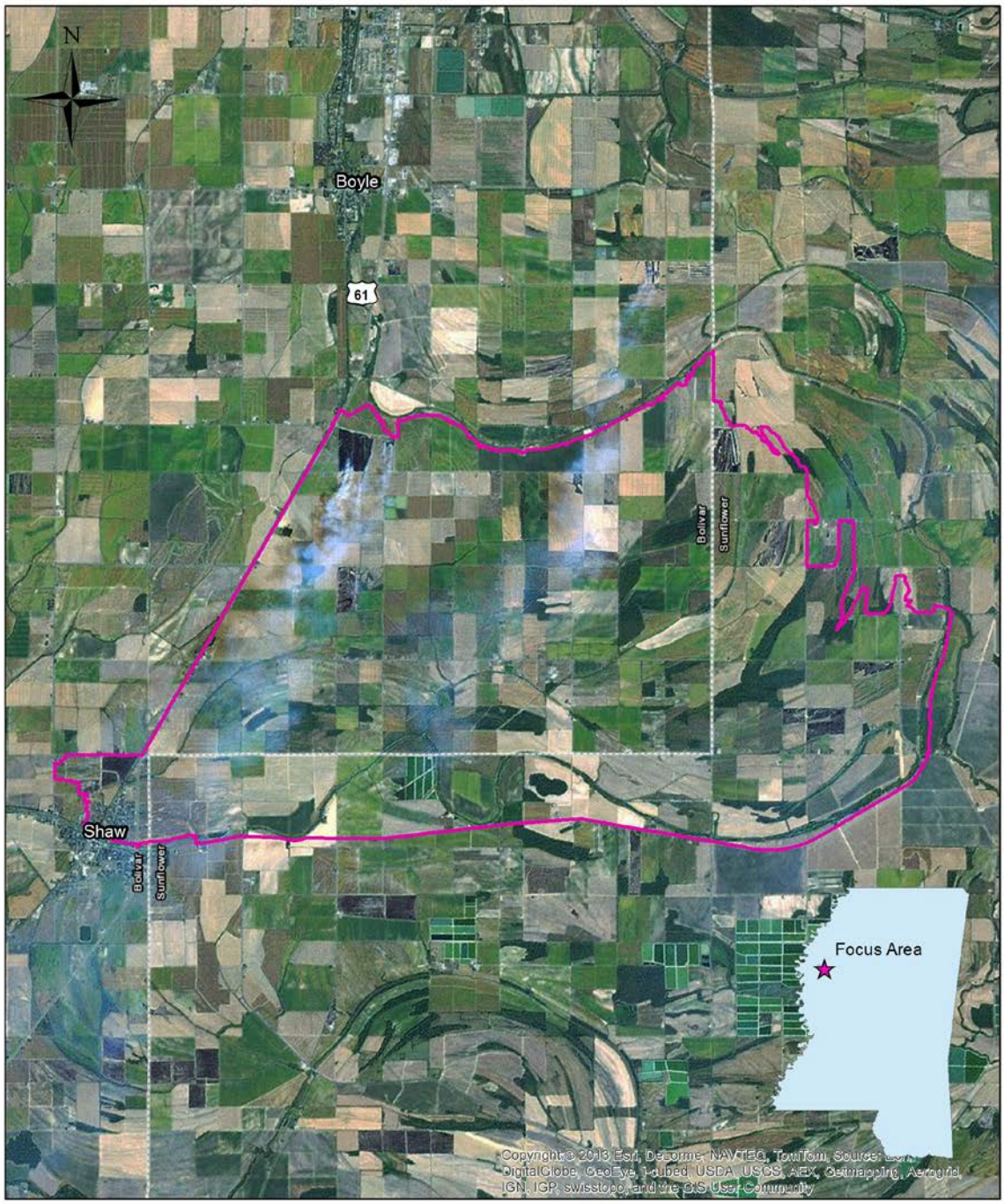
WATERSHED IMPLEMENTATION PLAN FOR UPPER PORTER BAYOU



Upper Porter Bayou Watershed

HUC 080302070503

Upper Porter Bayou

0 1 2 3 4 Miles

DELTA F.A.R.M.

WATERSHED IMPLEMENTATION PLAN FOR PORTER BAYOU, MS

Prepared for:

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1.0 PLAN GUIDANCE

1.1 Vision Statement

Upper Porter Bayou and its watershed are pleasant and safe places to live, work, recreate, and raise a family. Agriculture is productive and profitable, and its practices contribute to adequate water supply and quality to support fishing, swimming, aquatic life, and quality of life.

1.2 Mission Statement

Sustain agricultural profitability, while attaining designated water body uses through effective management of water quantity and quality.

1.3 Porter Bayou Watershed Implementation Team

Members of the Porter Bayou Watershed Implementation Team are:

- Producers - Steven Skelton, Stanley Jones, Henry Mosco, Carlis Lyon, Bern Prewitt Jr., David Rocconi, Michael Rocconi, Delbert Dean, Lawrence Reginelli, Boyer Britt
- New Porter Bayou Drainage District (NPBDD)
- Mississippi Department of Environmental Quality
- U.S. Environmental Protection Agency
- Delta F.A.R.M.
- U.S. Geological Survey
- U.S. Army Corp of Engineers Vicksburg District
- Natural Resource Conservation Service
- Mississippi State University
- Delta Wildlife
- Delta Council

2.0 WATERSHED DESCRIPTION

2.1 Geography

Upper Porter Bayou is a tributary of the Sunflower River in northwest Mississippi (Figure 2.1). The 20,190 acre Porter Bayou Watershed (HUC # 080302070503) includes parts of Bolivar and Sunflower Counties, Mississippi (Figure 2.1). The watershed is located in the Delta physiographic region, in the Mississippi Alluvial Plain, Northern Holocene Meander Belts ecoregion. Geology in this area consists of mostly unconsolidated deposits of sands, silts, and clays dating back as far as the Pleistocene (Stewart 2003). Only one municipality exists in the watershed, the City of Shaw (Figure 2.1). Several smaller communities are scattered around the watershed including Choctaw, Fraizer, and Linn. State Highways 61, 278, and 442 pass through the watershed. Cleveland and Indianola are two larger municipalities in close proximity (i.e., within 10 miles).

2.2 Soils

Soils in the Mississippi River Alluvial Plain physiographic region are primarily young soils (inceptisols) formed on alluvium, and range from mildly acidic to mildly alkaline (Stewart 2003). The 20,190 acre watershed is diverse, ranging from frequently flooded areas with heavy clay soils to well drained “cotton ground” with sandy loam soils. Alligator (poorly drained clay), Dundee (moderately to somewhat poorly drained fine sandy loam to silty clay loam), and Forestdale (somewhat poorly to poorly drained silty clay loam) soils are predominant throughout the watershed.

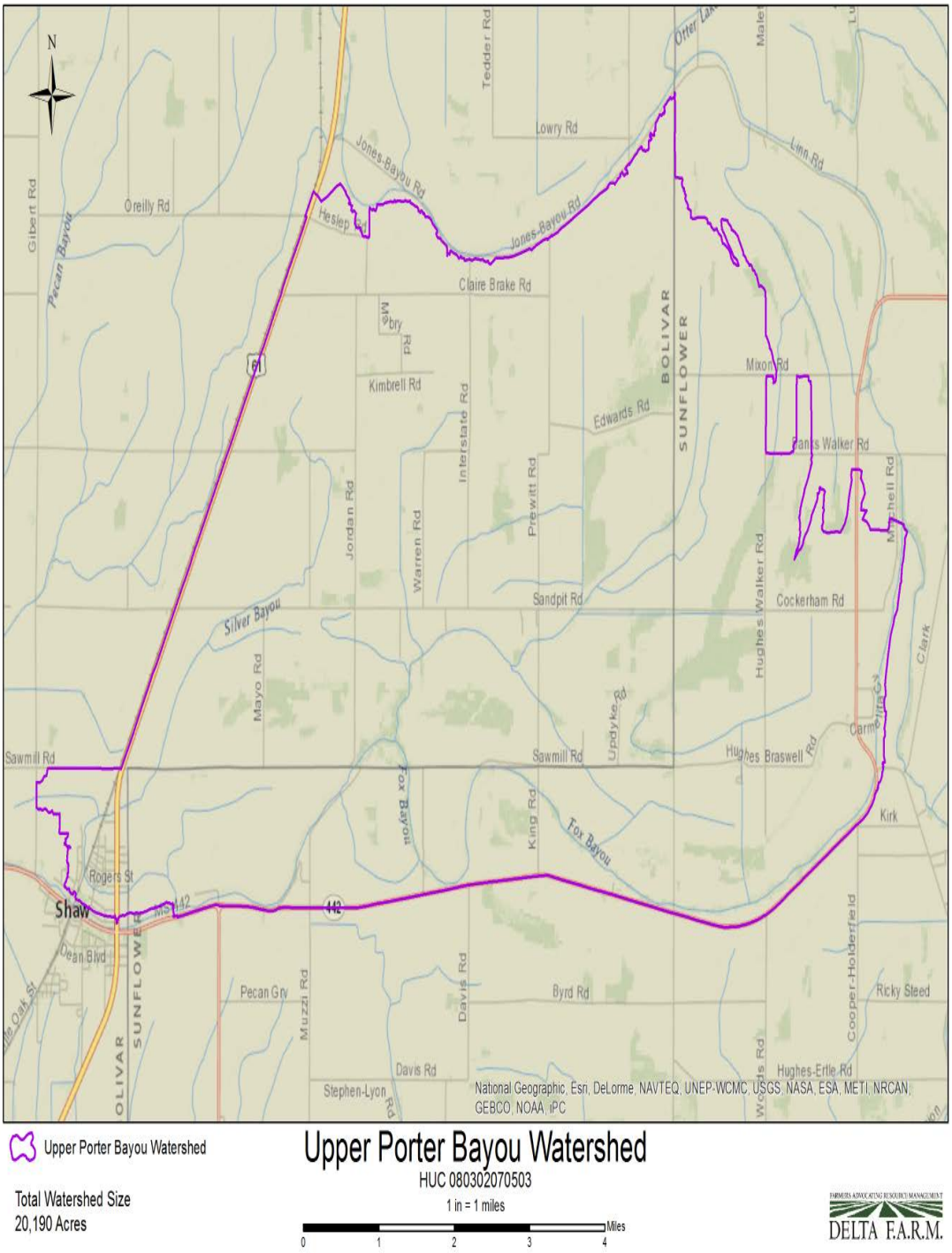

Figure 2.1. Upper Porter Bayou Watershed, Mississippi

2.3 Hydrology

The headwaters of Porter Bayou vary from roadside ditches to stream remnants coursing through marginal agricultural lands. The tributaries merge in the southeast corner of Bolivar County, MS. Traveling downstream, the bayou meanders through parts of Bolivar and Sunflower Counties in a large "horseshoe" fashion. Certain portions of the bayou are wide with gently sloping banks defined by cypress trees, while other portions are extremely narrow with high, steep banks. Eventually, Porter Bayou empties in to the Sunflower River north of Indianola, MS. Non-storm flows in Delta streams naturally decrease during summer months due to low rainfall. However, in the Porter Bayou watershed, irrigation water often supplements summer non-storm flows by providing a constant source of runoff throughout the growing season.

The watershed is characterized by poor drainage. The slow, meandering nature of the bayou has resulted in the accumulation of sediments and dense vegetation, both of which negatively impact drainage.

2.4 Land use

A map of watershed land use is shown in Figure 2.2. Agriculture is the predominant land use in the watershed comprising about 15,896 acres or roughly 78% of the watershed. Soybeans are the most common crop but corn, cotton, and rice are all common. In addition to production agriculture, there are roughly 1,000 acres of urban development, 2,000 acres of woody wetland, and the rest being fallow/undeveloped or open water.

2.5 Socioeconomics

2.5.1 Demographics

According to the 2010 census, the population for Bolivar County was 34,145, and 29,450 for Sunflower County[1]. In Both counties the 2010 population was down from the 2008 estimated population.

[1] http://www.olemiss.edu/depts/sdc/estimates/2008/CO-EST2008-01-28.htm,

2.5.2 Economy

There are a handful of small businesses within Shaw, however the lifeblood of the watershed is production agriculture. In addition to row crop agriculture, catfish farming is an important contributor to the economy of Sunflower County, and occurs but is diminishing in the Porter Bayou watershed (MSU 2009). The Delta region of Mississippi where Porter Bayou is located is classified as economically depressed. The estimated 2008 median household income for Bolivar County ($28,779) and Sunflower County ($28,266) were both below the state median household income ($37,818), and were in the lowest 11% of the state[2].

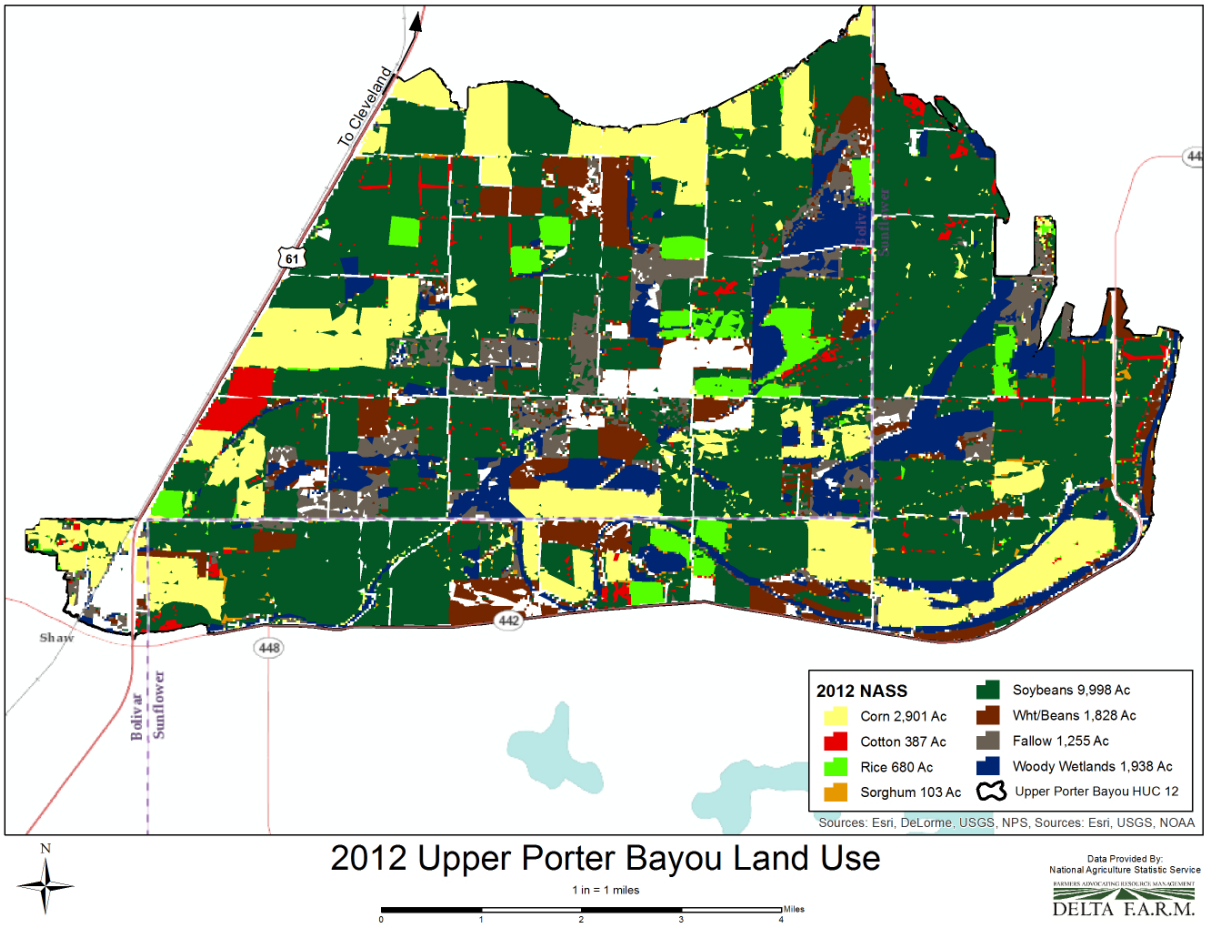

Figure 2.2. Land use map of Porter Bayou watershed

2 http://www.census.gov/did/www/saipe/data/index.html

2.6 Regulations

Federal and state regulations that apply in the Porter Bayou watershed may be useful tools, or impediments to achieving the vision for the watershed.

2.6.1 Federal

2.6.1.1 Clean Water Act

2.6.1.1.1. NPDES Point sources

There is one NPDES permitted wastewater discharge that discharges in the Porter Bayou watershed. The Shaw Publicly Owned Treatment Works (POTW) discharges in to Porter Bayou (permit # MS0024953). The Shaw POTW has a design flow capacity of 0.36 MGD.

2.6.1.1.2. NPDES Stormwater

The Porter Bayou watershed does not appear to be subject to MS4 storm water permitting under the Clean Water Act. Construction activities disturbing an area greater than 1 acre are subject to NPDES stormwater regulations.

2.6.1.1.3. 303(d) and TMDLs

Porter Bayou was placed on the Mississippi 2006 Section 303(d) List of Impaired Water Bodies (MDEQ 2007). Porter Bayou was listed due to evaluated causes of sediment/siltation, organic enrichment/low dissolved oxygen, nutrients, and total toxics (Figure 2.3). The Clean Water Act requires that total maximum daily load (TMDL) studies be completed for all water bodies included on the 303(d) list. Table 2.1 summarizes the TMDLs addressing Porter Bayou water quality impairments that have been completed as of June 2010. Because these TMDLs have been completed, Porter Bayou does not appear on the draft 2010 303(d) list (MDEQ 2010).

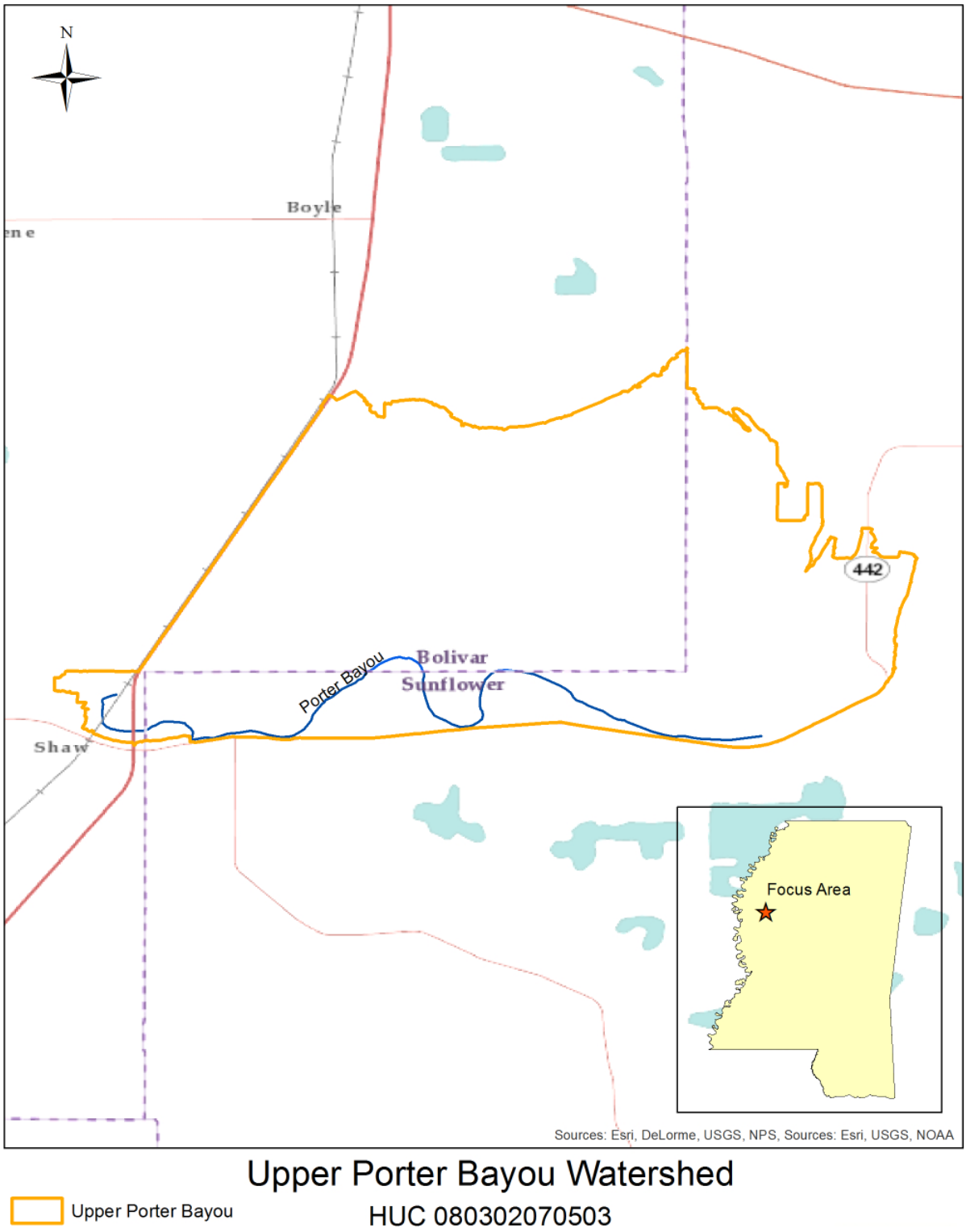

Figure 2.3. Location of impaired waters in Porter Bayou Watershed with completed TMDLs

Table 2.1. TMDLs for Porter Bayou

Parameter	TMDL Approval Date	Source to be Reduced	Recommended % Reduction
Total nitrogen	June 2008	NPS	84.05%
Total phosphorus	June 2008	NPS	95.17%
Sediment	April 2008	NPS	NA
Legacy pesticides	November 2005	NPS	NA

2.6.1.1.4. Navigable Waters

Several sections of the Clean Water Act deal with controlling impacts to navigable waters. Section 404 of the Clean Water Act controls the placement of dredge or fill materials into wetlands and other waters of the US. Section 401 of the Clean Water Act requires MDEQ to certify that a project requiring a Section 10 (see 2.6.1.2) or Section 404 permit will not violate the state water quality standards. These sections of the Clean Water Act require that impacts to qualifying waterbodies be avoided or minimized. Where impacts are unavoidable, mitigation may be required. Qualifying waterbodies include wetlands and "Other Waters of the US". The basic definition for Other Waters of the US, for the purpose of Section 404, is any waterbody that displays an ordinary high water mark (OHWM). This includes lakes and ponds that have a hydrological connection to a qualifying waterbody, and perennial, intermittent, or ephemeral stream channels which exhibit an OHWM. The US Army Corps of Engineers (USACE) administers the regulations associated with both of these sections.

The USACE issues two types of permits under Section 404; Individual Permits and Nationwide Permits (NWPs). Individual Permits are required when 1) impacts to wetlands exceed 0.5 acre, and/or 2) greater than 300 linear feet of a qualifying waterbody is to be impacted. This Individual Permit includes a period of public review, and processing generally takes between 60 and 120 days. The processing time can be greater if public hearings or environmental statements are required, or if all required information on the permit application form is not provided. NWPs are general permits typically used when minor impacts are necessary to wetlands (less than 0.5 acre) or a qualifying waterbody (any impacts less than 300 linear feet). Processing time is generally less and no public review period is necessary.

Mitigation for both wetland losses or stream function and value losses may be required by the USACE for a project authorized under either an individual or nationwide permit. The extent of the mitigation is dependent upon the size, quality, and functionality of the wetland or waterbody to be impacted.

2.6.1.2 **Rivers and Harbors Act**

Section 10 of the Rivers and Harbors Act regulates activities that have the potential to obstruct navigation in waters of the US, including wetlands.

2.6.1.3 **Farm Bill**

Under the Federal Food Security Act (Farm Bill), initially passed in 1985, all US farm operators are required to follow soil and wetland conservation guidelines specified in the law (i.e., Sodbuster and Swampbuster programs). Compliance with these guideline is a prerequisite for participation in most federal farm programs. Subsequent amendments to the Farm Bill have added programs that provide incentives to farm operators for enhancing water quality through such actions as taking highly erodible lands out of production, and restoring wetlands. One such program is the Mississippi River Basin Healthy Watersheds Initiative (MRBI). The MRBI is being implemented through NRCS programs funded by the Farm Bill, including the Cooperative Conservation Partnership Initiative, Wetlands Reserve Enhancement Program, and Conservation Innovation Grants. The Porter Bayou watershed is a target sub-watershed of the Sunflower River watershed for the MRBI.

2.6.1.4 **National Flood Insurance Program**

The National Flood Insurance Program (NFIP) is a non-regulatory federal program, which is administered by the Federal Emergency Management Agency (FEMA). However, this program provides mechanisms that can be used to restrict development in floodplains, which can have beneficial effects on water quality. The NFIP supports development and enforcement of

floodplain management plans and ordinances. All of the unincorporated areas of Bolivar and Sunflower Counties participate in the NFIP, as well as the City of Shaw[3].

2.6.1.5 **Safe Drinking Water Act**

All drinking water systems serving 25 people or more are considered public drinking water systems and are subject to EPA regulation through the Safe Drinking Water Act. Elements of the Safe Drinking Water Act include the Enhanced Surface Water Treatment Rule, Disinfection Byproducts Rule, and the requirement for Source Water Assessment and Protection. In Mississippi, the Safe Drinking Water Act is administered by the Mississippi State Department of Health. The lists of public water utilities provided on the Mississippi State Department of Health website indicate that there is one public water utility serving the residents of the Porter Bayou watershed – the Town of Shaw[4]. According to the EPA Safe Drinking Water Information System, the Shaw utility water source is groundwater, it serves 2,319 people, and the only drinking water quality standard violation was for fecal coliforms in 2002[5].

2.6.2 State

2.6.2.1 **Water quality standards**

The water use classifications are established by the State of Mississippi in the document *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007). The designated beneficial use for Porter Bayou is Fish and Wildlife (MDEQ 2008). The water quality standard applicable to the use of the water body and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007). Mississippi's current standards contain a narrative criteria that can be applied to nutrients which states "*Waters shall be free from materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor, taste, total suspended or dissolved solids, sediment, turbidity, 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 use* (MDEQ, 2007)."

3 http://www.msema.org/insurance/floodplain.html
4 http://msdh.ms.gov/msdhsite/_static/30,0,76,256.html
5 http://oaspub.epa.gov/enviro/sdw_form_v2.create_page?state_abbr=MS

The standard for dissolved oxygen states, "DO concentrations shall be maintained at a daily average of not less than 5.0 mg/l with an instantaneous minimum of not less than 4.0 mg/l." In addition, the State water quality standard regulations include a natural condition clause which was used in the TMDL to determine the appropriate DO for Porter Bayou under critical conditions. Natural conditions are defined as background water quality conditions due only to non-anthropogenic sources. The DO numeric criteria apply specifically with regard to substances attributed to sources (discharges, nonpoint sources, or instream activities) as opposed to natural phenomena. Waters may naturally have characteristics outside the limits established by these criteria. Therefore, naturally occurring conditions that fail to meet criteria should not be interpreted as violations of these criteria (MDEQ 2007).

2.6.2.2 **Highway Construction Runoff**

The Mississippi Department of Transportation (MDOT) is responsible for implementation of erosion and sediment control practices on highway construction. MDOT is required to apply to MDEQ for a Certificate of Permit Coverage for construction projects to be permitted through the state construction storm water general permit. As of June 7, 2010, there are no active water permits for highway construction in the Porter Bayou watershed (MDEQ enSearch, accessed June 2010).

2.6.2.3 **On-site wastewater treatment regulations**

State regulations addressing on-site wastewater treatment systems are administered through the Mississippi State Department of Health. Regulations are in place to address single-family residence on-site wastewater treatment systems, as well as on-site systems serving recreational vehicle campgrounds, developments, and multi-family dwellings. These regulations require approval and certification of all new installations of on-site wastewater treatment systems, including replacement of old systems. Certification is not required for systems in use prior to enactment of the regulations, providing they meet criteria specified in the regulations.[6]

6 http://www.msdh.ms.gov/msdhsite/_static/30,0,78.html,

2.6.2.4 **Fish consumption advisories**

Fish tissue sampling is conducted by MDEQ for the purpose of identifying potential human health threats. These data are used by a multi-agency task force to evaluate the need for fish consumption advisories in Mississippi. Porter Bayou is included in the Delta-wide consumption advisory for toxaphene and DDT. This advisory recommends that people limit consumption of carp, buffalo, gar, and catfish larger than 22 inches to no more than one meal every two weeks (MSDH 2001).

2.6.2.5 **Water Withdrawals**

Under Mississippi law, all wells drilled with a casing diameter of 6 inches or greater are required to have a water use permit. In addition, water use permits are required for surface water withdrawals, and construction of water storage impoundments. Permits are good for 10 years. The Yazoo Mississippi Delta Joint Water Management District (YMD) is responsible for processing water use permits in the Delta, including the Upper Porter Bayou watershed. Water use permits are issued by the MDEQ State Permit Board. Stakeholders are concerned about requirements to meter groundwater withdrawals because of future implications.

2.7 Existing management

Numerous drainage improvement efforts have been made over the years, and intense efforts are ongoing by the New Porter Bayou Drainage District (NPBDD) including; 1) Stream Bank Restoration, and 2) Alligator Weed Control and Eradication. Numerous sediment reducing BMPs have been voluntarily implemented throughout the watershed. Sediment reducing measures are also an integral part of NPBDD drainage projects.

The NRCS sponsored some watershed protection and flood prevention work in the watershed around 2003 (CFR 68(10):2007) and Environmental Quality Incentives Program [EQIP] 7 CFR Part 1466). More recently, U.S. EPA 319 funds were utilized to implement components of the Delta Nutrient Reduction Strategy within a small catchment in the headwaters of the Upper Porter Bayou Watershed.

3.0 RESOURCES AND CONDITION

3.1 Water quality

USGS and MSU began water quality sampling in 2010 within the watershed. MSU began sampling at edge of field and near field locations in order to monitor water leaving agricultural fields. USGS began sampling in tributaries farther downstream and within Porter Bayou itself. These monitoring efforts have led to a greater understanding of water quality within the bayou and leaving crop fields. As noted in Section 2.6.1.1.3, Lower Porter Bayou has been identified by MDEQ as not having water quality adequate to support its designated uses (listed in Section 2.6.2.1). However, this water quality assessment was an evaluated assessment, not based on water quality data.

3.2 Water quantity

Water supply is a growing concern in the region. Ground water depletion in the Mississippi Alluvial Plain has resulted in lower flows in many streams, including the Sunflower River (MS Museum of Natural Science 2005). The Porter Bayou watershed is near the area of greatest groundwater decline in the Delta (YMD 2008). In the watershed, ground water is withdrawn for drinking water and to irrigate crops.

3.3 Wildlife and Habitat

The US Fish and Wildlife Service has identified seven endangered or threatened species that may occur in or around the Porter Bayou Watershed. These species include; Fat Pocket Book mussels, Rabbit's Foot mussels, Sheepnose mussel, Least Tern, Pallid Stugeon (Occurs in Mississippi River), and Pondberry. Efforts to protect or enhance the habitats of the aforementioned species will be a high priority during the execution of the watershed plan. While the three mussels listed as endangered or threatened are normally found in larger riverine ecosystems restoration of streams in Porter Bayou may benefit these mussels. Least Terns will benefit greatly from shallow water management in wetlands and agricultural fields.

These shallow water areas provide ideal feeding location for these shore birds. Pallid Sturgeon will benefit due to the fact that water leaving Porter Bayou and entering the Sunflower River and eventually the MS River will be carrying less sediments and nutrients. Pondberry is an important wetland species. With on-going and future projects Pondberry habitat may be increased or enhanced.

3.4 Evaluation of Porter Bayou Fish Community

This evaluation of the Porter Bayou fish community is based on sampling performed by EDRC (Engineering Development and Research Center, US Army Corps of Engineers, Vicksburg, MS). Sampling was performed as part of stream community monitoring conducted by ERDC to assess the condition of fish communities in MS Delta streams. The sampling data provided the basis for the development of an index of biotic integrity *sensu* Karr (1981). The index uses metrics that capture the variety of feeding types (e.g. insectivores, predators), habitat selection (e.g. preferring current vs. pools) and taxonomy (e.g. sunfish and mninnows) present in a sample of fish. Sampling was conducted with seines according to a standardized protocol. Each sampling site was assigned an IBI score based on the values of the population metrics. Streams were categorized as large unregulated or small, and flowing or non-flowing. Higher IBI scores indicate a more diverse fish community.

Two Porter Bayou sampling locations were placed in the small flowing category while 3 locations were placed in the flowing category. Sampling was conducted at all 5 locations on October 2 and 3, 1996 and showed IBI values ranging from 11 to 15 and 9 to 13 for the non-flowing and flowing categories, respectively. These values are compared with other streams in both the flowing and non-flowing categories in Table 3.1. The results show that, at the time of sampling, the quality of the Porter Bayou fish communities could be described as generally in the lower quartile among similar streams. The applicability of these results, which were obtained in 1996, would depend on whether significant changes in habitat and water quality have occurred between 1996 and the present.

Table 3.1. Comparison of ERDC IBI Values for 3 Delta Water Body Categories with the Porter Bayou IBI Values from October 2 through 3, 1996 sampling

		Small Non-flowing	Small Flowing	Small Flowing + Non-Flowing
Percentile	25	11	13	13
	50	14	15	15
	75	17	17	17
Porter Bayou	Hwy 448	11	--	
	Miket Rd	15	--	
	Britt Rd.	--	10	
	Indianola	--	13	
	Olivehale	--	9	

3.5 Recreation

There are very few opportunities for in-stream recreational use of Upper Porter Bayou. Limited fishing opportunities exist where the bayou intersects public roadways.

4.0 STAKEHOLDER INTERESTS/ISSUES

Producers living or farming in the Porter Bayou watershed identified issues they would like addressed through a Watershed Implementation Plan. The issues identified by these stakeholders included water management, sediment, nutrients, invasive aquatic plants, and declining groundwater levels.

4.1 Water Management

Water management issues include both flooding and water shortages. The stakeholders identified flooding as a significant issue in the Upper Porter Bayou watershed. They also identified a need for improved water use efficiency and storage capacity. The potential effects of improvements, or lack thereof, may impact flooding on other land parcels was also a stakeholder concern.

4.1.1 Locations Where Water Management is an Issue

Stakeholders stated that flooding is an issue throughout the watershed. Insufficient flow capacity in the Porter Bayou channel upstream of Shaw and specifically behind the Trunk Line Gas facility was identified by stakeholders as particular area of concern.

4.1.2 Causes

During storms, water backs up and causes flooding. During the growing season, rainfall and surface water are not adequate to support crops.

4.1.3 Sources

Terrain in the watershed is relatively flat, making it less likely to drain well during storms. In addition, the dominant soil types in the watershed are characterized by poor drainage. Stakeholders identified sedimentation as contributing to flooding by reducing the conveyance capacity of ditches and streams. Beaver dams were also identified by stakeholders as contributing to flooding in the watershed.

4.2 Water Level Declines

The Porter Bayou watershed is near the area of greatest groundwater decline in the Delta (YMD 2008). Regional estimates of groundwater level change in the Delta indicate that between 1998 and 2008 the average groundwater level change in the area of the Porter Bayou watershed was between 0.4 and 0.9 foot per year (YMD 2008).

4.2.1 Locations Where Water Level Declines are an Issue

Groundwater levels are declining throughout the watershed (YMD 2008).

4.2.2 Cause

Water is being withdrawn from the Mississippi River Alluvial Aquifer faster than it is being recharged. Base flows in most Delta streams naturally decrease during the summer months due to less rainfall.

4.2.3 Sources

Irrigation accounts for the majority of the ground and surface water withdrawals in the Lower Porter Bayou watershed. As noted in Section 2.6.1.5, groundwater is also used to supply drinking water in the watershed.

4.3 Sediment

Stakeholders noted that sedimentation in ditches and streams contributes to flooding by reducing storage and flow conveyance capacity. There is a clear understanding among producers and the NPBDD that sedimentation directly results in reduced drainage. Stakeholders identified channel maintenance as a continual problem. The presence of herbicide-resistant weeds in the watershed may result in increased cultivation (i.e., decreased no-till practice), which could increase erosion and sediment loads. MDEQ has determined that there is a high probability that

sediment loads in Porter Bayou are at such levels that they interfere with fish and other wildlife. High sediment loads can affect aquatic life by causing reduced visibility (when the sediment is suspended in the water column) or by changing stream habitat when the sediment is deposited (e.g., covering spawning areas). The sediment TMDL recommended that sediment loads be reduced, although the recommended percent reduction was not specified.

4.3.1 Locations Where Sediment is an Issue

MDEQ has identified Upper Porter Bayou as not supporting its designated use of aquatic life support due to sediment. Producers, the NPBDD, and other stakeholders believe erosion and sedimentation is an issue throughout the watershed.

4.3.2 Cause

Sediment is the pollutant causing sedimentation and turbidity issues in Porter Bayou. Sediment is caused by erosion of soil particles from land use activities in the watershed and detachment of soil from the banks and beds of the bayou. Soils in the watershed tend to be fine grained, which could make them more susceptible to erosion.

4.3.3 Sources

On the Mississippi 2006 303(d) list, nonpoint sources are listed as the sources of sediment causing the impairment in Porter Bayou. In the sediment TMDL that addresses this impairment, a number of likely sediment sources were identified. These included agriculture, construction sites, roads, urban areas, mass wasting, gullies, channel instability, channel modification, and historical land use activities. The NPBDD has identified unstable banks as a significant source of sediment in Porter Bayou.

4.4 Nutrient Enrichment

Stakeholders identified nutrients in runoff as an issue of concern. Stakeholders also expressed concern about the costs associated with variable-rate fertilizer applications (i.e., precision agriculture). MDEQ has determined that there is a high probability that nutrient

concentrations in Upper Porter Bayou are at levels that can create conditions harmful to fish and other wildlife. High nutrient concentrations can support unusually high growth of algae or other aquatic plants. When the algae die, their decomposition uses oxygen from the water, which can result in low oxygen levels that are harmful to fish and other aquatic life. The TMDL for Porter Bayou recommends reduction of total phosphorus loads by around 95%, and reductions of total nitrogen loads by about 84% (MDEQ 2008).

4.4.1 Locations Where Nutrient Enrichment is an Issue

MDEQ has identified Upper Porter Bayou as not supporting its designated use of aquatic life support due to nutrient enrichment.

4.4.2 Cause

Nitrogen and phosphorus are the pollutants that are suspected of causing eutrophic conditions in these water bodies with high productivity and low dissolved oxygen levels. Total nitrogen and total phosphorus are the nutrient species addressed in the TMDL (MDEQ 2008).

4.4.3 Source

Nutrient loads are contributed by point sources and nonpoint sources in the watershed.

4.4.3.1 **Point Source**

The Shaw POTW (MS0024953) permit is for the discharge of treated domestic wastewater (i.e., sewage). The NPDES permit for the Shaw POTW includes limits for ammonia, total nitrogen, and total phosphorus that will go into effect in 2013 at the latest. These limits are summarized in Table 4.1.

Table 4.1. Nutrient limits in the NPDES permit for the Shaw POTW

Parameter	Maximum monthly average load (lb/day)	Maximum daily load (lb/day)	Maximum monthly average concentration (mg/L)	Maximum daily concentration (mg/L)
Ammonia N	7.5	11.2	2.48	3.72
Total nitrogen	34.5	69.0	na	na
Total phosphorus	15.6	31.2	na	na

4.4.3.2 **Nonpoint Sources**

The Porter Bayou Watershed WASP model indicated that the water quality impairment is due to nutrients from nonpoint sources. In the nutrient TMDL for Porter Bayou, cropland was assumed to be the greatest source of total nitrogen and total phosphorus loads (MDEQ 2008). In addition, the majority of nutrient loading to streams typically comes from storm water runoff (reference). As noted in Section 2.5, there are approximately 15,748 acres of cropland in the Upper Porter Bayou watershed.

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 (MDEQ 2008).

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 (EPA 1999). Phosphorus contained in the surface runoff due to fertilizers and animal excrement or watersheds with naturally occurring soils that 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 (MDEQ 2008). Water in the Mississippi Alluvial Aquifer (located under Porter Bayou watershed) is known to have a relatively high concentration of phosphorus. Therefore phosphorus can also enter surface waters from ground water seeps or discharges. USGS has an on-going sampling program to quantify phosphorus in groundwater in the Delta.

4.5 Organic Enrichment and Low DO

The presence of high levels of organic material in water bodies can reduce water oxygen levels such that aquatic life cannot be supported. The TMDL addressing this impairment states that reducing nutrient loads is expected to reduce organic enrichment and low dissolved oxygen conditions (MDEQ 2008). Therefore, no reduction is specified in the TMDL for organic material (TBODu).

4.5.1 Locations Where Organic Enrichment and Low DO are Issues

MDEQ has identified Upper Porter Bayou as not supporting its designated use of aquatic life support due to organic enrichment and low dissolved oxygen.

4.5.2 Cause

The nutrient TMDL assumed that nutrient enrichment was the cause of the organic enrichment and low dissolved oxygen conditions. As described in Section 4.2, high nutrient concentrations in a water body can encourage the growth of aquatic plants, which can encourage the growth of aquatic animals, all of which becomes organic material when it dies, and removes oxygen from the water as it decomposes. High levels of organic material decomposing in a water body deplete oxygen from the water and suffocate aquatic life.

4.5.3 Sources

While nutrient enrichment is believed to be the primary cause of organic enrichment and low dissolved oxygen conditions cited for Porter Bayou, there are potential sources of organic material in the watershed that may also contribute to these conditions. They are discussed below. See Section 4.4.3 for a discussion of nutrient sources in the Porter Bayou watershed.

4.5.3.1 **Point Sources**

The Shaw POTW (MS0024953) permit is for the discharge of treated domestic wastewater (i.e., sewage). The NPDES permit for the Shaw POTW includes limits for oxygen

demand and dissolved oxygen that will be effective no later than 2013 (Table 4.2). While this type of discharge can deplete oxygen downstream of the discharge point, the effect is usually fairly localized.

Table 4.2. Oxygen-related NPDES permit limits for Shaw POTW

Parameter	Maximum monthly average load (lb/day)	Maximum daily load (lb/day)	Maximum monthly average concentration (mg/L)	Maximum daily concentration (mg/L)	Minimum daily concentration (mg/L)
Dissolved Oxygen	na	na	na	na	6
BOD5	90	135	30	45	na

4.5.3.2 **Nonpoint Sources**

Organic material, such as crop residue, leaves, and chaff, can be washed into the water body from the surrounding land, and exert an oxygen demand as they decompose. Sources can also include plants along the stream banks.

4.6 Pesticides

A fish consumption advisory is in effect for long-lived pesticides in selected fish species that covers all Delta streams and lakes, including those in the Upper Porter Bayou watershed (see Section 2.6.2.4). Pesticide concentrations in soils, surface water or groundwater have not been identified as a health concern.

Stakeholders identified herbicide-resistant weeds as an issue in the watershed. New herbicide combinations are being developed to control these weeds.

4.6.1 Locations Where Pesticides are an Issue

Legacy pesticides in fish are an issue for all Delta water bodies, including Porter Bayou and all other water bodies in the watershed. Herbicide-resistant weeds occur throughout the watershed.

4.6.2 Causes

DDT and Toxaphene are the pesticides named in the Delta-wide fish consumption advisory. These pesticides degrade very slowly in the environment and are bioaccumulative, meaning they accumulate in living tissue and can be passed on to other organisms, including humans, through the food chain. Eventually, these pesticides can accumulate in certain fish species to the point that eating those fish can cause health problems in people. DDT and Toxaphene have been measured in fish tissue throughout the Delta at levels that may harm human health.

4.6.3 Sources

DDT and Toxaphene are no longer used in the US. The use of DDT was banned in the US in 1973, and use of Toxaphene was banned in 1982. Historically, however, DDT and Toxaphene were commonly used on croplands in the Delta, including the 15,748 acres of cropland in the Upper Porter Bayou watershed. Because it takes decades for these chemicals to degrade, they are still found in soils, sediments, and living organisms in the Delta. Recent measurement of concentrations of DDT and Toxaphene in fish tissue collected from the Delta indicate that concentrations of these pesticides are decreasing (MDEQ 2001). This suggests that the residual DDT and Toxaphene is finally degrading. Prolonged extensive use of glyphosate as a herbicide in the watershed has resulted in natural selection for glyphosate resistance in weeds. Farm equipment may facilitate transfer of resistant weed seeds among fields.

4.7 Aquatic Weeds

Stakeholders identified alligator weed as a problem in the watershed, primarily due to reductions in drainage capacity and loss of habitat diversity. Alligator weed is the object of an on-going NPBDD eradication program.

4.7.1 Locations

Alligator weed is present throughout Lower Porter Bayou, however the heaviest infestations are found within approximately 10 miles upstream and 10 miles downstream of Shaw, Ms.

4.7.2 Causes

Stream sedimentation has resulted in shallow water conditions throughout Porter Bayou. During the growing season, shallow, warm water with loose sediments beneath is an excellent medium for the establishment and growth of alligator weed. High growth rates exhibited by the plant give it a competitive advantage against native vegetation which has resulted in dense mats of monotypic alligator weed throughout the waterway.

4.7.3 Sources

While the exact source is difficult to determine, alligator weed is a non-native invasive plant that was likely introduced to the watershed through animal or water transfer.

5.0 RESTORATION AND PROTECTION GOALS

5.1 Water Quality

The restoration and protection goals for the Upper Porter Bayou Watershed are based, in part, on the goal of the Delta Nutrient Reduction Strategy; which is answering the following questions:

1. What percent reduction of sediment, nitrogen, and phosphorus loading is possible?
2. What do the sediment, nitrogen and phosphorus load reductions cost?
3. What are the benefits of these load reductions for stakeholders?
4. What nutrient load reductions will protect Delta water quality and the Gulf of Mexico?

5.2 Water Quantity

The restoration and protection goals for the Upper Porter Bayou Watershed are also based partly on the goals of the Mississippi Sustainable Resources Task Force, some of which include the following questions:

1. How much groundwater recharge is possible in the watershed?
2. How much groundwater savings can be achieved with voluntary conservation measures?
3. How much groundwater savings can be achieved through the development and use of surface water resources in the watershed?

6.0 TARGETING AND PRIORITIZATION

BMPs are will be implemented in the Upper Porter Bayou watershed through several projects. The prioritization and targeting processes used for these projects are described below.

6.1 Delta Nutrient Reduction Strategy

Nutrient loading in agricultural effluent varies by region, watershed, and individual field. The nutrient cycle in an agricultural watershed is an extremely complex system with many inputs and variables. To fully address the issue, a comprehensive approach must be used to ensure that all factors are considered. As part of the Delta Nutrient Reduction Strategy, the Site Characterization Work Group was tasked with developing a strategy to prioritize agricultural systems for nutrient reduction.

Using this strategy, systems within the Upper Porter Bayou Watershed were classified based on soil type, cropping practices, and existing drainage infrastructure. Soils can be described as ***heavy*** (clays), ***medium*** (loams) ***light*** (sandy loams), and ***mixed*** (clay, loam, and sandy loams found in close proximity due to ridge and swale topography). Cropping practices were initially classified as ***irrigated*** or ***dry land***, then by ***soybeans***, ***rice/soybean rotation***, ***cotton, or corn***. Drainage infrastructure can be classified as ***developed*** or ***undeveloped***. Developed land typically consists of leveled or precision graded fields with pipes, pads, and tailwater ditches, or ridge and swale land that has been shaped to facilitate furrow irrigation. Undeveloped land includes areas with significant ridge and swale and/or subject to frequent flooding. These areas are not developed because the development cost exceeds potential benefits.

Project sites within the Upper Porter Bayou Watershed may be selected for implementation of nutrient reduction BMPs (Figure 6.1). These proposed sites are characteristic of systems that are representative of the agricultural landscape throughout the Lower Porter Bayou watershed.

6.2 Mississippi River Basin Initiative Cooperative Conservation Partnership Initiative

Site's with active or planned water quality monitoring will be given priority to receive funds to implement BMPs under the Mississippi River Basin Initiative Cooperation Conservation Partnership Initiative (MRBI-CCPI) program. Producers must submit applications for funding to the appropriate NRCS county office.

6.3 Mississippi River Basin Initiative Wetland Reserve Enhancement Program

Areas within the Upper Porter Bayou watershed will be prioritized for wetland restoration based on gaps in waterfowl and wildlife habitat, existence of Wetland Reserve Program (WRP) contracts and producer willingness to participate in WRP. Ranking criteria for high priority restoration and enhancement projects, developed by DW and MDWFP, include factors such as location, riparian buffers, water availability, proximity to other waterfowl habitat, and connectivity with surrounding habitat. The Forest Breeding-Bird Decision Support Model results will also be considered as part of the prioritization process. In consultation with local NRCS staff, these ranking criteria will be used to help prioritize sites for WRP contracts.

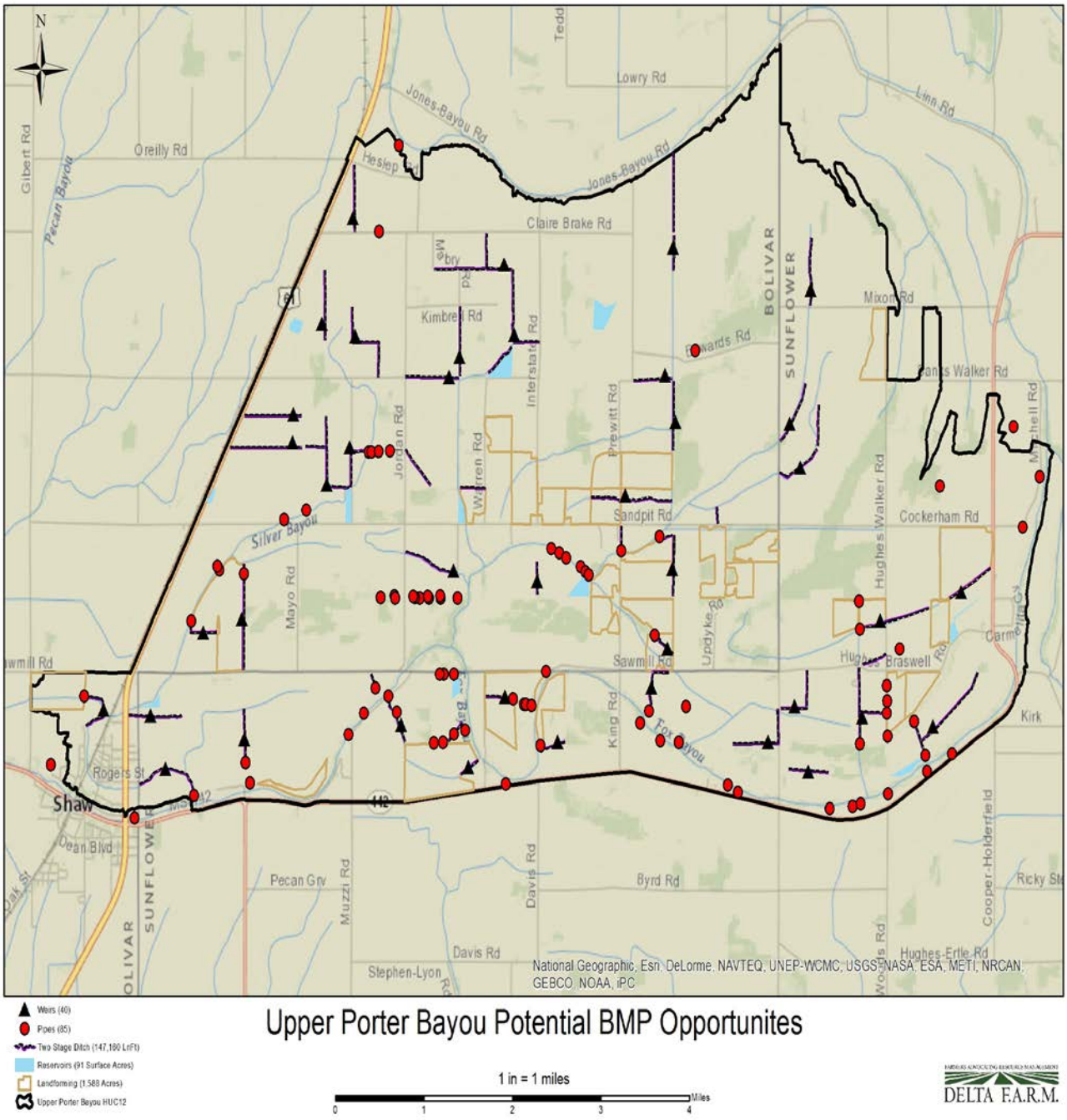

Figure 6.1. Upper Porter Bayou Potential BMP Opportunities

6.4 New Porter Bayou Drainage District Projects

The NPBDD conducts annual maintenance primarily in the waterway and floodway of Porter Bayou. Alligator weed is selectively managed against to promote the re-growth of native wetland plants. While the floodway is primarily dominated by a cypress/tupelo tree canopy, the NPBDD manages the understory vegetation for desirable herbaceous wetland plants, which provides significant improvements to water quality in the watershed.

7.0 MANAGEMENT

There are two underlying management principles of this WIP: ecosystem-based management and adaptive management. The goals and objectives of this plan reflect these principles. Each of these management principles is briefly described below, followed by watershed management actions that are planned for the near future to work toward the vision for Porter Bayou. Goals related to other existing or potential concerns in this watershed will be addressed in future implementation plans.

7.1 Ecosystem-Based Management

An ecosystem-based approach is being used for watershed management in the Upper Porter Bayou watershed. Porter Bayou and its watershed represent the ecosystem management unit. Although bayous and lakes are typically considered the ecosystem, water bodies and their watershed are inexorably coupled. Land use and land cover activities in the watershed directly or indirectly affect the water body. Sediment and nutrient loadings from the watershed drive many aquatic ecosystem processes, including both desirable and undesirable changes in the water body. The ecosystem, however, is characterized not only by its environmental attributes, but also by its socioeconomic attributes. Humans are part of, not apart from, aquatic ecosystems. Watershed management is fundamentally a social activity (Thornton and Creager 2001).

The benefits that accrue from reduced sediment and nutrient loadings to Upper Porter Bayou are not just in terms of increased water clarity, reduced sedimentation, reduced algal blooms, a more productive sport fishery, and greater recreational and aesthetic values. The agricultural community also benefits from reduced sediment and nutrient loadings. For example, Pimentel et al. (1995) estimated that each ton of sediment lost was worth about $6.75 per year to the farmer ($5.00 per ton for lost nutrients, and $1.75 per ton for lost soil and water capacity). The Delta sediment TMDL estimates that at least 0.007 tons per acre per day of sediment is lost. Based on this loss rate, just over approximately 40,600 tons of soil are lost from the Porter Bayou watershed each year (15,896 acres x 0.007 x 365), and the minimum estimate of dollars lost from the watershed is about $274,050 per year. This is equivalent to approximately $203,000 in lost nutrients from the watershed and approximately $71,050 in lost sediment and water capacity.

These estimates are very conservative because they are based on yield from the watershed, not loss from the fields (field losses are higher than delivery to the waterbody).

7.2 Adaptive Management Process

In addition to ecosystem-based management, an adaptive management process is being used for watershed management in the Upper Porter Bayou watershed. Adaptive management is "learning by doing" and has become the recommended approach for ecosystem and natural resources management, including watershed management (Christensen et al. 1996; Holling 1978; Jackson et al. 2001). Adaptive management has helped shift management from the concept that there is a "balance of nature" to a more realistic concept that ecosystems are dynamic, non-equilibrium systems. The environment is continually changing climate, development, agricultural practices, demographics, and societal values. Adaptive management is the only feasible approach for moving toward sustainable water resources (Coleman 1998).

Adaptive management, or learning by doing, means that periodic assessments must be made to determine if results-based criteria are being attained and if the water bodies and watershed are moving toward the desired vision for Porter Bayou and its watershed. The schedule for these periodic assessments and revision of the watershed management plan is discussed in Chapters 9 and 10. The rotating basin approach used by MDEQ is part of this periodic assessment process.

7.3 Planned activities

There are two key factors in this watershed that dictate which BMPs will be successful, *irrigation* and *development*. With development comes an increased financial investment by the landowner. As land cost increases, landowner willingness to take land out of production to implement BMPs decreases. This scenario calls for larger BMPs to be implemented in undeveloped areas that will treat runoff from upstream, developed areas. The less developed areas of the watershed are characterized by ridge and swale topography and there are more opportunities for BMP implementation. Low-lying swales are suitable for treatment wetlands,

while unimproved drainage ditches are prime candidates for low grade weirs, tail water recovery systems, and other BMPs.

Irrigation, particularly of rice, introduces an additional factor into the nutrient equation. Base flows in most Delta streams naturally decrease during the summer months due to less rainfall. Irrigation water supplements these base flows and often provides a constant source of runoff throughout the growing season. Although increased base flows benefit many aspects of stream health and water quality, it also reduces the ability of some BMPs to trap nutrients. For example, multiple low grade weirs are designed to trap and pool runoff allowing biological transformations to occur. With a steady base flow the utility of these in-stream BMPs is greatly diminished. To effectively treat this type of runoff we must focus on BMPs capable of treating or reusing large volumes of water. Therefore, for areas of the watershed characterized by both development and irrigation, tail water recovery systems, on-farm storage reservoirs, and treatment wetlands.

Given these considerations, the management practices currently targeted for the Porter Bayou watershed include

- Nutrient and sediment BMPs,
- Enroll marginal lands in wetland restoration programs,
- Water management projects,
- Wildlife management,
- Point source management,
- Riparian buffer restoration, and
- Alligator weed control.

7.3.1 Nutrient and Sediment BMPs

Upper Porter Bayou has been targeted for monitoring and installation of BMPs to reduce nutrient and sediment loads in cropland runoff. Specific nutrient and sediment BMPs that may be installed in the watershed include:

- Low-grade weirs,
- Pads and pipes,
- Irrigation tailwater recovery systems,
- Irrigation water conveyance pipe,
- Irrigation land leveling,
- Water control structures,
- Two stage ditches,
- Grassed waterways,
- Riparian buffers,
- Input management, and
- Conservation easements.

These BMPs are discussed below, and a map of potential locations can be found as Figure 1.

7.3.1.1 **Low-grade Weirs**

Installation of low-grade weirs in agricultural drainage ditches can improve water quality through removal of sediment and nutrients. The weirs slow flow during storm events and allow sediment to be deposited. In addition, holding water in the ditches behind the weirs creates environments that encourage biogeochemical transformation of nutrients, and may contribute to groundwater recharge (Kroger et al 2008[a]). One study in the Delta determined that low-grade weirs reduced annual phosphorus loads from cropland runoff by over 40% (Kroger et al. 2008[b]).

Low-grade weirs will be installed in ditches throughout the watershed as funding allows through various cost share programs.

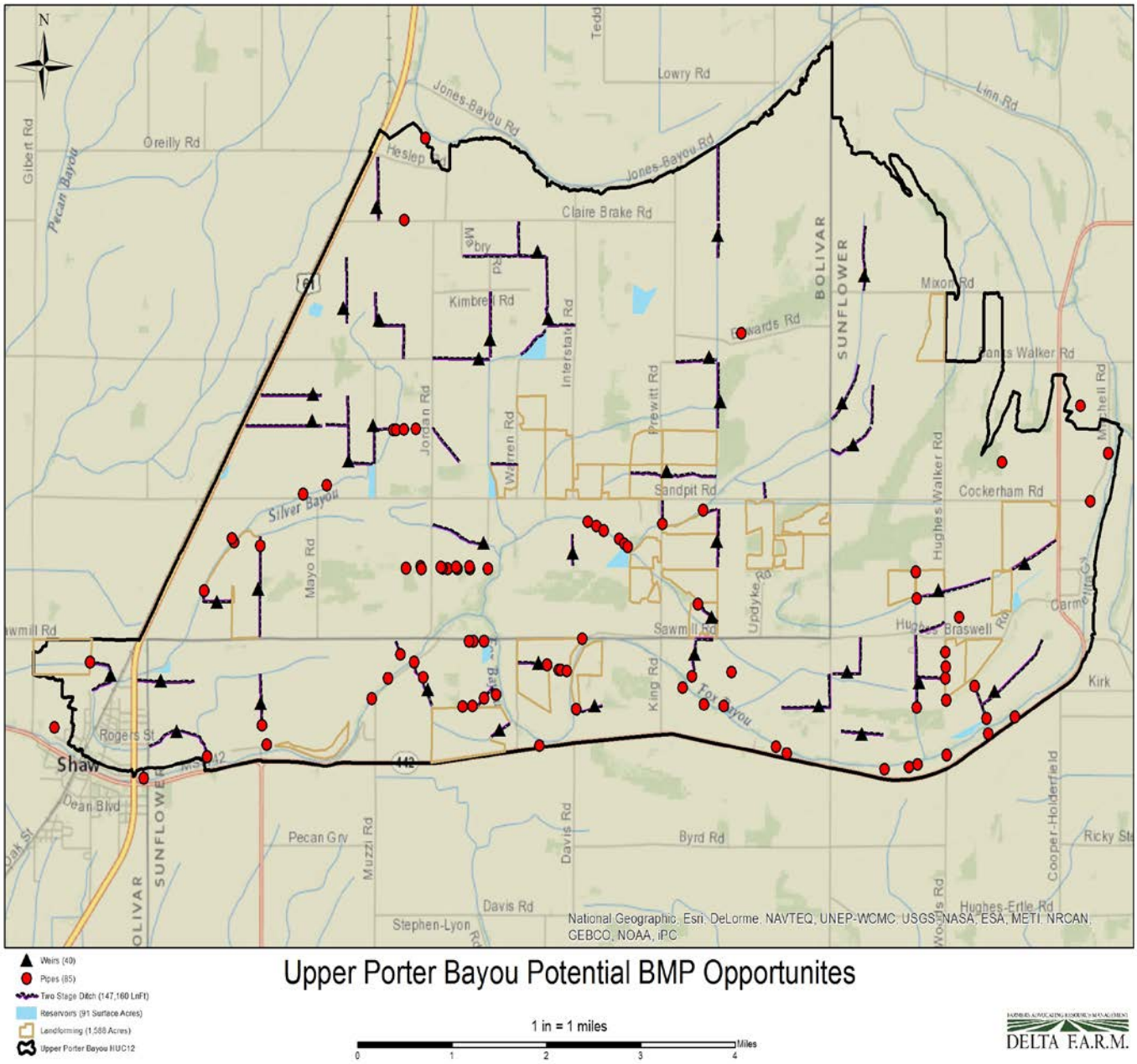

Figure 7.1. Proposed Locations for BMPs in the Upper Porter Bayou Watershed

Table 7.1. Installation of Low-grade Weirs in the Porter Bayou Watershed

Management Action	•Implement low grade weirs	
Objective	• Reduce sediment and nutrient loads into Upper Porter Bayou	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Increase groundwater recharge •Decreased sediment loading to downstream receiving systems • Decreased downstream nitrogen loading through denitrification and nitrogen uptake by aquatic vegetation • Decreased downstream phosphorous loading through sedimentation and uptake by aquatic vegetation	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of low grade weir expenses	2014-2017 Installation of low grade rip rap or concrete weirs.
EPA NPS Section 319	Provide funding assistance for cost-sharing of low grade weirs through Section 319 funding in the NPS program	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers	2014 though 2029 – Landowner maintenance of low-grade weirs.
USDA NRCS	Provide technical and financial assistance to producers for implementation of low grade weirs through NRCS programs (i.e. EQIP and MRBI).	Budget
Delta F.A.R.M.	Technical design and installation of low grade weirs. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	40 Low grade weirs @$5,000 = $200,000 Weir maintenance @ $875/year for 15 year contract = $525,000 **Total = $725,000**
USGS	Matching funds through cooperative partnership with MDEQ to monitor base and storm flow water quantity and quality associated with implementation of the low grade weirs.	

7.3.1.2 **Pads and Pipes (Water Control Structures)**

Pad and pipe systems control field runoff to reduce erosion and sediment delivery to downstream waters. The pad (a dike) routes flow through the pipe to provide an non-erodible route for runoff as an alternative to unlined ditches or gullies. This practice has been classified by the Mississippi NRCS as having the potential to decrease sediment loads slightly to significantly.[7] This practice is not expected to significantly affect nutrient loads, except for phosphorus associated with sediment loads.[8] Pad and pipe systems have already been installed in Upper Porter Bayou by some producers in the watershed. However, there is potential for installation in additional locations throughout the watershed (Figure 7.1). These systems could be designed and installed by the landowner, with assistance from Delta F.A.R.M or NRCS. Financial assistance for installation and maintenance of these systems may be provided by through the EPA Section 319 grant funds, NRCS cost share programs, or privately funded by the landowner or producer. See Table 7.2 for details of the plans for installing these systems.

7.3.1.3 **Irrigation Tailwater Recovery**

Tailwater recovery systems collect irrigation runoff water for reuse. This makes for more efficient use of irrigation water. Holding runoff water, such as in a collection pond, allows sediment to settle out, and creates environments that encourage biogeochemical transformation of nutrients, as well as contribute to groundwater recharge. In addition to water use management and water quality improvement, tailwater recovery ponds can benefit several of the species of concern identified in Section 3.3. Tailwater recovery systems are planned for the watershed and will be installed where suitable. The systems will be designed to recover drainage from cropland in the watershed. Systems may be designed and installed by the landowner with assistance from NRCS and Delta F.A.R.M. Financial assistance for installation of systems may be available from NRCS programs and/or EPA 319 grant funds. See Table 7.3 for details of the plans for installation of tailwater recovery systems in Upper Porter Bayou watershed.

[7] http://efotg.sc.egov.usda.gov/references/public/MS/ms-cppe-soil_706.PDF
[8] http://www.nrcs.usda.gov/technical/standards/nhcp.html

7.3.1.4 **Irrigation Water Conveyance Pipe**

This practice involves installing low pressure, underground plastic pipeline for the conveyance of water for irrigation. Use of underground pipe can reduce erosion and water loss, and improve irrigation water management. Installation of underground irrigation pipe is an eligible practice for the MRBI CCPI program. See Table 7.4 for details of the plans for installing underground irrigation pipe in the Porter Bayou watershed.

7.3.1.5 **Irrigation Land Leveling**

This practice involves modifying the shape of the land to planned grades that permit uniform and efficient application of irrigation water, reduce erosion and water logging, and provide for adequate drainage. Land leveling is an eligible practice for the MRBI CCPI and EQIP program. See Table 7.5 for details of the plans for implementing this practice in the Upper Porter Bayou watershed.

Table 7.2. Pads and Pipes

Management Action	Implement pads and pipes	
Objective	• Reduce sediment and nutrient loads to Upper Porter Bayou	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Participant	Activity	Schedule
Private Landowner	Private landowner's voluntarily participating and contributing cost-share portion of pad and pipe expenses.	2014-2017 installing pads and pipes 2014 through 2029 – Landowner maintenance of pads and pipes.
EPA NPS Section 319	Provide funding assistance for cost-sharing of pads and pipes through Section 319 funding in the NPS program.	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers.	Budget
USDA NRCS	Provide technical and financial assistance to producers for implementation of pads and pipes through NRCS programs (i.e. EQIP and MRBI).	207,000 Ft/Pad @$2.50 = $517,500 85 Pipes @ $2,500 = $212,500 Pipe maintenance @ $200/year for 15 year contract = $255,000 **Total = $985,000**
Delta F.A.R.M.	Technical design and installation of pads and pipes. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	
USGS	Matching funds through cooperative partnership with MDEQ to monitor vase and storm flow water quantity and quality associated with implementation of that pads and pipes.	

Table 7.3. Implement Irrigation Tailwater Recovery System

Management Action	•Implement tailwater recover (TWR) systems	
Objective	• Reduce groundwater depletion in the Delta and reduce sediment and nutrient loads to Upper Porter Bayou	
Performance Measure	•Reduce groundwater withdrawal by 36 ac-ft per year per system •Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Decreased electricity/ diesel cost of pumping irrigation water •Decreased nitrogen fertilizer costs by recirculation of irrigation return water • Decreased thermal shock to plants by using surface water vs. groundwater for irrigation • Decreased sediment and nutrient loading to downstream receiving systems	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of TWR expenses as set forth in NRCS EQIP, MRBI or other programs.	2014-2017 Installation of TWR systems
EPA NPS Section 319	Provide funding assistance for cost-sharing of TWR systems though Section 319 funding	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers	2014 though 2029 – Landowner operation and maintenance of TWR Systems.
USDA NRCS	Provide technical and financial assistance to producers for implementation of TWR systems through NRCS programs (i.e. EQIP and MRBI).	Budget
Delta F.A.R.M.	Technical design and installation TWR systems. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	$2,716 per ac/ft storage $30,000 equipment per system 5 systems – 20 ac/ft each
USGS	Matching funds through cooperative partnership with MDEQ to monitor base and storm flow water quantity and quality associated with implementation of the TWR systems.	100 ac/ft @ $2716 = $271,600 5 equipment sets @ $30,000 = $150,000 **Total = $421,600**

Table 7.4. Underground Irrigation Pipe

Management Action	•Install underground irrigation pipe	
Objective	• Reduce groundwater withdrawals and reduce sediment load to Upper Porter Bayou	
Performance Measure	•Reduce groundwater withdrawal by 36 ac-ft per year per system •Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Decreased groundwater withdrawals by reducing water losses •Decreased sediment loading to downstream receiving systems	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion installation expenses.	2014-2017 Installation
USDA NRCS	Provide technical and financial assistance through EQIP, MRBI, AWEP and similar programs.	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers.	
Delta F.A.R.M.	Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	
Budget		
Installation of 32,000 ft of underground pipe @ $8.00/ft **Total = $256,000**		

Table 7.5. Implement Irrigation Land Leveling

Management Action	•Implement land leveling	
Objective	• Reduce groundwater depletion in the Delta and reduce sediment loads to Upper Porter Bayou	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Decreased sediment loading to downstream receiving systems •Reduce groundwater withdrawals by increasing efficiency of irrigation use	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of land leveling expenses	2014 – 2017 Installation
USDA NRCS	Provide funding assistance for cost-sharing of land leveling through MRBI program.	
EPA NPS Section 319	Provide funding assistance for cost-sharing of land leveling through Section 319 funding in the NPS program	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers.	Budget
Delta F.A.R.M.	Technical design and installation of land leveling. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	1,588acres@$650/Acre = $1,032,200 **Total = $1,032,200**
USGS	Matching funds through cooperative partnerships and MDEQ to monitor base and storm flow water quantity and quality associated with implementation of the management practice.	

7.3.1.6 **Two-stage Ditches**

Constructing or modifying agricultural drainage ditches to include a small channel to carry effective discharge and benches to act as floodplains during higher flows. This type of construction can increase the stability of the ditch, reduce maintenance, and improve ecological function (NEH, 2007). See Table 7.6 for additional information on the plans for installation of two-stage ditches in the Upper Porter Bayou watershed.

7.3.1.7 **Grassed Waterways**

Grassed waterways convey runoff with minimal erosion, and can trap both sediment and nutrients. Grassed waterways are eligible practices for the MRBI-CCPI and EQIP program, and may beinstalled at potential locations in the watershed. See Table 7.7 for additional information on the plans for installation of grassed waterways in the Upper Porter Bayou watershed.

Table 7.6. Design, Construct, and Maintain Two-stage Ditches

Management Action	•Design, construct, and maintain two-stage ditches	
Objective	• Reduce sediment and nutrient loads to Upper Porter Bayou	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Increase groundwater recharge •Decreased sediment loading to downstream receiving systems • Decreased downstream nitrogen loading through denitrification and nitrogen uptake by aquatic vegetation • Decreased downstream phosphorous loading through sedimentation and uptake by aquatic vegetation	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of two stage ditch expenses	2014 - 2017 Installation of two stage ditches
USDA NRCS	Provide technical assistance for design.	
EPA NPS Section 319	Provide funding assistance for cost-sharing of land leveling through Section 319 funding in the NPS program	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers.	Budget
Delta F.A.R.M.	Technical design and installation of two stage ditches. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	Two State Ditch Construction $15/ft 147,160Lnft = $2,207,400 **Total = $2,207,400**
USGS	Matching funds through cooperative partnerships and MDEQ to monitor base and storm flow water quantity and quality associated with implementation of the management practice.	

7.3.1.9 **Conservation Easements**

Enrolling land in conservation programs can reduce erosion and runoff of sediment and nutrients. These lands can reduce erosion through stabilizing soil. Conservation lands can also act as filters to remove sediment and nutrients in runoff. Conservation programs generally provide some kind of financial incentive or compensation in return for removing the land from cultivation, such as rental payments, cost-share for restoration work, or tax credits. The USDA manages several programs for land conservation in Mississippi, including the Conservation Reserve Program, Conservation Stewardship Program, and Wildlife Habitat Enhancement Program. The Mississippi Fish and Wildlife Foundation also manages a conservation easement program, as do the Mississippi Land Trust Ducks Unlimited and Delta Wildlife.

7.3.1.10 **Riparian Buffers**

Riparian buffers help reduce bank erosion, provide and improve wildlife habitat, and trap sediment and nutrients from overland runoff to the waterway. Riparian buffers also serve as filters strips removing sediments from agricultural runoff entering the bayou through overland flow.

The NPBDD Stream Ban Restoration Project involves the mulching and grinding of woody underbrush along the banks of Porter Bayou. Native warm season grasses have been planted in high topographic areas as a means of bank stabilization and herbaceous wetland plants are being managed for in the floodway.

Table 7.7. Implement In-field Sediment Management Practices

Management Action	•Implement In-field sediment management practices	
Objective	• Reduce sediment and nutrient loads to Upper Porter Bayou by installing grassed waterways	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Field grade stabilization •Decreased soil erosion and increased agricultural production • Decreased loads to receiving streams of organic material and nutrients sorbed to soil particles • Increased soil organic and nutrient content	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of management practices	2014 - 2017 Installation of grassed water ways and filter strips.
USDA NRCS	Provide funding assistance for cost-sharing through, EQIP, MRBI and similar programs.	
EPA NPS Section 319	Provide funding assistance for cost-sharing of land leveling through Section 319 funding in the NPS program	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers.	Budget
Delta F.A.R.M.	Technical design and installation of sediment management practices. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	Grass Waterway 3,500ft @20.00/ft = $21,000 Filter Strips 10 acres @ $400/ac = $4,000 Cost of taking land out of production 10 acres @ $5,000/acre = $50,000 **Total = $75,000**

7.3.1.11 **Input Management**

Precision agriculture refers to one technique for managing crop inputs and yields using spatially referenced monitoring of field nutrient content, soil quality, and crop yield to more precisely apply fertilizers and pesticides using computer controlled equipment (Hudson and Hite 2001). Precision agriculture is expected to reduce the amount of inputs producers use, reducing their production costs, and runoff and infiltration of fertilizer nutrients and pesticide chemicals.

There is currently concern among Delta producers about the high start-up costs of precision agriculture, and the uncertainty about whether the technique actually increases producer profits. There is also uncertainty among producers about how to implement the techniques, and if it is even needed in the Delta. This technique was developed in the upper Midwest, which has very different soils and nutrient cycling than the Delta. Table 7.8 contains additional information.

7.3.2 Enroll Lands in Wetland Reserve Program

Natural and constructed wetlands have been shown to improve water quality through removal of sediment and nutrients. Slow flow through the wetlands allows sediments to be deposited. Nutrients are used by wetland plants, and the wet environment encourages biogeochemical transformation of nutrients. In addition, wetlands can be places of groundwater recharge.

Porter Bayou watershed is a target watershed under the MRBI Wetland Reserve Enhancement Program (WREP). Approximately 6,007 acres of wetlands currently exist in the Porter Bayou watershed (Figure 2.2). There are already a few wetland easements in the watershed. Delta Wildlife and Mississippi NRCS will assist with design of constructed wetlands. See Table 7.9 for additional information about wetland restoration and construction activities planned for Porter Bayou watershed.

7.3.3 Wildlife Management

Projects may be implemented in the Porter Bayou watershed with the purpose of improving and extending habitat for wildlife, primarily birds. These include restoration, creation, and management of wetlands through the Wetland Reserve Program and WREP, and shallow water development and management. Restored and constructed wetlands can provide wintering habitat, migratory stop-over sites, late summer/fall foraging sites, and breeding/nesting habitat for a number of waterfowl, forest, and migratory bird species. Shallow water development and management involves inundating fields during the winter to provide habitat for wildlife, including native and migrating waterfowl, migrating shorebirds, amphibians, and fish. As noted in Section 7.3.2, wetland restoration, construction, and management activities in Upper Porter Bayou are eligible for assistance under the MRBI. See Table 7.10 for additional information.

Other management practices also have the potential to improve or extend habitat for wildlife. Tailwater recovery ponds (Section 7.3.1.3) and off-channel storage ponds (Section 7.3.5.2) can provide habitat for waterfowl and amphibians. Riparian buffers (Section 7.3.1.9) can improve fisheries of the associated waterway, and provide habitat for terrestrial wildlife, including birds.

7.3.4 Alligator Weed Control

The existing NPBDD eradication program will be continued as adequate funds are available.

Table 7.8 Precision Agriculture and Input Management

Management Action	•Implement input management through precision agriculture	
Objective	• Reduce nutrient loading to Upper Porter Bayou	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• More efficient use of fertilizer •Potential for yield increases through better placement • Less fertilizer loss downstream	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of precision agriculture and input management.	2014 - 2017 implement precision agriculture and input management practices
USDA NRCS	Provide funding assistance for cost-sharing of precision agriculture and input management t through EQIP, MRBI or other programs.	
Delta F.A.R.M.	Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	**Budget** 6,000 acres @ $8.75/acre/year **Total = $157,500**

Table 7.9. Restore and Manage Wetlands

Management Action	•Restore and manage wetlands	
Objective	• Increase groundwater recharge and reduce sediment and nutrient loads to Upper Porter Bayou	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Increased groundwater table elevations •Increased groundwater recharge •Increased and enhanced shorebird, amphibian, waterfowl, fisheries, and wildlife habitat • Improved downstream water quality through decreased sediment and nutrient loading	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of wetland restoration expenses as set forth in CRP, WRP, EQIP, AWEP or other program requirements.	2014-2017
USDA NRCS	Provide funding assistance for cost-sharing of wetland restoration through, CRP, WRP, EQIP and similar programs. Provide technical assistance for restoration and management of wetlands.	
Delta F.A.R.M.	Technical design and installation of wetland management practices. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	Budget 200 acres @ $4,000/Acre **Total = $800,000**

Table 7.10. Construct and Manage Shallow WaterAreas

Management Action	•Construct and manage shallow water areas	
Objective	• Reduce sediment and nutrient loads to Upper Porter Bayou	
Performance Measure	•Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	•Increased and enhanced shorebird, amphibian, waterfowl, fisheries, and wildlife habitat • Improved downstream water quality through decreased sediment and nutrient loading	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of shallow water management expenses as set forth in NRCS EQIP or other program requirements.	2014-2017
USDA NRCS	Provide funding assistance for cost-sharing of shallow water management through EQIP and similar programs. Provide technical assistance for shallow water areas.	
Delta F.A.R.M.	Increase awareness of producers about cost share programs and deadlines, facilitate the enrollment of private land owners, and provide technical services and outreach to producers on the implementation management and benefits of shallow water management practices.	Budget 2,000 acres per year for 3 years @$28/ac/year **Total = $168,000**

7.3.5 Water Management Projects

Water management activities anticipated for Upper Porter Bayou include channel maintenance, installation of tailwater recovery systems, irrigation water, conveyance pipe, off-channel storage, dikes, and irrigation water management. Tailwater recovery systems are described in Section 7.3.1.2, and irrigation water conveyance pipe is described in Section 7.3.1.4. The remaining activities are described below.

7.3.5.1 **Channel Maintenance**

NPBDD will be the primary provider of channel maintenance, including clearing, snagging, dredging, and channel improvement.

7.3.5.2 **On-Farm Storage**

Off-channel water storage in addition to tailwater recovery impoundments (see Section 7.3.1.2), shallow water development (see Section 7.3.3), and restoration of wetlands (see Section 7.3.2) may be installed in the Upper Porter Bayou watershed. Development of off-channel water storage is an eligible practice under the MRBI-CCPI, AWEP and EQIP programs. Landowners will design and install off-channel water storage with assistance from NRCS and Delta F.A.R.M. Priority locations for off-channel water storage will be determined based on program prioritization criteria (Section 6.2). See Table 7.11 for additional information on installation of off-channel storage in the Upper Porter Bayou watershed.

7.3.5.3 **Dikes**

Dikes are embankments, usually constructed of earth, for the purpose of protecting land from flooding, or otherwise controlling water. Dikes are eligible practices under the MRBI CCPI program. Dikes may be constructed as needed.

7.3.5.4 **Irrigation Water Management**

Irrigation water management consists of practices to track and control the volume, frequency, and application rate of irrigation water in a planned and efficient manner. Irrigation water management may be implemented in the Upper Porter Bayou watershed through the MRBI CCPI, EQIP program. This may include implementation of the NRCS PHAUCET Irrigation Control Program. This program helps producers design flat poly pipe furrow irrigation systems by identifying the appropriate hole sizes to punch in the pipe based on variables such as the well pump rate, field slope, row lengths, and size of poly pipe (YMD 2009). This design assistance is expected to reduce water usage. Feedback from producers who have used PHAUCET has all been positive (YMD 2009). See Table 7.12 for additional information on planned implementation of irrigation water management in Upper Porter Bayou watershed.

7.3.6 Point Source Management

The Shaw POTW will be required to achieve NPDES permit limits for ammonia in its effluent by May 2013. As a condition of its NPDES permit, the Shaw POTW was required to submit an engineering report to MDEQ describing how the facility would come into compliance with the appropriate ammonia limit, by May 2011. Compliance with nutrient permit limits by small . POTWs is expected to be a wide-spread issue in the Delta.

7.4 Schedule

A schedule management practice implementation will be developed as funding sources are secured for plan implementation. However, it is anticipated that the project could begin in 2014 and continue through 2017 or beyond dependent on available funding.

Table 7.11. Design, Construct, and Operate On-farm Storage for Irrigation

Management Action	•Design, construct, and operate on-farm storage for irrigation	
Objective	• Reduce groundwater depletion in the Delta and reduce sediment and nutrient loads to Upper Porter Bayou	
Performance Measure	• Reduce groundwater withdrawal by 160ac-ft per year per system •Reduce sediment loading to Upper Porter Bayou by 30% •Reduce nitrogen loading to Upper Porter Bayou by 40% • Reduce phosphorous loading to Upper Porter Bayou by 50%	
Benefits	• Decreased groundwater withdrawal and increased groundwater recharge •Decreased electricity/diesel cost of pumping irrigation water • Decreased nitrogen fertilizer costs by recirculation of irrigation return water • Decreased thermal shock to plants by using surface water vs. groundwater for irrigation • Decreased sediment and nutrient loading to downstream receiving systems	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of on-farm storage expenses as set forth in NRCS EQIP, MRBI, or other program requirements.	2013-2014 Install On-farm storage reservoirs
USDA NRCS	Provide funding assistance for cost-sharing of off channel storage through EQIP, MRBI or other programs. Provide technical assistance for design, construction, and operation of on-farm storage.	
EPA NPS Section 319	Provide funding assistance for cost-sharing of land leveling through Section 319 funding in the NPS program	
MS Department of Environmental Quality	Contract with Delta F.A.R.M. to administer 319 funds with individual farmers.	Budget
Delta F.A.R.M.	Technical design and installation of on-farm storage reservoirs. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	Construction $1,500 per ac/ft Equipment $50,000 per System Operation and Maintenance for 15 year contract period $120,000 per system 9 systems 96 ac/ft each Construction 864 ac/ft @ $1,500 = $1,296,000 9 equipment sets @ $50,000 = $450,000 9 maintenance @ $120,000 = $1,080,000 **Total = $2,826,000**

Table 7.12. Irrigation Water Management

Management Action	•Implement irrigation water management practices	
Objective	• Reduce groundwater withdrawals	
Performance Measure	• 20% increase in irrigation efficiency where applied	
Benefits	• Decreased groundwater decline • Increased water levels in surrounding water bodies • Reduced production costs	
Participant	Activity	Schedule
Private Landowner	Private landowner voluntarily participating and contributing cost-share portion of irrigation management expenses.	2014 - 2017 Implement irrigation water management on multiple project sites
USDA NRCS	Provide funding assistance for cost-sharing of irrigation water management through EQIP, MRBI or other programs.	
Delta F.A.R.M.	Technical design and installation of irrigation management practices. Provide technical services and outreach to producers on the implementation, maintenance, and benefits of this management practice.	Budget
Yazoo Mississippi Delta Water Management District	Provide technical and financial assistance to producers for implementation of irrigation management practices.	3,000 acres @ $9/acre **Total = $27,000**

7.5 Budget

Table 7.13 below, summarizes the estimated budget information for the management actions discussed above. The total budget for these activities is approximately $2 million. Note that these estimates are preliminary and may change.

Table 7.13. Management Budget

Management Actions	Activities	Costs	Funding Sources
Nutrient and Sediment BMPs	Low Grade Weirs	$725,000	NRCS/EPA/Producer
	Tailwater Recovery	$421,600	NRCS/EPA/Producer
	Pads and Pipe	$985,000	NRCS/EPA/Producer
	Two Stage Ditch	$2,207,400	NRCS/EPA/Producer
	Grassed waterway & riparian buffers	$75,000	NRCS/FSA/EPA/Producer
	Underground Irrigation Pipe	$256,000	NRCS/EPA/Producer
	Land leveling	$1,032,200	NRCS/EPA/Producer
	Restore Wetlands	$800,000	NRCS/Producer
	Shallow Water Areas	$168,000	NRCS/EPA/Producer
	Input Management	$157,500	NRCS/EPA/Producer
Water management	On Farm storage reservoirs	$2,826,00	NRCS/EPA/Producer
	PHAUCET	$27,000	NRCS/EPA/Producer

8.0 EDUCATION AND OUTREACH

8.1 Goals

The goals of the awareness, outreach, and education activities outlined in this plan are:

- Get stakeholder input on issues to address;
- Make residents and landowners aware of issues in the watershed;
- Increase producer use of BMPs;
- Increase producer use of assistance programs;
- Make producers aware that BMPs personally benefit them, as well as the environment and community; and
- Foster pride in the watershed.

8.2 Activities

8.2.1 Stakeholder Meeting

The producers in Upper Porter Bayou were contacted by Delta F.A.R.M. to identify the issues they perceive and would like addressed in the management plan. These stakeholders were also apprised of the Delta Nutrient Reduction Strategy, and the associated work planned in the Porter Bayou watershed.

8.2.2 Nutrient and Sediment BMPs

The data gathered from the monitoring associated with BMP installations in Upper Porter Bayou watershed will be used to inform producers in the area, and the BMP sites will be included on informative tours for Delta farmers. Prewitt Farms lies in the Upper Porter Bayou watershed and currently serves as a demonstration farm where BMPs are showcased during the numerous farm tours that are held each year.

8.2.3 PHAUCET

Mississippi State University, Delta F.A.R.M., NRCS and the YMD Water Management District work to inform producers in the watershed about the PHAUCET program, its benefits and success, and how to implement it.

8.2.4 WRP Enrollment

The most effective outreach efforts are those that work one on one with individual landowners, which is the process that will be used by both DW and NRCS in implementing the WRP. NRCS will work with individual landowners first, to enroll land in WRP and draw up contracts for wetland easements. Once the contracts are signed, DW and NRCS will include the landowners in designing and constructing the WRP project, to ensure compatibility with farming practices, and provide insight and information on how wetland functions benefit the landowner. Ancillary benefits the landowner receives by having the WRP project on their property will be described and documented for use in future DW outreach and education.

Sustaining both the wetland functions and management activities over time will be significantly enhanced with three years of individual landowner outreach on wetland management. After three years, the wetlands will be established and close to being self-sustaining. Further, after 3 years of individual consultation and encouragement, landowner management activities are expected to become part of their routine farming practices.

8.3 Delta Nutrient Reduction Strategy

Ongoing activities associated with Delta Nutrient Reduction Strategy are expected to contribute to the awareness, education, and outreach goals of this plan. DNRS work groups routinely meet to discuss monitoring, best management practices, water management, input management, etc. Outcomes from these meetings are incorporated into education/outreach materials which are disseminated to producers and the general public through multiple outlets.

8.4 Schedule

Activities geared toward increasing awareness, outreach, and education will occur throughout the process of contracting, designing, installing, maintaining, and documenting management practices in the Upper Porter Bayou watershed. A schedule will be developed as funds are made available but implementation could potentially begin in 2014.

8.5 Budget

Awareness, outreach, and education activities planned in Porter Bayou watershed will be funded through grants and agency operations budgets. Budget information for awareness, outreach, and education activities for Porter Bayou watershed is summarized in Table 8.1. The total budget for these activities is $105,000.

Table 8.1. Budget for Porter Bayou Watershed Awareness, Outreach, and Education Activities

Education, Outreach Activity	Budget	Funding Sources
BMP Outreach	$60.000	EPA/NRCS
PHAUCET outreach	$15,000	YMD/MSU/Delta F.A.R.M.
Nutrient Reduction strategy	$30,000	EPA/MDEQ/Delta F.A.R.M.

9.0 EVALUATION

9.1 Monitoring

9.1.1 Water Quality

A water quality monitoring plan will be developed to evaluate water quality improvements in the Upper Porter Bayou watershed as funding is made available for future efforts. Current efforts by MDEQ, USGS, and MSU are monitoring flow, sediment, N, and P, and other constituents during both base flow and storm flow, prior to, and after, construction and implementation of conservation management practices to determine the resulting percent reduction in sediment, N, and P at the multiple spatial tiers. However, funding for these efforts is set to expire in 2014. See *Figure 7.1 for monitoring locations*.

9.1.2 Habitat

WRP Easement properties in the watershed are monitored by NRCS or a technical service provider such as Delta Wildlife. Site conditions are documented and reported to NRCS who maintains the records for each easement property.

9.1.3 Water Levels

Ground water levels in Upper Porter Bayou watershed are routinely monitored at selected wells by YMD. YMD surveys water levels in 550 wells throughout the Delta every year in the spring and fall (YMD 2008). There are no USGS continuous ground water monitoring wells located in the Porter Bayou watershed.[9]

Surface water levels do not appear to be routinely monitored at any water body in the Porter Bayou watershed. Water levels in the Sunflower River are monitored by a USGS gage upstream of Porter Bayou, at Sunflower.[10]

9.1.4 Water Use Survey

YMD conducts an annual water use survey for the five major crop types in the Delta – corn, cotton, soybeans, rice, and catfish. Between 100 and 150 sites are surveyed each year. Irrigation water volumes are estimated based on pump flow rate and monthly electricity usage.

9.1.5 Schedule

The schedule for monitoring activities well be developed as funding sources are made available.

[9] http://waterdata.usgs.gov/ms/nwis/gw

[10] http://waterdata.usgs.gov/ms/nwis/dv/?site_no=07288500&referred_module=sw

9.1.6 Budget

Budget information for monitoring activities is summarized in Table 9.2.

Table 9.2. Monitoring Budget Summary for Porter Bayou Watershed

Monitoring Activity	Budget	Funding Source
Water quality	$180,000 (3 years)	EPA/DEQ/USGS
Wetland habitat	agency budgets	NRCS
Ground water levels	agency budget	YMD
Water use	agency budget	YMD

9.2 Criteria

Water quality, groundwater use, and groundwater level measures will be used to evaluate whether implementing this plan has resulted in improvement in the Upper Porter Bayou watershed. These measurements will be compared to the performance measures for each management activity shown in Tables 8.1 through 8.7, and summarized below.

9.2.1 Nutrient targets

Mississippi does not have water quality standards for allowable nutrient concentrations. MDEQ currently has a Nutrient Task Force (NTF) working on the development of criteria for nutrients. The nutrient TMDL completed for Porter Bayou used preliminary annual average concentration targets of 1.05 mg/l for TN and 0.16 mg/l for TP (MDEQ 2008). The management targets for this plan are 40% reduction of TN load to Porter Bayou, and 50% reduction of the TP load to Porter Bayou.

9.2.2 Sediment

Simon et al (2000) developed acceptable ranges of sediment loadings at the effective discharge of Mississippi water bodies from suspended sediment concentration (SSC) data measured at stable streams in the same ecoregion. The effective discharge is the discharge which moves the most sediment, or is the channel-forming flow. The target range for the water bodies within the Yazoo River basin (which includes Upper Porter Bayou) is 0.0014 to 0.0045 tons per acre per day at the effective discharge.

9.2.3 Groundwater

For activities focused on reducing groundwater use, the management target is to reduce groundwater use by 40 acre-feet per year at the site of implementation. Restoration of wetlands also has a target of increasing the area available for groundwater recharge in the Porter Bayou watershed by 3 acres.

9.3 Assessment

Implementation milestones and schedules have been or will be developed for the management actions and education and outreach activities described in this plan. For implementation to be considered successful, all activity milestones must be met on time. Once the project is initiated, the Team will meet quarterly to review progress on achieving the milestones and make needed adjustments to the schedule.

Each Team member serves as the chair for one of the major management categories, such as sewerage, sediment and nutrient loading, etc. There is a subcommittee associated with each of these categories to ensure that the management actions are implemented.

In addition, the success of the implementation of this plan in achieving the management targets specified in Section 9.2, will be evaluated no later than 2020. This will be accomplished by the Watershed Implementation Team, or its designee(s), compiling and renewing available monitoring data (Section 9.1) and comparing results to the targets. A short report will be prepared by the evaluators, summarizing the results of their review. This information will be provided to all interested stakeholders and implementation participants in preparation for revising the Upper Porter Bayou Watershed Implementation Plan (WIP).

9.3.1 Plan

Specific management action schedules toward achieving the vision for the Upper Porter Bayou watershed are described in Chapter 7.0 and summarized in Table 7.14. If the schedules are not being met, the causes behind the failure to meet the goals will be determined, and actions will be taken. Specific management action goals and/or expectations are described in Chapter 7.0.

9.3.2 Education and outreach

Specific goals and/or expectations for education and outreach activities are described in Chapter 8.0. If the activity goals were not met, the causes behind the failure to meet the goals will be determined. In addition, the plan activities will be evaluated with regard to information and knowledge about the watershed and its waterbodies that has been gained since the existing plan was developed, as well as any relevant physical changes in the watershed or changes in policy affecting the watershed. Implementation of the activities will be reevaluated in light of all of this information on a quarterly basis, as discussed above.

10.0 Overall Budget

Table 10.1 Watershed Implementation Plan Budget

Activity	NRCS	EPA 319	Producer	Other	Total
BMPs	$ 3,699,575	$ 2,830,700	$ 3,105,425	$ -	**$ 9,635,700**
Monitoring	$ -	$ 90,000	$ -	$ 90,000	**$ 180,000**
Outreach	$ 30,000	$ 45,000	$ -	$ 30,000	**$ 105,000**

11.0 PLAN REVISION

Dependent on approval and funding, the Watershed Implementation Team will prepare a revised WIP, incorporating the changes requested by the reviewers and reconciling any conflicting comments or requests for change.

The WIP will be submitted to the Watershed Implementation Team and all others who submitted comments. Within two weeks of receiving the WIP, the team will notify their stakeholders of the availability of the revised WIP for stakeholder review. One month will be allowed for review of the . Comments will be due at the end of this review period. Within a month after the comments on the WIP are received, the Watershed Implementation Team will prepare a final updated WIP. The updated WIP will be submitted to the Watershed Implementation Team for review and approval. After the updated WIP has been approved, the team will notify their stakeholders of the completion and availability of the updated WIP for use as a guide for watershed restoration and protection activities.

Funding for revision of the WIP will come from the agencies included on the Watershed Implementation Team, and/or the Section 319 program.

12.0 REFERENCES

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