

Recreational Use Attainability Analysis for Dixon Creek (0101A) in the Canadian River Basin

Prepared for:
Texas State Soil and Water Conservation Board
Project 12-52

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Table of Contents

Acknowledgements	ii
Authors	ii
Table of Contents	iii
List of Figures	iv
List of Tables	v
Chapter 1 Introduction	1
Problem Statement	1
Objectives.....	3
Stakeholder and Agency Involvement	3
Chapter 2 Study Area	5
Description of Dixon Creek	5
Climatic Conditions.....	5
Land Use and Land Cover	6
Regulated Sources.....	10
Wastewater Discharge Facilities	10
Regulated Stormwater	10
Concentrated Animal Feeding Operations.....	10
Potential Unregulated Sources	10
Non-Permitted Agricultural Activities and Domesticated Animals.....	11
Wildlife	12
Feral Hogs	12
Failing On-Site Sewage Facilities.....	12
Historical Information on Recreational Use	12
Chapter 3 Study Methodology	15
Survey Methodology	15
Site Reconnaissance and Site Selection Strategy.....	15
Survey Site Descriptions	16
Field Survey Data Collection Activities	20
Average Depth at Thalweg and Substantial Pool Depths	20
Observational /Anecdotal Data	23
Photographs.....	23

Chapter 4 Survey Results	25
General Description of Stream and Survey Sites	25
<i>Physical Description of DX001.....</i>	<i>32</i>
<i>Physical Description of DX002.....</i>	<i>33</i>
<i>Physical Description of DX003.....</i>	<i>35</i>
<i>Physical Description of DX004.....</i>	<i>37</i>
<i>Physical Description of DX005.....</i>	<i>39</i>
<i>Physical Description of DX006.....</i>	<i>42</i>
<i>Physical Description of DX007.....</i>	<i>44</i>
<i>Physical Description of DX008.....</i>	<i>46</i>
Chapter 5 Observations and Interviews	49
Activities Observed.....	49
Activities Interviewed.....	49
Chapter 6 RUAA Summary	51
References.....	55

List of Figures

Figure 1-1	Watershed of Dixon Creek (0101A).	2
Figure 2-1	Monthly average precipitation and snowfall for Borger, Texas. Source: WRCC (2013) based on normals for 1981-2010.....	5
Figure 2-2	Monthly average maximum and minimum air temperatures for Borger, Texas compared to RUAA guidance for field surveys. Source: WRCC (2013) based on normals for 1981-2010 and TCEQ (2012).	6
Figure 2-3	Land Use and land cover of the Dixon Creek watershed (0101A). Source: 2006 National Land Cover Database.	9
Figure 3-1	RUAA site locations along Dixon Creek (0101A) and other features of interest within the Dixon Creek watershed.	17
Figure 4-1	Photograph of Dixon Creek at Site DX001 taken on July 27, 2013 of the upstream view of the 300-m transect.	32
Figure 4-2	Photograph of Dixon Creek Site DX001 taken on July 27, 2013 of the upstream view of the 30-m transect.	33
Figure 4-3	Photograph of Dixon Creek at Site DX002 taken on May 25, 2013 of the downstream view of the 150-m transect.....	34
Figure 4-4	Photograph of Dixon Creek at Site DX002 taken on July 27, 2013 showing the small pockets of water encountered during the second survey.	35

Figure 4-5	Photograph of Dixon Creek at site DX003 taken on May 25, 2013 of the upstream view of the 30-m transect.	36
Figure 4-6	Photograph of Dixon Creek at Site DX003 taken on May 25, 2013 of the upstream view of the 300-m transect.	37
Figure 4-7	Photograph of Dixon Creek at Site DX004 taken on May 25, 2013 of the upstream view of the 300-m transect.	38
Figure 4-8	Photograph of Dixon Creek at Site DX004 taken on May 25, 2013 of the upstream view of the 150-m transect.	39
Figure 4-9	Photograph of Dixon Creek at Site DX005 taken May 25, 2013 of the downstream view of the 30-m transect showing the barbed-wire fence.	40
Figure 4-10	Photograph of Dixon Creek near Site DX005 taken on May 25, 2013 showing the no trespassing sign at the property entrance.....	41
Figure 4-11	Photograph of Dixon Creek at Site DX005 taken on May 25, 2013 of the upstream view of the 150-m transect.	41
Figure 4-12	Photograph of Dixon Creek at Site DX005 taken on July 27, 2013 showing the pocket of water, which was encountered during both surveys.....	42
Figure 4-13	Photograph of Dixon Creek at Site DX006 taken May 25, 2013 of the upstream view of the 300-m transect.	43
Figure 4-14	Photograph of Dixon Creek at Site DX006 taken July 27, 2013 of the upstream view of the 30-m transect.	44
Figure 4-15	Photograph of Dixon Creek at Site DX007 taken May 25, 2013 of the downstream view of the 300-m transect.....	45
Figure 4-16	Photograph of Dixon Creek at Site DX007 taken July 27, 2013 of the upstream view of the 30-m transect showing the sunflowers.	46
Figure 4-17	Photograph of Dixon Creek at Site DX008 taken May 25, 2013 of the downstream view of the 300-m transect.....	47
Figure 4-18	Photograph of Dixon Creek at Site DX008 taken taken July 27, 2013, of the downstream view of the 30-m transect showing the sunflowers.....	48
Figure 6-1	Summary of observed and interviewed human activities on Dixon Creek..	52

List of Tables

Table 2-1	Land use/land cover classes within the Dixon Creek watershed.	7
Table 2-2	Estimated livestock numbers within the Dixon Creek watershed based on statistics for Hutchinson and Carson Counties adjusted for the percent of the county represented by the watershed (2.78% of Hutchinson County and 0.33% of Carson County).	11
Table 3-1	Location and description of RUAA monitoring sites.	18
Table 3-2	Rainfall records with maximum and minimum temperature for Borger, Texas 30 days prior to the first RUAA survey initiated on May 25, 2013.....	21

Table 3-3 Rainfall records with maximum and minimum temperatures for Borger, Texas 30 days prior to the second RUAA survey initiated on July 27, 2013. 22

Table 4-1 Stream Channel and corridor appearance for each site sampled along Dixon Creek (0101A) 26

Table 4-2 Thalweg depth, stream flow type, and site accessibility during two surveys of Dixon Creek (0101A). 27

Table 4-3 Description of surveyed stream sites along Dixon Creek during first survey performed in May 2013..... 28

Table 4-4 Description of surveyed stream sites along Dixon Creek during second survey performed in July 2013. 29

Table 4-5 Stream aesthetics and wildlife observations along Dixon Creek during first survey performed in May 2013..... 30

Table 4-6 Stream aesthetics and wildlife observations along Dixon Creek during first survey performed in July 2013. 31

Table 5-1 Summary of recreational activities noted in interviews for Dixon Creek. 50

Chapter 1 Introduction

Problem Statement

Dixon Creek is an unclassified water body identified for assessment purposes by the Texas Commission on Environmental Quality (TCEQ) as water body 0101A. Dixon Creek (0101A) initiates in Carson County and stretches north about 20 miles primarily through Hutchinson County before flowing into the Canadian River (Figure 1-1). The Dixon Creek watershed is primarily rural but includes portions of the City of Borger, Texas. Dixon Creek has two assessment units (AUs). Assessment Unit 0101A_01 is described as extending from the confluence with the Canadian River upstream to the confluence with the permitted outfall receiving waters tributary, and AU 0101A_02 is described as extending from the confluence with the permitted outfall receiving waters tributary to the confluence of the East, Middle, and West Forks of Dixon Creek (TCEQ, 2013). Dixon Creek (AU 0101A_01) was first listed for bacteria in 2000 and is also included in the 2012 Texas Integrated Report as impaired due to depressed dissolved oxygen concentrations and elevated selenium concentrations (TCEQ, 2013). Concerns along Dixon Creek according to the 2012 Texas Integrated Report include chlorophyll-*a* (0101A_02) and nitrate (0101A_01).

Dixon Creek has a presumed use of primary contact recreation based on the *Texas Surface Water Quality Standards* (TSWQS) (TCEQ, 2010). Prior to June 2010, as noted in the 2010 Texas Water Quality Inventory, only on two categories of recreation use, contact and noncontact, existed in Texas. In June 2010, the TCEQ adopted revisions to the TSWQS that expanded the designation of contact recreation into three categories (primary contact recreation, secondary contact recreation 1, and secondary contact recreation 2) based on varying degrees of interaction with the water, while maintaining a fourth category of noncontact recreation. These revisions were codified in the Texas Administrative Code (TAC), Title 30 Chapter 307 and became effective as a state rule on July 22, 2010 (TCEQ, 2010). As a result of these revisions to the TSWQS, all water bodies listed as impaired based on bacteria for contact recreation are scheduled to undergo a standards review to determine if primary contact recreation is appropriate or if a revision to that use category for recreation should be considered for a water body.

The TSWQS specifies a use attainability analysis (UAAs) to evaluate the presumed uses of a waterbody. To identify and assign attainable uses and criteria to individual waterbodies, UAAs evaluate physical, chemical, biological, and economic factors affecting use attainment of a waterbody (40 Code of Federal Regulations §131.10(g)). A recreational use attainability analysis (RUAA) is a specific type of UAA focused on determining the appropriate recreational use category of a waterbody, the findings of which are presented within this report for Dixon Creek (0101A).

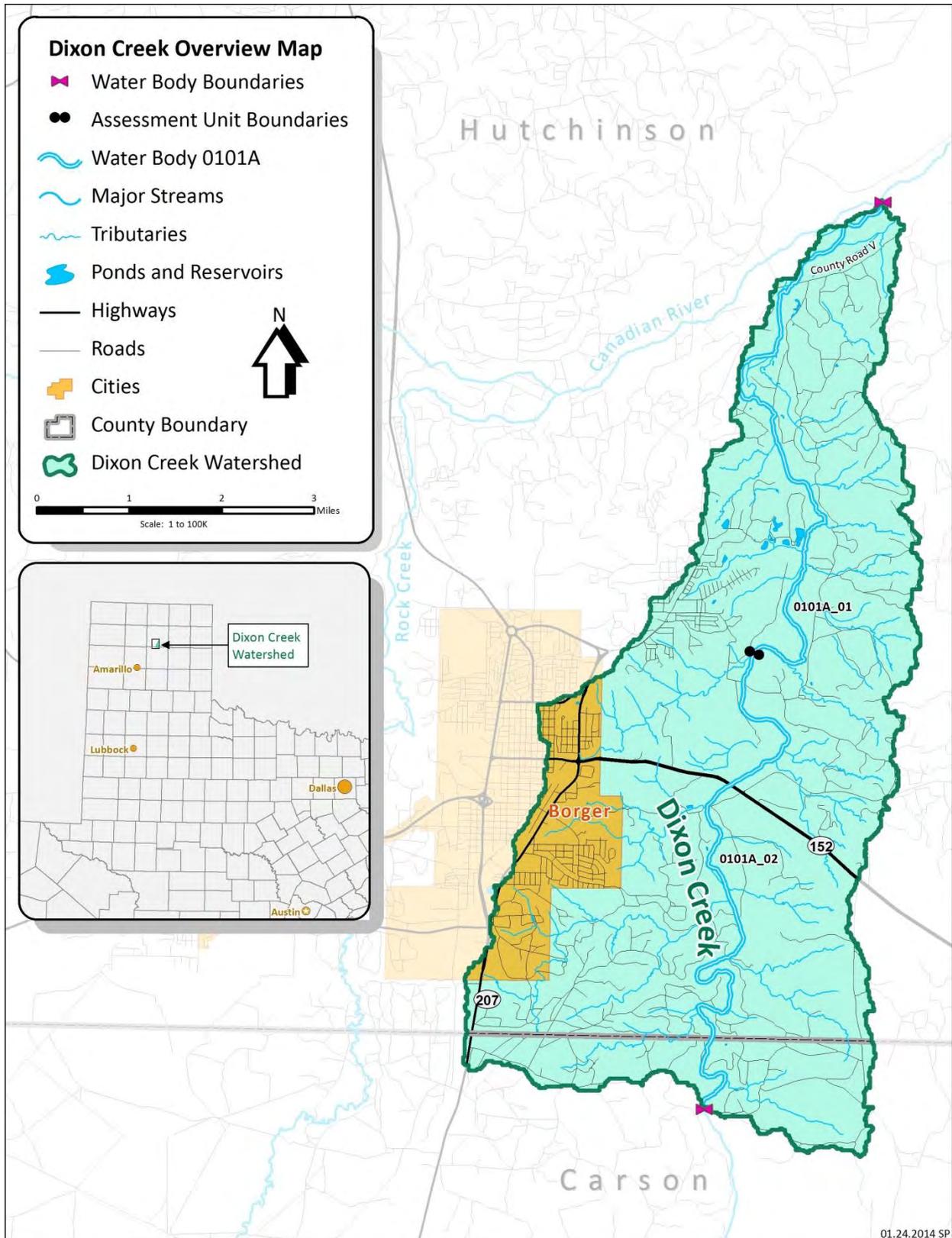


Figure 1-1 Watershed of Dixon Creek (Waterbody0101A).

Objectives

The objective of this report is to present the findings of a Comprehensive RUAA for Dixon Creek following the Texas Commission on Environmental Quality (TCEQ) February 2012 *Procedures for a Comprehensive RUAA and a Basic RUAA Survey* (TCEQ, 2012). An RUAA consists of three parts: field surveys to document waterbody characteristics and signs of recreation, interviews with stakeholders regarding past and current use of the waterbody, and a historical review regarding recreational use of the waterbody. All components of this RUAA were performed by Texas Institute for Applied Environmental Research (TIAER), which is located on the campus of Tarleton State University in Stephenville, Texas. Field surveys and interviews for the RUAA were conducted under a Texas State Soil and Water Conservation Board (TSSWCB) approved Quality Assurance Project Plan (QAPP; TIAER, 2013).

Stakeholder and Agency Involvement

The TSSWCB and its collaborating entities maintain an inclusive public participation process. From the inception of this project, the project team sought to ensure that stakeholders were informed and involved. TIAER provided coordination for public participation for this project.

Input from the TCEQ regional staff, United States Geological Survey regional staff, Texas Parks and Wildlife Department (TPWD) regional staff, TSSWCB, Hutchinson and Carson Soil and Water Conservation Districts, and other local agencies was solicited as well as input from watershed stakeholders on the need for the RUAA (see Contact Information Form available on the project website noted below). The involvement of stakeholders is recognized as the key source of information about the water body of interest, and in conducting the RUAA, can lead to improvement in the selection of survey sites.

Meetings with state agencies, river authority representatives, local officials, and stakeholders were held to give an overview of water quality issues within the Dixon Creek watershed and to obtain comments on proposed survey sites prior to field data collection. These public meetings were used to solicit input from all interested parties within the study area.

Meetings targeted local and state agencies as well as stakeholders in an effort to inform them of the assessment of water quality within Dixon Creek and the need for an RUAA. TIAER representatives met with Hutchinson County Commissioners, Borger City Council, Hutchinson Soil and Water Conservation District, Carson County Commissioners, Carson City Council, and Carson Soil and Water Conservation District. These meetings were held in Borger, Texas on January 14, January 15, February 6, and March 11, 2013, respectively.

A public meeting focusing specifically on the RUAA was held in Borger, Texas on April 16, 2013, at which all stakeholders in the watershed were invited. At this meeting input was sought on the proposed sampling sites for the Dixon Creek RUAA. Because there were some very large gaps between proposed survey sites, access to additional sites was solicited from stakeholders, as most portions of Dixon Creek are accessible only through private property.

On July 23, 2013, a Summary of Findings Meeting was held to provide an update with regard to activities conducted for the RUAA of Dixon Creek. This meeting was held to discuss findings from the initial RUAA field survey completed in May 2013. Stakeholders posed several questions

regarding how recreational use could be assessed given current dry conditions. The importance of interviews in providing feedback on past recreational use was emphasized by TIAER. Interview forms were made available at this meeting as well as through the project website. TIAER also solicited interviews from watershed stakeholders. While interviews were obtained from a number of individuals within the watershed, landowners with the creek-front property were specifically targeted for interviews at the meeting and via direct phone calls.

A final stakeholder meeting will occur in Borger, Texas during which findings of field surveys, the historical review, and interviews will be presented. The next steps of the RUAA will also be discussed at this meeting and feedback from stakeholders will be solicited. At the meeting, stakeholders will be informed of the availability of the draft RUAA report for public review and comment. The draft report will be made available via the project website and TIAER will provide hard copies if desired by individuals.

Watershed stakeholders were invited to attend public meetings through mailed invitations, public announcements (TCEQ and TSSWCB webpages), and individual phone calls. Information on past meetings for this RUAA, including minutes, presentations, and other information, can be found on the TSSWCB website: <http://www.tsswcb.texas.gov/en/managementprogram/ruaadixon>.

Chapter 2 Study Area

Description of Dixon Creek

The Dixon Creek watershed covers about 18,000 acres and includes portions of the City of Borger, Texas (estimated population 13,240). The flow type for Dixon Creek is defined by TCEQ as intermittent with pools (TCEQ, 2013), which means it generally does not flow throughout the year but does retain constant pools year round. According to the Red River Authority (RRA) 2013 Basin Highlights Report, Dixon Creek seldom has consistent flows and is often divided into two major pools (RRA, 2013). Due to contributions from industrial discharges, the lower portion of Dixon Creek often has flow, but the creek above these discharges is highly intermittent (RRA, 2004). Presumed uses for Dixon Creek (0101A) are primary contact recreation and general use. This unclassified water body was first listed on the 2000 Texas 303(d) List and every subsequent 303(d) List due to excessive bacteria and has also been listed for depressed dissolved oxygen. In 2010, water body 0101A was also listed as impaired due to elevated selenium in the water. A review of historical water quality data and a more detailed presentation of watershed characteristics for Dixon Creek is presented in the report, *Historical Review of Hydrology and Water Quality Data for Dixon Creek (0101A)* (Taylor, 2013 in draft).

Climatic Conditions

Annual precipitation for the Dixon Creek watershed was based on data for Borger, Texas. Normal precipitation (1981-2010) for Borger, Texas averages 22.9 inches with snowfall averaging 21.1 inches (WRCC, 2013). Peak rainfall months tend to be May through August with peak snowfall occurring in December and January (Figure 2-1).

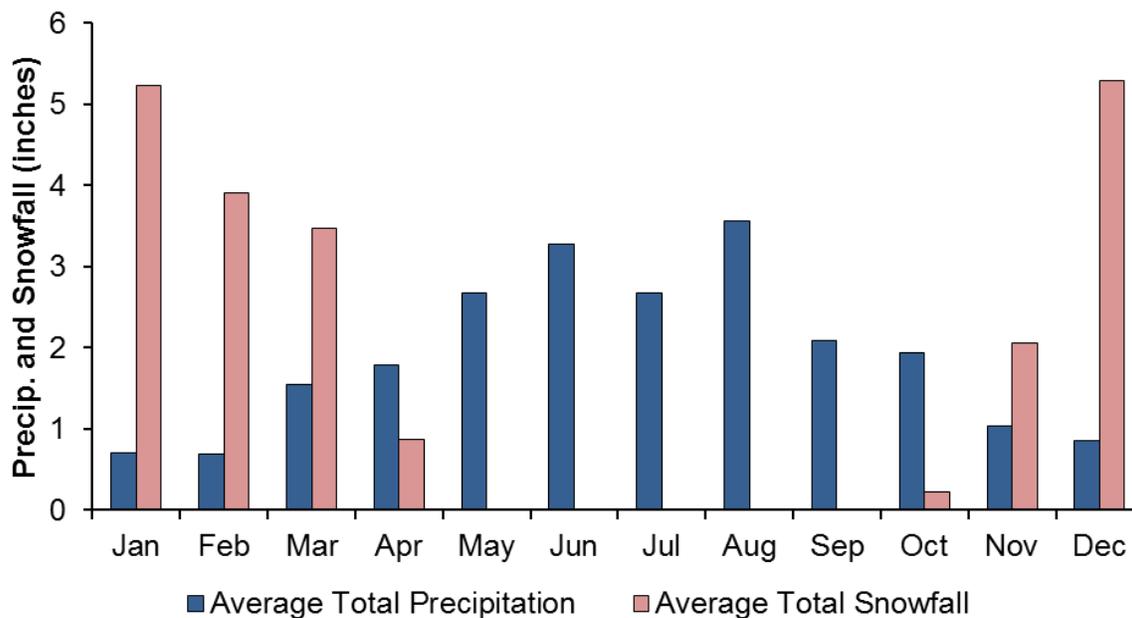


Figure 2-1 Monthly average precipitation and snowfall for Borger, Texas.

Source: WRCC (2013) based on normals for 1981-2010.

With regard to temperatures, average maximum temperatures for Borger, Texas ascend above 70° F (21° C) beginning in April and continuing through October (Figure 2-2). March through October are the months noted as generally suitable for assessing recreational use, but only if temperatures reach above 70° F (TCEQ, 2012).

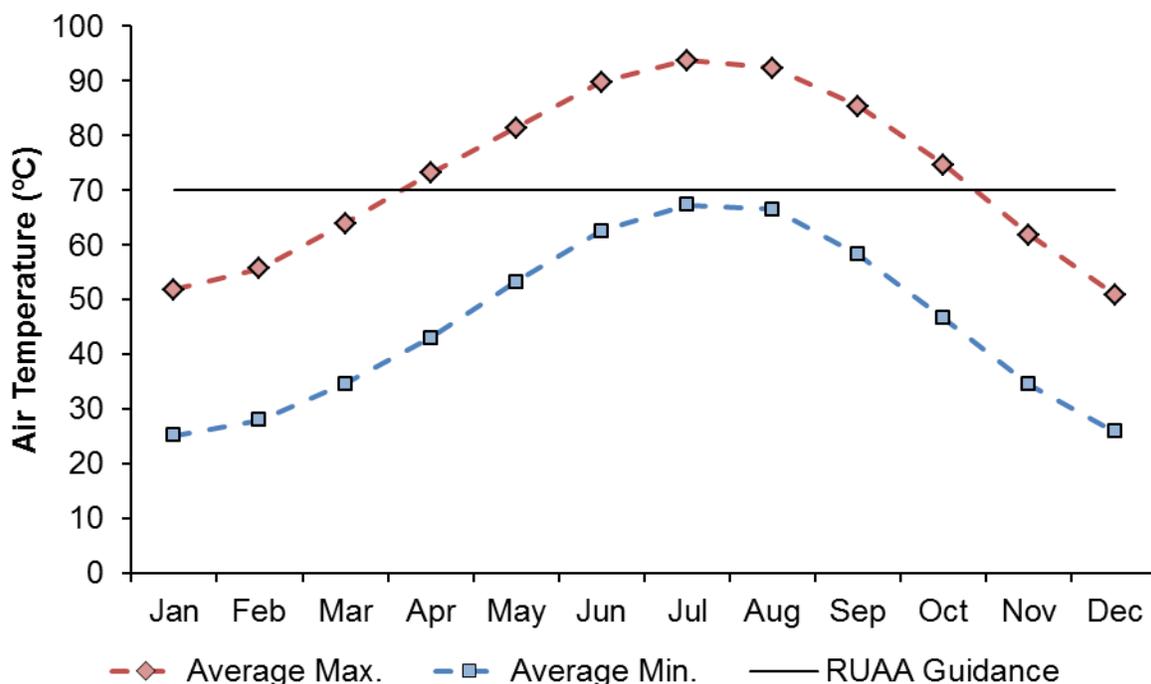


Figure 2-2 Monthly average maximum and minimum air temperatures for Borger, Texas compared to RUA A guidance for field surveys.

Source: WRCC (2013) based on normals for 1981-2010 and TCEQ (2012).

Land Use and Land Cover

The Dixon Creek watershed is in the center of the Borger oil field, where many of the early strikes that touched off the Panhandle boom of the late 1920s took place (RRA, 2004). Some refineries to the northeast of Borger still maintain operations in this region.

This area of Texas is within the Canadian/Cimarron Breaks of the Southwestern Tablelands and is comprised largely of sub-humid grassland and semiarid rangeland (Griffith et al, 2007). It is also part of the Rolling Plains vegetative region with original prairie vegetation largely comprised of tall- and midgrassess, although species, such as mesquite and pricklypear, are common invaders (Schuster and Hatch, 1990).

The land use/land cover for the Dixon Creek watershed highlights its rural natural with the dominant land use being Shrub/Scrub followed by grassland/herbaceous (Table 2-1 and Figure 2-3). Combined the developed land use classes represent only 8.26 percent of the watershed area.

Table 2-1 Land use/land cover classes within the Dixon Creek watershed.

Source: 2006 National Land Cover Database (USGS, 2013).

Class	Area (acres)	Percent (%)
Open Water	14	0.08
Developed, Open Space	237	1.32
Developed, Low Intensity	826	4.62
Developed, Medium Intensity	223	1.25
Developed, High Intensity	191	1.07
Deciduous Forest	6	0.03
Evergreen Forest	4	0.02
Shrub/Scrub	14,348	80.2
Grassland/Herbaceous	1,975	11.0
Cultivated Crops	34	0.19
Woody Wetlands	38	0.21
Total	17,895	100.0

The land use/land cover for the watershed area of Dixon Creek (0101A) was obtained from the National Land Cover Database (NLCD) maintained by the U.S. Geological Survey (USGS, 2013). The land use/land cover categories within the Dixon Creek watershed are described as follows from the NLCD legend:

- **Open Water** - areas of open water, generally with less than 25% cover of vegetation or soil.
- **Developed, Open Space** - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- **Developed, Low Intensity** - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
- **Developed, Medium Intensity** – areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
- **Developed High Intensity** - highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.

- **Deciduous Forest** - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
- **Evergreen Forest** - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
- **Shrub/Scrub** - areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
- **Grassland/Herbaceous** - areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- **Pasture/Hay** – areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
- **Cultivated Crops** – areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
- **Woody Wetlands** - areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Emergent Herbaceous Wetlands** - Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

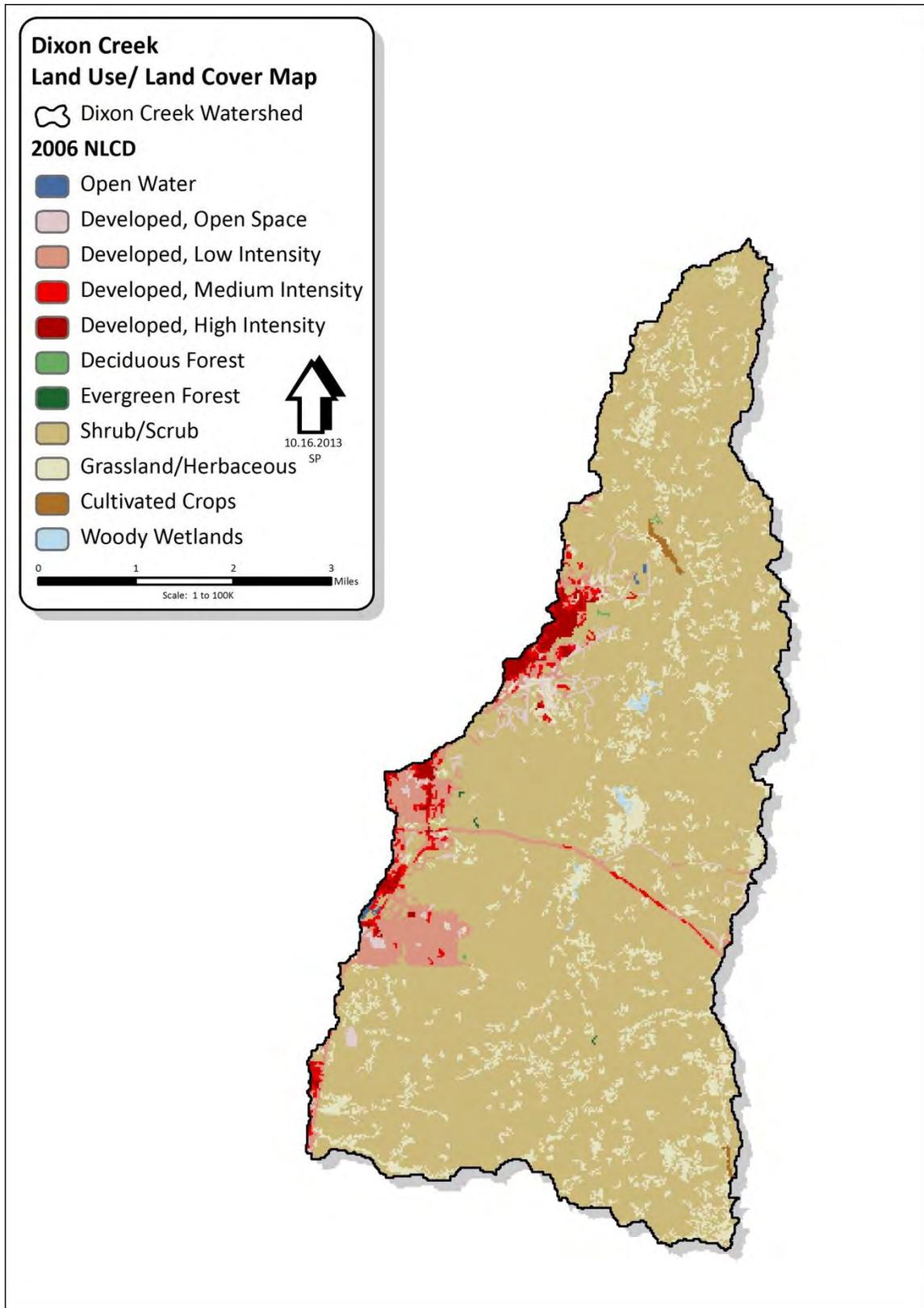


Figure 2-3 Land Use and land cover of the Dixon Creek watershed water body (0101A). Source: 2006 National Land Cover Database USGS, 2013).

Regulated Sources

Potential sources of fecal pollution, as measured by indicator bacteria *E. coli*, can be divided into two primary categories: regulated and unregulated. Pollution sources that are regulated have permits issued by TCEQ under the Texas Pollutant Discharge Elimination System (TPDES) and/or by the USEPA under the National Pollutant Discharge Elimination System (NPDES) and are generally point sources. Examples of regulated sources include domestic and industrial wastewater treatment facilities (WWTFs); stormwater from industries, construction, and municipal separate storm sewer systems (MS4s) of cities; and concentrated animal feeding operations (CAFOs). These various regulated sources are required to have either an individual permit that is specific for each facility or a general permit for operation.

Wastewater Discharge Facilities

There are two permitted industrial discharge facilities within the watershed, one associated with Conoco Phillips (EPA ID TX0009148 and TCEQ permit WQ0001064000) and the other with Chevron Phillips Chemical (EPA ID TX0095869 and TCEQ permit WQ0002484). Neither of these facilities currently have bacteria limits as part of their permit nor do they report bacteria levels as part of their discharge measurements. These two facilities have several industrial wastewater and stormwater discharge outfalls. The permitted discharge for the three wastewater outfalls of Chevron Phillips is 0.072 MGD, while the Conoco Phillips permitted discharge is 7.1 MGD. While neither facility discharges directly into Dixon Creek, these industrial discharges aid in maintaining flow in the lower third of the watershed. The primary outfall for Conoco Phillips routinely discharges about 5 MDG as a monthly average into an unnamed tributary of Dixon Creek within a quarter mile of Dixon Creek (EPA-ECHO data queried November 14, 2013).

Regulated Stormwater

The TPDES and the NPDES Municipal Separate Storm Sewer (MS4) Phase I and II rules require municipalities and certain other entities in urban areas to obtain permits for their stormwater systems. Phase I permits are individual permits for large and medium sized communities with populations exceeding 100,000, whereas Phase II permits are for smaller communities that are located within an “Urbanized Area”. An “Urbanized Area” is defined by the U.S. Census Bureau as an area with populations greater than 50,000 and with an overall population density of at least 1,000 people per square mile. The City of Borger has a total population of 13,251 based on 2010 population estimates from U.S. Census Bureau (Texas State Data Center, 2013) and is not considered to be located in an urbanized area based on population density, thus, the City of Borger is not required to obtain a permit for their stormwater system.

Concentrated Animal Feeding Operations

There are currently no permitted concentrated animal feeding operations (CAFO) located within the watershed of Dixon Creek (0101A).

Potential Unregulated Sources

Unregulated sources are typically nonpoint source in nature, meaning the pollution originates from multiple diffuse locations and is usually carried to surface waters by rainfall runoff, and the sources

are not regulated by permit under the TPDES and NPDES. Potential unregulated sources include wildlife (mammals and birds), large exotics, unmanaged feral animals (e.g., feral hogs), on-site sewage facilities (OSSFs), pets, and livestock. Sources observed during the RUAA surveys are specifically noted within the results.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby waterbodies. Livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2007). While these are county level statistics, and, thus, only a very rough estimate of livestock in the watershed (Table 2-2), these statistics indicate that a fairly large number of beef cattle may reside within the watershed. Several large ranches are located in the watershed, most notably portions of the historical Four Sixes Ranch (<http://www.6666ranch.com/>). The Red River Authority indicates that the creek is heavily utilized by local cattle ranchers as a source of water for their range livestock (RRA, 2004).

Table 2-2 Estimated livestock numbers within the Dixon Creek watershed based on statistics for Hutchinson and Carson Counties adjusted for the percent of the county represented by the watershed (2.78% of Hutchinson County and 0.33% of Carson County).

Source: USDA (2007).

County	Year	Cattle & Calves (all beef)	All Goats	All Sheep	Horses & ponies	Hogs
Hutchinson	2007	27,007	266	236	1,064	0
Carson	2007	35,912	65	0	559	685
Proportional Average for Dixon Creek Watershed	2007	869	8	7	31	2

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 1.6 dogs per household (AVMA, 2012) and about 1,500 households within the Dixon Creek watershed based on 2010 census population data (about 3,500 individuals and 2 individuals per household), there are potentially about 2,400 dogs within the Dixon Creek watershed. Most of the domestic pet population is expected to reside within the City of Borger. Other domestic animals, such as outdoor cats, also will contribute, but the number of cats is difficult to estimate as in many rural areas, domestic cats are often feral.

Wildlife

Between 2005 and 2012, average estimated whitetail deer densities ranged from 9.55 to 29.75 deer per 1,000 acres for the Panhandle/High Plains Wildlife District (TPWD, 2012); and, between 2006 and 2012, average estimated mule deer densities ranged from 3.41 to 6.51 deer per 1,000 acres within the regional management unit encompassing the Dixon Creek watershed (Gray, 2012a). Dixon Creek watershed also falls within the current pronghorn distribution range. In 2011, the Texas pronghorn population was estimated to be 14,648 (Gray, 2012b).

Feral Hogs

While feral hogs are not natural wildlife, they are an invasive, unmanaged species found throughout Texas that contributes bacteria to streams in a manner similar to native wildlife. Feral hogs are noted for moving in groups along waterways, and particularly in times of drought will congregate near perennial water sources to drink and wallow. Feral hogs are classified by TPWD as unprotected, exotic, non-game animals (Taylor, 2003). Although found throughout much of Texas, there is a scarcity of data on feral hog densities in Texas. Signs of feral hogs were encountered at several of the RUAA survey sites as noted in the field survey results.

Failing On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. The Dixon Creek watershed is very rural but also has a very low population density, particularly outside of the City of Borger. The 2010 U.S. Census Bureau (USCB) data indicates a population density for the Dixon Creek watershed outside of Borger of 1.9 people/ square mile or about 48 individuals (USCB, 2010). This assumes all individuals within the City of Borger are connected to Borger's sewer system.

Historical Information on Recreational Use

A review of historical information was performed regarding recreational water uses for Dixon Creek. 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, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review and searches.

Government Sources:

City of Borger

<http://www.ci.borger.tx.us/>

Nothing significant was found

Texas Parks and Wildlife

Jeff Bonner, Technical Guidance Biologist

Phone: 806-665-3494

Contacted on April 9, 2013 by Sarah Robinson

No significant information was given.

Library Sources:

Hutchinson County Library

<http://harringtonlc.org/hutchinson/websites/>

Phone: (806) 273-0126

Explored various links and online texts. Nothing significant was found.

Newspaper Sources:

Borger Herald News

<http://www.borgernewsherald.com/>

Phone: 806-273-5611

Explored various links and online texts. Nothing significant was found.

High Plains Observer: Hutchinson County

<http://highplainsobserverhutchinsoncounty.com>

Phone: (806) 659-5341

Explored various links and online texts. Nothing significant was found.

Internet Searches:

The Handbook of Texas Online

<http://www.tshaonline.org/>

Searched the handbook by river name. Nothing significant was found.

Family Old Photos

<http://www3.familyoldphotos.com/mainlist/tx/counties/Hutchinson+Co+TX>

Nothing significant was found.

Texas Escapes Online Magazine

<http://www.texasescapes.com/TOWNS/Borger/borger.htm>

Includes an anecdotal story from a man who grew up in a “tent city” along the banks of Dixon Creek in the 1930s or 1940s (date not clear).

<http://www.texasescapes.com/TOWNS/Borger/Borger-Texas-Dixon-Creek.htm>

Includes three pictures of Dixon Creek near Borger, Texas were found all taken in the 1920s.

No more recent use of Dixon Creek was indicated.

Chapter 3

Study Methodology

Survey Methodology

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 Dixon Creek, unclassified water body 0101A. The major field components of a Comprehensive RUAA are summarized as the following:

Site reconnaissance (completed April 2013)

Site selection (completed May 2013)

Field surveys (Survey 1: May 25-28, 2013; Survey 2: July 27-30, 2013)

The first two components, site reconnaissance and site selection, did not constitute formal data collection activities requiring an approved QAPP. These two components, however, were critical to the success of data collection activities under the last bullet; the field surveys, which included various field activities covered by a TSSWCB approved QAPP (TIAER, 2013).

Site Reconnaissance and Site Selection Strategy

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. To the degree possible, site reconnaissance was coordinated with watershed stakeholders in an effort to increase local landowner interest in water quality issues of Dixon Creek. A goal of the site reconnaissance based on the February 2012 RUAAA procedures (TCEQ, 2012), was to, if possible, locate three sites per every five miles of stream. The length of Dixon Creek (0101A) is 19.4 miles, so the goal was 12 sites for the RUAA.

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

- The location of areas along the water body that were accessible to the public and had the highest potential for recreational use, such as road crossings and parks (see Figure 3-1);
- The location of permitted wastewater outfalls and other potential point sources (see Figure 3-1);
- The hydrologic characteristics, such as stream type, streamflow, and hydrologic alterations; and
- The location of city boundaries or other designated population areas.

The site selection process took into account locations along Dixon Creek that were accessible to the public, had the highest potential for recreational use, and had TCEQ monitoring stations where historical data may have been previously collected. The site selection process also considered parks and bridge crossings along the river, as well as access through private lands adjacent to the river. Public access to Dixon Creek was limited to two road crossings, one at State Highway 152 and the other at County Road V. Although TCEQ has a surface-water sampling station located at

CR V (station 10016), fences close to the road on either side of CR V greatly limited public access to Dixon Creek at this location. Landowner permission to access creek via property on either side of CR V could not be obtained by TIAER. Because the RUAA field survey requires 300 meters of the creek to be accessed for public accessibility, this site was excluded from the RUAA field survey. Observations of Dixon Creek at the crossing of CR V for recreational activities were made from the road during both surveys, although not included as a formal survey site.

Of note, most access along Dixon Creek is available only via private property, the majority of which is held in fairly large land holdings, often bordered with high game fences. In several locations access to the creek was also restricted in that land owned by Conoco Phillips had to be accessed and traversed to reach private lands owned by others that abutted the creek. Landowners throughout the watershed with river front property were contacted regarding access to Dixon Creek for potential RUAA sites and a public meeting was held on April 16, 2013 in Borger to discuss the upcoming RUAA survey.

Although two landowners allowed access to their property for the RUAA field surveys, there were a few large gaps between stations, where access was only via private property and to which landowners denied or would not permit access. Several large ranches that border Dixon Creek were approached about the RUAA survey but opted not to participate.

Map reconnaissance and a ground survey of the study area yielded one public access location associated with a road crossing, at which private access was granted beyond the road right-a-way, and seven sites accessible only via private property (Table 3-1). While fewer than the desired 12 sites for the RUAA, the rural nature of much of the watershed and the limited number of road crossings along large stretches of the river made accessibility of the stream challenging. Landowner cooperation was essential in gaining access to much of Dixon Creek for the RUAA field surveys.

In May 2013, TIAER presented a list of proposed RUAA sites to TCEQ and TSSWCB. On May 21, 2013, TSSWCB received confirmation that TCEQ staff concur that an adequate number and spatial density of sites was selected to adhere to the RUAA guidelines. The final RUAA sites approved are noted in Figure 3-1 and Table 3-1.

Survey Site Descriptions

The location and general description of each RUAA site is provided in Table 3-1. Seven sites were selected with access exclusively via private property and one site was chosen at a public road crossing that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300 meter assessment. This public road crossing provided easy access to the stream, but a fence impeded access beyond 30 meters. Entrances to sites on private lands were limited by fences and locked gates. RUAA field surveys were performed in May and July 2013 at each of these locations. A brief description of each site follows.

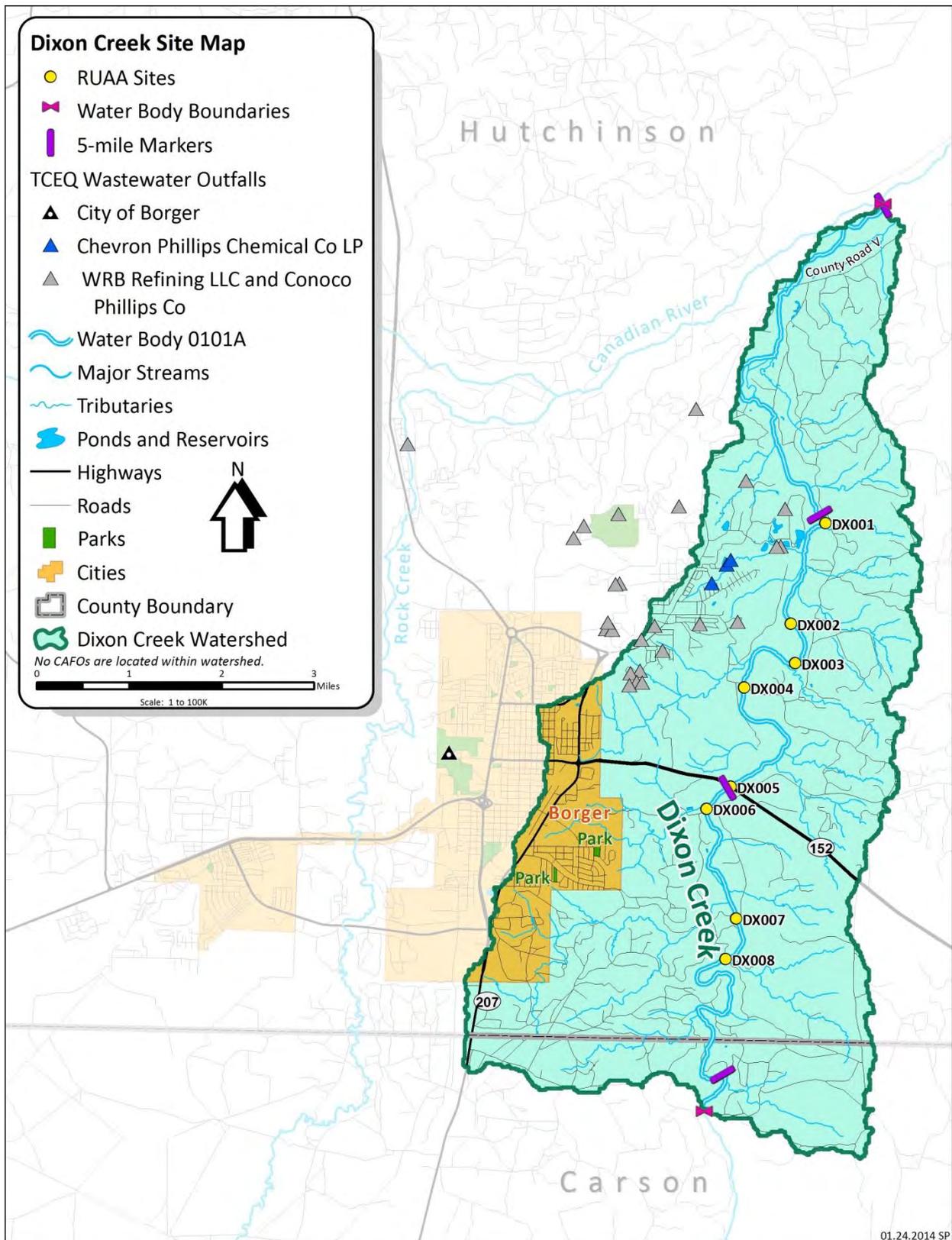


Figure 3-1 RUAA site locations along Dixon Creek (0101A) and other features of interest within the Dixon Creek watershed.

Table 3-1 Location and description of RUAA monitoring sites.

Sites are listed in downstream to upstream order. Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1m DOQQs and the NHD stream layer as reference guides.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)	Distance from Confluence (mi)	Distance from Upper Reach (mi)	Access
	DX001	Dixon Creek 4.84 river miles north of Hwy 152	35.706302	-101.3343	-	5.12	9.99	Private
	DX002	Dixon Creek 3.46 river miles north of Hwy 152	35.690383	-101.340472	1.38	6.50	8.61	Private
	DX003	Dixon Creek 2.86 river miles north of Hwy 152	35.684227	-101.339494	0.60	7.10	8.01	Private
	DX004	Dixon Creek 1.95 river miles north of Hwy 152	35.680161	-101.34921	0.91	8.01	7.10	Private
17045	DX005	Dixon Creek at SH 152, west of FM 2171, East of Borger	35.664585	-101.35132	1.95	9.96	5.15	Public ^a
	DX006	Dixon Creek 0.36 river miles south of Hwy 152	35.661016	-101.355854	0.36	10.32	4.79	Private
	DX007	Dixon Creek 1.87 river miles south of SH 152	35.643897	-101.349651	1.39	11.71	3.40	Private
	DX008	Dixon Creek 2.41 river miles south of SH 152	35.637501	-101.351495	0.58	12.29	2.82	Private

a. Access was public via a road crossing at site DX005, but private lands needed to be crossed to conduct the full 300 meter assessment.

Site DX001 is located on Dixon Creek 5.12 miles upstream of the confluence with Canadian River and 4.84 miles north of State Highway 152. Site DX001 was only accessible through fenced private property via a locked gate with the landowner serving as an escort. In addition, the landowner had to accompany TIAER field personnel through refinery property owned by Conoco Phillips. TIAER personnel were required to present identification at a guard station on the refinery property before they could access the landowner's property near the creek.

Site DX002 is located on Dixon Creek 6.50 miles upstream of the confluence with Canadian River and 3.46 miles north of State Highway 152. Site DX002 is 1.38 miles upstream of Site DX001 but on property owned by a separate landowner. Site DX002 was only accessible through fenced private property via a locked gate with the landowner serving as an escort. This site was also only accessible through property owned by Conoco Phillips.

Site DX003 is located on Dixon Creek 7.10 miles upstream of the confluence with Canadian River and 2.86 miles north of State Highway 152. Site DX003, like Site DX002, was only accessible through fenced private property via a locked gate with the landowner serving as an escort. This site was also only accessible through property owned by Conoco Phillips. Of note, Sites DX002, DX003, and DX004 were associated with the same landowner and only accessible via the same entrance requiring escort across the Conoco Phillips land.

Site DX004 is located on Dixon Creek 8.01 miles upstream of the confluence with Canadian River and 1.95 miles north of State Highway 152. Site DX004, like Sites DX002 and DX003, was only accessible through fenced private property via a locked gate with the landowner serving as an escort. Entrance to the property associated with this site was also only accessible through property owned by Conoco Phillips.

Site DX005 is located on Dixon Creek 9.96 miles upstream of the confluence with Canadian River at the bridge crossing on State Highway 152. The site was located east of Borger, Texas, just west of Farm-to-Market Road 2171. Site DX005 was only publicly accessible from the 0-m transect to the 30-m transect. The remaining length of the survey reach was only accessible through fenced private property via a locked gate with permission from the landowner.

Site DX006 is located on Dixon Creek 10.32 miles upstream of the confluence with Canadian River and 0.36 miles south of State Highway 152. Site DX006 was only accessible through fenced private property via a locked gate with permission from the landowner.

Site DX007 is located on Dixon Creek 11.71 miles upstream of the confluence with Canadian River and 1.87 miles south of State Highway 152. Site DX007 was only accessible through fenced private property via a locked gate with permission from the landowner.

Site DX008 is located on Dixon Creek 12.29 miles upstream of the confluence with Canadian River and 2.41 miles south of State Highway 152. Site DX008 was only accessible through fenced private property via a locked gate with permission from the landowner.

Field Survey Data Collection Activities

As specified in the procedures for a Comprehensive RUAA (TCEQ, 2012), two separate field surveys were conducted, one in May and one in July 2013. Both field surveys occurred during the warm season (air temperature greater than or equal to 70° F or 21° C) when human recreational activities were most likely to occur (May - September). Rainfall and temperature records 30 days prior to each survey are presented in Tables 3-2 and 3-3. Ideally, field surveys were to be conducted when stream flow conditions were normal. However, due to extended drought conditions, low flow conditions were encountered during the May 2013 survey, and in July 2013, many of the stream sites were dry as the drought conditions persisted through the summer of 2013. A total of 0.96 inches of precipitation was recorded 30-days prior to the May 2013 survey and 1.94 inches 30-days prior to the July 2013 survey for Borger, Texas. For May through September 2013, the monthly Palmer Drought Index indicated moderate to extreme drought for the High Plains region (TWDB, 2013).

Data collection activities for each of the two field surveys included the following activities at each RUAA site:

- Measurement of average depth at thalweg (deepest depth);
- Measurement of depths, lengths, and widths of substantial pools;
- Reporting of observational/anecdotal data required on the RUAA field forms; and
- Photographing any signs of recreation and site conditions including upstream, downstream, left bank, and right bank photos at the top, middle, and bottom transects.

Average Depth at Thalweg and Substantial Pool Depths

Determination of thalweg and substantial pool depths is applicable to contact recreation use determination for intermittent and perennial freshwaters according to TCEQ (2012). The thalweg is defined as the deepest depth of a transect perpendicular to the stream channel. A substantial pool was considered a pool greater than 1-m (3.28-ft) deep and 10-m (32.8-ft) long for the purposes of a RUAA Survey (TCEQ, 2012).

As instructed in the RUAA procedures (TCEQ, 2012), a 300-m (984-ft) reach at each station was evaluated to determine average thalweg depth. Eleven transects at 30-m (98.4-ft) intervals were established in the 300-m stream reach bracketing each station. Each reach surveyed was oriented downstream to up, the 0-m transect was always set as the most downstream and the 300-m transect as the most upstream. All transect distances including thalweg depths and pool depths and lengths are presented in units of meters per the RUAA procedures (TCEQ, 2012).

Table 3-2 Rainfall records with maximum and minimum temperature for Borger, Texas 30 days prior to the first RUAA survey initiated on May 25, 2013.

Survey date is highlighted in gray. Data obtained from the National Weather Service for Station ID: GHCND:USW00003024 located at the Borger Hutchinson County Airport.

Date	Daily Precipitation (in.)	Maximum Daily Temperature (° F)	Minimum Daily Temperature (° F)
26-Apr-13	0	79	52
27-Apr-13	0	81	44
28-Apr-13	0	89	57
29-Apr-13	0	94	64
30-Apr-13	0	96	65
1-May-13	0	72	35
2-May-13	0	52	34
3-May-13	0	69	30
4-May-13	0	70	36
5-May-13	0	70	38
6-May-13	0	77	50
7-May-13	0	85	50
8-May-13	0	88	57
9-May-13	0.75	79	52
10-May-13	0	70	52
11-May-13	0.02	77	49
12-May-13	0	86	52
13-May-13	0	93	62
14-May-13	0	89	63
15-May-13	0	88	62
16-May-13	0	90	57
17-May-13	0	96	61
18-May-13	0	100	73
19-May-13	0	88	64
20-May-13	0	85	58
21-May-13	0.19	75	52
22-May-13	0	91	54
23-May-13	0	82	61
24-May-13	0	88	64
25-May-13	0	91	62

Table 3-3 Rainfall records with maximum and minimum temperatures for Borger, Texas 30 days prior to the second RUA survey initiated on July 27, 2013.

Survey date is highlighted in gray. Data obtained from the National Weather Service for Station ID: GHCND:USW00003024 located at the Borger Hutchinson County Airport.

Date	Daily Precipitation (in.)	Maximum Daily Temperature (° F)	Minimum Daily Temperature (° F)
28-Jun-13	0	99	71
29-Jun-13	0	97	72
30-Jun-13	0.03	88	69
1-Jul-13	0	85	62
2-Jul-13	0	86	57
3-Jul-13	0.08	83	62
4-Jul-13	0.01	92	63
5-Jul-13	0	98	71
6-Jul-13	0	99	76
7-Jul-13	0	99	75
8-Jul-13	0	100	75
9-Jul-13	0	101	79
10-Jul-13	0	101	80
11-Jul-13	0	98	74
12-Jul-13	0	101	78
13-Jul-13	0	103	76
14-Jul-13	0.08	91	61
15-Jul-13	0.01	80	60
16-Jul-13	0.78	74	62
17-Jul-13	0.05	80	67
18-Jul-13	0	86	68
19-Jul-13	0	92	70
20-Jul-13	0.76	93	69
21-Jul-13	0	95	73
22-Jul-13	0	98	75
23-Jul-13	0	101	76
24-Jul-13	0.07	94	68
25-Jul-13	0.07	83	68
26-Jul-13	0	87	68
27-Jul-13	0	92	63

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 depth of greater than (>) the deepest measurable depth was reported.

Observational /Anecdotal Data

Anecdotal information was recorded during all surveys on field data sheets from the TSSWCB-approved QAPP (TIAER, 2013).

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

- channel flow status with regard to flow severity,
- stream type (e.g., ephemeral, intermittent, etc.),
- general weather conditions (cloud cover/rain),
- substrate type,
- stream accessibility, and
- anecdotal information related to observed human contact activities.

Photographs

TIAER staff created photographic records of each site during the field surveys. Photographs included an upstream view, left and right bank views, downstream view (as described in the Field Data Sheets), and any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs were intended to clearly depict the entire channel and were taken specifically at the top, middle, and bottom transects for the reach. Any items of interest, e.g., obstructions, were also photographed. Photographs were used to document evidence of recreational use (e.g., fishing tackle) and actual recreation, if encountered. Photographs were also used to document a lack of use (e.g., dry creek beds) or impediments to recreational use. In addition as part of the overall project, photographs were also taken to indicate potential bacteria sources to the waterbody. All photographs were cataloged in a manner that indicates the site location, date, view orientation, and what is being shown and will be submitted to the TSSWCB as part of the RUAA data packet. Selected photos representative of each RUAA field site are included in Chapter 4 along with the results of both surveys.

Chapter 4

Survey Results

General Description of Stream and Survey Sites

The RUAA surveys were conducted on May 25 and July 27, 2013 at all eight sites. The field surveys were performed on weekends at opportune times to observe recreational activities in and around Dixon Creek.

The field surveys were conducted during varying air temperatures as shown in Tables 3-2 and 3-3. Air temperatures during both surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities. At the time of the initial RUAA surveys on Dixon Creek the Palmer Drought Index (PDI) indicated severe hydrological drought conditions (NOAA, 2013). Total rainfall for the 30 days preceding the first survey was 0.96 inches (April 26 through May 24, 2013). Total rainfall for the 30 days preceding the second survey date was 1.94 inches (June 28 through July 26, 2013). No rain fell during either survey.

Table 4-1 displays the appearance of the stream channel and corridor at each site.

Table 4-2 shows the average thalweg depth for each site during each of the RUAA surveys. Access (public or private) to each site and the level of effort needed to access the stream from the streambank at each site is also provided in Table 4-2. Dixon Creek (0101A) was 19.4 miles long and the overall average thalweg depth was 0.07 m for both survey trips. The overall stream was considered intermittent with perennial pools, although specific sites may be dry when assessed.

Tables 4-3 and 4-4 show the maximum, minimum, and typical average widths at each site for each survey. The observed flow is also listed for each site per survey.

Stream aesthetics and wildlife observations are reported in Tables 4-5 and 4-6 for each site and survey. In general, the majority of observed tracks and fecal droppings reported in the tables are wildlife origin. Wildlife tracks included birds, raccoon, deer, canine, feline and feral hogs. Livestock tracks included cattle and horse. Observed trash was predominantly plastics and aluminum cans and was most common at the one public access bridge crossing, though no evidence of major dumping was observed. Trash on private lands, which was rarely observed, consisted of typical plastic cups, bottles, and sacks.

Table 4-1 Stream Channel and corridor appearance for each site sampled along Dixon Creek (0101A)

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
DX001	Natural	Mud/Clay	Shrub with herbaceous marsh	Large	No	Native
DX002	Natural	Sand	Shrub	Large	No	Native
DX003	Natural	Mud/Clay	Shrub	Large	No	Native
DX004	Natural	Mud/Clay	Shrub	Large	No	Native
DX005	Natural	Mud/Clay	Pasture	Large	No	Native
DX006	Natural	Mud/Clay	Shrub on left Pasture on right	Large	No	Native
DX007	Natural	Mud/Clay	Pasture	Large	No	Native
DX008	Natural	Sand	Pasture	Large	No	Native

Table 4-2 Thalweg depth, stream flow type, and site accessibility during two surveys of Dixon Creek (0101A).

a. Stream flow type represents TCEQ water body description (TCEQ, 2013).

Site	Transect length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type ^a	General Access	Bank Access ^b
DX001	300	11	0	0.34	0.36	Intermittent w/ Perennial pools	Private	E
DX002	300	11	0	0.00	0.00	Intermittent w/ Perennial pools	Private	E
DX003	300	11	0	0.00	0.00	Intermittent w/ Perennial pools	Private	E
DX004	300	11	0	0.16	0.19	Intermittent w/ Perennial pools	Private	E
DX005	300	11	0	0.03	0.03	Intermittent w/ Perennial pools	Public ^c	E
DX006	300	11	0	0.00	0.00	Intermittent w/ Perennial pools	Private	E
DX007	300	11	0	0.00	0.00	Intermittent w/ Perennial pools	Private	E
DX008	300	11	0	0.00	0.00	Intermittent w/ Perennial pools	Private	E

b. Bank access categorized as E = Easy, ME = Moderately Easy, MD = Moderately Difficult, or D = Difficult.

c. Publicly accessible only at the bridge crossing the stream.

Table 4-3 Description of surveyed stream sites along Dixon Creek during first survey performed in May 2013.

Site Number	Maximum width (m)	Minimum width (m)	Typical Average Width (m)	Observed Flow
DX001	64.0	0.4	25.0	Normal
DX002	0.0	0.0	0.0	Dry
DX003	0.0	0.0	0.0	Dry
DX004	14.0	0.0	0.0	No Flow
DX005	4.6	0.0	0.0	No Flow
DX006	0.0	0.0	0.0	Dry
DX007	0.0	0.0	0.0	Dry
DX008	0.0	0.0	0.0	Dry

Table 4-4 Description of surveyed stream sites along Dixon Creek during second survey performed in July 2013.

Site Number	Maximum width (m)	Minimum width (m)	Typical Average Width (m)	Observed Flow
DX001	40.0	2.8	15.0	Low
DX002	0.0	0.0	0.0	Dry
DX003	0.0	0.0	0.0	Dry
DX004	14.2	0.0	0.0	No Flow
DX005	5.5	0.0	0.0	No Flow
DX006	0.0	0.0	0.0	Dry
DX007	0.0	0.0	0.0	Dry
DX008	0.0	0.0	0.0	Dry

Table 4-5 Stream aesthetics and wildlife observations along Dixon Creek during first survey performed in May 2013.

(From Field Data Sheet-Section F). A = Absent, R = rare, C = Common, N = None, SP = Slight Presence, MP = Moderate Presence, LP = Large Presence, and NA = not applicable due to lack of water.

Station	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
DX001	C	C	N	Clear	Sludge	Clear	SP	MP	N	Tracks/Fecal	N	R	R
DX002	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	R	R
DX003	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	R	R
DX004	A	A	N	Brown	Sludge	Clear	N	N	N	Tracks/Fecal	N	R	R
DX005	A	A	N	Clear	Fine sediment	Clear	MP	N	N	Tracks/Fecal	N	R	R
DX006	A	A	N	NA	Fine sediment	NA	N	N	LP	Fecal	C	R	N
DX007	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal/Nests	N	R	N
DX008	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	R	R

Table 4-6 Stream aesthetics and wildlife observations along Dixon Creek during first survey performed in July 2013.

(From Field Data Sheet-Section F). A = absent, R = rare, C = common, Ab = abundant, N = none, SP = slight presence, MP = moderate presence, LP = large presence, and NA = not applicable due to lack of water.

Station	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
DX001	Ab	R	C	Brown	Fine sediment	Clear	SP	N	N	Tracks/Fecal/Nests	N	R	N
DX002	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	N	N
DX003	A	A	N	NA	Fine sediment	NA	SP	N	N	Tracks/Fecal	R	R	N
DX004	A	A	N	NA	Fine sediment	Clear/oil sheen	N	N	N	Tracks/Fecal	R	R	N
DX005	A	A	N	Brown	Fine sediment	Clear	N	N	MP	Tracks/Fecal	N	R	R
DX006	A	A	N	NA	Fine sediment	NA	N	N	MP	Tracks/Fecal	C	R	N
DX007	A	A	N	NA	Fine sediment	NA	N	N	MP	Tracks/Fecal/Nests	N	N	N
DX008	A	A	N	NA	Fine sediment	NA	N	N	MP	Tracks/Fecal	N	N	N

Physical Description of DX001

Dixon Creek at site DX001 was visited on May 25 and July 27, 2013. This site, located northeast of Borger, Texas in Hutchinson County, was accessible only through private lands that were fenced and locked. In addition to requiring landowner permission to access the site, the landowner had to accompany field personnel through refinery property owned by Conoco Phillips. TIAER personnel and the landowner had to provide photographic identification and vehicle information to drive through refinery property to reach the landowner's property. Once on the landowner's property, TIAER personnel had to drive approximately one mile through private property to reach the site. The site is located in a shrub dominated corridor for the upper half of the reach and herbaceous marsh for the lower half of the reach (Table 4-1). At the site, access to the stream was easy (Table 4-2). In certain areas, the bank easily sloughed off, but the banks were not steep and water depths were relatively shallow with an average thalweg depth of 0.35 m (1.15 ft) for both trips (Table 4-2). The photographs in Figures 4-1 and 4-2 depict the appearance of the site. Table 4-1 describes the stream channel and riparian zone appearance of this site.



Figure 4-1 Photograph of Dixon Creek at Site DX001 taken on July 27, 2013 of the upstream view of the 300-m transect.



Figure 4-2 Photograph of Dixon Creek Site DX001 taken on July 27, 2013 of the upstream view of the 30-m transect.

Site DX001 was wadeable for the entire 300-m reach length. The only flow observed was from the permitted discharge from the Conoco Phillips facility into the stream. Water depths during both surveys were predominately less than 0.5 meters (1.6 ft) deep. Wading in the stream was challenging due to the mud/clay bottom with sludge deposits. Additionally, in the lower half of the reach, dense vegetation consisting of cattails made wading more difficult. The flows observed were considered normal for this location and typical stream widths varied from 25 m (82 ft) in May to 15 m (49 ft) in July with maximum and minimum widths from both surveys occurring in May (Tables 4-3 and 4-4).

Aesthetic appearance of the water and wildlife observations for the site during each survey are summarized in Tables 4-5 and 4-6, respectively. There was a slight presence of snakes during both of surveys and a moderate presence of birds observed during the first survey consisting of ducks and blue heron. Bird nests were observed during both surveys. Tracks observed during each trip consisted of cattle, deer, raccoon, hog, and bird. Various types of feces were also found throughout the reach. As shown in the pictures of Figures 4-1 and 4-2, the water was clear in color with no scum or foam on the surface. Aquatic vegetation was common, especially in the lower half of the reach consisting of cattails, duckweed, and some algae. Trash was rarely observed and when encountered, consisted of typical plastic cups, bottles, and sacks.

Physical Description of DX002

Dixon Creek at site DX002 was visited on May 25 and July 27, 2013. This site, located east of Borger, Texas in Hutchinson County, was accessible only through private lands that were fenced

and locked. In addition to requiring landowner permission to access the site, the landowner had to accompany field personnel through a refinery owned by Conoco Phillips. TIAER personnel and the landowner had to provide photographic identification and vehicle information to drive through refinery property to reach the landowner's property. Once through the Conoco Phillips property, TIAER personnel traveled through a locked gate approximately one-half mile through the property to reach the site. The site is located in a shrub dominated corridor for the entire length of the reach as noted in Table 4-1 and depicted in Figure 4-3. At the site, access to the stream was easy due to very low banks and the lack of flowing water (Table 4-2). Table 4-1 summarizes the stream channel and riparian zone appearance of this site.



Figure 4-3 Photograph of Dixon Creek at Site DX002 taken on May 25, 2013 of the downstream view of the 150-m transect.

Site DX002 was wadeable for the entire 300-m reach length in that limited water was encountered. Most of the reach was dry except for a few small pockets of water at various locations. Figure 4-4 depicts the water observed at the site. The water depth recorded at each transect for both surveys was 0 meters. Walking in the stream was easy due to the dry mud/clay bottom. As the stream at transect sites was dry during both visits, minimum, maximum and typical average stream widths were also 0 m (Tables 4-3 and 4-4).



Figure 4-4 Photograph of Dixon Creek at Site DX002 taken on July 27, 2013 showing the small pockets of water encountered during the second survey.

Aesthetic appearances of the water and wildlife observations for the site during each survey are provided in Tables 4-5 and 4-6, respectively. Due to the lack of water, aquatic vegetation and algae were absent from the stream. No vertebrates or mammals were observed during either survey. Fecal droppings and animal tracks observed during both surveys were identified as cattle, raccoon, bird, and canine.

Physical Description of DX003

Dixon Creek at site DX003 was visited on May 25 and July 27, 2013. This site, located east of Borger, Texas in Hutchinson County, was accessible only through private lands that were fenced and locked. This site was owned by the same landowner as Site DX002 with the same access point requiring the landowner to accompany field personnel through property owned by Conoco Phillips. As noted above, TIAER personnel and the landowner had to provide photographic identification and vehicle information to drive through the refinery to reach the landowner's property. Once through the Conoco Phillips property, TIAER personnel traveled through a locked gate approximately one-half mile to reach this site. At the site, access to the stream was easy due to very low banks and the lack of flowing water (Table 4-2). The site is located in a shrub dominated corridor for the entire length of the reach as depicted in Figures 4-5 and 4-6. Table 4-1 summarizes the stream channel and riparian zone appearance of this site.



Figure 4-5 Photograph of Dixon Creek at site DX003 taken on May 25, 2013 of the upstream view of the 30-m transect.

Site DX003 was easily wadeable for the entire 300-m reach length due to a lack of water. Water depths recorded at each transect for both surveys were 0 meters, although small pockets of water were encountered during the second survey in July 2013, similar to those noted for DX002. As the stream at transect sites was dry during both visits, minimum, maximum and typical average stream widths were 0 m (Tables 4-3 and 4-4).

Aesthetic appearances of the water and wildlife observations for the site during each survey are provided in Tables 4-5 and 4-6, respectively. Due to the lack of water, aquatic vegetation and algae were absent from the stream. No vertebrates or mammals were observed during either survey. Cattle, deer and hog tracks were observed during both surveys as well as fecal droppings. Garbage, which was almost non-existent, consisted of three tires and typical plastics.



Figure 4-6 Photograph of Dixon Creek at Site DX003 taken on May 25, 2013 of the upstream view of the 300-m transect.

Physical Description of DX004

Dixon Creek at site DX004 was visited on May 25 and July 27, 2013. This site, located east of Borger, Texas in Hutchinson County, was accessible only through private lands that were fenced and locked. Like Sites DX002 and DX003, permission was sought and granted from the private landowner who then had to accompany field personnel through a refinery owned by Conoco Phillips. Photographic identification and vehicle information was required to proceed through refinery property to reach the landowner's property. Once through the Conoco Phillips property, TIAER personnel traveled through a locked gate approximately one-quarter mile through the property to reach the site. This site was owned by the same landowner as Sites DX002 and DX003. At the site, access to the stream was easy due to very low banks and either pooled or dry conditions with average thalweg depths averaging less than 0.2 m (0.7 ft, Table 4-2). The site is located in a shrub dominated corridor for the entire length of the reach as noted in Table 4-1 and depicted in both photographs of Figures 4-7 and 4-8. Table 4-1 further describes the stream channel and riparian zone appearance of this site.



Figure 4-7 Photograph of Dixon Creek at Site DX004 taken on May 25, 2013 of the upstream view of the 300-m transect.

Site DX004 was wadeable for the entire 300-m reach length. One pool was identified within the reach from around the 150-m transect to around the 240-m transect (Figure 4-8). Total length of the pool was 107 meters (351 ft) with a maximum width of 14 meters (46 ft). Maximum depth of the pool was 0.62 meters (2.0 ft). The mud/clay dominant substrate made for easy walking except for within the one identified pool. Sludge and fine sediment in the bottom of the pool made wading challenging. While the typical width of the stream at Site DX003 was 0 m, the maximum width was 14 m (46 ft), as recorded for the pool (Tables 4-3 and 4-4).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4-5 and 4-6, respectively. Aquatic vegetation and algae were absent from the stream even when water was present. No vertebrates or mammals were observed during either survey. Cattle, deer, canine, bird and hog tracks were observed during both surveys as well as fecal droppings. Garbage, which was almost non-existent, consisted of tires, cigarette butts, shotgun shells, and typical plastics.



Figure 4-8 Photograph of Dixon Creek at Site DX004 taken on May 25, 2013 of the upstream view of the 150-m transect.

Physical Description of DX005

Dixon Creek at site DX005 was visited on May 25 and July 27, 2013. This site, located on State Highway 152 east of Borger, Texas in Hutchinson County. Although the site is publicly accessible, it is only accessible from the 0-m transect to the 30-m transect. A barbed-wire fence located at the 30-m transect would impede travel further upstream. Figure 4-9 depicts the barbed-wire fence near the highway bridge. Access to the creek through private lands beyond the 30-m transect was fenced and locked. This site was owned by the same landowner as Sites DX002, DX003, and DX004; however, travel through refinery owned property was not required. With landowner permission, TIAER field personnel crossed a cattle guard and through a pasture just inside the property fence line to reach the site. There was a no trespassing sign located at the property entrance as shown in Figure 4-10. At the site, access to the stream was easy due to very low banks and the lack of flowing water with thalweg depths averaging 0.03 m (0.1 ft, Table 4-2). The site is located in a pasture dominated corridor for the entire length of the reach as noted in Table 4-1 and depicted in Figure 4-11. Table 4-1 summarizes the stream channel and riparian zone appearance of this site.



Figure 4-9 Photograph of Dixon Creek at Site DX005 taken May 25, 2013 of the downstream view of the 30-m transect showing the barbed-wire fence.

Site DX005 was wadeable for the entire 300-m reach length as only one area of water was encountered. This area with water was located between the 50-m transect and the 110-m transect as depicted in Figure 4-12. With depths of 0.25 meters (0.82 ft) or less, TIAER personnel did not identify this as a significant pool. Dimensions of this pocket of water were between 4.6 m (15 ft) to 5.5 m (18 ft) wide and approximately 60 m (20 ft) long during both of the surveys. The mud/clay dominant substrate made for easy walking except along the one identified pocket of water. Fine sediment on top of a clay bottom made wading challenging in the areas with water present. Typical widths encountered were 0 m with dry conditions noted for most transects, while maximum widths were associated with the one area with water (Tables 4-3 and 4-4).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4-5 and 4-6, respectively. Aquatic vegetation and algae were absent from the stream even when water was present. There was a moderate presence of snakes during the first survey and a moderate presence of livestock, as horses, during the second survey. No other vertebrates or mammals were observed during either survey. Cattle, deer, raccoon, bird, and horse tracks were observed during both surveys as well as fecal droppings. Garbage, which was rare, consisted of a tire, cups, cans, and a five-gallon bucket.



Figure 4-10 Photograph of Dixon Creek near Site DX005 taken on May 25, 2013 showing the no trespassing sign at the property entrance.



Figure 4-11 Photograph of Dixon Creek at Site DX005 taken on May 25, 2013 of the upstream view of the 150-m transect.



Figure 4-12 Photograph of Dixon Creek at Site DX005 taken on July 27, 2013 showing the pocket of water, which was encountered during both surveys.

Physical Description of DX006

Dixon Creek at site DX006 was visited on May 25 and July 27, 2013. This site, located east of Borger, Texas in Hutchinson County, was accessible only through private lands that were fenced and locked. Like Site DX005, permission was sought and granted from the same landowner and access was gained through the same cattle guard entrance. Once through the cattle guard, TIAER personnel drove approximately 0.4 miles along a private gravel road to reach the site. At the site, access to the stream was easy due to the absence of defined banks and the lack of flowing water (Figure 4-13 and Table 4-2). The site is located in a pasture dominated corridor for the entire length of the reach as noted in Table 4-1 and depicted in Figures 4-13 and 4-14. Table 4-1 further describes the stream channel and riparian zone appearance of this site.



Figure 4-13 Photograph of Dixon Creek at Site DX006 taken May 25, 2013 of the upstream view of the 300-m transect.

Site DX006 was easily wadeable for the entire 300-m reach length due to pasture like conditions and the lack of any water. One barbed-wire fence was crossed by field personnel near the 90-meter transect. The fence was a cross-fence used to separate different pastures for controlled grazing purposes. As the stream at transect sites was dry during both visits, minimum, maximum, and typical average stream widths were 0 m (Tables 4-3 and 4-4).

Aesthetic appearances of the water and wildlife observations for the site during each survey are provided in Tables 4-5 and 4-6, respectively. Aquatic vegetation and algae were absent from the stream during both surveys. There was a large to moderate presence of livestock with horses observed during both surveys. During the May survey, field personnel also heard domestic pets (dogs) from the landowner's house located very near the survey reach. No other vertebrates or mammals were observed during either survey. Cattle, deer, bird, and horse fecal droppings were observed during both surveys as well as tracks. Small garbage, primarily aluminum cans, was rarely observed in the stream channel. Large garbage consisting of tin, bricks, and large pieces of concrete were commonly observed along the left bank of the stream. A kid's rubber ball was also observed near the 90-m transect but is believed to have come from the yard of the landowners house just above the left side embankment.



Figure 4-14 Photograph of Dixon Creek at Site DX006 taken July 27, 2013 of the upstream view of the 30-m transect.

Physical Description of DX007

Dixon Creek at site DX007 was visited on May 25 and July 27, 2013. This site, located east of Borger, Texas in Hutchinson County, was accessible only through private lands that were fenced and locked. Like Sites DX005 and DX006, permission was sought and granted from the same landowner and access was gained through the same cattle guard entrance. Once through the cattle guard, TIAER personnel drove approximately 1.5 miles along private gravel and pasture roads and through another internal gate to reach the site. At the site, access to the stream was easy due to very low banks and the lack of flowing water (Table 4-2). The site is located in a pasture dominated corridor with scattered mesquite trees for the entire length of the reach as noted in Table 4-1 and depicted in Figure 4-15. Table 4-1 describes the stream channel and riparian zone appearance of this site.



Figure 4-15 Photograph of Dixon Creek at Site DX007 taken May 25, 2013 of the downstream view of the 300-m transect.

Site DX007 was easily wadeable for the entire 300-m reach length due to the sandy substrate and the lack of any water. During the second survey in July 2013, the stream channel had grown up with sunflowers which made navigation more hazardous, as depicted Figure 4-16. No water was encountered during either of the surveys. As the stream at this site was dry during both visits, minimum, maximum, and typical average stream widths were 0 m (Tables 4-3 and 4-4).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4-5 and 4-6, respectively. Aquatic vegetation and algae were absent from the stream during both surveys. No vertebrates or mammals were observed during either survey, although bird nests were seen during both surveys. Cattle, deer, and bird tracks were observed during both surveys as well as fecal droppings. Small garbage, consisting of an aluminum can and a plastic five-gallon paint bucket, were observed in the stream channel. No large garbage was observed in the channel or along the banks.



Figure 4-16 Photograph of Dixon Creek at Site DX007 taken July 27, 2013 of the upstream view of the 30-m transect showing the sunflowers.

Physical Description of DX008

Dixon Creek at site DX008 was visited on May 25 and July 27, 2013. This site, located east of Borger, Texas in Hutchinson County, was accessible only through private lands that were fenced and locked. Like Sites DX005, DX006, and DX007, permission was sought and granted from the same landowner and access was gained through the same cattle guard entrance. Once through the cattle guard, TIAER personnel drove approximately 2.3 miles along private gravel and pasture roads and through another internal gate to reach the site. At the site, access to the stream was easy due to very low banks and the lack of flowing water (Table 4-1). The site is located in a pasture dominated corridor with scattered dead mesquite trees for the entire length of the reach as noted in Table 4-1 and depicted in Figure 4-17. Table 4-1 describes the stream channel and riparian zone appearance of this site.



Figure 4-17 Photograph of Dixon Creek at Site DX008 taken May 25, 2013 of the downstream view of the 300-m transect.

Site DX008 was easily wadeable for the entire 300-m reach length due to the sandy substrate and the lack of any water. Like Site DX007, the stream channel had grown up with sunflowers for the survey conducted in July 2013; however, the coverage was not as vast as shown in Figure 4-18. As the stream at this site was dry during both visits, minimum, maximum, and typical average stream widths were 0 m (Tables 4-3 and 4-4).



Figure 4-18 Photograph of Dixon Creek at Site DX008 taken taken July 27, 2013, of the downstream view of the 30-m transect showing the sunflowers.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 4-5 and 4-6, respectively. Aquatic vegetation and algae were absent from the stream during both surveys. There was a moderate presence of livestock, cattle, observed during the second survey in July 2013. No other vertebrates or mammals were observed during either survey. Cattle, deer, and feline tracks were observed during one or both of the surveys as well as fecal droppings. Small garbage was rare only during the first survey in May 2013 and consisted of typical plastic cups and bottles and occasionally an aluminum can. Large garbage was not observed during either trip.

Chapter 5

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were apt to be observed. One of the eight selected sites was at a location that provided public access. The remaining seven sites were located on private property and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations. An additional site, located on County Road V, offered very minimal public access and was also visited in an attempt to observe some form of recreation. This site was not used as an RUAA site due to lack of landowner cooperation, but does often have flowing water due to industrial discharges upstream of this location.

No contact (primary or secondary) or noncontact recreational activities were observed by TIAER employees at any of the sites during the field surveys. The only evidence field personnel found of any possible recreation occurring was at Site DX004. Several spent shotgun shells were found on the bank of the stream channel. The garbage observed was considered incidental and not as a sign that the recreation was occurring along the creek. No evidence of recreation was found at any of the other sites.

Activities Interviewed

Ten interviews were conducted for Dixon Creek (0101A). Interviews were conducted of landowners along Dixon Creek as well as other persons of interest. A total of ten interviews were collected. No primary contact recreational activities were identified from the interviews. As shown in Table 5-1, there were only three instances noted of any form of recreation occurring along Dixon Creek.

Although he did not fish on Dixon Creek, the landowner of Sites DX002 through DX008 identified fishing as the only form of recreation he was aware of. He had observed people fishing underneath the bridge crossing State Highway 152, Site DX005. However, he had not observed any fishermen in the last two years because the creek has dried. He also stated that as a child, he would wade in the stream on his property, but that occurred before the 1970's.

One other interviewee stated that he hunted along Dixon Creek in the summer and fall. The reason he stated for not swimming was that there was not enough water to swim, even as a child.

The landowner's daughter of Site DX001, who has more than 30 years of knowledge about the creek completed an interview on her father's behalf. She stated that they have never recreated along the creek because they do not know what the upstream refinery was doing to the water. They were not water recreationalists to begin with but even if they were, they would not recreate in that stream.

Another interviewee claimed to have observed hunting and fishing on property downstream of site DX001. The property, owned by Conoco Phillips, is leased by a local landowner who has utilized the property for recreation during duck season.

The remaining interviewees all claimed to have not personally used, seen others use or heard of others using the stream for any form of recreation.

Table 5-1 Summary of recreational activities noted in interviews for Dixon Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interview feedback for that location. No recreational activities were observed during field surveys or site visits.

Site Name	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak
DX001						
DX002						
DX003						
DX004						
DX005	0,0,0	0,0,0	0,0,0	0,0,0	0,1,1	0,0,0
DX006						
DX007						
DX008						
General AU	0,0,0	0,0,0	0,0,0	1,1,0	0,1,0	0,0,0
Totals	0,0,0	0,0,0	0,0,0	1,0,0	0,1,1	0,0,0

Chapter 6

RUAA Summary

RUAA surveys were conducted at eight sites along Dixon Creek (0101A) on May 25, 2013 and July 27, 2013. The stream above the confluence with the Conoco Phillips outfall was dry except for one pool of water located at Site DX004 and sporadic pockets of water at a few of the other sites. The landowner at Site DX004 stated that the identified pool was used to water cattle and not for recreational purposes.

The stream below the confluence with the Conoco Phillips outfall did have flowing water, but recorded water depths were predominantly less than 0.5 meters deep. No significant pools were identified below the confluence. Additionally, dense aquatic vegetation and the mud and clay bottom along much of the stream would make any form of recreation difficult.

During the two surveys, there were no recreational activities observed by TIAER field staff. Additionally, there were no non-contact recreational activities observed during either survey. Interviews revealed that fishing has occurred at Site DX005, but the area of the stream open to the public is limited to the area immediately underneath the bridge of State Highway 152. The landowner stated that fishing has not occurred in the last two years due to the stream being dry. Another interviewee stated that he has hunted along Dixon Creek, but did not give an exact location. Recreational activities reported by interviewees are summarized in Figure 6-1 and the overall RUAA findings are summarized in the form below.

The Palmer Drought Severity Index (PDSI) represented extreme drought conditions during the first survey in May 2013 and moderate drought conditions during the second survey in July 2013.

While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered that would promote recreation.

The rural nature of the area surrounding Dixon Creek is an impediment to recreation. Except for Site DX005 and the location on County Road V, which are located at road crossings, all other access to Dixon Creek is through private property that is fenced, gated and locked. Access to most of the stream can only be gained through these properties by permission of the landowner. Even then, according to the interviewees, there is typically insufficient water to afford primary contact recreation. In most of the reach, there is no water to allow any form of water recreation.

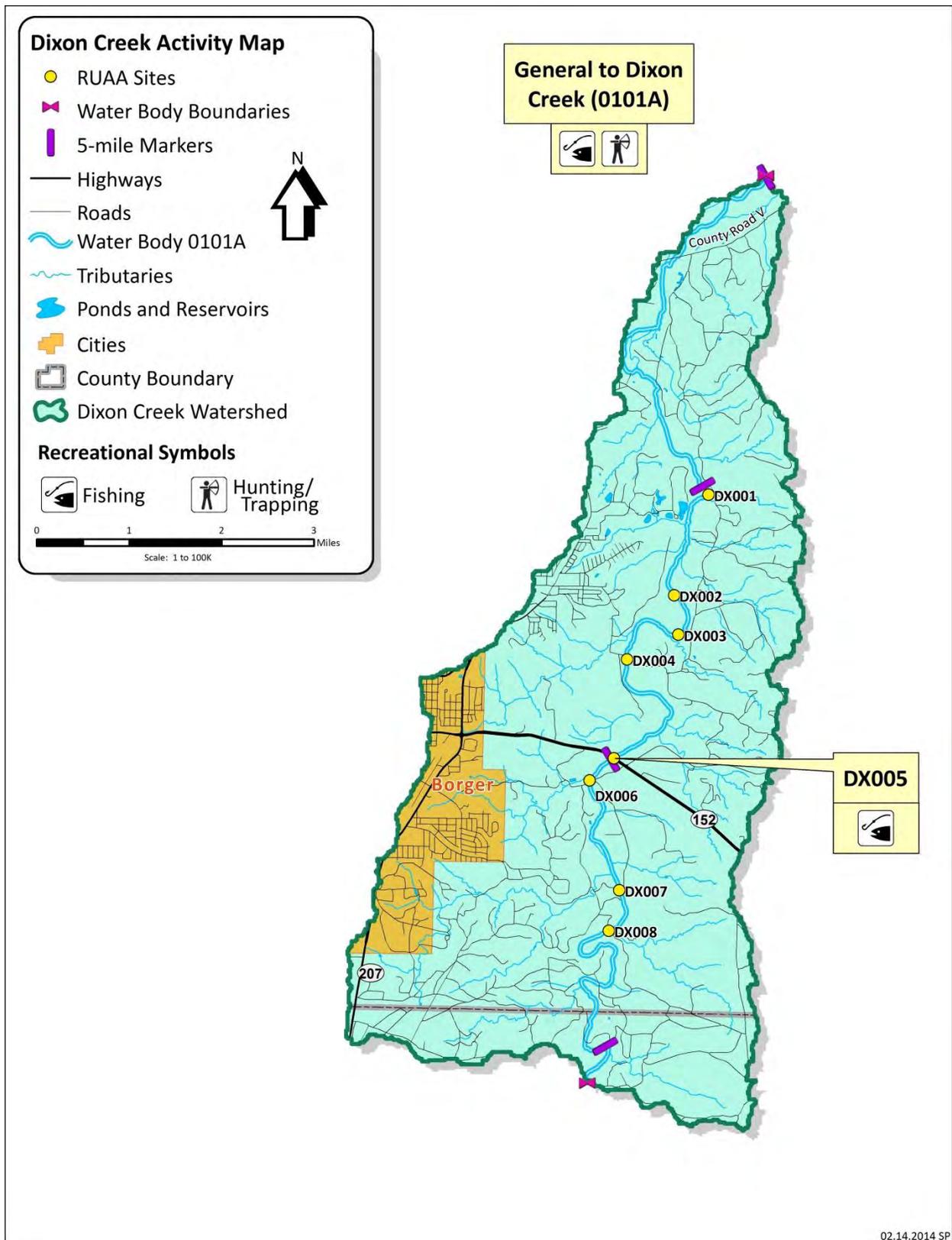


Figure 6-1 Summary of observed and interviewed human activities on Dixon Creek (0101A).

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Dixon Creek

Segment No. of Nearest Downstream Segment No.: Segment 0101

Classified?: No, unclassified water body

County: Hutchinson and Carson

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

b. Do secondary contact recreation 1 activities occur on the water body?

frequently seldom not observed or reported unknown

c. Do secondary contact recreation 2 activities occur on the water body?

frequently seldom not observed or reported unknown

d. Do noncontact recreation activities occur on the water body?

frequently seldom not observed or reported unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.07 meters

b. Are there substantial pools deeper than 1 meter? Yes No

c. What is the general level of public access?

easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

Mild-Extreme Drought

Incipient dry spell

Near Normal

Incipient wet spell

Mild-Extreme Wet

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