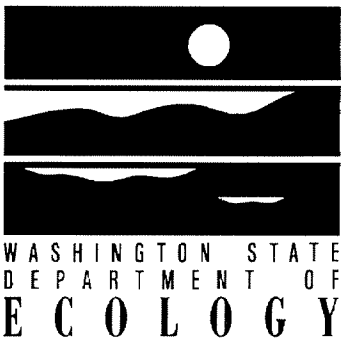

CITY OF TEKOA, WASTEWATER TREATMENT PLANT CLASS II INSPECTION, AUGUST 31 - SEPTEMBER 1, 1993

Water Body No. WA-56-1010
94-33

March 1994

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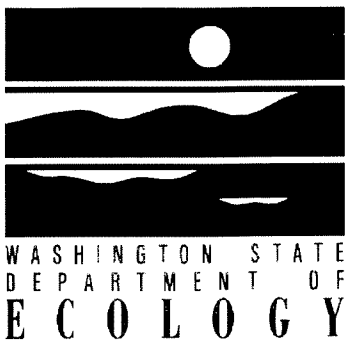

CITY OF TEKOA, WASTEWATER TREATMENT PLANT CLASS II INSPECTION, AUGUST 31 - SEPTEMBER 1, 1993

By
Paul Stasch

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

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ABSTRACT

A Class II Inspection was conducted on August 31 and September 1, 1993, at the City of Tekoa Wastewater Treatment Plant in Whitman County, Washington. The Tekoa facility is an activated sludge plant which discharges treated and disinfected effluent into upper Hangman Creek. The inspection data found the Tekoa facility was producing a high quality effluent. Effluent concentrations were all within the NPDES permit limitations. Effluent priority pollutant metal concentrations were all less than the EPA Water Quality Criteria for fresh waters.

INTRODUCTION

A Class II Inspection was conducted at the City of Tekoa Wastewater Treatment Plant (facility) on August 31 and September 1, 1993. The inspection was conducted by Paul Stasch of the Toxics, Compliance and Ground Water Investigations Section of the Environmental Investigations and Laboratory Services Program (EILS) of the Washington State Department of Ecology (Ecology). Mr. David Tysz, the facility operator, represented the City of Tekoa (Tekoa) and provided assistance onsite. Don Nichols of the Ecology Eastern Regional Office requested the inspection.

The facility is located approximately 40 miles southeast of Spokane in the Palouse agricultural area (Figure 1). The facility is a secondary (modified activated sludge) treatment plant, treating the wastewater from roughly 850 people. It was converted from a trickling filter system in 1974. Incoming sewage is pumped to the headworks from a wet well. Over the years, inadequate headworks, hydraulic overloading of the aeration basin due to excessive inflow and infiltration (I/I), and other system deficiencies reduced the reliability of the system to meet its NPDES permit effluent limitations (Nichols, and Tysz, personal communication). Some I/I problems were corrected following the City's compliance with an administrative order issued by the Ecology Eastern Regional Office in 1983. However, further modifications were required to assure compliance with the permit.

The City applied for and received a Washington State Centennial Clean Water grant to fund a system upgrade. The grant was awarded to Tekoa in 1988. Construction was completed in November 1990. The upgrade included repairing and recoating concrete in the basins, installing flow measuring devices, rewiring the plant, constructing a new lift station and sludge drying beds, adding a dechlorination system and replacing the bar screen and comminutor with static wedgewire (hydro) screens. The flow schematic is depicted on Figure 2.

The facility discharges wastewater into upper Hangman (Latah) Creek under the provisions of NPDES Permit No. WA-002314-1 (Figure 1). The permit was issued on December 22, 1988, and expired on December 22, 1993. Hangman Creek is a small, slow-moving stream (except during peak runoff conditions) which enters Washington from the State of Idaho and flows through the northern section of the Palouse before turning north to join the Spokane River. Little Hangman Creek flows into Hangman Creek about 0.4 miles upstream of where the facility's discharge enters. The effluent discharges directly onto the south bank of the creek before joining the receiving water. There is no diffuser. Intensive dry land farming occurs throughout the majority of the watershed. Cattle grazing is common in the riparian zone. The creek is designated Class A (Excellent) under Chapter 173-201A of the Washington Administrative Code (WAC). Biosolids (sewage sludge) are applied to agricultural lands adjacent to the facility.

The facility has had a history of operational difficulties. As a result, it has received extensive regulatory attention from Ecology. Class I Inspections were conducted by the

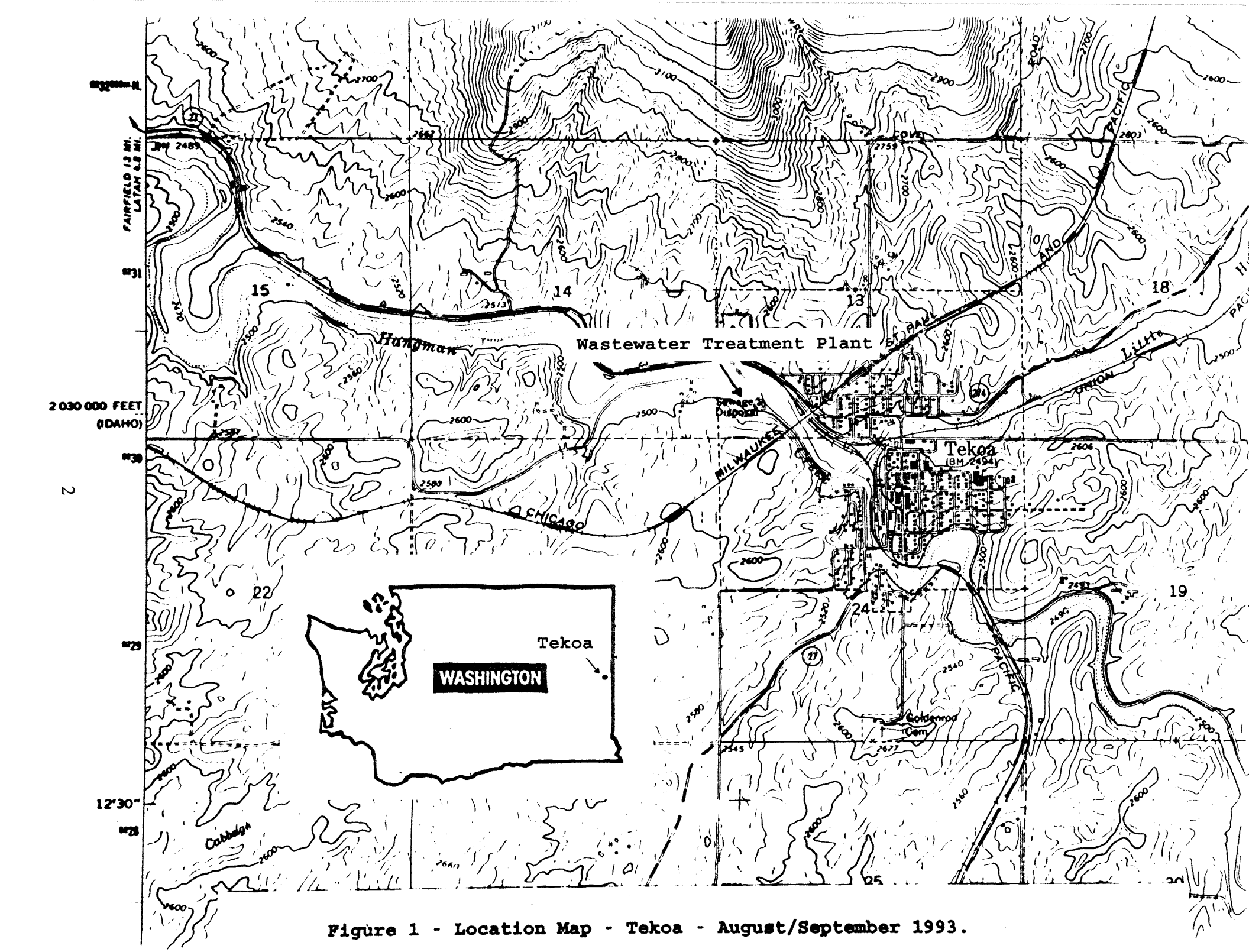

Figure 1 - Location Map - Tekoa - August/September 1993.

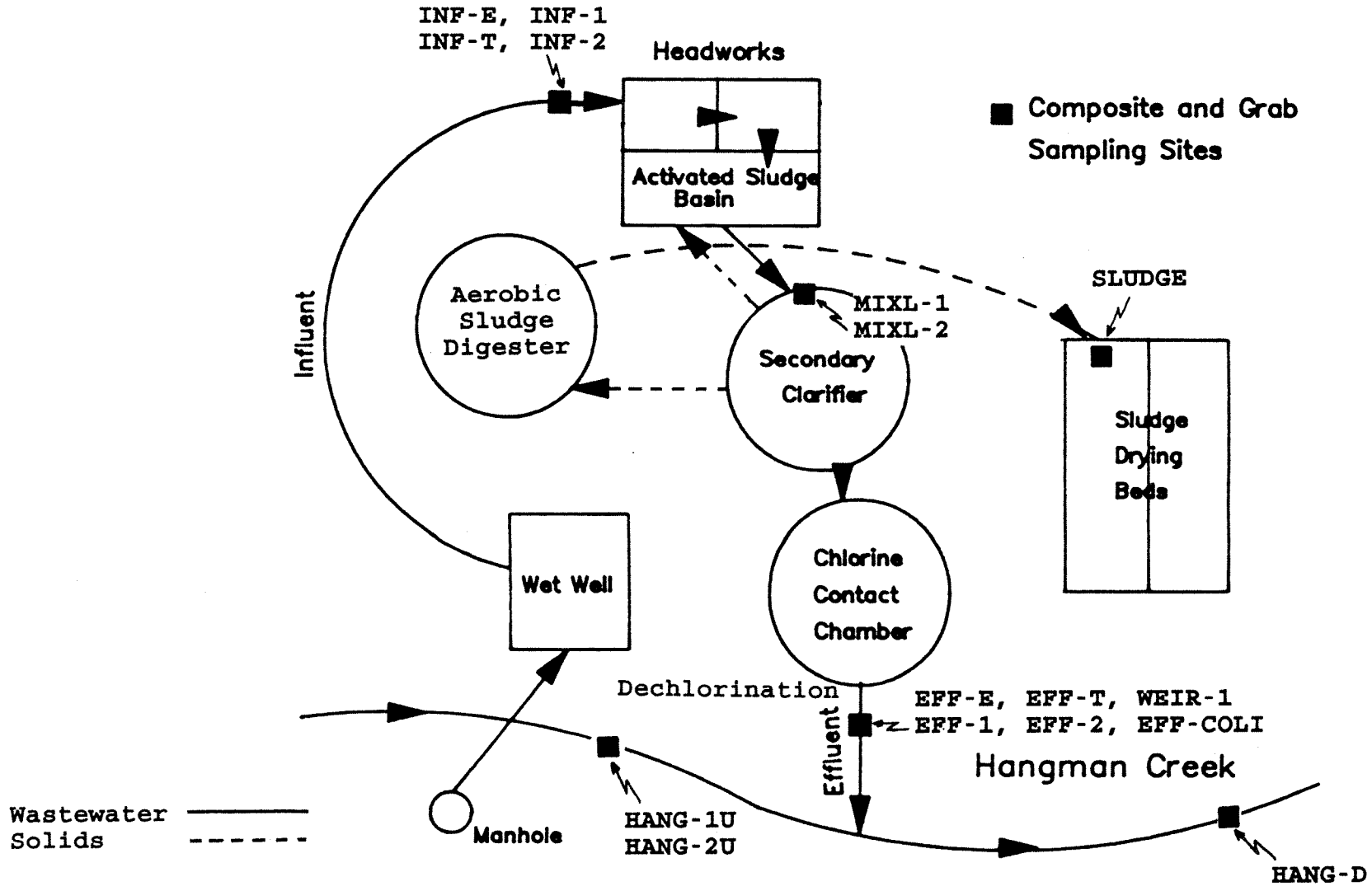

Figure 2 - Flow Schematic - Tekoa - August/September 1993

Eastern Regional Office on September 11, 1990; March 27, 1991; October 3, 1991; September 23, 1992; November 10, 1992; and April 2, 1993. Class II Inspections have occurred December 19-20, 1978 (Yake, 1979) and August 30-31, 1988 (Carey, 1989).

The specific objectives of this inspection were to:

1. verify compliance with the NPDES permit effluent limitations,

2. support the NPDES permit renewal process,

3. characterize wastewater toxicity with metals scans,

4. analyze the receiving water for background parameters, and

5. support the certification of the completion of the facility upgrade.

PROCEDURES

Ecology collected grab and composite samples from several locations within the facility. Sampling locations are identified on Figure 2 and described on Table 1. The sampling dates and parameters analyzed for are provided in Appendix A. The laboratories conducting the analyses are identified in Appendix B.

Two composite samples were collected. An influent composite sample was collected upstream of the screening equipment. Initially, the sampler intake hose was positioned downstream of the influent screens. However, after approximately two hours it was determined that a sufficient sample volume could not be collected at this point due to the intermittent pumping cycles of the wet well pumps. The sample location was moved upstream of the screens into a reservoir portion of the the unit. An effluent composite sample was collected immediately upstream from the 90°V-notched weir and after dechlorination. A blind duplicate of the effluent composite sample was also submitted to the laboratory. Ecology used Isco automated composite samplers which collected equal volumes of sample every 30 minutes for 24 hours. The compositors were iced to cool the collected sample to the desired 4°C.

The facility operator also collected influent and effluent composite samples. These samples were hand-composited from 150 milliliters of sample collected eight times on August 31, 1993, and two times on September 1, 1993, which correlated roughly with the Ecology sampling interval. The sub-samples were refrigerated during the collection period.

Ecology grab samples were collected at the composite sampling locations, at the sludge drying beds, of the mixed liquor entering the secondary clarifier, and from both upstream and downstream locations along the southern bank of Hangman Creek.

Table 1 - Sample Station Locations - Tekoa - August/September 1993.

Influent Wastewater (INF-E, INF-1, INF-2) - samples collected from the upstream side of the wedgewire screen at the headworks of the facility.

Influent Wastewater (INF-T) - sample collected from the downstream side of the wedgewire screen at the headworks of the facility.

Mixed Liquor (MIXL-1, MIXL-2) - samples collected at the influent to the secondary clarifier.

Effluent Wastewater (EFF-E, EFF-T, EFF-1, EFF-2, EFF-COLI, WEIR-1) - samples collected downstream of the SO_2 dechlorination system.

Sludge - sample collected from the sludge drying beds.

Upstream Hangman Creek (HANG-1U, HANG-2U) - samples collected on the south side of the creek, approximately 50 feet upstream of the facility outfall.

Downstream Hangman Creek (HANG-D) - sample collected on the south side of the creek, immediately downstream of the county road bridge and approximately 1000 feet downstream of the facility outfall.

Ecology and Tekoa samples were split for analysis by the Ecology Manchester Laboratory to evaluate Tekoa's sampling and analytical procedures. It should be noted that the Tekoa influent grab-composite sample was collected downstream of the influent screens while the Ecology composite sample was upstream of the screens. It should also be noted that Mr. Tysz did not collect enough additional sample for Ecology to analyze for all parameters desired. Tekoa only analyzed splits of the Ecology composite samples for the parameters BOD_5 and TSS. The Tekoa laboratory is not accredited by Ecology's Quality Assurance Section.

RESULTS AND DISCUSSION

Flow Measurements

Flows are measured and recorded at the facility with a Milltronics ultrasonic flow meter. Head readings are recorded on a disc chart. The head readings are then converted to flow and recorded electronically by the integrated computer within the Milltronics unit. The totalized flows are provided on demand to the operator for reporting on the Monthly Discharge Monitoring Reports.

The head readings recorded were verified against the depth gauge mounted in the effluent discharge chamber upstream of the 90°V-notched weir. No discrepancies were noted. Flow measurements were attempted. However, it was discovered that the weir plate may not be perpendicular to the floor of the effluent discharge chamber, rendering measurements inaccurate. It appears that it is tilted slightly upstream.

Quality Assurance/Quality Control

All the samples were received by the Manchester Laboratory in good condition with chain-of-custody tracking maintained. All samples were analyzed within the USEPA Contract Laboratory Program (CLP) or method holding times.

The continuing calibration blanks for copper were above the instrument detection limit, so copper results less than 10 times the instrument detection limit are qualified with a "J," denoting estimated values.

The procedural blanks associated with these metal samples showed no analytically significant levels of analytes, with the exception of copper.

The dissolved oxygen reductions for both the WEIR-1 and EFF-E BOD_5 samples was below the required range. Hence, the BOD_5 results for these samples are below the reporting limit of 6 mg/L, and have been qualified with a "J." The TOC result for sample SLUDGE exceeded the highest calibration standard available, and has been qualified with a "J."

A comparison of the analytical results of EFF-E to those of the blind duplicate WEIR-1 demonstrated close agreement between samples (Table 2). The results for TSS, TNVSS, BOD_5, COD, NO_2+NO_3-N and Total-P were identical or virtually identical. The results for TS showed the greatest variability but yielded a relative percent difference of only 5.4%.

All sampling equipment used to collect a sample for metals analyses received careful priority pollutant cleaning appropriate for such collection. The effluent composite sampler and the sample container were thoroughly washed with phosphorus free Liquinox soap, rinsed with tap water, rinsed with a 10% nitric acid solution and rinsed three times with deionized water.

The data generated by the analyses of these samples is considered reliable and can be used noting the data qualifications identified above.

General Chemistry

BOD_5, solids and nutrients data reveal the Tekoa influent to be typical of weak domestic wastewater (Metcalf and Eddy, 1991). Only the Total-P concentration was detected in the moderate strength range. Table 2 documents the influent concentrations of these parameters.

BOD_5, COD, TOC, TSS, nutrients and oil and grease concentrations were all reduced substantially through the facility. The NH_3-N concentration was reduced across the plant by nearly 98% while the NO_2+NO_3-N concentration increased by greater than three-fold. Thus, nitrification was occurring at the facility.

Total inorganic nitrogen (NH_3-N, NO_2+NO_3-N) removal through the treatment process was approximately 75%. Total phosphorus removal was 85%. Total residual chlorine field screening, using a La Motte DPD test kit, yielded results less than the detection limit of 0.1 mg/L in all three grab samples. Fecal coliform bacteria were detected in low numbers in the effluent grab samples. All three sample results were less than 50 colonies per 100 mLs of effluent. Therefore, it is reasonable to conclude that the chlorine concentration was sufficient to disinfect the effluent while the dechlorination system adequately removes the residual chlorine from solution. Table 2 documents the concentrations of effluent parameters.

The treatment plant removed high percentages of BOD_5 and TSS, and produced a highly nitrified effluent. The dissolved oxygen content of the effluent was also relatively high (7.6 mg/L). Investigations by both Yake (1979) and Carey (1989) documented similar findings.

NPDES Permit Compliance

Tekoa's compliance with their NPDES permit was very good at the time of the inspection (Table 3). The Ecology results for BOD_5 and TSS concentrations were well below those specified in the permit. The BOD_5 and TSS concentrations were approximately 10% of the

Table 2 – General Chemistry Results – Tekoa – August/September 1993.

Parameter	Location:	INF-E	INF-T	INF-1	INF-2	MIXL-1	MIXL-2	EFF-E	WEIR-1	EFF-T
	Type:	comp	comp	grab	grab	grab	grab	comp	comp	comp
	Date:	8/31-9/1	8/31-9/1	8/31/93	8/31/93	8/31/93	8/31/93	8/31-9/1	8/31-9/1	8/31-9/1
	Time:	@	@	0940	1320	1115	1345	#	#	#
	Lab Log #:	368230	368231	368232	368233	368243	368244	368234	368242	368235
GENERAL CHEMISTRY										
Conductivity (umhos/cm)								451		450
Alkalinity (mg/L, CaCO3)		213	228					153		152
Hardness (mg/L, CaCO3)								112		
TS (mg/L)		427	465					344	326	334
TNVS (mg/L)		260	279					255	258	239
TSS (mg/L)		103	103	105	125	5520	5400	3	3	3
TNVSS (mg/L)		36	33			2480	2400	2	2	2
% Solids										
BOD5 (mg/L)		89						2.7 J	2.5 J	
COD (mg/L)		120	140					16	17	17
TOC (mg/L)		36.3	39.8	49.4	41.7			6.8		5.0
TOC (mg/Kg-dr)										
NH3-N (mg/L)		18	11					0.35	0.26	0.29
NO2+NO3-N (mg/L)		1.4	1.1					4.5	4.5	4.5
Total-P (mg/L)		9.3	7.3					1.4	1.3	1.4
Oil and Grease (mg/L)				9 J	21 J					
F-Coliform MF (#/100ml)										
FIELD OBSERVATIONS										
Temperature (C)				18.1	17.2					
Temp-cooled+ (C)		3.4						2.8		
pH (SU)				7.87	8.22					
Chlorine (mg/L)										
	Free									
	Total									
Dissolved Oxygen (mg/L)										

+	Temperature of iced composite samples.
@	Composite sampling interval between 0840-0840 Hours.
#	Composite sampling interval between 0930-0930 Hours.
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.
INF-E	Ecology influent composite sample.
INF-T	Tekoa influent composite sample.
EFF-E	Ecology effluent composite sample.
EFF-T	Tekoa effluent composite sample.
MIXL	Mixed liquior sample.

Table 2 – General Chemistry Results – Tekoa – August/September 1993.

Parameter	Location:	EFF-1	EFF-2	EFF-COLI	SLUDGE	HANG-1U	HANG-2U	HANG-D
	Type:	grab	grab	grab	grab	grab	grab	grab
	Date:	9/1/93	9/1/93	9/1/93	8/31/93	9/1/93	8/31/93	9/1/93
	Time:	0725	0845	0920	1135	0705	1200	0630
	Lab Log #:	368236	368237	368245	368239	368240	368241	368238
GENERAL CHEMISTRY								
Conductivity (umhos/cm)								
Alkalinity (mg/L, CaCO3)						104	101	
Hardness (mg/L, CaCO3)						94	91	
TS (mg/L)								
TNVS (mg/L)								
TSS (mg/L)		3	3					
TNVSS (mg/L)								
% Solids					6			
BOD5 (mg/L)								
COD (mg/L)								
TOC (mg/L)		6.4	5.2			5.2	5.7	5.9
TOC (mg/Kg)					180000 J			
NH3-N (mg/L)						0.04 U	0.04 U	0.11
NO2+NO3-N (mg/L)								
Total-P (mg/L)								
Oil and Grease (mg/L)		1 U	1					
F-Coliform MF (#/100ml)		29	26	46				
FIELD OBSERVATIONS								
Temperature (C)		15.9	16.1			13.1	14.7	13.7
Temp-cooled+								
pH (SU)		7.55	8.07			7.79	8.21	7.93
Chlorine (mg/L)								
	Free	<0.1	<0.1	<0.1				
	Total	<0.1	<0.1	<0.1				
Dissolved Oxygen (mg/L)		7.6				6.4	8.45	6.4

+	Temperature of iced composite samples.
#	Composite sampling interval between 0930-0930 Hours.
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.
WEIR	Blind duplicate of Ecology effluent composite sample.
HANGU	Hangman Creek sample collected upstream of the Tekoa discharge.
HANGD	Hangman Creek sample collected downstream of the Tekoa discharge.
EFF-COLI	Effluent fecal coliform sample.

Table 3 – NPDES Effluent Limitation/Ecology Inspection Data Comparison – Tekoa – August/September 1993.

		NPDES Permit Limitations Monthly Average	Weekly Average	Location:	INF–E	EFF–E	WEIR–1	EFF–1	EFF–2	EFF–Coli
				Type:	Composite	Composite	Composite	grab	grab	grab
				Date:	8/31–9/01	8/31–9/01	8/31–9/01	9/01	9/01	9/01
				Lab Log #:	368230	368234	398242	368236	368237	368245
Flow										
	Dry Weather	0.20 MGD*								
	Wet Weather	0.30 MGD								
5 Day Biochemical Oxygen Demand		30 mg/L 35 lbs/day 85% Removal	45 mg/L 53 lbs/day		89 mg/L	2.7 J mg/L 3.5 lbs/day 97% removal	2.5 J mg/L			
Total Suspended Solids		30 mg/L 50 lbs/day 85% Removal	45 mg/L 75 lbs/day		103 mg/L	3 mg/L 3.9 lbs/day 97% removal	3 mg/L	3 mg/L	3 mg/L	
Fecal Coliform Bacteria		200/100mL	400/100mL					29/100mL	26/100mL	49/100mL
pH		Shall not be outside the range of 6.0 – 9.0						7.6	8.1	

* A flow of 0.155 MGD was taken from the Tekoa meter.
J The analyte was positively identified. The associated numerical result is an estimate.
INF–E Ecology influent composite sample.
EFF–E Ecology effluent composite sample.
WEIR–1 Blind duplicate of the Ecology effluent composite sample.

		NPDES Design Criteria to Prevent Facility Overloading Monthly Average	Inspection Data
Flow			
	Dry Weather	0.20 MGD	0.155 MGD
	Wet Weather	0.30 MGD	
	% of design capacity		78%
Influent BOD5	230 lbs/D		115 lbs/D
	% of design capacity		50%

monthly average concentrations specified in the permit. The BOD_5 and TSS loadings to Hangman Creek were 10% and 7.8% of the monthly average loadings specified in the permit, respectively. Fecal coliform bacteria counts were an order of magnitude less than the monthly average limit specified in the permit. The pH of the discharge was within permit limits. Plant loading was within design criteria for prevention of facility overloading.

Split Sample Analyses

Table 4 presents the results of the Tekoa and Ecology split sample analyses. Composite samples were collected using slightly different methodologies. Ecology used Isco automated composite samplers which collected equal volumes of sample every 30 minutes for 24 hours, while the Tekoa samples were hand-composited from 150 milliliters of sample collected eight times on August 31, 1993, and two times on September 1, 1993.

The Tekoa influent composite samples were also collected from a slightly different location than the Ecology samples. Their influent samples were collected after the wastewater had passed through the static wedgewire (hydro) screen. The Ecology samples were collected from the small basin immediately ahead of the screen.

Additionally, Mr. Tysz, the Tekoa operator, was unable to provide Ecology with enough sample volume for Ecology to analyze for all the parameters desired. This resulted in the absence of Ecology BOD_5 analytical results for the Tekoa sample stations.

A comparison of Ecology analyses between the Ecology and Tekoa sample stations demonstrated reasonably similar samples. One exception was noted: the NH_3-N result for the Ecology influent sample was 7 mg/L greater than the corresponding Tekoa sample. It is unlikely the NH_3-N could be removed from solution by the screen. Despite this exception it is believed the Tekoa sampling methodology yields representative results.

A comparison of analytical results between the Ecology and the Tekoa laboratories demonstrated a substantial difference for influent TSS. The TSS results from both laboratories were consistent at both sample stations, but the Tekoa laboratory reported lower influent values relative to the Ecology results. The Tekoa laboratory influent BOD_5 and effluent fecal coliform results were also notably higher than the Ecology results. However, Tekoa's analysis of effluent TSS and BOD_5 samples more closely approximated Ecology's results. It should be noted that the Tekoa laboratory has not been accredited by Ecology's Laboratory Accreditation Section. By July 1, 1994, the BOD_5 analyses will have to be conducted by an accredited laboratory.

Priority Pollutant Inorganics - Metals Scans

Three priority pollutant metals were present in the effluent: these were arsenic, copper and zinc (Table 5). None exceeded the EPA Water Quality Criteria for chronic freshwater exposures (USEPA, 1986).

Table 4 – Split Sample Results Comparison – Tekoa – August/September 1993.

		Location:	INF–E	INF–T	EFF–E	WEIR–1	EFF–T	EFF–1
		Type:	composite	grab–comp	composite	composite	grab–comp	grab
		Date:	8/31–9/01	8/31–9/01	8/31–9/01	8/31–9/01	8/31–9/01	9/01
		Lab Log #:	368230	368231	368234	368242	368235	368236
		Sampler:	Ecology	Tekoa	Ecology	Ecology	Tekoa	Ecology
PARAMETER	Analyzed by:							
Conductivity (mg/L, CaCO3)	Ecology				451		450	
	Tekoa							
Alkalinity (mg/L, CaCO3)	Ecology		213	228	153		152	
	Tekoa							
TS (mg/L)	Ecology		427	465	344	326	334	
	Tekoa							
TNVS (mg/L)	Ecology		260	279	255	258	239	
	Tekoa							
TSS (mg/L)	Ecology		103	103	3	3	3	
	Tekoa		81.5	82	2.6		5.5	
TNVSS (mg/L)	Ecology		36	33	2	2	2	
	Tekoa							
BOD5 (mg/L)	Ecology		89		2.7 J	2.5 J		
	Tekoa		120	73	1		2.2	
COD (mg/L)	Ecology		120	140	16	17	17	
	Tekoa							
TOC (mg/L)	Ecology		36.3	39.8	6.8		5	
	Tekoa							
NH3–N (mg/L)	Ecology		18	11	0.35	0.26	0.29	
	Tekoa							
NO2+NO3–N (mg/L)	Ecology		1.4	1.1	4.5	4.5	4.5	
	Tekoa							
Total–P (mg/L)	Ecology		9.3	7.3	1.4	1.3	1.4	
	Tekoa							
F–Coliform MF (#/100 mL)	Ecology							29
	Tekoa							160

INF–E	Ecology influent composite sample.
INF–T	Tekoa influent grab–composite sample.
EFF–E	Ecology effluent composite sample.
EFF–T	Tekoa effluent composite sample.
WEIR	Blind duplicate of the Ecology effluent composite sample.

Table 5 – Metals Scan Results – Tekoa – August/September 1993.

		Location:	EFF-E		HANG1UP		SLUDGE		EPA Water Quality Criteria Summary			
		Type:	comp		grab		grab		Freshwater Acute		Freshwater Chronic	
		Date:	9/1		9/1		8/31					
		Lab Log#:	368234		368240		368239					
Metals**			ug/L		ug/L		mg/Kg-dr		ug/L		ug/L	
Antimony			30	U	30	U	3	UJ	9000	*	1600	*
Arsenic			2.2	P	1.5	U	4.06	N				
	Pentavalent								850	*	48	*
	Trivalent								360		190	
Beryllium			1	U	1	U	0.33	P	130	*	5.3	*
Cadmium			2	U	2	U	3.04		3.6	+	1.1	+
Chromium			5	U	5	U	19.6					
	Hexvalent								16		11	
	Trivalent								1622	+	193	+
Copper			6.9	J	5.3	J	260		16	+	11	+
Lead			1	U	1	U	59		73	+	2.9	+
Mercury			0.05	U	1.05		0.783	J	2.4		0.012	
Nickel			10	U	10	U	20.1		1322	+	147	+
Selenium			2	U	2	U	3.26		260		35	
Silver			0.5	U	0.5	U	5.97	N	3.5	+	0.12	
Thallium			2.5	U	2.5	U	0.5	U	1400		40	
Zinc			20	P	15	P	672		109	+	99	+

NOTE: SOME INDIVIDUAL COMPOUND CRITERIA OR LOELS MAY NOT AGREE WITH GROUP CRITERIA OR LOELS. REFER TO APPROPRIATE EPA DOCUMENT ON AMBIENT WATER QUALITY CRITERIA FOR FULL DISSCUSSION.

P	The analyte was detected above the instrument detection limit but below the established minimum quantification limit.
UJ	The analyte was not detected at or above the reported estimated result.
U	The analyte was not detected at or above the reported result.
N	For metals analytes the spike sample recovery is not within control limits.
J	The analyte was positively identified. The associated numerical result is an estimate.
*	Insufficient data to develop criteria. Value presented is the LOEL – Lowest Observed Effect Level.
**	Results are reported as total metals for Hg in the water samples, and for sludge sample. Results are reported as total recoverable metals for the remaining metals in the water samples.
+	Hardness dependent criteria (92 mg/L used).
EFF-E	Ecology effluent composite sample.
HANG1UP	Hangman Creek sample collected upstream of the Tekoa discharge.

A number of priority pollutant metals were present in the sludge (Table 5). Only antimony and thallium were not detected. None of the metals concentrations exceeded the land application standards for the use or disposal of sewage sludge (USEPA, 1993). A comparison is provided in Table 6.

Sludge Management

Tekoa's sludge management in their drying beds was less than ideal. The sludge is manually loaded into a backhoe and applied on agricultural lands adjacent to the facility. The ability of the drying beds to adequately process sludge had clearly been exceeded. The operator reported that a filter press replacing the sludge drying beds has been purchased, installed and is currently operating.

Hangman Creek

Several parameters were measured in Hangman Creek to aid the permit writer in revising the permit for reissuance. General chemistry data are presented in Table 2 and metals data in Table 5.

Weather during the summer of 1993 was uncharacteristically cool and wet. In July, 2.08 inches of precipitation were recorded by the National Weather Service at the Spokane International Airport as compared to a monthly average of 0.67 inches. The July 1993 average temperature was 8.6°F below average for the month of July. In August, 1.24 inches of precipitation were recorded at the airport as compared to a monthly average of 0.72 inches. The August 1993 average temperature was 4.2°F below average for the month of August (Savoy, 1993). Therefore, instream flows at the time of the inspection may not be representative of typical flow patterns.

Hangman Creek has been identified as a surface water which does not meet state and federal water quality standards. Standard water quality parameters commonly exceeded are fecal coliforms, pH, turbidity and dissolved oxygen (Yake, 1979; Carey, 1989).

The creek continues to exhibit characteristics of degraded quality. The dissolved oxygen concentration measured at dawn upstream of the Tekoa discharge (6.4 mg/L) indicated that the waterbody violated the Class A surface water quality standard of 8.0 mg/L (Chapter 173-201 WAC). The D.O. concentration at the downstream location was also 6.4 mg/L. By 1200 Hours, the dissolved oxygen content at the upstream location had risen to 8.45 mg/L (Table 2). This is the expected diurnal pattern attributable to algal photosynthesis and was observed by Carey (1989). A corresponding rise in ambient creek pH was also documented.

Two additional findings were of interest. First, the background mercury concentration in the creek exceeded the EPA water quality criterion for freshwater chronic exposure by two orders of magnitude (Table 5). The source of the mercury is not known. Additional sampling is suggested to determine if the elevated mercury concentrations are typical.

Table 6 – Sludge Metals/EPA Land Application Regulations Comparison – Tekoa – August/September 1993.

	Location:	Sludge		Land Application Regulations (EPA, 1993)	
	Type:	grab			
	Date:	9/01		Pollutant *	Ceiling **
	Lab Log#:	368239			
Metals (total)		mg/Kg dr		mg/Kg dr	mg/Kg dr
Arsenic		4.06	N	41	75
Cadmium		3.04		39	85
Chromium		19.6		1200	3000
Copper		260		1500	4300
Lead		59		300	840
Mercury		0.783	J	17	57
Nickel		20.1		420	420
Selenium		3.26		36	100
Silver		6.0	N		
Zinc		672		2800	7500

P The analyte was detected above the instrument detection limit but below the established minimum quantification limit.
N For metals analytes the spike sample recovery is not within control limits.
J The analyte was positively identified. The reported result is an estimate.
* sludge suitable for land application with minimal restrictions if no pollutant concentrations are exceeded.
** sludge not suitable for land application if any ceiling concentration is exceeded

Second, a large aggregation of cyprinids (unidentified minnow species) was seen within the effluent plume in the creek.

RECOMMENDATIONS AND CONCLUSIONS

Flow Measurements

The plant flow meter appears to be accurate. However, the weir plate may not be perpendicular to the floor of the effluent discharge chamber. It appeared to be tilted slightly upstream.

- Proper positioning of the weir plate should be verified.

General Chemistry

BOD_5, solids and nutrient data reveal the Tekoa influent to be typical of weak domestic wastewater. The treatment plant removed high percentages of BOD_5 and TSS, produced a highly nitrified effluent. The dissolved oxygen content of the effluent was also relatively high (7.6mg/L).

NPDES Permit Compliance

Tekoa's compliance with their NPDES permit was very good at the time of the inspection. The effluent BOD_5 and TSS concentrations and loadings were approximately 10% of the monthly average limits specified in the permit. Fecal coliform bacteria counts were an order of magnitude less than the monthly average limit specified in the permit. The pH of the discharge was within the permit limits. Plant loading was within design criteria for prevention of facility overloading.

Split Sample Analyses

Composite samples were collected with a slightly different methodology. Ecology used automated composite samplers while the Tekoa samples were hand-composited. The Tekoa influent composite samples were also collected from a slightly different location than the Ecology samples. A comparison of Ecology analyses between the Ecology and Tekoa sample stations demonstrated a reasonably good agreement. Tekoa's composite samples are judged to be representative.

A comparison of analytical results between the Ecology and the Tekoa laboratories, though limited, demonstrated several differences in one or more TSS, BOD_5 and fecal coliform results.

- It is recommended that the Tekoa laboratory seek accreditation.

Priority Pollutant Inorganics - Metals Scans

Three priority pollutant metals were present in the effluent. These were arsenic, copper and zinc (Table 5). None exceeded the EPA Water Quality Criteria for chronic freshwater exposure (USEPA, 1986).

A number of priority pollutant metals were present in the sludge. However, none of the metals exceeded the levels limiting the land application of sludge.

Sludge Management

The ability of the drying beds to adequately process sludge had clearly been exceeded. The operator reported that a filter press to replace the sludge drying beds has been purchased, installed and is currently operating.

Hangman Creek

The creek continues to exhibit characteristics of degraded quality. The waterbody still violated the Class A surface water quality standard for dissolved oxygen.

The background mercury concentration in the creek exceeded the EPA water quality criterion for freshwater chronic exposure by two orders of magnitude. The source of the mercury is not known.

- Additional sampling is suggested to determine if the elevated mercury concentrations are typical.

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APPENDICES

Appendix A – Ecology Sampling Schedule and Parameters Analyzed – Tekoa – August/September 1993.

Parameter	Location:	INF-E	INF-T	INF-1	INF-2	MIXL-1	MIXL-2	EFF-E	EFF-T	EFF-1	EFF-2	HANG-D	WEIR-1	SLUDGE	HANG-1U	HANG-2U	EFF-COLI
	Type:	comp	comp	grab	grab	grab	grab	comp	comp	grab	grab	grab	comp	grab	grab	grab	grab
	Date:	8/31-9/01	8/31-9/01	8/31	8/31	8/31	8/31	8/31-9/01	8/31-9/01	9/01	9/01	9/01	8/31-9/01	8/31	9/01	8/31	9/01
	Time:	@	@	0940	1320	1115	1345	#	#	0725	0845	0630	#	1135	0705	1200	0920
	Lab Log #:	368230	368231	368232	368233	368243	368244	368234	368235	368236	368237	368238	368242	368239	368240	368241	368245
GENERAL CHEMISTRY																	
Conductivity								1	1								
Alkalinity		1	1					1	1						1	1	
Hardness								1	1						1	1	
SOLIDS 4		1	1					1	1				1				
TSS				1	1	1	1			1	1						
TNVSS						1	1										
% Solids														1			
% Volatile Solids														1			
BOD5		1	1					1	1				1				
COD		1	1					1	1				1				
TOC (water)		1	1	1	1			1	1	1	1	1			1	1	
TOC (soil/sed)														1			
NH3-N		1	1					1	1			1	1		1	1	
NO2+NO3-N		1	1					1	1				1				
Total-P		1	1					1	1				1				
Oil and Grease (water)				1	1					1	1						
F-Coliform MF										1	1						1
METALS																	
PP Metals (water)								1							1		
PP Metals (soil/sed)														1			
FIELD OBSERVATIONS																	
Temperature				1	1					1	1	1			1	1	
Temp-cooled*		1						1									
pH				1	1					1	1	1			1	1	
Chlorine										1	1						
Dissolved Oxygen										1		1			1	1	

@	Composite sampling interval between 0840-0840 Hours.
#	Composite sampling interval between 0930-0930 Hours.
*	Temperature of iced composite sample.
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.
INF-E	Ecology influent composite sample.
INF-T	Tekoa influent composite sample.
EFF-E	Ecology effluent composite sample.
EFF-T	Tekoa effluent composite sample.
MIXL	Mixed liquior sample.
WEIR	Blind duplicate of Ecology effluent composite sample.
HANGU	Hangman Creek sample collected upstream of the Tekoa discharge.
HANGD	Hangman Creek sample collected downstream of the Tekoa discharge.
EFF-COLI	Effluent fecal coliform sample.

Appendix B – Ecology Analytical Methods and Laboratories Used – Tekoa – August/September 1993.

PARAMETER	METHODS	LABORATORY USED
GENERAL CHEMISTRY		
Conductivity	EPA, Revised 1983: 120.1	Ecology (Manchester)
Alkalinity	EPA, Revised 1983: 310.1	Ecology (Manchester)
Hardness	EPA, Revised 1983: 130.2	Ecology (Manchester)
TS	EPA, Revised 1983: 160.3	Ecology (Manchester)
TNVS	EPA, Revised 1983: 160.3	Ecology (Manchester)
TSS	EPA, Revised 1983: 160.2	Ecology (Manchester)
TNVSS	EPA, Revised 1983: 160.2	Ecology (Manchester)
% Solids	EPA, Revised 1983: 160.3	Ecology (Manchester)
% Volatile Solids	EPA, Revised 1983: 160.4	Ecology (Manchester)
BOD5	EPA, Revised 1983: 405.1	Kitsap County Sewer District #5
COD	EPA, Revised 1983: 410.1	Sound Analytical Services, Inc.
TOC (water)	EPA, Revised 1983: 415.1	Ecology (Manchester)
TOC (soil)	EPA, Revised 1983: 415.1	Ecology (Manchester)
NH3-N	EPA, Revised 1983: 350.1	Sound Analytical Services, Inc.
NO2+NO3-N	EPA, Revised 1983: 353.2	Sound Analytical Services, Inc.
Total-P	EPA, Revised 1983: 365.3	Sound Analytical Services, Inc.
Oil and Grease (water)	EPA, Revised 1983: 413.1	Ecology (Manchester)
F-Coliform MF	APHA, 1989: 9222D	Ecology (Manchester)
PP Metals	EPA, Revised 1983: 200-299	Ecology (Manchester)

METHOD BIBLIOGRAPHY

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EPA, Revised 1983. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020 (Rev. March, 1983).

Appendix C - 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