Approved
August 2013

Enterococci Bacteria TMDL for Gulfport East Beach

Coastal Streams Basin

Harrison County, Mississippi

Prepared By

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MDEQ

FOREWORD

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Prefixes for fractions and multiples of SI units

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	D	10	deka	da
10^{-2}	centi	C	10^{2}	hecto	h
10^{-3}	milli	M	10^{3}	kilo	k
10^{-6}	micro	μ	10^{6}	mega	M
10^{-9}	nano	N	10^{9}	giga	G
10^{-12}	pico	P	10^{12}	tera	T
10^{-15}	femto	F	10^{15}	peta	P
10^{-18}	atto	A	10^{18}	exa	E

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
Acres	Sq. miles	0.00156	Days	Seconds	86400
Cubic feet	Cu. Meter	0.02832	Feet	Meters	0.3048
Cubic feet	Gallons	7.4805	Gallons	Cu feet	0.13368
Cubic feet	Liters	28.316	Hectares	Acres	2.4711
cfs	Gal/min	448.83	Miles	Meters	1609.34
cfs	MGD	0.64632	Mg/l	ppm	1
Cubic meters	Gallons	264.173	μg/l * cfs	Gm/day	2.45

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TABLES

TMDL INFORMATION PAGE

Table 1 2012 Section 303(d) Water Body Listing Information

Name	ID	County	HUC	Cause	Mon/Eval
Gulfport East Beach	250313	Harrison	03170009	Pathogens	Monitored
Location: At Gulfport from Teagarden Road east to the eastern side of William Carey College					
Gulf Park Estates Beach	250411	Jackson	03170009	Pathogens	Monitored
Location: Near Ocean Springs from Pelican Ave to Deer Street					

Table 2 Water Quality Standard

Parameter	Beneficial use	Water Quality Criteria
Enterococci Bacteria	Recreation	Enterococci shall not exceed a seasonal (May – October and November – April) geometric mean of 35 per 100 ml based on a minimum of 20 samples collected during each season.

Table 3 Enterococci Total Maximum Daily Loads

Beach Name	WLA (counts per day)	LA (counts per day)	MOS (counts per day)	Total TMDL (counts per day)	TMDL Percent Reduction
Gulfport East Beach	1.55+E10	1.55+E10	3.45+E09	3.45+E10	2.3% to 32%
Gulf Park Estates Beach	Delisted based on original listing being in error. No TMDL needed.				

EXECUTIVE SUMMARY

An enterococci bacteria TMDL was developed for Gulfport East Beach which is on the Mississippi 2012 Section 303(d) List of Impaired Water Bodies. This water body was listed due to monitoring data collected for the Mississippi Beach Monitoring Program.

MDEQ implemented a beach water quality monitoring and public notification program in 1998 through its inter-agency Beach Monitoring Task Force. Beginning in 1998, water samples were collected from nineteen beaches and tested for fecal coliform and enterococci along with several chemical parameters. If bacteria levels reach unsafe levels, (greater than 104 colonies per 100 ml of enterococci) advisories are placed on the beach stating that swimming is not recommended until bacterial levels return to safe levels. The advisories remain in place until the monitoring data indicate the water is safe for swimming and water contact. In addition to signage, MDEQ provides public notification of beach water quality conditions through press releases as well as posting near real time information on the state's Beach Monitoring Website.

Due to complexities associated with large scale open water boundaries, tidal influences, and variable storm water runoff, dynamic modeling was inappropriate for performing the TMDL allocations for this study. MDEQ applied a mass balance approach to develop the TMDL bacteria counts for these beaches. Although loadings from point and nonpoint sources in the watershed were not explicitly represented with a model, a source assessment was conducted. Nonpoint sources of enterococci include urban wildlife and stormwater runoff. Also considered were the nonpoint sources such as failing septic systems, damaged sewer systems, and other direct inputs to the beach. This area has stormwater MS4 NPDES Permit discharge included as point sources in the waste load allocation (WLA).

The seasonal and tidal variations in hydrology, climatic conditions, and watershed activities could not be represented with a mass balance approach. The TMDL was based on the estimated volume of water at 100 meters from the shoreline and the water quality criteria. An explicit 10% margin of safety (MOS) was used in the mass balance method to account for uncertainty.

Water quality data indicate violations of the enterococci standard in one beach, Gulfport East Beach and one former beach, Gulf Park Estates Beach. The estimated reduction needed for the Gulfport East Beach impairment from 2006 and 2007 range from 2.3% to 32%.

During the collection of the data, the beach status of the Gulf Park Estates Beach was removed in 2008, and data collection efforts were cancelled. This area now has a public pier and boat ramp. The sand area water interface does not have sufficient access or utilization to consider this area a beach. The original listing is now in error and will be proposed for delisting in 2014.

INTRODUCTION

1.1 Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies are required by Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired water bodies through the establishment of pollutant specific allowable loads. The pollutant of concern for this TMDL is pathogens represented by the indicator organism enterococci bacteria. EPA recommends the use of enterococci bacteria as indicator organisms in marine waters because levels of these organisms more accurately predict illness than levels of fecal coliform (EPA, 1986). This stronger correlation may be due to the longer survival rate in marine waters for enterococci than for fecal coliform, similar to the pathogens of concern (EPA, 2004).

This TMDL was developed for Gulfport East Beach. This beach is listed on the state's 2012 Section 303(d) List of Impaired Water Bodies due to data collected to support the Beach Monitoring Program. Gulf Park Estates Beach was listed based on data, however, the area no longer has beach status and is being proposed for delisted based on the original listing being in error.

Table 4 Beaches Included in TMDL

Name	ID	County	HUC	Cause	Mon/Eval
Gulfport East Beach	250313	Harrison	03170009	Pathogens	Monitored
Location: At Gulfport from Teagarden Road east to the eastern side of William Carey College					
Gulf Park Estates Beach	250411	Jackson	03170009	Pathogens	Monitored
Location: Near Ocean Springs from Pelican Ave to Deer Street					

The mass balance method is an applicable method for TMDL development with data in complex watersheds that are tidally influenced. This TMDL was developed using a mass balance method with the marine recreational water quality standard and an estimated volume of water based on aerial photograph interpretation and depth soundings collected at intervals from 0 - 100 meters from the shoreline at the beach.

1.2 Mississippi Beach Monitoring Program

Mississippi Department of Environmental Quality (MDEQ) implemented a beach water quality monitoring and public notification program in 1998 through its inter-agency Beach Monitoring Task Force. Beginning in 1998, water samples were collected from nineteen beaches and tested for fecal coliform and enterococci along with several chemical parameters. When bacteria levels reach unsafe levels, advisories are placed on the beach stating that swimming is not recommended until bacterial levels return to safe levels. The advisories remain in place until the monitoring data indicate the water is safe for swimming and water contact.

Under the BEACH Act, the Mississippi Beach Monitoring Program was expanded in 2005 to include twenty-two beaches, the frequency of sampling was increased for seven beaches, and the

indicator organism in our standard was changed from fecal coliform to enterococci bacteria. Sixteen of the twenty-two beaches were classified as Tier 1 Beaches, and they are monitored ten times per month during the recreational season, May through October. The six Tier II beaches are monitored 4 times per month. All beaches are monitored four times per month during the non-recreational season. However, beaches are not monitored during rainfall events. An advisory is placed on the Beach Monitoring Webpage advising against swimming within 24-hours of a significant rainfall event. This webpage provides public notification of the water quality at the Mississippi beaches and provides historical beach monitoring bacteria data. The public can view the website at http://www.usm.edu/gcrl/msbeach/index.cgi. The website provides near real-time data from all of the monitoring locations, current beach advisories, beach locations, pictures of all the monitored beaches, and maps locating the sampling sites. Also, information is provided about the history of beach advisories for all beach locations.

Water samples from the beaches are tested for enterococci bacteria and if the bacteria levels exceed MDEQ criterion, a no swimming advisory sign is posted on the beach section. Additional water samples are tested from the site and the no swim advisory remains posted at the site until bacteria levels return to safe levels. In addition to signage, MDEQ provides public notification of beach water quality conditions through press releases as well as posting near real time information on the state's Beach Monitoring Website

In 2004 MDEQ curtailed monitoring during significant rainfall events. While the bathers were protected, by the webpage posted advisory against swimming within 24-hours of a rainfall event; this reduced the number of samples being obtained with high enterococci bacteria levels during storms. From the review of the data, the policy decision was made to not collect samples during or right after a rain event. Samples indicated an elevated enterococci bacteria count, and the general statement of no swimming during or after rain events established for the beaches was considered to be protective of the bathers using the Mississippi beaches.

1.3 Applicable Water body Segment Use

The water use classification for Gulfport East Beach as established by the State of Mississippi in the *Water Quality Criteria for Intrastate, Interstate and Coastal Waters WPC-2* (MDEQ, 2012) regulation is Contact Recreation.

1.4 Applicable Water body Segment Standard

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 WPC-2* (MDEQ, 2012). The standard for enterococci for marine waters is categorized as primary recreation.

Coastal Recreational Waters are marine and estuarine waters that are suitable for recreational purposes, including such water contact activities as swimming, wading, and water skiing. Coastal recreational waters do not include inland waters upstream of the mouth of a river or a stream having a natural connection to the open sea. Water quality monitoring for bacteria content is conducted on these waters to protect the health of bathers. Water contact is discouraged on Mississippi's public access bathing beaches along the shoreline of Jackson, Harrison, and Hancock Counties when enterococci exceed 104 colonies per 100 ml and in all

other coastal recreational waters when enterococci exceed 501 colonies per 100 ml. When enterococci counts exceed 104 per 100 ml at the public access beaches, water contact advisories are issued by Mississippi's Beach Monitoring Task Force.

1.5 Recreation Classification and Bacteria Standard

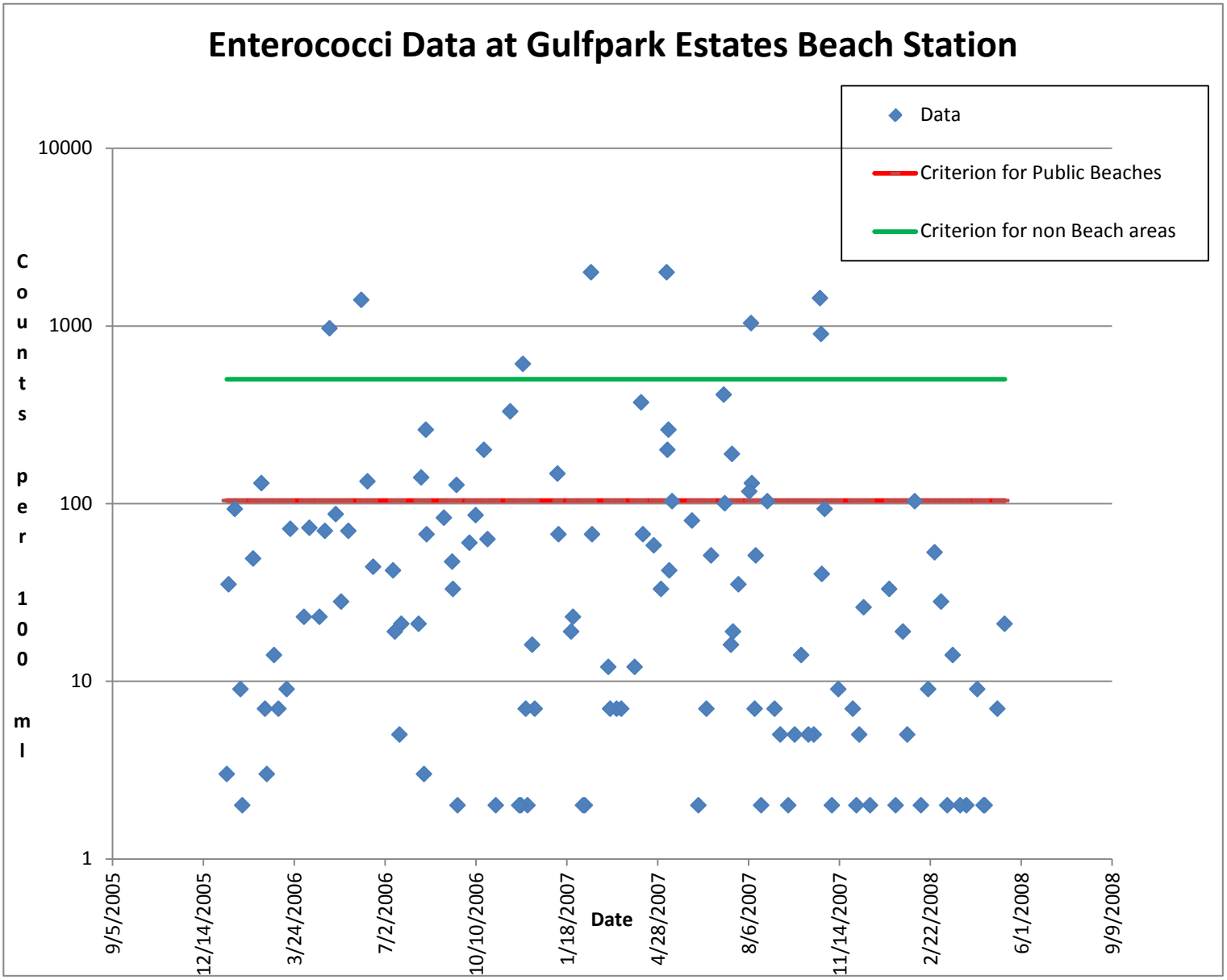
Waters in this classification are to be suitable for recreational purposes, including such water contact activities as swimming and water skiing. For both marine and estuarine coastal recreational waters, Enterococci shall not exceed a seasonal (May – October and November – April) geometric mean of 35 per 100 ml based on a minimum of 20 samples collected during each season. Coastal recreational waters do not include inland waters upstream of the mouth of a river or a stream having a natural connection to the open sea.

1.6 Justification for Delisting Gulfpark Estates Beach

The data collected at the Gulfpark Estates Beach are shown in the chart below. These data indicate the majority of the samples were below the geometric mean target. However, in 2008, MDEQ determined this area was not in reality a beach. A new pier was constructed after Hurricane Katrina beside the existing boat ramp. The area is not an attractive area for swimmers due to the rocky shore and limited sandy areas. The majority of the area is grass marsh and is inaccessible.

Gulfpark Estates had an activated sludge treatment plant that discharged treated effluent into the coastal canals just north of this area for many years. This facilities operator was the target of federal prosecution in the mid-1990s due to poor operation and maintenance. MDEQ considers this waste water treatment plant the major contributor to pathogen impairment in this area. Subsequently, the City of Ocean Springs provided an interceptor sewer to take the Gulfpark Estates treatment plant offline and eliminate the discharge to these waters. This action improved water quality in these canals and in this area.

Therefore, MDEQ intends to propose delisting this area from the 2014 Section 303d list due to an error in the original listing. The calculation of a TMDL is not necessary in this document.


Enterococci Data at Gulfpark Estates Beach Station
Data
Criterion for Public Beaches
Criterion for non Beach areas
10000
1000
100
10
1
Counts per 100ml
9/5/2005
12/14/2005
3/24/2006
7/2/2006
10/10/2006
1/18/2007
4/28/2007
8/6/2007
11/14/2007
2/22/2008
6/1/2008
9/9/2008
Date

TMDL CALCULATION AND WATER QUALITY DATA ASSESSMENT

2.1 Selection of a TMDL Endpoint

One of the major components of a TMDL is the establishment of numeric endpoints, which are used to evaluate the attainment of acceptable water quality. Numeric endpoints, therefore, represent the water quality goals that are to be achieved by implementing the load and waste load reductions specified in the TMDL. The endpoints allow for a comparison between observed water body conditions and conditions that are expected to restore designated uses. MDEQ applied the water quality standard for recreational marine waters to this TMDL.

2.2 Discussion of TMDL Calculations and Water Quality Data

Included in this section is the method used to estimate the volume of water at the beach. The length of the beach was determined by measurements of aerial photographs. The width of the contact recreation was set at 100 meters. Depth soundings were taken at several locations to estimate a depth curve which was then used to calculate an estimate of water volume. Aerial photography is included which shows the beach extent along with the existing culverts.

2.3 Calculation of the TMDL

The TMDL was calculated based on the following equation based on the estimated volume of water with an outer boundary of 100 meters and an enterococci concentration of 35 col. / 100 ml:

TMDL = WLA + LA + MOS

where WLA is the Waste Load Allocation, LA is the Load Allocation, and MOS is the Margin of Safety.

WLA = NPDES Permitted Discharges (MS4 Storm Water)

LA = Surface Runoff + Other Direct Inputs

MOS = 10% explicit

2.4 Mass Balance Procedure

A mass balance approach was used to calculate the TMDL. This method of analysis was selected because the nature of the water body precluded the use of more complex methods. The mass balance approach utilizes the conservation of mass principle. Loads are calculated by multiplying the enterococci concentration in the water body by a volume of water. The principle of the conservation of mass allows for the addition and subtraction of those loads to determine the appropriate numbers necessary for the TMDL and its components.

2.4.2 Calculation of Allowable Load

The water volume at the beach was estimated based on depth soundings taken along transects of the water body. The depth measurements were gathered at 10 m, 25 m, 50 m, 75 m and 100 m to estimate the depth gradient. This estimation was done using a spreadsheet formula that interpolated the depth along the curve between the measured sounding points. The resulting depth gradient was used to calculate the volume of water out to 100 meters for each beach. See Table 6.

The enterococci loads were calculated using the following relationship:

Load (counts/day) = [**Concentration** (counts/ 100 ml)] * [**Volume at 100 meters from shoreline** (m^3/day)] * (Conversion Factor)

where (Conversion Factor) = 1,000,000 ml/m^3

2.4.3 Calculation of Existing Load

For the calculation of the existing load, the geometric mean was determined. The percent reductions reported in the TMDL are based on the difference between the existing geometric mean and the standard.

2.4.4 Gulfport East Beach TMDL Calculation

Gulfport East Beach is located between Teagarden Road and the eastern side of the former location of William Carey College and fronts Highway 90. The beach is 2,254 meters in length.

The depth soundings used for this beach were collected at five transects and averaged for the gradient used. The water quantity is estimated to be 98,434.9 cubic meters.

The TMDL is calculated by multiplying the water quality standard of 35 / 100 ml times the volume of water, 98,434.9 m^3 times a conversion factors of 1000 lit / m^3 and 10 100 ml / lit. This equals a total TMDL of 3.45+E10 enterococci colonies per 100 ml.

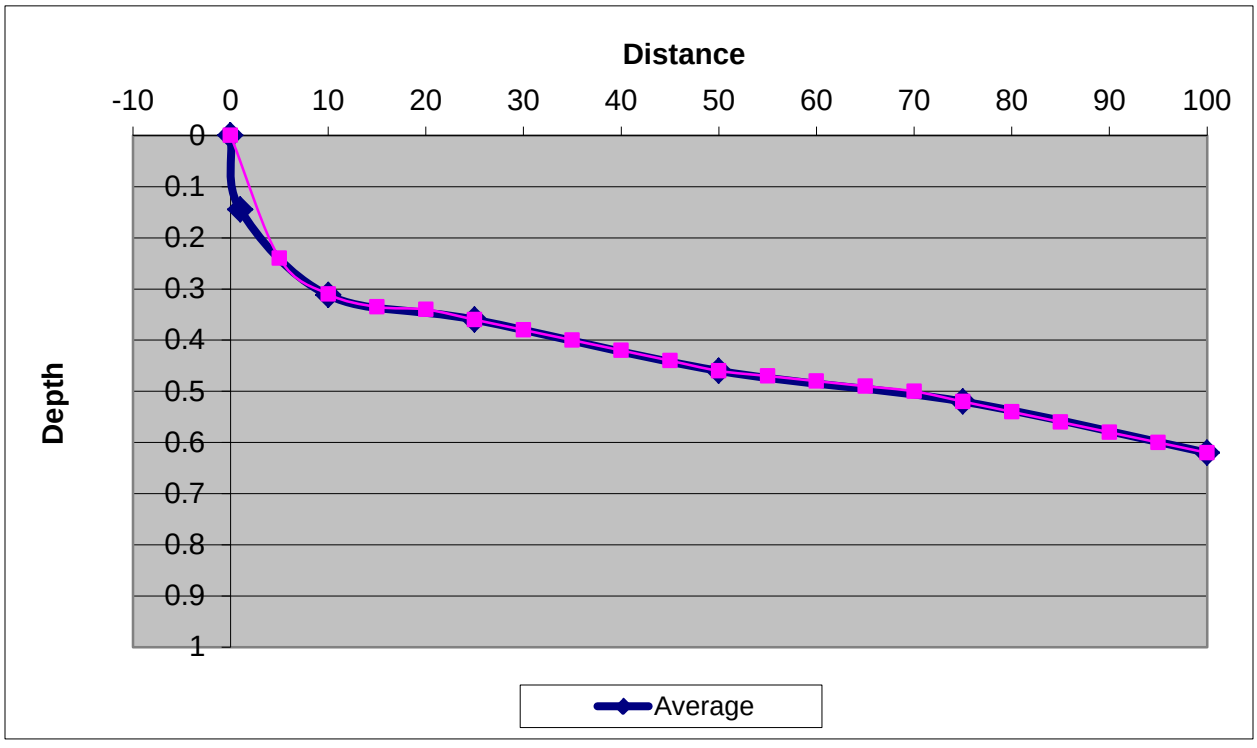
The margin of safety was set to 10% and the WLA and LA are equally divided. This is shown in Table 3. The aerial photograph shows the beach with the location of culverts that convey storm water runoff into the beach waters. The Cowan Road lift station has been a major source of bacteria runoff into the water body. Routine and constant maintenance is recommended for this lift station.

Gulfport East Beach Aerial View with Culverts Shown

Culverts shown by red circle, lift station shown in black diamond

Table 6 Gulfport East Beach Volume Calculations

Length (meters)	Average Depth	Distance Measured	Distance Interpolated	Volume Calculations			cubic meter	liter	Gallons
2254.45	0	0	0	0		0.6	1,352.7	1,352,670.0	357,337.6
	0.145	1	5	0.24	5	0.6	1,352.7	1,352,670.0	357,337.6
	0.31	10	10	0.31	5	1.55	3,494.4	3,494,397.5	923,122.2
	0.36	25	15	0.335	5	1.675	3,776.2	3,776,203.8	997,567.5
	0.46	50	20	0.34	5	1.7	3,832.6	3,832,565.0	1,012,456.6
	0.52	75	25	0.36	5	1.8	4,058.0	4,058,010.0	1,072,012.8
	0.62	100	30	0.38	5	1.9	4,283.5	4,283,455.0	1,131,569.1
			35	0.4	5	2	4,508.9	4,508,900.0	1,191,125.4
			40	0.42	5	2.1	4,734.3	4,734,345.0	1,250,681.6
			45	0.44	5	2.2	4,959.8	4,959,790.0	1,310,237.9
			50	0.46	5	2.3	5,185.2	5,185,235.0	1,369,794.2
			55	0.47	5	2.35	5,298.0	5,297,957.5	1,399,572.3
			60	0.48	5	2.4	5,410.7	5,410,680.0	1,429,350.4
			65	0.49	5	2.45	5,523.4	5,523,402.5	1,459,128.6
			70	0.5	5	2.5	5,636.1	5,636,125.0	1,488,906.7
			75	0.52	5	2.6	5,861.6	5,861,570.0	1,548,463.0
			80	0.54	5	2.7	6,087.0	6,087,015.0	1,608,019.2
			85	0.56	5	2.8	6,312.5	6,312,460.0	1,667,575.5
			90	0.58	5	2.9	6,537.9	6,537,905.0	1,727,131.8
			95	0.6	5	3	6,763.4	6,763,350.0	1,786,688.0
			100	0.62		1.5375	3,466.2	3,466,216.9	915,677.6
							98,434.9	98,434,923.1	26,003,755.4



2.5 Pre Katrina Enterococci Data

Table 7 provides the geometric mean of enterococci bacteria at Gulfport East Beach from 2000 through 2005. The data collected in 2004 and 2005 show a significant reduction in bacteria loads compared to the previous years.

In 2004 MDEQ curtailed monitoring during significant rainfall events. While the bathers were protected by the webpage posted advisory against swimming within 24-hours of a rainfall event; this policy reduced the number of samples being obtained with high enterococci bacteria levels during storms.

MDEQ placed advisory signs against swimming at sections of public beaches when a single sample maximum of enterococci bacteria exceeded counts of 104 col. /100 ml. If the counts remained elevated over time the local business owners put pressure on city and county officials to find the problem and fix it. There are several instances where this program identified broken sewer pipes that may have continued unless the public were made aware of the problem.

Table 7 Enterococci Geometric Mean Values by Beach and Year

Beach	2000	2001	2002	2003	2004	2005
Gulfport East Beach	207	273	215	448	45	46

2.6 Post Katrina Enterococci Data

The data collected at this beach between November 2005 and December 2010 were used to assess this beach as impaired for the 2012 Section 303(d) List of Impaired Waters. The geometric means which violate the standard are shown in the chart below and in red in Table 8. There were three impaired seasons in 2006 and 2007. There were no violations after 2007. This may be due to improved maintenance of the Cowen Road Lift Station.

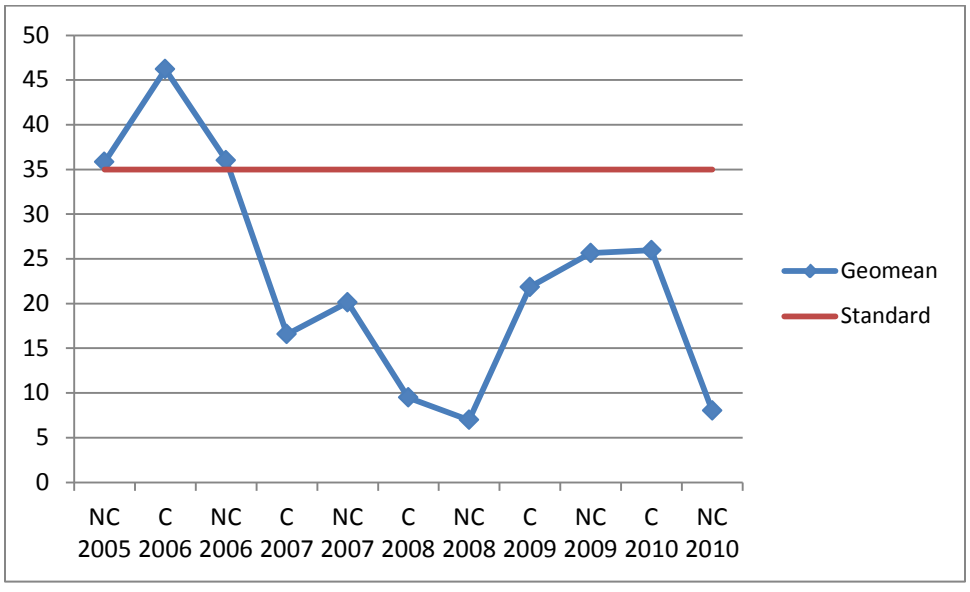


Table 8 Enterococci Data and Geometric Mean Values from 2006 thru 2012

Date	Enterococci Count	Season Station	Geometric Mean	Season Sample Count
12/13/2010	12	Non-Contact 2010-2011 Station11	8.01	9
12/8/2010	2	Non-Contact 2010-2011 Station11		
12/2/2010	5	Non-Contact 2010-2011 Station11		
12/1/2010	5	Non-Contact 2010-2011 Station11		
11/22/2010	9	Non-Contact 2010-2011 Station11		
11/18/2010	5	Non-Contact 2010-2011 Station11		
11/17/2010	500	Non-Contact 2010-2011 Station11		
11/9/2010	2	Non-Contact 2010-2011 Station11		
11/4/2010	5	Non-Contact 2010-2011 Station11		
10/26/2010	37	Contact 2010 Station11	25.96	14
10/18/2010	2	Contact 2010 Station11		
10/14/2010	2	Contact 2010 Station11		
10/6/2010	2	Contact 2010 Station11		
6/29/2010	2000	Contact 2010 Station11		
6/23/2010	103	Contact 2010 Station11		
6/22/2010	148	Contact 2010 Station11		
6/16/2010	9	Contact 2010 Station11		
6/8/2010	80	Contact 2010 Station11		
5/24/2010	5	Contact 2010 Station11		
5/19/2010	9	Contact 2010 Station11		
5/18/2010	158	Contact 2010 Station11		
5/11/2010	21	Contact 2010 Station11		
5/4/2010	65	Contact 2010 Station11		
4/28/2010	2	Non-Contact 2009-2010 Station11	25.64	34
4/20/2010	14	Non-Contact 2009-2010 Station11		
4/19/2010	3000	Non-Contact 2009-2010 Station11		
4/12/2010	2	Non-Contact 2009-2010 Station11		
4/6/2010	2	Non-Contact 2009-2010 Station11		
3/30/2010	2	Non-Contact 2009-2010 Station11		
3/23/2010	5	Non-Contact 2009-2010 Station11		
3/16/2010	7	Non-Contact 2009-2010 Station11		
3/15/2010	2	Non-Contact 2009-2010 Station11		
3/12/2010	390	Non-Contact 2009-2010 Station11		
3/10/2010	470	Non-Contact 2009-2010 Station11		
3/9/2010	1100	Non-Contact 2009-2010 Station11		
3/8/2010	1067	Non-Contact 2009-2010 Station11		
3/3/2010	40	Non-Contact 2009-2010 Station11		
2/23/2010	5	Non-Contact 2009-2010 Station11		
2/22/2010	2000	Non-Contact 2009-2010 Station11		
2/15/2010	2	Non-Contact 2009-2010 Station11		
2/8/2010	14	Non-Contact 2009-2010 Station11		
2/2/2010	35	Non-Contact 2009-2010 Station11		
1/25/2010	12	Non-Contact 2009-2010 Station11		
1/22/2010	168	Non-Contact 2009-2010 Station11		
1/12/2010	2	Non-Contact 2009-2010 Station11		
1/6/2010	2	Non-Contact 2009-2010 Station11		
12/29/2009	7	Non-Contact 2009-2010 Station11		

12/28/2009	23	Non-Contact 2009-2010 Station11		
12/17/2009	300	Non-Contact 2009-2010 Station11		
12/14/2009	1533	Non-Contact 2009-2010 Station11		
12/11/2009	390	Non-Contact 2009-2010 Station11		
12/10/2009	130	Non-Contact 2009-2010 Station11		
12/1/2009	37	Non-Contact 2009-2010 Station11		
11/24/2009	2	Non-Contact 2009-2010 Station11		
11/17/2009	9	Non-Contact 2009-2010 Station11		
11/12/2009	2	Non-Contact 2009-2010 Station11		
11/3/2009	5	Non-Contact 2009-2010 Station11		
10/28/2009	44	Contact 2009 Station11	21.84	35
10/20/2009	2	Contact 2009 Station11		
10/13/2009	2	Contact 2009 Station11		
10/6/2009	12	Contact 2009 Station11		
10/1/2009	16	Contact 2009 Station11		
9/22/2009	56	Contact 2009 Station11		
9/21/2009	30	Contact 2009 Station11		
9/18/2009	250	Contact 2009 Station11		
9/17/2009	120	Contact 2009 Station11		
9/10/2009	2	Contact 2009 Station11		
9/1/2009	12	Contact 2009 Station11		
8/24/2009	2	Contact 2009 Station11		
8/20/2009	300	Contact 2009 Station11		
8/11/2009	7	Contact 2009 Station11		
8/5/2009	28	Contact 2009 Station11		
7/30/2009	12	Contact 2009 Station11		
7/23/2009	40	Contact 2009 Station11		
7/22/2009	9	Contact 2009 Station11		
7/21/2009	107	Contact 2009 Station11		
7/20/2009	133	Contact 2009 Station11		
7/16/2009	2	Contact 2009 Station11		
7/15/2009	67	Contact 2009 Station11		
7/9/2009	35	Contact 2009 Station11		
7/8/2009	107	Contact 2009 Station11		
6/29/2009	77	Contact 2009 Station11		
6/24/2009	67	Contact 2009 Station11		
6/16/2009	2	Contact 2009 Station11		
6/11/2009	23	Contact 2009 Station11		
6/3/2009	5	Contact 2009 Station11		
5/29/2009	7	Contact 2009 Station11		
5/28/2009	250	Contact 2009 Station11		
5/19/2009	28	Contact 2009 Station11		
5/13/2009	12	Contact 2009 Station11		
5/12/2009	360	Contact 2009 Station11		
5/7/2009	2	Contact 2009 Station11		
4/28/2009	37	Non-Contact 2008-2009 Station11	6.97	27
4/22/2009	2	Non-Contact 2008-2009 Station11		
4/16/2009	5	Non-Contact 2008-2009 Station11		
4/6/2009	2	Non-Contact 2008-2009 Station11		
4/1/2009	56	Non-Contact 2008-2009 Station11		
3/31/2009	1033	Non-Contact 2008-2009 Station11		

3/30/2009	100	Non-Contact 2008-2009 Station11		
3/25/2009	320	Non-Contact 2008-2009 Station11		
3/24/2009	143	Non-Contact 2008-2009 Station11		
3/19/2009	2	Non-Contact 2008-2009 Station11		
3/10/2009	2	Non-Contact 2008-2009 Station11		
3/3/2009	2	Non-Contact 2008-2009 Station11		
2/25/2009	5	Non-Contact 2008-2009 Station11		
2/18/2009	80	Non-Contact 2008-2009 Station11		
2/12/2009	2	Non-Contact 2008-2009 Station11		
2/5/2009	2	Non-Contact 2008-2009 Station11		
1/30/2009	2	Non-Contact 2008-2009 Station11		
1/22/2009	2	Non-Contact 2008-2009 Station11		
1/14/2009	2	Non-Contact 2008-2009 Station11		
1/5/2009	2	Non-Contact 2008-2009 Station11		
12/15/2008	2	Non-Contact 2008-2009 Station11	-	-
12/12/2008	2	Non-Contact 2008-2009 Station11		
12/3/2008	2	Non-Contact 2008-2009 Station11		
11/25/2008	23	Non-Contact 2008-2009 Station11		
11/18/2008	2	Non-Contact 2008-2009 Station11		
11/12/2008	2	Non-Contact 2008-2009 Station11		
11/5/2008	2	Non-Contact 2008-2009 Station11		
10/21/2008	2	Contact 2008 Station11	9.47	30
10/15/2008	2	Contact 2008 Station11		
10/8/2008	2	Contact 2008 Station11		
9/30/2008	7	Contact 2008 Station11		
9/23/2008	2	Contact 2008 Station11		
9/16/2008	2	Contact 2008 Station11		
9/8/2008	2	Contact 2008 Station11		
9/4/2008	260	Contact 2008 Station11		
8/28/2008	30	Contact 2008 Station11		
8/18/2008	2	Contact 2008 Station11		
8/15/2008	56	Contact 2008 Station11		
8/6/2008	2	Contact 2008 Station11		
7/30/2008	2	Contact 2008 Station11		
7/22/2008	2	Contact 2008 Station11		
7/15/2008	2	Contact 2008 Station11		
7/8/2008	2	Contact 2008 Station11		
7/3/2008	2	Contact 2008 Station11		
7/2/2008	246	Contact 2008 Station11		
6/26/2008	2	Contact 2008 Station11		
6/25/2008	370	Contact 2008 Station11		
6/17/2008	2	Contact 2008 Station11		
6/11/2008	7	Contact 2008 Station11		
6/5/2008	35	Contact 2008 Station11		
6/4/2008	223	Contact 2008 Station11		
5/29/2008	7	Contact 2008 Station11		
5/28/2008	133	Contact 2008 Station11		
5/20/2008	70	Contact 2008 Station11		
5/19/2008	130	Contact 2008 Station11		
5/12/2008	2	Contact 2008 Station11		
5/6/2008	23	Contact 2008 Station11		

4/22/2008	93	Non-Contact 2007-2008 Station11	20.13	30
4/21/2008	100	Non-Contact 2007-2008 Station11		
4/16/2008	103	Non-Contact 2007-2008 Station11		
4/15/2008	2	Non-Contact 2007-2008 Station11		
4/14/2008	67	Non-Contact 2007-2008 Station11		
4/11/2008	833	Non-Contact 2007-2008 Station11		
4/10/2008	140	Non-Contact 2007-2008 Station11		
4/9/2008	210	Non-Contact 2007-2008 Station11		
4/3/2008	28	Non-Contact 2007-2008 Station11		
4/2/2008	23	Non-Contact 2007-2008 Station11		
3/26/2008	26	Non-Contact 2007-2008 Station11		
3/18/2008	47	Non-Contact 2007-2008 Station11		
3/12/2008	26	Non-Contact 2007-2008 Station11		
3/5/2008	77	Non-Contact 2007-2008 Station11		
2/27/2008	33	Non-Contact 2007-2008 Station11		
2/20/2008	23	Non-Contact 2007-2008 Station11		
2/19/2008	12	Non-Contact 2007-2008 Station11		
1/28/2008	58	Non-Contact 2007-2008 Station11		
1/23/2008	40	Non-Contact 2007-2008 Station11		
1/15/2008	2	Non-Contact 2007-2008 Station11		
1/8/2008	16	Non-Contact 2007-2008 Station11		
12/18/2007	2	Non-Contact 2007-2008 Station11		
12/12/2007	9	Non-Contact 2007-2008 Station11		
12/11/2007	340	Non-Contact 2007-2008 Station11		
12/6/2007	2	Non-Contact 2007-2008 Station11		
12/3/2007	2	Non-Contact 2007-2008 Station11		
11/29/2007	2	Non-Contact 2007-2008 Station11		
11/19/2007	2	Non-Contact 2007-2008 Station11		
11/13/2007	2	Non-Contact 2007-2008 Station11		
11/6/2007	2	Non-Contact 2007-2008 Station11		
10/30/2007	7	Contact 2007 Station11	16.56	62
10/29/2007	2	Contact 2007 Station11		
10/24/2007	2	Contact 2007 Station11		
10/17/2007	5	Contact 2007 Station11		
10/15/2007	65	Contact 2007 Station11		
10/11/2007	2	Contact 2007 Station11		
10/8/2007	2	Contact 2007 Station11		
10/4/2007	2	Contact 2007 Station11		
10/3/2007	2	Contact 2007 Station11		
10/1/2007	2	Contact 2007 Station11		
9/27/2007	2	Contact 2007 Station11		
9/25/2007	58	Contact 2007 Station11		
9/21/2007	733	Contact 2007 Station11		
9/19/2007	2	Contact 2007 Station11		
9/17/2007	2	Contact 2007 Station11		
9/13/2007	2	Contact 2007 Station11		
9/12/2007	5	Contact 2007 Station11		
9/11/2007	2	Contact 2007 Station11		
09/06/07	2	Contact 2007 Station11		
09/05/07	2	Contact 2007 Station11		
08/30/07	2	Contact 2007 Station11		

08/28/07	2000	Contact 2007 Station11		
08/23/07	5	Contact 2007 Station11		
08/22/07	2	Contact 2007 Station11		
08/21/07	30	Contact 2007 Station11		
08/16/07	77	Contact 2007 Station11		
08/15/07	390	Contact 2007 Station11		
08/14/07	97	Contact 2007 Station11		
08/13/07	933	Contact 2007 Station11		
08/07/07	2	Contact 2007 Station11		
07/26/07	58	Contact 2007 Station11		
07/25/07	123	Contact 2007 Station11		
07/23/07	2	Contact 2007 Station11		
07/19/07	2	Contact 2007 Station11		
07/18/07	230	Contact 2007 Station11		
07/17/07	58	Contact 2007 Station11		
07/12/07	85	Contact 2007 Station11		
07/11/07	28	Contact 2007 Station11		
07/09/07	2	Contact 2007 Station11		
07/02/07	44	Contact 2007 Station11		
06/29/07	47	Contact 2007 Station11		
06/28/07	280	Contact 2007 Station11		
06/27/07	180	Contact 2007 Station11		
06/21/07	14	Contact 2007 Station11		
06/18/07	2	Contact 2007 Station11		
06/15/07	70	Contact 2007 Station11		
06/13/07	1100	Contact 2007 Station11		
06/12/07	150	Contact 2007 Station11		
06/06/07	5	Contact 2007 Station11		
06/05/07	2	Contact 2007 Station11		
06/04/07	14	Contact 2007 Station11		
05/17/07	12	Contact 2007 Station11		
05/15/07	150	Contact 2007 Station11		
05/14/07	12	Contact 2007 Station11		
05/11/07	1	Contact 2007 Station11		
05/10/07	2	Contact 2007 Station11		
05/09/07	9	Contact 2007 Station11		
05/08/07	12	Contact 2007 Station11		
05/07/07	280	Contact 2007 Station11		
05/03/07	28	Contact 2007 Station11		
05/02/07	350	Contact 2007 Station11		
05/01/07	670	Contact 2007 Station11		
04/25/07	19	Non-Contact 2006-2007 Station11	36.02	30
04/24/07	2	Non-Contact 2006-2007 Station11		
04/23/07	21	Non-Contact 2006-2007 Station11		
04/20/07	42	Non-Contact 2006-2007 Station11		
04/19/07	600	Non-Contact 2006-2007 Station11		
04/13/07	26	Non-Contact 2006-2007 Station11		
04/10/07	37	Non-Contact 2006-2007 Station11		
04/09/07	12	Non-Contact 2006-2007 Station11		
04/04/07	73	Non-Contact 2006-2007 Station11		
04/03/07	320	Non-Contact 2006-2007 Station11		

03/19/07	7	Non-Contact 2006-2007 Station11		
03/14/07	12	Non-Contact 2006-2007 Station11		
03/07/07	197	Non-Contact 2006-2007 Station11		
03/05/07	2	Non-Contact 2006-2007 Station11		
02/20/07	633	Non-Contact 2006-2007 Station11		
02/14/07	163	Non-Contact 2006-2007 Station11		
02/07/07	197	Non-Contact 2006-2007 Station11		
02/05/07	12	Non-Contact 2006-2007 Station11		
01/29/07	90	Non-Contact 2006-2007 Station11		
01/25/07	7	Non-Contact 2006-2007 Station11		
01/23/07	5	Non-Contact 2006-2007 Station11		
01/08/07	700	Non-Contact 2006-2007 Station11		
12/14/06	2	Non-Contact 2006-2007 Station11		
12/11/06	2	Non-Contact 2006-2007 Station11		
12/06/06	1669	Non-Contact 2006-2007 Station11		
12/01/06	1833	Non-Contact 2006-2007 Station11		
11/27/06	2	Non-Contact 2006-2007 Station11		
11/20/06	300	Non-Contact 2006-2007 Station11		
11/17/06	35	Non-Contact 2006-2007 Station11		
11/01/06	2	Non-Contact 2006-2007 Station11		
10/25/06	70	Contact 2006 Station11	46.19	60
10/23/06	667	Contact 2006 Station11		
10/19/06	193	Contact 2006 Station11		
10/18/06	33	Contact 2006 Station11		
10/11/06	16	Contact 2006 Station11		
10/10/06	1100	Contact 2006 Station11		
10/09/06	30	Contact 2006 Station11		
10/05/06	550	Contact 2006 Station11		
10/03/06	2000	Contact 2006 Station11		
10/02/06	5	Contact 2006 Station11		
09/27/06	160	Contact 2006 Station11		
09/20/06	51	Contact 2006 Station11		
09/19/06	77	Contact 2006 Station11		
09/18/06	540	Contact 2006 Station11		
09/15/06	56	Contact 2006 Station11		
09/14/06	19	Contact 2006 Station11		
09/12/06	140	Contact 2006 Station11		
09/06/06	120	Contact 2006 Station11		
09/05/06	300	Contact 2006 Station11		
09/01/06	77	Contact 2006 Station11		
08/23/06	600	Contact 2006 Station11		
08/21/06	520	Contact 2006 Station11		
08/17/06	133	Contact 2006 Station11		
08/16/06	70	Contact 2006 Station11		
08/15/06	5	Contact 2006 Station11		
08/09/06	240	Contact 2006 Station11		
08/08/06	74	Contact 2006 Station11		
08/07/06	14	Contact 2006 Station11		
08/03/06	51	Contact 2006 Station11		
08/02/06	7	Contact 2006 Station11		
07/26/06	170	Contact 2006 Station11		

07/25/06	157	Contact 2006 Station11		
07/20/06	16	Contact 2006 Station11		
07/19/06	3	Contact 2006 Station11		
07/18/06	3	Contact 2006 Station11		
07/17/06	21	Contact 2006 Station11		
07/13/06	63	Contact 2006 Station11		
07/12/06	500	Contact 2006 Station11		
07/11/06	3	Contact 2006 Station11		
07/10/06	187	Contact 2006 Station11		
06/27/06	28	Contact 2006 Station11		
06/22/06	65	Contact 2006 Station11		
06/21/06	12	Contact 2006 Station11		
06/19/06	2000	Contact 2006 Station11		
06/15/06	70	Contact 2006 Station11		
06/14/06	90	Contact 2006 Station11		
06/13/06	16	Contact 2006 Station11		
06/07/06	140	Contact 2006 Station11		
06/06/06	12	Contact 2006 Station11		
06/01/06	3	Contact 2006 Station11		
05/23/06	3	Contact 2006 Station11		
05/22/06	3	Contact 2006 Station11		
05/17/06	2	Contact 2006 Station11		
05/16/06	42	Contact 2006 Station11		
05/15/06	9	Contact 2006 Station11		
05/11/06	5	Contact 2006 Station11		
05/09/06	260	Contact 2006 Station11		
05/08/06	3	Contact 2006 Station11		
05/04/06	3	Contact 2006 Station11		
05/01/06	19	Contact 2006 Station11		
04/27/06	23	Non-Contact 2005-2006 Station11	35.81	28
04/20/06	58	Non-Contact 2005-2006 Station11		
04/19/06	450	Non-Contact 2005-2006 Station11		
04/12/06	3	Non-Contact 2005-2006 Station11		
04/11/06	26	Non-Contact 2005-2006 Station11		
04/10/06	3	Non-Contact 2005-2006 Station11		
04/05/06	3	Non-Contact 2005-2006 Station11		
04/04/06	5	Non-Contact 2005-2006 Station11		
04/03/06	58	Non-Contact 2005-2006 Station11		
03/20/06	470	Non-Contact 2005-2006 Station11		
03/16/06	3	Non-Contact 2005-2006 Station11		
03/07/06	113	Non-Contact 2005-2006 Station11		
03/02/06	3	Non-Contact 2005-2006 Station11		
02/22/06	3	Non-Contact 2005-2006 Station11		
02/20/06	600	Non-Contact 2005-2006 Station11		
02/16/06	7	Non-Contact 2005-2006 Station11		
02/07/06	14	Non-Contact 2005-2006 Station11		
01/26/06	1033	Non-Contact 2005-2006 Station11		
01/24/06	370	Non-Contact 2005-2006 Station11		
01/19/06	70	Non-Contact 2005-2006 Station11		
01/10/06	7	Non-Contact 2005-2006 Station11		
12/19/05	1967	Non-Contact 2005-2006 Station11		

12/15/05	1700	Non-Contact 2005-2006 Station11		
12/02/05	3	Non-Contact 2005-2006 Station11		
11/29/05	14	Non-Contact 2005-2006 Station11		
11/28/05	110	Non-Contact 2005-2006 Station11		
11/17/05	26	Non-Contact 2005-2006 Station11		
11/08/05	42	Non-Contact 2005-2006 Station11		

SOURCE ASSESSMENT

Under the CWA, sources are broadly classified as either point or nonpoint sources. Under 40 CFR §122.2, a point source is defined as a discernible, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Point sources can be described by two broad categories: 1) NPDES regulated municipal and industrial wastewater treatment plants (WWTPs) and 2) NPDES regulated industrial activities (which include construction activities) and municipal storm water discharges (Municipal Separate Storm Sewer Systems [MS4s]). For the purposes of this TMDL, all sources of enterococci loading not regulated by NPDES permits are considered nonpoint sources.

3.1 Assessment of Point Sources

The three Mississippi coastal counties have Municipal Separate Storm Sewer System (MS4) permits which include the culverts and open conveyances to the beaches. These locations at the shoreline for Gulfport East Beach are shown in the aerial photography in the proceeding chapter. Stormwater is considered one of the sources of pollutant transport for this water body. Another source is wind and wave action that stirs up the settled material. As this material re-suspends in the water column, this generates a higher than normal bacteria count in the samples.

Typical Storm Water Culvert discharging on the Beach

3.2 Assessment of Nonpoint Sources

There are other potential nonpoint sources of enterococci bacteria for the beaches, including:

- Failing septic systems
- Other Direct Inputs
- Urban development

3.2.1 Failing Septic Systems

Septic systems have a potential to deliver enterococci bacteria loads to surface waters due to malfunctions, failures, and direct pipe discharges. Properly operating septic systems treat wastewater and dispose of the water through a series of underground field lines. The water is applied through these lines into a rock substrate, thence into underground absorption. The systems can fail when the field lines are broken, or when the underground substrate is clogged or flooded. A failing septic system's discharge can reach the surface, where it becomes available for wash-off into the environment. Another potential problem is a direct bypass from the system to a stream. In an effort to keep the water off the land, pipes are occasionally placed from the septic tank or the field lines directly to the creek.

Another consideration is the use of individual onsite wastewater treatment plants. These treatment systems are in wide use in Mississippi. They can adequately treat wastewater when properly maintained. However, these systems may not receive the maintenance needed for proper, long-term operation. These systems require some sort of disinfection to properly operate. When this expense is ignored, the water does not receive adequate disinfection prior to release.

Septic systems have an impact on nonpoint source enterococci impairment in the Coastal Basin. The best management practices needed to reduce this pollutant load need to prioritize eliminating septic tank failures and improving maintenance and proper use of individual onsite treatment systems.

Due to the urban nature of this beach, it is believed that while possible, it is unlikely that there are any septic tanks active in this area of Gulfport.

3.2.2 Wildlife

Wildlife contributes to the bacteria load in these water bodies. Small mammals and birds are the most prevalent contributors.

3.2.3 Urban Development and Other Direct Inputs

Other direct input of enterococci bacteria to the beach includes illicit discharges, human recreation, and leaking sewer collection lines. Enterococci bacteria contributions from urban areas come from storm water runoff and runoff contribution from improper disposal of sewage, lift station malfunctions, and sewer line breaks. This source is thought to be the major contributor to this impairment.

ALLOCATION

The allocation for this TMDL includes a wasteload allocation (WLA) for point sources, a load allocation (LA) for nonpoint sources, and a margin of safety (MOS).

4.1 Wasteload and Load Allocations

The storm water culverts are considered point sources under the MS4 NPDES permit. However, there is no way to quantify or characterize the distinction between the point and nonpoint source allocations for the beaches coming from the culverts. Therefore, to meet the requirements of an approvable TMDL, the WLA and LA will be divided equally from the TMDL minus the MOS.

4.2 Incorporation of a Margin of Safety (MOS)

The two types of MOS development are to implicitly incorporate the MOS using conservative assumptions or to explicitly specify a portion of the total TMDL as the MOS. For these segments, the MOS has been set at 10% of the total load.

Table 9 Enterococci TMDL Components for Gulfport East Beach

Beach Name	WLA (counts per day)	LA (counts per day)	MOS (counts per day)	Total TMDL (counts per day)	TMDL Percent Reduction
Gulfport East Beach	1.55+E10	1.55+E10	3.45+E09	3.45+E10	2.3% to 32%

4.3 Seasonality

The beach data are collected based on seasonal usage; there is a greater frequency of data collected during the summer season. The TMDL reductions were calculated based on the percentage difference between the impairment and the standard. This TMDL is appropriate for all seasons.

4.4 Reasonable Assurance

This component of TMDL development does not apply to this TMDL Report.

CONCLUSION

The bacteria levels increase in the water body as a result of storms or high winds. Increased wave action stirs up the settled material which increases the bacteria count in the water column. An engineered solution to remove the contribution via the stormwater culverts to the swimming area should be considered. Improved maintenance of the Cowen Road lift station is evident in the reduced overflows indicated by the data for this beach. Ongoing maintenance and operation of the sewer collection system in Gulfport is encouraged by MDEQ.

5.1 Future Monitoring

Mississippi's Beaches may receive ongoing monitoring to report water quality for recreational activities in the future. MDEQ will encourage local leaders and stakeholders to obtain funding and planning to reengineer the stormwater discharge culverts to divert the stormwater from the recreation beaches to improve water quality and the aesthetics of the environment.

5.2 Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the statewide newspaper and a newspaper on the coast. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs prior to the beginning of the public notice to those members of the public who have requested to be included on a TMDL email list. Anyone wishing to be included on the TMDL email list should contact Greg Jackson at Greg_Jackson@deq.state.ms.us. At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public meeting. All written comments received during the public notice period and at any public meeting become a part of the record of this TMDL. All comments will be considered in the ultimate completion of this TMDL for submission of this TMDL to EPA Region 4 for final approval.

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