92-e05

WA-23-1020GW

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

7171 Cleanwater Lane, Building 8, P.O. Box 47710 • Olympia, Washington 98504-7710

June 22, 1992

TO: Tapas Das

FROM: Barbara Carey Dick Yake for Barbara Carey

SUBJECT: Memorandum on Ground Water Sampling at National Frozen Foods/Midway Meats Land Application Site in Centralia

The attached report summarizes the findings from our sampling at National Frozen Foods/Midway Meats Field No. 3 land application site on October 22 and 30, 1991.

Results for four constituents were outside the limits of the ground water standards: pH, iron, total dissolved solids, and fecal coliform bacteria. In addition, several constituents were higher in the two wells assumed to be downgradient than in the presumed upgradient well. These constituents include BOD_5, ammonia, chloride, specific conductance, iron, total dissolved solids, total suspended solids, and in one well each, total phosphate and sodium.

Reduced oxygen conditions in the "downgradient" wells are indicated by the presence of ammonia and organic nitrogen in relatively high concentrations as well as high iron concentrations. Reduced oxygen conditions in ground water entering the Chehalis River downgradient of the site, coupled with BOD_5 loading, indicate a potential for increased oxygen demand in the river.

Ammonia levels in one of the downgradient wells is in the range considered chronically toxic to salmonids depending on pH.

Based on the above conclusions, we recommend the following actions to improve an assessment of the effects of the site on the Chehalis River:

1. Survey elevations of the monitoring wells to verify the ground water flow direction;

2. install an upgradient well east of the sprayfield and outside the influence of the sprayfield;

3. conduct *in situ* hydraulic conductivity tests at each well in order to estimate loading to the Chehalis River; and

4. evaluate ground water influence on dissolved oxygen and ammonia in the river during late summer or fall.

BC:kd
Attachment

cc: Cyronose Spicer, SWRO

RESULTS OF GROUND WATER SAMPLING AT NATIONAL FROZEN FOODS/ MIDWAY MEATS, CENTRALIA-- OCTOBER 1991

by Barbara Carey
June 22, 1992

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Toxics, Compliance, and Ground Water Investigations Section
Olympia, Washington 98504-7710

Water Body No. WA-23-1020-GW
(Segment No. 10-23-13-GW)

ABSTRACT

Three monitoring wells were sampled at the Field No. 3 land application site for National Frozen Foods and Midway Meats in Centralia, Washington. Four constituents were outside acceptable limits specified in Washington State Ground Water Standards: pH, total dissolved solids, iron, and fecal coliform bacteria. In addition, several parameters were found at higher concentrations in wells assumed to be downgradient of the land application site than those in the presumed upgradient well. These parameters included biological oxygen demand, ammonia, chloride, specific conductance, iron, total dissolved solids, total suspended solids, total phosphorus, and sodium. Anaerobic conditions were indicated in downgradient wells by predominantly unoxidized forms of nitrogen and high iron concentrations. Recommendations are included for further investigation of increased ammonia and oxygen demand effects on the nearby Chehalis River during the summer due to land application practices.

INTRODUCTION

The Toxics, Compliance, and Ground Water Investigations Section (TCGWIS) assisted the Watershed Assessments Section (WAS) with a Class II Inspection of National Frozen Foods (NFF) and Midway Meats (MM) in Chehalis, Washington, on October 22 and 30, 1991. The TCGWIS portion of the inspection included sampling of three wells in Field No. 3 for conventional water quality parameters. (See Figure 1 for site and well locations.) Wastewater

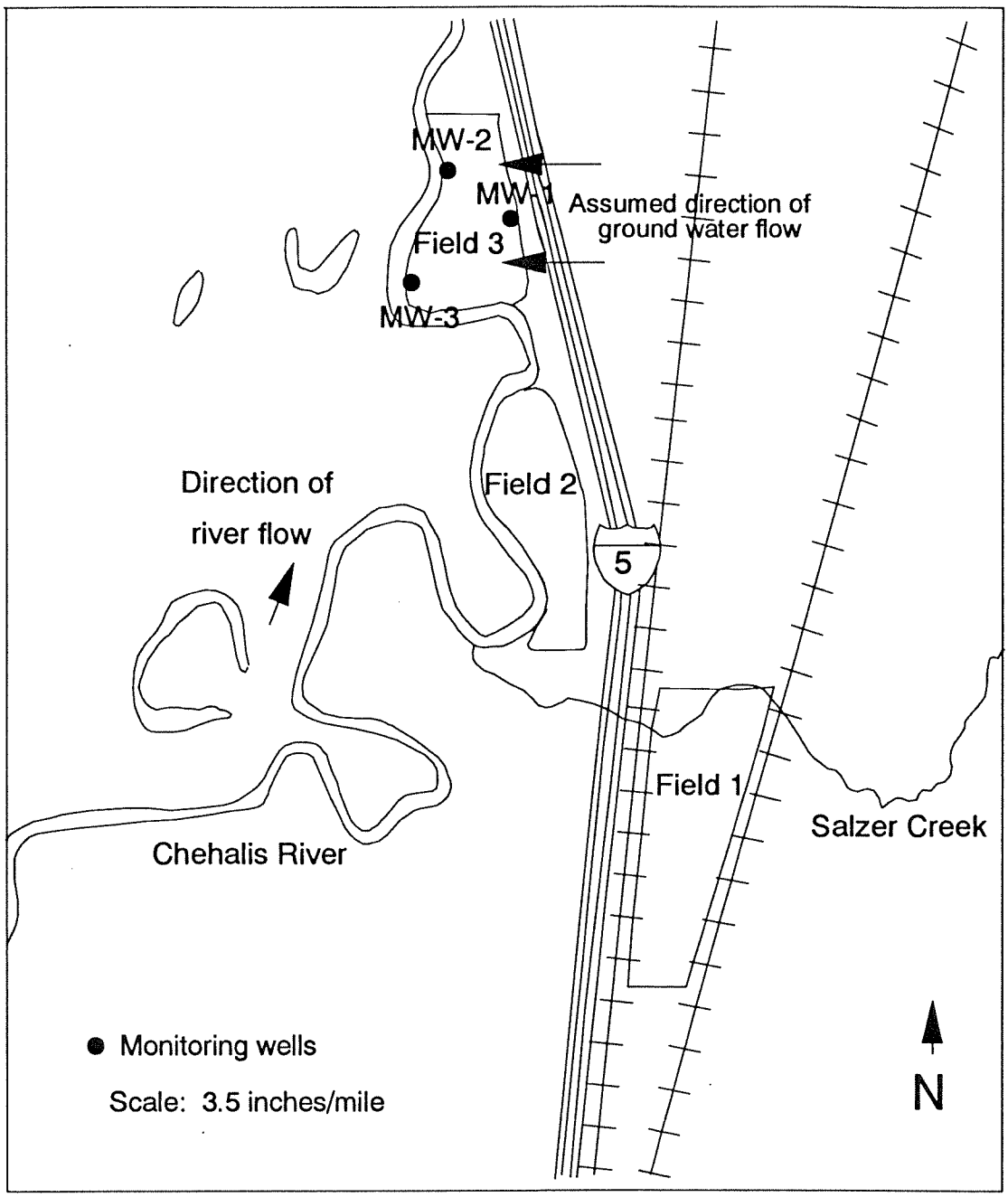

Figure 1. Sampling locations for National Frozen Foods/Midway Meats ground water monitoring.

from NFF is applied using line sprinkler irrigation from June through November. Wastewater from MM is also spread on Field No. 3. In addition, cattle are grazed on Field No. 3. Tapas Das of WAS and Cyronose Spicer of the Southwest Regional Office took part in field sampling.

Objectives of the report are shown below followed by a description of the sampling methods. Results and conclusions follow sampling methods. Finally, recommendations are presented based on the conclusions.

OBJECTIVES

The objectives for ground water sampling were to:

1. Provide ground water quality data from three monitoring wells at Field No. 3 when Class II effluent monitoring was conducted at National Frozen Foods and Midway Meats.

2. Evaluate data collected in the study to determine if land application at Field No. 3 is affecting ground water quality.

SAMPLING METHODS

Monitoring wells used for sampling are shown in Figure 1. Each well is two inches in diameter and made of Schedule 40 PVC with a five foot long slotted screen and 0.01-inch slots. A hollow stem auger was used to drill the wells. Well logs are shown in Appendix A. Depths of the wells and their locations are shown below:

	Depth (feet)	Latitude	Longitude
MW-1:	12.5	46° 42' 17.57"	122° 58' 22.12"
MW-2:	17.5	46° 42' 20.10"	122° 58' 32.77"
MW-3:	17.5	46° 42' 8.02"	122° 58' 37.77"

Samples were collected from each well and analyzed for specific conductance, turbidity, total suspended solids, total dissolved solids, total organic carbon, BOD_5, ammonia-nitrogen, nitrate-nitrogen, total persulfate nitrogen, total phosphorus, chloride, bromide, dissolved iron, sodium, and fecal coliform bacteria. Samples were obtained from all three wells on two separate days (October 22 and 30) to help define short-term variability of water quality results. The following subsection describes procedures for sample collection. Analytical methods and detection limits are listed in Table 1. The subsection following "Sampling Procedures" describes quality assurance techniques.

Table 1. Analytical parameters, methods and method detection limits.

Parameter	Method of Analysis*+	Method Detection Limit
Temperature	Beckman temperature probe	0.1 C
Water Level	Electric Well Probe	0.01 foot
pH	Beckman pH Meter	0.1 Std Unit
Specific Conductance (field)	Beckman Conductivity Bridge	10 umhos/cm
Specific Conductance (lab)	Std Method #2510	10 umhos/cm
Total Suspended Solids	EPA #160.2	
BOD	Std Method #5210B	1 mg/L
Ammonia-N	EPA #350.1	0.01 mg/L
Nitrate+ Nitrite-N	EPA # 353.2	0.01 mg/L
Total Persulfate-N	EPA # 353.2	
Total Phosphate-P	EPA # 365.1	0.01 mg/L
Chloride	Std Methods #4110B	0.1 mg/L
Sodium	Std Methods #3120B	0.03 mg/L
Total Dissolved Iron	Std Methods #3120B	0.007 mg/L
Fecal Coliform Bacteria	Std Methods #922D	1/100ml

* EPA, 1983. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.
+ American Public Health Association, 1989. Methods for the Examination of Water and Wastewater, 17th Edition.

Sampling Procedures

The following procedures were used to sample the three monitoring wells shown in Figure 1.

1. Beginning with the well that we assumed was least contaminated, MW-1, the static water level was measured to the nearest 0.01 foot using a clean electronic measuring tape.

2. At least three well volumes were purged from each well until temperature, pH, and conductivity stabilized (less than 10 percent change between successive purges). A peristaltic pump with silastic tubing was used for purging wells in all cases except MW-2 and MW-3 on October 22, 1991. A decontaminated teflon bailer was used in these two cases.

   Bailers were decontaminated with a Liquinox®/tap water wash, followed by sequential rinses of hot tap water, 10 percent nitric acid/distilled-deionized water, and pesticide-grade acetone. Bailers were then air-dried and wrapped in aluminum foil until used.

3. Dissolved iron samples were field-filtered using a 0.45-micron polycarbonate membrane filter and preserved with 1 mL nitric acid to pH less than 2. An in-line filter was used at MW-1. However, due to excessive filter clogging, a stainless steel and teflon filter bed equipped with a larger diameter filter was used for MW-2 and MW-3.

4. Samples were immediately placed in coolers and kept at 4°C until transported to the Ecology/EPA Region 10 Laboratory in Manchester, Washington. Analyses were performed by the Ecology/EPA Manchester Laboratory and contract laboratories. Chain-of-custody procedures were followed according to Ecology protocols (Huntamer and Hyre, 1991).

Quality Assurance

In addition to laboratory calibration standards and method blanks, field quality assurance samples were collected. These samples included duplicate samples, filter blanks for iron, and transport blanks for TOC. Deionized-distilled water used for field blanks was supplied by the Manchester Laboratory. Blank samples were analyzed only for the October 30 sampling event.

Duplicate samples collected at MW-2 provide an estimate of precision of combined field and laboratory procedures. Table 2 shows the mean and relative percent difference for duplicates. Relative percent differences are the ratio of the difference and the mean of the duplicate results expressed as a percentage. They are used to estimate analytical precision. Relative percent differences were generally within $\pm 25\%$. Relative percent differences between most duplicate analyses were lower on October 30, when the peristaltic pump was used, than on October 22 when bailers were used (Table 2). Despite lower variation between duplicates on the second date, relative percent differences remained high for total phosphorus (53%), BOD_5 (29%), and total dissolved solids (23%).

Table 2. Mean values and relative percent differences for duplicate samples at MW-2 on October 22 and 30, 1991.

Parameter	MW-2 Mean 10/22/91	MW-2 RPD* 10/22/91	MW-2 Mean 10/30/91	MW-2 RPD* 10/30/91	Blank 10/30/91
Specific Conductance-lab (umhos/cm)	527	1.3 %	517	0.8 %	
Turbidity (NTU)	58	38 %	85.5	0 %	
Total Suspended Solids (mg/L)	89	3.4 %	34	9.0 %	
Total Dissolved Solids (mg/L)	337	14 %	358	23 %	
Total Organic Carbon (mg/L)	4.4	2.3 %	4.5	1.3 %	2.59
BOD (mg/L)	6	0 %	3.5	29 %	
Ammonia-Nitrogen (mg/L)	0.092 B	4.3 %	0.078 B	1.3 %	0.026
Nitrate+Nitrite-N (mg/L)	0.01 U	0 %	0.01 U	0 %	0.01 U
Total Persulfate Nitrogen	0.308 B	25 %	0.220 B	0.5 %	0.054
Total Phosphorus (mg/L)	0.031	102 %	0.030	53 %	
Dissolved Iron (mg/L)	19.4	1.6 %	25.4	2.0 %	
Sodium (mg/L)	9.2	0.5 %	9.3	0.4 %	
Chloride (mg/L)	57.8	3.1 %	52.0	0.6 %	

* Relative Percent Difference = The ratio of the difference and mean of duplicate results expressed as a percentage.

RESULTS

Three aspects of ground water sampling results are discussed below. First, results are compared to ground water standards; second, results from upgradient and downgradient wells are compared, and finally, results for the two sampling dates are compared.

Ground Water Standards

Results for four parameters were outside the acceptable range specified in the ground water standards as well as secondary drinking water standards: dissolved iron, total dissolved solids, pH, and fecal coliform bacteria (Chapter 173-200 WAC; Chapter 248-54 WAC). Table 3 shows analytical results. The pH was below the allowable range in all three wells on both dates. The iron standard was exceeded at MW-2 and MW-3 on both days, while the total dissolved solids standard was exceeded only at MW-3. Iron exceeded the standard at MW-1 on October 30 but not on the previous date. Table 4 compares results for constituents that have ground water standards with their allowable limits.

Comparison of "Upgradient" and "Downgradient" Water Quality

The ground water flow direction is assumed to be westward toward the Chehalis River (Figure 1). Relative elevations of the well measuring points have not been surveyed. Therefore, it is not possible to verify the ground water flow direction with water level elevations in the wells. Measurements of depth to water are shown in Table 5 for use in determining ground water flow direction when well elevations are established.

If the assumed westward ground water flow direction is correct, then MW-1 is generally upgradient and MW-2 and MW-3 are downgradient of the sprayfield. Unfortunately, MW-1 is located within the sprayfield. Therefore, ground water quality samples from MW-1 are likely affected by land application.

Several constituents were found at higher concentrations in MW-2 and MW-3 than in MW-1, including BOD_5, ammonia-N, chloride, specific conductance, dissolved iron, and total suspended solids (see Table 3). Mean chloride values for October 22 and 30, 1991, were 57 times higher at MW-3 than at MW-1 and 16 times higher at MW-2 than at MW-1. Sodium and total phosphorus were also substantially higher at MW-3 than at MW-1.

Table 3. Sampling results for National Frozen Foods/ Midway Meats Field No. 3 and effluents on October 22 and 30, 1991.

Parameter	MW-1 10/22/91	MW-2 mean 10/22/91	MW-3 10/22/91	MW-1 10/30/91	MW-2 mean 10/30/91	MW-3 10/30/91	Effluent NFF-mean	Effluent MM-mean 10/22-23/91
Temperature (C)	12.5	10.6	11.3	12.5	10.8	11.9		
pH-field	5.97	6.04	6.09	5.83	6.10	6.00	4.76	
Specific Conductance-field (umhos/cm)	155	500	1,000 P	120	560	950		
Specific Conductance-lab (umhos/cm)	162	527	998	163	517	943	1,225	1,111
Turbidity (NTU)	2.0	58	110	9.0	86	187	388	1 U
Total Dissolved Solids (mg/L)	134	337	605	145	358	670	2,545	5,190
Total Suspended Solids (mg/L)	2	89	129	4	34	93		379
Total Organic Carbon (mg/L)	1 U	4.4 B	3.9 B	1 U	4.5 B	3.8	2,045	2,595
BOD (mg/L)	2	6	15	2 U	4	14	3,000	7,300
Ammonia-Nitrogen (mg/L)	0.015 B	0.092	1.14	0.036 B	0.078 B	1.19	18.8	19.9
Nitrate+Nitrite-N (mg/L)	1.07	0.010 U	0.010 U	0.767	0.010 U	0.010	1.300	0.758
Calculated Inorganic Nitrogen	1.08	0.102	1.15	0.803	0.088	1.2	20.1	20.6
Total Persulfate-N (mg/L)	1.08	0.308 B	1.32	0.787	0.220 B	1.28	111	631
Total Phosphorus (mg/L)	0.013	0.031	0.043	0.017	0.030	0.051	20.2	19.4
Dissolved Iron (mg/L)	0.085 B	19.4	114	0.418	25.4	116	15.1	10.8
Dissolved sodium (mg/L)	8.11	9.22	29.4	8.53	9.26	29.7	48	162
Chloride (mg/L)	3.5	58	200	3.4	52	187	66.8	130
Bromide (mg/L)	0.11 E	0.05 U	0.33 E	0.11 E	0.05 UE	0.39		
Fecal Coliform Bacteria (#/100ml)	1	7/3 U	7	1 U	1 U	1	14,850	345,000

B: Analyte was found in either the method or field blank, indicating sample may have been contaminated.
U: Analyte was not detected at or above the reported result.
E: Reported result is an estimate because of the presence of interferences.
P: Greater than the specified upper limit of the instrument.
Shading indicates exceedence of ground water standards (Chapter 173-200 WAC).

Table 4. Comparison of ground water standards for iron and total dissolved solids with mean concentrations for samples collected on October 22 and 30, 1991 (Chapter 173-200 WAC).

Parameter (mg/L)	Standard (mg/L)	MW-1+	MW-2++	MW-3+
pH, S.U.	6.5-8.5	5.9	6.1	6.0
Iron, Total+++	0.3	0.25	25	115
Total dissolved solids	500	140	348	638
Nitrate	10	0.92	0.01 U	0.01 U
Chloride	250	3.5	55	194
Total coliform, (#/100 mL)++++	1	1/1U	7/3U/1	7/1

+ Mean of two samples.
++ Mean of four samples.
+++ Standard is for total iron, but data are for dissolved iron, a subset of total iron.
++++ Standard is for total coliform bacteria, but data is for fecal coliform, a subset of total coliforms. Also, individual results are shown rather than mean values.
U Less than.

Table 5. Depth to water in wells at Field No. 3 in feet below top of casing (as marked).

Well	10/22/91	10/31/91
MW-1	7.46	7.55
MW-2	16.47	16.29
MW-3	14.00	13.87

Comparison of Results for Two Dates (October 22 and 30, 1991)

The relative variation between results for most constituents sampled on October 22, 1991, and those collected on October 30, were low. Exceedences of ground water standards occurred on both days, with two exceptions: at MW-1 where iron only exceeded the standard on October 30, and at MW-3 where fecal coliform bacteria only exceeded the standard on October 22.

CONCLUSIONS

Conclusions are presented below in the same order as in the "Results" section. Conclusions related to ground water standards are followed by comparisons of spatial differences and differences over a 10-day period.

Ground Water Standards

Four constituents were outside the limits of the ground water standards: pH, iron, total dissolved solids, and fecal coliform bacteria. The pH values below the allowable range in all three wells (6.5-8.5) do not appear to be due to natural background conditions, since the mean pH of six domestic wells in the area had a mean value of 6.8 (Ebbert and Payne, 1985).

Spatial Variation

Both "downgradient" wells (MW-2 and MW-3) exceeded the iron standard, while only MW-3 exceeded the total dissolved solids standard. The "upgradient" well (MW-1) exceeded the iron standard in one out of two samples. It should be noted that except for fecal coliform bacteria, the constituents outside the ground water standard limits are not based on human health. Rather they are based on aesthetic criteria such as taste, odor, or color. Elevated fecal coliform bacteria levels are probably related to a combination of cattle grazing and wastewater application. In addition to exceedences of ground water standards, several constituents were higher in wells assumed to be downgradient. These constituents included BOD_5, ammonia, chloride, specific conductance, iron, total dissolved solids, total suspended solids, total phosphate (MW-3), and sodium (MW-3).

The presence of ammonia in relatively high concentrations, coupled with the absence of nitrate and nitrite, indicate reducing conditions in samples from MW-2 and MW-3. High concentrations of iron at both sites is consistent with a lack of oxygen. Such low oxygen conditions increase iron solubility in water (Hem, 1967).

Elevated BOD_5, the presence of reduced nitrogen compounds and presumably low oxygen content in ground water near the Chehalis River at the site indicate a potential for increased oxygen demand in the river. The significance of the added oxygen demand depends on the loading of oxygen-demanding substances in ground water entering the river, mixing in the channel, as well as oxygen demand from other sources. The potential for effects on the river are likely to be highest during the summer, because streamflow is low, oxygen is less soluble at higher temperatures, and wastewater application rates are relatively high.

The concentration of ammonia found in MW-3 is in the range considered chronically toxic to salmonids, depending on pH (EPA, 1986). Like the potential for oxygen demand effects on the river, the potential for chronic toxicity violations in the river depends on ammonia loading to

the river from ground water leaving the site and mixing characteristics as well as pH. The four day average chronic toxicity levels are not to be exceeded more than once every three years (EPA, 1986).

Comparison of Data Collected on Two Dates

The only notable difference in results obtained from sampling 10 days apart is that exceedence of ground water standards for iron at MW-1 and fecal coliform bacteria at MW-3 occurred on only one of the two days.

RECOMMENDATIONS

The following recommendations would improve the ground water evaluation at the National Frozen Foods/Midway Meats site:

1. Elevations for monitoring well measuring points should be surveyed to the nearest 0.01 foot and tied to a common datum, preferably mean sea level. Water level elevations can be used to verify the general ground water flow direction. Depth to water should be measured in all wells each time samples are collected.

2. An upgradient well, unaffected by the sprayfield, should be installed east of the sprayfield.

3. *In situ* hydraulic conductivity tests should be conducted at each of the wells to estimate the hydraulic conductivity of the monitored aquifer. Hydraulic conductivity estimates are needed to estimate ground water flow, and thus pollutant loading to the Chehalis River.

4. Ground water influence on dissolved oxygen and ammonia in the river should be evaluated during late summer or fall.

REFERENCES

Ebbert, J.C. and K. L. Payne. 1985. Quality of Water in the Principal Aquifers of Southwestern Washington. USGS Water Resources Investigation Report 84-4093.

EPA. 1986. Quality Criteria for Water. EPA 440/5-86-001.

Hem, J.D. 1967. "Equilibrium Chemistry of Iron in Ground Water." In: Principles and Applications of Water Chemistry, S.D. Faust and J.V. Hunter, Eds., John Wiley & Sons, New York, pp. 625-637, 642-643.

Huntamer, D. and Hyre, J. Edited. 1991. Manchester Environmental Laboratory--Laboratory Users Manual. Washington State Department of Ecology.

Appendix A. National Frozen Foods, Chehalis, Monitoring Well Logs

LOG OF BORING No. MW-1

CASCADE EARTH SCIENCES, Ltd.

SE, NW, SEC 18, T14N, R2W

DRILLING CONTRACTOR Kring Drilling
DRILLER Charlie Whisnant

BY Doug Dillenberger
DATE 9-28-89 CHK'D BY

SAMPLE NO / SAMPLE TYPE	BLOWS PER 6 INCHES	SPT N	INCHES DRIVEN / INCHES RECOVERED	NUMBER OF RINGS	DEPTH IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	DATE DRILLED: / EQUIPMENT:	ELEVATION: / DESCRIPTION:	TESTS
					0		grout	0-6'	Soil, Lt brown color, silty and sandy, mostly fine grained	
					5		Seal	5'	Soil more moist then before	
								6-11'	Silty clay, Greenish-black contains 10% fine sand	
							Sand Pack			
								12.5'	T.D. of monitoring well	
					15				Intercasing is 2-inch diameter, Sch 40, PVC, with 5 feet long factory slotted 0.01 inch sized slots	
					20					
					25					
					30					

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

LOG OF BORING No. MW-2

CASCADE EARTH SCIENCES, Ltd.

NW, SE SEC18, T14N, R2W

DRILLING CONTRACTOR Kring Drilling
DRILLER Charlie Whisnant

BY Doug Dullenberger
DATE 10-16-89 CHK'D BY

SAMPLE NO / SAMPLE TYPE	BLOWS PER 6 INCHES	SPT-N	INCHES DRIVEN / INCHES RECOVERED	NUMBER OF RINGS	DEPTH IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	DATE DRILLED: / EQUIPMENT:	ELEVATION: / DESCRIPTION:
					0			0-5	Soil, Brown to Lt Brown Color, composed of Silty, Fine grain Sand
					5			5'-6'	Sand, Brown with 20% Silty clay
								6'-10'	Sand, Brown, with more Silt Then above
					10			10-19.5'	Sand, Greenish black color, with mixture of Fine grain Sand & Silt
									- TD 17.5 FT
					20				
					25				Intercasing consists of 2-inch diameter, Sch 40 PVC pipe, with Factory slotted 0.01 inch slots

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

LOG OF BORING No. MW-3

CASCADE EARTH SCIENCES, Ltd.

SW NE SEC 18, T1N N, R2W

DRILLING CONTRACTOR Kring Drilling
DRILLER Charlie Whisnant

BY Doug Dillenberger
DATE 6-6-89 CHK'D BY

SAMPLE NO / SAMPLE TYPE	BLOWS PER 6 INCHES	SPT-N	INCHES DRIVEN / INCHES RECOVERED	NUMBER OF RINGS	DEPTH IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	DATE DRILLED: / EQUIPMENT:	ELEVATION: / DESCRIPTION:	TESTS
					0			0-6	Top Soil, Brn, Sandy Silt	
					5			6-10	Soil, dark brown, moist Sandy Silt	
					10			10-17.5	Fine sand 80% with Silt and a Few pebbles Color is greenish black	
					15					
									TD is 17.5 Feet	
					20					

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

Appendix B. Water Quality Laboratory Results

12:25:43

Sample/Project Analysis Results

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

NFF / MM

Officer: TKD Account: D4200

(watch for duplicate results)

Laboratory: Ecology, Manchester

Source: Well (Test/Observation)

Sample No: 91 438230 Description: [redacted]

Begin Date: 91/10/22 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	162 *	umho/cm
Turbidty	Meter	2.0 *	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	2 *	mg/l
Solids	T-Dissol	134 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	1U	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	0.015 *	mg/l
Kjel-N	Total	1.08 *	mg/l
NO2NO3-N	Total	1.07 *	mg/l
Phos	Total	0.013 *	mg/l
O-PO4-P	Total	0.014 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	**Fe-Diss**	85.4B*	ug/l
Sodium	**Na-Diss**	8.11 *	~~ug/l~~ mg/l

PM

Ion Chromatography		Water-Total Result	Units
Chloride		**3.5 ***	**mg/l**

Ion Chromatography	Water-Filtere Result	Units
[redacted]	[redacted]	

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

Microbiological		Water-Total Result	Units
Coliform	Fecal	1 *	#/100mL

(Sample Complete)

12:25:43

Sample/Project Analysis Results

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 **438231** Description: [redacted] NFF/MM

Source: Well (Test/Observation)

Begin Date: 91/10/22 :

Gen Inorg/Phys-Speci		Water-Total Result		Units
Cond@25C	Meter	530	*	umho/cm
Turbidty	Meter	47.0	*	NTU

Solids - Specified		Water-Total Result		Units
Solids	T-Suspen	90	*	mg/l
Solids	T-Dissol	360	*	mg/l

Demand - Specified		Water-Total Result		Units
T-Org-C	Total	4.48	*	mg/l

Nutrients - Specifie		Water-Total Result		Units
NH3-N	Total	0.094	*	mg/l
Kjel-N	Total	0.346	*	mg/l
NO2NO3-N	Total	0.01U		mg/l
Phos	Total	0.046	*	mg/l
O-PO4-P	Total	0.054	*	mg/l

Metals - ICP Scan		Water-Filtere Result		Units
Iron	Fe-Diss	19200	*	ug/l
Sodium	Na-Diss	9.24	*	~~ug/l~~ mg/l

Ion Chromatography	Water-Total Result		Units
Chloride	**56.9**	*	**mg/l**

Ion Chromatography	Water-Filtere Result	Units
[redacted]	[redacted]	

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

Microbiological	Water-Total Result	Units
Coliform Fecal	7U	#/100mL

(Sample Complete)

12:25:43

Sample/Project Analysis Results

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD

Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 **438232**

Description: [redacted] NFF/MM

Source: Well (Test/Observation)

Begin Date: 91/10/22 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	998 *	umho/cm
Turbidty	Meter	110 *	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	129 *	mg/l
Solids	T-Dissol	605 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	3.87 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	1.14 *	mg/l
Kjel-N	Total	1.32 *	mg/l
NO2NO3-N	Total	0.01U	mg/l
Phos	Total	0.043 *	mg/l
O-PO4-P	Total	0.229 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	114000 *	ug/l
Sodium	Na-Diss	29.4 *	~~ug/l~~ mg/l Pm

Metals - ICP Scan Matrix Spike #1		Water-Filtere Result	Units
Iron	Fe-Diss	100	% Recov
Sodium	Na-Diss	94	% Recov

Metals - ICP Scan Matrix Spike #2		Water-Filtere Result	Units
Iron	Fe-Diss	100	% Recov
Sodium	Na-Diss	98	% Recov

Ion Chromatography		Water-Total Result	Units
Chloride		**200 ***	**mg/l**

Ion Chromatography		Water-Filtere Result	Units
BROMIDE	DISS.BR	**[redacted]**	**MG/L**

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

Microbiological		Water-Total Result	Units
Coliform	Fecal	7 *	#/100mL

(Sample Complete)

13-DEC-91
12:25:43

Washington State Department of Ecology
Sample/Project Analysis Results

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD Account: D4200

Laboratory: Ecology, Manchester

NFF/MM

Sample No: 91 **438233** Description: MW-4A (Replicate of MW 2)

Source: Well (Test/Observation)

Begin Date: 91/10/22 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	523 *	umho/cm
Turbidty	Meter	69.0 *	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	87 *	mg/l
Solids	T-Dissol	313 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	4.38 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	0.090 *	mg/l
Kjel-N	Total	0.269 *	mg/l
NO2NO3-N	Total	0.01U	mg/l
Phos	Total	0.015 *	mg/l
O-PO4-P	Total	0.074 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	19500 *	ug/l
Sodium	Na-Diss	9.19 *	~~ug/l~~ mg/l PM

Ion Chromatography		Water-Total Result	Units
Chloride		**58.7 ***	**mg/l**

Ion Chromatography		Water-Filtere Result	Units
BROMIDE	**DISS. BR**	**0.05US**	**MG/L**

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

Microbiological		Water-Total Result	Units
Coliform	Fecal	3U	#/100mL

(Sample Complete)

12:25:43 Sample/Project Analysis Results

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 **438234** Description: [redacted]

Source: Water (General)

Begin Date: 91/10/22 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	969 *	umho/cm
Turbidty	Meter	280 *	NTU

Microbiological	Water-Total Result	Units
[redacted]	[redacted]	

??

Solids - Specified		Water-Total Result	Units
Solids	Total	3440 *	mg/l
Solids	T-Dissol	1830J*	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	1810 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	2.54 *	mg/l
Kjel-N	Total	0.899 *	mg/l
NO2NO3-N	Total	1.11 *	mg/l
Phos	Total	13.0 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	5390 *	ug/l
Sodium	Na-Diss	46.8 *	~~ug/l~~ mg/l

Pm

Ion Chromatography	Water-Total Result	Units
Chloride	**57.9 ***	**mg/l**

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

(Sample Complete)

12:25:43 Sample/Project Analysis Results

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 438245 Description: [redacted]

Source: Industrial Effluent

Begin Date: 91/10/23 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	811 *	umho/cm
Turbidty	Meter	1U H	NTU

Microbiological	Water-Total Result	Units
Coliform Fecal	410000 *	#/100ml

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	465 *	mg/l
Solids	T-Dissol	3890 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	1970 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	18.2 *	mg/l
Kjel-N	Total	498 *	mg/l
NO2NO3-N	Total	0.687 *	mg/l
Phos	Total	16.4 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	8840 *	ug/l
Sodium	Na-Diss	103 *	~~ug/l~~ mg/l PM

Ion Chromatography	Water-Total Result	Units
Chloride	87.7 *	mg/l

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

(Sample Complete)

12:25:43

Sample/Project Analysis Results

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD

Account: D4200

Laboratory: Ecology, Manchester

Source: Water (General)

Sample No: 91 438244

Description: [redacted]

Begin Date: 91/10/23 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	1480 *	umho/cm
Turbidty	Meter	495 H	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	1060 *	mg/l
Solids	T-Dissol	3260J*	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	2280 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	35.1 *	mg/l
Kjel-N	Total	111 *	mg/l
NO2NO3-N	Total	1.49 *	mg/l
Phos	Total	27.3 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	**24800 ***	**ug/l**
Sodium	Na-Diss	**49.3 ***	~~ug/l~~ mg/l Pm

Ion Chromatography	Water-Total Result	Units
Chloride	**75.6 ***	**mg/l**

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

Microbiological	Water-Total Result	Units
[redacted] Fecal	[redacted]	

(Sample Complete)

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 438236 Description: BLANK-1

Source: Water (General)

Begin Date: 91/10/22 :

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	4.31 *	mg/l

Contract Laboratory Contract Lab Program		Water-Total Result	Units
VOA	GC/MS	ANALYZED	CLP

(Sample Complete)

Project: DOE-398K CHEHALIS RIVER TMDL STUDY

Officer: TKD Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 438235 Description: [redacted]

Source: Industrial Effluent

Begin Date: 91/10/22 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	1410 *	umho/cm
Turbidty	Meter	1U	NTU

Microbiological	Water-Total Result	Units
Coliform Fecal	[redacted]	[redacted]

??

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	292 *	mg/l
Solids	T-Dissol	6490 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	3220 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	21.6 *	mg/l
Kjel-N	Total	764 *	mg/l
NO2NO3-N	Total	0.828 *	mg/l
Phos	Total	22.3 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	12700 *	ug/l
Sodium	Na-Diss	221 *	~~ug/l~~ mg/l Pm

Ion Chromatography	Water-Total Result	Units
Chloride	172 *	mg/l

Contract Laboratory Contract Lab Program		Water-Total Result	Units
BOD	5 Day	ANALYZED	mg/l

(Sample Complete)

WATER MANAGEMENT LABORATORIES INC.

1515 80th St. E.
Tacoma, WA 98404
531-3121

October 29, 1991

Washington State Dept of Ecology
7411 Beach Drive E
Port Orchard, WA 98366-8204
Attn: Despina Strong

Dear Ms Strong:

The results of analysis of seven wastewater samples recieved on 10-23-91 are as follows:

Project: Chehalis TMDL

Sample Identification	Station/Date Collected	Biochemical Oxygen Demand (mg/l)
438230	MW1A/10-22-91	~~8~~ 2
438231	MW2A/10-22-91	~~4~~ 6
438232	MW3A/10-22-91	~~14~~ 15
438233	MW4A/10-22-91	~~6~~ <6
438234	Eff1-NF/10-22-91	~~3300~~ 3000
438235	Eff1-MM/10-22-91	~~7870~~ 7300
438250	~~Inf-A/not legible~~ Inf 1-ML	255

Lab number 89-09228

The samples arrived at Water Management Lab (WML) by DOE currier on 10-23-91 at 1410 hours and then logged in. The analysis began immediately. All dilutions were run in duplicate except a third dilution on samples numbered 428234 and 428235 was made The third dilution was made due to the high solids and wide BOD range of the two samples. This data is found on the second data page (last two entries). All effluent samples were analyzed for chlorine and dechlorinated if necessary. The dilutions for the effluent samples were seeded using seed provided by DOE..The true (BOD) value for the KHP QC is 66 mg/l and the sugar reference is 200 mg/l.

The tests were performed according to Standard Methods for the Examination of Water and Wastewater, 16th Edition.

Copies of all data, temperature records and Chain of Custody are enclosed.

Sincerely,

Alan Aplin
Chemist

WATER
MANAGEMENT
LABORATORIES INC.

1515 30th St.
Tacoma, WA
531-3121

November 15, 1991

Washington State Dept of Ecology
1411 Beach Drive E
Port Orchard, WA 98366-8204
Attn: Despina Strong

Dear Ms Strong:

The results of analysis of fifteen wastewater samples received on 10-24-91 are as follows:

Project: Grandview STP

Marc/Steve

Sample Identification	Biochemical Oxygen Demand (mg/l)
438282	888
438283	890
438286	915
438287	990
438290	720
438298	635
438299	640

Lab Number 89-09238

Project: Chehalis TMDL

Sample Identification	Biochemical Oxygen Demand (mg/l)
438244 Ex 2-NE	~~5930~~ cs 4950
438245 Ex 2-MM	~~5230~~ cs 4150
438251 In/2-ML	~~778~~ cs 780

Lab Number 89-09239

WASHINGTON STATE DEPARTMENT OF ECOLOGY
ENVIRONMENTAL INVESTIGATIONS AND LABORATORY SERVICES
MANCHESTER ENVIRONMENTAL LABORATORY

November 25, 1991

TO: Tapas Das

FROM: Craig Smith, Analytical Management

SUBJECT: Chehalis TMDL

SAMPLE RECEIPT
The samples were received by the Manchester Laboratory on 10/31/91, in good condition.

HOLDING TIMES
All analyses were performed within the specified holding time for BOD analysis (48hrs).

INSTRUMENT CALIBRATION
The D.O. meter was calibrated prior to the run and checked during the run.

PROCEDURAL BLANKS
The blank values were within the acceptable range for BOD's.

SPIKED SAMPLE ANALYSIS
Not applicable for this analysis.

PRECISION DATA
Not applicable for this analysis.

STANDARD REFERENCE MATERIAL
The KHP and sugar checks were within the acceptable ranges:

	True Value	Analyzed Value	Range
KHP	200	165	163 - 237
Sugar	66	64	52 - 76

SUMMARY
The data generated by the analysis of the samples above may be used without qualification.
If you have any questions concerning the results, please feel free to call me at SCAN 744-4737.

12:45:47

Sample/Project Analysis Results

Officer: TKD Account: D4200

Project: DOE-398L CHEHALIS TMDL

Laboratory: Ecology, Manchester

Source: Well (Test/Observation)

Sample No: 91 [redacted] Description: [redacted]

Begin Date: 91/10/30 :

del but contract lab Data

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	163 *	umho/cm
Turbidty	Meter	9.0 *	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	4 *	mg/l
Solids	T-Dissol	145 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	1U	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	0.036 *	mg/l
Kjel-N	Total	0.787 *	mg/l
NO2NO3-N	Total	0.767 *	mg/l
Phos	Total	0.017 *	mg/l

Nutrients - Specifie		Water-Filtere Result	Units
O-PO4-P	Diss	0.021 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	418 *	ug/l
Sodium	Na-Diss	8.53 *	~~ug/l~~ mg/l Pm

Ion Chromatography		Water-Total Result	Units
Chloride		3.4 *	mg/l

Ion Chromatography		Water-Filtere Result	Units
[redacted]		[redacted]	MG/L

Contract Lab Program		Water-Total Result	Units
BOD	5 Day	REQ	mg/l

Microbiological		Water-Total Result	Units
Coliform	Fecal	1U	#/100mL

(Sample Complete)

..:45:47

Sample/Project Analysis Results

Project: DOE-398L CHEHALIS TMDL

Officer: TKD

Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 448241

Description: [redacted]

Source: Well (Test/Observation)

Begin Date: 91/10/30 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	519 *	umho/cm
Turbidty	Meter	85.5 *	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	32 *	mg/l
Solids	T-Dissol	399 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	4.49 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	0.078 *	mg/l
Kjel-N	Total	0.220 *	mg/l
NO2NO3-N	Total	0.01U	mg/l
Phos	Total	0.038 *	mg/l

Nurrients - Specifie		Water-Filtere Result	Units
O-PO4-P	Diss	0.314 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	25100 *	ug/l
Sodium	Na-Diss	9.24 *	~~ug/l~~ mg/l pm

Ion Chromatography		Water-Total Result	Units
Chloride		51.8 *	mg/l

Ion Chromatography		Water-Filtere Result	Units
[redacted]	DISS.BR	0.05UE	MG/L

Contract Lab Program		Water-Total Result	Units
BOD	5 Day	REQ	mg/l

Microbiological		Water-Total Result	Units
Coliform	Fecal	1U	#/100mL

(Sample Complete)

Washington State Department of Ecology
Sample/Project Analysis Results

12:45:47

Officer: TKD Account: D4200

Project: DOE-398L CHEHALIS TMDL

Laboratory: Ecology, Manchester

Source: Well (Test/Observation)

Sample No: 91 448242 Description: MW-3B

Begin Date: 91/10/30 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond25C	Meter	943 *	umho/cm
Turbidty	Meter	187 *	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	93 *	mg/l
Solids	T-Dissol	670 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	3.83 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	1.19 *	mg/l
Kjel-N	Total	1.28 *	mg/l
NO2NO3-N	Total	0.01U	mg/l
Phos	Total	0.051 *	mg/l

Nutrients - Specifie		Water-Filtere Result	Units
O-PO4-P	Diss	1.40 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	116000 *	ug/l
Sodium	Na-Diss	29.7 *	~~ug/l~~ mg/l PM

Ion Chromatography	Water-Total Result	Units
Chloride	187 *	mg/l

Ion Chromatography		Water-Filtere Result	Units
BROMIDE	DISS.BR	0.39[redacted]	MG/L

Contract Lab Program		Water-Total Result	Units
BOD	5 Day	REQ	mg/l

Microbiological		Water-Total Result	Units
Coliform	Fecal	1U	#/100mL

(Sample Complete)

Sample/Project Analysis Results

Project: DOE-398L CHEHALIS TMDL

Officer: TKD

Account: D4200

Laboratory: Ecology, Manchester

Sample No: 91 448243

Description: [redacted] *

Source: Well (Test/Observation)

Begin Date: 91/10/30 :

Gen Inorg/Phys-Speci		Water-Total Result	Units
Cond@25C	Meter	515 *	umho/cm
Turbidty	Meter	85.5 *	NTU

Solids - Specified		Water-Total Result	Units
Solids	T-Suspen	35 *	mg/l
Solids	T-Dissol	316 *	mg/l

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	4.43 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	0.077 *	mg/l
Kjel-N	Total	0.219 *	mg/l
NO2NO3-N	Total	0.01U	mg/l
Phos	Total	0.022 *	mg/l

Nutrients - Specifie		Water-Filtere Result	Units
O-PO4-P	Diss	0.273 *	mg/l

Metals - ICP Scan		Water-Filtere Result	Units
Iron	Fe-Diss	25600 *	ug/l
Sodium	Na-Diss	9.28 *	~~ug/l~~ mg/l PM

Ion Chromatography		Water-Total Result	Units
Chloride		52.1 *	mg/l

Ion Chromatography		Water-Filtere Result	Units
[redacted]		[redacted]	MG/L

Contract Lab Program		Water-Total Result	Units
BOD	5 Day	REQ	mg/l

Microbiological		Water-Total Result	Units
Coliform	Fecal	1U	#/100mL

(Sample Complete)

Washington State Department of Ecology
Sample/Project Analysis Results

:45:47

Officer: TKD Account: D4200

Project: DOE-398L CHEHALIS TMDL

Laboratory: Ecology, Manchester

Source: Well (Test/Observation)

Sample No: 91 448246 Description: MW-5B (Blank ??)

Begin Date: 91/10/30 :

Demand - Specified		Water-Total Result	Units
T-Org-C	Total	2.59 *	mg/l

Nutrients - Specifie		Water-Total Result	Units
NH3-N	Total	0.026 *	mg/l
Kjel-N	Total	0.054 *	mg/l
NO2NO3-N	Total	0.01U	mg/l
Phos	Total	0.011 *	mg/l

Nutrients - Specifie		Water-Filtere Result	Units
O-PO4-P	Diss	0.01U	mg/l

(Sample Complete)