

DES MOINES CREEK WATER QUALITY STUDY

Prepared for

**FAA
PORT OF SEATTLE**

Prepared by

**PARAMETRIX, INC.
13020 Northup Way
Bellevue, Washington 98005**

February 1992

INTRODUCTION

Des Moines Creek flows through an urbanized watershed in southwestern King County. Originating at Bow Lake near Sea-Tac International Airport, the creek flows southwest for approximately three miles to Des Moines Beach Park on Puget Sound. As a tributary to Puget Sound, Des Moines Creek is designated as an extraordinary (Class AA) quality water body by the Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201).

Des Moines Creek once supported diverse aquatic life including coho salmon, cutthroat trout, steelhead trout, and possibly chum salmon (Herrera 1989). However, the water quality and aquatic ecosystem have been impaired by fuel spills and stormwater. Very few fish were observed during stream survey walks in lower Des Moines Creek in early December 1991.

No recent information is available on the water quality of Des Moines Creek. The only previously reported water quality data were the results of a comprehensive study approximately 18 years ago by Stevens, Thompson, and Runyan (1974). Since then, two jet fuel spills reported at Sea-Tac International Airport in 1985 and 1986 killed most aquatic life in the creek (Herrera 1989). Present water quality conditions and the degree to which stormwater pollution may limit the recovery of salmonids and other aquatic life in Des Moines Creek has not be documented.

Current water quality information is needed to support the analysis of construction and mitigation alternatives for the South Aviation Support Area. Because the alternatives include major modifications to upper Des Moines Creek and its watershed, it is important to document the water quality before construction begins. It is also important to determine the need to address water quality problems in the mitigation plan.

OBJECTIVES

The overall objective of this study was to characterize water quality in Des Moines Creek and its tributaries during a common storm runoff event to provide current water quality information. It was beyond the scope of this study to define the variability of Des Moines Creek water quality in response to storm events. Our purpose was to provide a general indication of stormwater impacts to water quality. Specific objectives of this study were to 1) determine if state water quality standards were met in Des Moines Creek during a storm runoff period, 2) identify any contaminants of concern in Des Moines Creek water and their general source areas, and 3) determine if stormwater pollution is likely to be causing toxic conditions in Des Moines Creek.

METHODS

Study methods included field measurements, visual observations, and collection of water samples for laboratory analysis. A Corning Checkmate meter and probes were used to measure water temperature, pH, conductivity, total dissolved solids, and dissolved oxygen

at the time of sample collection at each station. The Checkmate was calibrated at the first station prior to any measurements. All measurements, descriptions of sampling locations, and water quality observations were recorded in a waterproof field notebook. Sampling stations were visited in order from upstream to downstream so that they were all sampled, to the extent possible, during the same part of the storm hydrograph.

Grab samples of stream water were collected directly into containers provided by the laboratory. Samples were grabbed from midstream at approximately mid-depth. Samples were placed in a cooler on ice and delivered to Aquatic Research, Inc. laboratory and the Parametrix, Inc. bioassay laboratory on the day of sample collection. Analytical methods for conventional parameters followed Standard Methods for the Examination of Water and Wastewater (APHA et al. 1989). Metals were analyzed by furnace atomic absorption (FAA) or inductively coupled plasma (ICP) methods according to Methods for Chemical Analysis of Water and Wastes (USEPA 1983a). Using samples from two monitoring locations static acute toxicity screening tests were conducted on rainbow trout according to EPA Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms (USEPA 1985).

MONITORING LOCATIONS

Water quality was monitored at seven locations on Des Moines Creek, three tributaries to Des Moines Creek, and the outfall of a major stormwater discharge that originates at the SeaTac airport runway. The following monitoring stations are shown on Figure 1:

DC-1: Outlet from Bow Lake.

DC-2: Des Moines Creek near the southern-most Sea-Tac parking lot fence immediately upstream from the golf course.

DC-3: Discharge from the large stormwater outfall that originates at the Sea-Tac airport runways. This is the only station designated "DC" that was not on Des Moines Creek proper.

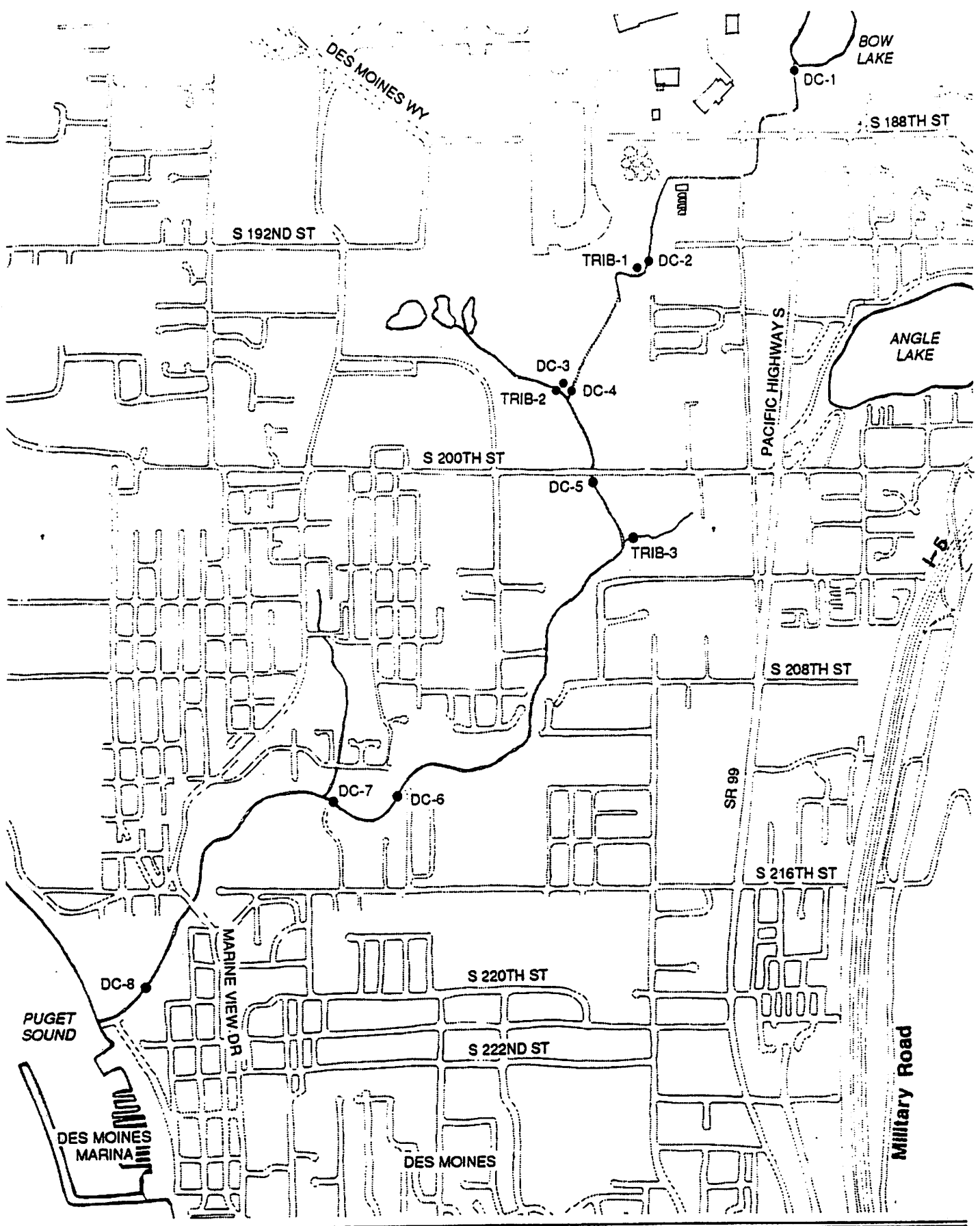
DC-4: Des Moines Creek where it exits the culvert from the golf course detention pond.

DC-5: Des Moines Creek immediately downstream from South 200th Street. A field duplicate sample was collected here and labeled DC-12.

DC-6: Des Moines Creek immediately upstream from the Midway Sewer District treatment plant property.

DC-7: Des Moines Creek immediately downstream from the treatment plant property.

DC-8: The King County gaging station on Des Moines Creek approximately 400 yd upstream from its mouth in Des Moines Beach Park.



NOT TO SCALE

Figure 1.
Water Quality Monitoring Stations
December 18, 1991

TRIB-1: Outlet of the ditch that lies between the southern-most parking lot and Des Moines Creek near DC-2.

TRIB-2: The mouth of the west fork of Des Moines Creek that originates at several ponds adjacent to the golf course.

TRIB-3: The mouth of the east fork of Des Moines Creek that enters the main stream approximately 500 yd downstream from South 200th Street.

RESULTS

Rainfall and Runoff Conditions

The Des Moines Creek water quality monitoring event on December 18, 1991 was preceded by five consecutive days of dry weather. Hard rain began at approximately 5:00 am and ended at 10:30 am resulting in a total accumulation of 0.38 inch. Daily rainfall at Sea-Tac was equal to or greater than 0.38 inch 31 times during 1991, thus the December 18 rainfall was a common storm event for the area.

It is important to consider the runoff conditions during sampling when evaluating stream water quality data. The storm hydrograph was probably near its peak when sampling began at 10:00 am at Station DC-1. Under ideal storm monitoring conditions the rain would have continued for several more hours. However, the stream slowly receded and water clarity improved during the day as the sampling proceeded downstream toward the mouth of Des Moines Creek. Sampling was completed at approximately 4:00 pm. Pollutant concentrations may have been highest before sampling occurred if the intense rainfall washed pollutants from the basin creating a "first flush" affect.

Results Relative To Water Quality Standards

Results from the December 18, 1991 storm event monitoring indicated that Class AA standards for several water quality parameters were not met during the event. Fecal coliform in Des Moines Creek ranged from 170/100 ml to 2,200/100 ml (see Table 1), well above the 50/100 ml standard. Fecal coliform levels met the standard in all tributary samples.

Dissolved oxygen (DO) measurements were below the 9.5 mg/L minimum standard at the outlet from Bow Lake (7.5 mg/L) and the three stations closest to the mouth of Des Moines Creek (3.8 to 7.5 mg/L). Initially we were concerned with the low DO measurements, particularly downstream from the Midway Sewer District treatment plant at SW-7. We notified the treatment plant of our measurements and they collected samples at SW-6 and SW-7 twice per day from December 24 through December 31 and tested them for dissolved oxygen using Standard Method 422B Winkler titrations (APHA et al. 1989). DO at SW-6 ranged from 11.1 to 12.0 mg/L and DO at SW-7 ranged from 11.3 to 12.0 mg/L during the 8-day test period, indicating no oxygen sag occurred in Des Moines Creek in the vicinity of the treatment plant. The DO measurements from December 18 were qualified as unusable

Table 1.

Des Moines Creek Water Quality - December 18, 1991

DC-1	DC-2	DC-3	DC-4	DC-5	DC-6	DC-7	DC-8	DC-12*	TRIB-1	TRIB-2	TRIB-3
5.2	5.8	6.0	6.4	6.2	6.4	6.6	6.5	4.8	4.8	4.8	8.2
6.23	6.53	6.60	7.01	7.30	7.51	7.43	7.44	5.69	7.00	6.94	6.94
95.1	48.8	81.2	95.7	158.7	136.7	142.8	148.2	10.11	186.9	191.2	191.2
7.5R	11.8R	12.5R	11.9R	9.8R	7.5R	3.8R	5.3R	--	5.8R	5.5R	5.5R
1.92	3.88	<1.00	1.72	1.48	1.38	1.14	<1.00	<1.00	1.22	<1.00	<1.00
41.3	28.3	18.8	13.6	14.9	12.3	11.4	9.70	11.0	20.9	11.4	11.4
5.1	34.0	4.4	14.0	7.0	10.0	8.6	9.2	8.2	6.7	4.3	2.6
13	51	2.5	18	8.7	10	9.1	8.1	8.9	6.6	8.0	1.3
48.8	24.6	40.4	48.1	79.7	68.8	71.7	78.7	--	5.08	93.6	98.1
<1.0	2.8	<1.0	1.6	1.8	1.6	1.4	2.0	--	1.3	1.5	1.3
440	2200	est 40	450	400	est 170	230	200	est 170	est 40	est 40	est 40
0.326	0.277	0.085	0.712	0.513	0.500	0.545	1.060	0.522	0.401	0.313	0.313
1.24	1.14	0.743	1.11	0.933	0.77	0.73	0.963	1.05	1.14	0.611	0.611
0.093	0.117	0.032	0.099	0.067	0.062	0.059	0.054	0.064	0.076	0.072	0.072
0.022	0.026	0.008	0.021	0.023	0.022	0.023	0.025	0.024	0.026	0.063	0.063
<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
0.003	0.008	0.018	0.008	0.004	0.006	0.005	0.005	0.006	0.001	0.006	0.006
<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
0.002	0.001	<0.0005	0.003	<0.0005	0.001	<0.0005	<0.0005	<0.0005	<0.0005	0.001	0.001
0.03	0.08	0.03	0.08	0.07	0.05	0.02	0.03	0.04	0.03	0.03	0.04

* DC-12 was a field duplicate sample collected at Station DC-5

-- not tested, field measurements at Station DC-5 were not duplicated

R datum rejected as unusable, faulty dissolved oxygen probe

est reported value was an estimate

(R) for the following reasons: 1) although we calibrated the Checkmate without difficulty on the morning of the sampling, the dissolved oxygen probe had recent trouble with calibration due to a corroded cathode tip, and 2) Midway Sewer District data using the more reliable Winkler titration method showed that the treatment plant had no effect on Des Moines Creek DO levels.

The pH at the outlet from Bow Lake (6.23) was below the 6.5 minimum water quality standard. Low pH was also measured at TRIB-1 (5.69), the outlet from an infiltration ditch that carries parking lot runoff. Low pH readings may be the result of acid precipitation, release of humic acids during the natural decomposition of leaves and other organic matter, or unidentified pollution sources.

The Class AA water quality standard for turbidity states that turbidity shall not exceed 5 NTU over background (upstream) turbidity when the background turbidity is 50 NTU or less. Using the outlet from Bow Lake as background (5.1 NTU turbidity), the standard was exceeded in Des Moines Creek only at DC-2 (34.0 NTU) and DC-4 (14.0 NTU). The stream water appeared an opaque grey at these two stations at the time of sampling. The most likely source of high turbidity between Bow Lake and the golf course is erosion at construction sites and particulates washed from streets and parking lots.

WAC 173-201 adopts EPA's ambient water quality criteria (USEPA 1986) for heavy metals and other toxic substances. Freshwater chronic criteria are four-day average concentrations that should not affect aquatic organisms unacceptably if they are exceeded no more than once every three years. Acute criteria are one-hour concentrations that should not be exceeded more than once every three years. Several of the heavy metals have been found to be more toxic in soft waters than in hard waters, thus the EPA developed hardness-dependent water quality criteria for those metals. For example, the criteria for copper range from 2 $\mu\text{g}/\text{L}$ in water with 10 mg/L hardness to 21 $\mu\text{g}/\text{L}$ for water with 200 mg/L hardness. Specific criteria for copper, lead, and zinc were calculated by sampling station for the levels of hardness measured in Des Moines Creek and tributary water samples (see Table 2). Hardness ranged from 2.7 mg/L at TRIB-1 to 60.4 mg/L at TRIB-3.

Metals concentrations in several samples from the December 18, 1991 storm event monitoring exceeded ambient water quality criteria indicating that toxic conditions may commonly occur in Des Moines Creek (Table 2).

- Freshwater chronic and acute criteria for both copper and zinc were exceeded in upper Des Moines Creek at DC-2 and DC-4, and in parking lot runoff at TRIB-1. Chronic criteria for lead were also exceeded at DC-2 and DC-4.
- Chronic and acute criteria for copper were exceeded in a stormwater discharge originating at SeaTac runways (DC-3).
- The chronic criterion for copper was exceeded in Des Moines Creek upstream from the treatment plant at DC-6.

Table 2. Des Moines Creek Sample Results for Selected Metals Compared to Hardness-Dependant Water Quality Criteria

Sampling Station	Hardness (mg/L)	Copper ($\mu\text{g/L}$)			Copper ($\mu\text{g/L}$)			Copper ($\mu\text{g/L}$)		
		Sample *	Criteria		Sample *	Criteria		Sample *	Criteria	
			Chronic	Acute		Chronic	Acute		Chronic	Acute
DC-1	39.7	<u>2.5</u>	5.4	7.4	<u>1.5</u>	1.0	25.2	28	48.5	53.5
DC-2	16.0	7.6	2.5	3.2	<u>1.4</u>	0.3	7.9	82	22.4	24.8
DC-3	31.5	18.3	4.4	6.0	<0.5	0.7	18.8	25	39.8	44.0
DC-4	31.2	7.5	4.4	5.9	<u>2.5</u>	0.7	18.5	84	39.5	43.6
DC-5	55.2	4.1	7.1	10.1	<0.5	1.5	38.3	<u>65</u>	64.1	70.7
DC-6	45.8	<u>6.2</u>	6.1	8.5	1.1	1.2	30.2	45	54.7	60.4
DC-7	47.4	5.3	6.2	8.8	<0.5	1.2	31.6	24	56.3	62.2
DC-8	49.4	4.6	6.5	9.1	<0.5	1.3	33.3	31	58.3	64.4
DC-12	54.1	5.9	7.0	9.9	<0.5	1.5	37.3	36	63.0	69.5
TRIB-1	2.7	2.9	0.5	0.6	<0.5**	0.03	0.8	33	5.0	5.6
TRIB-2	73.4	2.0	9.1	13.2	<0.5	2.1	55.1	26	81.6	90.0
TRIB-3	60.4	5.9	7.7	11.0	0.5	1.7	43.0	39	69.1	76.3

* Sample results that exceed freshwater chronic criteria are underlined, those that exceed both chronic and freshwater acute criteria are enclosed in a rectangle.

** Detection limit exceeds water quality criterion.

- The chronic criterion for lead was exceeded at the discharge from Bow Lake (DC-1).
- The chronic criterion for zinc was exceeded in Des Moines Creek immediately downstream from South 200th Street at DC-5.

Static acute toxicity bioassays were conducted on two Des Moines Creek samples (DC-5 and DC-8) collected during the December 18 storm event. Out of the 60 rainbow trout used in the 96-hour bioassay, there was only a single mortality. These results were consistent with metals analyses which indicated concentrations were below acute toxicity levels in Des Moines Creek at DC-5 and DC-8. Due to cost considerations, bioassay samples were collected at only these two stations. The lower metals concentrations and absence of toxicity in lower Des Moines Creek compared to the upper creek may have been due to: 1) improving water quality as the stream receded from peak stormflow and/or 2) dilution from inflows. If the first case was true, toxic conditions may also have been present in lower Des Moines Creek earlier in the storm event.

CONCLUSIONS

The water chemistry results from field measurements and laboratory analyses are presented in Table 1. Copies of the chemistry and bioassay laboratory reports are attached to this report.

1. The water quality standard for fecal coliform was exceeded throughout the stream and standards for pH and turbidity were violated at certain points in the upper reaches of Des Moines Creek. However, water quality in Des Moines Creek and its tributaries was generally better than the water quality of urban runoff reported by the National Urban Runoff Program (USEPA 1983b).
2. Metals concentrations in several samples from the December 18, 1991 storm monitoring event exceeded ambient water quality criteria indicating that toxic conditions may commonly occur in Des Moines Creek. Chronic and acute criteria for both copper and zinc were exceeded in upper Des Moines Creek and in tank farm parking lot runoff.
3. Metals concentrations and rainbow trout bioassays generally indicated toxic conditions were not present in lower Des Moines Creek downstream from South 200th Street. However, the lower creek was not sampled until stormflows were receding and water quality was improving. Further sampling and bioassays would be needed to conclusively determine the extent of toxicity.
4. Tributaries entering Des Moines Creek were generally of higher quality than the creek, and thus enhanced its water quality. Samples from the tributaries were generally lower in nutrients, solids, BOD, COD, oil and grease, fecal coliform, and metals than the main stream.
5. Des Moines Creek data exhibited a general trend of increasing water quality downstream from Station DC-2. There are two probable reasons for the trend. First, the upper

watershed is densely developed with large components of commercial and industrial land use. These land uses typically produce higher pollutant levels than the residential and open space land uses that dominate the basin downstream, thus the creek was diluted by inflows of higher water quality. Second, water samples were collected during peak runoff at the headwater stations and the stream was receding and clearing during the day as sampling progressed downstream. The differences in the timing of sample collection relative to the storm hydrograph probably overshadowed any affect of dilution by inflows.

6. Runoff from the airport runway, as monitored at the stormwater outfall in the golf course (DC-3) was generally very clean compared to typical urban runoff. DC-3 had some of the lowest sample concentrations of the study for nutrients, solids, BOD, fecal coliform, turbidity, oil and grease, lead, and zinc. The exception was copper which was somewhat higher at DC-3 than the other stations and exceeded ambient water quality criteria.
7. The increase in nitrate plus nitrite as nitrogen between DC-2 and DC-4/DC-5 may indicate that fertilizer applied to the golf course enters Des Moines Creek.

REFERENCES

- APHA et al. 1989. Standard methods for the examination of water and wastewater. Seventeenth edition. Published by American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Washington, D.C.
- Herrera. 1989. Des Moines Creek restoration project. Prepared for Municipality of Metropolitan Seattle by Herrera Environmental Consultants Inc. and Hall and Associates. December 1989.
- Stevens, Thompson, and Runyan. 1974. Water quality and drainage study. Seattle-Tacoma International Airport and vicinity master planning program. Prepared for the Port of Seattle and King County. Stevens, Thompson, and Runyan, Inc. Seattle, WA.
- USEPA. 1983a. Methods for chemical analysis of water and wastes. EPA-600/4-79-020 Revised March 1983. U.S. Environmental Protection Agency Environmental Monitoring and Support Laboratory. Cincinnati, Ohio.
- USEPA. 1983b. Results of the Nationwide Urban Runoff Program. Volume I. Final report Water Planning Division. U.S. Environmental Protection Agency. Washington, D.C.
- USEPA. 1985. Methods for measuring the acute toxicity of effluents to freshwater and marine organisms. EPA-600/4-85-013. U.S. Environmental Protection Agency. Cincinnati, Ohio.
- USEPA. 1986. Quality criteria for water. EPA-440/5-86-001. U.S. Environmental Protection Agency Office of Water Regulations and Standards. Washington, D.C.

AQUATIC RESEARCH INCORPORATED

3927 AURORA AVE. N. // SEATTLE, WA 98103 // (206)632-2715

CASE FILE NUMBER:	PA016-01	PAGE 1
REPORT DATE:	01/02/92	
DATE SAMPLED:	12/18/91	DATE RECEIVED: 12/18/91
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM PARAMETRIX / SASA		

CASE NARRATIVE

Twelve water sample was received by the laboratory in good condition. The sample was analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	NO3+NO2 (mg/l)	TKN (mg/l)	TOTAL-P (mg/l)	SRP (mg/l)	TSS (mg/l)	BOD (mg/l)	COD (mg/l)	FECALS (#/100ml)
DC-1	0.326	1.24	0.093	0.022	13	1.92	41.3	440
DC-2	0.277	1.14	0.117	0.026	51	3.88	28.3	2200
DC-3	0.085	0.743	0.032	0.008	2.5	<1.00	18.8	est 40
DC-4	0.712	1.11	0.099	0.021	18	1.72	13.6	450
DC-5	0.513	0.933	0.067	0.023	8.7	1.48	14.9	400
DC-6	0.500	0.770	0.062	0.022	10	1.38	12.3	est 170
DC-7	0.545	0.732	0.059	0.023	9.1	1.14	11.4	230
DC-8	1.06	0.693	0.054	0.025	8.1	<1.00	9.70	200
DC-12	0.522	1.05	0.064	0.024	8.9	<1.00	11.0	est 170
TRIB-1	0.110	0.324	0.015	0.008	6.6	<1.00	<5.00	<10
TRIB-2	0.401	1.14	0.076	0.026	8.0	1.22	20.9	est 40
TRIB-3	0.313	0.611	0.072	0.063	1.3	<1.00	11.4	est 40

SAMPLE ID	TURBIDITY (NTU)	FOG (mg/l)	ARSENIC (mg/l)	CADMIUM (mg/l)	COPPER (mg/l)	CHROMIUM (mg/l)	LEAD (mg/l)	ZINC (mg/l)
DC-1	5.1	<1.0	<0.0030	<0.002	0.0025	<0.005	0.0015	0.028
DC-2	34	2.8	<0.0030	<0.002	0.0076	<0.005	0.0014	0.082
DC-3	4.4	<1.0	<0.0030	<0.002	0.0183	<0.005	<0.0005	0.025
DC-4	14	1.6	<0.0030	<0.002	0.0075	<0.005	0.0025	0.084
DC-5	7.0	1.8	<0.0030	<0.002	0.0041	<0.005	<0.0005	0.065
DC-6	10	1.6	<0.0030	<0.002	0.0062	0.005	0.0011	0.045
DC-7	8.6	1.4	<0.0030	<0.002	0.0053	0.009	<0.0005	0.024
DC-8	9.2	2.0	<0.0030	<0.002	0.0046	<0.005	<0.0005	0.031
DC-12	8.2	NO SAMPLE	<0.0030	<0.002	0.0059	<0.005	<0.0005	0.036
TRIB-1	6.7	1.3	<0.0030	<0.002	0.0029	<0.005	<0.0005	0.033
TRIB-2	4.3	1.5	<0.0030	<0.002	0.0020	<0.005	<0.0005	0.026
TRIB-3	2.6	1.3	<0.0030	<0.002	0.0059	<0.005	0.0005	0.039

AQUATIC RESEARCH INCORPORATED

3927 AURORA AVE. N. // SEATTLE, WA 98103 // (206)632-2715

CASE FILE NUMBER:	PA016-01	PAGE 2
REPORT DATE:	01/02/92	
DATE SAMPLED:	12/18/91	DATE RECEIVED: 12/18/91
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM PARAMETRIX / SASA		

QA/QC DATA

QC PARAMETER	NO3+NO2 (mg/l)	TKN (mg/l)	TOTAL-P (mg/l)	SRP (mg/l)	TSS (mg/l)	BOD (mg/l)	COD (mg/l)	FECALS (#/100ml)
METHOD	SM17 4500NO3F	SM174500NORC	SM174500PF	SM174500PF	SM172540D	SM175210B	SM175220D	SM179221B
DATE ANALYZED	12/19/91	12/20/91	12/20/91	12/19/91	12/19/91	12/22/91	12/27/91	12/18/91
DETECTION LIMIT	0.010	0.100	0.002	0.001	0.50	1.00	5.00	10
DUPLICATE								
SAMPLE ID	DC1	DC4	DC1	DC3	TRIB 2	DC 2	DC 1	TRIB 3
ORIGINAL	0.326	1.11	0.093	0.008	8.0	3.88	41.3	est 40
DUPLICATE	0.328	1.07	0.088	0.009	10	3.08	41.3	est 30
RPD	0.61%	3.67%	5.52%	11.76%	22.22%	22.99%	0.00%	NC
SPIKE SAMPLE								
SAMPLE ID	DC1	DC4	DC1	DC3			DC 1	
ORIGINAL	0.326	1.11	0.093	0.008			41.3	
SPIKED SAMPLE	0.507	2.11	0.143	0.040			101	
SPIKE ADDED	0.200	1.00	0.050	0.040			50.0	
% RECOVERY	90.50%	100.00%	100.00%	80.00%	NA	NA	120.00%	NA
QC CHECK								
FOUND	0.858	0.984	0.106	0.016			62.8	
TRUE	0.861	1.00	0.114	0.015			69.0	
% RECOVERY	99.65%	98.40%	92.98%	102.60%	NA	NA	90.94%	NA
BLANK	<0.010	<0.100	<0.002	0.001	<0.50	<1.00	<5.00	NA

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.

AQUATIC RESEARCH INCORPORATED

3927 AURORA AVE. N. // SEATTLE, WA 98103 // (206)632-2715

CASE FILE NUMBER:	PA016-01	PAGE 3
REPORT DATE:	01/02/92	
DATE SAMPLED:	12/18/91	DATE RECEIVED: 12/18/91
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM PARAMETRIX / SASA		

QA/QC DATA

QC PARAMETER	TURBIDITY (NTU)	FOG (mg/l)	ARSENIC (mg/l)	CADMIUM (mg/l)	COPPER (mg/l)	CHROMIUM (mg/l)	LEAD (mg/l)	ZINC (mg/l)
METHOD	SM17 21308	SM174500NORC	EPA 206.2	EPA 200.7	EPA 220.2	EPA 200.7	EPA 239.2	EPA 200.7
DATE ANALYZED	12/19/91	12/20/91	12/23/91	12/20/92	12/20/92	12/20/92	12/20/92	12/20/92
DETECTION LIMIT	0.10	1.0	0.0030	0.002	0.0010	0.005	0.0005	0.003
DUPLICATE								
SAMPLE ID	TRIB 3		TRIB 1	TRIB 1	DC 2	TRIB 1	DC 2	TRIB 1
ORIGINAL	2.6		<0.0030	<0.002	0.0076	<0.005	0.0014	0.033
DUPLICATE	2.6		<0.0030	<0.002	0.0077	<0.005	0.0015	0.042
RPD	0.00%	NA	NC	NC	1.31%	NC	6.90%	24.00%
SPIKE SAMPLE								
SAMPLE ID			TRIB 1	TRIB 1	DC 2	TRIB 1	DC 2	TRIB 1
ORIGINAL			<0.0030	<0.002	0.0076	<0.005	0.0014	0.033
SPIKED SAMPLE			0.0269	0.051	0.0206	1.04	0.0148	0.561
SPIKE ADDED			0.0250	0.050	0.0125	1.00	0.0125	0.500
% RECOVERY	NA	NA	107.60%	102.00%	104.00%	104.00%	107.20%	105.60%
QC CHECK								
FOUND			0.0216	0.205	0.0207	0.069	0.0205	0.117
TRUE			0.0200	0.190	0.0200	0.075	0.0200	0.110
% RECOVERY	NA	NA	108.00%	107.89%	103.50%	92.00%	102.50%	106.36%
BLANK								
	NA	NA	<0.0030	<0.002	<0.0010	<0.005	<0.0005	<0.003

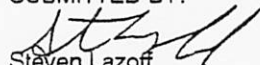
RPD = RELATIVE PERCENT DIFFERENCE.

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 TO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:


Steven Lazoff
Laboratory Director

COPY

EXECUTIVE SUMMARY OF TEST CONDITIONS AND RESULTS

Static Acute Screening Toxicity Tests For Rainbow Trout

Test Title: Port of Seattle SASA Des Moines Creek
Testing Dates: December 19 to 23, 1991
Test Facility: Parametrix, Inc.; 13020 Northup Way; Bellevue, WA 98005
Test Sponsor: Port of Seattle
Test Material: Stream water (grab sampled)
Test Species: Rainbow trout, *Onchorynchus mykiss*
Source: Cranmar Trout Farm; Kent, WA
Test Type: Static Acute Screening Toxicity Biomonitoring
Duration: 96 hours
Test Concentrations: 100% stream water and spring water control

Summary Table:

Test Organism	Mortality
Control	0%
DC 5	3.3%
DC 8	0%

INTRODUCTION

This test was conducted to determine the acute toxicity of Des Moines Creek water using Rainbow trout, *Onchorynchus mykiss*, beginning December 19, 1991.

METHODS

The test was conducted in accordance with the EPA's Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, March 1985 (600/4-85/013). A summary of test conditions may be found in Table 1.

SOURCE OF ORGANISMS

Rainbow trout were obtained from Cranmar Trout Farm in Kent, WA and were approximately 21 days old when testing began.

RESULTS

Test data is presented in Table 2. The results are summarized in the Executive Summary section of this report.

REFERENCES

U.S. EPA, 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, 600 4-85 013.

Table 1. Static acute Rainbow trout toxicity test.

Job Name: Port of Seattle SASA, Des Moines Creek

Job Number: 55-1723-04 (42)

Date: December 19, 1991

Test Protocol:	U.S. EPA, 1985. <u>Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms</u> (Third Edition), 600/4-85/013
Test Material:	Stream water grab samples
Test Organisms:	<i>Onchorynchus mykiss</i> (Rainbow Trout)
Number/Container:	Ten
Volume/Container:	3 liters
Test Concentrations:	100% stream water and control
Replicates:	Three
Test Duration:	96 hours
Control:	Spring water
Test Chambers:	1 gallon glass jars
Lighting:	Fluorescent bulbs (50-100 foot candles)
Aeration:	None
pH Range:	7.3 to 7.6 for control media 7.5 to 7.6 for DC 5 7.5 to 7.7 for DC 8
Temperature:	9.0 to 13.0°C
Chemical Data:	Dissolved oxygen, and temperature at initiation and every 24 hours; pH, specific conductivity, hardness, alkalinity, and chlorine at test initiation and termination
Effect Measured:	Mortality
Test Acceptability:	Control mortality less than 10%

Table 2. Static acute trout toxicity test.

Sample Source	Stream water	Test Dates	12/19 - 12/23/91	Time	15:00
Date Collected	Des Moines Creek	Test Organism	Rainbow trout	Staff	
Date Delivered	12/18/91	Dilution Media	Springwater		
		Required Temperature Range	12.0 ± 0.5°C		CFH

Conc.	Rep.	Num. Org. Cont	Immobile/Mortality				Total Mortality	pH				Dissolved Oxygen (mg/L)				Temp (°C)				Specific Conductivity		Hardness mg/L as CaCO3		Alkalinity mg/L as CaCO3		Chlorine (mg/L of Cl2)			
			0	24	48	72		96	0	96	0	24	48	72	96	0	96	0	24	48	72	96	0	96	0	96	0	96	0
Control	A	10	0	0	0	0	0	7.6	7.3	8.0	8.2	8.5	9.4	8.6	12.0	13.0	10.0	9.0	12.0	110	110	53.6	56.4	50.0	53.2	0	0	0	0
	B	10	0	0	0	0	0	7.5	7.4	7.8	8.0	8.1	8.9	8.4	12.0	13.0	10.0	9.0	12.0	120	110								
	C	10	0	0	0	0	0	7.5	7.4	8.0	8.0	8.4	9.1	8.5	12.0	13.0	10.0	9.0	12.0	120	120								
DC-5	A	10	0	0	1	0	0	7.6	7.5	10.2	8.6	8.3	8.8	8.3	12.0	13.0	10.0	9.0	12.0	110	110	61.6	59.2	49.2	49.6	0	0	0.05	0.03
	B	10	0	0	0	0	0	7.5	7.5	10.3	8.4	7.5	8.6	8.1	12.0	13.0	10.0	9.0	12.0	110	110								
	C	10	0	0	0	0	0	7.5	7.5	10.4	8.5	7.1	8.8	8.4	12.0	13.0	10.0	9.0	12.0	110	110								
DC-8	A	10	0	0	0	0	0	7.7	7.5	11.0	8.8	8.0	8.7	8.4	12.0	13.0	10.0	9.0	12.0	100	100	49.6	53.6	43.2	44.8	0	0	0.02	0.01
	B	10	0	0	0	0	0	7.7	7.5	11.1	8.9	8.2	9.0	8.3	12.0	13.0	10.0	9.0	12.0	100	100								
	C	10	0	0	0	0	0	7.7	7.5	11.1	9.1	8.2	8.5	8.2	12.0	13.0	10.0	9.0	12.0	100	100								

Initials: CFH JLS RF CFH
 Date: 12/19/12/20/12/21/12/22/12/23
 Average Fish Weight: 0.1823 g Ratio of flesh to water: 0.0608 g/L
 Mean Length: 26.7 mm Longest: 28 mm Shortest: 24 mm Ratio (long/short): 7: