January 25, 2001 Meeting of the Buffalo & Whiteoak Bayous Bacteria TMDL Stakeholder Group

Participants Present: Neil Bishop, Linda Broach, Claire Caudill, Cynthia Chappell, Catherine Elliott, Theo Glanton, Rod Hainey, Helen Lane, Mary Ellen Whitworth,

Support Team Present: Dania Drogolewicz, Lisa Gonzalez, Paul Jensen, Jim Lester, Carl Masterson, Tina Peterson, Hanadi Rifai, Yu-Chun Su, Monica Suarez, Andrew Sullivan, Mel Vargas

Others Present: Kirk Fleener (TNRCC), Trent Martin (HCPC), Todd Running (H-GAC), Chuck Wemple (H-GAC), Michele Wilkins (GBF)

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1. The meeting for the Buffalo & Whiteoak Bayous Bacteria TMDL Stakeholder Group was held from 6:00-9:00 PM at the Houston-Galveston Area Council (H-GAC) offices, 3555 Timmons Lane, Houston, Texas 77227, 2nd Floor, Conference Room A. Project notebooks were distributed to all members who were not present at the May 2000 Kickoff Meeting. **Jim Lester** of the Environmental Institute of Houston (EIH) welcomed the group. Self-introductions were made. The meeting agenda was approved.

2. **Mel Vargas**, TMDL Program Leader with the Texas Natural Resource Conservation Commission (TNRCC), gave an update on recent developments with the TNRCC TMDL Program that have occurred since May 2000. Additional policy directives and guidance have come from the Commission. The goal of the TMDL process is to restore and maintain the beneficial uses of a waterbody. Watershed action plans serve as a comprehensive study to plan for the restoration of beneficial uses. There are two distinct parts of the process:
    1) Technical – Must decide how much of a pollutant decrease is necessary to maintain the Surface Water Quality Standards
    2) Implementation – Must decide what management measures are to be incorporated into the implementation plan to achieve reductions

    According to the October 26, 2000 TMDL process flowchart, the TNRCC approves the TMDL allocation and sends it to the Environmental Protection Agency (EPA) for federal approval. The TNRCC then outlines the implementation plan. The EPA has no authority under current regulations to approve the implementation plan. The watershed action plan is actually the TMDL allocation and the implementation plan combined.

    Over the last several months the Commission has passed down a directive that makes a distinction between the development of the TMDL allocation and the implementation plan (the two are no longer packaged together for approval as they had been in the past).

    The Commission is challenging new regulations adopted by the EPA in July 2000. According to those regulations, the EPA would have federal approval over the implementation plan in addition to its approval over the TMDL allocation. The TNRCC is trying to maintain state responsibility and authority for the implementation plan. The Commission believes that implementation should be localized to local conditions and addressed at a state level rather than at the federal level.

Substantive edits were made by the TNRCC to the May 2000 meeting summary. The edits include changes to the roles and responsibilities of stakeholders that have evolved since the May 2000 meeting. (The stakeholders decided that they would like to have the changes incorporated into this meeting's summary and sent out to the stakeholder group prior to the next meeting -- Please see the end of this document for information regarding this)

Todd Running, Clean Rivers Program (CRP) Coordinator for the H-GAC, provided an update on CRP activities. He stated that the CRP would like to support the bacteria TMDL and further UH efforts by using DNA hybridization to determine what sources are out there. A contract has been awarded to PBS&J for $80,000. Dr. Paul Jensen is Project Manager. 3 sampling runs have been completed so far.

Dr. Jensen gave an update on the DNA hybridization project. He stated that samples are being collected and split between Health and Human Services and the TNRCC for lab analysis. Dr. Shelly Pain is using a Polymerase Chain Reaction (PCR) technique to identify particular DNA strands that have been associated in the literature with different bacterial sources.

3. **Lisa Gonzalez** then gave a brief presentation to review the draft Ground Rules for the Bacteria TMDL Stakeholder Group. Stakeholders were then asked to comment on the draft Ground Rules. The Ground Rules were approved with the following changes:
    - Absences: 3 or more absences *in a row* of which the facilitator was not informed of beforehand constitute a resignation *regardless of whether or not a substitute was sent*.
    - Observers: Meetings are open and observers welcome. As time permits, observers may make comments or ask questions. A 10-minute segment at the end of *each discussion topic* is set aside for additional comments as needed.
    - Decisionmaking Process: Once adopted, *formal recommendations* may be changed by consensus among group members as long as more than half the stakeholders and the TNRCC representative are present for the discussion. (This phrase was broken out of the "Development and Revision of Ground Rules" section)

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4. A presentation on technical findings to date was then given by **Dr. Hanadi Rifai**, an Associate Professor with the University of Houston's Department of Civil and Environmental Engineering. Dr. Rifai introduced her assistants, Monica Suarez and Tina Petersen. She also introduced the subcontractors who were present at the meeting: Dr. Paul Jensen and Dr. Yu-Chun Su with PBS&J.

   Dr. Rifai stated that she would be presenting a summary of the Phase I work completed thus far. They have been working on the project since March 2000. Two quarterly reports have been submitted to the TNRCC (A lay language report summary and glossary will be e-mailed to the stakeholders; full text of the reports will be made available on an H-GAC web page in the near future). The maps are in draft form and are subject to change.

   She began her presentation by defining the term, TMDL. TMDL allocation components get us from the target to the load allocation by:

1) Identifying the problem (not as simple as it sounds),
2) Identifying the water quality target (a complex issue)
3) Evaluating watershed and water quality conditions (is relatively simple involves looking at historic data)
4) Assessing pollutant sources using theoretical models (more complex) and
5) Allocating pollutant loads (the main goal)

The TMDL implementation plan is an extensive part of the process and includes:
1) Description of pollution control actions,
2) Development of a schedule for implementation of pollution control actions,
3) Assurances of load allocation goal achievement,
4) Determination of legal authority as some issues may not fall under the state umbrella,
5) Formulation of a follow-up plan and
6) Definition of measurable outcomes to evaluate plan implementation.

She defined the 303(d) list and stated that the list had previously been updated biannually. It is unclear as to when the lists will be updated next. She then went over the specific 303(d) listings for the water bodies included in this TMDL.

Major tasks for Phase I of the project include the:
1) Stakeholder/public education and involvement
2) Assessment of current levels and trends in the project area
3) Assessment of major sources, transport and fate of bacterial indicators of fecal contamination
4) Application of models to elucidate the sources and major processes controlling observed levels of fecal coliform
5) Develop a Quality Assurance Project Plan (QAPP) for additional data collection

Paul Jensen then gave a description of Buffalo and Whiteoak bayous explaining that these water bodies have some of the highest bacteria levels in the state and are very data rich. He explained that there is a dense monitoring station network in place. The Clean Rivers Program was instrumental in implementing a quality assurance system for data analysis.

He then explained fecal coliform data collection by listing the various agencies responsible for data collection. They include:
1) TNRCC and US Geological Survey (USGS) (1992-1999) collected H-GAC/San Jacinto River Basin data (conducted high flow stormwater monitoring)
2) H-GAC (1997-1999) collected local monitoring data
3) TNRCC (1993-1999) collected surface quality monitoring data (conducted low flow monitoring)
4) City of Houston Health and Human Services Dept. (H&HS) (1995-1998) collected bayou monitoring data (Data actually goes back farther than 1995. They sampled at low and high flow to determine ambient conditions.)
5) City of Houston Public Works and Engineering Dept. (PW&E) (1983- Jan 2000) (Monitored to identify problems in the storm water system. Limited their monitoring to low flow conditions.)

Linda Broach stated that the TNRCC monitoring (number 3 above) actually took place at high flow conditions. Sampling was done on a set schedule (every three months).

Jensen then presented a graph of cumulative flow frequency curves for Whiteoak Bayou at Heights Boulevard. He stated that the graph represents different averaging periods. None of the flows were less than 30 cubic feet per second (cfs). Almost 100% of the flows were at least 10,000 cfs. Flow is maintained by dry weather discharge flow.

A graph of cumulative flow frequency curves for Buffalo Bayou at West Belt was presented. Jensen stated that wastewater discharge maintains the flow. The Addicks and Barker Reservoirs also have an impact on the flow. As a result, Buffalo Bayou is hydrologically different than Whiteoak Bayou. Data for the period 1991-1999 had higher flow numbers than did the flow data for the periods 1983-1990 and 1983-1999. **Broach** suggested that this might due to increased return flows.

Jensen then presented a time series of Buffalo Bayou fecal coliform data collected at West Belt (1983-1999, flow less than 100 cfs). The analysis showed that there was no statistical difference between the TNRCC and City of Houston H&HS data. Therefore, the two data sets (both low flow data) could be combined. There was no large historical trend. However, lower levels of indicator bacteria were seen in the 1980's due to the presence of chlorine (from wastewater treatment) in the bayous. The bayou was in effect disinfected.

Time series data for Buffalo Bayou farther downstream at Shepherd Drive (1983-1999, flow less than 100 cfs) did not show the same effects of municipal wastewater treatment as did the data collected at West Belt. All data collected at this station were above the 400 cfu/dl criteria level.

A time series of Whiteoak Bayou fecal coliform data collected at W. Tidwell Ave. (1988-2000, flow less than 50 cfs) did indicate a possible chlorination effect (lower numbers in the 1980's). However, there were no real temporal trends. In the 1980's the City of Houston had major sewer collection system problems. In response to those problems, the City of Houston invested $1 billion in wastewater collection system improvements. Those improvements should be evident to some degree in the data. **Mary Ellen Whitworth** noticed that there was no data collected by the City H&HS Dept. shown on this graph. **Jensen** replied that H&HS did not collect data at this station.

Time series of Whiteoak Bayou fecal coliform data collected at Heights Blvd. (1988-2000, flow less than 50 cfs) indicated that fecal coliform levels associated with runoff events ranged from 10,000 cfu/dl to 100,000 cfu/dl. Jensen reminded the group that this was low flow data (less than 50 cfs). Therefore, fecal coliform levels are not as high as they would be if the samples had been collected during high flow.

Fecal coliform data collected along the main stem and tributaries of Buffalo Bayou from 1992-1999 (flow less than 100 cfs) indicated that not many observations were close to the 200 cfu level. Therefore, they did not often meet criteria levels. **Cynthia Chappell** asked if these data were expressed as geometric mean, do they indicate a 50 fold increase in bacteria levels from upstream to downstream. **Jensen** replied, no, it is more like a 6-10 fold increase. Do not assign too much value to this, as it has not been determined if there is any statistical significance. This is something on which he would like to follow up.

Fecal coliform data collected along the main stem and tributaries of Whiteoak Bayou from 1992-1999 (flow less than 50 cfs) indicate that some tributaries had higher bacteria levels while some levels were the same as bacteria levels seen in the main stem. Most bacteria levels were above the contact recreation criteria most of the time. It should be noted that most of this data was collected on just one day. Bacteria levels may actually be low one day and higher on others.

Fecal coliform data collected at high flow (greater than 1,000 cfs for Buffalo Bayou and greater than 300 cfs for Whiteoak Bayou) for the period 1992-1999 indicate the effects of flow on bacteria levels. Geometric means of Buffalo Bayou main stem and tributary bacteria levels (997 cfu/dl and 2,997 cfu/dl respectively) were substantially lower than Whiteoak Bayou main stem and tributary bacteria levels (9,711 cfu/dl and 36,372 cfu/dl respectively). Jensen stated that Buffalo Bayou bacteria levels may be lower to some degree due to a settling/cleansing effect caused by the barker and Addicks Reservoirs.

Dr. Rifai then presented information on potential sources of fecal coliform in Buffalo and Whiteoak Bayous. These sources include:

1) Treated effluent from point sources not completely disinfected (it is evident that smaller treatment plants have problems)
2) Regrowth or reactivation of bacteria after point source discharge (this is supported in the general literature)
3) Bacteria input from illicit discharges (these discharges are unregulated)
4) Discharge of untreated sewer due to sewer leaks or blockage
5) Bacteria from upstream sources (**Vargas** asked if this could be attributed to point sources or nonpoint sources. **Rifai** replied that it could be a little of both. It is something that needs to be investigated further.)
6) Untreated sewage from failed on-site wastewater systems in unsewered areas
7) Bacteria from birds concentrated at bridges (many monitoring stations are located at bridges)
8) Bacteria from runoff
9) Bacteria associated with stream sediments

A map of permitted dischargers to Buffalo and Whiteoak Bayous was presented (also given as a handout). Dr. Rifai stated that there are few large wastewater plants and many smaller ones (less than 1 million gallons per day (MGD)). The smaller plants' treatment methods may not be meeting standards. There are a number of these smaller plants in the watershed.

Wastewater discharges into Buffalo Bayou are permitted at 112.25 MGD. The 1998-1999 self-reported average flow was 42.39 MGD. Wastewater discharges into Whiteoak Bayou are permitted at 56.67 MGD. The 1998-1999 self-reported average flow was 21.62 MGD.

Less than 20% of the wastewater facilities along Buffalo and Whiteoak Bayous are required to report fecal coliform levels per their permit requirements. On the average, the self-reported bacteria levels are fairly low with a few exceedences evidenced.

Point source fecal coliform load data from the City of Houston for Buffalo and Whiteoak Bayous was presented. The data was actually reported for Greens Bayou and is only meant to give a ballpark figure for Buffalo and Whiteoak Bayous. The average bacterial concentrations of minor dischargers into Buffalo and Whiteoak Bayous were 2,114

cfu/dl and 2,114 cfu/dl respectively. The average bacterial concentrations of major dischargers (greater than 1 MGD) into Buffalo and Whiteoak Bayous were 2 cfu/dl and 54 cfu/dl respectively. The point source load for Buffalo Bayou is estimated to be $3.26x10^{14}$ cfu/yr. The point source load for Whiteoak Bayou is estimated to be $2.14x10^{14}$ cfu/yr. It should be noted that the average bacterial concentrations of major dischargers met the standards while the bacterial concentrations of minor dischargers often exceeded the standards.

A map of reported sewer leaks in Buffalo and Whiteoak Bayous during the period 1989-1996 was presented. **Theo Glanton** noted that the locations seen on this map represent those leaks that were targeted and reported as fixed by city employees. There may be additional leaks that are found, fixed and reported, but not shown on this map. That data may difficult or impossible to obtain.

Fecal coliform load from untreated dischargers was estimated by using data from other studies. This is meant to give a ballpark for Buffalo and Whiteoak Bayous. The data are 1 magnitude lower than those seen for the point source assessment. The volume of untreated discharges to Buffalo Bayou is estimated to 1,735,818 gallons with an estimated bacterial load of $3.28x10^{13}$ cfu. The volume of untreated discharges to Whiteoak Bayou is estimated to 701,435 gallons with an estimated bacterial load of $1.33x10^{13}$ cfu.

Dr. Rifai then presented permitted and self-reported average flow data on wastewater discharges upstream of monitoring points 11398 and 11142. Buffalo Bayou had higher permitted and self-reported average flows than did Whiteoak Bayou.

In a previous study of nonpoint source fecal coliform load, Buffalo Bayou was shown to have a higher average concentration while Whiteoak Bayou had a higher estimated nonpoint source load per year. Vargas asked how nonpoint source loads were calculated. Rifai replied that models were used to analyze land use data along with data for flow, rainfall and runoff. Nonpoint sources must be thought of in a different context than point sources as nonpoint sources are of a higher flow and are temporal.

Data for contributions to fecal coliform load by source type indicated that nonpoint sources made the largest contributions while point sources and leaks/bypasses ranked second and third respectively.

Land use data was analyzed, but there were no clear connections found between land use and bacteria levels.

In summary Rifai stated,
- There were nine potential bacteria source types
- Runoff dominates in wet weather and contributes during smaller rains (reservoirs also have an impact on flow)
- Point sources dominate dry weather flow with disinfection uncertain
- Sewer leaks exist, but flow is small
- More data and modeling are need for quantitative understanding

Future monitoring efforts include:
- AM and PM sampling of point sources (twice daily, if a hit is seen, then the source will be sampled again)

- Storm sewers will be checked for dry weather flow and sampled (data has been requested from the City of Houston)
- Sample smaller runoff events
- Study bacteria dynamics (rates of change day vs. night, effects of sediment and organic levels and regrowth tests)

In closing, Dr. Rifai stated that the issue is complex in that bacteria levels are affected by several sources and processes. A model is needed and should develop along with the data. Water quality targets need to be addressed, i.e. bacteria levels in runoff are far too high for contact recreation so what flow level is an appropriate target?

Rod Hainey asked if chlorination practices like those of the 1980's might have caused a decline in bacteria levels. **Rifai** replied that smaller wastewater treatment plants are causing the problem now. Some chlorinate and some do not. Therefore, chlorination may not be occurring at correct levels.

Whitworth asked if Task Force data had been analyzed. **Rifai** replied, yes, the data showed high numbers.

Vargas asked where the DNA effort fits in – will it be worked into the next work plan? **Jensen** replied, yes, PBS&J would submit a report in August 2001. **Vargas** added that the DNA report should be made available to this group.

Vargas asked in what year was the land use data collected? **Rifai** stated that the data are from 1990. **Vargas** then asked if more recent data is available and might that data be used to refine the assessments and modeling? He stated that he was trying to understand how sampling plans can shed light on land use and how we might differentiate between agriculture versus urban. **Rifai** replied that qualitative effects of agriculture are seen in White Oak Bayou, but not in Buffalo Bayou. **Vargas** added that nonpoint sources and point sources must be looked at more closely.

Linda Broach stated that even though sewer leaks account for a small portion of the flow, bypasses can actually be very large. Broach then asked if the large flows could be identified by talking to the wastewater section of the TNRCC. She would like to see the group get a better quantification of bypasses and leaks because she suspects that they are larger than the data would lead one to believe.

Regarding future monitoring efforts, **Glanton** asked if dry weather stormwater discharges were to be sampled. If so, he suggested that Dr. Rifai's team focus on the larger lines. There is a higher probability of flow from a larger land area. This might give a better representation of what actually happens. That strategy would at least narrow things down a bit. **Rifai** replied that they would at least attempt to narrow things down using age as factor, i.e. looking at older lines.

Broach asked if Rifai's team would be looking at high flow. **Rifai** stated that it was a good question. She is not sure if contact recreation is factor during times of high flow (people tend to stay out of the bayous during high flows). She is thinking more nonpoint sources as they relate to high flow. Then again there may be a lot of sources that are not of a nonpoint source origin.

Andrew Sullivan asked if the UH team was looking at sediment and resuspension. **Rifai** replied that there was no substantial sediment data available. **Broach** suggested that might be because many portions of Buffalo Bayou are difficult to access for sediment sampling.

Helen Lane asked if there was seasonal variation. **Rifai** replied that there was not. **Broach** added that the fecal bacteria are always present regardless of season.

Sullivan asked if *E. coli* would be sampled in addition to fecal coliforms. **Jensen** replied that a sampling plan is still in development, but *E. coli* might be supplemented with fecal coliform.

5. **Lester** then led the group in a discussion of what is next. It was stated that the condensed summary of Dr. Rifai's technical reports would be sent to the stakeholders. The full text of the reports would be posted on the internet (on the H-GAC website). Afternoon meetings are no problem for most members of the group with the exception of Cynthia Chappell and Helen Lane. A meeting to discuss the Phase II workplan will be held in late February or March.

6. Meeting Adjourned

Note:
Rather than incorporate TNRCC changes to the May 2000 meeting summary into this meeting summary, the TNRCC edits will either be made available for review on a protected H-GAC web page or sent to the stakeholders electronically. That document will be treated as a document separate from the May 3, 2000 meeting summary. Changes to the TNRCC policy directives and guidance for the TMDL stakeholder process will be an item discussed at the March 8, 2001 meeting.