APPENDIX B

MEC WATER RESOURCES INC.
2006 WATER QUALITY MONITORING STUDY

2006 CSO Monitoring Report

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I. INTRODUCTION

Macon Municipal Utilities (MMU) operates a combined sewer system with three combined sewer outfalls along Sewer Creek (Figure 1), an unclassified tributary to a Class C segment of the Middle Fork of the Salt River (Middle Fork)[1]. MMU retained the services of MEC Water Resources, Inc. (MEC) to plan and coordinate a combined sewer overflow (CSO) and receiving water quality monitoring effort in the summer of 2006. The primary objective of the project was to establish baseline water quality conditions prior to the MMU Phase 1 Interceptor CSO abatement project. The Phase 1 CSO abatement project consisted of directing high strength wastewater containing effluent from ConAgra Foods, Inc. (major local industry) directly to the wastewater treatment plant. Prior to the Phase 1 project a portion of the high-strength wastewater discharged through CSO 3 during CSO events.

MMU staff monitored two CSO events before the Phase 1 CSO abatement project sewer line connection was completed in September 2006. The ConAgra Foods facility was discharging negligible, if any, high-strength waste during the events. The objective of establishing the benefits of Phase 1 was therefore accomplished by coupling monitoring data with theoretical ConAgra loading rates to calculate the expected benefits of Phase 1 improvements.

This report summarizes the 2006 CSO monitoring efforts and highlights the data that best defined water quality conditions. MMU's Long Term Control Plan includes future monitoring that will continue to build on data collected by MMU in 2006 and earlier.

II. MONITORING APPROACH

A. Monitoring Site Locations and Methodology

MMU Staff conducted Events 1 and 2 on August 7 and August 27, 2006 respectively. MMU Staff also completed 2 baseflow monitoring runs (July 25th and September 26th, 2006) to provide dry-weather water quality data. Three CSO monitoring stations, one wastewater treatment plant (treatment plant) effluent station and seven receiving water monitoring sites (Figure 1, Table 1) were selected to measure storm event water quality and flow rates upstream and downstream of the City's three CSO outfalls. The receiving water locations were selected to monitor non-point source loadings into Sewer Creek in addition to the impacts of CSO and treatment plant discharges on the Middle Fork of the Salt River (Middle Fork). Site RW-1 was selected to provide water quality data in Sewer Creek upstream of CSO or treatment plant discharges. Sites RW-2 through RW-5 were selected to characterize Sewer Creek and Brush Creek downstream of CSO and treatment plant discharges prior to the confluence with the Middle Fork. Site RW-6 was selected to provide background water quality data for the Middle Fork, while RW-7 was selected to characterize the Middle Fork downstream of the confluence with Brush Creek. Site WWTP-001 (plant effluent) provided treatment plant discharge data.

[1] Current beneficial uses designated for the Middle Fork near Macon include: Livestock and Wildlife Watering, Protection of Aquatic Life and Human Health-Fish Consumption and Category B whole body contact recreation (Carnahan 2005). Sewer Creek is protected through application of general criteria (10 CSR 20-7.031 (3)) and acute numeric criteria for the protection of warm-water aquatic life.

Figure 1

CSO and Receiving Water Quality Monitoring Stations for 2006 Monitoring

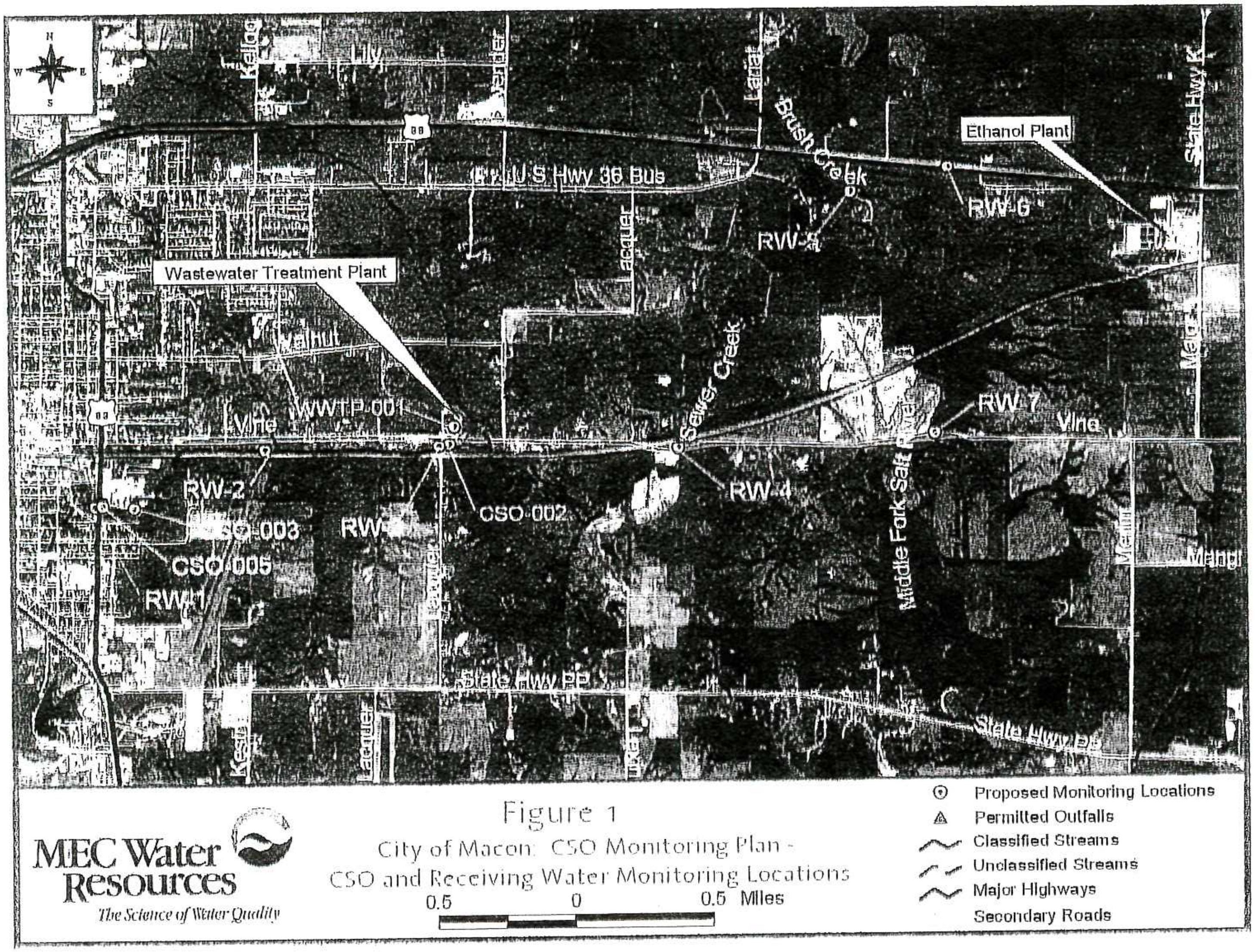


Table 1

Monitoring Locations: Distance Downstream from RW-1

Site ID	Receiving Stream	Distance Downstream (miles)
RW-1	Sewer Creek	-----
CSO-5	Sewer Creek	0.03
CSO-3	Sewer Creek	0.09
RW-2	Sewer Creek	0.83
RW-3	Sewer Creek	1.52
CSO-2	Sewer Creek	1.58
WWTP	Sewer Creek	1.61
RW-4	Sewer Creek	2.9
RW-5	Brush Creek	4.57
-------	Brush Creek & Middle Fork Confluence	4.79
RW-6	Middle Fork Salt River	0.26*
RW-7	Middle Fork Salt River	6.48

* miles upstream of Brush Creek and Middle Fork Salt River Confluence

Continuous flow meters were deployed at the CSO and treatment plant stations. Continuous water level sensors were deployed at the seven receiving water sites.

The monitoring plan called for 4 grab samples to be collected at each site during both events and to be analyzed for conventional pollutants, nutrients and bacteria (Table 2). One-hour sampling intervals were selected for the CSO stations. Longer intervals were selected for the receiving water sites. Fewer samples were collected if the duration of a CSO did not allow sufficient sampling time to collect four samples. Discrete field measurements (pH, dissolved oxygen (DO), conductivity, and temperature) were taken at least once per event at each site. Quality assurance samples (duplicates and field blanks) were also collected during each event according to the quality assurance procedures described in the project Sampling and Analysis Plan (MEC Water Resources, Inc. 2006).

Table 2. Wet-weather Sampling Event: Sample Type, Location and Analyses for CSO's, Treatment and Receiving Waters

Site ID	Sample Location	Targeted Sampling Interval	Targeted # of Samples per Event	Sample Analysis
Grab Samples				
RW-1	Sewer Creek Upstream of Hwy. 63	1 sample in the first hour and every 2 hours thereafter	4 (every sample)	5-Day BOD Total Suspended Solids Volatile Suspended Solids Nitrate-Nitrite Ammonia Total Nitrogen Total Phosphorus *Escherichia coli* (*E. coli*)
CSO-005 CSO-003 CSO-002	Hwy. 63 Grit Chamber Storage Basin	1 sample every hour for the first 4 hours from initiation of overflow		
RW-2 RW-3	Sewer Creek Midway between CSO's 002 and 003 Sewer Creek Upstream of Bridge @ Lacquer Rd.	1 sample in the first hour and every 2 hours thereafter		
WWTP-1	Flume	1 sample every hour for the first 4 hours from initiation of sampling		
RW-4	Sewer Creek @ Vine Street	1 sample in the first hour and every 2 hours thereafter		
RW-5	Brush Creek Upstream of Sewer Creek			
RW-6 RW-7	Middle Fork Salt River @ Highway 36 Middle Fork Salt River @ Vine Street	1 sample two hours after initiation and every 2 hours thereafter		
Discrete Field Measurements				
RW-1 CSO-005 CSO-003 RW-2 RW-3 CSO-002 WWTP-1 RW-4 RW-5 RW-6 RW-7	Same as above "	Once during each rainfall/sampling event	1	Dissolved Oxygen Conductivity Temperature pH

B. Staffing

MEC and MMU staff worked jointly to accomplish the monitoring project. MEC developed the Sampling Analysis Plan and trained MMU staff to conduct monitoring activities. The MMU field manager coordinated sampling events, mobilized field crews, managed field staff/equipment and entered data into the project database. The MMU sampling crew conducted field investigations and documented sampling data. MEC provided technical assistance as needed in addition to data analysis, quality assurance review and report development.

C. Description of CSO Events Monitored

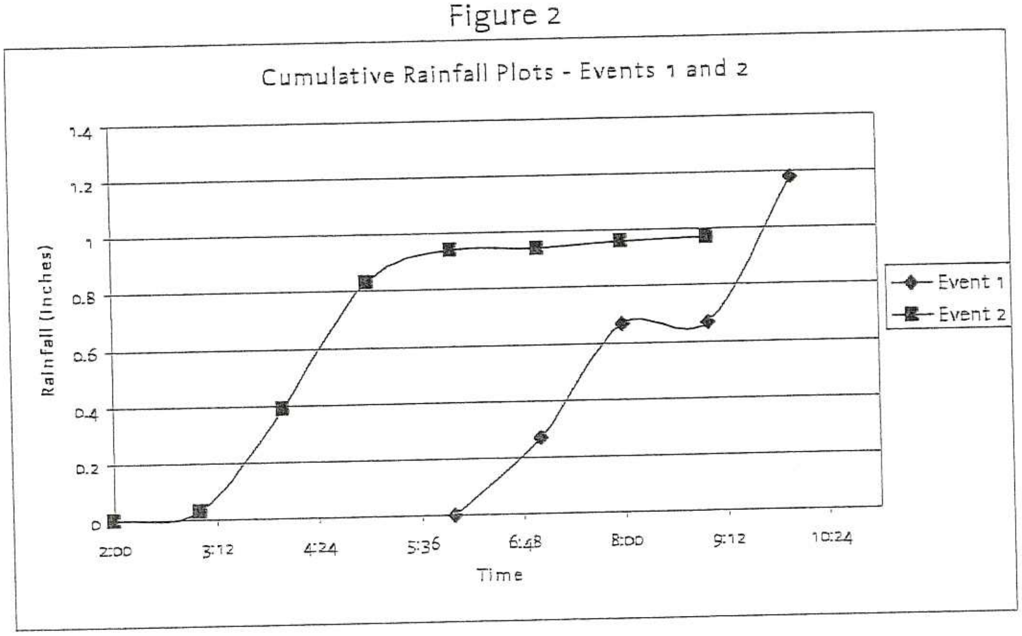
1) Rainfall and CSO Flow Characteristics

Macon Power Plant staff collected continuous rainfall data during Event 1 and 2 storms. Both storms produced similar total rainfall amounts of approximately one-inch and maximum rainfall intensities at or near 0.5 inches per hour (Table 3, Figure 2).

Table 3
Rainfall Characteristics for Event 1 and 2 Storms

	Event 1	Event 2
Date	8/7/2006	8/27/2006
Rainfall Start (24 hr)	7:00	3:00
Rainfall End (24 hr)	10:00	9:00
Total Rainfall (inches)	1.18	0.98
Average Hourly Rate (inches/hr)	0.39	0.16
Max Hourly Rate Rainfall (inches/hour)	0.51	0.44
Max Rainfall Time (24 hr)	10:00	5:00

Figure 2



CSO's 3 and 5 discharged during both Events. CSO 3 (grit chamber overflow) discharge rates and durations were similar with maximum flow rates of approximately 30 million gallons per day (MGD) and total flow durations of approximately 4.5 hours (Table 4). Average flow rates for CSO 3 were 20 MGD for Event 1 and 15 MGD for Event 2. CSO 5 (at Highway 63) discharge rates were also similar for both Events and lower in flow and duration compared to CSO 3. Maximum CSO 5 flow rates were approximately 7 MGD with total flow durations of approximately 2.5 hours. Average CSO 5 flow rates for Events 1 and 2 were 0.4 MGD and 0.9 MGD respectively. CSO 2 (treatment plant holding basin) did not overflow during either Event.

Table 4
CSO Flow Characteristics for Event 1 and 2 Storms

	Event 1		Event 2	
Date	8/7/2006		8/27/2006	
CSO	CSO 3	CSO 5	CSO 3	CSO 5
Start Time of CSO Event (24 hr)	6:45	8:30	4:15	5:15
End Time of CSO Event (24 hr)	11:19	11:00	8:58	8:00
Length of CSO Event (hrs)	4.57	2.50	4.72	2.75
Maximum Flow Rate (MGD)	29.9	7.56	31.15	6.65
Time of Maximum Flow (24 hr)	9:30	8:30	4:19	5:15
Total CSO Flow (MG)	1.6	0.3	1.2	0.6
Averge CSO Flow Rate (MGD)	8.2	2.46	6.0	5.25

*Note: CSO 2 had no overflow events during the 2006 monitoring.

2) Stage, Flow and Sample Collection Times

Sample collection times and stage hydrographs (receiving water sites) and flow hydrographs (CSO and treatment plant sites) were plotted (Appendix 1) to illustrate the discharge characteristics of each site in relation to the times when samples were collected. Sample collection typically commenced near or after the hydrograph peaks.

D. Baseflow Sampling

MMU staff conducted two baseflow monitoring runs to characterize the receiving water quality during dry-weather, (no CSO impact) conditions. Baseflow conditions were defined as low-flow conditions preceded by approximately two weeks with little or no precipitation. The baseflow events were conducted on July 25th and September 26th, 2006. Baseflow monitoring stations consisted of project receiving water sites with flow or pooled water on the sampling dates.

Grab samples were collected at each site during both baseflow runs and were analyzed for the same array of pollutants selected for the CSO event monitoring (Table 5). The same discrete field measurements and quality assurance samples were also collected. Receiving water flow data was not compiled for the baseflow runs.

Table 5. Baseflow Sampling Event: Sample Type, Location, and Analyses for Treatment Plant and Receiving Waters

Site ID	Sample Location	Targeted Sampling Interval	Targeted # of Samples per Event	Sample Analysis
Grab Samples				
RW-3	Sewer Creek Upstream of Bridge @ Lacquer Rd.	Once during baseflow sampling event	1	5-Day BOD Total Suspended Solids Volatile Suspended Solids Ammonia Total Nitrogen Nitrate Phosphorus *Escherichia coli (E. coli)*
WWTP-1	Flume			
RW-4	Sewer Creek @ Vine Street			
RW-5	Brush Creek Upstream of Sewer Creek			
RW-6 RW-7	Middle Fork Salt River @ Highway 36 Middle Fork Salt River @ Vine Street			
Discrete Field Measurements				
All the above sites	Same as above " " " " " " " " " " " "	Once during baseflow sampling event	Instream	Dissolved Oxygen Conductivity Temperature pH

III. RESULTS AND DISCUSSION

A. Wet-Weather Event Water Quality Data

Wet-weather water quality data collected during in August 2006 (Appendix 2) are presented graphically (Figures 3 through 15) to compare Event 1 and 2 concentrations. CSO event data collected by MMU staff in 2002 and 2003 are also provided (Appendix 4).

1) 5-Day Biochemical Oxygen Demand and Dissolved Oxygen

Five-day Biochemical Oxygen Demand (BOD5) concentrations for Event 1 were generally below 10 mg/L (Figures 3 and 4). The single Event 1 CSO 3 sample was the highest BOD5 concentration at 14 mg/L. The CSO 3 BOD5 concentrations for the four Event 2 samples were generally higher than the Event 1 sample. This difference may be attributed to Event 2 being sampled earlier in the CSO event (Appendix 1). The difference is not attributed to the loadings from the ConAgra facility considering the industry was not discharging during Event 2. Receiving water and treatment plant BOD5 concentrations for Event 2 were similar to Event 1, being at or below 10 mg/L. BOD5 concentrations in upstream Sewer Creek and upstream Middle Fork (RW-1 and RW-6) were on average 2 to 5 mg/L lower than receiving water samples collected at adjacent downstream sites (RW-2 and RW-7).

Figure 3

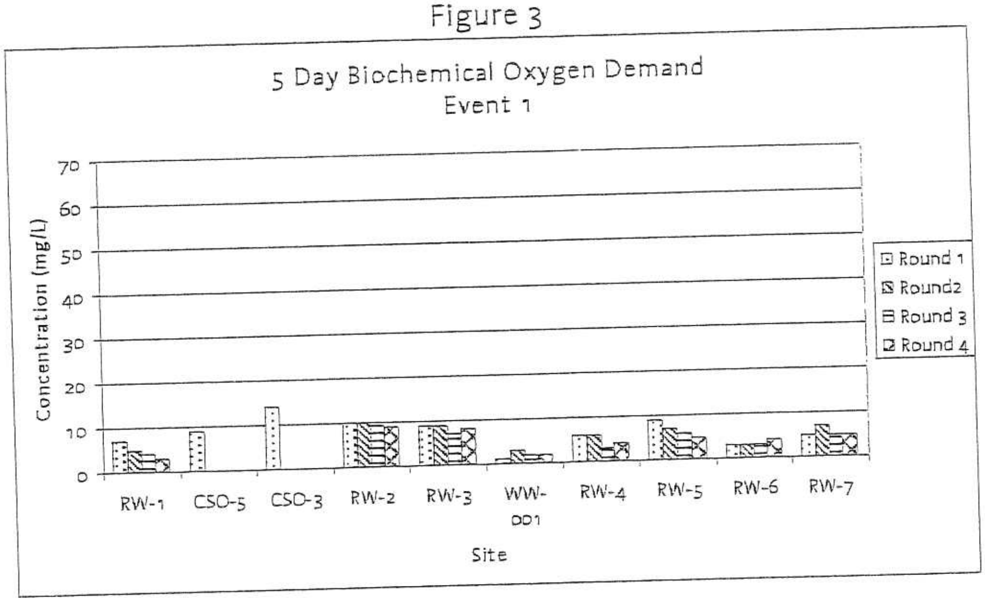
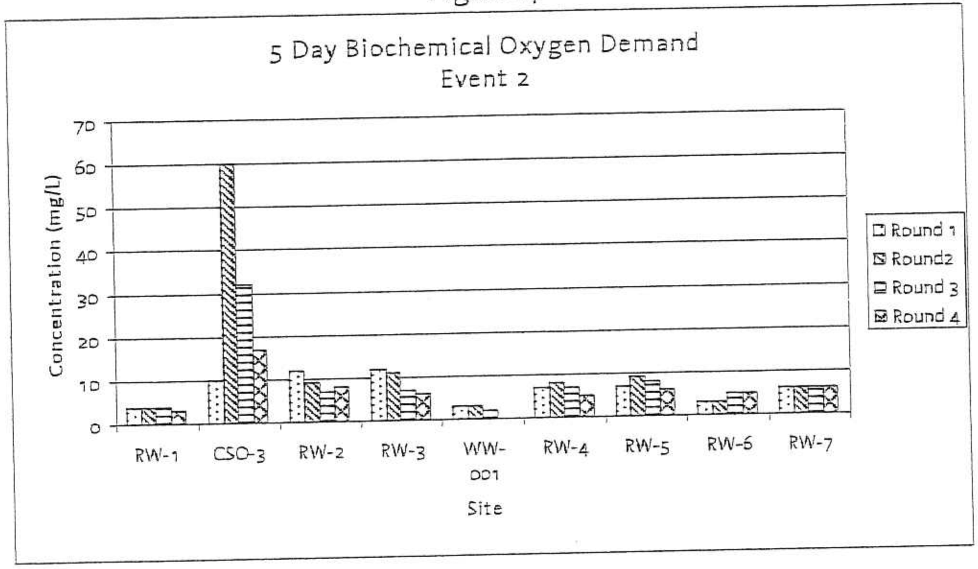
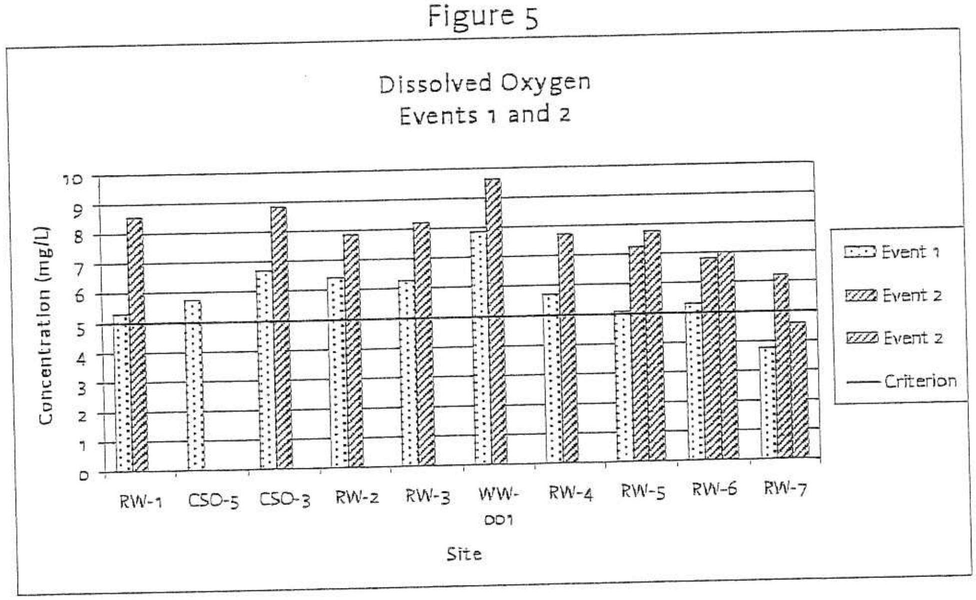


Figure 4



Event 1 and 2 dissolved oxygen (DO) measurements in Sewer Creek and Brush Creek (Figure 5) were at or above the 5.0 mg/L DO criteria (10 CSR 20-7, Table A). Upstream Middlefork (RW-6) DO concentrations were above the criteria for all three measurements. Downstream Middle Fork (RW-7) DO measured below the criteria for two of the three measurements. Event 1 DO for RW-7 was 3.7 mg/L and Event 2 measurements were 4.6 and 6.2 mg/L.

Figure 5



The water quality data collected in 2006 was MMU's first dataset developed for the selected Middle Fork sites. The relationship between CSO discharges and downstream dissolved oxygen concentrations has not been established. Future monitoring, potentially coupled with DO modeling, will help to determine the extent to which downstream DO concentrations are affected by CSO, treatment plant, non-point source or other point source discharges in the watershed.

2) Total and Volatile Suspended Solids

Total suspended solids (TSS) were higher in downstream receiving water sites compared to CSO and treatment plant discharges (Figures 6 and 7) indicating suspended solids in the system mostly originated from non-point sources. Highest sediment loadings were measured in RW-2 (Sewer Creek) as well RW-5 (Brush Creek) with TSS concentrations up to 350 mg/L. Average percent volatile suspended solids (VSS) for CSO and treatment plant samples averaged 32% and 36% respectively. Receiving water samples averaged 16% VSS.

Missouri has no numeric water quality criteria for total or volatile suspended solids. However, US EPA Region 7 developed a sediment Total Maximum Daily Load (TMDL) for the Middle Fork Salt River (Region 7 EPA, 2006). The TMDL identifies agricultural nonpoint sources as the cause of the impairment and states that "point sources do not contribute to water quality impairment relative to sediment impacts on stream biology".

Figure 6

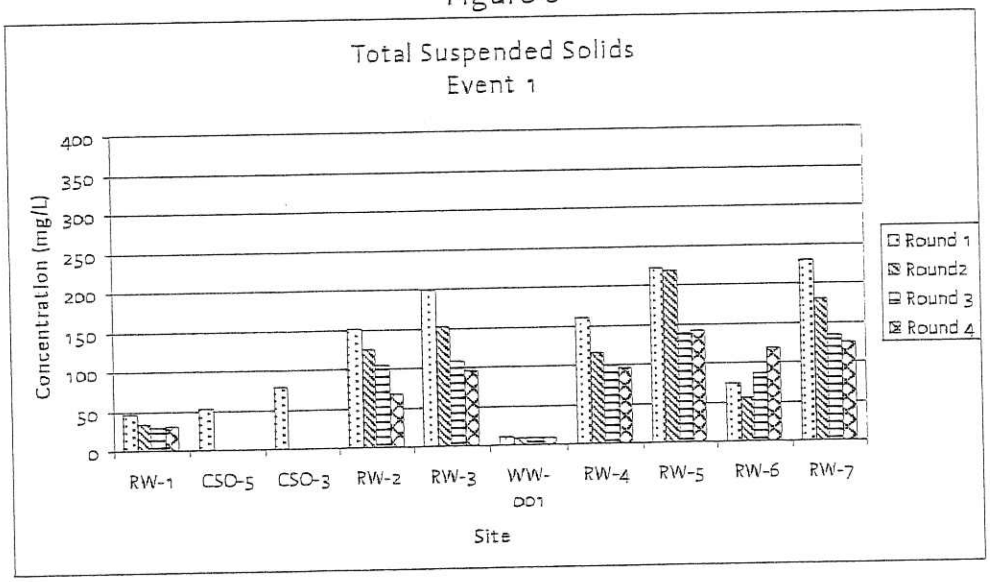
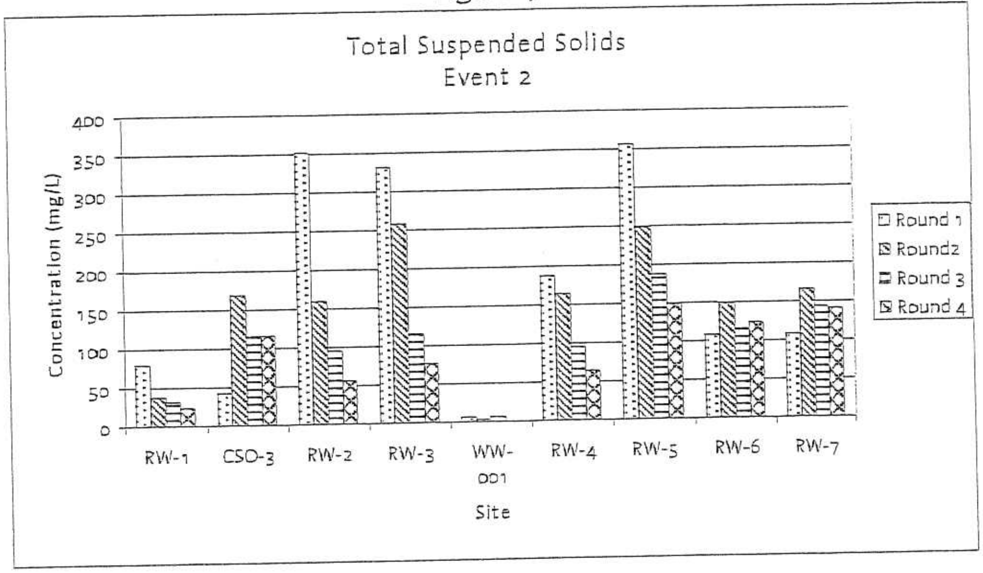


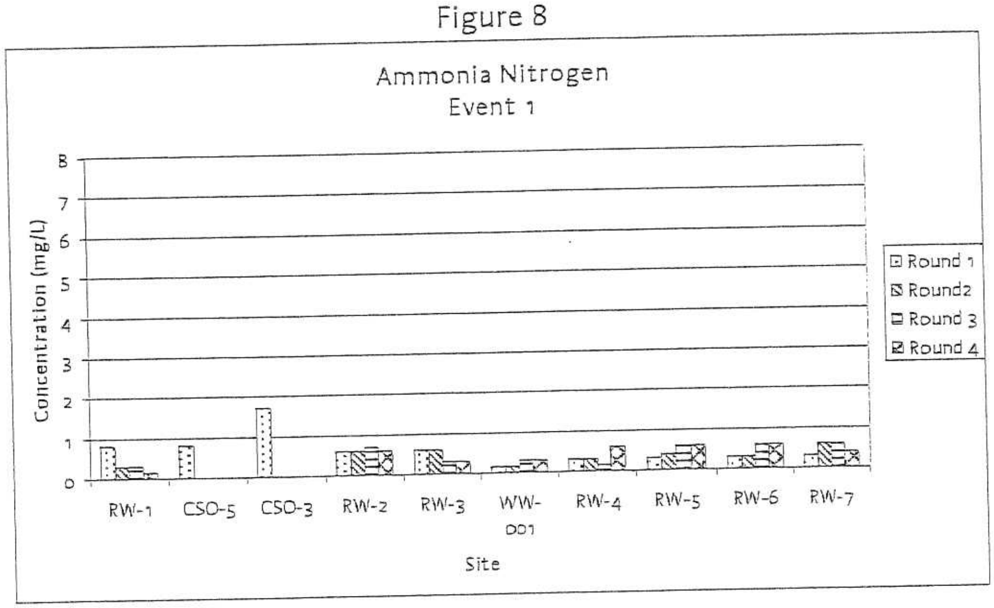
Figure 7



3) Ammonia Nitrogen

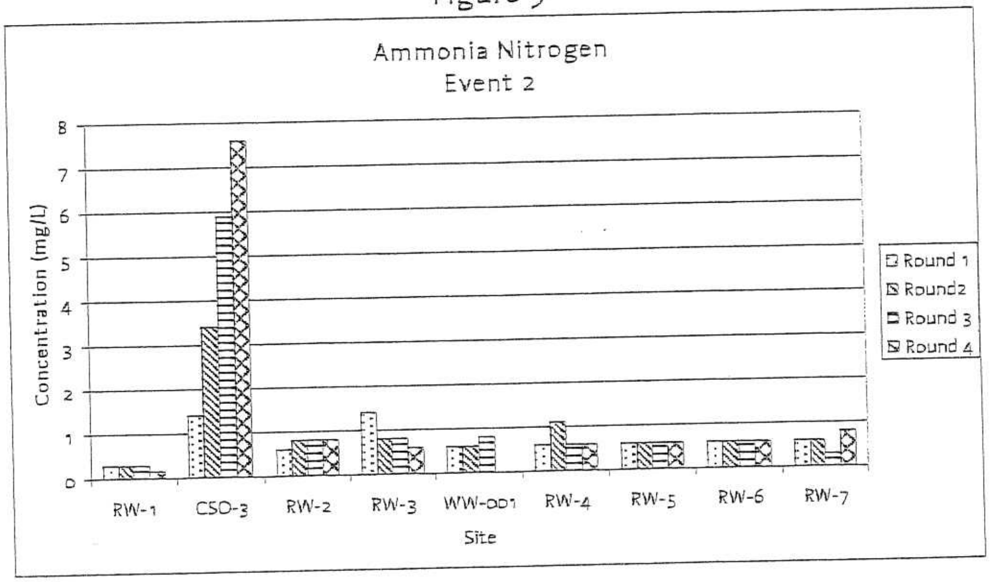
CSO 3 ammonia concentrations averaged 3.2 mg/L NH3-N. Event 2 CSO 3 concentrations were higher than the Event 1 sample (Figures 8 and 9). Ammonia concentrations at receiving water sites averaged 0.5 mg/L and were well below applicable Missouri water quality criteria.[2] Upstream Middle Fork (RW-6) concentrations were comparable to downstream (RW-7). Treatment plant effluent samples averaged 0.4 mg/L.

Figure 8



[2] Acute ammonia criteria for warm-water fisheries is 12.1 mg/L NH3-N at pH 7.8 (10 CSR 20-7, Table B1). Chronic ammonia criteria for early life stages present, pH 7.8 and temperature 26° C is 1.5 mg/L NH3-N (10 CSR 20-7, Table B3). Acute criteria apply to Sewer Creek, Brush Creek and Middle Fork. Acute and chronic criteria apply to Middle Fork.

Figure 9



4) Nitrate Nitrogen

Nitrate nitrogen concentrations were below 2 mg/L for all sites upstream of the treatment plant outfall (Figures 10 and 11). The treatment plant effluent was highly nitrified averaging 7.5 mg/L NO3-N for both Events. Nitrate concentrations downstream of the treatment plant outfall were elevated as expected. Downstream Middle Fork (RW-7) nitrate concentrations for both Events 1 and 2 were higher than Brush Creek samples (RW-5) and upstream Middle Fork samples (RW-6). This may likely be attributed to nitrate in wastewater treatment plant effluent from the Northeast Missouri Grain, LLC (NEMO) ethanol plant (Figure 1) permitted under Missouri State Operating Permit MO-0124575. Future monitoring should consider the merits of relocating the RW-7 site upstream of the ethanol plant receiving tributary. When sites were originally selected, MEC and MMU staff could not identify readily accessible alternative Middle Fork sites between the Brush Creek confluence and the ethanol plant receiving tributary. Depending on the sensitivity of future monitoring, MMU staff should further investigate potential alternative sites. These sites would be located on private property with neither all-weather roads nor bridge crossings and would require sampling from the stream bank.

Figure 10

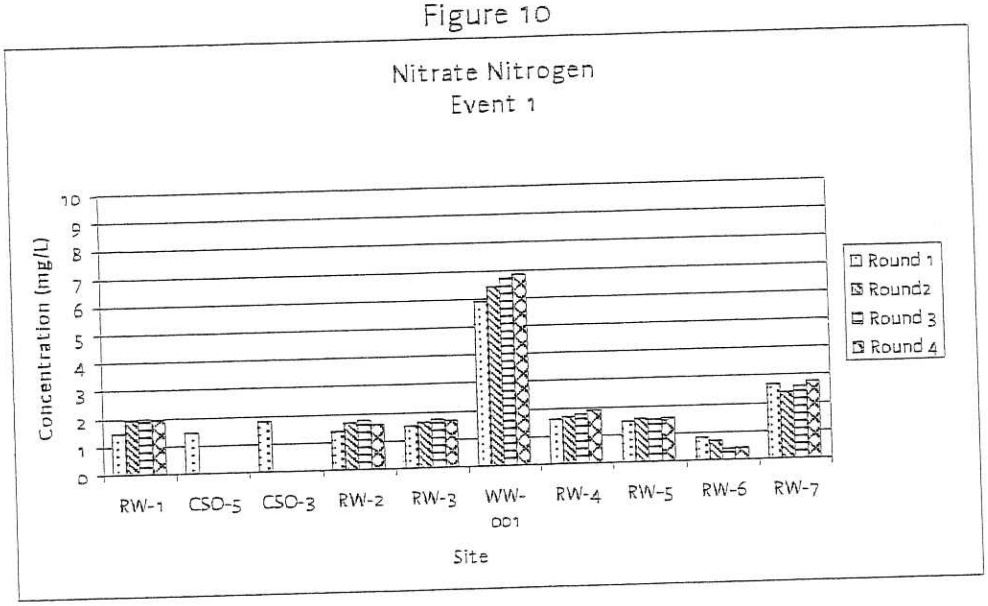
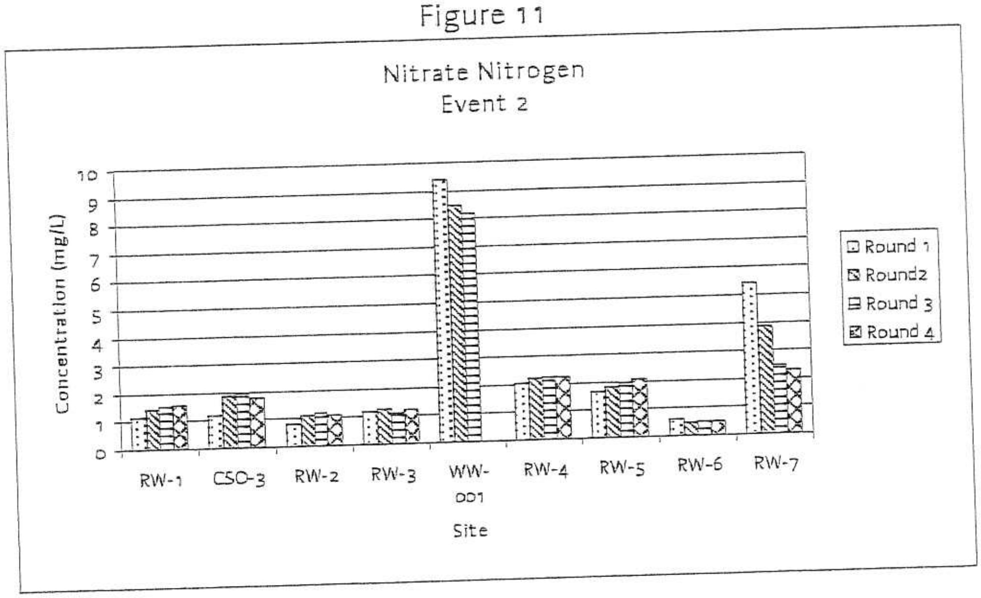


Figure 11



5) Total Phosphorus

For both Events, phosphorous concentrations were highest in plant effluent samples (Figures 12 and 13). CSO 3 phosphorus concentrations were higher in Event 2 and appeared to have a greater contribution to higher downstream phosphorus concentrations. As with nitrate (Section 4), phosphorus concentrations were higher in RW-7 samples than in RW-5 and RW-6 samples indicating potential contributions from the NEMO ethanol plant discharge.

Figure 12

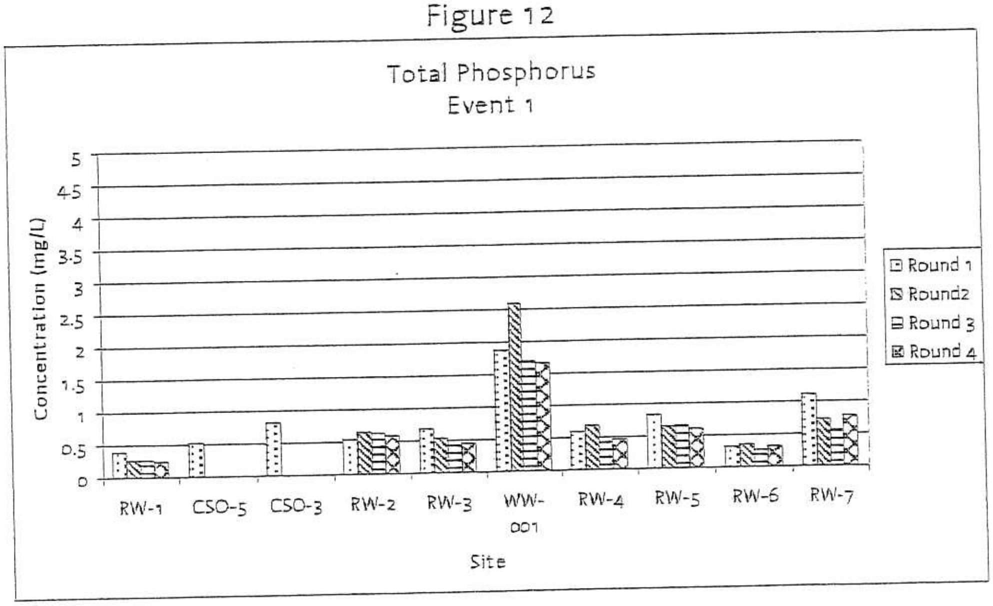
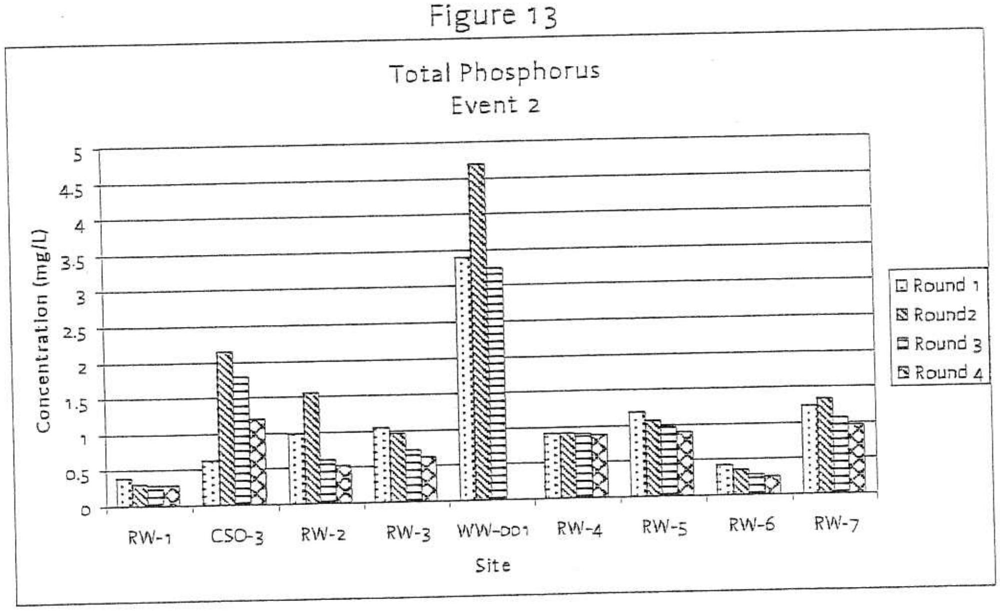


Figure 13

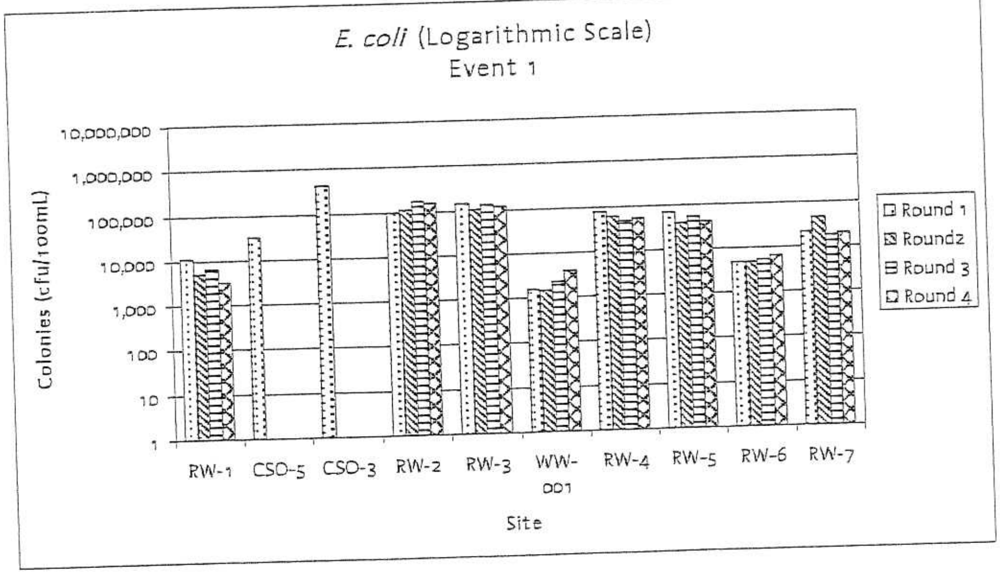


6) *Escherichia coli* – (*E. coli*)

CSO *E. coli* concentrations (Figures 14 and 15) ranged from 32,600 cfu/100 mL (CSO 5, Event 1) to 5,000,000 cfu/100 mL (CSO 3, Event 2). Receiving water sites ranged from 3,260 cfu/100 mL a (RW-1, Event 1) to 173,000 cfu/100 mL (RW-2, Event 2). The treatment plant effluent exhibited the lowest *E. coli* concentrations ranging from 1,580 cfu/100 mL (Event 1) to 26,000 cfu/100 mL (Event 2). Event 2 *E. coli* concentrations were generally higher than Event 1 for all sites.

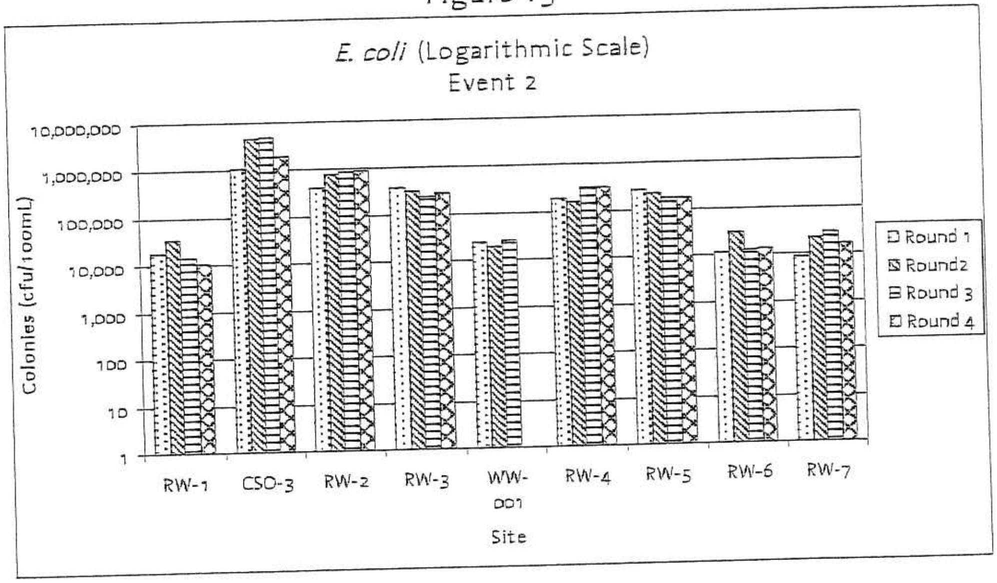
The Middle Fork near Macon is designated for Category B Whole Body Contact Recreation (Carnahan 2005). Missouri's Category B Whole Body Contact Recreation *E. coli* criterion is a recreational season geometric mean of 548 cfu/100 mL (10 CSR 20-7, Table A).[3] All Middle Fork samples upstream and downstream of CSO influences exceeded 548 cfu/100 mL. However, because the Missouri criterion is based on a recreational season average, the data do not necessarily indicate non-compliance. Middle Fork concentrations upstream of CSO discharges (RW-6) ranged from 4,600 to 11,500 cfu/100 mL. Downstream concentrations (RW-7) ranged from 8,700 to 43,500 cfu/100 mL. The increase in Middle Fork E. Coli concentrations was only observed during Event 1. Event 2 downstream concentrations were very similar to upstream.

Figure 14



[3] Recreational season is April 1 to October 31 (10 CSR 20-7, Table A).

Figure 15



B. Baseflow Monitoring

Baseflow data graphs (Figures 16 through 22) provide parameter concentrations for both baseflow runs. Average concentrations for wet-weather events were added to provide a comparison between baseflow and wet-weather event concentrations.

Baseflow BOD5 concentrations were generally below 4 mg/L (Figure 16). Baseflow DO concentrations (Figure 17) varied from 3.8 mg/L (RW-3, Run 2) to 11.8 mg/L (WWTP-Run 2). The variations are attributed to sunlight and algal photosynthesis influences because measurements were taken at mid-morning (Run 1) and mid-afternoon (Run 2). Two measurements on Sewer Creek were below the 5.0 mg/L criteria. DO concentrations below 5 mg/L are common in Missouri streams (Smale, M. A. and C. F. Rabeni, 1995) and do not necessarily indicate impairment by a pollutant.

Figure 16

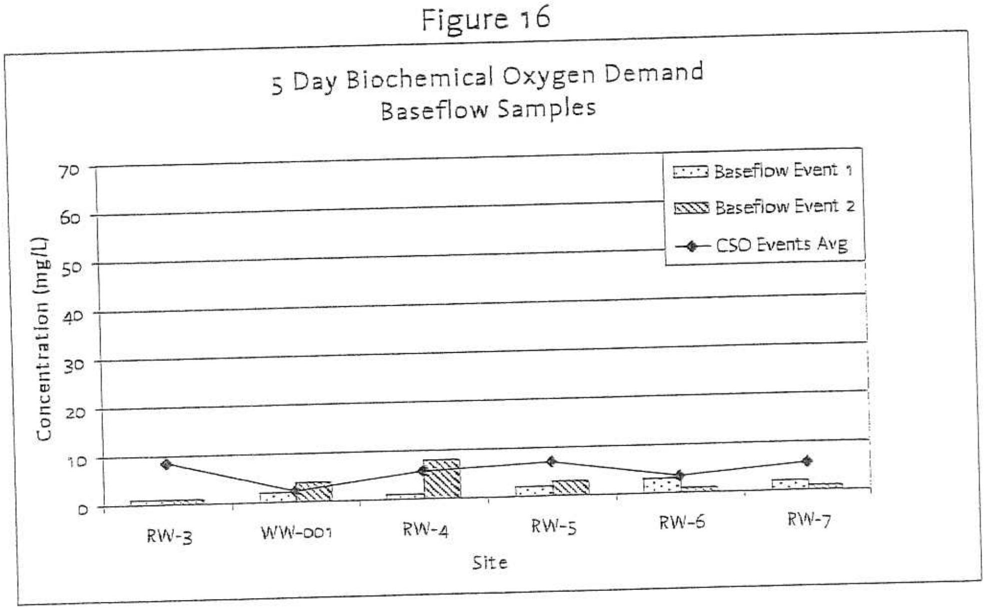
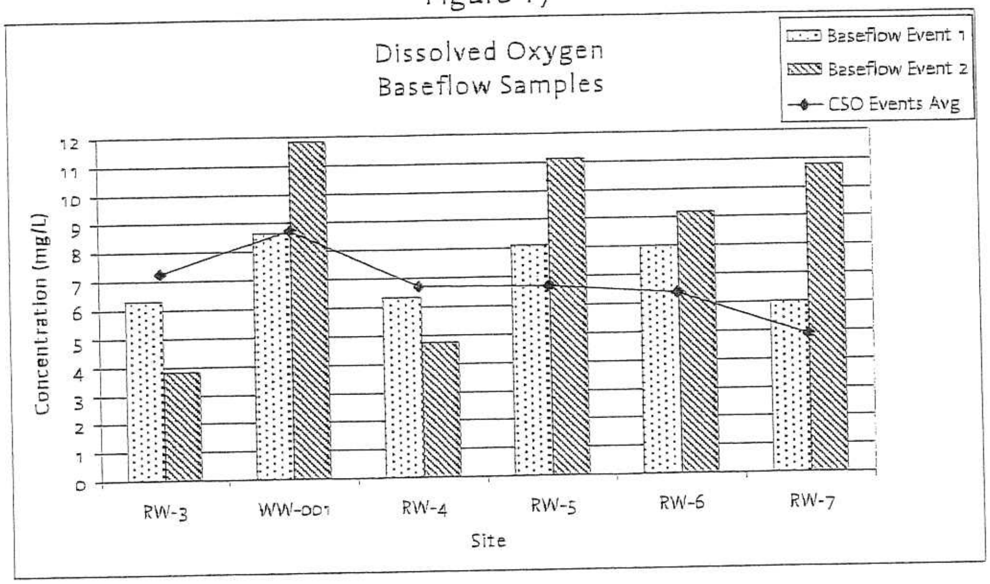
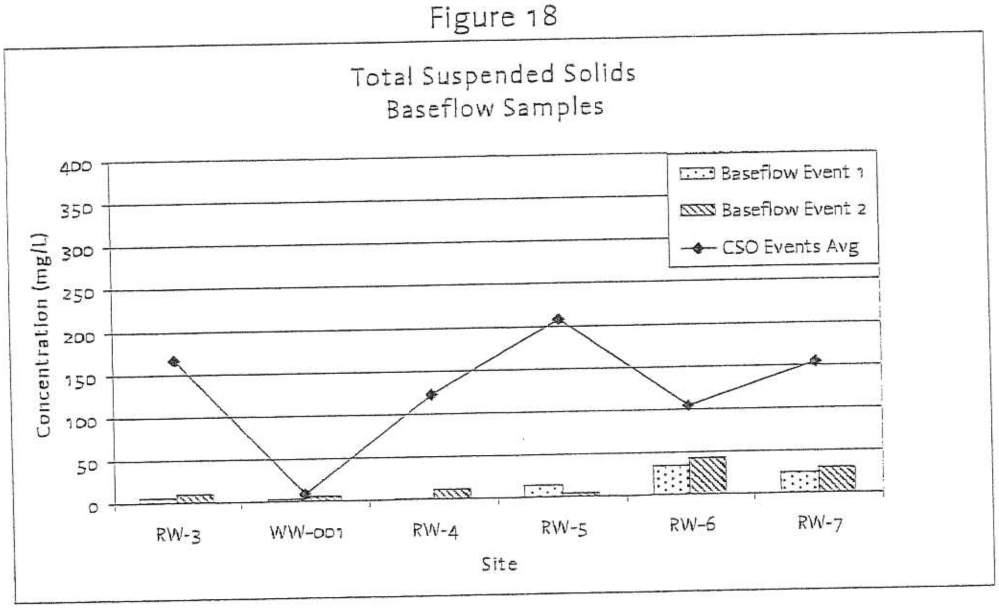


Figure 17



Baseflow TSS concentrations were lower than Event concentrations (Figure 18). Upstream Middle Fork had the highest TSS, averaging 39 mg/L.

Figure 18



Baseflow ammonia nitrogen concentrations were generally at or below the method detection limit of 0.3 mg/L NH3-N (Figure 19) and did not exceed Missouri ammonia criteria. Baseflow nitrate concentrations (Figure 20) were low for sites upstream of the wastewater treatment plant (RW-3 and RW-6). Nitrate-nitrogen concentrations for RW-4 and RW-5 Run 1 samples were higher than treatment plant effluent samples. The treatment plant is the only known source of nitrate upstream of RW-4 and RW-5. Therefore, the higher downstream nitrate concentrations were attributed either to elevated treatment plant nitrate that occurred earlier in the day or to analytical error. Wet-weather nitrate concentrations were generally lower than baseflow due to stormwater dilution.

Figure 19

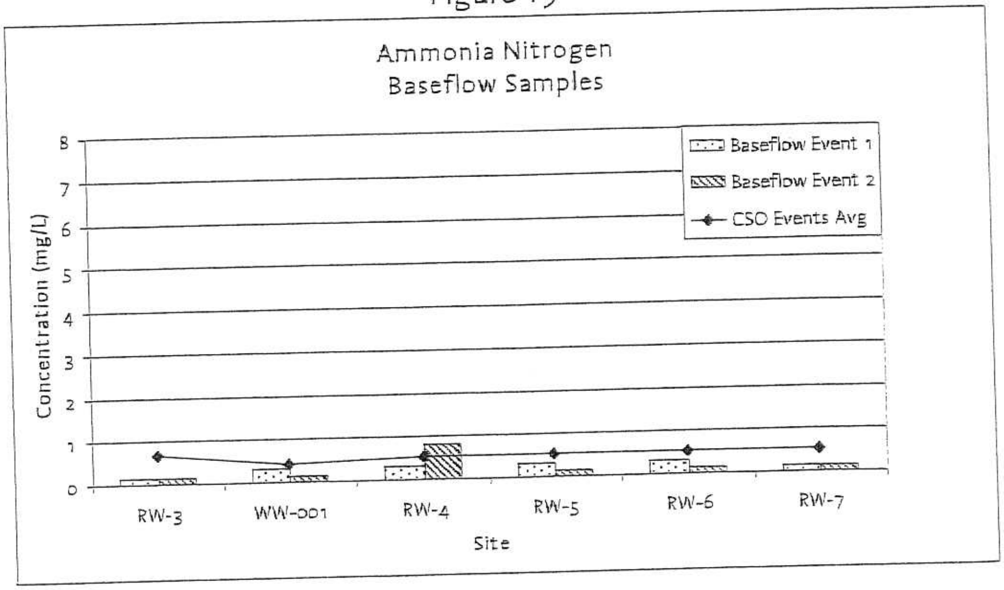
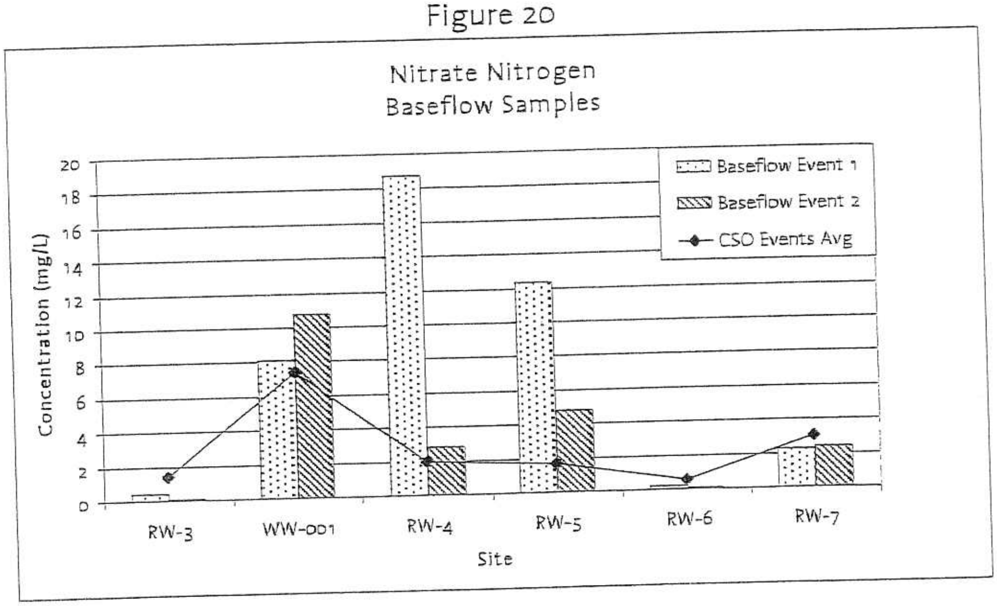
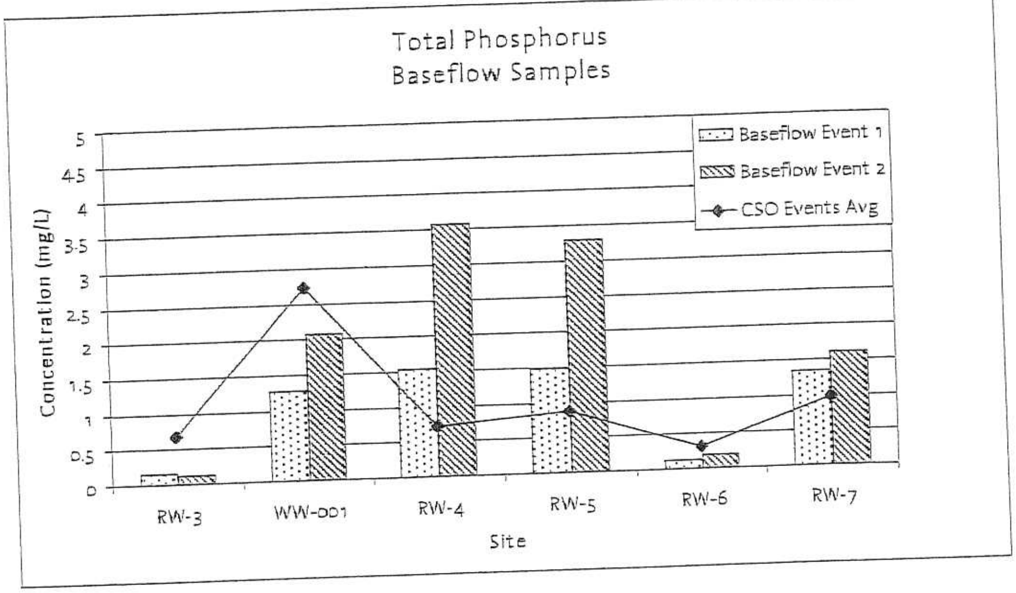


Figure 20



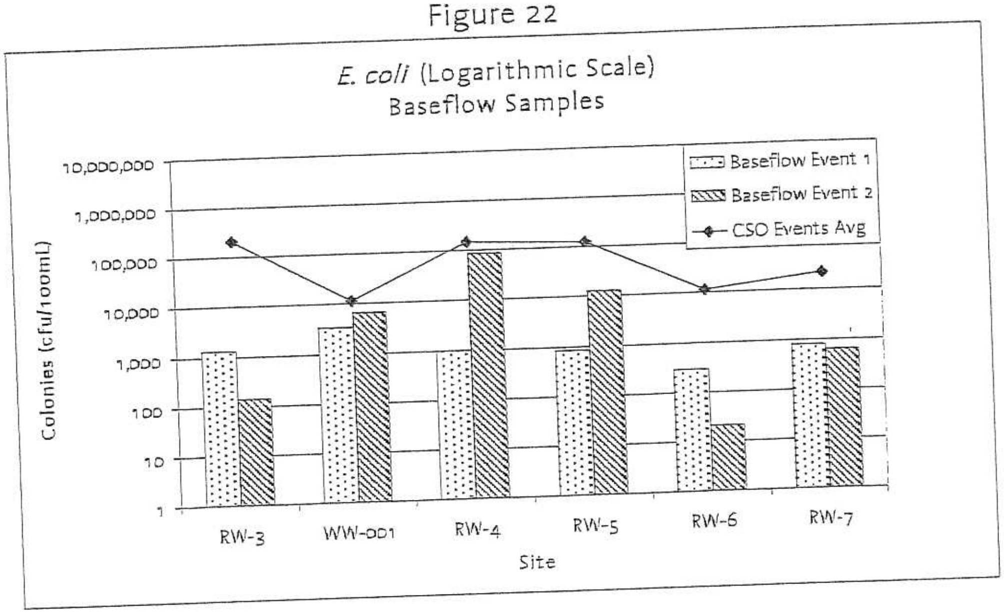
As with nitrate, baseflow total phosphorus concentrations were low in upstream samples and higher downstream of the treatment plant (Figure 21). Total phosphorus concentrations for RW-4 and RW-5 Run 2 samples were higher than treatment plant effluent samples likely due either to higher treatment plant concentrations earlier in the day or analytical error.

Figure 21



E. coli concentrations were lower in baseflow samples compared to wet-weather Events (Figure 22). Baseflow concentrations upstream of the treatment plant (RW-3 and RW-6) were lower than downstream sites. Upstream Middle Fork *E. coli* samples (RW-6) averaged 74 cfu/100 mL[4] and were both below the Category B Whole Body Contact Recreation criterion of 548 cfu/100 mL. Downstream Middle Fork Samples (RW-7) averaged 691 cfu/100 mL with both samples just above the Category B criterion.

Figure 22



[4] Geometric mean

C. Estimating Discharge Reduction Due to Phase 1 CSO Abatement Project

CSO 3 BOD5 concentrations and flow rates measured during Event 2 were used to predict the reduction in pollutant loading that would result from the Phase 1 CSO Abatement Project (Section I., Introduction). Event 2 was selected because samples collected during the event were more representative of the entire CSO event compared to Event 1.

Estimations of total BOD5 discharged during each event were compared to projected BOD5 discharges under three scenarios:

1) ConAgra discharging at the maximum daily permit limit (4,400 lbs/day BOD5 and 0.4 MGD)
2) ConAgra discharging at the 90^{th} percentile of 2005 loading rates (2,300 lbs/day and 0.26 MGD)
3) ConAgra discharging at the average 2005 loading rate (1,800 lbs/day and 0.22 MGD)

Estimated BOD5 discharge reductions for Event 2 ranged from 148 lbs per event (25% reduction) under average ConAgra loading rates to 433 lbs per event (49% reduction) under maximum ConAgra loading rates (Table 6).

Table 6

Estimated Reduction in CSO 3 BOD Discharge with Phase 1 CSO Abatement Project – Event 2

Estimated BOD5 Discharged from CSO 3 During Event 2 (no ConAgra Discharge)	Scenario 1 (Estimated BOD5 Abatement Assuming ConAgra Discharged at Maximum Daily Permit Loading During Event 2)		Scenario 2 (Estimated BOD5 CSO Abatement Assuming ConAgra Discharged at 90th Percentile of 2005 Loading During Event 2)		Scenario 3 (Estimated BOD5 CSO Abatement Assuming ConAgra Discharged at Average 2005 Loading During Event 2)	
lbs/event	lbs/event abated	% Reduction	lbs/event abated	% Reduction	lbs/event abated	% Reduction
443	433	49%	204	32%	148	25%

IV. FUTURE MONITORING RECOMMENDATIONS

The 2006 CSO monitoring project extended MMU's understanding of CSO and receiving water characteristics during both wet-weather and baseflow conditions. The project also enabled an evaluation of the improvement gained by the Phase 1 CSO abatement project.

Additional CSO monitoring is planned for 2007. Recommendations and improvements for future monitoring are as follows:

1. Begin wet-weather event sample collection earlier in the events to better characterize water quality during the entire events. Using automatic samplers will likely be required to reduce sampling response time for CSO's 3 and 5 as well as RW-1 and RW-2.

2. Relocate RW-7 to an alternative location upstream of the NEMO discharge receiving tributary. If a favorable alternative site cannot be identified, the NEMO discharges should be monitored to confirm contributions to RW-7.

3. Collect sufficient hydraulic and water quality data at CSO and receiving water sites to support a water quality model that can be used to assess compliance with water quality criteria. Sufficiently accurate rating curves for receiving water sites would need to be developed for a model. Additional DO monitoring would also be needed, potentially deploying continuous DO meters at RW-6 and RW-7.

V. REFERENCES

Carnahan, 2005. Code of State Regulations; Missouri Water Quality Standards, Title 10, Division 20, Chapter 7.

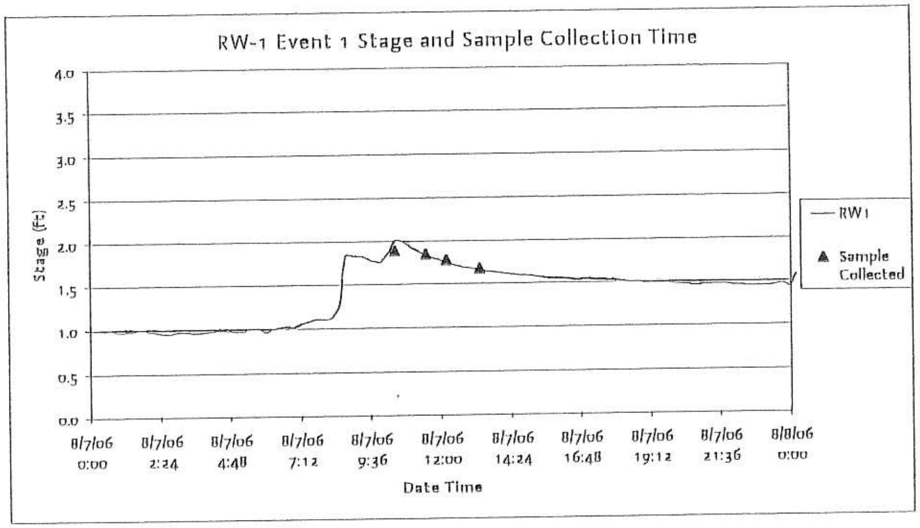
MEC Water Resources, Inc., 2006. Sampling and Analysis Plan - Baseline Combined Sewer Overflow Monitoring.

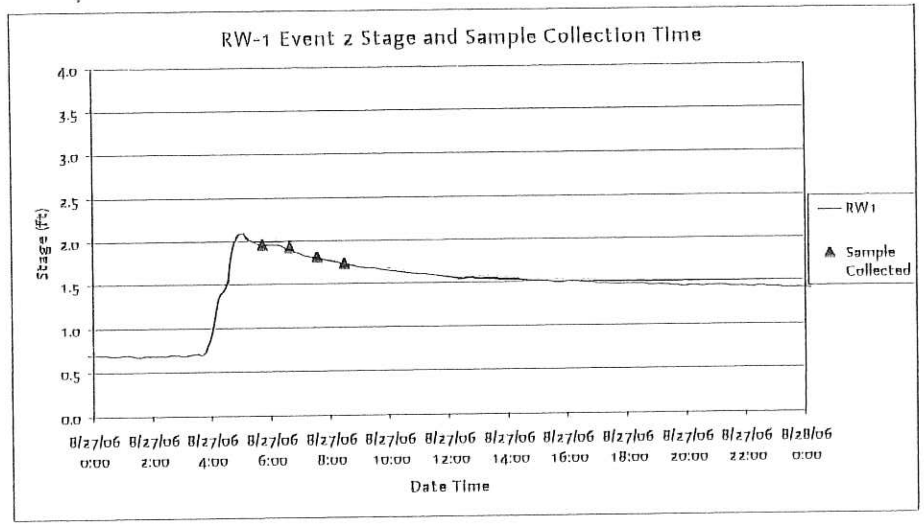
Smale, M. A. and C. F. Rabeni. 1995. Hypoxia and hyperthermia tolerances of headwater stream fishes. Trans. Am. Fish. Soc. 124: 698-710.

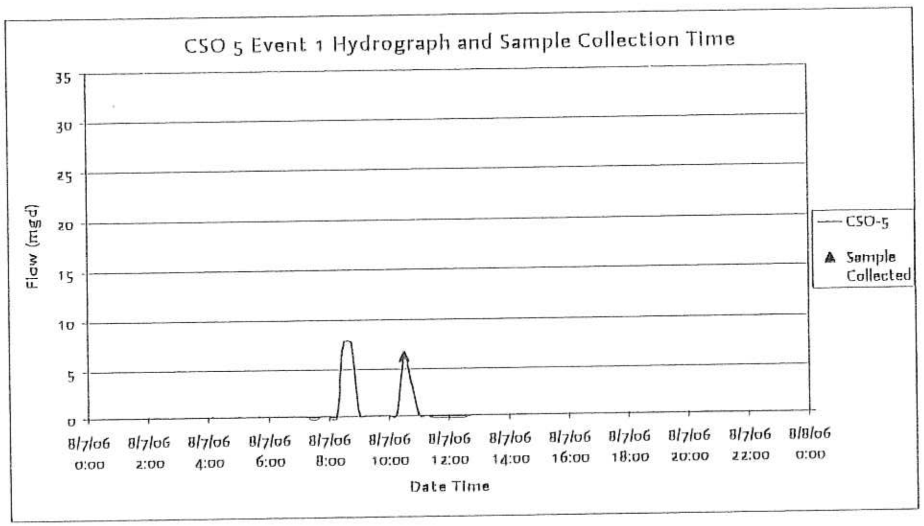
Region 7 EPA, 2006. Middle Fork Salt River, Monroe, Randolph, Shelby, and Macon Counties, Missouri, Total Maximum Daily Load

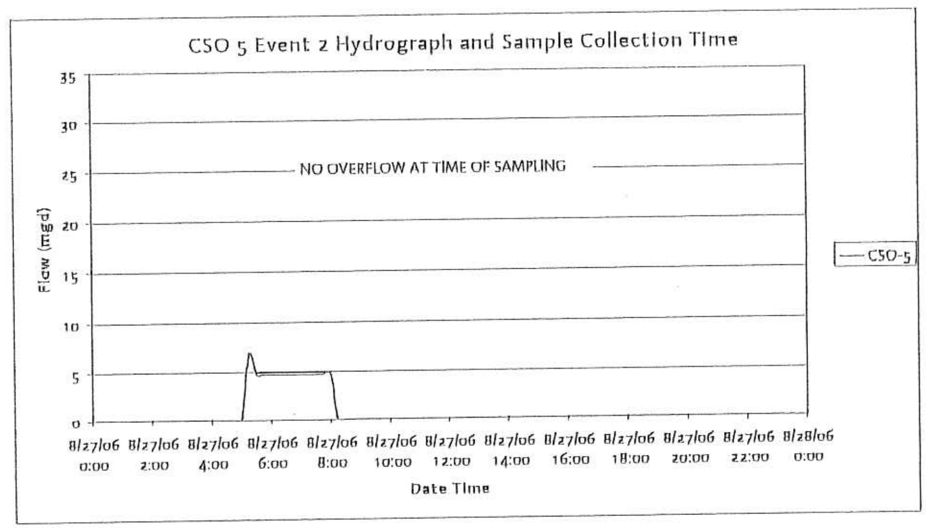
Appendix 1

Stage, Flow and Sample Collection Time Graphs

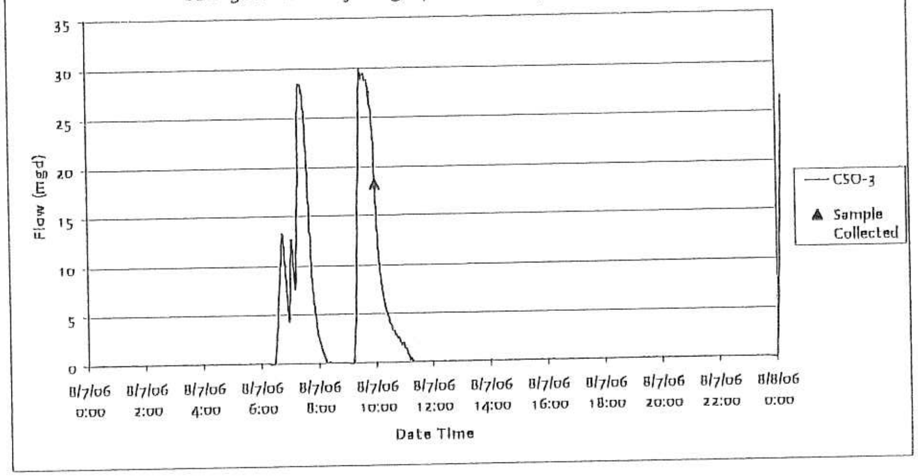

RW-1 Event 1 Stage and Sample Collection Time
Stage (ft)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/7/06 0:00
8/7/06 2:24
8/7/06 4:48
8/7/06 7:12
8/7/06 9:36
8/7/06 12:00
8/7/06 14:24
8/7/06 16:48
8/7/06 19:12
8/7/06 21:36
8/8/06 0:00
Date Time
RW1
Sample Collected


RW-1 Event 2 Stage and Sample Collection Time
Stage (ft)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/27/06 0:00
8/27/06 2:00
8/27/06 4:00
8/27/06 6:00
8/27/06 8:00
8/27/06 10:00
8/27/06 12:00
8/27/06 14:00
8/27/06 16:00
8/27/06 18:00
8/27/06 20:00
8/27/06 22:00
8/28/06 0:00
Date Time
RW1
Sample Collected

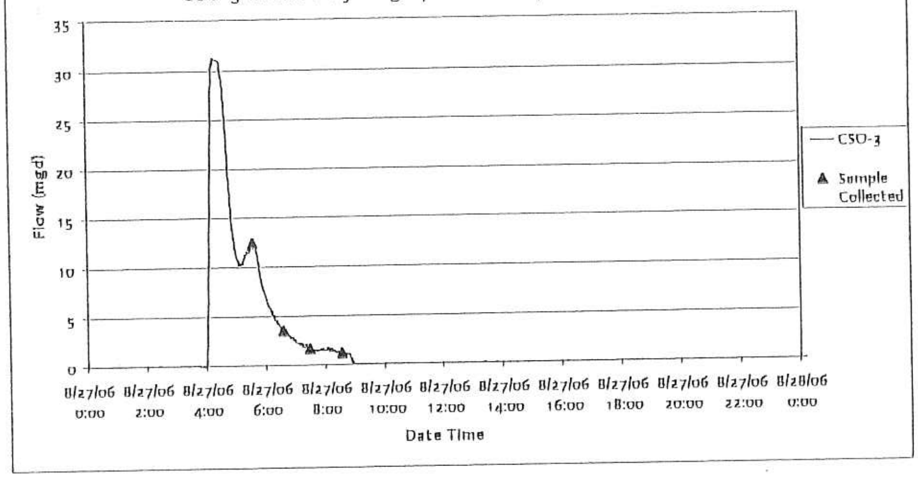

CSO 5 Event 1 Hydrograph and Sample Collection Time
Flow (mgd)
35
30
25
20
15
10
5
0
8/7/06 0:00
8/7/06 2:00
8/7/06 4:00
8/7/06 6:00
8/7/06 8:00
8/7/06 10:00
8/7/06 12:00
8/7/06 14:00
8/7/06 16:00
8/7/06 18:00
8/7/06 20:00
8/7/06 22:00
8/8/06 0:00
Date Time
CSO-5
Sample Collected


CSO 5 Event 2 Hydrograph and Sample Collection Time
NO OVERFLOW AT TIME OF SAMPLING
Flow (mgd)
35
30
25
20
15
10
5
0
8/27/06 0:00
8/27/06 2:00
8/27/06 4:00
8/27/06 6:00
8/27/06 8:00
8/27/06 10:00
8/27/06 12:00
8/27/06 14:00
8/27/06 16:00
8/27/06 18:00
8/27/06 20:00
8/27/06 22:00
8/28/06 0:00
Date Time
CSO-5

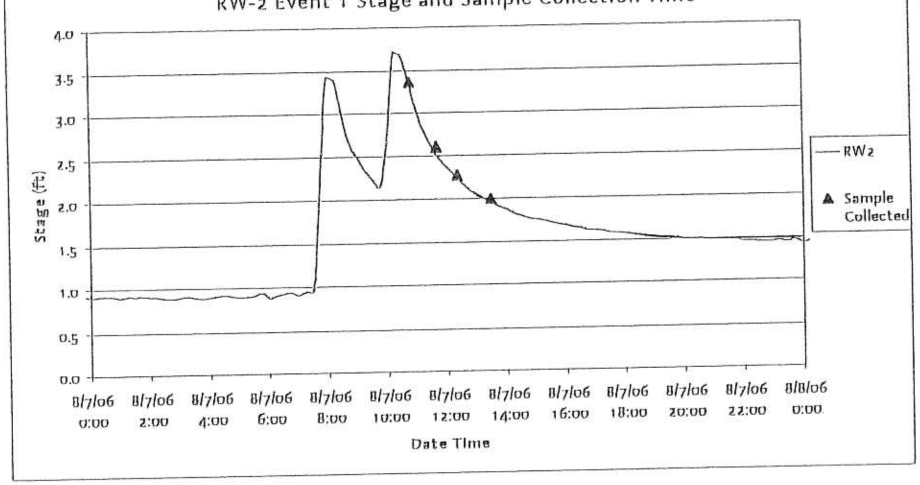
CSO 3 Event 1 Hydrograph and Sample Collection Time



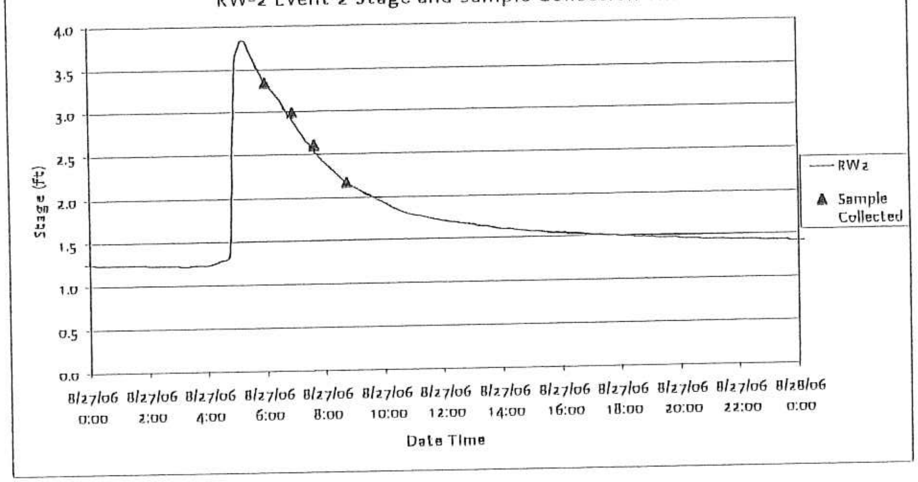
CSO 3 Event 2 Hydrograph and Sample Collection Time

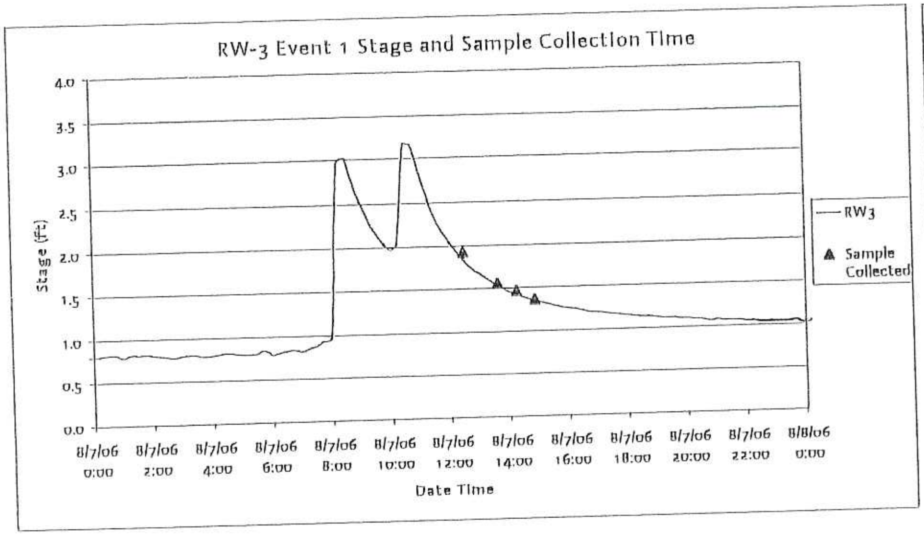


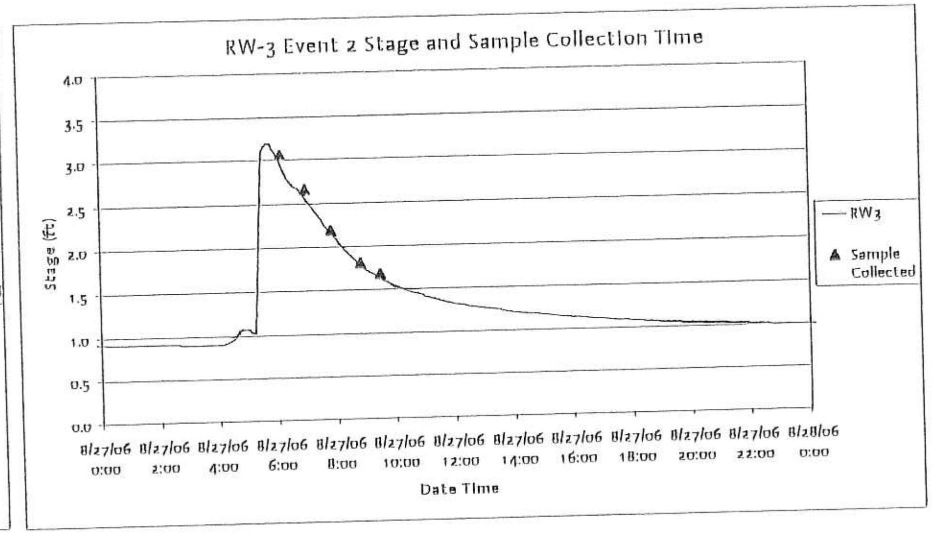
RW-2 Event 1 Stage and Sample Collection Time

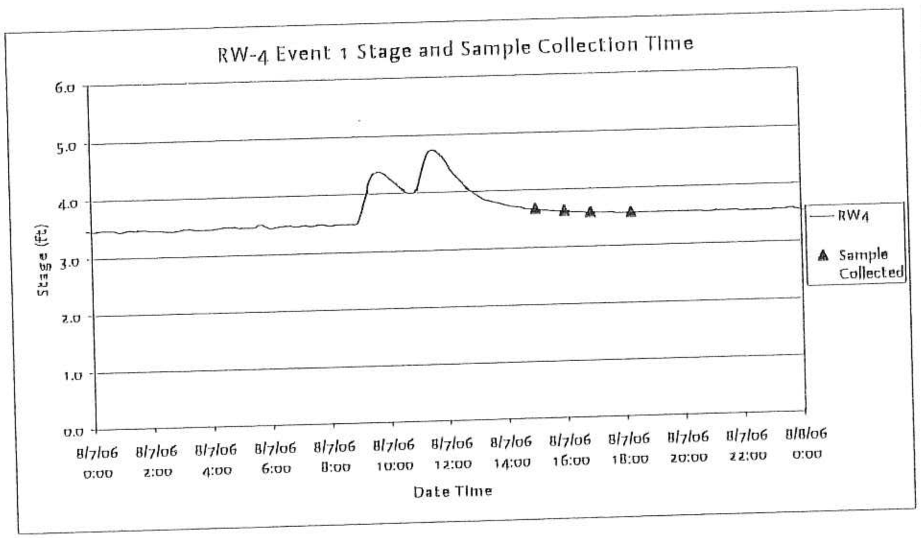


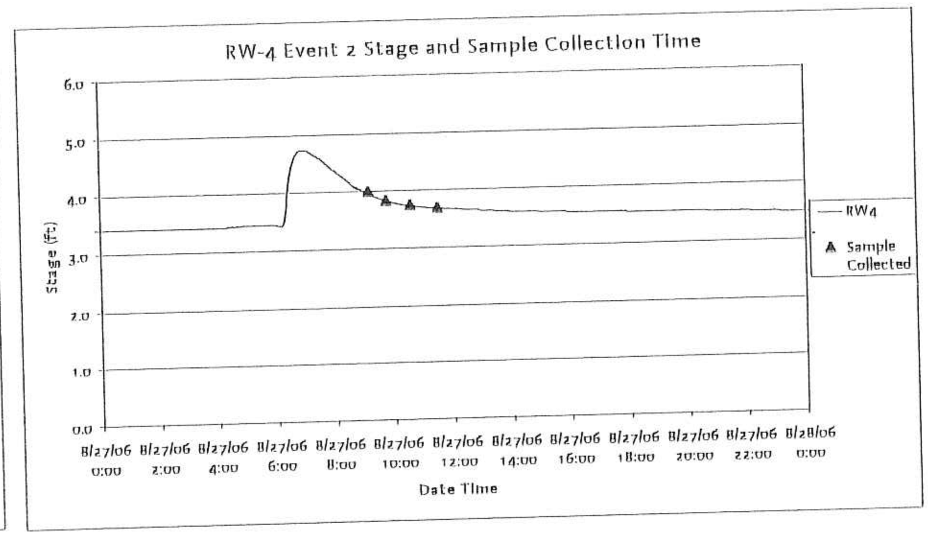
RW-2 Event 2 Stage and Sample Collection Time

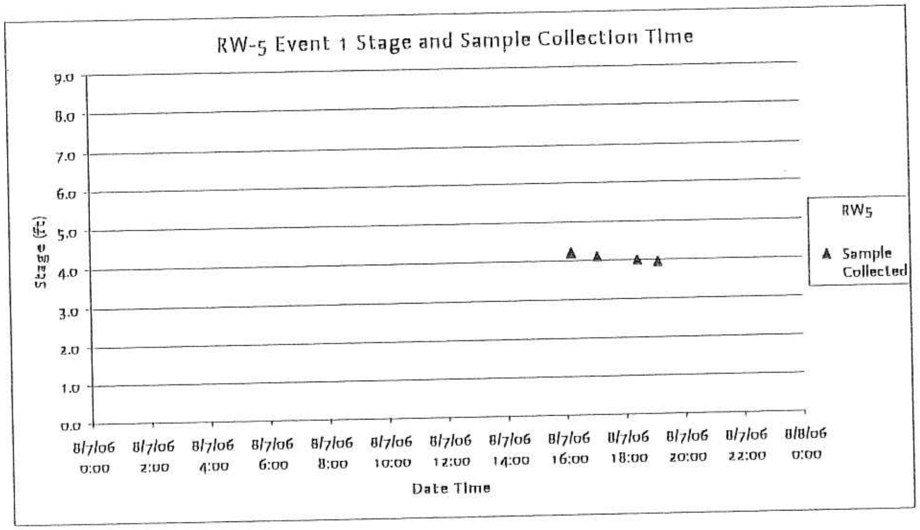


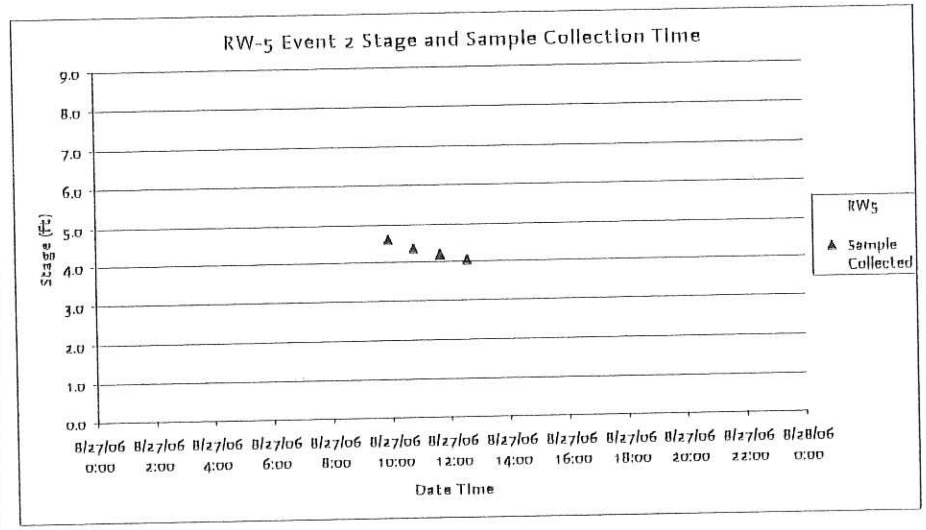

RW-3 Event 1 Stage and Sample Collection Time
Stage (ft)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/7/06 0:00
8/7/06 2:00
8/7/06 4:00
8/7/06 6:00
8/7/06 8:00
8/7/06 10:00
8/7/06 12:00
8/7/06 14:00
8/7/06 16:00
8/7/06 18:00
8/7/06 20:00
8/7/06 22:00
8/8/06 0:00
Date Time
RW3
Sample Collected

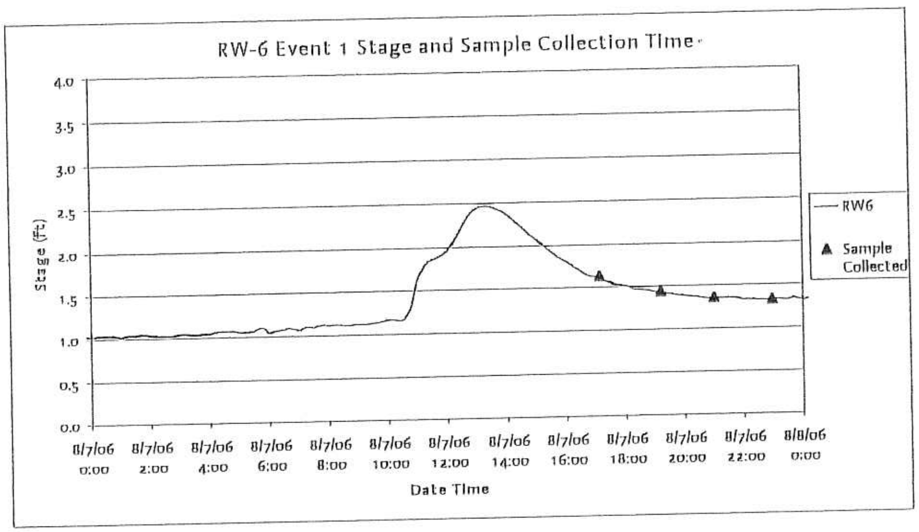

RW-3 Event 2 Stage and Sample Collection Time
Stage (ft)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/27/06 0:00
8/27/06 2:00
8/27/06 4:00
8/27/06 6:00
8/27/06 8:00
8/27/06 10:00
8/27/06 12:00
8/27/06 14:00
8/27/06 16:00
8/27/06 18:00
8/27/06 20:00
8/27/06 22:00
8/28/06 0:00
Date Time
RW3
Sample Collected

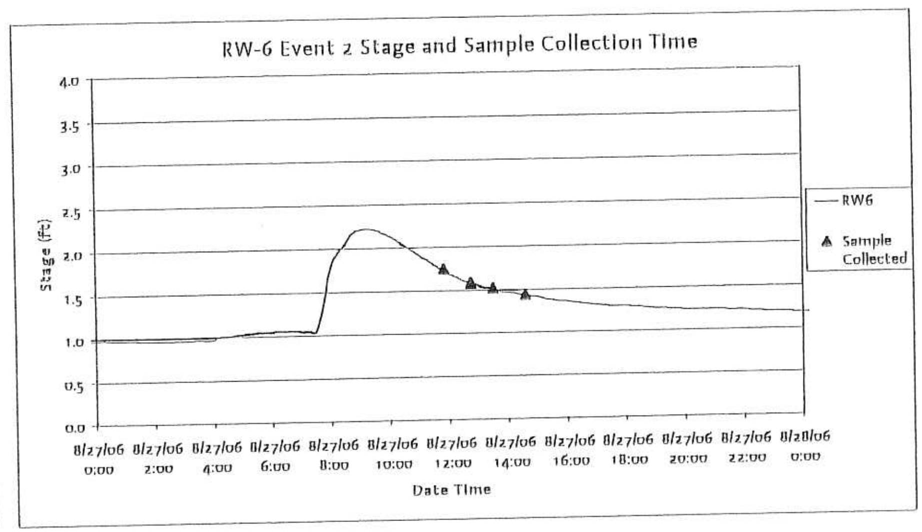

RW-4 Event 1 Stage and Sample Collection Time
Stage (ft)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
8/7/06 0:00
8/7/06 2:00
8/7/06 4:00
8/7/06 6:00
8/7/06 8:00
8/7/06 10:00
8/7/06 12:00
8/7/06 14:00
8/7/06 16:00
8/7/06 18:00
8/7/06 20:00
8/7/06 22:00
8/8/06 0:00
Date Time
RW4
Sample Collected

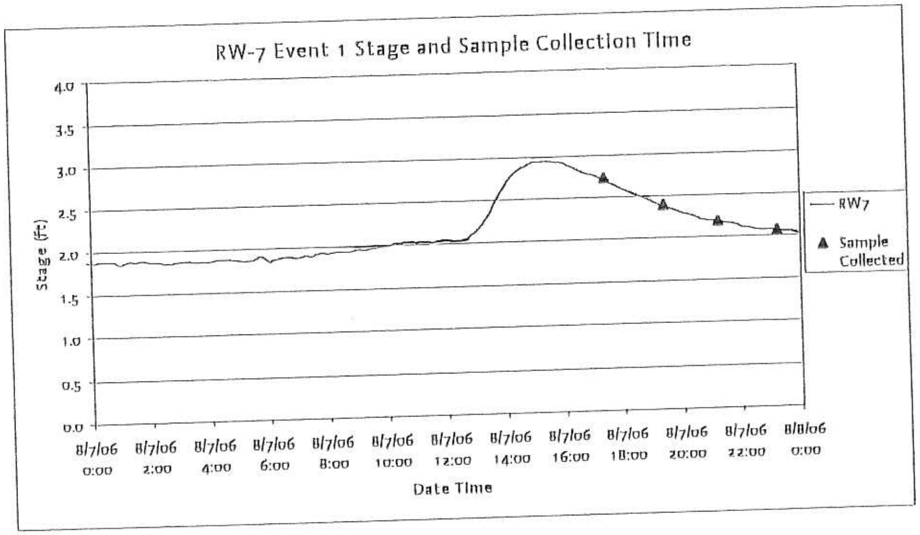

RW-4 Event 2 Stage and Sample Collection Time
Stage (ft)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
8/27/06 0:00
8/27/06 2:00
8/27/06 4:00
8/27/06 6:00
8/27/06 8:00
8/27/06 10:00
8/27/06 12:00
8/27/06 14:00
8/27/06 16:00
8/27/06 18:00
8/27/06 20:00
8/27/06 22:00
8/28/06 0:00
Date Time
RW4
Sample Collected

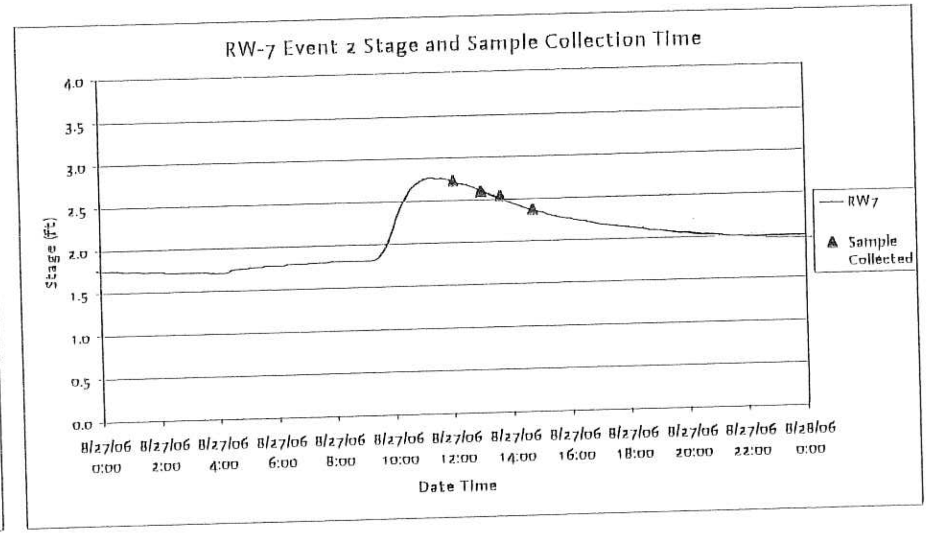

RW-5 Event 1 Stage and Sample Collection Time
Stage (ft)
RW5
Sample Collected
Date Time


RW-5 Event 2 Stage and Sample Collection Time
Stage (ft)
RW5
Sample Collected
Date Time


RW-6 Event 1 Stage and Sample Collection Time
Stage (ft)
RW6
Sample Collected
Date Time


RW-6 Event 2 Stage and Sample Collection Time
Stage (ft)
RW6
Sample Collected
Date Time


RW-7 Event 1 Stage and Sample Collection Time
Stage (ft)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/7/06 0:00
8/7/06 2:00
8/7/06 4:00
8/7/06 6:00
8/7/06 8:00
8/7/06 10:00
8/7/06 12:00
8/7/06 14:00
8/7/06 16:00
8/7/06 18:00
8/7/06 20:00
8/7/06 22:00
8/8/06 0:00
Date Time
RW7
Sample Collected


RW-7 Event 2 Stage and Sample Collection Time
Stage (ft)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/27/06 0:00
8/27/06 2:00
8/27/06 4:00
8/27/06 6:00
8/27/06 8:00
8/27/06 10:00
8/27/06 12:00
8/27/06 14:00
8/27/06 16:00
8/27/06 18:00
8/27/06 20:00
8/27/06 22:00
8/28/06 0:00
Date Time
RW7
Sample Collected

Appendix 2

2006 CSO Event Water Quality Data

Macon CSO Monitoring Event 1 - 8/7/06

Site ID	Sample ID	Sample Collection Date	Sample Collection Time	Sample Description (FB, Dup)	Water Temperature (°C)	Specific Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH (S.U.)	BOD5 (mg/L)	TSS (mg/L)	VSS (mg/L)	Nitrite-N (mg/L	Nitrate (mg/L)	TKN (mg/L)	Ammonia (mg/L)	T-Phos (mg/L	E. coli (cfu)	Remarks
RW-1	60010	8/7/06	10:25	Sample	23.9	290.1	5.3	7.8	7	46	6	0.056	1.46	2.2	0.8	0.39	11200	
RW-1	60011	8/7/06	10:25	Dup					7	46	<5	0.051	1.5	1.6	0.6	0.38	9800	
RW-1	60014	8/7/06	10:25	FB					<2	6	<5	<0.010	<0.10	<1	<.3	<.05	<10	
RW-1	60016	8/7/06	11:30	Sample					5	34	5	0.078	1.93	3.4	0.3	0.26	4880	
RW-1	60018	8/7/06	12:13	Sample					4	29	<5	0.059	1.91	2.2	0.3	0.26	6490	
RW-1	60022	8/7/06	13:20	Sample					3	31	<5	0.057	1.93	3.4	<.3	0.25	3260	
CSO-5	60012	8/7/06	10:30	Sample	24.2	288.2	5.73	8	9	52	7	0.048	1.46	1.1	0.8	0.52	32600	
CSO-3	60008	8/7/06	10:00	Sample	23.9	209.6	6.7	8.3	14	79	13	0.102	1.82	3.4	1.7	0.82	435000	
CSO-3	60009	8/7/06	10:00	Dup					14	100	14	0.066	1.72	3.4	1.6	0.78	291000	
CSO-3	60015	8/7/06	10:00	FB					<2	3	<5	<.010	<.10	1.1	<03	<.05	<10	
RW-2	60013	8/7/06	10:47	Sample	23.8	168	6.4	8.2	10	151	14	0.04	1.38	2.2	0.6	0.54	98000	
RW-2	60017	8/7/06	11:41	Sample					10	125	26	0.057	1.68	4.5	0.6	0.65	112000	
RW-2	60019	8/7/06	12:22	Sample					10	104	14	0.068	1.77	3.4	0.7	0.63	173000	
RW-2	60023	8/7/06	13:28	Sample					9	68	8	0.069	1.6	3.4	0.6	0.6	154000	
RW-3	60020	8/7/06	12:28	Sample	24.3	198.7	6.27	8.1	9	198	24	0.055	1.52	2.2	0.6	0.69	144000	
RW-3	60024	8/7/06	13:37	Sample					9	152	14	0.065	1.65	4.5	0.6	0.54	105000	
RW-3	60026	8/7/06	14:14	Sample					7	107	16	0.066	1.74	2.2	0.3	0.42	130000	
RW-3	60027	8/7/06	14:14	Dup					9	126	20	0.073	1.67	2.2	0.6	0.55	120000	
RW-3	60029	8/7/06	14:52	Sample					8	96	12	0.073	1.69	2.2	0.3	0.44	120000	
WW-001	60021	8/7/06	12:35	Sample	25.9	595	7.85	8.2	<2	11	<5	<.010	5.89	3.4	<.3	1.87	1580	
WW-001	60025	8/7/06	13:42	Sample					3	10	<5	<.010	6.41	2.2	<.3	2.6	1440	
WW-001	60028	8/7/06	14:17	Sample					2	10	<5	<.010	6.72	3.4	0.3	1.71	2240	
WW-001	60030	8/7/06	14:55	Sample					2	9	5	<.010	6.87	3.4	0.3	1.66	4030	
RW-4	60031	8/7/06	15:00	Sample	24.9	224.8	5.7	7.9	6	160	16	0.048	1.58	2.2	0.3	0.59	77000	
RW-4	60032	8/7/06	16:00	Sample					6	116	12	0.049	1.68	2.2	0.3	0.68	58000	
RW-4	60033	8/7/06	16:00	Dup					6	146	20	0.049	1.7	2.8	0.3	0.64	77000	
RW-4	60035	8/7/06	16:52	Sample					3	100	12	0.052	1.76	2.2	<.3	0.42	46000	
RW-4	60039	8/7/06	18:15	Sample					4	96	8	0.049	1.88	2.2	0.6	0.47	51700	
RW-5	60034	8/7/06	16:11	Sample	26	252.8	5.06	7.8	9	222	24	0.06	1.47	4.5	0.3	0.83	69000	
RW-5	60036	8/7/06	17:04	Sample					7	219	25	0.058	1.56	2.2	0.4	0.65	38700	
RW-5	60040	8/7/06	18:26	Sample					6	138	18	0.05	1.53	2.2	0.6	0.66	51700	
RW-5	60041	8/7/06	19:06	Sample					5	142	26	0.022	1.54	3.4	0.6	0.62	41000	
RW-6	60037	8/7/06	17:10	Sample	26.3	407.1	5.29	8	3	74	22	0.024	0.83	3.4	0.3	0.31	4610	
RW-6	60042	8/7/06	19:14	Sample					3	56	10	0.022	0.68	3.2	0.3	0.36	4610	
RW-6	60044	8/7/06	21:01	Sample					3	86	12	0.018	0.4	1.6	0.6	0.26	5480	
RW-6	60046	8/7/06	23:00	Sample					4	119	17	0.021	0.44	2.2	0.6	0.31	6490	
RW-7	60038	8/7/06	17:24	Sample	25.9	345.5	3.74	7.7	5	230	38	0.07	2.68	3.4	0.3	1.11	21400	
RW-7	60043	8/7/06	19:24	Sample					7	180	18	0.069	2.36	2.8	0.6	0.73	43500	
RW-7	60045	8/7/06	21:15	Sample					5	134	18	0.072	2.59	1.1	0.6	0.56	17300	
RW-7	60047	8/7/06	23:15	Sample					5	124	16	0.072	2.75	2.2	0.4	0.78	19900	
RW-7	60048	8/7/06	23:15	Dup					5	120	16	0.074	2.74	1.1	0.6	0.85	13000	
RW-7	60049	8/7/06	23:15	FB					<2	4	<5	<.010	<.10	<1	0.3	<.05	<10	

Macon CSO Monitoring Event 2 - 8/27/06

Site ID	Sample ID	Sample Collection Date	Sample Collection Time	Sample Description (FB, Dup)	Water Temperature (°C)	Specific Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH (S.U.)	BOD5 (mg/L)	TSS (mg/L)	VSS (mg/L)	Nitrite-N (mg/L	Nitrate (mg/L)	TKN (mg/L)	Ammonia (mg/L)	T-Phos (mg/L	E. coli (cfu)	Remarks
RW-1	60058	8/27/06	5:45	Sample	22.8	173.8	8.55	8	4	80	24	0.017	1.14	1.7	0.3	0.39	18600	
RW-1	60063	8/27/06	6:40	Sample					4	38	14	0.019	1.43	1.1	0.3	0.31	33900	
RW-1	60069	8/27/06	7:35	Sample					4	32	<5	0.02	1.52	1.1	0.3	0.28	14200	
RW-1	60073	8/27/06	8:30	Sample					3	24	<5	0.021	1.57	1.1	<.3	0.29	11000	
CSO-5	60066	8/27/06	5:50	FB					<2	<1	<5	<.010	<.10	<1	0.3	<.05	<10	
CSO-3	60056	8/27/06	5:35	Sample	23.6	213.6	8.85	8.1	10	42	20	0.028	1.19	2.2	1.4	0.63	1,100,000	
CSO-3	60057	8/27/06	5:35	Dup					16	112	48	0.032	1.22	2.2	1.7	0.54	731000	
CSO-3	60062	8/27/06	6:35	Sample					60	168	104	0.504	1.86	7.8	3.4	2.15	4,800,000	
CSO-3	60068	8/27/06	7:30	Sample					32	116	44	0.502	1.94	9.5	5.9	1.79	5,000,000	
CSO-3	60074	8/27/06	8:35	Sample					17	116	58	0.095	1.79	12.3	7.6	1.2	2,000,000	
RW-2	60060	8/27/06	6:00	Sample	23	193.4	7.84	8	12	352	56	0.036	0.82	2.2	0.6	0.98	397000	
RW-2	60059	8/27/06	6:00	Dup					13	360	82	0.037	1.11	2.2	1.1	1.07	397000	
RW-2	60064	8/27/06	6:55	Sample					9	160	60	0.035	1.11	1.1	0.8	1.55	775000	
RW-2	60070	8/27/06	7:40	Sample					7	96	21	0.04	1.19	2.2	0.8	0.6	870000	
RW-2	60075	8/27/06	8:45	Sample					8	56	<5	0.043	1.12	3.4	0.8	0.53	922000	
RW-3	60061	8/27/06	6:10	Sample	23.1	160.8	8.21	8.2	12	332	48	0.028	1.19	3.4	1.4	1.04	384000	
RW-3	60065	8/27/06	7:00	Sample					11	258	42	0.043	1.28	2.2	0.8	0.96	311000	
RW-3	60067	8/27/06	7:00	FB					<2	<1	<5	<.010	<.1	1.1	0.3	<.05	<10	
RW-3	60071	8/27/06	7:50	Sample					7	116	<5	0.041	1.1	3.4	0.8	0.73	241000	
RW-3	60076	8/27/06	8:50	Sample					6	76	6	0.047	1.25	3.4	0.6	0.63	283000	
RW-3	60079	8/27/06	9:30	Sample					6	108	<5	0.048	1.26	2.2	0.6	0.61	397000	
WW-001	60072	8/27/06	8:00	Sample	25.3	693	9.63	8.2	3	7	<5	0.017	9.4	1.1	0.6	3.4	25000	
WW-001	60078	8/27/06	8:55	Sample					3	3	<5	0.016	8.47	2.2	0.6	4.7	19200	
WW-001	60080	8/27/06	9:35	Sample					2	7	<5	0.016	8.19	2.2	0.8	3.24	26000	
RW-4	60077	8/27/06	9:10	Sample	23.2	244.2	7.71	8.1	7	188	12	0.037	2.05	3.4	0.6	0.92	184000	
RW-4	60081	8/27/06	9:45	Sample					8	164	16	0.043	2.19	3.4	1.1	0.91	154000	
RW-4	60083	8/27/06	10:35	Sample					7	96	18	0.046	2.25	3.4	0.6	0.89	311000	
RW-4	60086	8/27/06	11:30	Sample					5	64	14	0.045	2.24	3.4	0.6	0.88	311000	
RW-5	60082	8/27/06	9:55	Sample	23.4	226.3	7.25	8	7	356	12	0.035	1.66	3.4	0.6	1.18	260000	
RW-5	60084	8/27/06	10:45	Sample					9	248	36	0.036	1.83	3.4	0.6	1.07	224000	
RW-5	60085	8/27/06	10:45	Dup					8	216	32	0.037	1.82	2.2	0.8	1.06	224000	
RW-5	60087	8/27/06	11:40	Sample					8	188	36	0.039	1.93	3.4	0.6	1	173000	
RW-5	60090	8/27/06	12:35	Sample	24	269.3	7.76	7.7	6	148	32	0.042	2.09	2.2	0.6	0.89	173000	
RW-6	60088	8/27/06	11:50	Sample	23.4	224.5	6.82	7.8	3	108	20	<.010	0.59	3.4	0.6	0.43	11500	
RW-6	60091	8/27/06	12:45	Sample	23.7	211.6	7	7.7	3	148	28	<.010	0.45	2.2	0.6	0.36	31300	
RW-6	60694	8/27/06	13:30	Sample					5	116	16	0.01	0.49	2.2	0.6	0.29	13100	
RW-6	60096	8/27/06	14:35	Sample					5	124	16	0.01	0.5	2.2	0.6	0.25	13500	
RW-6	60097	8/27/06	14:35	Dup					5	130	26	<.010	0.45	2.2	0.3	0.28	10600	
RW-7	60089	8/27/06	12:05	Sample	23.9	628	6.22	7.6	6	108	28	0.058	5.42	2.2	0.6	1.23	8700	
RW-7	60092	8/27/06	13:00	Sample	24	434.5	4.58	7.6	6	166	18	0.058	3.84	3.4	0.6	1.33	21900	
RW-7	60093	8/27/06	13:00	Dup					5	156	20	0.058	3.89	3.4	0.3	1.33	31300	
RW-7	60095	8/27/06	13:40	Sample					6	144	24	0.053	2.46	2.2	0.3	1.06	29200	
RW-7	60098	8/27/06	14:45	Sample					6	140	36	0.052	2.29	3.4	0.8	0.97	15800	
RW-7	60099	8/27/06	14:45	Dup					<2	<1	<5	<.010	<.1	1.1	0.3	<.05	<10	

Appendix 3

2006 Baseflow Water Quality Data

Macon CSO Monitoring Baseflow Sampling Events 1 and 2

Site ID	Sample ID	Sample Volume	Sample Collection Date	Sample Collection Time	Sample Description (FB, Dup)	Water Temperature (°C)	Specific Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH (S.U.)	BOD5 (mg/L)	TSS (mg/L)	VSS (mg/L)	Nitrite-N (mg/L	Nitrate (mg/L)	TKN (mg/L)	Ammonia (mg/L)	T-Phos (mg/L	E. coli (cfu)	Remarks
1st Base flow																			
RW-3	60000	2 L	7/25/06	12:40	sample	24.9	480	6.3	7.8	<2	5	<5	0.026	0.42	<1	<.3	0.15	1300	
RW-4	60001	2 L	7/25/06	13:20	sample	24.7	749	6.35	7.9	<2	2	<5	0.047	18.7	<1	0.3	1.53	980	
RW-5	60002	2 L	7/25/06	13:45	sample	25.2	746	8.1	8.1	2	14	6	0.072	12.3	1.1	0.3	1.48	820	
RW-5	60005	2 L	7/25/06	13:45	Dup					2	17	<5	0.073	18.2	1.1	<.3	1.52	650	
RW-6	60003	2 L	7/25/06	13:55	sample	28.1	166	8.01	7.9	3	34	8	<.010	0.2	1.1	0.3	0.13	280	
RW-7	60004	2 L	7/25/06	14:15	sample	25.5	776	6	7.8	2	24	<5	0.023	2.27	2.2	<.3	1.35	770	
WW-001	60006	2 L	7/25/06	16:10	sample	27.1	874	8.65	8.43	2	3	<5	<.010	8.1	2.2	0.3	1.27	3380	
WW-001	60007	2 L	7/25/06	16:10	Dup					<2	<1	<5	<.010	<.1	1.1	<.3	<.05	<10	
2nd Base flow																			
RW-3	60100	2 L	9/26/2006	9:20	Sample	12.1	215.7	3.8	7.2	<2	10	<10	<0.010	<0.10	2.2	<0.3	0.13	134	
RW-4	60101	2 L	9/26/2006	9:30	Sample	15.7	893	4.75	7.7	8	12	<10	0.418	2.81	4.5	0.8	3.57	86600	
RW-5	60102	2 L	9/26/2006	9:45	Sample	14	858	11.12		3	4	<10	0.182	4.77	4.5	<0.3	3.3	13000	
RW-5	60103	2 L	9/26/2006	9:45	Dup					3	5	<10	0.159	4.85	4.5	<0.3	2.8	1460	
RW-6	60104	2 L	9/26/2006	10:00	Sample	14.4	118.5	9.19	8.2	<2	43	<10	<.010	<.10	2.2	<0.3	0.2	20	
RW-7	60105	2 L	9/26/2006	10:15	Sample	14.6	983	10.8	8	<2	30	<10	0.012	2.42	4.5	<.3	1.6	620	
WW-001	60106	2 L	9/26/2006	10:30	Sample	20.4	1027	11.82	8.2	4	5	<10	0.024	10.8	2.2	<.3	2.08	6630	
WW-001	60107	2 L	9/26/2006	10:30	Dup					4	8	<10	0.024	10.8	1.1	<.3	2.12	5500	

Appendix 4

2002-2003 CSO Event Data

2002 and 2003 CSO Monitoring Data

Site	Date	Time	Sample Hour (1-4)	Total Flow (MG)	DO (mg/L)	BOD (mg/L)	TSS (mg/L)	Ammonia (mg/L)	E. coli (cfu)	Remarks
CSO 5	10/4/2002	4:00	1		7.15	14.4	360	0.0159	60,000	No Overflow Tested Backwater
CSO 5	10/4/2002	5:00	2		7.63	9.7	96	0.0166	50,000	No Overflow Tested Backwater
CSO 5	10/4/2002	6:00	3		5.72	49.8	1904	0.0131	8,900,000	No Overflow Tested Backwater
CSO 5	10/4/2002	8:00	4		8.05	5.5	104	0.00176	110,000	No Overflow Tested Backwater
CSO 5	10/4/2002					14.3				Composite
US of CSO 3	10/4/2002	4:10	1		5.77	10.9	392	0.0077	150,000	
US of CSO 3	10/4/2002	5:10	2		7.51	4.3	456	0.00907	1,420,000	
US of CSO 3	10/4/2002	6:10	3		7.51	7.7	260	0.0827	290,000	
US of CSO 3	10/4/2002	8:05	4		7.14		84	0.00951	2,900,000	
US of CSO 3	4/16/2003	20:00			8.32	21.1	288	0.111		Grab
US of CSO 3	4/19/2003	23:15			9.52	9.5	290	40.3		Grab
US of CSO 3	4/24/2003	6:30	1		9.14	10.7	280	1.38	83,500	
US of CSO 3	4/24/2003	7:30	2		9.77	8.4	140	1.4		
US of CSO 3	4/28/2003	11:00			8.56	10.2	136	1.56	47,000	
US of CSO 3	5/1/2003	0:50	1		8.03	24.6	1,796	0.537	210,000	
US of CSO 3	5/1/2003	1:50	2		7.53	22.3	284	0.478		
CSO 3	9/19/2002			0.7315	5.89	185.6	376.7	0.131		
CSO 3	10/4/2002	4:20	1	0.70468		63.3	744	0.219	5,300,000	
CSO 3	10/4/2002	5:20	2	0.70468			192	0.267	7,700,000	
CSO 3	10/4/2002	6:20	3	0.70468		43.4	116	0.141	5,400,000	
CSO 3	10/4/2002	8:10	4	0.70468		67.3	152	0.162	790,000	
CSO 3	10/4/2002					60.6	148			Composite
CSO 3	12/18/2002			0.1909	1.45	394.5	2690	0.105		
CSO 3	4/16/2003			0.9293	9.02	113	499			Composite
CSO 3	4/16/2003	20:05				133.7	270	0.618		Grab
CSO 3	4/19/2003	22:00				16.9	106			Composite
CSO 3	4/19/2003	23:25		0.1182	9.22	32.9	306	100		Grab
CSO 3	4/24/2003	6:30	1	0.301	9.42	59.2	84	2	9,200,000	
CSO 3	4/24/2003	7:30	2		8.34	75.1	150	7		
CSO 3	4/24/2003					41.6	540			Composite
CSO 3	4/28/2003	11:00		1.5852		49.8	721			Composite
CSO 3	4/28/2003	11:00			7.5	102.7	194	9	420,000	Grab
CSO 3	5/1/2003	0:50		0.0277		121.7	268			Composite
CSO 3	5/1/2003	0:50	1		7.97	79.9	856	2	5,400,000	
CSO 3	5/1/2003	1:50	2		5.82	189.8	208	2		
CSO 3	5/4/2003			2.827		69.3	336	0.586		Composite
CSO 3	5/10/2003			2.278		38.6	72	12.8		Composite

2002 and 2003 CSO Monitoring Data

Site	Date	Time	Sample Hour (1-4)	Total Flow (MG)	DO (mg/L)	BOD (mg/L)	TSS (mg/L)	Ammonia (mg/L)	E. coli (cfu)	Remarks
DS of CSO 3	10/4/2002	4:30	1				584	0.213	13,000,000	
DS of CSO 3	10/4/2002	5:35	2				244	1.31	20,000,000	
DS of CSO 3	10/4/2002	6:25	3			31.7	124	0.148	10,400,000	
DS of CSO 3	10/4/2002	8:15	4			55	160	0.218	3,300,000	
DS of CSO 3	4/16/2003	20:10			8.91	78	312	0.824		Grab
DS of CSO 3	4/19/2003	23:35				14.8	444			Grab
DS of CSO 3	4/24/2003	6:30	1		9.26	48.3	92	25.6	6,100,000	
DS of CSO 3	4/24/2003	7:30	2		9.3	35	54	4.68		
DS of CSO 3	4/28/2003	11:00			7.33	73	214	3.03	240,000	
DS of CSO 3	5/1/2003	0:50	1		7.9	62.6	1064	2.58	7,800,000	
DS of CSO 3	5/1/2003	1:50	2		7	102.7	256	1.74		
ConAgra	10/4/2002			0.069		1255	355			Composite
ConAgra	12/18/2002			0.012		1527	195			
ConAgra	4/16/2003			0.02496		620	70	70		Grab
ConAgra	4/24/2003			0.0495		620	70	70		
ConAgra	5/1/2003								81,000,000	
ConAgra	5/10/2003			0.2202		620	70	70		
RW 3	10/4/2002		1	NO SAMPLE						
RW 3	10/4/2002	5:45	2			11.8	1352	0.06	390,000	
RW 3	10/4/2002	6:35	3			7.6	216	0.04	140,000	
RW 3	10/4/2002	8:25	4			12.03	192	0.07	800,000	
RW 3	4/16/2003	20:30			7.17	37.9	2032	2.72		
RW 3	4/19/2003	23:45				4.6	96			
RW 3	4/24/2003	6:30	1		9.27	12.6	76	25.7	2,100	
RW 3	4/24/2003	7:30	2		8.88	10.3	242	1.93		
RW 3	4/28/2003	11:00			7.92	22.8	612	1.23	210,000	
RW 3	5/1/2003	0:50	1		7.13	9.9	276	1.88	10,000	
RW 3	5/1/2003	1:50	2		7.6	11.8	432	1.38		
WWTP	10/4/2002					5.1	12.5			Composite
WWTP	4/16/2003	20:50		3.093	8.34	21.9	24	1.18		Grab
WWTP	4/19/2003	0:15		2.213	9.75	10.1	106	0.831		Grab
WWTP	4/24/2003			3.269		8.9	11.1			Composite
WWTP	4/24/2003	6:30	1		9.58	8.9	27	9.89	52,000	
WWTP	4/24/2003	7:30	2		9.86	8.4	122	2.74		
WWTP	4/28/2003	11:00		3.363		7.7	6.6			Composite
WWTP	4/28/2003	11:00			8.51	11.04	78	2.03	5,350	
WWTP	5/1/2003	0:50		1.941		6	16			Composite
WWTP	5/1/2003	0:50		1.941	8.28	7.1	23	4.17	134,000	
WWTP	5/1/2003	1:50			8.52	7.2	9	2.47		
DS of WWTP	4/16/2003	20:40			7.03	50.9	2418	2.65		Grab
DS of WWTP	4/19/2003	23:55			9.91	12.7	68	1.8		Grab
DS of WWTP	4/24/2003	6:30	1		9.23	7.7	72	3.11	41,000	
DS of WWTP	4/24/2003	7:30	2		9.62	9.1	76	0.996		
DS of WWTP	4/28/2003	11:00			7.99	17.5	502	0.786	50,000	
DS of WWTP	5/1/2003	0:50	1		8.01	8.5	84	1.78	1,600,000	
DS of WWTP	5/1/2003	1:50	2		5.94	18.8	572	1.06		

APPENDIX C

NINE MINIMUM CONTROLS

APPENDIX C

Nine Minimum Controls (NMCs) for the City of Macon, Missouri

The City of Macon and Macon Municipal Utilities (MMU) have developed and implemented the nine minimum controls described herewith. This report on NMCs will update the progress that has been achieved towards satisfying the technology-based requirements of the Clean Water Act. This report will also serve as the guide for continuing efforts to implement the NMCs.

The City first developed their NMC plan in 2001. The current state operating permit for the wastewater treatment plant (MO-0023221) includes a schedule of compliance item that requires the permittee submit an annual report documenting the implementation of the NMCs. This report is prepared to fulfill this compliance issue.

The NMCs are not temporary measures. These measures are a part of the City's long term efforts to address Combined Sewer Overflows (CSOs) and to develop a Combined Sewer Overflow Long-Term Control Plan.

All the NMC activities described herewith are either complete and fully implemented or are an ongoing effort. The following focuses on the specific city policies and efforts to reduce the occurrences and severity of CSO events through the continued implementation of the nine minimum controls.

1. Proper Operation and Regular Maintenance Programs for the Sewer System and CSO Outfalls.

MMU utilizes a systematic and aggressive operation and maintenance (O&M) program for the combined and separate wastewater collection systems.

a. MMU has assigned Roger Rector the primary management responsibility for the CSO project. Roger holds a D operator license in wastewater treatment and is the Assistant General Manager of water and gas distribution, and wastewater collection.

b. Macon's utility and street department staff is knowledgeable of city ordinances pertaining to the prohibition of storm drains to the sewer system. They are trained to identify and report violations of the ordinances. The wastewater collection system personnel and meter readers have identified several locations where storm water has been routed into the sanitary sewer. Those found on private property have been contacted requesting these non-compliance issues be resolved.

c. Operation and maintenance procedures are practiced to minimize the frequency and to improve the water quality of CSOs. Regular procedures that are practiced include:

* Wastewater treatment plant operators minimize the quantity of CSO at the grit chamber by computerized operation of the gate on the outlet of the grit chamber. The operator presets the position of the gate to maximize the amount of water that can be transported to the wastewater treatment plant via the 24" interceptor without overflowing the manhole on Vine Street. This has successfully prevented some CSO events and reduced the quantity of CSOs in other events. The procedure to automate the gate setting was completed in the Phase 1 sewer separation project.

* Quality of the CSO at the grit chamber is improved by the semi-annual cleaning of the grit chamber to remove accumulated grit and debris. The city purchased a vacuum excavator to perform these cleanings. These cleanings maintain the holding capacity of the grit chambers thus improving the quality of the CSOs.

d. The MMU staff utilizes a sewer jet machine purchased in 2004 and the new sewer video camera purchased in 2005 to maintain full capacity in lines to prevent backups and minimize CSOs. A breakdown of maintenance activities is attached to this NMC document for review.

2. Maximize Use of the Collection System for Storage.

a. MMU has completed construction of Phase 1 of a wastewater system improvements project that included partial storm and sanitary sewer separation. This project included the construction of a storm water collection system that removed storm water from approximately 10% of the city that previously flowed into the 6' combined sewer. Removal of this surface water from the combined sewer increases its capacity to retain storm water flow before discharge in a CSO.

b. This project also provided a separate sanitary sewer that moved high strength wastewater from ConAgra Foods and several areas of the collection system that had separate sanitary sewer. This separate sanitary sewer transports the sanitary waste to the 24" interceptor that flows directly to the wastewater treatment plant. This reduces the sanitary waste that is discharged in wet weather at the grit chamber and Highway 63 CSOs.

c. The City has obtained the assistance of the engineering firm of Shafer, Kline & Warren, Inc. to complete a facility plan for wastewater system improvements, including addressing the CSO issues. The facility plan recommends the capture and treatment of flows less than 25 MGD. Those flows in excess of 25 MGD are expected to have minimal effect on the water quality in the receiving streams. A water quality sampling and analysis plan has been initiated to verify the water quality impacts of the remaining CSOs on the receiving streams.

3. Review and Modification of Pretreatment Requirements.

The city has a pretreatment program in effect and enforces the provisions of the pretreatment permits issued by the city. The city currently has one industry, ConAgra Foods, with wastewater discharge that discharges into the combined sewer system. Phase 1 of the wastewater system improvements redirected ConAgra's wastewater from upstream of the grit chamber and Highway 63 CSOs to the 24" sewer below the grit chamber.

In addition to the above the City now aggressively enforces the ordinances requiring grease traps. All business suspected of needing grease traps have now completed their installations. The city inspects all traps quarterly. There has been significant decrease in the amount of grease that accumulates at the wastewater plant. The amount of grease that would be in a CSO is also less.

4. Maximization of Flow to the POTW for Treatment.

In 2003 the City videotaped the entire 72-, 48-, and 24-inch interceptors to determine their condition. The 72-, and 48-, lines are in reasonably good condition; however, the 24-inch line was almost completely blocked by root growth. The roots were cleaned from the 24-inch line. Maintaining full capacity in the 24-inch line should significantly reduce the overflows at the grit chamber. This 24" line will again be cleaned in 2008, as roots were detected during the most recent video inspection.

The engineering report prepared by Shafer, Kline & Warren, Inc. identifies Phase 2 improvements that will increase the capacity for transporting a portion of CSO water to the treatment plant.

The Phase 1 sewer project was designed to maximize the treatment of wastes by collecting sanitary sewer wastewater from the areas described above and directing them to the 24" interceptor that runs to the wastewater treatment plant.

It is anticipated that only 670 lbs/day of BOD and 760 lbs/day TSS from the sanitary sewer will remain in the CSOs at the grit chamber and Highway 63.

Tables 12 and 13 from the Long-Term Control Plan show the calculated remaining concentration of BOD and TSS levels for selected overflow events at the grit chamber. Generally, as the volume of the overflow increases, the concentrations of BOD and TSS decrease.

Future sampling and analysis will verify the effectiveness of removing these BOD and TSS contributions from the CSO at the grit chamber and Highway 63.

Additional combined sewer flow will be transported and treated in the Phase 2 wastewater treatment expansion. The capacity of the treatment plant will be increased to treat additional combined sewer flow to an appropriate level based on meeting appropriate water quality standards.

5. Elimination of CSOs During Dry Weather.

There are no CSOs during dry weather.

Dry weather overflows and sewer backups are responded to under current Macon Municipal Utilities policy. Maintenance such as flushing, root treatment, root cutting, or spot repairs are performed at the time of the occurrence. Work orders are generated, to revisit the site of these occurrences to perform preventative maintenance activities as needed.

6. Control of Solids and Floatable Materials.

The grit chamber with a mechanical bar screen is designed to remove settleable solids and floatables from the wastewater. The overflow basin at the wastewater plant acts as a large settling basin and is equipped with a baffle to prevent discharge of floatables. These facilities effectively control solids and floatable materials at these CSOs.

7. Pollution Prevention Programs.

City ordinances are reviewed on a regular basis to assure they include all the needed requirements to reduce or eliminate stormwater and other contaminants into the sanitary sewer system.

Inspections of the wastewater collection system are complete and ongoing. In addition to the wastewater collection crews, the meter readers have been trained to identify potential inflows into the combined sewer system and to report those conditions to management. Several violations have been identified, and contacts have been made with the responsible property owners requesting that they correct the situation.

8. Public Notification.

Signs posted at the CSO locations request anyone observing an overflow to report it to the City. The 24 hour number for the City, along with the outfall, and NPDES permit number are posted on each sign.

The City of Macon holds twice monthly public meetings of the Municipal Utilities Board. Each board meeting is opened for a period of time for a public hearing for the purpose of describing the LTCP progress and allowing anyone to comment or provide input on the Long-Term Control Plan. Any comments or input received is recorded in the official minutes for the meeting and considered for incorporation into the plan. The public hearings are on the agenda, which is posted in public places and published in the local newspaper. The Macon Municipal Utilities board has been holding these hearings since mid 2005.

9. Monitoring of CSO Impacts and the Efficacy of CSO Controls.

Macon's Combined Sewer Overflow Long-Term Control Plan includes the monitoring of the

CSOs and the analysis of their impact on the appropriate segment of the Middle Fork Salt River and unclassified receiving streams. MEC Water Resources, Inc. and Macon Municipal Utilities will implement a sampling and analysis plan in years 2006 through 2010. The initial part of the sampling and analysis plan is being implemented in 2006 prior to completion of the City's Phase 1 sewer separation project. Appendix B of the Long-Term Control Plan is the MEC Water Resources Sampling Plan. The baseline sampling and analysis plan will characterize CSO discharges and assess CSO impacts on receiving streams prior to completion of the Phase 1 improvements. In addition to monitoring wet-weather events, monitoring during dry-weather, baseflow conditions are also included in the plan. A continuing plan will be implemented after completion of Phase 1, through 2010, to obtain information that will be used to characterize the remaining CSO contributions to receiving stream loadings. Alternative controls for future implementation as appropriate will be evaluated.

Each future phase is proposed to include a water quality sampling and analysis program to characterize the remaining CSO contributions and provide appropriate direction for additional improvements.

WASTE WATER MAINTANCE SCHEDULE												
YEAR 2008												
PUT ROOT TREATMENT IN MANHOLES INDICATED IN RED IN APRIL AND NOVEMBER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CUT GRASS AROUND ALL LIFT STATIONS					*	*	*		*	*	*	
SPRAY FOR WEEDS AT LIFT STATIONS						*						
CHECK ALL AIR RELIEFS ON FORCE MAINS	*						*					
BUSINESS GREASE TRAP INSPECTIONS	*			*			*			*		
VACUUM OUT CELLS AT GRIT CHAMBER				*						*		
CHANGE OIL IN BOTH BLOWERS AND GRIT CHAMBER						*						*
PINE STREET CLEAN MAIN G5-020 THRU G5-024 CALL FERRELL MORGAN @ 829 PINE 385-2780 BEFORE JETTING MAIN			*				*				*	
PINE DRIVE CLEAN MAIN E3-004 TO E3-005 & E3-003, E3-011 TO E3-012 & THRU E3- 007 TO E3-OO6		*			*			*			*	
1000 BLK N. RUTHERFORD CLEAN MAIN E3-087 TO THE SOUTH					*						*	
WESTERN DRIVE CLEAN MAIN E5-096 TO E5-095 & E5-097 TO E5-096 & E5-098, E5-098 TO E5-099 & E5-100			*				*				*	
EAST END CARDNIAL DRIVE C5-069 THRU C5-072 TO C5-074, C5-069 THRU C5-070 TO C5-071, C5-069 TO C5-068		*						*				
HOLMAN PASTURE USE ROOT CUTTER C3-027 THRU C3-026 TO C3-025, C3-027 THRU C3-028 TO C3-029, C3-032 TO C3-034, C3-032 TO C3-033, C3-032 TO C3-029		*						*				
RUSTIC FROM SUNSET HILLS TO BLUEBIRD C5-035 THRU C5-033 TO C5-034, C5-035 THRU C5-O36 TO C5-037, C5-043 THRU C5-038 TO C5-037, C5-043 THRU C5-044 TO C5-045, C5-045 TO C5-046			*						*			
BETWEEN BENNETT AND SUMMIT, FROM GANZT TO THE NORTH E3-029 THRU E3-028 TO E3-027, E3-030 TO E3-029						*						*
607 SUNSET DRIVE C3-035 THRU C3-034 TO C3-032					*						*	
913 SUNSET DRIVE C3-037 THRU C3-038 TO C3-026					*						*	
LAURA LANE W. END C3-011 TO C3-012, C3-011 TO C3-013, C3-011 TO C3-016, C3-011 THRU C3-009 TO C3-008	*						*					
LOCUST STREET E. END G5-028 THRU G5-036 TO G5-037, G5-028 TO G5-032, G5-028 TO G5-029, G5-028 TO G5-027	*						*					
LEWIS BODY SHOP TO THE SOUTH G5-039 THRU G5-038 TO G5-037	*			*			*			*		
HEAD STREET FROM DAMERON TO HWY E9-021 TO E9-023, E9-021 TO E9-022	*			*			*			*		
1000 N. ROLLINS TO THE SOUTH E3-102 TO THE SOUTH			*						*			
SAXONY AT BRIGGS G3-002 TO G3-001, G3-002 TO G3-014, G3-003 TO G3-001			*			*			*			*
E BRIGGS CHRISTIAN CHURCH G3-011 TO G3-012 & G3-011 TO G3-022		*				*				*		
1401 ENGLEWOOD TO THE NORTH G3-024 TO G3-027	*						*					
908 OVERBROOK DRIVE G3-043 TO G3-042, G3-043 TO G3-044		*			*			*			*	
KENTUCKEY FRIED CHICKEN TO THE SOUTH E3-097 TO E3-096			*						*			
MAFFERY S. END N. & W. REDUCE PSI E3-064 TO E3-063, E3-064 TO E3-065			*						*			
MAPLE LANE & HILDALE REDUCE PSI G3-052 TO G3-055, G3-052 G3-054, G3-052 G3-051, G3-052 TO G3-053, G3-052 TO G3-067	*			*			*			*		
BRIGGS AND SENIOR CITIZENS TO THE SOUTH G3-008 TO G3-007, G3-008 THRU G3-009 TO G3-010			*			*			*			*
211 N WENTZ TO THE SOUTH E5-076 TO E5-077		*			*			*			*	
904 LAWNDALE TO THE EAST G3-039 TO G3-038						*						*
1112 MCGEE STREET E9-027 TO E9-028, E9-026 TO E9-027, E9-024 TO E9-026				*						*		
904 LOCUST TO THE WEST TO G5-033 TO G5-034	*						*					
1201 NOLL DRIVE (WATER PLANT) VACUUM OUT BASIN BY NOLL DRIVE		*										
CLEAN AND VACUUM OUT WET WELLS ON ALL LIFT STATIONS				*								
807 BOURKE AND BUCKHARDT TO NORTH E5-083 THRU E5-085 TO E5-086		*			*			*			*	
N END OF LOCH FORREST C3-013 TO C3-014	*						*					
505 SUNSET E5-088 TO E5-089 & E5-088 TO E5-087	*						*					
808 SUNSET C5-073 TO E5-005	*											
708 SUNSET E5-005 TO E5-006	*											
ARCLARA CT E5-090 THRU E5-092 TO E5-006	*											
RANCHLAND G3-072 TO G3-O73				*						*		
PINE CREST WEST OF ECONOMY PRODUCTS E3-037 TO E3-036		*						*				
HAWTHORN G3-102 TO G5-075 TO G5-074 & G5-074 TO G5-073, G5-074 TO G5-076	*						*					
PRIMROSE G3-132 THRU G3-131 TO G3-130			*						*			