

Carmichael Creek 9 Key Element Watershed Plan
HUC 031601020403 (MWS 8051)
GY19 Project Area
May 2, 2019

Element a: Identification of Causes and Sources of Impairment

The Carmichael Creek-Town Creek Watershed is located just south of Tupelo, Mississippi (MS). Most of the 26,002-acre watershed lies primarily within Lee County in northeast Mississippi and is part of the Tombigbee River Basin. According to the 2011 National Land Cover Database (NLCD), the landuse in this watershed is comprised of approximately 36% (9379 acres) forestry, 20 % (5319 acres) cropland, and 16% (4253 acres) pasture/grassland (Figure 1).

The water-use classification for streams in the Carmichael Creek - Town Creek Watershed, as established by [*Regulations for Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*](#) (11 Miss. Admin. Code Pt. 6, Ch. 2), is *Fish and Wildlife*. Waters with this classification are intended for fishing and propagation of fish, aquatic life, and wildlife. Waters included in the *Fish and Wildlife Classification* should also be suitable for secondary contact, which is defined as incidental contact with water including wading and occasional swimming.

The largest water body in the Carmichael Creek-Town Creek Watershed is Town Creek and serves as the receiving stream for the majority of the drainage in the watershed. Other named streams include Carmichael Creek and Leeper Creek; both flowing into Town Creek. The Town Creek Drainage Area (DA), segment MS013TE, has a long history with Mississippi’s Section 303(d) List of Impaired Water Bodies. This water body segment was initially listed as evaluated on the 1996 Section 303(d) List as impaired for pesticides, nutrients, siltation, and organic enrichment (O.E.)/low dissolved oxygen (D.O.). The entire drainage area was considered as an “evaluated” §303(d) listing versus a “monitored” listing as there were no water quality data to verify impairment status of the water bodies in the watershed. The OE/Low DO impairment was later removed from the 303(d) listing for Town Creek using monitoring data that showed the water quality standards for DO were being attained in Town Creek.

The Mississippi Department of Environmental Quality (MDEQ) has conducted statewide biological monitoring using benthic macroinvertebrates as the indicator to develop a regionally-calibrated *Index of Biological Integrity (IBI)* for wadeable streams. This index, known as the *Mississippi Benthic Index of Stream Quality (M-BISQ)*, was used in the biological assessment of the State’s wadeable streams and rivers. In 2012, Cowpenna Creek (805112), a tributary to Carmichael Creek and thence Town Creek, was assessed as biologically impaired and added to the Section 303(d) List. The stream name was corrected in 2014 to reflect Leeper Creek as the actual water body name. Leeper Creek, segment 805112, remains on the list of impaired waters and is currently being scheduled for a stressor identification study to determine the cause of impairment to the stream. Once that study is completed, and a primary probable cause of impairment is determined, a total maximum daily load (TMDL) will be developed for the identified cause(s) of impairment. Once the stressor process and resulting TMDL is completed for Leeper Creek, the watershed plan may be modified if new conservation practices are needed to address the impairment. Figure 1 shows the location of the impaired segments within the Carmichael Creek-Town Creek Watershed.

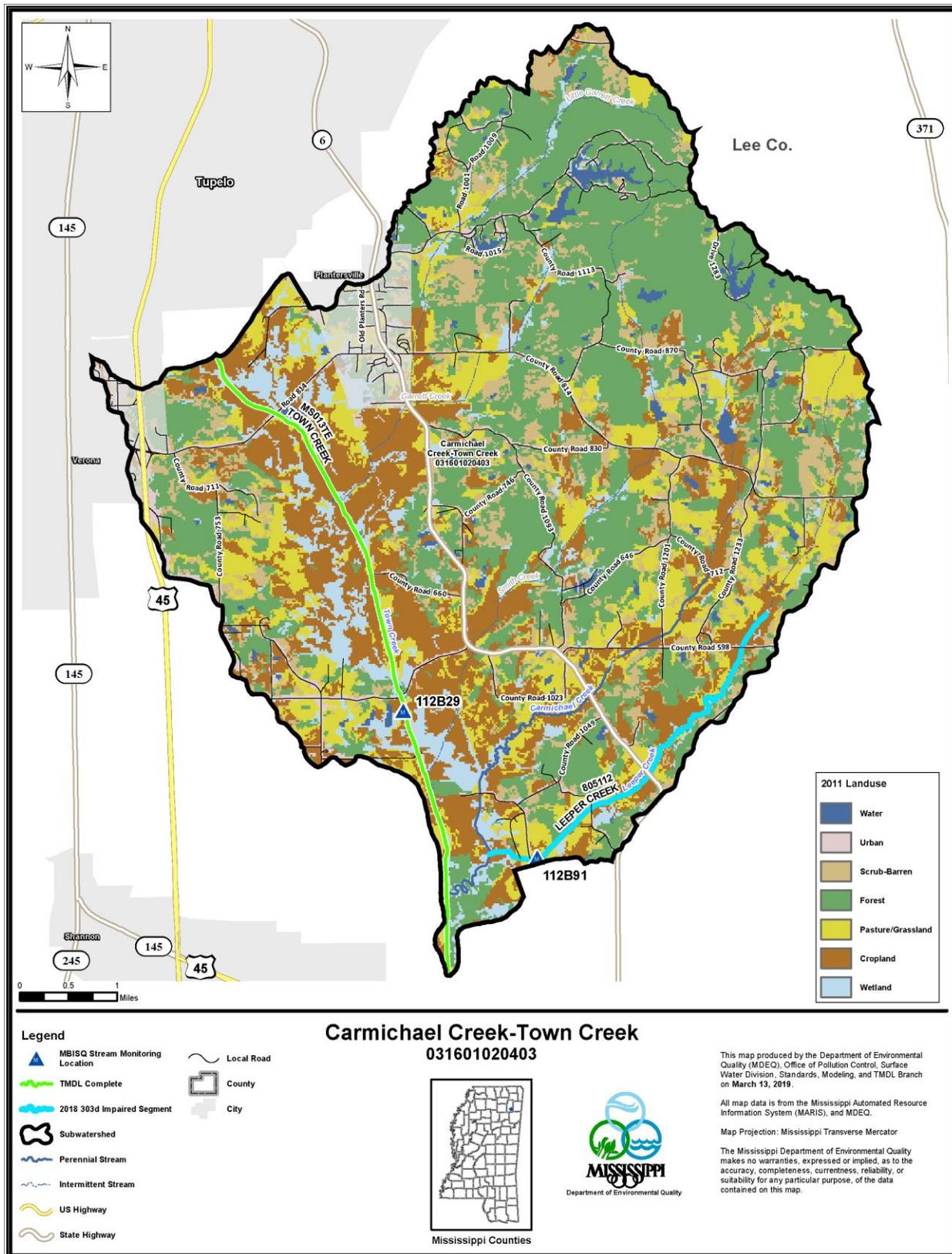


Figure 1: Landuse Distribution and Impaired Segments in Carmichael Creek - Town Creek Watershed

There are several TMDLs for Town Creek (MS013TE). Although the full extent of the segment spreads beyond the Carmichael Creek-Town Creek watershed boundary, the TMDL allocations apply to the segment of Town Creek that falls within the watershed. Town Creek segment MS013TE has TMDLs developed for nutrients (total nitrogen and total phosphorus), sediment, DDT and toxaphene that have been submitted to the United States Environmental Protection Agency (USEPA) Region IV.

Mississippi does not have water quality standards for allowable nutrient concentrations in streams; however, MDEQ is currently working in conjunction with a Nutrient Technical Advisory Group (TAG) on the development numeric nutrient criteria. According to the [Nutrient Total Maximum Daily Load for Town Creek \(MDEQ, 2009\)](#), an annual concentration of 0.7 mg/l is an applicable target for total nitrogen (TN) and 0.10 mg/l for total phosphorus (TP) for water bodies located in ecoregion 65. MDEQ used these preliminary target values for TMDL development which are subject to revision after the development of numeric nutrient criteria. During TMDL development, the Town Creek watershed evaluation indicated the impairment was due to phosphorus and nitrogen from point and nonpoint sources. The estimated existing ecoregion concentrations indicate reductions of nitrogen and phosphorus can be accomplished with installation of best management practices and reductions to point sources in the watershed. To meet the target nutrient concentrations, the TMDL calls for a Total Phosphorus (TP) reduction of 80% and Total Nitrogen (TN) reduction of 13%.

There were 15 National Pollutant Discharge Elimination System (NPDES) regulated municipal and industrial wastewater treatment plants (WWTPs) evaluated as part of the TMDL development in the area included in the TMDL modeling exercise for nutrients (Town Creek Watershed Hydrologic Unit Code (HUC) 03160102). The largest discharger in the TMDL area is the Tupelo Publically-owned Treatment Works (POTW). As a result, the TMDL recommends 13% reduction to the Tupelo POTW point source loading for TN and an 80% reduction of TP. There are no MS4 (Municipal Separate Storm Sewer System) permits within the TMDL area. It should be noted, of the 15 facilities identified in the TMDL, only 2 are located in the smaller drainage that represents the Carmichael Creek – Town Creek Watershed (HUC 031601020403). See below for the facilities that are located in this watershed with NPDES permits that include limits for TN and TP daily loading as pounds (lbs) per day and daily flow discharge shown as million gallons per day (MGD):

Table 1: List of Permitted Facilities in Watershed with Nutrient Allocation

Facility	Permit	Flow MGD	TN Load lbs/day	TP Load lbs/day
MS Department of Wildlife, Fisheries, and Parks, Tombigbee State Park	MS0033464	0.0075	0.072	0.033
Plantersville POTW	MS0020940	0.27	25.91	11.72

*The TMDL did not recommend TN and TP load reductions for these facilities.

Non-point source (NPS) loading of nutrients in a water body results from the transport of the pollutants into receiving waters by overland surface runoff, groundwater infiltration, and atmospheric deposition. The two primary nutrients of concern are nitrogen and phosphorus. Total nitrogen is a combination of many forms of nitrogen found in the environment. Inorganic

nitrogen can be transported in particulate and dissolved phases in surface runoff. Dissolved inorganic nitrogen can be transported in groundwater and may enter a water body from groundwater infiltration. Finally, atmospheric gaseous nitrogen may enter a water body from atmospheric deposition. Unlike nitrogen, phosphorus is primarily transported in surface runoff when it has been sorbed by eroding sediment. Phosphorus may also be associated with fine-grained particulate matter in the atmosphere and can enter streams as a result of dry fallout and rainfall (USEPA, 1999). However, phosphorus is typically not readily available from the atmosphere or the natural water supply (Davis and Cornwell, 1988). As a result, phosphorus is typically the limiting nutrient in most non-point source dominated rivers and streams, with the exception of watersheds which are dominated by agriculture and have high concentrations of phosphorus contained in the surface runoff due to fertilizers and animal excrement or watersheds with naturally occurring soils which are rich in phosphorus (Thomann and Mueller, 1987).

Watersheds with a large number of failing septic tanks may also deliver significant loadings of phosphorus to a water body. All domestic wastewater contains phosphorus which comes from humans and the use of phosphate containing automatic dishwashing detergents.

The implementation of best management practice (BMP) activities should reduce the nutrient load entering Town Creek. This will provide improved water quality for the support of aquatic life in the water bodies, and will result in the attainment of the applicable water quality standards

Town Creek has another TMDL entitled [*Total Maximum Daily Load Tombigbee River Basin Designated Streams in HUC 03160102 \(Town Creek\) for Impairment Due to Sediment, \(MDEQ, 2006\)*](#). This TMDL was completed for clean sediment. The *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters (11 Miss. Admin. Code Pt. 6, Ch. 2)* (MDEQ, 2016) regulation does not include a numerical water quality standard for aquatic life protection due to sediment. The narrative standard for the protection of aquatic life is sufficient for justification of TMDL development, but does not provide a quantifiable TMDL target. The target for this TMDL is based on reference sediment yields developed by the Channel and Watershed Processes Research Unit (CWPRU) at the U.S. Department of Agriculture, Agricultural Research Service, National Sedimentation Laboratory (NSL).

The CWPRU developed reference sediment yields, or targets, for each level III ecoregion within Mississippi. These yields were derived from the empirical analysis of historical flow and suspended sediment concentrations for stable streams in each level III ecoregion. For the Carmichael Creek – Town Creek watershed, the estimated allowable range of sediment loads for stable streams is 0.0004 to 0.0018 tons per acre per day at effective discharge. Also based on this analysis, a range of unstable values was assigned to the listed waterbodies within HUC 03160102 based on the level III ecoregion unstable stream values. The unstable range is representative of the existing loads that would be expected for water bodies within HUC 03160102. The unstable range for water bodies within HUC 03160102 is 0.002 to 0.054 tons per acre per day at the effective discharge. The unstable yields are larger than the target yields; therefore, a reduction is recommended for HUC 03160102. Based on the ranges of stable and unstable yield values, a reduction of 77% to 97% is recommended in HUC 03160102.

There are 2 facilities in watershed with NPDES permits that include limits for Total Suspended Solids (TSS) loads and daily Flow discharge.

Table 2: Permitted Facilities with TSS Limits

Facility	Permit	Flow MGD	TSS (lbs/day)
MS Department of Wildlife, Fisheries, and Parks, Tombigbee State Park	MS0033464	0.0075	6
Plantersville POTW	MS0020940	0.27	203

The TMDL did not require a reduction in TSS at those facilities because the analysis determined those sources provide negligible loadings of suspended solids to the receiving waters compared to wet weather sources (e.g., NPDES regulated construction activities and nonpoint sources). Also, the TSS component of a NPDES permitted facility is different from the pollutant addressed within this TMDL. The TSS component of the permitted discharges is generally composed more of organic material, and therefore, provides less direct impact on the biologic integrity of a stream (through settling and accumulation) than would stream sedimentation due to soil erosion during wet weather events. The pollutant of concern for the TMDL is sediment from landuse runoff and in-channel processes.

As of March 2003, discharge of storm water from construction activities disturbing more than one acre must obtain an NPDES permit. The purpose of the NPDES permit is to eliminate or minimize the discharge of pollutants (sediment) from construction activities. Since construction activities at a site are of a temporary, relatively short term nature, the number of construction sites covered by the general permit varies. The target for these areas is the same range as the TMDL target for the watershed. The wasteload allocation (WLAs) provided to the NPDES regulated construction activities will be implemented as BMPs as specified in Mississippi's General Stormwater Permits for Small Construction, Construction, and Phase I & II MS4 permits. Properly designed and well-maintained BMPs are expected to provide attainment of water quality standards. There are no MS4 permits within Tombigbee River Basin HUC 03160102.

Similar to nutrients and other pollutants, NPS loading of sediment in a water body results from the transport of the material into receiving waters by the processes of mass wasting, head cutting, gullyng, and sheet and rill erosion. Sources of sediment include: agriculture, silviculture, rangeland, construction sites, roads, urban areas, mass wasting areas, gullies, and surface mining. As such, sediment serves as a transport vehicle for a myriad of other pollutants including toxics. The DDT and toxaphene TMDL for Town Creek concluded these legacy pesticides as sediment-related pollutants subject to the implementation of the same best management practices to reduce sediment runoff as proposed in this watershed plan.

Element b: Expected Load Reduction

The [sediment TMDL](#) developed for Town Creek (MS013TE) and applicable for waters within the Carmichael Creek – Town Creek watershed concluded that yields would need to be reduced

by 77-97% in order to reflect stable conditions. The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) has a list of approved BMPs to address sedimentation and this list will be used to identify candidate BMPs in Broken Pumpkin Creek watershed.

At the time of nutrient TMDL development for Town Creek, and is presently the case, MDEQ does not have numeric nutrient criteria. Nutrients were addressed through an estimate of a preliminary total phosphorous concentration target and a preliminary total nitrogen concentration target. Based on the estimated existing and target TN and TP concentrations, the TMDL recommended a 13% reduction of the point and nonpoint TN loads and an 80% reduction of the point and nonpoint TP loads entering the water body to meet the preliminary target of 0.70 mg/l TN and 0.10 mg/l TP. The target values are subject to revision upon the adoption of numeric nutrient criteria or recommendations from the Nutrient Technical Advisory Group.

Non-point loading of nutrients and organic material in a water body results from the transport of the pollutants into receiving waters by overland surface runoff, groundwater infiltration, and atmospheric deposition. Unlike nitrogen, phosphorus is primarily transported in surface runoff when it has been sorbed by eroding sediment.

The NRCS has a list of approved BMPs to address nutrients and sedimentation. This list will be used to identify candidate BMPs in the Carmichael Creek – Town Creek watershed.

Element c: Proposed Management Measures

Coordinating partners with MDEQ include the Mississippi Association of Conservation Districts (MACD), the Mississippi Soil and Water Conservation Commission (MSWCC), the Natural Resource Conservation Service (NRCS), and the local Soil and Water Conservation Districts (SWCDs) throughout the state. These SWCDs are typically housed within USDA Service Centers co-located with NRCS offices. These USDA Service Centers handle federal assistance programs offered through the Farm Bill. As part of these services, SWCD staff communicate regularly with the local landowners and operators within the watershed as they work to support sign-ups for Farm Bill initiatives. Staff from MSWCC and the SWCD depend upon assistance from their NRCS partners in determining landowner interest in the watershed because they are on the farms and in the fields with the landowners, understand the needs at the local level, and have knowledge of the amount of unfunded applications for federal program assistance which meet Section 319 eligibility requirements.

Based on their analysis, installation of the following BMPs would mitigate sediment issues in the Carmichael Creek – Town Creek watershed, helping the stream recover: fencing, watering facilities, heavy use areas, stream crossings, ponds, sediment basins, establishment of permanent vegetation, forage and biomass planting, and nutrient management practices (lime and fertilizer). As stated above in Element a, much of the forest has recently been converted to pasture in this watershed. As such, BMPs will be prioritized for implementation in the newly converted pasture areas. Factors considered for determining specific locations for the placement of BMPs included the following attributes based upon best professional judgement:

1. Likely water quality benefit;
2. Willing landowners;
3. Implementation of the recommendations of the TMDL (i.e., “It is recommended that water bodies within [the watershed] be considered a priority for streambank and riparian buffer zone restoration and any sediment reduction BMPs, especially for road crossings, agricultural activities, and construction activities);
4. Ease of showing effectiveness of the BMP(s) through monitoring;
5. Shorter length of time for anticipated results (i.e., within the grant period);

Upon receipt of funding, MDEQ will coordinate with field staff from MSWCC in Lee County to target implementation in priority areas, then move to other areas as funds allow. A map depicting the landuse can be found in Figure 1. Additional considerations for prioritization of BMPs include the positioning of BMPs with willing landowners; the increased likelihood for leveraging of in-kind services; and proximity to pollutant sources to receiving streams.

Element d: Technical and Financial Assistance

As part of any Section 319 funded project, MDEQ requires a 40% match in project areas. This match may be in the form of actual dollars or may be provided as “in-kind” to project activities. Partners in this project who may contribute match include MSWCC, Lee County Soil and Water Conservation District, NRCS, United States Geological Survey (USGS) for additional monitoring, and/or local landowners and operators. For project implementation, administration, management, and watershed plan revision, as well as hosting and facilitating team meetings, MDEQ plans to work under a memorandum of agreement (MOA) with the MSWCC to implement this project. Project partners provided the funding amounts used to estimate costs for BMP installation. Provided below is summary of estimated costs for potential BMPs and overall project implementation:

Cost Estimate: Full Project Implementation:

Practice Name	Unit	No of Units	Unit Cost	Estimated Cost
Herbaceous Weed Management	ac	325	\$64.80	\$21,060.00
Cover Crop	ac	1000	\$55.86	\$55,860.00
Critical Area Planting	ac	55	\$483.84	\$26,611.20
Sediment Basin	cu yd	4250	\$3.34	\$14,195.00
Diversion	cu yd	9750	\$2.40	\$23,400.00
Fence	ft	20000	\$2.22	\$44,400.00
Field Border	ac	10	\$631.20	\$6,312.00
Grade Stabilization Structure	ea	45	\$15,000.00	\$675,000.00
Land Clearing	ac	20	\$530.65	\$10,613.00
Forage and Biomass Planting	ac	325	\$109.48	\$35,581.00
Livestock Pipeline	ft	10000	\$1.91	\$19,100.00
Prescribed Grazing	ac	500	\$57.13	\$28,565.00
Heavy Use Area Protection	ft	15000	\$3.23	\$48,450.00
Stream Crossing	ft	3750	\$11.07	\$41,512.50
Streambank and Shoreline Protection	ft	6000	\$198.60	\$1,191,600.00
Watering Facility	gal	5325	\$2.81	\$14,963.25
Underground Outlet	ft	5000	\$5.39	\$26,950.00
*Monitoring				\$140,328.00
*Technical Assistance				\$100,000.00
*Education/Outreach				\$69,500.00
*Project Management, Implementation, Coordination, Plan Revision				\$150,000.00

Total Estimated Project Cost**\$2,744,001**

* -Denotes fields that are estimated upon five incremental funding cycles of the project

Due to the magnitude of this project, it will need to be incrementally funded. In order to fully address all suggested conservation needs in the watershed, this plan recommends funding be provided in five (5) increments. To maximize education and outreach activities and monitoring efforts, MDEQ plans to leverage with existing programs already allocated for funding where possible. Below is the estimated budget for the first incremental funding (Phase 1) of this project:

Cost Estimate: Phase 1 Implementation

Practice Name	Unit	No of Units	Unit Cost	Estimated Cost
Critical Area Planting	ac	15	\$483.84	\$7,257.60
Sediment Basin	cu yd	2550	\$3.34	\$8,517.00
Diversion	cu yd	4445	\$2.40	\$10,668.00
Fencing	ft	3700	\$2.22	\$8,214.00
Grade Stabilization Structure	ea	10	\$15,000.00	\$150,000.00
Forage and Biomass Planting	ac	100	\$109.48	\$10,948.00
Stream Crossing	ft	1500	\$11.07	\$16,605.00
Streambank and Shoreline Protection	ft	100	\$198.60	\$19,860.00
Tank/Trough	ea	3	\$2,500.00	\$7,500.00
Underground Outlet	ft	1000	\$5.39	\$5,390.00
*Monitoring				\$74,328.00
*Technical Assistance				\$20,000.00
*Education/Outreach				\$13,900.00
*Project Management, Implementation, Coordination, Plan Revision				\$30,000.00

Phase 1 Estimated Project Cost**\$383,187.60****Element e: Information and Education**

The MDEQ, in cooperation with numerous federal, state, and local stakeholders has developed diversified information/education programs, best management practices manuals, literature, books, videos, and public service announcements that address pollutants from the seven (7) major land-use categories of Nonpoint Source Pollution, namely; agriculture, construction, forestry, on-site waste water disposal, surface mining, urban storm water runoff, and hydrologic modification. Audiences from pre-school to adults throughout the state are reached with a variety of mature, well-designed programs each year. These programs, events, manuals and literature can be used in the Carmichael Creek watershed project by tailoring them to address the sedimentation. A positive approach is used to reach the full diversity of people in the community with projects that foster a “sense of place”, a “sense of pride in community”, and a sense of the native plants, animals, and general ecology of their region, as well as, the history of the community and a sense of economics. Stakeholders and coordinators join together to participate in problem-solving brainstorming, plan development, training workshops, festival event planning, soil and water conservation field days, tree boards, poster, art and writing projects and other activities that promote collaboration and ownership of the watershed, as well

as, solutions to its problems. The ultimate goal is to bring about behavior changes and the use of “best management practices” that will improve water quality and the overall quality of life in the watershed. Evaluation forms, pre-test/post-test, surveys, and reporting of the number of people who attend workshops, trainings and events are among the methods used to measure the success of education/information programs. A partial list of MDEQ’s programs that could be used in the Carmichael Creek watershed are listed below:

- **Water Model Presentations** - Enviroscapes and groundwater aquifer models distributed statewide with training and related interactive lesson plans.
- **Teacher workshops** – train educators in proximity to the watershed about NPS pollution and provide materials and information that can be used in their classrooms.
- **Adopt A Stream** - workshops and training venues for citizens, teachers, and students in the Dry Creek Watershed.
- **Watershed Harmony Mobile Classroom** - for ages kindergarten – adults with state and federal public education objectives tailored for 4th and 5th grade students.
- **Storm Drain Marking** - projects for scouts, environmental clubs, and citizen groups.
- **“Train the trainer”** - workshops and materials for Soil and Water districts, Extension Service, etc.
- **“Waste Pesticide Disposal Event”** - The primary goal of this program is to help Mississippi farmers and property owners minimize the environmental risks associated with the disposal of waste-pesticide products by disposing of products in a safe and efficient manner.

As part of the education outreach efforts, the stakeholder group forming the Carmichael Creek Watershed Implementation Team (WIT) will participate in a minimum of 3 face-to-face meetings. The purpose of these meetings is to provide updates on implementation activities, education events and review and modify the watershed plan. In concert with these WIT meetings, and to incentivize stakeholder participation, project funding will be used to purchase food and other refreshments for the WIT along with providing support for renting facilities in which to host those events. In accordance with 41 CFR § 301-74.11, light refreshments, meals, and/or beverages are an allowable expense under Clean Water Act (CWA) Section 319, provided a description of the agenda, purpose, location, costs, etc., are outlined in an approved 319 grant workplan. The purpose of the meetings will be for updating the watershed plan, and hosting field days to showcase the implemented BMPs for the public. At this time, the exact number of participants and locations are not known therefore costs have been estimated for the purposes of this plan and will be updated.

Element f: Implementation Schedule

In the event of a Section 319 NPS funding award from MDEQ to support implementation of this watershed-based plan for this HUC 12 sub-watershed, MDEQ, along with support from the Watershed Implementation Team and Project Manager (where applicable), will:

1. Work to develop, execute, and implement a Subgrant Agreement that specifies the roles, tasks, requirements, and milestones for project implementation. (Month 1)

2. Facilitate, in coordination with MDEQ and other partners, meetings, media and social media promotion of the project, and coordinate activities to fully implement this plan. (Months 1-36)
3. Work with the Lee County SWCD, MSWCC, NRCS, and MDEQ to inform landowners and operators within the watershed about the project and work to secure commitments from priority area landowners and operators who are willing to participate in the project. (Months 1-6)
4. Work with the local SWCD, MSWCC, NRCS, and MDEQ to determine through GIS applications and intensive site surveys the priority areas within the sub-watershed that are contributing significant pollutant loads. All BMPs shall be installed in accordance with the guidelines developed in the latest edition of the NRCS Technical Field Manual, or other approved guidelines. (Months 1-36)
5. Facilitate, in cooperation with MDEQ and other monitoring partners, the completion and implementation of an effective and efficient plan to monitor baseline water quality conditions in the watershed and track changes in water quality over time resulting from the BMPs implemented through this project. (Plan Completion: Months 1-2); Implementation: Months 3-36)
6. Submit blank copies of standard maintenance agreements to MDEQ. (Months 13-36)
7. Conduct inspections of BMPs during construction (Months 3-36)
8. Coordinate with and support the local SWCD, MSWCC and NRCS in the collection of relevant GPS coordinates of all installed BMPs and incorporate this information into a GIS format. All geospatial data shall be collected in a manner consistent with the Federal Geographic Data committee-endorsed standards. (Months 3-36)
9. Collect adequate photo documentation before, during, and after installation of the approved BMPs. (Months 3-36)
10. Report measured, or estimated, nonpoint source pollutant load reduction, acreage affected, pre-and post- site conditions, and GIS data. (1-36)

Element g: Milestones and Outcomes

Milestone	Outcome	Probable Completion Date
Coordinate with the MDEQ, NRCS, MSWCC, USGS, and the Lee Co. Soil and Water District to determine priority areas that are contributing significant pollutant loads to Carmichael Creek Watershed	Target priority areas for BMPs	Months 1-2
Establish Watershed Implementation Team to begin refinement of Watershed Based Plan (WBP) for Carmichael Creek Watershed	Establish WIT	Months 1-2

Initiate watershed monitoring	Baseline condition monitoring	Completed using historical data
Meet with landowners and cooperators to secure commitments to install BMPs in priority areas	Landowner Commitment	Months 1-6
Establish routine meeting schedule for WIT to support WBP revision	WIT meetings	Months 1-36
Implement BMPs	BMP installation	Months 3-36
Coordinate with Landowners to inspect BMPs that were installed using Section 319 funds	BMP Inspection	Months 3-36
Begin monitoring to collect data on post-BMP water quality	Post-BMP Monitoring	Months 42-48
Finalize education and outreach plan scheduled	Education/Outreach events	Months 8-36
Finalize revised WBP	Final Revised WBP	Months 30-36

Goal: Reduce the Nutrient and Sediment loads entering into the Carmichael Creek –Town Creek Watershed.

Element h: Load Reduction Evaluation

The State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters do not include a water quality standard applicable to aquatic life protection due to sediment. However, a narrative standard for the protection of aquatic life was interpreted to determine an applicable target for the Town Creek TMDL. The narrative standard is that waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses. In lieu of numeric criteria for sediment and nutrients, the monitoring will be conducted to collect data on parameters that are considered surrogates for sediment (Total Suspended Solids, Total Suspended Sediment, turbidity) and nutrients along with conventional in-situ parameters generally measured to determine aquatic health (e.g. Dissolved Oxygen, pH, Temperature, Conductivity, Dissolved Solids) will also be obtained. The following thresholds will be used to measure compliance applicable with water quality criteria and/or target thresholds:

Table 3: Water Quality Thresholds for Carmichael Creek – Town Creek Watershed

Parameter	Threshold
Dissolved Oxygen	Daily Average of 5.0 mg/L; Instantaneous threshold of 4.0 mg/L
Dissolved Oxygen % Sat	≥ 70% - ≤ 125%
pH	6.0 – 9.0
Temperature	Not to exceed 90°F
Specific Conductance	Less than 1000 micromhos/cm
Dissolved Solids	Monthly average less than 750 mg/L; instantaneous threshold less than 1500 mg/L
Chemical Oxygen Demand	35 mg/L
Total Suspended Solids	65 mg/L
Turbidity	75 NTU
Total Nitrogen	0.7 mg/L annual concentration (numeric threshold established by Nutrient TMDL for Town Creek)
Total Phosphorus	0.10 mg/L annual concentration (numeric threshold established by Nutrient TMDL for Town Creek)
M-BISQ East Bioregion	71.6 Calibration 3 (Applicable to waters outside the Mississippi Alluvial Plain)

In addition to chemical data, biological community data and in-stream habitat surveys will be collected over the course of the project to determine attainment of the Aquatic Life Designated Use. These data are extremely helpful in identifying positive trends in water quality and should provide information to help determine if the implementation activities are resulting in water quality improvements. For freshwater wadeable streams, not including the Mississippi Alluvial Plain (i.e. Delta), Mississippi use a calibrated and verified index of biotic integrity to make water quality assessment decisions. This index, the Mississippi Benthic Index of Stream Quality (M-BISQ) was originally developed in 2000 and has undergone three recalibration efforts to refine the sensitivity of the index. As part of the index development process, the state was divided into unique bioregions. Within each bioregion, the index has a defined attainment threshold that is used to determine if the biological community measures collected at a site are representative of good water quality that can support a balanced benthic macroinvertebrate community. If the score is above the attainment threshold for the bioregion, the site is assessed as attaining the aquatic life use designation. Along with overall MBISQ scores, the in-stream habitat surveys will also be used to determine change over time.

It should be noted that recovery time of a stream is variable and may extend beyond the time frame identified in the workplan. At the end of the project, data will be analyzed to determine if the data indicate improvements to water quality in Carmichael Creek. In the event data indicate little or no positive change, a Stressor Analysis will be conducted to determine if any new or additional stressors are preventing improvements to water quality. If any new stressors are identified, the Watershed Implementation Team will identify future actions/activities to address those stressors.

Element i: Monitoring

Prior to BMP installation, pre-implementation monitoring will be conducted to serve as a baseline for the project. Historical monitoring data are also used as baseline data where available; however, no water quality monitoring has been conducted in Carmichael Creek. Other historical monitoring data is available in the Town Creek watershed for Town Creek and Leeper Creek. This varied water quality monitoring included water chemistry sample data (nutrients, suspended solids, oxygen demand, etc.), in-situ water chemistry (i.e. pH, temperature, specific conductance, and turbidity), as well as biological community monitoring for benthic macroinvertebrates and aquatic habitat assessment. A list of this historical water quality monitoring is provided in the table below, and their sample locations are shown in Figures 1 and 2.

Table 4: Monitoring Stations in Carmichael Creek – Town Creek Watershed

Station ID	Water Body	Sampling Year (s)	Agency	Project Type	Water Chem	In-Situ	Sonde	Benthics and/or Algal
112B29	Town Creek	2008	MDEQ	MBISQ	X	X		X
112B91	Leeper Creek	2009	MDEQ	MBISQ	X	X		X

Monitoring locations for this project will be selected using best professional judgment and will be targeted to reflect water quality downstream of BMP activity. Physical, chemical and/or biological data will be collected and specific parameters will be selected for monitoring based on the impairment cause being addressed by the BMP(s). Once BMP installation is complete, and there has been sufficient time for the stream to stabilize, post BMP monitoring will be initiated. Post BMP monitoring will be conducted in a way that allows for comparison with the pre-implementation data. Because recovery periods of streams can be dependent on type and amount of BMPs installed, more than 1 year of post-BMP data may be needed to observe a change in water quality. In some cases, it may take 5 or more years to see full benefits of BMPs. All data collection efforts will be conducted using trained personnel following established Standard Operating Procedures and adhering to agency Quality Assurance protocols.

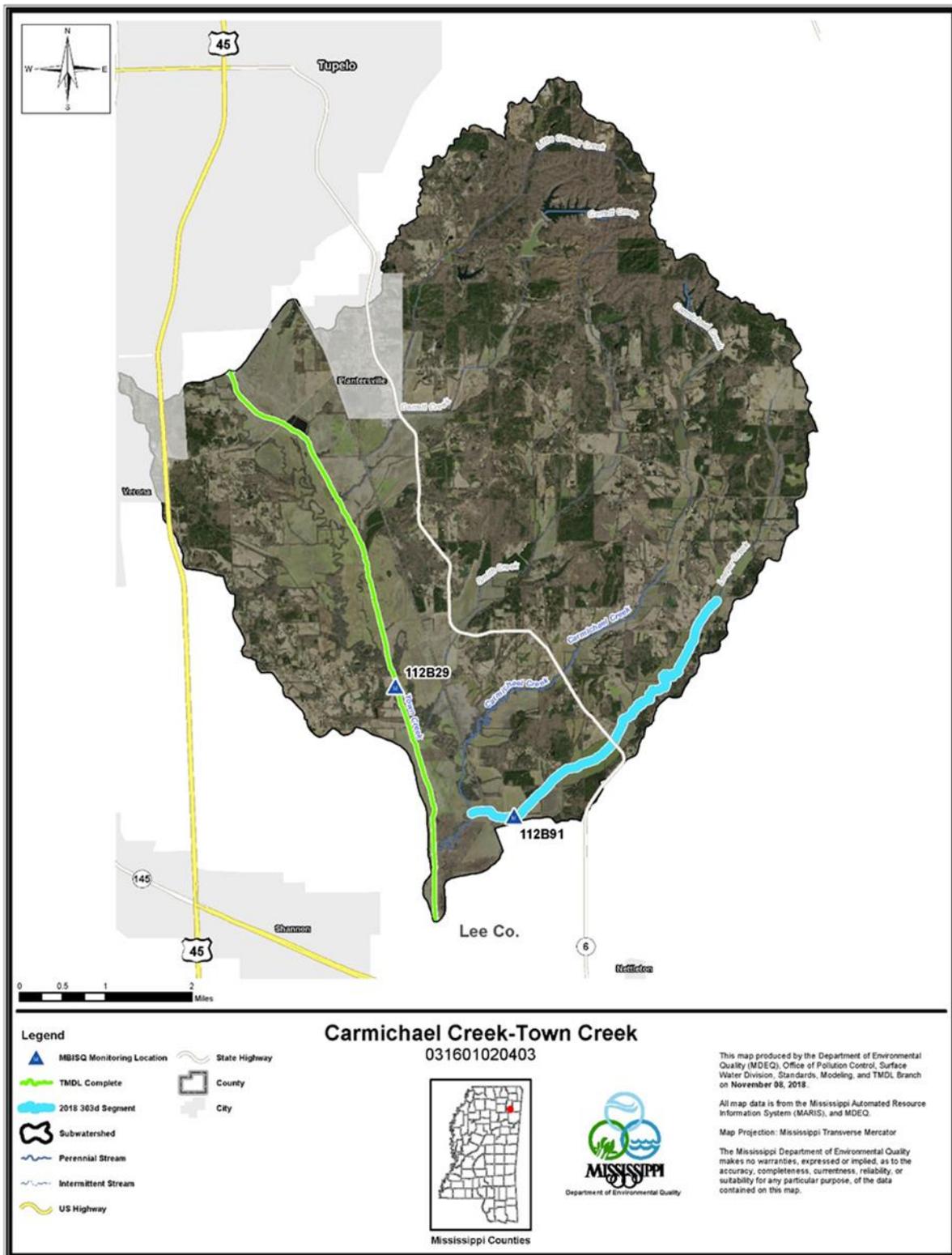


Figure 2: Monitoring Stations and Impaired Segments in Carmichael Creek – Town Creek Watershed