

Carters Creek Watershed Storm Water and Transportation Work Group Recommendation Report

This document describes the management measures recommended for implementation by the Carters Creek Watershed Storm Water and Transportation Work Group to address bacteria loading in the Carters Creek Watershed and its tributaries. The Storm Water and Transportation Work Group is made up of representatives from Brazos County, the cities of Bryan and College Station, local environmental consultants, Texas A&M University and local Texas Department of Transportation (TxDOT) personnel. Management measures are described in terms of the ten key elements required by the Texas Commission on Environmental Quality (TCEQ) to describe how the implementation of each management measure will help in meeting total maximum daily load (TMDL) requirements. The following measures are proposed for inclusion in the Carters Creek Watershed TMDL Implementation Plan (IP) by the Storm Water and Transportation Work Group:

1. Continue illicit discharge detection and elimination program
2. Enhance construction site runoff control measures
3. Conduct pollution prevention and good housekeeping measures

The measures listed above are either planned or recently implemented activities that some of the entities recently coming under municipal separate storm sewer systems (MS4) regulations are required to implement. Entities in the watershed currently under MS4 regulations are Brazos County, the cities of Bryan and College Station, Texas A&M and TxDOT. Each of these entities is under individual MS4 permits that are entity specific. As such, not all entities listed here will be responsible for each of the management practices listed here either.

Since the proposed measures presented in this document are in the early stages of being implemented; adaptive management will be critical to the long-term success of this implementation plan. Using data submitted to TCEQ for their bi-annual water quality assessment, current implementation of practices will be evaluated and those that prove to be effective in the Carters Creek watershed will be retained while those not effective can be removed. As changes in water quality are seen, modifications to this plan can and will be made to improve its effectiveness. Utilizing adaptive management throughout the process of implementing the plan will enable stakeholders to modify and improve the plan as progress is made and a better understanding of the watershed is developed.

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 (WWTF). Non-regulated sources are typically nonpoint sources, meaning that the pollution originates from multiple locations such as grazing livestock, pets and wildlife and are 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 in the Carters Creek Watershed. Specific sources identified in the watershed 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 *Technical Support Document for Bacteria TMDLs in Carters and Burton Creeks* (TIAER, 2010) were collected between September 2001 and October 2007 at three 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 storm water dominated flows do contribute a considerable amount of bacteria in the Carters Creek watershed.

This portion of the plan will focus efforts on targeting both permitted and non-permitted sources of bacteria contamination in the watershed. Storm water management measures proposed will work to address bacteria contributions from a variety of aspects thus broadening the effective reductions in storm water derived bacteria in the creeks.

Key Element #2

This element describes the programs identified to support the implementation management measures to reduce storm water derived bacteria contributions to the Carters Creek Watershed.

The Storm Water and Transportation Work Group was formed to develop management strategies and techniques geared to mitigate storm water derived bacteria contributions to the Carters Creek watershed as they relate to transportation and urban area influences. Using practices largely set forth in

the MS4 permits of each entity represented, the Work Group members selected management measures to include that were thought to have the highest potential to reduce bacteria loading to the water body. The impetus behind this decision was that all water quality data used in the development of this TMDL were collected prior to any of the MS4 mandated practices being implemented. As a result, the impacts of these practices have yet to be realized in subsequent water quality assessments. Costs were also immediately identified as an area of concern for all work group members and certainly influenced work group recommendations.

Many of the practices included in individual MS4 permits are identical or at least very similar in nature between the entities; however, this is not always the case and as such not all entities will be responsible for each practice. Coordination of efforts between these groups was viewed as a logical first step in mitigating storm water derived water quality impacts. The logical place to maintain coordination amongst all parties is in education, outreach and public involvement efforts. The Brazos Basin Storm Water Education Committee (BBSEC) is one mechanism currently in place that is facilitating the coordination of storm water education and outreach. This group meets approximately quarterly and will continue to do so into the future to discuss current efforts and coordinate future activities within the Carters Creek watershed as well as the larger Brazos County area.

Physical management practices will remain the responsibility of each respective entity implementing them.

Illicit Discharge Detection and Elimination Programs

These programs are designed to identify illicit discharges to the storm sewer collection and delivery system and implement a corrective action to eliminate the identified discharge. Efforts currently planned by entities in the watershed operating under active MS4 permits to implement their illicit discharge detection and elimination programs include:

- Continue to develop and update storm sewer maps; coordinate mapping between MS4 entities to ensure that maps mesh well and connections between entities are identified
- Develop and amend storm water ordinances (at the city level) to support Storm Water Management Plans (SWMP) and provide legal authority to require implementation of SWMP best management practices (BMPs)
- Continue implementing facility inspection and discharge detection training for MS4 entity employees
- Continue county-wide recycling program in place for household hazardous waste (HHW) (excludes TxDOT)
- Continually inspect storm sewer systems for dry weather flows
- Develop and implement a program to detect and eliminate sanitary sewer overflows and enhance enforcement of violations identified (excludes TxDOT)
- Explore the feasibility of implementing a Fats, Oils and Grease (FOG) abatement program

Enhancing Construction Site and Post Construction Runoff Control Measures

This measure is included to mitigate potential bacteria pollution associated with pollutant loading from storm water runoff originating at construction sites. Construction is considered to be a minimal contributor of *E. coli* in the watershed; however, *E. coli* are known to be associated with sediment which is a primary pollutant of concern at construction sites. Ensuring that proper storm water management measures are being utilized in construction areas is crucial to minimizing storm water impacts from these sites. The nature of many construction sites can lead to water quality problems that need proper management to abate. The initial disturbance to the site paired with increases in impervious surface and constant traffic in and out of the site warrant a well organized and coordinated approach to ensure that adequate measures are in place to curtail storm water contributions from these sites.

Active Construction

- Continue to review construction plans for storm water management compliance prior to beginning of construction; ensure that post construction storm water mitigation BMPs will adequately minimize any negative future impacts of storm water produced from the new construction
- Ensure that contractors adhere to storm water mitigation BMP implementation guidelines as set forth in their construction general permits

The active phase of most construction projects should not contribute significantly to bacteria loading in this or any watershed; however, once the construction process is completed a new land use has been created. This new land use has the potential to attract birds and mammals which can contribute bacteria to the area. Ensuring the adequate measures are incorporated into the building and property design and that those measures are actually implemented will serve as the primary means to mitigate future bacteria loadings from construction sites.

Post Construction

- Draft storm water ordinance (at the city level) granting legal authority for post-construction runoff practice implementation requirements
- Ensure that storm water mitigation practices were implemented according to general construction permit requirements and are functioning properly

Pollution Prevention and Good Housekeeping Plan

Implementing a “pollution prevention and good housekeeping plan” is a multi-faceted effort by entities operating under MS4 permits to reduce any negative impacts on storm water that the entity may contribute. Efforts employed in this effort range from education to physical practices and include participation by entity employees and the public. Efforts listed in local MS4 permits included in “pollution prevention and good housekeeping plans” are:

- Developing a storm sewer inlet cleaning/screening program
- Maintaining regular street sweeping program (cities, Texas A&M and TxDOT)

- Reviewing protocols for a spill response and prevention program
- Enhancing public employee education on storm water BMPs

Key Element #3

Key Element #3 describes the potential bacteria load reductions that could be achieved by implementing the management measure listed below in the Carters Creek Watershed.

Accurately predicting the level of load reduction expected through implementing most of the measures described above is difficult at best. With the exception of previously occurring sanitary sewer overflows (SSOs), data that accurately quantifies the volume and bacterial content of other components of the overall storm water load is not readily available. Without these data, current load estimates from individual sources nor an estimated load reduction for these sources can be accurately developed.

SSO Load Reduction Estimate

SSOs were identified as one contributor of *E. coli* into the storm sewer system for which a potential load reduction can be developed. Storm water managers actively identifying these SSOs and subsequently working with wastewater collection system personnel to rectify these problems is one management measure that will produce a quantifiable *E. coli* load reduction. Using the SSO information presented in the Technical Support Document for the Carters Creek Watershed Bacteria TMDLs and published literature values, the following equation was derived to estimate a potential load reduction for reducing the average number of SSO events by half.

$$.065 \frac{\text{SSOs}}{\text{day}} * 8748 \frac{\text{gallons}}{\text{SSO}} * \frac{10^6 \text{cfu}}{100\text{mL}} * .8 * 3785.2 \frac{\text{mL}}{\text{gallon}} = 1.72 \times 10^{10} \frac{\text{cfu}}{\text{day}}$$

In this equation, the inputs are as follows:

- $.065 \frac{\text{SSOs}}{\text{day}}$ - 248 SSOs recorded over a 1,884 day period *50%
- $8748 \frac{\text{gallons}}{\text{SSO}}$ = average SSO volume: 248 SSOs totaling 2,169,622 gallons of sewage
- $10^6 \frac{\text{cfu}}{100\text{mL}}$ = fecal coliform concentration rate in onsite septic facility effluent as reported by Metcalf & Eddy, 1991; Canter & Knox, 1985; Cogger & Carlile, 1984
- .8 = conversion factor to convert between fecal coliforms and *E. coli*
- $3785.2 \frac{\text{mL}}{\text{gallon}}$ - number of milliliters in a gallon

and the assumptions made include:

- Onsite septic facility effluent and wastewater spilled in an SSO event are treated as equal from an *E. coli* content perspective
- Reducing the number of SSO events by half is realistically achievable
- Colony Forming Units (CFUs) of *E. coli* and Most Probable Number (MPN) of *E. coli* are considered as equals and are used inter-changeably

Assuming that this level of load reduction can be achieved by reducing the average number of SSO occurrences by half and that the average SSO volume remains about the same, the average daily load in Carters Creek as measured at Station 11785 under very high flow conditions will be reduced from $1.6895 \times 10^{13} \frac{\text{MPN}}{\text{day}}$ to $1.6878 \times 10^{13} \frac{\text{MPN}}{\text{day}}$ for an overall load reduction of 0.1 percent. The very high flow condition was chosen because it was used in developing the TMDL for the watershed.

Construction Load Reduction Estimate

Bacteria load reductions from construction site derived stormwater can be approximated using sediment load reductions as a surrogate measure. A *Total Maximum Daily Load Implementation Plan for Knox Creek and Pawpaw Creek* in Virginia indicates that bacteria and sediment removal efficiencies of up to 85 percent can be achieved through properly implementing erosion and sediment controls. This estimated reduction is based upon no current erosion and sediment controls being implemented; this however is not a realistic assumption as construction general permits and SWMPs require these measures to be implemented. There are cases where these measures are not properly implemented or may be overwhelmed during a large rainfall event. The Storm Water and Transportation Work Group feel that load reduction should be reasonable through continued construction plan evaluations and site assessments during the active construction phase.

Illicit Discharge Load Reduction Estimate

Developing an estimated load reduction for illicit discharges in the watershed is limited by the data currently available. A watershed wide reconnaissance survey to identify illicit discharges to the stormwater collection and conveyance system has not been conducted. Similarly, volume of these discharges and the level of bacteria in them have not been quantified. Using an example from the Clear Creek watershed south of Houston, 22 percent of illicit discharges identified were found to contain elevated bacteria levels (TCEQ 2008). In report developed by PBS&J (2007), illicit discharges were identified as a major source of both instream flow and bacteria loading. In a creek dominated by wastewater treatment facility (WWTF) effluent a load reduction of 43 percent was observed while a creek not dominated by WWTF effluent realized a 77 percent load reduction as a result of illicit discharge detection and eliminations. Based on these findings, a load reduction of up to 43 percent as described above could theoretically be achieved in the Carters Creek watershed as both Carters and Burton Creeks are WWTF effluent dominated streams. Achieving this reduction would require all illicit discharges to be identified and corrected; however, this is not a realistic goal. Diligent efforts to identify

illicit discharges, especially SSO occurrences, are continually undertaken but despite best efforts all are not identified nor corrected.

Key Element #4

This element identifies technical and financial assistance needed to implement the projects in this management measure.

Technical Assistance

Current staffs employed by MS4 regulated entities fulfill the current technical assistance needs of each respective entity implementing measures to mitigate storm water runoff pollution contributions. Each of the management measures described under Key Element #2 has been planned and either has been implemented, is in the process of being implemented or will be implemented in the near future.

Should technical assistance needs arise in the future, several avenues exist for securing needed services. Engineering consulting firms have been utilized by MS4 regulated entities in the past and have provided their services in meeting technical assistance needs. Texas A&M engineering students also provide an opportunity for inexpensive technical assistance as well. Design projects are a common part of an engineering student's educational requirement at Texas A&M and in most cases produce very good results. As long as adequate lead time is available, this option could very easily be utilized.

The Texas Transportation Institute is another potential source of technical assistance should the need arise. TTI has expertise in conducting research and evaluating methodologies and BMPs for effectiveness in both mitigating storm water production and improving water quality through proper BMP selection and implementation.

Financial Assistance

Utilization of practices currently being implemented or planned for implementation through MS4 permit requirements has negated the need for additional financial resources at this point. Several items listed under Key Element #2 indicate that the use of that given practice will be explored. Should these practices be feasible, the need for additional financial resources will be evaluated at that time by the entity responsible for implementing the individual practice.

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 at multiple levels is considered to be a key aspect of decreasing bacteria contributions to Carters Creek watershed from storm water. Educating the public on storm water issues constitutes a management practice in and of itself, but education will also be instrumental in enhancing the effectiveness of other storm water management practices implemented as well.

Numerous educational efforts are already underway in the watershed and will be capitalized upon throughout the development and implementation of this TMDL Implementation Plan. Along these same lines, entities operating under MS4 permits are making concerted efforts to coordinate and collaborate on existing and future education and outreach efforts to the extent possible. The establishment of and continued participation in BBSEC by representative from Brazos County, the cities of Bryan and College Station, Texas A&M and TxDOT is the primary mechanism supporting this collaboration.

Efforts that will be coordinated and conducted by these entities to expand storm water education and inform citizens about the significance of negative storm water impacts on water quality include:

- Coordinate annual education and outreach events (ie. Earth Day, stream cleans, adopt-a-highway, etc.)
- Continue to develop and deliver public service announcements (PSA) regarding storm water protection; PSA content will include storm water, illegal dumping, litter, pet waste, lawn care, pharmaceuticals, etc.
- Maintain and update storm water content on entity websites
- Coordinate the distribution and content of education and outreach materials to targeted groups as appropriate (business, contractors, industry, residents)
- Develop educational partnerships with local schools and organizations
- Maintain and operate entity specific hotlines where storm water violations can be reported (with the exception of Brazos County)
- Develop and/or continue to implement storm drain stenciling programs
- Continue to conduct and promote watershed-wide clean-up events

Key Element #6

This element provides a schedule with milestones for implementing these management measures.

The proposed schedule of implementation as well as implementation milestones for the management measures recommended by the Storm Water and Transportation Work Group are included in each entity's MS4 SWMP. The table below illustrates the types of management measures as required in each entity's TCEQ MS4 Phase II permit. Milestones are completed within the five year permit term and updates are provided in the form of annual reports to assess performance and compliance. 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.

Stormwater and Transportation Workgroup Management Recommendations Management Measures , Milestones and implementation

Management Measure	Milestones	Reviewed and approved by TCEQ for the five year permit term
Education & Outreach	Specific to each entity's TCEQ MS4 Phase II permit SWMP	Updates provided to TCEQ in annual reports to assess performance and compliance
Illicit Discharge Detection & Elimination	Specific to each entity's TCEQ MS4 Phase II permit SWMP	Updates provided to TCEQ in annual reports to assess performance and compliance
Construction Site Runoff Control	Specific to each entity's TCEQ MS4 Phase II permit SWMP	Updates provided to TCEQ in annual reports to assess performance and compliance
Pollution Prevention & Good Housekeeping	Specific to each entity's TCEQ MS4 Phase II permit SWMP	Updates provided to TCEQ in annual reports to assess performance and compliance

Key Element #7

This element identifies interim, measureable milestones that will be used to document improvements in water quality due to implementation of these management measures.

Typical interim measurable milestones included but not limited to each entity's MS4 Phase II SWMP:

- Number of outreach events hosted
- Number of PSA updates completed
- Documentation of PSA delivery (number of times aired; number of online views)
- Websites kept current
- Documentation of storm water issues reported through entity hotlines
- Number of storm drains stenciled/marked
- Coordination of educational content and delivery; number of educational materials delivered (utility bill inserts, flyers, public and targeted presentations)
- Number of storm sewer map additions
- Number of amended storm water ordinances in support of SWMP
- Number of new employees trained
- Number of household hazardous waste collections
- Number of dry weather storm sewer flows detected
- Completion of Fats, Oils and Grease abatement program assessment

- Number of construction site plans reviewed
- Number of construction site inspections and permit violations identified
- Number of storm sewer inlets cleaned/screened
- Number of miles cleaned through street sweeping
- Documented changes in spill response and prevention protocols
- Number of employees trained in BMP inspection
- Number of watershed clean-ups

As the TCEQ Phase II MS4 Permit is a five year permit, it is prudent to note that annual reporting for each entity's permit is considered interim, thus satisfying key element #7. As previously mentioned, utilizing adaptive management throughout the process of implementing the plan will enable stakeholders to modify and improve the implementation plan and individual SWMPs as a better understanding of the watershed is developed.

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.

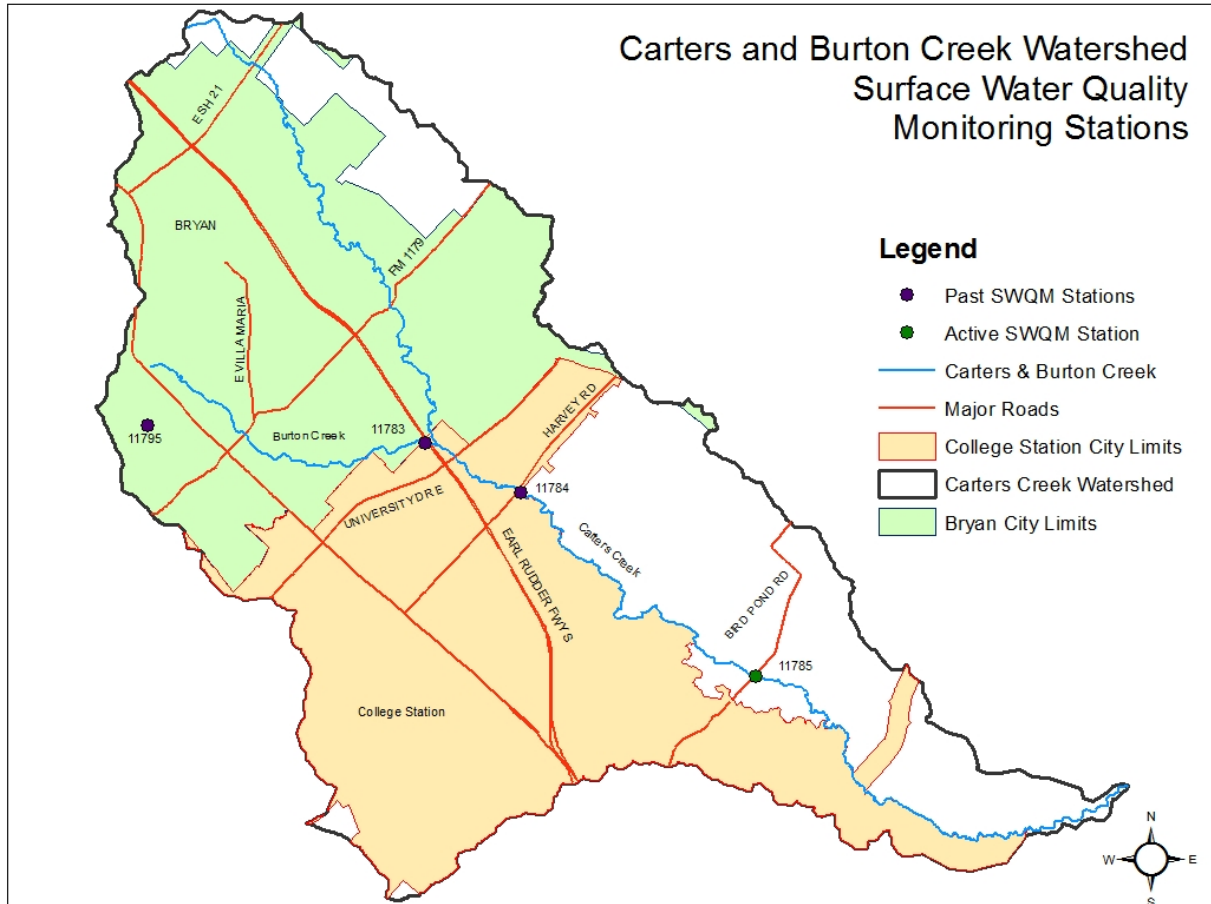
Key Element #9

This element describes the monitoring component of the Implementation 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 these management measures.

Brazos County – Responsible for implementing measures outlined in their entity specific MS4 permit. Also responsible for continued participation in BBSEC and coordinating education and outreach activities with other participating entities as described earlier.

City of Bryan – Responsible for implementing measures outlined in their entity specific MS4 permit. Also responsible for continued participation in BBSEC and coordinating education and outreach activities with other participating entities as described earlier.

City of College Station – Responsible for implementing measures outlined in their entity specific MS4 permit. Also responsible for continued participation in BBSEC and coordinating education and outreach activities with other participating entities as described earlier.

Texas AgriLife Research – Provide monitoring support as funding allows

Texas A&M University – Responsible for implementing measures outlined in their entity specific MS4 permit. Also responsible for continued participation in BBSEC and coordinating education and outreach activities with other participating entities as described earlier.

Texas Department of Transportation – Responsible for implementing measures outlined in their entity specific MS4 permit. Also responsible for continued participation in BBSEC and coordinating education and outreach activities with other participating entities as described earlier.

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

References

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