HOW'S THE WATER?

05

basin HIGHLIGHTS report

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How's The Water?

As a typical citizen, you probably really want to know the answer to that question in four situations:

1. When you take a drink from your water faucet.
2. When you go swimming.
3. When you are about to eat a fish that you just caught.
4. When you get a whiff of a terrible smell from some nearby water.

Most other times, you may not even think about water quality or take for granted that you will be told about a problem with the water. However, many consider water quality a very important subject. Commercial fishermen, wildlife managers, public health officials, scientists and environmental engineers need to have good information about what's in the water. So do local governments that are responsible for providing drinking water and wastewater treatment for their residents. Public citizens also benefit by having access to water quality data so they can make informed choices about where they swim and fish, and learn about voluntary actions they can take to help preserve our water resources for future generations.

H-GAC Clean Rivers Program Assessment Area

- **4 basins**
- **39 watersheds**
- **Draining over 9,130 square miles**
- **51 stream segments**
- **Over 16,000 stream miles**

Since 1992, the Houston-Galveston Area Council's (H-GAC) Clean Rivers Program has been working to provide the best possible water quality data to environmental professionals, local officials and the general public. H-GAC coordinates regional water quality monitoring activities with six local agencies and maintains a regional water quality database for the following river basins (see map):

- San Jacinto River
- Trinity–San Jacinto Coastal
- San Jacinto-Brazos
- San Bernard River

As part of the Clean Rivers Program, H-GAC also performs its own data analysis on watersheds within these basins, funds special studies and participates in public outreach activities. A summary of the program's 2004 activities is provided in this report.

So, how is the water? Not bad, as a whole, but, as you will see throughout this report, the health of the region's water bodies varies widely, as do the water quality management challenges.

At the regional scale, the greatest water quality concern today is elevated bacteria levels, which are a problem in nearly half of the stream segments in the region. Toxins also remain a problem in two segments of the Houston Ship Channel where segments 1006 and 1007 exceeded the standard for one or more toxins in 2004.

In terms of overall water quality problems, the Houston Ship Channel poses the greatest challenge. The Tidal segment (1006) and its tributaries exceed standards for a total of 10 water quality parameters. The Houston Ship Channel/ Buffalo Bayou Tidal segment (1007) and its tributaries exceeded a total of eight parameters.

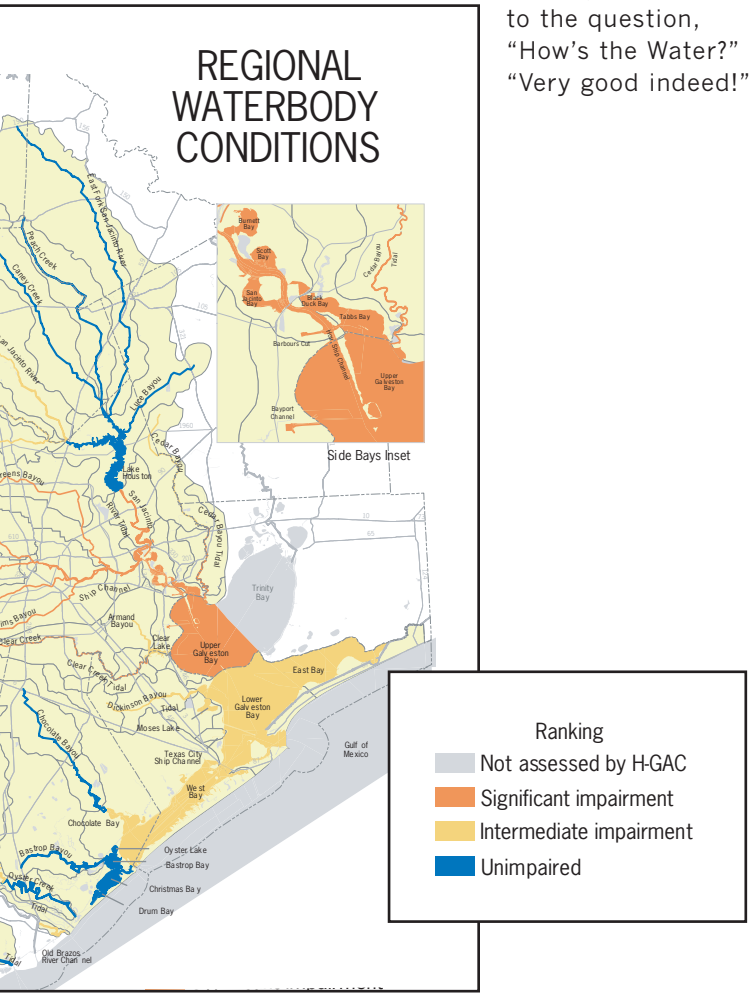
On the other end of the spectrum, the region has some very pristine waters in Christmas Bay (2434), Peach Creek (1011) and Caney Creek (1010). Each of these waterbodies has had minimal impact from development and has no known impairment.

In addition to these water bodies, H-GAC has summarized the water quality issues for all of the water bodies in its Clean Rivers Program area. This list can be found in the Appendix.

H-GAC's Clean Rivers Program is helping to provide the data, analysis and education to help the region achieve two straightforward goals:

1. Keep the clean waters clean.
2. Clean up impaired waters.

However, while the goals are simple, the solutions to water quality problems are complex and will require effort by all of us. We urge you to use the information in this report and on our Web site (www.h-gac.com/crp) to learn more about the condition of the water bodies where you live and work and get involved! There are many ways individuals can make a difference, including reporting pollution problems, volunteering as a citizen monitor, helping out in a clean up campaign. You can also help by the personal choices you make, such as reducing the amount of fertilizer or insecticide you use. We hope you'll join the many professionals and volunteers in the H-GAC region who are committed to making the answer to the question, "How's the Water?" "Very good indeed!"



Water Quality in 2004, Year in Review

H-GAC and its Clean Rivers Program (CRP) partners continued to make great strides in 2004, enhancing water quality data collection, strengthening quality assurance and streamlining the data management process. Local agencies conducting water quality monitoring under H-GAC's Regional Quality Assurance Project Plan (QAPP) include:

- City of Houston Department of Water Quality Control
- City of Houston Department of Health and Human Services
- City of Pearland
- Environmental Institute of Houston
- Harris County Pollution Control
- San Jacinto River Authority

Together, these agencies collected ambient water quality samples at more than 280 sites during 2004.

H-GAC Ambient Water Quality Monitoring Program

- 6 local agencies collecting samples
- 283 monitoring sites
- 5 laboratories analyzing samples
- Over 43,000 water quality measurements per year

Every March, H-GAC convenes a major Coordinated Monitoring Meeting, which includes all CRP partners, other local agencies doing water quality monitoring, and staff from the Texas Commission on Environmental Quality (TCEQ) and other state environmental agencies. The focus meeting is to maximize available dollars by reducing duplication of monitoring sites and/or parameters monitored. In 2004, this coordination resulted in the reduction of approximately 45 monitoring sites while the number of parameters being monitored was significantly expanded. A listing of the sites and parameters monitored in the H-GAC region can be found on the H-GAC Data Clearinghouse Web page.

Monitoring agencies revised their sampling efforts to maximize efficiency and reduce redundancy. The Galveston County Health District elected not to continue taking ambient water quality samples and has begun conducting storm water monitoring in Galveston County. To replace that effort, H-GAC obtained the services of the Environmental Institute of Houston (EIH) at the University of Houston – Clear Lake. Laboratory services for the EIH sampling has been contracted with Eastex Environmental Laboratory.

H-GAC staff also continued to work with its CRP partners to minimize the number of times data were handled. Through efforts of H-GAC's Regional Monitoring Workgroup, the data review checklist was refined to speed up and strengthen the process for ensuring that all quality assurance objectives are met for all data submittals. This process has resulted in the early identification of errors and a much quicker turnaround in getting the data to the TCEQ and the public.

In addition to coordination and quality assurance, H-GAC's Clean Rivers Program also conducted several initiatives in 2004 that will add significant value to local water quality monitoring. As the TCEQ moves closer to establishing standards for nutrients, H-GAC and its partner agencies have expanded their monitoring to include field filtered Orthophosphate and Chlorophyll *a* sampling. Measuring these parameters, along with new protocols for laboratory analysis, will provide a much better picture of nutrient levels in the region's water bodies. In 2004, H-GAC used CRP funding to purchase and distribute the necessary field pumps, tubing and filters for all monitoring partners to collect the preferred "field-filtered" orthophosphate phosphorus samples from all monitored sites on a quarterly basis. H-GAC plans to make this an ongoing program.

Additionally, H-GAC finalized a lab contract to measure the amount of Chlorophyll *a* found in water samples collected from lakes, reservoirs, bays, and estuary sites in the region. This is important because Chlorophyll *a* provides a very good indicator of the amount of algae in the region's water bodies. Algal blooms are a significant problem in some areas in that they deplete the supply of oxygen available for other aquatic life. A large volume of water is collected by the monitoring partners from approximately 40 sites on a quarterly basis and sent to the lab for analysis. Results will be used in future assessments.

H-GAC is also continuing to collect detailed information on priority water bodies by conducting several special studies throughout the region, which include:

A systematic monitoring study in the Lake Creek, Caney Creek and Peach Creek Watersheds. All three creeks drain into Lake Houston, which is a major source of drinking water for the City of Houston and other communities. The study was designed to collect data in streams that have historically had very little data collection. The final report for this study will be completed in August 2005.

A systematic monitoring study of Mustang Bayou, which starts near Missouri City, flows through Brazoria County and empties into West Bay. This study was also designed to collect data in a stream that had little or no past data collection. The final report for this study will be available in December 2005.

A bacteria die-off study in Buffalo Bayou will help us understand how long bacteria survive in the nutrient rich waters of coastal streams. Results of the study will assist in the modeling efforts for the Buffalo and White Oak Bayou Bacteria TMDL. The final report for this study will be available in August 2005.

A source identification study of Cypress Creek has shown elevated levels of bacteria over the last several years. The study is designed to point out potential sources of bacteria throughout the watershed. Results of this study will be available in August 2005 and will be used to secure 319 funds to implement Best Management Practices (BMPs) in the watershed to help reduce the overall bacteria in the creek.

Finally a Receiving Water Assessment (RWA) is being conducted in an unnamed tributary of White Oak Bayou to determine if it has been correctly placed

on the impaired waters list for not meeting the high aquatic life use standard. The results of this study will be available in August 2005.

In addition to special studies, H-GAC is working hard to assist local monitoring partners to receive Accreditation from the National Environmental Laboratory Accreditation Conference (NELAC). The accreditation is required by the State of Texas for any laboratory that provides data that can be used for regulatory or assessment purposes. This accreditation will not only ensure that local water quality data will be used by the state for water quality assessment, but it will also help local laboratories have more efficient operations.

H-GAC's Texas Watch Program continues to expand. It is the only volunteer environmental monitoring program in the state that has dedicated staff funded entirely by the Clean Rivers Program. Data generated by volunteers are used for screening water quality conditions in areas where professional monitoring is not currently conducted and is used to supplement professional data in areas where monitoring is occurring. The collection of data is not the only benefit generated by the Texas Watch Program. Educated citizens may be the biggest payoff for the program. Volunteers are not only trained to collect samples, but, after their training, they also have a better understanding of the connections between man and the environment and how each of us has an impact on the world around us. That is knowledge they can share every day with their friends and neighbors.

In addition to Texas Watch, H-GAC has a number of other public education and outreach tools that are used to increase awareness of water quality issues, including:

- Watershed Signs
- Watershed Brochures
- "What Watershed Do You Live In" Maps and Brochure
- Bacteria Brochure
- Dioxin Brochure
- Book Covers

These items are distributed at local and regional events, mailed to targeted audiences, placed at libraries and other public places and are available on the H-GAC Clean Rivers Program Web site.

More details about all of these programs are available later in this report.

Special Studies

Short-term projects are implemented by the H-GAC Clean Rivers Program for three reasons.

1. To collect baseline water quality, biological, and habitat data in areas of the region lacking historical information.

2. To address specific issues or problems already identified within a watershed.

3. To address water quality standards and permit issues.

The following sections briefly summarize the projects that were completed, conducted or being planned during 2003.

Lake Creek, Peach Creek and Caney Creek

These three stream segments are located in the northern part of the San Jacinto River Basin upstream of Lake Houston. The Lake Creek watershed is largely undeveloped woody areas and grasslands. One would expect minimal impact on the area water bodies. The watershed drains into the West Fork of the San Jacinto River southwest of Conroe, Texas. The USGS was contracted to "characterize" the three watersheds because little historical data exist for each.

Caney Creek flows into the East Fork of the San Jacinto River. The watershed land cover includes woody lands in the downstream and central regions with grasslands dominating in the rural north. The southern area has become increasingly urbanized and contains large sections of transitional land.

The Peach Creek watershed is primarily woody land and flows into Caney Creek approximately four miles upstream of the confluence with Lake Houston. It is substantially urbanized in the southern reaches but generally rural throughout the remainder of the watershed. As seen in the Caney Creek watershed, urban development is increasing at a rapid rate, but the "transitional land" appears sprinkled throughout the watershed as opposed to clustered in one area.

Data collection began in December 2002 and included continuous monitoring for basic water quality parameters, routine sampling for selected chemical constituents, and assessment of various biological attributes and indicators. USGS completed all water sampling in August 2004 and the biological work in October 2004. A draft report is under development, and a published document is expected in the summer of 2005.

Flow Studies

Knowledge of the chemical constituents in surface water is very important; however, the entire picture cannot be interpreted until "flow" information is included in the evaluation. For example, a pollutant will have a much greater impact on the stream if its concentration is elevated during high flow conditions as opposed to low flow conditions. Currently, flow data are not included in the list of parameters collected by H-GAC's local partners. Numerous locations are sampled during each day's sampling run, and time becomes critical in getting samples to the lab. To maintain current schedules without major modifications, a flow monitoring method has to be devised which would allow one person to collect quickly and efficiently the required information. Later, it would be used to extrapolate flow information about the site. Previously, the USGS developed a "ratings curve" method that could be applied to several sites in the H-GAC region. In 2004, the USGS evaluated 12 potential sites and identified five sites for the completion of "ratings curves." Data collection for the ratings curves begin in 2005.

Cypress Creek Source Identification

While many urban watersheds are experiencing extreme levels of bacterial contamination, the Cypress Creek watershed bacteria levels appear to be manageable. Although the creek is not meeting its contact recreation use designation at this time, an opportunity exists to restore contact recreation status to the watershed before the sources become unmanageable. Development in the watershed continues westward, and with it comes increased storm water runoff contaminated with bacteria from multiple sources. In an effort to control these levels and prevent higher concentrations as development continues, H-GAC has initiated a project to look at this watershed in detail. The project is three-fold: identify bacteria sources and gather base-line data on bacteria and nutrient loading to the creek, determine reduction/prevention options for future mitigation strategies and orchestrate a public outreach program to change/improve personal behavior in relation to pollution prevention.

The first planning meeting occurred in November 2004. The draft QAPP was finished in mid-December. Additionally, watershed reconnaissance and sample site selection were also completed in December. The project is scheduled to be completed in August 2005.

Habitat Update

In an effort to better understand the environmental quality and dynamics of the region's watersheds, a habitat data collection project was initiated in 2002 to properly characterize each monitoring site under the regional QAPP.

The project calls for photographs to be taken by local monitoring partners at each monitoring station. In order to better understand riparian environments, two photographs were taken at each site, one during summer when trees are full of leaves, and the other in winter when the leaves have dropped. The partners completed a datasheet at each station outlining physical and hydrologic characteristics, vegetative characteristics, aquatic life present and human influences. During future monitoring events, partners are asked to verify and update all information and make appropriate changes, as needed.

Information has been entered into a database, by basin, to complement the water quality data collected at the site. In addition, the information has been integrated into Geographic Information System (GIS) files which allows for custom mapping queries and regional geographic analysis. This information

can be found on H-GAC's Data Clearinghouse at: www.h-gac.com/dch.

H-GAC believes the integration of quantitative water quality data and qualitative information will allow environmental agencies and the public to better understand the relationship of a watershed's physical setting and its water quality parameters.

Bacteria Die-off

Historically, researchers have believed that Escherichia coli (E. coli) bacteria do not proliferate outside the body of warm-blooded animals and that concentrations in surface water decrease significantly after introduction into the environment. But in nutrient rich water such as the Houston area bayous, bacteria may not only sustain but increase their levels for an extended period of time following an influx of contamination. The assumption that bacterial concentrations will follow the natural growth/die-off cycle may be incorrect thus leading to poor decisions regarding the reopening of swimming areas and other TMDL influenced decisions.

This study will help determine how E. coli bacteria levels in Houston area surface waters actually react. It will also provide improved data on the die-off rate of indicator bacteria in Houston bayous by looking at multiple scenarios with different variables.

Planning for this special study began in January 2004 and culminated with approval of a QAPP in June. The city initiated the first round of sampling in October 2004, after which results were reviewed, evaluated and deemed acceptable by the planning team.

Consequently, it was decided no project procedural changes were necessary and sampling would continue as prescribed. The project is slated to be completed in 2005 with a final report due in August.

Mustang Bayou

In the past, two separate Receiving Water Assessments (RWAs) were performed on different reaches of the bayou, but this fragmented data set made classification difficult. This project was implemented to provide an integrated evaluation of physical, chemical, and biological characteristics in relation to human health concerns, ecological conditions, and designated uses. Assessment of the environmental quality of the bayou will provide information to determine the current status of the watershed and provide a baseline to aid in recognition of emerging problems and water quality trends. An additional goal of this project is to delineate the tidal and non-tidal segments of Mustang Bayou.

The Mustang Bayou watershed, with a drainage area slightly greater than 100 square miles, is located south of Houston in Brazoria County. The headwaters are located northeast of Fresno and extend southeast for approximately 30 miles where it flows into Chocolate Bay. The northern end of the watershed is comprised of mostly rural homesteads ranging in size from less than an acre to small ranches – all relying upon on-site wastewater disposal systems. The City of Alvin is situated in the middle of the watershed and is serviced by a municipal collection system and waste water treatment facility. Downstream of Alvin are agricultural fields and pasture lands with occasional homesteads also relying on on-site wastewater disposal systems.

Following approval of the QAPP in July 2004, USGS installed permanent monitoring sites and initiated bi-monthly water quality monitoring in August 2004. The first round of biological sampling was completed in September. Monitoring will continue through the end of 2005, and a final report is expected in 2006.

Bastrop Bayou Study

Bastrop Bayou is one of a few unchannelized bayous remaining in the Galveston Bay Estuary and Christmas Bay. Bastrop Bayou is part of the Texas Coastal Preserve, which is the home to some of the last assemblages of submerged aquatic vegetation on the Upper Texas Coast. In recent months, residents in the Bastrop and Austin Bayou watersheds have started expressing concerns about water quality in those bayous. Concerns have been raised about the land spreading of sludge, failing septic systems, possible illegal dumping of septic and/or solid waste, and stormwater discharge. Brazoria County's population started growing dramatically over the last several years. Long-standing family farms and ranches are being sold and developed for residential and commercial uses. This population increase will most assuredly intensify existing or emerging water quality problems within these and other coastal watersheds. Bastrop and Austin Bayous flow into the Christmas Bay complex, which is one of the last pristine estuaries on the Texas Gulf Coast. Water quality problems in these watersheds could degrade the water quality within Christmas Bay and its environs.

Increased impervious cover is one of the leading causes of water quality and flooding problems associated with storm water runoff. Increased development of the Bastrop Bayou watershed will increase the amount of impervious cover within the watershed and exacerbate stormwater runoff problems unless BMPs are identified, adopted and implemented early in the development process. Minimizing impervious surfaces and implementing water quality BMPs are critical to preventing degradation of surface water quality within the Bastrop Bayou and its associated waterbodies.

As mentioned above, citizens have also expressed concerns over potential turbidity, pesticide, and nutrient loading of Bastrop Bayou associated with development within the watershed. These issues could affect the water quality status of downstream waterbodies (i.e., Christmas Bay, Bastrop Bay, and Drum Bay) and adversely impact seagrass beds in Christmas Bay. Christmas Bay is designated a Coastal Preserve by Texas Parks and Wildlife Department and a Gulf Ecological Management Site (GEMS) by EPA's Gulf of Mexico Program.

H-GAC has secured a grant from the Galveston Bay Estuary Program to conduct a risk assessment of Bastrop Bayou and produce a watershed management plan for the area. Ambient monitoring for the project was started at nine sites in the watershed in November 2004. Samples are collected every other month and include normal field parameters (DO, temperature, pH, and conductivity or salinity) and standard laboratory run samples (E. Coli or Enterococcus, nutrients, TSS, TDS, VSS, and TOC). Sampling for Large Volume Sediment Sampling (LVSS) will begin in August 2005. LVSS monitoring will help determine what if any herbicides or pesticides may be attached to sediment particles as they are carried downstream.

Dioxin TMDL

Due to elevated levels of dioxins in the lower portion of the Houston Ship Channel (HSC) and upper Galveston Bay in 1990, the Texas Department of Health issued a seafood advisory for HSC and upper Galveston Bay stating that no one should consume more than one seafood meal per month (8 ounces/month) and women of child-bearing age should not consume any sea catfish or blue crab from the area.

Phase I of this study included assessments of existing data, major sources as well as fate and transport of dioxin in the environment. The assessment revealed limited sediment

data, no water quality data and very little source data.

Phase II of the study included additional data collection, refining a conceptual model, developing a steady-state water quality model and performing sensitivity analyses. This phase showed that concentrations of dioxin in the water exceeded Texas Surface Water Quality Standards more than 80 percent of the time. Although there are no standards for sediment, a Total Organic Carbon target was exceeded by 83 percent of sediment samples. Of tissue samples collected, 96 percent exceeded the health-based standard. Interestingly, dioxin concentrations measured during Phase II were as high or higher than historical levels, the estimated load from storm water runoff was about twice the load estimate from wastewater treatment facilities and loading from domestic wastewater treatment facilities was estimated to be about twice that from industrial facilities.

Phase III is considered the final phase of the project, although there is much to be done. The vast majority of data collection and monitoring will be completed by the end of August 2005. Some air monitoring is anticipated for 2006, but most activity will focus on calibrating and verifying the model that will be used to determine wasteload allocations and conducting model runs so that by the end of August 2006, TCEQ can determine TMDL allocations.

More information on stakeholder activities and technical reports can be found at: www.h-gac.com/dioxintmdl.

Bacteria TMDL

The Bacteria Stakeholder group met three times in 2004 and once so far in 2005. The group received briefings on progress of the studies from the project team which consists of The University of Houston, PBS&J, TCEQ and H-GAC. Briefings recapped the problem, reviewed historical data and data collected to date throughout the TMDL study. The study has identified many potential bacterial sources that are causing Buffalo and White Oak Bayous to be in violation of Texas Surface Water Quality Standards. Some of the potential sources include:

- Inadequate/incomplete disinfection of WWTP discharges
- Wastewater collection system leaks and overflows
- WWTP bypasses
- Unpermitted discharges to storm sewers
- Bacteria from upstream sources (Buffalo Bayou)
- Failed septic systems
- Nonpoint sources (NPS) from wildlife, urban NPS and stream sediment

Some of the important key issues that have been identified so far are:

- High Bacteria levels are distributed throughout the bayous
- Frequent rain and warm climate create conditions favorable to maintain bacteria
- No clear identifiable sources solely responsible for the problem
- Sediment in the bayou contain extremely high levels of bacteria
- Dominant source of indicator bacteria is storm water discharge and runoff
- Addicks and Barker Reservoirs allow bacteria to settle out before stormwater is released back into Buffalo Bayou helping to lower overall levels

Information from H-GAC's Bacteria Die-off study will be used in future modeling efforts to help predict overall bacteria levels in the system. Data collection for this project is complete. The current phase of work will involve developing load allocations for the watersheds and writing the TMDL Report. After the report is complete, the TMDL approval process will begin with TCEQ Commissioners and then move to the EPA for approval.

The implementation process also starts when the approval process begins. Implementation involves consultations with stakeholders, state and federal agencies – everyone who could be affected by the results of the TMDL. Examples of implementation plan elements include possible changes in wastewater and storm water permit requirements, changes is storm water management plans and best management practices programs.

There will be a need for continued evaluation to ensure that the plan is effective in helping to reduce bacteria levels throughout the system. This will include continued monitoring and adaptive management to make changes to the plan based on monitoring results.

The target schedule for implementation of the Bacteria TMDL is as follows:

- TMDL Report – December 2005
- TCEQ TMDL Adoption – June 2006
- EPA TMDL Approval – December 2006
- Implementation Plan Report – December 2006
- Implementation Plan Approval – June 2007

Copies of the work completed, stakeholder meeting information, etc. can be found at: www.h-gac.com/water resource/tmdl/bacteria tmdl/.

Invasive Species Control

H-GAC is working with local communities and the Galveston Bay Estuary Program to control Chinese tallow in parks and public land within the lower Galveston Bay watershed. H-GAC is currently working with the city of Seabrook to develop a work plan that will include tree removal, community outreach, public participation, and environmental education. H-GAC provided funding to Friends of Galveston Island State Park to offset expenses associated with a 200-acre tallow control project on Galveston Island's West End. For more information visit www.h-gac.com or contact Chuck Wemple at cwemple@h-gac.com or (713) 993-4514.

Non-point Education for Municipal Officials (NEMO)

H-GAC and Texas Sea Grant conducted a series of six workshops focusing on Non-point Education for Municipal Officials (NEMO) in 2003-2004. The NEMO workshops addressed a variety of environmental challenges and issues associated with urban growth, with a primary focus on reducing surface water pollution from non-point source runoff. Topics included reducing permeable surfaces, increasing housing densities, promoting green space, and implementing best management practices. The workshops provided an opportunity for planning and zoning commissions, public works departments, city council members, parks boards, and residential and commercial developers to learn the latest techniques in managing growth while fostering vibrant economies, promoting a healthy environment, and preserving a sense of community.

Workshops occurred in areas either currently exhibiting major growth, or forecasted to experience substantial development over the next 25 years. To date, over 95 individuals have attended the workshops with representatives from over five counties, 32 cities, two state agencies, and three non-governmental organizations. For more information, visit: www.h-gac.com or contact Chuck Wemple at cwemple@h-gac.com or (713) 993-4514.

H-GAC compiled a NEMO workbook to provide workshop attendees with additional information regarding open space preservation, reducing the urban footprint, implementing best management practices at the municipal level, and identifying economic development tools to finance smart growth. Workshop attendees provided very positive feedback regarding the document and in many cases requested additional copies to share with colleagues and other community leaders. The document is available on the H-GAC Web site at www.h-gac.com.

To foster a dialogue on the topic of urban density, H-GAC, Texas Sea Grant and the Gulf Coast Institute convened a consortium of national experts, local developers, policy makers, and planners whose ideas and perspectives will influence future development in our region. The resulting conference, Density by Design, featured four of America's top urban thinkers and authors discussing what they know about vibrant cities, metropolitan strategies, mixed-use financing, and transit-oriented design. The conference also featured two panels of local developers and civic leaders, who responded to these ideas as they relate to Houston and the region. Over 100 people attended the conference. Reports and presentations from the conference can be viewed on line at www.densitybydesign.com.

Environmental Enforcement

The Solid Waste Program of H-GAC hosts a quarterly meeting called the "Local Enforcement Roundtable." The group is comprised of peace officers, code enforcement officers, and planning officials of local governments within the H-GAC region. Topics of discussion in the past have included grant opportunities, GPS equipment training, abandoned vehicles, illegal dumping of tires, case studies, rules and regulations interpretation, and "sham recycling." The Local Enforcement Roundtable also provides an

opportunity for the participants to network to solve problems. Many of the water pollution cases that the officers discuss originate as solid waste cases. Illegal disposal of solid waste often provides incriminating information to link the illegal dumper to a much larger case in which different media are affected (soil, air, water).

Many participants in the Local Enforcement Roundtable also participate in the Houston Ship Channel Initiative. The Houston Ship Channel Initiative is an enforcement organization made up of many local, state, and federal agencies. The main participants include the Environmental Protection Agency, Federal Bureau of Investigation, Harris County District Attorney's Office Environmental Crimes Unit, Harris County Environmental Crimes Unit, Harris County Pollution Control, Houston Police Department Environmental Crimes Unit, Texas Commission on Environmental Quality, Texas Parks and Wildlife Environmental Crimes Unit, U.S. Coast Guard, and U.S. Attorney's Office.

H-GAC's Solid Waste Program staff is also launching its new Environmental Enforcement Database Application (EEDA). The EEDA is a regional enforcement database of environmental enforcement cases throughout the H-GAC region. Investigators enter case and disposition information and can also conduct specific queries to identify illegal dumping "hot spots." The EEDA is a secure, password-protected, Internet-based application that utilizes Geographic Information Systems (GIS) technology to provide a spatial perspective of illegal dumping activity within the H-GAC region. The data entered by investigators also provide H-GAC with valuable information to conduct regional analyses.

The Solid Waste Program has also begun initial steps toward the establishment of an Environmental Circuit Rider Prosecutor (ECRP) for the H-GAC region. The ECRP will provide counties with circuit criminal and civil prosecution services, education and on-site environmental enforcement and prosecution training, technical environmental assistance and funding assistance.

One of the largest accomplishments of the Local Enforcement Roundtable is that the participants are adopting a more regional point of view with regard to environmental enforcement. The officers and other participants are eager to work together because they realize that illegal dumping is a problem that relocates based on the strength and presence of enforcement activities. Cooperation among agencies is key to combating illegal dumping.

The Solid Waste Program staff has available two brochures and one poster to promote environmental enforcement within the region. One brochure targets adults and lists a number of environmental laws and regulations. The other brochure targets children and discusses why people illegally dump, what to do if they see somebody illegally dumping, among other things. The poster is similar to the adult brochure and is intended to be displayed in libraries, shop windows and other public places. Please visit www.h-gac.com/sw to view the brochures and poster. The Solid Waste program also has contracted with The Walraven Company to produce and distribute book covers to raise awareness of illegal dumping among school-age children.

2004 River, Lakes, Bays 'N Bayous Trash Bash®

Once a year thousands of Trash Bash® volunteers gather along the waterways of our region to do their part in cleaning up the environment. On March 27, 2004, 4,451 volunteers picked up 75 tons of trash and 551 tires within the Galveston Bay watershed. The dedicated team of volunteers, local and state agencies, citizens' groups, local businesses and industry have made the River, Lakes, Bays 'N Bayous Trash Bash® a success since 1994. Trash Bash® is regionally coordinated through the H-GAC Solid Waste program and won the Governor's Environmental Excellence award in 2004. To learn more about Trash Bash and to become a volunteer – visit www.trashbash.org.

Texas Watch Water Quality Monitoring Program

Texas Watch is designed to facilitate environmental stewardship by empowering a statewide network of concerned volunteers, partners and institutions in a collaborative effort to promote a healthy and safe environment.

As a Texas Watch partner since 1992, H-GAC shares the goal of the Texas Watch program: to improve water quality through public education and participation. Texas Watch has hundreds of volunteers conducting water quality monitoring statewide. Quality-assured data are used to support professional data and provide information vital to the health of our streams.

The H-GAC Texas Watch program remained steady in 2004, highlighted by an increase of local partnerships. More than 60 volunteers completed the first two phases of training, and 35 became certified water quality monitors. Additionally, four new trainers completed certification and join H-GAC as active facilitators for new volunteers.

To support environmental stewardship and education, H-GAC Texas Watch has developed alliances with local groups and institutions that share our concern for water quality. New groups working with H-GAC Texas Watch in 2004 include: Humble ISD, Montgomery County Preserve, Friends of Sheldon Lake, and Mercer Arboretum & Botanic Gardens. Most notable is the support of a new science project in the Humble ISD.

In April, students from Quest High School and Humble Ninth Grade Campus attended an educational session at the Jesse H. Jones Park and Nature Center to discuss water quality issues affecting Spring Creek. Students and science instructors completed Phase I, II, and III training in order to become certified water quality monitors. Led by science instructors from both campuses, students will conduct regular water quality monitoring as part of a Science Service Learning Project. Two instructors are in training to be certified facilitators and will be able to train new water quality monitors in-house. H-GAC Texas Watch continues to seek projects like this with dedicated facilitators to support the success. H-GAC Texas Watch volunteers provide valuable support to our efforts of environmental stewardship. If you are interested in becoming a certified water quality monitor or sponsoring Texas Watch activities, please contact Gayla Stock by phone at (713) 993-2516 or by e-mail at gstock@h-gac.com.

Estimating Surface Runoff Potential With GIS

The quality of a water body can be greatly affected by the amount of surface runoff it receives. For this reason, using its Geographic Information System (GIS), the H-GAC Clean Rivers Program developed a method to rapidly estimate the runoff for any area within the region. The process works by retrieving curve number (CN) values, which describe the storm water runoff potential for a drainage area. The CN values range from 0 to 100, with higher values indicating an increased runoff potential, and lower values indicating a decreased one. Knowing the average amount of runoff for an area will lead to more effective implementation of BMPs, and therefore to better water quality. These values were calculated using the GIS-based land cover database along with the Soil Survey Geographical Database from the NRCS (Natural Resources Conservation Service).

NELAC

The National Environmental Laboratory accreditation Conference (NELAC) has developed a set of standards for the accreditation of environmental laboratories performing testing and analysis of environmental samples of any matrix. Prior to NELAC, the existing state programs varied widely in scope and requirements. The NELAC Standard provides uniform requirements for accreditation of environmental laboratories and facilitates mutual recognition among laboratory accreditation programs. The Texas Commission on Environmental Quality will offer accreditation to the NELAC Standard as a voluntary option for environmental laboratories.

Changes from the current system

As each laboratory becomes accredited by any NELAC-recognized accrediting authority (i.e., TCEQ), the laboratory and the accredited scope of testing will be entered into a national database. Once a laboratory is accredited by one state for testing under a specific EPA program, it is accredited in another state for the same EPA program without having to meet additional accreditation requirements. The national database will simplify the search for a laboratory capable of performing testing under the requirements for a given EPA program.

ISO and NELAC

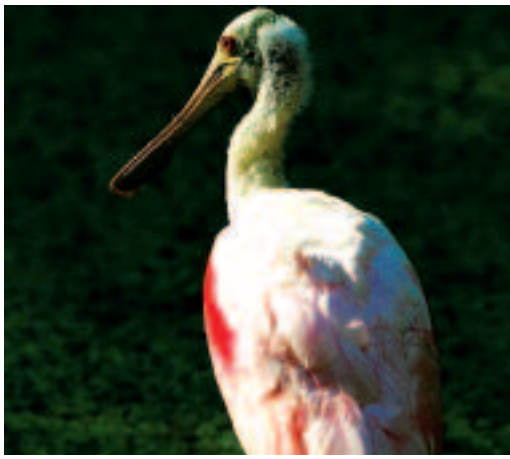
NELAC is based on several guidance documents that originated with the International Standards Organization (ISO), a body that develops consensus standards in a variety of technical fields. The two primary documents are ISO/IEC Guide 25: "General Requirements for the Competence of Calibration and Testing Laboratories," and ISO/IEC Guide 58: "Calibration and Testing Laboratory Accreditation Systems - General Requirements for Operation and Recognition." The NELAC quality system has been enhanced beyond the specifications of ISO/IEC Guide 25 to satisfy environmental program requirements; therefore, NELAC requirements, by design, are more stringent than ISO specifications. A NELAC accredited laboratory will meet the ISO specifications. An ISO certification does not entirely meet the NELAC requirements.

Costs

Services provided by NELAC accredited laboratories should provide higher value to stakeholders, though overall costs are expected to increase slightly.

H-GAC's role

H-GAC is taking a leadership role in the accreditation process. The first task is to meet with local officials who are in a position to allocate financial and human resources to the entire accreditation process. This has been a resounding success with our partners. All of the partners have expressed great enthusiasm and are contributing sufficient resources to gain accreditation. The second step is to assess the status of the laboratories. Through interviews of laboratory personnel and document inspections, a thorough review has been completed by H-GAC. The third step is to develop a realistic budget for the accreditation process. This step has also been accomplished and H-GAC's budget has been approved by the TCEQ. The fourth step is to deliver professional training for the process. Comprehensive, professional training classes are scheduled in late June for the partner agencies. The cost is completely funded by the Clean Rivers Program. Currently, H-GAC is reviewing documents. After the document reviews are completed and updated, H-GAC will conduct mock audits of the laboratory system. Any identified issues will be documented and corrected before an accreditation application is completed. Following a successful TCEQ audit, a NELAC accreditation will be granted for each of the partners. The substantive state fees for the accreditation and subsequent annual renewals are entirely funded by the Clean Rivers Program. The TCEQ audits are not anticipated until the latter part of FY 2007. H-GAC will continue to track laboratory performance by using PT samples. The cost of which will be wholly funded by the Clean Rivers Program.



More about NELAC?

You can find a variety of resources, including copies of the NELAC standards and a list of the approved Accrediting Authorities at: www.tnrcc.state.tx.us/enforcement/csd/qa/.

Evaluating Water Quality in Texas

The Texas Commission on Environmental Quality evaluates the condition of the state's water bodies on a periodic basis under the Clean Water Act Section 305(b). The results are contained within the Texas Water Quality Inventory and 303(d) List and are comprised of a complete listing of all water quality issues in the state. As required by the Act, the inventory is updated every two years and consists of a review of the past five years' worth of data collected by many organizations statewide including local agencies working with H-GAC. The 2004 Water Quality Inventory and 303(d) List, on which the following information is based, provides an assessment of water quality results collected between March 1, 1998 and February 28, 2003. This inventory is available on the TCEQ Web site. During the summer of 2003, the TCEQ evaluated the most recent five years' worth of data collected

between March 1, 1998 and February 28, 2003 to generate the 2004 Water Quality Inventory and 303(d) List.

The term "impairment" is assigned to a portion of a water body when certain water quality constituents reach threshold concentrations as specified in the Texas Surface Water Quality Standards and the Texas Drinking Water Standards based either on the number of exceedances or the mean concentration over the threshold. This designation indicates that the water quality "uses" of the water body (e.g., water supply, contact recreation, aquatic life, fish consumption) may be degraded. In other words, the water may not be fit to be used as a public water supply, the fish may not be able to get enough oxygen to survive, or swimming in the water may cause the swimmer to be exposed to disease producing organisms or fish tissue data indicate that consumption of fish may cause deleterious effects, etc. Water bodies that are shown to have an impairment for one or more constituents are included in the TCEQ's CWA Section 303(d) List.

Once a portion of a stream is placed on the list, a series of actions may be taken by the TCEQ to restore water quality, including, but not limited to: denial of increases in wastewater permit effluent limits; a Total Maximum Daily Load (TMDL) study to allocate pollutant loads to certain sources; and instituting a strategy for reducing loads from all sources.

The term partial impairment or concern is assigned to a portion of a water body under less rigorous requirements for number of measurements exceeding the threshold, sample frequency, etc. If there is only a small amount of data available or there are only a few samples not meeting the stream standards, then the stream cannot be assessed as impaired with sufficient confidence. Therefore, the water body may be identified as partially impaired or as having a concern for a certain constituent.

Concerns are also identified for nutrients and Chlorophyll *a*, toxic substances in fish tissue and sediment for which no stream standards have been developed but are otherwise useful in identifying water quality problems. Water bodies that are identified as partially impaired or as having concerns need more information to verify their condition. Additional data collection under the Clean Rivers Program during 2004 has been targeted towards those areas.

The next section of this report contains water quality assessment information about each of the major watersheds within H-GAC's Clean Rivers Program assessment area. It is presented as a result of TCEQ and H-GAC screening. It is important to remember that the information presented represents a snapshot in time and that water quality conditions are dynamic and can change over time. It is also important to note that although a segment may be identified as having "no known problems," it does not necessarily mean there are no problems. Rather there may have been limited or no data available and all uses may not have been assessed.

Local Water Quality Review

The following section contains information on each of H-GAC's Clean Rivers Program Watersheds. Each has been ranked according to the degree of water quality issues or concerns.

Ranking Key

1 Frog = Significant water quality impairment and/or concerns have been identified.

2 Frogs = Some water quality impairments and/or concerns have been identified.

3 Frogs = No known water quality impairments or concerns have been identified.

Trinity-San Jacinto Coastal Basin

(Watersheds are listed alphabetically.)

Cedar Bayou Above Tidal (0902)
Major tributaries: Adlong Ditch, Buck Gully

Cedar Bayou Above Tidal is currently listed as only partially supporting its aquatic life use due to low concentrations of dissolved oxygen (DO). Insufficient 24-hour DO data prevents

determination of the extent of the problem. TCEQ Region 12 office currently has two ongoing 24-hour DO monitoring events. Also, routine habitat, fish, and aquatic insect data were collected in 2004.

Cedar Bayou Tidal (0901)
Major tributaries: Cary Bayou, McGee Gully

The tidal portion of Cedar Bayou is currently listed as not meeting its fish consumption use due to dioxin in catfish and crab tissue. There is currently a special investigation into this issue. Results will be reported when they become available.

San Jacinto River Basin

(Watersheds are listed alphabetically, upstream to downstream.)

Buffalo Bayou Above Tidal (1014)
Major tributaries: Bear Creek, Langham Creek, Mason Creek, South Mayde Creek, Spring Branch Creek, Turkey Creek

Buffalo Bayou is divided into several segments due to the nature of the Houston Ship Channel. Segment 1014 constitutes the above tidal portion (freshwater) of the larger watershed.

Bacteria remain the predominant impairment issue. Several tributaries including Spring Branch Creek and Rummel Creek exhibit higher concentrations than most of the main stem. Neiman's Bayou exhibits lower concentrations with occasional "spikes," single recordings of high concentrations within the data set.

Currently, a special investigation is underway to determine sources of contamination. Please see the Bacteria TMDL project write-up that appears earlier in this report.

Additional ambient sites on tributaries upstream and within two major reservoirs, Addicks Reservoir and Barker Reservoir have been added. Some tributaries, Mason Creek and Turkey Creek, exhibit extremely high concentrations of bacteria while others appear manageable.

Nutrients, including ammonia, nitrate+ nitrite-nitrogen, orthophosphate, and total phosphorus, appear in excess throughout the main stem of Buffalo Bayou. H-GAC is working with local monitoring agencies to develop a more comprehensive nutrient monitoring plan.

Buffalo Bayou Tidal (1013)
Major tributary: Tidal portion of White Oak Bayou

Buffalo Bayou watershed is relatively small and encompasses downtown Houston. Many issues with above tidal portions of the bayou apply to tidal portions as well. High bacteria levels are a major concern. There is an on-going study addressing bacteria in Buffalo Bayou Above Tidal.

Bacteria concentrations exceed those in non-tidal portion of the bayou. E. coli was the preferred indicator for bacteria for all water bodies. Recently, the City of Houston changed its indicator organism for tidally influenced waters to Enterococcus.

Nutrients along the main stem remain elevated, and DO is listed as not meeting the designated standard. However, recent DO grab samples exhibit compliance.

TCEQ requires several 24-hour monitoring events to establish if the segment meets its standard before removal from the 303(d) list. USGS will be conducting 24-hour monitoring events in this segment as part of a statewide study. Previous ammonia concentrations were predominately below the established screening level of 0.58 mg/L, while other nutrients are elevated. H-GAC is working with the City of Houston to include a more comprehensive nutrient monitoring study in order to increase available data.

The segment was removed from the 2002 303(d) list for copper in water.

Caney Creek (1010)
Major tributaries: Camp Creek, Dry Creek, Little Caney Creek, McRae Creek, Spring Branch, West Fork Spring Branch, White Oak Creek

Caney Creek is not included on the TCEQ 303(d) list for any water quality issues or concerns. The watershed is predominately undeveloped and contains few known sources of pollution.

During 2002-2004, a systematic watershed monitoring study was conducted on Caney Creek. Data collection included; continuous monitoring for basic water quality parameters (water temperature, specific conductance, dissolved oxygen, and pH), routine sampling for selected chemical constituents, and an assessment of various biological attributes and indicators.

Basic water quality parameters (water temperature, specific conductance, dissolved oxygen, and pH) are typical of streams in the region. Dissolved oxygen levels were lowest during summer months, when water temperature was highest. Water quality chemical analysis showed results below TCEQ screening limits. Methods used to summarize biological community data indicate stream quality conditions are typically High or Exceptional.

Cypress Creek (1009)
Major tributaries: Dry Creek, Dry Gully, Faulkey Gully, Lemm Gully, Little Cypress Creek, Live Oak Creek, Mound Creek, Pillot Creek, Seals Gully, Spring Gully

Cypress Creek watershed is experiencing rapid westward growth. This segment does not meet its contact recreational use, for activities such as swimming, due to excessive levels of E. coli. While the segment currently does not qualify to meet its contact recreational use, it does appear to be manageable. A special project to determine sources of bacteria and initiate public outreach activities will begin in 2005.

There are also concerns for excessive nutrients and low dissolved oxygen levels along the main stem. Ammonia concentrations in 2004 were consistently above the screening level of 0.16 mg/L. Concentrations were slightly higher in several tributaries. H-GAC is working with the City of Houston to expand ambient monitoring to include additional nutrient parameters.

East Fork San Jacinto River (1003)
Major tributaries: Orange Branch, Miller Creek, Whiskey Branch, Winters Bayou

East Fork of the San Jacinto River is predominately undeveloped. A majority of the upper portion of the watershed is within Sam Houston National Forest. The segment is not on the list of impaired water bodies, and according to TCEQ WQI there are no known water quality concerns.

Greens Bayou Above Tidal (1016)
Major tributaries: Garners Bayou, Williams Gully

Above tidal portion of Greens Bayou experiences many issues associated with urban watersheds. While not as severe as Buffalo Bayou, high levels of E. coli are persistent throughout the watershed. A small watershed analysis, including the analysis of stormwater runoff, has begun for Garners Bayou watershed, which exhibits high E. coli concentrations. In addition, these data will be used in future projects as a basis for recommending structural and/or non-structural best management practices (BMPs) or remediation.

While nutrient levels are excessive along the main stem of Greens Bayou, ammonia concentrations and low dissolved oxygen levels in tributaries that feed the bayou are also a concern. Recent dissolved oxygen data appear lower in warmer months, which is normal for shallow, slow moving, warm water streams.

Chromium is listed as a concern along the main stem, based on a limited data set. This data need was considered during the coordinated monitoring process, and metals-in-water samples will be collected during 2005 to confirm the concern.

Houston Ship Channel/Buffalo Bayou (1007)
Major tributaries: Berry Bayou, Berry Creek, Brays Bayou, Country Club Bayou, Hunting Bayou, Keegans Bayou, Little Vince Bayou, Pine Gully, Plum Creek, Sims Bayou, Vince Bayou

Water quality standards for Houston Ship Channel/Buffalo Bayou apply to the Ship Channel as well as its tributaries. Hunting Bayou, Vince Bayou, Little Vince Bayou, Brays Bayou, and Sims Bayou, along with their smaller tributaries, are included in this watershed.

The main stem of HSC is listed as not meeting its fish consumption use due to dioxin in fish and crab tissue, and high occurrences of bacteria, prohibiting safe contact recreation use in non-tidal portions of tributaries within the watershed. It is also listed for not meeting the standards for PCBs, Chlordane, Dieldrin and Heptachlor Epoxide in fish tissue. Local monitoring agencies recently incorporated Enterococcus as indicator bacteria for tidal portions of water bodies in this watershed.

Low dissolved oxygen levels in many of the smaller tributaries is an issue. In 2002, these tributaries were assigned a High aquatic life use based on available flow information. Categories include: Exceptional, High, Intermediate, and Limited and have associated dissolved oxygen criteria for each.

H-GAC assisted TCEQ in assigning appropriated aquatic life use by conducting comprehensive assessments of some of these tributaries. Tributaries included in the assessments were non-tidal portions of Pine Gully, Plum Creek, Country Club Bayou, Sims Bayou, Brays Bayou, Hunting Bayou, an unnamed tributary of Sims Bayou, and an unnamed tributary of Buffalo Bayou (locally referred to as Japhet Gully). Each “subsegment” analysis included sampling for fish diversity, general water chemistry, flow, 24-hour DO, and habitat characteristics.

Results of the special study indicate habitat quality is Intermediate for all selected streams, except portions of Hunting Bayou which scored a habitat designation of Limited. Fish diversity is Limited for all selected streams except Sims Bayou Above Tidal, which appears to sustain Intermediate fish diversity.

Nutrient enrichment concerns are exhibited throughout many unclassified tributaries as well. Ammonia values continue to be elevated. H-GAC is working with City of Houston to expand ambient monitoring to include additional nutrient parameters. The main stem is listed with heavy metals in sediment concerns, primarily cadmium, copper, and zinc. Elevated pH values are also of concern.

Houston Ship Channel (1006)
Major tributaries: Boggy Bayou, Carpenters Bayou, Goodyear Creek, Halls Creek, Patrick Bayou, Tidal portion of Greens Bayou.

This segment includes Halls Bayou, Patrick Bayou, tidal portion of Greens Bayou, Carpenter’s Bayou, Sheldon Reservoir as well as other smaller tributaries to these water bodies. Tidal portions of bayous are assessed against established Houston Ship Channel standards. Non-tidal water bodies are characterized as unclassified segments and are assessed for aquatic life use and contact recreation.

Issues of low dissolved oxygen occur in some smaller tributaries of the watershed. H-GAC included comprehensive assessments of Big Gulch above tidal and two unnamed tributaries of Halls Bayou, as part of a study to assist TCEQ in assigning appropriate aquatic life use to some of these unclassified segments.

The Houston Ship Channel and tidal portions of tributaries are listed as not meeting their fish consumption use due to dioxin in fish and crab tissue. The channel is also listed for not meeting the standards for PCBs, Chlordane, Dieldrin and Heptachlor Epoxide in fish tissue; Mercury in water, sediment toxicity, and temperature (please see the Draft 2004 303(d) list summary in the Appendix of this report). Bacteria and ammonia levels continue to exceed applicable standards and screening levels. Local monitoring agencies recently incorporated Enterococcus as the bacteria indicator for tidal portions of water bodies in this watershed. Toxicity issues are associated with Patrick Bayou.

TCEQ Region 12 field office has scheduled special sampling for metals and organics in sediment and fish tissue at the Greens Bayou

confluence on the HSC, as well as sites along Greens Bayou Tidal and Patrick Bayou.

Houston Ship Channel/San Jacinto River (1005)
Major tributaries and bays: Barbours Cut, Black Duck Bay, Burnet Bay, Goose Creek, Old River, San Jacinto Bay, Scott Bay, Tabbs Bay

Water quality issues upstream of Lynchburg Ferry include dioxin and PCBs. A water quality study is currently underway to address dioxin. Results will be released at the conclusion of the project.

Harris County Pollution Control has expanded local monitoring to include data collection in Crystal Bay, a tributary of Goose Creek, as well as a site along the tidal portion of the San Jacinto River.

Lake Conroe (1012)
Major tributaries: Caney Creek, East Sandy Creek, Lewis Creek, Little Lake Creek, McDonald Creek, McGary Creek, West Fork San Jacinto River, West Sandy Creek

Lake Conroe serves as a drinking water source for the region as well as providing recreational opportunities. Based on TCEQ WQI, no known major water quality issues exist in the lake; however, there are concerns for low DO values and high pH value in some areas. Recent data show few instances of low DO and acceptable pH ranges. Lower DO values were observed in the summer when water temperatures were highest.

Lake Creek (1015)
Major tributaries: Caney Creek, Fish Creek, Garretts Creek, Landrum Creek, Little Caney Creek, Mound Creek

Based on TQEQ WQI, there are no known water quality problems associated with this watershed. However, very little historical data have been collected. Contact recreation, fish consumption, and general uses have not been assessed. Although the watershed is predominately rural or undeveloped, recent increases in residential development have been observed.

During 2002-2004, a systematic watershed monitoring study was conducted on Lake Creek. Data collection included; continuous monitoring for basic water quality parameters (water temperature, specific conductance, dissolved oxygen, and pH), routine sampling for selected chemical constituents, and an assessment of various biological attributes and indicators.

Results of basic water quality measurements (water temperature, specific conductance, dissolved oxygen, and pH) are typical of streams in the region. Dissolved oxygen levels were lowest during summer months, when water temperature was highest. Water quality chemical analysis displayed results below TCEQ screening limits. Methods used to summarize biological community data indicate stream quality conditions are typically High or Exceptional.

Lake Houston (1002)
Major tributaries: East Fork San Jacinto River, Luce Bayou, March Branch, Tarkington Bayou, West Fork San Jacinto River

Lake Houston provides the major drinking water supply and major recreation source for the City of Houston. The watershed encompasses the entire lake as well as Luce Bayou. No known major water quality issues exist. Elevated levels of nutrients and low dissolved oxygen values are a concern. Luce Bayou is noted as having a low DO concern.

There are eight watersheds that drain into Lake Houston. These include: Cypress Creek, Spring Creek, Lake Creek, the West Fork of San Jacinto River, Lake Conroe, Caney Creek, Peach Creek, and the East Fork of San Jacinto River. Water quality of these watersheds has a tremendous impact on public water supply.

Peach Creek (1011)
Major tributaries: Bee Branch, Boggy Creek, Duck Creek, Gully Branch, Gum Branch, Jayhawker Creek, Lawrence Creek, Mare Creek, Waterhole Branch

Based on TCEQ WQI, Peach Creek has no known water quality issues or concerns.

During 2002-2004, a systematic watershed monitoring study was conducted on Peach Creek. Data collection included; continuous monitoring for basic water quality parameters (water temperature, specific conductance, dissolved oxygen, and pH), routine sampling for selected chemical constituents, and an assessment of various biological attributes and indicators.

Basic water quality parameters (water temperature, specific conductance, dissolved oxygen, and pH) are typical of streams in the region. Dissolved oxygen levels were lowest during summer months, when water temperature was highest. Water quality chemical analysis displayed results below TCEQ screening limits. Methods used to summarize biological community data indicate stream quality conditions are typically High or Exceptional.

San Jacinto River Tidal (1001)
Major tributary: Gum Gully Creek

San Jacinto River Tidal segment includes the portion of the river that flows from Lake Houston outlet and drains to Galveston Bay. Primary water quality issues include PCBs and dioxin in fish and crab tissue up to the intersection of Highway 90.

Spring Creek (1008)
Major tributaries: Bear Branch, Birch Creek, Brushy Creek, Dry Creek, Lake Woodlands, Mill Creek, Mill Branch, Mink Branch, Panther Branch, Sulfur Branch, Three Mile Creek, Walnut Creek, Willow Creek

This segment is listed for not attaining its contact recreation use due to elevated bacteria levels. Results of E. coli data continue to be high along the main stem. Additional monitoring on Willow Creek in 2004 showed elevated levels of bacteria.

Routine DO data collected during ambient monitoring appear normal along the main stem of the creek; however, low DO levels are a concern. Low values observed along tributaries appear to be seasonal. TCEQ Region 12 has scheduled a special study for 2004 to address DO as well as habitat, fish species, and aquatic insects.

West Fork San Jacinto River (1004)
Major tributaries: Camp Creek, Caney Creek, Crystal Creek, East Fork Crystal Creek, Egypt Creek, Harpers Horsepen Branch, Lake Creek, Little Caney Creek, Rice Branch, Sand Branch, Stewarts Creek, West Fork Crystal Creek, White Oak Creek, Woodsons Gully Creek

Bacteria levels south and downstream of Conroe exceed maximum levels set for contact recreation use. DO and nutrients are major concerns along the main stem. City of Conroe has expressed an interest in conducting ambient water quality monitoring in some parts of the watershed.

White Oak Bayou (1017)
Major tributaries: Brickhouse Gully, Cole Creek, Little White Oak Bayou, Vogel Creek

White Oak Bayou is a major tributary to Buffalo Bayou and is included in the TMDL project addressing bacteria concerns.

Throughout the watershed, ammonia levels are above the screening level for fresh water bodies. In addition two unnamed tributaries exhibit low dissolved oxygen.

A special study was conducted on Brickhouse Gully to determine bacteria and ammonia loadings in 2002 and 2003. Please see the detailed description and results of the study in the Special Studies section of this report.

San Jacinto-Brazos Coastal Basin

(Watersheds are listed alphabetically.)

Armand Bayou (1113)
Major tributaries: Big Island Slough, Horsepen Bayou, Middle Bayou, Mud Lake, Spring Gully, Willow Spring Bayou

This segment is listed as not meeting standards due to low levels of dissolved oxygen. Low levels in the headwaters are a result from inadequate flushing of water through the bayou. TCEQ Region 12 field office has two ongoing sampling events for 24-hour DO. There are also concerns for excessive algal growth and high pH values. City of Houston has changed its bacteria indicator analysis from E. coli to Enterococcus for tidal sites within the watershed.

Bastrop Bayou (1105)
Major tributaries: Austin Bayou, Brushy Bayou, Flores Bayou

This watershed is predominately undeveloped, and according to TCEQ WQI no known water quality concerns exists. The City of Angleton is the only urban area in the watershed with numerous stock ponds and irrigation ponds.

The University of Houston at Clear Lake Environmental Institute began ambient monitoring on Bastrop Bayou and its tributaries in 2004. H-GAC began a Risk Assessment in 2004 to address water quality concerns of local residents in the watershed. Please see the Bastrop Bayou project write-up that appears earlier in this document.

Chocolate Bayou Above Tidal (1108)
Major tributaries: Hayes Creek, West Fork Chocolate Bayou

Sparsely developed with predominately agricultural land use, the watershed has no known water quality concerns. Brazoria County officials have expressed an interest in expanding their ambient monitoring within the watershed.

Chocolate Bayou Tidal (1107)
Major tributaries: Corner Bayou, Cottonwood Bayou, Pleasant Bayou

This watershed is predominately undeveloped and has no known water quality issues.

Clear Creek Above Tidal (1102)
Major tributaries: Cowart Creek, Hickory Slough, Mary's Creek, Mud Gully, Turkey Creek

This watershed is a mixture of residential and urban development. Undeveloped areas remain in the upper portion of the watershed. Elevated bacteria levels above contact recreation standard are observed throughout the watershed. DO data collected in 2004 are within expected values, with lower concentrations observed in warmer months. Also, nitrogen and phosphorus compounds are below the screening level along the main stem of Clear Creek.

City of Pearland's Water Production and Wastewater Treatment Division began routine monitoring in 2004. Mary's Creek portion of the watershed is included in Pearland's routine monitoring schedule.

Clear Creek Tidal (1101)
Major tributaries: Chigger Creek, Magnolia Creek

This watershed is a mixture of residential and urban development. Clear Creek and its major tributary Chigger Creek do not meet contact recreation use due to elevated bacteria levels. While there is a concern of elevated pH values along the main stem, there is an additional concern for high ammonia concentrations in Chigger Creek.

Dickinson Bayou Above Tidal (1104)
Freshwater portion of the watershed is predominately rural or undeveloped and does not meet contact recreation use due to high bacteria levels. Limited available E. coli data collected in 2002 shows grab samples below the 394 colonies/100 ml established standard.

Other concerns include dissolved oxygen (DO) and elevated ammonia concentrations. Historically, there has been limited monitoring coverage throughout the watershed.

Dickinson Bayou Tidal (1103)
Major tributaries: Bordens Gully, Cedar Creek, Geisler Bayou, Gum Bayou

The City of Dickinson is the center of major development. The main stem of the bayou is Limited as impaired for low dissolved oxygen. A special study conducted through CRP revealed that tidal fluctuations allow surface layers to flush and replenish themselves with dissolved oxygen, while deeper water layers are forced to remain in a stagnant stage.

The entire watershed is also listed as impaired due to high bacteria. Recently collected Enterococcus data have been variable. Low DO concerns are found in data from Borden's Gully and Geisler Bayou.

A TMDL study is currently underway to address low dissolved oxygen concerns within Dickinson Bayou. Watershed models are currently being developed to support the TMDL and should be completed in 2005.

Old Brazos River Channel (1111)
Dense industrial development dominates this watershed. While the segment is not listed as impaired, there are concerns for heavy metals in sediment; barium, copper, and nickel.

Oyster Creek Above Tidal (1110)
Over 80 percent of the watershed is undeveloped or rural, with the remaining residential development. Oyster Creek does not meet its aquatic life use due to occurrences of low DO. Low DO may be a result of lack of flow. Currently there is an enforcement action involving water rights with local levee control districts.

Oyster Creek Tidal (1109)
The City of Lake Jackson is the major development in this watershed. There are no known water quality problems. H-GAC is working with Brazoria County to expand its ambient monitoring program.

San Bernard River

San Bernard River Above Tidal (1302)
Major tributaries: Coushatta Creek, East Bernard Creek, Little San Bernard River, Middle Bernard River, Peach Creek, West Bernard Creek

This watershed is listed as impaired due to high bacteria and for temperature modifications in the upper 50 miles of the segment. Recent bacteria data results are close to the standard.

The segment is listed with impaired aquatic insect community and an impaired fish community. These biological concerns are thought to be related to natural sources.

During 2000 – 2002, a systematic watershed monitoring study was conducted on sites in the San Bernard River and its tributaries. Data collection included: continuous monitoring for basic water quality parameters (water temperature, specific conductance, dissolved oxygen, and pH), routine sampling for selected chemical constituents, and an assessment of various biological attributes and indicators.

This information was summarized and compared with similar data from other streams in southeast Texas. Measures of stream habitat compare closely to other riverine settings, as opposed to tidally influenced, coastal bayous. Similarly, measures of aquatic insect and fish population diversity are similar to water bodies with minimally impacted watersheds. Based on biological data, along with selected water chemistry and water quality parameter data that were also collected during 2000 – 2002, the San Bernard does not exhibit a significant impact on water quality.

San Bernard River Tidal (1301)
Major tributaries: Halls Bayou, Mound Creek

The watershed is predominately set in rural development, and there are no known water quality concerns.

Bays and Estuaries

Barbours Cut (2436)
This segment is in a heavily industrialized area. Dioxin in catfish and crab tissue samples prevents fish consumption. Exact sources of dioxon are not known at this time.

Bastrop Bay/Oyster Lake (2433)
The bay and lake are in an undeveloped estuarine environment and are part of the Christmas Bay system. According to TCEQ WQI, there are no known water quality issues.

Bayport Channel (2438)
This segment is in a heavily industrialized area. Dioxin in catfish and crab tissue impairs fish consumption. Exact sources of dioxin are not known at this time. TCEQ Region 12 field office has scheduled a special study for sampling metals and organics in sediments for 2005.

Black Duck Bay (2428), Burnett Bay (2430)
These segments are in a heavily industrialized area. Dioxin in catfish and crab tissue prevents fish consumption. Exact sources of dioxin are not known at this time.

Chocolate Bay (2432)
Major tributaries: Chocolate Bayou, Cloud Bayou, Halls Bayou, Mustang Bayou, Persimmon Bayou, Willow Bayou

Elevated bacteria levels from unknown sources prevent oyster harvesting. The bay receives water from Chocolate Bayou, Halls Bayou, Mustang Bayou, and Persimmon Bayou.

TCEQ Region 12 field office scheduled two 24-hour DO sampling events for Halls Bayou for 2004.

Christmas Bay (2434)
This area is surrounded by undeveloped wetland habitat and is part of a larger system of smaller bays and lakes. According to TCEQ WQI, there are no known water quality issues.

Clear Lake (2425)
Major tributaries: Jarboe Bayou, Robinson Bayou

Tributaries that feed the lake are impaired for contact recreation due to high levels of bacteria. The lake itself is listed with excessive nutrient levels. Robinson Bayou exhibits low dissolved oxygen.

Drum Bay (2435)
According to TCEQ WQI, there are no known water quality issues for these waters.

East Bay (2423)
An unknown source of bacteria impairs oyster harvesting. TCEQ Region 12 field office has scheduled two 24-hour DO monitoring events for Oyster Bayou for 2004.

Lower Galveston Bay (2439)
An unknown source of bacteria impairs oyster harvesting in the bay. There are no other known major water quality problems. The bay is a major recreational area.

Moses Lake (2431)
According to TCEQ WQI, there are no known water quality issues in this segment.

San Jacinto Bay (2427), Scott Bay (2429), Tabbs Bay (2426)
These segments are in the middle of, near, or downstream from heavy industrial areas.

Dioxin in catfish and crab tissue prevents fish consumption. Exact sources of dioxin are not known at this time. Bacteria impairment for Scott Bay and Tabbs Bay has been removed.

Texas City Ship Channel (2437)
This watershed contains highly intensive industrial activity. The channel is impaired due to low dissolved oxygen levels. There are also excessive nutrient concerns. Results from a special study indicate that dissolved oxygen levels are satisfactory; however, high concentrations of ammonia and phosphorus seem to be of concern. The 303(d) listing for impairment to the Aquatic Life Use due to depressed dissolved oxygen levels has been removed.

Upper Galveston Bay (2421)
The upper portion of the watershed contains a large amount of industrial activity, with barge transportation as the major activity. The lower portion of the watershed is a mix of residential and commercial communities.

Dioxin in catfish and crab tissue prevents fish consumption from Red Bluff to Five Mile Cut to Houston Point to Morgan's Point. Exact sources of dioxin are not known at this time.

West Bay (2424)
Major tributaries: Basford Bayou, Highland Bayou, Marchand Bayou, Offat's Bayou
West Bay system is located at the east end of Galveston Island and includes many small bays, lakes, and bayous. Oyster harvesting is prohibited in the main part of the bay. Highland Bayou and Marchland Bayou are both listed for high levels of bacteria and low dissolved oxygen. In addition, low DO levels are observed for Lake Madeline.

Recent Enterococcus data revealed that Highland Bayou and Marchland Bayou do not meet standards for contact recreation use. Recent DO data appear normal along Highland Bayou, Marchland Bayou and Lake Madeline with few instances below the standard. English Bayou and the Crash Basin are listed as concerns for elevated ammonia concentrations.

An RWA for Marchand and Highland Bayous is scheduled for 2005.

Gulf of Mexico (2501)
The only documented issue is mercury levels in King Mackerel at 43 inches below the surface or deeper. (Bolivar Roads/Bolivar Point, Bolivar Point to Port Aransas).

Summary

The biggest water quality concern throughout the region continues to be elevated bacteria levels, which inhibit safe contact recreation and oyster harvests. Toxicity, particularly dioxin, continues to be another issue of great concern. Special projects are currently underway to address these issues as well as some of the less severe issues including low dissolved oxygen levels in small tributaries. Other special studies have been initiated to identify sources of contamination and to help in the development of reasonable remediation and control strategies.

Expanded ambient monitoring has given water quality managers data to conduct better, and more efficient assessments. Monitoring in watersheds with limited data has improved the knowledge of water quality conditions in more rural areas. The combination of data collection, analysis, education, stakeholder involvement, and reasonable implementation strategies are key factors in watershed management and the understanding of aquatic ecological systems.

In late 2005 through May of 2006, H-GAC will conduct a water quality assessment and complete a Water Quality Summary Report. In addition to that report which summarizes data on a watershed basis, H-GAC will produce short one- to two-page summaries for municipalities within those watersheds. These short reports will contain information about water quality issues within each jurisdiction and offer a short two or three item list that identifies actions that could be taken to help mitigate the problems.

Resources

In addition to previous Basin Highlights and Summary Reports, the following publications are available through the CRP and H-GAC's Water Quality Planning Program. Reports and studies are also available for other programs such as habitat preservation and environmental enforcement. If you are interested in any of these publications, please contact H-GAC's Community and Environmental Planning Department at 713-993-2461. Many documents can be found online at www.h-gac.com.

Water Quality Reports and Guidance Manuals

Receiving Water Assessments for Urban Waterbodies Houston Ship Channel Tributary, 2003

Houston Ship Channel Water Quality Conditions Report, 2003

Hydrologic, Water Quality and Biological Data for Three Water Bodies Texas Gulf Coastal Plain, 2000-2002
A Guidance Manual for Identifying and Eliminating Illicit Connections to Municipal Separate Storm Sewer Systems (MS4), 2002

Dickinson Bayou Pre-TMDL Data Collection, 2002

Urban Bayou Bacteria Source Identification Study, 2001

Regional Habitat Index, USGS Phase 3 document Dioxin Sediment and Tissue Sampling in Houston Ship Channel and Upper Galveston Bay, 2001

Gulf Coast Region Water Quality Management Planning Document, 2000

Domestic Wastewater Regionalization White Paper, 2000

Copper Water Effects Ratio Study and Trace Metals Study for the Houston Ship Channel, 2000

Greens Bayou Intensive Survey and Wasteload Evaluation, 1999

Water Quality Data Analysis, 1999

Characterization of Water and Sediment Quality, Christmas Bay System, Brazoria County, Texas, 2000

Characterization of Water–Quality and Aquatic-Biological Conditions in the Panther Branch Watershed, near Houston,Texas, 1999

Identifying and Eliminating Illicit Connections Within the Clear Creek, 1998–1999

Gulf Coast Region Water Quality Management Planning Document, 1998

Fish, Benthic Macroinvertebrate, and Stream Habitat Data From the Houston-Galveston Area Council Service Area, Texas 1997–98, 1998

Nutrient Loading and Selected Water Quality and Biological Characteristics of Dickinson Bayou Near Houston, Texas 1995-97, 1997

Action Guide: Erosion and Sediment Control (Construction Activities), 1997

Local Government Water Quality Protection Study, 1994

Houston Ship Channel Success Story, 1992

Brochures

San Bernard Watershed Profile, 2003

Bacteria Brochure, 2003

Sims Bayou Watershed Profile, 2002

Bacteria in our Bayous, 2002

Greens Bayou Watershed Profile, 2001

Water Quality Data Clearinghouse, 2000

What Watershed Do You Live In?, 2000

Armand Bayou Watershed Profile, 1999

Videos

Can I Swim Here?, 2000

Segment	Segment Name	Area	Parameter	Category	Rank	Covered By
1001	San Jacinto River Tidal	From US Hwy 90 to downstream of I-10	PCBs in Fish Tissue	5A	H	TMDL
1005	Houston Ship Channel/San Jacinto River Tidal	Downstream I-10 to Lynchburg Ferry Road	PCBs in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Goodyear Creek Tidal	PCBs in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Goodyear Creek Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Goodyear Creek Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Goodyear Creek Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Greens Bayou Tidal	PCBs in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Greens Bayou Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Greens Bayou Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Greens Bayou Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	HSC Tidal	PCBs in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	HSC Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	HSC Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	HSC Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	PCBs in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Berry Bayou Tidal	PCBs in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Berry Bayou Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Berry Bayou Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Berry Bayou Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Brays Bayou Tidal	PCBs in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Brays Bayou Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Brays Bayou Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Brays Bayou Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Houston Ship Channel/Buffalo Bayou Tidal	PCBs in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Houston Ship Channel/Buffalo Bayou Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Houston Ship Channel/Buffalo Bayou Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Houston Ship Channel/Buffalo Bayou Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Hunting Bayou Tidal	PCBs in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Hunting Bayou Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Hunting Bayou Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Hunting Bayou Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Sims Bayou	PCBs in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Sims Bayou	Chlordane in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Sims Bayou	Dieldrin in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Sims Bayou	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Vince Bayou Tidal	PCBs in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Vince Bayou Tidal	Chlordane in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Vince Bayou Tidal	Dieldrin in Fish Tissue	5A	H	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Vince Bayou Tidal	Heptachlor Epoxide in Fish Tissue	5A	H	TMDL
1016	Greens Bayou Above Tidal	Upstream FM 1960 to US 59	Bacteria	5A	L	Routine, TMDL
1101	Clear Creek Tidal	Upstream of FM 528 to Confluence of Clear Creek	Bacteria	5A	M	Routine
1102	Clear Creek Above Tidal	Upper Segment Boundary to Upstream of FM 528	Bacteria	5A	M	Routine
1103	Dickinson Bayou Tidal	Upper Segment Boundary to SH 3	Bacteria	5A	M	Routine
1104	Dickinson Bayou Above Tidal	Entire Stream Reach	Bacteria	5A	M	Routine
1006D	Halls Bayou Below US 59	From US 59 to Hirsch Road	Bacteria	5A	M	TMDL
1006D	Halls Bayou Below US 59	Tidwell Road to Confluence with Greens Bayou	Bacteria	5A	M	TMDL
1006E	Halls Bayou Above US 59	Entire Stream Reach	Bacteria	5A	M	TMDL

Segment	Segment Name	Area	Parameter	Category	Rank	Covered By
1006F	Big Gulch Above Tidal	Entire Stream Reach	Bacteria	5A	M	TMDL
1006H	Spring Gully Above Tidal	Entire Stream Reach	Bacteria	5A	M	TMDL
1006I	Unnamed Tributary of Halls Bayou	Entire Stream Reach	Bacteria	5A	M	TMDL
1006J	Unnamed Tributary of Halls Bayou	Entire Stream Reach	Bacteria	5A	M	TMDL
1007B	Brays Bayou Above Tidal	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007C	Keegans Bayou Above Tidal	From Harris County Line to Confluence with Brays Bayou Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007D	Sims Bayou Above Tidal	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007E	Willow Waterhole Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007F	Berry Bayou	1.5 miles Upstream from Confluence with Sims Bayou to SH 3	Bacteria	5A	M	Routine, TMDL
1007G	Kuhlman Gully Above Tidal	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007H	Pine Gully Above Tidal	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007I	Plum Creek Above Tidal	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007K	Country Club Bayou Above Tidal	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007L	Unnamed Non-tidal Tributary of Brays Bayou	Entire Perennial Portion of Stream	Bacteria	5A	M	Routine, TMDL
1007M	Unnamed Non-tidal Tributary of Hunting Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007N	Unnamed Non-tidal Tributary of Sims Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007O	Unnamed Non-tidal Tributary of Buffalo Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1007P	Brays Bayou Above Tidal	From Alief Clodine Road to SH 6	Bacteria	5A	M	Routine, TMDL
1007Q	Sims Bayou Above Tidal	From South Post Oak to Hiram Clarke	Bacteria	5A	M	Routine, TMDL
1007Q	Sims Bayou Above Tidal	From Just South of West Orem to South Post Oak	Bacteria	5A	M	Routine, TMDL
1007R	Hunting Bayou Above Tidal	From Bains Street to Sayers Street	Bacteria	5A	M	Routine, TMDL
1007R	Hunting Bayou Above Tidal	From Falls Street to Loop 610	Bacteria	5A	M	Routine, TMDL
1007R	Hunting Bayou Above Tidal	From Loop 610 to IH-10	Bacteria	5A	M	Routine, TMDL
1013A	Little White Oak Bayou	From RR Tracks north of IH-610 to Trimble St.	Bacteria	5A	M	Routine, TMDL
1013A	Little White Oak Bayou	From Trimble Street to Confluence of Buffalo Bayou	Bacteria	5A	M	Routine, TMDL
1013C	Unnamed Non-tidal Tributary of Buffalo Bayou Tidal	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1014H	South Mayde Creek	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1014K	Turkey Creek	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1014M	Neimans Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1014N	Rummel Creek	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1014O	Spring Branch	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1016A	Garners Bayou	From a Point Adjacent to Vegas Road to Confluence with Greens Bayou	Bacteria	5A	M	Routine, TMDL
1016B	Unnamed Tributary of Greens Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1016C	Unnamed Tributary of Greens Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1016D	Unnamed Tributary of Greens Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1017A	Brickhouse Gully	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1017B	Cole Creek	From Flintlock Street to Confluence with White Oak Bayou	Bacteria	5A	M	Routine, TMDL
1017D	Unnamed Tributary of White Oak Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1017E	Unnamed Tributary of White Oak Bayou	Entire Stream Reach	Bacteria	5A	M	Routine, TMDL
1101B	Chigger Creek	FM 528 to the Confluence of Clear Creek	Bacteria	5A	M	Routine
1101B	Chigger Creek	From the Headwaters to FM 528	Bacteria	5A	M	Routine
1102A	Cowart Creek	Entire Stream Reach	Bacteria	5A	M	Routine
1102B	Mary's Creek	Entire Stream Reach	Bacteria	5A	M	Routine
1103B	Bordens Gully	Entire Stream Reach	Bacteria	5A	M	Routine
1103C	Geisler Bayou	Entire Stream Reach	Bacteria	5A	M	Routine
1103D	Gum Bayou	Entire Stream Reach	Bacteria	5A	M	Routine

Segment	Segment Name	Area	Parameter	Category	Rank	Covered By
2425C	Robinson Bayou	From Abilene St to Confluence with Clear Lake	Bacteria	5A	M	Routine
2425C	Robinson Bayou	From Headwaters to Abilene St.	Bacteria	5A	M	Routine
1001	San Jacinto River Tidal	From Lake Houston Dam to Hwy 90	Dioxin in Catfish and Crab	5A	U	TMDL
1001	San Jacinto River Tidal	From US Hwy 90 to Downstream of I-10	Dioxin in Catfish and Crab	5A	U	TMDL
1005	Houston Ship Channel/San Jacinto River Tidal	Downstream I-10 to Lynchburg Ferry Road	Dioxin in Catfish and Crab	5A	U	TMDL
1005	Houston Ship Channel/San Jacinto River Tidal	Goose Island to SH 146	Dioxin in Catfish and Crab	5A	U	TMDL
1005	Houston Ship Channel/San Jacinto River Tidal	Lynchburg Ferry Road to Goose Island	Dioxin in Catfish and Crab	5A	U	TMDL
1005	Houston Ship Channel/San Jacinto River Tidal	SH 146 to Morgans Point	Dioxin in Catfish and Crab	5A	U	TMDL
1006	Houston Ship Channel Tidal	Goodyear Creek Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1006	Houston Ship Channel Tidal	Greens Bayou Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1006	Houston Ship Channel Tidal	HSC Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Berry Bayou Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Brays Bayou Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Houston Ship Channel/Buffalo Bayou Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Hunting Bayou Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Sims Bayou	Dioxin in Catfish and Crab	5A	U	TMDL
1007	Houston Ship Channel/Buffalo Bayou Tidal	Vince Bayou Tidal	Dioxin in Catfish and Crab	5A	U	TMDL
1013	Buffalo Bayou Tidal	Entire Stream Reach	Bacteria	5A	U	Routine, TMDL
1014	Buffalo Bayou Above Tidal	Entire Stream Reach	Bacteria	5A	U	Routine, TMDL
1017	White Oak Bayou	Entire Stream Reach	Bacteria	5A	U	Routine, TMDL
1102	Clear Creek Above Tidal	Upper Segment Boundary to Upstream of FM 528	Chloride	5A	U	TMDL
1102	Clear Creek Above Tidal	Upper Segment Boundary to Upstream of FM 528	Total Dissolved Solids	5A	U	TMDL
1103	Dickinson Bayou Tidal	Upper Segment Boundary to SH 3	Depressed DO	5A	U	Routine, TMDL
2421	Upper Galveston Bay	Area West of a Line from Eagle Point to Five Mile Pass to Houston Point	Bacteria (Oyster Waters)	5A	U	Routine, TMDL
2421	Upper Galveston Bay	Red Bluff to Five Mile Cut to Houston Point to Morgans Point	Dioxin in Catfish and Crab Tissue	5A	U	TMDL
2422	Trinity Bay	Area in Northern Portion of the Bay near Trinity River Confluence	Bacteria (Oyster Waters)	5A	U	Routine
2423	East Bay	Area at the East End of the Bay near East Bay Bayou and ICWW to Marsh Point	Bacteria (Oyster Waters)	5A	U	Routine
2424	West Bay	24.4 Square Miles at the East End near Galveston and Texas City	Bacteria (Oyster Waters)	5A	U	Routine
2426	Tabbs Bay	Entire Segment	Dioxin in Catfish and Crab Tissue	5A	U	TDML
2427	San Jacinto Bay	Entire Segment	Dioxin in Catfish and Crab Tissue	5A	U	TDML
2428	Black Duck Bay	Entire Segment	Dioxin in Catfish and Crab Tissue	5A	U	TDML
2429	Scott Bay	Entire Segment	Dioxin in Catfish and Crab Tissue	5A	U	TDML
2430	Burnett Bay	Entire Segment	Dioxin in Catfish and Crab Tissue	5A	U	TDML
2432	Chocolate Bay	Entire Segment	Bacteria (Oyster Waters)	5A	U	Routine
2436	Barbours Cut	Entire Segment	Dioxin in Catfish and Crab Tissue	5A	U	TMDL
2438	Bayport Channel	Entire Segment	Dioxin in Catfish and Crab Tissue	5A	U	TMDL
2439	Lower Galveston Bay	Entire Segment	Bacteria (Oyster Waters)	5A	U	Routine
1008	Spring Creek	Field Store Road to SH 249	Depressed DO	5B	S	Routine
1110	Oyster Creek Above Tidal	From Just upstream of Ramsey Prison Unit to CR 290	Depressed DO	5B	S	Routine
1113	Armand Bayou Tidal	Upper Segment Boundary to Bay Area Blvd.	Depressed DO	5B	S	Routine, RWA
1113A	Armand Bayou Above Tidal	Entire Stream Reach	Depressed DO	5B	S	Routine, RWA
2422C*	Cotton Bayou	Upper Half of Bayou	Depressed DO	5B	S	

* New

Segment	Segment Name	Area	Parameter	Category	Rank	Covered By
902	Cedar Bayou Above Tidal	Entire Segment	Depressed DO	5C	D	Routine
1004	West Fork San Jacinto River	I-45 to a Point 10 Miles Downstream	Bacteria	5C	D	
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	Acute Toxicity in Sediment	5C	D	
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	Mercury in Water	5C	D	
1006	Houston Ship Channel Tidal	Patrick Bayou Tidal	Temperature	5C	D	
1007	Houston Ship Channel/Buffalo Bayou Tidal	Vince Bayou Tidal	Acute Toxicity in Sediment	5C	D	
1008	Spring Creek	IH-45 to Confluence with Lake Houston	Bacteria	5C	D	Routine
1009	Cypress Creek	Upper Portion of Segment to Confluence with Spring Creek	Bacteria	5C	D	Routine, SS
1302	San Bernard River Above Tidal	Lower 50 Miles	Bacteria	5C	D	Routine, SS
2442	Cedar Lakes	Entire Segment	Bacteria (Oyster Waters)	5C	D	Routine
1007H	Pine Gully Above Tidal	Entire Stream Reach	Depressed DO	5C	D	Routine
1007I	Plum Creek Above Tidal	Entire Stream Reach	Depressed DO	5C	D	Routine
1007K	Country Club Bayou Above Tidal	Entire Stream Reach	Depressed DO	5C	D	Routine
1007O	Unnamed Non-tidal Tributary of Buffalo Bayou	Entire Stream Reach	Depressed DO	5C	D	Routine
1007Q	Sims Bayou Above Tidal	From Just South of West Orem to South Post Oak	Depressed DO	5C	D	Routine
1007R	Hunting Bayou Above Tidal	From Bains Street to Sayers Street	Depressed DO	5C	D	Routine
1013A	Little White Oak Bayou	From RR Tracks north of IH-610 to Trimble St.	Depressed DO	5C	D	Routine
1014M	Neimans Bayou	Entire Stream Reach	Depressed DO	5C	D	Routine
1016D	Unnamed Tributary of Greens Bayou	Entire Stream Reach	Depressed DO	5C	D	Routine
1017D	Unnamed Tributary of White Oak Bayou	Entire Stream Reach	Depressed DO	5C	D	Routine
1103A	Bensons Bayou	Entire Stream Reach	Bacteria	5C	D	Routine
1113A	Armand Bayou Above Tidal	Entire Stream Reach	Bacteria	5C	D	Routine, RWA
2422B	Double Bayou West Fork	Entire Stream Reach	Depressed DO	5C	D	Routine
2424A	Highland Bayou	From FM 2001 to FM 519	Bacteria	5C	D	Routine, RWA
2424A	Highland Bayou	From Fairwood Road to Bayou Lane	Bacteria	5C	D	Routine, RWA
2424A	Highland Bayou	From Headwaters to FM 2004	Bacteria	5C	D	Routine, RWA
2424A	Highland Bayou	From Headwaters to FM 2004	Depressed DO	5C	D	Routine, RWA
2424C	Marchand Bayou	Entire Stream Reach	Bacteria	5C	D	Routine, RWA
2424C	Marchand Bayou	Entire Stream Reach	Depressed DO	5C	D	Routine, RWA
2425B	Jarbo Bayou	From Lawrence Road to Confluence with Clear Lake	Bacteria	5C	D	Routine
2425B	Jarbo Bayou	From Headwaters to Lawrence Road	Bacteria	5C	D	Routine

Routine = Routine Ambient Monitoring is currently underway
TMDL = TMDL is underway or scheduled
SS = Special Study is underway or scheduled
RWA = Receiving Water Assessment is Scheduled

5a = TMDL underway, scheduled, or to be scheduled
5b = Review of water quality standards needed
5c = Additional data required

H = High Priority
M = Medium Priority
L = Low Priority
S = Standards Review Needed
D = Additional Data Needed

Segments that came off the 303d list:
The entire segment 2429 was removed for Bacteria.

Contact Information

Todd Running
Clean Rivers Program Manager
Contract Administration, Special Studies Coordination,
Data Analysis and Assessment
todd.running@h-gac.com

Jean Wright
Senior Environmental Planner
Clean Rivers Program Monitoring Coordinator,
Quality Assurance Officer, Special Studies Coordination,
Data Analysis and Assessment
jean.wright@h-gac.com

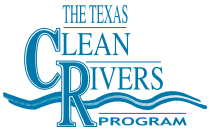
Bruce Ridpath
Senior Environmental Planner
Clean Rivers Program Data Manager,
Data Analysis and Assessment
bruce.ridpath@h-gac.com

Om Chawla
Laboratory Quality Assurance Specialist
NELAC, Laboratory Quality Assurance
om.chawla@h-gac.com

Gayla Stock
Texas Watch Volunteer Monitoring Coordinator
Volunteer Training and Certification
gayla.stock@h-gac.com

Patrick Horton
Chief Geographic Information System Specialist
GIS Data Development, Mapping and Geographic
Analysis, Web Content Development and Management
patrick.horton@h-gac.com

Ayo Jibowu
Senior Geographic Information Systems Analyst
GIS Data Development, Mapping and Geographic
Analysis, Web Content Development and
Interactive Mapping
ayo.jibowu@h-gac.com



Houston–Galveston Area Council 3555 Timmons Lane, Suite 120 Houston, TX 77027 Phone 713 627 3200 Fax 713 993 4503 www.h-gac.com