



TASK 5: DATA ANALYSIS AND REPORTING

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TASK 5: DATA ANALYSIS AND REPORTING

Introduction

The data analysis and reporting efforts outlined under this task include the examination of water quality issues throughout the basin so that a more complete understanding of water quality conditions may be generated and communicated to all the basin's stakeholders. The information in these reports will help shape decisions and the focus of projects in the basin.

The major deliverables due as a part of this task are the:

- Basin Highlights Report (annually, except when Basin Summary Report is due)
- Basin Summary Report (every 5 years)

Basin Highlights Report

The Basin Highlights Report is due on an annual basis and should provide a summary of activities conducted in the basin for the Clean Rivers Program during the prior year. This report will differ in content every other year in order to reduce the unnecessary repetition of information that does not change on an annual basis. In odd-numbered years, this report will be designed to update stakeholders on activities in a very short, one page program update. At the same time, the program partners will develop information to report on sources and causes (Exhibit 5B) for the state's biennial assessment of water quality, the *Water Quality Inventory and 303(d) List of Impaired Waters*. (www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/305_303.html)

On even-numbered years, this report will provide a description of water quality conditions and issues throughout the basin. This report should engage and educate the stakeholders on water quality. Of utmost importance is the need to make this document both user-friendly and useful to a wide audience; therefore, presentation of the information is nearly as important as the content. In this effort, it would be advisable to get steering committee input on the format and content of the document prior to its finalization. It may be appropriate to use the previous report as an example of a working draft. This report differs from the 5-year Basin Summary Report in the extent and presentation of the technical data analysis. The Basin Highlights Report provides a status of water quality and activities of the past year, whereas the Basin Summary Report involves detailed discussion of the findings from a comprehensive data analysis.

In those years when a Basin Summary Report is due, the Planning Agency will not prepare a Basin Highlights Report. Five copies of the draft report and five copies of the final report are to be submitted to the Clean Rivers Program (CRP) Project Manager. The Basin Highlights Report will be posted on the Planning Agency's Web site and mailed to basin steering committee members.

Content

On odd-numbered years, when a Basin Summary Report is not due, a shortened version of the Basin Highlights Report will consist of an update of activities for the previous year and an addendum that provides information for the TCEQ staff to use in preparation for the next TCEQ assessment, entitled the *Water Quality Inventory and 303(d) List of Impaired Waters*. The addendum to the report will contain information describing possible sources and causes of *Impairments* and *Concerns* on the latest TCEQ assessment. An outline for this addendum is provided in Exhibit 5B. This is being done to assist TCEQ in completing their work by providing "on-the-ground" reconnaissance and local



knowledge of the watershed surrounding the water body. Information describing data anomalies, results of data analysis, flow status, and even suggested future work will also be included where available.

On even-numbered years, when a Basin Summary Report is not due, a full Basin Highlights Report will be completed. An outline for the full Basin Highlights Report is provided in Exhibit 5A with some examples of satisfactory text attached. The report should, at a minimum:

- include an overview of basin water quality monitoring
- provide a list of the top water quality issues in the basin for stakeholder prioritization and monitoring decisions
- highlight participation of other organizations in the basin monitoring program
- describe water quality conditions for each segment/waterbody
- summarize findings from special studies
- include maps showing the location of sampling sites and water quality issues
- summarize Steering Committee and other public outreach activities, including volunteer water quality monitoring
- provide instructions on how to get involved in steering committee meetings, volunteer monitoring, and other opportunities for participation
- outline the CRP content featured on the Planning Agency's Web site

Basin Summary Report

The Basin Summary Report is designed to provide a comprehensive review of water quality data and related information for each river and coastal basin in Texas. This report serves to develop a greater understanding of water quality conditions and enhance the ability to make decisions regarding water quality issues. The report is completed once every five years for each river and coastal basin based upon the rotating basin permitting cycle. For this biennium, the Summary Report is due in 2008 for Group E and 2009 for Group A basins. The following items specify logistical requirements for the Basin Summary Report:

- A planning meeting with the Texas Commission on Environmental Quality (TCEQ) CRP Project Manager to discuss the format and organization of the report is required prior to significant work on the report to ensure objectives are met.
- A copy of the final report needs to be made available to each stakeholder. This may be accomplished by: handing out copies at the steering committee meetings, putting the report on the Internet, and mailing notices of its availability in hard copy upon request.
- Five copies of the draft report and five copies of the final report are to be sent to the TCEQ CRP Project Manager.
- At a minimum, the Executive Summary and maps of water quality issues should be posted to the Planning Agency's CRP Web page.

From the Texas Water Code, Section 26.0135, Clean Rivers Act, the summary report must:

- be sent to the State Soil and Water Conservation Board and Parks and Wildlife Department
- identify water quality concerns, impaired or potentially impaired uses, the cause and possible source of use impairment, and recommended actions the commission may take to address those concerns
- discuss the public benefits from the water quality monitoring and assessment program, including efforts to increase public input in activities related to water quality and the effectiveness of targeted monitoring in assisting the permitting process

- be approved by the basin steering committee and coordinated with the public and the commission
- include a review of wastewater discharges, nonpoint source pollution, nutrient loading, toxic materials, biological health of aquatic life, public education and involvement in water quality issues, local and regional pollution within the watershed
- identify significant issues affecting water quality

and with respect to the assessment each Planning Agency shall:

- identify water quality problems and known pollution sources and set priorities for taking appropriate action regarding those problems and sources
- recommend water quality management strategies for correcting identified water quality problems and pollution sources
- inform those parties (persons who pay fees under Section 26.0291 and steering committee members) of the availability and location of the summary report for inspection and shall solicit input from those parties concerning their satisfaction with or suggestions for modification of the summary report
- summarize all comments received from persons who pay fees under Section 26.0291 and from steering committee members and shall submit the report and the summaries to the governor, the lieutenant governor, and the speaker of the house of representatives not later than the 90th day after the date the river authority submits the summary report to the commission and other agencies

Content

The outline and description of content for the Basin Summary Report can be found in Exhibit 5C - Basin Summary Report Outline. The outline is provided to ensure content is consistent from basin to basin; however, the information may be presented in different ways. Input from users of the report has been favorable when all the information specific to a watershed is presented cohesively so as to get a more complete picture of a watershed's water quality. This report should answer the questions most stakeholders have, which tend to be:

- ▶ what are the water quality issues?
- ▶ why do the issues exist?
- ▶ what are the possible effects?
- ▶ what should be/could be done about it?

Exhibit 5C provides an explanation and illustration of how the various data review and analysis methods can be combined to provide an overall description of water quality by answering the questions listed above. The data review and analysis methods that we will be using that answer the questions include: descriptive statistics (percentiles), trend analysis (changes over time), and spatial analysis (differences from upstream to downstream and watershed characteristics).

Goals of the Report

This report serves to provide an explanation for why current water quality conditions exist by incorporating and interpreting the findings from the various data analysis functions. By explaining the findings, we can better describe the reasons for the problem so that something can be done with the information.

The information from the review will support the following functions:

- develop monitoring plans and update priorities
- enhance knowledge and understanding of water quality issues
- verify findings on the State's Water Quality Inventory
- correlate water quality conditions with possible sources
- prioritize water bodies for action

- select watersheds for special studies
- highlight those sections of the basin that need more land use information
- assess the success of water quality improvement projects

Watershed Characteristics Reference Information

In order to adequately analyze a water body, or watershed, knowledge of the factors influencing water quality is needed. It is important to regularly maintain information that will support this understanding. As new information is learned about a water body, or watershed, it can be added to the databank of information. This information can then be referenced to support the results of the water quality data review for inclusion in the reports. This information would best be maintained as mini fact-sheets about water bodies and their watersheds and could incorporate the Events Inventory. The deliverable for this work will be shown as descriptive information about sources and causes in the reports and in the deliverable in Exhibit 5B titled, *Information for Impairments and Concerns*.

Some of the information that should be maintained for each water body and its watershed, includes:

- ▶ hydrologic characteristics (e.g., streamflow variability, reservoir dynamics, seasonality, typical flows)
- ▶ natural characteristics (e.g., topography, slope, soils, vegetation, wildlife, average annual precipitation, average high and low temperatures, eco-regions)
- ▶ land use (e.g., estimate amount of crop land, rangeland, urban, forest; septic tank concerns; predominant crop types; urban/residential nonpoint source, landfills, industrial areas; quarry operations; oil/gas operations,)
- ▶ discharge to surface waters (e.g., industrial & municipal dischargers, discharge amounts, CAFOs, storm water permits)
- ▶ future changes anticipated in factors that affect water quality (e.g., population changes, increased number of industrial facilities)

Information for Impairments and Concerns

In order to support the TCEQ in its assessment of water quality, certain information will be provided to the TCEQ in the Spring of odd-numbered years. This information will be useful in providing the information needed to better characterize and understand water quality issues. Information such as flow status, possible sources in the watershed, possible reasons for water quality issues to occur, and data anomalies will be provided in a table. A template table will be provided to the Planning Agencies from a database maintained by the TCEQ. The Planning Agencies will then fill in or change the information in the table to help populate the TCEQ database. The table will contain all the *Impairments* and *Concerns* from the latest approved TCEQ assessment report. When not enough is known about a water body and its related issue, then the table may be left blank for that water body. It will be important for the Planning Agency to research those issues in preparation for the next assessment. This type of information should be acquired through stakeholder input as well as investigation. The information for this table should be reconciled with the Watershed Characteristics Reference Information. An example table is provided as Exhibit 5B.



Events Inventory

An inventory of one-time and seasonal events may be used to describe changes in water quality conditions. Events are defined as those occurrences that have the potential to either positively or negatively impact water quality. This information may be collected and developed for the entire river basin or just within watersheds under special study. The inventory can be used to help explain changes in water quality, or highly elevated values over short periods of time. The inventory may be useful in determining where improvements to water quality are expected and, when coupled with water quality trends, may indicate the reason for improvement. Over time, a watershed may experience more events (such as fertilizer or pesticide application) during certain seasons that will help focus monitoring to address those concerns.

Examples of events include:

- implementation of nonpoint source best management practices (NPS BMPs)
- new wastewater treatment plant or a change to effluent limits
- floods and droughts
- complaints about failing septic systems
- fish kills
- new land application of sludge
- seasonal crop fertilization or application of pesticides
- spills in or near water bodies

The events data can be collected by the Planning Agencies from local governmental organizations, such as city or county health departments. Other sources may also include media coverage, Steering Committee and/or stakeholder input, and state agencies that conduct and oversee the implementation of water quality related issues.

Updates to the inventory will be provided once each year in tabular format, by date and watershed. Additional effort to collect historical events data is necessary for priority watersheds to help in analyzing water quality data collected for special studies. The table or database for the events inventory should include watershed name, stream segment number, type of event, date or date range, the active participants, and a short description of the location. An example table is shown below.

Example Events Inventory

North Fork Elm Creek Watershed Segment No. 1240		
Event	Date	Location/Participants
Wastewater plant abandoned	02/1999	Gary Job Corps
NPS BMP - Composting Poultry Waste	05/1997-05/1999	Southwest Milam County/ 5 Agricultural Operations
New Stormwater Permit	07/2000	Brazos River downstream of the City of Waco
Fish Kill	08/2000	Little River downstream of Thattown
New Wastewater Permit 13097-001	11/2001	City of Mexia

This deliverable is optional for this biennium due to resource constraints throughout the program. The level of effort for this work can be determined by the Planning Agency through discussions with the CRP Project Manager and described in the work plan.





Exhibit 5A

Basin Highlights Report Outline and Examples



EXHIBIT 5A

BASIN HIGHLIGHTS REPORT OUTLINE

This Year's Highlights

- What were the major events or occurrences during the previous year (positive and negative)?
- What major issues (e.g., extreme drought, increasing development, confined animal operations, ongoing issues, natural salt pollution, record flood) are plaguing water quality for the basin?
- How have these events impacted water quality?
- What has been done to respond to water quality issues?

Water Quality Monitoring

This section involves a summarization of the monitoring that was planned, or occurred, during the past year including any participating entities and special projects.

- Present information on monitoring for the current fiscal year, to include:
 - Number of sites per entity, frequency, type of monitoring
- Map the coordinated monitoring schedule for the entire basin
 - Show and label sampling sites, water bodies, county boundaries, highways, & cities
- Explain what the water quality parameters mean and why they are important
- Provide a link to the web page that shows the entire monitoring schedule
- Highlight other organizations' participation in the monitoring program

Water Quality Conditions

The key to ensuring this portion of the report is adequate is to answer the questions the reader would ask, "why are levels elevated and what is being done about it?". When the answers to the questions are unknown and/or cannot be estimated, this information gap should be stated. If the previous year's report (including Basin Summary Report) contains a description of water quality for each TCEQ segment, and there is no new Water Quality Inventory, then this section can be copied from the previous year's report. A statement should be included that no new assessment information is available since the previous report. The examples provided after this outline are highly recommended.

Explain the TCEQ assessment and categorization process

- Explain the assessment and categorization methods used for the latest state-approved TCEQ Water Quality Inventory and 303(d) list and provide the web address for reference

Describe water quality

- For each segment/water body, provide a concise description of the key watershed and water body characteristics that draw a picture of water quality
- Indicate the status of the segment/water body on the latest TCEQ Water Quality Inventory and provide some possible reasons why there is a *Concern*, *Use Concern*, and/or *Impairment*.
- Highlight those water bodies that may have a water quality issue, or are significant due to size, location, or public interest, but which do not have a *Concern*, *Use Concern*, and/or *Impairment* and provide some possible reasons why the water quality is an issue.

Provide information on current or proposed work in the watershed

- Monitoring activities done in response to a water quality issue

- Proposed monitoring needed to better describe water quality (e.g., diel sampling for 2 years; monthly sampling for bacteria under a variety of flow conditions for 2 years; collect TDS in subwatersheds throughout the affected watershed to identify source areas)
- Describe special studies, activities to date, and any findings (reference special study reports that have been completed or will be completed in the near future)
- Accomplishments in the past year, or several years (e.g., 100 wells have been capped; 100,000 tons of manure have been composted and hauled out of the watershed; riparian buffers restored on over 15 miles of stream banks)

Map water quality issues

The map(s) should be at a scale that allows the reader to recognize where sampling sites and water quality issues are located in relation to major landmarks. In some cases, it may be useful to show the location of factors influencing water quality, such as wastewater treatment plants, CAFOs, and row-crop operations in order to show their spatial relationship to the water quality conditions and the sampling sites.

- Highlight segments or sections of segments with water quality issues (e.g. *Concerns, Use Concerns, and/or Impairments*)
- Include and label, at a minimum: streams/reservoirs, county boundaries, highways, cities, and segment boundaries

Special Studies

This section is optional and may be incorporated into the previous section. It is also useful to reference study reports and fact sheets for more detailed information.

- Describe special studies in process and any findings to date
 - Include information on why the special study was needed, the outline of the study's scope, the type of monitoring that is being done, and the results of data collection.

Stakeholder Participation & Public Outreach

- Describe opportunities for involving other monitoring entities in the program
 - Who is currently involved? What is their contribution?
- Explain the purpose of Steering Committee meetings (e.g. forum for providing input on water quality issues, establishing priorities for future work, and providing feedback on reports)
- Include a section on how individuals and organizations can get involved in the program
- Outline efforts that have been taken to get more involvement in the program
- Summarize prior Steering Committee discussions
- Summarize volunteer monitoring activities in the basin
- Include information on volunteer organizations and their activities, with contact information

Web Site

- Provide an overview of the information available on the web site
- Provide links to important pages, especially those with further detail on issues discussed in this report and those that allow the public to check on upcoming events

EXAMPLE TEXT FOR THE BASIN HIGHLIGHTS REPORT

This Year's Highlights

Example # 1:

Since its inception in 1934, the River Authority has served to protect surface water resources in the river basin. Today, the River Authority's mission is enhanced through partnerships with the TCEQ, the River Authority, and the Upper River Authority.

The partnerships are fostered by the Texas Clean Rivers Program, which provides funding and guidance to achieve the shared goal of clean water for future generations of Texans. This report highlights the activities of the River Authority and its CRP partners for 2000.

The most significant factor affecting water quality throughout the basin in 2000 was the severe drought. In the upper portion of the basin, much of the River east of the City went completely dry, forcing some residents to transport water to storage tanks at their homes. The decreased flows resulted in elevated chloride levels in the river above the reservoir. In the middle portion of the basin, the Lake was 21 feet below average in August, a level not seen since 1984. The river at State Highway 180 also went dry.

In November and December 2000, base flows returned to the River and many of its tributaries. The rains came with a cost, however. During one particularly heavy rain, approximately 37,000 fish were killed in the River when stormwater runoff transported pollutants that depleted the oxygen supply in the river.

Probably the most dramatic event took place in the middle basin in November when Lake #2 rose 40 feet in 13 days to capacity by December 1.

The upper portion of the basin has seen little relief from the drought. Small inflows into the lakes were not sufficient to increase water levels significantly. The capacity at Lake #3 in April 2001 was 12 percent, decreasing from 14.2 percent in 2000. Reservoir #1 gained eight feet of elevation, primarily due to one rainfall in March 2000. Reservoir #2 was at 17 percent of its capacity in April 2001.

Example #2:

The major events relating to water quality that occurred this year include the updated State of Texas Water Quality Inventory, the completion of the first year of the Reservoir #1 Water Quality Monitoring Program, the initiation of the dissolved metals study, identification of a leaking sewer main, improvements to the City #2 wastewater collection system, and a new fish consumption advisory for Lake #4.

The State's Water Quality Inventory identified eight new concerns (3 for nutrients, 3 for dissolved oxygen, and 2 for pH) and 5 new impairments (3 for bacteria and 2 for dissolved oxygen). Several historical data points for metals were removed from the assessment due to out-dated methodologies, therefore a dissolved metals in water study has been designed to verify whether there are any metals in water issues in the basin. Fifteen historical, long-term monitoring stations will be monitored quarterly for dissolved metals in water. At the end of the study period, the basin will have sufficient metals data to properly assess the levels of metals in water in most segments.

The Reservoir #1 Water Quality Monitoring Program was developed to address growing concerns over water quality conditions due to wastewater treatment facilities at the local papermill. Significant improvements in wastewater discharge from the papermill should help water quality in the long-term. In addition, the papermill is in the process of renovating its wastewater treatment facility to significantly reduce waste loads.

Example #3 (a portion of):

For fiscal year 2002, the River Authority has added four routine and three flow sites to the monitoring plan. Three of the routine sites are on River #1. These sites were added in response to concerns about water quality impacts resulting from increased public use of the river. The fourth site was added downstream of a petrochemical plant on the River #2. A polluted groundwater plume has been identified very close to the river. Efforts have been made by the plant to keep the plume from entering the river.

In addition, three sites were added to monitor flow on a monthly basis for one year to enable calculations to be made for wastewater effluent assimilative capacity. This data will replace assumptions made by the TCEQ when assigning allowable permit effluent limits.



EXAMPLE TEXT FOR THE BASIN HIGHLIGHTS REPORT

Water Quality Monitoring

Number of Sites Monitored						
Sampling Entity	Field	Conventional	Bacteria	Biological and Habitat	Metals in Water	Organics in Water
River Authority	20 monthly 8 quarterly			10 semi-annually	9 annually 1 semi-annually	2 semi-annually 2 quarterly
River Authority 2	11 quarterly		11 quarterly 19 weekly (May - Aug)	9 semi-annually	2 annually	
TCEQ	23 quarterly				5 annually 4 semi-annually	1 semi-annually
City	4 quarterly					

In addition to the routine and systematic monitoring sites, there are three special studies which include: metals in water quarterly at 15 sites, petroleum related products monthly at 3 sites, and conventional and field parameters monthly at 6 sites.

What are the Water Quality Groups?

Field - physical and chemical water quality characteristics that can be measured on-site, and generally include: dissolved oxygen (DO), conductivity, pH, temperature, stream flow, flow severity, secchi disc, and field observations/conditions.

Conventional - chemical and biological constituents in water that typically require laboratory analysis, and generally include: several forms of nitrogen, phosphorus, bacteria, chlorophyll-a, total dissolved solids, and total suspended solids.

... etc.

What is Dissolved Oxygen and Why is it Important?

Dissolved oxygen (DO) indicates the amount of oxygen available in the stream. Certain minimum concentrations are needed to support aquatic life. DO can be reduced by a number of factors such as elevated water temperatures and the loading of organic substances that require oxygen for decomposition (e.g., plant debris and wastewater effluent).

Why do we collect nutrients?

To determine compliance with water quality standards that are set by the TCEQ to protect human health and to determine if there is an unnatural loading of nutrients. High levels of nutrients can cause excessive plant growth which can lead to reduced dissolved oxygen in the stream, in turn this can reduce the survivability of fish. In addition, at certain levels nutrients can cause an excessive growth of algae which can result in taste and odor problems in drinking water.

... etc.

EXAMPLE TEXT FOR THE BASIN HIGHLIGHTS REPORT

Water Quality Conditions

Segment #1 Watershed: This stream is a 2nd order perennial stream with flows ranging from 3 cfs during July and August to a normal flow of 17 cfs the rest of the year. Rice and cotton farming can be found throughout the watershed and the soils are typically a dark clay loam. The slope of the land is minimal, as expected in the central coastal plain. There are 12 domestic outfalls and six industrial outfalls. The TCEQ listed this stream for not attaining its contact recreation use due to elevated bacteria counts in the lower 50 miles. The stream is listed with concerns for having an impaired aquatic insect community and an impaired fish community. It is unclear whether the aquatic community is affected by the activities in the watershed. There is currently a systematic watershed monitoring study being conducted to collect data to further explain the cause of high bacteria in the watershed. A trend analysis was conducted for the years 1990-2000 showing a steady, small increase in temperature over that period. See the 2001 Basin Summary Report for more details.

Segment #2 Watershed: The streams in this watershed are characterized by perennial low flows ranging from 2 to 8 cfs. The area is in the blackland prairie where soils are a dark clay loam and the slope of the streams is minimal, causing pooling and periods of no flow with standing water. While over 80% of the watershed is undeveloped, the area is experiencing rapid growth toward the west. There are 59 domestic outfalls and two industrial outfalls. The segment is listed for not attaining its contact recreation use due to elevated bacteria counts as well as for low dissolved oxygen occurrence from SH 249 to IH 45. Low dissolved oxygen is also found in the Upper Branch and Upper Lake sub-segments. Ammonia is a concern along Upper Branch. High levels of other nutrients, including nitrite+nitrate-nitrogen, ortho-phosphate phosphorus, and total phosphorus, are found along the main stem. There have been numerous sewer line failures in the watershed as well as a great deal of urban and commercial land use increasing run-off and stormwater flow. It is possible that the elevated nutrients are related to the outfalls and the elevated bacteria is due to run-off and sewer line leaks.

Segment #3 Watershed: This 15-mile portion of the main stem of the River is a sluggish, sloshing, bayou-type tidal stream with a man-made salt water barrier preventing salt water from moving further inland. This section of the River is influenced by flow from the main stem of the River upstream as well as from the Other River. The soils are silty central coastal plains and the slope is minimal. There are several large industrial outfalls, no municipal outfalls, and very little population in the surrounding watershed. The TCEQ listed this site as not meeting dissolved oxygen criteria to support aquatic life; however, current methods for assessing grab DO samples against the absolute minima criteria shows that this segment supports its aquatic life use. There are four 24-Hour DO sampling events scheduled for fiscal year 2005 to help determine if aquatic life use is supported. There were no trends shown for dissolved oxygen for summer or winter. As expected, the lower values are seen during the summer months. The TCEQ also listed this site as not meeting the screening criteria set for nitrite+nitrate nitrogen. It is apparent from the graph that there is a large percentage of exceedances over the period of record. The most likely source of the high nutrients is from the Other River Basin whose confluence is three miles upstream. The Other River Basin data shows higher nutrient concentrations than the ambient levels shown in the main stem of This River upstream of the confluence with the Other River Basin.

Segment #4 Watershed: This 38 mile portion of the XYZ River, from City 1 to Hwy 3, is characterized by a bedrock stream bed, flows that average 15 cfs, an average to above average slope for Texas, stream banks with solid rock and limestone soils, 30 inches average rainfall, and a typical temperature range of 20 to 100 degrees F. Two small towns are found in the watershed with populations less than 5000 each. A great deal of housing and retail development is occurring throughout the watershed which can cause sediment run-off and greater flooding potential, while reducing infiltration for spring flows. In addition, the installation of water wells has the potential to cause a reduction in spring flows. In 2004, the TCEQ stated that water quality standards and screening levels are met for all available data. The River Authority's review of data over time (trend analysis) indicates that substantially elevated levels of Sulfates occurred during a period of drought in 1999. A special study was conducted to locate the source of the elevated levels and the likely source is groundwater coming from the Big Creek sub-watershed. No biological or toxic data has been collected in this stretch of the river.

EXAMPLE TEXT FOR THE BASIN HIGHLIGHTS REPORT

Special Studies

Example #1

Creek #3 - Success Story: With such a broad array of bacteria problems in the region, trying to identify specific sources can be challenging. Looking at small tributaries that feed into larger bayous in the area is a good start to determine where the sources are located so that actions can be taken to prevent excessive bacteria from entering the water.

Some tributaries of Creek #3 were sampled for bacteria and were found to exceed the contact recreation standards. The small size of the tributaries (~1.6 miles long) allowed TCEQ staff to easily investigate the situation. Staff encountered three illegal bypass lines running from manholes to the area collection system and every manhole along the creek had sewage debris around it. Residents indicated that this has been a long-term problem. Raw sewage was flowing from one of the bypass lines while the TCEQ investigator was on the site. While a bacteria sample collected upstream showed 90 colonies/100 ml of water, an outfall 160 feet downstream exhibited 300,000 + colonies/100 ml of water.

The illegal lines have now been removed and the City is expanding the force mains and two lift stations to address any overflows. The collection system in the area will be reevaluated.

TCEQ staff will be evaluating data from other tributaries shown to have bacteria problems and initiate similar investigations for sources. As these problems are corrected, bacteria loads to the main stem will decrease.

The small tributary approach is an excellent step toward addressing bacteria issues with a minimal amount of data collection.

Example #2

Creek #4 - Volatile Organic Compounds: Water samples from a portion of Creek #4 have shown levels of the volatile organic chemicals 1,2-dichloroethane and 1,1,2-trichloroethane.

The Industry #1, Inc. waste site is an abandoned refinery located on approximately fifty-eight acres along Creek #4a, a tributary to Creek #4. The facility was operated from the late 1950's until 1982. Chemical spills at this facility have entered Creek #4a and contaminated soils and groundwater. Groundwater from the site is pumped, treated, and discharged to Creek #4a under a U.S. EPA Record of Decision amended in 1997. This discharge and direct migration of contaminated groundwater to Creek #4a are believed to be the only significant continuing sources of the VOCs to Creek #4. Concentrations are now below the water quality targets for protection of the fish consumption use. As a result, the Texas Department of Health has rescinded the health advisory.

Continued periodic monitoring will be required to confirm that concentrations of volatile organic compounds in Creek #4a and Creek #4 water do not exceed the water quality targets. Additional monitoring of the VOCs in fish tissue will be required to verify that fish continue to be safe for consumption.

EXAMPLE TEXT FOR THE BASIN HIGHLIGHTS REPORT

Stakeholder Participation & Public Outreach

Focus on Outreach

This River Authority's Clean Rivers Program public outreach activities include involvement of stakeholders and committee members planning and analysis of watershed management as well as watershed and water quality education for the public.

There are three main groups that help set priorities and direct water quality assessment activities for the program. They include a Steering Committee, a Technical Advisory Group, and a Regional Monitoring Workgroup. For more information on the roles of these committees and how to get involved, please visit:

www.abcdefg.abcd.tx.us/intro/introcmt.html

The River Authority has instituted several new approaches to educating the public about watersheds and water quality throughout the region. While continuing to participate in environmental festivals and outdoor events, the River Authority has also devised ways to reach others who may not attend or have access to those types of events.

One approach has been through direct mailouts. A brochure that summarizes Watershed #1 was mailed out randomly to approximately 3,000 residents in that watershed. Enclosed in the mailing was a postcard response survey that asked the recipient:

- 1) How familiar they were with the concept of a watershed,
- 2) Before receiving this document, did they know they lived in Watershed #1?, and
- 3) Had they learned anything new about the health of the aquatic environment from the information provided.

Many of the cards received indicated that the recipient had never heard of the watershed concept, did not know they lived in Watershed #1, and did learn something about the health of the aquatic environment. In addition, almost half of the recipients who returned their survey cards requested more information.

How Do I Get Involved?

- Learn more about how to prevent nonpoint source pollution, request a FREE copy of our brochure, "What Watershed Do You Live In?"
- Be aware of local laws and ordinances that aim to protect our waterways
- Report spills, fish kills, or illegal dumping to TCEQ's Pollution Hotline at 1-800-3OURBAY or to Texas Parks and Wildlife at 281-842-8100
- Volunteer to monitor a nearby creek or lake. Join the River Authority Texas Watch team, please visit: www.abcd.123
- Volunteer for other activities such as the annual Trash Bash, which aims to remove thousands of pounds of trash from area waterways, visit www.trashbash.org
- Check out our Data Clearinghouse for information, interactive maps, online databases, and more at: www.abcdefg.123.org
- Attend our next Clean Rivers Program Steering Committee Meeting which will be posted on our web site at www.abcdefg.123.steeringcmtmtgs.org

Web Site

The River Authority Clean Rivers Program web page contains a variety of different information. The Data Clearinghouse, www.abcdefg.123/waterdata, is full of information on watersheds, water quality, and includes other data resources.

The main features of the clearinghouse are: interactive mapping and customized water quality data query.

The complete 2001 Basin Summary Report, including trend analyses and detailed data reviews for each watershed, is available online at: www.abcdefg.123.resources/crp/watersheds.html

Special study summaries and reports are highlighted on the main CRP page at: www.abcdefg.123/intro.html.





Exhibit 5B

Information for Impairments and Concerns





EXHIBIT 5B Information for Impairments and Concerns

This document will be prepared in the Spring of odd-numbered years to support the completion of the *TCEQ Water Quality Inventory and 303(d) List*. Information will be provided for those water bodies with *Impairments* and/or *Concerns* on the prior TCEQ assessment report.

Water Body and Location	Flow Status	Parameter(s)	Possible Sources in the Watershed	Possible Reasons for Impairment and/or Concern	Special Study (Y/N)
Lavaca River upstream of Hallettsville	Intermittent with pools	Dissolved Oxygen	Two small towns <2000 pop. Two small WWTPs, 20/20, <0.5 MGD total Poultry operations Range land	Not enough flow during hot summer months when sandy substrate heats up.	TPWD/ LNRA 24Hr DO
Sulphur Creek at SH 183	Perennial	Bacteria	In downtown Lampasas, <3000 pop., above WWTP, near parks and golf course.	Run-off conditions show higher levels than rest of watershed. Steady state conditions are elevated, possibly related to water fowl, city sewer lines,	Y
Walnut Creek at IH-35	Intermittent-dry in summer for up to two weeks at a time	Bacteria Nitrate Dissolved Oxygen	In north Austin, >100,000 pop. in watershed.	Urban run-off, city sewer lines, low flows.	Continuous monitor
Plum Creek at Uhland	Perennial	Bacteria Nitrate	City WWTP, ~4MGD. Other smaller permits. None at capacity. City and rapidly growing urban development, >4000 in watershed. Rangeland, crop land.	Bacteria is elevated during steady state, and greatly accentuated during run-off, related to urban development and range/crop land. Nitrates may be in geology, but most of flow is City WWTP.	CRP-Y WPP- TSSWCB





Exhibit 5C

Basin Summary Report Outline



EXHIBIT 5C

BASIN SUMMARY REPORT OUTLINE

Executive Summary

The Executive Summary is intended to convey the essence of the larger summary report in a non-technical manner. The following is an outline for this overview:

Activities and Accomplishments - Describe the successes of the program and how the basin objectives have been accomplished over the past five years. Discuss how efforts undertaken with regard to monitoring (i.e., level of effort), geographic data sets, prioritization of water quality issues, efforts to involve basin stakeholders, and public outreach endeavors, have provided a benefit to the public.

Significant Findings - Summarize the results of the data analyses (e.g., number of sites with high levels of nutrients, positive and negative trends, and any hits with toxics). Describe major water quality issues and the most likely reasons for the water quality conditions. Highlight water quality that appears to be improving and report on any actions that have been taken to improve water quality.

Recommendations - Include specific recommendations for each watershed and explain the basis for the recommendation. Describe how the findings from the data analyses will be used to focus resources in the next biennium.

Summary Report

1.0 INTRODUCTION

The Introduction will provide the reader with the purpose of the report and sufficient background to understand the scope of the Clean Rivers Program (CRP) and the information provided within the report. The introduction will also include subsections with the following general headings:

- ▶ CRP and basin goals/objectives;
- ▶ coordination/cooperation with other basin entities;
- ▶ descriptive overview of the basin's characteristics, including key factors influencing water quality;
- ▶ summary of basin's water quality characteristics.

2.0 PUBLIC INVOLVEMENT

This section describes basin efforts to promote public involvement in water quality issues. Planning Agencies will summarize public information and education activities undertaken and evaluate the success of these activities. The report will also identify and discuss any public outreach materials developed (e.g., pamphlets for septic tank maintenance, NPS pollution education).

The basin Steering Committee needs to be discussed fully in this section. This may include a general description of membership, how the committee functions, and typical topics that are discussed at the meetings. This section should define how the committee's input is incorporated in decisions for focusing CRP resources (e.g., special studies, adding sites, adding parameters).

This section also should include efforts to seek public input for prioritizing water quality issues and monitoring projects, including Watershed Protection Plan/TMDL coordination efforts, review of stream standards, the State's Water Quality Inventory, and basin planning initiatives. Where applicable,



include a discussion on volunteer environmental monitoring (VEM) groups and the function of these groups.

If any watershed-based technical sub-committees have been formed, a short overview of the functionality of those committees should be provided. A more in-depth discussion of how a committee has been involved in a special study can be provided in the Watershed Summaries section of this report.

3.0 WATER QUALITY REVIEW

3.1 Water Quality Terminology

This section needs to provide a description of any technical terms, including monitoring parameters and how they relate to maintaining water quality standards. A short discussion of the quality controls behind the data should also be included.

3.2 Data Review Methodology

This section will include a discussion of the methods used to evaluate the data and should provide enough detail for the reader to be able to re-create your steps. Some of the process overviews include:

- an explanation of TCEQ's assessment methodology, along with how the State's information will be used in the report
- a discussion of the methods used to conduct the Trend Analysis specifying the parameters used to screen the data (e.g., number of records, period of record) and the criteria used to determine whether a trend exists (e.g., percent change per parameter)
- an explanation of any additional evaluation methods (e.g., compare descriptive statistics from site to site for similar watersheds to determine the relative level of concern; compare descriptive statistics upstream to downstream to find significant changes, then relate factors in the watershed to the change)
- a description of the index of biotic integrity used for biological surveys

3.3 Watershed Summaries

The review of water quality data and watershed characteristics should be presented within the context of a watershed to keep information for stations that are in close geographic proximity and subject to similar watershed characteristics together. For our purposes, a watershed is typically defined by a segment and the land/tributaries that drain to it. The following sections will make up each Watershed Summary and can be combined into a single descriptive paragraph, or set of paragraphs, to answer the questions:

- ▶ what are the water quality issues?
- ▶ why do the issues exist?
- ▶ what are the possible effects?
- ▶ what should be/could be done about it?



Steps in the Review of Water Quality

The first step in the review of water quality is to **identify water quality issues**. A water quality issue may be identified in one or more of the following ways:

- ▶ listed as an *Impairment* or *Concern* on the latest TCEQ *Water Quality Inventory and 303(d) List of Impaired Waters*
 - ▶ local concern of stakeholders; and
 - ▶ through the review and comparison of water quality data by the Planning Agency
- Note:** In those cases where there is no “identified water quality issue”, the report needs to include some discussion of water quality. The discussion should include an overview of the watershed characteristics, results from the latest TCEQ Assessment, and the descriptive statistics (e.g., percentiles) to show how they compare to other similar water bodies in the area.

Once a water quality issue has been identified through one of the methods listed above, a short description is needed explaining **why it was identified as an issue**. This could be stated in some of the following ways:

- ▶ Impaired/concern because 8 samples out of 28 collected over the past five years were over the criteria
- ▶ The 8 samples were in the range of 2 to 5 times higher than the criteria
- ▶ The median concentration is 25% higher in the most recent five years than in the prior five year period, showing a possible upward trend
- ▶ This waterbody exhibits the third highest median concentration of the parameter in the central watershed over the past five years

Next, **describe the water quality issue** by explaining why a water quality issue exists and the relative importance of that issue (e.g., how it reduces the use of the water body for its intended uses). The three paragraphs below are provided as examples of how this could be accomplished. The fourth paragraph provides an example of how to answer the question, **“what could be/should be done about it?”**.

The possible **sources** of pollution in the watershed include:

- ▶ rapid urban development bringing additional land application of fertilizers, pesticides, pet waste, septic systems, and new sewage outfalls, which can result in increased concentrations of nutrients, bacteria, and organic constituents in the water body
 - ▶ a large area of cropland involving tillage, the use of fertilizers and pesticides, which can result in increased sediment loads to the water body, as well as nutrients and organic constituents from the fertilizers and pesticides
 - ▶ wildlife waste which can add bacteria and nutrients
- Note:** A set of base maps showing the relationship of watershed characteristics with water quality conditions will be included in each *Watershed Summary*. The maps need to be at a suitable scale and contain an appropriate amount of detail, such as: water bodies with labels, major roads with labels, sampling sites with labels, counties and cities, segment boundaries, locations of water quality issues and factors influencing water quality.

The possible **reasons** for the water quality issue include:

- ▶ low flows, combined with pollution sources, do not provide adequate assimilative capacity
- ▶ a review of the flows related to the 8 elevated samples shows a direct correlation to rainfall and run-off, indicating that nonpoint sources are more likely to cause concentrations to exceed criteria, although base-level concentrations are somewhat elevated pointing to some influence from wastewater outfalls



- ▶ a review of the water quality upstream and downstream of the site show a decline from upstream to downstream possibly due to increased spring flows and distance from the rapid urban development in the upper portion of the watershed

The possible **effects** of the water quality issue include:

- ▶ the increased sedimentation can reduce the survivability of aquatic life and reduces the aesthetic use of the stream
- ▶ when flows increase after a rain event, the stream may not be suitable for swimming because bacteria concentrations increase by up to five times the state-established criteria
- ▶ nitrate concentrations at levels above 10 mg/L are considered too high for drinking water use, and levels above 30 mg/L are shown to have a negative impact on aquatic life in the stream
- ▶ the EPA has stated that perchlorate can cause developmental problems in children if consumed in drinking water

The best options for **addressing** this water quality issue include:

- ▶ continue the Planning Agency's supporting/technical role in the ongoing Watershed Protection Plan
- ▶ enhance stormwater controls for rock quarry operations
- ▶ work with local farmers to find an alternative to the use of atrazine
- ▶ obtain support for the regional wastewater treatment plan from local municipalities, developers, and county government
- ▶ conduct a special study to include two biological surveys including 24 hour dissolved oxygen measurements, target monitoring to run-off events as well as non-run-off events, and monitor monthly for two years at five sites in the watershed at locations near potential sources.

Evaluation of Biological and Toxics (Organics, Metals) Data

The information developed from biological surveys should be incorporated into the *Water Quality Review* to complement the findings from the water quality data. A comparison of the latest results to any previous results should be included to provide a long-term view of the information.

For toxics data compare the results to water quality standards, maximum contaminant levels, and/or screening levels and describe the relevance of the findings.

Actions In the Watershed

Information needs to be included in the report to inform the reader about special studies, permit support monitoring, activities to reduce pollution, and other efforts to address water quality issues that have taken place within the watershed. The detail of the discussion should describe how these activities relate to water quality issues previously identified and the extent of the efforts.

Data Analysis Instructions

This table includes step-by-step instructions for accomplishing the data analysis to support the *Water Quality Review* in order to answer the questions posed above. The basic steps include:

Identify Priority Sites & Relative Level of Concern (Descriptive Analysis)

- A. Create a five year data set with station, date, depth, parameter, gtl, and value.
 - 1. Remove profile data, keep top sample.
 - 2. If a station-parameter set contains less than 10 samples note this as "NA" - not enough data for analysis.
 - 3. In most cases, ignore the GTLT, unless it is known to be a problem.
- B. For each sampling location, calculate the 25th, 50th, 75th percentiles, as well as the mean.
- C. Group the results (percentiles) into separate data sets based on similar watershed and/or water body characteristics, such as Level 4 Ecoregion.
- D. Sort by parameter and then by 50th percentile (median), or by the mean (average), and put the results (station info., parameter, percentiles) either in an appendix to the report and/or on the web with a reference to their location in the report.
- E. Use these lists to help describe the relative level of concern for each water body (e.g., how much more or less is it than other comparable water bodies?).
- F. Select priority water quality issues for each area using the analysis results in concert with historical knowledge, watershed characteristics, and stakeholder input.

Identify Changes in Water Quality over Time (Trend Analysis)

- A. Select a set of stations that adequately represent the major segments in the basin.
- B. For those stations, prepare a trend analysis to provide information on the general improvements and declines in water quality throughout the basin.
 - 1. The trend analysis may involve a regression analysis of parameter and time, or in cases where a data set does not meet the normality requirements, the use of percent difference for the percentiles for two, three, or four consecutive 5-year periods may be used.
 - a. When using the regression analysis, a trend may be indicated when the r-stat value is greater than 2 and the p-value is less than 0.1 (need at least 10 years of data and at least 20 data points, and test for normality).
 - b. When using the percent difference, a trend may be indicated when the percent difference for the 50th percentile is greater than 25% (need 10 data points in each five year period). The percent difference may be unique to each parameter, so viewing the graph of the data over time will be crucial in making a more complete determination of whether a trend exists. It may be also useful to look at the 25th and 75th percentiles, and/or the mean to see if a change has occurred and indicate the findings in the report.
 - c. Graph the data by date to view the data and validate the results.
 - d. Whether or not a trend is found, provide a narrative to explain how the water quality varies over time, and if a trend is found the narrative needs to explain the trend.

Describe Watershed Influences on Water Quality (Spatial Analysis)

- A. Compare the descriptive statistics at site locations from upstream to downstream for identified water quality issues (*Impairment, Concern, Use Concern, Trend, Priority Sites*) to identify where changes occur and relate them to watershed characteristics.
- B. Relate information from the maps and the *Watershed Characteristics Reference Information* to each site in order to explain why the water quality issue exists.

Interpreting the Results

This section provides some tips for interpreting the information generated above, and should incorporate public input and historical knowledge, to explain the current status of water quality conditions. This will help answer the questions posed in the *Water Quality Review*.

The *Descriptive Statistics* will be used to explain the relative level of concern for each water body, regardless of the existence of a water quality issue. This will provide the reader some information explaining the current status of water quality. If the median for a parameter is well below most of the other similar sites in the area, then provide that information (e.g., for the 18 samples collected over the past 5 years, the median concentration of nitrate was 0.2 mg/L, putting it in the lower 25 percent of all water bodies in the area). The results of the latest *TCEQ Water Quality Inventory* should also be related here with a possible explanation for the water quality status.

The *Trend Analysis* results should be used to help identify any upcoming, worsening, or improving water quality conditions. The following questions are suggested for reviewing trend analysis results.

- (1) Does the data indicate an improvement or a reduction in water quality over time?
- (2) How strong is the trend (i.e., number of samples, amount of change)?
- (3) Is the trend expected to continue and what are the possible implications?
- (4) What are the possible reasons for the change?
- (5) How does the water quality change with changing flow conditions and/or seasons?

The review of information from the *Spatial Analysis* will include a description of the relationship between the location of specific factors in the watershed and the water quality data. The *Watershed Characteristics Reference Information* should be used to explain which factors have the most potential to affect water quality and why they tend to have the greatest influence. In some cases it may be effective to use Box and Whisker Plots to illustrate how the percentiles change from upstream to downstream for a specific parameter, and show where certain factors influence water quality.

4.0 RECOMMENDATIONS AND CONCLUSIONS

4.1 Recommendations and Comments

While watershed-specific recommendations are made in the Watershed Summaries, this section needs to include recommendations and comments made by stakeholders who reviewed the draft Basin Summary Report. In addition, an outline of the programmatic, regulatory, and legislative recommendations to protect and improve water quality throughout the basin need to be discussed. These recommendations may include a consideration of resources available for implementing the action.

The results of the analyses for this report, as well as input from stakeholders, should be used to set some preliminary priorities for addressing water quality issues. These priorities will help define where additional analysis may be needed for the Basin Summary Report. This will also help determine where additional information could be collected under the next biennium's Work Plan.

4.2 Conclusions

The report concludes with a discussion of how the Planning Agency's efforts have advanced the understanding of water quality. Also, this section will describe the Planning Agency's long-term vision of how basin efforts need to be directed during the next biennium to improve water quality.