	-
Pump 4 Sed 13	Bottom	0.0	-	-
Pump 6 Sed 1	Bottom	0.0	-	-
Pump 6 Sed 2	Bottom	0.0	-	-
Sed 11	Bottom	0.0	-	-
Sed 12	Bottom	0.0	-	-
Sed 3	Bottom	0.0	-	-
Mean		1.5		
Standard Deviation		3.6		
Median		0.0		

4 Discussion

During the Category 3-4 Hurricane Katrina, on 28-29 August 2005, 6-10 in. of rain fell in the New Orleans area. This amount was not significantly greater than many other storms. The Katrina storm surge on the Mississippi coast exceeded 20 ft in some areas, but ranged from 10-15 ft on the Louisiana coast east of New Orleans. Lake Pontchartrain was elevated a few feet for an extended time. By 29 August New Orleans levees were breached in several locations, and by 30 August 80 percent of New Orleans was flooded with up to 20 ft of brackish water.

For several days the floodwater remained high in the urbanized areas, and began to slowly recede as the levee breaches were patched and pumps were brought in or became operational. Tens of thousands of people who remained in the area were without basic necessities, and without a working sewage system. The main sewage treatment plant was submerged, damaged, and completely out of operation for several weeks. The smaller plant on the west bank received extensive storm damage and was also not operational.

The effects of several inches of rain and wind from the Category 3 Hurricane Rita caused several refailures of the levees in New Orleans on 23-24 September, and reflooding up to 10 ft. The operational pumps pumped huge volumes of floodwater and sediment continuously for 4-5 weeks. The last of the floodwaters were declared pumped out on October 11. The flooding and flows are detailed in the modeling report in the volume (Dortch et al. 2006). The pump-out of the flooded city and the hydraulic flows resulting from this operation and the levee systems was accomplished with three separate drainage areas or polders: New Orleans proper, New Orleans East, and St. Bernard Parish and the Lower Ninth Ward. Lake Pontchartrain received the bulk of the pumped floodwater from New Orleans proper and New Orleans East. The Violet Marsh received the pumped floodwater from the Lower Ninth Ward and Chalmette area.

The USEPA and the LADEQ conducted extensive measurement operations throughout the urbanized New Orleans area from September through

December. The only EPA and LADEQ floodwater and sediment microbiology data available are for fecal coliform bacteria. LSU (Pardue et al. 2005) and Texas Tech (Presley et al. 2006) led independent sampling expeditions in flooded New Orleans, principally in limited parts of New Orleans proper. They reported on a greater variety of contaminants over a more limited area than the EPA data. Much of the sewerage system was antiquated and permanently damaged from the flooding. Even during normal storms without flooding, the sewers cross flow into storm drainage (Pardue et al. 2005). The main EPA warning concerning contaminants in the floodwater was to avoid contact due to elevated sewage levels: *http://www.epa.gov/katrina/precautions.html*. Much raw sewage, particularly in the Lower Ninth Ward and Chalmette area polder, was still evident in surface waters when the authors sampled (February 2006).

The recreational (swimming) water criteria for bodily contact and accidental or incidental ingestion are developed in terms of other groups of organisms. The applicable standard is the primary contact recreational water quality criterion, which is 400 cfu/100 mL for fecal coliform bacteria (USEPA 2003, LADEQ 2004). This standard was exceeded in 53 of the 139 EPA Katrina water samples from Orleans and St. Bernard Parishes. The averages of the fecal coliform bacteria in cfu/100 mL reported in the EPA Katrina water samples from the three polders were 21,381 in New Orleans proper, 3,308 in New Orleans East and 1,287 in St. Bernard Parish and the Lower Ninth Ward. There are very few bacteriological sediment standards. The large National Sediment Quality Survey (USEPA 2004b) contains no bacteriological data. The federal biosolids rules are applicable to transported sediments that have been impacted by sewage sludge. The biosolids residential standard (40 CFR 503.32) for fecal coliform bacteria is 1000 cfu/g. This standard was exceeded by 162 of the 569 EPA Katrina sediment samples from Orleans and St. Bernard Parishes. The averages of the fecal coliform bacteria in cfu/g reported in the EPA Katrina sediment samples from the three polders were 31,645 in New Orleans proper, 9,980 in New Orleans East, and 30,196 in St. Bernard Parish and the Lower Ninth Ward.

The potential for infections from pathogens in sewage waste was the primary Katrina-related health concern of the EPA and CDC. Airborne molds are another microbial concern in New Orleans. The EPA issued flood-related mold warnings, especially concerning the black molds related to *Stachybotrys chartarum:*

(*http://www.epa.gov/katrina/healthissues.html#floodmold*). This report does not cover airborne pathogens, only the pathogens reported in the floodwaters and sediment.

The ERDC Environmental Microbiology Team supported the environmental modeling effort required for IPET Task 9 by obtaining and reducing data on fecal contamination and providing it to ERDC environmental modelers (Table 2). The fecal coliform data as a whole do not appear to result from random dilutions of a fecal source or sources because of the large number of non-detects reported. Once the non-detect values are removed, the remaining numerical values do tend to follow an expected unimodal lognormal distribution characteristic of random dilutions of a fecal source or sources. The reported non-detects appear to result from a separate source or sources of more dilute material, resulting in a bimodal distribution for the fecal coliform data as a whole. Several further outlying areas, including the Mississippi Sound and the Mississippi River Delta, are likely to have environmental impacts from the levee failures that are more dilute than the nearby ecosystems. These remote ecosystems are not modeled in this report, and samples were not collected from the remote areas.

Screening of New Orleans water and sediment samples for the coliform bacteria found in fecal material and correlated to infectious human disease frequently showed fecal coliform bacterial levels high above the regulatory levels of concern. As a result, health advisories due to infectious material in the flooded New Orleans areas were issued. The advisories were warranted. Assessment of the actual human health impacts due to infectious agents as a result of the flood is an ongoing process. Of the 10,047 New Orleans patient visits during and immediately after the flooding for which information was available to the Center for Disease Control and Prevention (CDC 2006), the most common were gastrointestinal, acute respiratory and skin infections. However, it will probably not be possible to capture all the data on illness of New Orleans residents who left the area and received medical treatments for infections. In the context of this report, it is important to point out that the high levels of fecal coliform bacteria revealed by the screening procedures did detect a human health risk due to infectious agents, that health advisories were issued, and that some summaries of impacts of human infections have been recently published. This series of events identifies a potential source of infectious materials that constitute a real environmental risk of unknown magnitude and duration on the environment around New Orleans as the city was pumped out and debris is removed.

Extending the fecal coliform indicator screening level analysis to areas adjacent to New Orleans is one of the few options open to use the data that are currently available. Simple water dilution calculations and coliform bacteria die-off rates in estuarine water indicate that fecal coliform counts would be below levels of concern for the majority of Lake Pontchartrain. This is indeed observed in the most recent data from the Lake Pontchartrain Basin Foundation. While this is good news, these data should not be equated to the lack of an environmental problem. According to EPA guidance and federal law (BEACH Act), fecal streptococci should have been used as the fecal indicator in estuarine water and not fecal coliform bacteria. The very high levels of fecal coliform bacteria in the floodwater indicated an obvious health risk. However, the interpretation of low fecal coliform counts in estuarine water in terms of risk to human health is problematic. Lack of correlation between low fecal coliform counts and human illness is one of the reasons EPA in 1986 changed its guidance in estuarine waters to the use of fecal streptococci. Additionally, recent literature has revealed that we are only beginning to understand the part of the life cycle of microbial pathogens of humans that occurs outside the human host. Taken together, the message here is that the current lack of an indicator of fecal waste problem in New Orleans and Lake Pontchartrain should not be interpreted as the absence of an environmental problem. On the other hand, Lake Pontchartrain itself is a recovering ecosystem with a long history of fecal and chemical pollution. It is not possible, with the data currently available, to evaluate the impact of the pump-out on the already impacted lake.

In contrast, much of the Violet Marsh is confined by levees and this small confined area received a great volume of material that was pumped out of the urbanized area of New Orleans. The authors were able to select specific tests and sample sites, and perform a quick survey of this system. As a result, we were able to show a probable environmental impact of BaP and fecal contamination that resulted from the pump-out of the Lower Ninth Ward of New Orleans and the Chalmette area that exceeded the historic level of BaP and fecal contamination that this system normally receives. The Violet Marsh was shown to have levels of contamination and ranges of indicators similar to other sewage-impacted wetlands areas (Grimalt et al. 1990) that are well above suggested sediment quality criteria (Kirchmer

1971, Murtaugh and Bunch 1967, Dutka et al. 1974). Other chemical tracers of anthropogenic contamination were also evident in the GC/MS analyses, but time did not permit a more detailed environmental forensics analysis of the data. Additional analyses are required to remove uncertainty due to assumptions that were made and the minimal statistical design of our Violet Marsh survey, and to quantify these impacts.

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List of Abbreviations

IPET	Interagency Performance Evaluation Task Force
BaP	benzo[a]pyrene
ERDC	U.S. Army Engineer Research and Development Center
USEPA	U.S. Environmental Protection Agency
SD	standard deviation
LADEQ	Louisiana Department of Environmental Quality
ng	nanogram
L	liter
cfu	colony forming unit
mL	milliliter
μg	microgram
g	gram
DEQ	Department of Environmental Quality
CFR	Code of Federal Regulations
gdw	gram dry weight
ILSI	International Life Sciences Institute
pmol	pico-mol
nmol	nano-mol
ppb	parts per billion
GC/MS	gas chromatography mass spectrometer
TPH	total petroleum hydrocarbons
NO	New Orleans
COE	Corps of Engineers
SS	stainless steel
v.v.v.v	volume to volume to volume to volume
DCM	dichloromethane
LLQ	lower limit for quantization

LLD	lower limit of detection
TMS	trimethylchlorosilane
µm	micro-meter
eV	electron volts
USGS	United States Geological Survey
LSU	Louisiana State University
STORET	EPA/LADEQ Katrina Central Data Warehouse (*http://oaspub.epa.gov/storetkp/dw*)
SQL	Sample quantization level
UCL	Upper confidence level
MPN	Most probable number

Appendix A: LPBF data

Lake Pontchartrain Basin Foundation
Basin-Wide Water Quality Monitoring Program
LPBF MASTER DATABASE 2005

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
		°C	mg/L	mS/cm	ppt	NTU		MPN/100 mL	MPN/100 mL
1	1/4/2005	12.1	9.48	9.28	5.2	3.18	7.98	33	
2	1/4/2005	13	9.19	8.02	4.5	1.05	7.78	13	
3	1/4/2005	11.6	8.72	8.91	5	2.88	7.62	23	
4	1/4/2005	11.7	10.06	9.11	5.1	2.48	7.45	79	
5	1/4/2005	13.5	8.97	10.19	5.8	1.16	7.76		
6	1/4/2005	17.5	7.55	0.04	0	5.25	7.29	130	
7	1/4/2005	15.6	8.24	2.63	1.4	6.89	6.97	79	
8	1/4/2005	16.8	10.1	8.95	5	3.53	7.67	170	
9	1/4/2005	18.6	8.58	9.09	5.1	2.67	7.48	4.5	
10	1/4/2005	16.2	10.83	7.15	4	8.02	7.62	49	
1	1/11/2005	15.7	8.6	9.11	5.1	3.17	7.46	49	
2	1/11/2005	15.5	5.31	9.14	5.1	2.03	7.52	110	
3	1/11/2005	15.1	7.1	8.83	4.9	1.65	7.47	11	
4	1/11/2005	14.6	7.41	8.98	5	1.8	7.27	79	
5	1/11/2005	15	6.89	9.64	5.5	0.87	7.62		
6	1/11/2005	16	8.52	0.04	0	13.3	6.65	920	
7	1/11/2005	16.2	6.15	1.5	0.8	18.1	6.48	920	
8	1/11/2005	16.9	7.43	6.19	3.4	5.61	6.69	1600	
9	1/11/2005	17.3	8.97	9.12	5.1	2.95	7		
10	1/11/2005	17.7	9.74	9.27	5.2	6.01	7.44	49	
1	1/12/2005	15.8	7.76	9.37	5.3	1.5	7.46	49	
2	1/12/2005	15.4	6.28	9.37	5.3	2.08	7.12	33	
3	1/12/2005	15.5	7.12	9.17	5.2	2.54	7.11	33	
4	1/12/2005	15.2	6.87	9.28	5.2	1.75	7.09	70	

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
5	1/12/2005	16.3	7.09	9.71	5.5	0.91	7.45	23	
6	1/12/2005	17	7.9	0.04	0	12.4	6.76	540	
7	1/12/2005	16.7	6.37	1.26	0.6	16	6.26	920	
8	1/12/2005	17	8.57	8.24	4.6	4.68	6.73	920	
9	1/12/2005	18.2	8.18	9.09	5.1	12.9	6.88	79	
10	1/12/2005	18.2	9.36	9.26	5.2	4.21	7.54	350	
1	1/18/2005	9.6	10.13	8.45	4.7	52.5	7.61	240	75
2	1/18/2005	9.2	10.08	8.4	4.6	37	7.6	79	20
3	1/18/2005	10.4		9.34	5.2	28.6	7.59	49	10
4	1/18/2005	9.8		9.67	5.4	33.8	7.53	130	10
5	1/18/2005	6.2		9.42	5.2	24.5	7.66	70	42
6	1/18/2005	8.7				11.6	7.68	240	164
7	1/18/2005	11				22.7	6.6	1600	42
8	1/18/2005	10.1				4.63	6.82	130	75
9	1/18/2005	7.4				1.18	7.16	7.8	5
10	1/18/2005	6.8				4.67	7.48	33	5
1	1/25/2005	10	8.92	7.25	4	13.6	8.2	22	10
2	1/25/2005	10.3	7.48	8.43	4.7	16.9	7.83	46	10
3	1/25/2005	10.5	8.63	8.72	4.9	21.6	7.64	79	20
4	1/25/2005	10.6	8.79	10.17	5.8	6.82	7.6	13	5
5	1/25/2005	8	9.68	10.35	5.8	12.3	7.66	17	5
6	1/25/2005	9.3	9.9	0.04	0	6.3	7.6	27	137
7	1/25/2005	9.7	8.85	3.69	2	9.52	6.94	49	20
8	1/25/2005	9.9	9.37	8.23	4.6	5.65	7.05	170	10
9	1/25/2005	8.8	10.53	8.96	5	14.3	7.05	7.8	5
10	1/25/2005	10.1	10.18	9.18	5.1	33.5	7.29	130	5
1	2/1/2005	11.9	9.51	6.31	3.5	59.3	7.73	540	453
2	2/1/2005	12.1	9.67	5.45	2.9	56.7	7.78	350	1091
3	2/1/2005	12	9.75	7.12	3.9	25.8	7.64	540	1184
4	2/1/2005	11.9	9.9	7.5	4.2	17.9	7.46	540	738
5	2/1/2005	12	9.42	9.26	5.2	39.2	7.51	350	504
6	2/1/2005	12.1	9.19	0.05	0	19.6	7.6	1700	2100

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
7	2/1/2005								
8	2/1/2005	11.9	8.2	8.02	4.5	3.91	6.83	1600	1091
9	2/1/2005	11.9	9.8	9.24	5.2	2.06	6.88	21	5
10	2/1/2005	11.8	9.43	11.97	6.9	4.66	6.99	130	192
1	2/2/2005	12.5	9.73	5.02	2.7	58.4	7.68	1700	2100
2	2/2/2005	12.3	8.91	6.53	3.6	29.4	7.72	1600	2100
3	2/2/2005	12.1	9.48	7.35	4.1	24.4	7.51	350	207
4	2/2/2005	12	8.59	7.84	4.4	19	7.53	220	478
5	2/2/2005	12.4	8.95	10.04	5.7	3.48	7.48	49	178
6	2/2/2005	11.5	9.54	0.03	0	52.2	6.41	1700	2100
7	2/2/2005								
8	2/2/2005	12	8.51	3.6	1.9	22.6	6.34	1700	2100
9	2/2/2005	12.2	9.68	9.03	5.1	6.19	6.62	920	406
10	2/2/2005	12.4	9.28	14.09	8.2	8.01	6.85	23	75
1	2/15/2005	13.7	9.33	6.52	3.6	4.84	10.1	1600	254
2	2/15/2005	13.8	6.16	7.04	3.9	4.07	7.8	130	31
3	2/15/2005	13.5	8.68	6.15	3.4	2.72	8.02	49	5
4	2/15/2005	13.7	8.61	7.38	4.1	3.67	7.79	33	10
5	2/15/2005	14.6	6.17	7.41	4.1	1.54	8.24	17	10
6	2/15/2005	14.6	9.7	0.04	0	23.6	7.13	1700	2100
7	2/15/2005	15	7.78	1.62	0.8	13.2	6.53	79	75
8	2/15/2005	14.8	8.49	7.15	4	14.8	6.63	1600	2100
9	2/15/2005	15.3	9.86	8.71	4.9	5.38		4.5	5
10	2/15/2005	15.5	10.17	8.26	4.6	5.63	6.97	110	10
1	2/22/2005	17.5	7.24	5.86	3.2	4.34	7.67	4.5	5
2	2/22/2005	16.7	6.74	7.24	4	2.31	7.38	46	31
3	2/22/2005	16.6	6.48	6.78	3.7	2.68	7.46	130	5
4	2/22/2005	17	5.79	7.35	4.1	3.2	7.48	31	5
5	2/22/2005	18.9	4.48	9.04	5.1	1.19	7.66	7.8	31
6	2/22/2005	18	7.93	0.04	0	6.71	7.2	220	75
7	2/22/2005	17.6	7.63	1.97	1	13.3	6.43	49	20
8	2/22/2005	17.9	7.73	6.89	3.8	7.81	6.64	350	53

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
9	2/22/2005	19.2	8.06	8.79	4.9	15.4	6.8	4.5	5
10	2/22/2005	17.9	9.12	8.57	4.8	3.45	6.95	33	5
1	2/23/2005	16.2	6.72	6.17	3.4	3.17	10.1	23	10
2	2/23/2005	17.2	6.64	7	3.9	3.46	7.78	49	99
3	2/23/2005	16.9	5.95	7.12	3.9	2.26	7.51	79	64
4	2/23/2005	16.8	5.76	7.12	3.9	3.16	7.16	13	5
5	2/23/2005	17.5	4.34	8.24	4.6	1.22	7.1	1	5
6	2/23/2005	18.9	7.84	0.04	0	8.63	7.04	110	150
7	2/23/2005	18.9	7.45	1.62	0.8	11.9	6.44	17	20
8	2/23/2005	18.7	8.23	8.36	4.7	6.81	6.66	140	20
9	2/23/2005	18.7	8.62	8.65	4.8	3.41	6.86	7.8	5
10	2/23/2005	19.1	8.58	8.53	4.8		6.96	140	31
1	3/1/2005	14.5	9.06	5.69	3.1	26.6	7.66	350	42
2	3/1/2005	14.1	9.5	6.22	3.4	24.3	7.65	280	53
3	3/1/2005	14.1	10.76	6.66	3.9	29.2	7.62	350	53
4	3/1/2005	14.5	9.25	7.21	4.1	30.8	7.48	280	31
5	3/1/2005	13.2	10.22	8.05	4.5	25	7.8	79	10
6	3/1/2005								
7	3/1/2005	14.4	6.93	1.88	1	14.3	7.7	49	87
8	3/1/2005	14.2	6.49	4.15	2.2	20.9	6.88	350	207
9	3/1/2005	11.9	10.17	7.12	3.9	28.1	6.96	49	53
10	3/1/2005	14.6	9.49	7.74	4.3	29.1	7.14	49	31
1	3/8/2005	15.3	9.37	6.29	3.5	46.9	7.55	110	99
2	3/8/2005	14.6	9.04	7.95	4.4	49.4	7.71	920	560
3	3/8/2005	15.2	9.9	8.61	4.8	45.2	7.7	1700	207
4	3/8/2005	15	9.86	8.51	4.6	47.4	7.69	1700	99
5	3/8/2005	14.5	8.96	9.63	5.4	25.2	7.89	130	87
6	3/8/2005	15	8.44	0.4	0	11	8	140	406
7	3/8/2005	15.3	7.85	3.04	1.6	12.2	7.31	49	10
8	3/8/2005	15.5	8.35	6.09	3.3	9.9	7.17	79	10
9	3/8/2005	14.2	9.63	6.64	3.7	32.5	7.27	49	31
10	3/8/2005	16	8.71	7.7	4.3	47.3	7.32	140	75

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
1	3/15/2005	16.7	8.75	5.33	2.9	50.2	7.73	79	64
2	3/15/2005	15.9	9.13	6.3	3.5	29.7	7.62	240	20
3	3/15/2005	16.5	9.45	6.37	3.6	29.6	7.75	33	42
4	3/15/2005	15.8	8.06	6.72	3.7	18.7	7.64	33	42
5	3/15/2005	15.1	5.05	9.47	5.3	26.9	7.71	130	64
6	3/15/2005	15.7	7.84	0.04	0	5.15	8.07	49	99
7	3/15/2005	16.6	7.88	3.5	1.8	7.91	7.19	6.8	10
8	3/15/2005	16.6	7.77	5.8	3.2	5.29	7.13	33	5
9	3/15/2005	15.5	8.43	6.32	3.5	4.12	7.32	7.8	5
10	3/15/2005	15.4	9.09	8	4.5	18.7	7.62	7.8	10
1	3/22/2005	16.7	8.61	5.71	3.1	16.1	7.73	11	31
2	3/22/2005	16.5	8.03	6.28	3.5	5.67	7.68	23	5
3	3/22/2005	15.9	7.4	7	3.9	5.1	7.58	7.8	10
4	3/22/2005	15.8	7.4	8.2	4.6	4.99	7.45	46	10
5	3/22/2005	17	7.13	10.01	5.7	2.01	7.56	70	5
6	3/22/2005	17.4	8.14	0.04	0	51.6	7.57	49	87
7	3/22/2005	17.6	7.95	2.82	1.5	11.2	6.81	49	20
8	3/22/2005	17.6	8.46	5.99	3.3	14	6.75	240	53
9	3/22/2005	18.9	8.21	6.31	3.4	15.1	6.82	49	31
10	3/22/2005	17.5	9.26	5.94	3.2	5.97	7.1	130	10
1	3/29/2005	18.3	5.14	5.25	2.8	15.9	7.92	33	20
2	3/29/2005	17.9	7.98	5.96	3.3	10.7	7.58	49	5
3	3/29/2005	18.2	9.55	6.11	3.3	13.1	7.91	49	5
4	3/29/2005	18.2	6.91	6.58	3.6	15.5	7.68	110	31
5	3/29/2005	18.5	9.47	7.47	4.1	12.8	7.6	23	5
6	3/29/2005	15.8	7.45	0.04	0	6.07	7.79	350	254
7	3/29/2005	18.9	5.75	3	1.6	8.98	6.86	7.8	10
8	3/29/2005	19.3	6.27	5.95	3.2	9.19	6.86	33	42
9	3/29/2005	17.6	8.36	6.76	3.7	21.2	7.13	11	10
10	3/29/2005	20.4	9.52	6.4	3.5	21.5	8.2	130	10
1	4/5/2005	19.2				10.1	7.45	130	5
2	4/5/2005	18.8				9.25	7.44	23	5

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
3	4/5/2005	18.9				12.5	7.3	33	453
4	4/5/2005	18.8				6.45	7.48	350	64
5	4/5/2005	19.2				4.37	7.32	33	20
6	4/5/2005	17.4	6.96	0.04	0	14.8	7.4	920	150
7	4/5/2005	19.2	5.84	1.85	0.9	9.79	6.72	110	10
8	4/5/2005	19.4	5.68		2.8	11.6	6.71	49	87
9	4/5/2005	19	7.18	6.59	3.6	49.6	7.01	33	5
10	4/5/2005	20.5	7.51	5.54	3	33.6	7.49	240	42
1	4/11/2005	21.3	7.58	4.62	2.5	23	7.68	49	10
2	4/11/2005	20.9	7.55	5.3	2.9	5.92	7.47	49	5
3	4/11/2005	20.7	7.42	5.71	3.1	7.28	7.39	79	271
4	4/11/2005	20.6	7.33	5.96	3.2	6.51	7.22	79	20
5	4/11/2005	20.8	8.06	7.59	4.2	2.34	7.55	22	10
6	4/11/2005	19.8	7.62	0.04	0	7.99	7.41	130	238
7	4/11/2005	21.1	7.12	2.74	1.4	10.8	6.65	49	5
8	4/11/2005	21.7	7.34	6.49	3.6	10.2	6.84	110	42
9	4/11/2005	21	8.1	6.68	3.7	19.4	7.06	49	20
10	4/11/2005	21.2	8.42	3.06	1.6	35	7.05	240	87
1	4/12/2005	21.1	7.06	4.1	2.2	49.1	7.58	1700	2100
2	4/12/2005	20.5	7.63	5.22	2.8	15.4	7.41	1700	2100
3	4/12/2005	20.4	8.51	5.25	2.8	23.1	7.5	1700	2100
4	4/12/2005	20	7.77	4.24	2.3	31.7	7.28	1700	2100
5	4/12/2005	20.2	7.98	5.18	2.8	40.9	7.55	1700	2100
6	4/12/2005	18.7	7.28	0.03	0	96.1	7.23	1700	2100
7	4/12/2005	21	5.8	4.17	2.2	14.5	6.45	220	406
8	4/12/2005	21.8	4.7	5.15	2.8	9.47	6.42	1600	1652
9	4/12/2005	21.1	7.64	5.75	3.1	32.1	6.96	130	164
10	4/12/2005	21.1	7.82	3.1	1.6	34.9	6.91	240	738
1	4/19/2005	21.3	8.48	6.06	3.3	5.36	7.56	13	31
2	4/19/2005	20.7	8.08	6.4	3.5	3.86	7.26	23	31
3	4/19/2005	20.7	8.39	7.23	4	7.79	7.4	23	20
4	4/19/2005	20.7	7.85	7.63	4.2	5.75	7.15	49	10

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
5	4/19/2005	20.9	8.38	7.49	4.1	3.07	7.76	13	5
6	4/19/2005	18.1	7.67	0.04	0	8.65	7.68	130	178
7	4/19/2005	20.5	5.2	0.59	0.3	19.2	6.65	46	20
8	4/19/2005	21.6	7.09	6.07	3.3	6.91	6.73	70	10
9	4/19/2005	20.6	7.74	6.32	3.5	23	7.11	13	5
10	4/19/2005	22	8.59	5.66	3.1	15.8	7.87	110	5
1	4/26/2005	20.1	8.79	5.97	3.3	21.8	7.7	70	53
2	4/26/2005	20	8.07	6.65	3.6	15.1	7.46	23	5
3	4/26/2005	20.5	7.91	6.92	3.8	9.42	7.36	13	5
4	4/26/2005	20.6	7.23	6.97	3.8	7.3	7.24	33	31
5	4/26/2005	19.9	8.46	8.03	4.5	4.09	8.03	45	5
6	4/26/2005	16.7	7.65	0.05	0	11.9	8.25	1600	1445
7	4/26/2005	20.2	6.73	2.83	1.5	10.8	6.94	23	31
8	4/26/2005	21	6.68	5.76	3.1	9.11	6.9	170	75
9	4/26/2005	18.9	7.9	5.83	3.2	44.8	7.04	240	99
10	4/26/2005	20.6	7.68	4.16	2.2	37.4	7.04	49	124
1	5/3/2005	21.2	7.51	6.41	3.5	76.5	7.52	350	75
2	5/3/2005	19.8	8.15	7.02	3.9	68.1	7.4	350	150
3	5/3/2005	20.4	8.07	9.15	5.1	21.3	7.53	110	87
4	5/3/2005	20.3	8.01	9.57	5.4	21.1	7.53	79	10
5	5/3/2005	19.4	7.39	7.01	3.9	28.8	7.83	49	42
6	5/3/2005	17.7	7.37	0.04	0	11	7.98	1600	150
7	5/3/2005	20	5.12	0.64	0.3	15	7.45	140	111
8	5/3/2005	20.2	5.89	4.16	2.2	10.1	7.36	240	111
9	5/3/2005	20.1	7.69	5.57	3	2.53	7.34	17	23
10	5/3/2005	20.9	8.25	3.97	2.1	9.5	7.61	33	20
1	5/10/2005	22.4	6.41	6.85	3.8	3.87	7.53	7.8	5
2	5/10/2005	22.6	6.76	7.71	4.3	2.74	7.48	2	5
3	5/10/2005	22.6	6.38	7.66	4.2	4.95	7.95	13	5
4	5/10/2005	22.8	6.11	8.5	4.7	3.14	7.53	4.5	5
5	5/10/2005	22.2	6.26	8.72	4.9	2.1	8.46	2	5
6	5/10/2005	20.1	7.17	0.05	0	7.89	7.91	1600	192

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
7	5/10/2005	22.3	4.79	1.12	0.6	9.85	6.85	21	111
8	5/10/2005	23.2	6.77	5.59	3	5.12	6.96	23	531
9	5/10/2005	23.2	7.7	6.08	3.3	3.91	7.18	2	5
10	5/10/2005	24.2	7.99	6.01	3.3	7.02	7.35	49	5
1	5/17/2005	24.8	5.78	7.4	4.1	9.68	7.22	7.8	20
2	5/17/2005	24.3	5.75	7.66	4.2	19.1	6.93	130	5
3	5/17/2005	24.3	6.72	7.46	4.1	7.4	7.1	1700	2100
4	5/17/2005	24.4	5.87	7.49	4.1	12.6	7.04	33	31
5	5/17/2005	24.8	6.09	9.17	5.1	11.6	7.31	11	10
6	5/17/2005	21.8	6.46	0.04	0	5.43	7.97	130	124
7	5/17/2005	24.6	5.5	2.46	1.3	8.12	6.98	33	42
8	5/17/2005	25.7	6.62	6.53	3.6	3.81	7.04	33	5
9	5/17/2005	25.3	6.9	6.98	3.8	3.07	7.27	1	5
10	5/17/2005	26.1	7.05	6.28	3.4	8.2	7.39	11	10
1	5/24/2005	28.9	4.44	7.57	4.2	4.35	7.03	33	10
2	5/24/2005	28.6	5.15	8.01	4.4	4.97	7.1	4.5	10
3	5/24/2005	28.7	6.88	7.98	4.6	14.2	7.35	4.5	20
4	5/24/2005	28.3	6.21	8.39	4.6	15.2	7.29	140	406
5	5/24/2005	27.4	7.27	8.88	4.7	16.9	7.68	17	87
6	5/24/2005	25.3	6.15	0.05	0	6.49	7.06	49	222
7	5/24/2005	29.4	5.38	6.16	3.3	4.6	6.88	4.5	10
8	5/24/2005	28.6	5.39	2.52	1.3	14.2	6.78	17	5
9	5/24/2005	27.1	7.75	6.18	3.4	23.8	7.2	11	10
10	5/24/2005	28.4	6.73	6.71	3.6	94.7	7.09	26	254
1	5/31/2005	26.8	5.92	7.48	4.1	10.8	7.51	1600	178
2	5/31/2005	26.6	5.9	8.47	4.7	5.14	7.26	540	64
3	5/31/2005	26.8	6.33	8.66	4.8	3.45	7.15	350	324
4	5/31/2005	26.7	5.59	8.64	4.8	2.97	7.02	540	99
5	5/31/2005	25.7	6.09	9.14	5.1	4.82	7.29	23	164
6	5/31/2005	21.5	6.6	0.03	0	42.1	6.29	1600	2100
7	5/31/2005	24.7	3.87	1.16	0.6	10.8	6.26	920	1298
8	5/31/2005	23.6	4.47	1.67	0.8	14.2	6.16	1700	2100

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
9	5/31/2005	25.2	6.88	5.16	2.8	6.94	6.39	540	53
10	5/31/2005	25.5	6.78	7.24	4	13.6	6.62	170	164
1	6/7/2005	27.6	5.23	6.74	3.7	4.88	7.26	920	324
2	6/7/2005	27.2	5.51	7.36	4	2.45	7.12	1600	324
3	6/7/2005	27.5	5.46	8.6	4.8	2.24	7.16	140	254
4	6/7/2005	27.4	5.25	8.52	4.7	2.36	7.07	350	137
5	6/7/2005	26.8	5.77	9.47	5.3	4.87	7.64	1	10
6	6/7/2005	23.5	6.43	0.05	0	9.26	7.22	130	137
7	6/7/2005	27.2	3.52	2.59	1.3	6.49	6.01	79	64
8	6/7/2005	27.9	3.74	4.83	2.6	4.37	6.02	170	150
9	6/7/2005	27.6	6.68	6.15	3.3	7.55	6.48	7.8	5
10	6/7/2005	28.1	6.73	6.96	3.8	5.86	6.7	13	10
1	6/14/2005	29.2	5.45	7.38	4	4.15	7.49	13	5
2	6/14/2005	29.3	4.93	8.28	4.6	3.14	7.18	13	20
3	6/14/2005	29.6	6.09	9.19	5.1	2.94	7.72	1	5
4	6/14/2005	29.5	6.3	9.41	5.2	3.24	7.68	6.8	5
5	6/14/2005	28.2	4.37	9.63	5.4	2.9	7.34	2	20
6	6/14/2005	27.1	6.31	0.05	0	6.76	7.09	130	64
7	6/14/2005	29.8	4.33	2.82	1.4	6.12	6.6	13	10
8	6/14/2005	30.2	4.23	4.97	2.6	3.97	6.53	23	75
9	6/14/2005	30.4	6.33	6.07	3.3		6.86	33	10
10	6/14/2005	30.4	6.96	7.42	4.1	7.95	7.18	7.8	5
1	6/15/2005	29.9	5.25	7.45	4.1	3.2	7.11	4.5	5
2	6/15/2005	29.4	4.85	8.59	4.8	2.79	6.97	9.3	5
3	6/15/2005	29.4	6.67	9.37	5.2	3.35	7.1	240	31
4	6/15/2005	29.2	5.72	9.63	5.4	3.79	7.23	23	5
5	6/15/2005	29.3	6.07	9.47	5.3	7.93	7.36	49	31
6	6/15/2005	27.2	5.91	0.05	0	5.58	7.14	540	53
7	6/15/2005	30	3.57	2.15	1.1	5.58	5.06	79	75
8	6/15/2005	30.8	4.7	4.96	2.6	6.02	5.13	46	42
9	6/15/2005	30	6.44	5.83	3.1	32.4	5.28	49	64
10	6/15/2005	30.1	6.03	7.57	4.1	24	5.3	23	10

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
1	6/21/2005	29.1	4.86	7.98	4.4	5.58	6.78	23	10
2	6/21/2005	29.3	5.66	9.14	5.1	5.68	7.11	4	5
3	6/21/2005	29.1	5.35	9.88	5.5	2.25	7.05	130	5
4	6/21/2005	29.5	6.73	9.95	5.6	3.35	7.41	4.5	10
5	6/21/2005	28.2	6.25	10.07	5.6	3.5	7.63	2	5
6	6/21/2005	25	5.8	0.05	0	8.3	6.57	130	150
7	6/21/2005	28.7	3.78	1.59	0.8	5.57	6.71	79	20
8	6/21/2005	29.2	4.88	4.12	2.2	4.22	6.86	33	5
9	6/21/2005	29.1	6.24	4.46	2.4	1.86	6.89	4	5
10	6/21/2005	29.5	6.53	7.43	4.1	3.45	6.88	23	5
1	6/28/2005	30.9	4.78	58.5	4.7	1.84	6.59	4.5	5
2	6/28/2005	30.3	4.56	9.17	5.1	2.45	6.6	70	5
3	6/28/2005	30.2	4.54	9.77	5.5	2.27	6.97	33	5
4	6/28/2005	30.1	4.16	9.76	5.4	2.39	6.96	33	5
5	6/28/2005	28.6	5.75	9.66	5.4	6.65	7.34	7.8	10
6	6/28/2005	26.3	6.67	0.05	0	8.02		110	99
7	6/28/2005	29.9	5.19	2.66	1.4	4.92		7.8	5
8	6/28/2005	30.3	4.99	4.4	2.3	5.54		4.5	10
9	6/28/2005	29.9	5.91	4.68	2.5	3.19		4.5	5
10	6/28/2005	29.3	6.53	8.03	4.4	4.21		13	5
1	7/5/2005	30	5.23	9.22	4.7	2.02		23	20
2	7/5/2005	29.2	4.1	10.16	5.2	1.95		13	20
3	7/5/2005	29.2	5	9.54	5.3	2.93		23	5
4	7/5/2005	29.5	4.19	9.74	5.4	2.12		33	31
5	7/5/2005	29.2	5.55	10.06	5.6	5.38		6.1	5
6	7/5/2005	27	6.12	0.05	0	7.51	7.33	350	238
7	7/5/2005	29.2	4.62	2.12	1.1	7.25	6.65	11	10
8	7/5/2005								
9	7/5/2005	28.1						79	20
10	7/5/2005	28.5	7.32	7.95	4.4	39.6	7.43	130	42
1	7/12/2005	27.7	4.18	9.53	5.3	11	6.96	22	20
2	7/12/2005	28	3.87	11.88	6.7	11.5	7.09	79	20

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
3	7/12/2005	28.4	5.02	10.02	5.6	7.36	7.58	14	10
4	7/12/2005	27.7	5.18	9.7	5.4	9.17	7.22	4.5	5
5	7/12/2005	28.4	3.75	9.19	5.1	7.49	7.06	2	10
6	7/12/2005	26.3	5.86	0.04	0	7.54	6.55	110	164
7	7/12/2005	28.1	4.13	0.98	0.5	8.56	6.51	13	20
8	7/12/2005	28.2	3.7	2.73	1.4	7.83	6.07	79	53
9	7/12/2005	28.8	6.7	4.45	2.4	35	6.37	33	20
10	7/12/2005	29.5	6.67	5.87	3.2	8.31	6.88	23	10
1	7/20/2005	29.8	6.2	9.32	5.2	12.8	6.88	4.5	31
2	7/20/2005	29.4	5.95	9.59	5.3	6.15	6.86	17	5
3	7/20/2005	29.5	5.7	9.36	5.2	2.75	6.92	79	5
4	7/20/2005	29.3	5.96	9.3	5.2	2.74	6.95	6.8	10
5	7/20/2005	29.4	6.1	8.59	4.8	4.04	7.27	7.8	5
6	7/18/2005	26	6.47	0.04	0	0	6.64	170	222
7	7/18/2005	28.9	3.46	0.58	0.3	11	6.51	49	42
8	7/18/2005	30	4.33	3.22	1.7	6.04	6.35	33	64
9	7/18/2005	30	6.83	4.13	2.2	13	6.9	33	31
10	7/18/2005	30.1	7.02	6.45	3.5	6.41	7.31	33	10
1	7/19/2005	29.8	5.52	9.46	5.3	13.9	6.91	46	42
2	7/19/2005	5.52	4.9	9.44	5.3	7.82	6.77	7.8	5
3	7/19/2005	4.9	5.46	9.19	5.1	3.29	6.89	33	20
4	7/19/2005	28.9	5.66	9	5	4.33	6.85	23	10
5	7/19/2005	28.9	6.64	8.37	4.6	15.5	7.07	13	5
6	7/19/2005	26	6.35	0.04	0	10.1	6.64	280	99
7	7/19/2005	29.1	3.5	0.75	0.04	10	6.44	23	31
8	7/19/2005	30.4	4.35	3.28	1.7	5.61	6.35	33	20
9	7/19/2005	30.3	6.77	4.58	2.4	2.67	6.34	1	5
10	7/19/2005	30.2	7.09	6.9	3.8	5.03	7.33	14	10
1	7/26/2005	32.4	3.35	9.18	5.1	6.23	6.71	70	20
2	7/26/2005	31.9	3.57	9.6	5.3	3.01	7.08	17	10
3	7/26/2005	31.4	5.01	9.5	5.3	2.34	7.35	1	5
4	7/26/2005	31.4	3.98	9.43	5.2	2.76	6.85	4.5	10

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
5	7/26/2005	30.3	3.77	8.62	4.8	1.61	7.08	2	10
6	7/26/2005	27.5	5.84	0.05	0	8.67	6.97	240	164
7	7/26/2005	30.6	1.73	1.22	0.6	9.3	6.34	13	10
8	7/26/2005	31.3	3.91	3.43	1.8	6.68	6.33	31	42
9	7/26/2005	31.4	6.1	4.37	2.3	2.74	6.21	1	5
10	7/26/2005	31.6	5.58	6.75	3.7	3.66	6.91	2	10
1	8/2/2005	31.5	5.25	8.43	4.6	11.7	6.67	79	344
2	8/2/2005	30.3	5.73	8.83	4.9	8.85	6.95	350	659
3	8/2/2005	30.2	5.89	8.62	4.8	15.8	7.08	1700	1091
4	8/2/2005	30.5	4.78	8.88	4.8	17.9	7.01	1700	2005
5	8/2/2005	28.8	4.85	9.2	5.1	7.51	6.97	79	42
6	8/2/2005	25	6.56	0.04	0	21.6	6.89	1600	1184
7	8/2/2005	29.4	2.07	1.15	0.6	9.11	6.22	49	64
8	8/2/2005	29.5	3.25	3.41	1.8	9.58	6	49	75
9	8/2/2005	28.4	6.53	4.27	2.3	13.8	6.29	110	10
10	8/2/2005	29	5.9	6.34	3.4	8.31	6.68	33	137
1	8/9/2005	31.8	5.66	5.81	3.1	9.42	6.53	33	31
2	8/9/2005	31.7	5.65	7.22	3.9	4.72	5.86	13	5
3	8/9/2005	31.5	6.55	8.1	4.4	4.66	6.51	14	10
4	8/9/2005	31.1	5.64	8.27	4.5	8.13	6.51	33	5
5	8/9/2005	29.4	6.24	10.12	5.7	14.3	7.5	4.5	5
6	8/9/2005	25.5	5.62	0.05	0	11.1	7.13	240	271
7	8/9/2005	28.6	3.03	0.65	0.3	9.6	6.47	17	31
8	8/9/2005	29	2.9	3.49	1.8	7.08	6.14	79	20
9	8/9/2005	29.2	6	4.8	2.6	7.66	6.4	7.8	5
10	8/9/2005	29.6	5.49	5.95	3.2	8.27	6.87	11	20
1	8/16/2005	30.9	5.23	5.91	3.2	15.9	6.38	130	31
2	8/16/2005	30.6	5.08	6.94	3.8	10.3	6.34	13	10
3	8/16/2005	30.6	5.61	6.39	3.4	5.82	6.75	23	5
4	8/16/2005	31	5.35	7.33	4	4.88	6.5	49	20
5	8/16/2005	30.8	4.8	8.67	4.8	2.6	7.01	2	5
6	8/16/2005	26.7	6.44	0.05	0	11.1	7.42	130	87

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
7	8/16/2005	30.2	3.81	2.35	1.2	6.28	6.34	4.5	10
8	8/16/2005	31.1	3.45	6.29	3.4	15.8	6.21	79	10
9	8/16/2005	30.5	6.96	7.04	3.8	4.61	6.51	2	5
10	8/16/2005	31.2	7.45	6.73	3.6	4.77	7.1	23	10
1	8/23/2005	31.8	4.92	6.82	3.7	17.4	6.59	140	150
2	8/23/2005	32	4.92	8.93	4.9	10.5	6.63	33	20
3	8/23/2005	32	5.21	9.74	5.4	6.78	7.02	23	10
4	8/23/2005	31.5	4.35	9.91	5.5	4.47	6.98	7.8	10
5	8/23/2005	30.6	5.13	9.41	5.2	7.49	7.54	13	5
6	8/23/2005	26.5	5.97	0.04	0	12.3	7.13	350	192
7	8/23/2005	31	4.79	3.62	1.9	4.97	6.39	7.8	20
8	8/23/2005	31.5	3.11	6.27	3.4	8.87	6.16	33	53
9	8/23/2005	30.5	6.25	6.73	3.7	4.2	6.26	2	5
10	8/23/2005	31.1	6.29	7.54	4.1	4.77	6.94	13	20
1	9/27/2005								
2	9/27/2005								
3	9/27/2005								
4	9/27/2005								
5	9/27/2005								
6	9/27/2005	28.9	4.45	0.05	0	7.43	6.48	130	104
7	9/27/2005	31.9	1.54	4.64	2.5	14.9	6.33	230	184
8	9/27/2005	30	3.99	9.64	5.4	11.8	6.88	80	80
9	9/27/2005								
10	9/27/2005	29.5	5.49	17.73	10.4	7.7	7.21	0	0
1	10/4/2005	27		12.42	7.1	62.3		13	30
2	10/4/2005	26.8	6.21	12.34	7	105		300	200
3	10/4/2005	27.5	6.6	12.7	7.2	20.3		30	30
4	10/4/2005	27.4	5.26	12.65	7.2	8.2		50	5
5									
11	10/4/2005	27.8	5.56	11.98	6.8	21		50	130
6	10/4/2005	25.3	5.67	0.05	0	7.01	6.85	230	30
7	10/4/2005	27.7	2.56	4.26	2.3	7.19	6.68	80	30

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
8	10/4/2005	28.1	6	10.65	6	7.65	7.01	80	200
9	10/4/2005								
10	10/4/2005	28.4	7.55	14.75	8.5		7.59	23	100
1	10/11/2005	23.8	6.19	10.77	6.1	44.2		50	6
2	10/11/2005	24.1	6.45	10.13	5.7	45.3		23	18
3	10/11/2005	24.7	7.86	11.03	6.3	14.1		7	1
4	10/11/2005	24.5	7.35	11.57	6.6	12.9		4	2
5									
11	10/11/2005	24.4	4.4	12.1	6.9	5.53		17	112
6	10/11/2005	21.6	6.66	0.05	0		7.63	170	110
7	10/11/2005	24.2	3.91	6.19	3.4		6.69	13	20
8	10/11/2005	24.5	6.83	12.81	7.4		7.07	8	8
9	10/11/2005								
10	10/11/2005	24.9	8.03	13.09	7.5		7.54	4	1
1	10/18/2005	23.5	6.47	10.8	6.1	30.3		30	8
2	10/18/2005	23.3	7.09	12.1	6.9	12.8		11	2
3	10/18/2005	24.5	6.69	13.7	7.9	8.17		1	1
4	10/18/2005	23.6	3.92	12.16	7	3.04		2	2
5									
11	10/18/2005	24.6	6.3	14.47	8.4	5.01		17	4
6	10/18/2005	19.7	6.96	0.05	0	7.23	7.85	50	28
7	10/18/2005	23.9	7.46	7.19	4	6.07	7.04	8	6
8	10/18/2005	24.1	5.71	11.78	6.7	8.75	7.06	1	14
9	10/18/2005								
10	10/18/2005	24.6	8.01	13.17	7.6	11.6	7.76	1	4
1	10/25/2005	16.4	8.31	9.97	5.6	50		70	36
2	10/25/2005	17.3	7.88	12.28	7.1	70.9		8	1
3	10/25/2005	17.1	8.74	12.94	7.5	35.9		500	150
4	10/25/2005	18.5	7.62	13.3	7.7	17.5		170	54
5									
11	10/25/2005		6.54	12.45	7.2	3.02		50	1
6	10/25/2005	15.4	7.96	0.05	0	6.03		230	52

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
7	10/25/2005	14.2	4.53	5.6	3	15.8		510	50
8	10/25/2005	19.6	7.18	10.94	6.2	7.14		300	8
9	10/25/2005								
10	10/25/2005	19	8.79	13.88	8.1	65		30	8
1	11/1/2005	18.4	8.37	12.47	7.2	27.6		80	2
2	11/1/2005	18.6	8.38	14.71	8.6	7.25		7	4
3	11/1/2005	18.5	8.47	15	8.8	11.3		13	0
4	11/1/2005	18.3	7.95	15.13	8.8	6.82		23	26
5									
11	11/1/2005	18.8	7.13	14.04	8.2	3.97		230	28
6	11/1/2005	16.9	7.98	0.05	0	5.6		300	32
7	11/1/2005	18.7	7.65	7.77	4.3	7.25		50	10
8	11/1/2005	18.8	7.99	9.47	5.3	5.13			
9	11/1/2005								
10	11/1/2005	18.9	8.19	13.99	8.1	14.7			
1	11/8/2005	20.3	6.57	11.99	6.9	3.85		30	36
2	11/8/2005	20.8	6.26	11.28	7	4.78		500	30
3	11/8/2005	20.1		12.43	7.1	2.54		14	10
4	11/8/2005	20.4	7.59	12.33	7.1	2.29		4	8
5									
11	11/8/2005	23.3	5.6	14.14	8.2	7.38		80	66
6	11/8/2005	21	6.93	0.06	0	5.25		500	32
7	11/8/2005	21.9	9.63	6.85	4.1	6.36		130	4
8	11/8/2005	21.2	8.11	9.75	5.5	6.4		50	10
9	11/8/2005								
10	11/8/2005	23.1	8.69	14.41	8.4	4.62		9	4
1	11/15/2005	21.4	6.05	11.75	6.7	4.03		50	16
2	11/15/2005	20.5	6.41	13.09	7.6	4.05		80	16
3	11/15/2005	20.7	7.37	14.67	8.5	4.1		11	8
4	11/15/2005	20.4	5.7	14.36	8.3	3.09		0	4
5	11/15/2005	23.1	3.15	13.33	7.7	3.88		500	500
6	11/15/2005	20.9	7.87	0.05	0			1600	72

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
7	11/15/2005	21.8	8.43	8.52	4.8	4.07		23	10
8	11/15/2005	21.8	7.49	12.01	6.9	5.37		80	50
9	11/15/2005								
10	11/15/2005	23.3	8.21	15.19	8.9			30	16
1	11/22/2005	13.4	8.68	11.48	6.6	55.9		30	8
2	11/22/2005	13.7	8.47	11.97	6.9	36.5		11	6
3	11/22/2005	13.9	9.75	13.39	7.1	46.9		50	6
4	11/22/2005	13.9	9.4	12.75	7.4	20.9		4	10
5	11/22/2005	14.3	6.31	13.46	7.8	1.31		30	54
6	11/22/2005	12.7	8.57	0.05	0	9.43		230	80
7	11/22/2005	15.2	8.67	6.99	3.9	9.85		130	10
8	11/22/2005	14.3	8.97	11.4	6.5	9.95		50	20
9	11/22/2005								
10	11/22/2005	16.1	9.09	14.45	8.4			30	0
1	11/29/2005	16	7.7	11.51	6.6	42.7		30	6
2	11/29/2005	15.7	8.05	12.17	7	18.1		300	82
3	11/29/2005	15.7	8.95	11.15	7.2	22.6		1100	112
4	11/29/2005	15.3	8.35	13.16	7.6	13		700	94
5	11/29/2005	16.7	6.03	13.44	7.8	1.63		50	18
6	11/29/2005	15.9	7.59	0.05	0	22.6		300	300
7	11/29/2005	16.3	8.68	7.58	4.2	5.97		170	190
8	11/29/2005	17.1	6.41	8.11	4.5	8.71		500	150
9	11/29/2005								
10	11/29/2005	16.7	8.56	20.13	12.1	18.5		70	4
1	12/6/2005	12.4	9.35	11.13	6.4	95.3		130	98
2	12/6/2005	12.9	9.28	11.51	6.6	79.5		80	14
3	12/6/2005	12.9	9.22	11.83	6.8	23.2		50	50
4	12/6/2005	12.4	9.48	12.22	7	21.2		80	16
5	12/6/2005								
11	12/6/2005	12.9	5.28	12.76	7.4	1.95		30	12
6	12/6/2005	11.9	8.45	0.05	0			3000	84
7	12/6/2005	12.8	8.82	6.35	3.5	4.79		130	41

Site	Date	Water Temp	Diss Oxy	Spec Cond	Salinity	Turbidity	pH	Fecal Coliform	Enterococci
8	12/6/2005	14	7.97	10.5	6	5.03		230	128
9	12/6/2005								
10	12/6/2005	13.3	9.69	16.71	9.9	12.5		30	8
1	12/13/2005	11.5	10.44	11.42	6.5	5.71		30	4
2	12/13/2005	11.4	6.64	12.09	6.9	10.9		50	4
3	12/13/2005	11.3	10.26	12.01	6.9	5.66		23	0
4	12/13/2005	11.3	9.36	12.51	7.2	5.08		8	0
5	12/13/2005								
11	12/13/2005	11.4	10.24	13.36	7.7	5.91		14	4
6	12/13/2005	10.9	8.95	0.05	0	4.94		170	12
7	12/13/2005	12.4	7.27	4.82	2.6	10.6		30	2
8	12/13/2005	12.5	9.81	12.01	6.9	3.81		50	4
9	12/13/2005								
10	12/13/2005	15.4	9.48	14.91	8.7	21.9		7	2

Appendix B: EPA data

Fecal Coliform Data from EPA's STORET Katrina Central Data Warehouse (*http://oaspub.epa.gov/storetkp/dw*)

Orleans Parish water fecal coliforms

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
LP-0004	30.10855	-89.7897	NAD83	OSVBOLD3	10/14/2005 0:00			*Non-detect	
LP-0002	30.170883	-89.752317	NAD83	OSVBOLD3	10/14/2005 0:00			*Non-detect	
LP-0023	30.181117	-89.816133	NAD83	OSVBOLD3	10/14/2005 0:00		Actual	*Non-detect	
LP-0018	30.26925	-90.029367	NAD83	OSVBOLD3	10/14/2005 0:00		Actual	*Non-detect	
LP-0015	30.170733	-89.704017	NAD83	OSVBOLD3	10/14/2005 0:00		Actual	*Non-detect	
LP-0007	30.302133	-89.996433	NAD83	OSVBOLD3	10/14/2005 0:00		Actual	*Non-detect	
LP-0007	30.302133	-89.996433	NAD83	OSVBOLD3	10/14/2005 0:00		Actual	*Non-detect	
LP-0029	30.07505	-90.1347	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	4	MPN/100ml
LP-0028	30.079833	-90.35615	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	10	MPN/100ml
LP-0024	30.1771	-90.334933	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	*Non-detect	
LP-0021	30.111067	-90.060733	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	2	MPN/100ml
LP-0020	30.058467	-90.190617	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	8	MPN/100ml
LP-0016	30.080833	-90.301133	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	4	MPN/100ml
LP-0016	30.080833	-90.301133	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	6	MPN/100ml
LP-0013	30.112967	-90.143683	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	*Non-detect	
LP-0012	30.108433	-90.252317	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	12	MPN/100ml
LP-0008	30.09575	-90.358417	NAD83	OSVBOLD3	10/13/2005 0:00		Actual	*Non-detect	
LP-0026	30.227017	-90.278083	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	*Non-detect	
LP-0019	30.183067	-90.214433	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	1	MPN/100ml
LP-0014	30.332167	-90.183833	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	1	MPN/100ml
LP-0003	30.217483	-90.21225	NAD83	OSVBOLD3	10/12/2005 0:00			*Non-detect	
LP-0030	30.298383	-90.2	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	*Non-detect	
LP-0027	30.311633	-90.09805	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	3	MPN/100ml
LP-0026	30.227017	-90.278083	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	*Non-detect	
LP-0022	30.331333	-90.262367	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	4	MPN/100ml
LP-0011	30.139667	-90.219783	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	1	MPN/100ml
LP-0006	30.244317	-90.258417	NAD83	OSVBOLD3	10/12/2005 0:00		Actual	1	MPN/100ml
LP-0009	30.226333	-90.10315	NAD83	OSVBOLD3	10/11/2005 0:00		Actual	*Non-detect	
LP-0001	30.165817	-90.030217	NAD83	OSVBOLD3	10/11/2005 0:00			*Non-detect	
LP-0025	30.232417	-90.065167	NAD83	OSVBOLD3	10/11/2005 0:00		Actual	4	MPN/100ml

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
LP-0017	30.1155	-89.941667	NAD83	OSVBOLD3	10/11/2005 0:00		Actual	2	MPN/100ml
LP-0010	30.22095	-89.950483	NAD83	OSVBOLD3	10/11/2005 0:00		Actual	2	MPN/100ml
LP-0005	30.202467	-90.0188	NAD83	OSVBOLD3	10/11/2005 0:00		Actual	1	MPN/100ml
LP-0005	30.202467	-90.0188	NAD83	OSVBOLD3	10/11/2005 0:00		Actual	1	MPN/100ml
11376	30.009285	-89.97991	NAD83	22201	11/5/2005 15:25	T0630-051105-03	Actual	135	cfu/100ml
11377	30.009745	-89.977305	NAD83	22202	11/5/2005 15:45	T0630-051105-04	Actual	126	cfu/100ml
11375	30.00933	-89.978316	NAD83	22200	11/5/2005 15:00	T0630-051105-02	Estimated	390	cfu/100ml
11374	30.01017	-89.964415	NAD83	22199	11/5/2005 14:10	T0630-051105-01	Estimated	200	cfu/100ml
11378	30.008701	-89.988171	NAD83	22203	11/5/2005 16:10	T0630-051105-05	Estimated	81	cfu/100ml
11061	29.986845	-90.044836	NAD83	20706	10/22/2005 9:34	T0726-051022-01	Actual	3900	cfu/100ml
11044	29.985956	-90.045468	NAD83	20651	10/21/2005 9:45	T0726-051021-01	Actual	1300	cfu/100ml
11021	29.986836	-90.044785	NAD83	20562	10/20/2005 9:17	T0335-051020-01	Actual	6727	cfu/100ml
10919	29.985908	-90.045408	NAD83	20536	10/19/2005 9:40	T0335-051019-01	Actual	664	cfu/100ml
10866	29.98677	-90.04473	NAD83	20324	10/18/2005 9:45	T0335-051018-01	Actual	764	cfu/100ml
10834	29.985998	-90.045308	NAD83	20190	10/17/2005 9:59	T0335-051017-01	Actual	3800	cfu/100ml
10813	29.98687	-90.044891	NAD83	1673	10/16/2005 10:25	T0335-051016-01	Estimated	62000	cfu/100ml
10809	29.985965	-90.045428	NAD83	1672	10/15/2005 15:33	T0335-051015-13	Actual	76000	cfu/100ml
10770	30.05868	-89.966296	NAD83	1468	10/14/2005 10:00	T0054-051014-01	Estimated	180	cfu/100ml
10772	29.986761	-90.044891	NAD83	1470	10/14/2005 12:55	T0054-051014-03	Actual	37000	cfu/100ml
10771	29.981681	-90.023403	NAD83	1469	10/14/2005 11:10	T0054-051014-02	Actual	50000	cfu/100ml
10743	29.98593	-90.045446	NAD83	1455	10/13/2005 11:45	T0054-051013-04	Actual	18000	cfu/100ml
10740	30.058483	-89.96645	NAD83	1451	10/13/2005 10:10	T0054-051013-01	Actual	*Non-detect	
10700	29.9869	-90.0449	NAD83	1823	10/12/2005 9:45	T0442-051012-01	Actual	3000	cfu/100ml
10707	30.0355	-90.0113	NAD83	1831	10/12/2005 12:20	T0442-051012-08	Actual	36	cfu/100ml
10699	29.981793	-90.023225	NAD83	1745	10/12/2005 12:50	T0429-051012-03	Actual	2100	cfu/100ml
10698	29.975678	-90.004216	NAD83	1744	10/12/2005 11:45	T0429-051012-02	Actual	100	cfu/100ml
10663	29.98686	-90.044878	NAD83	1447	10/11/2005 9:50	T0054-051011-01	Actual	6100	cfu/100ml
10683	29.97563	-90.00397	NAD83	1820	10/11/2005 13:00	T0442-051011-10	Actual	17	cfu/100ml
10682	29.9738	-90.00539	NAD83	1819	10/11/2005 12:00	T0442-051011-09	Actual	*Non-detect	
10665	29.98008	-90.02015	NAD83	1449	10/11/2005 12:10	T0054-051011-03	Actual	200	cfu/100ml
10666	30.058643	-89.966211	NAD83	1450	10/11/2005 14:00	T0054-051011-04	Actual	50	cfu/100ml
10628	29.97556	-90.004003	NAD83	1805	10/10/2005 12:05	T0442-051010-01	Actual	*Non-detect	
10614	30.058661	-89.966468	NAD83	1434	10/10/2005 12:40	T0054-051010-02	Actual	27	cfu/100ml
10632	29.98075	-90.02011	NAD83	1810	10/10/2005 15:29	T0442-051010-05	Actual	*Present >QL	
10630	29.975536	-90.003793	NAD83	1808	10/10/2005 14:15	T0442-051010-03	Actual	1200	cfu/100ml
10613	29.985866	-90.045421	NAD83	1433	10/10/2005 10:15	T0054-051010-01	Actual	11000	cfu/100ml
10611	29.97992	-90.018781	NAD83	1432	10/9/2005 16:05	T0054-051009-15	Actual	82	cfu/100ml
10610	29.974616	-90.00432	NAD83	1431	10/9/2005 15:05	T0054-051009-14	Actual	*Non-detect	
10594	29.977231	-90.011651	NAD83	1804	10/9/2005 16:30	T0442-051009-03	Actual	*Non-detect	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
10609	29.986921	-90.04482	NAD83	1430	10/9/2005 13:55	T0054-051009-13	Actual	*Present >QL	
10587	29.976736	-90.016516	NAD83	1417	10/8/2005 15:15	T0054-051008-05	Actual	83	cfu/100ml
10573	29.976721	-90.010841	NAD83	1802	10/8/2005 13:45	T0442-051008-08	Actual	200	cfu/100ml
10586	29.98587	-90.045426	NAD83	1416	10/8/2005 13:30	T0054-051008-04	Actual	6800	cfu/100ml
10585	29.986513	-90.125111	NAD83	1415	10/8/2005 12:00	T0054-051008-03	Actual	5800	cfu/100ml
10566	30.035626	-90.011516	NAD83	1795	10/8/2005 10:15	T0442-051008-01	Actual	100	cfu/100ml
10563	29.978071	-90.01587	NAD83	1793	10/7/2005 13:05	T0442-051007-11	Actual	40	cfu/100ml
10552	29.977188	-90.013405	NAD83	1412	10/7/2005 14:10	T0054-051007-03	Actual	*Present >QL	
10564	29.980166	-90.019358	NAD83	1794	10/7/2005 14:20	T0442-051007-12	Actual	64	cfu/100ml
10550	29.986878	-90.044878	NAD83	1410	10/7/2005 10:20	T0054-051007-01	Actual	3600	cfu/100ml
10551	29.994541	-90.100673	NAD83	1411	10/7/2005 11:50	T0054-051007-02	Actual	1100	cfu/100ml
10546	29.985766	-90.045418	NAD83	1409	10/6/2005 17:45	T0054-051006-05	Actual	*Present >QL	
10542	30.058823	-89.966333	NAD83	1400	10/6/2005 10:05	T0054-051006-01	Actual	27	cfu/100ml
10514	29.362626	-89.562276	NAD83	1781	10/6/2005 14:50	T0442-051006-03	Actual	91	cfu/100ml
10545	29.973066	-90.006506	NAD83	1407	10/6/2005 16:45	T0054-051006-04	Actual	100	cfu/100ml
10544	29.975601	-90.011406	NAD83	1405	10/6/2005 15:50	T0054-051006-03	Actual	*Non-detect	
10432	29.974161	-90.01439	NAD83	18584	10/5/2005 14:00	T0442-051005-06	Actual	300	cfu/100ml
10425	29.973415	-90.011876	NAD83	18553	10/5/2005 14:13	T0219-051005-08	Actual	200	cfu/100ml
10431	29.986895	-90.044888	NAD83	18583	10/5/2005 12:55	T0442-051005-05	Actual	60000	cfu/100ml
10433	29.98198	-90.02393	NAD83	18585	10/5/2005 15:45	T0442-051005-07	Actual	4400	cfu/100ml
10418	30.046516	-89.988681	NAD83	18546	10/5/2005 10:20	T0219-051005-01	Actual	4600	cfu/100ml
10331	29.973688	-90.012878	NAD83	18369	10/4/2005 11:40	T0219-051004-03	Actual	*Non-detect	
10348	30.04668	-89.988356	NAD83	18394	10/4/2005 9:00	T0335-051004-01	Actual	10	cfu/100ml
10329	29.984216	-90.037473	NAD83	18367	10/4/2005 9:30	T0219-051004-01	Actual	*Non-detect	
10332	29.974683	-90.017273	NAD83	18370	10/4/2005 12:30	T0219-051004-04	Actual	*Non-detect	
10330	29.981563	-90.02374	NAD83	18368	10/4/2005 10:00	T0219-051004-02	Actual	*Non-detect	
10301	29.986793	-90.044983	NAD83	18250	10/3/2005 10:15	T0219-051003-02	Estimated	13000	cfu/100ml
10300	29.988338	-90.067525	NAD83	18248	10/3/2005 9:00	T0219-051003-01	Actual	400	cfu/100ml
10303	29.97369	-90.01772	NAD83	18253	10/3/2005 12:50	T0219-051003-04	Actual	200	cfu/100ml
10303	29.97369	-90.01772	NAD83	18252	10/3/2005 12:50	T0219-051003-04	Actual	90	cfu/100ml
10246	29.969131	-90.005483	NAD83	18108	10/2/2005 13:45	T0335-051002-13	Actual	*Non-detect	
10246	29.969131	-90.005483	NAD83	18107	10/2/2005 13:45	T0335-051002-13	Actual	*Non-detect	
10248	29.984215	-90.037448	NAD83	18110	10/2/2005 16:15	T0335-051002-15	Actual	100	cfu/100ml
10247	29.97261	-90.017935	NAD83	18109	10/2/2005 14:50	T0335-051002-14	Actual	*Non-detect	
10214	29.986978	-90.044828	NAD83	18003	10/1/2005 13:50	T0335-051001-02	Actual	*Non-detect	
10213	29.967838	-90.008003	NAD83	18002	10/1/2005 11:30	T0335-051001-01	Actual	100	cfu/100ml
10152	29.988548	-90.068003	NAD83	17865	9/30/2005 11:00	T0335-050930-03	Estimated	200	cfu/100ml
10151	29.981826	-90.023351	NAD83	17864	9/30/2005 9:30	T0335-050930-02	Estimated	1600	cfu/100ml
10148	29.967111	-90.018495	NAD83	17860	9/30/2005 12:01	T0442-050930-02	Estimated	200	cfu/100ml

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
10149	30.011501	-90.119301	NAD83	17861	9/30/2005 14:00	T0442-050930-03	Actual	*Non-detect	
10141	30.058218	-89.966783	NAD83	17849	9/30/2005 9:50	T0219-050930-02	Estimated	300	cfu/100ml
10140	30.03472	-90.010603	NAD83	17848	9/30/2005 8:30	T0219-050930-01	Estimated	2200	cfu/100ml
10143	29.994503	-90.100611	NAD83	17852	9/30/2005 11:40	T0219-050930-04	Estimated	900	cfu/100ml
10150	30.01618	-90.06955	NAD83	17862	9/30/2005 8:04	T0335-050930-01	Estimated	700	cfu/100ml
10147	29.984208	-90.037536	NAD83	17858	9/30/2005 9:28	T0442-050930-01	Estimated	4000	cfu/100ml
10061	30.05809	-89.96681	NAD83	17541	9/29/2005 10:00	T0219-050929-03	Actual	1800	cfu/100ml
10059	29.99424	-90.101263	NAD83	17539	9/29/2005 7:15	T0219-050929-01	Actual	1900	cfu/100ml
10085	29.981686	-90.023468	NAD83	17695	9/29/2005 9:15	T0335-050929-02	Actual	500	cfu/100ml
10086	29.988305	-90.067593	NAD83	17696	9/29/2005 10:35	T0335-050929-03	Actual	1000	cfu/100ml
10062	29.986948	-90.044831	NAD83	17542	9/29/2005 12:10	T0219-050929-04	Actual	2500	cfu/100ml
10060	30.046786	-89.988471	NAD83	17540	9/29/2005 8:50	T0219-050929-02	Actual	1000	cfu/100ml
10085	29.981686	-90.023468	NAD83	17694	9/29/2005 9:15	T0335-050929-02	Actual	500	cfu/100ml
10084	30.01621	-90.069575	NAD83	17693	9/29/2005 7:50	T0335-050929-01	Actual	3000	cfu/100ml
10045	29.994175	-90.10086	NAD83	17502	9/28/2005 16:45	T0219-050928-03	Actual	1300	cfu/100ml
10040	30.016148	-90.069373	NAD83	17467	9/28/2005 15:00	T0441-050928-03	Actual	600	cfu/100ml
10044	30.058215	-89.96674	NAD83	17501	9/28/2005 14:00	T0219-050928-02	Actual	1900	cfu/100ml
10041	29.981465	-90.025366	NAD83	17468	9/28/2005 13:55	T0335-050928-01	Actual	900	cfu/100ml
10039	29.982128	-90.02787	NAD83	17466	9/28/2005 13:05	T0441-050928-02	Actual	400	cfu/100ml
10028	29.9815	-90.02625	NAD83	17422	9/26/2005 15:30	SW593-GB-G-N-09	Actual	2200	cfu/100ml
9864	29.988133	-90.067735	WGS84	17232	9/26/2005 12:10	SW202-KN-G-D-09	Actual	19000	cfu/100ml
9864	29.988133	-90.067735	WGS84	17231	9/26/2005 12:10	SW202-KN-G-N-09	Actual	10000	cfu/100ml
9854	29.986885	-90.044821	WGS84	17215	9/25/2005 9:00	SW600-gb-G-N-09	Actual	22000	cfu/100ml
9810	30.046608	-89.98866	WGS84	17193	9/25/2005 9:50	SW200-KN-G-D-09	Actual	30000	cfu/100ml
9857	29.967326	-90.020568	WGS84	17218	9/25/2005 13:30	SW598-gb-G-N-09	Actual	4800	cfu/100ml
9811	30.008701	-90.10819	WGS84	17194	9/25/2005 12:40	SW201-KN-G-N-09	Actual	490000	cfu/100ml
9856	29.963453	-90.021036	WGS84	17217	9/25/2005 12:00	SW599-gb-G-N-09	Actual	25000	cfu/100ml
9810	30.046608	-89.98866	WGS84	17192	9/25/2005 9:50	SW200-KN-G-N-09	Actual	23000	cfu/100ml
10025	29.966392	-89.99893	NAD83	17419	9/26/2005 11:00	SW590-GB-G-N-09	Actual	4300	cfu/100ml
10027	29.961883	-90.00083	NAD83	17421	9/26/2005 14:00	SW592-GB-G-N-09	Actual	4400	cfu/100ml
10026	29.96792	-89.99893	NAD83	17420	9/26/2005 12:30	SW591-GB-G-N-09	Actual	1400	cfu/100ml

Orleans Parish sediment fecal coliforms

The units as downloaded were cfu/100 mL. These were changed to cfu/g for this report.

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
11317	29.922093	-89.9427	NAD83	22122	11/4/2005 10:15	T0924-051104-01	Actual	*Non-detect	
11317	29.922093	-89.9427	NAD83	22121	11/4/2005 10:15	T0924-051104-01	Actual	*Non-detect	
10787	29.992123	-90.041395	NAD83	19918	10/14/2005 10:25	T0335-051014-01	Actual	24627	cfu/g
10787	29.992123	-90.041395	NAD83	19919	10/14/2005 10:25	T0335-051014-01	Actual	10499	cfu/g
9979	30.035516	-89.989746	NAD83	17326	9/27/2005 10:30	T0232-050927-07	Actual	*Non-detect	
9993	30.01357	-89.971351	NAD83	17341	9/27/2005 13:00	T0442-050927-09	Actual	26431	cfu/g
9994	30.030406	-89.98506	NAD83	17342	9/27/2005 13:28	T0442-050927-10	Actual	4390	cfu/g
9984	30.011935	-89.999445	NAD83	17331	9/27/2005 12:00	T0232-050927-12	Actual	*Non-detect	
9981	30.025391	-90.001008	NAD83	17328	9/27/2005 11:05	T0232-050927-09	Actual	*Present >QL	
9988	30.040308	-89.958715	NAD83	17335	9/27/2005 10:50	T0442-050927-04	Actual	11683	cfu/g
9986	30.058431	-89.96051	NAD83	17333	9/27/2005 9:50	T0442-050927-02	Actual	2501	cfu/g
9989	30.03342	-89.957681	NAD83	17336	9/27/2005 11:10	T0442-050927-05	Actual	9725	cfu/g
9990	30.038743	-89.966796	NAD83	17337	9/27/2005 11:35	T0442-050927-06	Actual	3505	cfu/g
9985	30.070808	-89.944141	NAD83	17332	9/27/2005 9:15	T0442-050927-01	Actual	*Non-detect	
9983	30.01282	-89.994848	NAD83	17330	9/27/2005 11:40	T0232-050927-11	Actual	*Non-detect	
9982	30.017603	-90.006113	NAD83	17329	9/27/2005 11:20	T0232-050927-10	Actual	*Non-detect	
9987	30.049565	-89.962603	NAD83	17334	9/27/2005 10:25	T0442-050927-03	Actual	3377	cfu/g
9991	30.04637	-89.97605	NAD83	17338	9/27/2005 12:05	T0442-050927-07	Estimated	*Non-detect	
9976	30.033878	-90.016466	NAD83	17321	9/27/2005 9:25	T0232-050927-03	Actual	*Present >QL	
9979	30.035516	-89.989746	NAD83	17325	9/27/2005 10:30	T0232-050927-07	Actual	*Non-detect	
9976	30.033878	-90.016466	NAD83	17322	9/27/2005 9:40	T0232-050927-04	Actual	*Present >QL	
9980	30.026596	-89.992233	NAD83	17327	9/27/2005 10:50	T0232-050927-08	Actual	11334	cfu/g
9978	30.039493	-89.993056	NAD83	17324	9/27/2005 10:10	T0232-050927-06	Actual	*Present >QL	
9973	30.018605	-90.02164	NAD83	17319	9/27/2005 8:50	T0232-050927-01	Actual	*Non-detect	
9976	30.033878	-90.016466	NAD83	17320	9/27/2005 9:00	T0232-050927-02	Actual	4614	cfu/g
9977	30.037393	-89.9993	NAD83	17323	9/27/2005 10:00	T0232-050927-05	Actual	*Present >QL	
9940	30.004006	-90.119291	WGS84	17300	9/26/2005 9:00	RS909-db-G-N-09	Actual	*Present >QL	
9953	29.9928	-90.112728	WGS84	17314	9/26/2005 16:00	RS921-db-G-D-09	Estimated	*Non-detect	
9953	29.9928	-90.112728	WGS84	17313	9/26/2005 16:00	RS921-db-G-N-09	Estimated	*Non-detect	
9951	29.988785	-90.110903	WGS84	17311	9/26/2005 14:44	RS920-db-G-N-09	Actual	*Non-detect	
9946	30.021178	-90.07956	WGS84	17306	9/26/2005 11:40	RS915-db-G-N-09	Actual	*Non-detect	
9945	30.020003	-90.088976	WGS84	17305	9/26/2005 11:20	RS914-db-G-N-09	Actual	*Non-detect	
9944	30.017243	-90.103046	WGS84	17304	9/26/2005 11:00	RS913-DB-G-N-09	Actual	*Non-detect	
9943	30.014745	-90.104035	WGS84	17303	9/26/2005 10:40	RS912-db-G-N-09	Actual	*Present >QL	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
9950	29.989026	-90.08808	WGS84	17310	9/26/2005 14:15	RS919-db-G-N-09	Actual	*Non-detect	
9947	30.012885	-90.081348	WGS84	17307	9/26/2005 12:00	RS916-db-G-N-09	Actual	*Non-detect	
9942	30.015066	-90.11207	WGS84	17302	9/26/2005 10:10	RS911-db-G-N-09	Actual	*Present >QL	
9949	29.99889	-90.103623	WGS84	17309	9/26/2005 13:00	RS918-DB-G-N-09	Actual	*Non-detect	
9948	29.99863	-90.0822	WGS84	17308	9/26/2005 12:30	RS917-db-G-N-09	Actual	*Present >QL	
9892	30.016156	-90.058148	WGS84	17254	9/26/2005 12:09	SS308-TS-G-N-09	Actual	*Non-detect	
9889	30.022033	-90.079473	WGS84	17249	9/26/2005 10:51	SS305-TS-G-N-09	Actual	11316	cfu/g
9896	29.989076	-90.054721	WGS84	17258	9/26/2005 13:47	SS312-TS-G-N-09	Actual	*Present >QL	
9894	30.000688	-90.065353	WGS84	17256	9/26/2005 13:10	SS310-TS-G-N-09	Actual	7597	cfu/g
9890	30.01165	-90.075816	WGS84	17250	9/26/2005 11:10	SS306-TS-G-N-09	Estimated	*Non-detect	
9887	30.022146	-90.056236	WGS84	17246	9/26/2005 0:00	SS303-TS-G-N-09	Actual	*Non-detect	
9888	30.02517	-90.063573	WGS84	17247	9/26/2005 10:06	SS304-TS-G-N-09	Actual	*Present >QL	
9886	30.021548	-90.068465	WGS84	17248	9/26/2005 10:32	SS302-TS-G-N-09	Actual	15718	cfu/g
9897	29.994186	-90.07147	WGS84	17259	9/26/2005 14:07	SS313-TS-G-N-09	Actual	*Present >QL	
9891	30.014003	-90.068486	WGS84	17253	9/26/2005 11:37	SS307-TS-G-N-09	Actual	*Present >QL	
9895	29.992841	-90.059301	WGS84	17257	9/26/2005 13:25	SS311-TS-G-N-09	Actual	*Present >QL	
9885	30.022908	-90.05206	WGS84	17245	9/26/2005 9:20	SS301-TS-G-N-09	Actual	*Present >QL	
9884	30.011013	-90.050745	WGS84	17244	9/26/2005 8:52	SS300-TS-G-N-09	Actual	*Present >QL	
9898	30.003788	-90.077713	WGS84	17260	9/26/2005 14:22	SS314-TS-G-N-09	Actual	4577	cfu/g
9899	29.990523	-90.080408	WGS84	17261	9/26/2005 14:45	SS315-TS-G-N-09	Actual	5722	cfu/g
10031	29.99148	-90.040368	NAD83	17532	9/25/2005 12:55	RS907-DB-G-N-09	Actual	*Non-detect	
10032	29.992778	-90.039353	NAD83	17534	9/25/2005 13:20	RS908-DB-G-D-09	Estimated	13070	cfu/g
10032	29.992778	-90.039353	NAD83	17533	9/25/2005 13:20	RS908-DB-G-N-09	Estimated	*Non-detect	
10029	29.991598	-90.041506	NAD83	17530	9/25/2005 11:45	RS905-DB-G-N-09	Actual	*Non-detect	
10030	29.991393	-90.04323	NAD83	17531	9/25/2005 12:20	RS906-DB-G-N-09	Actual	*Present >QL	
10024	29.990375	-90.04135	NAD83	17529	9/25/2005 11:20	RS904-DB-G-N-09	Actual	*Non-detect	
10020	29.987801	-90.039436	NAD83	17523	9/25/2005 9:10	RS901-DB-G-N-09	Actual	*Non-detect	
10023	29.988521	-90.040773	NAD83	17526	9/25/2005 9:50	RS902-DB-G-N-09	Actual	*Non-detect	
10022	29.987361	-90.041236	NAD83	17527	9/25/2005 10:50	RS903-DB-G-N-09	Actual	5055	cfu/g
9821	30.043541	-89.94467	WGS84	17205	9/25/2005 15:00	RS158-TD-G-N-09	Actual	*Present >QL	
9819	30.04451	-89.89242	WGS84	17203	9/25/2005 13:15	RS156-TD-G-N-09	Actual	41487	cfu/g
9818	30.03347	-89.921411	WGS84	17202	9/25/2005 12:45	RS155-TD-G-N-09	Actual	*Present >QL	
10019	29.98962	-90.039125	NAD83	17522	9/25/2005 8:30	RS900-DB-G-N-09	Actual	*Non-detect	
9822	30.059955	-89.947813	WGS84	17206	9/25/2005 15:45	RS159-TD-G-N-09	Actual	5253	cfu/g
9815	30.043321	-89.923653	WGS84	17199	9/25/2005 0:00	RS152-TD-G-D-09	Estimated	7940	cfu/g
9816	30.040041	-89.919353	WGS84	17200	9/25/2005 11:45	RS153-TD-G-N-09	Actual	*Non-detect	
9820	30.047955	-89.88641	WGS84	17204	9/25/2005 13:55	RS157-TD-G-N-09	Actual	26383	cfu/g
9817	30.036723	-89.925273	WGS84	17201	9/25/2005 12:10	RS154-TD-G-N-09	Actual	*Present >QL	
9815	30.043321	-89.923653	WGS84	17198	9/25/2005 11:15	RS152-TD-G-N-09	Estimated	*Present >QL	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
9814	30.038391	-89.933168	WGS84	17197	9/25/2005 10:40	RS151-TD-G-N-09	Actual	*Non-detect	
9812	30.02921	-89.93238	WGS84	17195	9/25/2005 8:30	RS150-TD-G-N-09	Actual	2956	cfu/g
9687	29.948265	-90.115746	WGS84	17058	9/25/2005 12:15	SS209-TS-G-N-09	Actual	*Non-detect	
9813	30.026998	-89.926471	WGS84	17196	9/25/2005 9:30	RS149-TD-G-N-09	Actual	4516	cfu/g
9684	29.94705	-90.096216	WGS84	17230	9/25/2005 0:00	SS206-TS-G-D-09	Actual	4373	cfu/g
9685	29.942281	-90.089838	WGS84	17056	9/25/2005 11:45	SS207-TS-G-N-09	Actual	*Present >QL	
9686	29.939166	-90.108141	WGS84	17057	9/25/2005 12:00	SS208-TS-G-N-09	Actual	170670	cfu/g
9680	29.947115	-90.101786	WGS84	17051	9/25/2005 0:00	SS202-TS-G-N-09	Actual	1951	cfu/g
9679	29.9612	-90.081733	WGS84	17050	9/25/2005 8:45	SS201-TS-G-N-09	Actual	13575	cfu/g
9681	29.960798	-90.101738	WGS84	17052	9/25/2005 9:55	SS203-TS-G-N-09	Actual	13764	cfu/g
9595	30.006778	-90.054158	WGS84	16936	9/19/2005 14:40	RS538-TD-G-N-09	Actual	37295	cfu/g
9593	30.016945	-90.062215	WGS84	16934	9/19/2005 0:00	RS536-TD-G-N-09	Actual	2892	cfu/g
9590	30.007708	-90.07029	WGS84	16932	9/19/2005 11:35	RS534-TD-G-N-09	Actual	*Present >QL	
9591	30.017491	-90.075885	WGS84	16933	9/19/2005 12:00	RS535-TD-G-N-09	Actual	71904	cfu/g
9588	30.007925	-90.084041	WGS84	16931	9/19/2005 10:50	RS533-TD-G-D-09	Actual	5855	cfu/g
9587	29.998008	-90.076056	WGS84	16929	9/19/2005 10:20	RS532-TD-G-N-09	Actual	12322	cfu/g
9588	30.007925	-90.084041	WGS84	16930	9/19/2005 10:50	RS533-TD-G-N-09	Actual	12977	cfu/g
9548	30.009961	-90.101938	WGS84	16867	9/18/2005 13:15	RS432-kk-G-N-09	Actual	78864	cfu/g
9550	29.982995	-90.085935	WGS84	16869	9/18/2005 14:10	RS434-kk-G-N-09	Actual	530740	cfu/g
9544	30.023386	-90.11081	WGS84	16863	9/18/2005 11:00	RS428-kk-G-N-09	Actual	*Non-detect	
9547	29.999563	-90.09475	WGS84	16866	9/18/2005 12:40	RS431-kk-G-N-09	Actual	*Non-detect	
9546	30.008643	-90.08682	WGS84	16865	9/18/2005 12:00	RS430-kk-G-N-09	Actual	*Non-detect	
9545	30.020975	-90.096111	WGS84	16864	9/18/2005 11:40	RS429-kk-G-N-09	Actual	76641	cfu/g
9551	29.988591	-90.102281	WGS84	16870	9/18/2005 14:30	RS435-kk-G-N-09	Actual	10720	cfu/g
9552	29.983041	-90.122386	WGS84	16871	9/18/2005 14:55	RS436-kk-G-N-09	Actual	*Non-detect	
9549	29.99739	-90.111088	WGS84	16868	9/18/2005 13:45	RS433-kk-G-N-09	Actual	*Non-detect	
9543	30.009391	-90.118341	WGS84	16862	9/18/2005 10:05	RS427-kk-G-D-09	Actual	11522	cfu/g
9529	30.017761	-90.026148	WGS84	16847	9/18/2005 14:20	RS530-TD-G-N-09	Actual	*Non-detect	
9530	30.01318	-90.016176	WGS84	16848	9/18/2005 0:00	RS531-TD-G-N-09	Actual	3393	cfu/g
9527	30.031351	-90.026198	WGS84	16845	9/18/2005 13:20	RS528-TD-G-N-09	Actual	*Non-detect	
9528	30.022835	-90.017963	WGS84	16846	9/18/2005 0:00	RS529-TD-G-N-09	Actual	*Non-detect	
9524	30.037786	-90.010855	WGS84	16843	9/18/2005 12:35	RS526-TD-G-N-09	Actual	*Non-detect	
9526	30.02897	-90.03214	WGS84	16844	9/18/2005 0:00	RS527-TD-G-N-09	Actual	*Non-detect	
9543	30.009391	-90.118341	WGS84	16861	9/18/2005 10:05	RS427-kk-G-N-09	Actual	61730	cfu/g
9523	30.03037	-90.00618	WGS84	16842	9/18/2005 11:25	RS525-TD-G-N-09	Actual	*Non-detect	
9521	30.02276	-90.0105	WGS84	16841	9/18/2005 0:00	RS524-TD-G-D-09	Actual	*Non-detect	
9520	30.016725	-90.001	WGS84	16839	9/18/2005 9:45	RS523-TD-G-N-09	Actual	*Non-detect	
9521	30.02276	-90.0105	WGS84	16840	9/18/2005 10:20	RS524-TD-G-N-09	Actual	*Non-detect	
9451	30.00442	-90.102665	WGS84	16768	9/17/2005 14:00	RS425-DB-G-N-09	Actual	19698	cfu/g

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
9448	29.967745	-90.007731	WGS84	16764	9/17/2005 11:26	RS422-DB-G-N-09	Actual	23788	cfu/g
9449	29.973036	-90.011968	WGS84	16766	9/17/2005 12:30	RS423-DB-G-N-09	Actual	*Non-detect	
9450	29.99725	-90.107701	WGS84	16767	9/17/2005 13:41	RS424-DB-G-N-09	Actual	593640	cfu/g
9446	29.969465	-90.01423	WGS84	16789	9/17/2005 10:55	RS421-DB-G-N-09	Actual	*Non-detect	
9445	29.970686	-90.018655	WGS84	16762	9/17/2005 10:10	RS420-db-G-N-09	Estimated	202960	cfu/g
9418	30.005995	-90.004415	WGS84	16666	9/16/2005 12:30	RS514-TD-G-N-09	Actual	*Non-detect	
9417	30.02291	-89.926845	WGS84	16665	9/16/2005 11:45	RS513-TD-G-N-09	Actual	*Non-detect	
9416	30.038611	-89.913246	WGS84	16664	9/16/2005 11:00	RS512-TD-G-N-09	Actual	16864	cfu/g
9420	30.005205	-90.024338	WGS84	16667	9/16/2005 13:25	RS515-TD-G-N-09	Actual	*Non-detect	
9413	30.03261	-89.894905	WGS84	16662	9/16/2005 9:20	RS510-TD-G-D-09	Actual	*Non-detect	
9415	30.021705	-89.900965	WGS84	16663	9/16/2005 0:00	RS511-TD-G-N-09	Actual	*Non-detect	
9413	30.03261	-89.894905	WGS84	16661	9/16/2005 9:20	RS510-TD-G-N-09	Actual	*Non-detect	
9408	30.037795	-90.006358	WGS84	16658	9/16/2005 12:10	RS418-RK-G-N-09	Actual	*Non-detect	
9409	30.020645	-90.013646	WGS84	16659	9/16/2005 12:35	RS419-RK-G-N-09	Actual	*Non-detect	
9407	30.031903	-89.996248	WGS84	16657	9/16/2005 0:00	RS417-RK-G-N-09	Actual	33576	cfu/g
9404	30.04226	-89.940375	WGS84	16654	9/16/2005 10:30	RS414-RK-G-N-09	Actual	*Non-detect	
9406	30.047113	-89.9838	WGS84	16656	9/16/2005 11:15	RS416-RK-G-N-09	Actual	20434	cfu/g
9405	30.029928	-89.97074	WGS84	16655	9/16/2005 11:00	RS415-RK-G-N-09	Actual	416250	cfu/g
9403	30.044481	-89.96238	WGS84	16651	9/16/2005 9:50	RS413-RK-G-N-09	Actual	*Non-detect	
9403	30.044481	-89.96238	WGS84	16652	9/16/2005 9:50	RS413-RK-G-D-09	Actual	*Non-detect	
9349	29.975776	-90.054536	WGS84	16553	9/15/2005 11:45	RS604-SO-G-D-09	Actual	*Present >QL	
9335	30.019278	-89.994501	WGS84	16537	9/15/2005 10:15	RS405-AD-G-D-09	Actual	*Non-detect	
9340	30.024816	-89.955936	WGS84	16540	9/15/2005 11:35	RS409-AD-G-N-09	Actual	*Present >QL	
9361	30.00514	-90.05052	WGS84	16567	9/15/2005 12:40	RS505-TD-G-N-09	Actual	*Non-detect	
9359	30.00615	-90.041335	WGS84	16565	9/15/2005 11:35	RS503-TD-G-N-09	Actual	*Non-detect	
9365	29.99012	-90.06854	WGS84	16571	9/15/2005 15:00	RS509-TD-G-N-09	Actual	*Non-detect	
9364	29.997465	-90.06351	WGS84	16570	9/15/2005 14:30	RS508-TD-G-N-09	Actual	*Non-detect	
9363	30.00492	-90.05708	WGS84	16569	9/15/2005 14:05	RS507-TD-G-N-09	Actual	*Present >QL	
9384	30.004695	-90.034195	NAD83	16564	9/15/2005 11:00	RS502-TD-G-N-09	Actual	*Non-detect	
9362	29.998298	-90.053961	WGS84	16568	9/15/2005 13:30	RS506-TD-G-N-09	Actual	*Present >QL	
9360	29.99705	-90.045345	WGS84	16566	9/15/2005 12:10	RS504-TD-G-N-09	Actual	*Non-detect	
9356	30.01122	-90.01769	WGS84	16561	9/15/2005 10:10	RS501-TD-G-D-09	Actual	6006	cfu/g
9348	29.976996	-90.066343	WGS84	16550	9/15/2005 11:15	RS603-SO-G-N-09	Actual	11341	cfu/g
9355	29.975903	-90.076103	WGS84	16558	9/15/2005 15:00	RS609-SO-G-N-09	Actual	396320	cfu/g
9351	29.966255	-90.034113	WGS84	16555	9/15/2005 13:15	RS606-SO-G-N-09	Actual	1703	cfu/g
9349	29.975776	-90.054536	WGS84	16552	9/15/2005 11:40	RS604-SO-G-N-09	Actual	*Present >QL	
9356	30.01122	-90.01769	WGS84	16560	9/15/2005 10:10	RS501-TD-G-N-09	Actual	*Non-detect	
9352	29.968088	-90.071328	WGS84	16556	9/15/2005 13:35	RS607-SO-G-N-09	Actual	*Non-detect	
9350	29.976151	-90.043471	WGS84	16554	9/15/2005 12:30	RS605-SO-G-N-09	Actual	*Non-detect	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
9354	29.968931	-90.080403	WGS84	16557	9/15/2005 14:15	RS608-SO-G-N-09	Actual	*Non-detect	
9336	30.019208	-89.985073	WGS84	16538	9/15/2005 10:45	RS406-AD-G-N-09	Actual	*Non-detect	
9343	30.024801	-89.981856	WGS84	16544	9/15/2005 12:30	RS412-AD-G-N-09	Actual	*Non-detect	
9342	30.023888	-89.973678	WGS84	16543	9/15/2005 12:10	RS411-AD-G-N-09	Actual	*Non-detect	
9347	29.98477	-90.07031	WGS84	16551	9/15/2005 10:30	RS602-SO-G-N-09	Actual	*Present >QL	
9341	30.025238	-89.964191	WGS84	16542	9/15/2005 11:55	RS410-AD-G-N-09	Actual	40515	cfu/g
9346	29.983791	-90.076665	WGS84	16549	9/15/2005 9:50	RS601-SO-G-N-09	Actual	*Non-detect	
9338	30.019681	-89.968393	WGS84	16541	9/15/2005 11:25	RS408-AD-G-N-09	Actual	66756	cfu/g
9335	30.019278	-89.994501	WGS84	16536	9/15/2005 10:15	RS405-AD-G-N-09	Actual	*Non-detect	
9337	30.018778	-89.976526	WGS84	16539	9/15/2005 11:05	RS407-AD-G-N-09	Actual	*Non-detect	
9260	29.989143	-90.049165	WGS84	16459	9/14/2005 10:45	RS153-SO-G-N-09	Actual	*Non-detect	
9265	29.981555	-90.034271	WGS84	16446	9/14/2005 13:15	RS157-SO-G-N-09	Actual	*Non-detect	
9269	29.967965	-90.030685	WGS84	16451	9/14/2005 15:15	RS453-SO-G-D-09	Actual	*Non-detect	
9288	29.965966	-90.023061	WGS84	16458	9/14/2005 10:40	RS404-AD-G-N-09	Actual	*Non-detect	
9285	29.973176	-90.122108	WGS84	16454	9/14/2005 8:45	RS401-AD-G-N-09	Actual	*Non-detect	
9287	29.958536	-90.100511	WGS84	16457	9/14/2005 9:50	RS403-AD-G-N-09	Actual	*Non-detect	
9283	29.985708	-90.026873	WGS84	16439	9/14/2005 9:15	RS151-SO-G-N-09	Actual	*Non-detect	
9286	29.972831	-90.111871	WGS84	16456	9/14/2005 9:15	RS402-AD-G-D-09	Actual	*Non-detect	
9286	29.972831	-90.111871	WGS84	16455	9/14/2005 9:15	RS402-AD-G-N-09	Actual	*Non-detect	
9269	29.967965	-90.030685	WGS84	16450	9/14/2005 15:15	RS453-SO-G-N-09	Actual	*Non-detect	
9267	29.973778	-90.053851	WGS84	16461	9/14/2005 14:30	RS451-SO-G-N-09	Actual	*Non-detect	
9268	29.97265	-90.04378	WGS84	16449	9/14/2005 15:00	RS452-SO-G-N-09	Actual	*Non-detect	
9263	29.97417	-90.039371	WGS84	16445	9/14/2005 12:45	RS156-SO-G-N-09	Actual	*Non-detect	
9266	29.973988	-90.029406	WGS84	16447	9/14/2005 13:45	RS158-SO-G-N-09	Actual	*Non-detect	
9262	29.981825	-90.044206	WGS84	16438	9/14/2005 12:00	RS155-SO-G-N-09	Actual	*Non-detect	
9261	29.982056	-90.05336	WGS84	16444	9/14/2005 11:30	RS154-SO-G-N-09	Actual	*Non-detect	
9238	29.96552	-90.12731	WGS84	16402	9/14/2005 13:05	RS148-TD-G-N-09	Actual	*Non-detect	
9259	29.992156	-90.037753	WGS84	16460	9/14/2005 9:45	RS152-SO-G-N-09	Actual	*Non-detect	
9259	29.992156	-90.037753	WGS84	16453	9/14/2005 9:45	RS152-SO-G-D-09	Actual	*Non-detect	
9236	29.951925	-90.1056	WGS84	16400	9/14/2005 11:55	RS146-TD-G-N-09	Actual	*Non-detect	
9237	29.96523	-90.117095	WGS84	16401	9/14/2005 12:25	RS147-TD-G-N-09	Actual	*Non-detect	
9235	29.95187	-90.096155	WGS84	16399	9/14/2005 0:00	RS145-TD-G-N-09	Actual	*Non-detect	
9233	29.94409	-90.100931	WGS84	16397	9/14/2005 10:05	RS143-TD-G-N-09	Actual	*Non-detect	
9234	29.943845	-90.091	WGS84	16398	9/14/2005 10:30	RS144-TD-G-N-09	Actual	*Non-detect	
9231	29.944085	-90.110905	WGS84	16395	9/14/2005 9:20	RS142-TD-G-N-09	Actual	*Non-detect	
9231	29.944085	-90.110905	WGS84	16396	9/14/2005 9:20	RS142-TD-G-D-09	Actual	*Non-detect	
9190	29.934516	-90.113513	WGS84	16355	9/13/2005 12:15	RS117-AD-G-D-09	Actual	996260	cfu/g
9212	30.00229	-89.97537	WGS84	16377	9/13/2005 14:50	RS127-TD-G-N-09	Actual	*Non-detect	
9208	30.012865	-89.97523	WGS84	16375	9/13/2005 12:15	RS124-TD-G-N-09	Actual	*Non-detect	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
9210	30.010795	-89.958535	WGS84	16376	9/13/2005 13:00	RS125-TD-G-N-09	Actual	*Non-detect	
9211	30.002875	-89.969805	WGS84	16370	9/13/2005 0:00	RS126-TD-G-N-09	Actual	*Non-detect	
9214	30.00478	-90.019815	WGS84	16379	9/13/2005 16:50	RS129-TD-G-N-09	Actual	*Non-detect	
9213	30.00069	-89.990325	WGS84	16378	9/13/2005 15:35	RS128-TD-G-N-09	Actual	*Non-detect	
9208	30.012865	-89.97523	WGS84	16374	9/13/2005 12:15	RS124-TD-G-D-09	Actual	*Non-detect	
9191	29.940043	-90.116948	WGS84	16356	9/13/2005 12:40	RS118-AD-G-N-09	Actual	17142	cfu/g
9207	30.023095	-89.94945	WGS84	16373	9/13/2005 11:50	RS123-TD-G-N-09	Actual	*Non-detect	
9205	30.012185	-89.989855	WGS84	16371	9/13/2005 10:50	RS121-TD-G-N-09	Actual	*Non-detect	
9206	30.012815	-89.98159	WGS84	16372	9/13/2005 11:20	RS122-TD-G-N-09	Actual	*Non-detect	
9187	29.932511	-90.089318	WGS84	16351	9/13/2005 11:15	RS114-AD-G-N-09	Actual	1294	cfu/g
9190	29.934516	-90.113513	WGS84	16354	9/13/2005 12:15	RS117-AD-G-N-09	Actual	19876	cfu/g
9186	29.939006	-90.084653	WGS84	16350	9/13/2005 10:55	RS113-AD-G-N-09	Actual	*Non-detect	
9189	29.933893	-90.106513	WGS84	16353	9/13/2005 12:00	RS116-AD-G-N-09	Actual	12060	cfu/g
9188	29.933591	-90.098438	WGS84	16352	9/13/2005 11:40	RS115-AD-G-N-09	Actual	*Present >QL	
9162	29.955093	-90.132848	WGS84	16339	9/13/2005 11:44	RS109-JC-G-N-09	Actual	*Non-detect	
9184	29.927233	-90.093601	WGS84	16348	9/13/2005 10:10	RS111-AD-G-N-09	Actual	6517	cfu/g
9185	29.927553	-90.101915	WGS84	16349	9/13/2005 10:40	RS112-AD-G-N-09	Actual	260160	cfu/g
9159	29.949173	-90.121583	WGS84	16337	9/13/2005 11:11	RS106-JC-G-N-09	Actual	*Non-detect	
9160	29.943496	-90.125071	WGS84	16338	9/13/2005 11:27	RS107-JC-G-N-09	Actual	*Non-detect	
9161	29.955425	-90.125071	WGS84	16340	9/13/2005 11:44	RS108-JC-G-N-09	Actual	223970	cfu/g
9158	29.95478	-90.116945	WGS84	16336	9/13/2005 10:56	RS105-JC-G-N-09	Actual	*Non-detect	
9157	29.961093	-90.114311	WGS84	16335	9/13/2005 10:35	RS104-JC-G-D-09	Actual	*Non-detect	
9157	29.961093	-90.114311	WGS84	16334	9/13/2005 10:35	RS104-JC-G-N-09	Actual	*Non-detect	
9156	29.960915	-90.121605	WGS84	16333	9/13/2005 10:16	RS103-JC-G-N-09	Actual	*Non-detect	
9155	29.961708	-90.127961	WGS84	16332	9/13/2005 10:04	RS102-JC-G-N-09	Actual	8916	cfu/g
8964	29.964105	-90.0149	WGS84	16320	9/12/2005 13:35	RS068-TD-G-N-09	Actual	95577	cfu/g
8960	29.96977	-90.0312	WGS84	16312	9/12/2005 14:45	RS069-TD-G-N-09	Actual	4972	cfu/g
8962	29.962805	-90.009	WGS84	16319	9/12/2005 13:20	RS067-TD-G-N-09	Actual	42886	cfu/g
8914	29.97323	-90.04782	WGS84	16277	9/12/2005 11:10	RS052-AD-G-N-09	Actual	*Present >QL	
8913	29.97318	-90.05359	WGS84	16275	9/12/2005 10:40	RS051-AD-G-N-09	Actual	14192	cfu/g
8912	29.97321	-90.05968	WGS84	16274	9/12/2005 10:25	RS040-AD-G-N-09	Actual	*Non-detect	
8911	29.96824	-90.06176	WGS84	16272	9/12/2005 10:05	RS039-AD-G-N-09	Actual	3589	cfu/g
8910	29.96838	-90.06916	WGS84	16271	9/12/2005 9:35	RS038-AD-G-D-09	Actual	*Non-detect	
8910	29.96838	-90.06916	WGS84	16270	9/12/2005 9:35	RS038-AD-G-N-09	Actual	*Non-detect	
8497	29.97281	-90.11645	WGS84	15973	9/11/2005 15:30	RS037-AD-G-N-09	Actual	68900	cfu/g
8902	29.94316	-90.08256	WGS84	15964	9/11/2005 0:00	RS030-AD-G-N-09	Actual	289690	cfu/g
8495	29.98376	-90.09815	WGS84	15971	9/11/2005 13:30	RS035-AD-G-N-09	Actual	67974	cfu/g
8494	29.97697	-90.08321	WGS84	15970	9/11/2005 13:10	RS034-AD-G-N-09	Actual	96895	cfu/g
8493	29.9644	-90.06847	WGS84	15969	9/11/2005 12:40	RS033-AD-G-N-09	Actual	61659	cfu/g

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
8490	29.95273	-90.079772	WGS84	15966	9/11/2005 10:55	RS031-AD-G-N-09	Actual	14818	cfu/g
8491	29.95994	-90.07092	WGS84	15967	9/11/2005 11:50	RS032-AD-G-N-09	Actual	11735	cfu/g
8491	29.95994	-90.07092	WGS84	15968	9/11/2005 11:50	RS032-AD-G-D-09	Actual	33200	cfu/g
11441	29.97472	-90.017433	NAD83	22297	11/6/2005 14:45	T0630-051106-05	Actual	*Non-detect	
11441	29.97472	-90.017433	NAD83	22295	11/6/2005 14:45	T0630-051106-05	Actual	*Non-detect	
11442	29.967591	-90.02251	NAD83	22296	11/6/2005 14:57	T0630-051106-06	Actual	*Non-detect	
14031	29.97403	-90.008193	NAD83	31221	11/5/2005 13:00	T0630-051105-01	Actual	155340	cfu/g
11322	29.957013	-90.012555	NAD83	22127	11/4/2005 14:10	T0924-051104-06	Actual	41512	cfu/g
11321	29.959285	-90.021505	NAD83	22126	11/4/2005 13:25	T0924-051104-05	Actual	*Non-detect	
11320	29.958936	-90.025896	NAD83	22125	11/4/2005 12:50	T0924-051104-04	Actual	529140	cfu/g
11304	29.964678	-90.005523	NAD83	22068	11/3/2005 14:25	T0924-051103-06	Actual	*Non-detect	
11302	29.97383	-90.001036	NAD83	22066	11/3/2005 13:40	T0924-051103-04	Actual	*Non-detect	
11303	29.968581	-90.003678	NAD83	22067	11/3/2005 14:05	T0924-051103-05	Actual	*Non-detect	
12439	29.967445	-90.014451	NAD83	31080	11/2/2005 15:30	T0924-051102-05	Actual	*Non-detect	
12438	29.968993	-90.021401	NAD83	31147	11/2/2005 14:55	T0924-051102-04	Actual	*Non-detect	
12440	29.965786	-90.008908	NAD83	31267	11/2/2005 15:58	T0924-051102-06	Actual	*Non-detect	
12438	29.968993	-90.021401	NAD83	31281	11/2/2005 14:55	T0924-051102-04	Actual	*Non-detect	
12476	29.973748	-90.015376	NAD83	31174	10/30/2005 9:57	T0335-051030-01	Actual	*Non-detect	
12477	29.96973	-90.009515	NAD83	31121	10/30/2005 10:45	T0335-051030-02	Actual	*Non-detect	
12478	29.971111	-90.007386	NAD83	31105	10/30/2005 11:36	T0335-051030-03	Actual	*Non-detect	
12478	29.971111	-90.007386	NAD83	31110	10/30/2005 11:30	T0335-051030-03	Actual	*Non-detect	
12243	29.977678	-90.010815	NAD83	31063	10/29/2005 11:25	T0335-051029-02	Actual	*Non-detect	
12473	29.978931	-90.016365	NAD83	31126	10/29/2005 11:55	T0335-051029-03	Actual	*Non-detect	
12242	29.975648	-90.004063	NAD83	31206	10/29/2005 10:40	T0335-051029-01	Actual	*Non-detect	
12475	29.978153	-90.02005	NAD83	31046	10/29/2005 12:50	T0335-051029-05	Actual	*Non-detect	
12474	29.979498	-90.019781	NAD83	31268	10/29/2005 12:15	T0335-051029-04	Actual	*Non-detect	
12475	29.978153	-90.02005	NAD83	31256	10/29/2005 12:50	T0335-051029-05	Actual	*Non-detect	
10631	29.975536	-90.003793	NAD83	19250	10/10/2005 14:38	T0442-051010-04	Actual	*Non-detect	
10170	29.964071	-90.0147	NAD83	17890	9/30/2005 12:35	T0232-050930-07	Actual	*Non-detect	
10169	29.962608	-90.009371	NAD83	17889	9/30/2005 12:25	T0232-050930-06	Actual	*Non-detect	
10168	29.966876	-90.008075	NAD83	17887	9/30/2005 12:05	T0232-050930-05	Actual	*Non-detect	
10171	29.961723	-90.021546	NAD83	17891	9/30/2005 13:00	T0232-050930-08	Actual	*Non-detect	
10166	29.969525	-90.014155	NAD83	17886	9/30/2005 10:46	T0232-050930-03	Actual	52367	cfu/g
10167	29.973001	-90.011981	NAD83	17888	9/30/2005 10:46	T0232-050930-04	Actual	*Non-detect	
10165	29.970555	-90.018676	NAD83	17885	9/30/2005 10:05	T0232-050930-02	Actual	*Non-detect	
10164	29.965965	-90.023136	NAD83	17884	9/30/2005 9:16	T0232-050930-01	Actual	*Non-detect	

St. Bernard Parish sediment fecal coliforms

The units as downloaded were cfu/100 mL. These were changed to cfu/g for this report.

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
11121	29.949615	-89.93824	NAD83	21320	10/27/2005 13:53	T0918-051027-01	Actual	*Non-detect	
12431	29.873025	-89.863261	NAD83	31202	11/27/2005 14:10	T0703-051127-10	Actual	*Non-detect	
12429	29.86734	-89.82044	NAD83	31153	11/27/2005 13:35	T0703-051127-08	Actual	4261	cfu/g
12428	29.892415	-89.898335	NAD83	31086	11/27/2005 13:10	T0703-051127-07	Actual	*Non-detect	
12426	29.864708	-89.817681	NAD83	31146	11/27/2005 11:40	T0703-051127-05	Actual	*Non-detect	
12430	29.87303	-89.847926	NAD83	31197	11/27/2005 13:55	T0703-051127-09	Actual	*Non-detect	
12425	29.863238	-89.817976	NAD83	31013	11/27/2005 11:20	T0703-051127-04	Actual	1110700	cfu/g
12423	29.865776	-89.839501	NAD83	31186	11/27/2005 10:30	T0703-051127-02	Actual	*Non-detect	
12427	29.866166	-89.817896	NAD83	31278	11/27/2005 11:55	T0703-051127-06	Actual	426230	cfu/g
12422	29.865758	-89.84175	NAD83	31260	11/27/2005 10:00	T0703-051127-01	Estimated	402240	cfu/g
12424	29.864768	-89.837635	NAD83	31251	11/27/2005 10:50	T0703-051127-03	Actual	*Non-detect	
12422	29.865758	-89.84175	NAD83	31088	11/27/2005 10:00	T0703-051127-01	Estimated	5268	cfu/g
12413	29.872581	-89.865655	NAD83	31201	11/26/2005 10:45	T0703-051126-02	Actual	*Non-detect	
12412	29.873165	-89.853805	NAD83	31249	11/26/2005 10:15	T0703-051126-01	Estimated	1121	cfu/g
12421	29.876083	-89.817458	NAD83	31135	11/26/2005 14:45	T0703-051126-10	Actual	*Non-detect	
12420	29.877218	-89.806811	NAD83	31099	11/26/2005 14:25	T0703-051126-09	Actual	*Non-detect	
12419	29.876088	-89.832251	NAD83	31026	11/26/2005 14:05	T0703-051126-08	Actual	*Non-detect	
12418	29.87704	-89.828796	NAD83	31094	11/26/2005 13:50	T0703-051126-07	Actual	3300	cfu/g
12415	29.869451	-89.854835	NAD83	31122	11/26/2005 11:45	T0703-051126-04	Actual	3785	cfu/g
12412	29.873165	-89.853805	NAD83	31280	11/26/2005 10:15	T0703-051126-01	Estimated	*Non-detect	
12417	29.868023	-89.83229	NAD83	31154	11/26/2005 13:35	T0703-051126-06	Actual	*Non-detect	
12416	29.872211	-89.85483	NAD83	31133	11/26/2005 12:05	T0703-051126-05	Actual	*Non-detect	
12414	29.868271	-89.854605	NAD83	31005	11/26/2005 11:35	T0703-051126-03	Actual	*Non-detect	
12336	29.860723	-89.780796	NAD83	31225	11/25/2005 11:50	T0456-051125-02	Actual	*Non-detect	
12337	29.861425	-89.78055	NAD83	31288	11/25/2005 12:05	T0456-051125-03	Actual	*Non-detect	
12343	29.87197	-89.80949	NAD83	31014	11/25/2005 15:25	T0456-051125-09	Actual	*Non-detect	
12339	29.861966	-89.779606	NAD83	31144	11/25/2005 12:25	T0456-051125-05	Actual	*Non-detect	
12344	29.867838	-89.800561	NAD83	31004	11/25/2005 15:55	T0456-051125-10	Actual	*Non-detect	
12340	29.86036	-89.777253	NAD83	31019	11/25/2005 14:05	T0456-051125-06	Actual	1798	cfu/g
12338	29.862765	-89.78095	NAD83	31214	11/25/2005 12:15	T0456-051125-04	Actual	*Non-detect	
12335	29.861766	-89.783311	NAD83	31265	11/25/2005 11:05	T0456-051125-01	Actual	48173	cfu/g
12342	29.862478	-89.779916	NAD83	31123	11/25/2005 14:40	T0456-051125-08	Actual	*Non-detect	
12341	29.859836	-89.776553	NAD83	31183	11/25/2005 14:30	T0456-051125-07	Actual	*Non-detect	
12336	29.860723	-89.780796	NAD83	31156	11/25/2005 11:50	T0456-051125-02	Actual	*Non-detect	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
12402	29.866918	-89.802075	NAD83	31143	11/24/2005 9:40	T0703-051124-01	Actual	*Non-detect	
12402	29.866918	-89.802075	NAD83	31016	11/24/2005 9:40	T0703-051124-01	Actual	*Non-detect	
12406	29.863363	-89.797396	NAD83	31200	11/24/2005 11:00	T0703-051124-05	Actual	*Non-detect	
12405	29.861415	-89.797731	NAD83	31136	11/24/2005 10:45	T0703-051124-04	Actual	335700	cfu/g
12404	29.865601	-89.798221	NAD83	31089	11/24/2005 10:30	T0703-051124-03	Actual	*Non-detect	
12409	29.862018	-89.796925	NAD83	31207	11/24/2005 13:40	T0703-051124-08	Actual	29757	cfu/g
12411	29.876321	-89.82893	NAD83	31137	11/24/2005 14:25	T0703-051124-10	Actual	*Non-detect	
12408	29.86491	-89.796798	NAD83	31151	11/24/2005 13:25	T0703-051124-07	Actual	*Non-detect	
12410	29.876051	-89.808053	NAD83	31285	11/24/2005 14:15	T0703-051124-09	Actual	*Non-detect	
12407	29.865985	-89.797526	NAD83	31263	11/24/2005 11:15	T0703-051124-06	Actual	*Non-detect	
12403	29.868831	-89.802198	NAD83	31258	11/24/2005 10:05	T0703-051124-02	Actual	*Non-detect	
12327	29.866363	-89.811728	NAD83	31176	11/23/2005 13:00	T0456-051123-03	Actual	*Non-detect	
12327	29.866363	-89.811728	NAD83	31296	11/23/2005 13:00	T0456-051123-03	Actual	*Non-detect	
12332	29.867448	-89.808723	NAD83	31289	11/23/2005 15:45	T0456-051123-08	Actual	*Non-detect	
12333	29.869303	-89.808808	NAD83	31222	11/23/2005 16:00	T0456-051123-09	Actual	5320	cfu/g
12330	29.862846	-89.804786	NAD83	31205	11/23/2005 15:05	T0456-051123-06	Actual	*Non-detect	
12331	29.869478	-89.807868	NAD83	31209	11/23/2005 15:20	T0456-051123-07	Actual	17798	cfu/g
12329	29.864705	-89.805188	NAD83	31182	11/23/2005 14:55	T0456-051123-05	Actual	*Non-detect	
12328	29.866373	-89.805126	NAD83	31120	11/23/2005 14:45	T0456-051123-04	Actual	*Non-detect	
12326	29.868115	-89.812765	NAD83	31068	11/23/2005 12:50	T0456-051123-02	Actual	*Non-detect	
12334	29.873601	-89.80825	NAD83	31148	11/23/2005 16:20	T0456-051123-10	Actual	*Non-detect	
12325	29.871796	-89.81353	NAD83	31027	11/23/2005 12:35	T0456-051123-01	Actual	*Non-detect	
12401	29.875075	-89.813698	NAD83	31180	11/22/2005 15:20	T0703-051122-10	Actual	*Non-detect	
12395	29.868228	-89.815961	NAD83	31248	11/22/2005 13:50	T0703-051122-04	Actual	*Non-detect	
12400	29.877503	-89.813	NAD83	31031	11/22/2005 15:00	T0703-051122-09	Actual	*Non-detect	
12399	29.880288	-89.812835	NAD83	31132	11/22/2005 14:50	T0703-051122-08	Actual	*Non-detect	
12398	29.877605	-89.815663	NAD83	31279	11/22/2005 14:30	T0703-051122-07	Actual	*Non-detect	
12393	29.868396	-89.834241	NAD83	31098	11/22/2005 11:35	T0703-051122-02	Actual	*Non-detect	
12396	29.87042	-89.815791	NAD83	31104	11/22/2005 14:10	T0703-051122-05	Actual	*Non-detect	
12397	29.873675	-89.815668	NAD83	31198	11/22/2005 14:15	T0703-051122-06	Actual	*Non-detect	
12392	29.865566	-89.839805	NAD83	31302	11/22/2005 11:05	T0703-051122-01	Actual	*Non-detect	
12392	29.865566	-89.839805	NAD83	31048	11/22/2005 11:05	T0703-051122-01	Actual	*Non-detect	
12394	29.867088	-89.819468	NAD83	31290	11/22/2005 12:25	T0703-051122-03	Actual	1905	cfu/g
12295	29.865246	-89.842508	NAD83	31017	11/21/2005 9:55	T0442-051121-01	Actual	*Non-detect	
12302	29.873088	-89.834246	NAD83	31107	11/21/2005 13:35	T0442-051121-08	Actual	*Non-detect	
12303	29.872973	-89.836203	NAD83	31038	11/21/2005 13:45	T0442-051121-09	Actual	*Non-detect	
12298	29.864478	-89.84939	NAD83	31203	11/21/2005 11:05	T0442-051121-04	Actual	*Non-detect	
12299	29.864475	-89.839666	NAD83	31145	11/21/2005 11:30	T0442-051121-05	Actual	*Non-detect	
12297	29.868383	-89.849248	NAD83	31244	11/21/2005 10:45	T0442-051121-03	Actual	*Non-detect	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
12296	29.867201	-89.849535	NAD83	31142	11/21/2005 10:20	T0442-051121-02	Actual	*Non-detect	
12304	29.870865	-89.834715	NAD83	31226	11/21/2005 14:00	T0442-051121-10	Actual	*Non-detect	
12300	29.869143	-89.832848	NAD83	31247	11/21/2005 13:10	T0442-051121-06	Actual	*Non-detect	
12301	29.870938	-89.833415	NAD83	31165	11/21/2005 13:25	T0442-051121-07	Actual	*Non-detect	
12295	29.865246	-89.842508	NAD83	31204	11/21/2005 9:55	T0442-051121-01	Actual	*Non-detect	
11904	29.866428	-89.854095	NAD83	24677	11/20/2005 14:45	T0703-051120-10	Actual	*Non-detect	
11903	29.864411	-89.851375	NAD83	24676	11/20/2005 14:30	T0703-051120-09	Actual	*Non-detect	
11896	29.867356	-89.852186	NAD83	24669	11/20/2005 11:00	T0703-051120-02	Actual	*Non-detect	
11895	29.866075	-89.852983	NAD83	24668	11/20/2005 10:20	T0703-051120-01	Actual	*Non-detect	
11901	29.870435	-89.856176	NAD83	24674	11/20/2005 13:55	T0703-051120-07	Actual	*Non-detect	
11902	29.86546	-89.851025	NAD83	24675	11/20/2005 14:15	T0703-051120-08	Actual	*Non-detect	
11900	29.87198	-89.856516	NAD83	24673	11/20/2005 13:40	T0703-051120-06	Actual	*Non-detect	
11899	29.8677	-89.856368	NAD83	24672	11/20/2005 11:55	T0703-051120-05	Actual	*Non-detect	
11897	29.86905	-89.852466	NAD83	24670	11/20/2005 11:20	T0703-051120-03	Actual	6078	cfu/g
11895	29.866075	-89.852983	NAD83	24717	11/20/2005 10:20	T0703-051120-01	Actual	*Non-detect	
11898	29.871581	-89.85261	NAD83	24671	11/20/2005 11:35	T0703-051120-04	Actual	*Non-detect	
11843	29.864643	-89.858865	NAD83	24546	11/19/2005 15:15	T0703-051119-07	Actual	324030	cfu/g
11841	29.861541	-89.861833	NAD83	24544	11/19/2005 14:45	T0703-051119-05	Actual	*Non-detect	
11846	29.87027	-89.861048	NAD83	24549	38675.67014	T0703-051119-10	Actual	*Non-detect	
11837	29.866978	-89.866918	NAD83	24538	11/19/2005 12:10	T0703-051119-01	Actual	*Present >QL	
11839	29.876055	-89.866928	NAD83	24542	11/19/2005 12:55	T0703-051119-03	Actual	10752	cfu/g
11844	29.860485	-89.8589	NAD83	24547	11/19/2005 15:30	T0703-051119-08	Actual	*Non-detect	
11842	29.866638	-89.858881	NAD83	24545	11/19/2005 15:05	T0703-051119-06	Actual	*Non-detect	
11845	29.86883	-89.860885	NAD83	24548	11/19/2005 15:50	T0703-051119-09	Actual	*Non-detect	
11837	29.866978	-89.866918	NAD83	24539	11/19/2005 12:10	T0703-051119-01	Actual	*Present >QL	
11838	29.862788	-89.86681	NAD83	24541	11/19/2005 12:35	T0703-051119-02	Actual	490220	cfu/g
11840	29.874103	-89.866776	NAD83	24543	11/19/2005 13:10	T0703-051119-04	Actual	418490	cfu/g
11806	29.88103	-89.87829	NAD83	24472	11/18/2005 12:40	T1066-051118-05	Actual	*Non-detect	
11811	29.87184	-89.86663	NAD83	24477	11/18/2005 16:30	T1066-051118-10	Actual	*Non-detect	
11810	29.869595	-89.866835	NAD83	24476	11/18/2005 16:15	T1066-051118-09	Actual	6030	cfu/g
11804	29.875211	-89.869846	NAD83	24470	11/18/2005 12:10	T1066-051118-03	Actual	*Non-detect	
11802	29.882488	-89.881241	NAD83	24466	11/18/2005 11:30	T1066-051118-01	Actual	*Non-detect	
11807	29.877001	-89.869216	NAD83	24473	11/18/2005 14:15	T1066-051118-06	Actual	*Non-detect	
11803	29.879095	-89.874201	NAD83	24469	11/18/2005 11:55	T1066-051118-02	Actual	*Non-detect	
11809	29.866148	-89.885431	NAD83	24475	11/18/2005 15:50	T1066-051118-08	Actual	*Non-detect	
11802	29.882488	-89.881241	NAD83	24467	11/18/2005 11:30	T1066-051118-01	Actual	*Non-detect	
11808	29.869875	-89.881458	NAD83	24474	11/18/2005 15:10	T1066-051118-07	Actual	*Non-detect	
11805	29.87087	-89.869896	NAD83	24471	11/18/2005 12:25	T1066-051118-04	Actual	*Non-detect	
11776	29.86088	-89.8954	NAD83	24418	11/17/2005 15:20	T1066-051117-10	Actual	9721	cfu/g

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
11775	29.86262	-89.86956	NAD83	24417	11/17/2005 15:05	T1066-051117-09	Actual	*Present >QL	
11769	29.87116	-89.89587	NAD83	24411	11/17/2005 13:25	T1066-051117-03	Actual	*Non-detect	
11772	29.87192	-89.87621	NAD83	24414	11/17/2005 14:15	T1066-051117-06	Actual	47157	cfu/g
11773	29.86884	-89.87161	NAD83	24415	11/17/2005 14:35	T1066-051117-07	Actual	22533	cfu/g
11768	29.86362	-89.89418	NAD83	24410	11/17/2005 11:55	T1066-051117-02	Actual	*Non-detect	
11770	29.864445	-89.87991	NAD83	24412	11/17/2005 13:45	T1066-051117-04	Actual	36495	cfu/g
11767	29.86268	-89.89138	NAD83	24408	11/17/2005 11:45	T1066-051117-01	Estimated	84427	cfu/g
11771	29.86377	-89.87829	NAD83	24413	11/17/2005 14:00	T1066-051117-05	Actual	*Non-detect	
11774	29.86269	-89.86963	NAD83	24416	11/17/2005 14:50	T1066-051117-08	Actual	*Non-detect	
11767	29.86268	-89.89138	NAD83	24407	11/17/2005 11:45	T1066-051117-01	Estimated	463510	cfu/g
11730	29.875748	-89.888206	NAD83	24332	11/16/2005 12:30	T0703-051116-03	Actual	637760	cfu/g
11733	29.873548	-89.885853	NAD83	24335	11/16/2005 14:00	T0703-051116-06	Actual	7189	cfu/g
11728	29.874313	-89.893523	NAD83	24329	11/16/2005 11:40	T0703-051116-01	Actual	*Non-detect	
11737	29.871651	-89.887875	NAD83	24339	11/16/2005 14:50	T0703-051116-10	Actual	31421	cfu/g
11736	29.87162	-89.890346	NAD83	24338	11/16/2005 14:40	T0703-051116-09	Actual	354290	cfu/g
11728	29.874313	-89.893523	NAD83	24330	11/16/2005 11:40	T0703-051116-01	Estimated	78854	cfu/g
11731	29.875491	-89.886436	NAD83	24333	11/16/2005 12:40	T0703-051116-04	Actual	33948	cfu/g
11735	29.869881	-89.889638	NAD83	24337	11/16/2005 14:30	T0703-051116-08	Actual	1115800	cfu/g
11732	29.873685	-89.884533	NAD83	24334	11/16/2005 12:50	T0703-051116-05	Actual	589120	cfu/g
11729	29.873683	-89.889553	NAD83	24331	11/16/2005 12:15	T0703-051116-02	Actual	220810	cfu/g
11734	29.868946	-89.888503	NAD83	24336	11/16/2005 14:15	T0703-051116-07	Actual	*Present >QL	
12272	29.9109	-89.905178	NAD83	31303	11/15/2005 11:30	T0335-051115-01	Actual	*Non-detect	
12272	29.9109	-89.905178	NAD83	31119	11/15/2005 11:30	T0335-051115-01	Actual	*Non-detect	
12274	29.913608	-89.901735	NAD83	31264	11/15/2005 11:55	T0335-051115-03	Actual	*Non-detect	
12273	29.912191	-89.903656	NAD83	31270	11/15/2005 11:45	T0335-051115-02	Actual	*Non-detect	
12276	29.915573	-89.900975	NAD83	31284	11/15/2005 12:15	T0335-051115-05	Actual	*Non-detect	
12275	29.914793	-89.900145	NAD83	31118	11/15/2005 12:10	T0335-051115-04	Actual	*Non-detect	
11608	29.895113	-89.898833	NAD83	24120	11/14/2005 11:50	T0335-051114-01	Estimated	*Non-detect	
11608	29.895113	-89.898833	NAD83	24121	11/14/2005 11:50	T0335-051114-01	Estimated	23644	cfu/g
11612	29.914291	-89.89292	NAD83	24126	11/14/2005 13:25	T0335-051114-05	Actual	6022	cfu/g
11611	29.916203	-89.891748	NAD83	24125	11/14/2005 13:10	T0335-051114-04	Actual	2942	cfu/g
11609	29.894683	-89.89623	NAD83	24123	11/14/2005 12:05	T0335-051114-02	Actual	*Non-detect	
11610	29.91521	-89.893361	NAD83	24124	11/14/2005 13:05	T0335-051114-03	Actual	*Non-detect	
11604	29.89564	-89.89597	NAD83	24083	11/13/2005 13:35	T0335-051113-07	Actual	*Non-detect	
11605	29.897825	-89.896761	NAD83	24084	11/13/2005 13:42	T0335-051113-08	Actual	*Non-detect	
11606	29.897528	-89.898345	NAD83	24085	11/13/2005 13:50	T0335-051113-09	Actual	*Non-detect	
11607	29.895756	-89.896633	NAD83	24086	11/13/2005 14:00	T0335-051113-10	Actual	*Non-detect	
11603	29.894233	-89.897755	NAD83	24082	11/13/2005 13:20	T0335-051113-06	Actual	*Non-detect	
11582	29.91369	-89.90038	NAD83	23978	11/12/2005 14:10	T0456-051112-08	Actual	*Non-detect	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
11583	29.90851	-89.90678	NAD83	23979	11/12/2005 14:40	T0456-051112-09	Actual	*Non-detect	
11584	29.89814	-89.90216	NAD83	23980	11/12/2005 15:00	T0456-051112-10	Actual	*Non-detect	
11581	29.90737	-89.89754	NAD83	23977	11/12/2005 13:50	T0456-051112-07	Actual	*Non-detect	
11580	29.90494	-89.89773	NAD83	23976	11/12/2005 13:40	T0456-051112-06	Actual	*Non-detect	
11580	29.90494	-89.89773	NAD83	23975	11/12/2005 13:30	T0456-051112-06	Actual	*Non-detect	
11560	29.91985	-89.90637	NAD83	23929	11/11/2005 14:20	T0456-051111-09	Actual	*Non-detect	
11558	29.91649	-89.89461	NAD83	23927	11/11/2005 13:45	T0456-051111-07	Actual	*Non-detect	
11559	29.92133	-89.90508	NAD83	23928	11/11/2005 14:00	T0456-051111-08	Actual	*Non-detect	
11557	29.9179	-89.89092	NAD83	23926	11/11/2005 13:30	T0456-051111-06	Actual	135330	cfu/g
11561	29.91566	-89.91308	NAD83	23930	11/11/2005 14:40	T0456-051111-10	Actual	*Non-detect	
11535	29.90238	-89.896851	NAD83	23846	11/10/2005 11:45	T0335-051110-02	Actual	*Non-detect	
11534	29.905543	-89.898603	NAD83	23845	11/10/2005 11:00	T0335-051110-01	Actual	*Non-detect	
11538	29.91163	-89.903116	NAD83	23849	11/10/2005 12:32	T0335-051110-05	Actual	*Non-detect	
11536	29.908131	-89.902031	NAD83	23847	11/10/2005 12:05	T0335-051110-03	Actual	*Non-detect	
11534	29.905543	-89.898603	NAD83	23844	11/10/2005 11:00	T0335-051110-01	Actual	*Non-detect	
11537	29.911331	-89.898865	NAD83	23848	11/10/2005 12:20	T0335-051110-04	Actual	*Non-detect	
11507	29.90865	-89.8927	NAD83	23761	11/9/2005 11:15	T0630-051109-01	Actual	*Non-detect	
11511	29.9149	-89.892	NAD83	23765	11/9/2005 12:20	T0630-051109-05	Actual	*Non-detect	
11508	29.9116	-89.89011	NAD83	23762	11/9/2005 11:40	T0630-051109-02	Actual	*Non-detect	
11509	29.9146	-89.88831	NAD83	24706	11/9/2005 11:55	T0630-051109-03	Actual	*Non-detect	
11510	29.91136	-89.89446	NAD83	23764	11/9/2005 12:05	T0630-051109-04	Actual	49081	cfu/g
11507	29.90865	-89.8927	NAD83	23760	11/9/2005 11:15	T0630-051109-01	Actual	*Non-detect	
12489	29.919321	-89.915051	NAD83	31044	11/8/2005 10:35	T0335-051108-01	Actual	11017	cfu/g
12491	29.918675	-89.910721	NAD83	31055	11/8/2005 11:15	T0335-051108-03	Actual	5346	cfu/g
12490	29.922103	-89.909501	NAD83	31082	11/8/2005 11:00	T0335-051108-02	Actual	8039	cfu/g
12489	29.919321	-89.915051	NAD83	31006	11/8/2005 10:35	T0335-051108-01	Actual	19235	cfu/g
11470	29.920945	-89.913745	NAD83	22384	11/7/2005 12:00	T0335-051107-03	Actual	*Non-detect	
11469	29.92414	-89.909771	NAD83	22383	11/7/2005 11:45	T0335-051107-02	Actual	*Non-detect	
11468	29.925201	-89.911263	NAD83	22381	11/7/2005 11:40	T0335-051107-01	Actual	*Non-detect	
11469	29.92414	-89.909771	NAD83	22382	11/7/2005 11:45	T0335-051107-02	Actual	*Non-detect	
11439	29.92392	-89.906778	NAD83	22293	11/6/2005 13:55	T0630-051106-03	Actual	*Non-detect	
11437	29.927041	-89.90561	NAD83	22291	11/6/2005 13:25	T0630-051106-01	Actual	2611	cfu/g
11438	29.928005	-89.902465	NAD83	22292	11/6/2005 13:45	T0630-051106-02	Actual	*Non-detect	
11440	29.931661	-89.902698	NAD83	22294	11/6/2005 14:10	T0630-051106-04	Actual	*Non-detect	
11319	29.922727	-89.901103	NAD83	22124	11/4/2005 10:55	T0924-051104-03	Actual	74181	cfu/g
11318	29.924126	-89.902808	NAD83	22123	11/4/2005 10:35	T0924-051104-02	Actual	*Non-detect	
11300	29.902271	-89.901611	NAD83	22064	11/3/2005 11:45	T0924-051103-02	Estimated	119770	cfu/g
11301	29.919976	-89.891868	NAD83	22065	11/3/2005 12:20	T0924-051103-03	Actual	11198	cfu/g
11300	29.902271	-89.901611	NAD83	22063	11/3/2005 11:45	T0924-051103-02	Estimated	*Present >QL	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
11299	29.867038	-89.813075	NAD83	22062	11/3/2005 11:00	T0924-051103-01	Actual	*Non-detect	
12436	29.940426	-89.931176	NAD83	31236	11/2/2005 11:50	T0924-051102-02	Actual	*Non-detect	
12435	29.925781	-89.907486	NAD83	31170	11/2/2005 11:20	T0924-051102-01	Actual	*Non-detect	
12434	29.86165	-89.897578	NAD83	31010	11/1/2005 11:20	T0924-051101-03	Estimated	*Non-detect	
12433	29.881411	-89.894073	NAD83	31032	11/1/2005 10:25	T0924-051101-02	Actual	4302	cfu/g
12432	29.897168	-89.897595	NAD83	31189	11/1/2005 9:40	T0924-051101-01	Actual	2568	cfu/g
12434	29.86165	-89.897578	NAD83	31161	11/1/2005 11:20	T0924-051101-03	Estimated	116450	cfu/g
12481	29.900261	-89.898983	NAD83	31169	10/31/2005 11:15	T0335-051031-03	Actual	*Non-detect	
12480	29.86276	-89.797543	NAD83	31127	10/31/2005 10:35	T0335-051031-02	Actual	*Non-detect	
12481	29.900261	-89.898983	NAD83	31168	10/31/2005 11:15	T0335-051031-03	Actual	*Non-detect	
9906	29.86752	-89.846331	WGS84	17270	9/26/2005 13:35	RS166-TD-G-N-09	Actual	*Non-detect	
9902	29.871438	-89.813368	WGS84	17265	9/26/2005 11:30	RS162-TD-G-N-09	Actual	*Non-detect	
9905	29.864913	-89.842676	WGS84	17269	9/26/2005 13:15	RS165-TD-G-N-09	Actual	*Non-detect	
9907	29.866841	-89.850403	WGS84	17271	9/26/2005 14:00	RS167-TD-G-N-09	Actual	*Non-detect	
9902	29.871438	-89.813368	WGS84	17266	9/26/2005 11:30	RS162-TD-G-D-09	Actual	*Non-detect	
9904	29.870411	-89.834828	WGS84	17268	9/26/2005 12:30	RS164-TD-G-N-09	Actual	*Non-detect	
9901	29.866861	-89.809356	WGS84	17264	9/26/2005 11:00	RS161-TD-G-N-09	Actual	5180	cfu/g
9903	29.866878	-89.817818	WGS84	17267	9/26/2005 12:00	RS163-TD-G-N-09	Actual	*Present >QL	
9900	29.867785	-89.802163	WGS84	17263	9/26/2005 10:30	RS160-TD-G-N-09	Actual	1792	cfu/g
9883	29.877756	-89.878613	WGS84	17243	9/26/2005 13:00	RS409-kk-G-N-09	Actual	33795	cfu/g
9880	29.874385	-89.88525	WGS84	17240	9/26/2005 12:10	RS406-kk-G-N-09	Actual	*Present >QL	
9878	29.871831	-89.878886	WGS84	17238	9/26/2005 11:15	RS404-kk-G-D-09	Estimated	23491	cfu/g
9879	29.873431	-89.876066	WGS84	17239	9/26/2005 11:40	RS405-kk-G-N-09	Actual	6357	cfu/g
9878	29.871831	-89.878886	WGS84	17237	9/26/2005 11:15	RS404-kk-G-N-09	Estimated	118990	cfu/g
9882	29.881515	-89.887703	WGS84	17242	9/26/2005 12:40	RS408-kk-G-N-09	Actual	*Non-detect	
9874	29.871946	-89.866795	WGS84	17233	9/26/2005 10:00	RS400-kk-G-N-09	Actual	17835	cfu/g
9875	29.863755	-89.869316	WGS84	17234	9/26/2005 10:25	RS401-kk-G-N-09	Actual	*Non-detect	
9877	29.863558	-89.88008	WGS84	17236	9/26/2005 11:00	RS403-kk-G-N-09	Actual	*Non-detect	
9876	29.864946	-89.872563	WGS84	17235	9/26/2005 10:35	RS402-kk-G-N-09	Actual	*Non-detect	
10269	29.9529	-89.96217	NAD83	18186	9/25/2005 0:00	RS410-KK-G-N-09	Actual	*Non-detect	
10268	29.93967	-89.95827	NAD83	18185	9/25/2005 0:00	RS409-KK-G-N-09	Actual	*Non-detect	
9459	29.9603	-89.97039	WGS84	16771	9/17/2005 9:40	RS516-TD-G-N-09	Actual	13079	cfu/g
9454	29.957728	-89.989125	WGS84	16774	9/17/2005 11:35	RS519-TD-G-N-09	Actual	*Non-detect	
9455	29.96497	-89.99039	WGS84	16775	9/17/2005 12:10	RS520-TD-G-N-09	Actual	23808	cfu/g
9458	29.966116	-90.001725	WGS84	16778	9/17/2005 14:50	RS522-TD-G-N-09	Actual	*Non-detect	
9453	29.959481	-89.982351	WGS84	16773	9/17/2005 11:05	RS518-TD-G-N-09	Actual	2940	cfu/g
9456	29.96956	-89.997095	WGS84	16777	9/17/2005 14:10	RS521-TD-G-D-09	Actual	*Non-detect	
9456	29.96956	-89.997095	WGS84	16776	9/17/2005 14:10	RS521-TD-G-N-09	Actual	*Non-detect	
9460	29.955925	-89.979865	WGS84	16772	9/17/2005 10:35	RS517-TD-G-N-09	Actual	*Non-detect	

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
8957	29.954905	-90.007085	WGS84	16317	9/12/2005 12:25	RS066-TD-G-D-09	Actual	*Non-detect	
8957	29.954905	-90.007085	WGS84	16318	9/12/2005 12:25	RS066-TD-G-N-09	Actual	*Non-detect	
8954	29.945645	-89.97905	WGS84	16314	9/12/2005 11:00	RS063-TD-G-N-09	Actual	*Non-detect	
8955	29.948695	-89.99367	WGS84	16315	9/12/2005 11:30	RS064-TD-G-N-09	Actual	*Non-detect	
8941	29.936131	-89.952953	WGS84	16299	9/12/2005 13:13	RS044-JC-G-N-09	Actual	9603	cfu/g
8953	29.94751	-89.975525	WGS84	16313	9/12/2005 10:30	RS062-TD-G-N-09	Actual	*Non-detect	
8952	29.95482	-89.97224	WGS84	16326	9/12/2005 9:50	RS061-TD-G-N-09	Actual	*Non-detect	
8956	29.95588	-89.997845	WGS84	16316	9/12/2005 12:00	RS065-TD-G-N-09	Actual	*Non-detect	
8940	29.942006	-89.961045	WGS84	16298	9/12/2005 12:56	RS043-JC-G-N-09	Actual	64207	cfu/g
8939	29.949616	-89.957698	WGS84	16322	9/12/2005 12:35	RS042-JC-G-N-09	Actual	78976	cfu/g
8937	29.955385	-89.955743	WGS84	16295	9/12/2005 12:17	RS041-JC-G-N-09	Actual	*Non-detect	cfu/g
8934	29.938703	-89.936136	WGS84	16292	9/12/2005 10:43	RS018-JC-G-N-09	Actual	*Non-detect	
8935	29.938121	-89.942215	WGS84	16293	9/12/2005 11:04	RS019-JC-G-N-09	Actual	*Non-detect	
8936	29.941475	-89.95087	WGS84	16294	9/12/2005 11:29	RS020-JC-G-N-09	Actual	17450	cfu/g
12281	29.961345	-89.985275	NAD83	31093	11/15/2005 14:25	T0335-051115-10	Actual	*Non-detect	
12277	29.954981	-89.984885	NAD83	31181	11/15/2005 13:40	T0335-051115-06	Actual	*Non-detect	
12280	29.961345	-89.986088	NAD83	31076	11/15/2005 14:10	T0335-051115-09	Actual	*Non-detect	
12279	29.957846	-89.987851	NAD83	31212	11/15/2005 13:55	T0335-051115-08	Actual	*Non-detect	
12278	29.956538	-89.988371	NAD83	31085	11/15/2005 13:50	T0335-051115-07	Actual	*Non-detect	
11616	29.970656	-89.993215	NAD83	24130	11/14/2005 14:17	T0335-051114-09	Actual	*Non-detect	
11617	29.965811	-89.994563	NAD83	24131	11/14/2005 14:20	T0335-051114-10	Actual	*Non-detect	
11615	29.96711	-89.993306	NAD83	24129	11/14/2005 14:10	T0335-051114-08	Actual	*Non-detect	
11614	29.96216	-89.99589	NAD83	24128	11/14/2005 14:00	T0335-051114-07	Actual	2755	cfu/g
11613	29.96302	-89.998681	NAD83	24127	11/14/2005 13:45	T0335-051114-06	Actual	*Present >QL	
11601	29.966361	-89.99053	NAD83	24079	11/13/2005 11:25	T0335-051113-04	Actual	*Non-detect	
11600	29.957891	-89.976075	NAD83	24078	11/13/2005 11:05	T0335-051113-03	Actual	*Non-detect	
11599	29.96104	-89.977616	NAD83	24077	11/13/2005 10:50	T0335-051113-02	Actual	*Non-detect	
11602	29.969816	-89.991836	NAD83	24081	11/13/2005 11:45	T0335-051113-05	Actual	*Non-detect	
11598	29.964125	-89.975758	NAD83	24075	11/13/2005 10:15	T0335-051113-01	Actual	*Non-detect	
11598	29.964125	-89.975758	NAD83	24076	11/13/2005 10:15	T0335-051113-01	Actual	*Non-detect	
11575	29.95993	-90.00216	NAD83	23969	11/12/2005 10:20	T0456-051112-01	Actual	*Non-detect	
11576	29.95379	-90.00713	NAD83	23970	11/12/2005 10:50	T0456-051112-02	Actual	152950	cfu/g
11578	29.95136	-89.97077	NAD83	23972	11/12/2005 11:40	T0456-051112-04	Actual	*Non-detect	
11577	29.95374	-90.00019	NAD83	23971	11/12/2005 11:15	T0456-051112-03	Actual	*Non-detect	
11579	29.96266	-89.9697	NAD83	23973	11/12/2005 12:00	T0456-051112-05	Actual	*Non-detect	
11555	29.96127	-89.98843	NAD83	23924	11/11/2005 12:20	T0456-051111-04	Actual	*Non-detect	
11553	29.9431	-89.9766	NAD83	23922	11/11/2005 11:30	T0456-051111-02	Estimated	50557	cfu/g
11556	29.96775	-89.98697	NAD83	23925	11/11/2005 12:39	T0456-051111-05	Actual	*Non-detect	
11554	29.95513	-89.99433	NAD83	23923	11/11/2005 12:00	T0456-051111-03	Actual	1294	cfu/g

Station ID	Latitude	Longitude	Horiz. Dat.	Activity ID	Activity Start	Activity Comment	Value Type	Result Value	Units
11553	29.9431	-89.9766	NAD83	23921	11/11/2005 11:40	T0456-051111-02	Estimated	*Non-detect	
11552	29.94149	-89.97292	NAD83	23920	11/11/2005 10:40	T0456-051111-01	Actual	5393	cfu/g
11540	29.949353	-89.977243	NAD83	23851	11/10/2005 13:27	T0335-051110-07	Actual	*Non-detect	
11541	29.948728	-89.975628	NAD83	23852	11/10/2005 13:43	T0335-051110-08	Actual	*Non-detect	
11539	29.94454	-89.974545	NAD83	23850	11/10/2005 12:55	T0335-051110-06	Actual	*Non-detect	
11543	29.948945	-89.98857	NAD83	23854	11/10/2005 14:17	T0335-051110-10	Actual	*Non-detect	
11542	29.953211	-89.985573	NAD83	23853	11/10/2005 14:05	T0335-051110-09	Actual	*Non-detect	
11514	29.95791	-89.96604	NAD83	23768	11/9/2005 13:25	T0630-051109-08	Actual	*Non-detect	
11515	29.95265	-89.96897	NAD83	23769	11/9/2005 13:35	T0630-051109-09	Actual	*Non-detect	
11516	29.95705	-89.97179	NAD83	23770	11/9/2005 13:45	T0630-051109-10	Actual	4490	cfu/g
11513	29.96087	-89.96536	NAD83	23767	11/9/2005 13:15	T0630-051109-07	Actual	*Non-detect	
11512	29.95617	-89.96043	NAD83	23766	11/9/2005 12:45	T0630-051109-06	Actual	*Non-detect	
12492	29.943808	-89.967951	NAD83	31131	11/8/2005 11:40	T0335-051108-04	Actual	47375	cfu/g
12494	29.948108	-89.971968	NAD83	31172	11/8/2005 12:45	T0335-051108-06	Actual	*Non-detect	
12493	29.949025	-89.967606	NAD83	31052	11/8/2005 12:30	T0335-051108-05	Actual	*Non-detect	
11472	29.948416	-89.961323	NAD83	22386	11/7/2005 12:42	T0335-051107-05	Actual	9204	cfu/g
11471	29.944676	-89.964101	NAD83	22385	11/7/2005 12:25	T0335-051107-04	Actual	412660	cfu/g
11473	29.952761	-89.963383	NAD83	24705	11/7/2005 12:54	T0335-051107-06	Actual	*Non-detect	
12437	29.9451	-89.97258	NAD83	31217	11/2/2005 13:20	T0924-051102-03	Actual	7166	cfu/g
12482	29.941356	-89.963403	NAD83	31282	10/31/2005 11:45	T0335-051031-04	Actual	*Non-detect	
10211	29.948508	-89.993741	NAD83	17999	10/1/2005 12:40	T0139-051001-09	Actual	*Non-detect	
10210	29.947488	-89.986501	NAD83	17998	10/1/2005 12:15	T0139-051001-08	Actual	*Non-detect	
10209	29.949145	-89.983196	NAD83	17997	10/1/2005 11:55	T0139-051001-07	Actual	*Non-detect	
10212	29.960463	-89.974693	NAD83	18001	10/1/2005 13:15	T0139-051001-10	Actual	*Non-detect	
10205	29.955848	-89.979563	NAD83	17993	10/1/2005 10:10	T0139-051001-03	Actual	*Non-detect	
10206	29.961013	-89.972171	NAD83	17994	10/1/2005 10:45	T0139-051001-04	Actual	*Non-detect	
10204	29.957933	-89.989653	NAD83	17992	10/1/2005 9:50	T0139-051001-02	Actual	*Non-detect	
10203	29.956455	-89.998298	NAD83	17991	10/1/2005 9:02	T0139-051001-01	Actual	*Non-detect	
10207	29.955463	-89.9733	NAD83	17995	10/1/2005 11:10	T0139-051001-05	Actual	*Non-detect	
10208	29.950701	-89.97901	NAD83	17996	10/1/2005 11:30	T0139-051001-06	Actual	*Non-detect	
10177	29.960323	-89.984043	NAD83	17898	9/30/2005 15:35	T0232-050930-14	Actual	*Non-detect	
10176	29.964925	-89.990581	NAD83	17897	9/30/2005 15:25	T0232-050930-13	Actual	7871	cfu/g
10175	29.96951	-89.997128	NAD83	17896	9/30/2005 15:05	T0232-050930-12	Actual	38989	cfu/g
10173	29.954975	-90.007116	NAD83	17893	9/30/2005 14:38	T0232-050930-10	Actual	*Non-detect	
10174	29.965878	-90.0018	NAD83	17894	9/30/2005 14:45	T0232-050930-11	Estimated	31485	cfu/g
10174	29.965878	-90.0018	NAD83	17895	9/30/2005 14:45	T0232-050930-11	Estimated	3476	cfu/g

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE *(DD-MM-YYYY)*
June 2007

2. REPORT TYPE
Final report

3. DATES COVERED *(From - To)*

4. TITLE AND SUBTITLE
Environmental Consequences of the Failure of the New Orleans Levee System During Hurricane Katrina; Microbiological Analysis

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Herbert Fredrickson, John Furey, Chris Foote, and Margaret Richmond

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Environmental Laboratory, U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199; SpecPro, Inc., 4815 Bradford Drive, Suite 201, Huntsville, AL 35805

8. PERFORMING ORGANIZATION REPORT NUMBER
ERDC/EL TR-07-7

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
Washington, DC 20314-1000

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
Multiple failures of the levee system protection for the City of New Orleans in the aftermath of Hurricane Katrina in August 2005 led to the flooding of the metropolitan area. The floodwaters and sediments contained some dissolved and entrained chemical and microbial contaminants. Subsequent pumping of floodwater from the city to the adjacent environment and the ongoing removal of sediment and sediment-coated debris are potential mechanisms to distribute these contaminants to the local environment. The recalcitrant hydrocarbon benzo[a]pyrene (BaP) was used as an indicator of hydrophobic organic contaminants and microbial and sterol indicators of fecal material to assess sources and sinks of these classes of contaminants. These data provided a basis for contaminant transport and fate models. Additionally, this report specifically focuses on the Violet Marsh area outside the levee from the Lower Ninth Ward of New Orleans and on the Chalmette area of St. Bernard Parish, looking at potential environmental impacts.

Water fecal coliform counts (colony forming units (cfu) per 100 mL of water) ranged from 100 to 490,000 (mean=21,381, standard deviation=74,541, median=2,200) in New Orleans proper, 10 to 30,000 (mean=3,308, SD=8,093, median=200) in New Orleans East, and 17 to 25,000 (mean=1,287, SD=4,381, median= 100) in St. Bernard Parish and the Lower Ninth Ward polders. The LADEQ primary contact recreational water quality criterion for fecal coliforms is 400 cfu/100 mL.

(Continued)

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. TELEPHONE NUMBER** *(include area code)*
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED		90	

14. ABSTRACT (continued)

Floodwater in all three polders frequently exceeded this standard, and no trend (increasing or decreasing cfu/100 mL) was evident with time as the water was pumped out. BaP levels in water (μg/L) were all non-detect except one data point at 0.42 μg/L in New Orleans proper. BaP is a hydrophobic organic contaminant that would tend to sorb to sediment particles and settle from the water standing in the city.
Comparison of the levels of indicators in the surface of sediment cores to those in the bottoms of the cores shows that Violet Marsh has had a history of fecal and BaP contamination, much presumably coming primarily from the sewage treatment plant that drains into Bayou Bienvenue. The flooding of New Orleans and the subsequent pumpout resulted in higher levels of fecal material and BaP in the surface sediments of the marsh and a wider distribution of these contaminants throughout the marsh.