Example Watershed-Based Plans

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Key Elements of Watershed Plans

- Identification of Sources of Bacteria
- Estimated Loading Reductions Needed
- Description of Management Measures
- Education and Outreach Needed
- Schedule for Implementation
- Implementation Milestones
- Possible Sources of Financial Assistance and Estimated Costs
- Measures of Success (i.e. indicators to measure reductions)
- Monitoring plan to evaluate effectiveness

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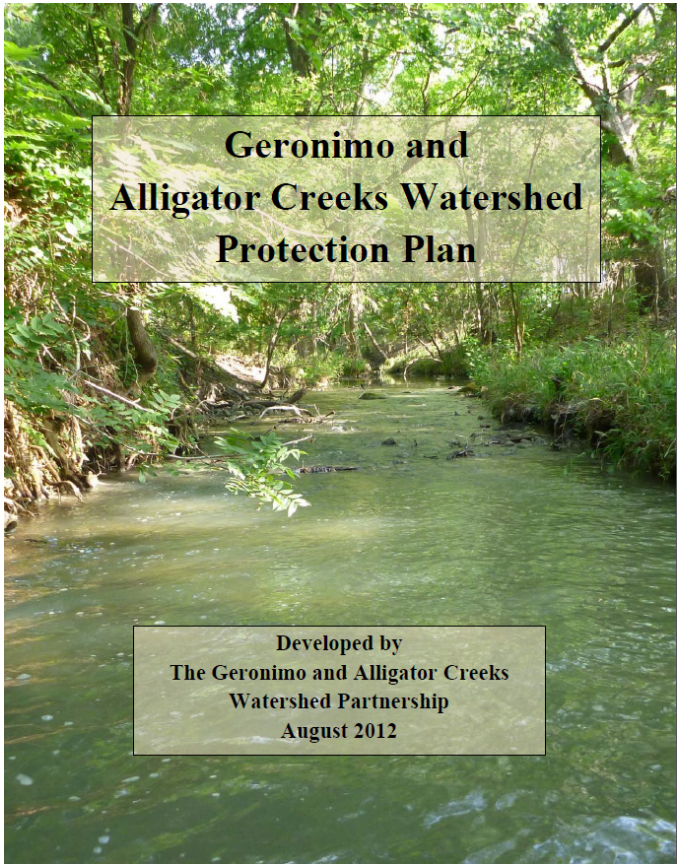
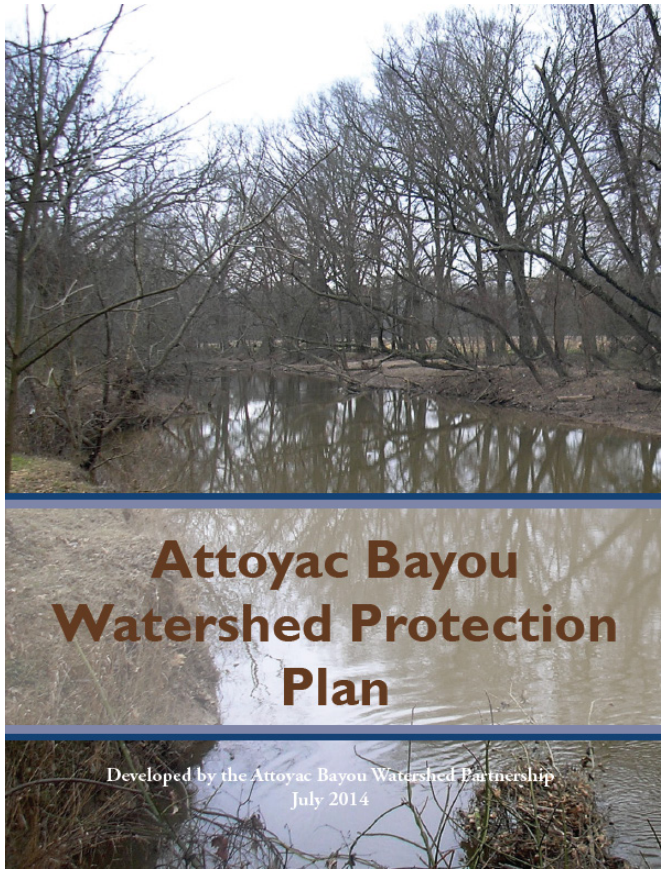
Example Watershed-Based Plans





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Chapter 1 – Watershed Management

- Watershed definition
- Watersheds and water quality
- Benefits of watershed approach
- Watershed-based planning
- Adaptive management

Definition of a Watershed

A watershed is the land area that drains to a common waterway such as a stream, lake, estuary, wetland or, ultimately, the ocean. All land surfaces on Earth are included in a watershed; some are very small while others encompass large portions of nations or continents. For example, many smaller watersheds, or sub-watersheds, combine to form the Attoyac Bayou watershed, which is actually a small part of the Neches River Basin.

A Watershed's Impacts on Water Quality

All activities, both human and natural, that occur within the boundaries of a watershed have the potential to influence water quality in the receiving water body. As a result, an effective management strategy that addresses water quality issues in a watershed's receiving water body must examine all human activities and natural processes within that watershed.

The Watershed Approach

The Watershed Approach is "a flexible framework for managing water resource quality and quantity within a specified drainage area or watershed. This approach includes engaging stakeholders to make management decisions supported by sound science and appropriate technology" (USEPA 2008). The Watershed Approach is based on the following principles:

- geographic focus based on hydrology rather than political boundaries;
- water quality objectives based on scientific data;
- coordinated priorities and integrated solutions; and,
- diverse, well-integrated partnerships.

A watershed's boundaries often cross municipal, county and state boundaries, because they are determined by the landscape. Using the Watershed Approach, all potential sources of pollution entering a waterway can be addressed through the process by all potential watershed stakeholders.

A stakeholder is anyone who lives, works or has an interest within the watershed or may be affected by decisions; stakeholders can include individuals, groups, organizations or agencies. Stakeholder involvement is critical for effectively employing a holistic approach to watershed management that adequately addresses all watershed concerns.

Watershed Protection Plan (WPP) Development Process

WPPs are locally driven mechanisms for voluntarily addressing complex water quality problems that cross multiple jurisdictions. WPPs are coordinated frameworks for implementing prioritized water quality protection and restoration strategies driven by environmental objectives. Through the development process, stakeholders are encouraged to holistically address all of the sources and causes of impairments and threats to both surface water and groundwater resources within a watershed. To help ensure that plans developed will effectively address water quality issues when implemented, the U.S. Environmental Protection Agency (USEPA) has established nine key elements that it deems critical for achieving water quality improvements. These elements are listed and defined in Appendix A.

WPPs serve as tools to better leverage the resources of local governments, state and federal agencies and non-governmental organizations. WPPs integrate activities and prioritize implementation projects based upon technical merit and benefits to the watershed, promote a unified approach to seeking funding for implementation and create a coordinated public communication and education program. Developed and implemented through diverse, well-integrated partnerships, a WPP assures the long-term health of the watershed with solutions that are socially acceptable, economically viable and achieve environmental goals for water resources. Adaptive management is used to modify the WPP based on an on-going, science-based process that involves monitoring and evaluating strategies and incorporates new knowledge into decision making.

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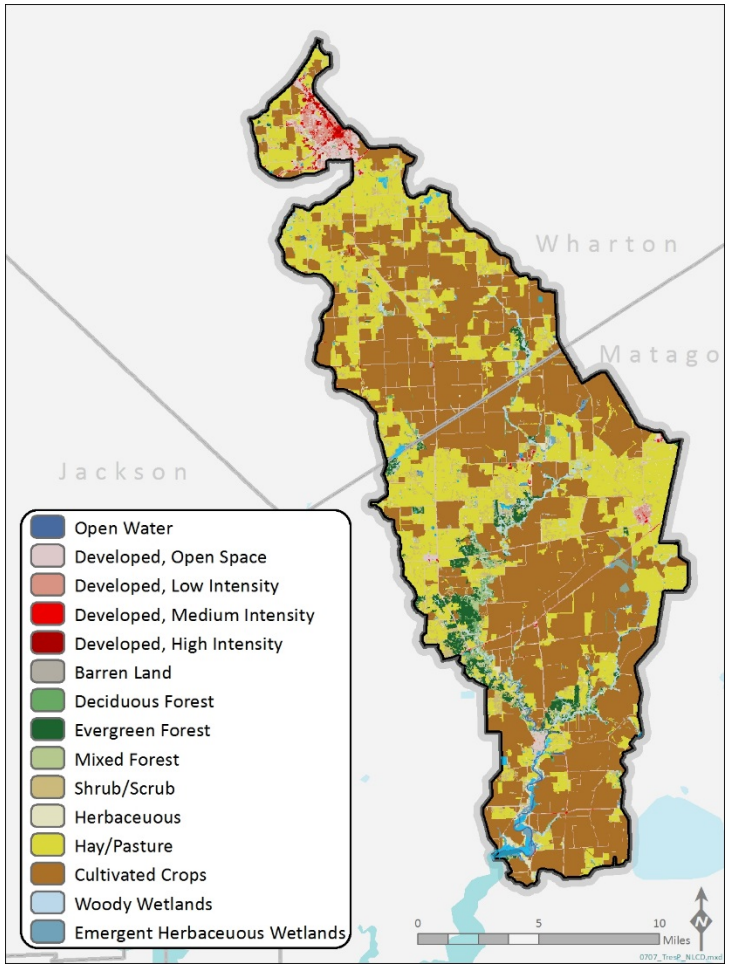
Chapter 2 – Watershed Characterization

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



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Chapter 3 – Estimates of Bacteria and Reductions

- Estimates of Current Bacteria Sources & Loads
- Estimates of Load Reductions Needed

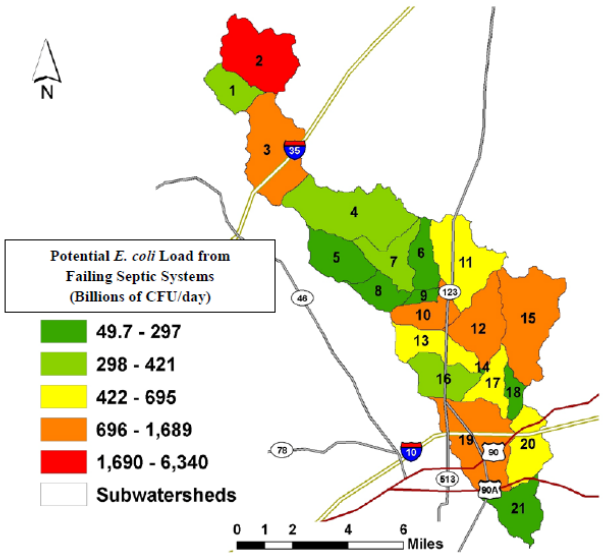

Figure 5.6. Average daily potential *E. coli* load from failing septic systems by subwatershed.

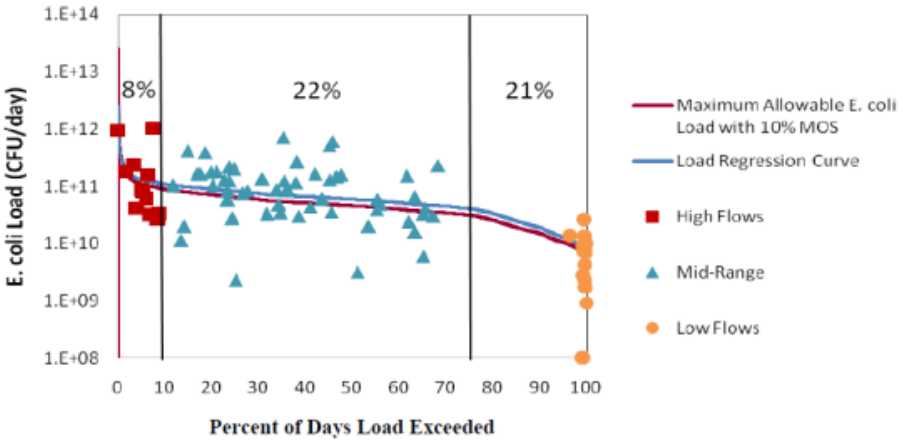

Table 5.1. Potential pollutant sources in the Geronimo and Alligator Creeks Watershed identified by the Steering Committee.

Source Categories	Potential Sources	Bacteria	Nitrate-Nitrogen
Urban	Urban Runoff	X	X
	Dogs	X	X
Wastewater	Septic Systems	X	X
Agriculture	Cropland		X
	Cattle	X	X
	Horses	X	X
	Goats	X	X
Wildlife and Nondomestic Animals	Deer	X	X
	Feral Hogs	X	X

Table 4.2. Mean annual loads, load reductions and target loads for the Haberle Road monitoring station.

Pollutant	Mean Annual Load	Mean Annual Load Reduction	Mean Annual Target Load	Reduction Goal (%)
E. coli (cfu/year)	3.47×10^{13}	9.66×10^{12}	2.51×10^{13}	26
Nitrate-nitrogen (g/year)	6.99×10^{5}	5.92×10^{5}	1.07×10^{5}	85

Chapter 4 – Strategies for Implementation

- Management Measures
  - Stormwater Management Plans
  - Wastewater collection & treatment system upgrade
  - Septic system inspection, repair, replacement
  - Feral Hog Control
  - TPWD wildlife mgt plans
  - NRCS & TSSWCB conservation plans
- Education & Outreach

Table 6.7. Recommended number of feral hogs to be removed by subwatershed.

County	Subwatershed	Total Hogs	Hogs To Be Removed
Comal	1	0	0
	2	0	0
	3	0	0
	County Total	0	0
Guadalupe	4	0	0
	5	79	21
	6	2	1
	7	114	30
	8	104	27
	9	69	18
	10	82	21
	11	133	35
	12	177	46
	13	91	24
	14	10	3
	15	170	44
	16	75	19
	17	130	34
	18	118	31
	19	73	19
	20	73	19
	21	124	32
	County Total	1625	422
	Watershed Total	1625	422

Chapter 4 – Strategies Continued

- Schedule, Milestones, Estimated Funding Needs
- Pollutant Load Reductions Resulting from Implementation

Table 8.1. Jurisdiction, implementation milestones, and estimated financial cost for management measures.

Management Measure	Jurisdiction	Unit Cost	Number Implemented			Total Cost
			Year			
			1-3	4-6	7-10	
Urban Stormwater Management Measures						
Pet Waste Collection Stations	City of New Braunfels	$620/station $85 annual/station	6	3	3	$14,325
Pet Waste Collection Stations	City of Seguin	$620/station $85 annual/station	5	2	2	$10,935
Initiate Spay/Neuter Program	City of New Braunfels	$35,000	1	---	---	$35,000

Table 8.3. Estimated pollutant load reductions expected upon full implementation of the Geronimo and Alligator Creeks Watershed Protection Plan.

Management Measure	Expected *E. coli* Load Reduction[1]
Urban Stormwater Management Measures	
Pet Waste Collection Stations	6.38×10^{11}
Pet Waste Ordinance and Outreach and Education Program	
Pet Spay/Neuter Programs	
Comprehensive Urban Stormwater Assessments and stormwater conveyance modifications	1.87×10^{12}
Street Sweeping	
Phase II Permit Activities	

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Chapter 5 – Sources for Implementation

- Sources of Technical Assistance

TECHNICAL ASSISTANCE

Successful implementation of the Geronimo and Alligator Creeks Watershed Protection Plan relies on active engagement of local stakeholders, but also will require support and assistance from a variety of other sources. The technical expertise, equipment, and manpower required for many management measures are beyond the capacity of the local stakeholders alone. As a result, direct support from one or a combination of several entities will be essential to achieve water quality goals in the watershed. Focused and continued implementation of key restoration measures will require the creation of multiple full-time equivalent positions in the watershed to coordinate and provide technical assistance to stakeholders.

- Sources of Financial Assistance

Environmental Quality Incentives Program (EQIP)

The **USDA-NRCS** operates this program to provide a voluntary conservation program for farmers and ranchers to address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land. EQIP offers contracts with a maximum term of 10 years, which provide financial and technical assistance to plan and implement prescribed conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP activities are carried out according to a plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or practices to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions and are approved by the local SWCD. Table 10.1 includes a list of practices recently implemented in the Attoyac Bayou watershed area during 2009-2013 as well as the amount of funding paid to enrolling producers during the same period.

Local Work Groups provide recommendations to USDA-NRCS on allocating EQIP county base funds and on resource concerns for other USDA Farm Bill programs. Attoyac Bayou stakeholders are encouraged to participate in the Local Work Group to promote the goals of this WPP as compatible with the resource concerns and conservation priorities for EQIP.

www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

Chapter 6 – Measures of Success

Monitoring and Water Quality Criteria

MONITORING AND WATER QUALITY CRITERIA

Water quality data will be analyzed using a 3-year geometric mean for *E. coli* bacteria to examine trends in Geronimo and Alligator Creek. These values will be compared to the incremental reductions outlined in Table 7.1 to determine if any adjustments to the implementation strategy are necessary. The Partnership will review progress of implementation efforts outlined in the WPP each year, and especially at milestone years 3, 6, and 10, in order to make critical decisions on adaptive management. In addition, water quality data will be analyzed every 6 months to examine short-term trends and to compare against the water quality criteria.

Current water quality monitoring efforts in the Geronimo and Alligator Creeks watershed rely on the existing monthly routine monitoring station at Haberle Road (Station #12576). This location has been the main sampling location since 2003, it is used by TCEQ to conduct the assessment for the Texas Water Quality Integrated Report, and will be an important part of continued efforts to track the success of implementation. An additional routine monitoring site will be added on Geronimo Creek just above the confluence with the Guadalupe River. This new site will be utilized to monitor changes in water quality at the lower end of the watershed as implementation progresses.

Ambient in-stream data collected at these sites will include: flow, *E. coli,* nitrate-nitrogen, ammonia-nitrogen, total Kjeldahl nitrogen, total dissolved solids, total suspended solids, pH, chlorophyll-a, pheophytin, sulfate, orthophosphorus, total phosphorus, total hardness, temperature, turbidity, chloride, and dissolved oxygen.

Though not all of these measurements are necessary to assess current impairments or concerns, routine monitoring for this suite of parameters will detect the development of additional water quality problems as well as measuring progress toward goals to address the current issues.

Adaptive Management

ADAPTIVE IMPLEMENTATION

Due to the dynamic nature of watersheds and the countless variables governing landscape processes across scales of time and space, some uncertainty is to be expected when a watershed protection plan is developed and implemented. As the recommended restoration measures of the Geronimo and Alligator Creeks Watershed Protection Plan are put into action, it will be necessary to track the water quality response over time and make any needed adjustments to the implementation strategy. In order to provide flexibility and enable such adjustments, adaptive implementation will be utilized throughout the process.

Adaptive implementation (AI) is often referred to as "learning by doing" (USDA, 2007). It is the ongoing process of accumulating knowledge of the cause of impairment as implementation efforts progress, which results in reduced uncertainty associated with modeled loads. As implementation activities are instituted, water quality is tracked to assess impacts and guide adjustments, if necessary, to future implementation activities. This on-going, cyclic implementation and evaluation process serves to focus project efforts and optimize impacts. Watersheds in which the impairment is dominated by nonpoint source pollutants, such as Geronimo and Alligator Creeks, are good candidates for AI.

Adaptive Implementation relies on constant input of watershed information and the establishment of intermediate and final water quality targets. Pollutant concentration targets for Geronimo and Alligator Creeks were developed based on complete implementation of the watershed protection plan and assume full accomplishment of pollutant load reductions by the end of the 10-year project period (Table 7.1). While some of the less complex management measures recommended here will be relatively simple to implement early in the process, implementation of other measures will require more time, energy, and funding. For this reason, reductions in pollutant loads and associated concentrations initially may be gradual. However, it can be assumed that reductions in the loadings will be tied to the implementation of management measures throughout the watershed. Thus, these projected pollutant targets will serve as benchmarks of progress, indicating the need to maintain or adjust planned activities. While water quality conditions likely will change and may not precisely follow the projections indicated here, these estimates serve as a tool to facilitate stakeholder evaluation and decision-making based on AI.

Questions?

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