

# CHAPTER 1 INTRODUCTION

## Problem Statement

The Texas Commission on Environmental Quality (TCEQ) has led an effort to assess the water quality of the following urban creeks in the Dallas-Ft. Worth Metroplex area of North Central Texas:

- Sycamore Creek (Segment 0806E),
- Cottonwood Branch (Segment 0822A),
- Grapevine Creek (Segment 0822B),
- Copart Branch Mountain Creek (Segment 0841E),
- Cottonwood Creek (Segment 0841F),
- Dalworth Creek (Segment 0841G),
- Delaware Creek (Segment 0841H),
- Estelle Creek (Segment 0841J),
- Fish Creek (Segment 0841K),
- Kirby Creek (Segment 0841N), and
- West Irving Creek (Segment 0841U).

Each of these streams was first placed on the State of Texas 303(d) list in 2006 (TCEQ, 2007) and has remained on subsequent biennial 303(d) listings up to and including the draft 2010 list (TCEQ, 2010a). The cause of impairment in each of these streams is concentrations of the indicator bacteria *Escherichia coli* (*E. coli*) that exceed the criteria used to evaluate attainment of the contact recreation use

Each of the 11 streams referred to above has a presumed contact recreation use based on the *Texas Surface Water Quality Standards* adopted on June 30, 2010 (TSWQS; TCEQ, 2010b). Questions have, however, been raised by stakeholders generally across the state and particularly in the watersheds of these streams as to the appropriateness of the current primary contact recreation use designation to nearly all Texas water bodies, including these 11 streams. The recently adopted TSWQS revisions include an expansion of the former contact recreation use into three categories: Primary Contact Recreation (PCR), Secondary Contact Recreation 1 (SCR1), and Secondary Contact Recreation 2 (SCR2).

The recent TSWQS also specifies a means to evaluate the uses of a water body through a process referred to as a use-attainability analysis (UAAs). UAAs are assessments of the physical, chemical, biological, and economic factors affecting attainment of water body use (40 Code of Federal Regulations § 131.10(g)), which are conducted to identify and assign attainable uses and criteria to individual water bodies. Recreational use-attainability analysis (RUAA) is a specific type of UAA focused on determining the appropriate recreational use of a water body.

The 303(d) listing of each of these 11 streams for bacteria concentrations exceeding that criteria used to evaluate attainment of primary contact recreation use and the recent TSWQS that provide additional categories of recreational use support conducting RUAs on each of these 11 streams.

## **Objectives**

Comprehensive RUA surveys were performed on the 11 study streams following the Texas Commission on Environmental Quality (TCEQ) May 2009 *Procedures for a Comprehensive RUA and a Basic RUA Survey* (TCEQ, 2009). The 11 study streams included: 1) Sycamore Creek, 2) Cottonwood Branch, 3) Grapevine Creek, 4) Copart Branch Mountain Creek, 5) Cottonwood Creek, 6) Dalworth Creek, 7) Delaware Creek, 8) Estelle Creek, 9) Fish Creek, 10) Kirby Creek, and 11) West Irving Creek. All surveys were performed by Texas Institute for Applied Environmental Research (TIAER) staff located on the Tarleton State University Stephenville, Texas campus.

The objectives of the Comprehensive surveys and ancillary public information activities were to:

- Have approved a special study quality assurance plan (SS QAP) providing quality assurance and quality control (QA/QC) for the surveys
- Perform a reconnaissance trip and determine appropriate sites on each study stream for performing the RUA surveys
- Perform three RUA surveys on each of the study streams under appropriate hydrological and meteorological conditions
- Develop a report for TCEQ of the findings of the RUA surveys
- Perform public information meetings

In total these objectives are designed to provide TCEQ the information to allow their evaluation of the recreational use category for each stream.

## **Summary Status of Objectives**

The project SS QAP was approved by TCEQ on July 14, 2009. The SS QAP in conjunction with the TCEQ TMDL Program QAPP provide the guidance for conducting RUA surveys to ensure all information are collected under appropriate procedures and with all necessary quality assurance and quality control. Included within the SS QAP was a monitoring plan detailing specific locations where RUA surveys would be conducted on each of the 11 streams. Initial site locations were determined from information obtained on a reconnaissance trip of each stream performed on April 22 and 23, 2009. The initial stream sites were presented at a June 11, 2009 informational meeting of relevant cities, regional agencies, and state agencies, and feedback from attendees during the meeting and immediately following the meeting culminated in a final set of survey sites for each stream.

At the June 11, 2009 meeting TCEQ and TIAER presented the concept of Comprehensive RUAs, the then proposed TSWQS revisions regarding three categories of recreation use (PCR, SCR1, and SCR2), and the previously mentioned discussions on site selection. Entities represented at this meeting included:

Texas Commission on Environmental Quality, Region 4 Office  
Texas Parks and Wildlife Department  
Texas State Soil and Water Conservation Board  
Texas AgriLife Research  
Tarrant Regional Water District  
Trinity River Authority  
Dallas Ft. Worth International Airport  
City of Coppell  
City of Dallas  
City of Ft. Worth  
City of Grand Prairies  
City of Irving  
City of Arlington staff could not attend but were updated through a subsequent telephone conversation

Three RUAA surveys were performed for the sites along each stream. The information and data collected during each survey are discussed in the next chapter on methodologies. Each survey began during the work week but also included visitation of sites during the weekend to maximize opportunity to observe recreational activities in and around each site. Interviews of the public in the vicinity of each site were also part of the surveys. Weather conditions for each survey were selected to occur during warm weather (air temperatures > 70°F) and under streamflow conditions conducive to safe recreation use if such use does occur. For these survey conditions appropriate streamflow conditions were defined as those not strongly influenced by rainfall induced stormwater runoff for several days prior to the surveys, meaning that sustained or typical dry, warm-weather streamflow was occurring.

Initial scheduling of the first survey was for late July 2009, as soon as logistically feasible after the July 16<sup>th</sup> approval of the SS QAP, to be followed by a second survey in late August 2009, and a third in early summer of 2010. However, the weather did not cooperate as the Dallas Ft. Worth area experienced some welcomed rainfall events in late July, which necessitated postponement of the first survey such that two 2009 surveys were conducted in August 2009. The three RUAA surveys were conducted on the following dates:

Tuesday, August 4, 2009 through Saturday, August 8, 2009  
Tuesday, August 25, 2009 through Saturday, August 29, 2009  
Thursday, May 27, 2010 – Monday, May 31, 2010 (Memorial Day weekend)

An information public meeting was conducted on April 9, 2010 to provide interested parties an update on the progress of the Comprehensive RUAA and the initial findings from the first two surveys conducted in 2009. A second informational meeting on April 22, 2010 focused on only two of the streams (Cottonwood Branch and Grapevine Creek) and included presentations and discussions not only on the RUAA, but also progress on developing bacteria total maximum daily loads (TMDLs) for these two streams. The two meetings included attendees representing the following:

Texas Commission on Environmental Quality, Region 4 Office  
Texas Parks and Wildlife Department  
Dallas Ft. Worth International Airport  
City of Coppell  
City of Dallas  
City of Ft. Worth  
City of Grand Prairies  
City of Irving  
North Central Texas Council of Governments  
U.S. Geological Survey  
and a representative of the general public

Also as part of the public interaction process, agencies and cities were asked if a recreational use-attainability analysis was appropriate for the 11 streams included in this study. The following responses were obtained, where a response of “Yes” indicates that it was appropriate to conduct these studies and “No” would be a contrary response that the studies should not be conducted:

Texas State Soil & Water Conservation Board, Mr. Aaron Wendt, response of *Yes* on June 9, 2009  
Texas Commission on Environmental Quality, Mr. John Mummert, response of *Yes* on June 11, 2009  
Texas Parks & Wildlife Department, Ms. Jennifer Bronson, response of *Yes* on September 1, 2009  
Trinity River Authority, Ms. Angela Kilpatrick, response of *Yes* on August 18, 2010.  
Tarrant Regional Water District, Mr. Mark Ernst, response of *Neutral* on July 22, 2010  
North Central Texas Council of Government, Mr. Sam Brush, response of *Neutral* on August 18, 2010.  
City of Irving, Mr. Bob Ressler, response of *Yes* on June 16, 2009  
City of Fort Worth, Ms. Casey Nettles, response of *Yes* on June 18, 2009  
City of Grand Prairies, Ms. Echo Rexroad, response of *Yes* on June 25, 2009  
City of Irving, Ms. Karen Sidall, response of *Yes* on July 13, 2010 (TIAER interacted with the City of Irving repeatedly in the summer of 2009 in deciding upon site locations and getting interview information but neglected to formally ask this question until July 2010.)

Presentation of the information and data collected in performing the Comprehensive RUAA constitute the remainder of this report.

## CHAPTER 2

# STUDY AREA OVERVIEW AND METHODOLOGY

### Overview of Study Area

The 11 streams that are the focus of the RUAA surveys lie within the Dallas-Ft. Worth Metroplex area and also within Dallas and Tarrant Counties (Figure 2-1.) Each of the study streams has a presumed primary contact recreation use under the recently adopted Texas Surface Water Quality Standards (TCEQ, 2010b). A brief description of each study stream follows immediately below with more detailed information provided within the individual report chapters for each stream. The description provided for each stream is the segment description provided in the 2008 303(d) List (TCEQ, 2008b), which was the working stream description at the time the RUAA surveys were planned.

### Sycamore Creek (0806E)

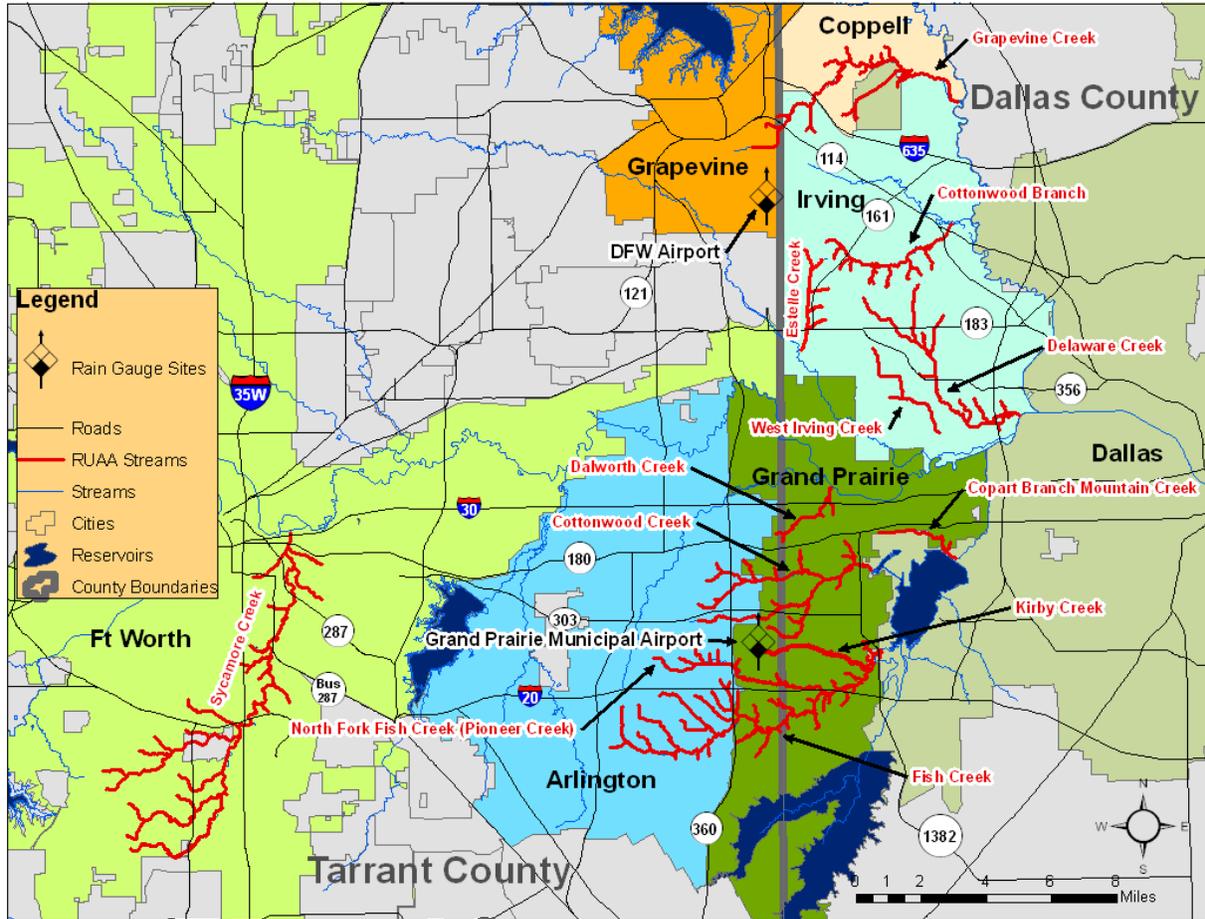
Segment 0806E is a five-mile stretch of the creek running generally south to north from the confluence with the Echo Lake tributary near S. Riverside Drive to the confluence with the West Fork Trinity River (0806) in Fort Worth, Texas. Located in southeast Fort Worth, the watershed surrounding Sycamore Creek is residential, interspersed with commercial areas and some light industry. TCEQ information indicates that streamflow is perennial and the presumed aquatic life use is high (TCEQ, 2010c).

### Cottonwood Branch (0822A)

Segment 0822A is a six mile unclassified stream running upstream from its confluence with Hackberry Creek to Valley View Road in Irving, Texas, Dallas County. Cottonwood Branch flows generally west to east from near State Highway (SH) 161 on the east side of Dallas/Fort Worth International Airport (DFW International Airport), through Irving, Texas, and to a confluence with Hackberry Creek near Dallas, Texas just west of the Elm Fork Trinity River. TCEQ lists flow type for this stream as intermittent with pools and based on this flow regime assigned a presumed aquatic life use of limited (TCEQ, 2010c).

### Grapevine Creek (0822B)

Segment 0822B is small tributary of the Elm Fork Trinity River (0822) below Lake Lewisville. Grapevine Creek originates in Tarrant County on the north end of DFW International Airport and flows generally northeast through Grapevine, Texas and forms the boundary between Coppell and Irving, Texas prior to entering the Elm Fork Trinity River near Carrollton, Texas north of Dallas. TCEQ lists flow type for this stream as intermittent and based on this flow regime assigned a presumed aquatic life use of minimal (TCEQ, 2010c).



**Figure 2-1** Map of Dallas/Fort Worth Metroplex showing location of urban creeks.

### **Copart Branch Mountain Creek (0841E)**

Segment 0841E is 2.8 mile stretch of the creek running upstream from confluence with Mountain Creek to approximately 0.3 miles upstream of Camden Road on Dallas Naval Academy, Dallas County. The watershed surrounding Copart Branch is densely commercial with a large portion of the businesses being auto salvage. TCEQ lists flow type for this stream as intermittent with pools and based on this flow regime assigned a presumed aquatic life use of limited (TCEQ, 2010c).

### **Cottonwood Creek (0841F)**

Segment 0841F is 6.5 mile stretch of the creek running upstream from approx. 0.1 mi. upstream of Mountain Creek Reservoir in Dallas County, to SH 360 in, Tarrant County. TCEQ lists the flow type for Cottonwood as perennial and based on this flow regime assigned a presumed aquatic life use of high (TCEQ, 2008).

**Dalworth Creek (0841G)**

Segment 0841G is 2.2-mile unclassified segment running upstream from the confluence with Lower West Fork Trinity River (0841) to County Line Road (currently identified on maps as NW19th Street) in Grand Prairie, Texas. TCEQ lists this water body as perennial for flow type and based on this flow type has assigned a presumed aquatic life use of high (TCEQ, 2010c).

**Delaware Creek (0841H)**

Segment 0841H is an 8.5-mile unclassified segment running upstream from its confluence with Lower West Fork Trinity River (0822) to Finley Road in Irving, Texas. TCEQ lists the flow type for Delaware Creek as intermittent with pools and based on this flow type has assigned a presumed aquatic life use of limited (TCEQ, 2010c).

**Estelle Creek (0841J)**

Segment 0841J is a 4-mile reach running upstream from its confluence with Bear Creek (0841B) to Valley View Lane in Irving, Texas. This unclassified creek is little more than a concrete drainage way, except for a pooled area near West Pioneer Dr. The flow type for this creek is listed by TCEQ as intermittent and based on this flow type the assigned aquatic life use is minimal (TCEQ, 2010c).

**Fish Creek (0841K)**

Fish Creek is a 10.5-mile stretch of the creek running upstream from approximately 100-m downstream of FM 382 in Grand Prairie, Texas, to approximately 0.25 miles upstream of Collins Road in Arlington, Texas. The flow type listed by TCEQ for Fish Creek is perennial and based on this flow type the presumed aquatic life use is high (TCEQ, 2010c).

**Kirby Creek (0841N)**

Segment 0841N is a 4-mile unclassified segment running upstream from confluence with Fish Creek in Grand Prairie, Texas, to just upstream of Great Southwest Parkway in Arlington, Texas. Flow type for this creek is listed as perennial and the presumed aquatic life use based on flow type is high (TCEQ, 2010c).

**West Irving Creek (0841U)**

Segment 0841U is a 4-mile reach running upstream from approximately 0.4 miles downstream of Oakdale Road to just south of Sowers Road entirely within the City of Irving, Texas. Flow type for West Irving Creek is listed as intermittent and the presumed aquatic life use is minimal based on the flow type (TCEQ, 2010c).

**Historical Information**

A review of historical information was performed regarding recreational water uses for each of the 11 RUAA streams. The review considered the time period of November 28, 1975 to the present. In accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, newspapers, and universities were searched and contacted in addition to generic internet searches. The following is a summary of the review and searches.

**The Handbook of Texas Online**

<http://www.tshaonline.org>

Searched the handbook by stream name and by community. Nothing significant was found.

**Trinity River Vision**

<http://www.trinityrivervision.org>

No information found specifically for these urban creeks

**Government sources:**

*City of Grand Prairie including City of Grand Prairie Parks Department and Keep GP Beautiful and Adopt a Stream.*

No additional information was found beyond the information that was provided through interviews for this RUAA and which are reported elsewhere in this report.

*City of Arlington Parks Department*

[parksdepartment@arlingtontx.gov](mailto:parksdepartment@arlingtontx.gov)

No additional information was found specifically for these urban creeks.

*City of Irving Drainage Program Coordinator (Karen Siddall)*, [http://www.trb-wv.com/IRVING/IRVING%20TRB-WO%202325-FY10/RUAA\\_Tasks/Final\\_Report\\_TCEQ/Draft\\_Report\\_TCEQ\\_Aug10/Tims\\_edit/parksdepartment@arlingtontx.gov](http://www.trb-wv.com/IRVING/IRVING%20TRB-WO%202325-FY10/RUAA_Tasks/Final_Report_TCEQ/Draft_Report_TCEQ_Aug10/Tims_edit/parksdepartment@arlingtontx.gov)

Ms. Siddall provided a report on an erosion control study dated March 1992 that covered all of the parks and recreational areas in Irving. The report had only one mention of recreation and that was Frisbee golfers in Fritz Park retrieving their discs from Delaware Creek.

Ms. Siddall also sent a copy of a photo in the Irving Rambler (Vol. 6, Issue 26, June 20, 2009) showing kids on bikes in the middle of Delaware Creek in Centennial Park.

Ms. Siddall mentioned at the June 11, 2009 RUAA planning meeting infrequent high water rescues of youths who get in some of the city's urban creeks during and immediately after rainfall runoff events. Specific creek names were not provided.

**Historical Society Sources:**

*Arlington Historical Society*

<http://www.arlingtontxhistoricalsociety.org/index.html>

[fielderh@swbell.net](mailto:fielderh@swbell.net)

No information on the urban creeks provided from this source.

*Dallas Historical Society*

<http://www.dallashistory.org/index.html>

Referred to the GB Dealey Library (see library sources below).

*The Portal to Texas History*

<http://texashistory.unt.edu/>

Searched resources from 1970 – 2009 using creek names as search terms. Nothing pertinent was found through this search.

**Library Sources:**

*G. B. Dealey Library (in the West Texas room of the Hall of State)*

<http://www.dallashistory.org/about/research.htm>

Hall of State: Grand Avenue

Dallas, TX 75210

Susan Richards, Researcher

Ms. Richards reported that she found nothing specifically for these urban creeks

*Irving Library*

[http://catalog.cityofirving.org/rooms/portal/page/Sirsi\\_HOME](http://catalog.cityofirving.org/rooms/portal/page/Sirsi_HOME)

Senior Archivalist: Jan Hart

Ms. Hart indicated that she searched but could find nothing on these urban creeks.

*Grand Prairie Library*

<http://www.gptx.org/index.aspx?page=293>

Phone: 972- 237-5700

TIAER staff made a phone call to the library and was told the only thing they could offer was some floodplain documents which were unlikely to provide us the information we were seeking.

*Coppell Library*

[library@coppelltx.gov](mailto:library@coppelltx.gov)

Ms. Tracy Williams of the Coppell Library indicated that she searched everything they had, including newspaper articles, and found nothing on Grapevine Creek. She said she had some floodplain maps and an environmental impact statement, but after some discussion about the documents it was agreed that these documents did not include useful information for the purposes of this study.

**Academia:**

TIAER staff searched colleges and universities online for professors and/or programs that might provide leads or information but this search availed nothing worth a follow-up.

The search for historical information on recreational uses in these 11 urban creeks at the resources mentioned above resulted in only very limited findings. At most resources, nothing was found specific to these streams. A conversation with Ms. Siddall of the City of Irving resulted in some information regarding recreational uses near and in stream within the City of Irving.

**Climatic Conditions**

North Central Texas, the regional area containing the 11 creeks for this study, has a subtropical climate characterized by hot summers and mild winters, resulting in a wide annual temperature range (NWS, 2009a). Fair skies generally accompany the highest temperatures of summer, which are often above 100° F; however, the low temperature rarely exceeds 80° F at night (NWS, 2009a). Winters are mild, but northern cold fronts occur about three times each month, and often are accompanied by sudden drops in temperature. Periods of extreme cold that occasionally occur are short lived, so that even in January mild weather occurs frequently (NWS, 2009a). The

frost-free period generally lasts for about 249 days, with the last frost occurring in mid March and the first frost occurring in mid to late November (NWS, 2009a). Annual average precipitation is approximately 35.5 inches (902 mm) based on recorded measurements at DFW International Airport from 1994 through 2008 (NWS, 2009b).

Antecedent rainfall data associated with the three RUAA surveys were obtained for locations at the DFW International Airport and Grand Prairie Airport (Table 2-1 and Table 2-2, respectively). The locations of these two airports are depicted by the rain gauge symbols on Figure 2-1. Note that the dates of the three surveys are shown on each table by gray shading. The late July 2009 rainfall dates and associated amounts that resulted in postponement of the first scheduled survey until early August are clear from the data in both tables.

## **METHODOLOGIES**

The following text provides details of the data collection activities designed to obtain the necessary field-related information for a RUAA. A Comprehensive RUAA was conducted for the Trinity River Basin unclassified segments 0806E, 0822A, 0822B, 0841E, 0841F, 0841G, 0841H, 0841J, 0841K, 0841N, and 0841U. The major components of a Comprehensive RUAA are summarized as the following:

- Site reconnaissance (completed May 2009)

- Site selection (completed June 2009)

- Field surveys (2009 - August 4 – 7 and August 25 – 29, 2009; 2010 – May 27 – 31, 2010)

The first two components, site reconnaissance and site selection, did not constitute formal data collection activities requiring a SS QAP. These two components, however, were critical to the success of data collection activities under the last bullet; the field survey, which did include various field activities (e.g., streamflow measurement) covered by an approved SS QAP.

### **Site Reconnaissance and Site Selection**

The site reconnaissance was conducted prior to performing field survey activities. The reconnaissance had the purpose of collecting background information and selecting appropriate sites for the field survey. The site selection process took into account locations where the identified segments were accessible to the public and had the highest potential for recreational use. The site selection process considered parks and bridge crossings along the various streams included in this study.

The number of sites selected attempted to adhere to the guidelines in the May, 2009 draft procedures for performing a RUAA (TCEQ, 2009) wherein it states “In general, choose three (3) sites per every five (5) miles of stream.” Because each segment of this study varied in length, TIAER tried to identify an appropriate number of sites on each stream based on the 3/5 criterion.

The following information was compiled using Geographic Information System (GIS) based tools prior to, during, and immediately following the site reconnaissance:

- locate areas in which each segment was accessible to the public and had the highest potential for recreational use;

**Table 2-1** Rainfall records for DFW International Airport for July and August 2009 and April and May 2010. (Dates of surveys are highlighted in gray shades)

July 2009		August 2009		April 2010		May 2010	
Date	Rainfall (in)	Date	Rainfall (in)	Date	Rainfall (in)	Date	Rainfall (in)
1	0	1	0.63	1	0	1	T
2	0	2	0	2	0.09	2	0
3	0	3	0	3	0	3	0.16
4	0	4	0	4	T	4	0
5	0.07	5	0.02	5	0	5	0
6	T	6	T	6	0	6	0
7	0	7	0	7	T	7	0
8	0	8	0	8	0	8	0
9	0.12	9	0	9	0	9	0.08
10	0	10	0	10	0	10	0
11	0	11	0	11	0	11	0
12	0	12	0	12	0	12	0
13	0	13	0	13	0	13	0
14	0	14	T	14	0	14	0.6
15	0	15	0	15	T	15	T
16	0	16	0	16	0.02	16	0
17	T	17	0	17	1.26	17	0.02
18	0	18	0	18	0.27	18	0
19	0.01	19	0	19	T	19	0
20	0.01	20	0	20	0	20	T
21	0.09	21	0.99	21	0	21	0
22	0	22	0	22	T	22	0
23	T	23	0	23	0.08	23	0
24	0	24	0	24	0.31	24	0
25	0	25	0	25	0	25	0
26	T	26	0	26	0	26	0
27	0.63	27	T	27	0	27	T
28	T	28	0	28	0	28	0
29	T	29	0	29	0	29	0
30	1.01	30	0	30	T	30	0.23
31	0.15	31	0			31	0

locate wastewater treatment plant outfall locations and potential point sources;

characterize the watershed, including land use;

determine hydrologic characteristics, such as stream type, streamflow, hydrologic alterations, etc.; and

locate proposed sites for data collection

### Field Survey Data Collection Activities

The procedures for a Comprehensive RUAA (TCEQ, 2009) specify two different field surveys occur on different weekends or the summer holiday during the warm season (air temperature greater than or equal to 70°) and when human recreational activities were most likely to occur

**Table 2-2** Rainfall records for Grand Prairie Airport for July and August 2009 and April and May 2010. (Dates of surveys are highlighted in gray shades)

July 2009		August 2009		April 2010		May 2010	
Date	Rainfall (in)	Date	Rainfall (in)	Date	Rainfall (in)	Date	Rainfall (in)
1	0	1	0	1	0	1	0.04
2	0	2	0	2	0	2	0
3	0	3	0	3	0	3	0
4	0	4	0	4	0	4	0
5	0	5	0	5	0	5	0
6	0.07	6	0	6	0	6	0
7	0	7	0	7	0	7	0
8	0	8	0	8	0	8	0
9	0	9	0	9	0	9	0.13
10	0	10	0	10	0	10	0
11	0	11	0	11	0	11	0
12	0	12	0	12	0	12	0
13	0	13	0	13	0	13	0
14	0	14	0	14	0	14	0.02
15	0	15	0	15	0.02	15	0
16	0	16	0	16	0	16	0
17	0.36	17	0	17	0.45	17	0
18	0	18	0	18	0.16	18	0
19	0	19	0	19	0	19	0
20	0	20	0	20	0	20	0
21	0	21	0	21	0	21	0
22	0	22	0	22	0	22	0
23	0	23	0	23	0.01	23	0
24	0	24	0	24	0.19	24	0
25	0	25	0	25	0	25	0
26	0.35	26	0	26	0	26	0
27	0.85	27	0.02	27	0	27	0
28	0	28	0	28	0	28	0
29	0	29	0	29	0	29	0
30	0.51	30	0	30	0	30	0
31	0.43	31	0			31	0

(March - October). Further, field surveys were conducted when stream flow conditions were normal, avoiding unusual antecedent conditions of extreme drought and wet weather. For this study the decision was made by TCEQ to go beyond the minimum of two different field surveys and to conduct a third survey.

The data collection activities for each of the three field surveys included the following activities at each selected site:

- instantaneous streamflow
- average depth at thalweg and substantial pool depths
- observational/anecdotal data required by the recreational UAA
- air and water temperature measurements
- photographic record

### **Instantaneous Streamflow Measurements**

An instantaneous water velocity measurement was made at each site using the most applicable current meter. The collection of velocity measurements under wadeable stream conditions was performed using either a SonTek Flow Tracker Acoustic Doppler Velocimeter or a Teledyne RDI StreamPro™ Acoustic Doppler Current Profiler (ADCP). Velocity measurements followed protocols outlined in the TCEQ Surface Water Quality Monitoring Procedures Manual, Volume 1 (2008a). TIAER personnel used the stream flow measurement form developed by TIAER, which follows guidance and contains the information in TCEQ manuals (TCEQ, 2008a and 2009).

Streamflow determination used existing United State Geological Survey (USGS) gage stations if the station was located within a quarter mile of a site (TCEQ, 2009). No USGS gage stations, however, were located on the small urban creeks of this study. TIAER field staff used the Stream Flow (Discharge) Measurement Form and followed the procedures outlined in the most recent TCEQ Surface Water Quality Monitoring Procedures, Volume 1, RG-415 (TCEQ, 2008a).

### **Average Depth at Thalweg and Substantial Pool Depths**

Determination of thalweg depths and substantial pool depths is applicable to contact recreation use determination for unclassified intermittent and perennial freshwaters according to TCEQ (2008a). The thalweg is defined as the deepest depth of a transect perpendicular to the stream channel.

As instructed in the RUAA procedures manual (TCEQ, 2009), a 300-meter (m) reach at each station was evaluated to determine average depth at the thalweg. At least 11 transects at 30-m intervals were established in the 300-m stream reach of each station. By convention, the 0-m transect was established at the most downstream point of the reach and the 300-m transect defined the most upstream point of the reach.

Determination of the thalweg in both wadeable and non-wadeable streams was determined as described in the Procedures for a Comprehensive RUAA and a Basic RUAA Survey (TCEQ, 2009), Section E – Item 1 Wadeable Streams and Item 2 Non-wadeable Streams.

Measuring each transect was accomplished, where wadeable, using a surveyor's rod to measure depth. At some locations, where water depth did not allow wading, or submerged obstructions created unsafe situations, a Teledyne RDI StreamPro™ Acoustic Doppler Current Profiler (ADCP) was used to identify the thalweg.

### **Observational /Anecdotal Data**

Anecdotal information was recorded on field data sheets during all surveys and studies using the field data sheets for Basic and Comprehensive UAA Surveys from the draft guidance (TCEQ, 2009).

Types of observational and anecdotal records included, but were not limited to, the following:

- channel flow status,
- stream type (e.g., ephemeral, intermittent, etc.),
- streamflow,

general weather conditions (cloud cover/rain), including 30-day conditions and antecedent rainfall record,  
substrate type,  
accessibility, and  
anecdotal information related to observed human contact activities.

### **Air and Water Temperature Measurements**

Water temperature was measured using a 600 XLM YSI multiprobe and a 650 MDS data-logger. Water temperature, in degrees C, was logged onto the appropriate field data sheet. Air temperature was measured by a handheld thermometer in degrees C. Both instruments were checked against a NTIS certified thermometer on an annual basis.

### **Photographs**

TIAER staff created photographic records of each site during the site survey. Photographs included an upstream view, left and right bank views, downstream view at the 0-m, 150-m and 300-m transects (as described in the Field Data Sheets), any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs were taken to show evidence of recreational use (e.g. rope swings) and actual recreation (e.g., fishing). Photographs were also taken to show a lack of use, such as dry streambeds. When necessary for interpretation, photographs are provided with an obvious scale for reference. Photographs are cataloged in a manner that indicates the site location, date, view orientation and what is being shown. Because of legal concerns, photographs of minors were not taken except at a distance, from the back, or with parent's permission, which at times limited documentation.