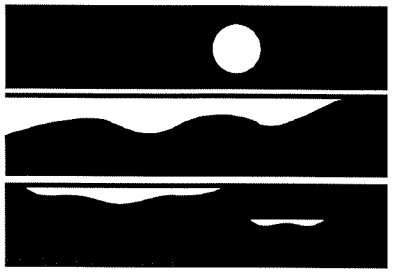

CITY OF MEDICAL LAKE
SEWAGE TREATMENT FACILITY
CLASS II INSPECTION

September 1994

Water Body N. WA-54-1020
Publication No. 94-156
printed on recycled paper

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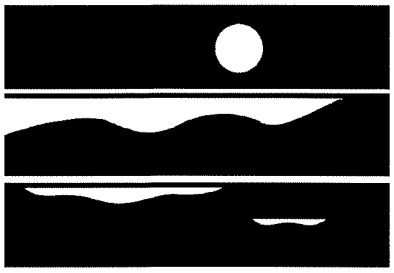

City of Medical Lake Sewage Treatment Facility Class II Inspection

by
Guy Hoyle-Dodson

Environmental Investigations and Laboratory Services Program
Olympia, Washington 98504-7710

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Abstract

A Class II Inspection was conducted September 20-22, 1993, at the city of Medical Lake Wastewater Treatment facility in Spokane County, Washington. The Medical Lake facility operates an aerated lagoon connected in series with two large unaerated treatment/settling lagoons. The plant discharge flows several miles in an open channel before discharging to Deep Creek. Effluent flow meter calibration was checked and the meter was found to be accurate. Recalibration of pump flow measurements or, if necessary, the addition of an influent flow measurement device is recommended. A higher than typical BOD_5/TOC ratio was found for influent samples. TSS removal efficiency was moderate likely due to algae growth in the settling ponds. NH_3-N removal occurred in the system. Most effluent results are within the Ecology compliance order load and concentration limits, but several exceed NPDES permit limits. Effluent pH exceeded both NPDES permit and compliance order limits. Effluent TSS concentration exceeded the percent of influent concentration stipulated by the monthly NPDES permit limit. Chlorine residual appeared high and it is recommended that the minimal concentration and optimal retention time be determined to reliably achieve permit fecal coliform limits. Split sample analyses found good correspondence between samples and good correspondence between laboratories for most parameters except BOD_5. Wastewater metal concentrations were all within EPA and state water quality criteria for receiving waters. Concentrations of sludge metals did not exceed EPA criteria for the land application of municipal sludge, although fecal coliform densities exceeded Class A land application standards.

Summary

Flow Measurements

Medical Lake's effluent flow measurement device accurately reflected the Ecology flow measurements at the effluent weir. Effluent flow is reported to be only 36% of influent flow. The discrepancy may be attributed in part to evaporation and infiltration, but inaccuracies in influent flow measurement may also contribute.

Wastewater General Chemistry

Influent parameters were generally within typical ranges. A BOD_5 removal of 79% and a TSS removal of 33% were calculated with Ecology analytical results. Most NH_3-N was removed in the system. Most TOC and TSS removal occurred in the aeration basin. Low overall TSS removal efficiency and TSS increases across the treatment/settling lagoons basins suggest excessive algae growth in the two basins.

NPDES Comparisons

Effluent BOD_5 and TSS concentrations and loads were all within the compliance order monthly and weekly average limits. BOD_5 results exceeded the NPDES permit monthly concentration limit. One TSS result exceeded the NPDES permit monthly load limit, and all TSS results exceeded the permit monthly and weekly concentration limits. Plant TSS effluent concentration was greater than the 15% of influent concentration required by the monthly NPDES permit limit. Effluent pH exceeded the upper range of the permit limit and the compliance order. High pH was likely due to algae growth in the treatment/settling lagoons.

Plant flow rate and fecal coliform densities were within NPDES permit and compliance order limits. Chlorine residual appeared high and may be excessive to meet NPDES permit fecal coliform limits.

Split Samples

Comparison of Ecology lab results for Ecology and Medical Lake effluent samples showed good correspondence. Medical Lake lab results for the two BOD_5 effluent samples had a relative percent error of 39%. Both Ecology and Medical Lake influent samples correlated well for BOD_5, but showed more variability for TSS.

Comparisons between laboratories showed close TSS results, but the Medical Lake lab BOD_5 results did not closely match Ecology lab results. Fecal coliform results for both labs were uniformly low. The Cheney STP lab, which performed the analyses for the Medical Lake

facility, is not accredited. It is reported that they do not dechlorinate BOD_5 samples before testing.

Detected Organics and Priority Pollutant Metals

Arsenic, copper, selenium, and zinc were detected in the effluent. None exceeded the EPA or state water quality criteria for receiving waters.

Sludge

Sludge nutrient concentrations produce a nitrogen loading rate for land application to field crops of 1.8 to 7.3 tons dry solids/acre·year. The sludge fecal coliform density exceeds the EPA Class A pathogen limitation for the land application of municipal sludge by a factor of 36. Sludge sample VOAs and BNAs were detected in low concentrations with the exception of Bis(2-Ethylhexyl)Phthalate. A land application criteria is not available for this compound. Concentrations of detected priority pollutant metals in the sludge did not exceed the EPA metals criteria for the land application of municipal sludge.

Recommendations

Flow Measurements

- Recalibration of pump measurements or the addition of an influent flow measurement device is recommended to provide more accurate plant loading measurements.

NPDES Comparisons

- Rectify excessive effluent TSS and low TSS removal efficiency by reducing retention time in the treatment/settling lagoons as a means to control algae growth.
- Confirm algae growth as the source of excessive pH in the effluent.
- Identify and maintain the minimal chlorine concentration and optimal contact time to achieve fecal coliform limits.

Split Samples

- An influent composite or grab composite sample is recommended.
- The lab which does the Medical Lake analysis needs to be accredited by July 1, 1994 to conform to Washington Administrative Code 173-220.

Introduction

A Class II Inspection was conducted at the City of Medical Lake Sewage Treatment Plant (STP) on September 20-22, 1993. Guy Hoyle-Dodson of the Washington State Department of Ecology's Toxics Investigations Section conducted the investigation. Pat Hallinan, municipal permit manager for the Department of Ecology's Eastern Regional Office, provided background information on facility operation. Medical Lake City Public Works Superintendent, Earl Davis; Public Works Maintenance Supervisor, Dan Dorshorst; and facility operator, Bill Ahlf provided information and assistance on site.

The Medical Lake STP serves a population of approximately 2900, consisting mainly of private residences and small retail businesses. The plant discharges effluent to Deep Creek a tributary of the Spokane River. An NPDES Permit (No. WA-002114-3) was issued July 1, 1977, with an expiration date of June 30, 1982. The facility is operating under an administrative extension of that permit. An additional administrative order (No. DE 91WQ-E376) was issued December 31, 1991, providing new, less stringent limitations for several permit parameters. The order will remain in effect until the construction of a planned system upgrade to be completed by October 1, 1996.

The Class II Inspection was initiated by the Department of Ecology to evaluate permit compliance and to provide information about facility loading and lagoon bottom sludge composition. Specific objectives of the inspection included:

1. Assess NPDES permit compliance;

2. Assess wastewater toxicity with priority pollutant metal scans;

3. Characterize solids and nutrient composition of lagoon bottom sludge;

4. Assess sludge toxicity with fecal coliform tests, priority pollutant organic scans, and metals scans;

5. Evaluate treatment facility performance;

6. Evaluate permittee's self-monitoring with split samples.

Setting

The Medical Lake treatment facility is located in Spokane County, Washington, just north of the city of Medical Lake (*Figure 1*). The facility uses an aerated lagoon system followed by chlorination. The city began operation of the lagoon system in 1977 and incorporated minor

modifications through the years. In 1992 aerators were added to lagoon #1 to improve secondary treatment.

The system consists of influent wetwell, a mechanically aerated primary lagoon (4.48 acres), two facultative treatment/settling lagoons (3.41 and 3.12 acres) operated in series, and a chlorine contact chamber (*Figure 2*). Raw wastewater from the wetwell is pumped to a splitter box and diverted into the primary lagoon. Pump records are used to estimate influent flow volumes.

Lagoon #1 is the principal secondary treatment unit. Five floating agitators provide aeration and also promote counterclockwise flow through lagoon #1. Flow enters at the north bank, completes a 270 degree circuit, and discharges to lagoon #2. Sludge accumulates on the lagoon bottom and has not been dredged during the life of the system.

Lagoons #2 and #3 are used primarily for settling. Mechanical agitation of their surfaces is limited to the prevention of ice build-up during the winter. Accumulated sludge has never been dredged.

Effluent from lagoon #3, the last in the series, is chlorinated and discharged to a chlorine contact chamber. A 45° V-notch weir with a Polysonics ultrasound flow meter records effluent flow rates. Discharge from the contact chamber cascades onto a rock spillway then flows down an open channel.

The discharge is atypical in that it flows for about four miles through surrounding agricultural land before emptying into Deep Creek (*Figure 1*). This connecting channel is open to a variety of non-point pollution sources. Farm animals have direct contact with the channel. Agricultural and residential runoff likely contribute additional contamination. Flow in this channel is seasonal, and during the dry season surface volumes recharge into the ground for short distances then resurface. The channel's confluence with Deep Creek was not accessible during the inspection.

Ecology's compliance order mandates that an upgraded treatment system, capable of meeting NPDES treatment limits, will be built to replace the current system no later than October 1, 1996. A new mechanical system which discharges to Medical Lake is presently under design.

Procedure

Ecology collected both grab and composite samples at the STP. Composite samples were collected from wastewater at two stations (*Figure 2 & Appendix A*); the influent wetwell and the effluent from the chlorination chamber. All composite samples were collected using Ecology ISCO composite samplers with equal volumes of the sample collected every 30 minutes over a 24 hour period. Grab samples were collected at all composite stations as well as several other sites.

Medical Lake personnel collected grab samples at the influent splitter box and from the effluent at the outfall from the chlorine contact chamber. Medical Lake samples were not equivalent to those collected by Ecology's composite samplers, but represented the STP's typical sampling procedures.

Ecology composite samples and Medical Lake grab samples were split for analysis by both Ecology and Medical Lake laboratories. Parameters analyzed, samples collected, and the sampling schedule appear in Appendix B.

Samples for Ecology analysis were put in appropriate containers and preserved as necessary. The samples were packed in ice and delivered to the Ecology Manchester Laboratory. Analytical procedures and laboratories performing the analyses are summarized in Appendix C.

Quality Assurance/Quality Control

Sampling quality assurance included priority pollutant cleaning of sampling equipment (*Appendix D*). One duplicate of a composite sample was analyzed to assess sample splitting and analytic consistency. Sampling in the field followed all protocols for holding times, preservation, and chain-of-custody set forth in the Manchester Lab Laboratory Users Manual (Ecology, 1991).

Laboratory QA/QC including holding times, spike and duplicate spike sample analyses, precision data, and control sample (LCS) analyses were typically within appropriate ranges. Initial and continuing calibration verification standards were within relevant USEPA (CLP) control limits. Procedural blanks were predominantly free from contamination. Qualifiers are included in the data table where appropriate. Specific QA/QC concerns are noted in Appendix D.

Results and Discussion

Flow Measurements

Effluent flows were measured by ultrasonic meter in conjunction with a 45° V-notch weir located at the end of the chlorine contact chamber. At the time of the inspection, the flow recorded by the effluent totalizer was generally used as the plant flow for NPDES permit reporting. The effluent weir was inspected by Ecology and it appeared to be properly configured. An instantaneous flow measurement by Ecology taken at the weir (0.091 MGD) compared closely with the Medical Lake metered instantaneous measurement (0.086 MGD). The daily flow rate calculated from totalizer values over a two-day period was 0.092 MGD.

Medical Lake estimated influent flow through pump records. Estimated average influent flow during the inspection was 0.25 MGD. Apparent average daily losses across the system for the month of September ranged from 0.1 MGD to 0.15 MGD and may be attributed in part to evaporation and infiltration. The lack of steady state flow makes verification difficult, but inaccurate flow measurements could produce a sizeable portion of the discrepancy between influent and effluent flows. Recalibration of pump flow measurements is recommended to produce greater accuracy and allow a better evaluation of plant loading. If necessary, a direct influent flow measurement device should be considered.

Wastewater General Chemistry

Influent

BOD_5 concentration in the influent (207 mg/L) fell within the typical medium concentration range for untreated domestic wastewater (*Table 1*). TOC influent concentration (104 mg/L) fell into the "weak" range and BOD_5 /TOC ratio was higher than typical (Metcalf & Eddy, 1991, pg. 83).

Influent total solids (600 mg/L) and total non-volatile solids (311 mg/L) (*Table 1*) fell into a "medium" concentration range for typical domestic influent (Metcalf & Eddy, 1991).

Effluent

Due to the long retention time in the facility ($\cong$ 95 days), fairly uniform influent quality is assumed in order to estimate treatment. Inspection results showed a BOD_5 reduction from 207 mg/L in the influent to 44 mg/L in the effluent (79% removal) (*Tables 1&2*). BOD_5 removal efficiency compared well with other modified aeration designs (Metcalf & Eddy, 1991). Other oxygen demand parameters, TOC and COD, did not display comparable removal efficiencies.

Ecology composite samples showed a decrease in total suspended solids (TSS) from 144 mg/L to 98 mg/L with a removal efficient of approximately 33% across the plant (*Tables 1&2*). Ammonia nitrogen (NH_3-N) concentrations decreased from an average of 25.5 mg/L in the influent to 0.135 mg/L in the effluent (*Table 1*). Nitrification was accompanied by a greater than expected reduction in alkalinity. Nitrite-Nitrate nitrogen (NO_2+NO_3-N) concentrations increased, but was still less than 0.5 mg/L in the effluent (*Table 1*). Denitrification and/or incorporation of nitrogen into algae are likely explanations for the low NO_2+NO_3-N in the effluent. Total phosphorous removal efficiency exceeded 52%.

Treatment/Settling Lagoons

TSS and TOC removal occurred in the aerated lagoon. TSS increased across the two treatment/settling basins 6% and 16% respectively, and TOC increased 43% (Table 2). BOD_5 was not measured between lagoons. These increases and the relatively low removal efficiency across the STP most likely result from the growth of algae in the two settling basins. During the inspection the basins' waters were noticeably green. Calculated retention time for the two basins was about 95 days. Limiting the retention time in the basins may reduce algae growth, although this could also effect nutrient reduction.

Discharge Ditch

Little change was detected in TSS and TOC concentrations at the open channel 100 yards downstream of the effluent discharge (*Table 2*). Moderate increases in NH_3-N and large increases in NO_2+NO_3-N were seen at the same location. This may reflect a non-point discharge or the decomposition of algae and surrounding plant life in the channel.

NPDES Permit Comparisons

Table 3 compares inspection results to NPDES permit limits and compliance order limits. The compliance order acts as a guide for the Department of Ecology to exercise its prosecutorial discretion, but does not amend NPDES permit limits. This is intended to control discharges and still allow the present Medical Lake facility to continue operation until completion of the proposed facility upgrade.

Effluent BOD_5 and TSS concentrations and loads were all within compliance order monthly and weekly average limits (*Table 4*). Effluent loads for BOD_5 (32 lb/day & 28 lb/day) were all within NPDES permit limits (*Table 3*). The Ecology effluent TSS concentration and the Medical Lake effluent BOD_5 concentration failed to meet the NPDES monthly permit limit which restricts the effluent concentration to no more than 15% of the influent concentration if the influent concentration is less than 200 mg/L. The Ecology TSS effluent sample concentration was 67% and the Medical Lake BOD_5 effluent sample concentration was 20% of each respective influent concentration. The Medical Lake effluent sample produced a TSS load (78 lb/day) that exceeded the NPDES permit monthly average limit, but was within the weekly average limit. BOD_5 effluent concentrations were all greater than monthly NPDES permit limits, but within weekly average limits. TSS effluent concentrations were above both monthly and weekly NPDES permit limits. Effluent pH averaged 9.0 and exceeded the upper range of the permit limit by more than 6% (*Table 3*). The high pH is likely associated with the high algae population. It is suggested that Medical Lake determine the extent of this relationship.

An effluent flow rate of 0.09 MGD was well below the NPDES permit limit of 0.3 MGD (*Table 3*). The effluent fecal coliform count was well within compliance order and NPDES

permit limits. Ecology grab sample results were below detection and Medical Lake grab sample results were 20 and 40 colonies/100ml. Although chlorination achieved the desired fecal coliform levels, the total chlorine residual in the effluent composite sample was high (6.0 mg/L). A grab sample taken previous to the composite sample found total chlorine residual to be below detection (< 0.1 mg/L). Large variations in effluent chlorine residual concentrations appeared to have occurred. Chlorine concentration was also high in the open channel (0.6 mg/L). It is suggested that chlorine concentrations and contact time be modified to determine the lowest chlorine concentration which will achieve compliance with permit fecal coliform limits.

Split Samples

Sample Comparisons

Comparisons of the Ecology lab's results for all effluent samples and BOD_5 influent samples collected by Ecology and Medical Lake were good (*Table 4*). Medical Lake results were similar for the two effluent TSS samples and the two influent BOD_5 samples.

The Medical Lake laboratory effluent BOD_5 samples produced a relative percent difference of 39% between the Ecology and Medical Lake samples. Relative percent differences between the Medical Lake sample influent TSS and the Ecology sample influent TSS were 33% for Ecology lab results and 27% for the Medical Lake lab results. It is recommended that Medical Lake conduct influent composite or grab-composite sampling to improve representativeness.

Laboratory Comparisons

Agreement between Ecology and Medical Lake analytical results were mixed. Influent and effluent TSS results from both laboratories agreed closely (*Table 5*). Relative percent differences did not exceed 3% between influent pairs and 16% between effluent pairs.

BOD_5 composite influent and effluent comparisons were somewhat more divergent (*Table 4*). Medical Lake's influent results were generally higher, and effluent results generally lower than Ecology's results. Relative percent differences exceeded 50% between influent pairs and remained above 35% for any effluent pairs. It is reported that the lab performing the analyses does not dechlorinate BOD_5 samples before testing. Review of protocols for BOD_5 testing is advised.

The Medical Lake and the Ecology lab's fecal coliform results were similar, with the former reporting very low counts and the later reporting counts below detection (*Table 4*).

Testing for Medical Lake is currently performed by the city of Cheney Public Wastewater Treatment Plant Laboratory. This lab is not accredited. All testing laboratories need to be accredited by July 1, 1994 (173-220 WAC, 1992).

Wastewater Priority Pollutant Metals

Wastewater was analyzed for metals only. Arsenic, copper, selenium, and zinc were all detected in the effluent (*Table 5*). None exceeded either the EPA hardness adjusted water quality criteria for receiving waters (EPA, 1986) or the State of Washington Water Quality Standards for Surface Waters (173-201A WAC, 1992). Appendix E contains the results of all target metals.

Sludge

Characterization of lagoon sludge was done to determine its impact for potential land application. Kjeldahl-N concentrations for the sludge ranged from 10,100 - 22,000 mgN/Kg-dry wt. (*Table 1*). The composite total Kjeldahl-N concentration for all three basins was 20,700 mgN/Kg-dry wt. The calculated nitrogen limitation application rate based on nutrient uptake for selected field crops range from 1.8 to 7.3 tons dry solid/acre·year (Metcalf & Eddy, 1991). Assuming a sludge depth of one-third meter, a specific gravity of 1.01, and an average percent weight dry solids of 10%, the total weight of dry sludge from the three lagoons is approximately 1,654 tons. For a one time disposal to land under cultivation for wheat and alfalfa, this would require 227 and 918 acres of farmland, respectively.

Fecal coliform densities ranged from 450/100g-wet wt. (64 colonies/g - dry wt.) in lagoon #3 to an average of 1,400,000/100g-wet wt. (100,000/g - dry wt.) in lagoon #1 (*Table 1*). The later density exceeds the Class A pathogen limitation for the land application of municipal sewage sludge of 1,000/g-dry wt. (EPA, 1993 - 40 CFR Part 503). The composite sample density of 220,000/100g-wet wt. (36,700/g - dry wt.) exceeds the limitation by a factor of 36.

Sludge samples were analyzed for VOAs and BNAs as well as metals. Detected VOAs were all found in low concentrations (*Table 5*). Bis(2-Ethylhexyl)Phthalate was the BNA detected in the highest concentration (12,000 μg/Kg-dry wt.). A complete list of target compounds and results is included in Appendix E. Tentatively identified compounds are presented in Appendix F.

Most priority pollutant metals were detected in all sludge samples (*Table 5*). None were detected in concentrations that exceeded the EPA metals criteria for the land application of municipal sludge (*Table 6*) (EPA, 1993).

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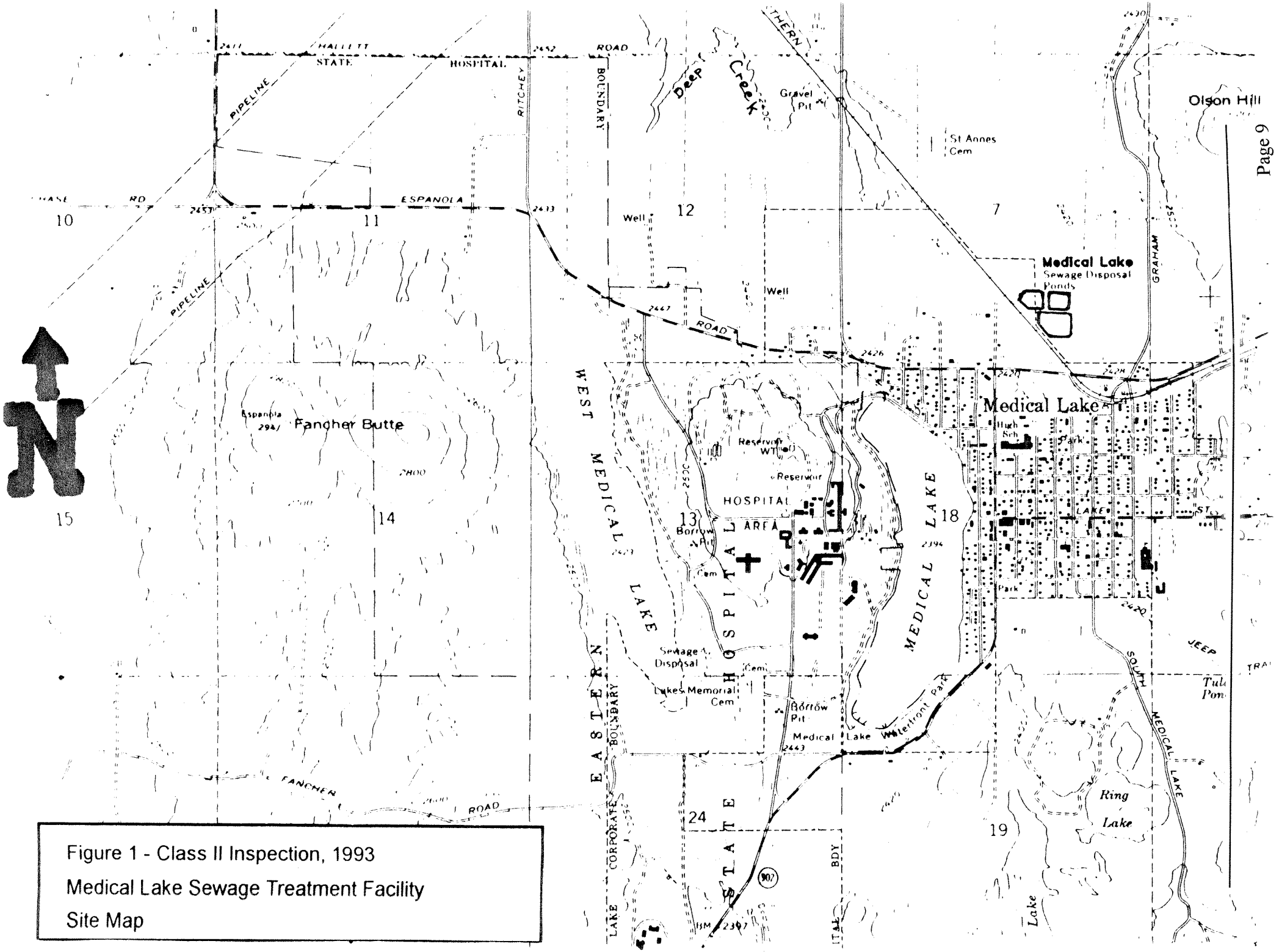

Figure 1 - Class II Inspection, 1993
Medical Lake Sewage Treatment Facility
Site Map

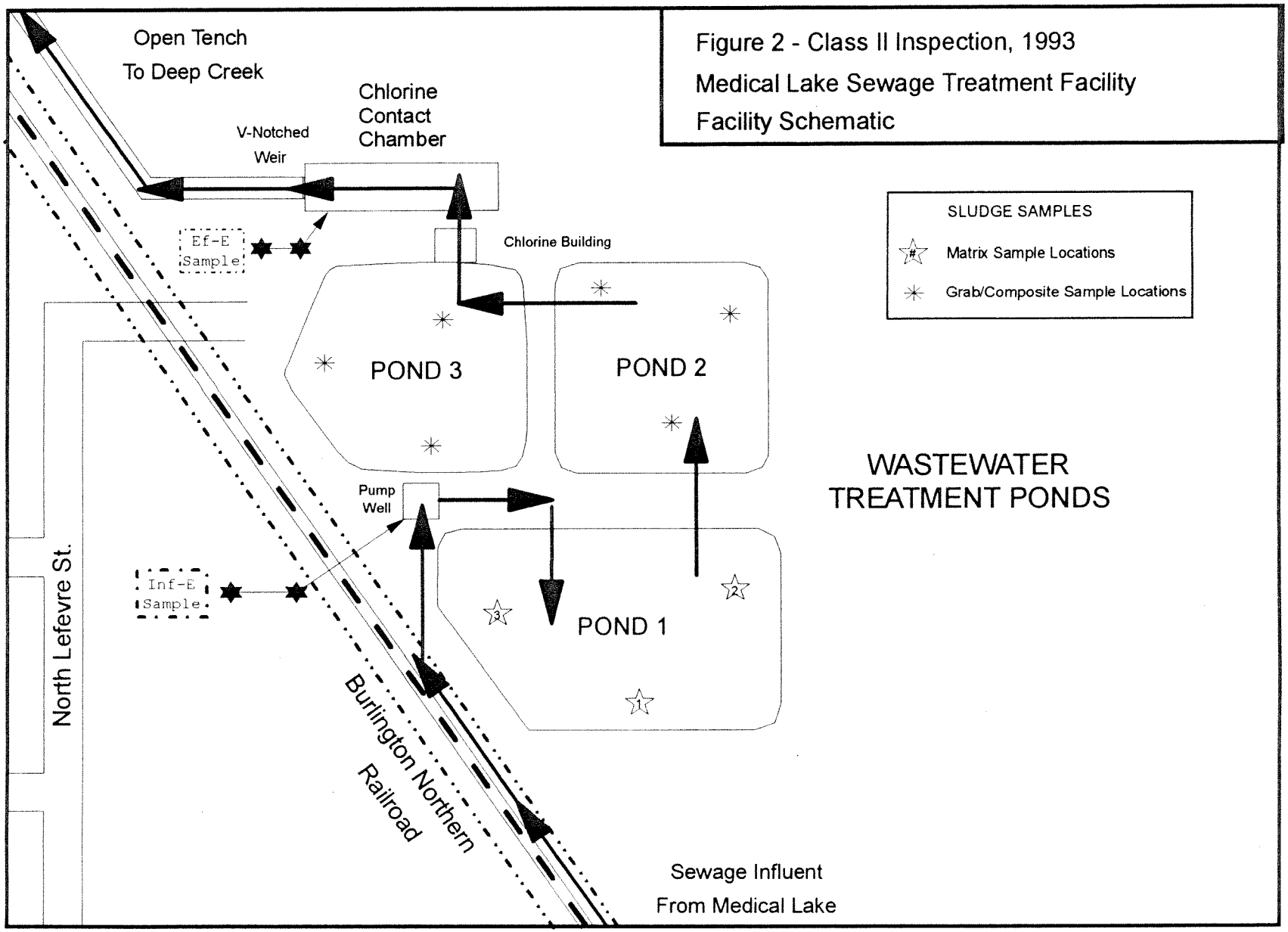
Figure 2 - Class II Inspection, 1993
Medical Lake Sewage Treatment Facility
Facility Schematic
Open Tench
To Deep Creek
Chlorine
Contact
Chamber
V-Notched
Weir
Ef-E
Sample
Chlorine Building
SLUDGE SAMPLES
Matrix Sample Locations
Grab/Composite Sample Locations
POND 3
POND 2
WASTEWATER
TREATMENT PONDS
Pump
Well
Inf-E
Sample
POND 1
North Lefevre St.
Burlington Northern
Railroad
Sewage Influent
From Medical Lake

Table 1 – General Chemistry Results – Medical Lake Class II Inspection, 1993

Parameter / Location:	Inf-E-1	Inf-E-2	Inf-E	Inf-M	Ef-pond-1	Ef-pond-2	Ef-E-1 & Ef-E-3	Ef-E-2 & Ef-E-4	Ef-E	Duplicate	Ef-M
Type:	grab	grab	comp	grab	grab	grab	grab	grab	comp	comp	grab
Date:	09/21	09/21	09/21-22	09/22	09/21	09/21	09/21	09/21	09/21-22	09/21-22	09/22
Time:	0935	1710	@	0915	1040	1045	1010	1725	@	@	1048
Lab Log #:	398130	398131	398132	398133	398134	398135	398136 & 398138	398137 & 398139	398140	398149	398141
GENERAL CHEMISTRY											
Conductivity (umhos/cm)	810	759	750	792	709	669	602	603	609	601	605
Alkalinity (mg/L CaCO3)			270	318					207	207	209
Hardness (mg/L CaCO3)			125	128					143	140	144
SOLIDS 4											
TS (mg/L)			600 J	633 J					549 J	544 J	563 J
TNVS (mg/L)			311 J	306 J					306 J	304 J	335 J
TSS (mg/L)	125 J	140 J	144 J	200 J	78 J	83 J	68 J	42 J	96 J	100 J	109 J
TNVSS (mg/L)			37 J	43 J					26 J	27 J	27 J
% Solids											
% Volatile Solids											
OXYGEN DEMAND PARAMETERS											
BOD5 (mg/L)			207	196					44	35	39
COD (mg/L)			422	435					369	231	238
TOC (water mg/L)	90.2	119	104	116	59.1	72.8	78.1	77.8	88.5	86.7	86.3
TOC (soil/sed – % C dry wt.)											
NUTRIENTS											
Total Kjeldahl-N (mg/L)											
Total Kjeldahl-N (soil/sed – mg N/Kg-dry wt.)											
NH3-N (mg/L)			25.5	32.7			0.459	1.46	0.135	0.763	1.59
NH3-N (soil/sed – mg N/Kg-dry wt.)											
NO2+NO3-N (mg/L)			0.080	0.078			0.510	0.491	0.487	0.496	0.471
NO2+NO3-N (soil/sed – mg N/Kg-dry wt.)											
Total-P (mg/L)			5.81	6.62			2.76	2.24	2.81	2.98	2.86
Total-P (soil/sed – mg/Kg-dry wt.)											
MISCELLANEOUS											
Oil and Grease (mg/L)	32 J	41 J					3 J	2 J			
F-Coliform MF (#/100mL)							3 U	3 U			
Fecal Coliform MPN (sed #/100g-wet)											
FIELD OBSERVATIONS											
Temperature (C)	16.7	17.1			11.0	10.7	11.0	12.1			10.1
Temp-cooled (C)*+			3.4	15.2					4.1	4.3	
pH	8.3	7.8	8.0	8.6	8.1	8.9	9.1	9.0	9.2	9.2	9.2
Conductivity (umhos/cm)	807	774	798	786	738	672	626	616	630	618	614
Chlorine (mg/L)							<= 0.1		6.0		6.0

E	Ecology sample
M	Medical Lake sample
Inf	Influent sample
Ef	Effluent sample
grab	Grab sample
comp	Composite sample
grab/composite	Grab –composite sample

Duplicate	Duplicate of Ef-E sample for blind analysis
Pond-1	Lagoon #1 effluent
Pond-2	Lagoon #2 effluent
J	The analyte was positively identified. The associated numerical value is an estimate.
U	The analyte was not detected at or above the reported result.
@	24-hour composite sample period: 07:00-07:00
*+	Refrigerated sample

Table 1 – General Chemistry Results – Medical Lake Class II Inspection, 1993

Parameter II	Location	Out-E	Sludge-2	Sludge-3	Matrix-1	Matrix-2	Matrix-3	Sludge-123
	Type:	grab	grab/comp	grab/comp	grab	grab	grab	grab/comp
	Date:	09/22	09/21	09/21	09/21	09/21	09/21	09/21
	Time:	1115	1130	1330	1415	1430	1450	1520
	Lab Log #:	398142	398143	398144	398145	398146	398147	398148
GENERAL CHEMISTRY								
Conductivity (umhos/cm)		601						
Alkalinity (mg/L CaCO3)		209						
Hardness (mg/L CaCO3)		148						
SOLIDS 4								
TS (mg/L)								
TNVS (mg/L)								
TSS (mg/L)		100 J						
TNVSS (mg/L)								
% Solids			8.0	7.0	11.0	14.0	17.0	6.0
% Volatile Solids			2.8	2.2	3.0	3.5	3.6	2.3
OXYGEN DEMAND PARAMETERS								
BOD5 (mg/L)								
COD (mg/L)								
TOC (water mg/L)		83.2						
TOC (soil/sed – % C dry wt.)			11.7	12.3	10.6	7.78	7.66	12.9
NUTRIENTS								
Total Kjeldahl-N (mg/L)								
Total Kjeldahl-N (soil/sed – mg N/Kg-dry wt.)			22,000	17,200	15,300	18,200	10,100	20,700
NH3-N (mg/L)		2.27						
NH3-N (soil/sed – mg N/Kg-dry wt.)			875	735	798	1,160	530	1,580
NO2+NO3-N (mg/L)		4.75						
NO2+NO3-N (soil/sed – mg N/Kg-dry wt.)			6.7	5.2	4.6	3.8	2.4	5.9
Total-P (mg/L)		2.75						
Total-P (soil/sed – mg/Kg-dry wt.)			2,820	3,980	2,080	2,150	1,790	4,170
MISCELLANEOUS								
Oil and Grease (mg/L)								
F-Coliform MF (#/100mL)		17						
Fecal Coliform MPN (sed #/100g-wet)			33,000	450	1,100,000	330,000	2,800,000	220,000
FIELD OBSERVATIONS								
Temperature (C)		12.8						
Temp-cooled (C)*+								
pH		8.6						
Conductivity (umhos/cm)		601						
Chlorine (mg/L)		0.6						

Sludge 2	Sludge composite sample from Lagoon #2
Sludge 3	Sludge composite sample from Lagoon #3
Matrix	Sludge samples from a matrix in pond #1
Sludge-123	Composite sludge sample from all three lagoons
grab/composite	Grab -composite sample
*+	Refrigerated sample

J	The analyte was positively identified. The associated numerical value is an estimate.
Out	Outfall into channel which flows to Deep Creek
grab	Grab sample
comp	Composite sample

Table 2 – General Chemistry Percent Reduction – Medical Lake Class II Inspection, 1993

Parameter I	Location:	Inf–E	Ef–Pond–1	Percent Reduction Across Pond–1	Ef–pond–2	Percent Reduction Across Pond–2	Ef–E	Percent Reduction Across Pond–3	Ecology Percent Reduction Across STP	Out–E	Percent Reduction In Ditch*	Inf–M	Ef–M	Medical Lake Percent Reduction Across STP
	Type:	comp	grab		grab		comp			grab		grab	grab	
	Date:	09/21–22	09/21		09/21		09/21–22			09/22		09/22	09/22	
	Time:	@	1040		1045		@			1115		0915	1048	
	Lab Log #:	398132	398134		398135		398140			398142		398133	398141	
GENERAL CHEMISTRY														
Alkalinity (mg/L CaCO3)		270					207		23%	209	–1%	318	209	34%
Hardness (mg/L CaCO3)		125					143		–14%	148	–3%	128	144	–13%
SOLIDS 4														
TSS (mg/L)		144 J	78 J	46%	83 J	–6%	96 J	–16%	33%	100 J	–4%	200 J	109 J	46%
OXYGEN DEMAND PARAMETERS														
BOD5 (mg/L)		207					44		79%			196	39	80%
COD (mg/L)		422					369		13%			435	238	45%
TOC (water mg/L)		104	59	43%	73	–23%	89	–22%	15%	83	6%	116	86	26%
NUTRIENTS														
NH3–N (mg/L)		26					0		99%	2	–1581%	33	2	95%
NO2+NO3–N (mg/L)		0.08					0.487		–509%	4.75	–875%	0.078	0.471	–504%
Total–P (mg/L)		6					3		52%	3	2%	7	3	57%

E	Ecology sample	Out	Outfall into Deep Creek
M	Medical Lake sample	J	The analyte was positively identified. The associated numerical value is an estimate.
Inf	Influent sample	Pond–1	Lagoon #1 effluent – South Lagoon
Ef	Effluent sample	Pond–2	Lagoon # 2 effluent – East Lagoon
grab	Grab sample	*	100 yards downstream from chlorine contact chamber discharge.
comp	Composite sample	@	24–hour composite sample period: 07:00–07:00
grab/composite	Grab –composite sample		

Table 3 – NPDES Limits Inspection Results – Medical Lake, 1993

Parameter	NPDES Permit Limits		NPDES Compliance Order Limits*		Inspection Data						
					Ecology Composite		STP Composite				
Location:					Inf–E	Ef–E	Inf–M	Ef–M	Ef–E–1 & Ef–E–3	Ef–E–2 & Ef–E–4	Out–E
Type:					comp	comp	grab	grab	grab	grab	grab
Date:					09/21–22	09/21–22	09/22	09/22	09/21	09/21	09/22
Time:					@	@	0915	1048	1010	1725	1115
	Monthly Average	Weekly Average	Monthly Average	Weekly Average							
Lab Log #:					398132	398140	398133	398141	398136 & 398138	398137 & 398139	398142
BOD5											
(mg/L)	30	45	85	105	207	44	196	39			
(lbs/D)	75	113	215	265	148	32	141	28			
% of Influent	Monthly and weekly average effluent BOD5 concentration shall be 15 % of influent BOD5 concentration if influent BOD5 concentration is 200 mg/L or less.		Monthly average effluent BOD5 concentration shall not exceed 100 mg/L or 42% of influent concentration**			21		20			
TSS											
(mg/L)	30	45	115	160	144 J	96 J	200 J	109			
(lbs/D)	75	113	290	400	103	69	143	78			
% of Influent	Monthly and weekly average effluent TSS concentration shall be 15 % of influent TSS concentration if influent TSS concentration is 200 mg/L or less.					67		55			
Fecal coliform (#/100 mL)	200	400	200	400					3 U	3 U	17
pH (S.U.)	6.5 < pH < 8.5		6.5 < pH < 8.5						9.1	9.0	8.6
Flow (MGD)	0.3				0.086	0.086	0.086	0.086			
Total Chlorine Residual (mg/L)	N.A.		Total residual chlorine shall be maintained at a level sufficient to attain fecal coliform limits.			6.0		6.0	<0.1		0.6

E Ecology sample
M Medical Lake sample
Inf Influent sample
Ef Effluent sample
grab Grab sample
comp Composite sample
grab/Grab –composite sample

Out Outfall into Deep Creek
J The analyte was positively identified. The associated numerical value is an estimate.
U The analyte was not detected at or above the reported result.
* Administrative order in effect December 31, 1991.
** The 100 mg/L monthly limit represents a discrepancy with the compliance order's previous 85 mg/L monthly limit.
@ 24–hour composite sample period: 07:00–07:00
Exceeds monthly average permit limit

Table 4 – Split Sample Result Comparison – Medical Lake, 1993

Parameter		Location:	Inf–E	Inf–M	EF–E	EF–M	Ef–E–3	Ef–E–4
		Type:	comp	grab	comp	grab	grab	grab
		Date:	09/21–22	09/22	09/21–22	09/22	09/21	09/21
		Time:	@	0915	@	1048	1010	1725
		Lab Log #:	398132	398133	398140	398141	398138	398139
	Laboratory							
TSS (mg/L)	Ecology		144 J	200 J	96 J	109 J		
	Medical Lake		149	195	93.3	92.7		
BOD5 (mg/L)	Ecology		207	196	44	39		
	Medical Lake		354	352	31	20.8		
Fecal Coliform (#/100 ml)	Ecology						3 U	3 U
	Medical Lake						20	40

@	24 hour composite. Collection period: 0700 – 0700.
Inf	Influent samples.
Ef	STP effluent
Comp	composite sample
grab/comp	Grab composite sample

E	Ecology Sample
M	Medical Lake Sample
J	The analyte was positively identified. The associated numerical value is an estimate.
U	The analyte was not detected at or above the reported result.

Table 5 - Detected VOAs, BNAs, PEST/PCBS, and METALS - Medical Lake, 1993

Parameters	Location:	Sludge-123	EPA Water Quality Criteria Summary	
	Type:	grab/comp		
	Date:	09/15	Acute	Chronic
	Time:	1520	Fresh	Fresh
	Lab Log#:	398148		
VOA Compounds		ug/Kg-dry wt.	(ug/L)	(ug/L)
Acetone		94		
Carbon Disulfide		72		
Benzene		20	5,300 *	
Toluene		22	17,500 *	
Total Xylenes		16 J		

Parameters	Location:	Sludge-123	EPA Water Quality Criteria Summary	
	Type:	grab/comp		
	Date:	09/15	Acute	Chronic
	Time:	1520	Fresh	Fresh
	Lab Log#:	398148		
BNA Compounds		ug/Kg-dry wt.	(ug/L)	(ug/L)
Bis(2-Ethylhexyl) Phthalate		12,000 J	940 *(i)	3 *(i)

Parameters	Location:	Inf-E	Ef-E	Duplicate	Sludge-2	Sludge-3	Matrix-1	Matrix-2	Matrix-3	Sludge-123	EPA and Ecology Water Quality Criteria Summary	
	Type:	comp	comp	comp	grab/comp	grab/comp	grab	grab	grab	grab/comp		
	Date:	09/21-22	09/21-22	09/21-22	09/21	09/21	09/21	09/21	09/21	09/21		
	Time:	@	@	@	1130	1330	1415	1430	1450	1520	Acute	Chronic
	Lab Log#:	398132	398140	398149	398143	398144	398145	398146	398147	398148	Freshc	Fresh d
		ug/L	ug/L	ug/L	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.	(ug/L)	(ug/L)
Metals¤ Hardness = 140												
Arsenic		2.2 PB	2.6 PB	1.5 PB	4.17	3.29	4.68	4.96	4.07	3.77	360.0 c	190.0
Beryllium		1 U	1 U	1 U	0.28 P	0.30 P	0.36 P	0.37 P	0.34 P	0.26 P	130 *	5.3 *
Cadmium		0.62 P	0.1 U	0.1 U	4.62	1.7 P	3.44	4.35	3.03	4.59	5.0 +	1.3 +
Chromium		5 U	5 U	5 U	13.6	11.2	15	15.7	14.4	17.7		
	Hexavalent										16	11
	Trivalent										2,287 +	273 +
Copper		43.3	7.6 PB	11 PB	249	125	179	213	149	228	21.0 +	13.6 +
Lead		3.9 P	1.0 U	1.0 U	50.1	21.8	67.2	88.5	58.5	47.3	86 +	3.4 +
Mercury		0.37 P	0.051 U	0.05 U	3.09 P	0.443 P	1.20	1.02	0.994	2.98 P	2.4	0.012
Nickel		10 U	10 U	10 U	11	12	12	12.7	11.1	14.2	1,791 +	199 +
Selenium		2.0 U	3.6 P	2.0 U	3.1 P	1.4 P	2.0 P	2.1 P	1.4 P	2.6 P	20.0	5.0
Silver		0.50 U	0.50 U	0.50 U	7.36	2 P	2.3 P	3.14	1.5 P	6.5	3.8 +	
Zinc		84.9	4.7	4 U	496	221	444	542	401	459	138.7 +	125.6 +

@	Composite sample period: 07:00-07:00	B	Analytes was found in the analytical methods blank, indicating the sample may have been contaminated.	+	Hardness dependent criteria (140 mg/L)
Inf	Influent Sample	J	The analyte was positively identified. The associated numerical result is an estimate.	¤	Water samples: Total Recoverable;
Ef	Effluent Sample	N	The spike sample recovery was not within control limits.		Sludge samples & Hg: Total
E	Ecology Sample	P	The analyte was detected above the instrument detection level, but below the established minimum quantitation limits.		
Sludge-2	Sediment sample from lagoon #2	U	The analyte was not detected at or above the reported result		
Sludge-3	Sediment sample from lagoon #3	UJ	The analyte was not detected at or above the reported estimated result.		
Matrix	Composite of three sediment samples from lagoon #1		Parameters exceeding EPA and state water quality criteria		
Sludge-123	Combined sediment samples from lagoons 1, 2, & 3.	*	Insufficient data to develop criteria. The value presented is the LOEL -- Lowest Observable Effects Level		
Duplicate	Blind duplicate of EF-E sample	c	A 1-hour average concentration not to be exceeded every three years on the average		
i	Total Phthalate Esters	d	A 4-day average concentration not to be exceeded every three years on the average		

Table 6 – EPA Metals Concentration Criteria for the Land Application of Municipal Sudge – Medical Lake, 1993

Parameter	Location:	Sludge–2	Sludge–3	Matrix–1	Matrix–2	Matrix–3	Sludge–123	EPA Standards for Disposal of Sewage Sludge	
	Type:	grab/comp	grab/comp	grab	grab	grab	grab/comp		
	Date:	9/21	9/21/1993	9/21	9/21	9/21	9/21/1993		
	Time:	@	@	1415	1430	1450	1520	Ceiling Concentrations *	Pollutant Concentrations **
	Lab Log #:	398143	398144	398145	398146	398147	398148		
Metals		(mg/Kg–dry wt.)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)
Arsenic		4.17	3.29	4.68	4.96	4.07	3.77	75	41
Cadmium		4.62	1.7 P	3.44	4.35	3.03	4.59	85	39
Chromium		13.6	11.2	15	15.7	14.4	17.7	3000	1200
Copper		249	125	179	213	149	228	4300	1500
Lead		50.1	21.8	67.2	88.5	58.5	47.3	840	300
Mercury		3.09 P	0.443 P	1.20	1.02	0.994	0.298	57	17
Molybdenum								75	18
Nickel		11	12	12	12.7	11.1	14.2	420	420
Selenium		3.1 P	1.4 P	2 P	2.1 P	1.4 P	2.6 P	100	36
Zinc		496	221	444	542	401	459	7500	2800

Sludge –123	Composite sludge sample from all three lagoons
Sludge–2	Sediment sample from Lagoon #2
Sludge–3	Sediment sample from Lagoon #3
Matrix	Sediment sample from Lagoon #1
grab/comp	Grab –composite sample
*	Ceiling concentration limit for bulk sewage sludge or for sewage sludge sold or given away in a bag or other container.
**	Pollutant concentration limit of bulk sewage sludge if it is applied to agricultural land, forest land, a public contact site, or a reclaimation site.

P The analyte was detected above the the instrument detection limit, but below the established minimum quantitation limit.

Appendices

Appendix A - Sampling Stations Description - Medical Lake, 1993

Inf-E-1&2	Grab sample of influent wastewater collected from the headwork diverter box - Collected in both A.M. and P.M..
Inf-E	Ecology 24-hour composite sample of influent wastewater collected from the headwork's wetwell.
Inf-M	Medical lake grab sample of influent wastewater collected from the headwork diverter box.
Ef-pond-1	Grab sample of Lagoon #1 effluent taken from discharge pipe into lagoon# 2.
Ef-pond-2	Grab sample of Lagoon #2 effluent taken from transfer box at discharge into lagoon #3.
Ef-E-1&2	Grab sample of effluent from the weir overflow at the end of the chlorine contact chamber.
Ef-E-3&4	Fecal coliform grab sample of effluent from the weir overflow at the end of the chlorine contact chamber.
Ef-E	Ecology 24-hour composite sample collected from the weir overflow at the end of the chlorine contact chamber.
Ef-M	Medical Lake effluent grab sample collected from the weir overflow at the end of the chlorine contact chamber.
Out-E	Grab sample taken from the open channel to Deep Creek approximately 150 ft downstream from the weir overflow at the end of the chlorine contact chamber.
Sludge-2	Composite sample of bottom sludge collected from three locations in lagoon #2
Sludge-3	Composite sample of bottom sludge collected from three locations in lagoon #3
Matrix-#	Individual bottom sludge samples collected in a matrix pattern from lagoon #1
Sludge-123	Composite sample of bottom sludge collected from the centers of all three lagoons.
Duplicate	Duplicate of effluent sample for blind analysis.

Appendix B – Sample Schedule – Medical Lake Class II Inspection, 1993

Parameter	Location:	Inf–E–1	Inf–E–2	Inf–E	Inf–M	Ef–pond–1	Ef–pond–2	Ef–E–1 & Ef–E–3	Ef–E–2 & Ef–E–4	Ef–E	Ef–M	Out–E
	Type:	grab	grab	comp	grab	grab	grab	grab	grab	comp	grab	grab
	Date:	09/21	09/21	09/21–2	09/22	09/21	09/21	09/21	09/21	09/21–2	09/22	09/22
	Time:	0935	1710	@	0915	1040	1045	1010	1725	@	1048	1115
	Lab Log #:	398130	398131	398132	398133	398134	398135	398136 & 398138	398137 & 398139	398140	398141	398142
GENERAL CHEMISTRY												
Conductivity		E	E	E	E	E	E	E	E	E	E	E
Alkalinity				E	E					E	E	E
Hardness				E	E					E	E	E
SOLIDS–4												
TS				E						E		
TNVS				E						E		
TSS		E	E	EM	EM	E	E	E	E	EM	EM	E
TNVSS				E						E		
% Solids												
% Volatile Solids												
OXYGEN DEMAND PARAMETERS												
BOD5				EM	EM					EM	EM	
COD				E	E					E	E	
TOC (water)		E	E	E	E	E	E	E	E	E	E	E
TOC (soil/sed)												
NUTRIENTS												
Total Kjeldahl N												
NH3–N				E	E			E	E	E	E	E
NO2+NO3–N				E	E			E	E	E	E	E
Total–P				E	E			E	E	E	E	E
MISCELLANEOUS												
Oil and Grease (water)		E	E					E	E			
F–Coliform MF								EM	EM			E
F–Coliform (soil/sed)												
ORGANICS												
VOC (soil/sed)												
BNAs (soil/sed)												
METALS												
PP Metals (water)				E						E		
PP Metals (soil/sed)												
FIELD OBSERVATIONS												
Temperature		E	E			E	E	E	E			E
Temp–cooled*+				E	E					E	E	
pH		E	E	E	E	E	E	E	E	E	E	E
Conductivity		E	E	E	E	E	E	E	E	E	E	E
Chlorine								E				E

E	Ecology analysis	Out	Outfall into channel which flows to Deep Creek
M	Medical Lake analysis	Pond–1	Lagoon #1 effluent
Inf	Influent sample	Pond–2	Lagoon #2 effluent
Ef	Effluent sample	@	24–hour composite sample period: 07:00–07:00
grab	Grab sample	*+	Refrigerated sample
comp	Composite sample		
grab/composite	Grab –composite sample		

Appendix B – Sample Schedule – Medical Lake Class II Inspection, 1993

Parameter II	Location	Sludge–2	Sludge–3	Matrix–1	Matrix–2	Matrix–3	Sludge–12	Duplicate
	Type:	grab/comp	grab/comp	grab	grab	grab	grab/comp	comp
	Date:	09/21	09/21	09/21	09/21	09/21	09/21	09/21–22
	Time:	1130	1330	1415	1430	1450	1520	@
	Lab Log #:	398143	398144	398145	398146	398147	398148	398149
GENERAL CHEMISTRY								
Conductivity								E
Alkalinity								E
Hardness								E
SOLIDS–4								
TS								E
TNVS								E
TSS								E
TNVSS								E
% Solids		E	E	E	E	E	E	
% Volatile Solids		E	E	E	E	E	E	
OXYGEN DEMAND PARAMETERS								
BOD5								E
COD								E
TOC (water)								E
TOC (soil/sed)		E	E	E	E	E	E	
NUTRIENTS								
Total Kjeldahl N		E	E	E	E	E	E	
NH3–N		E	E	E	E	E	E	E
NO2+NO3–N		E	E	E	E	E	E	E
Total–P		E	E	E	E	E	E	E
MISCELLANEOUS								
Oil and Grease (water)								
F–Coliform MF								
F–Coliform (soil/sed)		E	E	E	E	E	E	
ORGANICS								
VOC (soil/sed)							E	
BNAs (soil/sed)							E	
METALS								
PP Metals (water)								E
PP Metals (soil/sed)		E	E	E	E	E	E	
FIELD OBSERVATIONS								
Temperature								E
Temp–cooled*+								
pH								E
Conductivity								E
Chlorine								

Sludge 2	Sludge composite sample from Lagoon #2	Duplicate	Duplicate of previous sample for blind analysis
Sludge 3	Sludge composite sample from Lagoon #3	grab	Grab sample
Matrix	Sludge samples from a matrix in pond #1	comp	Composite sample
Sludge–123	Composite sludge sample from all three lagoons	@	24–hour composite sample period: 07:00–07:00
grab/composite	Grab –composite sample		
*+	Refrigerated sample		

Appendix C – Analytic Methods – Medical Lake, 1993

PARAMETER	MANCHESTER_METHODS	LAB USED
GENERAL CHEMISTRY		
Conductivity	EPA, Revised 1983: 120.1	Ecology
Alkalinity	EPA, Revised 1983: 310.1	Ecology
Hardness	EPA, Revised 1983: 130.2	Ecology
SOLIDS–4		
TS	EPA, Revised 1983: 160.3	Ecology
TNVS	EPA, Revised 1983: 160.3	Ecology
TSS	EPA, Revised 1983: 160.2	Ecology
TNVSS	EPA, Revised 1983: 160.2	Ecology
% Solids	APHA, 1989: 2540G.	Ecology
% Volatile Solids	EPA, Revised 1983: 160.4	Ecology
OXYGEN DEMAND PARAMETERS		
BOD5	EPA, Revised 1983: 405.1	Ecology
COD	EPA, Revised 1983: 410.1	Analytical Resources, Inc.
TOC (water)	EPA, Revised 1983: 415.1	Analytical Resources, Inc.
TOC (soil/sed)	EPA, Revised 1983: 415.1	Analytical Resources, Inc.
NUTRIENTS		
Total Kjeldahl N	EPA, Revised 1983: 351.3	Analytical Resources, Inc.
NH3–N	EPA, Revised 1983: 350.1	Analytical Resources, Inc.
NO2+NO3–N	EPA, Revised 1983: 353.2	Analytical Resources, Inc.
Total–P	EPA, Revised 1983: 365.3	Analytical Resources, Inc.
MISCELLANEOUS		
Oil and Grease (water)	EPA, Revised 1983: 413.1	Ecology
F–Coliform MF	APHA, 1989: 9222D.	Ecology
F–Coliform (soil/sed)	APHA, 1989: 9221A.	Ecology
ORGANICS		
VOC (soil/sed)	EPA, 1986: 8240	Analytical Resources, Inc.
BNAs (soil/sed)	EPA, 1986: 8270	Analytical Resources, Inc.
METALS		
PP Metals (water)	EPA, Revised 1983: 200–299	Ecology
PP Metals (soil/sed)	EPA, Revised 1983: 200–299	Ecology

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Appendix D - Medical Lake Class II Inspection, 1993

Priority Pollutant Metal Cleaning Procedures for Wastewater Collection Equipment.

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO3 solution
4. Rinse three (3) times with distilled/deionized water
5. Allow to dry and seal with aluminum foil

Priority Pollutant Cleaning Procedures for Sludge Collection Equipment.

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO3 solution
4. Rinse three (3) times with distilled/deionized water
5. Rinse with high purity methylene chloride
6. Rinse with high purity acetone
7. Allow to dry and seal with aluminum foil

Specific QA/QC concerns

1. Water sample Procedural blanks detected the presence of arsenic and copper. The laboratory qualified these data with the "B" qualifier to indicate blank contamination when sample levels are less than ten times blank levels.

2. Sludge sample spike recoveries for antimony and thallium were outside of the CLP accepted limits. Antimony also exhibited a Relative Percent Difference (RPD) for precision and a Laboratory Control Sample (LCS) analysis outside the acceptable limits. Results for these elements are qualified with "N" or "J" depending on the severity of interferences found.

3. Semi-volatiles were extracted eight days past the SW-846 recommended holding times, but were analyzed within the 40 day extraction holding time. Detected results have been qualified with a "J" and non-detected analytes with a "UJ".

4. Semi-volatile analyses found matrix spike recovery for two compounds exceeded advisory QC limits. Results have already been qualified by "J" for holding time violations.

5. During the analyses of solids Manchester laboratory experienced a spill of phenol in their weighing room. This precluded the use of that room for weighing samples and weighing was done in a room without regulated humidity. This may have allowed some absorption of moisture during the weighing, slightly compromising the results. Consequently the lab has qualified all solids results with the "J" qualifier indicating that they are an estimate.

Appendix E - VOA and BNA Scan Results - Medical Lake, 1993.

Parameters	Location:	Sludge-123
	Type:	grab/comp
	Date:	09/21
	Time:	1520
	Lab Log#:	398148
VOA Compounds		ug/Kg-dry wt.
Chloromethane		32 U
Bromomethane		32 U
Vinyl Chloride		32 U
Chloroethane		32 U
Methylene Chloride		32 U
Acetone		94
Carbon Disulfide		72
1,1-Dichloroethene		16 U
1,1-Dichloroethane		16 U
trans-1,2-Dichloroethene		16 U
cis-1,2-Dichloroethene		16 U
Chloroform		16 U
1,2-Dichloroethane		16 U
2-Butanone (MEK)		81 U
1,1,1-Trichloroethane		16 U
Carbon Tetrachloride		16 U
Vinyl Acetate		16 U
Bromodichloromethane		16 U
1,2-Dichloropropane		16 U
cis-1,3-Dichloropropene		16 U
Trichloroethene		16 U
Dibromochloromethane		16 U
1,1,2-Trichloroethane		16 U
Benzene		20
trans-1,3-Dichloropropene		16 U
2-Chloroethylvinyl Ether		16 U
Bromoform		16 U
4-Methyl-2-Pentanone (MIBK)		81 U
2-Hexanone		81 U
Tetrachloroethene		16 U
1,1,2,2-Tetrachloroethane		16 U
Toluene		22
Chlorobenzene		16 U
Ethylbenzene		16 U
Styrene		16 U
Total Xylenes		16 J
Trichlorofluoromethane		32 U
1,1,2-Trichlorotrifluoroethane		32 U

U	The analyte was not detected at or above the reported result.
J	The analyte was positively identified. The associated numerical result is an estimate.
Sludge-123	Composite grab sample from each of the three lagoons.
grab/comp	Grab composite sample
	Detected Parameters

Appendix E - VOA and BNA Scan Results - Medical Lake, 1993.

Parameters	Location:	Sludge-123
	Type:	grab/comp
	Date:	09/21
	Time:	1520
	Lab Log#:	398148
BNA Compounds		ug/Kg-dry wt.
Phenol		13,000 UJ
Bis(2-Chloroethyl)Ether		13,000 UJ
2-Chlorophenol		13,000 UJ
1,3-Dichlorobenzene		13,000 UJ
1,4-Dichlorobenzene		13,000 UJ
Benzyl Alcohol		33,000 UJ
1,2-Dichlorobenzene		13,000 UJ
2-Methylphenol		13,000 UJ
Bis(2-Chloroisopropyl)Ether		13,000 UJ
4-Methylphenol		13,000 UJ
N-Nitroso-di-n-Propylamine		13,000 UJ
Hexachloroethane		13,000 UJ
Nitrobenzene		13,000 UJ
Isophorone		13,000 UJ
2-Nitrophenol		33,000 UJ
2,4-Dimethylphenol		13,000 UJ
Benzoic Acid		67,000 UJ
Bis(2-Chloroethoxy)Methane		13,000 UJ
2,4-Dichlorophenol		20,000 UJ
1,2,4-Trichlorobenzene		13,000 UJ
Naphthalene		13,000 UJ
4-Chloroaniline		20,000 UJ
Hexachlorobutadiene		13,000 UJ
4-Chloro-3-Methylphenol		13,000 UJ
2-Methylnaphthalene		13,000 UJ
Hexachlorocyclopentadiene		33,000 UJ
2,4,6-Trichlorophenol		33,000 UJ
2,4,5-Trichlorophenol		33,000 UJ
2-Chloronaphthalene		13,000 UJ
2-Nitroaniline		33,000 UJ
Dimethyl Phthalate		13,000 UJ
Acenaphthylene		13,000 UJ
3-Nitroaniline		33,000 UJ
Acenaphthene		13,000 UJ
2,4-Dinitrophenol		67,000 UJ
4-Nitrophenol		67,000 UJ
Dibenzofuran		13,000 UJ
2,6-Dinitrotoluene		33,000 UJ
2,4-Dinitrotoluene		33,000 UJ
Diethyl Phthalate		33,000 UJ

U	The analyte was not detected at or above the reported result.
J	The analyte was positively identified. The associated numerical result is an estimate.
Sludge-123	Composite grab sample from each of the three lagoons.
grab/comp	Grab composite sample

Appendix E - VOA and BNA Scan Results - Medical Lake, 1993.

Parameters	Location:	Sludge-123
	Type:	grab/comp
	Date:	09/21
	Time:	1520
	Lab Log#:	398148
BNA Compounds		ug/Kg-dry wt.
4-Chlorophenyl Phenylether		13,000 UJ
Fluorene		13,000 UJ
4-Nitroaniline		33,000 UJ
4,6-Dinitro-2-Methylphenol		67,000 UJ
N-Nitrosodiphenylamine		13,000 UJ
4-Bromophenyl Phenylether		13,000 UJ
Hexachlorobenzene		13,000 UJ
Pentachlorophenol		33,000 UJ
Phenanthrene		13,000 UJ
Carbazole		13,000 UJ
Anthracene		13,000 UJ
Di-n-Butyl Phthalate		13,000 UJ
Fluoranthene		13,000 UJ
Pyrene		13,000 UJ
Butylbenzyl Phthalate		13,000 UJ
3,3'-Dichlorobenzidine		33,000 UJ
Benzo(a)Anthracene		13,000 UJ
Bis(2-Ethylhexyl)Phthalate		12,000 J
Chrysene		13,000 UJ
Di-n-Octyl Phthalate		13,000 UJ
Benzo(b)Fluoranthene		13,000 UJ
Benzo(k)Fluoranthene		13,000 UJ
Benzo(a)Pyrene		13,000 UJ
Indeno(1,2,3-cd)Pyrene		13,000 UJ
Dibenzo(a,h)Anthracene		13,000 UJ
Benzo(g,h,i)Perylene		13,000 UJ

U	The analyte was not detected at or above the reported result.
J	The analyte was positively identified. The associated numerical result is an estimate.
Sludge-123	Composite grab sample from each of the three lagoons.
grab/comp	Grab composite sample
	Detected Parameters

Appendix F - Metals Scan Results - Medical Lake, 1993

Parameters	Location	Inf-E	Ef-E	Duplicate	Sludge-2	Sludge-3	Matrix-1	Matrix-2	Matrix-3	Sludge-123
	Type:	comp	comp	comp	grab/comp	grab/comp	grab	grab	grab	grab/comp
	Date:	09/21-22	09/21-22	09/21-22	09/21	09/21	09/21	09/21	09/21	09/21
	Time:	@	@	@	1130	1330	1415	1430	1450	1520
	Lab Log#	398132	398140	398149	398143	398144	398145	398146	398147	398148
		ug/L	ug/L	ug/L	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.	mg/Kg-dry wt.
Metals										
Antimony		30 U	30 U	30 U	3 U	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
Arsenic		2.2 PB	2.6 PB	1.5 PB	4.17	3.29	4.68	4.96	4.07	3.77
Beryllium		1 U	1 U	1 U	0.28 P	0.30 P	0.36 P	0.37 P	0.34 P	0.26 P
Cadmium		0.82 P	0.10 U	0.10 U	4.62	1.7 P	3.44	4.35	3.03	4.59
Chromium		5 U	5 U	5 U	13.6	11.2	15	15.7	14.4	17.7
Copper		43.3	7.6 PB	11 PB	249	125	179	213	149	228
Lead		3.9 P	1.0 U	1.0 U	50.1	21.8	67.2	88.5	58.5	47.3
Mercury		0.37 P	0.051 U	0.05 U	3.09 P	0.443 P	1.20	1.02	0.994	2.98 P
Nickel		10 U	10 U	10 U	11	12	12	12.7	11.1	14.2
Selenium		2.0 U	3.6 P	2.0 U	3.1 P	1.4 P	2.0 P	2.1 P	1.4 P	2.6 P
Silver		0.50 U	0.50 U	0.50 U	7.36	2 P	2.3 P	3.14	1.5 P	6.5
Thallium		2.5 U	2.5 U	2.5 U	0.50 UN	0.50 UN	0.05 UN	0.50 UN	0.05 UN	0.05 UN
Zinc		84.9	4.7	4 U	496	221	444	542	401	459

@	Composite sample period: 07:00-07:00
Inf	Influent Sample
Ef	Effluent Sample
E	Ecology Sample
Sludge-2	Sediment sample from lagoon #2
Sludge-3	Sediment sample from lagoon #3
Matrix	Composite sediment sample from lagoon #1
Sludge-123	Combined sediment samples from lagoons 1, 2, & 3.
Duplicate	Blind duplicate of EF-E sample

B	Analytes was found in the analytical methods blank, indicating the sample may have been contaminated.
J	The analyte was positively identified. The associated numerical result is an estimate.
N	The spike sample recovery was not within control limits.
P	The analyte was detected above the instrument detection level, but below the established minimum quantitation limits.
U	The analyte was not detected at or above the reported result
UJ	The analyte was not detected at or above the reported estimated result.
	Detected parameters

Appendix G - Tentatively Identified Compounds - Medical Lake, 1993

Sample Location: Sludge-123
Type: grab/comp
Date: 9/21/93
Time: 1520
Sample ID: 398148

Volatile Organics:

Compound Name	Estimated Concentration (µg/Kg-dry wt.)	Qualifier
1. Unknown (b.p. m/e 207)	110	J
2. Silane Isomer (b.p. m/e 281)	150	JN
3. Unknown Hydrocarbon (b.p. m/e 57)	260	JN
4. Unknown Hydrocarbon (b.p. m/e 57)	440	JN
5. 7-Dimethyl-Undecane C13.H28 (b.p. m/e 57)	480	JN
6. Unknown Hydrocarbon (b.p. m/e 57)	710	JN
7. 1-Methyl-4-(1-Methylethenyl)-Cyclohexene C10.H16	290	JN
8. 8-Dimethyl-Undecane C13.H28 (b.p. m/e 57)	130	JN
9. Unknown Hydrocarbon (b.p. m/e 57)	270	JN
10. Trimethyl-Dodecane (b.p. m/e 57)	480	JN

Sample Location: Sludge-123
Type: grab/comp
Date: 9/21/93
Time: 1520
Sample ID: 398148

BNAs:

Compound Name	Estimated Concentration (µg/Kg-dry wt.)	Qualifier
1. 2,7,10-Trimethyl-Dodecane (b.p. m/e 57)	34000	JN
2. Unknown Hydrocarbon (b.p. m/e 57)	22000	JN
3. Unknown Hydrocarbon (b.p. m/e 69)	20000	JN
4. Unknown (b.p. m/e 69)	41000	J
5. Unknown (b.p. m/e 55)	100000	J
6. Unknown (b.p. m/e 43)	140000	J
7. Unknown (b.p. m/e 231)	39000	J
8. Unknown (b.p. m/e 43)	14000	J
9. Unknown (b.p. m/e 43)	15000	J
10. Unknown (b.p. m/e 43)	37000	J
11. Unknown (b.p. m/e 43)	39000	J
12. Unknown (b.p. m/e 43)	28000	J
13. 3,3-Thiobis-,Didodecyl Ester Propanoic Acid	340000	J

J The analyte was positively identified. The associated numerical result is an estimate.
JN The analyte was tentatively identified. The associated numerical result is an estimate

Appendix H - GLOSSARY

ABN	Acid base-neutral, semivolatile organics, see BNA
AED	Atomic Emission Detector
BNA	Base-neutral acids, semivolatiles, see ABN
BOD	Biological Oxygen Demand
CLP	Contract Laboratory Program
COD	Chemical Oxygen Demand
co-elutants	When two or more compounds have the same chromatographic retention time
CVAA	Cold Vapor Atomic Absorption
d-deuterium	An isotope of hydrogen
DL	Detection Limit
DOC	Dissolved Organic Carbon
DW	Dangerous Waste
ECD	Electron Capture Detector-Sensitive to halogen compounds - use: halogenated hydrocarbons
EHW	Extremely Hazardous Waste
ELD	Electrolytic Detector - Hall
EP TOX	Extraction Procedure Toxicity
Fatty Acid	Monobasic organic acids derived from hydrocarbons; include both saturated and unsaturated acids
FID	Flame Ionization Detector-Sensitive to carbon compounds, used in the determination of hydrocarbons
Flash Point	Minimum temperature that will enable combustion or explosions to take place
FTIR	Fourier Transform Infra-Red
GC	Gas Chromatography
GCMS	Gas Chromatography Mass Spectrometry, also GC/MS
HC	Hydrocarbon
HDPE	High Density Polyethylene
HH	Halogenated Hydrocarbon
HPLC	High Performance Liquid Chromatography
HSD	Halogen-Specific Detector - use: halogenated hydrocarbons
HW	Hazardous Waste
HWPAH	Hazardous Waste Polynuclear Aromatic Hydrocarbon
ICP	Inductively Coupled Plasma
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
IDL	Instrument Detection Limit
isomer	One of two or more substances which have the same elementary composition but differ in structure and hence in properties
isotope	One of two or more nuclides having the same atomic number, but differing in mass number

Isotopically labelled	The substitution of one or more isotopes for elements in a compound
kg	kilogram (1 X 10^3 grams)
L	Liter (1 X 10^3 milliliters)
LC50	Concentration which is lethal to 50% of the test organisms
LOD	Limit of Detection
LOEC	Lowest Observable Effect Concentration
m^3	Cubic meter (1 X 10^3 liters)
MBAS	Methylene Blue Active substances
metalloids	Elements that exhibit transitional characteristics between metals and non-metals, examples include silver, selenium, antimony
MF	Membrane Filter
mg	milligram (1 X 10^{-3} grams)
mL	Milliliter (1 X 10^{-3} liters)
MPN	Most Probable Number
ng	Nanogram (1 X 10^{-9} grams)
nm	Nanometer (1 X 10^{-9} meters)
NOEC	No Observable Effect Concentration
NPDES	National Pollution Discharge Elimination System
NPOC	Non-Purgeable Organic Carbon
NTU	Nephelometric Turbidity Unit
OSHA	Occupation Safety and Health Administration
OSW	Office of Solid Waste
PCB	Polychlorinated Biphenyl
PE	Polyethylene
pg	Picogram (1 X 10^{-12} grams)
pH	Hydrogen Ion Concentration
PID	Photoionization Detector - use: aromatic hydrocarbons
PLM	Polarized Light Microscopy
POC	Purgeable Organic Carbon
Polyvalent	Capable of having more than one valance state
PP	Priority Pollutant
ppb	Parts per billion (1 X 10^{-9} ug/L or ug/kg)
ppm	Parts per million (1 X 10^{-6} ug/L or ug/kg)
ppt	Parts per thousand (1 X 10^{-3} ug/L or ug/kg)
PQL	Practical Quantitation Limit
PUF	Polyurethane Foam
SDWA	State Drinking Water Act
SOW	Statement of Work
SW	Solid Waste

TC	Target Compounds or Total Carbon
TCD	Thermal Conductivity Detector
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TIC	Total Inorganic Carbon or for GCMS Tentatively Identified Compound
TNVS	Total Non-Volatile Solids
TNVSS	Total Non-Volatile Suspended Solids
TOC	Total Organic Carbon
TP	Total Phosphorous
TPH	Total Petroleum Hydrocarbons
TS	Total Solids
TSS	Total Suspended Solids
TVS	Total Volatile Solids
ug	Microgram (1×10^{-6} grams)
ug/m^3	Microgram per cubic meter
VOA	Volatile Organic Analysis
VOC	Volatile Organic Carbon
ZHE	Zero Headspace Extractor