

# Three Mile Creek Watershed Management Plan

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## Appendix E – Groundwater, sediment and stormwater sampling and Results

### USA Sampling and Testing Plan

Assess groundwater contribution up and down gradient. Groundwater flow and samples will be obtained from river craft and will not require site access. Perform Subtitle D analysis.

**Parameters:** Groundwater flow rate and volume; 126 Priority Pollutants; TKN, NH<sub>3</sub>, and NO<sub>x</sub>, SRP and TP; BOD; COD; fecal coliform (freshwater reaches), Enterococcus (brackish water reaches); field pH, conductivity, DO, temp., ORP.

**Frequency:** Once in September. Dry weather - rainfall must be less than 0.1-inches for prior 72 hours.

**Samples:** 4- 1 each from 4 sites; two up gradient and two down gradient of landfill; one pair for One Mile Creek and one pair for TMC. Assumes all 4 samples will be brackish water. Please note brackish water samples on sample containers.

### **Groundwater contribution assessment throughout TMC**

Assess groundwater contribution at various points throughout the watershed. Groundwater flow and samples can be obtained from river craft and will not require site access. Propose to perform limited list of parameters for analysis. One sample session can be performed this summer. Project also has potential for long term sampling in future years.

**Parameters:** Surface water flow rate; 8 RCRA metals; TKN, NH<sub>3</sub>, and NO<sub>x</sub>; SRP and TP; BOD; COD; fecal coliform (freshwater reaches), Enterococcus (brackish water reaches); field pH, conductivity, DO, temp., ORP, turbidity, salinity.

**Frequency:** Once in September. Dry weather - rainfall must be less than 0.1-inches for prior 72 hours.

**Sites:** 20 – 2 each from 10 sites, see map provided in Figure 3-3. Please note brackish water samples on sample containers.

### **Sediment sample assessment throughout TMC**

Assess sediments at various points throughout the watershed. Three samples will be obtained from each site and composited for analysis. Samples will be obtained from river craft and will not require site access.

**Parameters:** 8 RCRA metals; moisture content; organic content; TN; TP; BOD; COD; fecal coliform (freshwater reaches), Enterococcus (brackish water reaches); visual characterization.

**Frequency:** Once in September. Dry weather, rainfall less than 0.1-inches for 72 hours.

**Samples:** 10 – 1 each from 10 sites, see map. Please note brackish water samples on sample containers.



## USA Field Report

### Groundwater and Sediment Sample Collection In The Three Mile Creek Watershed

Graduate student researchers from the University of South Alabama Marine Sciences and Environmental Toxicology programs collected groundwater and sediment samples at locations throughout the Three Mile Creek watershed in Mobile, Alabama during September and October 2013. The locations of these sample sites are displayed on Figures 1 and 2 below.

These samples were collected to:

- 1) Generically assess the chemical makeup of baseflow/groundwater entering Three Mile Creek and selected tributaries throughout the watershed;
- 2) Generically characterize any contaminants entrained in the creek

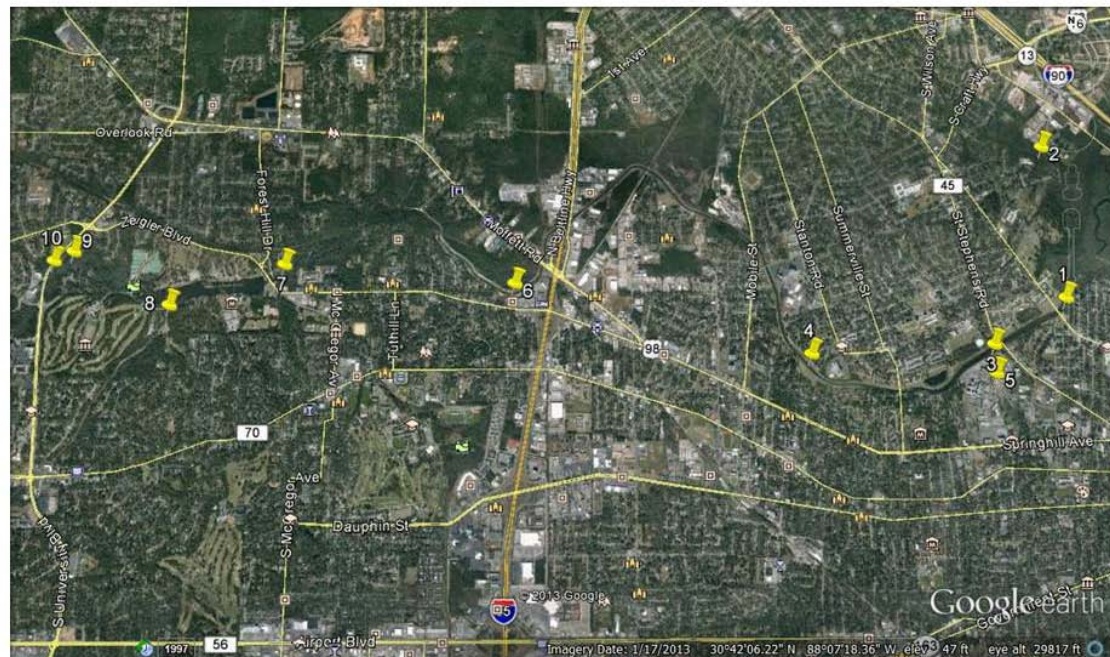


Figure 1. Locations of Sediment (SD) and Baseflow/Groundwater (GW) sample locations in the Three Mile Creek watershed.

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sediments in the watershed; and

3) Specifically assess the chemical composition of groundwater entering the creek system from an abandoned municipal solid waste landfill located near downtown Mobile (the Hickory Street Landfill).

The details of each of these sample subsets are described below, along with relevant information regarding sample collection and handing procedures.

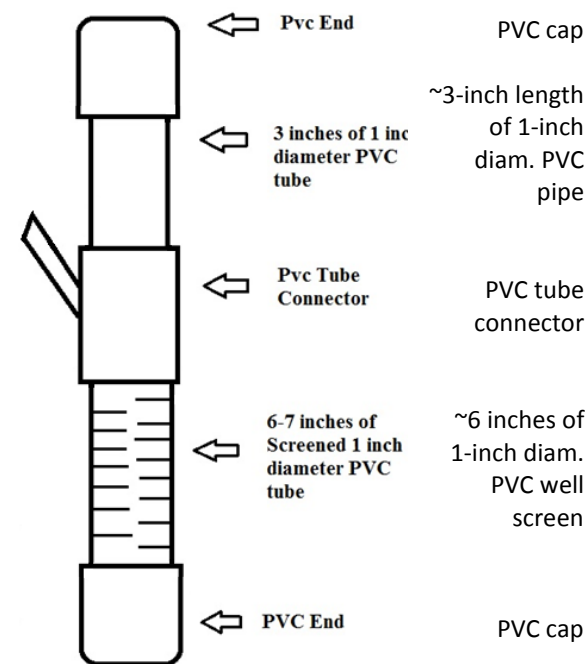
## Watershed Baseflow/Groundwater Samples

Baseflow/groundwater (GW) samples were collected at the locations displayed on Figure 1. The exception was location 1, where access concerns have prevented the collection of any samples to date.

Sampling was accomplished at all other locations using *mini piezometers* such as the one described schematically in Figure 3. Each of these was constructed onsite using PVC well screen, riser pipe, and fittings. A clear plastic sampling tube was attached to each mini piezometer. This tube was in turn connected at the surface to a peristaltic pump.

At sampling locations 2GW through 10GW mini piezometers were emplaced into the creek bottom sediments close to the shoreline so that the screened section was completely buried. Prior to sampling, each piezometer was pumped for a few minutes and then allowed to rest. After a short equilibration period, the pressure of groundwater in the tubes at each sampling location was visually gauged and measured. Positive pressure gradients (groundwater rising in the tube above the level of local surface water) were indicative of groundwater flow into the creek. If no positive gradient was observed, the mini piezometer was relocated to other spots closer to shore at the same sampling location until a positive gradient was observed.

Figure 3. Mini piezometer schematic.



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Piezometers displaying positive pressure gradients were sampled. To accomplish this, each was purged using a peristaltic pump and *low-flow/low-stress* sampling techniques.

Purging began with withdrawal of water from each mini piezometer at a rate that balanced discharge and recharge (equilibrium) and ended with the stabilization of field temperature, pH, and specific conductance readings as follows:

- pH = +/- 0.05
- Temperature = +/- 0.5 °C
- Conductivity = +/- 5%

Once the field parameters stabilized, groundwater was collected from the discharge stream of the peristaltic pump. For collection of VOC samples, the peristaltic pump discharge rate was placed on the lowest setting to minimize sample agitation.

Once collected, each sample was placed into a laboratory-provided sample container for subsequent laboratory analysis. Sample containers were labeled with waterproof ink, placed on ice in sealed laboratory-supplied coolers, and transported to the laboratory (TestAmerica Laboratories at 900 Lakeside Drive, Mobile, Alabama) for analysis within allotted holding times. Complete chain-of-custody documentation accompanied all coolers.

Personnel involved in groundwater (and all other) sampling wore clean latex gloves that were disposed of after each sample was collected, along with all tubing and other expendables used during the process.

Non-disposable sampling equipment (probes, etc.) was decontaminated prior to reuse using the following five-step procedure:

- 1) Phosphate-free detergent wash
- 2) Potable water rinse
- 3) Deionized water rinse
- 4) Isopropanol rinse
- 5) Deionized water rinse and air dry

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## Groundwater Sample Results Matrix

Reports detailing the Groundwater Sample Results can be found according to the site location in the table below. The reports follow at the end of this Appendix. For example, at site 1GW, the BOD results can be found in the report with “400-80120-5” on the cover.

Sample Site Name	Groundwater Sample Results Report Name						
	Gen Chem	O-P	P	Metals	BOD	Enterococci	Coliform, Fecal
<b>1GW</b>							
1	400-80120-1						
2		400-80120-2					
3			400-80120-3				
4				400-80120-4			
5					400-80120-5		
6-7						*	*
<b>2GW</b>							
1	*						
2		*					
3			*				
4				*			
5					*		
6-7						*	*
<b>3GW</b>							
1	400-80120-6						
2-7		400-80383-7	400-80383-7	400-80383-7	400-80383-7	400-80383-7	400-80383-7
<b>4GW</b>							
1	400-80120-7						
2		400-80120-8					
3			400-80120-9				

Sample Site Name	Groundwater Sample Results Report Name						
	Gen Chem	O-P	P	Metals	BOD	Enterococci	Coliform, Fecal
4				400-80120-10			
5					400-80120-11		
6-7						400-80383-6	400-80383-6
<b>5GW</b>							
1-5	400-80411-2	400-80411-2	400-80411-2	400-80411-2	400-80411-2	*	*
<b>6GW</b>							
1	400-80120-16						
2		400-80120-17					
3			400-80120-18				
4				400-80120-19			
5					400-80120-20		
6-7						400-80383-5	400-80383-5
<b>7GW</b>							
1	400-80118-10						
2		400-80118-11					
3			400-80118-12				
4				400-80118-13			
5					400-80118-14		
6-7						400-80383-4	400-80383-4
<b>8GW</b>							
1	400-80118-7						
2		400-80118-6					
3	400-80118-5		*				
4				400-80118-4			
5					400-80118-3		
6-7						400-80383-3	400-80383-3

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Sample Site Name	Groundwater Sample Results Report Name						
	Gen Chem	O-P	P	Metals	BOD	Enterococci	Coliform, Fecal
9GW							
1-7	400-80383-2	400-80383-2	400-80383-2	400-80383-2	400-80383-2	400-80383-2	400-80383-2
10GW							
1-7	400-80383-1	400-80383-1	400-80383-1	400-80383-1	400-80383-1	400-80383-1	400-80383-1

*\*Sample results not obtained.*

## Sediment Samples

Sediment (SD) samples were collected at the same locations as the baseflow/groundwater samples (Figure 1). These samples were collected from the upper 2 to 3 inches of sediment in the creek bed near the shoreline.

At each sampled location (2SD through 2SD), previously undisturbed sediment was collected using a glass container and then placed in a decontaminated glass mixing bowl. The material was then carefully homogenized with a glass mixing spoon. Subsequently, aliquots from the composited sample were placed in each laboratory-supplied sample container. These were then sealed, labeled, and placed on ice in laboratory-supplied coolers. The sealed coolers, along with completed chain-of-custody forms, were driven to the laboratory within allotted holding times for analysis.



### Sediment Sample Results Matrix

Reports detailing the Sediment Sample Results can be found according to the site location in the table below. The reports follow at the end of this Appendix. For example, at site 3SD, the Coliform, Fecal results can be found in the report with “400-80383-9” on the cover.

Sample Site Name	Sediment Sample Report Results		
	Metals	Gen Chem	Coliform, Fecal
<b>1SD</b>			
1	400-80120-12		
2		400-80120-13	
3			*
<b>2SD</b>			
1	*		
2		*	
3			*
<b>3SD</b>			
1-3	400-80383-9	400-80383-9	400-80383-9
<b>4SD</b>			
1	400-80120-14		
2		400-80120-15	
3			400-80383-13
<b>5SD</b>			
1-2	400-80411-1	400-80411-1	
3			*
<b>6SD</b>			
1	400-80120-21		



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Sample Site Name	Sediment Sample Report Results		
	Metals	Gen Chem	Coliform, Fecal
2		400-80120-22	
3			400-80383-12
<b>7SD</b>			
1	400-80118-8		
2		400-80118-9	
3			400-80383-14
<b>8SD</b>			
1	400-80118-1		
2		400-80118-2	
3			400-80383-11
<b>9SD</b>			
1-3	400-80383-8	400-80383-8	400-80383-8
<b>10SD</b>			
1-3D	400-80383-10	400-80383-10	400-80383-10

*\*Sample results not obtained.*

### Hickory Street Landfill Samples

Four locations (HS-1, 2, 3, and 4) were targeted for acquisition of groundwater discharge samples in the vicinity of the Hickory Street Landfill at the locations shown on Figure 2. One of these samples (HS-1) was located upgradient of the landfill and three (HS-2 through 4) were located downgradient. The HS-1 location was accessed by land at Earle Street bridge in the Orange Grove subdivision just north of Beauregard Street. The three downgradient sampling sites were all accessed by boat.

At each HS sampling location, a mini piezometer (Figure 3) was constructed and emplaced into the creek bottom close to the shoreline as described above. This allowed for low-flow/low-stress sample acquisition using a peristaltic pump. All HS groundwater sample acquisition, handing, and documentation/transport procedures, as well as all decontamination procedures, were carried out as described previously.

Four locations (HS-1, 2, 3, and 4) were targeted for acquisition of groundwater discharge samples in the vicinity of the Hickory Street Landfill at the locations shown on Figure 2. One of these samples (HS-1) was located upgradient of the landfill and three (HS-2 through 4) were located downgradient. The HS-1 location was accessed by land at Earle Street bridge in the Orange Grove subdivision just north of Beauregard Street. The three downgradient sampling sites were all accessed by boat.



Figure 2. Locations of Hickory Street Landfill targeted groundwater (HS) samples.

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## Stormwater Sample Results Matrix

Reports detailing the Stormwater Sample Results can be found according to the site location in the table below. The reports follow at the end of this Appendix. For example, at site HS2, the Phenol results can be found in the report with “400-80278-11” on the cover.

Sample Site Name	Stormwater Sample Report Results									
	P	O-P	Metals	VOC	Semi-VOC	PCB	BOD	Phenol	Gen Chem	Cyanide
<b>HS1</b>										
1-14	400-80411-3	400-80411-3	400-80411-3	400-80411-3	400-80411-3	400-80411-3	400-80411-3	400-80411-3	400-80411-3	400-80411-3
<b>HS2</b>										
1	400-80278-27	-	-	-	-	-	-	-	-	-
2		400-80278-2								
3			400-80278-3							
4				400-80278-4						
6					400-80278-6					
8						400-80278-8				
10							400-80278-10			
11								400-80278-11		
12									400-80278-12	
13										400-80278-13
14									400-80278-14	
<b>HS3</b>										
1	400-80278-28									
2		400-80278-15								
3			400-80278-16							
4				400-80278-17						
6					400-80284-1					

Sample Site Name	Stormwater Sample Report Results									
	P	O-P	Metals	VOC	Semi-VOC	PCB	BOD	Phenol	Gen Chem	Cyanide
8						400-80284-3				
10							400-80278-19			
11								400-80278-20		
12									*	
13										400-80278-22
14									*	
<b>HS4</b>										
1	400-80278-29									
2		400-80278-23								
3			400-80278-24							
4				400-80278-25						
6					400-80284-5					
8						400-80284-7				
10							400-80284-9			
11								400-80284-10		
13										400-80284-12
14									400-80284-13	

\*Sample results not obtained.

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Laboratory Reports from USA Sampling Discussed Above

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