Yazoo Pass Watershed
9 Key Element Plan
HUC 080302040903
MWS 9317
GY21 Project Area
September 27, 2021

Element a: Identification of Causes and Sources of Impairment

Yazoo Pass Watershed (080302040903) is located predominately in northeastern Coahoma County with a small amount in northwestern Quitman County. Yazoo Pass Watershed is a 25,662-acre watershed where cropland comprises 75% (19,185acres) of the land use within the watershed. Wetlands 10.5% (2,715 acres) and 10% water (2,557 acres) make up another 20.5% of the landuse. Urban, pasture-grassland, forest, and scrub-barren are the remaining land uses (about 4.5%) according to the 2016 National Land Cover Database (NLCD) (Figure 1).

Beginning in 1998, the Yazoo-Mississippi Delta Water Management District (YMD) began to organize watershed level meetings throughout the Coldwater River Watershed, which included Moon Lake. In 2003, the U.S. Army Corp of Engineers signed an agreement with YMD and the Tunica County Soil and Water Conservation District (TCSWCD) to develop a watershed-scale plan to further identify watershed problems and solutions. Subsequently, YMD and TCSWCD entered into multi-year agreement whereas funds were provided for monitoring and conservation practice implementation. According to the 2008 report by YMD, although $1,025,000 had been spent on conservation practices in the Coldwater River (HUC 8) Watershed, very little work had been completed within the Moon Lake watershed, particularly in the Phillip's Bayou watershed (HUC 10) where only one site had been documented as an installed conservation practice.

Moon Lake is also included in a Coldwater River Watershed-Based Plan developed by Delta F.A.R.M. in 2012. While the plan covered the entire HUC 8 watershed, BMP implementation and evaluation focused on specific sites where funding from the NRCS Mississippi River Basin Initiative was leveraged.

Yazoo Pass Watershed is a sub-watershed of the Phillips Bayou-Yazoo Pass larger HUC 10 watershed and is the watershed that contains Moon Lake. The surface area of Moon Lake is approximately 2,308 acres, and the mean depth is 5.5 meters (FTN, 1991). Inflow to Moon Lake enters from Phillips Bayou to the north. Moon Lake drains through the Yazoo Pass to the east. The Moon Lake Watershed is a small part of an immense flood plain that is nearly level. Moon Lake is a popular destination for recreational users enjoying activities such as boating and fishing. Due to this, the east bank of the lake is highly developed, with houses lining much of the perimeter. A portion of the western bank has also been subject to development. With high public use comes interest and concern for maintaining optimal conditions for fishing and boating. Historical declines in lake conditions have prompted several studies and investigations of the lake and surrounding watershed. One of the first was *An Environmental Assessment of Moon Lake, Mississippi and its Watershed* in 1989 by the USDA- ARS National Sedimentation

Laboratory. Following this, a *Phase I Diagnostic/Feasibility study was* conducted by FTN Associates in 1991. These studies were conducted in response to concerns of reduction in depth, water clarity, and the possible presence of pesticides. Results of the studies indicated that while pesticides weren't an issue elevated turbidity levels following storms were preventing the lake from achieving its recreational and fishery potential. .

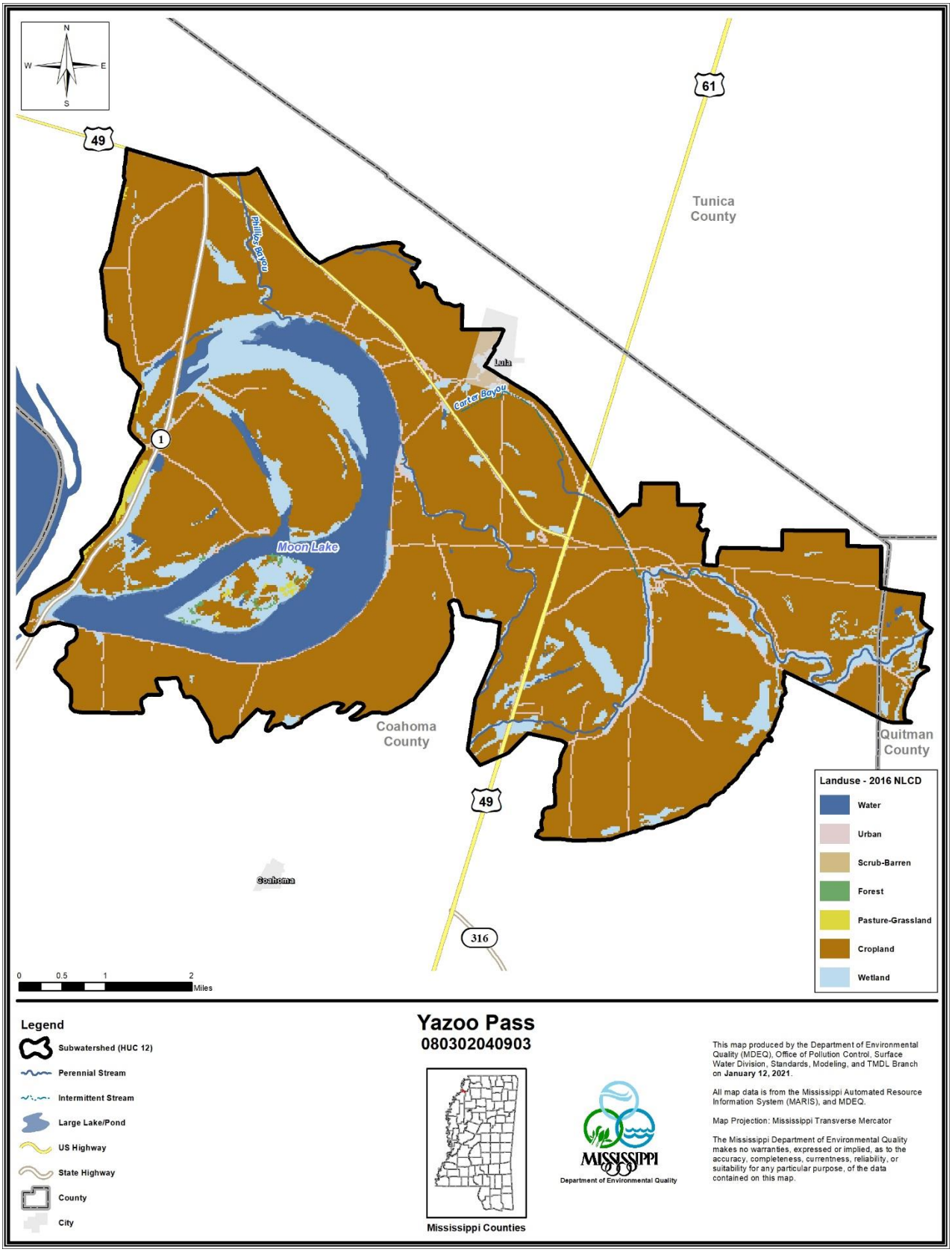

Figure 1: Yazoo Pass Watershed Landuse Map

In 1996, Moon Lake (MS320MLM) was included on MS's Section 303(d) List of Impaired Water Bodies for siltation, nutrients, and pesticides. A Total Maximum Daily Load (TMDL) was developed for sediment/siltation for Moon Lake in 2003. With the advancement of technology and data since this TMDL was written, the watershed area included in the TMDL has now been divided into three 12-digit HUCs (Figure 2). The lake itself lies in the Yazoo Pass sub- watershed (HUC 080302040903).

There are no facilities in the Yazoo Pass Watershed with NPDES permits that include limits for Total Suspended Solids (TSS) which is used as an indicator of sediment contributions from permitted activities. The pollutant of concern for the Moon Lake TMDL is sediment from land-use runoff. Certain contaminants may be associated with sediment such as pesticides and nutrients. These contaminants were not addressed directly within this TMDL. However, these contaminants would also be controlled by the same best management practices (BMPs) that control the sediment from nonpoint sources of pollution. The target for the TMDL was based on reference sediment yields developed by the Channel and Watershed Processes Research Unit (CWPRU) at the National Sedimentation Laboratory (NSL). Based on the ranges of stable and unstable yield values, a reduction in sediment of 35% to 56% is needed in the Yazoo Pass watershed.

Nonpoint loading of sediment in a water body results from the transport of material into receiving waters by the processes of mass wasting, head cutting, gullying, and sheet and rill erosion. Sources of sediment include agriculture, silviculture, rangeland, construction sites, roads, urban areas, mass wasting areas, gullies, surface mining, in-channel and instream sources, and historical landuse activities and channel alterations.

In 1998, Moon Lake was placed on the Section 303(d) list for fecal coliform. Although there the limited data available did not indicate an impairment, Moon Lake was included on the impaired waters list and classified as "evaluated" based on information that was included in the *Phase I Diagnostic/Feasibility study* for Moon Lake conducted by FTN Associates in 1991. Moon Lake was listed because the potential to exceed the standard was observed based on a septic survey that identified direct pipes and failing septic tanks (FTN, 1991). Subsequently in 2003, the *Phase One Fecal Coliform TMDL for Moon Lake* was developed by MDEQ to address the fecal coliform listing.

There are no permitted discharges in Moon Lake for pathogens. The potential nonpoint sources of fecal coliform bacteria for Moon Lake include failing septic systems, wildlife, and direct inputs, such as direct pipes. Human contributions from failing septic systems and direct pipes were identified as the primary source of bacteria in Moon Lake. As a part of the Phase One TMDL, MDEQ recommended that a reduction in the observed potential pollutant load be achieved through the elimination of all open pipes and inadequate individual wastewater treatment systems.

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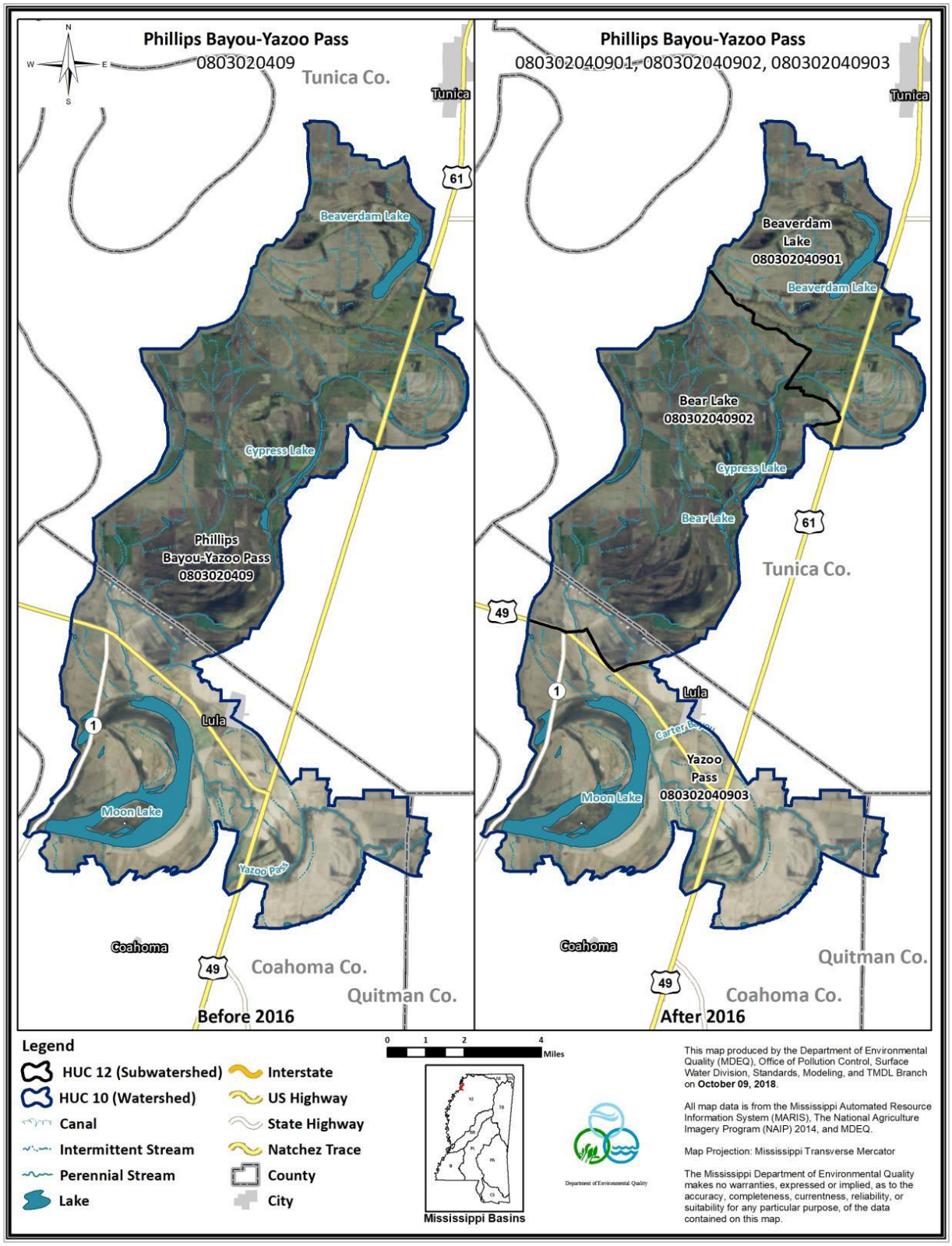

Figure 2: HUC 10 changed to HUC12

Element b: Expected Load Reduction

The TMDL for sedimentation/siltation on Moon Lake called for a 35% to 56% reduction in the sediment loading to the waterbodies within the watershed. Nonpoint loading of sediment in a water body results from the transport of material into receiving waters by the processes of mass wasting, head cutting, gullying, and sheet and rill erosion. Sources of sediment include agriculture, silviculture, rangeland, construction sites, roads, urban areas, mass wasting areas, gullies, surface mining, in-channel and instream sources, and historical landuse activities and channel alterations. The Natural Resources Conservation Service (NRCS) has a list of approved BMPs that address sedimentation issues and this list will be used to identify BMPs that are candidates to be used in the Yazoo Pass Watershed.

According to the Phase One TMDL for fecal coliform that was developed in 2003 for Moon Lake, there are no permitted discharges in Moon Lake for pathogens. The potential nonpoint sources of fecal coliform bacteria include failing septic systems, wildlife, and direct inputs, such as direct pipes. MDEQ recommended that a reduction in the observed potential pollutant load be achieved through the elimination of all open pipes and inadequate individual wastewater treatment systems.

Element c: Proposed Management Measures

In the Yazoo Pass Watershed, MDEQ will be working with the non-profit group Delta Farmers Advocating Resource Management (better known as Delta F.A.R.M), a long-time partner in this region of the state. As a local resource to farmers, Delta F.A.R.M. staff communicate regularly with the local landowners and operators within the watershed as they work to support sign-ups for Farm Bill and other conservation initiatives. Delta F.A.R.M. staff understand conservation needs at the local level and are aware of needs not funded through NRCS programs which meet Section 319 eligibility requirements. Under this watershed plan, Delta F.A.R.M. will implement conservation strategies for the Yazoo Pass Watershed. Stakeholder committees representing lake and farm interests have been established and preliminary discussions are underway regarding priority areas for conservation practice implementation.

Preliminary surveys of the Yazoo Pass watershed have been conducted to estimate the type and quantity of conservation practices needed on the landscape. Delta F.A.R.M. used this as a starting point to initiate surveys to prioritize sites for implementation so that the greatest environmental gain may be achieved with the available resources. Farm stakeholders in the watershed have expressed interest in working cooperatively to implement and maintain conservation practices. Being in close proximity to the Mississippi River, the Yazoo Pass watershed is characterized by ridge and swale topography, which is prone to sedimentation loss due to sheet, rill, and gully erosion. Gully erosion will be addressed with water control structures, both slotted and riser pipes. Sheet and rill erosion will be addressed through structural conservation practices as well as non-structural agricultural management practices. Structural measures include low-grade weirs and two-stage vegetated ditches. Non-structural practices such as cover crops and reduced tillage are proven to be the best method of addressing sheet and rill erosion. However, this requires farmers to alter their crop production practices, thus introducing risk of financial loss. Overcoming these hurdles to the adoption of cover crops, reduced tillage, and other practices that improve soil health while providing environmental benefits has been a large part of Delta F.A.R.M.'s work over the past several years. This work will be transitioned into the Yazoo Pass watershed by working with farmers to implement these practices, with technical and financial assistance, in priority areas prone to high rates of sediment and nutrient

loss. Delta F.A.R.M. will also identify opportunities for BMP implementation through NRCS covered programs and provide assistance to producers throughout the application and implementation process. Based on their analysis, installation of the following BMPs would mitigate the sediment issues in the Yazoo Pass Watershed:

- Water Control Structure
- Vegetated Ditches
- Grade Stabilization Structures
- Cover Crops
- Nutrient Management

In order to address any potential pathogen issues in Moon Lake, MDEQ will work with the MS Department of Health and the established lake landowner association. Along with the MS Department of Health, MDEQ will provide education and outreach materials to landowners around the lake regarding the proper operation and maintenance requirements for septic systems. Where possible, MDEQ will work with landowners to identify potential funding sources to support any maintenance needs.

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 that may contribute match include Delta F.A.R.M., USGS (monitoring), project partners, and/or local landowners. Delta F.A.R.M. provided the following numbers used to estimate costs for BMP installation. Funding was also estimated to support education and outreach activities for the operation and maintenance of onsite septic systems. Provided below is a summary of estimated project costs for full-scale watershed restoration:

Estimated Quantity and Cost of Project Implementation for the Yazoo Pass Watershed.

BMPs	Size/Amount	Estimated Cost
Grade Stabilization Structure (#)	32 @ $6,480	$207,360
Water Control Structure (#)	82 @ $2,400	$196,800
Vegetated Ditch (in ft)	20,898 @ $10	$208,980
Cover Crop (ac)	17,727 @ $73	$1,294,071
Education/Outreach		
Full Watershed		$30,000
Lake Landowners (OSDS)		$50,000
Monitoring		$58,500
Project Management, Implementation, Coordination, Plan Revision		$109,320
Total Estimated Project Cost		$2,155,031

Given the large financial burden of full watershed-scale conservation practice implementation, an incremental approach focusing on building producer partnerships and leveraging other

federal, state, and private investment in conservation should be considered. The following table summarizes the quantity and costs of project implementation that could occur through an initial implementation phase.

Phase 1: Estimated Quantity and Cost of Project Implementation for the Yazoo Pass Watershed.

BMPs	Size/Amount	Estimated Cost
Grade Stabilization Structure (#)	5 @ $6,480	$32,400
Water Control Structure (#)	40 @ $2,400	$96,000
Cover Crop (3 80 ac sites - 2 yr.)	$73	$35,040
Education/Outreach	N/A	$24,900
Full Watershed		$15,000
Lake Landowners (OSDS)		$25,000
Monitoring	N/A	$29,250
Project Management, Implementation, Coordination, Plan Revision		$54,660
Total Estimated Project Cost		$312,250

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: 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 Yazoo Pass watershed project by tailoring them to address the sedimentation and bacteria issues in the watershed. 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 Yazoo Pass 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 Yazoo Pass Watershed.
- **Watershed Harmony Mobile Classroom -** for ages kindergarten – adults with state and federal public education objectives tailored for 4th and 5th grade students.
- **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.
- **On-Site Disposal System** – Provides education on the proper operation and maintenance of on-site septic systems and provides information on available resources to address failing systems in the watershed.

As part of the education outreach efforts, the stakeholder group forming the Yazoo Pass Watershed Implementation Team (WIT) will participate in a minimum of 3 face-to-face meetings. In addition, staff will meet with the subset of landowners with property adjacent to Moon Lake to discuss issues related to bacteria in the lake and potential inputs from septic systems. The purpose of these meetings is to provide updates on implementation activities, education materials, 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.

Element f: Implementation Schedule

The following work plan describes the approaches and tasks that the grantee shall collaboratively perform with project partners to advance and implement this watershed-based plan. During this effort, the grantee will work with the MDEQ Basin Team and will put forth its best effort to perform the tasks identified below within the given timetable.

1. Upon approval of 9 Key Element Watershed Plan, the grantee shall work with MDEQ to develop, execute, and implement a Sub-Grant Agreement that defines the roles, tasks, requirements, and milestones of the grantee. (Month 1)

2. The grantee, with assistance from MDEQ, shall determine priority areas that are contributing significant pollutant loading to the watershed. (Months 1-2)

3. The grantee, with assistance from MDEQ, shall assist in the identification of members and development of a Watershed Implementation Team (WIT). (Months 1-2)

4. The grantee, with assistance from the WIT, shall develop a Watershed Based Plan (WBP) for the watershed that includes the tasks for achieving a reduction in sediment and

pathogen loadings to waterbodies within the watershed. This WBP will include the 9 Key Element Plan as an attachment. (Months 24-36)

5. The grantee, in cooperation with the WIT, MDEQ, and others, shall assist in the development and implementation of a watershed monitoring plan for the project (Months 1-36).

6. The grantee shall inform landowners and operators within the identified priority areas about the project and secure commitments from these priority-area landowners and operators who are willing to participate in the project. (Months 1-12)

7. The grantee, in accordance with the previously submitted and approved WBP, shall develop plans for the installation of BMPs on priority lands within the watershed. (Months 2-36)

8. The grantee shall assist participants in installing approved BMPs. 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 2-36)

9. The grantee shall, in a timely manner, notify MDEQ project officer of all project-site locations/inspections/public meetings so that MDEQ project officer may have the opportunity to attend. (Months 2-36)

10. The grantee shall collect relevant GPS coordinates of all implemented practices and incorporate into GIS format. All geospatial data shall be collected in a manner consistent with the Federal Geographic Data Committee endorsed standards. (Months 1-36)

11. The grantee shall take adequate photo documentation before, during, and after the installation of the implemented practice. (Months 1-36)

12. The grantee shall submit quarterly reports not later than the 25th of April, July, October, and January of each year showing the status of tasks and start/completion dates of each task. (Months 1-36)

13. The grantee shall make project presentations as requested by MDEQ. (Month 1-36)

14. The grantee shall assist the MDEQ project officer in conducting inspections during construction. (Months 3-36)

15. The grantee shall submit a final report to MDEQ to include measured, or estimated, non-point source pollutant reductions or water quality improvements, acreage affected, pre- and post- site conditions, and GIS data. The grantee shall make revisions, if necessary, upon the request of MDEQ. (Month 36)

Element g: Milestones and Outcomes

Milestone	Outcome	Probable Completion Date
Coordinate with the MDEQ, NRCS, USGS, and partners to determine priority areas that are contributing significant pollutant loads to Moon Lake	Target priority areas for BMPs	Month 1-6
Establish Watershed Implementation Team to begin refinement of Watershed Based Plan for Yazoo Pass watershed	Establish WIT	Month 1-2
Initiate watershed monitoring	Baseline condition monitoring	Month 3-12
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 implementation/ revision	WIT meetings	Months 1-36
Implement BMPs	BMP installation	Months 12-36
Coordinate with Delta F.A.R.M. to inspect BMPs that were installed using Section 319 funds	BMP Inspection	Months 24-36
Begin monitoring to collect data on post-BMP water quality	Post-BMP Monitoring	Months 30-42
Finalize education and outreach plan	Education/Outreach events scheduled	Months 8-36
Finalize revised WBP	Final Revised WBP	Months 28-36

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 Moon Lake 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, the monitoring plan will be designed to collect data on parameters that are considered surrogates for sediment concentrations and may include measurements for total suspended solids, total suspended sediment, and turbidity along with conventional parameters generally measured to determine aquatic health (e.g., dissolved oxygen, pH, temperature, conductivity). For pathogens, waters must meet a 30-day geometric mean of 126 per 100 ml, nor should the samples examined during the 30-day period exceed 410 per 100 ml more than 10% of the time for *E. coli*. The following thresholds will be used to measure compliance with water quality criteria:

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	<50 mg/l
Turbidity	<100 NTU
Total Suspended Solids	<80 mg/l
E. coli	30-day geometric mean of 126 per 100 ml; samples during 30-day period should not exceed 410 per 100 ml more than 10% of the time

In addition to chemical data, biological community data and in stream habitat surveys will be collected over the course of the project. 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. As has been done in other watersheds in this region, MDEQ and Delta F.A.R.M. will work with other watershed partners to identify opportunities to establish edge of field monitoring. MDEQ will continue to monitor Moon Lake as part of the state's Ambient Lake Monitoring Program. In addition to ambient monitoring, MDEQ will collect *E. coli* in the lake to monitor for pathogens.

It should be noted that recovery time of a stream is variable and may extend beyond the timeframe identified in the work plan. At the end of the project, data will be analyzed to determine if they indicate improvements to water quality. 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 chemical and biological monitoring have been compiled to serve as a baseline for the project along with any historical data available in the Yazoo Pass Watershed (which contains Moon Lake). This varied water quality monitoring included water chemistry data (nutrients, suspended solids, oxygen demand, chlorides, etc.), in-situ field measurements for such parameters as dissolved oxygen, pH, temperature, specific conductance, turbidity and secchi depth (lakes), datalogger (sonde) deployment for continuous in-situ field measurement data as well as biological community monitoring for benthic macroinvertebrates in streams and algal chlorophyll-a in lakes for trophic index determination. A summary of this historical water quality monitoring in the Yazoo Pass watershed is provided in the table below and their locations are shown in Figure 3.

Station ID	Water Body	Sample Year(s)	Collecting Agency	Project	Water Chem	In-Situ	Sonde	Benthics
A0270015	Yazoo Pass	2009, 2013	USGS, MDEQ	Delta BISQ	X			X
YZ291	Moon Lake	2002-2004, 2009, 2011, 2015 - 2020	MDEQ	Nutrient Criteria, Ambient Lakes Status & Trends	X	X		
YZ292	Moon Lake	2002-2004, 2009, 2011, 2015 - 2020	MDEQ	Nutrient Criteria, Ambient Lakes Status & Trends	X	X		
YZ431	Moon Lake	2002-2004, 2009, 2011, 2015 - 2020	MDEQ	Nutrient Criteria, Ambient Lakes Status & Trends	X	X		

Post-implementation monitoring locations will be selected using best professional judgment and will be targeted to reflect water quality downstream of BMP activity. 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.

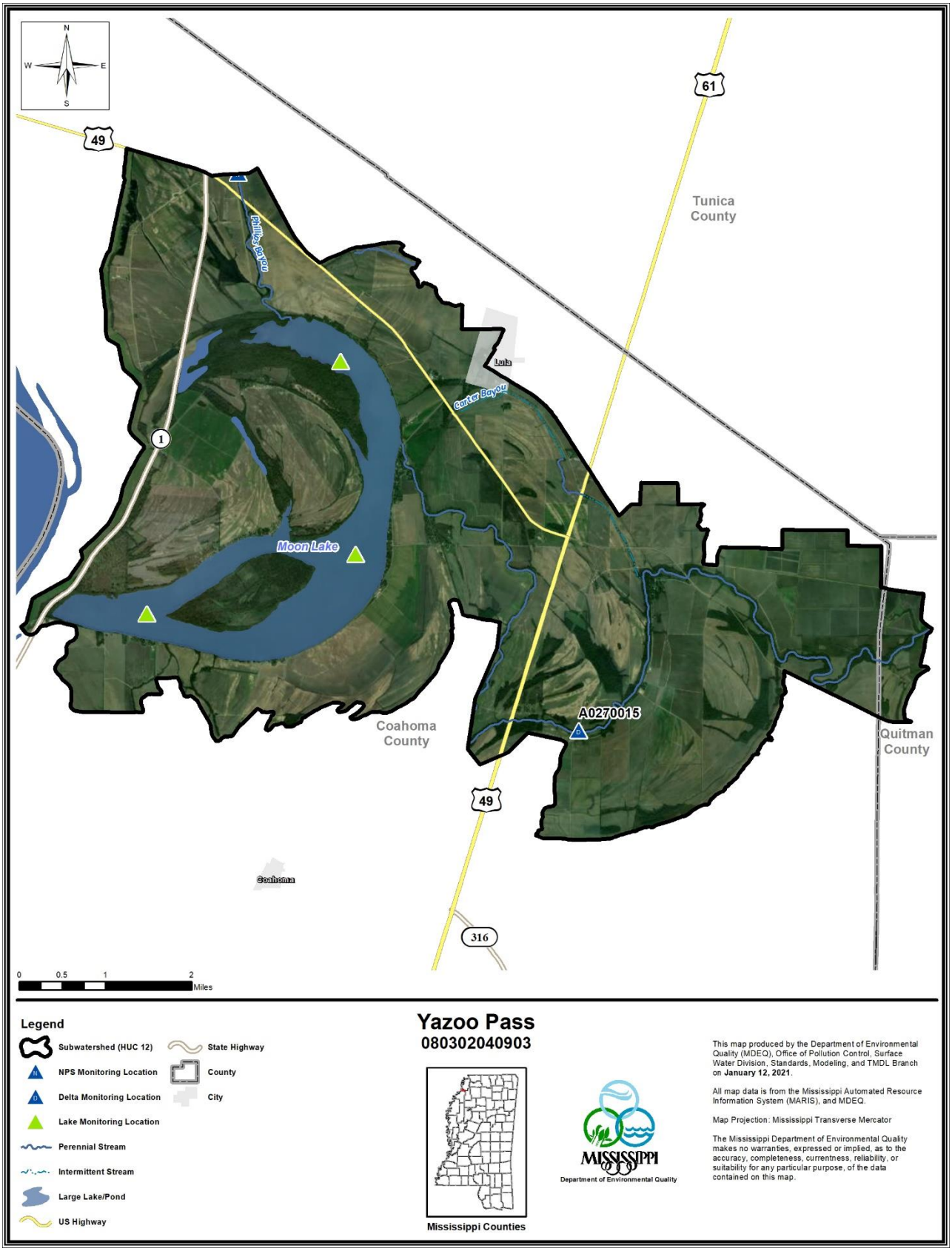

Figure 3: Monitoring Locations: Yazoo Pass Watershed