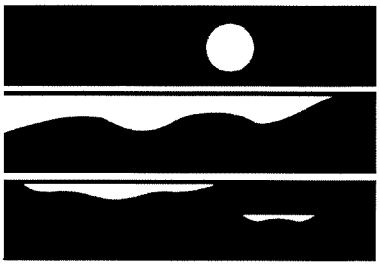


City of Marysville
Wastewater Treatment Plant

Class II Inspection

January 1997

Publication No. 97-304

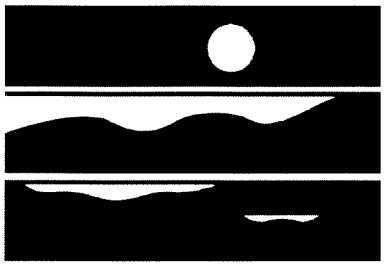
printed on recycled paper

If you have special accommodation needs or require this document in alternative format, please contact the Environmental Investigations and Laboratory Services Program, Toxics Investigations Section, Joan LeTourneau at (360) 407-6764 (voice). Ecology's telecommunications device for the deaf (TDD) number at Ecology Headquarters is (360) 407-6006.

For additional copies of this publication, please contact:

Department of Ecology
Publications Distributions Office
P. O. Box 47600
Olympia, Washington 98504-7600
(360) 407-7472

Refer to Publication Number 97-304



City of Marysville Wastewater Treatment Plant

Class II Inspection

---

by
Guy Hoyle-Dodson

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

January 1997

Water Body No. WA-07-1010

Publication No. 97-304
printed on recycled paper

Table of Contents

Table of Contents (cont.)

List of Figures and Tables

Abstract

An announced Class II inspection was conducted March 3-6, 1996 at the City of Marysville Wastewater Treatment Plant (Marysville) in Snohomish County, Washington. Included were analyses of three industrial contributors to the Marysville collection system: National Foods Corporation, Pacific Coast Feathers Company, and Quil Ceda Tanning Company.

Moderate reductions in BOD_5, $CBOD_5$, TOC, and TSS occurred across the treatment plant, but calculations suggest that more robust removal efficiencies are theoretically possible. Effluent ammonia concentration was relatively high, but was not expected to exceed water quality criteria at the edge of the acute mixing zone. Analysis of the facility's complete mix aeration cells determined that aeration met minimum oxygenation requirements, but was inadequate for mixing. Marysville should investigate the impact of mixing on treatment effectiveness. Calculations suggest that the current recirculation rate to the first and second oxidation ponds from the fourth lagoon may not be highly effective in reducing BOD_5. Detention time across the two oxidation ponds appears to be adequate and sludge buildup was minimal. BOD_5 and TSS concentrations increased across the third and fourth stabilization ponds, and this is likely due to algae growth. The in-plant sand filter appeared to be operating effectively.

The 24-hour effluent composite $CBOD_5$ concentration exceeded the NPDES permit weekly and monthly average limits. Although the comparison is based upon a single sample, Marysville should ensure that the plant does not on average exceed these limits. TSS was 80% of the weekly limit and Marysville should ensure that the limit is not exceeded during seasons when greater algae growth may occur. The Pacific Coast Feathers BOD_5 grab sample and Quil Ceda Tanning BOD_5 24-hour composite sample concentrations exceeded state waste discharge permit daily maximum limits. National Foods 24-hour composite pH measurement also exceeded the state waste discharge permit limit. The dischargers should ensure that effluents concentrations are within permit limits. Contributions of toxic loads to the Marysville treatment plant influent were generally low.

The Marysville whole effluent copper concentration exceeded water quality criteria, but is expected to be reduced to below criteria within the dilution zone. The Marysville effluent chronic fathead minnow bioassay indicated toxicity at low concentrations, and a reasonable potential exists for chronic conditions in the receiving water. Additional bioassays, including bioassays for marine organisms, are recommended. Effluent $CBOD_5$ and BOD_5 results differed substantially for Ecology and Marysville split samples and it is recommended that Marysville review holding procedures. Marysville sludge concentrations do not exceed limits for land application or hazardous waste designation.

Summary

Flow Measurements

Daily 24-hour influent flow reported by Marysville was 3.95 MGD during the period of the 24-hour composites and averaged 4.03 MGD during the inspection. Effluent flow was 3.83 MGD during the period of the 24-hour composites and averaged 3.84 MGD. The inaccessibility of influent Parshall flume and effluent weir precluded independent verification of flow measurements. The apparent losses across the treatment system may be due to non-steady state flows, evaporation, lagoon liner leakage, or inaccurate flow measurements. Flow through the sand filters was estimated to be 1.24 MGD. 2.6 MGD of unfiltered wastewater (68% of total) was combined with the filtered flow before final discharge. Recirculation flow from the fourth lagoon (12.96 MGD) was combined with backwash reject from the sand filters (216,000 gal/day) and returned to the first lagoon. Daily discharge to the collection system from National Foods, Inc., Quil Ceda, and Pacific Coast Feathers were 41,040 gal/day, 10,300 gal/day, and 52,783 gal/day respectively.

Wastewater General Chemistry and Treatment Plant Design

Treatment Plant Influent

Influent concentrations of Total Solids (TS - 528 mg/L), Total Suspended Solids (TSS - 191 mg/L), and ammonia nitrogen (NH_3-N - 18 mg/L) were slightly less than the typical medium concentrations for untreated domestic wastewater. The five-day Biochemical Oxygen Demand (BOD_5 262 mg/L) was 19% greater and the BOD_5/TOC ratio (2.83) about two times greater than typical medium values. The data suggests that, as compared to typical domestic influents, biologically inactive organic carbon compounds were scarce in the Marysville influent and that this should result in better relative effluent quality.

Aeration Cell Effluent

Reduction in total BOD_5 across the aeration cells was 52%. TSS concentration decreased from 191 mg/L to 80 mg/L. Aeration in the cell appears to be suitable for oxygen requirements, but inadequate for mixing. The reaction rate coefficient (k_1) for the cells due to respiration alone was approximately 0.85 d^{-1} (to the base e at 20° C), and was within typical values. A rough estimate of k_1 with settling included was approximately 1.3 d^{-1} (20° C). The value is greater than the minimum k_1 (0.6 d^{-1} at 20° C) required by Ecology design standards for complete mix lagoon systems to ensure full treatment of

domestic sewage. TSS concentration across the aeration cells was reduced 58% in contrast to a predicted increase of about 40%. It is likely considerable settling was taking place.

Oxidation Lagoon #2 Effluent

Reductions in total BOD_5 across oxidation ponds #1 and #2 exceeded 67%. The calculated theoretical effluent BOD_5 result (26.4 mg/L) was 36% less than the measured BOD_5 (41 mg/L) result. There is a question about the efficacy of recirculation in reducing BOD_5 loads. The TSS influent concentration (54 mg/L) decreased 33% across the two-lagoon system. Overflow rate was 11 gal/ft^2·d and the solids loading per unit area was 2.7×10^{-4} lb/ ft^2·h. Detention time (4.1 days) was greater than recommended minimums for settling after aerated lagoon treatment systems. The sludge accumulation rate was approximately 0.03 inches/year equally distributed.

Stabilization Lagoon #4 Effluent

The reported effluent total BOD_5 concentration for lagoon #4 effluent was 29 mg/L, but this value is suspect. The reason for the anomalous total BOD_5 result is unknown. Lagoon #4 effluent total BOD_5 concentration was calculated from a mass balance of filter effluent load and final effluent load and found to be approximately 65.4 mg/L. For the purposes of this report the calculated value was used. Total BOD_5 across polishing lagoons #3 and #4 increased about 60%, an increase that is most likely due to algae growth. A predicted reduction in BOD_5 was calculated to be between 65% to 80%. TSS also increased 17%, which is also consistent with the growth of algae. Lagoon overflow rate (10.5 gal/ft^2·d) and sludge loading (2.3×10^{-4} lb/ ft^2·h) were well within typical values. It is reasonable to expect that the sludge accumulation rate would be consistent with that in lagoons #1 and #2.

Sand Filter Effluent

Filtration across the sand filter achieved reductions of 65% in TSS, 59% in total BOD_5, and 20% in soluble BOD_5 as well as reductions in ammonia nitrogen, Kjeldahl nitrogen, and total phosphorus. This resulted in overall reductions in the final effluent of 18% for TSS, 36% for total BOD_5, and 5.4% for soluble BOD_5. There was also an increase of nitrate and nitrite nitrogen.

Treatment Plant Effluent

Ecology results showed a total BOD_5 reduction from 262 mg/L in the influent to 53 mg/L in the effluent for 80% removal. Total suspended solids (TSS) decreased from 191 mg/L to 47 mg/L, for 76% removal efficiency. Carbonaceous BOD_5 showed a 75% reduction. TOC, Kjeldahl nitrogen, ammonia nitrogen, and total phosphorous were reduced 59%, 29%, 19%, and 40% respectively. Nitrate and nitrite nitrogen increased 11.7%, an

increase that appeared to take place largely in the sand filter. Chlorine residual concentrations in all samples were less than the detection limit. Permitted mixing zone dilution factors are 8.8 and 17 for acute and chronic zones respectively. A mass balance calculation showed adequate dilution at the acute and chronic dilution zone boundaries.

Industrial Contributor Discharge Results and State Permit Comparisons

National Foods Corporation

The Ecology composite sample pH result for National Foods discharge was 11.92. This exceeds the state discharge permit pH range limit. The inspection result did not exceed specific dangerous waste corrosivity limits, but was sufficiently close to warrant attention. The Ecology total BOD_5 composite result was equal to or greater than 820 mg/L, and at the minimum value within the interim effluent limit. The reported value exceeds the new final effluent BOD_5 limit (effective date: July 1). The Ecology TSS composite result was well within interim and final effluent limits. The discharge's contribution to the Marysville treatment plant influent represents about:

- $\geq$3% of the BOD_5 load,
- $\geq$2% of the $CBOD_5$ load,
- 7% of the TOC load,
- 1% of the phosphorus load.

Pacific Coast Feathers Company

The Ecology BOD_5 grab-composite sample result (318 mg/L) for the Pacific Coast Feathers discharge exceeded the state waste discharge permit daily maximum limit. Ecology TSS result was about 80 % of the permit limit. TOC, oil & grease, and ammonia nitrogen results were 353 mg/L, 55 mg/L, and 15 mg/L respectively. The discharge's contribution to the Marysville treatment plant influent represents about:

- 1.5% of the total BOD_5 load,
- 10% of its TOC load,
- 2% of the TSS load,
- 4% of the oil & grease load,
- slightly more than 1% of its ammonia nitrogen load.

Quil Ceda Tanning Company

The Ecology BOD_5 composite sample result (373 mg/L) for Quil Ceda Tanning discharge exceeded the state waste permit daily maximum by 24%. TSS, oil & grease results, and sulfide results were well within state permit limits. The discharge's contribution to the Marysville treatment plant influent represents about:

- less than 1% of the total BOD_5 load,
- less than 0.1% of the TSS load
- 1.4% of the ammonia nitrogen load,
- 2.0% of the Kjeldahl nitrogen load,
- less than 0.1% of the oil & grease load,

NPDES Permit Comparisons

The lagoon #4 effluent 24-hour composite TSS concentration (60.1 mg/L) and load (1403 lb/day), as modified to reflect portions of the effluent below 2.8 MGD, were within NPDES permit monthly and weekly average limits. The TSS concentration (22 mg/L) and load (194 lb/day) for the filtered portion exceeding 2.8 MGD were also within permit monthly and weekly average limits. Percent reduction from the influent concentration for the portion that exceeded 2.8 MGD (89%) was greater than the 85% minimum monthly average reduction required by the permit.

The Ecology composite 24-hour effluent $CBOD_5$ concentration (48 mg/L) exceeded the permit monthly average limit by 92% and the weekly average limit by 20%. The effluent 24-hour composite $CBOD_5$ load (1533 lb/day) exceeded NPDES permit monthly average effluent load limits by 21%, but was within the weekly average load limit. The percent reduction from the influent concentration (75%) was less than the minimum monthly average reduction (85%) required by the permit. All other parameters were within permit influent design loads and effluents limits.

Detected Priority Pollutant Organics and Metals

Marysville Treatment Plant

VOA compounds and BNA compounds results did not exceed either freshwater or marine acute and chronic water quality criteria. One priority pollutant metal, copper (10 µg/L), exceeded the marine acute water quality criteria (2.5 µg/L) in the whole effluent. Dilution in the receiving water (acute dilution factor: 8.8) should reduce this concentration to less than 46% of the acute criteria.

Quil Ceda

A single VOA compound, acetone, was detected in two Quil Ceda effluent grab samples, one at 52,700 µg/L and the other at 58,800 µg/L. Total discharge load was approximately 5.1 lbs/day. This load should have produced a concentration in the treatment plant influent of about 150 µg/L, but it apparently volatilized in the collection system. One BNA compound, benzoic acid (122 µg/L), was discharged at an appreciable concentration. Four metals were detected in the Quil Ceda discharge, but the highest concentration, chromium (515 µg/L), was calculated to contribute about 14% to the Marysville treatment plant influent chromium load (0.329 lbs/day).

Effluent Bioassays

The *Daphnia magna* acute 48-hour survival test found 100% survival at all concentrations in the dilution series, except at 100% effluent which produced a 5% mortality. Statistical analysis determined that the Lowest Observable Effective Concentration (LOEC) and the No Observable Effective Concentration (NOEC) were both greater than 100%.

The fathead minnow (*Pimephales promelas*) chronic 7-day survival and growth test produced a survival analysis with an LC50 of 57.8%, LOEC of 25.0%, and NOEC of 12.5%. The growth analysis found a LOEC of 12.5%, NOEC of 6.25%, and 25/50% growth inhibition concentration (Icp) of 10.5%. This represents a statistically significant difference in response at a concentration less than the acute critical effluent concentration. A reasonable potential exists for chronic toxicity in the receiving water.

Split Samples

Sample Comparisons

Relative percent differences (RPD) between pairs of BOD_5 and pH samples were less than variation in precision cited in the EPA comparison of interlaboratory analysis of selected parameters (EPA, March 1983). The RPD between influent TSS values is close to four times the interlaboratory variation in precision, which suggests that there was a difference between Ecology and Marysville composite sampling technique. This may be due to inadequate mixing when dividing the sample in preparation for analysis. Ecology BOD_5 and $CBOD_5$ results for Ecology and Marysville effluent samples were divergent, with a RPD of 65% and 100% respectively. This may be the result of an elevated holding temperature for the Marysville sample.

Laboratory Comparisons

Ecology and Marysville laboratory results for influent samples collected by both Ecology and Marysville were well matched, indicating that the Marysville laboratory performance was good.

Sludge

General Chemistry

Total Kjeldahl nitrogen in the sludge was about 1972 mg/L wet weight. Total accumulated sludge was about 3.94×10^5 lbs of nitrogen. For sustainable nutrient uptake rates during land application this would require a minimum of at least 820 acres applied over one year.

The sludge dry weight fecal coliform density was 149 colonies per grams (1700 #/100g -wet wt.) and was less than the maximum limit for fecal coliform density of 1000 #/g dry wt. required for Class A sewage sludge land application (EPA, 1993).

Detected Priority Pollutants

Five VOAs and eight BNAs were detected in the composite sludge sample. One BNA, 3B-coprostanol, was detected at 97,500 µg/Kg-dry wt. Eleven metals were detected in the sludge. Copper, lead, and chromium concentrations (234, 139, and 254 mg/Kg-dry wt. respectively) appear to reflect the removal over time of relatively high influent concentrations. The concentrations of priority pollutants in the sludge did not exceed either EPA standards for land application of sewage sludge or screening concentrations for the dangerous waste designation criteria. Chromium and lead approached 30% and 16% of the dangerous waste screening concentration (20 times maximum leachate extract toxicity limit).

Recommendations

General Chemistry and Plant Design

- Marysville should independently verify the accuracy of influent and effluent flow meters.
- Marysville should determine if increased mixing in the aeration cells will improve treatment efficiency.
- Marysville should test treatment efficiency with reduced recirculation to determine if recirculation rate could be reduced or the practice discontinued entirely.

Industrial Contributor Discharge Results and State Permit Comparisons

- National Foods should reduce discharge pH to meet the permit limit.
- Pacific Coast Feathers should reduce daily BOD_5 to within the permit limit.
- Quil Ceda should reduce BOD_5 concentrations to within the permit limits.

NPDES Permit Comparisons

- Marysville should ensure that TSS concentrations and loads do not exceed permit limits during periods of enhanced algae growth.
- Marysville should ensure that monthly average effluent BOD_5 concentrations and loads do not exceed permit limits.

Bioassay Results

- Marysville should characterize effluent toxicity by testing as outlined in section 050 of WAC 173-205.
- Bioassays specific to marine organisms should be conducted to evaluate the potential for effluent toxicity at the edge of the dilution zone.

Split Samples

- Marysville should ensure that the composite sample is mixed during aliquot breakdown.

- Marysville should ensure that holding temperatures for effluent samples are held at less than 4° C.

Introduction

A Class II inspection was conducted at the City of Marysville Municipal Wastewater Treatment Plant (WWTP) on March 3-6, 1996. Several industrial contributors to the treatment plant were also examined. Guy Hoyle-Dodson and Steven Golding, environmental engineers for the Washington State Department of Ecology Toxics Investigations Section, conducted the investigation. Mike Dawda, Ecology Northwest Regional Office permit manager, provided background information and assisted during the inspection. Dale Thayer, Marysville WWTP manager, provided information on facility operation and assistance on site.

The Marysville WWTP serves the city of Marysville and surrounding area, which include residential, commercial, and industrial contributors. An NPDES Permit (No. WA-002249-7) was issued June 20, 1994 with an expiration date of June 20, 1999. Industrial facilities that contribute to the system include such activities as metal finishing, egg processing, feather processing, berry processing, and tanning. Three facilities were identified as major contributors of flow and five-day Biochemical Oxygen Demand (BOD_5):

1. National Food Corporation (egg processing)
2. Pacific Coast Feathers Company (duck and goose feather processing)
3. Quil Ceda Tanning Company (specialty hide tanning and dyeing)

The Class II inspection was initiated by the Department of Ecology to evaluate permit compliance and provide information about facility loading and performance. Results from industrial contributors will be used to develop effective pretreatment programs. Special attention was paid to treatment effectiveness across the various components of the treatment system. The inspection also focused on flow measurements, concentrations of priority pollutant organics and metals in effluent, and sludge characterization.

Objectives of the inspection included:

- Evaluate NPDES permit compliance by analysis of influent and effluent permit parameters to determine concentrations and loads

- Evaluate wastewater toxicity by comparing priority pollutant organics and metals scan results to Washington State acute and chronic water quality criteria

- Evaluate wastewater toxicity with effluent bioassays

- Evaluate treatment plant performance with the goal of estimating the reaction rate coefficient

- Evaluate WWTP self-monitoring program through sample splits and independent laboratory analysis

- Evaluate sludge toxicity by comparisons to federal and state land application and dangerous waste regulations

- Evaluate oxygen demand parameters, nutrients, complex organics, and metals discharged to the collection system by major industrial contributors

Setting

The Marysville wastewater treatment facility is located in Snohomish County, Washington, south of the city of Marysville on Ebey Slough, a channel of the Snohomish River estuary (Figure 1). The WWTP treatment system uses two complete mix aeration cells, two primary oxidation (waste stabilization) lagoons, and two final polishing lagoons, usually connected in series (Figure 2). A portion of the lagoon system effluent can be treated by a backwash sand filter system, which is then recombined with the unfiltered portion. The final combined effluent is treated by chlorine disinfection.

The WWTP headworks consists of a screwpump, mechanical bar screen, comminutor, grit chamber, and Parshall flume. Influent enters the headworks from two main trunk lines: a west line that is pumped from a wet well on the west end of the facility, and a north line that enters just above the screwpump. All industrial contributors discharge directly to the plant's collection system. Influent flows are measured at the Parshall flume by ultrasonic meter.

Flow from the headworks enters a two cell complete mix aeration system for initial biological treatment. The cells are isolated from the first oxidation pond by hydraulic curtain barriers which extend to its full depth. Floating 25-Hp aerators (eight in Cell #1 and five in Cell #2) provide aeration. The two initial complete mix cells can be operated in either series or in parallel. During the inspection the cells were operated in series. Discharge to the remainder of the first pond is via a narrow breach in the southwest corner of Cell #2's hydraulic curtain.

Flow from the complete mix aeration cells is merged in the first oxidation lagoon with recirculation discharge from the fourth polishing lagoon combined with backwash from the sand filters. A scum baffle just downstream of the recirculation dischargers skims floating debris and grease. The first oxidation pond is not heavily aerated, and appears to act as a facultative lagoon. It is separated from the second oxidation lagoon by another long hydraulic curtain with a small breach at the west end to allow flow. The second oxidation lagoon is also largely quiescent and likely acts as a sedimentation lagoon, although some facultative treatment may occur. Some recirculation is also discharged at the head of the second lagoon.

The final two lagoons act as polishing lagoons and are physically separated from the second oxidation lagoon by a earthen barrier. Two 48-inch culverts to conduct flows from lagoon two to lagoon four. The third and fourth lagoon are partitioned by a hydraulic curtain running the length of a larger lagoon with a breach at the south end. The third lagoon contains six 7.5 Hp aerators which provide localized aeration. The fourth lagoon is unaerated and likely acts as a sedimentation lagoon. At the discharge end of the fourth lagoon there are a series of suction headers for collecting recirculation.

A portion of the effluent from the fourth lagoon can be diverted to a backwash sand filter during high flow for additional treatment of total suspended solids (TSS). During low flows (< 2.8 MGD) this effluent is pumped directly to the chlorine contact chamber for disinfection. During higher flows a portion of the fourth lagoon effluent is treated by the filter and recombined with untreated lagoon effluent before entering the chlorine contact chamber. An in-line meter at the end of the chlorine contact chamber measures effluent flows. Discharge is via a 28-inch diameter polyethylene force main to a 36-foot long diffuser with seven ports fitted with "T" risers. The outfall is located at a depth of 12.5 feet, approximately 181 feet from the north bank of Steamboat Slough, a channel of the Snohomish River estuary which feeds into Possession Sound. The receiving water is designated a marine water body for the purpose of water quality criteria comparisons.

Several industrial dischargers contribute substantial influent loads to the Marysville treatment plant.

National Foods Corporation

National Foods is an egg processor located northeast of Marysville. The facility operates under State Waste Discharge Permit No. 7332, expiration date June 1, 1999. The main sources of wastewater at the plant are:

- washwater generated from washing plastic egg flats using a detergent product called Quorum Yellow
- washwater from egg washing using a product containing sodium hydroxide, trisodium tripolyphosphate, poly oxamer, and sodium chloride
- washwater from egg washing using a product containing iodine and phosphoric acid
- pasteurization process clean-in-place water using sodium hydroxide
- chasing liquids used in the pasteurization process
- truck and floor washings from the truck maintenance shop
- waste eggs from breakage and floor washings, treated by centrifuge to remove the denser egg waste from the wash water (Krigbaum, 1996)

Recovered egg waste is sold to a pet food manufacturer. The plant mixes washwaters containing egg wastes, detergents, and defoamers to sanitary sewage from the facility and discharges this mixture to the collection system. Discharge flow to the collection system is limited to 122,000 gallons per day.

Pacific Coast Feathers Company

Pacific Coast Feathers, also located northeast of Marysville, processes goose and duck feathers. Feathers are cleaned and rinsed in a series of washers. The resulting cleaned feathers and down are air dried and separated by blowers. Pacific Coast Feathers contributes over 300,000 gallons per day to the collection system. The process wash water discharged to the collection system contains animal wastes, oils & grease, polyflock, detergents, and surfactants (Crider, 1996)

Quil Ceda Tanning Company

Quil Ceda, located within Marysville on Quilceda Creek, cures largely specialty animal hides (deer, elk, moose, bear, antelope, goat, caribou, and cow) producing finished leather. The facility operates under State Waste Discharge Permit No. 7270, expiration date October 30, 1999. The process utilizes salt as an initial preservative, hydrated lime and soda ash as a caustic to remove animal wastes, a chemical reactant consisting of ammonium sulfate and Warmteck to remove soda ash and lime from the hides, a chromium and sulfuric acid solution to preserve the hides, organic dyes for coloring, talcum for softening, and steam drying. A separate sulfide treatment system employing magnesium sulfate and alum removes solids from the caustic wastewater and produces a supernatant which is pumped through the main wastewater treatment system.

The main wastewater treatment system consists of a series of sedimentation and aeration tanks. In the first aeration tank phosphoric acid, an enzyme, and a bacterial culture is added to initiate biological treatment. The wastewater proceeds through several additional aeration tanks, with chlorination in the final tank. Daily discharge to the collection system is limited by permit to 16,000 gallons. Sludge from the sulfide treatment system is added to sludge from the main wastewater treatment system and sold as fertilizer. Other solids produced by the tannery are hauled to a landfill (Fifield, 1996).

Procedures

Ecology collected both grab and composite samples at the WWTP. Composite samples were collected March 5-6 from wastewater at the plant at three stations (Figure 2 & Appendix A): influent at the headworks just upstream of the Parshall flume, flow from complete mix Cell #2 into the first oxidation pond, and disinfected effluent just above the final weir. All strainers were submerged approximately 12 inches below the surface of the flow and positioned to prevent entrainment of sediments. The Cell #2 station compositor was transported by boat to its location and mounted on a small floating platform near the breach in the hydraulic curtain. Additional composite samples were collected March 5-6 from the discharge to the collection system of two industrial contributors: Quil Ceda Tanning Company and National Foods Corporation. The Quil Ceda sample was collected from a holding tank just prior to discharge, and the National Foods sample was collected from a manhole just upstream of the collection system.

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. Due to an apparent pump malfunction, the effluent compositor collected sample aliquots that contained less volume than had been originally programmed for. However, the compositors collected the full 48 samples over the 24-hour collection period and inspection of the pump mechanism suggests that each aliquot volume was equal and the total volume collected was representative of the effluent flow for that period. One transfer blank was collected on March 4 by running deionized (DI) water through the effluent compositor prior to sampling.

Grab samples for oil & grease, TSS, and volatile organics were collected at influent and effluent composite stations, both in the morning and afternoon of March 5. Single grab samples for a wide range of general chemistry parameters were taken March 5 from the second oxidation pond's discharge to the third lagoon, from the fourth lagoon's effluent, from the sand filter's discharge to the chlorine contact chamber, and from the sand filter's backwash recirculation flow. A morning and afternoon grab sample for fecal coliform was taken March 6 from the final effluent. A three-part grab-composite for bioassays was collected March 5-6 from the effluent just prior to the chlorine contact chamber to avoid chlorine contamination of the sample. A two-part grab-composite was also collected from Pacific Coast Feathers effluent the afternoons of March 5 and 6. Two separate grabs were collected from the Quil Ceda composite sample location, one on March 5 and the other on March 6. Finally, a grab-composite was collected by petite ponar from three locations in fourth lagoon's sediments on the evening of March 6.

Marysville personnel collected composite samples at the influent headworks and above the final effluent weir. The Marysville influent and effluent samples were taken March 6. The Marysville sample locations were similar to the locations of the Ecology influent and final effluent composite samplers. Marysville composite samples were split for analysis by both

Ecology and Marysville 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. Samples were packed in ice for delivery to the Ecology Manchester Laboratory. Holding time restrictions were observed for all samples. Analytical procedures and laboratories performing the analyses are summarized in Appendix C. Sampling quality assurance included priority pollutant cleaning of sampling equipment (Appendix D).

Quality Assurance/Quality Control

A transfer blank was submitted for semi-volatile organics and metals analyses. Sampling quality assurance included ultra cleaning (priority pollutant cleaning) of sampling equipment to remove trace priority pollutant contaminants. Sampling in the field followed all protocols for holding times, preservation, and chain-of-custody set forth in the Manchester Environmental Laboratory Lab Users Manual (Ecology, 1994).

Laboratory QA/QC, including holding times, Laboratory Control Sample (LCS) analysis, matrix spike and duplicate spike sample analyses, surrogate recoveries, and precision data were, with the exceptions noted below, within appropriate ranges. Initial calibration verification standards and continuing calibration standards were within relevant USEPA (CLP) control limits. Procedural blanks were predominantly free from contamination. For bioassays the conduct of testing, responses to positive and negative controls, and water quality data were all appropriate. Qualifiers are included in the data table where appropriate. The following are specific concerns:

General Chemistry

The extraction process for the oil & grease analysis produced emulsions that were difficult to break, reducing extraction efficiency which could produce low results. All oil & grease samples were qualified with a "J" indicating an estimated result. Soluble BOD for treatment plant influent and aeration cell composite samples, as well as 5-day and inhibited BOD for the National Foods composite sample, were all qualified with a "G", indicating that the result is greater than the value reported. This was due to insufficient dilution of these samples, producing a 5-day dissolved oxygen concentration of less than 1 ppm.

Volatile and Semivolatile Organics

Low levels of certain target volatile and semi-volatile compounds were detected in laboratory blanks. The EPA "five times rule" was applied to all target compounds that were found in the blank. If the concentrations of the compounds in the samples were

greater than or equal to five times the concentration of the compounds in the associated method blank, they are considered native to the sample. Matrix spike and matrix spike duplicate recoveries for the water sample volatiles were approximately 50% of expected. This has been attributed to inadvertently spiking solutions at half the specified levels. Because relative percent differences (RPDs) are within specifications no qualifiers have been added unless there was no recovery. Any target compounds not within acceptable QC limits for both percent recovery and RPD have been qualified with a "J" to indicate that the result is an estimate. One compound was not recovered and the data was rejected (REJ). Three samples had internal standards outside of accepted limits. Dilutions were analyzed on all samples to provide better quantitation results. The dilution appeared to reduce matrix interference, and the internal standard area counts were acceptable in the reanalysis.

Metals

Spike recoveries in the sludge sample for thallium by GFAA and antimony by ICP were low. Recovery of antimony in the LCS sample was also low. These parameters are qualified with "UJ" as undetected at the estimated detection level due to the observed low spike recoveries. Chromium and zinc spike levels were reported "NC, as not calculated, due to the sample level being four times the spike level. Spike recoveries in the water samples were low for arsenic, lead, selenium, and thallium. They are qualified as "UJ" as undetected at the estimated detection level or J as estimated due to the observed low spike recoveries. Water sample lead results are qualified with a "J" as an estimate or a "UJ" as undetected at estimated detection levels due to RPD precision being outside CLP acceptance windows.

Chlorinated Pesticides/PCB

Water surrogate recoveries were low for several parameters resulting in the application of the "J" qualifier to indicate that the result is an estimate. This may have been due to matrix effects.

Results and Discussion

Flow Measurements

Marysville determines plant effluent flows for NPDES permit reporting purposes by totalizer flow measurements at the effluent weir. Influent flows are determined, also by totalizer flow measurements, at the headworks Parshall flume. Daily 24-hour (08:00-08:00) totalized influent flows reported by Marysville were 4.11 MGD for March 4-5 and 3.95 MGD for March 5-6, with an average daily flow over the two-day period of 4.03 MGD. Effluent flows for each day of March 3-6 were 3.85 MGD, 3.84 MGD, and 3.83 MGD respectively (average: 3.84 MGD).

The exact cause of the difference in influent and effluent flows is unknown, but may be due to non-steady state flow, evaporation, lagoon liner failure, or inaccurate flow meters. The inaccessibility of influent Parshall flume and effluent weir precluded independent verification of flow measurements. The accuracy of all flow meters should be verified by Marysville. Flow through the sand filters for March 5-6 was estimated to be 1.24 MGD, leaving approximately 2.6 MGD of unfiltered wastewater (68% of total) entering the chlorine contact chamber. Recirculation flow from the fourth lagoon, and reject from the filters, produce a combined flow back to ponds #1 and #2 of almost 13 MGD (estimated from pump capacity). Reject (backwash) flow from the sand filters, as estimated from pump capacity, was approximately 216,000 gallons per day.

The combined daily discharge from National Foods processes to the collection system was 41,040 gallons for the 24-hour period, 14:00-14:00, on March 5-6. Quil Ceda discharged 10,300 gallons to the collection system for a 24-hour period on March 5-6. Pacific Coast Feathers discharged a total of 52,783 gallons for a 24-hour period on March 5-6.

General Chemistry Results and Treatment Plant Effectiveness

Treatment Plant Influent

Ecology general chemistry results are presented in Table 1. Influent concentrations of total solids (TS - 528 mg/L), total suspended solids (TSS - 191 mg/L), and ammonia nitrogen (NH_3-N - 18 mg/L) were all slightly less than the typical medium concentration for untreated domestic wastewater (Metcalf & Eddy, 1991). Five-day biochemical oxygen demand (BOD_5 - 262 mg/L) was 19% greater than the typical medium concentration. The average influent oil & grease concentration (O&G - 20 mg/L) was 60% less than the typical weak concentration. The total organic carbon (TOC - 92.4 mg/L) was slightly more than the typical weak concentration and the BOD_5/TOC ratio (2.83) was about two

times greater than typical values. Since the BOD_5 load falls into a typical range, the data suggest a scarcity of the biologically inactive organic carbon load relative to typical treatment plant influents (APHA, 1992). The weakness of the total non-volatile suspended solids (TNVSS - 19 mg/L) concentration in the influent likely represents the absence of typical inorganic constituents and would not account for the paucity of biologically inactive organic carbon loads. The scarcity of compounds resistant to breakdown by conventional biological treatment should result in improved effluent quality relative to other typical treatment plants A discrepancy between the field and laboratory conductivity results may be due to instrument failure.

Aeration Cell Effluent

Aeration in the cells appears to be suitable for oxygenation requirements, but inadequate for complete mixing. A calculated estimate of the aerator power needed to achieve the required oxygen saturation across each cell was 43 6 horsepower (Metcalf & Eddy, 1992), well within the available horsepower observed being used during the inspection. This power calculation uses dissolved BOD_5, but the reported influent and effluent soluble BOD_5 results (both 17 mg/L) were qualified by the laboratory as representing the lowest possible values with no constraint on an upper limit. The influent result in particular is unusually low for typical domestic wastewater and likely underreports the actual value by a considerable amount.

For the purpose of the oxygenation requirement and power calculations it was assumed that influent soluble BOD_5 was approximately 50% of the total BOD_5 result. This assumption was based on survey results of soluble to total BOD_5 ratios found for a number of typical domestic influents (Viessman & Hammer, 1985; EPA, Oct., 1983). Calculation of theoretical soluble BOD_5 concentration expected in the aeration cell effluent was approximately 11 mg/L, very close to the reported minimum 17 mg/L actually found in the aeration cells effluent. As a result this 17 mg/L minimum value was believed to be representative and was retained for use as the effluent soluble BOD_5 value in all pertinent calculations. As calculated, the estimate of power requirements is believed to be a good approximation.

Reductions in total BOD_5 across the aeration cells approached 52% (Table 2). The reaction rate coefficient (k_1) for each cell due to respiration alone (no settling included), as calculated using total BOD_5 values and the 1st order kinetic equation (assuming k_1 is the same for each cell in the series), was approximately 0.85 d^{-1} (to the base e at 20° C). This value falls into the range of typical k_1 values for similar systems (range: 0.25 d^{-1} to 1.0 d^{-1} to the base e at 20° C - Metcalf & Eddy, 1992).

The uncertainty in dissolved BOD_5 concentrations and the absence of a clarifier immediately following the aeration cells made quantification of the cells' biological reaction efficiency with settling difficult to determine using conventional algorithms. Assuming that BOD_5 concentration after settling will be largely dissolved BOD_5, a rough

estimate of k_1 with settling was derived by equating the 1st order reaction rate equation to the monod equation concerned with soluble substrate removal kinetics and using previously indicated total to soluble BOD_5 ratios. The k_1 for the complete mix aeration cells with substrate settling factored in is approximately 1.3 d^{-1} (base e at 20° C). The value is more than twice as great as the minimum k_1 of 0.6 d^{-1} (base e and at 20° C) as stipulated for complete mix aerated lagoon systems with settling to ensure full treatment of domestic sewage (Labib, 1996). This would further indicate that biological activity in the cells is of a high order and is sufficient to aerobically treat the Marysville influent BOD_5 load.

During the inspection large quiescent zones were observed in the complete mix cells and it appeared likely that the cells were inadequately mixed. To conform to draft Ecology design criteria for maintaining suspended solids in aerated lagoons, power requirements greater than 50 hp/Mgal are needed (Labib, 1996). At the low end power requirements were calculated to be 244 hp for each 4.89 Mgal complete mix cell. Since the power required for oxygen saturation across each cell was 43.6 horsepower, this indicates that horsepower required for mixing would govern the design. Total horsepower in Cell #1 and Cell #2 is 200 hp (8 - 25 hp aerators) and 125 hp (5 - 25 hp aerators), respectively. For a complete mixed regime, cell #1 is about 82% and cell #2 is about 51% of these minimum power requirements, suggesting that the cells were not adequately mixed. Additional calculations also suggest that considerable settling was taking place in the cells. TSS concentration across the aeration cells decreased from 191 mg/L to 80 mg/L. This reduction (58%) is at odds with an expected estimated increase in TSS of about 39% across these systems due to microorganism growth.

The anticipated accumulation of sludge within the complete mix cells may have a long-term detrimental effect on treatment as volumes decrease and flow is impeded. Marysville should investigate the build-up of sludge in the complete mix aeration cells. Marysville should increase mixing power and coverage in the cells.

Oxidation Lagoon #2 Effluent

Reductions in total BOD_5 across oxidation lagoons #1 and #2 exceeded 67% (Table 2). An analysis was performed using the 1st order removal rate equation for aerobic-anaerobic (facultative) ponds (Metcalf & Eddy, 1992), assuming a range of dispersion coefficients (1-4) and a reaction rate k_1 of 0.12 d^{-1} (recommended minimum k_1 to the base e adjusted to 8.5° C - Labib, 1996). The analysis of the two-lagoon system (with recirculation equal three times the plant flow rate) indicates that the maximum predicted BOD_5 of 26.4 mg/L was 36% less than the measured effluent BOD_5 result (41 mg/L). Maximum calculated k_1 for the system was 0.06 d^{-1} (base e at 8.5° C), less than the recommended minimum k_1 by a factor of two.

It should be noted that Marysville recirculation rate exceeds 3.0 Q (plant flow) and this is greater than the rates of 0.5 to 2.0 Q typically used (Metcalf & Eddy, 1992). Also of note

is the predicted effluent BOD_5 result when analyzed without recirculation from the fourth lagoon (43.1 mg/L - at the highest diffusion coefficient value). The predicted effluent result with recirculation was only 39% less than the predicted result without recirculation. These calculations assumed the same reaction rates, dispersion factor coefficients, and detention times; although the unrecirculated analysis may have lower coefficients (due to less energetic kinetics). The comparison raises questions about the efficacy of recirculation in reducing BOD_5 loads. Although recirculation may provide the alternative benefit of increased treatment of ammonia nitrogen, Marysville should evaluate treatment efficiency without recirculation to determine if the recirculation rate could be reduced or the practice discontinued entirely. It is possible that other solutions for increasing treatment effectiveness for BOD_5 (i.e. reducing algae growth) may be more cost effective.

TSS concentrations across the system decreased 33%, with a final concentration (54 mg/L) typical for these systems (WEF, 1992 and Metcalf & Eddy, 1992). The overflow rate was 11 $gal/ft^2 \cdot day$ and the solids loading per unit area was $2.7 \text{ X } 10^{\wedge -4}$ $lb/ft^2 \cdot h$. Detention time (4.1 days with recirculation) was greater than recommended minimums for settling after aerated lagoon treatment systems. Assuming a typical range for the volatile solids anaerobic reaction rate coefficient of 0.52 y^{-1} to 0.92 y^{-1}, the sludge accumulation rate can be expected to range between $1.87 \text{ X } 10^{\wedge 5}$ lb/year to $2.82 \text{ X } 10^{\wedge 5}$ lb/year. With a specific density of about 1.01 the maximum accumulation rate is approximately 0.03 inches/year equally distributed.

Stabilization Lagoon #4 Effluent

Total BOD_5 concentration for lagoon #4 effluent of 29 mg/L (Table 1) appears to be low and is suspect for several reasons:

- Final effluent total BOD_5 (53 mg/L) was substantially higher despite additional treatment of a portion of lagoon #4 effluent by the sand filter.
- Final effluent total BOD_5 result appears to be the more reliable than the fourth lagoon total BOD_5 value, since it is closely matched by a concurrent $CBOD_5$ result (48 mg/L), which is almost 40% greater than the lagoon #4 total BOD_5 result.
- Lagoon #4 effluent TOC concentration was also higher than the lagoon #4 total BOD_5 value, whereas the opposite is usually the case due to the BOD_5 test's oxidation of other organically bound elements, such as nitrogen and hydrogen (APHA, 1992).
- The filter effluent total BOD_5 result (27 mg/L) has almost the same concentration as the lagoon #4 total BOD_5 result despite considerable removal of BOD_5 load as evidenced by the backwash BOD_5 concentration.

The reason for the anomalous total BOD_5 result is unknown. Lagoon #4 effluent total BOD_5 concentration was calculated from a mass balance of filter effluent load and final effluent load and found to be approximately 65.4 mg/L. For the purposes of the inspection the calculated value of lagoon #4 effluent total BOD_5 seems more reliable.

The increase of total BOD_5 in lagoon #4 effluent above that in lagoon #2 effluent may be attributed to algae growth in the polishing lagoons.

Using the calculated lagoon #4 effluent total BOD_5 concentration, total BOD_5 across polishing lagoons #3 and #4 increased about 60%. The predicted reduction in BOD_5 is between 65% to 80%. This is based on the recommended reaction rate coefficient of 0.10 d^{-1} (adjusted to 5.2°C - Labib, 1996), a range of dispersion factors (0.05-4.0), and a detention time which excludes recirculation. The difference between predicted and actual is most likely due to algae growth in the lagoons, although variations in plant loading cannot be discounted. TSS also increased 17%, which is also consistent with the growth of algae. This increase occurred during seasonably mild temperatures and during the hotter summer months algae growth would likely be much greater, creating even greater BOD_5 concentrations.

Lagoon overflow rate (10.5 gal/ft^2·d) and sludge loading (2.3 x 10^{-4} lb/ ft^2·h) were well within typical peak values. The sludge accumulation rate across the lagoons #3 and #4 could not be calculated due to the increase of solids across the system. It can be assumed that some settling occurs. Since the retention time with recirculation (4.2 days) in lagoons #3 and #4 is similar to that in the previous two lagoons and TSS loads to the lagoons are less, it is reasonable to expect that the sludge accumulation rate is no greater than that in lagoons #1 and #2. The 1994 hydrographic survey of the Marysville facility indicates that sludge accumulation is heaviest in portions of lagoon #1, with more moderate accumulations in portions of lagoons #3 and #4 (Livingstone Associates, 1994). The depth of sludge accumulation in lagoons #3 and #4 may also be attenuated by facultative assimilation of organic wastes into algae.

Sand Filter Effluent

Filtration across the sand filter achieved a 65% reduction in TSS load and an overall 18% reduction in the final effluent TSS load (Table 2). Using the calculated total BOD_5 for the lagoon #4 effluent, total BOD_5 was reduced 59% across the sand filter, for a 36% reduction of the final effluent BOD_5 load. Dissolved BOD_5 was reduced 20% and 5.4% in each case, respectively. There was also reduction in Kjeldahl nitrogen and total phosphorus. A reduction in ammonia nitrogen (13%) and a concurrent increase in nitrate and nitrite nitrogen concentration across the filter indicates that nitrification was taking place. The latter concentration increased by a factor of 20.

Treatment Plant Effluent

Reductions across the entire system were calculated and the results presented in Table 2. Ecology results showed a total BOD_5 reduction from 262 mg/L in the influent to 53 mg/L in the effluent (approximately 80% removal). Carbonaceous BOD_5 showed a 75% reduction. Total suspended solids (TSS) decreased from 191 mg/L to 47 mg/L with a removal efficiency of approximately 76% across the system. Removal efficiency across

the plant for TOC was 59%. Kjeldahl nitrogen, ammonia nitrogen, and total phosphorous were reduced 29%, 19%, and 40% respectively. Nitrate and nitrite nitrogen increased 117%, from 0.39 mg/L to 0.868 mg/L, an increase that appeared to take place largely in the sand filter. Analysis of Marysville samples displayed similar reductions for TSS, but showed greater removal efficiencies for carbonaceous BOD_5 and total BOD_5. The data suggest moderately effective treatment of TSS and BOD_5 and less effective nitrification. Chlorine residual concentrations in all samples were less than detection limits.

An Ecology-approved city of Marysville mixing zone study (Jones and Stokes, 1996) suggests mixing zone dilution factors of 8.8 and 17 for acute and chronic zones respectively. A mass balance calculation incorporating Washington State Water Quality Standards mixing zone specifications was calculated to project maximum end-of-pipe concentrations which would not produce violations of total ammonia criteria at the acute and chronic dilution zone boundaries (Ecology, 1994). The calculation uses an adjusted total ammonia nitrogen criteria based upon the receiving water pH, salinity, and temperature observed for March during a 1993-1994 receiving water study (Jones and Stokes, 1994). The upstream receiving water ammonia concentration was taken from a 1995 TMDL study (Cusimano, 1994). The maximum allowable whole effluent ammonia nitrogen concentrations were 181 mg/L and 51.9 mg/L for the acute and chronic criteria respectively. The effluent ammonia nitrogen concentration (15 mg/L) determined during the inspection was within the allowable acute and chronic concentrations.

Industrial Contributor Discharge Results and State Permit Comparisons

National Foods Corporation

Table 3 compares inspection results to state discharge permit limits. The pH of the Ecology composite sample result for National Foods discharge was 11.92. This exceeds the specific prohibition cited in the facility's state waste discharge permit, limiting all pH results to between 5.0 and 11.0. National Foods should lower discharge pH to meet the permit limit. Although the inspection result did not exceed specific dangerous waste corrosivity limits (12.5) the composite sample was sufficiently close to warrant attention.

The Ecology total BOD_5 composite result was equal to or greater than 820 mg/L (281 lbs/day). The actual BOD_5 concentration is tentative, since the result was qualified with a "G" indicating that it was a minimum value and that the actual value was greater than or equal to the reported value. The lowest possible value was within the interim effluent limit (1500 mg/L & 700 lbs/day - authorized through June 30, 1996). The minimum value exceeds the final effluent limit for BOD_5 (300 mg/L - beginning July 1, 1996) and National Foods should ensure that discharges will meet the new limits.

The Ecology TSS composite result (83 mg/L) was well within interim and final effluent limits (350 mg/L). The discharge's contribution to the Marysville treatment plant influent represents about:

- ≥ 3% of the BOD_5 load,
- ≥ 2% of the $CBOD_5$ load,
- 7% of the TOC load,
- 1% of the phosphorus load.

Other parameter contributions to the treatment plant influent were less than 1%.

Pacific Coast Feathers Company

The Ecology BOD_5 grab-composite sample result (318 mg/L) for the Pacific Coast Feathers discharge exceeded the state waste discharge permit daily maximum limit of 300 mg/L. Pacific Coast Feathers should reduce daily BOD_5 to below the permit limit. The Ecology TSS result (281 mg/L) was about 80% of the permit limit. Care should be taken to ensure that variability in daily TSS concentrations does not exceed permit limits. TOC, oil & grease, and ammonia nitrogen results were 353 mg/L, 55 mg/L, and 15 mg/L respectively. The discharge's contribution to the Marysville treatment plant influent represents about:

- 1.5% of the total BOD_5 load,
- 10% of its TOC load,
- 2% of the TSS load,
- 4% of the oil & grease load,
- slightly more than 1% of its ammonia nitrogen load.

Quil Ceda Tanning Company

The Ecology BOD_5 composite sample result (373 mg/L) for Quil Ceda discharge exceeded the state waste permit daily maximum of 300 mg/L by 24%. Quil Ceda should reduce BOD_5 concentrations to within permit limits. TSS (60 mg/L), oil & grease results (estimated at 8 and 10 mg/L), and sulfide results (1.2 and 1.5 mg/L) were well within state permit limits. Conductivity and hardness were 13,600 µmos/cm and 772 mg/L respectively. The discharge's contribution to the Marysville treatment plant influent represents about:

- less than 1% of the total BOD_5 load,
- less than 0.1% of the TSS load
- 1.4% of the ammonia nitrogen load,
- 2.0% of the Kjeldahl nitrogen load,
- less than 0.1% of the oil & grease load,

NPDES Permit Comparisons

Table 4 compares inspection results to NPDES permit limits. The permit allows different TSS limits depending on the proportion of flow above or below 2.8 MGD. A calculation is used to determine the combined flow proportional concentrations of fourth lagoon effluent and filter effluent to compare to limits for flows under 2.8 MGD. The permit limits for flow above 2.8 MGD are compared directly to final effluent concentrations. The fourth lagoon and filter effluent TSS concentration (60.1 mg/L), as modified to reflect portions of the effluent below 2.8 MGD, was within NPDES permit monthly and weekly average limits. The TSS load for this portion (1403 lb/day) was under the maximum monthly and weekly average permit load. The TSS concentration (22 mg/L) and load (194 lb/day) for the filtered portion exceeding 2.8 MGD were also within permit monthly and weekly average limits. Percent reduction from the influent concentration for the portion that exceeded 2.8 MGD (89%) was greater than the 85% minimum monthly average reduction required by the permit. The TSS concentration was 80% of the weekly limit and Marysville should ensure that the limit is not exceeded during months when algae growth is more prolific.

The Ecology composite 24-hour effluent $CBOD_5$ concentration (48 mg/L) exceeded the permit monthly average limit by 92% and the weekly average limit by 20%. The effluent 24-hour composite $CBOD_5$ load (1533 lb/day) exceeded NPDES permit monthly average effluent load limits by 21%, but was within the weekly average load limit. The percent reduction from the influent concentration (75%) was less than the minimum monthly average reduction (85%) required by the permit. Marysville 24-hour effluent $CBOD_5$ results (16 mg/L) were within permit limits, but it is believed that the result underreports the actual concentration due to the high sample holding temperature (9.4° C). Marysville should ensure that monthly effluent concentrations and loads do not exceed permit limits. BOD_5 samples should also be preserved at 4° C before analysis.

Effluent fecal coliform results were well below permit limits and pH results were within the stipulated range. The reported totalized average influent flow of 4.03 MGD was well below the NPDES permit design limit of 6.1 MGD. Influent BOD_5 concentrations and load were well below both permit overloading limits.

Detected Priority Pollutant Organics and Metals

Table 5 summarizes concentrations of organic parameters detected with priority pollutant scans. Table 6 summarizes detected priority pollutant metals. Appendix E contains results of all targeted organic compounds and metals results. Tentatively identified compounds are presented in appendix F. A glossary is included in appendix G.

Marysville Treatment Plant

Three VOA compounds and six BNA compounds were detected in the treatment plant 24-hour composite effluent sample (Table 5), but concentrations did not exceed either freshwater or marine acute and chronic water quality criteria. Influent results displayed one appreciable VOA concentration (methylene chloride - 251 µg/L-estimated) and two appreciable BNA concentrations (benzoic acid - 230 µg/L-estimated and 3b-coprostanol - 300 µg/L-estimated).

Five priority pollutant metals were detected in the plant effluent (Table 6). Only one, copper (10 µg/L), exceeded the marine acute water quality criteria (2.5 µg/L) in the whole effluent. Dilution in the receiving water (dilution factor: 8.8) should reduce this concentration to less than 46% of the acute criteria. Influent concentrations include chromium (9.8 µg/L), copper (46 µg/L), and lead (6.7 µg/L-estimated).

Quil Ceda Tanning Company

A single VOA compound, acetone, was detected at elevated concentrations in the two Quil Ceda grab samples, one at 52,700 µg/L and the other at 58,800 µg/L. Total discharge load was approximately 5.1 lbs/day. This load is equivalent to a concentration in the treatment plant influent of about 150 µg/L, but it apparently volatilized in the collection system before reaching the Marysville treatment plant. Five detected BNAs were discharged to the collection system from Quil Ceda. Only Benzoic acid was discharged at an appreciable concentration (122 µg/L). Four metals were detected in the Quil Ceda discharge. The highest concentration found was chromium (515 µg/L), but the discharge load (0.044 lbs/day) was calculated to contribute less than 14% to the treatment plant influent chromium load (0.329 lbs/day).

Effluent Bioassays

Ecology bioassay results detected no acute effluent toxicity, but considerable chronic effluent toxicity (Table 7). The *Daphnia magna* acute 48-hour survival test found 100% survival at all concentrations in the dilution series, except at 100% effluent which produced a 5% mortality. Statistical analysis determined that the Lowest Observable Effective Concentration (LOEC) and the No Observable Effective Concentration (NOEC) were both greater than 100%.

The fathead minnow (*Pimephales promelas*) chronic 7-day survival and growth test found generally declining survival and growth with increasing concentration (90% of fathead minnows died after 7-days in 100% effluent). The survival analysis produced an LC50 of 57.75%, LOEC of 25%, and NOEC of 12.5%. The growth analysis produced a LOEC of 12.5%, NOEC of 6.25%, and 25/50% growth inhibition concentration (Icp) of 10.5%.

Since the NOEC is 6.25%, this represents a statistically significant difference in response at a concentration lower than the acute critical effluent concentration (an acute dilution factor of 8.8 produces a critical concentration at 11.4% of 100% effluent)

The chronic test exceeds the performance standard cited in the Washington State Whole Effluent Toxicity Testing and Limits (WAC 173-205). Since a reasonable potential exists for chronic conditions in the receiving water, it is suggested that the effluent be further characterized by toxicity testing as outlined in section-050 of WAC 173-205. Since Marysville discharges to a marine water, it is also recommended that bioassays specific to marine organisms be conducted to evaluate the potential for effluent toxicity at the edge of the dilution zone.

The cause of toxicity in the effluent might be ammonia or copper concentrations, since both were found to exceed chronic water quality criteria in the whole effluent. The facility should investigate treatment methods to decrease the discharge of these contaminates to the receiving water.

Split Samples

Sample Comparisons

With the exception of Ecology TSS results, analysis of the Ecology and Marysville influent composite samples collected October 5-6 generally compared well (Table 8). Relative percent differences (RPD) between pairs of BOD_5 and pH samples were less than variation in precision cited in the EPA comparison of interlaboratory analysis of selected parameters (EPA, March, 1983). The RPD between influent TSS values is close to four times the interlaboratory variation in precision. This suggests there is a difference between Ecology and Marysville composite sampling techniques with a predominate effect on TSS, and this may be due to inadequate mixing when dividing the sample for analysis. Ecology and Marysville TSS results for their respective effluents grab samples from pond #4 and the filter were more closely matched, perhaps reflecting grab samples being less susceptible to mixing errors.

Ecology BOD_5 and $CBOD_5$ results for Ecology and Marysville effluent samples were divergent, with a RPD of 65% and 100% respectively. As previously mentioned this may be the result of elevated holding temperature for the Marysville sample, which would likely produce the lower Marysville BOD_5 concentrations. Marysville should ensure that holding temperatures for effluent samples are held at a temperature less than 4° C.

Laboratory Comparisons

Ecology and Marysville laboratory results for influent samples collected by Ecology were well matched, with RPDs between samples of 6.7% for TSS, 4.3% for BOD_5, and 1.1% for $CBOD_5$. The two labs BOD_5 and $CBOD_5$ results for the Marysville sample were also close (RPD: 6.6% and 7.1% respectively) This would suggest that the Marysville laboratory performance was good.

Sludge

General Chemistry

Total Kjeldahl nitrogen in the sludge was 17,300 mg/Kg dry weight or, given a percent solids of 11.4%, about 1972 mg/L-wet weight (Table 1). Total accumulated sludge, as reported by the 1994 Marysville biosolids quality evaluation (Livingstone Associates, 1994), is approximately one foot evenly distributed over the four ponds for a total sludge volume of 9.05×10^7 liters. This represent about 3.94×10^5 lbs of nitrogen. Nutrient uptake rates of nitrogen for various forage crops range from 50 lbs/acre·year to 480 lbs/acre·year. For sustainable land application this load would require a minimum of at least 820 acres for application over one year.

The sludge dry weight fecal coliform density was 149 colonies (most probable number) per gram (1700 #/100 grams - wet wt.). This is less than the maximum limit for fecal coliform density of 1000 #/g dry wt. required for Class A sewage sludge land application (EPA, 1993).

Detected Priority Pollutants

Five VOA compounds and eight BNA compounds were detected in the composite sludge sample. One BNA compound, 3B-coprostanol, was detected at 97,500 µg/Kg-dry wt. Eleven metals were detected in the sludge. Copper, lead, and chromium concentrations (234 mg/Kg-dry wt., 139 mg/Kg-dry wt., and 254 mg/Kg-dry wt. respectively) reflect the removal over time of influent concentrations. The concentrations of priority pollutants in the sludge did not exceed either EPA standards for land application of sewage sludge or screening concentrations for the dangerous waste designation criteria (Table 9). Chromium and lead did approach 30% and 16% of the dangerous waste screening concentration (20 times maximum leachate extract toxicity limit).

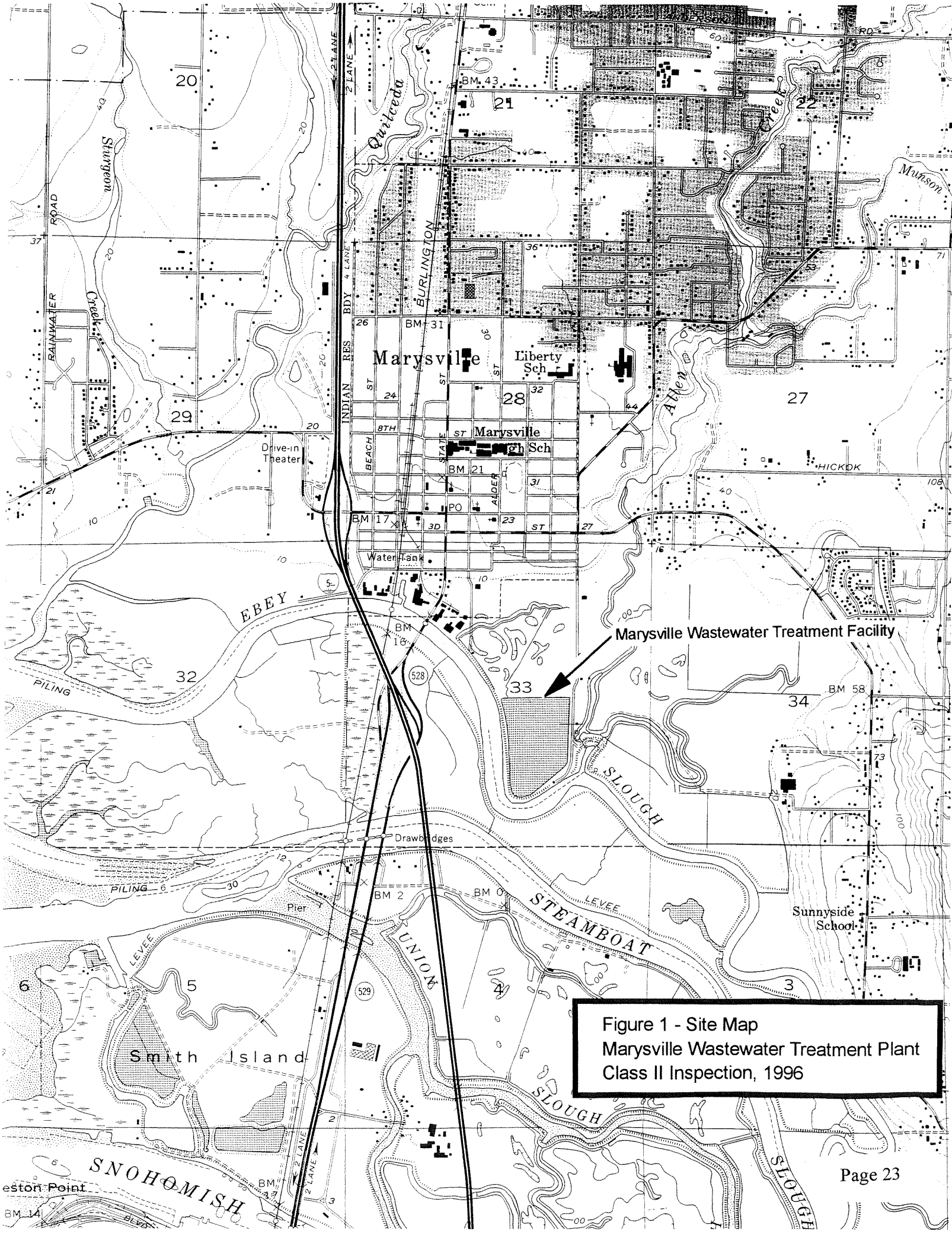


Figure 1 - Site Map
Marysville Wastewater Treatment Plant
Class II Inspection, 1996

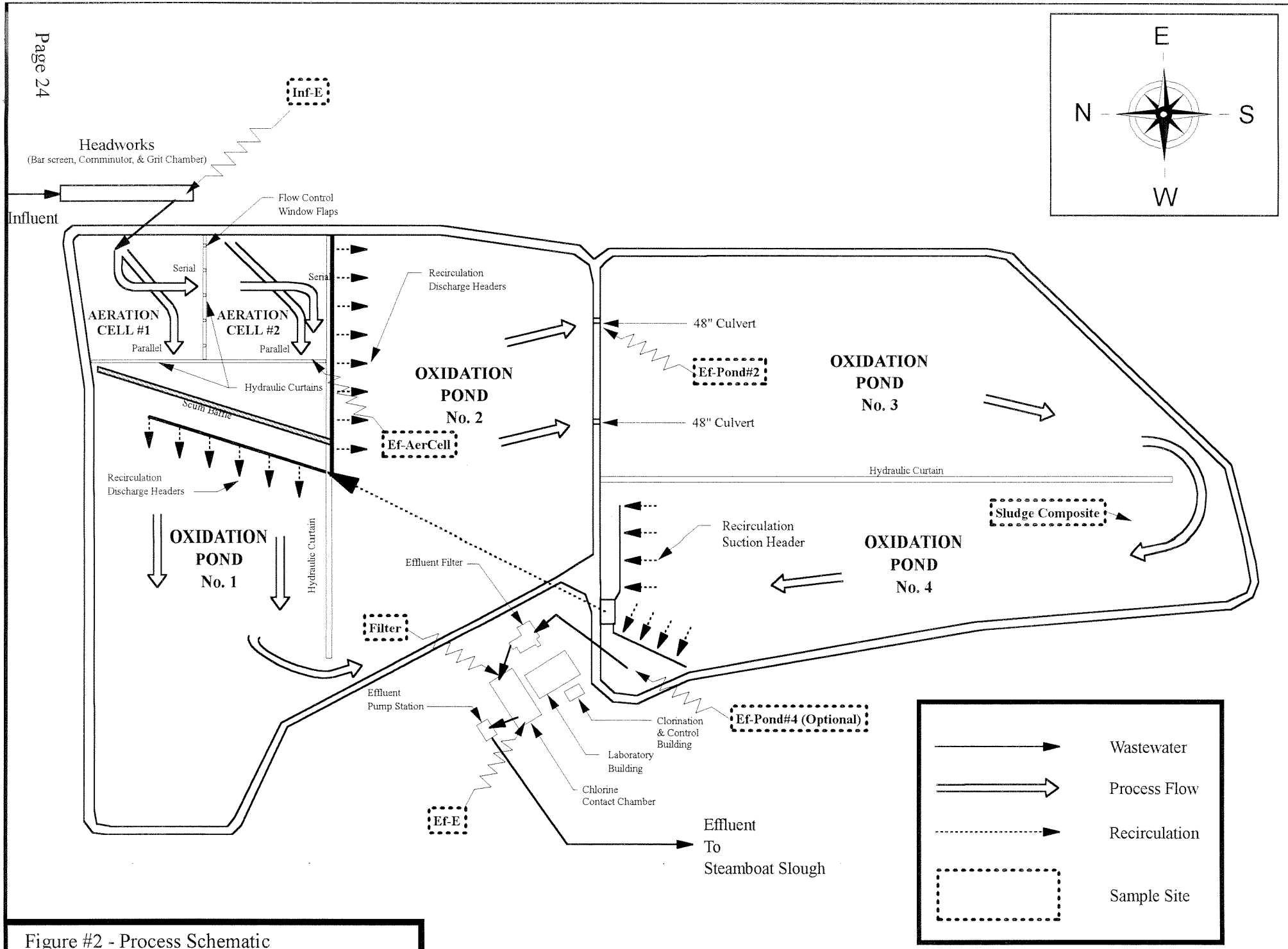


Figure #2 - Process Schematic
City of Marysville Wastewater Treatment Plant
Class II Inspection, 1996

Table 1 - General Chemistry Results - Marysville Class II, 1996.

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Inf-M	Ef-AerCell	Ef-Pond#2	Ef-Pond#4	Filter	Ef-E-1	Ef-E-2	Ef-EGrab1	EF-EGrab2
	Type:	grab	grab	comp	comp	comp	grab	grab	grab	grab	grab	grab	grab
	Date:	03/5	03/5	03/5-6	03/5-6	03/5-6	03/5	03/5	03/5	03/5	03/5	03/6	03/6
	Time:	0930	1650	08:00-08:00	08:00-08:00	08:00-08:00	1715	1740	1040	1200	1810	1100	1810
	Lab Log #:	108230	108231	108232	108233	108234	108235	108236	108237	108238	108239	108252	108253
GENERAL CHEMISTRY													
Conductivity (umhos/cm)		466	915	483		487	477	467	468	469	467	471	
Alkalinity (mg/L CaCO3)				153		149	146	141	103			125	
Hardness (mg/L CaCO3)				55.4									
Sulfide (mg/L)		1 U	1 U							1 U	1 U		
SOLIDS													
TS (mg/L)				528		339	380	305	274				
TNVS (mg/L)				204		315	212	175	195				
TSS (mg/L)		125	131	191		80	54	63	22	44	33		
TNVSS (mg/L)				19		11	3	5	6				
% Solids													
% Volatile Solids													
OXYGEN DEMAND PARAMETERS													
BOD5 (mg/L)				262	249	126	41	29	27				
CBOD5 (inhibited -mg/L)				185	189								
BOD5 (Soluable -mg/L)				>17 G		>17 G	5	5	4 U				
TOC (water mg/L)				92.4		57.1	53	50.5	30.6				
TOC (soil)													
NUTRIENTS													
Total Kjeldahl Nitrogen (TKN) (mg/L)				27		23.4	26.2	24.7	15.1				
NH3-N (mg/L)				18		16	16	16	14				
NO2+NO3-N (mg/L)				0.387		0.132	0.01 U	0.086	1.7				
Total-P (mg/L)				4.96		4.02	4.08	3.91	1.57				
MISCELLANEOUS													
Oil and Grease (mg/L)		27 J	13 J							3 J	2 J		
F-Coliform MF (#/100mL)												3	3 U
Fecal Coliform (sediment #/100gm)													
FIELD OBSERVATIONS													
Temperature (° C)		11.2	12.7				8.5	7.9	7.2		7.6	7.9	8.3
Temp-cooled (° C)$^{+-}$				2.9	10	2.4							
pH		7.58	7.51	7.54	7.28	7.42	7.08	7.72	6.95		7.21	7.34	7.12
Conductivity (umhos/cm)		294	576	291	341	283	315	319	316		317	321	491
Chlorine (mg/L)												≤0.01	≤0.01

Inf	influent sample	Ef-Pond#4	Pond #4 effluent sample	+-	Refrigerated sample
Ef	effluent sample	Filter	Plant filter effluent sample	G	The result was greater than the value reported. The result is a minimum value.
E	Ecology sample	Ef-EGrab1	AM effluent fecal coliform sample	J	The analyte was positively identified. The associated numerical result is an estimate.
M	Marysville sample	Ef-EGrab2	PM effluent fecal coliform sample	U	The analyte was not detected at or above the reported result.
Ef-AerCell	Aeration cell effluent sample	comp	Composite sample		
Ef-Pond#2	Pond #2 effluent sample	grab	Grab sample		

Table 1 (cont.) - General Chemistry Results - Marysville Class II, 1996.

Parameter	Location:	Ef-E	Ef-Bio	Ef-M	Trnsf-Blk	Sludge	Nat-Food	PCFeath	Ef-QC-1	Ef-QC-2	Ef-QC	BackWash
	Type:	comp	grab-comp	comp	grab	grab	comp	comp-grab	grab	grab	comp	grab
	Date:	03/5-6	03/5	03/5-6	03/4	03/5	03/5-6	03/5&6	03/5	03/5	03/5-6	03/5
	Time:	08:00-08:00	0910	08:00-08:00	1310	1810	08:00-08:00	1512	1620	1345	08:00-08:00	1100
	Lab Log #:	108240	108241	108242	108243	108244	108245	108246	108247	1E+05	108249	108251
GENERAL CHEMISTRY												
Conductivity (umhos/cm)			467				787	456	13600	13800	13600	478
Alkalinity (mg/L CaCO3)							308	65.5				112
Hardness (mg/L CaCO3)		52.7									772	
Sulfide (mg/L)									1.2	1.5		
SOLIDS												
TS (mg/L)		303										719
TNVS (mg/L)		184										253
TSS (mg/L)		47	35	51			83	281	72	96	60	391
TNVSS (mg/L)		4										375
% Solids						11.4						
% Volatile Solids						3.2						
OXYGEN DEMAND PARAMETERS												
BOD5 (mg/L)		53		27			>820 G	318			373	308
CBOD5 (inhibited -mg/L)		48		16			>413 G					
BOD5 (Soluable -mg/L)												4
TOC (water mg/L)		39.3					668	353			154	179
TOC (soil)												
NUTRIENTS												
Total Kjeldahl Nitrogen (TKN) (mg/L)		19.9				1972 #					145	44.5
NH3-N (mg/L)		15					1.11	15			137	14
NO2+NO3-N (mg/L)		0.868					2.19	2.31			0.082	1.51
Total-P (mg/L)		3.05					4.97	4.6			0.827	5.62
MISCELLANEOUS												
Oil and Grease (mg/L)								55 J	8 J	10 J		
F-Coliform MF (#/100mL)												
Fecal Coliform (sediment #/100gm)						1700						
FIELD OBSERVATIONS												
Temperature (° C)			7.3					19.1 *	9.1	10.2		7.2
Temp-cooled (° C)+-		4.5		9.4			2.2				3.3	
pH		7.49	7.07	6.87			11.92	7.15	7.98	7.93	8.00	7.26
Conductivity (umhos/cm)		296	316	329			868	456	9950	8900	8500	319
Chlorine (mg/L)									≤0.01	≤0.01		

Ef	effluent sample	PCFeath	Pacific Feathers Company effluent sample	comp	Composite sample
E	Ecology sample	QC	Quil Ceda Tanning Company effluent sample	grab	Grab sample
M	Marysville sample	BackWash	Marysville Backwash effluent sample	#	Wet wt.
Trnsf-Blk	Effluent Transfer blank	G	The result was greater than the value reported. The result is a minimum value.		
Sludge	Pond#4 bottom sludge sample	J	The analyte was positively identified. The associated numerical result is an estimate.		
Nat-Food	Nation Foods Inc. effluent sample	comp-grab	Composite grab sample		

Table 2 - General Chemistry Percent Reduction - Marysville Class II, 1996.

Parameter	Location:	Inf-E	Ef-AerCell	Percent Reduction Across 1st & 2nd Aeration Cells (assumes steady state)	Ef-Pond#2	Percent Reduction Across 1st & 2nd Treatment Ponds (assumes steady state)	Ef-Pond#4	Percent Reduction Across 3rd & 4th Treatment Ponds (assumes steady state)
	Type:	comp	comp		grab		grab	
	Date:	03/5-6	03/5-6		03/5		03/5	
	Time:	08:00-08:00	08:00-08:00		1715		1740	
	Lab Log #:	108232	108234		108235		108236	
GENERAL CHEMISTRY								
Conductivity (umhos/cm)		483	487	-0.83%	477	2.1%	467	2.1%
Alkalinity (mg/L CaCO3)		153	149	2.6%	146	2.0%	141	3.4%
SOLIDS								
TS (mg/L)		528	339	36%	380	-12%	305	20%
TNVS (mg/L)		204	315	-54%	212	33%	175	17%
TSS (mg/L)		191	80	58%	54	33%	63	-17%
TNVSS (mg/L)		19	11	42%	3	73%	5	-67%
OXYGEN DEMAND PARAMETERS								
BOD5 (mg/L)		262	126	52%	41	67%	65.4 #	-60%
CBOD5 (inhibited -mg/L)		185						
BOD5 (Soluable -mg/L)		>17 G	>17 G		5	> 71%	5	0.0%
TOC (water mg/L)		92.4	57.1	38%	53	7.2%	50.5	4.72%
NUTRIENTS								
Total Kjeldahl Nitrogen (TKN) (mg/L)		27	23.4	13%	26.2	-12%	24.7	5.73%
NH3-N (mg/L)		18	16	11%	16		16	
NO2+NO3-N (mg/L)		0.387	0.132	66%	0.01 U	92%	0.086	-760%
Total-P (mg/L)		4.96	4.02	19%	4.08	-1.5%	3.91	4.2%
FIELD OBSERVATIONS								
Conductivity (umhos/cm)		291	283	2.7%	315	-11%	319	-1%

Inf	influent sample	G	The result was greater than the value reported. The result is a minimum value.
Ef	effluent sample	U	The analyte was not detected at or above the reported result.
E	Ecology sample	comp	Composite sample
Ef-Pond#2	Pond #2 effluent sample	grab	Grab sample
Ef-Pond#4	Pond #4 effluent sample	#	This measured result (29 mg/L) is suspect and a calculated result of 65.4 mg/L is used in the report.

Table 2 - General Chemistry Percent Reduction - Marysville Class II, 1996.

Parameter	Location:	Filter	Percent Reduction In Load (Total Load) Across Sand Filter*	Ef-E	Ecology Percent Reduction In Load Across Treatment Plant	Inf-M	Ef-M	Marysville Percent Reduction In Load Across Treatment plant
	Type:	grab		comp		comp	comp	
	Date:	03/5		03/5-6		03/5-6	03/5-6	
	Time:	1040		08:00-08:00		08:00-08:00	08:00-08:00	
	Lab Log #:	108237		108240		108233	108242	
GENERAL CHEMISTRY								
Conductivity (umhos/cm)		468	-0.21% (-0.06%)					
Alkalinity (mg/L CaCO3)		103	27% (7.3%)					
SOLIDS								
TS (mg/L)		274	10% (2.7%)	303	44%			
TNVS (mg/L)		195	-11% (-3.1%)	184	13%			
TSS (mg/L)		22	65% (18%)	47	76%		51	74% #
TNVSS (mg/L)		6	-20% (-5.4%)	4	80%			
OXYGEN DEMAND PARAMETERS								
BOD5 (mg/L)		27	58.7% @ (15.9%) @	53	80%	249	27	89%
CBOD5 (inhibited -mg/L)				48	75%	189	16	92%
BOD5 (Soluable -mg/L)		4 U	> 20% (5.4%)					
TOC (water mg/L)		30.6		39.3	59%			
NUTRIENTS								
Total Kjeldahl Nitrogen (TKN) (mg/L)		15.1	39% (10%)	19.9	29%			
NH3-N (mg/L)		14	13% (3.4%)	15	19%			
NO2+NO3-N (mg/L)		1.7	-1877% (-507%)	0.868	-117%			
Total-P (mg/L)		1.57	60% (16%)	3.05	40%			
FIELD OBSERVATIONS								
Conductivity (umhos/cm)		316	0.9% (0.25%)	296	1.4%	341	329	6%

Inf influent sample
Ef effluent sample
E Ecology sample
M Marysville sample

G The result was greater than the value reported. The result is a minimum value.
U The analyte was not detected at or above the reported result.
* Load based on percent of Pond#4 effluent diverted to filter. Marysville reports that approximately 27 % of effluent flow (1.24 MGD) is made up of filter effluent. (Total load) is that percent load of the total effluent dicharged from the plant.
\# Ecology Influent quantity used in percent load calculation.
@ Calculation is based on 65.4 mg/L sand filter influent load

comp Composite sample
grab Grab sample

Table 3 - State Waste Discharge Permit Comparisons - Marysville Class II Inspection, 1996

National Foods, Inc.

Parameter	State Waste Discharge Permit Limits		Inspection Results
		Location:	Nat-Food
		Type:	comp
	Daily Maximum	Date:	03/5-6
		Time:	08:00-08:00
		Lab Log #:	108245
Discharge Total BOD_5			
Interim Limits*			
Concentration: (mg/L)	1500		820 G
Loading: (lbs/day)	700		281
Final Limits**			
Concentration: (mg/L)	300		820 G
Discharge TSS			
Interim & Final Limits			
Concentration (mg/L)	350		83
Interim & Final Discharge Flow			
(gal/day)	122,000		41,040
pH			
	7.0 - 11.0		11.92

Pacific Coast Feather Co.

Parameter	State Waste Discharge Permit Limits		Inspection Results
		Location:	PCFeath
		Type:	grab-comp
	Daily Maximum	Date:	03/5&6
		Time:	1512
		Lab Log #:	108246
Discharge BOD_5			
Concentration: (mg/L)	300		318
Discharge TSS			
Concentration (mg/L)	350		281
Discharge Flow			
(gal/day)	122,000		52,783

Quil Ceda Tanning Company

Parameter	State Waste Discharge Permit Limits			Inspection Results		
			Location:	Ef-QC	Ef-QC-1	Ef-QC-2
			Type:	comp	grab	grab
	Montly Average	Daily Maximum	Date:	03/5&6	03/5	03/5
			Time:	08:00-08:00	1620	1345
			Lab Log #:	108249	108249	108249
Discharge BOD5						
Concentration: (mg/L)		300		373		
Discharge TSS						
Concentration (mg/L)		350		60		
Discharge Flow						
(gal/day)		122,000		10,300		
Sulfide						
Concentration (mg/L)		24.0			1.2	1.5
Oil & Grease						
Concentration (mg/L)		100			8 J	10 J
pH						
	7.0	11.0		8.00	7.98	7.93
Chromium						
Concentration (mg/L)	8	12		0.515		

Nat-Food	National Foods, Inc. effluent sample	J	The analyte was positively identified. The associated numerical result is an estimate.
PCFeath	Pacific Coast Feathers Co. effluent sample		
Ef-QC	Quil Ceda Tanning Company effluent sample	G	The result was greater than the value reported. The result is a minimum value.
comp	Ecology composite sample	*	Effective date expires June 30, 1996
grab	Ecology grab sample.	**	Effective date begins July 1, 1996
grab-comp	Ecology grab composite sample.		

Table 4 - NPDES Comparison Results - Marysville Class II Inspection, 1996.

Parameter	NPDES Permit Effluent Limits			Ecology Composites		Marysville Composites		Ecology Grabs			
	Monthly Average	Weekly Average	Location:	Inf-E	Ef-E	Inf-M	Ef-M	Ef-E-1	Ef-E-2	Ef-EGrab1	EF-EGrab2
			Type:	comp	comp	comp	comp	grab	grab	grab	grab
			Date:	03/5-6	03/5-6	03/5-6	03/5-6	03/5	03/5	03/6	03/6
			Time:	08:00-08:00	08:00-08:00	08:00-08:00	08:00-08:00	1200	1810	1100	1810
			Lab Log #:	108232	108240	108233	108242	108238	108239	108252	108253
Effluent Carbonaceous Biochemical Oxygen Demand (CBOD5)											
Concentration: (mg/L)	25	40			48		16				
Loading: (lbs/day)	1272	2035			1533 *		511 *				
Percent Reduction	≥85% Monthly averages shall not exceed 25 mg/L or 15% of influent monthly average				82%		94%				
Effluent TSS											
For Flow ≤ 2.8 MGD											
Concentration (mg/L)	75	110									
Loading: (lbs/day)	1757	2627									
For Flow > 2.8 MGD											
Concentration (mg/L)	30	45			47		51	44	33		
Loading: (lbs/day)	826	1238			1501 *		1,629 *	1,405 *	1,054 *		
Percent Reduction	≥85% Monthly averages shall not exceed 25 mg/L or 15% of influent monthly average				76%		74%	78%	83%		
Effluent Fecal Coliform											
Concentration (count/100 mL)	200	400								3	3 U
Effluent pH											
(S.U.)	6.0 < pH < 9.0				7.49		6.87		7.21	7.34	7.12
Influent Flow Overloading Limits											
(MGD)	6.1				3.95		4.03				
Influent BOD_5 Overloading Limits											
(mg/L)					262		249				
(lbs/day)	10200				8,631 **		8,203 **				

E	Ecology 4-hour composite sample
M	Marysville 24-hour composite sample
Inf	Influent sample
Ef	Effluent sample
comp	Composite sample
grab	Ecology grab sample.
Ef-EGrab1	AM effluent fecal coliform sample
Ef-EGrab2	PM effluent fecal coliform sample
*	Load calculated from an average effluent flow of 3.84 MGD recorded 3/3-6/96.
**	Load calculated from an March 5-6 influent flow of 3.95 MGD recorded 3/4-6/96.

Table 5 - Detected VOAs and BNAs - Marysville Class II, 1996.

Parameter	Location:	Inf-E-1	Inf-E-2	Ef-E-1	Ef-E-2	EPA/Ecology Water Quality Criteria Summary				Sludge	Ef-QC-1	Ef-QC-2
	Type:	grab	grab	grab	grab					grab	grab	grab
	Date:	03/5	03/5	03/5	03/5					03/5	03/5	03/5
	Time:	0930	1650	1200	1810					1810	1620	1345
	Lab Log#:	10823	108231	108238	108239	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine	108244	108247	108248
VOA Compounds		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt	µg/L	µg/L
Methylene Chloride			251 I			11,000 *(a)		12,000 *(a)	6,400 *(a)			
Acetone											52700 I	58800 I
cis-1,2-Dichloroethene		0.3 J				11,600 *(b)		224,000 *(b)				
Chloroform		5.1	6.6	0.6 J	0.54 J	28,900 *	1,240 *	12,000 *(a)	6,400 *(a)			
1,1,1-Trichloroethane			0.4 J			18,000 *(c)		31,200 *				
Bromodichloromethane		0.3 J				11,000 *(a)		12,000 *(a)	6,400 *(a)			
Trichloroethene		0.3 J	0.31 J			45,000 *	21,900 *	2,000 *				
Tetrachloroethene		0.69 J	0.98 J			5,280 *	840 *	10,200 *	450 *			
Toluene		1.7	20	0.07 J		17,500 *		6,300 *	5,000 *			
Ethylbenzene		0.11 J	0.55 J			32,000 *		430 *				
1,2,4-Trimethylbenzene		0.67 J	26							9.3 J		
1,3,5-Trimethylbenzene		0.2 J	7.4							13 J		
sec-Butylbenzene			0.26 J									
p-Isopropyltoluene		0.38 J	0.75 J							12 J		
1,4-Dichlorobenzene		0.56 J	0.91 J			1,120 *(h)	763 *(h)	1,970 *(h)		20 J		
1,2-Dichlorobenzene			0.13 J			1,120 *(h)	763 *(h)	1,970 *(h)				
Naphthalene			1.5 J			2,300 *	620 *	2,350 *				
o-Xylene			2.3							3 J		
n-Propylbenzene			2.5									

Parameter	Location:	Inf-E	Ef-E	Trnsf-Bl	EPA/Ecology Water Quality Criteria Summary				Sludge	Ef-QC
	Type:	comp	comp	grab					grab	comp
	Date:	03/5-6	03/5-6	03/4					03/5	03/5-6
	Time:	08:00-08:00	08:00-08:0	1310					1810	08:00-08:00
	Lab Log#:	108232	108240	108243	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine	108244	108249
BNA Compounds		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L
Benzoic Acid		230 J	0.87 J							122 I
Isophorone			0.25	0.5	117,000 *		12,900 *		553 J	
Naphthalene		0.44	0.03 J	0.057 J	2,300 *	620 *	2,350 *		173 J	1.2
2-Methylnaphthalene		0.24	0.02 J	0.077 J					65 J	0.086 J
Benzyl Alcohol		9								
4-Methylphenol		28							930 J	
1,4-Dichlorobenzene		0.64			1,120 *(h)	763 *(h)	1,970 *(h)			
4-Chloroaniline									825 J	
Phenol		11	0.22		10,200 *	2,560 *	5,800 *			0.49
Pyrene							300 *(n)		286 J	
Fluoranthene				0.013 J	3,980 *		40 *	16 *	322 J	
1-Methylnaphthalene		0.19		0.045 J						0.073 J
3B-Coprostanol		300 J	8.4 J						97500	
Caffeine		41 I								

Ef	Effluent sample	Sludge	Pond sludge sample	grab	Grab sample	c	Total Trichloroethanes
Inf	Influent sample	comp	Composite sample	a	Total Halomethanes	h	Total Dichlorobenzenes
E	Ecology sample	I	The reported result is an estimate because of the presence of interference.	b	Total Dichloroethenes	n	Total Polynuclear Aromatic Hydrocarbons
QC	Quil Ceda Tanning Company sample.	J	The analyte was positively identified. The associated numerical result is an estimate.				
Trnsf-Blk	Effluent transfer blank sample.	*	Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.				

Table 6 - Detected Metals - Marysville Class II, 1996.

Parameter	Location:	Inf-E	Ef-E	EPA/Ecology Water Quality Criteria Summary				Sludge	Ef-QC
	Type:	comp	comp					grab	comp
	Date:	03/5-6	03/5-6	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine	03/5	03/5-6
	Time:	08:00-08:00	08:00-08:00					1810	08:00-08:00
	Lab Log#:	108232	108240					108244	108249
Metals		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/Kg-dry wt.	µg/L
Hardness =	53								
Arsenic				360.0 (c)	190.0 (d)	69.0 (c)	36.0 (d)	11.9	
Beryllium				130.0 *	5.3 *			0.32	
Cadmium		0.39	0.2	1.7 +(c)	0.6 +(d)	37.2 (c)	8.0 (d)	3.41	
Chromium (Total)		9.8						254	515
	Hexavalent			16.0 (c)	11.0 (d)	1,100 (c)	50.0 (d)		
	Trivalent			1,032 +(c)	123.1 +(d)	10,300 *(c)			
Copper		46	10	8.4 +(c)	5.9 +(d)	2.5 (c)		234	6.8
Lead		6.7 J	1.9 J	25.0 +(c)	0.97 +(d)	151.0 (c)	5.8 (d)	139	
Mercury (Total)		0.13		2.4 (c)	0.012 (d)	2.1 (c)	0.025 (d)	1.57	
Nickel		3.7	3	787 +(c)	87.0 +(d)	71.0 (c)	7.9 (d)	53.8	17.7
Selenium				20.0	5.0	300.0	71.0	17.5	
Silver		1.1		0.7 +(a)		1.2 (a)		10.6	
Zinc		72.5	17	60.0 +(c)	55.1 +(d)	85.0 (c)	77.0 (d)	465	30

Ef	Effluent sample	J	The analyte was positively identified. The associated numerical result is an estimate.
Inf	Influent sample	*	Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.
E	Ecology sample	+	Hardness dependent criteria (53 mg/L used).
QC	Quil Ceda Tanning Company sample.	c	A 1-hour average concentration not to be exceeded more than once every three years on the average.
comp	Composite sample		
grab	Grab sample	d	A 4-day average concentration not to be exceeded more than once every three years on the average.
		a	An instantaneous concentration, not to be exceeded at any time.

Table 7 - Effluent Bioassay Results - Marysville Class II, 1996

NOTE: tests were run effluent prior to chlorine contact chamber (Ef-Bio: Lab Log #108241)

Daphnia magna - 48-hour survival test

(Daphnia magna)

Sample	Number Tested *		Percent Survival
Control	20		100
6.25 % Effluent	20		100
12.5 % Effluent	20		100
25 % Effluent	20		100
50 % Effluent	20		100
100 % Effluent	20		95

Survival
LC50 Could not be calculated
LOEC > 100 % effluent
NOEC > 100 % effluent

* 4 replicates of 5 organisms

Fathead Minnow - 7 day survival and growth test

(Pimephales promelas)

Sample	Number Tested *		Percent Survival	Average Dry Weight per Fish (mg)
Control	40		97.5%	0.488
6.25 % Effluent	40		95.0%	0.401
12.5 % Effluent	40		95.0%	0.349
25 % Effluent	40		75.0%	0.339
50 % Effluent	40		75.0%	0.349
100 % Effluent	40		10.0%	0.322

Survival	Growth
LC50 = 57.7 % effluent	
LOEC = 25 % effluent	LOEC = 12.5 % effluent
NOEC = 12.5 % effluent	NOEC = 6.25 % effluent
IC_P = Not calculated	ICp = 10.5%

* four replicates of 10 organisms

NOEC	No observable effects concentration
LOEC	Lowest observable effects concentration
LC50	Lethal concentration for 50% of the organisms
IC_P	Inhibition Concentration 25/50% - the dilution concentration at which the exposed population showed a 25/50% growth inhibition

Table 8 - Split Sample Result Comparison - Marysville Class II, 1995

	Location:	Inf-E	Inf-M	Ef-Pond#4(E)	EF-Pond#4(M)	Filter(E)	Filter(M)	Ef-E	Ef-M	PCFeath(E)	PCFeath(PCF)
	Type:	comp	comp	grab	grab-comp	grab	grab-comp	comp	comp	comp-grab	grab
	Date:	03/5-6	03/5-6	03/6	03/5-6	3/5	3/6	03/5-6	03/5-6	03/5&6	03/6
	Time:	08:00-08:00	08:00-08:00	1100		1040		08:00-08:00	08:00-08:00	1512	
	Lab Log #:	108232	108233	108236		108237		108240	108242	108246	
General Chemistry											
Parameter	**Laboratory**										
TSS	Ecology	199		63	63	22	19	47	51		
(mg/L)	Marysville	186	280						49 *		
BOD5	Ecology	262	249					53	27		
(mg/L)	Marysville	251	233						22.7		
CBOD5	Ecology	185	189					48	16		
(mg/L)	Marysville	183	203						11.7		
pH	Ecology	8.74	7.84					7.49	6.87		
	Marysville	7.42	7.02						7.14 **		
TSS	Ecology									281	277
	PCFeather										
BOD_5	Ecology									318	230
	PCFeather										
Oil & Grease	Ecology									55	156
	PCFeather										

E	Ecology sample
M	Marysville sample
PCF	Pacific Coast Feathers Inc.
grab	grab sample
comp	Composite sample
EF	Effluent sample
Inf	Influent sample

* Flow weighted combination of fiter and pond#4 effluent.

** Negative $\log_{10}$ of the final concentration drived from the addition of hydrogen ion loads from the filter and the the 4th lagoon.

Table 9 - Sludge Result Comparisons to the EPA Land Application Concentration Criteria and to the Dangerous Waste Concentration Thresholds- Marysville Class II, 1996

Parameter	Location:	Sludge	Volumetric Concentration of Parameters@	EPA Standards for Land Application of Sewage Sludge		Dangerous Waste Regulations Designation Criteria		
	Type:	grab						
	Date:	03/5						
	Time:	1810		Ceiling Concentrations *	Pollutant Concentrations **	Toxicity Charascteristics List +		Screening Concentrations# (20 Times)
	Lab Log #:	108244						
VOA Compounds		µg/Kg-dry wt.	mg/L			(mg/L)		(mg/L)
1,4-Dicclorobenzene		20 J	**0.002**	N.A.	NA	7.5		**150**
Metals		(mg/Kg-dry wt.)	(mg/L)	(mg/Kg-dry wt.)	(mg/Kg-dry wt.)	(mg/L)		(mg/L)
Arsenic		11.9	**1.37**	75	41	5.0		**100.0**
Cadmium		3.41	**0.39**	85	39	1.0		**20.0**
Chromium (Total)		254	**29.2**	3000	1200	5.0		**100.0**
Copper		234		4300	1500			**N.A.**
Lead		139	**16.0**	840	300	5.0		**100.0**
Mercury (Total)		1.57	**0.18**	57	17	0.2		**4.0**
Nickel		53.8		420	420			**N.A.**
Selenium		17.5	**2.02**	100	36	1.0		**20.0**
Silver		10.6	**1.22**	N.A.	N.A.	5.0		**100.0**
Zinc		465		7500	2800			**N.A.**

* 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.

\+ Maximum concentration of the contaminates for the leachate extract toxicity characteristic.

\# Screening concentration criteria of parameter which recommends that such wastes be designated by test methods set forth in WAC 173-303-110.

@ Wet weight concentration of parameter converted to volumetric concentration assumming a sludge specific gravity of 1.01.

Sludge Marysville Pond#4 bottom sludge sample

N.A. Not Applicable

Appendices

Appendix A - Sampling Stations Descriptions - Marysville Class II, 1996

Inf-E-# Ecology grab samples of Marysville influent wastewater collected from the channel just above the influent Parshall flume. Collected 03/5/96 in both A.M. and P.M.

Inf-E Ecology 24-hour composite sample of Marysville influent wastewater collected from the channel just above the influent Parshall flume. Collected 03/5-6/96

Inf-M Marysville 24-hour composite sample of Marysville influent wastewater collected from the channel just above the influent Parshall flume. Collected 03/5-6/96

Ef-AerCell Ecology 24-hour composite sample of Marysville in-plant wastewater collected from the channel draining the two complete mix aeration cell into oxidation pond #1. Collected 03/5-6/96.

Ef-Pond#2 Ecology grab sample of Marysville in-plant wastewater collected from the culvert draining oxidation pond #2 into polishing pond #3. Collected 03/5/96 in the P.M.

Ef-Pond#4 Ecology grab sample of Marysville in-plant wastewater collected from the pump wet well for the outflow of polishing pond #4, upstream of the sand filters and the chlorine contact chamber. Collected 03/5/96 in the P.M.

Filter Ecology grab sample of Marysville in-plant wastewater collected from the pump wet well for the outflow from the sand filter to the chlorine contact chamber. Collected 03/5/96 in the A.M.

Ef-E-# Ecology grab samples of Marysville effluent wastewater collected above the weir at the end of the chlorine contact chamber, just prior to final discharge. Collected 03/5/96 in both A.M. and P.M.

Ef-EGrab# Ecology fecal coliform grab samples of Marysville effluent wastewater collected above the weir at the end of the chlorine contact chamber, just prior to final discharge. Collected 03/6/96 in both A.M. and P.M.

Ef-E Ecology 24-hour composite sample of Marysville effluent wastewater collected above the weir at the end of the chlorine contact chamber, just prior to final discharge. Collected 03/5-6/96.

Ef-Bio Three-part Ecology bioassay grab-composite sample of Marysville unchlorinated effluent collected from manhole just after the convergence of sand filter effluent and the remainder of pond#4 effluent, prior to the chlorine contact chamber. One portion collected on 03/05/96 and two others on 03/06/96.

Ef-M Marysville grab-composite samples of in-plant wastewater collected from the end of pond#4 and the effluent from the sand filter, then combined to represent the final effluent for analysis. Collected 03/05-6/96.

Transblk Ecology grab sample of effluent compositor distilled rinse. - Collected 03/04/96.

Sludge Ecology grab-composite sample of Marysville lagoon bottom sludge collected by petite ponar from a boat at the upper (south) end of lagoon #4. - Collected 03/5/96 in the P.M.

Nat-Food Ecology 24-hour composite sample of National Foods, Inc. effluent discharge to the Marysville collection system, collected from a manhole just prior to discharge to the city collection system. - Collected 03/5-6/96.

PCFeath Ecology grab-composite sample of Pacific Coast Feathers Company effluent discharge to the Marysville collection system, collected from a grease trap just prior to the city collection system. - Collected 03/5-6/96.

Ef-QC-# Ecology grab samples of Quil Ceda Tanning Company effluent discharge to the Marysville collection system, collected from the final effluent treatment tank, just prior to discharge to the city collection system. Collected 03/5-6/96 one in the PM and one in the AM.

Ef-QC-# Ecology 24-hour composite sample of Quil Ceda Tanning Company effluent discharge to the Marysville collection system, collected from the final effluent treatment tank, just prior to discharge to the city collection system. Collected 03/5-6/96.

Backwash Ecology grab sample of Marysville sand filter backwash collected from pump wet well, just prior to recirculation to oxidation lagoons #1 & #2. Collected 03/05/96

Appendix B - Sampling Schedule - Marysville Class II, 1996.

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Inf-M	Ef-AerCell	Ef-Pond#2	Ef-Pond#4	Filter	Ef-E-1	Ef-E-2	Ef-EGrab1	EF-EGrab2
	Type:	grab	grab	comp	comp	comp	grab	grab	grab	grab	grab	grab	grab
	Date:	03/5	03/5	03/5-6	03/5-6	03/5-6	03/5	03/5	03/5	03/5	03/5	03/6	03/6
	Time:	0930	1650	08:00-08:00	08:00-08:00	08:00-08:00	1715	1740	1040	1200	1810	1100	1810
	Lab Log #:	108230	108231	108232	108233	108234	108235	108236	108237	108238	108239	108252	108253
GENERAL CHEMISTRY													
Conductivity		E	E	E		E	E	E	E	E	E	E	
Alkalinity				E		E	E	E	E			E	
Hardness				E									
Sulfide		E	E							E	E		
SOLIDS													
TS				E		E	E	E	E				
TNVS				E		E	E	E	E				
TSS		E	E	E&M	M	E	E	E&M	E&M	E	E		
TNVSS				E		E	E	E	E				
% Solids													
% Volatile Solids													
OXYGEN DEMAND PARAMETERS													
BOD5 (total)				E&M	E&M	E	E	E	E				
CBOD5 (inhibited)				E&M	E&M								
BOD5 (Soluble)				E		E	E	E	E				
TOC (water)				E		E	E	E	E				
TOC (soil/sed)													
NUTRIENTS													
Total Kjeldahl Nitrogen (TKN)				E		E	E	E	E				
NH3-N				E		E	E	E	E				
NO2+NO3-N				E		E	E	E	E				
Total-P				E		E	E	E	E				
MISCELLANEOUS													
Oil and Grease (water)		E	E							E	E		
F-Coliform MF												E	E
F-Coliform (soil/sed)													
ORGANICS													
VOC (water)		E	E							E	E		
VOC (soil/sed) - Extensive TICs													
BNAs (water)				E									
BNAs (soil/sed) - Extensive TICs													
Pest/PCB (water) - Chlorinated				E									
Pest/PCB (soil/sed) - Chlorinated													
METALS													
PP Metals (water)				E									
PP Metals (soil/sed)													
BIOASSAYS													
Daphnia magna (acute)													
Fathead Minnow (chronic)													
FIELD OBSERVATIONS													
Temperature		E	E				E	E	E		E	E	E
Temp-cooled +-				E	E	E							
pH		E	E	E&M	E&M	E	E	E	E		E	E	E
Conductivity		E	E	E	E	E	E	E	E		E	E	E
Chlorine												E	E

Inf	influent sample	Ef-Pond#4	Pond #4 effluent sample	+-	Refrigerated sample
Ef	effluent sample	Filter	Plant filter effluent sample		
E	Ecology sample and Analysis	Ef-EGrab1	AM effluent fecal coliform sample		
M	Marysville sample and Analysis	Ef-EGrab2	PM effluent fecal coliform sample		
Ef-AerCell	Aeration cell effluent sample	comp	Composite sample		
Ef-Pond#2	Pond #2 effluent sample	grab	Grab sample		

Appendix B - Sampling Schedule - Marysville Class II, 1996.

Parameter	Location:	Ef-E	Ef-Bio	Ef-M	Trnsf-Blk	Sludge	Nat-Food	PCFeath	Ef-QC-1	Ef-QC-2	Ef-QC	BackWash
	Type:	comp	grab-comp	comp	grab	grab	comp	comp-grab	grab	grab	comp	grab
	Date:	03/5-6	03/5	03/5-6	03/4	03/5	03/5-6	03/5&6	03/5	03/5	03/5-6	03/5
	Time:	08:00-08:00	0910	08:00-08:00	1310	1810	08:00-08:00	1512	1620	1345	08:00-08:00	1100
	Lab Log #:	108240	108241	108242	108243	108244	108245	108246	108247	1E+05	108249	108251
GENERAL CHEMISTRY												
Conductivity			E				E	E	E	E	E	E
Alkalinity							E	E				E
Hardness		E									E	
Sulfide									E	E		
SOLIDS												
TS		E										E
TNVS		E										E
TSS		E	E	E&M			E	E&PCF	E	E	E	E
TNVSS		E										E
% Solids						E						
% Volatile Solids						E						
OXYGEN DEMAND PARAMETERS												
BOD5 (total)		E		E&M			E	E&PCF			E	E
CBOD5 (inhibited)		E		E&M			E					
BOD5 (Soluble)												E
TOC (water)		E					E	E			E	E
TOC (soil/sed)												
NUTRIENTS												
Total Kjeldahl Nitrogen (TKN)		E				E					E	E
NH3-N		E					E	E			E	E
NO2+NO3-N		E					E	E			E	E
Total-P		E					E	E			E	E
MISCELLANEOUS												
Oil and Grease (water)								E&PCF	E	E		
F-Coliform MF												
F-Coliform (soil/sed)						E						
ORGANICS												
VOC (water)									E	E		
VOC (soil/sed) - Extensive TICs						E						
BNAs (water)		E			E						E	
BNAs (soil/sed) - Extensive TICs						E						
Pest/PCB (water) - Chlorinated		E			E						E	
Pest/PCB (soil/sed) - Chlorinated						E						
METALS												
PP Metals (water)		E			E						E	
PP Metals (soil/sed)						E						
BIOASSAYS												
Daphnia magna (acute)			E									
Fathead Minnow (chronic)			E									
FIELD OBSERVATIONS												
Temperature			E					E	E	E		E
Temp-cooled		E		E			E				E	
pH		E	E	E&M			E	E	E	E	E	E
Conductivity		E	E	E			E	E	E	E	E	E
Chlorine									E	E		

Ef	effluent sample	PCFeath	Pacific Coast Feathers Company effluent sample	comp	Composite sample
E	Ecology sample and Analysis	PCF	Pacific Coast Feathers Company analysis	grab	Grab sample
M	Marysville sample and Analysis	QC	Quil Ceda Tanning Company effluent sample		
Trnsf-Blk	Effluent Transfer blank	BackWash	Marysville Backwash effluent sample		
Sludge	Pond#4 bottom sludge sample	comp-grab	Composite grab sample		
Nat-Food	Nation Foods Inc. effluent sample				

Appendix C - Laboratory Methods - Marysville Class II, 1996

Parameter	Manchester Methods	APHA Methods	Lab Used
GENERAL CHEMISTRY			
Conductivity	EPA, Revised 1983: 120.1	APHA, 1995: 2510A.	Manchester Lab
Alkalinity	EPA, Revised 1983: 310.1	APHA, 1995: 2320B.	Manchester Lab
Hardness	EPA, Revised 1983: 130.2	APHA, 1995: 2340C	Manchester Lab
Sulfide	EPA, Revised 1983: 376.1		Manchester Lab
SOLIDS			
TS	EPA, Revised 1983: 160.3	APHA, 1995: 2540B.	Manchester Lab
TNVS	EPA, Revised 1983: 106.3	APHA, 1995: 2540E.	Manchester Lab
TSS	EPA, Revised 1983: 160.2	APHA, 1995: 2540D.	Manchester Lab
TNVSS	EPA, Revised 1983: 106.2	APHA, 1995: 2540D&E	Manchester Lab
% Solids	APHA, 1995: 2540G	APHA, 1995: 2540G.	Manchester Lab
% Volatile Solids	EPA, Revised 1983: 160.4	APHA, 1995: 2540E.	Manchester Lab
OXYGEN DEMAND PARAMETERS			
BOD5 (total)	EPA, Revised 1983: 405.1	APHA, 1995: 5210B.	Manchester Lab
CBOD5 (inhibited)	EPA, Revised 1983: 410.1	APHA, 1995: 5210B.	Manchester Lab
BOD5 (Soluble)	APHA, 1995: 5210B.	APHA, 1995: 5210B.	Manchester Lab
TOC (water)	EPA, Revised 1983: 415.1	APHA, 1995: 5310B.	Sound Analytical Services, Inc
TOC (soil/sed)	EPA, Revised 1983: 415.1	APHA, 1995: 5310B.	Sound Analytical Services, Inc
NUTRIENTS			
Total Kjeldahl Nitrogen (TKN)		ALPA, 1995:4500N_{org}	Manchester Lab
NH3-N	EPA, Revised 1983: 350.1	APHA, 1995: 4500-NH	Manchester Lab
NO2+NO3-N	EPA, Revised 1983: 353.2	APHA, 1995: 4500-NO	Manchester Lab
Total-P	EPA, Revised 1983: 365.3	APHA, 1995: 4500-PF.	Manchester Lab
MISCELLANEOUS			
Oil and Grease (water)	EPA, Revised 1983: 413.1	APHA, 1995: 5520B	Manchester Lab
F-Coliform MF	APHA, 1995: 9222D.	APHA, 1995: 9221D.	Manchester Lab
F-Coliform (soil/sed)	APHA, 1995: 9221A	APHA, 1995: 9221A.	Manchester Lab
ORGANICS			
VOC (water)	EPA, 1986: 8260	APHA, 1995: 6	Manchester Lab
VOC (soil/sed) - Extensiv	EPA, 1986: 8240	APHA, 1995: 6210B.	Manchester Lab
BNAs (water)	EPA, 1986: 8270	APHA, 1995: 6410B.	Manchester Lab
BNAs (soil/sed) - Extensiv	EPA, 1986: 8270	APHA, 1995: 6410B.	Manchester Lab
Pest/PCB (water) - Chlori	EPA, 1986: 8080	APHA, 1995: 6630C.	Manchester Lab
Pest/PCB (soil/sed) - Chlo	EPA, 1986: 8080	APHA, 1995: 6630C.	Manchester Lab
METALS			
PP Metals (water)	EPA, Revised 1983: 200-2	APHA, 1995: 3000-350	Manchester Lab
PP Metals (soil/sed)	EPA, Revised 1983: 200-2	APHA, 1995: 3000-350	Manchester Lab
BIOASSAYS			
Fathead Minnow (acute)	EPA 1993: 1000.0	APHA, 1995: 8910B&C	Beak Consultants
Fathead Minnow (chronic)	EPA 1989: 1000.0	APHA, 1995: 8910B&C	Beak Consultants

METHOD BIBLIOGRAPHY:

APHA-AWWA-WPCF, 1995. Standard Methods for the Exanination of Water and Wastewater, 19th Edition.

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

EPA, 1986: SW846. Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, 3rd. ed.,November, 1986.

EPA, 1989. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving waters to Freshwater Organisms.

EPA, 1993 Methods for Measuring Acute Toxicity of Effluent and Receiving Waters to Freshwater Marine Organisms. Fourth Edition, EPA/600/4-90/027 Washington D.C. 1993.

Appendix D - Quality Assurance/Quality Control - Marysville Class II Inspection, 1996

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% HNO_3 solution
4. Rinse three (3) times with distilled/deionized water
5. Rinse with high purity acetone
6. Rinse with high purity Hexane
7. Rinse with high purity acetone
8. Allow to dry and seal with aluminum foil

Appendix E - VOA, BNA, Pesticide/PCB and Metals Scan Results - Marysville Class II, 1996.

Parameter	Location:	Inf-E-1	Inf-E-2	Ef-E-1	Ef-E-2	Sludge	Ef-QC-	Ef-QC-2
	Type:	grab	grab	grab	grab	grab	grab	grab
	Date:	03/5	03/5	03/5	03/5	03/5	03/5	03/5
	Time:	0930	1650	1200	1810	1810	1620	1345
	Lab Log#:	108230	108231	10823	108239	108244	108247	108248
VOA Compounds		µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L	µg/L
Chloromethane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
Dichlorodifluoromethane		2 UJ	2 UJ	2 UJ	2 UJ	4 U	20 UJ	20 UJ
Bromomethane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
Vinyl Chloride		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Chloroethane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
Trichlorofluoromethane		2 UJ	2 UJ	2 UJ	2 UJ	17 U	20 UJ	20 UJ
Methylene Chloride		1.6 UJ	251 I	1 UJ	1 UJ	35 U	10 UJ	10 UJ
Acetone		20 UJ	20 UJ	20 UJ	20 UJ	700 UJ	52700 I	58800 I
Carbon Disulfide		1 U	1 U	1 U	1 U	86 UJ	10 U	10 UJ
1,1-Dichloroethene		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
1,1-Dichloroethane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
trans-1,2-Dichloroethene		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
cis-1,2-Dichloroethene		0.3 J	1 U	1 U	1 U	17 U	10 U	10 UJ
2,2-Dichloropropane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
Bromochloromethane		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Chloroform		5.1	6.6	0.55 J	0.54 J	17 U	10 U	10 U
1,2-Dichloroethane		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
1,1,1-Trichloroethane		1 U	0.4 J	1 U	1 U	17 U	10 U	10 U
Carbon Tetrachloride		1 U	1 U	1 U	1 U	17 UJ	10 U	10 UJ
1,1-Dichloropropene		1 U	1 U	1 U	1 U	17 U	10 U	10 U
Bromodichloromethane		0.34 J	1 U	1 U	1 U	17 UJ	10 U	10 UJ
1,2-Dichloropropane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
Dibromomethane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
trans-1,3-Dichloropropene		1 U	1 U	1 U	1 U	16 U	10 U	10 UJ
Trichloroethene		0.25 J	0.31 J	1 U	1 U	17 U	10 U	10 U
Dibromochloromethane		1 U	1 U	1 U	1 U	17 UJ	10 U	10 UJ
1,2-Dibromoethane (EDB)		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
1,1,2-Trichloroethane		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
1,3-Dichloropropane		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Benzene		1 U	1 U	1 U	1 U	17 UJ	10 U	10 U
cis-1,3-Dichloropropene		2 U	2 U	2 U	2 U	18 U	20 U	20 U
Bromoform		2 U	2 U	2 U	2 U	17 UJ	20 U	20 UJ
2-Hexanone		1 U	1 U	1 U	1 U	69 U	10 U	10 U

Inf	influent sample	grab	Grab sample
Ef	effluent sample	I	The reported result is an estimate because of the presence of interference.
E	Ecology sample	J	The analyte was positively identified. The associated numerical result is an estimate.
Sludge	Pond sludge sample	UJ	The anaylte was not detected at or above the reported estimated result.
QC	Quil Ceda Tanning Company sample	U	The analyte was not detected at or above the reported result.

Appendix E (cont.) - VOA, BNA, Pesticide/PCB and Metals Scan Results - Marysville Class II, 1996.

Parameter	Location:	Inf-E-1	Inf-E-2	Ef-E-1	Ef-E-2	Sludge	Ef-QC-	Ef-QC-2
	Type:	grab	grab	grab	grab	grab	grab	grab
	Date:	03/5	03/5	03/5	03/5	03/5	03/5	03/5
	Time:	0930	1650	1200	1810	1810	1620	1345
	Lab Log#:	10823	108231	10823	108239	108244	108247	108248
VOA Compounds		µg/L	µg/L	µg/L	µg/L	µg/Kgdry wt.	µg/L	µg/L
Tetrachloroethene		0.69 J	0.98 J	1 U	1 U	17 U	10 U	10 U
1,1,2,2-Tetrachloroethane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
1,1,1,2-Tetrachloroethane		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Toluene		1.7	20	0.067 J	1 U	17 UJ	10 U	10 UJ
Chlorobenzene		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Ethylbenzene		0.11 J	0.55 J	1 U	1 U	17 UJ	10 U	10 UJ
Bromobenzene		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
1,2,3-Trichloropropane		1 U	1 U	1 U	1 U	17 UJ	10 U	10 UJ
2-Chlorotoluene		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
4-Chlorotoluene		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
1,2,4-Trimethylbenzene		0.67 J	26	1 U	1 U	9.3 J	10 U	10 UJ
tert-Butylbenzene		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
1,3,5-Trimethylbenzene		0.2 J	7.4	1 U	1 U	13 J	10 U	10 UJ
sec-Butylbenzene		1 U	0.26 J	1 U	1 U	17 U	10 U	10 UJ
p-Isopropyltoluene		0.38 J	0.75 J	1 U	1 U	12 J	10 U	10 UJ
1,2,3-Trichlorobenzene		1 U	1 U	1 U	1 U	34 UJ	10 U	10 UJ
1,4-Dichlorobenzene		0.56 J	0.91 J	1 U	1 U	20 J	10 U	10 UJ
1,2-Dichlorobenzene		1 U	0.13 J	1 U	1 U	35 U	10 U	10 UJ
1,2,4-Trichlorobenzene		2 UJ	2 UJ	2 UJ	2 UJ	35 UJ	20 UJ	20 UJ
Naphthalene*		2 UJ	1.5 J	2 UJ	2 UJ	86 UJ	20 UJ	20 UJ
Hexachlorobutadiene		1 U	1 U	1 U	1 U	35 UJ	10 U	10 UJ
o-Xylene		0.2 J	2.3	1 U	1 U	3 J	10 U	10 UJ
1,3-Dichlorobenzene		1 U	1 U	1 U	1 U	35 U	10 U	10 UJ
1,1-Dichloropropanone		10 UJ	10 UJ	10 UJ	10 UJ	86 U	100 UJ	100 UJ
1-Chlorobutane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
2-Methyoxy-2-Methylpropane		1 U	1 U	1 U	1 U	17 U	10 U	10 U
Acrylonitrile		2 U	2 UJ	2 UJ	2 UJ	35 U	20 UJ	20 UJ
Allyl Chloride		5 UJ	5 UJ	5 UJ	5 UJ	17 U	50 UJ	50 UJ
Chloroacetonitrile		2 U	2 U	2 U	2 U	17 U	20 U	REJ
Ethyl Ether		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Ethylmethacrylate		1 U	1 U	1 U	1 U	35 U	10 U	10 UJ
Hexachloroethane		1 U	1 U	1 U	1 U	17 UJ	10 U	10 UJ

Inf	Influent sample	grab	Grab sample
Ef	Effluent sample	I	The reported result is an estimate because of the presence of interference.
E	Ecology sample	J	The analyte was positively identified. The associated numerical result is an estimate.
Sludge	Pond sludge sample	UJ	The anaylte was not detected at or above the reported estimated result.
QC	Quil Ceda Tanning Company sample	U	The analyte was not detected at or above the reported result.

Appendix E (cont.) - VOA, BNA, Pesticide/PCB and Metals Scan Results - Marysville Class II, 1996.

Parameter	Location:	Inf-E-1	Inf-E-2	Ef-E-1	Ef-E-2	Sludge	Ef-QC-	Ef-QC-2
	Type:	grab	grab	grab	grab	grab	grab	grab
	Date:	03/5	03/5	03/5	03/5	03/5	03/5	03/5
	Time:	0930	1650	1200	1810	1810	1620	1345
	Lab Log#:	10823	108231	10823	108239	108244	108247	108248
VOA Compounds		µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L	µg/L
Iodomethane								
Methyacrilonitrile		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Methyl acrylate		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Methyl Methacrylate		2 UJ	2 UJ	2 UJ	2 UJ	17 U	20 UJ	20 UJ
n-Butylbenzene		1 U	1 U	1 U	1 U	35 U	10 U	10 UJ
n-Propylbenzene		1 U	2.5	1 U	1 U	17 U	10 U	10 UJ
Nitrobenzene		20 U	20 U	20 U	20 U	REJ	200 U	200 UJ
Pentachloroethane		1 U	1 U	1 U	1 U	17 U	10 U	10 UJ
Propionitrile		10 U	10 U	10 U	10 U	NA	100 U	REJ
Tetrahydrofuran		2 U	2 U	2 U	2 U	86 U	20 U	20 UJ
Trans-1,4-Dichloro-2-butene		1 U	1 U	1 U	1 U	REJ	10 U	10 UJ

	Location:	Inf-E	Ef-E	Trnsf-Bl	Sludge	Ef-QC
	Type:	comp	comp	grab	grab	comp
	Date:	03/5-6	03/5-6	03/4	03/5	03/5-6
	Time:	08:00-08:00	08:00-08:00	1310	1810	08:00-08:00
	Lab Log#:	108232	108240	108243	108244	108249
BNA Compounds		µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L
Benzo(a)Pyrene		0.17 U	0.2 UJ	0.15 UJ	3000 U	0.12 UJ
2,4-Dinitrophenol		3.5 UJ	4 UJ	3 UJ	30000 U	2.50 UJ
Dibenzo(a,h)Anthracene		0.17 U	0.2 UJ	0.15 UJ	7510 U	0.12 UJ
Benzo(a)Anthracene		0.17 U	0.2 U	0.15 U	1500 U	0.1 U
4-Chloro-3-Methylphenol		0.17 U	0.2 U	0.15 U	3000 U	0.1 U
Aniline		0.17 U	0.2 U	0.15 U	1500 UJ	0.12 U
Benzoic Acid		230 J	0.87 J	6 UJ	30000 U	122.00 I
Hexachloroethane		0.17 U	0.2 U	0.15 U	1500 UJ	0.12 U
Hexachlorocyclopentadiene		1.7 U	2 U	1.5 U	REJ	1.20 U
Isophorone		0.17 U	0.25	0.5	553 J	0.12 U
Acenaphthene		0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Phenanthrene		0.35 U	0.4 U	0.021 J	1500 U	0.25 U
N-Nitrosodiphenylamine		0.17 U	0.2 U	0.15 U	3000 U	0.12 U
Fluorene		0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Carbazole		0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Hexachlorobutadiene		0.17 U	0.2 U	0.15 U	1500 U	0.12 U

Inf	Influent sample	I	The reported result is an estimate because of the presence of interference.	comp	Composite sample
Ef	Effluent sample	J	The analyte was positively identified. The associated numerical result is an estimate.	grab	Grab sample
E	Ecology sample	UJ	The anaylte was not detected at or above the reported estimated result.	Trnsf-Blk	Effluent Transfer blank
Sludge	Pond sludge sample	U	The analyte was not detected at or above the reported result.		
QC	Quil Ceda Tanning Company sample	REJ	The datum is unsuitable for all purposes.		

Appendix E (cont.) - VOA, BNA, Pesticide/PCB and Metals Scan Results - Marysville Class II, 1996.

Location:	Inf-E	Ef-E	Trnsf-Bl	Sludge	Ef-QC
Type:	comp	comp	grab	grab	comp
Date:	03/5-6	03/5-6	03/4	03/5	03/5-6
Time:	08:00-08:00	08:00-08:00	1310	1810	08:00-08:00
Lab Log#:	108232	108240	108243	108244	108249
BNA Compounds	µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L
Pentachlorophenol	1.7 U	2 U	1.5 U	7510 U	1.2 U
2,4,6-Trichlorophenol	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
2-Nitroaniline	3.5 U	4 U	3 U	3000 U	2.5 U
2-Nitrophenol	1.7 U	2 U	1.5 U	7510 U	1.2 U
Naphthalene	0.44	0.03 J	0.057 J	173 J	1.2
2-Methylnaphthalene	0.24	0.02 J	0.077 J	65 J	0.086 J
2-Chloronaphthalene	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
3,3'-Dichlorobenzidine	1.7 U	2 U	1.5 U	3000 U	1.2 U
Benzidine	1.7 U	2 UJ	1.5 UJ	15000 U	1.2 UJ
2-Methylphenol	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
1,2-Dichlorobenzene	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
2,4,5-Trichlorophenol	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Nitrobenzene	0.17 U	0.2 U	0.15 U	3000 U	0.12 U
3-Nitroaniline	1.7 U	2 U	1.5 U	3000 UJ	1.2 U
4-Nitroaniline	1.7 U	2 U	1.5 U	3000 UJ	1.2 U
4-Nitrophenol	0.87 U	1 U	0.75 U	15000 U	0.62 U
Benzyl Alcohol	9	0.2 U	0.15 U	3000 U	0.12 U
2,4-Dimethylphenol	0.17 U	0.2 U	0.15 U	3000 U	0.12 U
4-Methylphenol	28	0.2 U	0.15 U	930 J	0.12 U
1,4-Dichlorobenzene	0.64	0.2 U	0.15 U	1500 UJ	0.12 U
4-Chloroaniline	0.17 U	0.2 U	0.15 U	825 J	0.12 U
Phenol	11	0.22	0.15 U	1500 U	0.49
Pyridine	0.35 U	0.4 U	0.3 U	3000 U	0.25 U
Bis(2-Chloroethyl)Ether	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Bis(2-Chloroethoxy)Methane	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Di-n-Octyl Phthalate	1.7 U	2 UJ	1.5 UJ	7510 U	1.2 UJ
Hexachlorobenzene	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Anthracene	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
1,2,4-Trichlorobenzene	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
2,4-Dichlorophenol	0.17 U	0.2 U	0.15 U	3000 U	0.12 U
2,4-Dinitrotoluene	3.5 U	4 U	3 U	7510 U	2.5 U
1,2-Diphenylhydrazine	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Pyrene	0.17 U	0.2 U	0.15 U	286 J	0.12 U
Dibenzofuran	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Indeno(1,2,3-cd)Pyrene	0.17 U	0.2 UJ	0.15 UJ	7510 U	0.12 UJ
Benzo(b)Fluoranthene	0.17 U	0.2 UJ	0.15 UJ	1500 U	0.12 UJ

Ef	Effluent sample	J	The analyte was positively identified. The associated numerical result is an estimate.	comp	Composite sample
Inf	Influent sample	UJ	The anaylte was not detected at or above the reported estimated result.	grab	Grab sample
E	Ecology sample	U	The analyte was not detected at or above the reported result.		
QC	Quil Ceda Tanning Company sample	Sludge	Pond sludge sample		

Appendix E (cont.) - VOA, BNA, Pesticide/PCB and Metals Scan Results - Marysville Class II, 1996.

Location:	Inf-E	Ef-E	Trnsf-Bl	Sludge	Ef-QC
Type:	comp	comp	grab	grab	comp
Date:	03/5-6	03/5-6	03/4	03/5	03/5-6
Time:	08:00-08:00	08:00-08:00	1310	1810	08:00-08:00
Lab Log#:	108232	108240	108243	108244	108249
BNA Compounds	µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L
Fluoranthene	0.17 U	0.2 U	0.013 J	322 J	0.12 U
Benzo(k)Fluoranthene	0.17 U	0.2 UJ	0.15 UJ	1500 U	0.12 UJ
Acenaphthylene	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Chrysene	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
4,6-Dinitro-2-Methylphenol	1.7 U	2 U	1.5 U	15000 U	1.2 U
1,3-Dichlorobenzene	0.17 U	0.2 U	0.15 U	1500 UJ	0.12 U
2,6-Dinitrotoluene	3.5 U	4 U	3 U	7510 U	2.5 U
N-Nitroso-di-n-Propylamine	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
1-Methylnaphthalene	0.19	0.2 U	0.045 J	1500 U	0.073 J
2-Chlorophenol	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Bis(2-Chloroisopropyl)Ether	0.17 U	0.2 U	0.15 U	1500 U	0.12 U
Retene	0.17 U	0.2 U	0.15 U	3000 U	0.12 U
3B-Coprostanol	300 J	8.4 J	3 UJ	97500	2.5 UJ
Caffeine	41 I	0.2 U	0.15 U	3000 U	0.12 U
N-Nitrosodimethylamine	0.87 U	1 U	0.75 U	7510 U	0.62 U
Benzothiazole					7 NJ
Ethanol, 2-(2-Butoxyethoxy)-, Acetate	147 NJ		19 NJ		
Cyclohexasiloxane, Dodecamethyl-			0.96 NJ		
Cholesterol		6.8 NJ		13900 NJ	19 NJ

Location:	Inf-E	Ef-E	Trnsf-Bl	Sludge	Ef-QC
Type:	comp	comp	grab	grab	comp
Date:	03/5-6	03/5-6	03/4	03/5	03/5-6
Time:	08:00-08:00	08:00-08:00	1310	1810	08:00-08:00
Lab Log#:	108232	108240	108243	108244	108249
Pesticide/PCB Compounds	µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L
alpha-BHC	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
beta-BHC	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
delta-BHC	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
gamma-BHC (Lindane)	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Heptachlor	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Aldrin	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Heptachlor Epoxide	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Endosulfan I	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Dieldrin	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
4,4'-DDE	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ

Ef	Effluent sample	QC	Quil Ceda Tanning Company sample.	NJ	There is evidence that the analyte is present. The associated numerical result is an estimate	Sludge	Pond sludge sample
Inf	Influent sample	comp	Composite sample	UJ	The anaylte was not detected at or above the reported estimated result.		
E	Ecology sample	grab	Grab sample	U	The analyte was not detected at or above the reported result.		

Appendix E (cont.) - VOA, BNA, Pesticide/PCB and Metals Scan Results - Marysville Class II, 1996.

Location:	Inf-E	Ef-E	Trnsf-Bl	Sludge	Ef-QC
Type:	comp	comp	grab	grab	comp
Date:	03/5-6	03/5-6	03/4	03/5	03/5-6
Time:	08:00-08:00	08:00-08:00	1310	1810	08:00-08:00
Lab Log#:	108232	108240	108243	108244	108249
Pesticide/PCB Compounds	µg/L	µg/L	µg/L	µg/Kg-dry wt.	µg/L
Endrin	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Endosulfan II	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
4,4'-DDD	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Endosulfan Sulfate	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
4,4'-DDT	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Methoxychlor	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Endrin Ketone	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ
Toxaphene	0.14 UJ	0.15 U	0.1 U	900 U	0.18 UJ
Endrin Aldehyde	0.0091 UJ	0.01 U	0.0034 U	30 U	0.0062 UJ

Location:	Inf-E	Ef-E	Trnsf-Bl	Sludge	Ef-QC
Type:	comp	comp	grab	grab	comp
Date:	03/5-6	03/5-6	03/4	03/5	03/5-6
Time:	08:00-08:00	08:00-08:00	1310	1810	08:00-08:00
Lab Log#:	108232	108240	108243	108244	108249
Metals	µg/L	µg/L	µg/L	mg/Kg-dry wt.	µg/L
Antimony	30 U	30 U	30 U	3 UJ	30 U
Arsenic	1.5 UJ	1.5 UJ	1.5 UJ	11.9	1.5 UJ
Beryllium	2 U	2 U	2 U	0.32	2 U
Cadmium	0.39	0.2	0.2 U	3.41	0.2 U
Chromium	9.8	5 U	5 U	254	515
Copper	46	10	5 U	234	6.8
Lead	6.7 J	1.9 J	1 UJ	139	3 UJ
Mercury (Total)	0.13	0.05 U	0.05 U	1.57	0.05 U
Nickel	3.7	3	1 U	53.8	17.7
Selenium	1.5 UJ	1.5 UJ	1.5 UJ	17.5	1.5 UJ
Silver	1.1	0.5 U	0.5 U	10.6	0.5 U
Thallium	1.5 UJ	1.5 UJ	1.5 UJ	0.4 UJ	1.5 UJ
Zinc	72.5	17	4 U	465	30

Inf	Influent sample	J	The analyte was positively identified. The associated numerical result is an estimate.	comp	Composite sample
Ef	effluent sample	UJ	The anaylte was not detected at or above the reported estimated result.	grab	Grab sample
E	Ecology sample	U	The analyte was not detected at or above the reported result.		
Sludge	Pond sludge sample				
QC	Quil Ceda Tanning Company sample				

Appendix F - Tentatively Identified Compounds - Marysville Class II, 1996

Inf-E-1
grab
03/5
0930
108230

Volatile Organic Analysis (VOA)

Parameter	Value	Qualifier	Units
Formic acid, butyl ester	0.6	NJ	ug/L
Hexanal	0.41	NJ	ug/L
Cyclotestrasiloxane	0.32	NJ	ug/L
7-Oxabicyclo[2.2.1]Heptane, 1-methyl-4-(1-Methylethyl)	0.71	NJ	ug/L
Cineole	2.5	NJ	ug/L

Inf-E-2
grab
03/5
1650
108231

Volatile Organic Analysis (VOA)

Parameter	Value	Qualifier	Units
Benzene 1-Ethyl-2-Methyl-	17	NJ	ug/L
Benzene 1-Ethyl-3-Methyl-	6.8	NJ	ug/L
Benzene 1,2,3-Trimethyl-	8	NJ	ug/L

Ef-E-1
grab
03/5
1200
108238

Volatile Organic Analysis (VOA)

Parameter	Value	Qualifier	Units
Cyclopentane, 1,1,3,3-tetramethyl-	3.3	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Marysville Class II, 1996

Ef-E-2
grab
03/5
1810
108239

Volatile Organic Analysis (VOA)

Parameter	Value	Qualifier	Units
Cyclohexane, (ethoxymethoxy)-	3.3	NJ	ug/L

EF-QC-1
grab
03/5
1620
108247

Volatile Organic Analysis (VOA)

Parameter	Value	Qualifier	Units
Cyclotrisiloxane, Hexamethyl	13	NJ	ug/L
2-Pentene, 3,4-dimethyl, (	17	NJ	ug/L
Cyclotetrasiloxane, Octamethyl-	7.7	NJ	ug/L

EF-QC-2
grab
03/5
1345
108248

Volatile Organic Analysis (VOA)

Parameter	Value	Qualifier	Units
Cyclotrisiloxane, Hexamethyl	13	NJ	ug/L
3Penten-2One, 4-methyl-	15	NJ	ug/L
Cyclotetrasiloxane, Octamethyl-	6.4	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Sludge
grab-comp
03/5
1810
108244

Volatile Organic Analysis (VOA)

Parameter	Value	Qualifier	Units
Unknown Hydrocarbon 01	117	NJ	ug/L
Unknown Hydrocarbon 02	124	NJ	ug/L
Unknown Hydrocarbon 03	288	NJ	ug/L
Unknown Hydrocarbon 04	119	NJ	ug/L
Unknown Hydrocarbon 05	311	NJ	ug/L
Unknown Hydrocarbon 06	264	NJ	ug/L
Unknown Hydrocarbon 07	271	NJ	ug/L
Unknown Hydrocarbon 08	343	NJ	ug/L
2-Hexene, 5,5-Dimethyl-, (Z)-	118	NJ	ug/L
2-Hexene	674	NJ	ug/L
Bicyclo[2,2,2]octan-1-ol	276	NJ	ug/L
Cyclotrisiloxane, 2,3-Dimethyl-	91	NJ	ug/L
Pentane, 2,2,3-Trimethyl-	270	NJ	ug/L
Nonane, 3-Methyl-5 Propyl	1520	NJ	ug/L
Heptane, 2,2-Dimethyl	1850	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Marysville Class II, 1996

Inf-E
comp
03/5-6
0800-0800
108232

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	12	NJ	ug/L
Unknown 02	1.6	NJ	ug/L
Unknown 03	38	NJ	ug/L
Unknown 04	25	NJ	ug/L
Unknown 05	118	NJ	ug/L
Unknown 06	56	NJ	ug/L
Unknown 07	27	NJ	ug/L
Unknown 08	22	NJ	ug/L
Unknown 09	18	NJ	ug/L
Unknown 11	84	NJ	ug/L
Unknown 12	52	NJ	ug/L
Unknown Hydrocarbon 01	2.2	NJ	ug/L
Unknown Hydrocarbon 02	21	NJ	ug/L
2-propanol. 1-(2-Methoxy-Methylethoxy)-	6.1	NJ	ug/L
Ethanol, 2-(2-Butoxyethoxy)-, Acetate	147	NJ	ug/L
Cyclopropane, Nonyl-	34	NJ	ug/L
Decanoic Acid, Tetra-	152	NJ	ug/L
Hexadecanoic Acid	1150	NJ	ug/L
Oleic Acid	4740	NJ	ug/L
Cholest-3-ene, (5.alpha.)-	72	NJ	ug/L
Cholest-5-en-3-ol (3.beta.)	79	NJ	ug/L
Ethanol, 2-Butoxy-	19	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Ef-E
comp
03/5-6
0800-0800
108240

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	7.4	NJ	ug/L
Unknown 02	7.3	NJ	ug/L
Unknown 03	3.6	NJ	ug/L
Unknown 04	2.7	NJ	ug/L
Unknown 05	3.8	NJ	ug/L
Unknown 06	2	NJ	ug/L
Unknown 07	4.2	NJ	ug/L
Unknown 08	7.3	NJ	ug/L
Unknown 09	4.4	NJ	ug/L
Unknown 10	1.9	NJ	ug/L
Unknown 11	4.3	NJ	ug/L
Unknown 12	3	NJ	ug/L
Unknown 13	2.2	NJ	ug/L
Unknown 14	1.9	NJ	ug/L
Unknown 15	5.6	NJ	ug/L
Unknown 16	4.4	NJ	ug/L
Cholesterol	6.8	NJ	ug/L
2-Propanol, 1-(2-Methoxy-1-Methylethoxy)-	2.9	NJ	ug/L
Phosphoric Acid Tributyl Ester	4	NJ	ug/L
Phenol, Nonyl-	3.3	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Marysville Class II, 1996

Trnf-blk
grab
03/4
1310
108243

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	5.7	NJ	ug/L
Unknown 02	6.8	NJ	ug/L
Unknown 03	6.6	NJ	ug/L
Unknown 04	5.5	NJ	ug/L
Unknown 05	5.2	NJ	ug/L
Unknown 06	2.5	NJ	ug/L
Unknown 07	8.9	NJ	ug/L
Unknown 08	9.4	NJ	ug/L
Unknown 09	10	NJ	ug/L
Unknown 10	9.1	NJ	ug/L
Unknown 11	12	NJ	ug/L
Unknown 12	8.6	NJ	ug/L
Unknown 13	5.4	NJ	ug/L
Unknown 14	4	NJ	ug/L
Unknown 15	2.6	NJ	ug/L
4-Hydroxy-4-Methylpentan-2-one	9	NJ	ug/L
Ethanol, 2-(2-Butoxyethoxy)-	3.3	NJ	ug/L
Cyclohexasiloxane, Dodecamethyl-	0.96	NJ	ug/L
Ethanol, 2-(2Butoxyethoxy)-, Acetate	19	NJ	ug/L
Phosphoric Acid Tributyl Ester	43	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Marysville Class II, 1996

EF-QC
grab
03/4
1345
108249

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	28	NJ	ug/L
Unknown 02	7.4	NJ	ug/L
Unknown 03	4.7	NJ	ug/L
Unknown 04	7.2	NJ	ug/L
Unknown 05	11	NJ	ug/L
Unknown 06	133	NJ	ug/L
Unknown 07	70	NJ	ug/L
Unknown 08	220	NJ	ug/L
Unknown 09	919	NJ	ug/L
Unknown 10	11	NJ	ug/L
Unknown 11	15	NJ	ug/L
Unknown 12	40	NJ	ug/L
Phenol, 4-(2,2,3,3-Tetramethylbutyl)-	17	NJ	ug/L
Disulfide, Dimethyl	13	NJ	ug/L
3-Penten-2-One, 4-Methyl-	17	NJ	ug/L
4-Hydroxy-4-methylpentan-2-one	26	NJ	ug/L
2-methyl-2, 4-Pentanediol	27	NJ	ug/L
Pentanoic Acid, 4-Methyl-	101	NJ	ug/L
Cyclopentanol, 1,2-dimethyl-3-(1-methyle	9.7	NJ	ug/L
Camphor (Acn)	14	NJ	ug/L
Alpha-Terpeneol	47	NJ	ug/L
Benzothiazole	7	NJ	ug/L
Benzenepropanoic Acid	99	NJ	ug/L
Benzothiazole, 2(Methylthio)-	33	NJ	ug/L
Ethanol, 2-[2-[4-(1,1,3,3-Te	133	NJ	ug/L
Cholesterol	19	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Marysville Class II, 1996

Sludge
grab-comp
03/5
1810
108244

BNA/Pesticides

Parameter	Value	Qualifier	Units
Unknown 01	17600	NJ	ug/L
Unknown 02	21400	NJ	ug/L
Unknown 03	14300	NJ	ug/L
Unknown 04	21100	NJ	ug/L
Unknown 05	24200	NJ	ug/L
Unknown 06	14600	NJ	ug/L
Unknown 07	20500	NJ	ug/L
Unknown 08	33100	NJ	ug/L
Unknown 09	59800	NJ	ug/L
Unknown Hydrocarbon 01	10900	NJ	ug/L
M-Xylene	13600	NJ	ug/L
Naphthalene, 1,2-Dihydro-1,1,6-Trimethyl-	5520	NJ	ug/L
Naphthalene, 1,3-Dimethyl	2980	NJ	ug/L
2-Nonylphenol	23000	NJ	ug/L
Phenol, Nonyl	47900	NJ	ug/L
Phenol, 4-(2,2,3,3-Tetramethylbutyl)-	26700	NJ	ug/L
Phytol	77400	NJ	ug/L
3,7,11-Tridecatrienenitrile, 4,8,12-Trimethyl-	21700	NJ	ug/L
Cholestan-3-ol, acetate, (3.beta.,5.alph	5160	NJ	ug/L
Vitamin E	14100	NJ	ug/L
Cholesterol	13900	NJ	ug/L
Cholestane, 14-methyl-, (5.alpha.)-	33000	NJ	ug/L
Epicholestanol	56400	NJ	ug/L
(24R,25R)-5,6-Dihydro-5.alpha.-aplystero	28900	NJ	ug/L
Chondrillasterol	50500	NJ	ug/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix G - GLOSSARY - Marysville Class II Inspection, 1994

BOD_5	Five Day Biological Oxygen Demand
$CBOD_5$	Carbonaceous Five Day Biological Oxygen Demand
$CaCO_3$	Calcium Carbonate
CLP	Contract Laboratory Program
CVAA	Cold Vapor Atomic Absorption
D.O.	Dissolved Oxygen
EPA	Environmental Protection Agency
k	Maximum Rate of Substrate Utilization
k_1	1st order reaction Rate Coefficient (derived for Total BOD_5 with settling)
Ks	Half-Velocity constant
kg	kilogram ($1 X 10^3$ grams)
L	Liter ($1 X 10^3$ milliliters)
lbs/day	Pounds per Day
LOD	Limit of Detection
m^3	Cubic meter ($1 X 10^3$ liters)
MF	Membrane Filter
mg	milligram ($1 X 10^{-3}$ grams)
MGD	Million Gallons per Day
mL	Milliliter ($1 X 10^{-3}$ liters)
MPN	Most Probable Number
NH_3	AmmoniaNPDES National Pollutant Discharge Elimination System
PCB	Polychlorinated Biphenyls
pH	Log_{10} of Negative Hydrogen Ion Concentration
PO_4	Phosphate
PP	Priority Pollutant
ppm	Parts per million ($1 X 10^{-6}$ kg/L, 1 mg/L, or 1 mg/kg)
ppt	Parts per thousand ($1 X 10^{-3}$ kg/L, 1 g/L, or 1 g/kg)
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
TIC	Total Inorganic Carbon or Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TNVS	Total Non-Volatile Solids
TNVSS	Total Non-Volatile Suspended Solids
TOC	Total Organic Carbon
TP	Total Phosphorous
TS	Total Solids
TSS	Total Suspended Solids
TVS	Total Volatile Solids
ug	Microgram ($1 X 10^{-6}$ grams)

ug/L	Micrograms per Liter
VOA	Volatile Organic Analysis
VSS	Volatile Suspended Solids
WWTP	Wastewater Treatment Plant
X	Volatile Suspended Solids