Alabama Department of Environmental Management

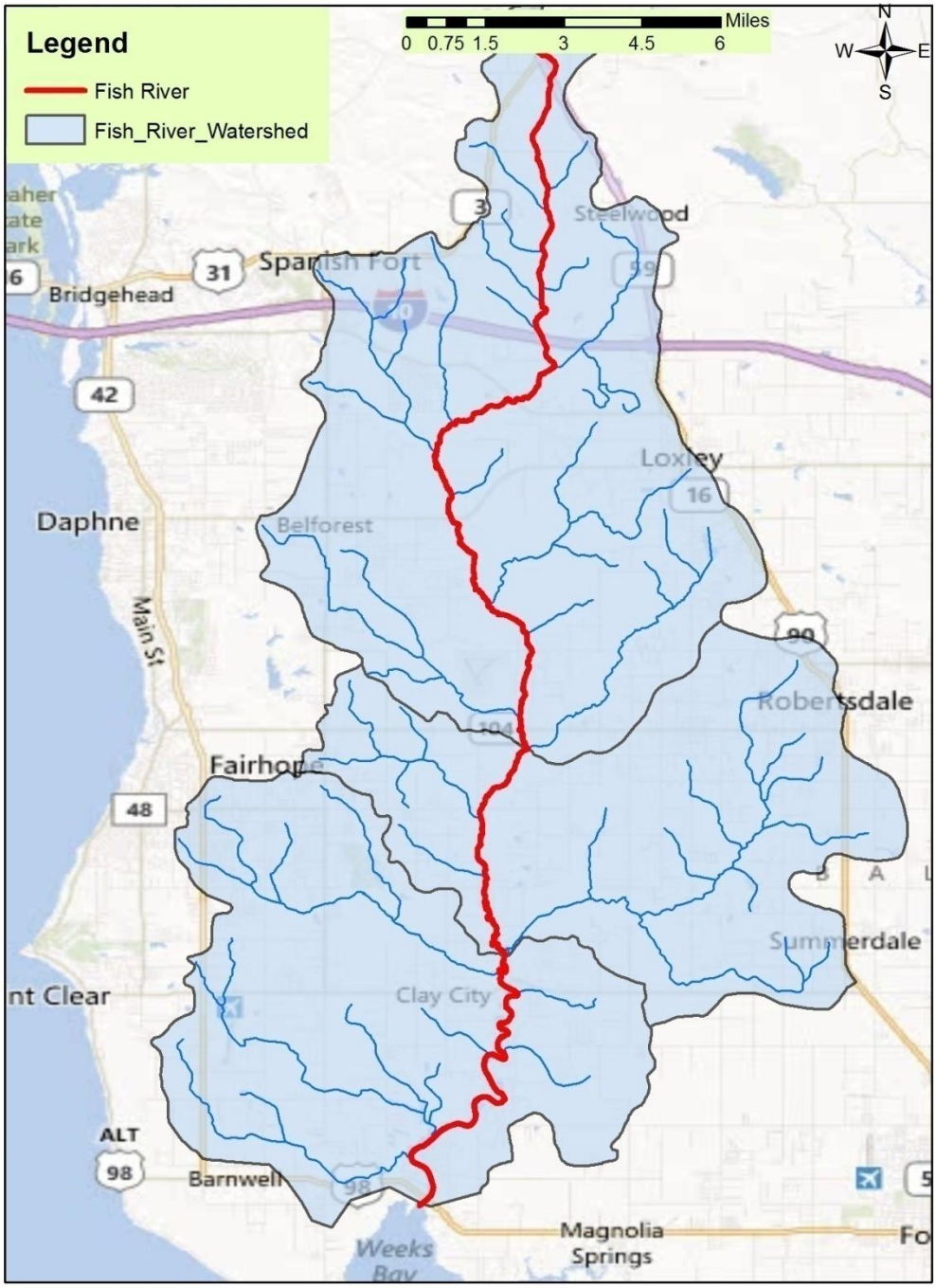
Final

Total Maximum Daily Load (TMDL)
For
Fish River

Assessment Unit ID # AL03160205-0204-112
Pathogens (E. coli)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
August 2013

Figure 1: The Fish River Watershed



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1.0 Executive Summary

Section §303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the Total Maximum Daily Load (TMDL) for pollutants causing the use impairment. A TMDL is the sum of individual wasteload allocations for point sources (WLAs), load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Fish River is on the §303(d) list for pathogens from Weeks Bay to its source, which is located near Stapleton, Alabama. Fish River forms in Baldwin County and is included in the Mobile Bay Basin. Fish River is the primary freshwater source for Weeks bay, one of only three Outstanding National Resource Waters in Alabama, and home to the Weeks Bay National Estuarine Research Reserve. The river flows south for approximately 30 miles until it empties into Weeks Bay. The total drainage area for Fish River watershed is 151.4 square miles. The primary use classification for Fish River is Fish & Wildlife and Swimming. Since the criteria for pathogens under the Swimming designated use is more stringent than the criteria for the Fish and Wildlife designated use, the Swimming criteria will be applied throughout the TMDL.

Fish River was first listed on the §303(d) list in 1998 based on data collected in 1996 by the Geological Survey of Alabama, which indicated the stream was impaired for fecal coliform. The Fish River was initially sampled in 1990 and was found to exceed the fecal coliform single sample water quality criterion multiple times, and at multiple stations. The historical pathogens data for the Fish River is included in the Appendix 7.3. The pathogen indicator for non coastal areas was changed in December 2009 to Escherichia coli (E. coli). Due to this change, Fish River was sampled from 2007-2010 for E. coli and enterococci in coastal areas, which will be the basis for this TMDL.

In 2010, 2011, and 2012 §303(d) sampling studies were performed by ADEM on Fish River to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2010-2012 data will be used to assess the water quality of Fish River because it is the most current data and provides the best picture of the current water quality conditions of the stream. The January 2012 edition of ***Alabama's Water Quality Assessment and Listing Methodology*** section 4.8.2, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody when that data indicates a change in water quality has occurred. Also, as a result of the Alabama Environmental Management Commission's (EMC) adoption of the Escherichia coli (E. coli) criteria as the new bacterial indicator, this TMDL will be developed from E. coli data collected at station FI-1 and the enterococci data collected at FSHB-7 and WB-1, even though the 1996 data that prompted the listing of Fish River was based on the fecal coliform criteria. The more recent bacterial data is listed in the Appendix for reference. ADEM collected 90 samples from Fish River in 2010, 2011, and 2012. According to the data collected, Fish River was not meeting the pathogen criterion applicable to its use classification of Fish and Wildlife and Swimming. Therefore, a TMDL will be developed for pathogens (E. coli) for Fish River.

A mass balance approach was used for calculating the pathogen TMDL for the Fish River. The mass balance approach utilizes the conservation of mass principle. Existing loads were calculated by

multiplying the E. coli concentrations times the respective in-stream flows and a conversion factor. The mass loading was calculated using the single or geometric mean sample exceedance event which resulted in the highest percent reduction. In this case it was determined that the highest percent reduction was calculated from a single sample, E. coli violation of 660 colonies/100 mL measured on September 5, 2012 at FI-1. This violation calls for a reduction of 68%. In the same manner as existing loads were calculated, an allowable load was calculated for the single sample E. coli criterion of 235 colonies/100 mL (235 colonies/100 mL – 10% Margin of Safety).

Table 1 is a summary of the estimated existing load, allowable load, and percent reduction for the single sample criterion vs. the geometric mean criterion, as well as for the point sources continuously discharging into the Fish River watershed. Table 2 lists the TMDL defined as the maximum allowable enterococci loading under critical conditions for the Fish River.

Table 1: E. coli Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load Single Sample	2.89E+12	9.26E+11	1.96E+12	68%
Golden Triangle WWTP[a]	0	1.43E+10	0	0%
Town of Loxley WWTP[b]	8.12E+8	5.69E+9	0	0%
Spanish Fort WWTP	1.57E+9	2.31E+10	0	0%

a. This facility is currently under construction.
b. The permit for the Town of Loxley WWTP still requires monitoring for Fecal Coliform. It will be revised during the next permit cycle to reflect the change in indicator species to E. coli.
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Table 2: E. coli TMDL for the Fish River

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
1.07E+12	1.03E+11	4.31E+10	68%	0	9.26E+11	68%

a. There are no CAFOs in the Fish River watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in E. coli loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for E. coli.
e. TMDL was established using the single sample E. coli criterion of 235 colonies/100ml.

Compliance with the terms and conditions of existing and future NPDES permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria and we are committed towards targeting the load reductions to improve water quality in the Fish River watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

2.0 Basis for §303(d) Listing

2.1 Introduction

Section §303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the total maximum daily load (TMDL) for pollutants causing use impairment. The TMDL process establishes the allowable loading of pollutants for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified the 30.01 mile segment of the Fish River as impaired for pathogens. The §303(d) listing was originally reported on Alabama's 1998 List of Impaired Waters based on Geological Survey of Alabama data collected in 1996 and included on all subsequent lists. The source of the impairment is listed on the 2012 §303(d) list as pasture grazing.

2.2 Problem Definition

Waterbody Impaired:	Fish River – Weeks Bay to its source
Impaired Reach Length:	30.01 miles
Impaired Drainage Area:	151.4 square miles
Water Quality Standard Violation:	Pathogens (Single Sample Max, E. coli, Geometric Mean Max, E. coli, Single Sample Max enterococci)
Pollutant of Concern:	Pathogens (E.coli, enterococci)
Water Use Classification:	Swimming/ Fish and Wildlife

Usage Related to Classification:
The impaired stream segment is classified as Fish and Wildlife (F&W) and Swimming and Other Whole Body Water-Contact Sports (S). Usage of waters in this classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d).

(a) Best usage of waters: fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food-processing purposes.

(b) Conditions related to best usage: the waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

(c) Other usage of waters: it is recognized that the waters may be used for incidental water contact and recreation during June through September, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

(d) Conditions related to other usage: the waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

As well as ADEM Admin. Code R. 335-6-10-.09(3) (a) and (b)

(a) Best usage of waters: swimming and other whole body water-contact sports.∗

(b) Conditions related to best usage: the waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports. The quality of waters will also be suitable for the propagation of fish, wildlife and aquatic life. The quality of salt waters and estuarine waters to which this classification is assigned will be suitable for the propagation and harvesting of shrimp and crabs.

∗ ***NOTE****: In assigning this classification to waters intended for swimming and water-contact sports, the Commission will take into consideration the relative proximity of discharges of wastes and will recognize the potential hazards involved in locating swimming areas close to waste discharges. The Commission will not assign this classification to waters, the bacterial quality of which is dependent upon adequate disinfection of waste and where the interruption of such treatment would render the water unsafe for bathing.*

Pathogens Criterion:

Criterion for acceptable bacteria levels for the F&W use classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(e)7(i) and (ii) as follows:

7. Bacteria:

(i) In non-coastal waters, bacteria of the E. coli group shall not exceed a geometric mean of 548 colonies/100 ml; nor exceed a maximum of 2,507 colonies/100 ml in any sample. In coastal waters, bacteria of the enterococci group shall not exceed a maximum of 275 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours.

(ii) For incidental water contact and recreation during June through September, the bacterial quality of water is acceptable when a sanitary survey by the controlling health authorities reveals no source of dangerous pollution and when the geometric mean E. coli organism density does not exceed 126 colonies/100 ml nor exceed a maximum of 487 colonies/100 ml in any sample in non-coastal waters. In coastal waters, bacteria of the enterococci group shall not exceed a geometric mean of 35 colonies/100 ml nor exceed a maximum of 158 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours. When the geometric bacterial coliform organism density exceeds these levels, the bacterial water quality shall be considered acceptable only if a second detailed sanitary survey and evaluation discloses no significant public health risk in the use of the waters. Waters in the immediate vicinity of discharges of sewage or other wastes likely to contain bacteria harmful to humans, regardless of the degree of treatment afforded these wastes, are not acceptable for swimming or other whole body water contact sports.

Criterion for acceptable bacteria levels for the Swimming and Other Whole Body Water-Contact Sports use classification is described in ADEM Admin. Code R. 335-6-10-.09(3)(c)6(i),(ii) and (iii) as follows:

(i) Waters in the immediate vicinity of discharges of sewage or other wastes likely to contain bacteria harmful to humans, regardless of the degree of treatment afforded these wastes∗, are not acceptable for swimming or other whole body water-contact sports.

(ii) In all other areas, the bacterial quality of water is acceptable when a sanitary survey by the controlling health authorities reveals no source of dangerous pollution and when the geometric mean *E. coli* organism density does not exceed 126 colonies/100 ml nor exceed a maximum of 235 colonies/100 ml in any sample in non-coastal waters. In coastal waters, bacteria of the enterococci group shall not exceed a geometric mean of 35 colonies/100 ml nor exceed a maximum of 104 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours. When the geometric mean bacterial organism density exceeds these levels, the bacterial water quality shall be considered acceptable only if a second detailed sanitary survey and evaluation discloses no significant public health risk in the use of the waters.

(iii) The policy of nondegradation of high quality waters shall be stringently applied to bacterial quality of recreational waters.

Criteria Exceeded:

Fecal coliform data collected by the Geological Survey of Alabama in 1996 was used for listing the Fish River on Alabama's 1998 §303(d) list. At the time fecal coliform was considered by the Department to be the appropriate indicator species for the pathogens criteria. The fecal coliform criteria for the Fish and Wildlife use classification at the time of the listing were as follows:

7. Bacteria

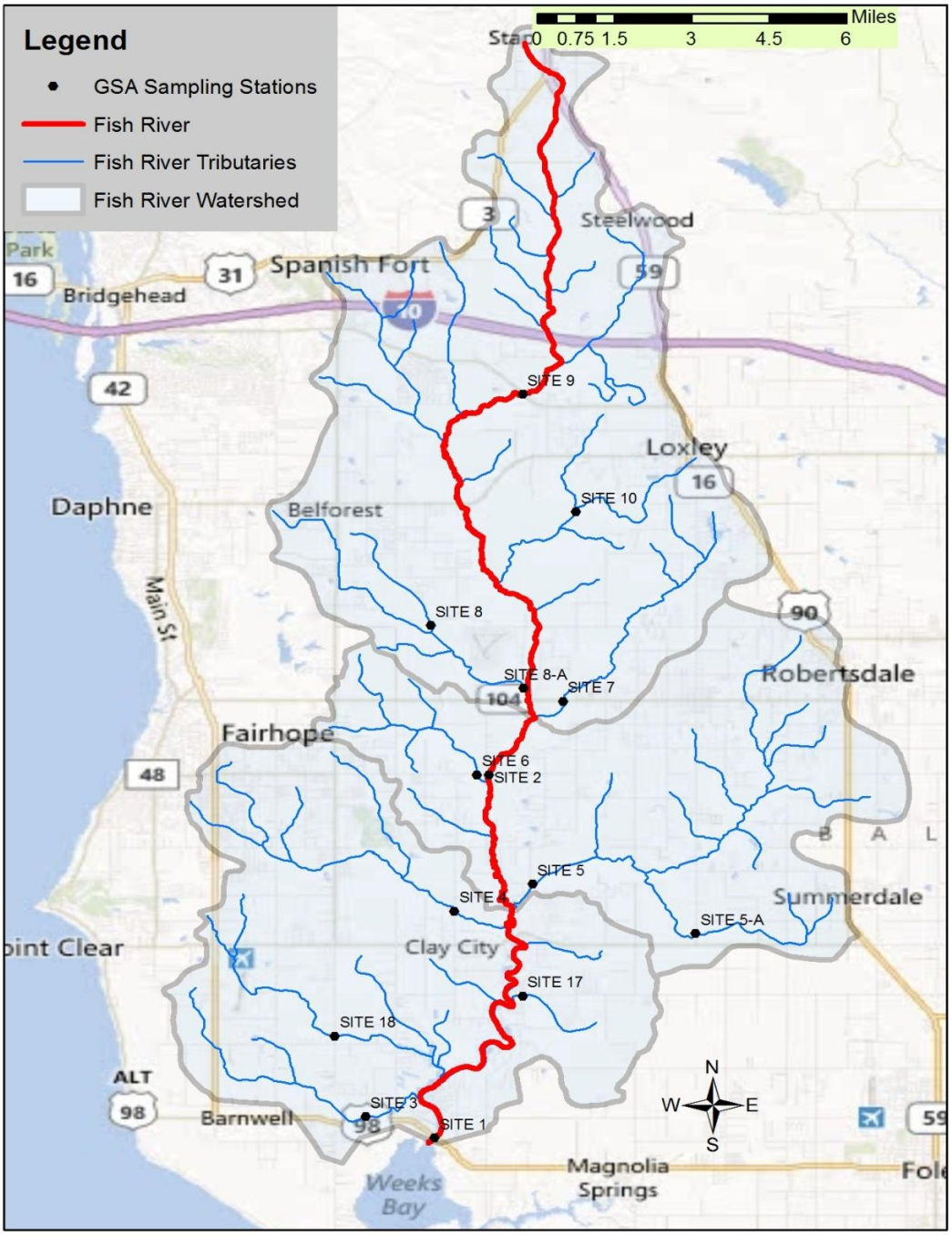
(i) in non coastal waters, bacteria of the fecal coliform group shall not exceed a geometric mean of 1,000 colonies/100 ml; nor exceed a maximum of 2,000 colonies/100 ml in any sample. In coastal waters, bacteria of the enterococci group shall not exceed a maximum of 275 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours

(ii) For incidental water contact and recreation during June through September, the bacterial quality of water is acceptable when a sanitary survey by the controlling health authorities reveals no source of dangerous pollution and when the geometric mean fecal coliform organism density does not exceed 200 colonies/100 ml in non-coastal waters. In coastal waters bacteria of the enterococci group shall not exceed a geometric mean of 35 colonies/100 ml nor exceed a maximum of 158 colonies/100 ml in any sample

In addition, the Swimming designated use carried additional criteria of a maximum of 200 colonies per 100mL, for a geometric mean sample, year round. In coastal waters the Swimming designated use also required the more stringent criteria of not exceeding a geometric mean of 35 colonies/100 ml nor exceed a maximum of 104 colonies/100 ml in any sample

The Weeks Bay watershed study performed by the GSA included 601 fecal coliform samples taken in the Fish River. The locations of these samples are displayed below. Due to the large size of the GSA dataset only the single sample violation events are presented in the appendix.

Figure 2: Geological Survey of Alabama Sampling Stations



3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

On December 11, 2009, the Alabama EMC adopted the E. coli criteria as the bacterial indicator to assess the levels of bacteria in freshwater. Prior to the adoption of the E. coli criteria, the fecal coliform criteria were used by ADEM as the bacterial indicator for freshwater. The E. coli criteria was recommended by the EPA as a better correlation to swimming and incidental water contact associated health effects than fecal coliform in the 1986 publication ***Quality Criteria for Water***, (EPA 440/5-86-001). As a result of this bacterial indicator change, this TMDL will be developed from E. coli data collected at station FI-1 which was sampled in 2010, 2011, and 2012; even though the 1996 data that prompted the listing of Fish River was based on the fecal coliform criteria.

In addition the portion of Fish River downstream from Clay City is classified as coastal waters. Because of this the enterococci criteria will be applied at stations WB-1, which was sampled multiple times a year from 2007-2012 and FSHB-7, which was sampled in 2011. For the purpose of this TMDL a single sample maximum E. coli target of 211.5 colonies/100 mL will be used. This target was derived by using a 10% explicit margin of safety from the single sample maximum of 235 colonies/100 mL criterion. This target is considered protective of water quality standards and should not allow the single sample maximum of 235 colonies/100 mL to be exceeded. In addition a geometric mean target of 113.4 colonies per 100ml will be used over a series of five samples taken at least 24 hours apart over the course of 30 days. This target was also derived by using a 10% explicit margin of safety from the geometric mean criteria of 126 colonies per 100ml. This target is considered protective of water quality standards and should not allow the geometric mean maximum criteria to be exceeded. Additionally the target concentrations of enterococci will be 93.6 colonies per 100ml for a single sample and 31.5 colonies per 100ml for the geometric mean enterococci in the coastal areas. These targets were derived in the same fashion as the E. coli targets were and are considered protective of water quality standards and should not allow the criteria to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Fish River Watershed

A point source can be defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source contributions can typically be attributed to municipal wastewater facilities, illicit discharges, and leaking sewer systems in urban areas. Municipal wastewater treatment facilities are permitted through the National Pollutant Discharge Elimination System (NPDES) process administered by ADEM. In urban settings sewer lines typically run parallel to streams in the floodplain. If a leaking sewer line is present, high concentrations of bacteria can flow into the stream or leach into the groundwater. Illicit discharges are found at facilities that are discharging bacteria when not permitted, or when the pathogens criterion established in the issued NPDES permit is not being upheld.

Continuous Point Sources
There are currently four NPDES permitted facilities in the Fish River watershed. These are as follows:

1. Golden Triangle WWTP
2. Baldwin County Sewer Service WWTP
3. Spanish Fort WWTP
4. Loxley WWTP

The Golden Triangle WWTP is a semi public/private municipal facility that has been permitted but currently is under construction and not yet in operation. It is located in the upper part of the Fish River Watershed, approximately 0.6 miles north of the I-10 Bridge over Fish River. Currently the draft permit for the Golden Triangle WWTP has a proposed E. coli limit of 126 col/100ml for the monthly average and 235 col/100 ml as the daily maximum, which is the applicable pathogen criteria for the Swimming use classification. At this time it is questionable if the facility will become operational in the foreseeable future. Should the facility become operational in the future the facility will be required to comply with the provisions of this TMDL.

The Baldwin County Sewer Service WWTP currently does not have an active NPDES permit due to having switched to underground injection for disposal of treated effluent, though it has discharged to the surface in the past. Should the Baldwin County Sewer Service WWTP choose to revert to a surface discharge it will require a new NPDES permit that is in accordance with the provisions of this TMDL. No E. coli loading to the Fish River will be attributed to the Baldwin County Sewer Service WWTP.

The Spanish Fort WWTP is a facility comprised of two municipal wastewater treatment plants with outfalls located within just a few feet of each other. Both plants are permitted as one source and modeled as such for purposes of Waste Load Allocations. Therefore they will be considered as one source for purposes of this TMDL. The Spanish Fort WWTP is a 1.25 MGD municipal facility that discharges to Bay Branch approximately two tenths of a mile from the Fish River. Bay Branch has a designated use of Fish and Wildlife which carries with it less stringent criteria for pathogens than does the Swimming designated use. Owing to the proximity of the outfall, and the small drainage area of Bay Branch (2.83 square miles) the Spanish Fort WWTP will be required to comply with the provisions of this TMDL in order to be protective of the Fish River during critical low flow conditions for Bay Branch.

The Town of Loxley WWTP is a 0.75 MGD municipal wastewater treatment plant that discharges directly to the Fish River. The permit for this facility has not been revised or reissued since the Department changed the pathogen criteria from Fecal Coliform to E. coli. The Loxley WWTP will be required to comply with the provisions of this TMDL.

Any future NPDES regulated discharges that are considered by the Department to be a pathogen source will be required to meet the in-stream water quality criteria for pathogens at the point of discharge. Currently, Loxley WWTP is reporting their pathogen data in fecal coliform (colonies/100 mL). In addition, Loxley WWTP has pathogen limits in the form of fecal coliform. During the next permit re-issuance pathogen criterion in the permit will be updated to ensure that applicable in-stream E. coli criterion for the Fish River is maintained.

Figure 3: NPDES Permitted Dischargers in the Fish River Watershed

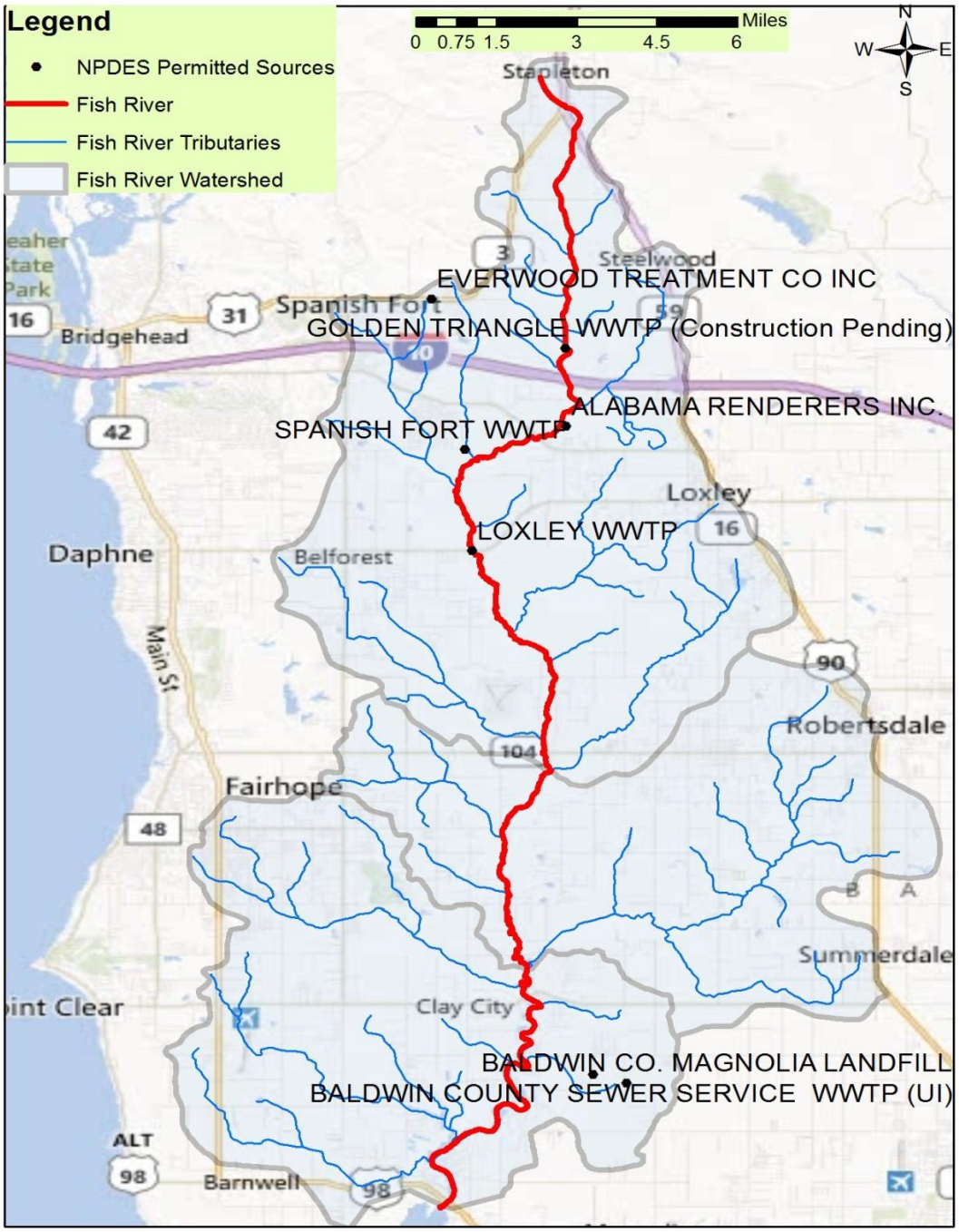


Table 3: Permitted NPDES dischargers in the Fish River Watershed

Type	NPDES #	Facility Name	Stream	Flow (MGD)
Municipal	AL0078794	Golden Triangle WWTP	Fish River	3.0
Municipal	AL0073334	Baldwin County Sewer Service WWTP	NA- underground injection	N/A
Municipal	AL0060283	Town of Loxley WWTP	Fish River	0.75
Municipal	AL0042234	Spanish Fort WWTP	Bay Branch	1.25

Non-Continuous Point Sources

There are currently three NPDES stormwater dischargers within the Fish River watershed.

Everwood Treatment Co. Inc (AL0064866) is a facility that currently pressure treats lumber using a non-arsenical and non-chromium based process. The process itself is closed loop with zero discharge of process waters. The current NPDES permit covers stormwater only. The permitted stormwater discharge flows unto an unnamed tributary of Turkey Branch and then into the Fish River. Because of this, the Everwood Treatment Co. is not considered to be a source of pathogens due to the lack of discharge and the nature of the process. The sanitary waste from this facility is disposed of through the Baldwin County sewer system. No E. coli loading to the Fish River will be attributed to the Everwood Treatment Company, nor will this facility receive an allocation in this TMDL.

Baldwin County Magnolia Landfill (AL0069345) receives household garbage, rubbish, commercial solid waste, and other non hazardous wastes. This facility discharges landfill wastewater, much of its stormwater, its sanitary waste, and the leachate from the landfill, through an underground injection system. The NPDES permit that allows for the landfill to discharge to surface water only covers stormwater which is diverted from the landfill by perimeter ditches which route the stormwater to a series of sedimentation ponds designed to contain a 25 year, 24 hour storm. While the existing and draft permits require the facility to monitor for pathogens, it has reported no discharge for the last several years. This lack of discharge data and the fact that the waters discharged to the surface receiving stream do not contact the landfill waste directly, indicates that this facility is not a signifigant source of pathogens to the Fish River. No E. coli loading to the Fish River will be attributed to the Baldwin County Magnolia Landfill, nor will it receive an allocation through this TMDL.

Alabama Renderers Inc. (AL0069418) is a transfer station for Birmingham Hide and Tallow where restaurant waste grease is collected and shipped for processing. On site there is a wastewater lagoon and waste grease lagoon. Alabama Renderers Inc. does not discharge any process wastewater at this location. Sanitary wastewater is disposed of through an onsite septic system. As such, Alabama Renderers Inc. is only permitted for discharge of stormwater into the Fish River. The current permit only requires Alabama Renderers Inc. to monitor for pathogens in the storm water runoff. Therefore, Alabama Renderers will not be given an allocation in this TMDL. However, Alabama Renderers Inc. will be required to comply with the provisions of this TMDL through implementation of Best Management Practices (BMPs).

Table 4: NPDES Stormwater Dischargers within the Fish River watershed

Type	NPDES #	Facility Name	Stream	Flow (MGD)
Industrial	AL0064866	Everwood Treatment Co. Inc	UT to Turkey Branch	Storm Water
Industrial	AL0069345	Baldwin County Magnolia Landfill	Barner Branch	Storm Water
Industrial	AL0069418	Alabama Renderers Inc.	Fish River	Storm Water

Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), from which it is often discharged untreated into local waterbodies. To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain a NPDES permit and develop a stormwater management program.

Phase I, issued in 1990, requires *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. Phase II, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.

Generally, Phase I MS4s are covered by individual permits and Phase II MS4s are covered by a general permit. Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges.
An MS4 is a conveyance or system of conveyances that is:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.;
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.);
- Not a combined sewer; and
- Not part of a Publicly Owned Treatment Works (sewage treatment plant).

Currently, there are four Phase II Municipal Separate Stormwater Sewer System (MS4) areas partially located within the Fish River watershed. These MS4s are the City of Daphne, City of Fairhope, City of Spanish Fort, and the unincorporated parts of Baldwin County considered by the Census Bureau to be urbanized areas. All four of these MS4's are covered and regulated by the Alabama general permit for phase II MS4s. Future MS4s will be required to demonstrate consistency with the assumptions and requirements of this TMDL.

Table 5: MS4's in the Fish River Watershed

NPDES #	Facility Name	Phase
ALR040039	City of Daphne	II
ALR040040	City of Fairhope	II
ALR040042	Unincorporated Baldwin Co.	II
ALR040041	City of Spanish Fort	II

Sanitary sewer overflows (SSOs) have the potential to severely impact water quality and can often result in the violation of water quality standards. It is the responsibility of the NPDES wastewater discharger or collection system operator for non-permitted "collection only" systems to ensure that releases do not occur. Unfortunately, releases to surface waters from SSOs are not always preventable or reported.

From review of ADEM DMR files it was found that Spanish Fort WWTP has reported 81 SSOs between the March 2002 and November 2012. However, almost all of these were very small, less than 1000 gallons. Also, Loxley WWTP reported 13 separate SSOs between 2005 and 2012. Several of these were of significant volume and are presented in Table 6 below. Of the SSOs reported, none occurred on the days that violations were documented within the Fish River.

Table 6: Significant SSOs in the Fish River watershed

NPDES #	Facility Name	Date	Estimated volume of release (gal)
AL0060283	Town of Loxley WWTP	4/7/05	30,000
AL0060283	Town of Loxley WWTP	5/22/03	Between 12,000 and15,000
AL0060283	Town of Loxley WWTP	6/9/12	> 100,000
AL0060283	Town of Loxley WWTP	7/23/03	*
AL0060283	Town of Loxley WWTP	9/17/04	Between 10,000 and 50,000
AL0042234	Spanish Fort WWTP	3/3/09	**

* This SSO was reported as 200-500 gallons per hour with no information on how long it persisted.
** This SSO had no volumetric information included in the report. It was reported as a broken 12 inch line located at the plant, which is very close to the river.

3.2.2 Nonpoint Sources in the Fish River Watershed

Nonpoint sources of bacteria do not have a defined discharge point, but rather, occur over the entire length of a stream or waterbody. On the land surface bacteria can accumulate over time and be washed into streams or waterbodies during rain events. Therefore, there is some net loading of bacteria into streams as dictated by the watershed hydrology.

A review of DMR data from the major point sources in the Fish River watershed seems to indicate that the impairment that exists is not attributable to the dischargers. Therefore nonpoint sources are believed to be the primary source of bacteria. Land use in this watershed is primarily agriculture and forest. Approximate land use proportions are 42.1% agricultural, 21.4% forested, and 11.8% developed, with the remaining 24.7% further delineated below.

Agricultural land can be a source of E. coli bacteria. Runoff from pastures, animal feeding areas, improper land application of animal wastes, and animals with direct access to streams is all mechanisms that can contribute bacteria to waterbodies. A reconnaissance of the watershed was conducted and it did not reveal a significant number of animals being reared in the watershed. While both cattle and horses were present, the overwhelming majority of the watershed's agricultural area appears to be planted in row crops and hay. Additionally most of the observed fields were not fenced, indicating that those fields were not able to be used for livestock rearing. This seems to indicate that the impact from livestock is minimal to Fish River.

E. coli bacteria can also originate from forested areas due to the presence of wild animals such as deer, raccoons, turkey, waterfowl, etc... Wildlife will deposit feces onto land surfaces, where it can be transported during rainfall events to nearby streams. Control of these sources is usually limited to land management BMPs and may be impracticable in most cases. As a result, forested areas are not specifically targeted in this TMDL.

E. coli loading from developed areas is potentially attributable to multiple sources including storm water runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. On-site septic systems are common in unincorporated portions of the watershed and may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

3.3 Land Use Assessment

Land use for the Fish River watershed was determined using ArcMap with land use datasets derived from the 2006 National Land Cover Dataset (NLCD). Figure 5 displays the land use areas for the Fish River watershed. Table 7 depicts the primary land uses in the Fish River watershed.

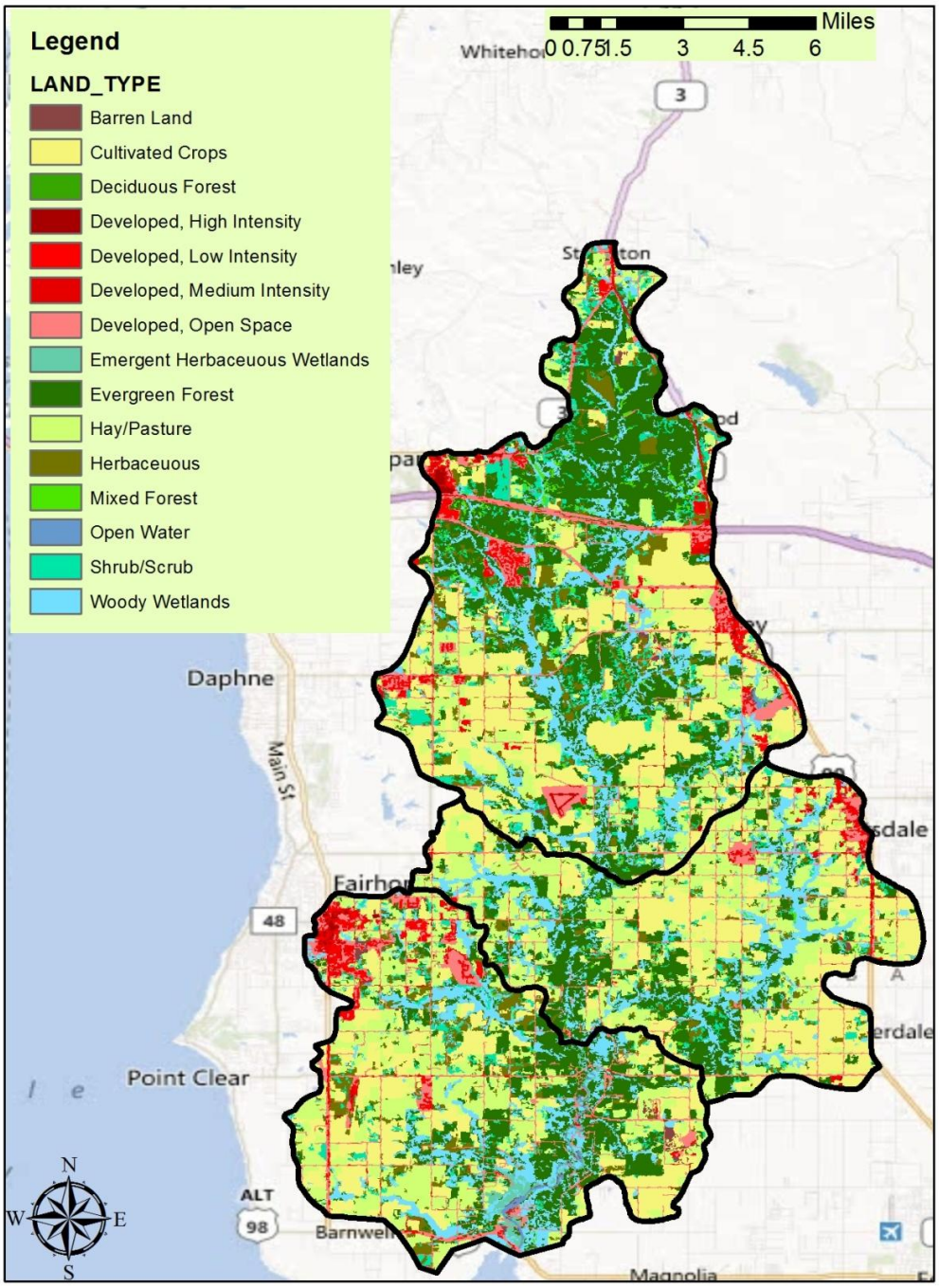
The majority of the Fish River watershed is split among forests comprising 21.4% of the watershed and agriculture at 42.1%. The remaining land use being approximately 11.8% developed and 24.7% other. Developed land includes both commercial and residential land uses. A further break down of the agricultural land use reveals that about 24% of the agricultural land is pasture/hay both of which can be utilized for cattle grazing during certain periods throughout the year and, in turn, contribute to pathogen

run-off into streams if proper BMPs are not employed. On-site septic systems are common in unincorporated portions of the watershed and may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

Table 7: Land use in the Fish River watershed

Land Use	2006
Open Water	0.2%
Developed Open Space	8.0%
Developed Low Intensity	2.7%
Developed Medium Intensity	0.8%
Developed High Intensity	0.2%
Barren Land (Rock/Sand/Clay)	0.5%
Deciduous Forest	0.0%
Evergreen Forest	20.8%
Mixed Forest	0.6%
Shrub/Scrub	4.4%
Grassland/Herbaceous	6.2%
Pasture/Hay	20.7%
Cultivated Crops	21.3%
Woody Wetlands	12.4%
Emergent Herbaceous Wetlands	1.0%
Total	**100.00%**
Cumulative Land Use	
Developed	11.8%
Forested	21.4%
Agriculture	42.1%
Other	24.7%
Total	**100.00%**

Figure 4: Land Use in the Fish River Watershed



3.4 Linkage between Numeric Targets and Sources

The Fish River watershed has three main land uses, namely agriculture, forest, and developed. Pollutant loadings from forested areas tend to be low due to their filtering capabilities and will be considered as background conditions. The most likely sources of pathogen loadings in the Fish River watershed are from the agricultural land uses and failing septic systems. It is not considered a logical approach to calculate individual components for nonpoint source loadings. Hence, there will not be individual loads or reductions calculated for the various nonpoint sources. The loadings and reductions will only be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

ADEM collected monthly water quality data for Fish River at one non-costal station (FI-1) along the impaired water body from May 2010 to June 2012, from which 34 samples were collected. This includes two intensive measurement periods, June and July 2011, and September and October 2011, to collect geometric mean sample data. ADEM also sampled two coastal stations along Fish River for water quality data. At one station (FSHB-7) enterococci was sampled between February 2011 and November 2011. At the other station (WB-1) sampling was performed from June 2007 through December 2012. Both coastal stations had intensive sampling performed on them at the same times as the non-coastal station. There were a total of 15 samples taken at station FSHB-7 and 42 total samples taken at stationWB-1.

A single sample violation occurred at FI-1 on October 12, 2011. An E. coli concentration of 270 colonies/100 mL was measured on this day. A flow of 45 cfs was measured on this day at FI-1. A single sample violation occurred at FI-1 on July 10, 2012. An E. coli concentration of 270 colonies/100 mL was measured on this day. A flow of 54 cfs was measured on this day at FI-1. A single sample violation occurred at FI-1 on September 5, 2011. An E. coli concentration of 660 colonies/100 mL was measured on this day. A flow of 179 cfs was measured on this day at FI-1. In addition the period of sampling between September 22, 2011 and October 20, 2011 yielded a geometric mean violation of 187.43 colonies/100 mL. The average of the flows taken during this sampling period is 46.6 cfs, which was used for geometric mean load calculations.

At station FSHB-7 an enterococci sample was taken on September 22, 2011 which contained 140 colonies/100ml. No flow was taken on that day. A total of fifteen samples were taken during the 2010-2012 monitoring that ADEM conducted. This is the only violation event at that station. In accordance with our 2012 Assessment and Listing Methodology, Station FSHB-7 is considered to be out of compliance as with a sample size of fifteen samples, no single sample is allowed to be in exceedance of the enterococci criteria.

At station WB-1 single sample violations occurred on October 23, 2007 and on January 6, 2011, containing 160 colonies/100ml and 590 colonies/100ml respectively. No flows were taken at that time. These are the only enterococci violation events that occurred at station WB-1. In accordance with our 2012 Assessment and Listing Methodology, Station WB-1 is considered the be in compliance as with a sample size of 42 samples, water quality is considered acceptable as long as there are two or fewer violation events.

Of the two stations which are considered to be out of compliance, the violation event which results in the largest percentage reduction was selected as the basis for this TMDL. This was station FI-1 which had a concentration of E. coli of 660 col/100ml and a flow of 179 cfs measured on September 5, 2012.

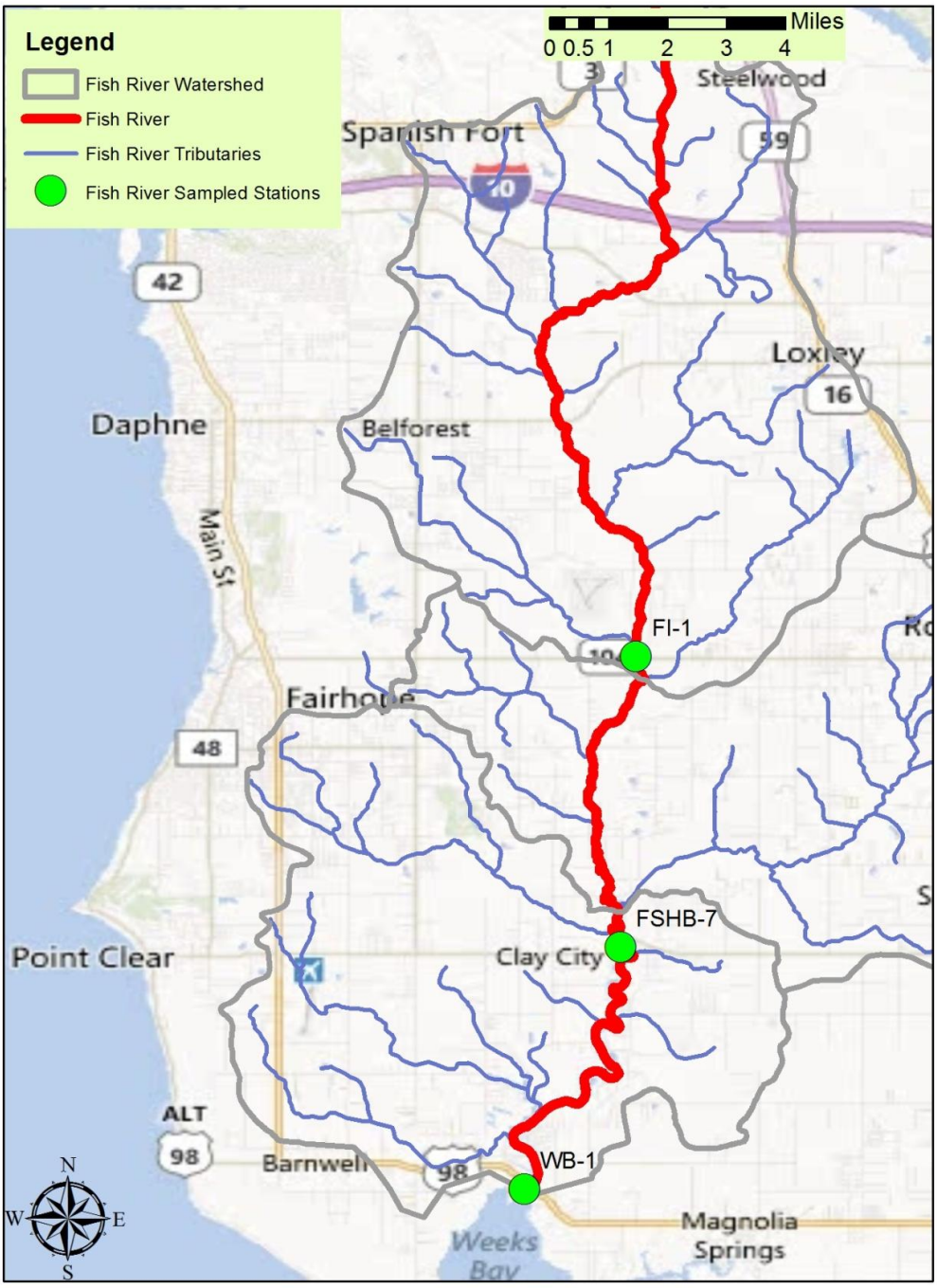
Table 8: Pathogen Single Sample Maximum Violations on Fish River

Station	Date	Pathogen group	col/100mL	Flow (cfs)	Flow measured (?)
FI-1	10/12/2011	E. coli	270	45	Yes
FI-1	7/10/2012	E. coli	270	54	Yes
FI-1	9/5/2012	E. coli	660	179	Yes
FSHB-7	9/22/2011	enterococci	140	Not Available	No
WB-1	10/23/2007	enterococci	160	Not Available	No
WB-1	1/6/2011	enterococci	590	Not Available	No

Table 9: E. coli Geometric Mean Violations on Fish River

Station	Violation	E.coli col/100mL	Date Range
FI-1	GEOMETRIC MEAN =	187.43	9/22/2011-10/20/2011

Figure 5: ADEM sampling stations in the Fish River



3.6 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the TMDL analysis: 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations.

Both an explicit and implicit MOS was incorporated into this TMDL. The MOS accounts for the uncertainty associated with the limited availability of data used in this analysis. An explicit MOS was applied to the TMDL by reducing the appropriate target criterion concentration by ten percent and calculating a mass loading target with measured or calculated flow data. The single sample E coli maximum value of 235 colonies/100 mL was reduced by 10% to 211.5 colonies/100 mL, while the geometric mean criteria was reduced in the same fashion to 113.4 colonies/100 mL.

4.0 TMDL Development

4.1 Definition of a TMDL

A total maximum daily load (TMDL) is the sum of individual wasteload allocations for point sources (WLAs), load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS). The margin of safety can be included either explicitly or implicitly and accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. As discussed earlier, the MOS is explicit in this TMDL. A TMDL can be denoted by the equation:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while achieving water quality standards under critical conditions.

For some pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). However, for pathogens, TMDL loads are typically expressed in terms of organism counts per day (colonies/day), in accordance with 40 CFR 130.2(i).

4.2 Load Calculations

A mass balance approach was used to calculate the E. coli TMDL for the Fish River. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the E. coli concentration and the estimated in-stream flow together. The existing load was calculated for the single sample violation in 2011. In the same manner, the allowable loads for a single sample were calculated for the appropriate criterion. Although there were single-sample and geometric mean violations, the TMDL was based on the highest calculated load percent reduction to achieve applicable water quality criteria.

Existing Conditions

The **single sample** mass loading was calculated by multiplying the E. coli single sample exceedance concentration of 660 colonies/100 mL by the measured flow of 179 cfs. This concentration was calculated based on measurements at FI-1 on September 5, 2012. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of E. coli to the Fish River under the single sample exceedance condition.

$$\frac{179\text{ft}^3}{\text{s}}\times\frac{660\ \ \text{colonies}}{100\,\text{mL}}\times\frac{24465755\ \ \ 100\,\text{mL}*\text{s}}{\text{ft}^3*\text{day}}=\frac{2.89\times10^{12}\,\text{colonies}}{\text{day}}$$

The **continuous point sources** mass loading was calculated by taking the 95th percentile of E. coli or fecal coliform monitoring results reported in the Discharge Monitoring Reports (DMR) submitted by the facility. This is multiplied by the 95th percentile of the monthly average flow reported by the facility and the appropriate conversion factor to determine the existing load. It should be noted that the existing load for the Golden Triangle WWTP is zero since the facility is not yet operational.

Town of Loxley WWTP[a]

$$0.7897MGD\times\frac{1.55\,\text{ft}^3}{\text{s}*MGD}\times\frac{27.102\,\text{colonies}}{100\,\text{mL}}\times\frac{24465755\ \ \ 100\,\text{mL}*\text{s}}{\text{ft}^3*\text{day}}=\frac{8.12\times10^{8}\,\text{colonies}}{\text{day}}$$

a. The permit for the Town of Loxley WWTP still requires monitoring for Fecal Coliform. It will be revised during the next permit cycle to reflect the change in indicator species to E. coli.

Spanish Fort WWTP

$$0.6871MGD\times\frac{1.55\,\text{ft}^3}{\text{s}*MGD}\times\frac{60.3\,\text{colonies}}{100\,\text{mL}}\times\frac{24465755\ \ \ 100\,\text{mL}*\text{s}}{\text{ft}^3*\text{day}}=\frac{1.57\times10^{9}\,\text{colonies}}{\text{day}}$$

Allowable Conditions

The **allowable load** to the watershed was calculated under the same physical conditions as discussed above for the single sample criterion. This is done by taking the product of the estimated flow and the allowable concentration. This value is then multiplied by the conversion factor to calculate the allowable load.

For the **single sample** E coli concentration of 211.5 colonies/100 mL, the allowable E. coli loading is:

$$\frac{179\ \text{ft}^3}{\text{s}}\times\frac{211.5\,\text{colonies}}{100\,\text{mL}}\times\frac{24465755\ \ \ 100\,\text{mL}*\text{s}}{\text{ft}^3*\text{day}}=\frac{9.26\text{x}10^{11}\,\text{colonies}}{\text{day}}$$

The explicit margin of safety of 23.5 colonies/100 mL equals a daily loading of:

$$\frac{179\text{ft}^3}{\text{s}} \times \frac{23.5\,\text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.03\text{x}10^{11}\,\text{colonies}}{\text{day}}$$

The WLA portion of this TMDL was calculated by multiplying the design flow of the continuous dischargers operating in the Fish River watershed by the applicable monthly average permit limits. This value was then multiplied by a conversion factor to come up with the appropriate loading. This calculation results in a loading of:

Golden Triangle WWTP

$$3MGD \times \frac{1.55\,\text{ft}^3}{\text{s} * MGD} \times \frac{126\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.43 \times 10^{10}\,\text{colonies}}{\text{day}}$$

Town of Loxley WWTP[a]

$$0.75MGD \times \frac{1.55\,\text{ft}^3}{\text{s} * MGD} \times \frac{200\ \ \text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{5.69 \times 10^{9}\,\text{colonies}}{\text{day}}$$

a. The permit for the Town of Loxley WWTP still requires monitoring for Fecal Coliform. It will be revised during the next permit cycle to reflect the change in indicator species to E. coli.

Spanish Fort WWTP[a]

$$1.25MGD \times \frac{1.55\,\text{ft}^3}{\text{s} * MGD} \times \frac{487\text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.31 \times 10^{10}\,\text{colonies}}{\text{day}}$$

a. Spanish Fort WWTP does not discharge to the Fish River directly; rather it discharges to a tributary with a less stringent criterion for Pathogens. The value of 487 col/100ml is the summer criteria for this discharger.

The difference in the pathogen loading between the existing condition (violation event) and the allowable condition converted to a percent reduction represents the total load reduction needed to achieve the enterococci water quality criterion. The TMDL was calculated as the total daily E. coli load to the Fish River as evaluated at station WB-1. Table 10 shows the result of the E. coli loads and required reductions for the point and nonpoint sources located in the Fish River Watershed.

Table 10: E. coli Load and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load Single Sample	2.89E+12	9.26E+11	1.96E+12	68%
Golden Triangle WWTP[a]	0	1.43E+10	0	0%
Town of Loxley WWTP[b]	8.12E+8	5.69E+9	0	0%
Spanish Fort WWTP	1.57E+9	2.31E+10	0	0%

a. This facility is currently under construction
b. The permit for the Town of Loxley WWTP still requires monitoring for Fecal Coliform. It will be revised during the next permit cycle to reflect the change in indicator species to E. coli.
.

From Table 10, compliance with the single sample E. coli criterion maximum of 235 colonies/100 mL requires a reduction in the E. coli nonpoint source load of 68%. The TMDL, WLA, LA and MOS values necessary to achieve the applicable E. coli criterion are provided in Table 11 below.

Table 11: E. coli TMDL for the Fish River

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
1.07E+12	1.03E+11	4.31E+10	68%	0	9.26E+11	68%

a. There are no CAFOs in the Fish River watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in E. coli loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for E. coli.
e. TMDL was established using the single sample E. coli criterion of 235 colonies/100ml.

4.3 TMDL Summary

The Fish River was placed on Alabama's §303(d) list in 1998 based on data collected by the Geological Survey of Alabama in 1996. From 2007 through 2012, ADEM collected additional water quality data using the newly adopted pathogen impairment criteria, with E. coli serving as the primary pathogen

indicator in non coastal waters, and enterococci in coastal waters. The data collected by ADEM in 2011 confirmed the pathogen impairment and provided the basis for TMDL development.

A mass balance approach was used to calculate the E. coli TMDL for The Fish River. Based on the TMDL analysis, it was determined that a 68% reduction in E coli loading was necessary to achieve compliance with applicable water quality standards.

Currently, Town of Loxley WWTP has fecal coliform limits as part of their NPDES permit. During the next permit re-issuance, the pathogen criterion in the permit needs to be updated to ensure that applicable in-stream E. coli criterion in the Fish River is maintained.

Compliance with the terms and conditions of existing and future NPDES sanitary and stormwater permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria, and we are committed towards targeting the load reductions to improve water quality in the Fish River watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

5.0 Follow up monitoring

ADEM has adopted a basin approach to water quality management; an approach that divides Alabama's fourteen major river basins into five groups. Each year, ADEM's water quality resources are concentrated in one of the five basin groups. One goal is to continue to monitor §303(d) listed waters. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed. This monitoring will occur in each basin according the schedule shown below.

Table 12: 303(d) Follow Up Monitoring Schedule

River Basin Group	Year to be Monitored
Tennessee	2013
Chattahoochee / Chipola / Choctawhatchee / Perdido-Escambia	2014
Alabama / Coosa / Tallapoosa	2015
Escatawpa / Mobile / Lower Tombigbee / Upper Tombigbee	2016
Black Warrior/ Cahaba	2017

6.0 Public Participation

As part of the public participation process, this TMDL was placed on public notice and made available for review and comment. The public notice was prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL was made available on ADEM's Website: www.adem.state.al.us. The public can also request paper or electronic copies of the TMDL by contacting Mr. Chris Johnson at 334-271-7827 or cljohnson@adem.state.al.us. The public was given an opportunity to review the TMDL and submit comments to the Department in writing. At the end of the public review period, all written comments received during the public notice period became part of the administrative record. ADEM considered all comments received by the public prior to finalization of this TMDL and subsequent submission to EPA Region 4 for final review and approval.

7.0 Appendices

Appendix 7.1
References

ADEM Administrative Code, 2010. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2010. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's §303(d) Monitoring Program. 2002, 2006 & 2010. ADEM.

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, January 2012.

Alabama Department of Environmental Management, 2006 §303(d) List and Fact Sheet. ADEM.

Alabama Department of Environmental Management (ADEM) Laboratory QA Manual, Chapter 5, Table 5-2: ADEM Laboratory Qualifier Codes and, June 13, 2005.

United States Environmental Protection Agency, 1991. Guidance for Water Quality-Based Decisions: The TMDL Process. Office of Water. EPA 440/4-91-001.

United States Environmental Protection Agency, 1986. Quality Criteria for Water. Office of Water. EPA 440/4-91-001.

Geological Survey of Alabama, 2003. Bulletin 173: Water Quality and Biological Monitoring in Weeks Bay Watershed, Alabama 1994-98

Appendix 7.2
ADEM Water Quality Data

Station ID	Activity Date	Flow CFS	E Coli
FI-1	5/10/2010	81	8
FI-1	6/14/2010	71	3
FI-1	7/8/2010	74	9
FI-1	8/4/2010	99	40
FI-1	9/8/2010	62	5
FI-1	10/7/2010	56	14
FI-1	11/8/2010	64	6
FI-1	12/13/2010	72	6
FI-1	1/6/2011	107	28
FI-1	2/24/2011	55	9
FI-1	3/16/2011	60	7
FI-1	5/19/2011	41	79
FI-1	6/13/2011	38	80
FI-1	6/16/2011	35	73
FI-1	6/28/2011	37	110
FI-1	7/5/2011	36	46
FI-1	7/12/2011	37	110
FI-1	8/11/2011	50	160
FI-1	9/22/2011	62	170
FI-1	10/6/2011	43	150
FI-1	10/12/2011	45	270
FI-1	10/18/2011	42	160
FI-1	10/20/2011	41	210
FI-1	11/9/2011	49	140
FI-1	3/7/2012	44	110
FI-1	4/9/2012	41	86
FI-1	5/1/2012	35	160
FI-1	6/5/2012	32	64
FI-1	7/10/2012	54	270
FI-1	8/2/2012	60	190
FI-1	9/5/2012	179	660
FI-1	10/3/2012	90	210
FI-1	11/7/2012	61	190
FI-1	12/6/2012	56	93
FL-1	Geomean 6/13/11-7/12/11		79.9
FL-1	Geomean 9/22/11-10/20/11		187.4

Station	Activity Date	Flow CFS	enterococci

ID			
WB-1	6/19/2007		52
WB-1	8/8/2007		22
WB-1	10/23/2007		160
WB-1	8/19/2008		2
WB-1	10/14/2008		22
WB-1	6/24/2009		2
WB-1	8/12/2009		16
WB-1	10/20/2009		2
WB-1	5/17/2010		10
WB-1	6/17/2010		2
WB-1	7/14/2010		2
WB-1	8/10/2010		2
WB-1	9/8/2010		2
WB-1	10/5/2010		2
WB-1	11/9/2010		26
WB-1	12/16/2010		3
WB-1	1/6/2011		590
WB-1	2/23/2011	-970	2
WB-1	3/15/2011	241	30
WB-1	5/18/2011	-2034	2
WB-1	6/13/2011		2
WB-1	6/16/2011	-1365	2
WB-1	6/28/2011		2
WB-1	7/5/2011		2
WB-1	7/12/2011		4
WB-1	8/10/2011	2131	4
WB-1	9/22/2011		20
WB-1	10/6/2011		2
WB-1	10/12/2011		2
WB-1	10/18/2011	-2202	68
WB-1	10/20/2011		20
WB-1	11/9/2011		72
WB-1	3/7/2012		4
WB-1	4/9/2012		2
WB-1	5/1/2012		2
WB-1	6/7/2012		26
WB-1	7/10/2012		4
WB-1	8/2/2012		2
WB-1	9/5/2012		56
WB-1	10/3/2012		26
WB-1	11/7/2012		8
WB-1	12/6/2012		18
WB-1	Geomean 6/13/11-7/12/11		2.3
WB-1	Geomean 9/22/11-10/20/11		10.2

Station ID	Activity Date	Flow CFS	enterococci
FSHB-7	2/23/2011	27	12
FSHB-7	3/15/2011	214	14
FSHB-7	5/18/2011	-98	4
FSHB-7	6/13/2011		12
FSHB-7	6/16/2011		8
FSHB-7	6/28/2011		4
FSHB-7	7/5/2011		2
FSHB-7	7/12/2011		16
FSHB-7	8/10/2011	361	6
FSHB-7	9/22/2011		140
FSHB-7	10/6/2011		4
FSHB-7	10/12/2011		18
FSHB-7	10/18/2011	-125	50
FSHB-7	10/20/2011		24
FSHB-7	11/9/2011	-110	34
FSHB-7	Geomean 6/13/11-7/12/11		6.6
FSHB-7	Geomean 9/22/11-10/20/11		26.1

Appendix 7.3
Geological Survey of Alabama
Fecal Coliform single sample violations 1994-1998

Station	Date	Fecal coli	Flow
		#colonies/100ml	cubic feet/second
SITE 1	7/19/94	3,100	328
SITE 1	4/16/96	10,600	23,000
SITE 1	3/10/98	4,000	1,000
SITE 2	7/19/94	4,600	144
SITE 2	1/24/95	3,600	151
SITE 2	4/16/96	6,800	10,000
SITE 2	8/13/96	32,000	381
SITE 2	7/21/98	3,500	220
SITE 4	1/24/95	2,000	17.4
SITE 4	7/23/97	2,100	40.5
SITE 4	2/11/98	2,500	41
SITE 4	7/21/98	2,800	17
SITE 5-A	4/16/96	9,700	48.7
SITE 5-A	7/21/98	2,600	17
SITE 6	6/13/94	2,500	2.81
SITE 6	1/24/95	3,500	6.82
SITE 6	4/16/96	5,000	15
SITE 6	12/10/96	2,100	3.74
SITE 7	3/2/94	5,700	91.8
SITE 7	7/18/94	5,200	20.5
SITE 7	1/23/95	2,000	37.8
SITE 7	4/15/96	20,000	453
SITE 7	7/15/96	2,300	36.6
SITE 7	3/9/98	2,000	63
SITE 8-A	3/2/94	47,000	97
SITE 8-A	5/4/94	18,000	5.1
SITE 8-A	7/19/94	2,100	9.69
SITE 8-A	10/17/94	3,100	5.13

SITE 8-A	11/14/94	2,600	3.81
SITE 8-A	1/23/95	83,000	18.6
SITE 8-A	2/13/95	5,200	7.48
SITE 8-A	4/15/96	4,400	480
SITE 8-A	3/9/98	2,300	71
SITE 9	3/2/94	4,000	173
SITE 9	5/3/94	4,200	29.2
SITE 9	7/18/94	5,800	28.5
SITE 9	1/23/95	9,000	52.8
SITE 9	10/15/97	2,500	39.1
SITE 10	3/2/94	12,200	47.5
SITE 10	7/19/94	30,000	14.4
SITE 10	1/23/95	86,000	28.9
SITE 10	2/13/95	2,100	5.94
SITE 10	4/15/96	5,900	60
SITE 10	3/9/98	3,900	29
SITE 18	4/16/96	24,000	4
SITE 18	7/15/96	4,200	1.38
SITE 18	8/11/97	2,300	1.21

Appendix 7.4
Fish River Watershed Photos

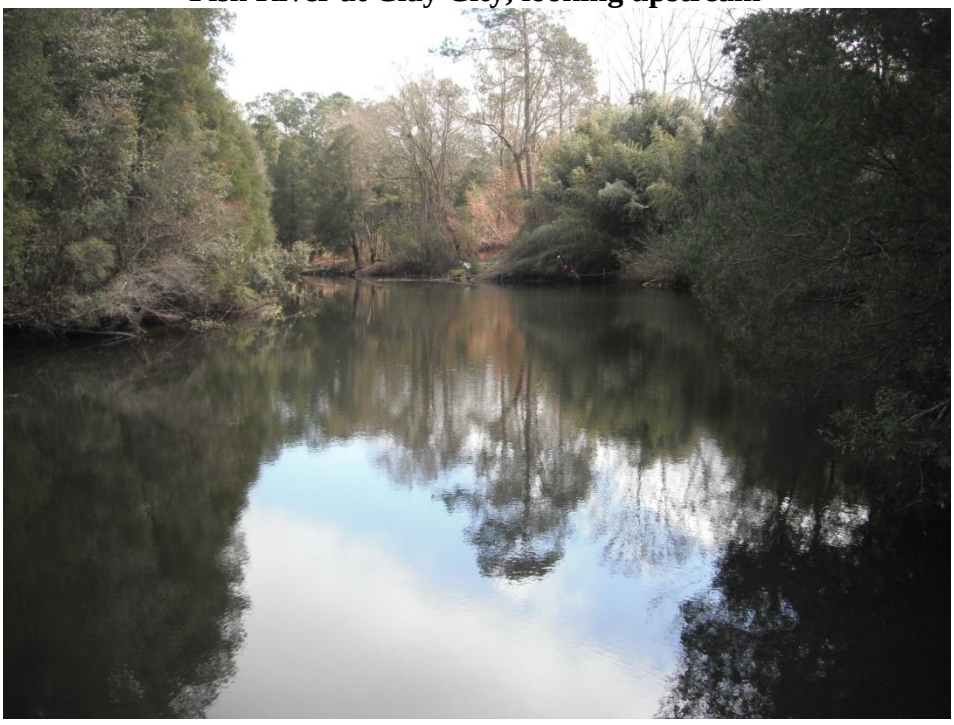
Fish River at hwy 98, looking upstream

Fish River at Hwy 98, looking downstream

Fish River at Honey Rd. Boat Ramp, looking upstream

Fish River at Honey Rd. Boat Ramp, looking downstream

Fish River at Clay City, looking upstream



Fish River at Clay City looking downstream

Fish River at Baldwin CR 48, looking upstream

Fish River at Baldwin CR 48, looking downstream

Fish River at AL-104, looking upstream

Fish River at AL-104, looking downstream