**Total Maximum Daily Loads for Indicator Bacteria in Buffalo Bayou and Whiteoak Bayous**
**Contract No. 582-6-70860**
**Work Order No. 582-6-70860-01**
**FINAL PROGRESS REPORT FOR FY2006– December, 2006**

**<u>Response</u> to Non-Technical Type Comments**

### 1. Preliminary Draft TMDL should be furnished to Stakeholders prior to the Public Draft Notice of Draft TMDL during the adoption process.

TxDOT Comment 1, Page 1
HC Comment Page 3, Paragraph 3

Prior to the TMDL adoption process, the TCEQ typically schedules meetings to discuss the TMDL Report to clarify information and improve the stakeholders' ability to comment effectively. The typical public comment period during the adoption process of the TMDL is 30 days.

### 2. The water quality standard for contact recreation should be reevaluated prior to the development of TMDLs for contact recreation impairments.

TxDOT Comment 2, Page 1; COH Comment 1, Page 1

The Water Quality Standards for the State of Texas are currently being reevaluated under a triennial review. If, as a result of this process, the contact recreation standards are changed in a manner affecting a TMDL goal, any TMDLs for contact recreation that have been completed would be revised and resubmitted for adoption and approval. Also any TMDL projects that are under way would be reevaluated. Changes in the contact recreation standard would change the load capacity (LC) for indicator bacteria in the TMDL equation and the reductions in the load allocation (LA) and the waste load allocation (WLA) would be adjusted accordingly. This is a process for which the TCEQ and the EPA have clear procedures.

### 2a. The indicator species used for contact recreation use is not appropriate.

COH Comment 2, Page 2
HC Comment 1a, Page 4

The EPA has encouraged the use of *E. coli* as an indicator for assessing the human health risk from contact recreation since 1986 and the standard was adopted by the TCEQ in 2000. Of the indicator bacteria tests available at this time (fecal coliform and *E. coli*), *E .coli* is the most useful because it is the most species specific of the two available indicators. We agree that there might be a better indicator species for contact recreation. However, no alternative indicator has been identified by the EPA. Further efforts at the federal level could result in a better indicator in the near future.

**3. Public and private expenditures necessary to comply with pollutant discharge permit requirements revised due to TMDL implementation will cause widespread economic harm.**

COH Comment Chapter 3, Page 3, Paragraph 2
TxDOT Comment 2, Page 2
LP Comment Source Identification Page 2, Paragraph 1 & Paragraph 3: Closing Remarks, Page 6, Paragraph 2, Sentence 1

The Implementation Plan is the second element of the TMDL process. The Implementation Plan is designed to achieve the reductions to the load allocation (LA) and the waste load allocation (WLA) established in an adopted TMDL. The WLA establishes limits on the loads from sources that discharge under a permit and the LA establishes limits on the loads from sources that contribute a load but are not covered by a permit.

The Implementation Plan will be developed by the stakeholders in the watershed under the organization of a Watershed Protection Partnership advisory committee. This committee will have the responsibility to develop all of the provisions of the Implementation Plan. Work groups will be organized to address all issues relevant to achieving the required reductions. Each work group will be given the responsibility to develop strategies for the different sources. Requirements pertaining to permitted dischargers will be identified by work groups and approved by the Watershed Protection Partnership.

The primary dischargers identified under the waste load allocation are wastewater treatment facilities and the Municipal Separate Storm Sewer Systems (MS4) permit operating throughout Harris County. The provisions already in place under these permits address most indicator bacteria sources. For example, wastewater treatment facilities must currently comply with disinfection requirements and the MS4 permit requires prevention of dry weather discharges and sanitary sewer overflows from reaching the bayous. Continued and more efficient compliance with the provisions of these permits should not cause economic harm. Representatives from the JTF have agreed to this principal in a recent meeting with the EPA.

Economics is a factor that should be examined by each work group. While all implementation activities are required to identify funding sources, schedules for implementation activities can be adjusted so that funding is available to conduct the activities. Through this requirement the stakeholders control the economic impact of the implementation plan.

**4. The TMDL document that is adopted by the TCEQ should formally reference the development of an Implementation Plan designed to achieve the reductions cited.**

TxDOT Comment 3, Page 2

All TMDL Reports now have the following language to reference the Implementation Plan as a formal part of the TMDL process.

The TMDL development process involves the preparation of two documents:

1) **a TMDL**, which determines the maximum amount of pollutant a water body can receive in a single day and still meet applicable water quality standards, and
2) **an implementation plan (I-Plan)**, which is a detailed description and schedule of the regulatory and voluntary management measures necessary to achieve the pollutant reductions identified in the TMDL.

During TMDL development, the TCEQ determines the acceptable pollutant load for impaired water bodies and apportions the load among broad categories of pollutant sources in the watershed. This information is summarized in a TMDL report such as this document.

During TMDL implementation, the TCEQ develops the management strategies needed to restore water quality to an impaired water body. This information is summarized in an implementation plan (I-Plan) which references, but is separate from, the TMDL document. The I-Plan details load reduction and other mitigation measures planned to restore water quality in an impaired water body.

The TCEQ is committed to developing I-Plans for all TMDLs adopted by the commission and to ensuring the plans are implemented. I-Plans are critical to ensure water quality standards are restored and maintained. They are not subject to EPA approval.

The TCEQ works with stakeholders to develop the strategies summarized in the I-Plan. I-Plans may use an adaptive management approach that achieves initial loading allocations from a subset of the source categories. Adaptive management allows for development or refinement of methods to achieve the environmental goal of the plan.

Periodic and repeated evaluations of the effectiveness of implementation methods assure that progress is occurring, and may show that the original distribution of loading among sources should be modified to increase efficiency. This adaptive approach provides reasonable assurance that the necessary regulatory and voluntary activities to achieve the pollutant reductions will be implemented.

## 5. Use adaptive management, phased TMDLs, and phased implementation in contact recreation TMDLs.

LP Comment Source Identification, Page 1, Paragraph 4; Comment Closing Remarks, Page 6, Paragraph 4
TxDOT Comment 4, Page 2

As the Implementation Plan is developed, the stakeholders will be encouraged to incorporate phases and adaptive management strategies into the final plan. The "phased TMDL" approach is, in effect, a part of all TMDLs in Texas. Any time the standards for a water body covered by a TMDL are revised or significant new data becomes available, the TMDL will be reviewed to determine if the TMDL and Implementation Plan require modifications.

Current EPA guidance for developing TMDLs speaks of a "phased approach to developing TMDLs", frequently referred to as "phased TMDLs". A "phased TMDL" describes TMDLs that are established despite significant data uncertainty and where the loading capacity and allocation scheme may be revised in the future as additional information is obtained. These phased TMDLs may also occur when a revision of the applicable water quality standard is underway and will necessitate development of a second, revised TMDL to comply with the new standard. All phased TMDLs must include all elements of a regular TMDL, including load allocations, waste load allocations, and a margin of safety. As with any TMDL, they must be established to attain and maintain the applicable water quality standard. The regulations (40 CFR Part 130.7) require all TMDLs to be calculated to achieve applicable water quality standards, this was affirmed by a recent court decision.

Additional information can be found in the EPA document: http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.html.

**6. There is too much uncertainty in characterizing indicator bacteria loads and too little is known about the behavior of indicator bacteria in the watershed and the waterbodies to be able to develop a TMDL.**

COH Comment 3, Page 2, Comment 10, Page 5
TxDOT Comment 1e, Page 3
HC Comment 4, Page 5
JC Discussion Comment, Page 2
LP Comment Page 1 Sentence 3; Comment Source Identification, Page 1, Paragraph 4

The goal of the TMDL project is to establish the load allocations for the two general categories of loads, the load allocation (LA) and the waste load allocation (WLA). The purpose of the TMDL study is to use the best available information in a reasonable amount of time to determine the load allocations. Although there are uncertainties in determining specific loads, there is sufficient information to establish the allocations for the broad categories (LA and WLA).

We recognize that there are uncertainties in indicator bacteria TMDLs and there are a number of factors that are built into the TMDL process to help address them. First, by assigning allocations to the two broad categories of load allocations, a detailed characterization of the exact amount of loads from each component of the categories is not required. Without specific restrictions being placed on each source, stakeholders have the flexibility to address the individual sources in the most efficient manner possible. Second, developing the implementation plan with multiple phases linked to adaptive management strategies will provide opportunities for a clearer understanding of the specific loads without requiring unreasonable reduction measures. Third, if at any time during this process, information is developed that shows that the TMDL allocations should be changed, there is a well developed process to make the needed changes to the TMDL allocations.

The adaptive management opportunities in developing the implementation plan can also be used to continue refining the understanding of the overall threat to human health of the different sources of indicator bacteria in the watershed and the behavior of indicator bacteria in the water bodies. By using that strategy, there is the opportunity to ensure that resources are best used to address the highest risks to human health. Also, the designated uses of the water bodies can be assessed to ensure that the efforts are being made to achieve the most appropriate goals.

**7. The allocations (amount of reductions) that the study currently shows are likely to be used for the final TMDL allocations are unrealistic.**

COH Comment 4, Page 2
LP Closing Remarks, Page 6, Paragraph 2, Sentence 2
HC Comment Page 2, Paragraph 4

The provisions of the Clean Water Act require that a TMDL be established to meet water quality standards. The indicator bacteria concentrations measured within the water bodies covered by the TMDL are extremely high. By simply looking at how much reduction is needed to reduce the measured levels to the levels that meet the standards, it is mathematically apparent that high percentages of reductions are needed. The range of reductions is similar to other indicator bacteria TMDLs from around the country.

The implementation plan actions can be designed so that there is sufficient time to use available resources to make significant improvements to the indicator bacteria concentrations in the bayous. T the implementation plan process can provide the time for the TCEQ and stakeholders to work

together to improve the general knowledge of indicator bacteria, risk to human health, and other fundamental issues.

### 8. The contact recreation use designations for the water bodies covered by the TMDL are not realistic and makes the requirements of the TMDL unrealistic.

HC Comment 1b, Page 4
COH Comment Ch1, P1, Page 1

In the first water quality standards to be adopted under the federal Clean Water Act in 1973, recreational uses and criteria were a mix of contact and non-contact recreation. In 1973, the classified list of water bodies in the Houston area was smaller than it is currently. [The San Jacinto watershed, for example, included the above-tidal portions of Spring Creek, Cypress Creek, Caney Creek, and Peach Creek.] The urban bayous were typically classified as non-contact recreation, with fecal coliform criteria of 2,000 or 1,000 per 100 ml. These uses and criteria were generally assigned based on the experience of aquatic scientists who were familiar with the water bodies. These uses and criteria were periodically adjusted for some of the bayous based on observations and other information. Peach Creek, for example, became contact recreation, with a fecal coliform criterion of 200 per 100 ml, in 1981; and by the 1984 revisions the criterion for the remaining non-contact water bodies was uniformly set at 2,000 fecal coliform per 100 ml (rather than having some at 1,000 per 100 ml). Up into the 1980's, specific uses and criteria were not "presumed" for unclassified water bodies in the general criteria of the standards.

In 1983, EPA substantially changed the federal regulations for water quality standards, and Use Attainability Analyses were required for all water bodies that were considered to be designated for less than "fishable/swimmable"; and EPA equated "swimmable" with primary contact recreation. Accordingly, EPA conditionally approved the 1984 revisions of the Texas Surface Water Quality Standards to require use-attainability analyses for a large number of specific classified segments and for smaller, unclassified water bodies.

Initial submittals of most use-attainability analyses, such as for Dickinson Bayou for a recreational use of less than primary contact recreation in 1985, were disapproved by EPA.

In 1986, a consortium of environmental groups sued EPA for approving the Texas Water Quality Standards, and part of the lawsuit focused on the lack of use-attainability analyses for designations of less than "fishable/swimmable". The lawsuit was revised in 1988, remained in court for a number of years, and is no now longer an active legal action.

In the 1988 water quality standards revisions, the "presumed" use for small, unclassified streams was designated as contact recreation, except where a Use Attainability Analysis was approved by EPA and the stream was individually designated in the water quality standards. Classified water bodies also were designated for contact recreation except for those few instances where a use-attainability analysis had been approved by EPA, such as for the Houston Ship Channel Segments 1006 and 1007 (where there is no designated recreational use). There were other ship channel areas — such as Texas City, Bayport Channel, and the lower part of the Houston Ship Channel (Segment 1005) — that were also designated for non-contact recreation due to concerns by port authorities that recreation wasn't safe due to ship traffic. However, EPA required that these other ship channels be assigned criteria commensurate with contact recreation use.

TCEQ adopted the EPA's current criteria that are based on *E. coli* for freshwater and Enterococci for tidal waters in the standards revisions for the year 2000. Currently only contact and non-contact recreation uses are available under the Texas Surface Water Quality Standards.

During the analysis of the possible load reductions for the Buffalo and Whiteoak Bayous Indicator Bacteria TMDL project, the water quality standard for non-contact recreation was assessed along with the contact recreation standard. The difference between the contact (126 colony forming units per 100 milliliters) and non-contact recreation (605 colony forming units per 100 milliliters) standards changes the reductions required by the TMDL allocations very little because the very high in-stream indicator bacteria concentrations.

Water Quality Standards Team of TCEQ with the Houston-Galveston Area Council has a project underway to establish a protocol for a Use Attainability Analysis for contact recreation. Once that protocol is established, a Use Attainability Analysis will be conducted on selected Houston area water bodies to determine if a change in use designation is appropriate.

Conducting a Use Attainability Analysis and a change in designated use (a rule change) will take several years. During that time, the TMDL will be completed and an implementation plan will be developed by the Watershed Partnership. This provides the residents of the watershed with the opportunity to work on improvements that are needed under either contact or non-contact recreation standards.

**9. The Bacteria Load Estimation Spreadsheet Tool (BLEST) mass balance calculation tool should be in the public domain. An unprotected version of this tool should be made available to the public.**

TXDOT Comment 5, Page 3
HC Comment Page 2, Paragraph3

The BLEST mass balance calculation tool is a part of a copyrighted dissertation at the University of Houston. A fully operational protected version is available on the TCEQ website (http://www.tceq.state.tx.us/implementation/water/tmdl/22-buffalobayou.html#participation). In this version, inputs can be modified and the results can be viewed providing the public with the ability to calculate load allocations for any set of data. Detailed descriptions of the elements of the calculations are available in the accompanying report and a detailed information sheet is provided that shows the data and calculations for a single sub-basin in the tool.

A replacement mass balance calculation tool is being developed that performs the load calculations with the same logic, formulas and data but does not have all of the automated features of the BLEST mass balance calculation tool. This unprotected replacement tool will be used for the load calculations and will be provided to all stakeholders in October, 2007 for review.

**10. The Bacteria Load Estimation Spreadsheet Tool (BLEST) does not consider dynamic processes. The model does not adequately handle consideration of dynamic processes and in-stream transport and fate processes such as settling, re-suspension, regrowth, and die-off.**

TxDOT Comment 2b, Page 4
HC Comment 3, Page 4; Comment 36, Page 11; Comment 91, Page 20

The Bacteria Load Estimation Spreadsheet Tool does not consider these processes. The Bacteria Load Estimation Spreadsheet Tool is a mass balance method designed to calculate the indicator bacteria loads entering the bayous and to determine the load allocations based on a calculated load capacity. This particular mass balance method determines the loads from 119 sub-

basins in the two watersheds. The load capacity is determined by multiplying the target concentration of indicator bacteria times the flow in the bayou. The target concentration of indicator bacteria is determined is the contact recreation standard. This establishes the indicator bacteria load that the bayou can receive assuming no in-stream process that may increase or decrease the load capacity. Settling and re-suspension, regrowth and die-off, and other processes either increase or decrease the load capacity of the bayous. All of these processes are likely specific to the conditions in each water body and there is little information to determine how these processes alter the load capacity. The strategy taken in the mass balance method is to use the sum of all in-stream processes as a calibration factor that is adjusted to make the load estimates match with the observed in-stream water quality measurements. This approach is supported by the observation that the current in-stream concentrations need to be decreased approximately the same amount as the calculated waste load and load allocations so that the in-stream concentrations meet the standard.

For the final allocations, three analytical methods will be used. The Bacteria Load Spreadsheet Estimation Tool will provide load estimated based on mass balance, the Load-Duration method will provide load estimates based on flow-based measurements, and the HSPF watershed model will provide load estimates based on simulations of watershed process and in-stream process including settling and re-suspension and regrowth and die-off. The results of all three analytical methods will be considered in determining the final load allocations.

**11. Regrowth of bacteria in the bayous is a significant process that has not been correctly characterized. Regrowth of bacteria is a significant process that may be a significant contributor to the bacteria concentrations in the bayous.**

TxDOT Comment 2a, Page 4
LP Comment Bacteria Regrowth, Page 5, Paragraph 5

The survival and replication of indicator bacteria in a natural water body is a very difficult property to determine. Two experiments were conducted to investigate this attribute for this project. One study, was conducted in chambers in Buffalo Bayou by the University of Houston to simulate environmental conditions (January 2003 Report, Chapter 3) and one study sponsored by H-GAC under the Clean Rivers Program was conducted in a laboratory by the City of Houston (November 2005 Report, Chapter 8). Both of these studies identified a reduction in indicator bacteria concentrations over time. When examining other studies conducted nationwide, the results vary widely from increases in concentrations to reductions. The National Sanitation Foundation study presented at the February 7, 2007 stakeholder meeting is an example of a laboratory study of the effects of waste water treatment on the survival and replication of indicator bacteria. The study determined that, under laboratory conditions, sanitized wastewater treatment effluent when inoculated with indicator bacteria creates conditions under which the bacteria survive and replicate. The study did not identify the particular nutrients or chemistry conditions that caused this and it did not address how those conditions would apply in a natural environment. The difficulty with all of these studies is that indicator bacteria survival and replication characteristics in a natural water body are affected by a very large and diverse set of conditions, such as predation, competition, and sunlight and there is no definitive answer to the survival and replication question.

The strategy used in the TMDL study is to assume that all of the factors controlling indicator bacteria survival and replication balance. As a result, the indicator bacteria load capacity of the water bodies is not decreased due to survival and replication.

The TCEQ is funding a two-year study conducted by the Texas A&M University at Galveston to investigate a number of parameters that influence survival and replication of bacteria in the

environment of Buffalo and Whiteoak watershed. Although this study will not provide a characterization of regrowth/die-off rates but it will provide information on conditions that influence survival and replication. This information may lead to methods to control bacteria during the implementation phase of the project.

**12. Make distinctions among storm water point source loads. All potential sources that could contribute indicator bacteria loads to the bayous should have an assigned waste load allocation. This would include industrial facilities, construction sites, and Phase II municipal separate storm water systems.**

LP Comment BLEST Tool, Page 3 Paragraph 3 & 4; Page 4, Paragraph 2
TxDOT Comment 2i, Page 5
COH Comment Chapter 3, Page 1, Paragraph 6
HC Comment BLEST 15, Page 7, BLEST Comment 42, Page 12

The TMDL will establish only the overall load allocation and the overall waste load allocation. This provides the most flexibility in developing the implementation plan strategies by avoiding individual limits and by allowing the individual components to be addressed in the Implementation Plan by the watershed stakeholders. The Buffalo and Whiteoak Indicator Bacteria TMDL project has incorrectly identified runoff conveyed loads as Municipal Separate Storm Sewer Systems (MS4) indicator bacteria loads. This will be corrected in all subsequent documents to clearly describe the indicator bacteria loads being contributed by rainfall runoff. This load includes all sources that may contribute indicator bacteria into the MS4 conveyance system from all regulated storm water discharges. These sources include but limited to; sanitary sewer overflows, dry weather storm sewer discharges, watershed rainfall runoff through Phase I and Phase II Municipal Separate Storm Sewer Systems, rainfall runoff from industrial facilities, and rain fall runoff from construction sites. The load calculated for rainfall runoff includes all contributors.

**13. Sanitary sewer overflows should be part of the wastewater load allocation.**

TxDOT Comment 2j & 2p, Pages 5 and 6
COH Comment Section 3.2.2, Page 2, Paragraph 3 & 6
HC Comment 62, Page 15

Sanitary sewer overflows (SSOs) are a part of the overall waste load. The Buffalo and Whiteoak Indicator Bacteria TMDL project incorrectly identified runoff bacteria loads as Municipal Separate Storm Sewer Systems (MS4) indicator bacteria loads and included sanitary sewer overflows in that category. This will be corrected in all subsequent documents to clearly describe the indicator bacteria loads being contributed by rainfall runoff. Sanitary sewer overflows will be a separate item under the overall wasteload calculation.

**14. Some dry weather loads should be part of the load allocation. Storm water permitting regulations define certain "allowable non-storm water discharges" such as lawn watering, foot drains with uncontaminated groundwater, and similar discharges. Recent studies by Harris County have illustrated that many of these allowable non-storm water discharges actually contain elevated concentrations of indicator bacteria.**

TxDOT Comment 2r, Page 6; Comment 2x, Page 7
HC Comment 55, Page 14

All discharges identified as being potential allowable discharges to a Municipal Separate Storm Sewer System must be controlled if they contain a significant source of a pollutant to waters of the United States. This is stated in Part II (a) (6) (a) (2) of NPDES permit number TXS001201 for the Houston-Harris County Municipal Separate Storm Sewer System: "Categories of non-storm water discharges exempted from the prohibition on non-storm water must not be reasonably expected (based on information available to the Permittees) to be significant sources of pollutants to the Municipal Separate Storm Sewer System,…". This provision is based on the requirements of 40 CFR 122.26 (d) (2) (iv) (B) (1).

**40 CFR 122.26 (d) (2) (iv) (B) (1)**: A description of a program, including inspections, to implement and enforce an ordinance, orders or similar means to prevent illicit discharges to the municipal separate storm sewer system; this program description shall address all types of illicit discharges, however the following category of non-storm water discharges or flows shall be addressed where such discharges are identified by the municipality as sources of pollutants to waters of the United States: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)) to separate storm sewers, uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water (program descriptions shall address discharges or flows from fire fighting only where such discharges or flows are identified as significant sources of pollutants to waters of the United States);

Because these sources are contributing indicator bacteria loads, these discharges properly belong in the waste load category for areas covered by an MS4 permit.

**15. The Margin of Safety is inappropriately selected. It is unnecessary and excessive to include both an implicit and explicit Margin of Safety, especially due to the explicit Margin of Safety including a future growth provision.**

TxDOT Comment 2v, Page 7
HC Comment 117, Page 25; Comment 120, Page 26

Considering that the implementation measures will be focused on reducing the bacteria loads from the same sources that are affected by the population increase, the additional allocation is not necessary and an explicit Margin of Safety will not be included in the allocations.

**16. Although source and treatment control BMPs have had modest success in improving receiving water quality, it is quite doubtful that implementing a comprehensive BMP program in the two watersheds will be successful in meeting current bacteria state standards during all flow regimes.**

LP Comment Limitations of BMPs, Page 2

The adaptive management aspect of the Implementation Plan provides the opportunity to carefully evaluate the benefits of all BMPs and to employ those that are the most effective and cost efficient. Also, the Implementation Plan is a long term strategy for improving the indicator bacteria water quality that can include measures to evaluate the overall threat to human health of the indicator bacteria in the storm water load. Many other communities are addressing storm water sources in TMDLs, for example: http://www.epa.gov/owow/tmdl/17_TMDLs_Stormwater_Sources.pdf.

**17. The report should include a thorough explanation of what BLEST is and why the mass balance method was chosen to calculate loading rather than the HSPF watershed model that was used initially.**

COH Comment Chapter 3, Page 1, Paragraph 5
HC Comment 13, Page 6; Comment 33, Page 11; Comment 34, Page 11, Comment 118, Page 26; Comment 119, Page 26

BLEST is a mass balance calculation tool developed to calculate loadings from the approximately 120 sub-basins in the Buffalo and Whiteoak bayous Watersheds. The method is a simple mass balance calculation that has been used in numerous indicator bacteria TMDLs across the nation.

The mass balance method also provides a method to develop the allocations for three flow ranges. This approach provides the opportunity to prioritize implementation activities toward flows that have the highest potential for human exposure. The low and median flow ranges represent the most potential for exposure followed by the high flow range which represents conditions where exposure is at a minimum. During implementation, efforts can be focused on reducing indicator bacteria loads during low and median flows while postponing actions designed for high flows. This will provide the time to develop an understanding of the threat to human health from storm water conveyed indicator bacteria loads and a clearer understanding of practical, cost effective control measures.

The mass balance method for determining the indicator bacteria loads and the load allocations was chosen over the HSPF watershed model for several reasons. First, the review of the HSPF model by some stakeholders demonstrated objections to the construction of the model and the values of the parameters that were used, and a request to make the model more complex. Because of these objections it was decided that most stakeholders and the general public would not have confidence in the model if they did not understand the objections to the model or if it became more complex. So the more simple mass balance method was used. Second, the mass balance method is the most direct method for determining loads and allocations. All of the calculations are simple and direct and the parameters used have easily understandable meanings. The HSPF model uses complex mathematics and computer code that is not easily understood. The mass balance method provides stakeholders a better opportunity to provide input into the numbers behind the calculations.

To provide input on the HSPF model, an in-depth understanding of very complex parameters is needed.

To increase confidence in the final TMDL allocations, three different calculation methods will be used. The indicator bacteria loads and the load allocations will be determined using the mass balance method, load duration curves, and the HSPF watershed model. The results of the three calculation methods will provide guidance and some flexibility in selecting the final TMDL allocations.

### 18. Include a discussion of the uses and criteria that are the objective of the TMDL.

HC Comment 8, Page 5
COH Comment Chapter 1, Page 1, Paragraph 1
PJ Comment Section 1, Page 1, Sentence 1
TxDOT Comment 1a & 1c, Page 3

The posted report dated December 2006, is a report for the project that summarizes the work conducted during the fiscal year 2005. As such, the report was not designed to discuss all aspects of the impairments, the designated uses, or the TMDL process.

- Background information on the standards and uses for the water body segments in the project can be found in the previous reports available on the TCEQ website at: http://www.tceq.state.tx.us/implementation/water/tmdl/22-buffalobayou.html.
- The June 2001 and January 2003 reports contain discussions about the uses and standards. Information on the origin of uses and standards can be found on the TCEQ Surface Water Quality Monitoring website at: http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/mtr/swqm_resources.html.
- Details on the standards and uses for the water body segments in the project can be obtained by contacting the Water Quality Assessment Section (512-239-4576). Information on water quality standards from the EPA can be found at: http://www.epa.gov/waterscience/standards/handbook/.

The State of Texas has two categories of recreational use for surface water bodies; contact recreation and non-contact recreation. As defined in the Surface Water Quality Standards (Texas Administrative Code §§307.1-307.10), contact recreation is "Recreational activities involving a significant risk of ingestion of water, including wading by children, swimming, water skiing, diving, and surfing". Non-contact recreation is defined as "Aquatic recreational pursuits not involving a significant risk of water ingestion; including fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity". Contact recreation applies to all bodies of freshwater except where specifically designated otherwise.

A designation of contact recreation is not a guarantee that the water is free of disease-causing organisms (pathogens). Indicator bacteria, although not generally pathogenic, are indicative of potential contamination by feces of warm blooded animals. The criteria for contact recreation are based on the indicator bacteria rather than direct measurement of pathogens. Criteria are expressed as the number of "colony forming units" of bacteria per 100 milliliters (ml) of water (about 3 1/3 ounces).

The freshwater contact recreation standard is: The geometric mean of *E. coli* should not exceed 126 colony forming units per 100 ml. In addition, single samples of *E. coli* should not exceed 394 colony forming units per 100 ml. Additional information on the basis for the standard can be found on the EPA website: http://www.epa.gov/waterscience/beaches/local/sum2.html.

## 19. Include a discussion that flow is treated wastewater.

PJ Comment Section 1, Page 1, Sentence 3
HC Comment 9, Page 5
TxDOT Comment 1b, Page 3

The posted report dated December 2006, is a report for the project that summarizes the work conducted during the fiscal year 2005. As such, the report was not designed to discuss all aspects of the TMDL study. Background information can be found in the previous reports available on the TCEQ website at: http://www.tceq.state.tx.us/implementation/water/tmdl/22-buffalobayou.html. The June 2001, January 2003, November 2004, and November 2005 reports contain discussions about the flows within the segments in the study.

The review of historical data and the development of the hydrologic and hydraulic component of the HSPF model demonstrate that the base flow in the water body segments in the project as defined by the 0% to 30% interval in the flow-duration curve is provided by wastewater treatment discharges.

## 20. Clarify work status by providing a list or table or work sequence.

HC Comment 5, Page 5; Comment 6, Page 5
COH Comment Chapter 1, Page 1, Paragraph 2
TxDOT Comment 1d, Page 3

The posted report dated December 2006, is a report for the project that summarizes the work conducted during the fiscal year 2005. As such, the report was not designed to discuss all aspects of the TMDL study. The work that was accomplished for each fiscal year is described in detail in the previous reports available on the TCEQ website at: http://www.tceq.state.tx.us/implementation/water/tmdl/22-buffalobayou.html.

The following table provides a summary of the work orders for the project.

Project Summary

| FY2000 | | | |
|---|---|---|---|
| **Contract** | **Work Order** | **Amount** | **Work** |
| 582-0-80121 | 1 | $95,000 | Acquire all available historical data for the watersheds and water bodies in the project. Use the acquired data to assess current levels and trends of bacterial indicators of fecal pathogens in the water bodies in the project and assess major sources, transport and fate of indicator bacteria. Develop and apply HSPF model to assess the sources and major processes controlling observed levels of indicator bacteria. Develop a quality assurance project plan for additional data collection. Participate in stakeholder and public participation processes. |

| FY2001 | | | |
|---|---|---|---|
| **Contract** | **Work Order** | **Amount** | **Work** |
| 582-0-80121 | 2 | $114,000 | Collect and analyze samples from the water bodies and dischargers in the project watersheds under all flow conditions as described in the QAPP developed under Work Order #1. With the historical data and data collected under Work Order #2, assess |

| | | | |
|---|---|---|---|
| | | | the current levels and trends of indicator bacteria in the water body segments in the project and assess the major sources of indicator bacterial. Modify the HSPF model to assess the sources and major processes controlling observed levels of indicator bacteria using the new data. Conduct a preliminary analysis of the TMDL allocations. Participate in stakeholder and public participation processes. |
| | | | |
| **FY2002** | | | |
| **Contract** | **Work Order** | **Amount** | **Work** |
| 582-0-80121 | 2 | $140,827 | Continue the work started in FY2001 |
| | | | |
| **FY2003** | | | |
| **Contract** | **Work Order** | **Amount** | **Work** |
| 582-0-80121 | 5 | $120,000 | Investigation concluded that the bacteria content of the discharge from Barker and Addicks reservoirs to Buffalo Bayou exceeded the contact recreation standard. This resulted in the decision to include the upper Buffalo Bayou watershed in the Barker and Addicks area in the TMDL project. A Bacteria Source Tracking (BST) study, additional water and sediment samples were planned. Investigations of leaks, overflows, bypasses, and sludge disposal from wastewater systems planned. Modifications to the HSPF watershed model to include all of the new data and water supply diversions and withdrawals planned. Participate in stakeholder and public participation processes. |
| | | | |
| **FY2004** | | | |
| **Contract** | **Work Order** | **Amount** | **Work** |
| 582-0-80121 | 6 | $449,750 | QAPP for BST and additional sampling prepared and approved. BST samples and water and sediment samples collected. Investigations of leaks, overflows, bypasses, and sludge disposal from wastewater systems conducted. Water supply diversions and withdrawals investigated and included in watershed model. HSPF watershed model modified to include all new information. Participate in stakeholder and public participation processes. |
| | | | |
| **FY2005** | | | |
| **Contract** | **Work Order** | **Amount** | **Work** |
| 582-0-80121 | 8 | $250,000 | Sampling and analysis begun in FY2004 completed. HSPF watershed model completed. Preliminary TMDL load allocations determined. Participate in stakeholder and public participation processes. |
| | | | |
| **FY2006** | | | |
| **Contract** | **Work Order** | **Amount** | **Work** |
| 582-6-70860 | 1 | $100,000 | Continued development of TMDL allocations using mass balance method and load duration curves. Participate in stakeholder and public participation processes. |

| |
|---|
| **FY2007** |

| Contract | Work Order | Amount | Work |
|---|---|---|---|
| 582-6-70860 | 9 | $100,000 | Continued development of TMDL allocations using mass balance method. Participate in stakeholder and public participation processes. |
| 582-6-70860 | 9 Amend#1 | $50,000 | Modifications to mass balance method, load duration curves, and HSPF model based on comments received. Modifications to TMDL allocations. |
| | | | |

***Note: The work order numbers are not sequential because other TCEQ projects being conducted by the University of Houston used the other work order numbers.***

**21. It should be made clear in the report that the criterion for non-contact recreation is also considered.**

PJ Comment Section 1, Page 1, Sentence 6
COH Comment Chapter 1, Page 1, Paragraph 2

Subsequent reports will clearly indicate the analysis of the TMDL allocations for a non-contact recreation value for indicator bacteria.

**22. The Stakeholder/Public Participation Section should detail all stakeholder involvement, not just involvement by the University of Houston, Also, the report does not include a stakeholder meeting held on September 7, 2006.**

COH Comment Chapter 2, Page 1, Paragraph 4

The posted report dated December 2006, is a report for the project that summarizes the work conducted during the fiscal year 2005. The report only includes public participation through August 2005 in which the University of Houston participated. A more complete list of meetings is available on the TCEQ website at: http://www.tceq.state.tx.us/implementation/water/tmdl/22-buffalobayou.html. The Houston-Galveston Area Council also maintains a website for public participation for the project at: http://www.h-gac.com/HGAC/Programs/Water+Resources/Total+Maximum+Daily+Loads+TMDL+/default.htm.

**23. The word "pathogen" is misused. Pathogenic organisms are not directly measured and indicator bacteria are the recreational use standard**

HC Comment 2, Page 4

The terms, "pathogen", "fecal pathogen", "bacteria" and any other terms for indicator bacteria will henceforth be referred to as "indicator bacteria".

**24. Provide an explanation that the TMDL project uses indicator bacteria as a surrogate for estimating pathogens and that these indicator bacteria are most often associated with fecal contamination but can also thrive in any moist nutrient-rich environment apart from animal inputs.**

HC Comment 7, Page 5

The posted report dated December 2006, is a report for the project that summarizes the work conducted during the fiscal year 2005. As such, the report was not designed to discuss all aspects of the contact recreation standard. Background information on the standards and uses for the water body segments in the project can be found in the previous reports available on the TCEQ website at: http://www.tceq.state.tx.us/implementation/water/tmdl/22-buffalobayou.html.

- The June 2001 and January 2003 reports contain discussions about the uses and standards.
- The November 2004 and November 2005 reports contain additional information on E. coli concentrations in soils, mulch and compost.
- Information on the origin of uses and standards can be found on the TCEQ Surface Water Quality Monitoring website at: http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/mtr/swqm_resources.html.
- Details on the standards and uses for the water body segments in the project can be obtained by contacting the Water Quality Assessment Section (512-239-4576). Information on water quality standards from the EPA can be found at: http://www.epa.gov/waterscience/standards/handbook/.

**25. In the report in general and in the BLEST tables in particular, a load allocation under the Waste Load Allocation is referred to as "MS4" is incorrect. This should be more appropriately labeled "NPDES/TPDES regulated discharges".**

LP Comment BLEST Tool, Page 3, Paragraph 2 & 5

The term "MS4" will henceforth be referred to by the terms "NPDES/TPDES regulated discharges" or "permitted discharges".

**26. Include a statement that submerged outfalls were not included in this analysis.**

HC Comment 54, Page 14

The posted report dated December 2006, is a report for the project that summarizes the work conducted during the fiscal year 2005. No outfall sampling was conducted during the year. All of the discharge sampling that was conducted in this project is described in the January 2003, November 2004, November 2003, and November 2005 reports. Sampling was conducted at the weir within the wastewater treatment facilities which is the compliance point for treatment plant operations. No outfalls were sampled in this study.

**27. Use the words “empirically-calculated” rather than “known” in the last sentence, first paragraph of Page 33.**

HC Comment 63, Page 15

Care will be taken in all subsequent report to not use the term “known” for any information that is derived or otherwise calculated so that it will not create the impression of certainty.

**28. Section 3.2.1 states that wastewater treatment plant discharges “have the potential to make up a large portion of the bacteria load because of their nature.” This statement is not explained or justified.**

COH Comment Section 3.2.1, Page 2

Care will be taken in all subsequent report to not use speculative language such as the example in this comment.