



Kickapoo Creek in Henderson County Watershed Protection Plan

Project Update and Overview

Texas Institute for Applied Environmental Research
Stephenville, Texas

May 2, 2023



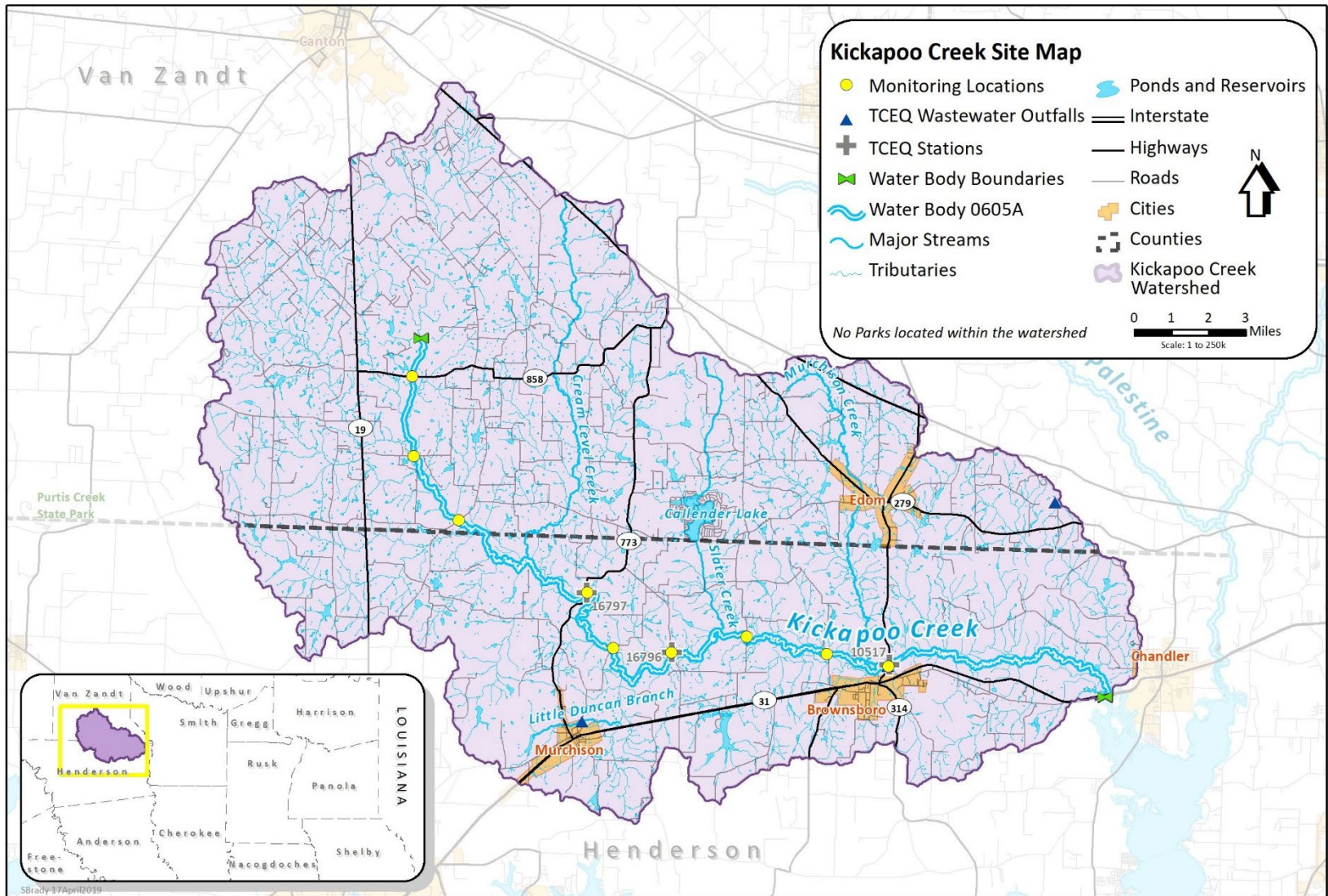
Topics for Today

- Recap of February 8th Meeting
- Review Chapters 1 - 6
- Review Chapters 7 - 10
- Stakeholder input
- Next Steps & Open Discussion



Review of Previous Meeting

Kickapoo Creek in Henderson County



Routine Monitoring Locations

Kickapoo Creek

Site ID	Site Description	Latitude	Longitude
10517	Kickapoo Creek crossing at FM 314 in Henderson County*	32.309099	-95.605826
21618	Kickapoo Creek crossing at Henderson CR 3514 in Henderson County	32.309099	-95.605826
22163	Kickapoo Creek crossing at Henderson CR 3520 in Henderson County	32.319451	-95.67152
16796	Kickapoo Creek crossing at FM1803 in Henderson County	32.312309	-95.705716
22164	Kickapoo Creek crossing at Henderson CR 3806 in Henderson County*	32.313565	-95.732693
16797	Kickapoo Creek crossing at FM 773 Henderson County	32.334668	-95.745165
22165	Kickapoo Creek crossing at 1861 in Van Zandt County	32.361167	-95.805017
22166	Kickapoo Creek crossing at CR 4206 in Van Zandt County*	32.385408	-95.826422
22167	Kickapoo Creek crossing at FM 858 in Van Zandt County	32.416093	-95.828130

*indicate sites where TIAER will conduct 24-hour DO



What is a Watershed Protection Plan

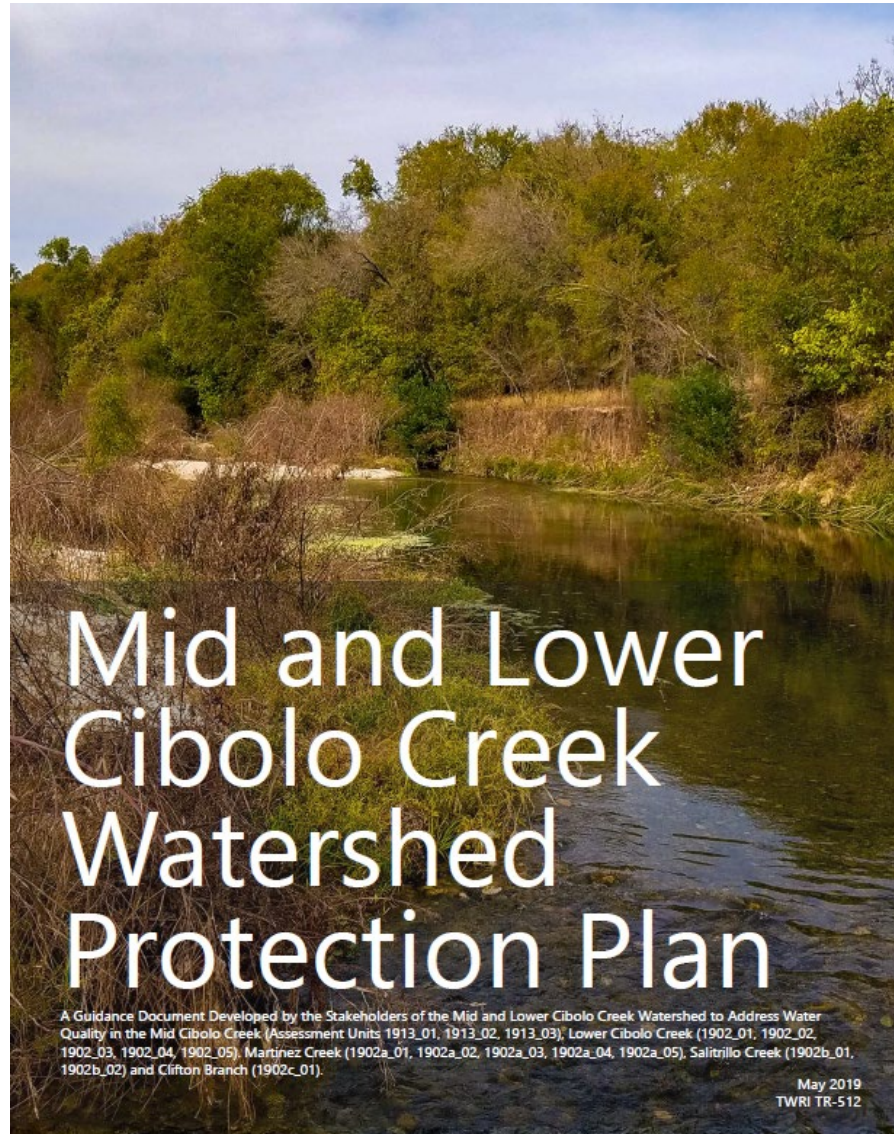
- Goal = improve, restore, or maintain good water quality within a particular watershed
- WPPs address complex water quality issues
- WPPs are tools to better leverage the resources of local governments, state and federal agencies, and non governmental organizations
- WPPs are a voluntary and proactive approach to integrating activities and prioritizing best management practices

Goals of the WPP



- Address impairments in Kickapoo Creek
- Dependent on stakeholder support and participation

Example WPPs



Chapter 1 – Watershed Management

- Watershed Definition
- Watersheds and water quality
- Benefits of watershed approach
- Watershed-based planning
- Adaptive Management

Chapter 1 Introduction to Watershed Management



The Watershed Approach

The watershed approach is widely accepted by state and federal water resource management agencies to facilitate water quality management. The U.S. Environmental Protection Agency (EPA) describes the watershed approach as “a flexible framework for managing water resource quality and quantity within a specified drainage area or watershed” (EPA 2008). The watershed approach requires engaging stakeholders to make management decisions backed by sound science (EPA 2008). One critical aspect of the watershed approach is that it focuses on hydrologic boundaries rather than political boundaries to address potential water quality impacts to all potential stakeholders.

A stakeholder is anyone who lives, works, has interest within the watershed or may be affected by efforts to address water quality issues. Stakeholders may include individuals, groups, organizations or agencies. The continuous involvement of stakeholders throughout the watershed approach is critical for effectively selecting, designing and implementing management measures that address water quality throughout the watershed.

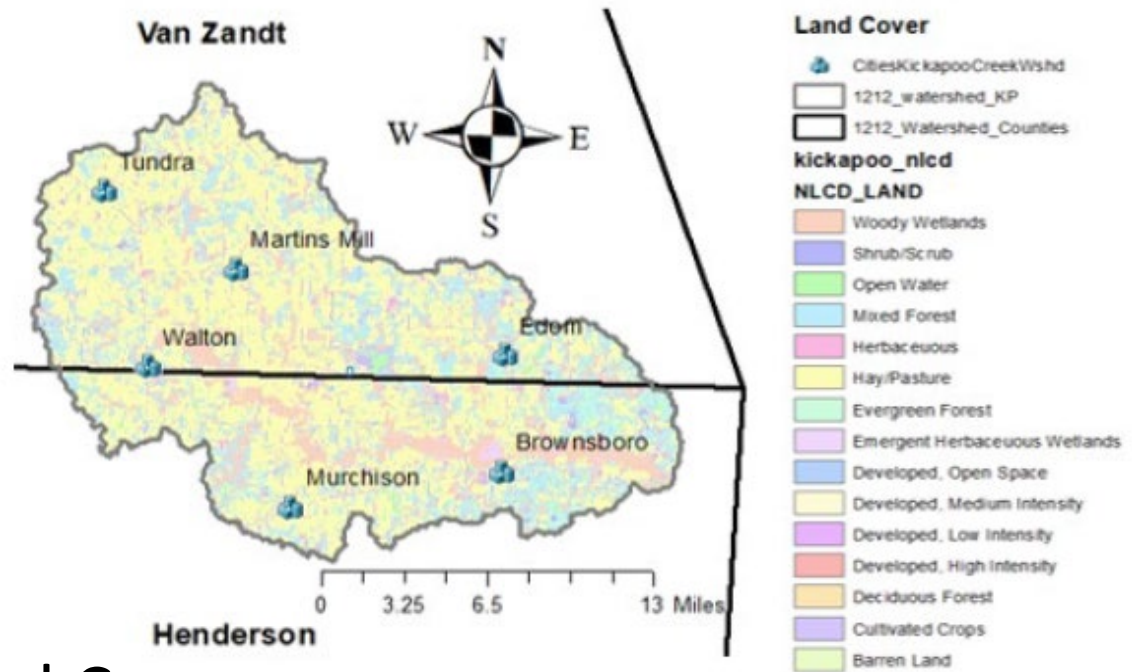
Watershed Protection Plan

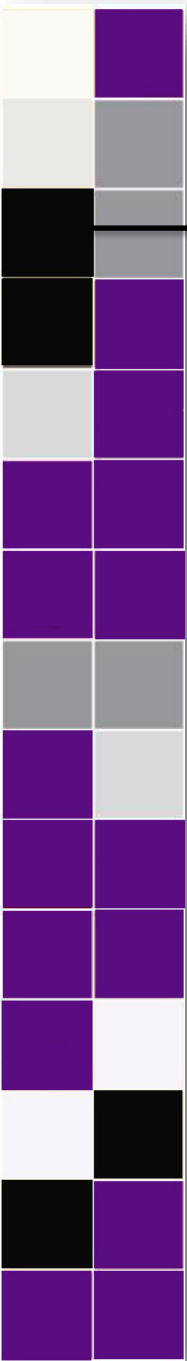
Watershed protection plans (WPPs) are locally driven mechanisms for voluntarily addressing complex water quality problems that cross political boundaries. A WPP serves as a framework to better leverage and coordinate resources of local, state and federal agencies, in addition to non-governmental organizations.

The Mid and Lower Cibolo Creek WPP follows the EPA's nine key elements, which are designed to provide guidance for the development of an effective WPP (EPA 2008). WPPs will vary in methodology, content and strategy based on local priorities and needs. However, common fundamental

Chapter 2 – Watershed Characterization

- Watershed boundaries
- Topography
- Soils
- Climate
- Ecoregions
- Land Use/Land Cover
- Permitted Discharges
- Surface & Groundwater Resources
- Water Quality





Chapter 2 – Watershed Characterization

- Overview
 - Describes the current conditions of the watershed
 - Developed through state and federal data resources and local stakeholder knowledge
 - This information is used through the plan to identify pollution loadings, management measures, and prioritize critical areas



Chapter 3 – Water Quality

- Overview
 - TIAER conducted routine, monthly, ambient water quality monitoring at nine sites on Kickapoo Creek
 - Routine field parameters included
 - Water temperature, pH, D.O., Conductivity, Flow
 - Water samples collected for analysis of
 - *E.coli*, NH₃-N, TSS, VSS, NO₂-N+NO₃-N, TKN, PO₄-P, T.P., BOD, and CHLA
 - To address the D.O. impairment, 24-hour D.O. monitoring conducted at 3 sites (10517, 22164, 22166)

Chapter 3 – Water Quality - Bacteria

Table 3.5. Watershed Impairments in the 2020 Texas Integrated Report for Kickapoo Creek

Parameter	Category	AUs	Criteria
Bacteria	5c*	0605A_01	126 cfu/100mL
		0605A_02	
DO 24-hr Average	5c*	0605A_01	3.0 mg/L
DO 24-hr Minimum	5c*	0605A_01	2.0 mg/L

Table 3.8. Bacterial Impairment status of Kickapoo Creek

Source: 2020 Texas Integrated Report, Observations used from December 2011 to November 2018 to obtain *E. coli* geometric mean

Assessment Unit	Description	<i>E. coli</i>	Support Status
0605A_01	From the confluence with Lake Palestine (0605) east of Brownsboro in Henderson County to the confluence with Slater Creek (0605E).	307.47	Not Supporting
0605A_02	From the confluence with Slater Creek (0605E) upstream to the confluence with unnamed tributary about 1.62 km north of FM 858 in Van Zandt County at NHD RC 12020001000161.	287.89	Not Supporting

Chapter 3 – Water Quality - DO

Table 3.5. Watershed Impairments in the 2020 Texas Integrated Report for Kickapoo Creek

Parameter	Category	AUs	Criteria
Bacteria	5c*	0605A_01	126 cfu/100mL
		0605A_02	
DO 24-hr Average	5c*	0605A_01	3.0 mg/L
DO 24-hr Minimum	5c*	0605A_01	2.0 mg/L

Table 3.9. Dissolved oxygen impairment status of Kickapoo Creek

Source: 2020 Texas Integrated Report, Observations used from December 2011 to November 2018 to obtain DO grab minimum

Assessment Unit	Description	DO grab minimum (mg/L)	Support Status
0605A_01	From the confluence with Lake Palestine (0605) east of Brownsboro in Henderson County to the confluence with Slater Creek (0605E).	1.33 (1/3 exceedances)	Not Supporting
0605A_02	From the confluence with Slater Creek (0605E) upstream to the confluence with unnamed tributary about 1.62 km north of FM 858 in Van Zandt County at NHD RC 12020001000161.	N/A (0/18 exceedances)	Fully Supporting



Chapter 4 – Potential Sources of Pollution

- Overview
 - Impairments of Kickapoo Creek watershed are primarily due to the excessive fecal indicator bacteria
 - Point Source Pollution vs Nonpoint Source Pollution
 - Point Source: enter receiving waters at identifiable locations (such as a pipe)
 - Nonpoint Source: includes anything that is not a point source and enters the water body by runoff moving over and/or through the ground

Pollutant Source	Pollutant Type	Potential Cause	Potential Impact
WWTFs/SS Os/MS4s	Bacteria, nutrients	<p>Inflows & Infiltrations</p> <ul style="list-style-type: none"> Overload from large storm events Conveyance system failures due to age, illicit connections, blockages, etc. 	Untreated wastewater may enter watershed or water bodies
OSSFs	Bacteria, nutrients	<ul style="list-style-type: none"> System not properly designed for site specific conditions Improper function due to age or lack of maintenance /sludge removal Illegal discharge of untreated wastewater 	Improperly treated wastewater reaches soil surface; may runoff into water bodies
Urban Runoff	Bacteria, nutrients	<p>Stormwater runoff from lawns, parking lots, dog parks, etc.</p> <ul style="list-style-type: none"> Improper application of fertilizers Improper disposal of pet waste 	Stormwater drains quickly route water directly to water body
Livestock	Bacteria, nutrients	<ul style="list-style-type: none"> Manure transport in runoff Direct fecal deposition to streams Excessive runoff from pastures due to over grazing Riparian area disturbance and degradation 	Deposited directly into water body or may enter during runoff events
Wildlife	Bacteria, nutrients	<ul style="list-style-type: none"> Manure transport in runoff Direct fecal deposition to streams Riparian area disturbance and degradation 	Deposited directly into water body or enters during runoff events
Pets	Bacteria, nutrients	<ul style="list-style-type: none"> Fecal matter not properly disposed of Lack of dog owner education regarding effects of improper disposal 	Bacteria and nutrients enter water body through runoff
Illegal Dumping	Bacteria, nutrients, litter	Disposal of trash and animal carcasses in or near water body	Direct or indirect contamination of water body

Livestock Population Estimates

Table 4.4. Estimated Livestock Populations.

County	Area Ratio	Cattle & Calves	All Goats	Mule, Burros, and Donkeys	Horses & Ponies
Henderson	0.141	59,076	2,083	1,389	3,914
Van Zandt	0.183	89,422	3,917	1,123	4,253
Watershed		24,694	1,011	401	1,330

Table 4.5. Estimated Deer Populations.

Total Area of watershed (acres)	Total area minus Open water, Developed and Barren(acres)	# Deer per 1000 acres	Total # of Deer in the watershed
179,251	165,940	46	7,633

Table 4.6. Estimated Feral Hogs Populations.

Total Area of watershed (sq. mile)	Total area minus Open water, Developed and Barren (sq. mile)	# Hogs per sq. mile	Total # of Hogs in the watershed
280.08	259.28	12.65	3280



Chapter 5 – Pollutant Source Assessment

- Overview
 - Estimates the load capacity and the current load of *E. coli* within the watershed
 - Using the SELECT tool, TIAER highlighted areas of the watershed with the highest potential for bacteria loading from various potential pollutant sources
 - Allows watershed stewards to prioritize when, what, and where best management areas can be assigned within the watershed.



Chapter 6 – Management Measures

- Overview
 - According to SELECT modeling, cattle, pets, deer, and OSSFs have the highest potential to contribute *E. coli* to the water body and its tributaries; however, all potential sources in the watershed contribute at some level.
 - Due to the diverse potential sources, a range of management strategies are recommended to address all potential sources of *E.coli* in the watershed.



Chapter 6 – Management Measures

1. Developing and Implementing Water Quality Management Plans or Conservation Plans
2. Promote Technical and Direct Operational Assistance to Landowners for Feral Hog Control
3. Identify and Repair or Replace Failing On-Site Sewage Systems
4. Manage SSOs and Unauthorized Discharges
5. Reduce Illicit Dumping
6. Increase Proper Pet Waste Management



Education and Outreach

CHAPTER 7

Chapter 7 – Education & Outreach

Long-term commitments from citizens and landowners will be necessary for achieving comprehensive improvements in the Kickapoo Creek watershed.

A full-time watershed coordinator position is recommended to support WPP implementation.

- The role of the Watershed Coordinator is to lead efforts to establish and maintain working partnerships with stakeholders.
- Serves as a point of contact for all things related to WPP development, implementation, and the WPP itself.

- Education Programs
 - Elementary Watershed Education
 - Low Impact Development
 - Construction Inspection Registration Course
 - Annual Inspection & Maintenance Certification Course
 - Texas Stream Teams
 - Healthy Lawns
 - Urban Riparian and Stream Restoration Workshop
 - Feral Hog Management Workshop
 - Lone Star Healthy Streams Workshop
 - OSSF Operation and Maintenance Workshop
 - Texas Well Owners Network Training
 - Riparian and Stream Ecosystem Program
 - Wildlife Management Workshop



Chapter 7 – Education & Outreach

The Watershed Coordinator will play a critical role in the transition from the WPP Development (current) to the WPP Implementation (future).

- Organize & host periodic public meetings and needed educational events
- Seek out and meet with a focused group of stakeholders to identify and secure implementation funds for the best management practices



Plan Implementation

CHAPTER 8



Chapter 8 – Plan Implementation

The first step to successful implementation is to create a reasonable implementation schedule with interim goals and estimated costs.

The implementation schedule is set over a 10-year period

Schedule, Milestones, Estimated Costs

Table 7.1. Implementation schedule.

Management Measure	Responsible Party	Estimated Unit Cost	Number Implemented Time frame (year) 1-3	Number Implemented Time frame (year) 4-6	Number Implemented Time frame (year) 7-10	Estimated Total Cost
Cattle and other Livestock						
Develop funding to hire a WQMP technician	TSSWCB, SWCDs, Watershed Coordinator	\$60,000/year		1		\$600,000
Develop, implement, and provide financial assistance for CPs and WQMPs	Producers, landowners, NRCS, TSSWCB, SWCDs, Watershed Coordinator	\$30,000/plan	10	15	25	\$1,500,000
Deliver education and outreach programs and workshops to landowners	AgriLife Extension, ANRA, Watershed Coordinator	N/A	1	1	1	N/A
Feral Hog Management						
Voluntarily construct fencing around deer feeders to prevent feral hog utilization	Landowner, ranch managers, leasees	\$200/feeder		As many as possible		N/A
Voluntarily trap/remove/shoot feral hogs to reduce numbers	Landowner, ranch managers, leasees	N/A		As many as possible		N/A
Develop and implement wildlife management plans and wildlife management practices	Landowners, producers, TPWD, Watershed Coordinator	N/A		As many as possible		N/A
Deliver feral hog education workshops	AgriLife Extension, Lonestar Healthy Streams, TPWD, Watershed Coordinator	\$3,000 each workshop	1	1	1	\$9,000
OSSF Management						
Identify, inspect, and repair or replace OSSFs as funding allows	Counties, contractors	\$8,000-\$10,000/system	20	40	40	\$800,000-\$1,000,000
Operate and OSSF education, outreach, and training program for	AgriLife Extension, Watershed Coordinator	\$3,500	1	1	1	\$10,500

Schedule, Milestones, Estimated Costs

Management Measure	Responsible Party	Estimated Unit Cost	Number Implemented Time frame (year) 1-3	Number Implemented Time frame (year) 4-6	Number Implemented Time frame (year) 7-10	Estimated Total Cost
Installer, service providers and homeowners						
Develop and deliver materials (postcards, websites, handouts, etc.) to educate homeowners	Watershed Coordinator	\$1,000		As needed		\$1,000
Municipal Sanitary Sewer Overflow or Unauthorized Discharges						
Identify potential resources and develop programs to assist homeowners with sewage pipe replacement	Watershed Coordinator, AgriLife Extension, cities	N/A		As many as possible		N/A
Identify and replace pipes contributing to I&I problems as funding permits	Cities, property owners, contractors	\$3,000 - \$20,000/site				
Develop and deliver educational materials to residents and property owners	Cities, AgriLife Extension, Watershed Coordinator	N/A	1	1	1	N/A
Illegal Dumping						
Promote and expand education and outreach efforts in the watershed	Cities, AgriLife Extension, Watershed Coordinator	N/A				
Legal action	Local watershed law enforcement			As needed		
Pet Waste Management						
Pet waste station establishment and maintenance	Cities, HOAs, counties, Watershed Coordinator	\$150 per station	10	20	20	\$7,500
Pet waste education materials	Cities, HOAs, counties, veterinarian hospitals, Watershed Coordinator	N/A	Annually, in addition to current informational flyers			N/A



Resources to Implement the Watershed Protection Plan

CHAPTER 9



Chapter 9 – Implementation Resources

Technical and financial assistance will be needed to maximize the implementation and management measures

Grant funding will be a substantial source for technical assistance in:

- Livestock management
- Feral hog management
- OSSF management
- SSO and Unauthorized Discharge management
- Illicit Dumping
- Pet Waste Management

Chapter 9 – Implementation Resources

Table 9.1 Summary of potential sources of technical assistance

Technical Assistance	
Management Measure (MM)	Potential Sources
MM1: Promote and implement WQMPs or CPs	TSSWCB; local SWCDs; NRCS; AgriLife Extension
MM2: Promote technical and direct operational assistance to landowners for feral hog control	AgriLife Extension; TPWD; NRCS; TSSWCB
MM3: Identify and repair or replace failing on-site sewage systems	Designed technicians from counties; AgriLife Extension
MM4: Manage SSOs and Unauthorized Discharges	City public works department; engineering firms; AgriLife Extension
MM5: Reduce Illicit Dumping	AgriLife Extension; county law enforcement; TPWD game wardens
MM6: Increase proper pet waste management	City public works department; AgriLife Extension



Measuring Success

CHAPTER 10



Chapter 10 – Measuring Success

Stakeholders will review progress of the WPP in meeting goals at least every 5 years.

Progress will be reviewed using the following assessments:

- Water Quality
- Implementation Progress
- External Factors

Chapter 10 – Measuring Success

Table 10.1 The water quality targets for impaired water bodies in Kickapoo Creek in Henderson County

Station ID	AU	Current Concentration (cfu/100mL)	5 Years After Implementation	10 Years After Implementation
10517	0605A_01	237	181.5	120
21618	0605A_01	317	221.5	120
22163	0605A_01	104	115	120
16796	0605A_02	168	147	120
16797	0605A_02	306	216	120
22164	0605A_02	184	155	120
22165	0605A_02	404	265	120
22166	0605A_02	505	315.5	120
22167	0605A_02	377	251.5	120



Chapter 10 – Measuring Success

- **Water quality:** Stakeholders will review water quality assessments of Kickapoo Creek in Henderson County. Additional water quality analysis, as available will also be used. An increase in pollutant concentrations or percent exceedances will be considered a negative outcome.
- **Implementation Progress:** Stakeholders will review the overall progress of the WPP in meeting anticipated measurable milestones. Substantial delays or lower-than-expected achievements in milestones will be considered a negative outcome.
- **External Factors:** Stakeholders will evaluate, as appropriate, available data concerning trends in population growth, land use, economic factors, new water quality criteria, and other relevant issues to evaluate changes to the amount or number of potential pollutant sources outlined in the WPP. A significant increase in potential pollutant sources or hydrologic changes will be considered a negative outcome.



Review Chapters 7 - 10

- Kickapoo Creek WPP Chapter 7 DRAFT

https://www.tarleton.edu/tiaer/wp-content/uploads/sites/59/2023/04/Kickapoo-Creek-draft-WPP-chapter-7-final.for_stakeholders.pdf

- Kickapoo Creek WPP Chapter 8 DRAFT

https://www.tarleton.edu/tiaer/wp-content/uploads/sites/59/2023/04/Kickapoo-Creek-draft-WPP-chapter-8-final.for_stakeholders.pdf

- Kickapoo Creek WPP Chapter 9 DRAFT

https://www.tarleton.edu/tiaer/wp-content/uploads/sites/59/2023/04/Kickapoo-Creek-draft-WPP-chapter-9-final.for_stakeholders.pdf

Kickapoo Creek WPP Chapter 10 DRAFT

<https://www.tarleton.edu/tiaer/wp-content/uploads/sites/59/2023/04/Kickapoo-Creek-draft-WPP-chapter-10-draft-tsswcb.pdf>



Next Steps

30 Day Comment period opens May 4
– (closes June 2)

EPA will review the final WPP

Once accepted, the plan will begin the
implementation phase



Questions?

Project Website:

<https://www.tarleton.edu/tiaer/kickapoo-creek-wpp/>

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