

## Carters Creek Watershed Natural Resources Work Group

### Recommendation Report

This document describes the key elements involved with the implementation of the management measures developed by the Carters Creek Watershed Natural Resources Work Group to address bacteria loading contributions primarily from livestock and wildlife derived sources. Work group members include representatives from the Natural Resource Conservation Service (NRCS), Texas AgriLife Extension Service, Brazos County Farm Bureau, Texas A&M University faculty and Texas Parks and Wildlife Department (TPWD). The following are the management measures proposed for the Carters Creek watershed TMDL Implementation Plan (IP):

1. Discuss modifications to Agricultural Tax Valuation requirements
2. Voluntary Best Management Practice (BMP) Implementation

The following key elements for natural resources management will be incorporated into the implementation strategy for the Carters Creek Watershed TMDL IP, which will include all management measures proposed by the four work groups to address bacteria loading in the Carters Creek Watershed.

Once developed, an adaptive management strategy will be used to adjust the IP as needed since its initial implementation will demonstrate which management measures prove most effective given watershed specific conditions. The Texas Commission on Environmental Quality (TCEQ) will assess water quality in the Carters Creek watershed every two years as part of updating the *Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d)*. As changes in the creek's water quality are observed, modifications to the IP will be made accordingly. This adaptive management strategy will allow stakeholders to learn and adapt as implementation progress is made. The ultimate goal is for the Carters Creek Watershed TMDL IP is to reduce *E. coli* loading to the waterbodies such that they meet the state mandated water quality standards.

#### Key Element #1

*This element identifies the causes of the impairment, in this case the sources of bacteria that need to be controlled by the TMDL and the Implementation Plan.*

Potential sources of bacteria pollution can be divided into two primary categories: *regulated* and *non-regulated*. Pollution sources that are regulated have permits under the Texas Pollutant Discharge Elimination System (TPDES) such as MS4s or wastewater treatment facilities. Non-regulated sources are typically nonpoint source in nature, meaning the pollution originates from multiple locations such as grazing livestock, pets and wildlife. This type of pollution is usually carried to surface waters by rainfall runoff.

For the purposes of this assessment, specific causes of the bacteria impairment were not identified. Rather, larger source categories were defined and collectively evaluated to define the overall bacterial loading to the Carters Creek watershed. Specific sources identified in the watershed and listed alphabetically include:

***Regulated Sources:***

- Municipal separate storm sewer system
  - Dry weather discharges/Illicit discharges
- Wastewater treatment facilities
  - Sanitary sewer overflows

***Non-Regulated Sources:***

- Failing on-site sewage facilities
- Agricultural activities and domesticated animals
- Wildlife and unmanaged animal contributions

Water quality sampling data utilized in developing the TMDL for Carters and Burton Creek were collected between September 2001 and October 2007 at three key index sites within the watershed. Geometric means of data collected at each site exceeded the state's water quality standard of 126 colony forming units (CFUs) of bacteria per 100 mL water sample across all flow conditions with bacteria levels under 'very high flow' conditions exhibiting the highest bacteria geometric mean levels. This finding indicates that stormwater dominated flows do contribute a considerable amount of bacteria to the Carters Creek watershed.

The land use and land cover within the Carters Creek watershed indicates that the western portion of the watershed is dominated by developed urban area, and the eastern portion is rural. The Carters Creek watershed, excluding the Burton Creek sub-watershed, is predominately urban in its western portion and predominately rural (e.g., wooded, grassland, and agriculture) in its eastern portion. In contrast, the Burton Creek watershed is dominated by the urban landscape. Table 1 illustrates respective land use percentages within each watershed area.

Though land uses in the watershed have changed and continue to change, a large percentage of the Carters Creek watershed can still be characterized as rural or undeveloped. In total, the watershed encompasses 36,424 acres of which 9,775 acres, or 27 percent, is given an agricultural tax valuation (this is different than a general land use). Another 240 acres, or 0.7 percent, has been given a wildlife use tax valuation which is similar to the agricultural tax valuation (Brazos County Appraisal District, 2011). In the future, the continued shift in land use from rural to suburban may limit the level of involvement in some of the projects proposed for the Natural Resource Management Key Elements.

Table 1. Carters Creek Watershed Land Use/Land Cover  
(Source: 2001 National Land Cover Database as reported in TIAER 2010)

Land Use Description	Burton Creek Subwatershed % Total	Carter Creek Watershed % Total (excludes Burton Creek subwatershed)	Total Carters Creek Watershed % Total
Residential	68.32	31.93	36.33
Pasture / Grassland	0.28	22.80	20.07
Forest	n/a	14.41	12.66
Commercial / Industrial	30.45	11.95	14.20
Shrubland	0.20	9.44	8.32
Open Water / Wetlands	0.60	8.09	7.18
Cropland	0.03	0.68	0.61
Barren Land	n/a	0.68	0.61
Total	100.00	100.00	100.00

This portion of the plan will focus efforts on voluntarily targeting non-point sources of bacteria loading originating in the more rural areas of the watershed through technical and financial assistance for landowners as well as education and outreach. Natural resource management measures proposed will work to address bacteria contributions through a variety of mechanisms thus broadening the effective reductions in natural resource derived bacteria in the creeks.

## Key Element #2

*This element describes the programs identified to support the implementation of these management measures to protect the natural resources within the watershed.*

Agriculture and wildlife in the Carters and Burton Creek watershed consist solely of unregulated operations. As a result, voluntary implementation of any management measures is the only method for addressing bacteria loading stemming from these sources. With the trend of land fragmentation expected to continue in the rural portions of the watershed and the strong possibility of expanding urbanization in these same areas, educating existing and new landowners on available programs and providing them with pertinent information was seen as the most logical tool for use. Larger properties are continually being subdivided into ranchettes or large lots where people are able to house a small number of livestock and may not realize the full impacts of their actions; as such, this will be a key demographic targeted with future educational efforts.

### **Voluntary Best Management Practice (BMP) Implementation**

Voluntary BMP implementation has been recommended by the Natural Resources work group as a means to increase the implementation of physical management measures in the Carters Creek

watershed. Financial incentives provided to the landowner through several agency programs will serve as the catalyst to encourage private landowners to actually implement BMPs geared toward minimizing negative impacts to instream water quality and specifically reducing bacteria.

### ***Environmental Quality Incentives Program***

NRCS's Environmental Quality Incentives Program (EQIP) program can facilitate the implementation of BMPs in the watershed. The EQIP program provides financial assistance payments to eligible producers based on a portion of average practice implementation costs. Payment rates can vary in the level of assistance provided to the producer. Local NRCS personnel should be contacted to determine current assistance rates and eligibility guidelines. The EQIP program aims to work with farmers and ranchers to promote agricultural production and environmental quality as compatible goals. Each county sets a priority ranking system for the types of practices that will be given highest priority during the funding year. A producer's property being located in an impaired water body's watershed is also considered when ranking an application. EQIP applications are accepted year round; however, submission deadlines are usually applied. For further information on EQIP and to contact your local Brazos County NRCS field office (<http://www.nrcs.usda.gov/programs/eqip/>).

### ***Water Quality Management Plans***

Another technical and financial assistance opportunity that can be utilized in the Carters Creek watershed is the Water Quality Management Plan (WQMP) program through the Texas State Soil and Water Conservation Board (TSSWCB). Through this program, a site-specific conservation plans that are developed at the request of the landowner through assistance from local soil and water conservation districts (SWCDs). The plan includes appropriate land treatment practices, production practices, management measures, technologies or combinations thereof. The purpose of WQMPs is to achieve a level of pollution prevention or abatement determined by the TSSWCB, in consultation with local soil and water conservation districts, to be consistent with state water quality standards. WQMPs can include conservation practices such as brush management, cross fencing, pasture planting, alternative water source development, vegetative buffers, filter strips, slope stabilization, land shaping, stream crossings, rotational grazing and may also include application of innovative technologies. Once a plan is developed, it is reviewed by NRCS and TSSWCB personnel to ensure that the plan will meet needed water quality management goals. SWCDs assist with project coordination, technology transfer, notification of the availability of technical and financial assistance, and private landowner cooperation in installation of conservation practices.

Participation in the WQMP Program includes the following five steps:

1. An individual requests planning assistance through the local Soil and Water Conservation District.
2. The plan is developed with NRCS and TSSWCB assistance.
3. The WQMP is certified.

4. The individual implements the WQMP on his/her land.
5. The WQMP is subject to annual status reviews.

For more information on WQMPs and the process to apply for technical and financial assistance through this program contact your local SWCD (<http://www.tsswcb.state.tx.us/en/wqmp>).

### ***Discuss modifications to Agricultural Tax Valuation requirements***

In some cases, over stocking of a property by livestock animals may be done as a function of the landowner's efforts to maintain their agricultural tax valuation on their property. The extent to which this occurs in the Carters Creek watershed is not known and may not be a major issue. Generally speaking, the actions related to this management measure will not be carried out under any specific program. This effort will simply entail holding discussions with the Brazos County Appraisal District to evaluate the current livestock stocking requirements and identify any potential areas where they can be modified to help in protecting water quality.

### **Key Element #3**

*Key Element #3 describes the potential bacteria load reductions that could be achieved by implementing designated practices through the EQIP and WQMP programs in the Carters Creek watershed.*

Potential load reductions that could be achieved by implementing practices through the EQIP and WQMP programs will depend specifically on the particular BMP implemented by each individual landowner and the number of livestock in each landowner's operation. BMPs that have been included in EQIP or WQMP programs, that have been documented to measurably reduce the amount of fecal bacteria loading from cattle, and that can be employed in the Carters Creek watershed include exclusionary fencing, filter strips, prescribed grazing, stream crossings and watering facilities with fencing, prescribed grazing and water development being the three most likely practices to be implemented.

These BMPs have been the subject of various research efforts and estimated bacteria reduction efficiencies have been established for these practices through these studies. Table 2 lists the individual practice, the range of bacteria removal efficiency and the midpoint of the efficiency range as described in the literature. While research conducted in these works was not conducted in the Carters Creek watershed nor in Texas in most cases, these studies do illustrate the abilities of these practices to reduce bacteria contributions from livestock. Without watershed specific BMP efficiency evaluations, using the midpoint of the effectiveness ranges should be a safe assumption for predicting potential load reductions that could be realized through voluntary BMP implementation; however, using the lowest effectiveness rate will likely give a more dependable prediction for load reductions.

One challenge that will be experienced in the Carters Creek watershed when working with landowners to utilize these programs will be pressure from land development. As the population of the Bryan and College Station area continues to grow increasing demands for currently undeveloped lands in the watershed will persist. Many of the rural areas that are currently utilized for agricultural purposes on the fringes of the urbanized area are being shopped for development opportunities and this trend will likely continue into the future. As a result, landowners who feel that they will sell their property soon may be apprehensive to implement conservation practices through the EQIP or WQMP programs due to requirements to maintain practices over a designated period of time. If the practice is not maintained, they risk having to reimburse either NRCS or TSSWCB for the financial assistance originally provided.

Table 2. Livestock BMP Fecal Coliform Removal Efficiencies

Management Practice	Effectiveness: Low	Effectiveness:	
	Rate	High Rate	Mid-point
Exclusionary Fencing <sup>1</sup>	30%	94%	62%
Filter Strips <sup>2</sup>	30%	100%	65%
Prescribed Grazing <sup>3</sup>	42%	66%	54%
Stream Crossing <sup>4</sup>	44%	52%	48%
Watering Facility <sup>5</sup>	51%	94%	72.5%

<sup>1</sup> Brenner et al. 2004, Brenner 1996, Cook 1998, Hagedorn et al. 1999, Line 2002, Line 2003, Lombardo et al. 2000, Meals 2001, Meals 2004

<sup>2</sup> Casteel et al. 2005, Cook 1998, Coyne et al. 1998, Fajardo et al. 2001, Goel et al. 2004, Larsen et al. 1994, Lewis et al. 2010, Lime et al. 1998, Mankin & Okoren 2003, Roodsari et al. 2005, Stuntebeck & Bannerman 1998, Sullivan 2007, Tate 2006, Young 1980

<sup>3</sup> Tate et al. 2004, USEPA 2010

<sup>4</sup> Inamdar et al. 2002, Meals 2001

<sup>5</sup> Byers et al. 2005, Hagedorn et al. 1999, Sheffield et al. 1997

To calculate potential load reductions for each of these five BMPs, a generic equation has been developed based upon the number of animal units (AU), average fecal material production rates of beef cattle, the average *E. coli* content of beef cattle manure and the selected BMP effectiveness rate as listed above in Table 2. This generic form of equation based on AUs was chosen because an accurate estimation of BMP implementation cannot be clearly defined. Since BMP implementation is strictly voluntary, no firm number of BMPs that will be installed can be established. The number of cattle or AUs in an operation that voluntarily implements some of these BMPs can also not be determined prior to the actual implementation. As a result, basing the equation on the number of AUs can serve as a starting point for making estimations of potential load reductions that could be realized by implementing each practice.

$$\text{Potential Load Reduction} = \# \text{ of AUs} * \frac{37,195 \frac{g}{day}}{AU} * 7.97 \times 10^5 * \text{BMP Effectiveness Rate}$$

In this equation, inputs are as follows:

- AU = animal unit defined as 1,000 pounds of animal weight (ie. a 1,400lb cow = 1.4 AU)
- $37,195 \frac{g}{day}$  = the average fecal production rate of beef cattle as reported by Metcalf & Eddy, 1991
- $7.97 \times 10^5$  = the average *E. coli* production per gram of beef cattle fecal matter as reported by R. Karthikeyan, 2011 unpublished data from pastured cattle in the Cedar Creek watershed, Brazos County, Texas
- BMP Effectiveness rate = midpoint of BMP efficiencies as illustrated in Table 1

## Key Element #4

*This element identifies technical and financial assistance needed to implement the projects in these management measures.*

### Technical Assistance

Technical assistance for these projects will be performed by various agencies - NRCS, SWCDs, the Texas AgriLife Extension Service, TPWD and TSSWCB. Each of these agencies has a natural resource management focus and will serve as excellent resources for information seeking landowners.

Technical assistance for voluntarily implementing BMPs through the EQIP and WQMP programs is provided by the appropriate agency personnel. The NRCS District Conservationist provides landowners with technical assistance when implementing their EQIP program while local SWCDs and regional TSSWCB personnel provide technical assistance for WQMP program implementation. Brazos County SWCD can be contacted by email at [brazoscountyswcd@tx.nacdn.org](mailto:brazoscountyswcd@tx.nacdn.org) and the NRCS District Conservationist can be contacted at 979-846-4814 ext. 3.

TPWD is also a source of technical assistance to landowners interested in managing their properties for wildlife. While management measures specifically targeting wildlife are not included in the recommendations of the work group, assistance does exist for those interested in such activities. Through the agency website, <http://www.tpwd.state.tx.us/landwater/>, interested persons can access information about obtaining an agricultural tax appraisal based on wildlife management, Farm Bill provisions for wildlife management, the Landowner Incentives Program as well as many

other resources. For more specific information on available assistance through TPWD, contact your local wildlife biologist at 979-845-5798.

### **Financial Assistance**

Financial assistance for the projects in these management measures will come from a variety of sources. NRCS provides funds for the EQIP program and the amount of cost-share available to the producer varies from year to year. Funding TSSWCB's WQMP program is similar in nature to the EQIP program; however, funds are typically only available through special projects funded through TSSWCB. If funds are available, the program offers up to 60 percent reimbursement for approved practices up to a maximum of \$15,000 through the WQMP program. Each of these programs contain operation and maintenance requirements that the producer must adhere to when receiving financial assistance. If these requirements are not met, the producer may be forced to return funding received to the agency.

TPWD also has funding assistance available to eligible landowners through the Landowner Incentives Program. Funds available through this program can reimburse a landowner for up to 75 percent of total project costs. If interested contact your local wildlife biologist at 979-845-5798.

### **Key Element #5**

*This element describes the education component to enhance the public understanding of the Carters Creek watershed Implementation Plan and to encourage their participation.*

Education is seen as a primary tool for changing livestock and wildlife management practices in the watershed. For the most part, this watershed is urbanizing and some properties currently under agricultural or wildlife uses are actively being promoted for development. In years to come, low intensity residential areas and ranchettes will likely dominate the watershed. As a result, the Natural Resources work group recommends the following educational programming in conjunction with current educational efforts already implemented in the county by the Texas AgriLife Extension Service, Producers Cooperative and others:

- focus general, educational events regarding watershed management, wildlife management, livestock management and feral hog management as necessary in the watershed and county
- focus on small landowner programming with special emphasis on promoting wildlife tax valuations on small properties as opposed to agricultural use tax valuations due to acreage and stocking rate requirements
- focus on grazing management for all agricultural interests in the watershed, observation in the watershed shows widespread evidence of moderate to severe over-grazing



Direct mailings will also be used to notify selected agricultural producers of and encourage them to participate in technical and financial assistance program available in the watershed. As all recommended management targeting agricultural activities in the watershed is voluntary, providing general information through educational avenues and direct contact are the primary mechanisms that will be utilized.

The Texas AgriLife Extension Service through the local County Extension Agent periodically delivers educational programming of relevance here in Brazos County and in the watershed. College Station also serves as the state headquarters for the Texas AgriLife Extension Service and many of the topical experts on the items listed above are housed at a Texas A&M University. As a result, the delivery of pertinent educational events should be easier here than in some other areas of the state.

Producers Cooperative, a local cooperative feed mill and farm supply store, also hosts educational seminars on selected topics. Though not all focused on water quality or watershed management, they too are of use to local landowners and can and do illustrate how water quality can be impacted by on-farm actions. This is a very popular series and will be continued in the future.

## **Key Element #6**

*This element provides a schedule with milestones for implementing each of the projects and activities related to this management measures.*

Table 3 below illustrates the implementation schedule and implementation milestones of each management measure proposed for implementation as described above. Funding availability, utilizing adaptive management procedures and other unforeseen events can greatly impact the responsible entity's ability to adhere to this implementation schedule and meet designated milestones. As a result this schedule and milestones will be used as implementation goals and will be implemented to the extent possible.

Table 3. Natural Resource Work Group Management Recommendations Implementation Schedule & Milestones

Type of Management Measure	Management Measure	Implementation Schedule	Milestones
Voluntary BMP Implementation	Identify targeted landowners where BMP implementation will likely be most effective in positively impacting water quality and rank them based on size and proximity to stream channels	within year 1	current landowners identified
	Make contact with landowners of prioritized properties to inform them of cost-share program opportunities	year 2 - contact priority 1 year 3 - contact priority 2 year 4 - contact priority 3	direct mailings sent to each group
	Work with landowners to implement BMPs on private properties	as landowners request assistance	# of BMPs implemented
Agricultural Tax Valuation Modifications	Initiate talks with Brazos Co. Appraisal District to discuss needed for modification to current requirements for Ag Tax Valuations	within year 1	discussion held and decision made on needed changes
	Work with MS student to quantify impacts of conversion from Ag to wildlife	as funding allows	impacts quantified
	Explore ability to send educational information to landowners through the Appraisal District to Ag & wildlife valued lands	within year 1	discussion held

## Key Element #7

*This element identifies the interim, measurable milestones for these management measures that will be used to determine its ongoing progress and effectiveness.*

- The number of educational programs delivered and number of program participants in and near the watershed that contain topical material that including water quality, quantity, land management, livestock management and other topics as appropriate that can directly or indirectly impact instream water quality
- Documentation of efforts made to discuss modifications to agricultural tax valuation requirements for the county
- Results of Masters student work to quantify water quality impacts resulting from conversion from agricultural to wildlife land management scheme
- Documentation of discussion with Appraisal District to explore the ability to send information to selected landowners along with annual tax documents
- Identification and prioritizing of properties in the watershed with the highest potential for positively impacting instream water quality through BMP implementation

- Documentation of direct contact to inform landowners of BMP implementation assistance opportunities
- Number of BMPs implemented in the watershed and number of acres impacted

## Key Element #8

*This element defines the indicators that will be used to document improvements in water quality due to implementation of these management measures.*

Monitored instream *E. coli* concentrations will be used to document improvements in water quality due to implementation of the above described management measures. Data reported to TCEQ for inclusion in their surface water quality monitoring information system (SWQMIS) and used in their bi-annual water quality assessments will be used as the primary indicator of water quality improvements. *E. coli* data included in the Draft 2010 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d) will be used as the benchmark for tracking improvements. *E. coli* are reported in units of most probable number (MPN) per 100 mL of water and the geometric mean of at least 10 samples collected over a 7-year monitoring period should not exceed 126 mpn/100 mL. TCEQ station 11785 located at Bird Pond Road (Figure 1) will be used as the index site for future water quality assessments. As reported in the *Draft 2010 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d)* (TCEQ 2010), bacteria levels reported at this site during the most recent water quality assessment were 753.1 mpn/100mL. During this same assessment, Burton Creek's *E. coli* levels were found to be 527.1 mpn/100mL (station 11783) and Country Club Branch was reported as 503.9 mpn/100mL (station 11795); both well above the imposed *E. coli* standard.

## Key Element #9

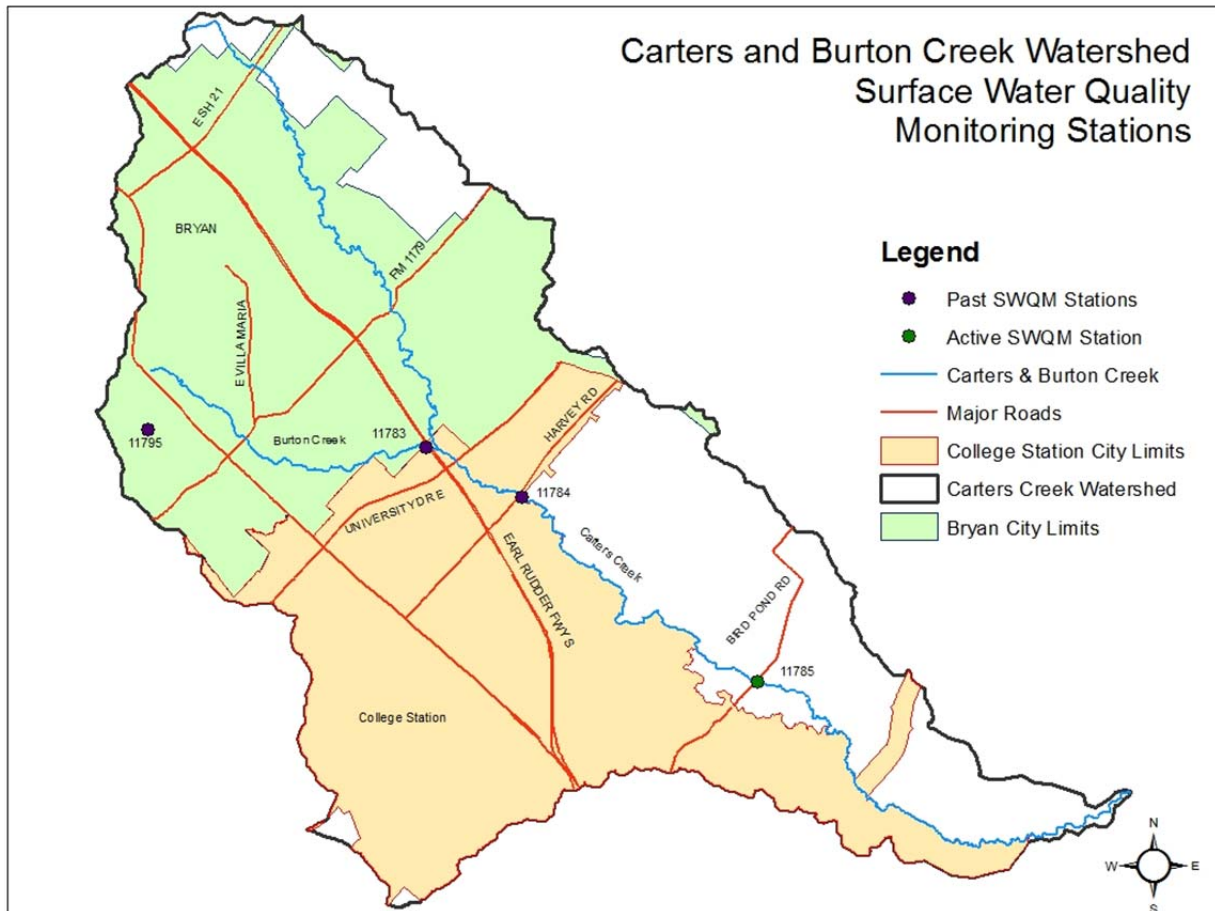
*This element describes the monitoring component of the Plan to determine the attainment of the water quality standards throughout the watershed.*

Water quality monitoring conducted and used to assess water quality in the Carters Creek watershed has been conducted in the past approximately quarterly by TCEQ and the Brazos River Authority at four monitoring stations (Figure 1) (Burton Creek: Station 11783, Carters Creek: Station 11784, Carters Creek: Station 11785, Country Club Branch: Station 11795). Beginning in August 2007, data collection in the watershed was reduced to monitoring Carters Creek station 11785 located on Bird Pond road. As a result, future monitoring conducted at station 11785 will be the benchmark dataset for determining water quality standard attainment.

Additionally, efforts to secure funding and conduct spatially and temporally intensive watershed monitoring to better characterize the breadth and distribution of *E. coli* loading in the watershed will be

undertaken as part of this TMDL Implementation Plan effort. Should funding be secured, these data will also provide good information to not only document improvements in water quality, but to refine local knowledge of the watershed and hopefully hone in on 'E. coli hotspots' in the watershed. This proposed monitoring scheme will be planned in coordination with all involved in developing the TMDL IP and Texas A&M Soil and Crop Sciences Department faculty. Additionally, the proposed monitoring will build upon earlier watershed monitoring conducted in the watershed. If funded, these data will also be used in future water quality assessments. Two NELAC approved labs exist in close proximity to the watershed and will be contracted for sample analysis so that data can be used incorporated into SWQMIS for future water quality assessments.

Figure 1. Carters Creek Watershed with Active and Past SWQM stations



## Key Element #10

*This element provides the following list of entities responsible for implementing this management measure.*

**Natural Resources Conservation Service (NRCS)** – Provides technical and financial assistance for BMP implementation through the EQIP and other program; landowner notification of program availability; track implementation of BMPs for documentation of implementation success

**Soil and Water Conservation District (SWCD)** – Assist with project coordination, technology transfer, notification of the availability of technical and financial assistance, and private landowner cooperation in the planning an installation of conservation practices

**Texas AgriLife Extension Service** – Provide technical assistance in the form of education and outreach to watershed landowners and residents on natural resource, water quality and watershed management

**Texas AgriLife Research** – Provide monitoring support as funding allows

**Texas Parks and Wildlife Department (TPWD)** – Provide education on the importance of vegetation and the role of wildlife as needed; monitor implementation of the plan

**Texas State Soil and Water Conservation Board (TSSWCB)** – Provides technical and financial assistance to landowners through the WQMP and other programs; tracks number and type of practices implemented for tracking implementation success

**Texas Water Resources Institute** – Provide coordination as needed and support for securing funds to implemented recommended management measures

Others as appropriate – Collaborate with others to provide opportunities to present program information to potential participants at their member meetings

## References

TCEQ 2010. Draft 2010 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d).  
<http://www.tceq.texas.gov/compliance/monitoring/water/quality/data/10twqi/10twqi>

TIAER 2010. Technical Support Document for Bacteria TMDLs in Carters Creek (Segment 1209C) and  
Burton Creek (Segment 1209L)

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