WATER EFFECT RATIO SCREENING STUDY AT SEATTLE-TACOMA INTERNATIONAL AIRPORT: TOXICITY EVALUATION OF SITE WATER

Prepared for

PORT OF SEATTLE
Seattle-Tacoma International Airport
P.O. Box 68727
Seattle, Washington 98168-0727

Prepared by

PARAMETRIX, INC.
5808 Lake Washington Blvd. NE
Kirkland, Washington 98033

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AR 041921

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1. INTRODUCTION

This report summarizes the procedures and results of biological testing conducted on site water from Seattle-Tacoma International Airport (STIA) for the Port of Seattle (POS). The purpose of these tests is to provide screening-level toxicity information in anticipation of formal tests that will be used to set site-specific water quality standards via a water effect ratio. Site water consisted of receiving water, outfall discharge, and a mixture of the two.

All biological testing was conducted by Parametrix's Environmental Toxicology Laboratory in Kirkland, Washington. Analytical chemistry was provided by Aquatic Research Incorporated in Seattle, Washington.

2. SAMPLE SOURCE AND HANDLING

Samples were collected according to the Storm Water Quality Sampling and Analysis Plan (SAP) dated December 11, 1998. Highlights of these procedures, as well as minor deviations from this plan, are described below. Pertinent client and sampling/test information is summarized in Table 1.

Table 1. Screening-level study: summary information.

Client name	Port of Seattle
Parametrix job number	55-2912-01 (61)
Date of sampling	January 14, 1999
Toxicity testing requirements	Acute screening-level *Ceriodaphnia dubia* bioassays
Sample location	Seattle-Tacoma International Airport
Name of receiving water	**Miller Creek Upstream** of Lake Reba **Miller Creek Downstream** (@ 8th Ave. S.) **Lake Reba Outfall** to Miller Creek **Walker Creek** @ SR 509 **East Branch Des Moines Creek** @ fork **West Branch Des Moines Creek** near fork **STIA Outfall SDS-3** (005) **City of Sea-Tac Storm Outfall** to NW Ponds
Samples collected by	Ron Simmons, Justin Kophs

Samples were collected at eight locations (Table 1) during a storm event (as defined in the *POS Procedure Manual for Stormwater Monitoring*) on the morning of 14 January 1999. The antecedent dry period preceding this storm was 86 hours. Precipitation started at 1600 on 13 January and ended at 1600 on 14 January 1999; samples were taken from approximately 0700 to 1000 on 14 January. Approximately 1.18 inches of rain fell at STIA during this 24-hour storm. Rainfall intensity

increased from the beginning of the event through the three-hour period in which the grab samples were collected.

Parametrix staff collected two-liter grab samples at 15-minute intervals over a three-hour period from seven of the eight sampling sites. Field staff approached sampling locations carefully from downstream to avoid stirring up sediment and compromising sample integrity. Water level (stage) was measured in the culvert immediately following each grab sample. Temperature and pH measurements were recorded at least once during the three-hour event at each location. Field data (i.e., date and time) were recorded in field data logbooks currently located in project files at Parametrix.

POS staff collected samples at the eighth location (SDS-3), with an ISCO sampler programmed to take flow-weighted composite samples.

Samples were placed on ice immediately after collection, and delivered to the Parametrix laboratory shortly after collection of the last grab sample at each location. Within 4 hours of receipt by the laboratory, all grab samples were flow-weight-composited into a 10-liter cubitainer based on flow estimates. Flow at each location was estimated by entering stage measurements into the Manning or empirical stage-discharge equations.

Sample water from SDS-3 was mixed with sample water from Miller Creek Downstream and Walker Creek sites to represent the proposed ratio of Third Runway stormwater to receiving water. SDS-3 stormwater, which almost exclusively drains runways, taxiways, and infields, is assumed to be representative of future stormwater from the Third Runway. The proportions of these mixes were estimated to be 1 part SDS-3 to 5 parts Miller Creek Downstream, and 4 parts SDS-3 to 1 part Walker Creek based on hydrographs generated using HSPF.

Subsamples for analytical chemistry were decanted from the ten composited samples into clean bottles provided by Aquatic Research (samples volumes for dissolved analyses were filtered through a 0.45 μm filter), immediately after compositing and mixing. The subsamples were delivered to Aquatic Research with completed chain-of-custody forms on 15 January at 1300, approximately 30 hours after collection.

Two liters of each sample were used by Parametrix for the 48-hour acute screening-level bioassays.

Quality assurance and quality control elements addressed during sample collection included:

- bottles labeled with the location and interval designation,
- bottles rinsed three times with ambient water,
- samples collected in new (or cleaned by the analytical lab) HDPE bottles,
- bottles inverted before being placed in water for rinses and grabs (to minimize collection of surface water),
- interval samples placed in a cooler with ice to maintain the samples at 4°C.

3. SCREENING-LEVEL BIOASSAYS

Two liters of each sample were used by Parametrix for the 48-hour acute screening-level bioassay. Test conditions are summarized in Table 2.

Table 2. Summary of test conditions for the acute screening-level *Ceriodaphnia dubia* bioassay.

Test Dates	15-17 January 1999
Test Protocol	Washington State Department of Ecology, WAC Chapter 173-205, 1993; WDOE Publication No. WQ-R-95-80; and *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (USEPA 1993).
Test Material	Composite samples of site water from at Seattle-Tacoma International Airport
Test Organisms/Age	*Ceriodaphnia dubia* (water flea); ≤ 24 hours at initiation
Source of Organisms	In-house cultures
Acclimation Period	None
Number/Test Chamber	5
Volume/Test Chamber	25 mL
Test Concentrations	0 and 100% site water
Replicates	Four
Reference Toxicant	Copper as copper sulfate
Test Duration	48 hours
Control/Dilution Media	Natural spring water; Gold Creek Trout Farm, Woodinville, Washington (80-100 mg/L hardness as $CaCO_3$)
Preparation Date of Control/ Dilution Water	12 January 1999
Pretreatment of Dilution Water	None
Test Chambers	30 mL polypropylene cups
Lighting	Fluorescent bulbs (50-100 foot candles)
Photoperiod	16 hours light; 8 hours dark
Aeration	None
Feeding	None
Renewal	None
Temperature	20 ± 1°C
Chemical Data	Dissolved oxygen, temperature, and pH at test initiation and every 24 hours; conductivity at test initiation and termination; hardness, alkalinity, salinity, ammonia, and residual chlorine at test initiation for 100% site water
Effect Measured	Mortality
Test Acceptability	Control mortality ≤10%
Endpoints reported	Percent survival in 100% site water Lowest observed effect concentration (LOEC) No observed effect concentration (NOEC)

4. RESULTS

Records of biological and chemical data collected during testing and the statistical analyses used for reporting are included in Appendix A of this report. Water quality parameters are reported in Appendix B. Hydrographs for Miller and Walker Creeks were generated using HSPF and are included in Appendix C of this report.

Bioassay results are summarized in Table 3 below. Overall, there was 100% survival in 100% site water for all ten tests, NOECs of 100% site water and LOECs of >100% site water. Control responses and reference toxicant results were within acceptable ranges for all ten tests.

Table 3. Summary of bioassay results.

Sample	Percent Survival 100% Site Water	NOEC	LOEC
Miller Creek Downstream	100	100	<100
Miller Creek Upstream	100	100	<100
STIA Outfall SDS-3	100	100	<100
City of Sea-Tac Storm Outfalls	100	100	<100
Walker Creek	100	100	<100
Des Moines Creek -West	100	100	<100
Des Moines Creek -East	100	100	<100
Lake Reba	100	100	<100
Mixture: SDS-3 + Miller Downstream	100	100	<100
Mixture: SDS-3 + Walker Creek	100	100	<100

5. REFERENCES

U.S. EPA. 1993. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. EPA/600/4-90/027F, August 1993. U.S. Environmental Protection Agency, Cincinnati, Ohio.

WDOE. 1997. Laboratory guidance and whole effluent toxicity test review criteria. Washington State Department of Ecology, Publication No. WQ-R-95-80. Revised March 1997.

APPENDIX A

ACUTE SCREENING-LEVEL *Ceriodaphnia dubia* BIOASSAY DATA

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: MC
Test Dates: 1/15-1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house, <24 hours

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.3	8.4	8.4	8.9	8.7	322	261
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.6	8.3	8.4	8.5	8.8	8.7	131	136
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JC	BQB	BQB	THM	BQB	BQB	THM	BQB	BQB	THM	BQB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.

NT = Not Taken

DEO

Comments

AR 041928

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: ~~MCR~~ MC U JP 1/15
Test Dates: 1/15-1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1430
Source/Age of Organisms: In house, <24 hours

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.3	8.4	8.4	8.9	8.7	327	261
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.8	8.4	8.4	8.7	8.8	8.7	82	162
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JP	BQB	BQB	JP	BQB	BQB	JPM	BQB	BQB	JP	BQB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.
NT = Not Taken

Comments

2144 DW

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: SDS3
Test Dates: 1-15-99 – 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house, <24 hours

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH C	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) C	48
Control	A	5	5	5	8.2	8.2	8.3	8.4	9.0	8.8	322	365
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.5	8.4	8.4	8.9	9.0	8.8	53	108
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JC	BDB	BDB	KM	BDB	BDB	KM	BDB	BDB	KM	BDB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.

NT = Not Taken

Comments: DSD

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: ~~MCR~~ MC v JP 1/15
Test Dates: 1/15-1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1430
Source/Age of Organisms: In house, <24 hours

Temp (°C) Day 0 20 Day 1 20 Day 2 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.3	8.4	8.4	8.9	8.7	327	261
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.8	8.4	8.4	8.7	8.8	8.7	82	163
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JP	BGB	BGB	JP	BGB	BGB	[illegible]	BGB	BGB	JP	BGB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.

NT = Not Taken

Comments

2144 DED

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: SDS3
Test Dates: 1-15-99 – 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house, <24 hours

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.2	8.3	8.4	9.0	8.8	321	365
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.5	8.4	8.4	8.9	9.0	8.8	53	108
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JC	BOB	BOB	JHM	BOB	BOB	[illegible]	BOB	BOB	[illegible]	BOB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.

NT = Not Taken

Comments

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: STO
Test Dates: 1/15/99 – 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1200
Source/Age of Organisms: In house, <24 hrs

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	4.2	8.2	8.3	8.4	9.0	8.8	525	305
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100 %	A	5	5	5	7.5	8.3	8.4	8.3	8.9	8.8	166	177
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JP	RDB	RDB	HM	RDB	RDB	HM	RDB	RDB	HM	RDB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.

NT = Not Taken

Comments: ________

PED

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: WC
Test Dates: 1/15 - 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house, <24 hrs

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.2	8.2	8.4	9.0	9.0	324	399
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.7	8.2	8.2	8.8	9.0	9.0	131	183
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JC	BQB	BQB	HM	BQB	BQB	HM	BQB	BQB	HM	BQB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.
NT = Not Taken

Comments

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: DMC-West
Test Dates: 1/15-1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house, <24 hrs

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.2	8.2	8.4	9.0	9.0	327	326
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.4	8.3	8.3	8.10	9.0	9.0	159	159
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
Initials		JC	BJB	BJB	AM	BJB	BJB	AM	BJB	BJB	AM	BJB
Date		1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.
NT = Not Taken

QEO

Comments

AR 041935

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: DMC-east
Test Dates: 1/15 - 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house, <24 hours

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.3	8.2	8.4	9.0	9.1	327	414
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.6	8.4	8.3	8.8	9.0	9.1	52	80
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JC	BQB	BQB	AM	BQB	BQB	AM	BQB	BQB	AM	BQB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.

NT = Not Taken

Comments

BQB

AR 041936

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: LR
Test Dates: 1/15 - 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: ~~In house~~, <24 hrs

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) C	48
Control	A	5	5	5	8.7	8.3	8.2	8.4	9.0	9.1	327	414
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100%	A	5	5	5	7.6	8.5	8.4	8.7	9.0	9.1	251	314
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	JC	BQB	BQB	HM	BQB	BQB	HM	BQB	BQB	HM	BQB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.
NT = Not Taken

Comments

2150 DEO

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: POS
Sample: SD53 - MC
Test Dates: 1/15/99 - 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house, <24h

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) C	24	48	Specific Conductivity (µS) C	48
					8.2	8.1	8.5	8.4	9.0	9.2	327	319
Control	A	5	5	5								
	B	5	5	5								
	C	5	5	5								
	D	5	5	5	7.1	8.2	8.5	8.9	8.9	9.2	118	199
100%	A	5	5	5								
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	[illegible]	BOB	BOB	[illegible]	BOB	BOB	[illegible]	BOB	BOB	[illegible]	BOB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.

NT = Not Taken

Comments

AR 041938

STATIC ACUTE *Ceriodaphnia dubia* TOXICITY TEST

Client: ADS
Sample: 5053 - WC
Test Dates: 1-15-99 - 1/17/99

Sample Collection Date: 1/14/99
Test Initiation Time: 1400
Source/Age of Organisms: In house ≤ 24 hrs

Temp (°C) Day 0: 20 Day 1: 20 Day 2: 20

Conc.	Rep.	Number of Organisms 0	24	48	pH 0	24	48	Dissolved Oxygen (mg/L) 0	24	48	Specific Conductivity (µS) 0	48
Control	A	5	5	5	8.2	8.1	8.5	8.4	9.0	9.2	327	319
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
100 %	A	5	5	5	6.9	8.3	8.5	8.9	8.8	9.1	70	107
	B	5	5	5								
	C	5	5	5								
	D	5	5	5								
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	Initials	[illegible]	BJB	BJB	[illegible]	BJB	BJB	[illegible]	BJB	BJB	[illegible]	BJB
	Date	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/16	1/17	1/15	1/17

Shading represents areas for which data collection is not required.
NT = Not Taken

DJO

Comments

APPENDIX B

FIELD-MEASURED WATER QUALITY PARAMETERS

Initial chemical and physical determinations in 100% site water.

Parameter Measured	SDS-3	STO	WC	MC	DMC-W
Temperature (°C)	8	4	4	4	4
Salinity (ppt)	0	0	0	0	0
Dissolved oxygen (mg/L)	11.0	11.0	11.6	11.8	8.5
pH	6.8	8.1	7.8	7.7	7.5
Conductivity (µS)	52	58	130	128	155
Total hardness (mg/L as $CaCO_3$)	20	28	50	56	60
Total alkalinity (mg/L as $CaCO_3$)	22	32	48	48	86
Total residual chlorine (mg/L)	0.04	0.02	0.02	0.05	0.06
Ammonia (mg/L)[1]	<1	<1	<1	<1	<1

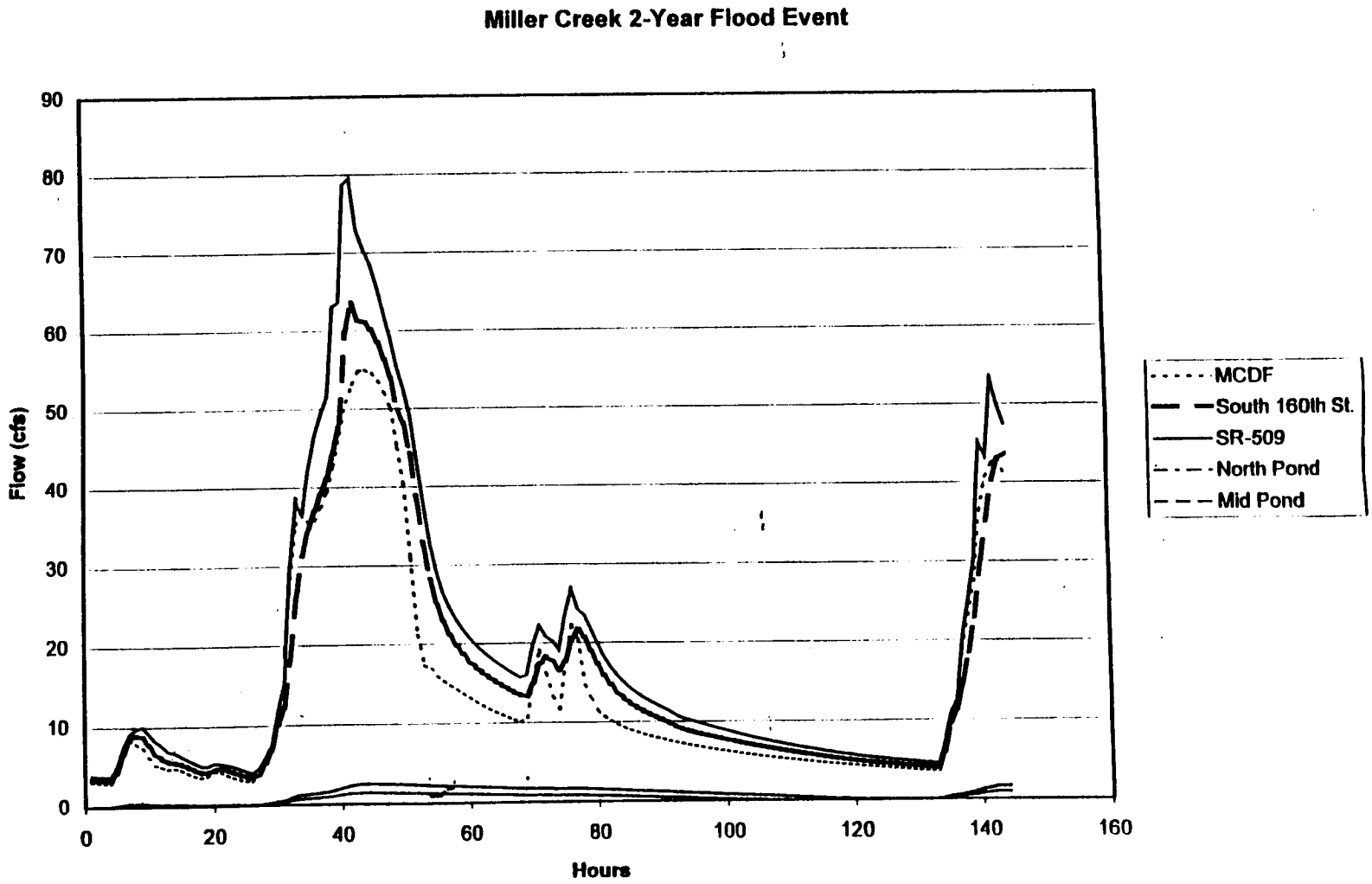
[1] La Motte colorimetric test kit, Detection Limit 1 mg/L

Parameter Measured	DMC-E	LR	MCB	SDS-3 + MC	SDS-3 + WC
Temperature (°C)	4	4	4	4	4
Salinity (ppt)	0	0	0	0	0
Dissolved oxygen (mg/L)	11.7	10.0	11.1	9.2	9.1
pH	7.7	7.4	7.6	6.9	6.9
Conductivity (µS)	49	245	80	123	71
Total hardness (mg/L as $CaCO_3$)	38	112	32	44	26
Total alkalinity (mg/L as $CaCO_3$)	22	112	38	68	30
Total residual chlorine (mg/L)	0.02	0.03	0.03	0.07	0.05
Ammonia (mg/L)[1]	<1	<1	<1	<1	<1

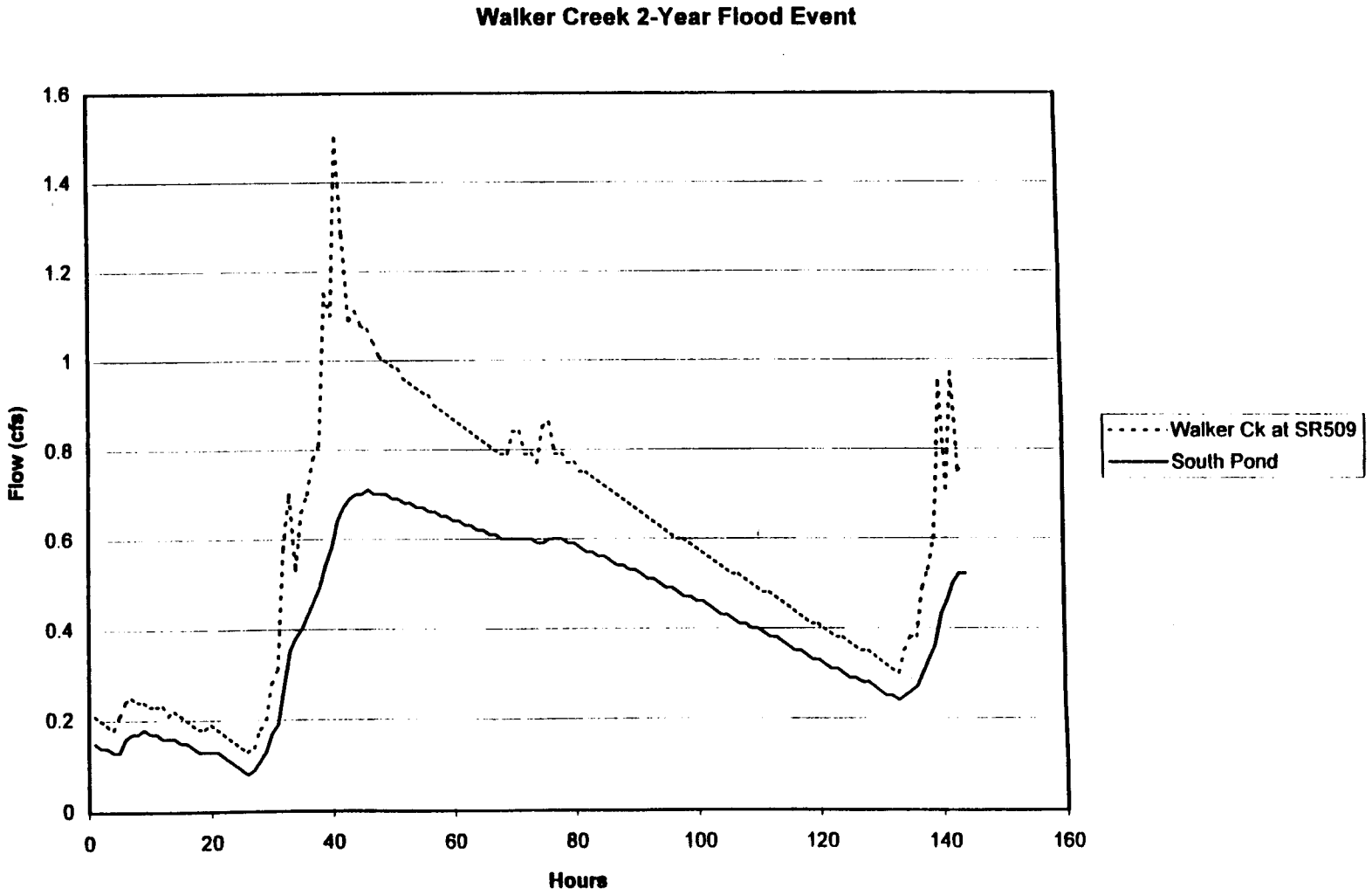
[1] La Motte colorimetric test kit, Detection Limit 1 mg/L

APPENDIX C

MILLER CREEK AND PROPOSED THIRD RUNWAY OUTFALL HYDROGRAPHS, 2-YEAR STORM


Miller Creek 2-Year Flood Event
Flow (cfs)
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
Hours
MCDF
South 160th St.
SR-509
North Pond
Mid Pond

AR 041943


Walker Creek 2-Year Flood Event
Flow (cfs)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
160
Hours
Walker Ck at SR509
South Pond

AR 041944