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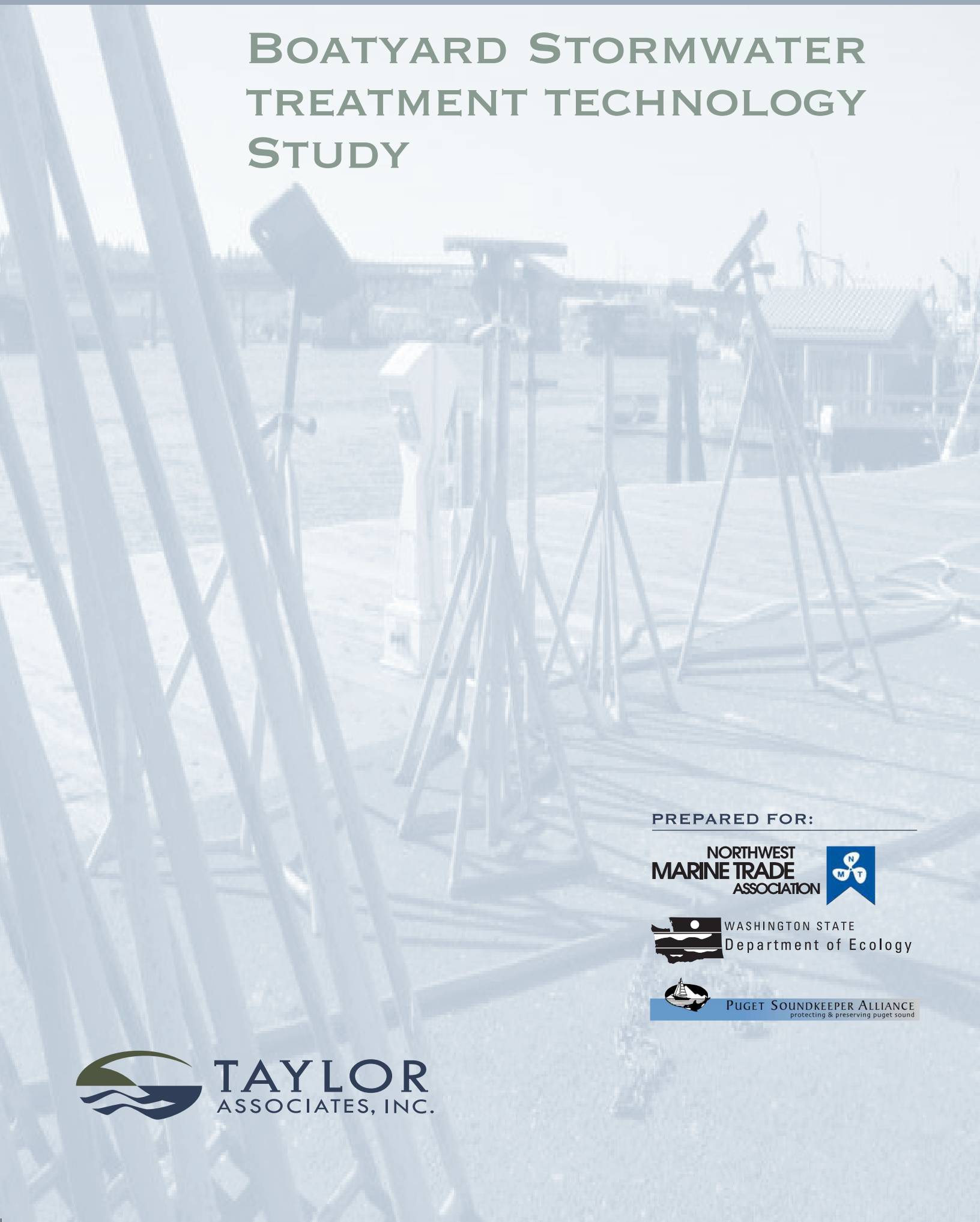
Boatyard Stormwater treatment technology Study



PREPARED FOR:

NORTHWEST MARINE TRADE ASSOCIATION

WASHINGTON STATE Department of Ecology

PUGET SOUNDKEEPER ALLIANCE
protecting & preserving puget sound

TAYLOR ASSOCIATES, INC.

Boatyard Stormwater Treatment Technology Study

Final Report

March 2008

Prepared For
Northwest Marine Trade Association
Puget Soundkeeper Alliance
Washington State Department of Ecology

Prepared By
Taylor Associates, Inc.

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EXECUTIVE SUMMARY

Project Overview. This report summarizes the methods and results of data collected from a study of three stormwater treatment technologies that were installed at three boatyards around Puget Sound. These three technologies include (1) the StormwateRx Aquip™ (Aquip) installed at the Port of Edmonds Boat Workyard, (2) the Siemens Water Technologies Wastewater Ion Exchange (WWIX) Services installed at the Canal Boatyard, and (3) the Water Tectonics, Inc. Wave Ionics™ Electro-Coagulation System Treatment (Wave Ionics) installed at CSR Marine. Each technology was installed to treat runoff from approximately one to two acres of predominately impervious surfaces where boats are maintained and serviced. The Northwest Marine Trade Association (NMTA), Puget Soundkeeper Alliance (PSA), and Washington State Department of Ecology (WSDOE) collaborated on the study to assess the ability of the different technologies to remove contaminants, especially metals and TSS, from the boatyards' stormwater runoff. A steering committee comprised of members and representatives from the NMTA, PSA and Ecology was put together to oversee the study.

Technology Description. This section includes brief descriptions of the three technologies evaluated. More complete descriptions of each technology can be found at their respective websites which are listed below.

(1) StormwateRx® Aquip™ (www.stormwaterx.com). The Aquip is a passive adsorptive filtration technology designed specifically for reduction of stormwater pollutants such as turbidity and metals from industrial sites, including boatyards. The overall treatment capacity of the Aquip system installed in the Edmonds Boat Workyard was 5.4 gallons per minute (gpm).

(2) Siemens Water Technologies, Inc. Wastewater Ion Exchange Systems (www.water.siemens.com). The WWIX utilizes ion exchange resins and other media to remove specific ionic contaminants such as metals from stormwater and wastewater. The overall treatment capacity of the system installed at the Canal Boatyard was 10 gpm.

(3) Water Tectonics, Inc. Wave Ionics™ Electro-Coagulation System Treatment (www.watertectonics.com). The Wave Ionics is an electro-coagulation system that uses electrical current to coagulate particles by forcing contaminated water to flow between closely spaced metal plates across which an electrical potential is applied. The overall treatment capacity of the system installed at CSR Marine was 50 gpm.

Sampling Approach. Rainfall and water quality data were collected for seven storm events for the Aquip and WWIX, and four storm events for the Wave Ionics between November 2007 and February 2008. Influent and effluent samples were collected at discrete flow rates of approximately 5.4 gpm for the Aquip, 13.5 gpm for the Wave Ionics, and 10 gpm for the WWIX using automated water quality samplers. Samplers were programmed to collect grab and time-paced composite samples, which were submitted for total suspended solids (TSS) and total and dissolved copper (Cu), lead (Pb) and zinc (Zn) analysis.

Effluent Concentrations relative to discharge criteria. Effluent data for the three technologies were compared to discharge criteria set by the pilot study steering committee for total and dissolved copper, lead, and zinc. The steering committee did not establish a discharge criterion for TSS. The effluent results are summarized in the table below. The results generally indicate the technologies performed better in the removal of total and dissolved lead and zinc than total and dissolved copper.

Table i. Percent of effluent results that met the discharge criteria.

	Discharge Criteria	Aquip *(n=28)*	Wave Ionics *(n=15)*	WWIX *(n=28)*
Cu	10 µg/L	57.1	0.0	64.3
Pb	100 µg/L	100	86.7	100
Zn	100 µg/L	82.1	60	100
Cu, diss.	10 µg/L	75.0	26.6	78.6
Pb, diss.	10 µg/L	100	100	100
Zn, diss.	100 µg/L	85.7	100	100

Pollutant reduction. Percent pollutant reduction for each parameter was calculated for the three technologies. Total inflow was equal to the total outflow for the Aquip and WWIX technologies due to the design of the technologies and the sampling approaches. As a result, the concentration reduction is equivalent to a mass loading reduction for these technologies on an event basis. Because of the large size, detention volume, and resulting sampling approach for the Wave Ionics the inflow was not equal to the outflow.

The average percent pollutant reduction for the grab and the composite samples for each technology are summarized in the table below. Overall removal rates ranged from 59.9 to 98.0 percent for Aquip, -92.6 to 97.8 percent for the Wave Ionics, and 75.8 to 99.0 percent for the WWIX.

Table ii. Average percent pollutant reduction for grab and composite samples for each technology.

	Aquip		Wave Ionics		WWIX	
	Grab	Comp	Grab	Comp	Grab	Comp
Cu	98.0	94.9	38.0	94.8	99.0	99.2
Pb	94.4	62.3	39.2	95.7	97.1	97.3
Zn	73.8	59.9	0.6	92.0	96.4	97.3
Cu, diss.	94.2	93.4	96.9	85.6	98.4	98.7
Pb, diss.	N/A[1]	N/A	83.0	70.2	81.3	75.8
Zn, diss	66.9	58.1	97.8	92.5	96.7	97.2
TSS	94.7	83.5	-92.6	80.3	91.5	95.1

[1] All influent and effluent dissolved lead results from the Aquip were below the laboratory method detection limit.

1.0 PROJECT OVERVIEW

Stormwater that flows across boatyards can pick up debris and contaminants from the yard and surrounding areas and carry these into nearby water bodies. Of particular concern are metals such as copper, lead, and zinc. Copper, which is used in boat paint to deter plant and animal growth on boats, can have a lethal and sublethal effect on salmonid species.

The Washington State Department of Ecology (Ecology) has issued a National Pollutant Discharge Elimination System (NPDES) Boatyard General Permit to provide pollutant control of pressure wash wastewater and stormwater runoff from boatyards. In 2005, Ecology reissued the NPDES Boatyard General Permit which included benchmarks for copper, lead and zinc levels (Ecology 2005). Both the Northwest Marine Trade Association (NMTA) and the Puget Soundkeeper Alliance (PSA) appealed the permit, and in July 2007 reached a settlement with Ecology. The settlement funded a pilot study to determine the effectiveness of treatment for boatyard stormwater runoff. A steering committee comprised of members and representatives from the NMTA, PSA and Ecology was put together to oversee the study.

Three technologies were selected for the pilot study and were installed at three boatyards around Puget Sound. The technologies included (1) the StormwateRx® Aquip™ (Aquip), a passive adsorptive filtration system installed at the Port of Edmonds Boat Workyard, (2) the Siemens Water Technologies Wastewater Ion Exchange (WWIX) Services, an ionic exchange system installed at the Canal Boatyard, and (3) the Water Tectonics Wave Ionics™ Electro-Coagulation System Treatment (Wave Ionics) installed at CSR Marine. The objective of this study, as outlined in the settlement agreement, was to “evaluate the performance of various technologies to reduce the levels of metals, particularly lead, copper, and zinc” (NMTA et al 2007). This was accomplished by collecting influent and effluent samples at a discrete flow rate for each technology during storm events between November 2007 through February 2008. This report summarizes the technologies, sampling methods, and results of data collected during this study.

2.0 PROJECT DESCRIPTION

This section describes the project participants, boatyards and the three different stormwater treatment technologies tested as part of the treatment technology study.

2.1 PROJECT PARTICIPANTS

The roles and responsibilities for each project participant are listed below.

Project Manager

Dean Shaughnessy
Marina Consulting Services, Inc.
deans@marinacsi.com
360-387-6574

Steering Committee

Gary Bailey
Water Quality Permit Specialist
Washington State Department of Ecology
360-407-6433
gbai461@ecy.wa.gov

Michael Campbell
President
Northwest Marine Trade Association
206-634-0911
michael@nmta.net

Marina Hench
Director of Government Affairs
Northwest Marine Trade Association
206-634-0911
marina@nmta.net

Richard Horner
Consultant to Puget Soundkeeper Alliance
206-782-7400
rrhorner@msn.com

Sue Joerger
Soundkeeper and Executive Director
Puget Soundkeeper Alliance
206-297-7002
suejoerger@pugetsoundkeeper.org

Barry Kellems, P.E.
Consultant to Northwest Marine Trade Association
Arcadis
206-726-4710
barry.kellems@arcadis-us.com

Katie Kolarich
Program Coordinator
Puget Soundkeeper Alliance
206-297-7002
katie@pugetsoundkeeper.org

Sampling Program Project Manager

Carla Milesi
Taylor Associates, Inc.
206-267-1408
carla@taylorassoc.net

Vendor Contacts

Siemens Water Technologies
Terry Ovstaedal
Sales Engineer
425-244-0345
terry.ovstaedal@siemens.com

StormwateRx, LLC
Cal Noling, P.E.
Chief Executive Officer
caln@stormwaterx.com

Daniel Scarpine, P.E.
Vice President
daniels@stormwaterx.com
503-233-4660

Water Tectonics, Inc.
Jim Mothersbaugh
Founder
425-742-2062
jim@watertectonics.com

2.2 BOATYARD DESCRIPTIONS

The three technologies were installed and tested at three different boatyards around Puget Sound: (1) the Port of Edmonds Boat Workyard, (2) the Canal Boatyard, and (3) CSR Marine. A brief descriptions of each boat yard is provided below.

The Port of Edmonds Boat Workyard is located along the City of Edmonds waterfront just south of the Edmonds ferry dock. The boatyard is slightly less than one acre and is made up almost exclusively of paved surfaces which provide areas for boat building and repairs. The entire boatyard drains to a standard sized catch basin that serves as the influent collection point for the Aquip system. Stormwater runoff from the Port of Edmonds Boat Workyard drains directly into Puget Sound.

The Canal Boatyard is located in the Ballard neighborhood of Seattle. The three acre drainage area is made up almost exclusively of paved surfaces which provide areas for boat building and repairs. The entire three acres drains to a large settling tank which serves as the influent collection point for the WWIX system. The settling tank then drains into the Lake Washington Ship Canal approximately 1.3 miles east of the Hiram M. Chittenden Locks.

CSR Marine is located in the Magnolia neighborhood of Seattle. The boatyard is approximately 1.6 acres, with a little over 0.5 acres draining to a standard sized catch basin that serves as the influent collection point for the Wave Ionics system. The drainage area is made up almost exclusively of paved surfaces that provide areas for boat repair and building. Stormwater runoff that leaves the CSR Marine boatyard drains into the Lake Washington Ship Canal approximately 0.40 miles east of the Hiram M. Chittenden Locks.

Figure 1. Locations of the three boatyards selected for the pilot study.

2.3 TECHNOLOGY DESCRIPTIONS

This section includes brief descriptions of the three technologies evaluated. More complete descriptions of each technology can be found at their respective websites, which are listed below.

StormwateRx® Aquip™ (www.stormwaterx.com). The StormwateRx Aquip is a passive adsorptive filtration technology designed specifically for reduction of stormwater pollutants such as turbidity and metals from industrial sites, including boatyards. The system uses a pre-treatment chamber followed by a series of inert and adsorptive filtration media to effectively trap pollutants. The filter removes total, dissolved, and ionized pollutants within the pre-treatment chamber by gravity settling or floatation, and

in the filtration chamber via a combination of chemical precipitation, adsorption, micro-sedimentation, and filtration. The Aquip system installed at the Port of Edmonds boatyard is approximately nine feet long by 2.5 feet wide by 4.5 feet tall at its widest sections. The overall treatment capacity of the system is 5.4 gallons per minute (gpm).

Siemens Water Technologies, Inc. Wastewater Ion Exchange Systems (www.water.siemens.com). The Siemens WWIX utilizes ion exchange resins and other media to remove specific ionic contaminants such as metals from stormwater and wastewater. The WWIX system installed at the Canal Boatyard consists of four, 3.6-cubic feet tanks (each tank measures eight inches in diameter by 48 inches tall). The first tank consists of a carbon tank to remove organics and/or oxidizers prior to the ion exchange tanks. The remaining three ion exchange tanks remove targeted dissolved solids and metals. The overall treatment capacity of the system is 10 gpm.

Water Tectonics, Inc. Wave Ionics™ Electro-Coagulation System Treatment (www.watertectonics.com). The Water Tectonics, Inc. Wave Ionics is an electro-coagulation system that uses electrical current to coagulate particles by forcing contaminated water to flow between closely spaced metal plates, across which an alternating, direct or pulsing electrical potential is applied. The particles agglomerate into larger particles and either rise to the top or settle to the bottom of the water column. The Wave Ionics system installed at CSR Marine consists of a 1,000-gallon surge tank followed by electro-coagulation cells which initiate the coagulation process. Water then passes into a 1,000-gallon settling tank, followed by a 1,000-gallon clear well tank and a sand filter before exiting the system.

3.0 MONITORING METHODS

This section provides an overview of the monitoring methods, including sampling approach, qualifying events, stormwater quality parameters, sample collection, sample handling and quality control procedures.

3.1 SAMPLING APPROACH

Due to the variations in the size and drainage systems of the boatyards, as well as the size and flow capacity of the technologies, sampling approaches were tailored for each site and technology. To assess the average influent and effluent water quality for each technology, automated water quality samplers were programmed to collect grab and time-paced composite samples over a relatively constant inflow period. The inflow rates sampled for the technologies were determined by the treatment capacity of the

technologies and/or the anticipated flow coming off the site during an averaged size storm event. For the Aquip, the flow rate was set at 5.4 gpm; for the Wave Ionics, it was approximately 13 gpm; and for the WWIX, it was approximately 10 gpm.

Relatively constant inflow rates were maintained through the use of inlet pumps. The pumps used with the Aquip and Wave Ionics systems were triggered by an attached float. When a rise in water level in the inlet catch basin lifted the float, the pump would turn on. Subsequently, when a drop in water level in the catch basin lowered the float, the pumps would turn off. As a result, during some events sampled for these technologies, the pumps cycled on and off and did not provide a consistent flow through the technology during the sample event. In addition, because the inlet pumps were automatically triggered with a rise in water level, the Aquip and Wave Ionics technologies had water flowing through their systems during any storm large enough to turn on the inlet pumps and not only during events sampled as part of this study.

Because the settling tank at the Canal Boatyard provided a larger detention volume, the pump used with the WWIX was manually turned on by boatyard staff at the start of the sample event and ran constantly throughout the duration of the event. The inlet pump was turned off at the completion of the sample event. As a result water flowed through the WWIX technology only during events sampled as part of this study.

3.2 QUALIFYING EVENTS

Qualifying storm and sample events were not defined for this project. Targeted storm criteria defined in the sampling plan (Appendix A) included an antecedent dry period of less than 0.10 inches of rain in the previous 24-hours with a 70 percent probability of a storm intensity of 0.2 inches in six hours. This intensity was selected in order to be large enough to mobilize pollutants and provide enough runoff to minimize the cycling on and off of the technologies' inlet pumps. Per an email from the NMTA project manager, and to increase the likelihood of sampling all the storms on the tight schedule, the antecedent dry period conditions were dismissed in early December 2007.

3.3 STORMWATER QUALITY PARAMETERS

Stormwater quality parameters evaluated as part of this study, along with their field procedures and analytical methods, are listed below (Table 1).

Table 1. Pilot study stormwater quality parameters - field procedures and analytical methods.

Parameter	Minimal Sample Size	Preservation Method	Holding Time	EPA/SM Method	Reporting Limit and Units
TSS	1000 ml	Cool 4ºC	7 days	EPA 160.2	0.50 mg/L
Total copper (Cu)	250 ml	Cool 4ºC (lab – HNO_3 to pH <2)	6 months	EPA 220.2, EPA 200.7	0.0010 mg/L
Total lead (Pb)				EPA 239.2	0.0010 mg/L
Total Zinc (Zn)				EPA 200.7	0.005 mg/L
Dissolved copper (Cu)	250 ml	Cool 4ºC (lab – filter, HNO_3 to pH <2)	24 hours until preserved, 6 months	EPA 220.2, EPA 200.7	0.0010 mg/L
Dissolved lead (Pb)				EPA 239.2	0.0010 mg/L
Dissolved zinc (Zn)				EPA 200.7	0.005 mg/L

3.4 SAMPLE COLLECTION

Influent and effluent samples were collected from all three technologies. For the Aquip and Wave Ionics technologies, influent samples were collected from the inlet pipes just upstream of the technology. The inlet pipe to the WWIX system was under pressure, which made it difficult to collect consistent sample volume from the pipe. As a result, the influent sample line was attached to the WWIX inlet pipe and samples were collected in the settling tank at the same level and adjacent to the opening of the WWIX inlet pipe. Effluent samples for all three technologies were collected just downstream of the outlet of each technology.

Influent and effluent samples were collected using Isco portable automated water quality samplers that were programmed to collect one grab and three, one-hour time paced composite samples. The samplers were manually started by boatyard or Taylor Associates (Taylor) staff. The influent samplers collected a grab sample immediately after the samplers were started and then moved on to collect three, one-hour time paced composites with a five minute sampling interval between subsamples. To collect paired influent and effluent samples, the Aquip and WWIX technologies effluent samplers were

programmed with a time delay to account for the detention times of each technology. For the Wave Ionics technology, the effluent sampler was inhibited until an Isco Liquid Level Actuator sensed the presence of water at the effluent sample collection point. (The collection of paired influent and effluent samples was not possible with the Wave Ionics technology due to the large detention volume and detention time.)

All samples were collected through vinyl intake lines into one-gallon polypropylene bottles. Prior to each storm event targeted for sampling, the sample intake lines were rinsed with approximately two liters of laboratory grade deionized water (DI) to avoid cross-contamination from previously sampled events. Sample bottles were cleaned by the analytical laboratory using Liqui-Nox and a DI water rinse followed by an acid rinse with 10 percent nitric acid and another DI water rinse.

3.5 SAMPLE HANDLING

Proper sample collection, handling, preservation, transport, and custody procedures were followed as described in the Sampling Plan (Appendix A). Sample containers were appropriately labeled and chain-of-custody forms were filled out. Samples were retrieved from the automated samplers using an adaptation of the “clean hands/dirty hands” protocols for metals grab sample collection as outline in EPA Method 1669: Sampling ambient water for trace metals at EPA water quality criteria levels (EPA 1996). Samples were delivered to the laboratory within 24-hours of the onset of sample collection to ensure holding times for metals were not exceeded.

3.6 QUALITY CONTROL PROCEDURES

Quality control (QC) samples were collected and analyzed for field and laboratory activities to estimate bias. The QC procedures were conducted to determine if any of the sample containers, preservation methods, handling procedures, or sampling equipment contributed constituents to the sample. This section provides a brief description of the field and laboratory quality control samples and their associated frequency and acceptance criteria.

3.6.1 Field Quality Control

Quality control samples consisted of collecting one internal field duplicate at both the influent and effluent sample points for each technology. This totaled 12 field duplicates for the project (one grab duplicate and one composite duplicate for both the influent and effluent sample points for each of the three technologies) which is a rate of 11 percent. Relative percent differences (RPD) were calculated for the field duplicates and compared

to an acceptance criteria that states the RPD should be less than 20 percent for samples with results greater than five times the reporting limit.

3.6.2 Laboratory Quality Control

Samples were submitted for analysis to the Aquatic Research, Inc., a laboratory accredited by the Washington State Department of Ecology. Laboratory quality control checks included method blanks, check standards, analytical duplicates, blank spikes, and matrix spikes. Quality control results for laboratory activities were reviewed by the Laboratory Quality Assurance (QA) Officer and summarized in each lab report. Laboratory reports included the laboratory QC results summary as well as laboratory results for both storm and QC samples.

3.7 DATA ANALYSIS

This section provides an overview of the data analysis procedures that occurred after collection of the data in the field. The application of these procedures to data collected during this study is provided in Section 4.2.

3.7.1 Storm Event Data

Rainfall data from sampled storms were analyzed for the following information:

- Storm Event Antecedent Dry Conditions (measured rainfall, duration);
- Storm Event Conditions (total precipitation, duration, intensity); and
- Sampling Period Conditions (total precipitation).

Rainfall data were collected at two separate locations. Rainfall for the Port of Edmonds boatyard was provided by the City of Edmonds and collected at the rooftop of the City of Edmonds Wastewater Treatment Plant, which is located approximately 0.3 miles to the northeast of the boatyard. Rainfall for the Canal Boatyard and CSR Marine was provided by Seattle Public Utilities and collected at the rooftop of Seattle Public Library's Ballard Branch, which is located approximately 0.6 miles to the northeast of CSR Marine and 1.0 mile to the northwest of Canal Boatyard. The QA/QC and maintenance related to the rain gauges and rain data was not performed or tracked by Taylor staff.

3.7.2 Pollutant Concentration Reduction

Removal efficiencies were calculated for each parameter for each technology as described below. The collection of paired influent and effluent samples was possible for the Aquip and WWIX systems, so the pollutant concentration reduction for those systems was calculated using Method no. 1. Total inflow was equal to the total outflow for both

the Aquip and WWIX due to the design of the technologies and the sampling approaches. As a result, the calculated concentration reduction is equivalent to a mass loading reduction for these technologies on an event basis.

Due to the size and detention volume of the Wave Ionics system, the collection of paired samples was not feasible. Pollutant concentration reduction from the Wave Ionics system was calculated using Method no. 2.

Method no. 1: Individual Storm Pollutant Concentration Reduction (SCR)
The individual storm pollutant concentration reduction (SCR) method was used to calculate the pollutant reduction for each water quality parameter during each individual storm.

$$SCR_i = 1 - \frac{C_{i,eff}}{C_{i,in}}$$

Where:
i = storm number
$C_{i,in}$ = influent concentration for the grab or time-paced composite for storm
$C_{i,eff}$ = effluent concentration for the grab or time-paced composite for storm

Method no. 2: Average Pollutant Concentration Reduction (ACR)
The average pollutant concentration reduction (ACR) method was used to calculate the average pollutant reduction for each water quality parameter for all storm events.

$$ACR = 1 - \frac{AvgC_{eff}}{AvgC_{in}}$$

Where:
C_{in} = Average influent concentration for the grab or time-paced composite from all storms
C_{eff} = Average effluent concentration for the grab or time-paced composite from all storms

4.0 RESULTS

This section summarizes the data collected by Taylor staff for the Aquip installed at the Port of Edmonds Boat Workyard, the Wave Ionics installed at CSR Marine and the WWIX system installed at the Canal Boatyard. Results include storm event characteristics, water quality data, pollutant concentration reduction and quality

assurance results. Section 5.0 provides a more detailed discussion of the data collected for each parameter.

4.1 STORM EVENTS

Storms were sampled over a four month period from November 2007 through February 2008, with seven storms sampled for the Aquip, seven storms sampled for the WWIX, and four storms sampled for the Wave Ionics. Some systems were sampled concurrently, resulting in 12 storms being sampled overall between the three technologies. This concurrent sampling resulted in the collection of 122 stormwater samples (each technology was set up to collect one grab and three composite samples from both the influent and effluent stations). Table 2 provides a summary of the storm characteristics for the 12 storms sampled.

Table 2. Summary of characteristics of storms sampled for the pilot study

Technology	Date	Storm Size (in)[1]	Duration (hrs)	Intensity (in/hr)	Dry Antecedent[2] (hrs)	Rain during sampling duration (in)
WWIX	11/26/2007	0.28	2.25	0.12	161	0.28
WWIX	11/28/2007	0.16	5.5	0.03	43.5	0.14
Wave Ionics	12/13/2007	0.07	2	0.04	225.5	0.07
WWIX						0.03
Aquip	12/13/2007	0.04	0.5	0.08	229	0.00
WWIX	12/19/2007	0.17	4	0.04	14	0.12
Aquip	12/19/2007	0.27	4.5	0.06	2.5	0.22
WWIX	12/27/2007	0.29	15.75	0.02	38.75	0.15
Aquip	12/27/2008	0.21	9	0.02	42	0.06
WWIX	1/3/2008	0.37	14	0.03	7.25	0.07
Aquip	1/3/2008	0.46	17	0.03	18	0.09
WWIX	1/8/2008	0.28	8.5	0.03	41.5	0.07
Aquip	1/9/2008	0.35	5	0.07	36	0.25
Wave Ionics	1/14/2008	0.5	7	0.07	53.5	0.26
Aquip	1/14/2008	0.71	5	0.14	54.5	0.21
Wave Ionics	1/30/2008	0.13	4.25	0.03	34.75	0.06
Aquip	2/6/2008	0.24	4.5	0.05	204	0.14
Wave Ionics	2/8/2008	0.37	12.75	0.03	40	0.06

Notes:

[1] Rainfall for the Aquip technology was recorded at the City of Edmonds Wastewater Treatment Plant. Rainfall for the Wave Ionics and WWIX technologies was recorded at the Seattle Public Library Ballard Branch.

[2] Antecedent criteria = less than 0.10 inches of rain in 24 hours.

4.2 WATER QUALITY DATA

This section presents water quality data results for the three technologies. These results included presentation of influent and effluent data, pollutant concentration reduction, irreducible minimum and reliable effluent concentrations, and field QC data.

4.2.1 Influent and Effluent Data

The average, median, minimum and maximum concentrations for influent and effluent results were calculated for each parameter for each technology. In addition, effluent results were compared to discharge criteria established by the steering committee. These summary statistics are included in Table 3. Detailed water quality data for all storms is provided in Appendix C.

Concentrations reported as less than the detection limit were included in this analysis by using the value of half the detection limit as the concentration. If both the influent and effluent concentration were below the detection limit, samples were excluded since it is not possible to look for any differences between influent and effluent concentrations.

4.2.2 Pollutant Concentration Reduction

Removal efficiencies were calculated for each parameter as described in Section 3.7.2. The average percent pollutant concentration reduction for each parameter are included in Table 3. Comparison of summary statistics from influent and effluent water quality data for the three technologies. Once again, concentrations reported as less than the detection limit were included in the analysis by using a value of half the detection limit as the concentration. If both the influent and effluent concentration were below the detection limit, samples were excluded from all pollutant reduction analyses.

4.2.3 Irreducible Minimum and Reliable Effluent Concentrations

The irreducible minimum effluent concentrations and reliable effluent concentrations were calculated for each parameter for the three technologies. The irreducible minimum represents the lowest effluent concentration for a given parameter that the dataset indicated can be achieved by the treatment technology. The irreducible minimum effluent concentration is the lowest recorded concentration unless the dataset contained outliers. If the dataset contained outliers the concentration was trimmed to the 5th percentile for the complete ordered effluent dataset.

Table 3. Comparison of summary statistics from influent and effluent water quality data for the three technologies.

Technology	Grab/ Comp	Influent (µg/L)					Effluent (µg/L)					Avg. PCR[1]	no. samples above criteria[2]	percent of samples above criteria
		n	**Avg.**	**Med.**	**Min.**	**Max**	***n***	**Avg.**	**Med.**	**Min.**	**Max.**			
Copper, total														
Aquip	Comp	16	181.6	120.5	60.0	503.0	19	9.3	7.6	4.0	21.0	94.9	6	31.6
	Grab	7	582.4	266.0	128.0	1490.0	9	11.9	10.3	5.3	21.0	98.0	6	66.7
WaveIonics	Comp	9	2380.3	2490.0	454.0	4600.0	10	123.6	92.5	11.4	403.0	94.8	10	100.0
	Grab	5	4664.0	4140.0	3370.0	6590.0	5	2891.6	752.0	14.0	10200.0	38.0	5	100.0
WWIX	Comp	20	1085.2	939.5	578.0	2220.0	20	8.5	7.5	2.0	18.7	99.2	6	30.0
	Grab	8	1101.6	797.5	191.0	2350.0	8	11.0	10.0	2.3	19.4	99.0	4	50.0
Copper, dissolved														
Aquip	Comp	16	110.6	82.5	47.0	391.0	19	7.3	6.2	2.9	18.3	93.4	5	26.3
	Grab	7	151.0	128.0	108.0	311.0	9	8.8	8.0	4.7	14.5	94.2	2	22.2
WaveIonics	Comp	9	213.2	181.0	47.0	675.0	10	30.8	14.3	9.3	87.0	85.6	8	80.0
	Grab	5	402.2	161.0	127.0	1390.0	5	12.5	10.9	8.4	22.0	96.9	3	60.0
WWIX	Comp	20	538.2	509.0	368.0	960.0	20	7.0	6.1	2.0	17.4	98.7	3	15.0
	Grab	8	560.9	537.5	30.0	1010.0	8	9.0	7.8	2.0	16.8	98.4	3	37.5
Lead														
Aquip	Comp	16	2.1	2.0	2.0	3.7	19	2.0	2.0	2.0	2.0	68.3	0	0.0
	Grab	7	6.5	2.0	2.0	18.0	9	2.0	2.0	2.0	2.0	94.4	0	0.0
Wave Ionics	Comp	9	131.3	137.0	21.6	240.0	10	6.2	3.4	2.0	21.5	95.7	0	0.0
	Grab	5	221.2	190.0	149.0	310.0	5	134.6	45.5	2.0	453	39.2	2	40.0
WWIX	Comp	20	36.8	28.5	4.3	96.0	20	2.0	2.0	2.0	2.0	97.3	0	0.0
	Grab	8	34.8	24.5	3.5	103.0	8	2.0	2.0	2.0	2.0	97.1	0	0.0
Lead, dissolved														
Aquip	Comp	16	2.0	2.0	2.0	2.0	19	2.0	2.0	2.0	2.0	n/a[3]	0	0.0
	Grab	7	2.0	2.0	2.0	2.0	9	2.0	2.0	2.0	2.0	n/a	0	0.0
Wave Ionics	Comp	9	2.6	2.0	2.0	5.6	10	2.0	2.0	2.0	2.0	70.1	0	0.0
	Grab	5	4.7	2.0	2.0	13.9	5	2.0	2.0	2.0	2.0	83.0	0	0.0
WWIX	Comp	20	3.9	3.8	2.0	6.4	20	2.0	2.0	2.0	2.0	75.8	0	0.0
	Grab	8	4.5	4.2	2.0	8.3	8	2.0	2.0	2.0	2.0	81.3	0	0.0

Notes:
[1] PCR = pollutant concentration reduction. Results where both the influent and effluent concentrations were below laboratory detection limits were not included in the calculation of the average pollutant concentration reduction.
[2] Discharge criteria was established by pilot study steering committee for all parameters except TSS. For parameters with a discharge criteria range, criteria was set at the higher end of the range.
[3] All influent and effluent dissolved lead results from the Aquip technology were below the laboratory detection limit.
[4] No discharge criteria was established for TSS

Table 3. Comparison of summary statistics from influent and effluent water quality data for the three technologies (cont'd).

Technology	Grab/ Comp	Influent (µg/L)					Effluent (µg/L)					Avg. PCR[1]	no. samples above criteria[2]	percent of samples above criteria
		n	**Avg.**	**Med.**	**Min.**	**Max**	***n***	**Avg.**	**Med.**	**Min.**	**Max.**			
TSS														
Aquip	Comp	16	3.7	2.8	0.5	9.0	19	0.8	0.5	0.5	2.0	83.5	n/a[4]	n/a
	Grab	7	14.2	8.0	1.3	40.0	9	0.8	0.8	0.5	1.5	94.7	n/a	n/a
Wave Ionics	Comp	9	104.6	104.0	20.0	200.0	10	20.7	9.0	0.5	58.0	80.3	n/a	n/a
	Grab	5	155.4	178.0	83.0	202.0	5	299.3	240.0	0.5	916.0	-92.6	n/a	n/a
WWIX	Comp	20	15.3	12.5	4.5	34.0	20	0.9	0.5	0.5	3.0	95.1	n/a	n/a
	Grab	8	15.0	14.0	2.7	31.0	8	1.3	1.2	0.5	2.8	91.5	n/a	n/a
Zinc														
Aquip	Comp	16	190.1	144.0	93.0	656.0	19	76.2	70.0	46.0	153.0	59.9	3	15.8
	Grab	7	305.1	210.0	164.0	555.0	9	79.9	76.0	49.0	127.0	73.8	2	22.2
Wave Ionics	Comp	9	803.2	863.0	303.0	1160.0	10	64.5	63.5	7.0	168.0	92.0	1	10.0
	Grab	5	1424.0	1340.0	1010.0	2160.0	5	1415.8	670.0	9.0	5080.0	0.6	4	80.0
WWIX	Comp	20	437.3	348.0	196.0	1110.0	20	12.0	10.5	6.0	29.0	97.3	0	0.0
	Grab	8	515.1	335.5	156.0	1150.0	8	17.0	13.0	6.0	31.0	96.4	0	0.0
Zinc, dissolved														
Aquip	Comp	16	165.4	122.0	78.0	577.0	19	69.3	67.0	44.0	138.0	58.1	2	10.5
	Grab	7	224.1	196.0	150.0	491.0	9	74.1	68.0	43.0	120.0	66.9	2	22.2
Wave Ionics	Comp	9	302.2	274.0	200.0	483.0	10	23.1	13.5	5.0	65.0	92.5	0	0.0
	Grab	5	490.0	353.0	160.0	1260.0	5	11.0	10.0	7.0	14.0	97.8	0	0.0
WWIX	Comp	20	349.6	261.0	164.0	849.0	20	10.2	9.0	5.0	29.0	97.2	0	0.0
	Grab	8	416.0	312.5	102.0	922.0	8	14.3	11.0	5.0	29.0	96.6	0	0.0

Notes:
[1] PCR = pollutant concentration reduction. Results where both the influent and effluent concentrations were below laboratory detection limits were not included in the calculation of the average pollutant concentration reduction.
[2] Discharge criteria was established by pilot study steering committee for all parameters except TSS. For parameters with a discharge criteria range, criteria was set at the higher end of the range.
[3] All influent and effluent dissolved lead results from the Aquip technology were below the laboratory detection limit.
[4] No discharge criteria was established for TSS

Reliable effluent represents the highest the effluent concentrations are expected to be based on the dataset for a given parameter for each technology. The reliable effluent concentration is the highest recorded concentration unless the dataset contained outliers. If the dataset contained outliers the concentration was trimmed to the 95th percentile for the complete ordered effluent dataset. Table 4 summarizes the irreducible minimum and reliable effluent concentrations for each parameter for the three technologies tested as part of the boatyard study.

Table 4. Irreducible minimum and reliable effluent concentrations from the three technologies.

	Irreducible minimum effluent concentration	Reliable effluent concentration
Copper, total (µg/L)		
Aquip	4.0	21.0
Wave Ionics	11.4	4992.0[1]
WWIX	2.0	19.4
Copper, dissolved (µg/L)		
Aquip	2.9	18.3
Wave Ionics	8.4	87.0
WWIX	2.0	17.4
Lead, total (µg/L)		
Aquip	ND	ND[2]
Wave Ionics	2.0	232.0[1]
WWIX	ND	ND
Lead, dissolved (µg/L)		
Aquip	ND	ND
Wave Ionics	2.0	2.0
WWIX	ND	ND
Zinc, total (µg/L)		
Aquip	46.0	153.0
Wave Ionics	7.0	2245.0[1]
WWIX	6.0	31.0
Zinc, dissolved (µg/L)		
Aquip	43.0	138.0
Wave Ionics	5.0	65.0
WWIX	5.0	29.0
TSS (mg/L)		
Aquip	0.3	2.0
Wave Ionics	0.3	454.0[1]
WWIX	0.3	3.0

Notes:

[1] Dataset contained outlier. Concentration represents 95th percentile for the complete ordered effluent dataset for associated parameter.

[2] ND: Results were below the laboratory method detection limit.

4.2.4 Field QC Data

Internal field duplicates were collected as part of the study at a rate of 11 percent of the total number of samples collected. Results from the field duplicates were compared to an acceptance criteria stating there should be less than 20 percent difference for samples with results greater than five times the laboratory detection limit. Results from the original and duplicate samples along with the RPD are listed in Table 5. The RPD was generally less than 20 percent, however the results for several parameters did not meet the acceptance criteria. The inlet grab duplicate collected at the WWIX unit exceeded the acceptance criteria for total lead with a RPD of 39.5 percent. For the outlet grab duplicate collected at the Wave Ionics unit, the RPDs for total copper, lead, zinc, dissolved zinc and TSS were 116.2 percent, 100.8 percent, 112.1 percent, 33.3 percent and 60 percent, respectively. The exceedance of the acceptance criteria in several of the parameters may point to the inherent variability of stormwater data.

In addition, a considerably higher amount of flocculant was noted in the original outlet grab sample than the duplicate outlet grab sample from the Wave Ionics. The automated sampler rinses the sample line between samples which can result in a gap of several minutes between the original and duplicate samples. The flocculant may have mostly flushed through before the duplicate grab sample was collected, and a higher amount of flocculant in the original sample could account for the higher pollutant concentration.

Table 5. Results from internal field duplicates collected from all three technologies.

Technology	Sample Date	Sample ID	Parameters						
			Cu (µg/L)	Pb (µg/L)	Zn (µg/L)	Cu, diss. (µg/L)	Pb, diss. (µg/L)	Zn, diss. (µg/L)	TSS (mg/L)
WWIX	12/13/07	CBY-IN121307GRAB	2350	103	1150	1010	7.4	922	27
		CBY-IN121307GRABFD	2120	69	1140	1010	8.3	915	31
		RPD (%)	10.3	39.5	0.9	0.0	11.5	0.8	13.8
WWIX	12/13/07	CBY-IN121307COMP	2220	96	1110	960	6.4	849	28
		CBY-IN121307COMPFD	2180	94	1110	955	6.4	845	24
		RPD (%)	1.8	2.1	0.0	0.5	0.0	0.5	15.4
WWIX	12/13/07	CBY-OUT121307GRAB	194	ND	31	168	ND	29	2.8
		CBY-OUT121307GRABFD	192	ND	30	145	ND	27	2.3
		RPD (%)	1.0	ND	3.3	14.7	ND	7.1	19.6
WWIX	12/13/07	CBY-OUT121307COMP	187	ND	29	150	ND	25	3
		CBY-OUT121307COMPFD	186	ND	29	174	ND	29	2.5
		RPD (%)	0.5	ND	0.0	14.8	ND	14.8	18.2
Aquip	1/14/08	POE-IN011408GRAB	1490	17.7	429	137	ND	214	40
		POE-IN011408GRABFD	1410	18	414	127	ND	196	34
		RPD (%)	5.5	1.7	3.6	7.6	ND	8.8	16.2
Aquip	1/14/08	POE-IN011408COMP	287	3.7	168	84	ND	119	7.5
		POE-IN011408COMPFD	256	2.6	153	85	ND	123	6.5
		RPD (%)	11.4	34.9	9.3	1.2	ND	3.3	14.3

Notes:

ND: Results were below the laboratory detection limit.

Results in bold boxes indicate RPD exceeded the criteria for field duplicates.

Table 5. Results from internal field duplicates collected from all three technologies (cont'd).

Technology	Sample Date	Sample ID	Parameters						
			Cu (µg/L)	Pb (µg/L)	Zn (µg/L)	Cu, diss. (µg/L)	Pb, diss. (µg/L)	Zn, diss. (µg/L)	TSS (mg/L)
Aquip	1/14/08	POE-OUT011408GRAB	12	ND	127	10	ND	120	1.5
		POE-OUT011408GRABFD	14	ND	122	11	ND	113	1.3
		RPD (%)	15.4	ND	4.0	9.5	ND	6.0	14.3
Aquip	1/14/08	POE-OUT011408COMP	14	ND	103	12	2	99	1.8
		POE-OUT011408COMPFD	15	ND	104	12	3.2	101	1.5
		RPD (%)	6.9	ND	1.0	0.0	46.2	2.0	18.2
Wave Ionics	2/8/08	CSR-IN020808GRAB	3570	149	1040	149	ND	160	188
		CSR-IN020808GRABFD	3370	153	1010	161	ND	164	202
		RPD (%)	5.8	2.6	2.9	7.7	ND	2.5	7.2
Wave Ionics	2/8/08	CSR-IN020808COMP	2710	138	885	181	ND	227	138
		CSR-IN020808COMPFD	2640	138	863	185	ND	229	140
		RPD (%)	2.6	0.0	2.5	2.2	ND	0.9	1.4
Wave Ionics	2/8/08	CSR-OUT020808GRAB	2760	138	1030	9	ND	14	156
		CSR-OUT020808GRABFD	732	45.5	290	10.9	ND	10	84
		RPD (%)	**116.2**	**100.8**	**112.1**	19.1	ND	**33.3**	**60.0**
Wave Ionics	2/8/08	CSR-OUT020808COMP	153	8	6.8	12.3	ND	11	58
		CSR-OUT020808COMPFD	142	7.4	6.3	13.5	ND	12	56
		RPD (%)	7.5	7.8	7.6	9.3	ND	8.7	3.5

Notes:

ND: Results were below the laboratory detection limit.

Results in bold boxes indicate RPD exceeded the criteria for field duplicates.

5.0 RESULTS AND DISCUSSION

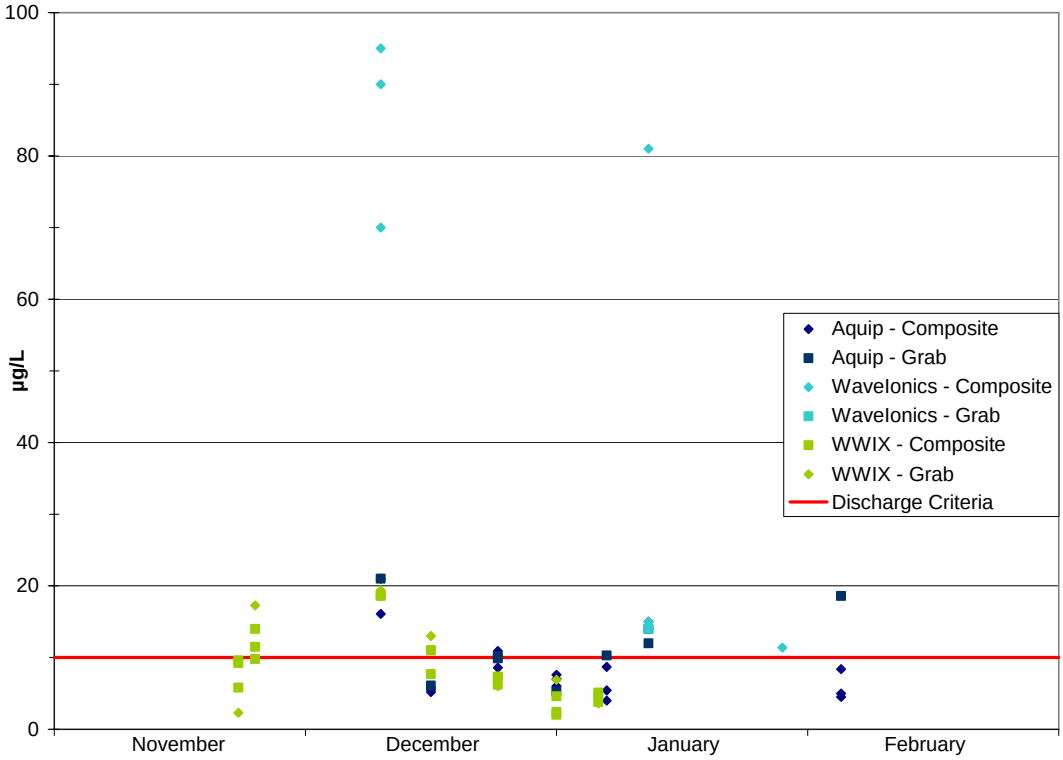
The project scope for Taylor was limited to collection of the monitoring data and a simple presentation of the project results. Because the project budget was limited, the project scope specifically excluded (1) interpretation of the monitoring data collected in this study, (2) development of conclusions regarding the treatment performance of each technology, and (3) the direct comparisons to other technologies.

This section provides a discussion of the impact of the technologies on each parameter. As guidance to future reviewers of the monitoring results, Taylor recommends that the operational conditions and treatment capacity that each technology was subjected to during the study (relative to the designed operational conditions and treatment capacity) be factored into any analysis, comparison or interpretation of the data results. A brief overview of the how the pilot study conditions varied from normal operating conditions is included in Section 6.0.

5.1 TOTAL COPPER

Figure 2 shows a graph of the effluent total copper levels from the three treatment technologies relative to the discharge criteria of 10 µg/L set by the steering committee. None of the effluent composite or grab samples from the Wave Ionics technology met the discharge criteria. Effluent concentrations for the Wave Ionics averaged 1046.29 µg/L. For WWIX, 14 of 20 (70 percent) composite samples and four of eight (50 percent) grab sample results met the criteria. Effluent concentrations for the WWIX averaged 9.1 µg/L with all results below 20 µg/L. For the Aquip, 13 of 19 (68.4 percent) composite samples and three of nine (33.3 percent) grab sample results met the discharge criteria. Effluent concentrations for the Aquip average 10.2 µg/L with all but one result below 20 µg/L.

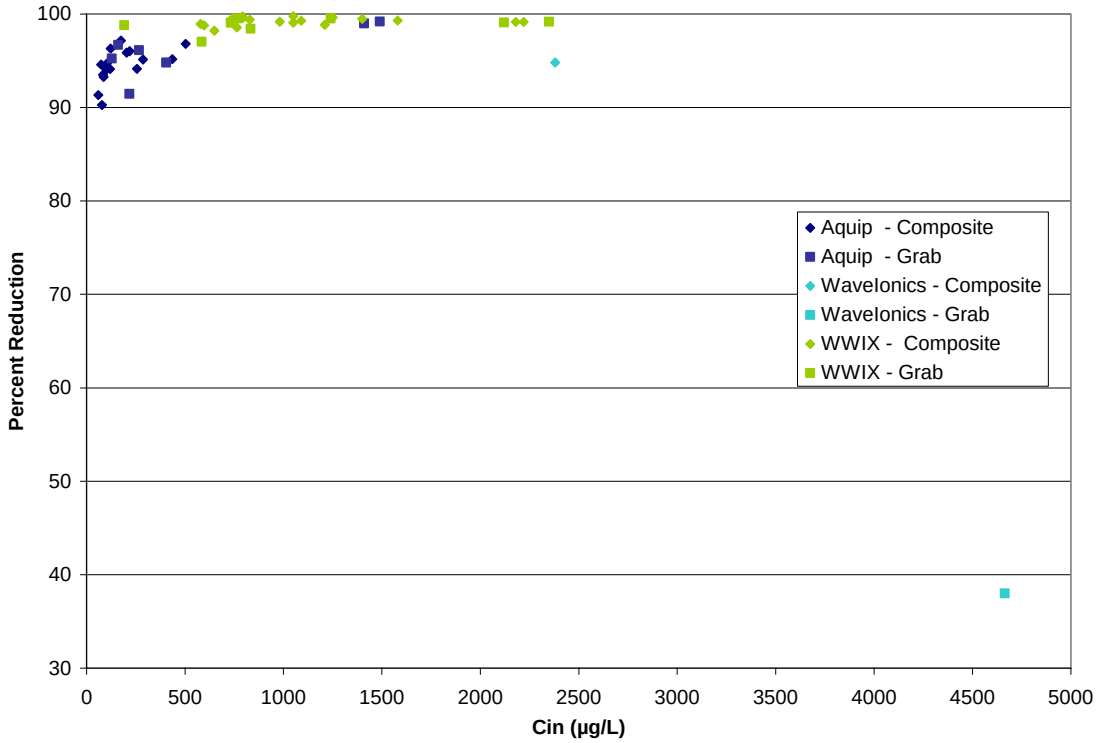
Figure 2. Effluent total copper concentrations relative to discharge criteria from three treatment technologies sampled during 12 storm events between November 2007 and February 2008.



Note: Wave Ionics results of 752 µg/L from 12/13/07 grab, 176 µg/L from 1/14/08 composite, 10200 µg/L from 1/30/08 grab, 403 µg/L from 1/30/08 composite, 2760 µg/L and 732 µg/L from 2/8/08 grabs, and 153 µg/L and 142 µg/L from 2/8/08 composites were not included on graph.

The percent pollutant concentration reduction of total copper relative to influent concentrations from the three treatment technologies is demonstrated in Figure 3. The collection of paired influent and effluent samples was not feasible with the Wave Ionics technology, so the percent reduction is calculated from the average influent and effluent concentrations for both the composite and grab sample results. The average reduction of the composite samples for the Wave Ionics was 94.8 percent, and the average of the grab samples was 38.0 percent. Copper reduction for the WWIX ranged from 98.6 to 99.9 percent for composite samples (with an average of 99.2 percent) and ranged from 97.0 to 99.5 percent for the grab samples (with an average of 99.0 percent). Aquip total copper reduction ranged from 90.3 to 97.1 percent for the composite samples (with an average of 94.9 percent), and ranged from 91.5 to 99.2 percent for the grab samples (with an average of 98.0 percent).

Figure 3. Percent reduction of total copper from composite and grab samples collected from three treatment technologies.



Note: The collection of paired influent and effluent samples was not possible with the Wave Ionics technology, therefore the percent reduction is based on an average influent and average effluent concentrations for all storms sampled as part of the study.

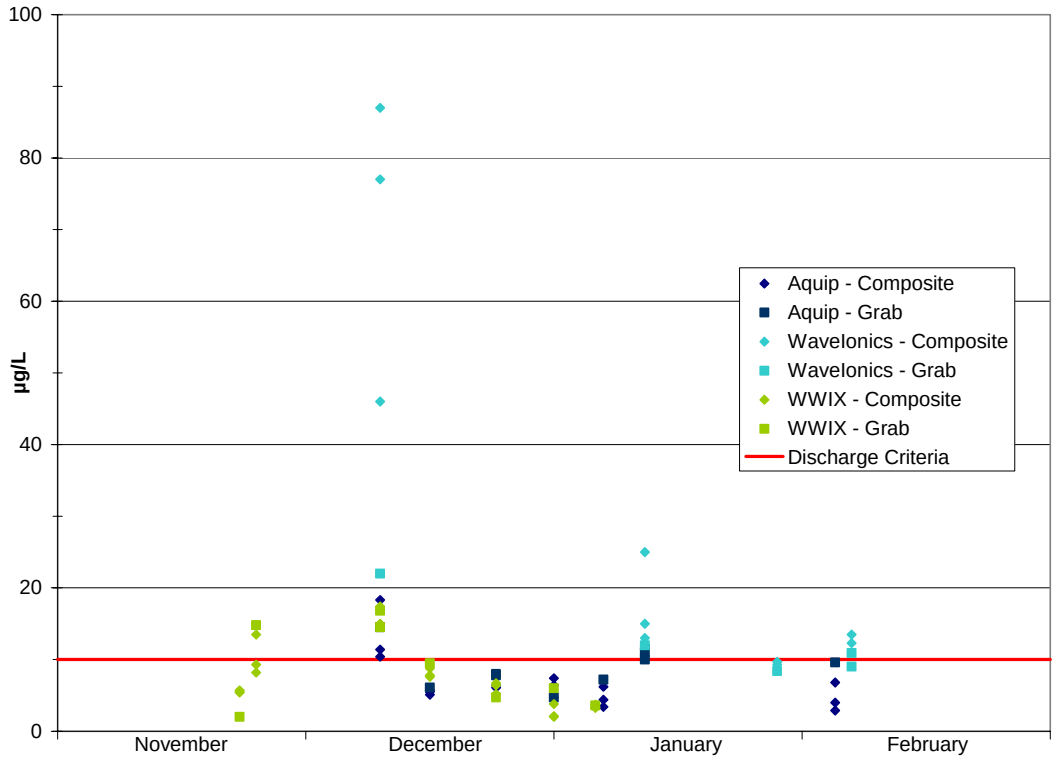
Results from the study generally indicate the WWIX and Aquip systems performed better than the Wave Ionics in removal of total copper, with the WWIX performing slightly better than the Aquip. This is particularly evident in the first flush grab samples.

5.2 DISSOLVED COPPER

Figure 4 shows a graph of the effluent dissolved copper levels from the three treatment technologies relative to the discharge criteria of 10 µg/L set by the steering committee. For the Wave Ionics, two of 10 (20 percent) composite samples and two of five (40 percent) grab sample results met the discharge criteria. Effluent concentrations for the Wave Ionics averaged 24.67 µg/L. For WWIX, 17 of 20 (85 percent) composite samples and five of eight (62.5 percent) grab sample results met the criteria. Effluent concentrations for the WWIX averaged 7.5 µg/L with all results below 20 µg/L. For the Aquip, 14 of 19 (73.7 percent) composite samples and seven of nine (77.8 percent) grab

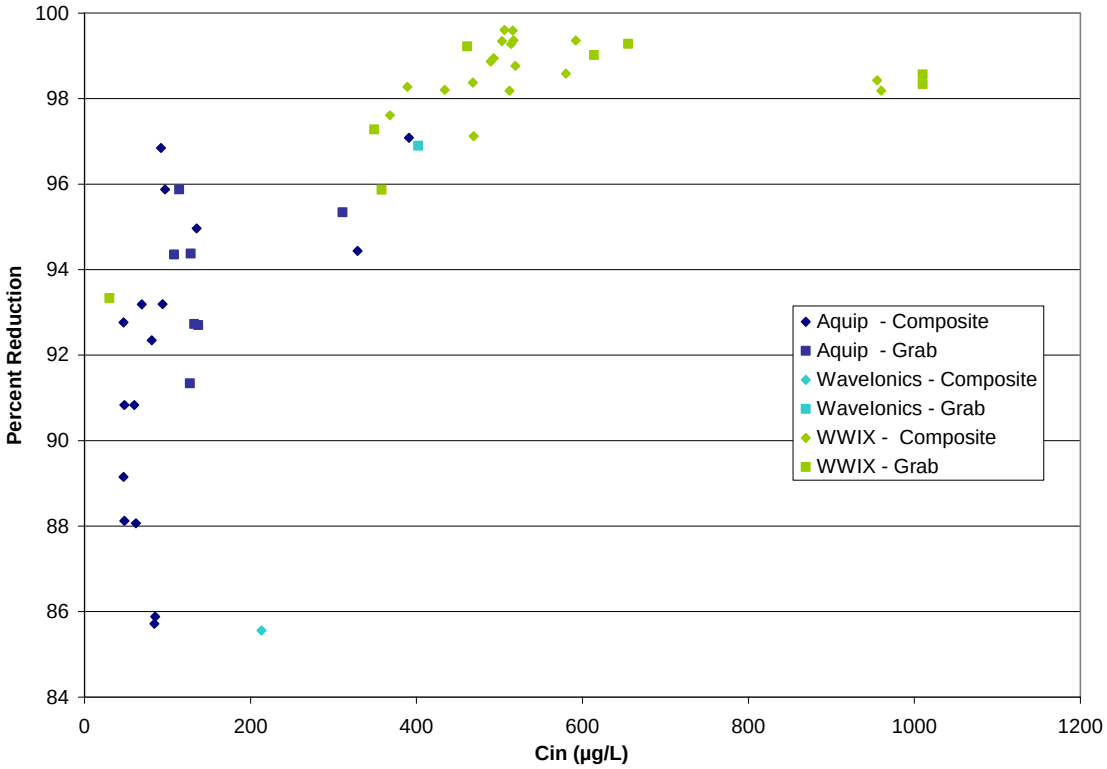
sample results met the discharge criteria. Effluent concentrations for the Aquip averaged 7.8 µg/L with all results below 20 µg/L.

Figure 4. Effluent dissolved copper concentrations relative to discharge criteria from three treatment technologies sampled during 12 storm events between November 2007 and February 2008.



The percent pollutant concentration reduction of dissolved copper relative to influent concentrations from the three treatment technologies is demonstrated in Figure 5. The collection of paired influent and effluent samples was not feasible with the Wave Ionics technology, so the percent reduction is calculated from the average influent and effluent concentrations for both the composite and grab sample results. The average reduction of dissolved copper from the composite samples for the Wave Ionics was 85.6 percent, and the average of the grab samples was 96.9 percent. Dissolved copper reduction for the WWIX ranged from 97.1 to 99.8 percent for composite samples (with an average of 98.7 percent), and ranged from 95.9 to 99.3 percent for the grab samples (with an average of 98.4 percent). Aquip dissolved copper reduction ranged from 85.7 to 97.1 percent for the composite samples (with an average of 93.4 percent), and ranged from 91.3 to 95.9 percent for the grab samples (with an average of 94.2 percent).

Figure 5. Percent reduction of dissolved copper from composite and grab samples collected from three treatment technologies.



Note: The collection of paired influent and effluent samples was not possible with the Wave Ionics technology, therefore the percent reduction is based on an average influent and average effluent concentrations for all storms sampled as part of the study.

When reviewing the effluent concentrations results from the study generally indicate the WWIX and Aquip technologies performed better than the Wave Ionics in removal of dissolved copper. Influent dissolved copper concentrations for the WWIX and Wave Ionics technologies were higher, which resulted in comparable percent pollutant concentration reductions (with slightly better performance observed for the WWIX technology).

5.3 TOTAL LEAD

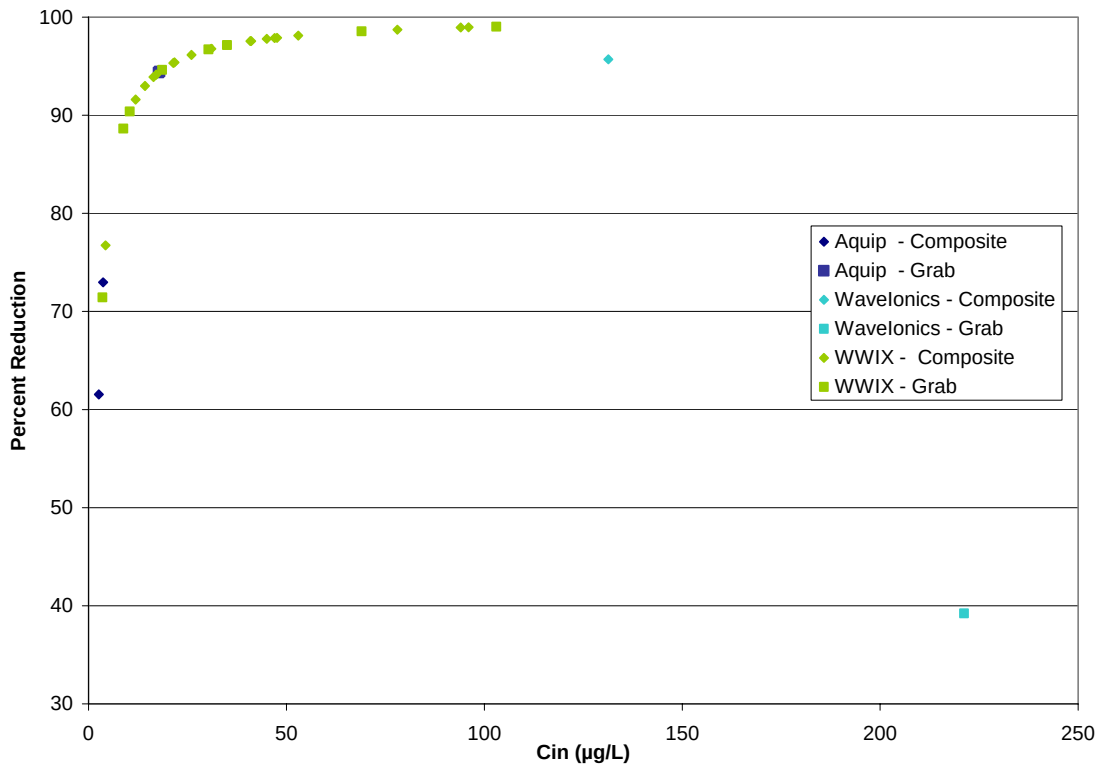
Figure 6 shows a graph of the effluent total lead levels from the Wave Ionics relative to the discharge criteria of 100 µg/L set by the steering committee. All effluent results for the WWIX and Aquip technologies were below the laboratory detection limit of 2.0 µg/L and were therefore not included in the figure. For the Wave Ionics technology, all of the composite samples and three of five (60 percent) grab sample effluent concentrations met the discharge criteria. Results from the total lead effluent concentrations for the Wave Ionics averaged 48.57 µg/L.

Figure 6. Effluent total lead concentrations relative to discharge criteria from the Wave Ionics sampled during 4 storm events between November 2007 and February 2008.

Note: Wave Ionics results of 453ug/L from 1/30/08 grab was not included on graph.

The percent pollutant concentration reduction of total lead relative to influent concentrations from the three treatment technologies is shown in Figure 7. The collection of paired influent and effluent samples was not feasible with the Wave Ionics technology, so the percent reduction is calculated from the average influent and effluent concentrations for both the composite and grab sample results. The average reduction of dissolved lead from the Wave Ionics composite samples was 95.7 percent, and the average of the grab samples was 39.2 percent. Total lead reduction for the WWIX ranged from 76.7 to 99.0 percent for composite samples (with an average of 97.3 percent), and ranged from 71.4 to 99.0 percent for the grab samples (with an average of 97.1 percent). Only two composite and two grab influent concentrations from the Aquip were greater than the laboratory detection limit of 2.0 µg/L, so the percent pollutant reduction was calculated for those results only. The Aquip composite samples had a percent reduction of 73.0 percent and 61.5 percent (with an average of 68.3 percent). The grab samples had a percent reduction of 94.4 percent and 94.4 percent (with an average of 94.4 percent).

Figure 7. Percent reduction of total lead from composite and grab samples collected from three treatment technologies



Note: The collection of paired influent and effluent samples was not possible with the Wave Ionics technology, therefore the percent reduction is based on an average influent and average effluent concentrations for all storms sampled as part of the study.

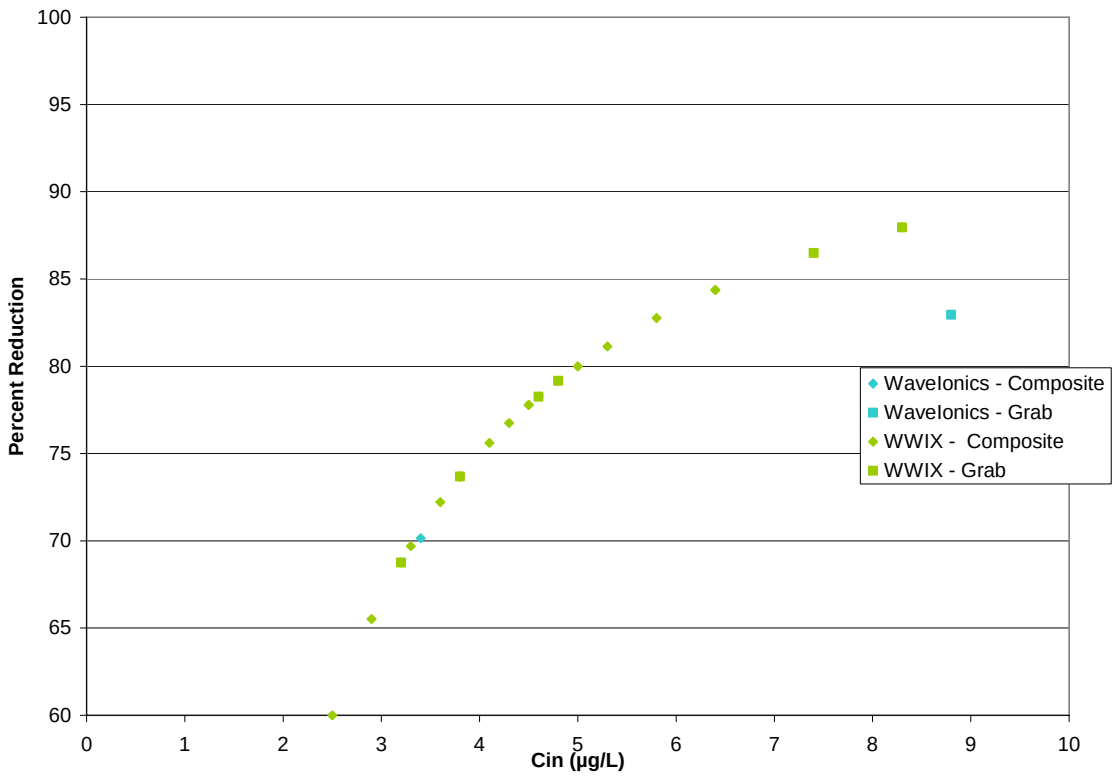
Results from the study generally indicate the WWIX performed the best in the removal of total lead, followed by the Aquip and Wave Ionics technologies.

5.4 DISSOLVED LEAD

All effluent dissolved lead concentrations from the three technologies were below the laboratory detection limit of 2 µg/L. The percent pollutant concentration reduction of dissolved lead relative to influent concentrations from two of the treatment technologies is shown in Figure 8. All Aquip influent and effluent dissolved lead concentrations were below the laboratory detection limit, so no Aquip results are included in the graph. The collection of paired influent and effluent samples was not feasible with the Wave Ionics technology, so the percent reduction is calculated from the average influent and effluent concentrations for both the composite and grab sample results. The average reduction of dissolved lead from the Wave Ionics composite samples was 70.2 percent, and the average of the grab samples was 83.0 percent. Dissolved lead reduction for the WWIX ranged from 50.0 to 84.4 percent for composite samples (with an average of 75.8 percent)

and ranged from 71.4 to 88.0 percent for the grab samples (with an average of 81.3 percent).

Figure 8. Percent reduction of dissolved lead from composite and grab samples collected from two treatment technologies.



Note: The collection of paired influent and effluent samples was not possible with the Wave Ionics technology, therefore the percent reduction is based on an average influent and average effluent concentrations for all storms sampled as part of the study.

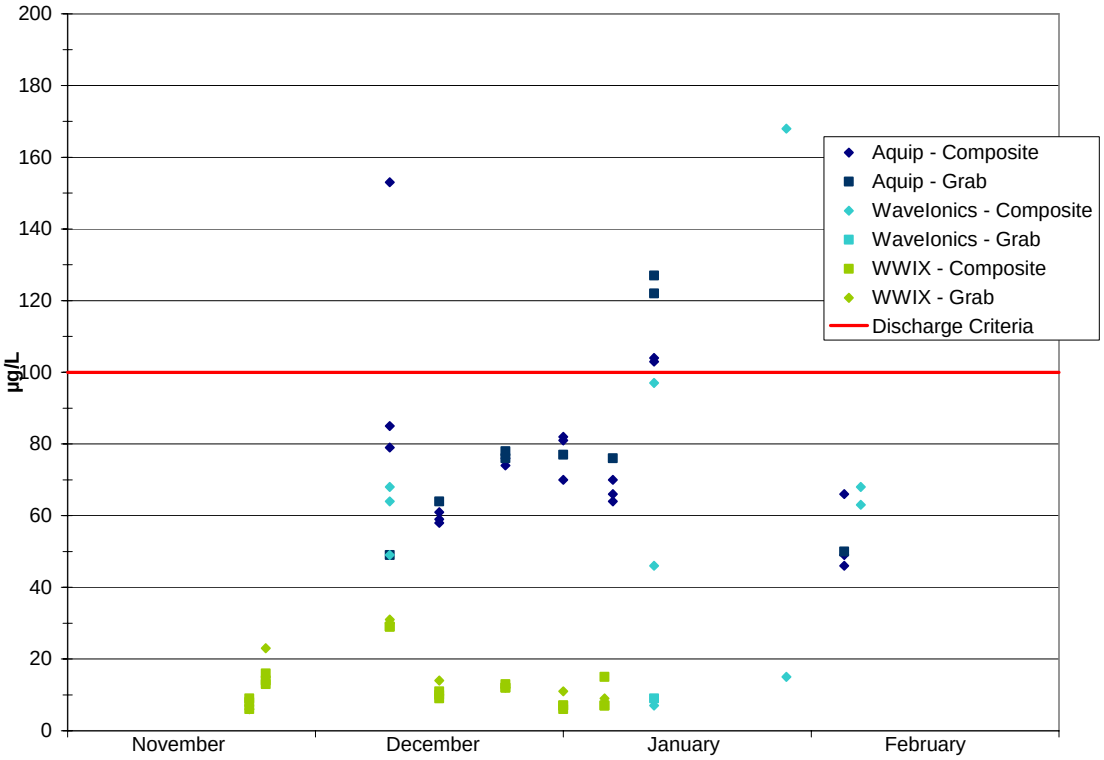
Results from the study generally indicate little difference between the performances of the WWIX and Wave Ionics technologies.

5.5 TOTAL ZINC

Figure 9 shows a graph of the effluent total zinc levels from the three treatment technologies relative to the discharge criteria of 100 µg/L set by the steering committee. For the Wave Ionics, nine of 10 (90 percent) composite samples and one of five (20 percent) grab sample results met the discharge criteria. Effluent concentrations for the Wave Ionics averaged 514.93 µg/L. For WWIX, all of the composite or grab results met the criteria. Effluent concentrations for the WWIX averaged 13.2 µg/L. For the Aquip, 16 of 19 (84.2 percent) composite samples and seven of nine (77.8 percent) grab sample

results met the discharge criteria. Effluent concentrations for the Aquip averaged 77.4 µg/L.

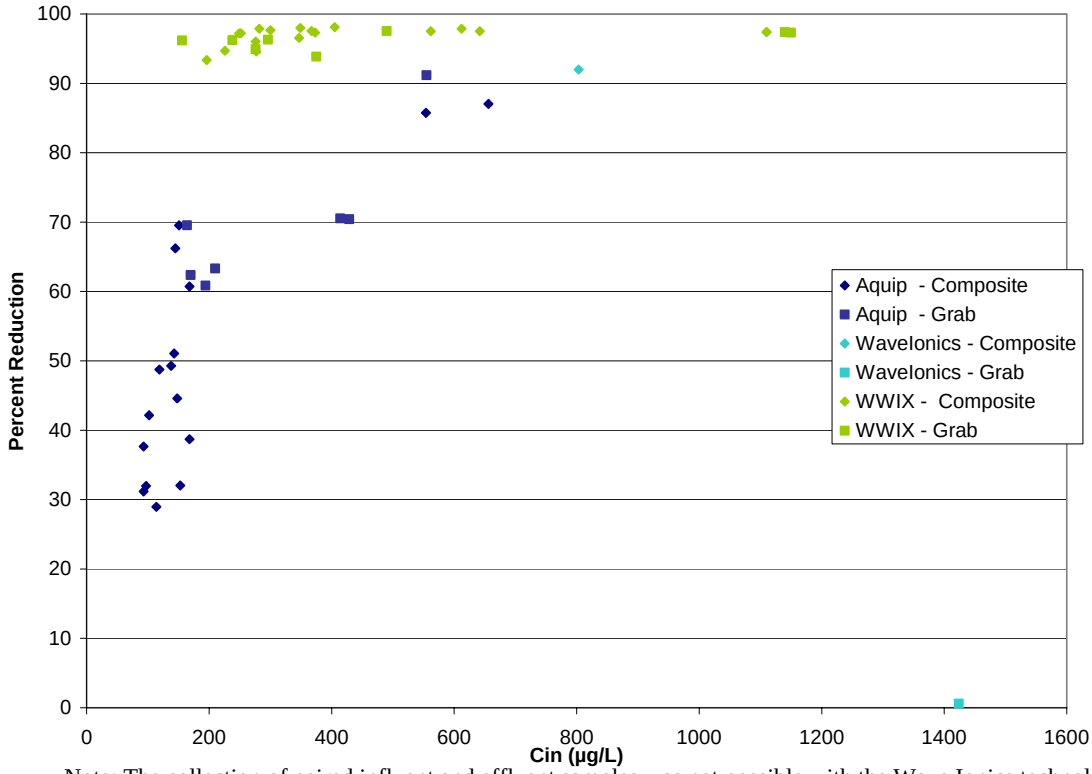
Figure 9. Effluent total zinc concentrations relative to discharge criteria from three technologies sampled during 12 storm events between November 2007 and February 2008.



Note: Wave Ionics results of 670 µg/L from 12/13/07 grab, 5080 µg/L from 1/30/08 grab, and 1030 µg/L from 2/8/08 grab were not included on graph.

The percent pollutant concentration reduction of total zinc relative to influent concentrations from the three treatment technologies is shown in Figure 10. The collection of paired influent and effluent samples was not feasible with the Wave Ionics technology, so the percent reduction is calculated from the average influent and effluent concentrations for both the composite and grab sample results. The average reduction of total zinc from the Wave Ionics composite samples was 92.0 percent, and the average of the grab samples was 0.6 percent. Total zinc reduction for the WWIX ranged from 93.4 to 98.0 percent for composite samples (with an average of 97.3 percent), and ranged from 94.0 to 97.6 percent for the grab samples (with an average of 96.4 percent). Pollutant reduction for the Aquip for total zinc ranged from 28.9 percent to 87.0 percent for composite samples (with an average of 59.9 percent), and ranged from 60.8 percent to 91.2 percent for grab samples (with an average of 73.8 percent).

Figure 10. Percent reduction of total zinc from composite and grab samples collected from three treatment technologies.



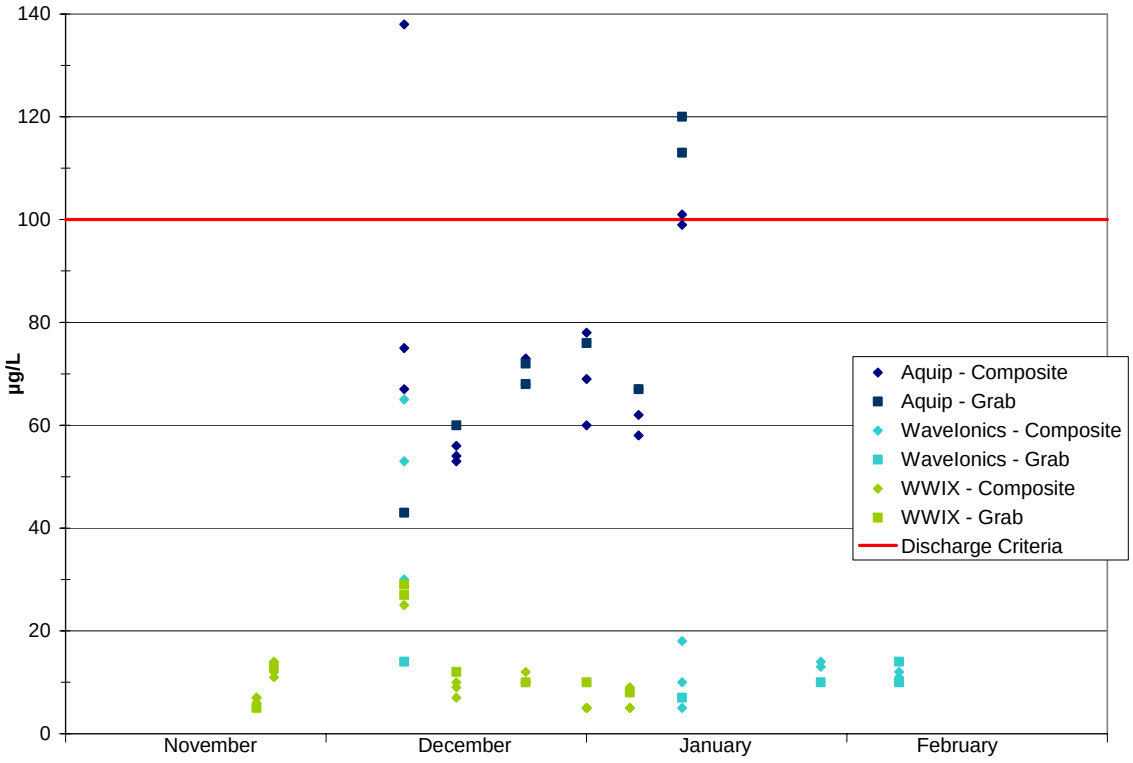
Note: The collection of paired influent and effluent samples was not possible with the Wave Ionics technology, therefore the percent reduction is based on an average influent and average effluent concentrations for all storms sampled as part of the study.

Results from the effluent concentrations and percent pollutant reduction generally indicate the WWIX performed the best in the removal of total zinc, followed by the Aquip and then the Wave Ionics technologies.

5.6 DISSOLVED ZINC

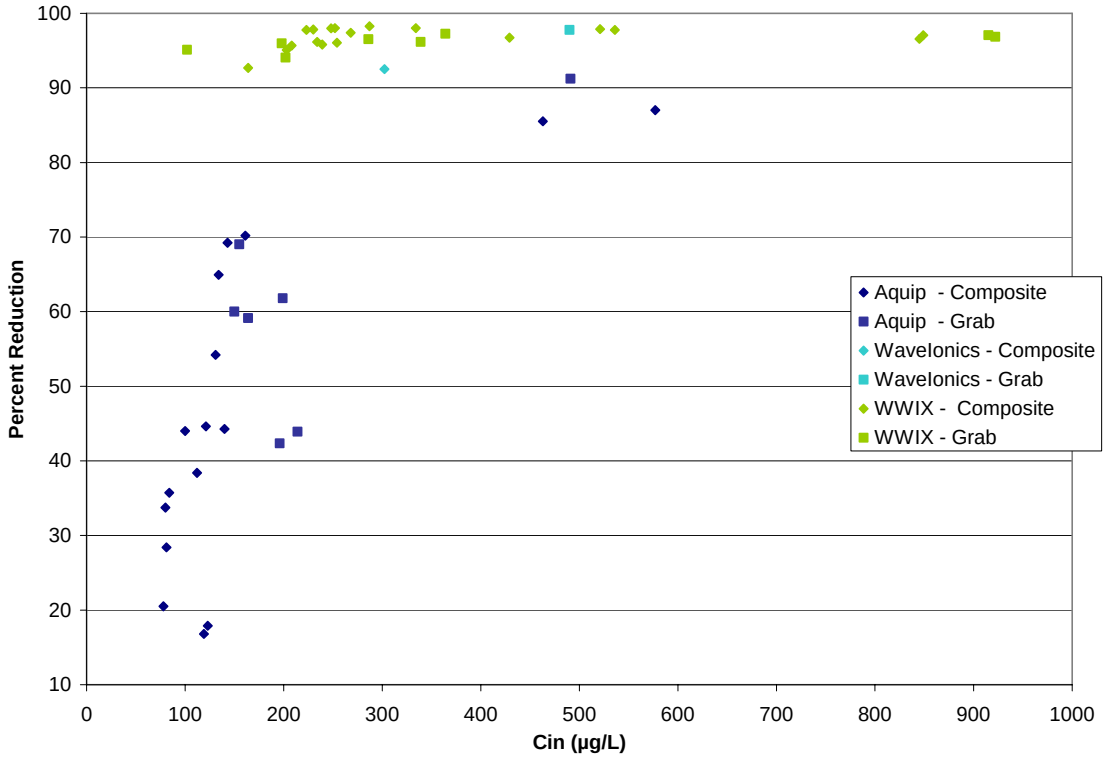
Figure 11 shows a graph of the effluent dissolved zinc levels from the three treatment technologies relative to the discharge criteria of 100 µg/L set by the steering committee. All of the Wave Ionics and WWIX composite or grab results met the discharge criteria. Effluent concentrations for the Wave Ionics averaged 18.75 µg/L. Effluent concentrations for the WWIX averaged 10.7 µg/L. For the Aquip 17 of 19 (89.5 percent) composite samples and seven of nine (77.8 percent) grab sample results met the discharge criteria. Effluent concentrations for the Aquip averaged 70.9 µg/L.

Figure 11. Effluent dissolved zinc concentrations relative to discharge criteria from three technologies sampled during 12 storm events between November 2007 and February 2008.



The percent pollutant concentration reduction of dissolved zinc relative to influent concentrations from the three treatment technologies is shown in Figure 12. The collection of paired influent and effluent samples was not feasible with the Wave Ionics technology, so the percent reduction is calculated from the average influent and effluent concentrations for both the composite and grab sample results. The average reduction of dissolved zinc from the Wave Ionics composite samples was 92.4 percent, and the average of the grab samples was 97.8 percent. Dissolved zinc reduction for the WWIX ranged from 92.7 to 99.1 percent for composite samples (with an average of 97.2 percent), and ranged from 94.1 to 97.6 percent for the grab samples (with an average of 96.7 percent). Pollutant reduction for the Aquip for dissolved zinc ranged from 16.8 percent to 87.0 percent for composite samples (with an average of 58.1 percent), and ranged from 42.3 percent to 91.2 percent for grab samples (with an average of 66.9 percent).

Figure 12. Percent reduction of dissolved zinc from composite and grab samples collected from three treatment technologies.



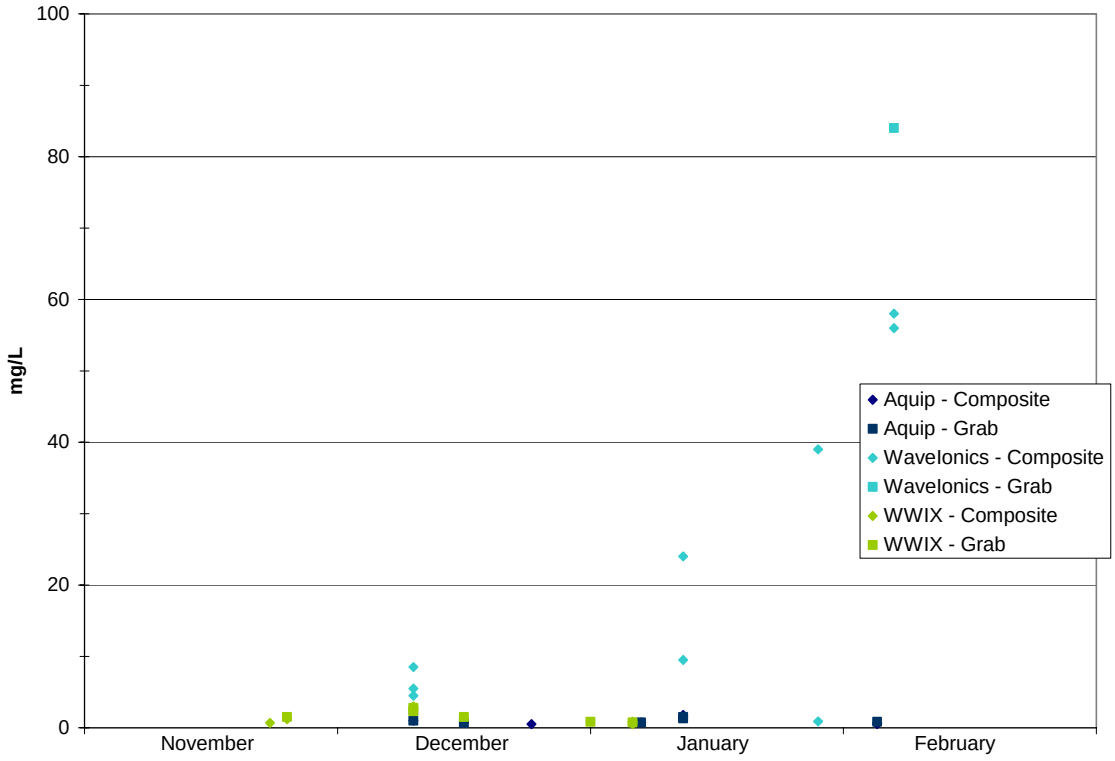
Note: The collection of paired influent and effluent samples was not possible with the Wave Ionics technology, therefore the percent reduction is based on an average influent and average effluent concentrations for all storms sampled as part of the study.

Results from the effluent concentrations and percent pollutant reduction generally indicate the WWIX and Wave Ionics technologies performed better than the Aquip in the removal of dissolved zinc.

5.7 TSS

Figure 13 shows a graph of the effluent TSS levels from the three treatment technologies. No discharge criterion was set by the steering committee for TSS. Effluent TSS concentrations from the Wave Ionics ranged from below the laboratory detection limit of 0.5 mg/L to 58 mg/L for the composite samples and from below the laboratory detection limit to 916 mg/L for the grab samples. For the WWIX, effluent TSS concentrations ranged from below the laboratory detection limit to 3 mg/L for the composite samples and from below the laboratory detection limit to 2.8 mg/L for the grab samples. Effluent TSS concentrations for the Aquip ranged from below the laboratory detection limit for the composite and grab samples to 2.0 mg/L for the composite samples and 1.5 mg/L for the grab samples.

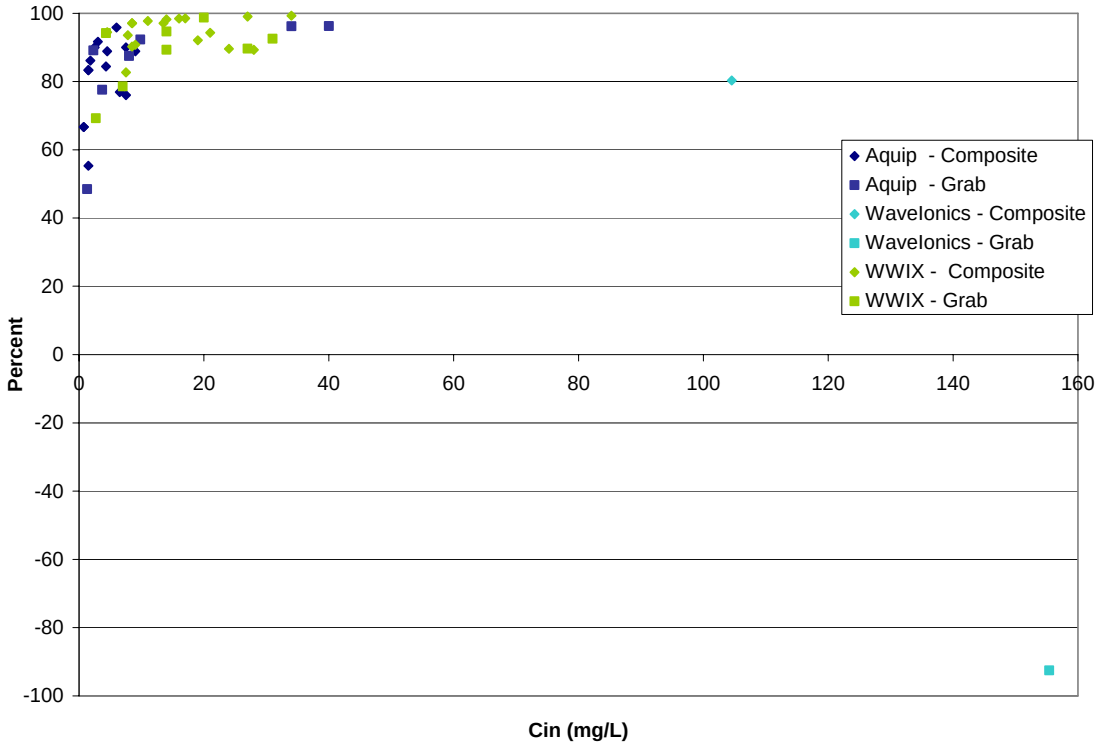
Figure 13. Effluent TSS concentrations from three technologies sampled during 12 storm events between November 2007 and February 2008.



Note: Wave Ionics results of 214 µg/L from 12/13/07 grab, 916 µg/L from 1/30/08 grab, and 256 µg/L from 2/8/08 grab were not included on graph.

The percent pollutant concentration reduction of TSS relative to influent concentrations from the three treatment technologies is shown in Figure 14. The collection of paired influent and effluent samples was not feasible with the Wave Ionics technology, so the percent reduction is calculated from the average influent and effluent concentrations for both the composite and grab sample results. The average reduction of TSS from the Wave Ionics composite samples was 80.3 percent, and the average of the grab samples was -92.6 percent. TSS reduction for the WWIX ranged from 82.7 to 99.3 percent for composite samples (with an average of 95.1 percent), and ranged from 69.3 to 98.8 percent for the grab samples (with an average of 91.5 percent). Pollutant reduction for the Aquip for TSS ranged from 50.0 percent to 95.8 percent for composite samples (with an average of 83.5 percent), and ranged from 48.5 percent to 96.3 percent for grab samples (with an average of 94.7 percent).

Figure 14. Percent reduction of TSS from composite and grab samples collected from three treatment technologies.



Note: The collection of paired influent and effluent samples was not possible with the Wave Ionics technology, therefore the percent reduction is based on an average influent and average effluent concentrations for all storms sampled as part of the study.

Results from the study generally indicate the WWIX and Aquip systems performed better than the Wave Ionics in removal of TSS. This is particularly evident in the first flush grab samples.

6.0 VENDOR FEEDBACK

As stated in Section 5.0, Taylor recommends that the operational conditions and treatment capacity that each technology was subjected to during the study (relative to the designed operational conditions and treatment capacity) be factored into any analysis, comparison or interpretation of the data results.

To assist in the evaluation of operational conditions among the three technologies, the vendors were requested to provide a brief description of how the pilot study conditions varied from normal operating conditions for their units. The following operational information was provided by StormwateRx for the Aquip and Water Tectonics for the Wave Ionics technologies. No information was provided by Siemens for the WWIX.

6.1 STORMWATERX AQUIP

The Aquip pilot system installed at the Port of Edmonds Boat Workyard was equipped with a data logger that allowed for the calculation of the total gallons of stormwater that were treated by the unit. The data were used to compare the design conditions to the actual conditions of the unit installed in the workyard. The Aquip pilot system was designed to treat 5.4 gpm. Based on the Port of Edmonds drainage area, the design water quality flow rate using the Western Washington Hydrology Model is 31 gpm. Therefore, at a flowrate of 5.4 gpm, the Aquip should theoretically treat 17.4 percent of the site's flow volume.

Based on the resulting flow record collected by the datalogger, the total volume treated by the Aquip pilot system during the study period of 11/21/07 and 2/12/08 was 105,650 gallons. Using local rainfall data from Seattle, the calculated rainfall volume during the study period for the one-acre boat workyard was 301,380 gallons (this assumes 80 percent rainfall capture). As a result, the Aquip captured a greater percentage of the runoff and treated 35 percent of the site's total volume during the study period. Comparing this with the annual design volume of 17.4 percent, the system effectively operated at two times its design service life. This extended operation may be reflected in the sampling data.

6.2 WATER TECTONICS, INC. WAVE IONICS ELECTRO-COAGULATION SYSTEM TREATMENT

The current Wave Ionics system at CSR marine was designed to operate at 50 gpm. Due to constraints around the drainage size of the boatyard and anticipated runoff volumes, the unit set up to run at a lower inflow rate of 16 gpm. This lower inflow rate created a low flow environment in the treatment cells, which can promote cell loading (blinding) and a less than favorable treatment environment.

At the normal flow rate of 50 gpm, the cells will flush or process the sediments by design and avoid building up in the cell. The actual run time and volume of flow through the system was much lower than normal operating conditions (approximately 23 hours at 16 gpm or approximately 22,080 gallons). This again was due to a smaller drainage area and low runoff volumes as well as the lack of sizeable rain events during the test period. Since the start-up date was critical, few changes were made to the Wave Ionics unit to meet the flow requirements of the pilot study once the study commenced. Water Tectonics has since learned how critical the site collection system and sizing is to promote maximum treatment performance.

REFERENCES

Agreement, 2007. Settlement Agreement between Northwest Marine Trade Association, Puget Soundkeepers Alliance, and Washington State Department of Ecology. July 2007.

Ecology, 2005. Boatyard General Permit, National Pollutant Discharge Elimination System. NPDES General Permit No. WAG-030000. December 2005. http://www.ecy.wa.gov/programs/wq/permits/boatyard/boatyard_2005_permit/boatyard_permit_signed.pdf

EPA, 1996. Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levles. July 1996. http://www.brooksrand.com/FileLib/1669.pdf

Appendix A. Sampling Plan

Northwest Marine Trade Association Stormwater Treatment Pilot Project Sampling Plan –DRAFT

Prepared for: Northwest Marine Trade Association, Puget Soundkeepers Alliance, and Department of Ecology Steering Committee

Prepared by: Taylor Associates, Inc.

November 2007

Introduction

The Northwest Marine Trade Association, Puget Sound Keepers Alliance, and the Department of Ecology have entered into a settlement agreement to resolve differences in the draft NPDES Boatyard General Permit. Among the goals in this agreement is to test the performance of stormwater treatment technologies at boatyards. This document describes the sampling plan for testing of three distinct stormwater treatment technologies installed at three boatyards around Puget Sound: a StormwateRx unit at the Port of Edmonds boatyard; a Water Tectonics unit at CSR Marine West; and a Siemens unit at the Canal Boatyard in Ballard. This study will provide water quality data to the settlement agreement Steering Committee (the Committee) to evaluate the degree of treatment achieved by the technologies. Due to the limited content intended for this sampling plan, it does not follow complete quality assurance project plan (QAPP) guidelines.

Goals/Objectives

The goal of this study is to evaluate the water quality treatment performance of each technology for removal of total suspended solids (TSS), and dissolved and total copper (Cu), lead (Pb) and zinc (Zn). This objective will be accomplished by collecting a first flush grab and time-paced composite water quality samples at the inlet and outlet of each technology for up to six storm events. Treatment effectiveness will be determined by comparing influent and effluent concentrations for the above mentioned parameters. The sample collection period for this project is anticipated to occur between November 2007 and January 2008, but may extend longer if necessary. This schedule will largely be dependant on suitable rain events occurring during these months.

Sampling Plan

Stormwater samples will be collected at each technology for up to six storm events. Targeted storm event criteria will include an antecedent dry period of < 0.1 inches of rain in 24 hours, with a 70 percent probability of a storm intensity of 0.2 inches in six hours. Websites used to determine if a targeted storm meets these criteria will include:

- The National Oceanic and Atmospheric Administration's National Weather Service (http://www.weather.gov/)
- The Center for Ocean-Land-Atmosphere Studies' 3.5-day meteogram (http://wxmaps.org/pix/seanam.png)
- The Center for Ocean-Land-Atmosphere Studies' 7-day meteogram (http://wxmaps.org/pix/seagfs.png)
- The Unisys Weather's 2-day meteogram (http://weather.unisys.com/mos/meteogram/mos_met_SEA_inv.html).

Sample collection and reset will only occur during normal business hours – 6am to 6pm Monday through Friday (excluding holidays).

The three technologies may or may not be sampled concurrently during each storm event. The anticipated schedule is to sample two events in November, two events in December, and two events in January. Meeting this schedule will be dependent on installations of the technologies, equipment performance, and the availability of suitable storm events during these months.

Automated water quality samplers are being used to collect samples at all three boatyards. Sampling equipment includes pairs of Isco 6700 or 3700 automated water quality samplers installed at the inlet and outlet of each technology. Both the inlet and outlet samples are collected using vinyl sample intake lines and a four 3.7-liter polypropylene bottle set-up in the sampler base. Prior to each storm event targeted for sampling, samplers will be set up by Taylor Associates staff and the sampler intake lines will be back flushed with approximately two liters of laboratory grade deionized (DI) water to avoid cross-contamination from previously sampled events.

After coordinating with Taylor Associates staff to confirm runoff from a particular site has triggered the inlet pump (float switch activated), boatyard staff will manually start the inlet and outlet samplers. The samplers will be configured with a 2-part program: Part A will collect a single 2000-ml first flush grab sample into Bottle 1; Part B will collect up to three, sequentially collected, time-paced composite samples into Bottles 2 through 4. Due to variations in the set up of each technology, programming specifics vary. The programming details for each technology are outlined below.

CSR West Marine – Water Tectonics Electrocoagulation System

Part A: First Flush Grab Sample

Boatyard staff at CSR West Marine will manually start both the inlet (CSR-In) and outlet (CSR-Out) samplers after being directed to do so by Taylor Associates staff. Immediately after the CSR-In station is started the sampler will begin Part A of the program and attempt to collect a 2000-ml first flush grab sample into Bottle 1. Due to a potential lag in time between water entering and exiting the technology, CSR-Out will be delayed until an Isco Liquid Level Actuator confirms water is present in the outlet pipe before starting Part A of the program and collecting its 2000-ml first flush grab sample into Bottle 1. If the samplers do not detect any water while attempting to collect the grab sample they will retry one time.

Part B: Time Paced Composite Samples

After completing Part A of the sampling program the samplers will move on to Part B. Part B of the sampling program entails collecting up to three 1-hour duration, time-paced composite samples into Bottles 2 through 4. To collect the time-paced composite samples both the inlet and outlet samplers will be programmed with a 5-minute time pacing rate. As such, every 5 minutes the sampler will attempt to collect a 300-ml subsample into one composite bottle. After one hour (12 subsamples) the sampler will move onto the next bottle and continue the program. Samples will only be collected when the pump is running and water is flowing through the technology. If no water is flowing through the technology the sampler will record a "No Liquid Detect" reading. The overall goal for time paced composite collection is to obtain samples from the initial three hours of a selected storms runoff volume and to collect a minimum of six subsamples (1800 ml) in each of three bottles provided for this part of the autosampler program.

Port of Edmonds - StormwateRx System

Part A: First Flush Grab Sample

Boatyard staff at the Port of Edmonds will manually start both the inlet (POE-In) and outlet (POE-Out) samplers after being directed to do so by Taylor Associates, Inc. staff. Immediately after POE-In is started by the boatyard staff the sampler will begin Part A of the program and attempt to collect a 2000-ml first flush grab sample into Bottle 1.

The StormwateRx system installed at the Port of Edmonds has a detention time of approximately 15 minutes when pumping at the 5.4gpm flow rate. In an effort to collect paired inflow and outflow samples, POE-Out will be programmed with a 15 minute delay to start. After the boatyard staff start the sampler POE-Out will wait 15 minutes for one detention volume to flush through before starting Part A of the program and collecting its 2000-ml first flush grab sample into Bottle 1. If the samplers do not detect any water while attempting to collect the grab sample they will retry one time.

Part B: Time Paced Composite Samples

After completing Part A of the sampling program the samplers will move on to Part B, which entails collecting up to three 1-hour duration, time-paced composite samples into Bottles 2 through 4. To collect the time-paced composite samples both the inlet and outlet samplers will be programmed with a 5-minute time pacing rate. As such, every 5 minutes the sampler will attempt to collect a 300-ml subsample into one composite bottle. After one hour (12 subsamples) the sampler will move onto the next bottle and continue the program. Samples will only be collected when the pump is running and water is flowing through the technology. If no water is flowing through the technology when the sampler attempts to collect a subsample it will retry one time and then record a "No Liquid Detect" reading. The overall goal for time paced composite collection is to obtain samples from the initial three hours of a selected storms runoff volume and to collect a minimum of six subsamples (1800 ml) in each of three bottles provided for this phase of the autosampler program. .

Canal Boatyard - Siemens System

Sampling plan details for the Siemens system will be determined after the installation of the technology has been completed. An amendment to this plan, with complete sampling implementation details, will be attached once approved by the Committee.

Sample Handling and Processing

After the sampling routine is finished, the downloaded autosampler reports will be inspected to determine if the minimum number of subsamples have been met. Samples will be retrieved from the units using an adaptation of the "clean hands/dirty hands" protocols for metals grab sample collection as outlined in EPA Method 1669: Sampling ambient water for trace metals at EPA water quality criteria levels.

For both the inlet and outlet stations, Bottle 1 will labeled as a grab sample and Bottles 2 through 4 will be labeled as three separate composite samples. Bottles will be labeled as follows:

Grab Sample:

- Inlet station: "[CSR-In, POE-In, or CBY-In][6-digit date]Grab"
- Outlet station: "[CSR-Out, POE-Out, or CBY-Out][6-digit date]Grab"

Composite Samples:

- Inlet station: "[CSR-In, POE-In, or CBY-In][6-digit date]Comp[1, 2, or 3]"
- Outlet station: "[CSR-Out, POE-Out, or CBY-Out][6-digit date]Comp[1, 2, or 3]"

The six digit date used for the composite samples will be the date of the first subsample of that composite sample. For project identification on Chain of Custody (COC) forms and laboratory reports, this study will be referred to as "NMTA Boatyard Study."

After labeling, samples will be stored in coolers on ice and transported to the analytical laboratory (Aquatic Research, Inc. [AQR]) within 24 hours of the time of the last subsample was collected to meet the maximum holding time requirements for filtration for dissolved metals.

Analytical Parameters

All samples will be analyzed for the following parameters:

- TSS
- total & dissolved Cu
- total & dissolved Pb
- total & dissolved Zn

A minimum volume of 1.6 liters will be required for a complete analysis. If there is insufficient sample volume for complete laboratory analysis, parameters will be prioritized as follows:

1) Total and dissolved Cu
2) Total and dissolved Zn
3) Total and dissolved Pb
4) TSS

A standard analytical data turnaround time of 2 weeks will be requested from the laboratory.

Field Quality Control (QC) Samples

Field QC samples will include internal field duplicates at a rate of one of the successfully collected pairs of stormwater samples submitted for analysis at each of the boatyards. At least one duplicate will be collected at the inlet and outlet sample points of each of the three sites during the pilot study. Thus six internal field duplicates will be collected for this project.

To collect the internal field duplicate, for one storm event at each boatyard the sampler programming for both the inlet and outlet samplers will be changed to collect two simultaneous grab samples followed by two simultaneous composite samples. As a result, for that boatyard during that storm event only one primary grab and one primary composite, along with one duplicate grab and one duplicate composite, will be collected from both the inlet and the outlet samplers. Field duplicates will be handled in the same manner as primary samples. Field duplicate bottles will be labeled as follows:

Grab Sample:

- Inlet station: "[CSR-In, POE-In, or Canal-In][6-digit date]GrabFD"
- Outlet station: "[CSR-Out, POE-Out, or Canal-Out][6-digit date]GrabFD"

Composite Samples:

- Inlet station: "[CSR-In, POE-In, or Canal-In][6-digit date]Comp1FD"
- Outlet station: "[CSR-Out, POE-Out, or Canal-Out][6-digit date]Comp1FD"

Laboratory QC Protocols

Aquatic Research, Inc., the laboratory being used for sample analysis, is certified by the Washington State Department of Ecology for the analysis of environmental water samples. All samples bottles used during the study will be cleaned by the lab prior to being deployed in the field. Cleaning will involve a combination of washing with Liquinox, a laboratory grade soap, and an acid rinse.

Laboratory QC checks for TSS analysis will include method blanks, check standards, and analytical duplicates. For the total and dissolved metals analysis laboratory QC checks will include prep blanks (filter blanks for dissolved and digestion blanks for total), check standards, blank spikes for total metals, matrix spikes, and analytical duplicates. All QC checks will be done at a minimum of a 5 percent frequency.

Reporting

Electronic and hard copies of the lab reports will be sent to Taylor Associates, Inc. and forwarded on to Rich Horner, Barry Kellems, and Dean Shaughnessy. After completion of all 6 storm events, Taylor Associates will prepare a report using the analytical results (including QC samples) for the 6 successful storm events at each site. The report will summarize the sampling procedures, sampling scheme and general flow conditions through the technology, laboratory results, and a calculation of apparent treatment removal efficiency. For technologies where the collection of paired influent and effluent samples is feasible an individual storm pollutant concentration reduction will be calculated using 1 – [Cout]/[Cin] for each of the paired grab and composite samples. For technologies where the collection of paired influent and effluent samples is not feasible, an average pollutant concentration reduction will be calculated using 1-[Avg. Cout]/[Avg. Cin] using an average concentration from all six storms. In addition the report will include:

- Photos of the site technologies and sampling locations
- Up to two data graphs per site
- Chain-of-Custody forms
- Field sheets
- Isco sample report logs

Schematics of the overall site, storm drain system, or other site characterization will not be presented. Final conclusions regarding the treatment performance, literature searches and summaries, and comparisons to other technologies will not be presented in the report.

Northwest Marine Trade Association Stormwater Treatment Pilot Project Sampling Plan

Amendment A
Canal Boatyard – Siemens Water Quality Monitoring Plan

Canal Boatyard - Siemens System

Part A: First Flush Grab Sample

Boatyard staff at the Canal Boatyard will manually start both the inlet (CBY-In) and outlet (CBY-Out) samplers after being directed to do so by Taylor Associates, Inc. staff. Immediately after CBY-In is started by the boatyard staff the sampler will begin Part A of the program and attempt to collect a 2000-ml first flush grab sample into Bottle 1.

The Siemens system installed at the Canal Boatyard has a detention time of approximately 20 minutes when pumping at the 10 gpm flow rate. In an effort to collect paired inflow and outflow samples, CBY-Out will be programmed with a 20 minute delay to start. After the boatyard staff start the sampler CBY-Out will wait 20 minutes for one detention volume to flush through before starting Part A of the program and collecting its 2000-ml first flush grab sample into Bottle 1. If the samplers do not detect any water while attempting to collect the grab sample they will retry one time.

Part B: Time Paced Composite Samples

After completing Part A of the sampling program the samplers will move on to Part B, which entails collecting up to three 1-hour duration, time-paced composite samples into Bottles 2 through 4. To collect the time-paced composite samples both the inlet and outlet samplers will be programmed with a 5-minute time pacing rate. As such, every 5 minutes the sampler will attempt to collect a 300-ml subsample into one composite bottle. After one hour (12 subsamples) the sampler will move onto the next bottle and continue the program. Samples will only be collected when the pump is running and water is flowing through the technology. If no water is flowing through the technology when the sampler attempts to collect a subsample it will retry one time and then record a "No Liquid Detect" reading. The overall goal for time paced composite collection is to obtain samples from the initial three hours of a selected storms runoff volume and to collect a minimum of six subsamples (1800 ml) in each of three bottles provided for this phase of the autosampler program. .

Appendix B. Lab Reports

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-24	PAGE 1	
REPORT DATE:	12/19/07		
DATE SAMPLED:	11/26/07	DATE RECEIVED:	11/27/07

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Eight water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CBY-IN112607GRAB	0.191	0.0035	0.156	0.030	<0.0020	0.102	4.3
CBY-OUT112607GRAB	0.0023	<0.0020	0.006	<0.0020	<0.0020	<0.005	<0.50
CBY-IN112607COMP1	0.673	0.0110	0.318	0.488	0.0025	0.296	4.5
CBY-IN112607COMP2	0.821	0.0108	0.367	0.520	0.0025	0.312	8.0
CBY-IN112607COMP3	1.45	0.0209	0.530	0.460	<0.0020	0.394	28
CBY-OUT112607COMP1	0.0096	<0.0020	0.009	0.0055	<0.0020	0.007	<0.50
CBY-OUT112607COMP2	0.0058	<0.0020	0.006	0.0054	<0.0020	0.006	<0.50
CBY-OUT112607COMP3	0.0092	<0.0020	0.008	0.0057	<0.0020	0.007	0.67

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LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-24	PAGE 2	
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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	11/29/07	11/29/07	11/29/07	11/28/07	11/28/07	11/28/07	
DATE ANALYZED	12/13/07	12/13/07	12/12/07	12/13/07	12/13/07	12/12/07	12/03/07
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	CBY-OUT112607COMP3	CBY-OUT112607COMP3	BATCH	BATCH
ORIGINAL	<0.0020	<0.0020	0.006	0.0057	<0.0020	0.033	54
DUPLICATE	<0.0020	<0.0020	0.006	0.0061	<0.0020	0.033	53
RPD	NC	NC	0.00%	5.93%	NC	0.30%	1.87%
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	CBY-OUT112607COMP3	CBY-OUT112607COMP3	BATCH	
ORIGINAL	<0.0020	<0.0020	0.006	0.0057	<0.0020	0.033	
SPIKED SAMPLE	0.0126	0.0123	1.07	0.0177	0.0114	1.13	
SPIKE ADDED	0.0125	0.0125	1.00	0.0125	0.0125	1.00	
% RECOVERY	101.04%	98.72%	106.13%	95.52%	91.44%	110.15%	NA
QC CHECK (mg/l)							
	0.0248	0.0249	1.05	0.0248	0.0249	1.06	9.4
TRUE	0.0250	0.0250	1.00	0.0250	0.0250	1.00	10
% RECOVERY	99.36%	99.60%	104.76%	99.36%	99.60%	105.74%	94.00%

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

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LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-25	PAGE 1	
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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Eight water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CBY-IN112807GRAB	0.585	0.0088	0.375	0.358	<0.0020	0.339	7.0
CBY-IN112807COMP1	1.21	0.0476	0.642	0.469	0.0020	0.521	19
CBY-IN112807COMP2	1.05	0.0411	0.612	0.580	0.0038	0.536	21
CBY-IN112807COMP3	0.649	0.0119	0.562	0.512	0.0033	0.429	7.5
CBY-OUT112807GRAB	0.0173	<0.0020	0.023	0.0148	<0.0020	0.013	1.5
CBY-OUT112807COMP1	0.0140	<0.0020	0.016	0.0135	<0.0020	0.011	1.5
CBY-OUT112807COMP2	0.0098	<0.0020	0.013	0.0082	<0.0020	0.012	1.2
CBY-OUT112807COMP3	0.0115	<0.0020	0.014	0.0093	<0.0020	0.014	1.3

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PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: TAY021-25 PAGE 2
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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	12/05/07	12/05/07	12/05/07	11/29/07	11/29/07	11/29/07	
DATE ANALYZED	12/11/07	12/11/07	12/12/07	12/17/07	12/17/07	12/11/07	12/04/07
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	<0.0020	<0.0020	0.028	0.0032	<0.0020	0.014	10
DUPLICATE	<0.0020	<0.0020	0.028	0.0032	<0.0020	0.014	9.5
RPD	NC	NC	0.72%	0.31%	NC	0.00%	5.13%
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	<0.0020	<0.0020	0.028	0.0032	<0.0020	0.014	
SPIKED SAMPLE	0.0121	0.0148	1.12	0.0166	0.0118	1.93	
SPIKE ADDED	0.0125	0.0125	1.00	0.0125	0.0125	2.00	
% RECOVERY	96.96%	118.08%	109.40%	107.20%	94.72%	95.93%	NA
QC CHECK (mg/l)							
	0.0256	0.0251	1.05	0.0274	0.0231	0.963	9.3
TRUE	0.0250	0.0250	1.00	0.0250	0.0250	1.00	10
% RECOVERY	102.48%	100.48%	104.76%	109.40%	92.56%	96.33%	93.00%

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-26	PAGE 1	
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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Twenty three water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CBY-IN121307GRABFD	2.12	0.069	1.14	1.01	0.0083	0.915	31
CBY-IN121307GRAB	2.35	0.103	1.15	1.01	0.0074	0.922	27
CBY-IN121307COMPFD	2.18	0.094	1.11	0.960	0.0064	0.845	24
CBY-IN121307COMP	2.22	0.096	1.11	0.955	0.0064	0.849	28
CBY-OUT121307COMPFD	0.0186	<0.0020	0.029	0.0174	<0.0020	0.029	2.5
CBY-OUT121307COMP	0.0187	<0.0020	0.029	0.0150	<0.0020	0.025	3.0
CBY-OUT121307GRABFD	0.0192	<0.0020	0.030	0.0145	<0.0020	0.027	2.3
CBY-OUT121307GRAB	0.0194	<0.0020	0.031	0.0168	<0.0020	0.029	2.8
POE-IN121307GRAB	0.405	<0.0020	0.555	0.311	<0.0020	0.491	8.0
POE-IN121307COMP1	0.436	<0.0020	0.554	0.329	<0.0020	0.463	9.0
POE-IN121307COMP2	0.503	<0.0020	0.656	0.391	<0.0020	0.577	6.0
POE-OUT121307GRAB	0.0210	<0.0020	0.049	0.0145	<0.0020	0.043	1.0
POE-OUT121307COMP1	0.0210	<0.0020	0.079	0.0183	<0.0020	0.067	1.0
POE-OUT121307COMP2	0.0161	<0.0020	0.085	0.0114	<0.0020	0.075	<0.50
POE-OUT121307COMP3	0.0186	<0.0020	0.153	0.0104	<0.0020	0.138	2.0
CSR-IN121307GRAB	4.14	0.190	2.16	1.39	0.0139	1.26	83
CSR-IN121307COMP1	2.31	0.130	0.989	0.675	0.0056	0.483	85
CSR-IN121307COMP2	0.749	0.0374	0.453	0.297	0.0032	0.273	43
CSR-IN121307COMP3	0.454	0.0216	0.303	0.229	0.0024	0.200	20
CSR-OUT121307GRAB	0.752	0.0346	0.670	0.022	<0.0020	0.014	240
CSR-OUT121307COMP1	0.070	<0.0020	0.049	0.046	<0.0020	0.030	8.5
CSR-OUT121307COMP2	0.090	<0.0020	0.064	0.077	<0.0020	0.053	5.5
CSR-OUT121307COMP3	0.095	<0.0020	0.068	0.087	<0.0020	0.065	4.5

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2,200.7	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	12/18/07	12/18/07	12/18/07	12/14/07	12/14/07	12/14/07	
DATE ANALYZED	01/02/08	01/02/08	01/02/08	01/02/08	01/03/08	01/02/08	12/19/07
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	CBY-IN121307GRABFD	CBY-IN121307GRABFD	CBY-IN121307GRABFD	CSR-IN121307GRAB	CBY-OUT121307COMP	CBY-IN121307GRABFD	CSR-OUT121307COMP3
ORIGINAL	2.12	0.069	1.14	1.39	<0.0020	0.915	4.5
DUPLICATE	1.96	0.069	1.16	1.41	<0.0020	0.921	4.5
RPD	7.68%	0.43%	1.23%	0.97%	NC	0.62%	0.00%
SPIKE SAMPLE							
SAMPLE ID	CBY-IN121307GRABFD	CBY-IN121307GRABFD	CBY-IN121307GRABFD	CSR-IN121307GRAB	CBY-OUT121307COMP	CBY-IN121307GRABFD	
ORIGINAL	2.12	0.069	1.14	1.39	<0.0020	0.915	
SPIKED SAMPLE	3.19	1.20	2.25	2.46	0.0143	2.10	
SPIKE ADDED	1.00	1.00	1.00	1.00	0.0125	1.00	
% RECOVERY	106.68%	113.52%	111.13%	106.49%	114.32%	118.53%	NA
QC CHECK (mg/l)							
	1.01	1.02	1.03	1.01	0.0243	1.03	9.3
TRUE	1.00	1.00	1.00	1.00	0.0250	1.00	10
% RECOVERY	100.74%	101.56%	102.97%	101.09%	97.08%	103.06%	93.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Sixteen water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CBY-IN121907GRAB	0.833	0.035	0.276	0.349	0.0032	0.202	14
CBY-IN121907COMP1	0.763	0.031	0.276	0.368	0.0038	0.208	11
CBY-IN121907COMP2	1.58	0.078	0.373	0.434	0.0043	0.239	34
CBY-IN121907COMP3	1.09	0.047	0.367	0.468	0.0038	0.268	14
CBY-OUT121907GRAB	0.013	<0.0020	0.014	0.0095	<0.0020	0.012	1.5
CBY-OUT121907COMP1	0.011	<0.0020	0.011	0.0088	<0.0020	0.009	<0.50
CBY-OUT121907COMP2	0.011	<0.0020	0.010	0.0078	<0.0020	0.010	<0.50
CBY-OUT121907COMP3	0.0077	<0.0020	0.009	0.0076	<0.0020	0.007	<0.50
POE-IN121907GRAB	0.128	<0.0020	0.170	0.108	<0.0020	0.150	1.3
POE-IN121907COMP1	0.104	<0.0020	0.119	0.060	<0.0020	0.100	1.5
POE-IN121907COMP2	0.060	<0.0020	0.093	0.047	<0.0020	0.080	<0.50
POE-IN121907COMP3	0.086	<0.0020	0.102	0.048	<0.0020	0.084	1.8
POE-OUT121907GRAB	0.0061	<0.0020	0.064	0.0061	<0.0020	0.060	0.67
POE-OUT121907COMP1	0.0055	<0.0020	0.061	0.0055	<0.0020	0.056	0.67
POE-OUT121907COMP2	0.0052	<0.0020	0.058	0.0051	<0.0020	0.053	<0.50
POE-OUT121907COMP3	0.0058	<0.0020	0.059	0.0057	<0.0020	0.054	<0.50

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LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2,200.7	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	01/07/08	01/07/08	01/07/08	12/20/07	12/20/07	12/20/07	
DATE ANALYZED	01/09,10/08	01/09,10/08	01/09/08	01/07,10/08	01/10/08	01/07/08	12/21/07
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	BATCH	POE-OUT121907COMP3	POE-OUT121907COMP3	POE-IN121907GRAB	POE-OUT121907COMP3	POE-IN121907GRAB	BATCH
ORIGINAL	0.0058	<0.0020	0.059	0.108	<0.0020	0.150	52
DUPLICATE	0.0057	<0.0020	0.059	0.107	<0.0020	0.149	53
RPD	2.44%	NC	1.02%	0.37%	NC	0.87%	1.43%
SPIKE SAMPLE							
SAMPLE ID	BATCH	POE-OUT121907COMP3	POE-OUT121907COMP3	POE-IN121907GRAB	POE-OUT121907COMP3	POE-IN121907GRAB	
ORIGINAL	0.0058	<0.0020	0.059	0.108	<0.0020	0.150	
SPIKED SAMPLE	0.0174	0.0125	1.15	1.05	0.0137	1.12	
SPIKE ADDED	0.0125	0.0125	1.00	1.00	0.0125	1.00	
% RECOVERY	92.40%	100.32%	109.30%	94.52%	109.76%	96.52%	NA
QC CHECK (mg/l)							
	0.0246	0.0233	1.04	0.962	0.0233	0.968	9.5
TRUE	0.0250	0.0250	1.00	1.00	0.0250	1.00	10
% RECOVERY	98.56%	93.12%	103.74%	96.17%	93.12%	96.82%	95.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

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DATE SAMPLED:	12/27/07	DATE RECEIVED:	12/28/07

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Twelve water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CBY-IN122707GRAB	1.24	0.0303	0.490	0.655	0.0038	0.364	20
CBY-IN122707COMP1	1.40	0.0409	0.347	0.519	0.0036	0.254	27
CBY-IN122707COMP2	0.597	0.0164	0.196	0.389	0.0029	0.164	8.5
CBY-IN122707COMP3	0.578	0.0043	0.226	0.493	<0.0020	0.203	4.5
CBY-OUT122707GRAB	0.0060	<0.0020	0.012	0.0047	<0.0020	0.010	<0.50
CBY-OUT122707COMP1	0.0073	<0.0020	0.012	0.0064	<0.0020	0.010	<0.50
CBY-OUT122707COMP2	0.0073	<0.0020	0.013	0.0067	<0.0020	0.012	<0.50
CBY-OUT122707COMP3	0.0062	<0.0020	0.012	0.0052	<0.0020	0.010	<0.50
POE-OUT122707GRAB	0.0102	<0.0020	0.078	0.0080	<0.0020	0.072	<0.50
POE-OUT122707GRABFD	0.0099	<0.0020	0.076	0.0078	<0.0020	0.068	<0.50
POE-OUT122707COMP1	0.0086	<0.0020	0.074	0.0061	<0.0020	0.068	<0.50
POE-OUT122707COMP1FD	0.0109	<0.0020	0.076	0.0064	<0.0020	0.073	<0.50

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LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-28	PAGE 2	
REPORT DATE:	02/05/08		
DATE SAMPLED:	12/27/07	DATE RECEIVED:	12/28/07

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	01/08/08	01/08/08	01/08/08	12/28/07	12/28/07	12/28/07	
DATE ANALYZED	01/09,29/08	01/29/08	01/09/08	01/07,29/08	01/29/08	01/07/08	01/03/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	CBY-IN122707GRAB	POE-OUT122707COMP1FD	CBY-IN122707GRAB	BATCH
ORIGINAL	0.0087	<0.0020	0.059	0.655	<0.0020	0.364	130
DUPLICATE	0.0088	<0.0020	0.059	0.656	<0.0020	0.364	130
RPD	1.72%	NC	1.02%	0.12%	NC	0.03%	0.00%
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	CBY-IN122707GRAB	POE-OUT122707COMP1FD	CBY-IN122707GRAB	
ORIGINAL	0.0087	<0.0020	0.059	0.655	<0.0020	0.364	
SPIKED SAMPLE	0.0207	0.0133	1.15	1.66	0.0112	1.40	
SPIKE ADDED	0.0125	0.0125	1.00	1.00	0.0125	1.00	
% RECOVERY	96.08%	106.56%	109.30%	100.28%	89.76%	103.45%	NA
QC CHECK (mg/l)							
	0.0255	0.0252	1.04	0.962	0.0252	0.968	9.5
TRUE	0.0250	0.0250	1.00	1.00	0.0250	1.00	10
% RECOVERY	102.16%	100.88%	103.74%	96.17%	100.88%	96.82%	95.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-29	PAGE 1	
REPORT DATE:	02/05/08		
DATE SAMPLED:	01/03/08	DATE RECEIVED:	01/03/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Sixteen water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CBY-IN010308GRAB	0.732	0.0104	0.296	0.614	0.0046	0.286	2.7
CBY-IN010308COMP1	1.25	0.053	0.349	0.592	0.0050	0.287	17
CBY-IN010308COMP2	1.05	0.045	0.300	0.516	0.0045	0.252	16
CBY-IN010308COMP3	0.792	0.026	0.282	0.506	0.0041	0.248	8.5
CBY-OUT010308GRAB	0.0069	<0.0020	0.011	0.0060	<0.0020	0.010	0.83
CBY-OUT010308COMP1	0.0046	<0.0020	0.007	0.0038	<0.0020	<0.005	<0.50
CBY-OUT010308COMP2	0.0024	<0.0020	0.007	0.0021	<0.0020	0.005	<0.50
CBY-OUT010308COMP3	<0.0020	<0.0020	0.006	<0.0020	<0.0020	<0.005	<0.50
POE-IN010308GRAB	0.160	<0.0020	0.210	0.114	<0.0020	0.199	2.3
POE-IN010308COMP1	0.101	<0.0020	0.139	0.069	<0.0020	0.131	3.0
POE-IN010308COMP2	0.078	<0.0020	0.114	0.062	<0.0020	0.112	2.5
POE-IN010308COMP3	0.119	<0.0020	0.148	0.094	<0.0020	0.140	1.5
POE-OUT010308GRAB	0.0053	<0.0020	0.077	0.0047	<0.0020	0.076	<0.50
POE-OUT010308COMP1	0.0060	<0.0020	0.070	0.0047	<0.0020	0.060	<0.50
POE-OUT010308COMP2	0.0076	<0.0020	0.081	0.0074	<0.0020	0.069	<0.50
POE-OUT010308COMP3	0.0070	<0.0020	0.082	0.0064	<0.0020	0.078	<0.50

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: TAY021-29 PAGE 2

REPORT DATE: 02/05/08

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	01/09/08	01/09/08	01/09/08	01/04/08	01/04/08	01/04/08	
DATE ANALYZED	01/10,31/08	01/10,31/08	01/10/08	01/11,31/08	01/31/08	01/11/08	01/09/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	POE-OUT010308COMP3	POE-OUT010308COMP3	POE-OUT010308COMP3	POE-OUT010308COMP3	CBY-IN010308GRAB	POE-OUT010308COMP3	CBY-IN010308GRAB
ORIGINAL	0.0070	<0.0020	0.082	0.0064	0.0046	0.078	2.7
DUPLICATE	0.0067	<0.0020	0.081	0.0066	0.0043	0.079	2.5
RPD	4.08%	NC	1.72%	3.23%	5.16%	0.51%	9.52%
SPIKE SAMPLE							
SAMPLE ID	POE-OUT010308COMP3	POE-OUT010308COMP3	POE-OUT010308COMP3	POE-OUT010308COMP3	CBY-IN010308GRAB	POE-OUT010308COMP3	
ORIGINAL	0.0070	<0.0020	0.082	0.0064	0.0046	0.078	
SPIKED SAMPLE	0.0199	0.0119	1.14	0.0195	0.0172	1.24	
SPIKE ADDED	0.0125	0.0125	1.00	0.0125	0.0125	1.00	
% RECOVERY	102.80%	94.88%	105.88%	104.96%	101.28%	116.60%	NA
QC CHECK (mg/l)							
	0.0247	0.0246	1.06	0.0247	0.0246	0.974	9.6
TRUE	0.0250	0.0250	1.00	0.0250	0.0250	1.00	10
% RECOVERY	98.64%	98.40%	105.59%	98.64%	98.40%	97.43%	96.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-30	PAGE 1	
REPORT DATE:	02/07/08		
DATE SAMPLED:	01/08/08	DATE RECEIVED:	01/08/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Eight water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CBY-IN010808GRAB	0.762	0.0186	0.238	0.461	0.0048	0.198	14
CBY-IN010808COMP1	0.791	0.0217	0.252	0.503	0.0045	0.223	7.8
CBY-IN010808COMP2	0.731	0.0171	0.249	0.517	0.0053	0.230	9.0
CBY-IN010808COMP3	0.829	0.0214	0.277	0.514	0.0058	0.234	8.5
CBY-OUT010808GRAB	0.0036	<0.0020	0.009	0.0036	<0.0020	0.008	0.75
CBY-OUT010808COMP1	0.0038	<0.0020	0.007	0.0033	<0.0020	<0.005	0.50
CBY-OUT010808COMP2	0.0047	<0.0020	0.007	0.0033	<0.0020	<0.005	0.83
CBY-OUT010808COMP3	0.0051	<0.0020	0.015	0.0037	<0.0020	0.009	0.83

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: TAY021-30 PAGE 2

REPORT DATE: 02/07/08

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

QC PARAMETER	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	01/14/08	01/14/08	01/14/08	01/09/08	01/09/08	01/09/08	
DATE ANALYZED	01/23,31/08	01/31/08	01/23/08	01/22,31/08	01/31/08	01/22/08	01/14/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	CBY-OUT010808COMP3	CBY-OUT010808COMP3	CBY-OUT010808COMP3	CBY-OUT010808COMP3	BATCH	BATCH	BATCH
ORIGINAL	0.0051	<0.0020	0.015	0.0037	<0.0020	0.121	71
DUPLICATE	0.0049	<0.0020	0.012	0.0041	<0.0020	0.113	72
RPD	2.99%	NC	19.26%	10.96%	NC	6.58%	1.40%
SPIKE SAMPLE							
SAMPLE ID	CBY-OUT010808COMP3	CBY-OUT010808COMP3	CBY-OUT010808COMP3	CBY-OUT010808COMP3	BATCH	BATCH	
ORIGINAL	0.0051	<0.0020	0.015	0.0037	<0.0020	0.121	
SPIKED SAMPLE	0.0158	0.0135	0.986	0.0181	0.0139	1.25	
SPIKE ADDED	0.0125	0.0125	1.00	0.0125	0.0125	1.00	
% RECOVERY	85.68%	108.24%	97.11%	114.80%	111.04%	112.97%	NA
QC CHECK (mg/l)							
	0.0247	0.0246	1.03	0.0247	0.0246	1.00	9.5
TRUE	0.0250	0.0250	1.00	0.0250	0.0250	1.00	10
% RECOVERY	98.64%	98.40%	103.10%	98.64%	98.40%	99.97%	95.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-31	PAGE 1	
REPORT DATE:	02/08/08		
DATE SAMPLED:	01/09,10/08	DATE RECEIVED:	01/10/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Eight water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
POE-IN010908GRAB	0.266	<0.0020	0.194	0.129	<0.0020	0.164	9.8
POE-IN010908COMP1	0.219	0.0020	0.143	0.081	<0.0020	0.121	7.5
POE-IN010908COMP2	0.083	<0.0020	0.097	0.048	<0.0020	0.081	1.5
POE-IN011008COMP3	0.074	<0.0020	0.093	0.047	<0.0020	0.078	0.75
POE-OUT010908GRAB	0.0103	<0.0020	0.076	0.0072	<0.0020	0.067	0.75
POE-OUT010908COMP1	0.0087	<0.0020	0.070	0.0062	<0.0020	0.067	0.75
POE-OUT010908COMP2	0.0054	<0.0020	0.066	0.0044	<0.0020	0.058	<0.50
POE-OUT011008COMP3	0.0040	<0.0020	0.064	0.0034	<0.0020	0.062	<0.50

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PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-31	PAGE 2	
REPORT DATE:	02/08/08		
DATE SAMPLED:	01/09,10/08	DATE RECEIVED:	01/10/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	01/14/08	01/14/08	01/14/08	01/10/08	01/10/08	01/10/08	
DATE ANALYZED	01/23/08,02/07/08	02/07/08	01/23/08	01/22/08,02/07/08	02/07/08	01/22/08	01/15/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	POE-IN010908COMP1	POE-IN010908GRAB	POE-IN010908COMP1	BATCH
ORIGINAL	0.0053	<0.0020	0.015	0.081	<0.0020	0.121	66
DUPLICATE	0.0051	<0.0020	0.012	0.077	<0.0020	0.113	63
RPD	5.00%	NC	19.26%	4.92%	NC	6.58%	4.65%
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	POE-IN010908COMP1	POE-IN010908GRAB	POE-IN010908COMP1	
ORIGINAL	0.0053	<0.0020	0.015	0.081	<0.0020	0.121	
SPIKED SAMPLE	0.0162	0.0137	0.986	1.19	0.0137	1.25	
SPIKE ADDED	0.0125	0.0125	1.00	1.00	0.0125	1.00	
% RECOVERY	86.88%	109.92%	97.11%	110.94%	109.28%	112.97%	NA
QC CHECK (mg/l)							
	0.0243	0.0248	1.03	0.974	0.0248	1.00	9.7
TRUE	0.0250	0.0250	1.00	1.00	0.0250	1.00	10
% RECOVERY	97.32%	99.16%	103.10%	97.42%	99.16%	99.97%	97.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-32	PAGE 1	
REPORT DATE:	02/07/08		
DATE SAMPLED:	01/14/08	DATE RECEIVED:	01/15/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Fifteen water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
POE-IN011408GRAB	1.49	0.0177	0.429	0.137	<0.0020	0.214	40
POE-IN011408GRABFD	1.41	0.0180	0.414	0.127	<0.0020	0.196	34
POE-IN011408COMP	0.287	0.0037	0.168	0.084	<0.0020	0.119	7.5
POE-IN011408COMPFD	0.256	0.0026	0.153	0.085	<0.0020	0.123	6.5
POE-OUT011408GRAB	0.012	<0.0020	0.127	0.010	<0.0020	0.120	1.5
POE-OUT011408GRABFD	0.014	<0.0020	0.122	0.011	<0.0020	0.113	1.3
POE-OUT011408COMP	0.014	<0.0020	0.103	0.012	<0.0020	0.099	1.8
POE-OUT011408COMPFD	0.015	<0.0020	0.104	0.012	0.0032	0.101	1.5
CSR-IN011408GRAB	5.65	0.310	1.57	0.184	0.0037	0.513	178
CSR-IN011408COMP1	3.77	0.240	1.16	0.105	<0.0020	0.375	200
CSR-IN011408COMP2	2.49	0.153	0.758	0.091	0.0022	0.320	104
CSR-OUT011408GRAB	0.014	<0.0020	0.009	0.012	<0.0020	0.007	<0.50
CSR-OUT011408COMP1	0.176	0.0098	0.097	0.015	<0.0020	0.010	24
CSR-OUT011408COMP2	0.081	0.0048	0.046	0.025	<0.0020	0.018	9.5
CSR-OUT011408COMP3	0.015	<0.0020	0.007	0.013	<0.0020	<0.005	<0.50

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-32	PAGE 2	
REPORT DATE:	02/07/08		
DATE SAMPLED:	01/14/08	DATE RECEIVED:	01/15/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	01/21/08	01/21/08	01/21/08	01/15/08	01/15/08	01/15/08	
DATE ANALYZED	01/29/08,02/06/08	02/06/08	01/29/08	01/29/08,02/06/08	02/06/08	01/29/08	01/21/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	POE-OUT011408COMP	POE-OUT011408COMP	POE-OUT011408COMP	CSR-IN011408GRAB	POE-IN011408GRAB	CSR-IN011408GRAB	CSR-OUT011408COMP2
ORIGINAL	0.014	<0.0020	0.103	0.184	<0.0020	0.513	9.5
DUPLICATE	0.014	<0.0020	0.102	0.188	<0.0020	0.521	9.5
RPD	0.72%	NC	0.20%	1.94%	NC	1.68%	0.00%
SPIKE SAMPLE							
SAMPLE ID	POE-OUT011408COMP	POE-OUT011408COMP	POE-OUT011408COMP	CSR-IN011408GRAB	POE-IN011408GRAB	CSR-IN011408GRAB	
ORIGINAL	0.014	<0.0020	0.103	0.184	<0.0020	0.513	
SPIKED SAMPLE	0.024	0.0103	1.14	1.17	0.0127	1.56	
SPIKE ADDED	0.013	0.0125	1.00	1.00	0.0125	1.00	
% RECOVERY	81.12%	82.72%	104.15%	98.12%	101.60%	104.65%	NA
QC CHECK (mg/l)							
	0.0257	0.0256	0.980	0.948	0.0256	0.980	9.6
TRUE	0.0250	0.0250	1.00	1.00	0.0250	1.00	10
% RECOVERY	102.80%	102.40%	97.95%	94.76%	102.40%	97.95%	96.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-33	PAGE 1	
REPORT DATE:	02/18/08		
DATE SAMPLED:	01/30/08	DATE RECEIVED:	01/31/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Six water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CSR-IN013008GRAB	6.59	0.304	1.34	0.127	<0.0020	0.353	126
CSR-IN013008COMP1	4.60	0.225	1.09	0.109	<0.0020	0.339	124
CSR-IN013008COMP2	1.70	0.100	0.728	0.047	<0.0020	0.274	87
CSR-OUT013008GRAB	10.2	0.453	5.08	0.0084	<0.0020	0.010	916
CSR-OUT013008COMP1	0.403	0.0215	0.168	0.0097	<0.0020	0.013	39
CSR-OUT013008COMP2	0.0114	<0.0020	0.015	0.0093	<0.0020	0.014	0.87

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: TAY021-33 PAGE 2
REPORT DATE: 02/18/08
DATE SAMPLED: 01/30/08 DATE RECEIVED: 01/31/08
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2,200.7	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	02/12/08	02/12/08	02/12/08	02/01/08	02/01/08	02/01/08	
DATE ANALYZED	02/14,15/08	02/14,15/08	02/14/08	02/14,15/08	02/15/08	02/14/08	02/04/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	CSR-OUT013008COMP2	CSR-OUT013008COMP2	CSR-OUT013008COMP2	CSR-IN013008GRAB	CSR-IN013008GRAB	CSR-IN013008GRAB	BATCH
ORIGINAL	0.0114	<0.0020	0.015	0.127	<0.0020	0.353	105
DUPLICATE	0.0129	<0.0020	0.015	0.137	<0.0020	0.345	107
RPD	12.31%	NC	0.00%	7.53%	NC	2.12%	1.89%
SPIKE SAMPLE							
SAMPLE ID	CSR-OUT013008COMP2	CSR-OUT013008COMP2	CSR-OUT013008COMP2	CSR-IN013008GRAB	CSR-IN013008GRAB	CSR-IN013008GRAB	
ORIGINAL	0.0114	<0.0020	0.015	0.127	<0.0020	0.353	
SPIKED SAMPLE	0.0224	0.0119	0.978	1.11	0.0119	1.35	
SPIKE ADDED	0.0125	0.0125	1.00	1.00	0.0125	1.00	
% RECOVERY	88.00%	94.88%	96.22%	98.27%	94.96%	100.08%	NA
QC CHECK (mg/l)							
	0.0259	0.0261	0.980	0.964	0.0261	0.980	9.4
TRUE	0.0250	0.0250	1.00	1.00	0.0250	1.00	10
% RECOVERY	103.64%	104.48%	97.95%	96.38%	104.48%	97.95%	94.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-34	PAGE 1	
REPORT DATE:	02/20/08		
DATE SAMPLED:	02/06/08	DATE RECEIVED:	02/07/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Eight water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
POE-IN020608GRAB	0.218	<0.0020	0.164	0.132	<0.0020	0.155	3.7
POE-IN020608COMP1	0.203	<0.0020	0.168	0.135	<0.0020	0.161	4.3
POE-IN020608COMP2	0.175	<0.0020	0.151	0.097	<0.0020	0.143	4.5
POE-IN020608COMP3	0.122	<0.0020	0.145	0.092	<0.0020	0.134	0.75
POE-OUT020608GRAB	0.0186	<0.0020	0.050	0.0096	<0.0020	0.048	0.83
POE-OUT020608COMP1	0.0084	<0.0020	0.066	0.0068	<0.0020	0.048	0.67
POE-OUT020608COMP2	0.0050	<0.0020	0.046	0.0040	<0.0020	0.044	0.50
POE-OUT020608COMP3	0.0045	<0.0020	0.049	0.0029	<0.0020	0.047	<0.50

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PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-34	PAGE 2	
REPORT DATE:	02/20/08		
DATE SAMPLED:	02/06/08	DATE RECEIVED:	02/07/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	02/12/08	02/12/08	02/12/08	02/07/08	02/07/08	02/07/08	
DATE ANALYZED	02/14,18/08	02/18/08	02/14/08	02/14,18/08	02/18/08	02/14/08	02/11/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	POE-OUT020608COMP3
ORIGINAL	0.0085	<0.0020	0.015	0.127	<0.0020	0.353	<0.50
DUPLICATE	0.0080	<0.0020	0.015	0.137	<0.0020	0.345	<0.50
RPD	6.54%	NC	0.00%	7.53%	NC	2.12%	NC
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.0085	<0.0020	0.015	0.127	<0.0020	0.353	
SPIKED SAMPLE	0.0205	0.0107	0.978	1.11	0.0112	1.35	
SPIKE ADDED	0.0125	0.0125	1.00	1.00	0.0125	1.00	
% RECOVERY	95.60%	85.60%	96.22%	98.27%	89.52%	100.08%	NA
QC CHECK (mg/l)							
	0.0248	0.0247	0.980	0.964	0.0247	0.980	9.5
TRUE	0.0250	0.0250	1.00	1.00	0.0250	1.00	10
% RECOVERY	99.28%	98.64%	97.95%	96.38%	98.64%	97.95%	95.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-35	PAGE 1	
REPORT DATE:	02/20/08		
DATE SAMPLED:	02/08/08	DATE RECEIVED:	02/09/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

CASE NARRATIVE

Eight water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
SAMPLE ID	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CSR-IN020808GRAB	3.57	0.149	1.04	0.149	<0.0020	0.160	188
CSR-IN020808GRABFD	3.37	0.153	1.01	0.161	<0.0020	0.164	202
CSR-IN020808COMP1	2.71	0.137	0.885	0.181	<0.0020	0.227	138
CSR-IN020808COMP1FD	2.64	0.138	0.863	0.185	<0.0020	0.229	140
CSR-OUT020808GRAB	2.76	0.138	1.03	0.0090	<0.0020	0.014	256
CSR-OUT020808GRABFD	0.732	0.0455	0.290	0.0109	<0.0020	0.010	84
CSR-OUT020808COMP1	0.153	0.0080	0.068	0.0123	<0.0020	0.011	58
CSR-OUT020808COMP1FD	0.142	0.0074	0.063	0.0135	<0.0020	0.012	56

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	TAY021-35	PAGE 2	
REPORT DATE:	02/20/08		
DATE SAMPLED:	02/08/08	DATE RECEIVED:	02/09/08

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TAYLOR ASSOCIATES - NMTA

QA/QC DATA

	TOTAL RECOVERABLE METALS			DISSOLVED METALS			
QC PARAMETER	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	COPPER (mg/l)	LEAD (mg/l)	ZINC (mg/l)	TSS (mg/l)
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA
METHOD	EPA 220.2,200.7	EPA 239.2,200.7	EPA 200.7	EPA 220.2,200.7	EPA 239.2	EPA 200.7	EPA 160.2
DATE PREPARED	02/12/08	02/12/08	02/12/08	02/09/08	02/09/08	02/09/08	
DATE ANALYZED	02/14/08	02/14,18/08	02/14/08	02/14,18/08	02/18/08	02/14/08	02/13/08
PRACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0020	0.0020	0.005	0.50
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010	0.005	0.50
DUPLICATE							
SAMPLE ID	BATCH	CSR-OUT020808COMP1FD	CSR-OUT020808COMP1FD	BATCH	CSR-OUT020808COMP1FD	BATCH	BATCH
ORIGINAL	0.142	0.0074	0.063	0.127	<0.0020	0.353	5.5
DUPLICATE	0.146	0.0073	0.065	0.137	<0.0020	0.345	5.0
RPD	3.06%	1.36%	3.15%	7.53%	NC	2.12%	9.52%
SPIKE SAMPLE							
SAMPLE ID	BATCH	CSR-OUT020808COMP1FD	CSR-OUT020808COMP1FD	BATCH	CSR-OUT020808COMP1FD	BATCH	
ORIGINAL	0.142	0.0074	0.063	0.127	<0.0020	0.353	
SPIKED SAMPLE	1.11	0.0208	1.05	1.11	0.0112	1.35	
SPIKE ADDED	1.00	0.0125	1.00	1.00	0.0125	1.00	
% RECOVERY	97.29%	106.96%	98.90%	98.27%	89.52%	100.08%	NA
QC CHECK (mg/l)							
	0.964	0.0247	0.980	0.964	0.0247	0.980	9.3
TRUE	1.00	0.0250	1.00	1.00	0.0250	1.00	10
% RECOVERY	96.38%	98.64%	97.95%	96.38%	98.64%	97.95%	93.00%
BLANK	<0.0020	<0.0020	<0.005	<0.0020	<0.0020	<0.005	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

Submitted By:

Steven Lazoff
Laboratory Director

Appendix C. Chain of Custodies

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy **Page 1 of 1**
Sampling Personnel: JB **Case File#**

Turnaround Requirements:
___48 hour ___7 day _X_ Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN112607GRAB	11/26/2007	16:45	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-OUT112607GRAB	11/26/2007	17:07	Grab		SW		1	X	X	X	X	X	X	X
3	CBY-IN112607COMP1	11/26/2007	16:48	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-IN112607COMP2	11/26/2007	17:45	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-IN112607COMP3	11/26/2007	18:45	Comp		SW		1	X	X	X	X	X	X	X
6	CBY-OUT112607COMP1	11/26/2007	17:09	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUT112607COMP2	11/26/2007	18:09	Comp		SW		1	X	X	X	X	X	X	X
8	CBY-OUT112607COMP3	11/26/2007	19:09	Comp		SW		1	X	X	X	X	X	X	X
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															

* Time first subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	JON BERG	S. NIELSON		
Signature:	[signature]	[signature]		
Affiliation:	TAYLOR ASSOCIATES	ARI		
Date:	11/27/07	11/27/07		
Time:	1548	1548		

Miscellaneous Notes:

11/28/07 Btls not labeled as comp1, comp2, comp3

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: C. Milesi Case File#

Turnaround Requirements:
__48 hour __7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN112807GRAB	11/28/07	1443	GRAB		SW		1	X	X	X	X	X	X	X
2	CBY-IN112807COMP1	11/28/07	1446	COMP		SW		1	X	X	X	X	X	X	X
3	CBY-IN112807COMP2	11/28/07	1543	COMP		SW		1	X	X	X	X	X	X	X
4	CBY-IN112807COMP3	11/28/07	1643	COMP		SW		1	X	X	X	X	X	X	X
5	CBY-OUT112807GRAB	11/28/07	1505	GRAB		SW		1	X	X	X	X	X	X	X
6	CBY-OUT112807COMP1	11/28/07	1507	COMP		SW		1	X	X	X	X	X	X	X
7	CBY-OUT112807COMP2	11/28/07	1607	COMP		SW		1	X	X	X	X	X	X	X
8	CBY-OUT112807COMP3	11/28/07	1707	COMP		SW		1	X	X	X	X	X	X	X
9															
10															
11															
12															
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* Time last subsample taken for composite samples.
first

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	S. Nilsson		
Signature:	Carla Milesi	[illegible]		
Affiliation:	TAI	ARE		
Date:	11/29/07	11/29/07		
Time:	11:56	1156		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy
Sampling Personnel: JB, RR
Page 1 of 1
Case File#

Turnaround Requirements:
___48 hour ___7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN121307GRABFD	121307	1304	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-IN121307GRAB	121307	1304	Grab		SW		1	X	X	X	X	X	X	X
3	CBY-IN121307COMPFD	121307	1307	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-IN121307COMP	121307	1307	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-OUT121307COMPFD	121307	1327	Comp		SW		1	X	X	X	X	X	X	X
6	CBY-OUT121307COMP	121307	1327	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUT121307GRABFD	121307	1325	Grab		SW		1	X	X	X	X	X	X	X
8	CBY-OUT121307GRAB	121307	1325	Grab		SW		1	X	X	X	X	X	X	X
9	POE-IN121307GRAB	121307	1351	Grab		SW		1	X	X	X	X	X	X	X
X 10	POE-IN121307COMP1	121307	1352	Comp		SW		1	X	X	X	X	X	X	X
X 11	POE-IN121307COMP2	121307	1511	Comp		SW		1	X	X	X	X	X	X	X
12	POE-OUT121307GRAB	121307	1406	Grab		SW		1	X	X	X	X	X	X	X
X 13	POE-OUT121307COMP1	121307	1409	Comp		SW		1	X	X	X	X	X	X	X
14	POE-OUT121307COMP2	121307	1514	Comp		SW		1	X	X	X	X	X	X	X
X 15	POE-OUT121307COMP3	121307	1609	Comp		SW		1	X	X	X	X	X	X	X
16	CSR-IN121307GRAB	121307	1154	Grab		SW		1	X	X	X	X	X	X	X
17	CSR-IN121307COMP1	121307	1157	Comp		SW		1	X	X	X	X	X	X	X
18	CBR-IN121307COMP2	121307	1257	Comp		SW		1	X	X	X	X	X	X	X
19	CSR-IN121307COMP3	121307	1357	Comp		SW		1	X	X	X	X	X	X	X
20	CSR-OUT121307GRAB	121307	1222	Grab		SW		1	X	X	X	X	X	X	X
21	CSR-OUT121307COMP1	121307	1224	Comp		SW		1	X	X	X	X	X	X	X
22	CSR-OUT121307COMP2	121307	1324	Comp		SW		1	X	X	X	X	X	X	X
23	CSR-OUT121307COMP3	121307	1424	Comp		SW		1	X	X	X	X	X	X	X
24															

* Time last subsample taken for composite samples.

X LOW VOLUME SAMPLES: PLEASE PRIORITIZE metals!

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Tom Berg	S. Milesi		
Signature:	[illegible]	[illegible]		
Affiliation:	TAYLOR ASSOCIATES	ARI		
Date:	12/14/07	12/14/07		
Time:	1244	1244		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy **Page 1 of 1**
Sampling Personnel: JB **Case File#**

Turnaround Requirements:
___48 hour ___7 day _X_ Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN112607GRAB	11/26/2007	16:45	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-OUT112607GRAB	11/26/2007	17:07	Grab		SW		1	X	X	X	X	X	X	X
3	CBY-IN112607COMP1	11/26/2007	16:48	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-IN112607COMP2	11/26/2007	17:45	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-IN112607COMP3	11/26/2007	18:45	Comp		SW		1	X	X	X	X	X	X	X
6	CBY-OUT112607COMP1	11/26/2007	17:09	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUT112607COMP2	11/26/2007	18:09	Comp		SW		1	X	X	X	X	X	X	X
8	CBY-OUT112607COMP3	11/26/2007	19:09	Comp		SW		1	X	X	X	X	X	X	X
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23															
24															

* Time first subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	JON BERG	S. NIELSON		
Signature:	[signature]	[signature]		
Affiliation:	TAYLOR ASSOCIATES	ARI		
Date:	11/27/07	11/27/07		
Time:	1548	1548		

Miscellaneous Notes:

11/28/07 Btls not labeled as comp1, comp2, comp3

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy **Page 1 of 1**
Sampling Personnel: JB **Case File#**

Turnaround Requirements:
___48 hour ___7 day _X_ Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN112607GRAB	11/26/2007	16:45	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-OUT112607GRAB	11/26/2007	17:07	Grab		SW		1	X	X	X	X	X	X	X
3	CBY-IN112607COMP1	11/26/2007	16:48	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-IN112607COMP2	11/26/2007	17:45	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-IN112607COMP3	11/26/2007	18:45	Comp		SW		1	X	X	X	X	X	X	X
6	CBY-OUT112607COMP1	11/26/2007	17:09	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUT112607COMP2	11/26/2007	18:09	Comp		SW		1	X	X	X	X	X	X	X
8	CBY-OUT112607COMP3	11/26/2007	19:09	Comp		SW		1	X	X	X	X	X	X	X
9															
10															
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* Time first subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	JON BERG	S. NIELSON		
Signature:	[signature]	[signature]		
Affiliation:	TAYLOR ASSOCIATES	ARI		
Date:	11/27/07	11/27/07		
Time:	1548	1548		

Miscellaneous Notes:

11/28/07 Btls not labeled as comp1, comp2, comp3

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: C. Milesi Case File#

Turnaround Requirements:
__48 hour __7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN112807GRAB	11/28/07	1443	GRAB		SW		1	X	X	X	X	X	X	X
2	CBY-IN112807COMP1	11/28/07	1446	COMP		SW		1	X	X	X	X	X	X	X
3	CBY-IN112807COMP2	11/28/07	1543	COMP		SW		1	X	X	X	X	X	X	X
4	CBY-IN112807COMP3	11/28/07	1643	COMP		SW		1	X	X	X	X	X	X	X
5	CBY-OUT112807GRAB	11/28/07	1505	GRAB		SW		1	X	X	X	X	X	X	X
6	CBY-OUT112807COMP1	11/28/07	1507	COMP		SW		1	X	X	X	X	X	X	X
7	CBY-OUT112807COMP2	11/28/07	1607	COMP		SW		1	X	X	X	X	X	X	X
8	CBY-OUT112807COMP3	11/28/07	1707	COMP		SW		1	X	X	X	X	X	X	X
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* Time last subsample taken for composite samples.
first

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	S. Nilsson		
Signature:	Carla Milesi	[illegible]		
Affiliation:	TAI	ARE		
Date:	11/29/07	11/29/07		
Time:	11:56	1156		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy
Sampling Personnel: JB, RR
Page 1 of 1
Case File#

Turnaround Requirements:
___48 hour ___7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN121307GRABFD	121307	1304	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-IN121307GRAB	121307	1304	Grab		SW		1	X	X	X	X	X	X	X
3	CBY-IN121307COMPFD	121307	1307	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-IN121307COMP	121307	1307	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-OUT121307COMPFD	121307	1327	Comp		SW		1	X	X	X	X	X	X	X
6	CBY-OUT121307COMP	121307	1327	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUT121307GRABFD	121307	1325	Grab		SW		1	X	X	X	X	X	X	X
8	CBY-OUT121307GRAB	121307	1325	Grab		SW		1	X	X	X	X	X	X	X
9	POE-IN121307GRAB	121307	1351	Grab		SW		1	X	X	X	X	X	X	X
X 10	POE-IN121307COMP1	121307	1352	Comp		SW		1	X	X	X	X	X	X	X
X 11	POE-IN121307COMP2	121307	1511	Comp		SW		1	X	X	X	X	X	X	X
12	POE-OUT121307GRAB	121307	1406	Grab		SW		1	X	X	X	X	X	X	X
X 13	POE-OUT121307COMP1	121307	1409	Comp		SW		1	X	X	X	X	X	X	X
14	POE-OUT121307COMP2	121307	1514	Comp		SW		1	X	X	X	X	X	X	X
X 15	POE-OUT121307COMP3	121307	1609	Comp		SW		1	X	X	X	X	X	X	X
16	CSR-IN121307GRAB	121307	1154	Grab		SW		1	X	X	X	X	X	X	X
17	CSR-IN121307COMP1	121307	1157	Comp		SW		1	X	X	X	X	X	X	X
18	CBR-IN121307COMP2	121307	1257	Comp		SW		1	X	X	X	X	X	X	X
19	CSR-IN121307COMP3	121307	1357	Comp		SW		1	X	X	X	X	X	X	X
20	CSR-OUT121307GRAB	121307	1222	Grab		SW		1	X	X	X	X	X	X	X
21	CSR-OUT121307COMP1	121307	1224	Comp		SW		1	X	X	X	X	X	X	X
22	CSR-OUT121307COMP2	121307	1324	Comp		SW		1	X	X	X	X	X	X	X
23	CSR-OUT121307COMP3	121307	1424	Comp		SW		1	X	X	X	X	X	X	X
24															

* Time last subsample taken for composite samples.

X LOW VOLUME SAMPLES: PLEASE PRIORITIZE metals!

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Tom Berg	S. Milesi		
Signature:	[illegible]	[illegible]		
Affiliation:	TAYLOR ASSOCIATES	ARI		
Date:	12/14/07	12/14/07		
Time:	1244	1244		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy
Page 1 of 1
Sampling Personnel: C. Milesi Case File#

Turnaround Requirements:
__48 hour __7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN121907GRAB	12/19/07	747	GRAB		SW		1	X	X	X	X	X	X	X
2	CBY-IN121907COMP1	12/19/07	750	COMP		SW		1	X	X	X	X	X	X	X
3	CBY-IN121907COMP2	12/19/07	847	COMP		SW		1	X	X	X	X	X	X	X
4	CBY-IN121907COMP3	12/19/07	947	COMP		SW		1	X	X	X	X	X	X	X
5	CBY-OUT121907GRAB	12/19/07	808	GRAB		SW		1	X	X	X	X	X	X	X
6	CBY-OUT121907COMP1	12/19/07	810	COMP		SW		1	X	X	X	X	X	X	X
7	CBY-OUT121907COMP2	12/19/07	910	COMP		SW		1	X	X	X	X	X	X	X
8	CBY-OUT121907COMP3	12/19/07	1010	COMP		SW		1	X	X	X	X	X	X	X
9	POE-IN121907GRAB	12/19/07	645	GRAB		SW		1	X	X	X	X	X	X	X
10	POE-IN121907COMP1	12/19/07	646	COMP		SW		1	X	X	X	X	X	X	X
11	POE-IN121907COMP2	12/19/07	745	COMP		SW		1	X	X	X	X	X	X	X
12	POE-IN121907COMP3	12/19/07	845	COMP		SW		1	X	X	X	X	X	X	X
13	POE-OUT121907GRAB	12/19/07	702	GRAB		SW		1	X	X	X	X	X	X	X
14	POE-OUT121907COMP1	12/19/07	705	COMP		SW		1	X	X	X	X	X	X	X
15	POE-OUT121907COMP2	12/19/07	805	COMP		SW		1	X	X	X	X	X	X	X
16	POE-OUT121907COMP3	12/19/07	905	COMP		SW		1	X	X	X	X	X	X	X
17															
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21															
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23															
24															

* Time of first successful subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	S. NILESON		
Signature:	Carla Milesi	[illegible]		
Affiliation:	TAI	ARI		
Date:	12/19/07	12/19/07		
Time:	1508	1508		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: C. Milesi Case File#_____

Turnaround Requirements:
___48 hour ___7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN122707GRAB	12/27/07	1517	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-IN122707COMP1	12/27/07	1519	Comp		SW		1	X	X	X	X	X	X	X
3	CBY-IN122707COMP2	12/27/07	1617	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-IN122707COMP3	12/27/07	1717	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-OUT122707GRAB	12/27/07	1538	Grab		SW		1	X	X	X	X	X	X	X
6	CBY-OUT122707COMP1	12/27/07	1540	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUT122707COMP2	12/27/07	1640	Comp		SW		1	X	X	X	X	X	X	X
8	CBY-OUT122707COMP3	12/27/07	1740	Comp		SW		1	X	X	X	X	X	X	X
9	POE-OUT122707GRAB	12/27/07	1509	Grab		SW		1	X	X	X	X	X	X	X
10	POE-OUT122707GRABFD	12/27/07	1509	Grab		SW		1	X	X	X	X	X	X	X
11	POE-OUT122707COMP1	12/27/07	1510	Comp		SW		1	X	X	X	X	X	X	X
12	POE-OUT122707COMP1FD	12/27/07	1510	Comp		SW		1	X	X	X	X	X	X	X
13															
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22															
23															
24															

* Time of first successful subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	Olga Anatoryan		
Signature:	Carla Milesi	[illegible]		
Affiliation:	TAI	ART		
Date:	12/28/07	12-28-07		
Time:	1056	1056		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N. Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: C. Milesi Case File#_____

Turnaround Requirements:
___48 hour ___7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-IN010308GRAB	1/3/8	904	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-IN010308COMP1	1/3/8	907	Comp		SW		1	X	X	X	X	X	X	X
3	CBY-IN010308COMP2	1/3/8	1004	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-IN010308COMP3	1/3/8	1104	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-OUT010308GRAB	1/3/8	925	Grab		SW		1	X	X	X	X	X	X	X
6	CBY-OUT010308COMP1	1/3/8	927	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUT010308COMP2	1/3/8	1027	Comp		SW		1	X	X	X	X	X	X	X
8	CBY-OUT010308COMP3	1/3/8	1127	Comp		SW		1	X	X	X	X	X	X	X
9	POE-IN010308GRAB	1/3/8	915	Grab		SW		1	X	X	X	X	X	X	X
10	POE-IN010308COMP1	1/3/8	916	Comp		SW		1	X	X	X	X	X	X	X
11	POE-IN010308COMP2	1/3/8	1015	Comp		SW		1	X	X	X	X	X	X	X
12	POE-IN010308COMP3	1/3/8	1115	Comp		SW		1	X	X	X	X	X	X	X
13	POE-OUT010308GRAB	1/3/8	930	Grab		SW		1	X	X	X	X	X	X	X
14	POE-OUT010308COMP1	1/3/8	931	Comp		SW		1	X	X	X	X	X	X	X
15	POE-OUT010308COMP2	1/3/8	1031	Comp		SW		1	X	X	X	X	X	X	X
16	POE-OUT010308COMP3	1/3/8	1131	Comp		SW		1	X	X	X	X	X	X	X
17															
18															
19															
20															
21															
22															
23															
24															

* Time last subsample taken for composite samples.
first

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	S. NICHOLSON		
Signature:	Carla Milesi	[signature]		
Affiliation:	TAI	ARI		
Date:	1/3/08	1/3/08		
Time:	1530	1530		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: R. Brown Case File#_____

Turnaround Requirements:
___48 hour ___7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CBY-INOC0808GRAB	1/8/08	842	Grab		SW		1	X	X	X	X	X	X	X
2	CBY-INOC0808Comp1	1/8/08	845	Comp		SW		1	X	X	X	X	X	X	X
3	CBY-INOC0808Comp2	1/8/08	942	Comp		SW		1	X	X	X	X	X	X	X
4	CBY-INOC0808Comp3	1/8/08	1042	Comp		SW		1	X	X	X	X	X	X	X
5	CBY-OUTC0808GRAB	1/8/08	903	Grab		SW		1	X	X	X	X	X	X	X
6	CBY-OUTC0808Comp1	1/8/08	905	Comp		SW		1	X	X	X	X	X	X	X
7	CBY-OUTC0808Comp2	1/8/08	1005	Comp		SW		1	X	X	X	X	X	X	X
8	CBY-OUTC0808Comp3	1/8/08	1105	Comp		SW		1	X	X	X	X	X	X	X
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															

* Time of first successful subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Kristy Brown	Mahlon Gabomsh		
Signature:	Kristy A. Brown	Mahlon Gabomsh		
Affiliation:	TAI	ARI		
Date:	1/8/08	1/8/08		
Time:	14:47	14:47		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: C. Milesi Case File#

Turnaround Requirements:
___48 hour ___7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	POE-IN010908GRAB	1/9/08	2221	GRAB		SW		1	X	X	X	X	X	X	X
2	POE-IN010908COMP1	1/9/08	2222	COMP		SW		1	X	X	X	X	X	X	X
3	POE-IN010908COMP2	1/9/08	2321	COMP		SW		1	X	X	X	X	X	X	X
4	POE-IN011008COMP3	1/10/08	0021	COMP		SW		1	X	X	X	X	X	X	X
5	POE-OUT010908GRAB	1/9/08	2237	GRAB		SW		1	X	X	X	X	X	X	X
6	POE-OUT010908COMP1	1/9/08	2238	COMP		SW		1	X	X	X	X	X	X	X
7	POE-OUT010908COMP2	1/9/08	2338	COMP		SW		1	X	X	X	X	X	X	X
8	POE-OUT011008COMP3	1/10/08	0038	COMP		SW		1	X	X	X	X	X	X	X
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															

* Time of first successful subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	S. Nelson		
Signature:	Carla Milesi			
Affiliation:	TAI	ARI		
Date:	1/10/08	1/10/08		
Time:	1150	1150		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: JON BERG Case File#

Turnaround Requirements:
__48 hour __7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	POE-INO11403GRAB	01/14/08	1409	GRAB		SW		1	X	X	X	X	X	X	X
2	POE-INO11403GRAB FD	01/14/08	1409	GRAB					X	X	X	X	X	X	X
3	POE-INO11403COMP	01/14/08	1410	COMP					X	X	X	X	X	X	X
4	POE-INO11403COMP FD	01/14/08	1410	COMP					X	X	X	X	X	X	X
5	POE-OUTO11403GRAB	01/14/08	1424	GRAB					X	X	X	X	X	X	X
6	POE-OUTO11403GRAB FD	01/14/08	1424	GRAB					X	X	X	X	X	X	X
7	POE-OUTO11403COMP	01/14/08	1425	COMP					X	X	X	X	X	X	X
8	POE-OUTO11403COMP FD	01/14/08	1425	COMP					X	X	X	X	X	X	X
9	CSR-INO11403GRAB	01/14/08	1439	GRAB					X	X	X	X	X	X	X
10	CSR-INO11403COMP1	01/14/08	1440	COMP					X	X	X	X	X	X	X
11	CSR-INO11403COMP2	01/14/08	1540	COMP					X	X	X	X	X	X	X
12	CSR-OUTO11403GRAB	01/14/08	1440	GRAB					X	X	X	X	X	X	X
13	CSR-OUTO11403COMP1	01/14/08	1442	COMP					X	X	X	X	X	X	X
* 14	CSR-OUTO11403COMP2	01/14/08	1542	COMP					X	X	X	X	X	X	X
15	CSR-OUTO11403COMP3	01/14/08	1642	COMP					X	X	X	X	X	X	X
16															
17															
18															
19															
20															
21															
22															
23															
24															

* Time of first successful subsample taken for composite samples. * LOW VOLUME! PLEASE PRIORITIZE METALS!

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	JON BERG	S. NIELSON		
Signature:	[signature]	[signature]		
Affiliation:	FAT	FAT		
Date:	1/15/08	1/15/08		
Time:	1423	1423		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: CM Case File#

Turnaround Requirements:
__48 hour __7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CSR-IN013008GRAB	1/30/08	2042	GRAB		SW		1	x	x	x	x	x	x	x
* 2	CSR-IN013008COMP1	1/30/08	2043	COMP		SW		1	x	x	x	x	x	x	x
* 3	CSR-IN013008COMP2	1/30/08	2158	COMP		SW		1	x	x	x	x	x	x	x
4	CSR-OUT013008GRAB	1/30/08	2133	GRAB		SW		1	x	x	x	x	x	x	x
5	CSR-OUT013008COMP1	1/30/08	2205	COMP		SW		1	x	x	x	x	x	x	x
6	CSR-OUT013008COMP2	1/30/08	2235	COMP		SW		1	x	x	x	x	x	x	x
7	POE-OUT013008GRAB	1/30/08	1936	GRAB		SW		1	x	x	x	x	x	x	x
8	POE-OUT013008COMP1	1/30/08	1937	COMP		SW		1	x	x	x	x	x	x	x
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															

* Time of first successful subsample taken for composite samples.

* For Samples w/ low volume prioritize metals

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	S. Nielson		
Signature:	Carla Milesi	[illegible]		
Affiliation:	TAI	ARI		
Date:	1/30/08	1/31/08		
Time:	1530	1530		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy Page 1 of 1
Sampling Personnel: C. Milesi Case File#_____

Turnaround Requirements:
___48 hour ___7 day X Standard

Item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	POE-IN020608GRAB	2/6/8	2109	Grab		SW		1	X	X	X	X	X	X	X
2	POE-IN020608COMP1	2/6/8	2110	Comp		SW		1	X	X	X	X	X	X	X
3	POE-IN020608COMP2	2/6/8	2209	Comp		SW		1	X	X	X	X	X	X	X
4	POE-IN020608COMP3	2/6/8	2309	Comp		SW		1	X	X	X	X	X	X	X
5	POE-OUT020608GRAB	2/6/8	2124	Grab		SW		1	X	X	X	X	X	X	X
6	POE-OUT020608COMP1	2/6/8	2125	Comp		SW		1	X	X	X	X	X	X	X
7	POE-OUT020608COMP2	2/6/8	2225	Comp		SW		1	X	X	X	X	X	X	X
8	POE-OUT020608COMP3	2/6/8	2325	Comp		SW		1	X	X	X	X	X	X	X
9															
10															
11															
12															
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14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															

Analyses Requested

* Time of first successful subsample taken for composite samples.

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	S. NELSON		
Signature:	[illegible]	[illegible]		
Affiliation:	TAI	ARI		
Date:	2/7/08	2/7/08		
Time:	1247	1247		

Miscellaneous Notes:

Chain of Custody Record

NMTA Boatyard Study - Automated Sampling: Chain of Custody Record

Laboratory: Aquatic Research Inc., 3927 Aurora Ave. N, Seattle, WA 98103 206-632-2715

Consultant Contact: Carla Milesi, Taylor Associates, 206.267.1408
NMTA Contact: Dean Shaughnessy. Page 1 of 1
Sampling Personnel: C. Milesi Case File#_____

Turnaround Requirements:
___48 hour ___7 day X Standard

Analyses Requested

item	Sample ID	Date	Time*	Grab/Comp	Lab ID	Matrix	Other	# containers	TSS	Total Recoverable Cu	Total Recoverable Pb	Total Recoverable Zn	Dissolved Cu	Dissolved Pb	Dissolved Zn
1	CSR-IN020808GRAB	2/8/8	1735	GRAB		SW		1	X	X	X	X	X	X	X
2	CSR-IN020808GRABFD	2/8/8	1735	GRAB		SW		1	X	X	X	X	X	X	X
3	CSR-IN020808COMP1	2/8/8	1747	COMP		SW		1	X	X	X	X	X	X	X
4	CSR-IN020808COMP1FD	2/8/8	1747	COMP		SW		1	X	X	X	X	X	X	X
5	CSR-OUT020808GRAB	2/8/8	1741	GRAB		SW		1	X	X	X	X	X	X	X
6	CSR-OUT020808GRABFD	2/8/8	1741	GRAB		SW		1	X	X	X	X	X	X	X
7	CSR-OUT020808COMP1	2/8/8	1744	COMP		SW		1	X	X	X	X	X	X	X
8	CSR-OUT020808COMP1FD	2/8/8	1744	COMP		SW		1	X	X	X	X	X	X	X
9															
10															
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12															
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19															
20															
21															
22															
23															
24															

* Time of first successful subsample taken for composite samples.

For sampler w/ low volume prioritize metals

	Relinquished by:	Received by:	Relinquished by:	Received by:
Printed Name:	Carla Milesi	RAMEN GABANSKI		
Signature:	Carla Milesi	[illegible]		
Affiliation:	TAI	ARI		
Date:	2/9/08	2/9/08		
Time:	925	9:25		

Miscellaneous Notes:

2 WEEK TAT

Appendix D. Field Datasheets

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 11/26/07 1200 Staff: CM, JB Weather: Overcast, cold

Site: CBY Inflow Rate: ~10gpm

	Inlet	Outlet
Calibrate sample volume?	Y	Y
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	N/A	N/A
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 11/26/07 1630 Staff: CM Weather: raining

Boatyard Staff: Steve

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	1645 11/26/07	1647 11/26/07
Notes:		

SAMPLE COLLECTION

Date/Time: 11/27/07 11:54 Staff: RB, JB Weather: sunny

	Inlet	Outlet
Grab Time:	1645 11/26/07	1707 11/26/07
Grab Volume:	GOOD	GOOD
Composite 1: Begin Time	1 of 12 Btl #2 @ 1648	1 of 12 Btl #2 (1709)
# of subsamples collected?	12 of 12	12 of 12
missed aliquots? (eg. #2, #7, #9)	NO	NO
approx. volume	To The Brim	75% full
Composite 2: Begin Time:	1 of 12 Btl #3 @ 1745	1 of 12 Btl #3 (1809)
# of subsamples collected?	12 of 12	12 of 12
missed aliquots? (eg. #2, #7, #9)	NO	NO
approx. volume	To the Brim	75%
Composite 3: Begin Time:	1 of 12 Btl #4 @ 1845	1 of 12 Btl #4 (1909)
# of subsamples collected?	12 of 12	12 of 12
missed aliquots? (eg. #2, #7, #9)	NO	NO
approx. volume	To the brim	75%
Any sampler/logging errors? **	NO	NO
Field Duplicate Grab Time:	NO	NO
Field Duplicate Grab Volume:	NO	NO
Field Duplicate Composite: Begin Time	NO	NO
# of sample collected		
missed aliquots?		
approx. volume		
Data download? (Y/N)	NO	NO
Sampling report saved? (Y/N)	NO	NO

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, *THEN* reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 11/27/07 12:00 Staff: RB, JR Weather: Sunny

Site: CBY Inflow Rate: 10 GPM

	Inlet	Outlet
Calibrate sample volume?	NO	NO
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	YES	YES
Clean bottles/lids off? (Y/N)	YES	YES
Backflush sample lines? (Y/N)	YES	YES
Drain DI from line? (see back side for details)	NO	NO
Check sample line connections?	YES	YES
Check clock?	YES	YES
Review Program? (see site specific sheet for programming details)	YES	YES
Internal Field Duplicate?	—	—
Test distributor arm (Y/N)	YES	YES
Sampler off?	YES	YES

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 11/28/07 1440 Staff: CM Weather: raining

Boatyard Staff: Steve

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 11/29/07 915 Staff: RB CM Weather: Sunny

	Inlet	Outlet
Grab Time:	1443	1505
Grab Volume:	OK-full	OK
Composite 1: Begin Time	1446	1507
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	none	none
approx. volume	OK-full	OK
Composite 2: Begin Time:	1543	1607
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	none	none
approx. volume	OK-full	OK
Composite 3: Begin Time:	1643	1707
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	none	none
approx. volume	OK-full	OK
Any sampler/logging errors? **	No	No
Field Duplicate Grab Time:	N/A	N/A
Field Duplicate Grab Volume:	N/A	|
Field Duplicate Composite: Begin Time	N/A	|
# of sample collected	N/A	|
missed aliquots?	N/A	|
approx. volume	N/A	↓
Data download? (Y/N)	N	N
Sampling report saved? (Y/N)	N	N

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, *THEN* reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 11/29/07 930 Staff: CM, RB Weather: 3 P. Cloudy

Site: CBY Inflow Rate: ~10gpm

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	N	N
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	Y	Y
Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 12/13/07 1255 Staff: CM Weather: Raining

Boatyard Staff: CM

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes: CM went to site to start sampler		

SAMPLE COLLECTION

Date/Time: 12/14/07 9:30 Staff: RB, JB Weather: Cloudy

	Inlet	Outlet
Grab Time:	12/13/07 13:04	12/13/07 13:25
Grab Volume:	OK.	OK
Composite 1: Begin Time	12/13/07 13:07	12/13/07 13:27
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	—	—
approx. volume	OK	OK
Composite 2: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 3: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Any sampler/logging errors? **	N	N
Field Duplicate Grab Time:	12/13/07 13:04	12/13/07 13:25
Field Duplicate Grab Volume:	OK	OK
Field Duplicate Composite: Begin Time	12/13/07 13:07	12/13/07 13:27
# of sample collected	12	12
missed aliquots?	—	—
approx. volume	OK	OK
~~Data download? (Y/N)~~		
Sampling report saved? (Y/N)		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 12/14/07 9:40 Staff: RB, JB Weather: Cloudy

Site: CBY Inflow Rate: ~ 10 gpm

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 12/19/07 730 Staff: JB Weather: Raining

Boatyard Staff: —

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y

Notes: JB went to site to start samplers

SAMPLE COLLECTION

Date/Time: 12/19/07 1230 Staff: SO, CM Weather: overcast

	Inlet	Outlet
Grab Time:	12/19/07 747	12/19/07 808
Grab Volume:	ok - full	a little low
Composite 1: Begin Time	12/19/07 750	12/19/07 810
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	ok	ok
Composite 2: Begin Time:	12/19/07 847	12/19/07 910
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	ok	ok
Composite 3: Begin Time:	12/19/07 947	12/19/07 1010
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	ok	ok
Any sampler/logging errors? **	N	N
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 12/19/07 1230 Staff: CM, SO Weather: overcast

Site: CBY Inflow Rate: ~10gpm

	Inlet	Outlet
Calibrate sample volume?	N	Y
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	N/A	N/A
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 12/27/07 1930 Staff: CM Weather: Raining

Boatyard Staff: Steve

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 12/28/07 815 Staff: CM Weather: Cloudy

	Inlet	Outlet
Grab Time:	12/27/07 1517	12/27/07 1538
Grab Volume:	OK	OK
Composite 1: Begin Time	12/27/07 1519	12/27/07 1540
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK-full	OK
Composite 2: Begin Time:	12/27/07 1617	12/27/07 1640
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK-full	OK
Composite 3: Begin Time:	12/27/07 1717	12/27/07 1740
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK-full	OK
Any sampler/logging errors? **	No	No
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 12/28/07 830 Staff: CM Weather: Cloudy / Windy

Site: CBY Inflow Rate: _____

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see backside for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/3/08 Staff: CM Weather: Raining

Boatyard Staff: Steve

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 1/3/08 1245 Staff: CM Weather: ~~H~~ rain

	Inlet	Outlet
Grab Time:	1/3/08 904	1/3/08 925
Grab Volume:	OK-full	OK
Composite 1: Begin Time	1/3/08 907	1/3/08 927
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK-full	OK
Composite 2: Begin Time:	1/3/08 1004	1/3/08 1027
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK-full	OK.
Composite 3: Begin Time:	1/3/08 1104	1/3/08 1127
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK-full	OK
Any sampler/logging errors? **	No	No
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 1/3/08 1300 Staff: CM Weather: lt. rain

Site: CBY Inflow Rate: _____

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see backside for details)	N/A	N/A
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/8/08 8:30 Staff: CM Weather: Rainy

Boatyard Staff: Steve

Raining at site?: Yes Pumps running? Yes

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 1/8/08 14:00 Staff: RB Weather: Cloudy

	Inlet	Outlet
Grab Time:	8:42	9:03
Grab Volume:	good	good
Composite 1: Begin Time	8:45	9:05
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	—	—
approx. volume	100%	good
Composite 2: Begin Time:	9:42	10:05
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	—	—
approx. volume	100%	good
Composite 3: Begin Time:	10:42	11:05
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	—	—
approx. volume	100%	good
Any sampler/logging errors? **	No	No
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time	—	—
# of sample collected	—	—
missed aliquots?	—	—
approx. volume	—	—

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 11/9/07 1215 Staff: CM Weather: Sunny

Site: CSR Inflow Rate: ~13 gpm

	Inlet	Outlet
Calibrate sample volume?	Y	Y
Bottles Labeled (eg CSR-Inl. CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 11/26/07 16:50 Staff: CM Weather: Raining

Boatyard Staff: Steve

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: _____ Staff: _____ Weather: _____

False Start - ~~See~~ reverse

	Inlet	Outlet
Grab Time:		
Grab Volume:		
Composite 1: Begin Time		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 2: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 3: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Any sampler/logging errors? **		
Field Duplicate Grab Time:		
Field Duplicate Grab Volume:		
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		
Data download? (Y/N)		
Sampling report saved? (Y/N)		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, *THEN* reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

CM coordinated w/ Steve @ CSR, was told the Samplers were started. When TAI went to retrieve samples on 11/27/07, Samplers were off & had never been started

Storm Data Sheet - NMTA Boatyard Study

False Start

Still set up from 11/9/07

SAMPLING SET-UP

Date/Time: 11/07/07 1325 Staff: RB, JB Weather: Sunny

Site: CSR Inflow Rate: ~13 gpm

	Inlet	Outlet
Calibrate sample volume?	Done on 11/9/07	
Bottles Labeled (eg CSR-In1, CSR-In2, etc)		
Clean bottles/lids off? (Y/N)		
Backflush sample lines? (Y/N)		
Drain DI from line? (see back side for details)		
Check sample line connections?		
Check clock?		
Review Program? (see site specific sheet for programming details)		
Internal Field Duplicate?		
Test distributor arm (Y/N)		
Sampler off?		

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 11/28/07 Staff: CM Weather: Raining

Boatyard Staff: Steve

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 11/29/07 1022 Staff: RB, CM Weather: P. Cloudy

	Inlet	Outlet
Grab Time:	1457	—
Grab Volume:		
Composite 1: Begin Time	1459	
# of subsamples collected?	1	
missed aliquots? (eg. #2, #7, #9)	11	
approx. volume	—	
Composite 2: Begin Time:	—	Power Failure
# of subsamples collected?	—	
missed aliquots? (eg. #2, #7, #9)	—	
approx. volume	—	
Composite 3: Begin Time:	—	
# of subsamples collected?	—	
missed aliquots? (eg. #2, #7, #9)	—	
approx. volume	—	
Any sampler/logging errors? **	Y	Y
Field Duplicate Grab Time:	N	
Field Duplicate Grab Volume:	N	
Field Duplicate Composite: Begin Time	—	
# of sample collected	—	
missed aliquots?	—	
approx. volume	—	
Data download? (Y/N)	N	
Sampling report saved? (Y/N)	N	

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

Samplers started, inlet collected grab & 1 subsample of COMP1. Outlet never triggered because of power failure at WaterTectonics trailer

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 11/29/07 1020 Staff: RB, CM Weather: P. Cloudy

Site: CSR Inflow Rate: ~13 gpm → done already

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-Inl, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)		Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 12/13/07 1155 Staff: CM Weather: raining

Boatyard Staff: Chip White

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes: inlet started, outlet active/disabled		

SAMPLE COLLECTION

Date/Time: 12/14/07 840 Staff: RB, JB Weather: Cloudy

	Inlet	Outlet
Grab Time:	12/13/07 11:54	12/13/07 12:22
Grab Volume:	OK	OK
Composite 1: Begin Time	12/13/07 11:57	12/13/07 12:24
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	8	—
approx. volume	Overfill	OK
Composite 2: Begin Time:	12/13/07 12:57	12/13/07 13:24
# of subsamples collected?	6	12
missed aliquots? (eg. #2, #7, #9)	2-5, 7, 8	—
approx. volume	Overfill	OK
Composite 3: Begin Time:	12/13/07 13:57	12/13/07 14:24
# of subsamples collected?	12	6
missed aliquots? (eg. #2, #7, #9)	—	3-8
approx. volume	OK	OK
Any sampler/logging errors? **	Yes	Yes
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time	—	—
# of sample collected	—	—
missed aliquots?	—	—
approx. volume	—	—
~~Data download? (Y/N)~~		
~~Sampling report saved? (Y/N)~~		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

* Too many "no liquid detects" on all comps. Overfilled into base approx. 1.5 gallons! for inlet. Outlet had a few "no liquid detects" on comp 3 but no overfill.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 12/14/07 8:40 Staff: RB, JB Weather: Cloudy

Site: CSR Inflow Rate: ~ 13 gpm

	Inlet	Outlet
Calibrate sample volume?	—	—
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see backside for details)	Y	N/A
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/14/08 1448 Staff: CM Weather: Raining

Boatyard Staff: Frank

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 1/15/08 Staff: JB Weather: MOSTLY SUNNY / 36-40°F

	Inlet	Outlet
Grab Time:	1439 1/14/08	1440
Grab Volume:	Good 100%	Good 100%
Composite 1: Begin Time	1440 1/14/08	1442
# of subsamples collected?	7 of 12	12 of 12
missed aliquots? (eg. #2, #7, #9)	8-12 NO LIQUID DETECT	NONE
approx. volume	Good 75%	100%
Composite 2: Begin Time:	1540	1542
# of subsamples collected?	2 of 12	12 of 12
missed aliquots? (eg. #2, #7, #9)	3-12 NO LIQUID	NONE
approx. volume	15%	100%
Composite 3: Begin Time:	1640	1642
# of subsamples collected?	0	10 of 12
missed aliquots? (eg. #2, #7, #9)	1-12 NO LIQUID	10-12 NO LIQUID Detect
approx. volume	NONE	90%
Any sampler/logging errors? **	"NO LIQUID" as mentioned above	YES
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time	—	—
# of sample collected	—	—
missed aliquots?	—	—
approx. volume	—	—

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

12/19/07 - Visited site after storm. Samplers had been started, inlet had all "NLD". Outlet was active/disabled. Pump never ran?

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 1/15/08 1157 Staff: JB Weather: SUNNY

Site: CSR Inflow Rate: 13 ~ gpm

	Inlet	Outlet
Calibrate sample volume?	NO	NO
Bottles Labeled (eg CSR-Inl, CSR-In2, etc)	YES	YES
Clean bottles/lids off? (Y/N)	YES	YES
Backflush sample lines? (Y/N)	YES	YES
Drain DI from line? (see back side for details)	YES	YES
Check sample line connections?	YES	YES
Check clock?	YES 3min slow/Fixed	YES 2min slow/Fixed
Review Program? (see site specific sheet for programming details)	YES	YES
Internal Field Duplicate?	NO	NO
Run diagnostics/Test distributor arm (Y/N)	YES	YES
Sampler off?	YES	YES

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/30/08 845 Staff: CM Weather: Raining

Boatyard Staff: —

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y

Notes: CM came to site to start samplers. Met w/ Tyler of Watertectonics

SAMPLE COLLECTION

Date/Time: 1/31/08 1245 Staff: CM Weather: overcast

	Inlet	Outlet
Grab Time:	1/30/08 2042	1/30/08 2133
Grab Volume:	OK	OK
Composite 1: Begin Time	1/30/08 2043	1/3/08 2205
# of subsamples collected?	5	6
missed aliquots? (eg. #2, #7, #9)	4,5,6,8,9,10,11	1-6
approx. volume	OK	OK
Composite 2: Begin Time:	1/30/08 2158	1/30/08 2235
# of subsamples collected?	1	7
missed aliquots? (eg. #2, #7, #9)	1,2,3,5,6,7,8,9,10,11,12	8 - 12
approx. volume	OK	OK
Composite 3: Begin Time:	N/A	N/A
# of subsamples collected?	Ø	Ø
missed aliquots? (eg. #2, #7, #9)	all	all
approx. volume	N/A	N/A
Any sampler/logging errors? **	No	No
Field Duplicate Grab Time:	N/A	N/A
Field Duplicate Grab Volume:	N/A	N/A
Field Duplicate Composite: Begin Time	N/A	N/A
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 1/31/08 1300 Staff: CM Weather: P. Sunny

Site: CSR Inflow Rate: ~13 gpm

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	Y	Y
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 2/8/08 1745 Staff: CM Weather: raining

Boatyard Staff: —

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y

Notes: Went to site to start samplers. Pump cycling on & off.

SAMPLE COLLECTION

Date/Time: 2/9/08 Staff: CM Weather: overcast

	Inlet	Outlet
Grab Time:	2/8/08 1735	2/8/08 1741
Grab Volume:	OK	OK
Composite 1: Begin Time	2/8/08 1747	2/8/08 1744
# of subsamples collected?	3	6
missed aliquots? (eg. #2, #7, #9)	1,2,4,6,8-12*	7-12*
approx. volume	OK	OK
Composite 2: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 3: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Any sampler/logging errors? **	Y	Y
Field Duplicate Grab Time:	OK	2/8/08 1741
Field Duplicate Grab Volume:	2/8/08 1735	OK
Field Duplicate Composite: Begin Time	2/8/08 1747	2/8/08 1744
# of sample collected	3	6
missed aliquots?	1,2,4,6,8-12	7-12
approx. volume	OK	OK

** If sampling errors record on back side.

-OVER-

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Samplers were off when arrived. Outlet GPI tripped after 8th inlet (6th outlet) subsample for comp & compFD.
Enough volume for full analysis.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 11/7/07 1030 Staff: CM Weather: lt. rain

Site: POE Inflow Rate: 5.4 gpm

	Inlet	Outlet
Calibrate sample volume?	Y	Y
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see backside for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: _____ Staff: _____ Weather: _____

Boatyard Staff: _____

Raining at site?: _____ Pumps running? _____

	Inlet	Outlet
Program Started? (Y/N)	1634	DIDN'T START
Notes:		

SAMPLE COLLECTION

Date/Time: 11/27/07 1006 Staff: CM, JB, RB Weather: sunny

	Inlet	Outlet
Grab Time:	1634	DIDN'T START
Grab Volume:	NO LIQUID DETECTED	
Composite 1: Begin Time		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 2: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 3: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Any sampler/logging errors? **		
Field Duplicate Grab Time:		
Field Duplicate Grab Volume:		
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		
Data download? (Y/N)		
Sampling report saved? (Y/N)		

Start

False

NO! PUMP Didn't work See notes on back of 11/27/07 field sheet

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 11/27/07 1039 Staff: RB, JB Weather: Sunny

Site: [redacted] POE Inflow Rate: 5.4 gpm

	Inlet	Outlet
Calibrate sample volume?	NO	NO
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	YES	
Clean bottles/lids off? (Y/N)	YES	
Backflush sample lines? (Y/N)	YES	
Drain DI from line? (see back side for details)	YES	
Check sample line connections?	YES	
Check clock?	YES	
Review Program? (see site specific sheet for programming details)	YES	
Internal Field Duplicate?	NO	
Test distributor arm (Y/N)	YES	
Sampler off?	YES	

*all ready setup See reverse

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 12/13/07 1345 Staff: CM Weather: Raining lightly

~~Boatyard~~ Staff: BT

Raining at site?: Lt. Rain Pumps running? N

	Inlet	Outlet
Program Started? (Y/N)	Y	Y

Notes: BT went to site to troubleshoot pump. Reset power. Started samplers

SAMPLE COLLECTION

Date/Time: 12/14/07 11:10 Staff: RB, JB Weather: Cloudy

	Inlet	Outlet
Grab Time:	12/13/07 13:51	12/13/07 14:06
Grab Volume:	OK	OK
Composite 1: Begin Time	12/13/07 13:52	12/13/07 14:09
# of subsamples collected?	5	3
missed aliquots? (eg. #2, #7, #9)	6-12	4-12
approx. volume	50%	50%
Composite 2: Begin Time:	12/13/07 15:11	12/13/07 15:14
# of subsamples collected?	4	5
missed aliquots? (eg. #2, #7, #9)	1-4, 9-12	1, 6-11
approx. volume	40%	66%
Composite 3: Begin Time:	N/A	12/13/07 16:09
# of subsamples collected?	0	2
missed aliquots? (eg. #2, #7, #9)	1-12	2-8, 10-12
approx. volume	0%	25%
Any sampler/logging errors? **	Yes	Yes
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time	—	—
# of sample collected	—	—
missed aliquots?	—	—
approx. volume	—	—
~~Data download? (Y/N)~~		
Sampling report saved? (Y/N)		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.

Out: Backflush line with DI, No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, *THEN* reattach quick connect at inlet sample collection point.

Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In:

Out:

Coord. w/ boatyard staff on 11/20/07. during storm. Pump not working. Staff said they didn't turn on sampler. Later another staff said it was pumping & they did turn on samplers. Visited site on 11/27/07, inlet sampler had been started, outlet had not. Pump wasn't working so all samples were "No liquid detect". Reset inlet station.

12/14/07 all missed samples due to "no more liquid" or "no liquid detect" errors.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 12/14/07 11:15 Staff: RB, JB Weather: Cloudy

Site: POE Inflow Rate: 5.4gpm

	Inlet	Outlet
Calibrate sample volume?	No	No
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 12/19/07 630 Staff: JB Weather: Raining

Boatyard Staff: ?

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 12/19/07 1130 Staff: CM/SO Weather: lt. rain

	Inlet	Outlet
Grab Time:	12/19/07 645	12/19/07 702
Grab Volume:	OK	OK
Composite 1: Begin Time	12/19/07 646	12/19/07 705
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Composite 2: Begin Time:	12/19/07 745	12/19/07 805
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Composite 3: Begin Time:	12/19/07 845	12/19/07 905
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Any sampler/logging errors? **	N	N
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 12/19/07 1145 Staff: CM, SO Weather: lt. rain

Site: POE Inflow Rate: _____

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	Y	Y
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 12/27/07 1430 Staff: CM Weather: Raining

Boatyard Staff: Kevin D.

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 12/28/07 915 Staff: CM Weather: Cloudy

	Inlet	Outlet
Grab Time:	1453	12/27/07 1509
Grab Volume:	0	OK
Composite 1: Begin Time	1454	12/27/07 1510
# of subsamples collected?	Ø	12
missed aliquots? (eg. #2, #7, #9)	12	Ø
approx. volume	Ø	OK
Composite 2: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 3: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Any sampler/logging errors? **	Y	N
Field Duplicate Grab Time:	12/27 1453	12/27 1509
Field Duplicate Grab Volume:	~~1451~~ Ø	OK
Field Duplicate Composite: Begin Time	12/27 1454	12/27 1510
# of sample collected	Ø	12
missed aliquots?	12	Ø
approx. volume	Ø	OK

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Piece of debris lodged in inlet intake line. NLD's for all samples.
outlet samples submitted

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 12/28/07 930 Staff: CM Weather: Cloudy

Site: POE Inflow Rate: ~5 gpm

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/3/08 930 Staff: CM Weather: Rain

Boatyard Staff: Kevin D.

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 1/3/08 1400 Staff: CM Weather: lt. rain

	Inlet	Outlet
Grab Time:	1/3/08 915	1/3/08 930
Grab Volume:	OK	OK
Composite 1: Begin Time	1/3/08 916	1/3/08 931
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Composite 2: Begin Time:	1/3/08 1015	1/3/08 1031
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Composite 3: Begin Time:	1/3/08 1115	1/3/08 1131
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Any sampler/logging errors? **	N	N
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 1/3/08 1405 Staff: cm Weather: lt. rain

Site: POS Inflow Rate: 5.4 gpm

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/9/08 2215 Staff: CM Weather: Raining

Boatyard Staff: Norman

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 1/10/08 1041 Staff: CM Weather: P. Sunny

	Inlet	Outlet
Grab Time:	1/9/08 2221	1/9/08 2237
Grab Volume:	OK	OK
Composite 1: Begin Time	1/9/08 2222	1/9/08 2238
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Composite 2: Begin Time:	1/9/08 2321	1/9/08 2338
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Composite 3: Begin Time:	1/10/08 0021	1/10/08 0038
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK	OK
Any sampler/logging errors? **	N	N
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 1/10/08 1100 Staff: CM Weather: P. Sunny

Site: P09 Inflow Rate: 5.4

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	Y	Y
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/14/08 1415 Staff: ~~TB~~ CM Weather: raining

Boatyard Staff: Ian

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 1/15/08 1300 Staff: JB Weather: sunny 40°F

	Inlet	Outlet
Grab Time:	1409 1/14/08	1424 1/14/08
Grab Volume:	OK	OK
Composite 1: Begin Time	1410	1425
# of subsamples collected?	12 of 12	12 of 12
missed aliquots? (eg. #2, #7, #9)	NONE	NONE
approx. volume	GOOD 100%	GOOD 100%
Composite 2: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Composite 3: Begin Time:		
# of subsamples collected?		
missed aliquots? (eg. #2, #7, #9)		
approx. volume		
Any sampler/logging errors? **	NONE	NONE
Field Duplicate Grab Time:	1409	1424
Field Duplicate Grab Volume:	GOOD	GOOD
Field Duplicate Composite: Begin Time	1410	1425
# of sample collected	12 of 12	12 of 12
missed aliquots?	NONE	NONE
approx. volume	100%	100%

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 1/15/08 Staff: JB Weather: sunny

Site: POE Inflow Rate: 5.4 gpm

	Inlet	Outlet
Calibrate sample volume?	NO	NO
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	YES	YES
Clean bottles/lids off? (Y/N)	YES	YES
Backflush sample lines? (Y/N)	YES	YES
Drain DI from line? (see back side for details)	YES	YES
Check sample line connections?	YES	YES
Check clock?	YES	YES
Review Program? (see site specific sheet for programming details)	YES	YES
Internal Field Duplicate?	NO / changed program back	NO
Run diagnostics/Test distributor arm (Y/N)	YES	YES
Sampler off?	YES	YES

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 1/30/08 1900 Staff: cm Weather: Raining

Boatyard Staff: Rick

Raining at site?: Y Pumps running? Y

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

AMPLE COLLECTION

Date/Time: 1/31/08 1430 Staff: cm Weather: P. cloudy

	Inlet	Outlet
Grab Time:	—	1/30/08 1936
Grab Volume:	Ø	~~1/30 OK 1937~~
Composite 1: Begin Time	—	1/30/08 1937
# of subsamples collected?	Ø	12
missed aliquots? (eg. #2, #7, #9)	12	Ø
approx. volume	Ø	OK
Composite 2: Begin Time:	—	1/30/08 1937
# of subsamples collected?	Ø	12
missed aliquots? (eg. #2, #7, #9)	12	Ø
approx. volume	Ø	OK
Composite 3: Begin Time:	—	
# of subsamples collected?	Ø	
missed aliquots? (eg. #2, #7, #9)	12	
approx. volume	Ø	
Any sampler/logging errors? **		
Field Duplicate Grab Time:	—	
Field Duplicate Grab Volume:	Ø	
Field Duplicate Composite: Begin Time	—	
# of sample collected	Ø	
missed aliquots?	12	
approx. volume	Ø	

** If sampling errors record on back side.

Sampler error - quick connect not fastened. Did not submit samples per DS.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Storm Data Sheet - NMTA Boatyard Study

SAMPLING SET-UP

Date/Time: 1/31/08 1430 Staff: CM Weather: P. Cloudy

Site: POE Inflow Rate: 5.4 gpm

	Inlet	Outlet
Calibrate sample volume?	N	N
Bottles Labeled (eg CSR-In1, CSR-In2, etc)	Y	Y
Clean bottles/lids off? (Y/N)	Y	Y
Backflush sample lines? (Y/N)	Y	Y
Drain DI from line? (see back side for details)	Y	Y
Check sample line connections?	Y	Y
Check clock?	Y	Y
Review Program? (see site specific sheet for programming details)	Y	Y
Internal Field Duplicate?	N	N
Run diagnostics/Test distributor arm (Y/N)	Y	Y
Sampler off?	Y	Y

BOATYARD COORDINATION/SAMPLER INITIATION

Date/Time: 2/6/08 2100 Staff: CMd Weather: Raining

Boatyard Staff: David

Raining at site?: Yes Pumps running? Yes

	Inlet	Outlet
Program Started? (Y/N)	Y	Y
Notes:		

SAMPLE COLLECTION

Date/Time: 2/7/08 1145 Staff: CM Weather: overcast

	Inlet	Outlet
Grab Time:	2/6/08 2109	2/6/08 2129
Grab Volume:	OK - 50%	OK - 50%
Composite 1: Begin Time	2/6/08 2110	2/6/08 2125
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK - full	OK - full
Composite 2: Begin Time:	2/6/08 2209	2/6/08 2225
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK - full	OK - full
Composite 3: Begin Time:	2/6/08 2309	2/6/08 2325
# of subsamples collected?	12	12
missed aliquots? (eg. #2, #7, #9)	Ø	Ø
approx. volume	OK - full	OK - full
Any sampler/logging errors? **	No	No
Field Duplicate Grab Time:	—	—
Field Duplicate Grab Volume:	—	—
Field Duplicate Composite: Begin Time		
# of sample collected		
missed aliquots?		
approx. volume		

** If sampling errors record on back side.

Draining DI from line:

CSR:

In: Backflush line with DI. Detach quick connect at inlet collection point. Allow DI to drain out of line. Reattach quick connect.
Out: Backflush line with DI. No need to drain DI from sample line.

POE:

In: Backflush line with DI. Detach quick connect at inlet collection point (PVC "Tee"). Detach sample line from pump tubing. Allow DI to drain from sample line. Reattach sample line to pump tubing, ***THEN*** reattach quick connect at inlet sample collection point.
Out: Backflush line with DI. Detatch quick connect at oulet collection point (PVC "Tee"). Allow DI to drain out of line. Reattach quick connect.

CANAL:

In: Backflush line with DI. No need to drain DI from sample line.
Out: Backflush line with DI. No need to drain DI from sample line.

Appendix E. Water Quality Data

Table E-1. Water quality data collected from the Aquip system during seven storm events.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
12/13/2007	Comp1	Copper	436.0	21.0	0.95183	95.18	µg/l			N
12/13/2007	Comp2	Copper	503.0	16.2	0.96779	96.78	µg/l			N
12/13/2007	Comp3	Copper		18.6			µg/l			N
12/13/2007	Grab	Copper	405.0	21.0	0.94815	94.81	µg/l			N
12/13/2007	Comp1	Copper, dissolved	329.0	18.3	0.94438	94.44	µg/l			N
12/13/2007	Comp2	Copper, dissolved	391.0	11.4	0.97084	97.08	µg/l			N
12/13/2007	Comp3	Copper, dissolved		10.4			µg/l			N
12/13/2007	Grab	Copper, dissolved	311.0	14.5	0.95338	95.34	µg/l			N
12/13/2007	Comp1	Lead	1.0	1.0			µg/l	ND	ND	Y
12/13/2007	Comp2	Lead	1.0	1.0			µg/l	ND	ND	Y
12/13/2007	Comp3	Lead		1.0			µg/l		ND	Y
12/13/2007	Grab	Lead	1.0	1.0			µg/l	ND	ND	Y
12/13/2007	Comp1	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
12/13/2007	Comp2	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
12/13/2007	Comp3	Lead, dissolved		1.0			µg/l		ND	Y
12/13/2007	Grab	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
12/13/2007	Comp1	TSS	9.0	1.0	0.88889	88.89	mg/l			N/A
12/13/2007	Comp2	TSS	6.0	0.25	0.95833	95.83	mg/l		ND	N/A
12/13/2007	Comp3	TSS		2.0			mg/l			N/A
12/13/2007	Grab	TSS	8.0	1.0	0.87500	87.50	mg/l			N/A
12/13/2007	Comp1	Zinc	554.0	79.0	0.85740	85.74	µg/l			Y
12/13/2007	Comp2	Zinc	656.0	85.0	0.87043	87.04	µg/l			Y
12/13/2007	Comp3	Zinc		153.0			µg/l			N
12/13/2007	Grab	Zinc	555.0	49.0	0.91171	91.17	µg/l			Y
12/13/2007	Comp1	Zinc, dissolved	463.0	67.0	0.85529	85.53	µg/l			Y
12/13/2007	Comp2	Zinc, dissolved	577.0	75.0	0.87002	87.00	µg/l			Y
12/13/2007	Comp3	Zinc, dissolved		138.0			µg/l			N
12/13/2007	Grab	Zinc, dissolved	491.0	43.0	0.91242	91.24	µg/l			Y
12/19/2007	Comp1	Copper	104.0	5.5	0.94712	94.71	µg/l			Y
12/19/2007	Comp2	Copper	60.0	5.2	0.91333	91.33	µg/l			Y
12/19/2007	Comp3	Copper	86.0	5.8	0.93256	93.26	µg/l			Y
12/19/2007	Grab	Copper	128.0	6.1	0.95234	95.23	µg/l			Y
12/19/2007	Comp1	Copper, dissolved	60.0	5.5	0.90833	90.83	µg/l			Y
12/19/2007	Comp2	Copper, dissolved	47.0	5.1	0.89149	89.15	µg/l			Y
12/19/2007	Comp3	Copper, dissolved	48.0	5.7	0.88125	88.13	µg/l			Y
12/19/2007	Grab	Copper, dissolved	108.0	6.1	0.94352	94.35	µg/l			Y
12/19/2007	Comp1	Lead	1.0	1.0			µg/l	ND	ND	Y
12/19/2007	Comp2	Lead	1.0	1.0			µg/l	ND	ND	Y

ND = below lab detection level

Outlet sample above criteria

Table E-1. Water quality data collected from the Aquip system during seven storm events.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
12/19/2007	Comp3	Lead	1.0	1.0			µg/l	ND	ND	Y
12/19/2007	Grab	Lead	1.0	1.0			µg/l	ND	ND	Y
12/19/2007	Comp1	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
12/19/2007	Comp2	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
12/19/2007	Comp3	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
12/19/2007	Grab	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
12/19/2007	Comp1	TSS	1.5	0.7	0.55333	55.33	mg/l			N/A
12/19/2007	Comp2	TSS	0.25	0.25			mg/l	ND	ND	N/A
12/19/2007	Comp3	TSS	1.8	0.25	0.86111	86.11	mg/l		ND	N/A
12/19/2007	Grab	TSS	1.3	0.7	0.48462	48.46	mg/l			N/A
12/19/2007	Comp1	Zinc	119.0	61.0	0.48739	48.74	µg/l			Y
12/19/2007	Comp2	Zinc	93.0	58.0	0.37634	37.63	µg/l			Y
12/19/2007	Comp3	Zinc	102.0	59.0	0.42157	42.16	µg/l			Y
12/19/2007	Grab	Zinc	170.0	64.0	0.62353	62.35	µg/l			Y
12/19/2007	Comp1	Zinc, dissolved	100.0	56.0	0.44000	44.00	µg/l			Y
12/19/2007	Comp2	Zinc, dissolved	80.0	53.0	0.33750	33.75	µg/l			Y
12/19/2007	Comp3	Zinc, dissolved	84.0	54.0	0.35714	35.71	µg/l			Y
12/19/2007	Grab	Zinc, dissolved	150.0	60.0	0.60000	60.00	µg/l			Y
12/27/2007	Comp	Copper		8.6			µg/l			Y
12/27/2007	CompFD	Copper		10.9			µg/l			N
12/27/2007	Grab	Copper		10.2			µg/l			N
12/27/2007	GrabFD	Copper		9.9			µg/l			Y
12/27/2007	Comp	Copper, dissolved		6.1			µg/l			Y
12/27/2007	CompFD	Copper, dissolved		6.4			µg/l			Y
12/27/2007	Grab	Copper, dissolved		8.0			µg/l			Y
12/27/2007	GrabFD	Copper, dissolved		7.8			µg/l			Y
12/27/2007	Comp	Lead		1.0			µg/l		ND	Y
12/27/2007	CompFD	Lead		1.0			µg/l		ND	Y
12/27/2007	Grab	Lead		1.0			µg/l		ND	Y
12/27/2007	GrabFD	Lead		1.0			µg/l		ND	Y
12/27/2007	Comp	Lead, dissolved		1.0			µg/l		ND	Y
12/27/2007	CompFD	Lead, dissolved		1.0			µg/l		ND	Y
12/27/2007	Grab	Lead, dissolved		1.0			µg/l		ND	Y
12/27/2007	GrabFD	Lead, dissolved		1.0			µg/l		ND	Y
12/27/2007	Comp	TSS		0.25			mg/l		ND	N/A
12/27/2007	CompFD	TSS		0.25			mg/l		ND	N/A
12/27/2007	Grab	TSS		0.25			mg/l		ND	N/A
12/27/2007	GrabFD	TSS		0.25			mg/l		ND	N/A

Table E-1. Water quality data collected from the Aquip system during seven storm events.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
12/27/2007	Comp	Zinc		75.0			µg/l			Y
12/27/2007	CompFD	Zinc		76.0			µg/l			Y
12/27/2007	Grab	Zinc		78.0			µg/l			Y
12/27/2007	GrabFD	Zinc		76.0			µg/l			Y
12/27/2007	Comp	Zinc, dissolved		68.0			µg/l			Y
12/27/2007	CompFD	Zinc, dissolved		73.0			µg/l			Y
12/27/2007	Grab	Zinc, dissolved		72.0			µg/l			Y
12/27/2007	GrabFD	Zinc, dissolved		68.0			µg/l			Y
1/3/2008	Comp1	Copper	101.0	6.0	0.94059	94.06	µg/l			Y
1/3/2008	Comp2	Copper	78.0	7.6	0.90256	90.26	µg/l			Y
1/3/2008	Comp3	Copper	119.0	7.0	0.94118	94.12	µg/l			Y
1/3/2008	Grab	Copper	160.0	5.3	0.96688	96.69	µg/l			Y
1/3/2008	Comp1	Copper, dissolved	69.0	4.7	0.93188	93.18841	µg/l			Y
1/3/2008	Comp2	Copper, dissolved	62.0	7.4	0.88065	88.06452	µg/l			Y
1/3/2008	Comp3	Copper, dissolved	94.0	6.4	0.93191	93.19149	µg/l			Y
1/3/2008	Grab	Copper, dissolved	114.0	4.7	0.95877	95.87719	µg/l			Y
1/3/2008	Comp1	Lead	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Comp2	Lead	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Comp3	Lead	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Grab	Lead	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Comp1	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Comp2	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Comp3	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Grab	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/3/2008	Comp1	TSS	3.0	0.25	0.91667	91.66667	mg/l		ND	N/A
1/3/2008	Comp2	TSS	2.5	0.25	0.90000	90.00000	mg/l		ND	N/A
1/3/2008	Comp3	TSS	1.5	0.25	0.83333	83.33333	mg/l		ND	N/A
1/3/2008	Grab	TSS	2.3	0.25	0.89130	89.13043	mg/l		ND	N/A
1/3/2008	Comp1	Zinc	138.0	70.0	0.49275	49.27536	µg/l			Y
1/3/2008	Comp2	Zinc	114.0	81.0	0.28947	28.94737	µg/l			Y
1/3/2008	Comp3	Zinc	148.0	82.0	0.44595	44.59459	µg/l			Y
1/3/2008	Grab	Zinc	210.0	77.0	0.63333	63.33333	µg/l			Y
1/3/2008	Comp1	Zinc, dissolved	131.0	60.0	0.54198	54.19847	µg/l			Y
1/3/2008	Comp2	Zinc, dissolved	112.0	69.0	0.38393	38.39286	µg/l			Y
1/3/2008	Comp3	Zinc, dissolved	140.0	78.0	0.44286	44.28571	µg/l			Y
1/3/2008	Grab	Zinc, dissolved	199.0	76.0	0.61809	61.80905	µg/l			Y
1/9/2008	Comp1	Copper	219.0	8.7	0.96027	96.02740	µg/l			Y
1/9/2008	Comp2	Copper	83.0	5.4	0.93494	93.49398	µg/l			Y

Table E-1. Water quality data collected from the Aquip system during seven storm events.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
1/9/2008	Comp3	Copper	74.0	4.0	0.94595	94.59459	µg/l			Y
1/9/2008	Grab	Copper	266.0	10.3	0.96128	96.12782	µg/l			N
1/9/2008	Comp1	Copper, dissolved	81.0	6.2	0.92346	92.34568	µg/l			Y
1/9/2008	Comp2	Copper, dissolved	48.0	4.4	0.90833	90.83333	µg/l			Y
1/9/2008	Comp3	Copper, dissolved	47.0	3.4	0.92766	92.76596	µg/l			Y
1/9/2008	Grab	Copper, dissolved	128.0	7.2	0.94375	94.37500	µg/l			Y
1/9/2008	Comp1	Lead	2.0	1.0			µg/l		ND	Y
1/9/2008	Comp2	Lead	1.0	1.0			µg/l	ND	ND	Y
1/9/2008	Comp3	Lead	1.0	1.0			µg/l	ND	ND	Y
1/9/2008	Grab	Lead	1.0	1.0			µg/l	ND	ND	Y
1/9/2008	Comp1	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/9/2008	Comp2	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/9/2008	Comp3	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/9/2008	Grab	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/9/2008	Comp1	TSS	7.5	0.8	0.90000	90.00000	mg/l			N/A
1/9/2008	Comp2	TSS	1.5	0.25	0.83333	83.33333	mg/l		ND	N/A
1/9/2008	Comp3	TSS	0.8	0.25	0.66667	66.66667	mg/l		ND	N/A
1/9/2008	Grab	TSS	9.8	0.8	0.92347	92.34694	mg/l			N/A
1/9/2008	Comp1	Zinc	143.0	70.0	0.51049	51.04895	µg/l			Y
1/9/2008	Comp2	Zinc	97.0	66.0	0.31959	31.95876	µg/l			Y
1/9/2008	Comp3	Zinc	93.0	64.0	0.31183	31.18280	µg/l			Y
1/9/2008	Grab	Zinc	194.0	76.0	0.60825	60.82474	µg/l			Y
1/9/2008	Comp1	Zinc, dissolved	121.0	67.0	0.44628	44.62810	µg/l			Y
1/9/2008	Comp2	Zinc, dissolved	81.0	58.0	0.28395	28.39506	µg/l			Y
1/9/2008	Comp3	Zinc, dissolved	78.0	62.0	0.20513	20.51282	µg/l			Y
1/9/2008	Grab	Zinc, dissolved	164.0	67.0	0.59146	59.14634	µg/l			Y
1/14/2008	Comp	Copper	287.0	14.0	0.95122	95.12195	µg/l			N
1/14/2008	CompFD	Copper	256.0	15.0	0.94141	94.14063	µg/l			N
1/14/2008	Grab	Copper	1490.0	12.0	0.99195	99.19463	µg/l			N
1/14/2008	GrabFD	Copper	1410.0	14.0	0.99007	99.00709	µg/l			N
1/14/2008	Comp	Copper, dissolved	84.0	12.0	0.85714	85.71429	µg/l			N
1/14/2008	CompFD	Copper, dissolved	85.0	12.0	0.85882	85.88235	µg/l			N
1/14/2008	Grab	Copper, dissolved	137.0	10.0	0.92701	92.70073	µg/l			Y
1/14/2008	GrabFD	Copper, dissolved	127.0	11.0	0.91339	91.33858	µg/l			N
1/14/2008	Comp	Lead	3.7	1.0	0.72973	72.97297	µg/l		ND	Y
1/14/2008	CompFD	Lead	2.6	1.0	0.61538	61.53846	µg/l		ND	Y
1/14/2008	Grab	Lead	17.7	1.0	0.94350	94.35028	µg/l		ND	Y
1/14/2008	GrabFD	Lead	18.0	1.0	0.94444	94.44444	µg/l		ND	Y

Table E-1. Water quality data collected from the Aquip system during seven storm events.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
1/14/2008	Comp	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/14/2008	CompFD	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/14/2008	Grab	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/14/2008	GrabFD	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
1/14/2008	Comp	TSS	7.5	1.8	0.76000	76.00000	mg/l			N/A
1/14/2008	CompFD	TSS	6.5	1.5	0.76923	76.92308	mg/l			N/A
1/14/2008	Grab	TSS	40.0	1.5	0.96250	96.25000	mg/l			N/A
1/14/2008	GrabFD	TSS	34.0	1.3	0.96176	96.17647	mg/l			N/A
1/14/2008	Comp	Zinc	168.0	103.0	0.38690	38.69048	µg/l			N
1/14/2008	CompFD	Zinc	153.0	104.0	0.32026	32.02614	µg/l			N
1/14/2008	Grab	Zinc	429.0	127.0	0.70396	70.39627	µg/l			N
1/14/2008	GrabFD	Zinc	414.0	122.0	0.70531	70.53140	µg/l			N
1/14/2008	Comp	Zinc, dissolved	119.0	99.0	0.16807	16.80672	µg/l			Y
1/14/2008	CompFD	Zinc, dissolved	123.0	101.0	0.17886	17.88618	µg/l			N
1/14/2008	Grab	Zinc, dissolved	214.0	120.0	0.43925	43.92523	µg/l			N
1/14/2008	GrabFD	Zinc, dissolved	196.0	113.0	0.42347	42.34694	µg/l			N
2/6/2008	Comp1	Copper	203.0	8.4	0.95862	95.86207	µg/l			Y
2/6/2008	Comp2	Copper	175.0	5.0	0.97143	97.14286	µg/l			Y
2/6/2008	Comp3	Copper	122.0	4.5	0.96311	96.31148	µg/l			Y
2/6/2008	Grab	Copper	218.0	18.6	0.91468	91.46789	µg/l			N
2/6/2008	Comp1	Copper, dissolved	135.0	6.8	0.94963	94.96296	µg/l			Y
2/6/2008	Comp2	Copper, dissolved	97.0	4.0	0.95876	95.87629	µg/l			Y
2/6/2008	Comp3	Copper, dissolved	92.0	2.9	0.96848	96.84783	µg/l			Y
2/6/2008	Grab	Copper, dissolved	132.0	9.6	0.92727	92.72727	µg/l			Y
2/6/2008	Comp1	Lead	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Comp2	Lead	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Comp3	Lead	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Grab	Lead	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Comp1	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Comp2	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Comp3	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Grab	Lead, dissolved	1.0	1.0			µg/l	ND	ND	Y
2/6/2008	Comp1	TSS	4.3	0.7	0.84419	84.41860	mg/l			N/A
2/6/2008	Comp2	TSS	4.5	0.5	0.88889	88.88889	mg/l			N/A
2/6/2008	Comp3	TSS	0.8	0.25	0.66667	66.66667	mg/l		ND	N/A
2/6/2008	Grab	TSS	3.7	0.8	0.77568	77.56757	mg/l			N/A
2/6/2008	Comp1	Zinc	168.0	66.0	0.60714	60.71429	µg/l			Y
2/6/2008	Comp2	Zinc	151.0	46.0	0.69536	69.53642	µg/l			Y

Table E-1. Water quality data collected from the Aquip system during seven storm events.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
2/6/2008	Comp3	Zinc	145.0	49.0	0.66207	66.20690	µg/l			Y
2/6/2008	Grab	Zinc	164.0	50.0	0.69512	69.51220	µg/l			Y
2/6/2008	Comp1	Zinc, dissolved	161.0	48.0	0.70186	70.18634	µg/l			Y
2/6/2008	Comp2	Zinc, dissolved	143.0	44.0	0.69231	69.23077	µg/l			Y
2/6/2008	Comp3	Zinc, dissolved	134.0	47.0	0.64925	64.92537	µg/l			Y
2/6/2008	Grab	Zinc, dissolved	155.0	48.0	0.69032	69.03226	µg/l			Y

Table E-2. Water quality data collected from the WWIX system during seven storms.

Date	Sample ID	Test Name	Cin	Cout	PRE	%PRE	Units	Flag In	Flag out	Below discharge criteria?
11/26/2007	AVG COMP	Copper	981.3	8.2	0.99164	99.16	µg/l			Y
11/26/2007	Comp1	Copper	673.0	9.6			µg/l			Y
11/26/2007	Comp2	Copper	821.0	5.8		0.00	µg/l			Y
11/26/2007	Comp3	Copper	1450.0	9.2		0.00	µg/l			Y
11/26/2007	Grab	Copper	191.0	2.3	0.98796	98.80	µg/l			Y
11/26/2007	AVG COMP	Copper, dissolved	489.3	5.5	0.98869	98.87	µg/l			Y
11/26/2007	Comp1	Copper, dissolved	488.0	5.5			µg/l			Y
11/26/2007	Comp2	Copper, dissolved	520.0	5.4			µg/l			Y
11/26/2007	Comp3	Copper, dissolved	460.0	5.7			µg/l			Y
11/26/2007	Grab	Copper, dissolved	30.0	2.0	0.93333	93.33	µg/l		ND	Y
11/26/2007	AVG COMP	Lead	14.2	2.0	0.85948	85.95	µg/l		ND	Y
11/26/2007	Comp1	Lead	11.0	2.0			µg/l		ND	Y
11/26/2007	Comp2	Lead	10.8	2.0			µg/l		ND	Y
11/26/2007	Comp3	Lead	20.9	2.0			µg/l		ND	Y
11/26/2007	Grab	Lead	3.5	2.0	0.42857	42.86	µg/l		ND	Y
11/26/2007	AVG COMP	Lead, dissolved	2.3	2.0	0.14286	14.29	µg/l			Y
11/26/2007	Comp1	Lead, dissolved	2.5	2.0			µg/l		ND	Y
11/26/2007	Comp2	Lead, dissolved	2.5	2.0			µg/l		ND	Y
11/26/2007	Comp3	Lead, dissolved	2.0	2.0			µg/l	ND	ND	Y
11/26/2007	Grab	Lead, dissolved	2.0	2.0			µg/l	ND	ND	Y
11/26/2007	AVG COMP	TSS	13.5	0.6	0.95877	95.88	mg/l			N/A
11/26/2007	Comp1	TSS	4.5	0.50			mg/l		ND	N/A
11/26/2007	Comp2	TSS	8.0	0.50			mg/l		ND	N/A
11/26/2007	Comp3	TSS	28.0	0.67			mg/l			N/A
11/26/2007	Grab	TSS	4.3	0.50	0.88372	88.37	mg/l		ND	N/A
11/26/2007	AVG COMP	Zinc	405.0	7.7	0.98107	98.11	µg/l			Y
11/26/2007	Comp1	Zinc	318.0	9.0			µg/l			Y
11/26/2007	Comp2	Zinc	367.0	6.0			µg/l			Y
11/26/2007	Comp3	Zinc	530.0	8.0			µg/l			Y
11/26/2007	Grab	Zinc	156.0	6.0	0.96154	96.15	µg/l			Y
11/26/2007	AVG COMP	Zinc, dissolved	334.0	6.7	0.98004	98.00	µg/l			Y
11/26/2007	Comp1	Zinc, dissolved	296.0	7.0			µg/l			Y
11/26/2007	Comp2	Zinc, dissolved	312.0	6.0			µg/l			Y
11/26/2007	Comp3	Zinc, dissolved	394.0	7.0			µg/l			Y
11/26/2007	Grab	Zinc, dissolved	102.0	5.0	0.95098	95.10	µg/l		ND	Y
11/28/2007	Comp1	Copper	1210	14	0.98843	98.84	µg/l			N
11/28/2007	Comp2	Copper	1050	9.8	0.99067	99.07	µg/l			Y
11/28/2007	Comp3	Copper	649	11.5	0.98228	98.23	µg/l			N

ND = below detection limit

Outlet sample above criteria

Bottles not labeled as separate compsites, so no individual paired comps. PCR calculated using average influent and average effluent concentrations.

Table E-2. Water quality data collected from the WWIX system during seven storms.

Date	Sample ID	Test Name	Cin	Cout	PRE	%PRE	Units	Flag In	Flag out	Below discharge criteria?
11/28/2007	Grab	Copper	585	17.3	0.97043	97.04	µg/l			
11/28/2007	Comp1	Copper, dissolved	469.0	13.5	0.97122	97.12	µg/l			
11/28/2007	Comp2	Copper, dissolved	580.0	8.2	0.98586	98.59	µg/l			Y
11/28/2007	Comp3	Copper, dissolved	512.0	9.3	0.98184	98.18	µg/l			Y
11/28/2007	Grab	Copper, dissolved	358.0	14.8	0.95866	95.87	µg/l			
11/28/2007	Comp1	Lead	47.6	2.0	0.95798	95.80	µg/l		ND	Y
11/28/2007	Comp2	Lead	41.1	2.0	0.95134	95.13	µg/l		ND	Y
11/28/2007	Comp3	Lead	11.9	2.0	0.83193	83.19	µg/l		ND	Y
11/28/2007	Grab	Lead	8.8	2.0	0.77273	77.27	µg/l		ND	Y
11/28/2007	Comp1	Lead, dissolved	2.0	2.0	0.00000	0.00	µg/l		ND	Y
11/28/2007	Comp2	Lead, dissolved	3.8	2.0	0.47368	47.37	µg/l		ND	Y
11/28/2007	Comp3	Lead, dissolved	3.3	2.0	0.39394	39.39	µg/l		ND	Y
11/28/2007	Grab	Lead, dissolved	2.0	2.0			µg/l	ND	ND	Y
11/28/2007	Comp1	TSS	19.0	1.50	0.92105	92.11	mg/l			N/A
11/28/2007	Comp2	TSS	21.0	1.20	0.94286	94.29	mg/l			N/A
11/28/2007	Comp3	TSS	7.5	1.30	0.82667	82.67	mg/l			N/A
11/28/2007	Grab	TSS	7.0	1.50	0.78571	78.57	mg/l			N/A
11/28/2007	Comp1	Zinc	642.0	16.0	0.97508	97.51	µg/l			Y
11/28/2007	Comp2	Zinc	612.0	13.0	0.97876	97.88	µg/l			Y
11/28/2007	Comp3	Zinc	562.0	14.0	0.97509	97.51	µg/l			Y
11/28/2007	Grab	Zinc	375.0	23.0	0.93867	93.87	µg/l			Y
11/28/2007	Comp1	Zinc, dissolved	521.0	11.0	0.97889	97.89	µg/l			Y
11/28/2007	Comp2	Zinc, dissolved	536.0	12.0	0.97761	97.76	µg/l			Y
11/28/2007	Comp3	Zinc, dissolved	429.0	14.0	0.96737	96.74	µg/l			Y
11/28/2007	Grab	Zinc, dissolved	339.0	13.0	0.96165	96.17	µg/l			Y
12/13/2007	Comp	Copper	2220	18.7	0.99158	99.15766	µg/l			
12/13/2007	Comp (FD)	Copper	2180	18.6	0.99147	99.14679	µg/l			
12/13/2007	Grab	Copper	2350	19.4	0.99174	99.17447	µg/l			
12/13/2007	Grab (FD)	Copper	2120	19.2	0.99094	99.09434	µg/l			
12/13/2007	Comp	Copper, dissolved	955	15	0.98429	98.42932	µg/l			
12/13/2007	Comp (FD)	Copper, dissolved	960	17.4	0.98188	98.18750	µg/l			
12/13/2007	Grab	Copper, dissolved	1010	16.8	0.98337	98.33663	µg/l			
12/13/2007	Grab (FD)	Copper, dissolved	1010	14.5	0.98564	98.56436	µg/l			
12/13/2007	Comp	Lead	96	2	0.97917	97.91667	µg/l		ND	Y
12/13/2007	Comp (FD)	Lead	94	2	0.97872	97.87234	µg/l		ND	Y
12/13/2007	Grab	Lead	103	2	0.98058	98.05825	µg/l		ND	Y
12/13/2007	Grab (FD)	Lead	69	2	0.97101	97.10145	µg/l		ND	Y
12/13/2007	Comp	Lead, dissolved	6.4	2	0.68750	68.75000	µg/l		ND	Y

Table E-2. Water quality data collected from the WWIX system during seven storms.

Date	Sample ID	Test Name	Cin	Cout	PRE	%PRE	Units	Flag In	Flag out	Below discharge criteria?
12/13/2007	Comp (FD)	Lead, dissolved	6.4	2	0.68750	68.75000	µg/l		ND	Y
12/13/2007	Grab	Lead, dissolved	7.4	2	0.72973	72.97297	µg/l		ND	Y
12/13/2007	Grab (FD)	Lead, dissolved	8.3	2	0.75904	75.90361	µg/l		ND	Y
12/13/2007	Comp	TSS	28	3	0.89286	89.28571	mg/l			N/A
12/13/2007	Comp (FD)	TSS	24	2.5	0.89583	89.58333	mg/l			N/A
12/13/2007	Grab	TSS	27	2.8	0.89630	89.62963	mg/l			N/A
12/13/2007	Grab (FD)	TSS	31	2.3	0.92581	92.58065	mg/l			N/A
12/13/2007	Comp	Zinc	1110	29	0.97387	97.38739	µg/l			Y
12/13/2007	Comp (FD)	Zinc	1110	29	0.97387	97.38739	µg/l			Y
12/13/2007	Grab	Zinc	1150	31	0.97304	97.30435	µg/l			Y
12/13/2007	Grab (FD)	Zinc	1140	30	0.97368	97.36842	µg/l			Y
12/13/2007	Comp	Zinc, dissolved	849	25	0.97055	97.05536	µg/l			Y
12/13/2007	Comp (FD)	Zinc, dissolved	845	29	0.96568	96.56805	µg/l			Y
12/13/2007	Grab	Zinc, dissolved	922	29	0.96855	96.85466	µg/l			Y
12/13/2007	Grab (FD)	Zinc, dissolved	915	27	0.97049	97.04918	µg/l			Y
12/19/2007	Comp1	Copper	763	11	0.98558	98.55832	µg/l			N
12/19/2007	Comp2	Copper	1580	11	0.99304	99.30380	µg/l			N
12/19/2007	Comp3	Copper	1090	7.7	0.99294	99.29358	µg/l			Y
12/19/2007	Grab	Copper	833	13	0.98439	98.43938	µg/l			N
12/19/2007	Comp1	Copper, dissolved	368	8.8	0.97609	97.60870	µg/l			Y
12/19/2007	Comp2	Copper, dissolved	434	7.8	0.98203	98.20276	µg/l			Y
12/19/2007	Comp3	Copper, dissolved	468	7.6	0.98376	98.37607	µg/l			Y
12/19/2007	Grab	Copper, dissolved	349	9.5	0.97278	97.27794	µg/l			Y
12/19/2007	Comp1	Lead	31	2	0.93548	93.54839	µg/l		ND	Y
12/19/2007	Comp2	Lead	78	2	0.97436	97.43590	µg/l		ND	Y
12/19/2007	Comp3	Lead	47	2	0.95745	95.74468	µg/l		ND	Y
12/19/2007	Grab	Lead	35	2	0.94286	94.28571	µg/l		ND	Y
12/19/2007	Comp1	Lead, dissolved	3.8	2	0.47368	47.36842	µg/l		ND	Y
12/19/2007	Comp2	Lead, dissolved	4.3	2	0.53488	53.48837	µg/l		ND	Y
12/19/2007	Comp3	Lead, dissolved	3.8	2	0.47368	47.36842	µg/l		ND	Y
12/19/2007	Grab	Lead, dissolved	3.2	2	0.37500	37.50000	µg/l		ND	Y
12/19/2007	Comp1	TSS	11	0.5	0.95455	95.45455	mg/l		ND	N/A
12/19/2007	Comp2	TSS	34	0.5	0.98529	98.52941	mg/l		ND	N/A
12/19/2007	Comp3	TSS	14	0.5	0.96429	96.42857	mg/l		ND	N/A
12/19/2007	Grab	TSS	14	1.5	0.89286	89.28571	mg/l			N/A
12/19/2007	Comp1	Zinc	276	11	0.96014	96.01449	µg/l			Y
12/19/2007	Comp2	Zinc	373	10	0.97319	97.31903	µg/l			Y
12/19/2007	Comp3	Zinc	367	9	0.97548	97.54768	µg/l			Y

Table E-2. Water quality data collected from the WWIX system during seven storms.

Date	Sample ID	Test Name	Cin	Cout	PRE	%PRE	Units	Flag In	Flag out	Below discharge criteria?
12/19/2007	Grab	Zinc	276	14	0.94928	94.92754	µg/l			Y
12/19/2007	Comp1	Zinc, dissolved	208	9	0.95673	95.67308	µg/l			Y
12/19/2007	Comp2	Zinc, dissolved	239	10	0.95816	95.81590	µg/l			Y
12/19/2007	Comp3	Zinc, dissolved	268	7	0.97388	97.38806	µg/l			Y
12/19/2007	Grab	Zinc, dissolved	202	12	0.94059	94.05941	µg/l			Y
12/27/2007	Comp1	Copper	1400	7.3	0.99479	99.47857	µg/l			Y
12/27/2007	Comp2	Copper	597	7.3	0.98777	98.77722	µg/l			Y
12/27/2007	Comp3	Copper	578	6.2	0.98927	98.92734	µg/l			Y
12/27/2007	Grab	Copper	1240	6	0.99516	99.51613	µg/l			Y
12/27/2007	Comp1	Copper, dissolved	519	6.4	0.98767	98.76686	µg/l			Y
12/27/2007	Comp2	Copper, dissolved	389	6.7	0.98278	98.27763	µg/l			Y
12/27/2007	Comp3	Copper, dissolved	493	5.2	0.98945	98.94523	µg/l			Y
12/27/2007	Grab	Copper, dissolved	655	4.7	0.99282	99.28244	µg/l			Y
12/27/2007	Comp1	Lead	41	2	0.95110	95.11002	µg/l		ND	Y
12/27/2007	Comp2	Lead	16	2	0.87805	87.80488	µg/l		ND	Y
12/27/2007	Comp3	Lead	4	2	0.53488	53.48837	µg/l		ND	Y
12/27/2007	Grab	Lead	30	2	0.93399	93.39934	µg/l		ND	Y
12/27/2007	Comp1	Lead, dissolved	3.6	2	0.44444	44.44444	µg/l		ND	Y
12/27/2007	Comp2	Lead, dissolved	2.9	2	0.31034	31.03448	µg/l		ND	Y
12/27/2007	Comp3	Lead, dissolved	2	2			µg/l	ND	ND	Y
12/27/2007	Grab	Lead, dissolved	3.8	2	0.47368	47.36842	µg/l		ND	Y
12/27/2007	Comp1	TSS	27	0.5	0.98148	98.14815	mg/l		ND	N/A
12/27/2007	Comp2	TSS	8.5	0.5	0.94118	94.11765	mg/l		ND	N/A
12/27/2007	Comp3	TSS	4.5	0.5	0.88889	88.88889	mg/l		ND	N/A
12/27/2007	Grab	TSS	20	0.5	0.97500	97.50000	mg/l		ND	N/A
12/27/2007	Comp1	Zinc	347	12	0.96542	96.54179	µg/l			Y
12/27/2007	Comp2	Zinc	196	13	0.93367	93.36735	µg/l			Y
12/27/2007	Comp3	Zinc	226	12	0.94690	94.69027	µg/l			Y
12/27/2007	Grab	Zinc	490	12	0.97551	97.55102	µg/l			Y
12/27/2007	Comp1	Zinc, dissolved	254	10	0.96063	96.06299	µg/l			Y
12/27/2007	Comp2	Zinc, dissolved	164	12	0.92683	92.68293	µg/l			Y
12/27/2007	Comp3	Zinc, dissolved	203	10	0.95074	95.07389	µg/l			Y
12/27/2007	Grab	Zinc, dissolved	364	10	0.97253	97.25275	µg/l			Y
1/3/2008	Comp1	Copper	1250	4.6	0.99632	99.63200	µg/l			Y
1/3/2008	Comp2	Copper	1050	2.4	0.99771	99.77143	µg/l			Y
1/3/2008	Comp3	Copper	792	2	0.99747	99.74747	µg/l		ND	Y
1/3/2008	Grab	Copper	732	6.9	0.99057	99.05738	µg/l			Y
1/3/2008	Comp1	Copper, dissolved	592	3.8	0.99358	99.35811	µg/l			Y

Table E-2. Water quality data collected from the WWIX system during seven storms.

Date	Sample ID	Test Name	Cin	Cout	PRE	%PRE	Units	Flag In	Flag out	Below discharge criteria?
1/3/2008	Comp2	Copper, dissolved	516	2.1	0.99593	99.59302	µg/l			Y
1/3/2008	Comp3	Copper, dissolved	506	2	0.99605	99.60474	µg/l		ND	Y
1/3/2008	Grab	Copper, dissolved	614	6	0.99023	99.02280	µg/l			Y
1/3/2008	Comp1	Lead	53	2	0.96226	96.22642	µg/l		ND	Y
1/3/2008	Comp2	Lead	45	2	0.95556	95.55556	µg/l		ND	Y
1/3/2008	Comp3	Lead	26	2	0.92308	92.30769	µg/l		ND	Y
1/3/2008	Grab	Lead	10.4	2	0.80769	80.76923	µg/l		ND	Y
1/3/2008	Comp1	Lead, dissolved	5	2	0.60000	60.00000	µg/l		ND	Y
1/3/2008	Comp2	Lead, dissolved	4.5	2	0.55556	55.55556	µg/l		ND	Y
1/3/2008	Comp3	Lead, dissolved	4.1	2	0.51220	51.21951	µg/l		ND	Y
1/3/2008	Grab	Lead, dissolved	4.6	2	0.56522	56.52174	µg/l		ND	Y
1/3/2008	Comp1	TSS	17	0.5	0.97059	97.05882	mg/l		ND	N/A
1/3/2008	Comp2	TSS	16	0.5	0.96875	96.87500	mg/l		ND	N/A
1/3/2008	Comp3	TSS	8.5	0.5	0.94118	94.11765	mg/l		ND	N/A
1/3/2008	Grab	TSS	2.7	0.83	0.69259	69.25926	mg/l			N/A
1/3/2008	Comp1	Zinc	349	7	0.97994	97.99427	µg/l			Y
1/3/2008	Comp2	Zinc	300	7	0.97667	97.66667	µg/l			Y
1/3/2008	Comp3	Zinc	282	6	0.97872	97.87234	µg/l			Y
1/3/2008	Grab	Zinc	296	11	0.96284	96.28378	µg/l			Y
1/3/2008	Comp1	Zinc, dissolved	287	5	0.98258	98.25784	µg/l		ND	Y
1/3/2008	Comp2	Zinc, dissolved	252	5	0.98016	98.01587	µg/l			Y
1/3/2008	Comp3	Zinc, dissolved	248	5	0.97984	97.98387	µg/l		ND	Y
1/3/2008	Grab	Zinc, dissolved	286	10	0.96503	96.50350	µg/l			Y
1/8/2008	Comp1	Copper	791	3.8	0.99520	99.51960	µg/l			Y
1/8/2008	Comp2	Copper	731	4.7	0.99357	99.35705	µg/l			Y
1/8/2008	Comp3	Copper	829	5.1	0.99385	99.38480	µg/l			Y
1/8/2008	Grab	Copper	762	3.6	0.99528	99.52756	µg/l			Y
1/8/2008	Comp1	Copper, dissolved	503	3.3	0.99344	99.34394	µg/l			Y
1/8/2008	Comp2	Copper, dissolved	517	3.3	0.99362	99.36170	µg/l			Y
1/8/2008	Comp3	Copper, dissolved	514	3.7	0.99280	99.28016	µg/l			Y
1/8/2008	Grab	Copper, dissolved	461	3.6	0.99219	99.21909	µg/l			Y
1/8/2008	Comp1	Lead	21.7	2	0.90783	90.78341	µg/l		ND	Y
1/8/2008	Comp2	Lead	17.1	2	0.88304	88.30409	µg/l		ND	Y
1/8/2008	Comp3	Lead	21.4	2	0.90654	90.65421	µg/l		ND	Y
1/8/2008	Grab	Lead	18.6	2	0.89247	89.24731	µg/l		ND	Y
1/8/2008	Comp1	Lead, dissolved	4.5	2	0.55556	55.55556	µg/l		ND	Y
1/8/2008	Comp2	Lead, dissolved	5.3	2	0.62264	62.26415	µg/l		ND	Y
1/8/2008	Comp3	Lead, dissolved	5.8	2	0.65517	65.51724	µg/l		ND	Y

Table E-2. Water quality data collected from the WWIX system during seven storms.

Date	Sample ID	Test Name	Cin	Cout	PRE	%PRE	Units	Flag In	Flag out	Below discharge criteria?
1/8/2008	Grab	Lead, dissolved	4.8	2	0.58333	58.33333	µg/l		ND	Y
1/8/2008	Comp1	TSS	7.8	0.5	0.93590	93.58974	mg/l			N/A
1/8/2008	Comp2	TSS	9	0.83	0.90778	90.77778	mg/l			N/A
1/8/2008	Comp3	TSS	8.5	0.83	0.90235	90.23529	mg/l			N/A
1/8/2008	Grab	TSS	14	0.75	0.94643	94.64286	mg/l			N/A
1/8/2008	Comp1	Zinc	252	7	0.97222	97.22222	µg/l			Y
1/8/2008	Comp2	Zinc	249	7	0.97189	97.18876	µg/l			Y
1/8/2008	Comp3	Zinc	277	15	0.94585	94.58484	µg/l			Y
1/8/2008	Grab	Zinc	238	9	0.96218	96.21849	µg/l			Y
1/8/2008	Comp1	Zinc, dissolved	223	5	0.97758	97.75785	µg/l		ND	Y
1/8/2008	Comp2	Zinc, dissolved	230	5	0.97826	97.82609	µg/l		ND	Y
1/8/2008	Comp3	Zinc, dissolved	234	9	0.96154	96.15385	µg/l			Y
1/8/2008	Grab	Zinc, dissolved	198	8	0.95960	95.95960	µg/l			Y

Table E-3. Water quality data collected from the Wave Ionics system during four storms.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
12/13/2007	Comp1	Copper	2310.0	70.0	Paired sample collection not feasible for the Wave Ionics technology so pollutant concentration reduction was not calculated for each individual sample. Calculations used the average influent and average effluent concentrations to determine the average pollutant concentration reduction for each parameter.		µg/l			N
12/13/2007	Comp2	Copper	749.0	90.0			µg/l			N
12/13/2007	Comp3	Copper	454.0	95.0			µg/l			N
12/13/2007	Grab	Copper	4140.0	752.0			µg/l			N
12/13/2007	Comp1	Copper, dissolved	675	46			µg/l			N
12/13/2007	Comp2	Copper, dissolved	297	77			µg/l			N
12/13/2007	Comp3	Copper, dissolved	229.0	87.0			µg/l			N
12/13/2007	Grab	Copper, dissolved	1390	22			µg/l			N
12/13/2007	Comp1	Lead	130.0	1.0			µg/l		ND	Y
12/13/2007	Comp2	Lead	37.4	1.00			µg/l		ND	Y
12/13/2007	Comp3	Lead	21.6	1.00			µg/l		ND	Y
12/13/2007	Grab	Lead	190.0	34.6			µg/l			Y
12/13/2007	Comp1	Lead, dissolved	5.6	1.0			µg/l		ND	Y
12/13/2007	Comp2	Lead, dissolved	3.2	1.0			µg/l		ND	Y
12/13/2007	Comp3	Lead, dissolved	2.4	1.0			µg/l		ND	Y
12/13/2007	Grab	Lead, dissolved	13.9	1.0			µg/l		ND	Y
12/13/2007	Comp1	TSS	85.0	8.5			mg/l			N/A
12/13/2007	Comp2	TSS	43.0	5.5			mg/l			N/A
12/13/2007	Comp3	TSS	20.0	4.5			mg/l			N/A
12/13/2007	Grab	TSS	83.0	240.0			mg/l			N/A
12/13/2007	Comp1	Zinc	989.0	49.00			µg/l			Y
12/13/2007	Comp2	Zinc	453.0	64.00			µg/l			Y
12/13/2007	Comp3	Zinc	303	68			µg/l			Y
12/13/2007	Grab	Zinc	2160.0	670.00			µg/l			N
12/13/2007	Comp1	Zinc, dissolved	483.0	30.0			µg/l			Y
12/13/2007	Comp2	Zinc, dissolved	273.0	53.0			µg/l			Y
12/13/2007	Comp3	Zinc, dissolved	200.0	65.0			µg/l			Y
12/13/2007	Grab	Zinc, dissolved	1260.0	14.0			µg/l			Y
1/14/2008	Comp1	Copper	3770.0	176.0			µg/l			N
1/14/2008	Comp2	Copper	2490.0	81.0			µg/l			N
1/14/2008	Comp3	Copper		15.0			µg/l			N
1/14/2008	Grab	Copper	5650.0	14.0			µg/l			N
1/14/2008	Comp1	Copper, dissolved	105.0	15.0			µg/l			N
1/14/2008	Comp2	Copper, dissolved	91.0	25.0			µg/l			N
1/14/2008	Comp3	Copper, dissolved		13.0			µg/l			N
1/14/2008	Grab	Copper, dissolved	184.0	12.0			µg/l			N
1/14/2008	Comp1	Lead	240.0	9.8			µg/l			Y
1/14/2008	Comp2	Lead	153.0	4.8			µg/l			Y
1/14/2008	Comp3	Lead		1.0			µg/l		ND	Y
1/14/2008	Grab	Lead	310.0	1.0			µg/l		ND	Y
1/14/2008	Comp1	Lead, dissolved	2.0	1.0			µg/l	ND	ND	Y
1/14/2008	Comp2	Lead, dissolved	2.2	1.00			µg/l		ND	Y
1/14/2008	Comp3	Lead, dissolved		1.00			µg/l		ND	Y
1/14/2008	Grab	Lead, dissolved	3.7	2.0			µg/l			Y
1/14/2008	Comp1	TSS	200.0	24.00			mg/l			N/A
1/14/2008	Comp2	TSS	104.0	9.50			mg/l			N/A
1/14/2008	Comp3	TSS		0.25			mg/l		ND	N/A
1/14/2008	Grab	TSS	178.0	0.25			mg/l		ND	N/A
1/14/2008	Comp1	Zinc	1160.0	97.0			µg/l			Y
1/14/2008	Comp2	Zinc	758.0	46.0			µg/l			Y
1/14/2008	Comp3	Zinc		7.0			µg/l			Y
1/14/2008	Grab	Zinc	1570.0	9.0			µg/l			Y
1/14/2008	Comp1	Zinc, dissolved	375.0	10.00			µg/l			Y

ND= below detection level

Outlet sample above criteria

	Parameter	Average pollutant reduction
	Copper	94.81
	Lead	95.70
	Zinc	91.97
	Copper, dissolved	85.56
	Lead, dissolved	70.15
	Zinc, dissolved	92.44
COMP	TSS	80.29

	Parameter	Average pollutant reduction
	Copper	38.00
	Lead	39.23
	Zinc	0.58
	Copper, dissolved	96.90
	Lead, dissolved	82.95
	Zinc, dissolved	97.76
GRAB	TSS	-92.57

Table E-3. Water quality data collected from the Wave Ionics system during four storms.

Date	Sample ID	Test Name	Cin	Cout	SCR	%SCR	Units	Flag In	Flag out	Below discharge criteria?
1/14/2008	Comp2	Zinc, dissolved	320.0	18.00	Paired sample collection not feasible for the Wave Ionics technology so pollutant concentration reduction was not calculated for each individual sample. Calculations used the average influent and average effluent concentrations to determine the average pollutant concentration reduction for each parameter.		µg/l			Y
1/14/2008	Comp3	Zinc, dissolved		2.50			µg/l		ND	Y
1/14/2008	Grab	Zinc, dissolved	513.0	7.00			µg/l			Y
1/30/2008	Comp1	Copper	4600.0	403.0			µg/l			
1/30/2008	Comp2	Copper	1700.0	11.4			µg/l			
1/30/2008	Grab	Copper	6590.0	10200.0			µg/l			
1/30/2008	Comp1	Copper, dissolved	109.0	9.7			µg/l			Y
1/30/2008	Comp2	Copper, dissolved	47.0	9.3			µg/l			Y
1/30/2008	Grab	Copper, dissolved	127.0	8.4			µg/l			Y
1/30/2008	Comp1	Lead	225.0	21.5			µg/l			Y
1/30/2008	Comp2	Lead	100.0	1.0			µg/l		ND	Y
1/30/2008	Grab	Lead	304.0	453.0			µg/l			
1/30/2008	Comp1	Lead, dissolved	2.0	1.0			µg/l	ND	ND	Y
1/30/2008	Comp2	Lead, dissolved	2.0	1.00			µg/l	ND	ND	Y
1/30/2008	Grab	Lead, dissolved	2.0	1.0			µg/l	ND	ND	Y
1/30/2008	Comp1	TSS	124.0	39.00			mg/l			N/A
1/30/2008	Comp2	TSS	87.0	0.87			mg/l			N/A
1/30/2008	Grab	TSS	126.0	916.00			mg/l			N/A
1/30/2008	Comp1	Zinc	1090.0	168.0			µg/l			
1/30/2008	Comp2	Zinc	728.0	15.0			µg/l			Y
1/30/2008	Grab	Zinc	1340.0	5080.0			µg/l			
1/30/2008	Comp1	Zinc, dissolved	339.0	13.00			µg/l			Y
1/30/2008	Comp2	Zinc, dissolved	274.0	14.00			µg/l			Y
1/30/2008	Grab	Zinc, dissolved	353.0	10.00			µg/l			Y
2/8/2008	Comp	Copper	2710.0	153.00			µg/l			
2/8/2008	CompFD	Copper	2640.0	142.00			µg/l			
2/8/2008	Grab	Copper	3570.0	2760.00			µg/l			
2/8/2008	GrabFD	Copper	3370.0	732.00			µg/l			
2/8/2008	Comp	Copper, dissolved	181.0	12.30			µg/l			
2/8/2008	CompFD	Copper, dissolved	185.0	13.50			µg/l			
2/8/2008	Grab	Copper, dissolved	149.0	9.00			µg/l			Y
2/8/2008	GrabFD	Copper, dissolved	161.0	10.90			µg/l			
2/8/2008	Comp	Lead	137.0	8.00			µg/l			Y
2/8/2008	CompFD	Lead	138.0	7.40			µg/l			Y
2/8/2008	Grab	Lead	149.0	138.00			µg/l			
2/8/2008	GrabFD	Lead	153.0	45.50			µg/l			Y
2/8/2008	Comp	Lead, dissolved	2.0	1.00			µg/l	ND	ND	Y
2/8/2008	CompFD	Lead, dissolved	2.0	1.00			µg/l	ND	ND	Y
2/8/2008	Grab	Lead, dissolved	2.0	1.00			µg/l	ND	ND	Y
2/8/2008	GrabFD	Lead, dissolved	2.0	1.00			µg/l	ND	ND	Y
2/8/2008	Comp	TSS	138.0	58.00			mg/l			N/A
2/8/2008	CompFD	TSS	140.0	56.00			mg/l			N/A
2/8/2008	Grab	TSS	188.0	256.00			mg/l			N/A
2/8/2008	GrabFD	TSS	202.0	84.00			mg/l			N/A
2/8/2008	Comp	Zinc	885.0	68.00			µg/l			Y
2/8/2008	CompFD	Zinc	863.0	63.00			µg/l			Y
2/8/2008	Grab	Zinc	1040.0	1030.00			µg/l			
2/8/2008	GrabFD	Zinc	1010.0	290.00			µg/l			
2/8/2008	Comp	Zinc, dissolved	227.0	11.00			µg/l			Y
2/8/2008	CompFD	Zinc, dissolved	229.0	12.00			µg/l			Y
2/8/2008	Grab	Zinc, dissolved	160.0	14.00			µg/l			Y
2/8/2008	GrabFD	Zinc, dissolved	164.0	10.00			µg/l			Y