The Effects of Simpson Timber Company and Louisiana-Pacific Corporation Log Pond Discharge on the Biota and Water Quality of Janes Creek, Humboldt County

ABSTRACT

North Coast Regional Water Quality Control Board staff investigated water quality, benthic invertebrate populations, freshwater algae populations, fish survival, and fish population size of Janes Creek upstream and downstream of a log pond discharge on February 15-20, April 4-6, and July 26 and 27, 1977.

Chemical oxygen demand in Janes Creek was increased by the discharge from 13 to 56 mg/l. Biochemical oxygen demand was increased from 1.3 to 6.6 mg/l. Dissolved oxygen concentration decreased on the average from 12.5 to 7.0 mg/l as a result of the discharge.

Benthic invertebrates exhibited a shift from clean water pollution-intolerant forms to pollution-tolerant forms. The density of pollution-tolerant forms in Janes Creek downstream of the discharge was 200 times greater than upstream of the discharge. Density of pollution-intolerant forms upstream was 18 times greater than downstream.

Freshwater algae showed a shift from diatoms upstream in Janes Creek to green algae, euglenids, and protozoans downstream. Sphaerotilus natans (sewage fungus) was found in large numbers downstream of the discharge, but not upstream.

Steelhead trout survival as tested with live-car bioassays for 96 hours was 100% both upstream and downstream of the discharge. The fish recovered from the live cars downstream of the discharge, however, had gill hyperplasia, indicative of chronic ammonia toxicity.

The natural populations of cutthroat trout (Salmo clarkii) downstream of the discharge were weak in young-of-the-year age class strength. More than 75% of the fish upstream of the discharge were young-of-the-year. Less than 50% of the fish downstream were young-of-the-year. The external appearance of fish downstream was a darkening of the body color, slight opaqueness of the eyes, and paleness of the gill filaments. Fish upstream were brightly colored externally, as well as having bright red gill filaments.

The log pond discharge adversely affects the aquatic ecology of Janes Creek, altering benthos, algae, and fish populations.

INTRODUCTION

Simpson Timber Company, Mad River Plywood, and Louisiana-Pacific Corporation, Humboldt Flakeboard, discharge wastes to a log pond which overflows to Janes Creek, a tributary of Humboldt Bay. On February 15-20, April 4-6, and July 26-27, 1977, the North Coast Regional Water Quality Control Board staff investigated the effects of the log pond overflow on the aquatic biota and water quality of Janes Creek.

Investigations included live-car bioassays with steelhead rainbow trout (Salmo gairdnerii gairdnerii), benthic invertebrate sampling, freshwater algae sampling, and water quality sampling in February, and electroshocking for fish population estimates, discharge measurements, and dissolved oxygen monitoring in April and July, 1977.

DESCRIPTION OF STUDY AREA

Janes Creek is a small cold-water stream originating on Fickle Hill, northeast of Arcata, and flows approximately 5.6 miles to Humboldt Bay (Figure 1). The upper 2.2 miles of Janes Creek flows through redwood forests, and is bordered by dense riparian vegetation. The stream character changes approximately 400 feet below the log pond overflow, becoming wider with little riparian vegetation as it flows through pastures and residential areas to Humboldt Bay. The stream is inhabited by cutthroat trout (Salmo clarkii) in the upper reaches and by stickleback (Gasterosteus aculeatus) in the lower reaches. Average width is four feet; average depth is 1.5 feet. Average volocity and flow were one foot per second and 0.5 cubic feet per second during the February survey upstream of the log pond.

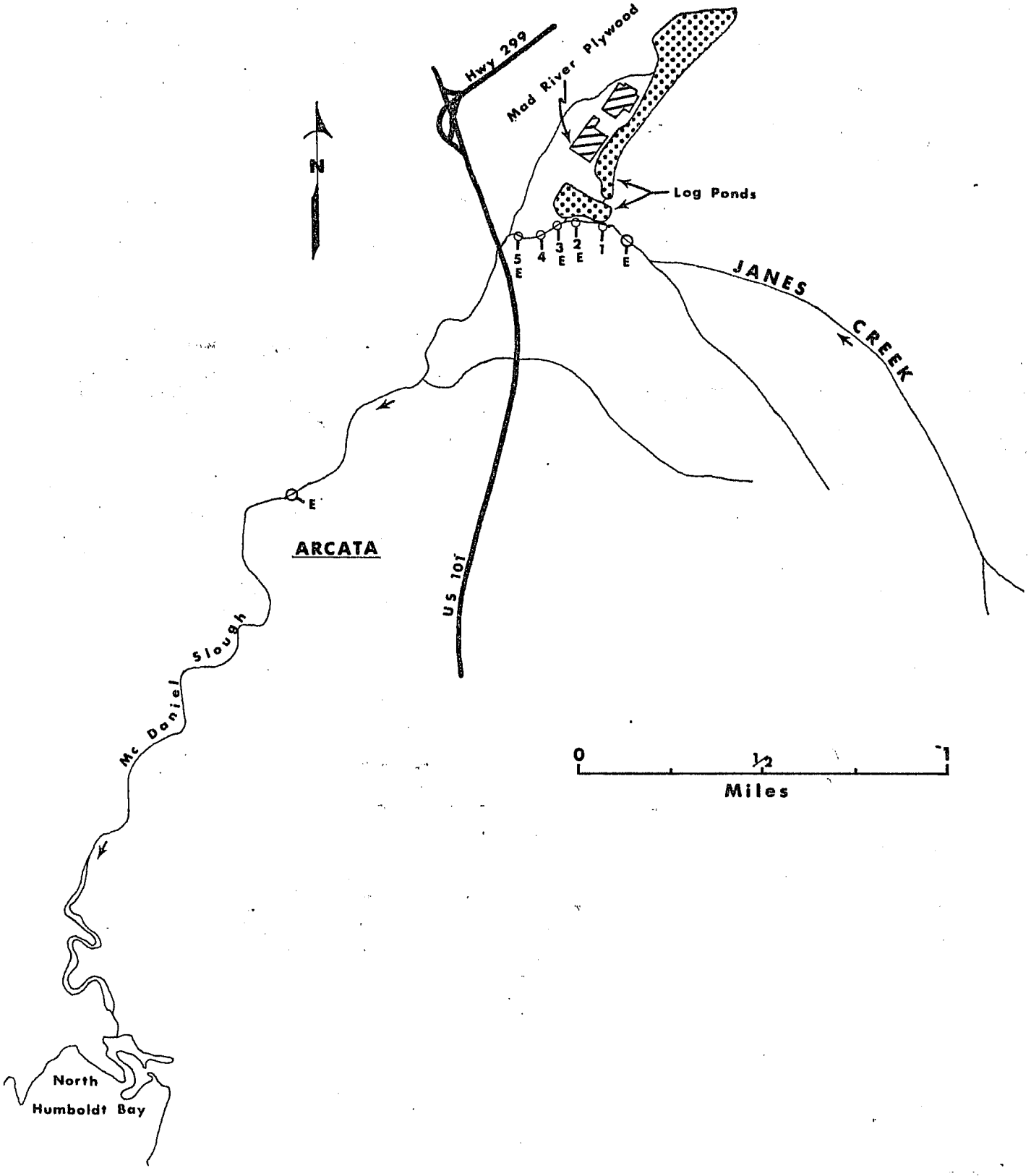


Figure 1. The location of Mad River Plywood Company and the Janes Creek study section (numbers 1 through 5 indicate sampling stations, "E" indicates electroshocking stations).

METHODS

Sampling Sites

Five sampling sites were established on Janes Creek--two upstream and three downstream of the log pond overflow (Figure 2).

Fish survival, benthic invertebrates, dissolved oxygen, freshwater algae, and water temperatures were sampled at Stations #1 through #5. Water quality samples were obtained at Stations #2 and #3 and at the outfall. Fish electroshocking was done at Stations #2, #3, #5, upstream of Station #1, and at Alliance Road. All samples from the stations upstream of the outfall were considered controls--natural, undisturbed stream.

Biological Studies

Live-car bioassays were conducted with steelhead rainbow trout from Humboldt State University Hatchery. Average fish weight was 24.8 grams. Age from hatching was 11.5 months (Merritt, personal communication). The fish were acclimated to Janes Creek for 16 hours prior to the tests. Twelve fish were placed in a live car at each station at noon on February 16. Behavior and survival was noted three times a day. Dissolved oxygen and water temperature were measured at least once a day at each station for the duration of the tests. The fish and live cars were removed after 96 hours. Two live fish from each live car were preserved and returned to the lab for necropsy at the end of the bioassays.

Fish electroshocking was done on April 5, and July 26-27, 1977 at five stations--two upstream and three downstream of the outfall. At each station, a 100-foot section of stream was blocked with nets to prevent movement of fish, and shocked with a Smith-Root Type VII electroshocker. The two-pass method was used to estimate fish population size. Fish collected were identified, measured to the nearest 0.1 inch fork length, and returned to the stream.

Benthic invertebrate samples were obtained with a Surber square-foot sampler. Three samples were obtained at each station prior to the bioassays. The samples were preserved in 70% ethanol and returned to the lab for enumeration. Organisms were keyed to order (family when possible) using Usinger (1974) and Pennak (1953).

Freshwater algae were obtained from the flowing stream at all stations. The samples were preserved in formalin and taken to an independent lab for enumeration.

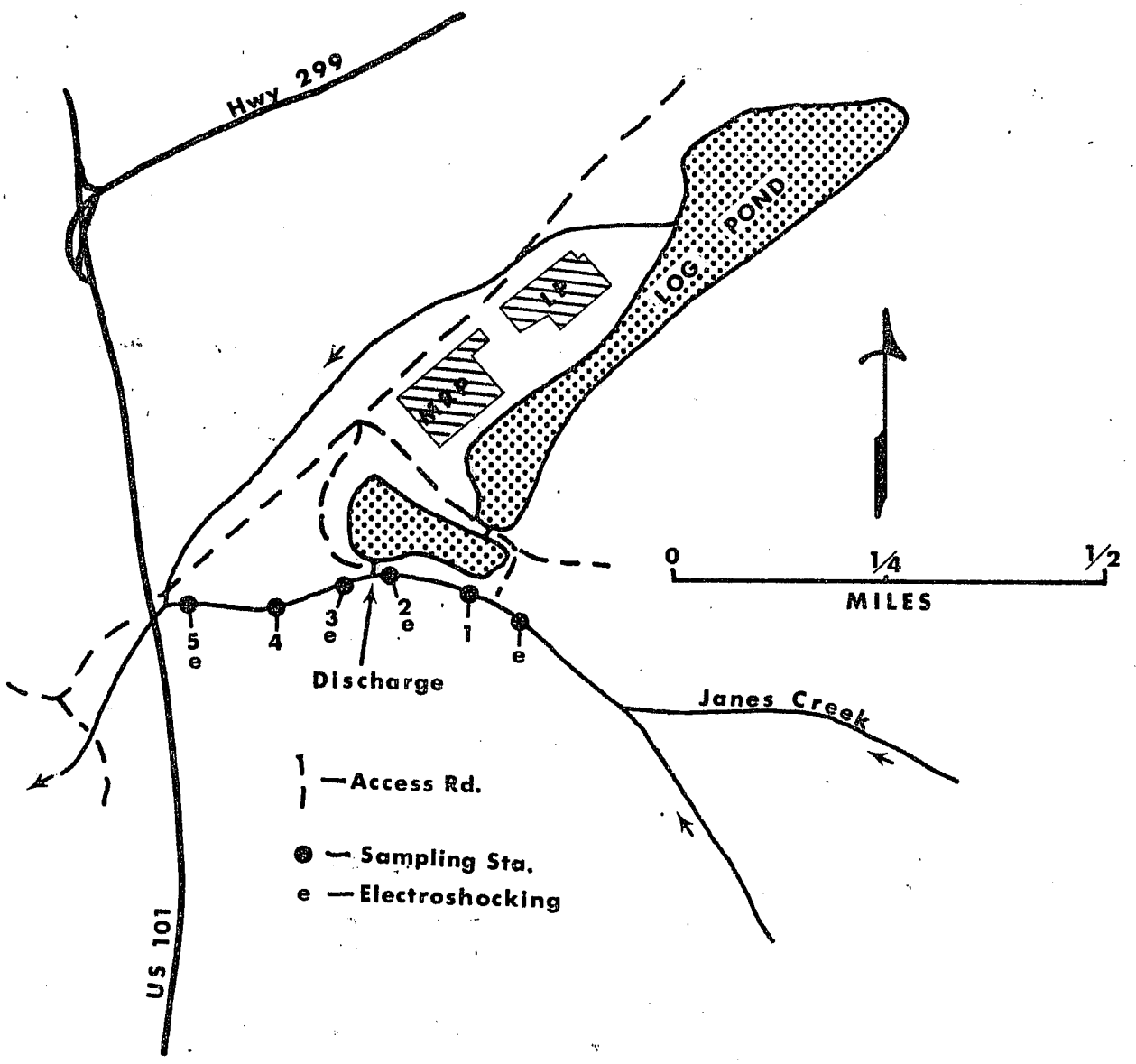


Figure 2. Location of sampling stations and log pond discharge on Janes Creek. (Electroshocking station at Alliance Road not shown; MRP = Mad River Plywood Mill; LP = Louisiana-Pacific Mill.)

Water Quality Measurements

Dissolved oxygen concentration and temperature were measured at each station at least once a day from February 15 through 20. Dissolved oxygen was measured again on April 4, 5, and 6 along the whole stream length. Water quality measurements (excluding formaldehyde) were performed by an independent laboratory using Standard Methods (APHA, 1975).

Stream Discharge Measurements

Stream discharge was measured using Rhodamine-WT dye on April 6, 1977. The dye was dripped into the stream 0.1 miles upstream of the outfall at the rate of 100 ml per minute. Fluorescence in the stream was measured with a Turner 111 fluorometer fitted with a flow-through door directly upstream of the outfall (Station #2) and 0.2 miles downstream of the outfall (Station #5). Fluorescence was recorded at the peak of the dye cloud. Dye concentration in the stream was calculated from calibration curves. Stream discharge was calculated using the following relationship:

$$Q_1(D_1) = (Q_1 + Q_2)D_2 ,$$

where Q_1 = discharge at Station #2

Q_2 = discharge at the outfall

D_1 = dye concentration at Station #2

D_2 = dye concentration at Station #5

The discharge of the outfall (Q_2) was obtained from Simpson's weir and recording gauge on the outfall.

RESULTS

Fish Bioassays

Survival of steelhead rainbow trout was 100% at all stations during the 96-hour test period. Dissolved oxygen concentrations and water temperatures at the upper stations (#1 and #2) ranged from 11.1 to 13.0 mg/l oxygen, and 7.0 to 9.5°C. The same measurements at the lower stations (#3, #4, and #5) ranged from 6.6 to 8.4 mg/l oxygen, and 10.0 to 11.5°C (Appendix A).

Necropsy information on the test fish showed some evidence of gill hyperplasia in the fish downstream of the outfall (Appendix B). The fish upstream of the outfall showed no evidence of gill hyperplasia. The observer removing the fish from the live cars also noticed some opaqueness of the eyes in the fish downstream of the outfall.

Fish Electroshocking

In April, cutthroat trout (Salmo clarkii) in Janes Creek averaged 3.1 inches fork length (FL) in the two upstream stations, and 3.9 inches in two of the downstream stations. No trout were found at the downstream-most station at Alliance Road.

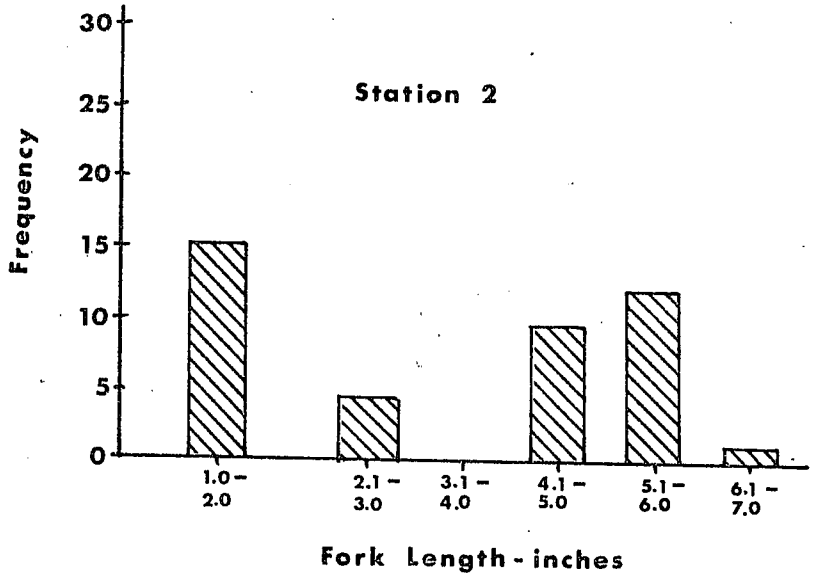
Population estimates with 95% confidence limits were 6 ± 0 and 34 ± 1 for the downstream stations, and 29 ± 10 and 23 ± 1 for the upstram stations (Appendix C). The fish populations downstream of the discharge showed weak year class strength for young-of-the-year fish.

In July, cutthroat trout averaged 3.9 inches (FL) downstream of the discharge, and 2.5 inches (FL) upstream of the discharge. The smaller average length of fish upstream of the discharge is due to a greater frequency of small fish (young-of-the-year) in the population. These small fish comprised more than 75% of the population upstream, but less than 50% of the population downstream of the discharge (Figure 3).

Population estimates with 95% confidence limits were 38 ± 12 for the downstream station, and 57 ± 1 for the upstream station in July (Appendix C).

Benthic Invertebrates

Densities of total invertebrates ranged from 58 to 1,886 organisms per square foot. The lowest densities occurred upstream of the outfall (Table 1 and Appendix D). Major taxa of benthic invertebrates were divided into moderate pollution-tolerant and moderate pollution-intolerant. Intolerant taxa included Gammarus sp. (freshwater amphipods), Ephemeroptera (mayflies), Trichoptera (caddisflies), Plecoptera (stoneflies), Simuliidae (blackflies), and Elmidae (riffle beetles) (EPA 1973a). Tolerant toxa



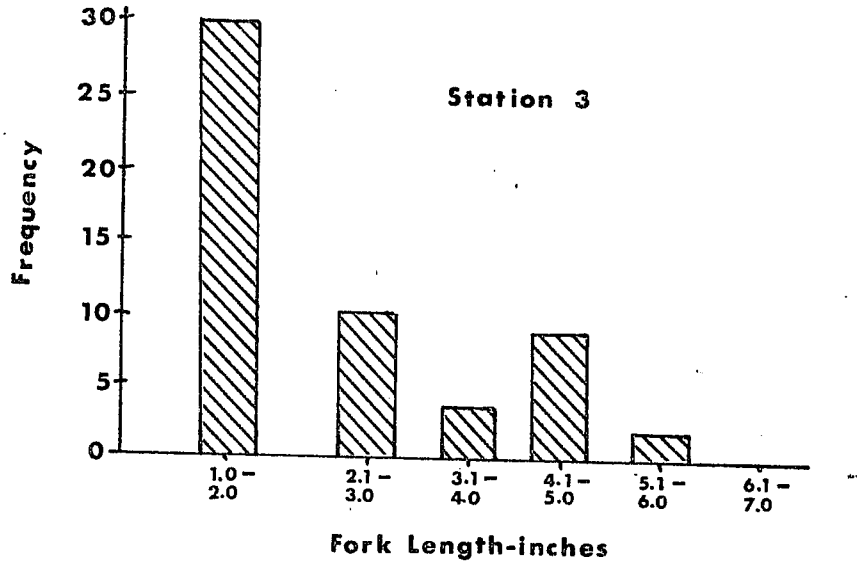


Figure 3. Length frequency for fish collected in Janes Creek upstream (#3) and downstream (#2) of the log pond discharge in July, 1977.

Table 1. Number of benthic invertebrates per square foot at the five stations on Janes Creek. (Average of three samples per station.)

	STATION NO.				
Pollution Intolerant Taxa	1	2	3	4	5
Gammarus sp.	52	18	4	7	*
Ephemeroptera	122	34	2		
Trichoptera	5	2	*		*
Plecoptera	8	*			
Simuliidae	*				
Elmidae	*				
Pollution Tolerant Taxa					
Chironomidae	*	*	729	1157	791
Tubificidae			910	144	1090
Other Oligochaeta	11	4	*		
Gerridae		*			
Other Hemiptera			*		
Other Coleoptera		*			*
Hirudinea				3	1
Mollusca			1	5	3
Total Organisms	198	58	1652	1318	1886

* = less than $1/ft^2$ average

included Chironomidae (midges), Tubificidae (Sludge worms), other Oligochaeta (worms), Gerridae (water striders), other Hemiptera (true bugs), other Coleoptera (beetles), Hirudinea (leeches), and Mollusca (snails and clams) (EPA, 1973a).

The percent intolerant taxa decreased and percent tolerant taxa increased from the upper stations through the lower stations (Figure 4). The densities of the three main intolerant taxa also decreased from the upper stations to the lower stations (Figure 5). The densities of the three main tolerant taxa increased from the upper stations through the lower stations (Figure 5).

Freshwater Algae

The only freshwater algae found in Janes Creek upstream of the outfall were diatoms (Chrysophyta) of the genus Fragillaria (Table 2). These organisms occurred in very small numbers--5 to 6 organisms/ml. Green algae (Chlorophyta) of the genus Closteriopsis were the predominant organisms downstream of the outfall. Next in abundance were Euglenophytes (genus Trachelomonas) and Ciliates (genera Halteria and Paramecium). Euglena sp. occurred at Station #5 (Table 2, Appendix D). Numbers of organisms downstream of the discharge were large: 160-240 organisms/ml.

A definite change in freshwater algae occurred as a result of the log pond discharge. The clean-water diatoms (Fragillaria) were replaced by large numbers of green algae (Closteriopsis), flagellated algae (Euglena and Trachelomonas), and protozoans (Halteria and Paramecium).

Sphaerotilus natans (sewage fungus associated with organic pollution) was found throughout the stream downstream of the discharge. No colonies of Sphaerotilus natans were found upstream of the discharge.

Water Quality

Averages of water quality measurements for the February sampling appear in Table 3. Of greatest significance are the chemical oxygen demand, ammonia-nitrogen, and tannin-like substances. All of these parameters were increased by the log pond discharge into Janes Creek.

Ammonia-nitrogen in the stream in April decreased from 18 mg/l to 7.2 mg/l as one moved further downstream from the outfall. Chemical oxygen demand and dissolved oxygen concentration (Figure 6) also followed this trend.

Stream Discharge Measurements

Stream discharge was 0.62 million gallons per day (MGD) upstream of the outfall and 0.99 MGD downstream of the outfall. Since the discharge of the outfall was 0.37 MGD, 37% of Janes Creek downstream of the outfall was log pond waste on April 6, 1977 (Appendix E).

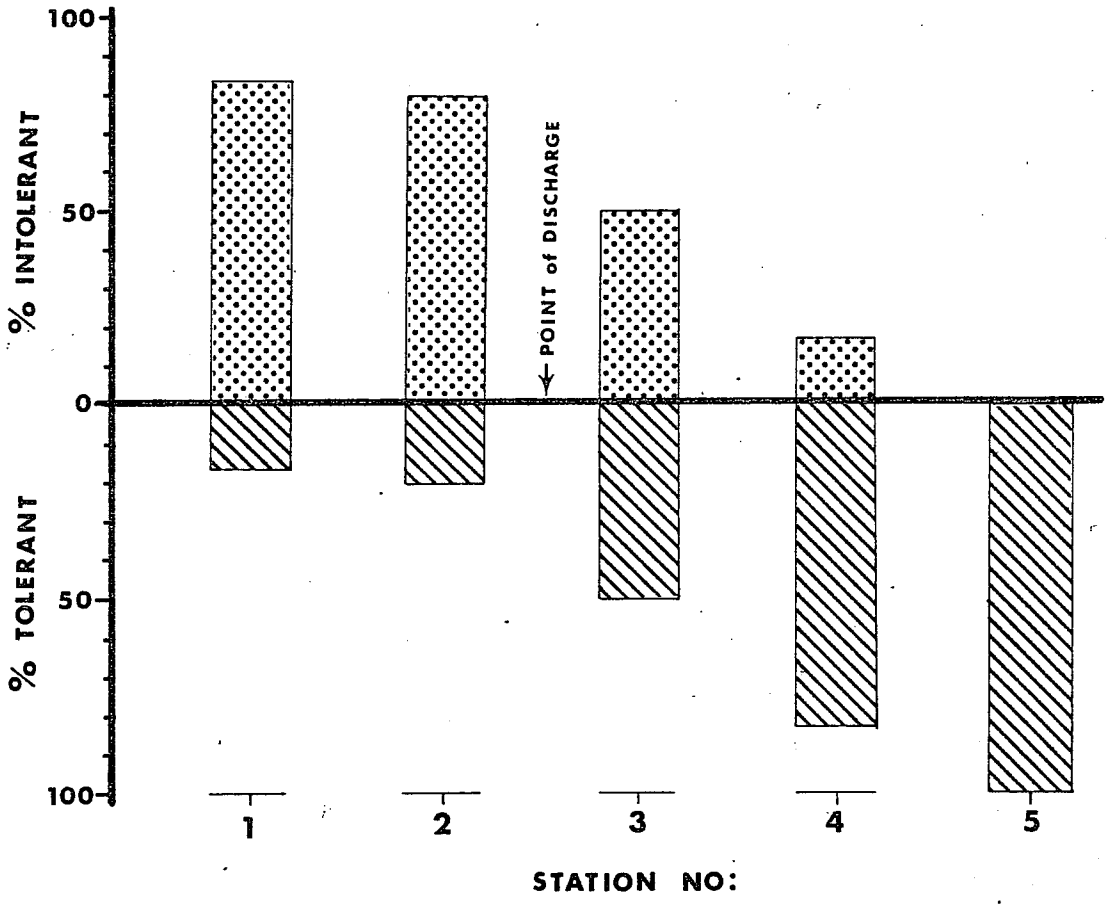


Figure 4. The percent pollution intolerant and pollution tolerant taxa of benthic invertebrates at the five stations on Janes Creek. (Tolerant and intolerant taxa are listed in the text. Only those taxa with > 2/ft^2 were used in the analysis.)

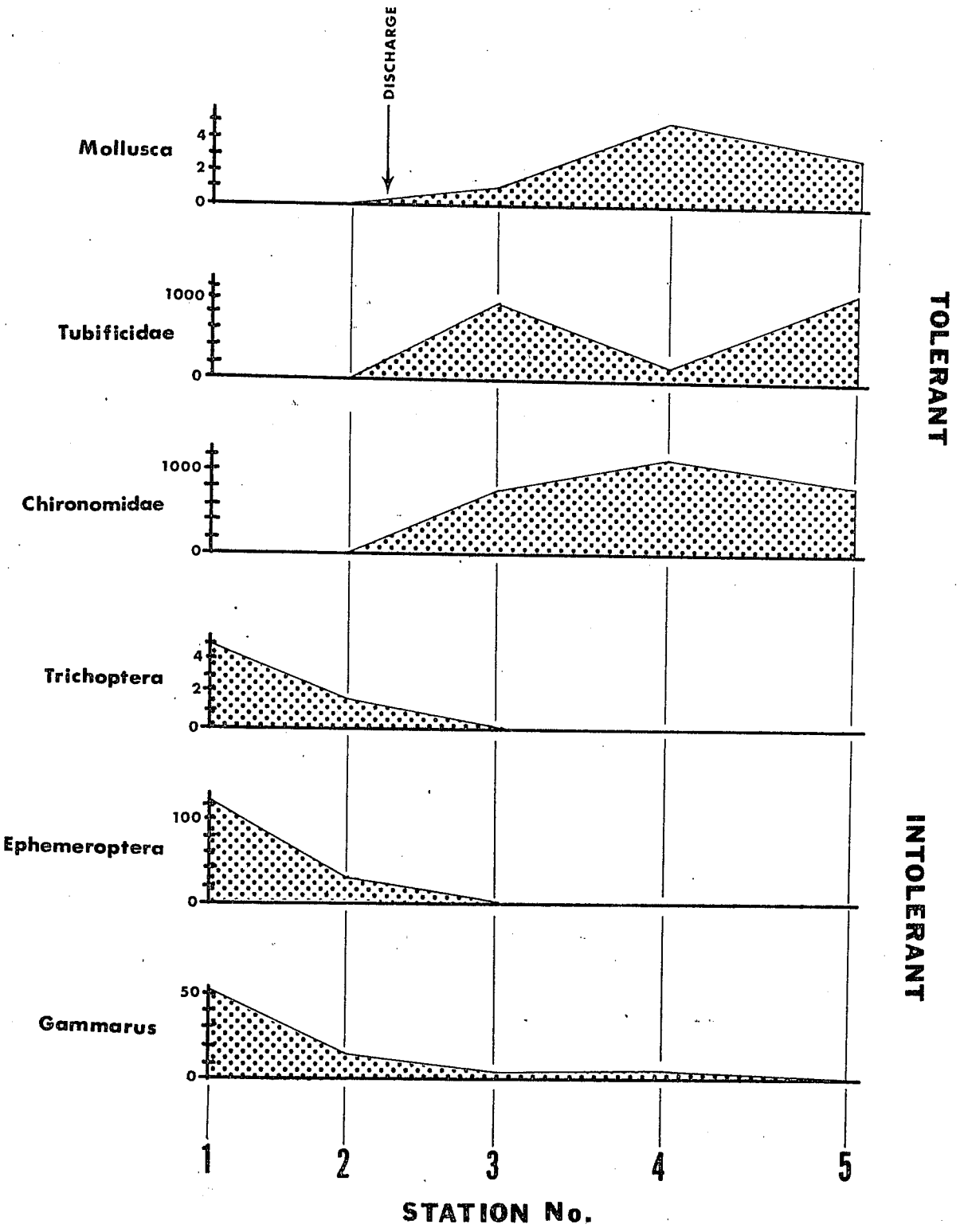


Figure 5. Densities (no./ft^2) of the six main pollution tolerant and pollution intolerant categories at the five sampling stations on Janes Creek (average of three samples per station).

Table 2. Algal genera and abundance in Janes Creek in February of 1977.

Sample Description	Total ml Collected	Identifiable Major Organisms	No. Organisms/ml Sample Collected
Janes Crk. #1	146	1. Diatoms - Fragillaria	6
Janes Crk. #2	142	1. Diatoms - Fragillaria	5
Janes Crk. #3	150	1. Closteriopsis 2. Trachelomonas 3. Halteria 4. Paramecium	240
Janes Crk. #4	141	1. Closteriopsis 2. Trachelomonas 3. Halteria	190
Janes Crk. #5	134	1. Closteriopsis 2. Trachelomonas 3. Euglena 4. Paramecium	160

Table 3. Water quality parameters in Janes Creek above the outfall (A), and below the outfall (C), and in the outfall (B) in February of 1977. (Average of 9 samples.)

	A	B	C
Fecal coliform (MPN/100 ml)	28	14	42
Hexane extractables (mg/l)	< 1	0.6	< 1
Phenols (mg/l)	0.001	0.008	0.004
Formaldehyde (mg/l)	0.05	10.0	5.4
Sulfide (mg/l)	0.03	0.11	0.08
Chemical oxygen demand (mg/l)	13	110	56
Biochemical oxygen demand (mg/l)	1.3	12	6.6
Hydronium ion (pH) (pH units)	7.5	7.3	7.5
Ammonia-nitrogen (mg/l)	0.04	38	20
Tannin-like substances (mg/l)	1.0	6.4	3.8
Nonfilterable residue (mg/l)	6.6	12	12
Settleable solids (ml/l)	0.02	0.11	0.08

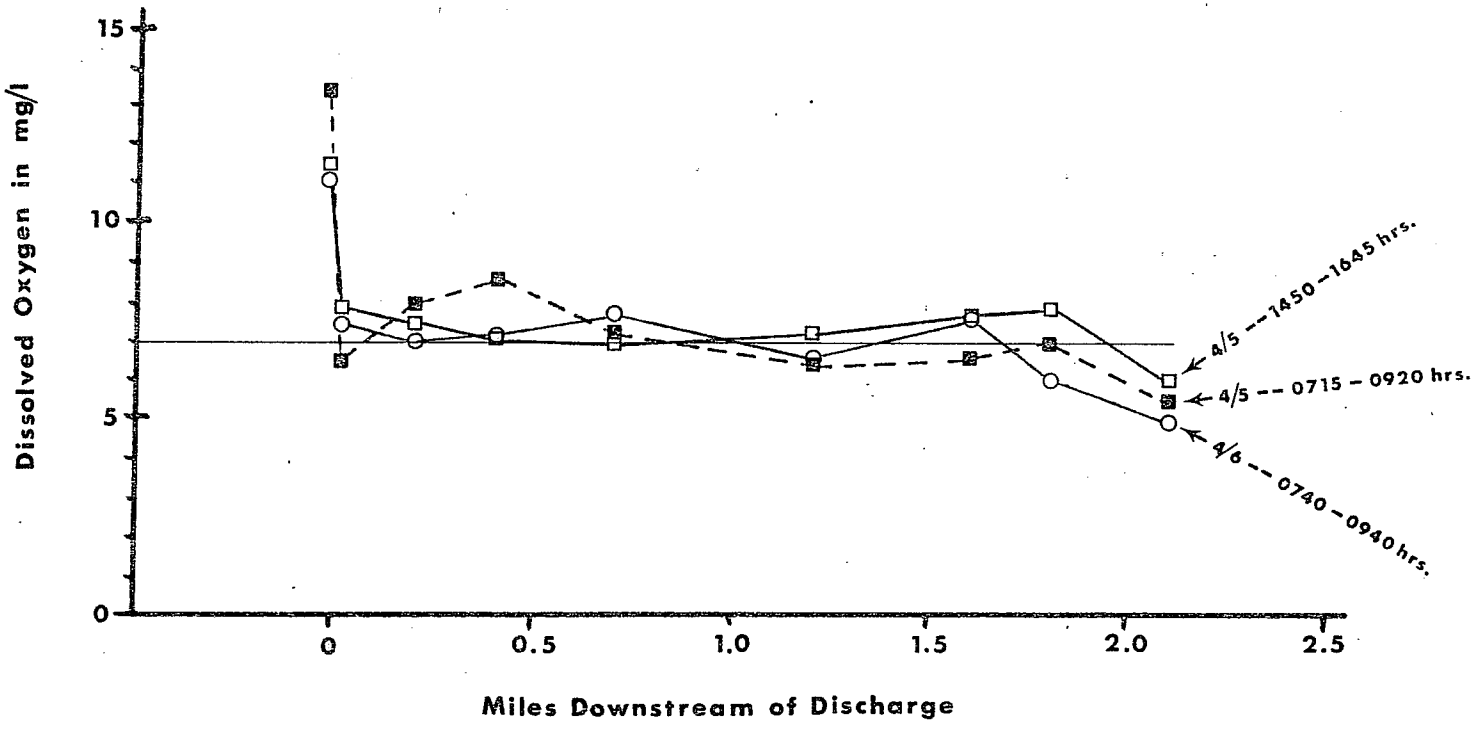


Figure 6. Dissolved oxygen concentrations in Janes Creek on April 5 and 6, 1977.

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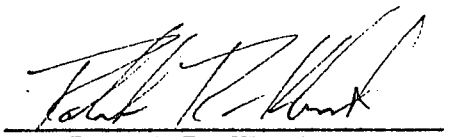

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APPENDIX A

APPENDIX A

Live-car bioassay data for Janes Creek, 2/16 - 2/20/1977.
Species = Salmo gairdneri from HSU Hatchery.
Stations 1 & 2 upstream of discharge, stations 3,4, & 5 downstream of discharge.
Twelve fish per live-car.
Two fish removed at end of test, preserved in formalin, and necropsied for each station.

Station	Date	Time	Dissolved Oxygen	pH	Water Temp.°C	Mortalities
1	2/16	1110	---	---	9.0	0
2	"	1125	---	---	9.0	0
3	"	1130	---	---	11.0	0
4	"	1135	---	---	11.0	0
5	"	1145	---	---	11.0	0
1	2/16	1405	11.3,11.2	7.2	9.5	0
2	"	1420	11.1,11.2	7.2	9.5	0
3	"	1430	7.1,7.3	6.8	11.5	0
4	"	1445	7.4,7.5	7.0	11.5	0
5	"	1500	6.8,6.9	7.2	11.5	0
1	2/17	1000	12.1,12.0	7.2	9.0	0
2	"	0845	11.9,12.0	7.2	9.0	0
3	"	0915	7.0,7.1	7.0	11.5	0
4	"	0930	7.4,6.9	7.2	11.5	0
5	"	0945	6.7,6.6	7.2	11.5	0
1	2/17	1500	---	---	9.5	0
2	"	1510	---	---	9.5	0
3	"	1530	---	---	11.5	0
4	"	1540	---	---	11.5	0
5	"	1545	---	---	11.5	0
1	2/18	0805	13.0	---	7.0	0
2	"	0740	---	---	7.0	0
3	"	0820	7.0	---	10.0	0
4	"	0820	7.3	---	10.0	0
5	"	0830	8.0	---	10.0	0

Station	Date	Time	Dissolved Oxygen	pH	Water Temp.°C	Mortalities
1	2/18	1200	---	---	---	0
2	"	1200	---	---	---	0*
3	"	1200	---	---	---	0
4	"	1200	---	---	---	0
5	"	1200	---	---	---	0
1	2/19	0845	12.3	---	8.5	0
2	"	0830	12.2	---	8.5	0
3	"	0800	8.4	---	11.0	0
4	"	0900	8.4	---	11.0	0
5	"	0915	8.3	---	11.0	0
1	2/19	1200	---	---	---	0
2	"	1200	---	---	---	0
3	"	1200	---	---	---	0
4	"	1200	---	---	---	0
5	"	1200	---	---	---	0
1	2/20	0800	11.7	---	8.5	0
2	"	0745	11.6	---	8.5	0
3	"	0730	6.7	---	11.0	0**
4	"	1000	---	---	---	0**
5	"	1000	---	---	---	0**

* - one fish lethargic
** - fish have opaque eyes

APPENDIX B

#1

FISH MORTALITY

INVESTIGATOR: R. Klamt DATE: 2/20/77

~~TIME:~~ _____ ~~WEATHER:~~ _____ ~~DATE OF KILL:~~ _____

LOCATION OF KILL: James Creek - Station #1

Live-car bioassay - 96 hr.

WATER TEMP.: 8.5°C WATER COLOR: Clear

DISSOLVED O_2: 11.7 pH: — CL_o: —

FISH ~~INVOLVED IN KILL~~

SPECIES ~~INVOLVED~~: Salmo gairdneri

~~NUMBER ESTIMATED DEAD~~: _____

GENERAL APPEARANCE

Normal	■	Nervous and scary	☐
Sluggish	☐	Floating listlessly	☐
Flashing	☐	Swimming upside down or on the side	☐
		Spiraling or corkscrewing	☐
		Making spasmodic movements	☐
		Sinking to the bottom	☐
		Rubbing against the bottom	☐

Other:

Normal

BODY SURFACE

Normal ■ /Bluish film: in patches ☐ or all over ☐ /Grayish-white: patches ☐ or tufts ☐ Swollen areas as furuncles ☐ Deep open lesions with pus and blood ☐ /Shallow red ulcers: small ☐ large ☐ /Necrotic areas: separate ☐ confluent ☐ gray ☐ lt. brown ☐ on head ☐ all over ☐ lips and head especially ☐ /Granulations: glass bead-like ☐ pearl-like ☐ on fins ☐ on body ☐ variable in size ☐ /Pinpoint pimples ☐ Cysts ☐ /Pinpoint spots: white ☐ or black ☐ /Parasites: very small, barely visible, soft ☐ or longer, hard ☐ (often with swallowtail appearance) /Fish abnormally dark: entire body ☐ certain body areas ☐ Indicate where _____

Growth ☐ Irregular ☐ proliferating ☐ on surface ☐ or protruding from: vent ☐ nostrils ☐ mouth ☐ Warts ☐ gills ☐

FINS

Normal ■ Swollen ☐ Necrotic ☐ Frayed ☐ Bluish-white ☐ Twisted ☐ Eroded ☐ /Spots present: white ☐ black ☐ /Blood-shot ☐ Parasite present ☐

CAUDAL PEDUNCLE Normal

Slightly swollen ☐ Very swollen ☐ Necrotic ☐ Inflamed ☐ Bluish-white ☐ Fungus-like tufts present ☐

#1

GILLS Normal

Covers open more than normally ☐ Swollen ☐ Covered with mucus, food and dirt particles ☐ Patches: white ☐ brown ☐ gray ☐

(IF EXAMINED UNDER MICROSCOPE)

Filaments and Lamellae: swollen ☐ fused ☐ club-shaped ☐ ballooned ☐ Cottony tufts present ☐
Small grayish-white objects: on filaments ☐ on lamellae ☐ between filaments ☐ between lamellae ☐ normal
Color of gills: deep red ☐ pale red ☐ pale pink ☐ hemorrhagic ☐

MUSCULATURE Normal

Sores ☐ or Furuncles ☐ filled with red pus Small red spots ☐ Well defined sores ☐ or cysts ☐ filled with creamy ☐ or cheesy ☐ contents Hard cysts like sand grains: small ☐ large ☐ black ☐ or yellow ☐

EYES

Normal ■ Opaque ☐ White: lens ☐ or center ☐
Tiny spots in lens ☐ Red spots in cornea ☐
Popeye ☐ One eye missing ☐ Both eyes missing ☐.
If a needle is inserted in the eye socket and the eye is pressed while fish head is under water, gas bubbles ☐ or opaque fluid ☐ escapes.

BODY CAVITY

Appears normal ■ Excessive fluid present ☐ /Fluid: Colorless ☐ Opaque ☐ Bloody ☐ /Present in lining: Spots ☐ or Hemorrhages ☐
/Worms: Tape-like ☐ or Round ☐ /Small Cysts ☐

INTESTINAL TRACT

Normal ■ Empty ☐ Filled with food ■ /Filled with mucus: Colorless ☐ Yellow ☐ Reddish ☐
Hind gut bloody ☐ Blood in vent ☐ Stomach opened ☐
Roundworms present ☐ Flatworms present ☐

LIVER

Normal ■ Red ☐ Yellow ☐ Brown ☐ Pale ☐
Color of coffee with cream ☐ Marbled ☐ Spotty ☐ /Cysts: Small ☐ or Large ☐
/Gall Bladder Bile: Greenish-yellow ☐ or Bluish-Black ☐ Watery Clear ☐

SPLEEN

Red ■ Black-red ☐ Pale ☐ Spotty ☐ Shriveled ☐ Swollen ☐ Lumpy ☐ Grossly Enlarged ☐

PYLORIC CAECA

Normal ■ Fused together ☐ Swollen ☐ Worms Inside ☐ Bloodshot ☐

KIDNEY

Normal ■ /Pinpoint Spots: Gray ☐ or White ☐
Gray pustules: How many: Where located:
Small ☐ Large ☐ Creamy consistency ☐ Hard and gritty ☐ Cheesy Consistency ☐

TUMORS Normal

Any internal organ: Much enlarged ☐ Irregular in shape ☐

2 fish examined preserved in formalin

#2

FISH MORTALITY

INVESTIGATOR: R. Klamt DATE: 2/20/77

~~TIME:~~ _____ ~~WEATHER:~~ _____ ~~DATE OF KILL:~~ _____

LOCATION ~~OF KILL~~: James Creek - Station #2 —

Live-car bioassay - 96 hr.

WATER TEMP.: 8.5°C WATER COLOR: Clear

DISSOLVED O_2: 11.6 pH: — CL_o: —

~~FISH INVOLVED IN KILL~~

SPECIES ~~INVOLVED~~: Salmo gairdneri

~~NUMBER ESTIMATED DEAD~~: _____

GENERAL APPEARANCE

Normal	■	Nervous and scary	☐
Sluggish	☐	Floating listlessly	☐
Flashing	☐	Swimming upside down or on the side	☐
		Spiraling or corkscrewing	☐
		Making spasmodic movements	☐
		Sinking to the bottom	☐
		Rubbing against the bottom	☐

Other:

Normal

BODY SURFACE

Normal ■ /Bluish film: in patches ☐ or all over ☐ /Grayish-white: patches ☐ or tufts ☐ Swollen areas as furuncles ☐ Deep open lesions with pus and blood ☐ /Shallow red ulcers: small ☐ large ☐ /Necrotic areas: separate ☐ confluent ☐ gray ☐ lt. brown ☐ on head ☐ all over ☐ lips and head especially ☐ /Granulations: glass bead-like ☐ pearl-like ☐ on fins ☐ on body ☐ variable in size ☐ /Pinpoint pimples ☐ Cysts ☐ /Pinpoint spots: white ☐ or black ☐ /Parasites: very small, barely visible, soft ☐ or longer, hard ☐ (often with swallowtail appearance) /Fish abnormally dark: entire body ☐ certain body areas ☐ Indicate where _____

Growth ☐ Irregular ☐ proliferating ☐ on surface ☐ or protruding from: vent ☐ nostrils ☐ mouth ☐ Warts ☐ gills ☐

FINS

Normal ■ Swollen ☐ Necrotic ☐ Frayed ☐ Bluish-white ☐ Twisted ☐ Eroded ☐ /Spots present: white ☐ black ☐ /Blood-shot ☐ Parasite present ☐

CAUDAL PEDUNCLE Normal

Slightly swollen ☐ Very swollen ☐ Necrotic ☐ Inflamed ☐ Bluish-white ☐ Fungus-like tufts present ☐

#2

GILLS normal

Covers open more than normally ☐ Swollen ☐ Covered with mucus, food and dirt particles ☐ Patches: white ☐ brown ☐ gray ☐

(IF EXAMINED UNDER MICROSCOPE)

Filaments and Lamellae: swollen ☐ fused ☐ club-shaped ☐ ballooned ☐ Cottony tufts present ☐
Small grayish-white objects: on filaments ☐ on lamellae ☐ between filaments ☐ between lamellae ☐ normal
Color of gills: deep red ☐ pale red ☐ pale pink ☐ hemorrhagic ☐

MUSCULATURE normal

Sores ☐ or Furuncles ☐ filled with red pus Small red spots ☐ Well defined sores ☐ or cysts ☐ filled with creamy ☐ or cheesy ☐ contents Hard cysts like sand grains: small ☐ large ☐ black ☐ or yellow ☐

EYES

Normal ■ Opaque ☐ White: lens ☐ or center ☐
Tiny spots in lens ☐ Red spots in cornea ☐
Popeye ☐ One eye missing ☐ Both eyes missing ☐.
If a needle is inserted in the eye socket and the eye is pressed while fish head is under water, gas bubbles ☐ or opaque fluid ☐ escapes.

BODY CAVITY

Appears normal ■ Excessive fluid present ☐ /Fluid: Colorless ☐ Opaque ☐ Bloody ☐ /Present in lining: Spots ☐ or Hemorrhages ☐
/Worms: Tape-like ☐ or Round ☐ /Small Cysts ☐

INTESTINAL TRACT

Normal ■ Empty ☐ Filled with food ■ /Filled with mucus: Colorless ☐ Yellow ☐ Reddish ☐
Hind gut bloody ☐ Blood in vent ☐ Stomach opened ☐
Roundworms present ☐ Flatworms present ☐

LIVER

Normal ■ Red ☐ Yellow ☐ Brown ☐ Pale ☐
Color of coffee with cream ☐ Marbled ☐ Spotty ☐ /Cysts: Small ☐ or Large ☐
/Gall Bladder Bile: Greenish-yellow ☐ or Bluish-Black ☐
Watery Clear ☐

SPLEEN

Red ■ Black-red ☐ Pale ☐ Spotty ☐ Shriveled ☐ Swollen ☐ Lumpy ☐ Grossly Enlarged ☐

PYLORIC CAECA

Normal ■ Fused together ☐ Swollen ☐ Worms Inside ☐ Bloodshot ☐

KIDNEY

Normal ■ /Pinpoint Spots: Gray ☐ or White ☐
Gray pustules: How many: Where located:
Small ☐ Large ☐ Creamy consistency ☐ Hard and gritty ☐ Cheesy Consistency ☐

TUMORS none

Any internal organ: Much enlarged ☐ Irregular in shape ☐

2. fish examined preserved in formalin

#3

FISH MORTALITY

INVESTIGATOR: R. Klamt DATE: 2/20/77

~~TIME:~~ _____ ~~WEATHER:~~ _____ ~~DATE OF KILL:~~ _____

LOCATION ~~OF KILL~~: James Creek - Station #3

Live-car bioassay - 96 hr.

WATER TEMP.: 11°C WATER COLOR: Black

DISSOLVED O_2: 6.7 pH: — CL_o: —

FISH ~~INVOLVED IN KILL~~

SPECIES ~~INVOLVED~~: Salmo gairdneri

~~NUMBER ESTIMATED DEAD:~~ _____

GENERAL APPEARANCE

Normal	■	Nervous and scary	☐
Sluggish	☐	Floating listlessly	☐
Flashing	☐	Swimming upside down or on the side	☐
		Spiraling or corkscrewing	☐
		Making spasmodic movements	☐
		Sinking to the bottom	☐
		Rubbing against the bottom	☐

Other:

Some gill hyperplasia, dark color externally, light kidney & liver

BODY SURFACE

Normal ■ /Bluish film: in patches ☐ or all over ☐ /Grayish-white: patches ☐ or tufts ☐ Swollen areas as furuncles ☐ Deep open lesions with pus and blood ☐ /Shallow red ulcers: small ☐ large ☐ /Necrotic areas: separate ☐ confluent ☐ gray ☐ lt. brown ☐ on head ☐ all over ☐ lips and head especially ☐ /Granulations: glass bead-like ☐ pearl-like ☐ on fins ☐ on body ☐ variable in size ☐ /Pinpoint pimples ☐ Cysts ☐ /Pinpoint spots: white ☐ or black ☐ /Parasites: very small, barely visible, soft ☐ or longer, hard ☐ (often with swallowtail appearance) /Fish abnormally dark: entire body ■ certain body areas ☐ Indicate where.....

Growth ☐ Irregular ☐ proliferating ☐ on surface ☐ or protruding from: vent ☐ nostrils ☐ mouth ☐ Warts ☐ gills ☐

FINS

Normal ■ Swollen ☐ Necrotic ☐ Frayed ☐ Bluish white ☐ Twisted ☐ Eroded ☐ /Spots present: white ☐ black ☐ /Blood-shot ☐ Parasite present ☐

CAUDAL PEDUNCLE Normal

Slightly swollen ☐ Very swollen ☐ Necrotic ☐ Inflamed ☐ Bluish-white ☐ Fungus-like tufts present ☐

#3

GILLS normal ext.

Covers open more than normally ☐ Swollen ☐ Covered with mucus, food and dirt particles ☐ Patches: white ☐ brown ☐ gray ☐

(IF EXAMINED UNDER MICROSCOPE)

Filaments and Lamellae: swollen ☐ fused ☐
club-shaped ■ ballooned ☐ Cottony tufts present ☐
Small grayish-white objects: on filaments ☐
on lamellae ☐ between filaments ☐
between lamellae ☐
Color of gills: deep red ☐ pale red ■ pale pink ☐ hemorrhagic ☐

✓ some hyperplasia

MUSCULATURE normal

Sores ☐ or Furuncles ☐ filled with red pus Small red spots ☐ Well defined sores ☐ or cysts ☐ filled with creamy ☐ or cheesy ☐ contents Hard cysts like sand grains: small ☐ large ☐ black ☐ or yellow ☐

EYES

Normal ☐ Opaque ■ White. lens ☐ or center ☐ ✓
Tiny spots in lens ☐ Red spots in cornea ☐
Popeye ☐ One eye missing ☐ Both eyes missing ☐.
If a needle is inserted in the eye socket and the eye is pressed while fish head is under water, gas bubbles ☐ or opaque fluid ☐ escapes.

BODY CAVITY

Appears normal ■ Excessive fluid present ☐ /Fluid: Colorless ☐ Opaque ☐ Bloody ☐ /Present in lining: Spots ☐ or Hemorrhages ☐
/Worms: Tape-like ☐ or Round ☐ /Small Cysts ☐

INTESTINAL TRACT very small amt. food

Normal ☐ Empty ■ Filled with food ☐ /Filled with mucus: Colorless ☐ Yellow ☐ Reddish ☐
Hind gut bloody ☐ Blood in vent ☐ Stomach opened ☐
Roundworms present ☐ Flatworms present ☐

LIVER

Normal ☐ Red ☐ Yellow ☐ Brown ☐ Pale ■
Color of coffee with cream ☐ sl. Marbled ■ Spotty ☐ /Cysts: Small ☐ or Large ☐
/Gall Bladder Bile: Greenish-yellow ☐ or Bluish-Black ☐ Watery Clear ☐

✓

SPLEEN

Red ■ Black-red ☐ Pale ☐ Spotty ☐ Shriveled ☐ Swollen ☐ Lumpy ☐ Grossly Enlarged ☐

PYLORIC CAECA

Normal ■ Fused together ☐ Swollen ☐ Worms Inside ☐ Bloodshot ☐

KIDNEY Light color

Normal ■ /Pinpoint Spots: Gray ☐ or White ☐ ✓
Gray pustules: How many: Where located:
Small ☐ Large ☐ Creamy consistency ☐ Hard and gritty ☐ Cheesy Consistency ☐

TUMORS none

Any internal organ: Much enlarged ☐ Irregular in shape ☐

2 fish examined
Preserved in formalin

F. K. Hunt

#4

FISH MORTALITY

INVESTIGATOR: R. Klamt DATE: 2/20/77

~~TIME:~~ _____ ~~WEATHER:~~ _____ ~~DATE OF KILL:~~ _____

LOCATION ~~OF KILL:~~ James Creek - Station #4 —
Core-car bioassay - 96 hr.

WATER TEMP.: — WATER COLOR: Black

DISSOLVED O_2: — pH: — CL_o: —

~~FISH INVOLVED IN KILL~~

SPECIES ~~INVOLVED~~: Salmo gairdneri

~~NUMBER ESTIMATED DEAD:~~ _____

GENERAL APPEARANCE

Normal	■	Nervous and scary	☐
Sluggish	☐	Floating listlessly	☐
Flashing	☐	Swimming upside down or on the side	☐
		Spiraling or corkscrewing	☐
		Making spasmodic movements	☐
		Sinking to the bottom	☐
		Rubbing against the bottom	☐

Other:

BODY SURFACE

Normal ■ /Bluish film: in patches ☐ or all over ☐ /Grayish-white: patches ☐ or tufts ☐ Swollen areas as furuncles ☐ Deep open lesions with pus and blood ☐ /Shallow red ulcers: small ☐ large ☐ /Necrotic areas: separate ☐ confluent ☐ gray ☐ lt. brown ☐ on head ☐ all over ☐ lips and head especially ☐ /Granulations: glass bead-like ☐ pearl-like ☐ on fins ☐ on body ☐ variable in size ☐ /Pinpoint pimples ☐ Cysts ☐ /Pinpoint spots: white ☐ or black ☐ /Parasites: very small, barely visible, soft ☐ or longer, hard ☐ (often with swallowtail appearance) /Fish abnormally dark: entire body ■ certain body areas ☐ Indicate where _____

Growth ☐ Irregular ☐ proliferating ☐ on surface ☐ or protruding from: vent ☐ nostrils ☐ mouth ☐ Warts ☐ gills ☐

Some gill hyperplasia, dark color externally, light kidney + liver

FINS

Normal ■ Swollen ☐ Necrotic ☐ Frayed ☐ Bluish-white ☐ Twisted ☐ Eroded ☐ /Spots present: white ☐ black ☐ /Blood-shot ☐ Parasite present ☐

CAUDAL PEDUNCLE normal

Slightly swollen ☐ Very swollen ☐ Necrotic ☐ Inflamed ☐ Bluish-white ☐ Fungus-like tufts present ☐

#4

GILLS normal ext.

Covers open more than normally ☐ Swollen ☐ Covered with mucus, food and dirt particles ☐ Patches: white ☐ brown ☐ gray ☐

(IF EXAMINED UNDER MICROSCOPE)

Filaments and Lamellae: swollen ☐ fused ☐
club-shaped ■ ballooned ☐ Cottony tufts present ☐
Small grayish-white objects: on filaments ☐
on lamellae ☐ between filaments ☐
between lamellae ☐ some hyperplasia
Color of gills: deep red ☐ pale red ■ pale pink ☐ hemorrhagic ☐

MUSCULATURE normal

Sores ☐ or Furuncles ☐ filled with red pus Small red spots ☐ Well defined sores ☐ or cysts ☐ filled with creamy ☐ or cheesy ☐ contents Hard cysts like sand grains: small ☐ large ☐ black ☐ or yellow ☐

EYES

Normal ☐ Opaque ■ White. lens ☐ or center ☐
Tiny spots in lens ☐ Red spots in cornea ☐
Popeye ☐ One eye missing ☐ Both eyes missing ☐
If a needle is inserted in the eye socket and the eye is pressed while fish head is under water, gas bubbles ☐ or opaque fluid ☐ escapes.

BODY CAVITY

Appears normal ■ Excessive fluid present ☐ /Fluid: Colorless ☐ Opaque ☐ Bloody ☐ /Present in lining: Spots ☐ or Hemorrhages ☐
/Worms: Tape-like ☐ or Round ☐ /Small Cysts ☐

INTESTINAL TRACT

Normal ☐ Empty ■ Filled with food ☐ /Filled with mucus: Colorless ☐ Yellow ☐ Reddish ☐
Hind gut bloody ☐ Blood in vent ☐ Stomach opened ☐
Roundworms present ☐ Flatworms present ☐

LIVER

Normal ☐ Red ☐ Yellow ☐ Brown ☐ Pale ■
Color of coffee with cream ☐ sl. Marbled ■ Spotty ☐ /Cysts: Small ☐ or Large ☐
/Gall Bladder Bile: Greenish-yellow ☐ or Bluish-Black ☐
Watery Clear ☐

SPLEEN

Red ■ Black-red ☐ Pale ☐ Spotty ☐ Shriveled ☐ Swollen ☐ Lumpy ☐ Grossly Enlarged ☐

PYLORIC CAECA

Normal ■ Fused together ☐ Swollen ☐ Worms Inside ☐ Bloodshot ☐

KIDNEY (light color)

Normal ■ /Pinpoint Spots: Gray ☐ or White ☐
Gray pustules: How many: Where located:
Small ☐ Large ☐ Creamy consistency ☐ Hard and gritty ☐ Cheesy Consistency ☐

TUMORS none

Any internal organ: Much enlarged ☐ Irregular in shape ☐

2 fish examined preserved in formalin

F. K. Kleinholz

#5

FISH MORTALITY

INVESTIGATOR: R. Klamt DATE: 2/20/77

~~TIME:~~ _____ ~~WEATHER:~~ _____ ~~DATE OF KILL:~~ _____

LOCATION ~~OF KILL~~: Jones Creek - Station #5 —

Live-car bioassay - 96hr.

WATER TEMP.: — WATER COLOR: Black

DISSOLVED O_2: — pH: — CL_o: —

FISH ~~INVOLVED IN KILL~~

SPECIES ~~INVOLVED~~: Salmo gairdneri

~~NUMBER ESTIMATED DEAD~~: _____

GENERAL APPEARANCE

Normal	■	Nervous and scary	☐
Sluggish	☐	Floating listlessly	☐
Flashing	☐	Swimming upside down or on the side	☐
		Spiraling or corkscrewing	☐
		Making spasmodic movements	☐
		Sinking to the bottom	☐
		Rubbing against the bottom	☐

Other:

BODY SURFACE

Normal ■ /Bluish film: in patches ☐ or all over ☐ /Grayish-white: patches ☐ or tufts ☐ Swollen areas as furuncles ☐ Deep upen lesions with pus and blood ☐ /Shallow red ulcers: small ☐ large ☐ /Necrotic areas: separate ☐ confluent ☐ gray ☐ lt. brown ☐ on head ☐ all over ☐ lips and head especially ☐ /Granulations: glass bead-like ☐ pearl-like ☐ on fins ☐ on body ☐ variable in size ☐ /Pinpoint pimples ☐ Cysts ☐ /Pinpoint spots: white ☐ or black ☐ /Parasites: very small, barely visible, soft ☐ or longer, hard ☐ (often with swallowtail appearance) /Fish abnormally dark: entire body ■ certain body areas ☐ Indicate where _____

Growth ☐ Irregular ☐ proliferating ☐ on surface ☐ or protruding from: vent ☐ nostrils ☐ mouth ☐ Warts ☐ gills ☐

Some gill hyperplasia, dark color externally, light colored liver + kidney

FINS

Normal ■ Swollen ☐ Necrotic ☐ Frayed ☐ Bluish-white ☐ Twisted ☐ Eroded ☐ /Spots present: white ☐ black ☐ /Blood-shot ☐ Parasite present ☐

CAUDAL PEDUNCLE Normal

Slightly swollen ☐ Very swollen ☐ Necrotic ☐ Inflamed ☐ Bluish-white ☐ Fungus-like tufts present ☐

#5

GILLS normal ext.

Covers open more than normally ☐ Swollen ☐ Covered with mucus, food and dirt particles ☐ Patches: white ☐ brown ☐ gray ☐

(IF EXAMINED UNDER MICROSCOPE)

Filaments and Lamellae: swollen ☐ fused ☐
club-shaped ■ ballooned ☐ Cottony tufts present ☐
Small grayish-white objects: on filaments ☐
on lamellae ☐ between filaments ☐
between lamellae ☐
Color of gills: deep red ☐ pale red ■ pale pink ☐ hemorrhagic ☐

some hyperplasia ✓

MUSCULATURE Normal

Sores ☐ or Furuncles ☐ filled with red pus Small red spots ☐ Well defined sores ☐ or cysts ☐ filled with creamy ☐ or cheesy ☐ contents Hard cysts like sand grains: small ☐ large ☐ black ☐ or yellow ☐

EYES

Normal ☐ Opaque ■ White: lens ☐ or center ☐
Tiny spots in lens ☐ Red spots in cornea ☐
Popeye ☐ One eye missing ☐ Both eyes missing ☐ ✓
If a needle is inserted in the eye socket and the eye is pressed while fish head is under water, gas bubbles ☐ or opaque fluid ☐ escapes.

BODY CAVITY

Appears normal ■ Excessive fluid present ☐ /Fluid: Colorless ☐ Opaque ☐ Bloody ☐ /Present in lining: Spots ☐ or Hemorrhages ☐
/Worms: Tape-like ☐ or Round ☐ /Small Cysts ☐

INTESTINAL TRACT

Normal ☐ Empty ■ Filled with food ☐ /Filled with mucus: Colorless ☐ Yellow ☐ Reddish ☐
Hind gut bloody ☐ Blood in vent ☐ Stomach opened ☐
Roundworms present ☐ Flatworms present ☐

LIVER

Normal ☐ Red ☐ Yellow ☐ Brown ☐ Pale ■
Color of coffee with cream ☐ Sl. Marbled ■ Spotty ☐ /Cysts: Small ☐ or Large ☐ ✓
/Gall Bladder Bile: Greenish-yellow ☐ or Bluish-Black ☐
Watery Clear ☐

SPLEEN

Red ■ Black-red ☐ Pale ☐ Spotty ☐ Shriveled ☐ Swollen ☐ Lumpy ☐ Grossly Enlarged ☐

PYLORIC CAECA

Normal ■ Fused together ☐ Swollen ☐ Worms Inside ☐ Bloodshot ☐

KIDNEY Light color

Normal ■ /Pinpoint Spots: Gray ☐ or White ☐ ✓
Gray pustules: How many: Where located:
Small ☐ Large ☐ Creamy consistency ☐ Hard and gritty ☐ Cheesy Consistency ☐

TUMORS none

Any internal organ: Much enlarged ☐ Irregular in shape ☐

2 fish examined preserved in formalin

F. P. Klontz

APPENDIX C

~~ute of California~~ The Resources Agency

Memorandum

To : Dr. David C. Joseph, Executive Officer
California Regional Water Quality Control Board
North Coast Region
1000 Coddingtown Center
Santa Rosa, CA 95406

Date: May 3, 1977

From : **Department of Fish and Game** – Region 1

Subject: Janes Creek, Fishery Resource Evaluation and Water Quality Samples, April 5 and 6, 1977, Humboldt County

At the request of your staff, Janes Creek was electrofished on April 5, 1977 to evaluate the fishery resources in relation to the log pond discharge from Simpson Lumber Company's Mad River Plywood Mill. Water samples were also collected and analyzed for various parameters.

Study Area

Janes Creek is a small coastal stream originating near Fickle Hill north of Arcata. The upper stream areas flow through redwood forests and are bordered by dense riparian vegetation. The stream character changes below a small four foot falls, becoming wider with less instream cover; however, riparian vegetation is excellent. Below the Highway 101 crossing, the creek becomes open and sluggish with little cover for salmonids. (See Figure 1.)

Methods

Four 100 foot study stations were electrofished, two below the log pond discharge and two above (Figure 1). These were the same stations which were electrofished on November 13, 1975 and September 1, 1976. Fish populations were sampled using a Smith Root Type VIII back pack electrofisher with two hand held probes. Narcotized fish were collected, identified, measured, and released back to the stream. Two passes of equal effort were made in order to estimate the fish population using the Seber and LeCren (1967) population estimation procedure.

Results:

Population estimates of coastal cutthroat trout are shown in Table 1. For comparison, the population estimates obtained from the 9-1-76 and 11-3-75 surveys are included.

The trout averaged 3.88 inches (fork length) in the two stations downstream from the discharge and 3.07 inches in the two upstream stations.

Water Quality Samples:

Water samples from the log pond discharge and from Janes Creek above and below the discharge were collected on 4-6-77 for chemical analyses (See Figure 2). The parameters measured and methods used were as follows:

Temperature - Taylor Mercury Thermometer
pH - (measured by Regional Board staff - meter)
Conductivity- Beckman RB3 bridge
Turbidity - Hach 2100 A Turbidimeter
Alkalinity - Titration Method
Hardness - Titration Method
Hydroxylated Aromatics (Tanins & lignins) - Tyrosine Method
N-Ammonia - Nessler Method
Phenol - 4-Amioantipyrine method

Temperature, pH, and conductivity were measured in the field. The remaining analyses were performed at the Region 1 water quality laboratory in Redding. The results are shown in Table 2.

Discussion:

The results indicate that the fish populations in the downstream stations have reestablished since the phenol spill which occurred in August 1976. With the exception of Station 2, the population estimates for 4-5-77 were very similar to the prespill estimates obtained on 11-3-75.

The chemical analyses indicate that there was a change in the water quality of Janes Creek below the log pond discharge. However, in terms of toxicity to fish, both the hydroxylated aromatics (or tannic acid) and unionized ammonia were below toxic levels in the creek at the time the samples were taken. We have conducted bioassays at our laboratory using pure tannic acid solutions and have determined the 96 hour LC_{50} to be 14.7 mg/1. The concentration in Janes Creek of 5.48 mg/1 was below this level. However, it should also be pointed out that the toxicity level in Janes Creek would also depend on the amount of phenolics in the discharge since the test also measures other hydroxylated aromatics in addition to tannic acid.

The toxicity of ammonia to fish is dependent on the amount of unionized ammonia in solution. The amount of unionized ammonia is dependent on pH and temperature. Since we measured the ammonia concentration as N, pH, and temperature of Janes Creek, we used the procedure of Morgan and Turner 1977 (see attached Administrative Report) to calculate the unionized ammonia concentration in Janes Creek. The results were as follows:

	Ammonia as N mg/1	Unionized Ammonia mg/1
Upstream - B	1.59	0.028
Discharge - C	33.25	0.217
Downstream D	20.38	0.148
E	20.00	0.127
F	15.75	0.098

Acute toxicity data for fish indicates that the LC_{50} value for unionized ammonia ranges from 0.29 to 0.89 mg/1, with salmonids being the most sensitive. The concentration in the discharge of 0.217 mg/1 is slightly below the reported lethal level.

Even though the concentrations in Janes Creek were below the lethal levels during the sample period, either an increase in pH or temperature could result in concentrations toxic to the trout population. For example, an increase of 0.3 pH units or a $10^{o}C$ increase in temperature would double the amount of unionized ammonia present.

Conclusions:

Based on the 3 electroshocking surveys, the cutthroat trout in Janes Creek can survive below the discharge under certain conditions. Since the fish are mobile, they can move out of the area if toxic conditions occur. Concentrations of unionized ammonia in Janes Creek are above the recommended maximum limit of 0.025 mg/1. Even though concentrations were not lethal at the time of sampling, slight changes in pH or temperature would create toxic conditions.

If you have any questions, please contact Dennis Wilson of my staff.

R. J. O'Brien
Regional Manager

Attachment

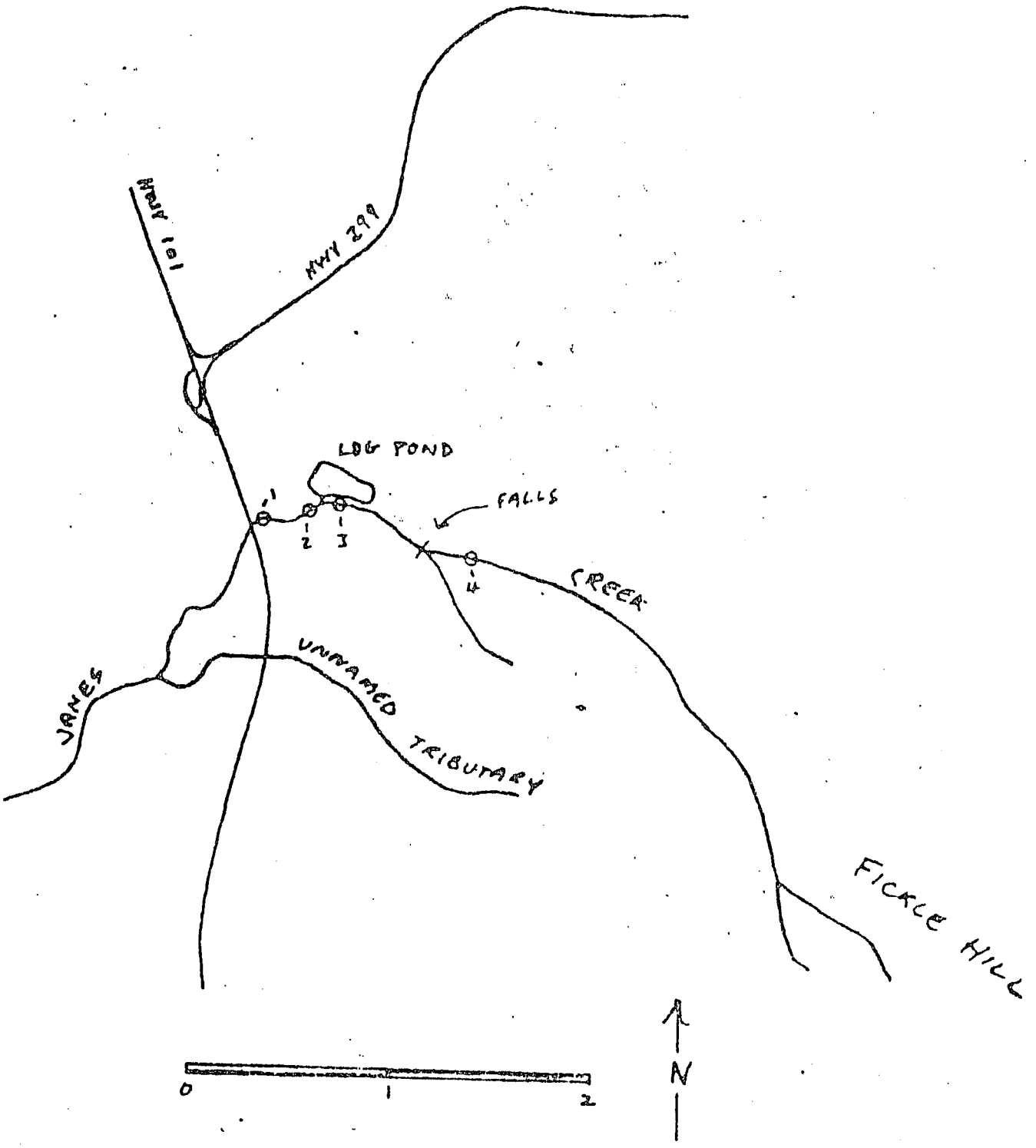


Figure 1. UPPER JANES CREEK
0-1 ELECTROFISHING STATIONS

DPL '76

Table 1 Electrofishing results and population estimates (95 percent confident limits) of coast cutthroat trout, Janes Creek, Humboldt County

Date	Stations 1	2	3	4
4-5-77				
Pass 1	8	33	20	21
Pass 2	0	1	6	2
Population Estimate	6±0	34±1	29±10	23±1
9-1-76				
Population Estimate	0	1	69±9	53±18
11-3-75				
Population Estimate	8±2	10±0	21±0	21±0

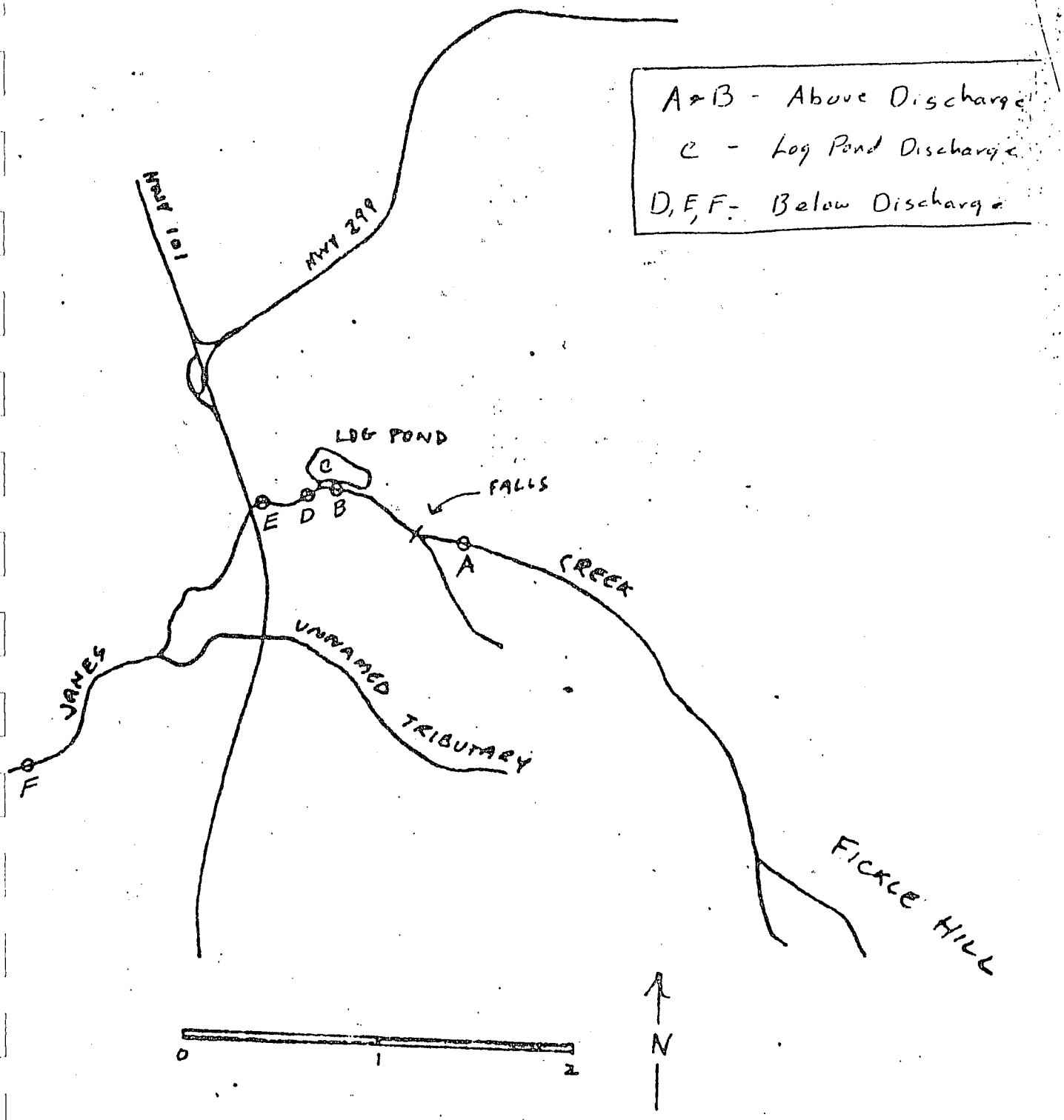


Figure 2. Upper Janes Creek Water Quality Stations, A, B, C, D, E, and F.

Table 2 Results of Chemical Analyses, Water Samples from Janes Creek, 0830 - 0930 April 6, 1977

Parameter	Sample Stations: Upstream A	Upstream B	Discharge C	Downstream D	Downstream E	Downstream F
Temperature (°C)	8.4	8.5	13.9	11.2	11.0	10.8
pH	7.85	7.85	7.4	7.55	7.5	7.5
Conductivity (μ mhos/cm)	120	120	540	350	350	290
Turbidity (NTU)	6.8	8.3	18	15	13	12
Bicarbonate Alkalinity (mg/l)	27	32	204	126	125	100
Hardness (mg/l as $CaCO_3$)						
Calcium	16	17	74	49	46	40
Total	33	34	102	71	68	62
Hydroxylated Aromatics as mg/l Tannic Acid	1.67	1.59	10.54	5.48	5.42	5.48
N-Ammonia (mg/l)	0.49	0.56	33.25	20.38	20.00	15.75
Phenol (mg/l)	-	-	0.42	-	-	-

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
North Coast Region

Interoffice Communication

MEMORANDUM

TO: Frank Reichmuth DATE: August 9, 1977

FROM: Bob Klamt

SUBJECT: Electrofishing - Janes Creek, July 1977

On July 26, 1977, RWQCB staff and DFG personnel conducted a population estimate on Janes Creek. Four stations were established: Station 1 - just upstream of the railroad crossing; Station 2 - just downstream of the outfall; Station 3 - just upstream of the outfall; and Station 4 - 0.2 miles upstream of the outfall. All stations were 100 feet long. The two-pass method (Seber and LeCren, 1967) was employed. Station 4 was not sampled due to breakdown of the equipment.

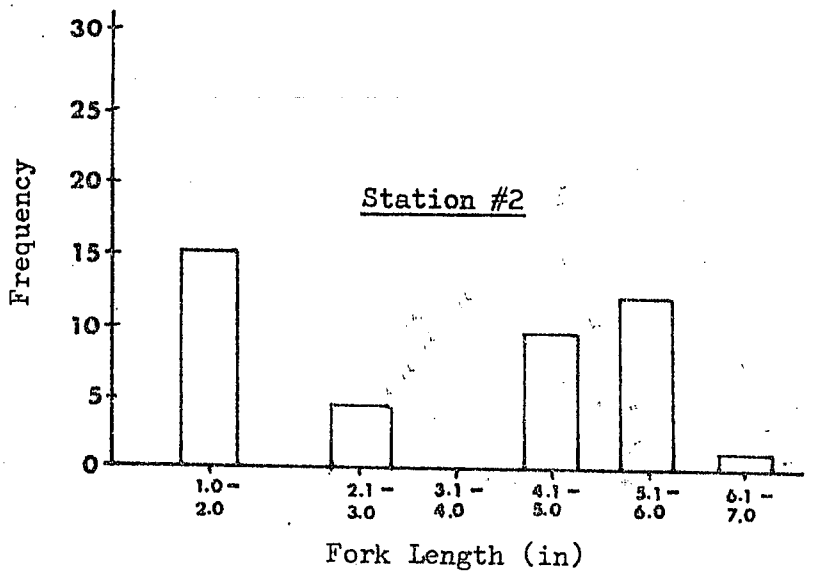
Results

Station Number	# Fish Captured Pass I	Pass II	Population Estimate
1	1	0	1
2	23	9	38 ± 12
3	53	3	57 ± 1

All fish captured were cutthroat trout (Salmo clarkii) with the exception of one stickleback (Gasterosteus aculeatus) at Station 2. The stickleback was not included in the population estimate.

The one fish captured at Station 1 was 5.6 inches fork length (FL). Fish at Station 2 ranged from 1.2 to 6.4 inches FL; and at Station 3, from 1.1 to 5.2 inches FL. Size class frequency appears as Figure 1.

Flow in Janes Creek at the time of sampling was estimated as 0.5 cfs upstream of the outfall and 1.8 cfs downstream of the outfall.



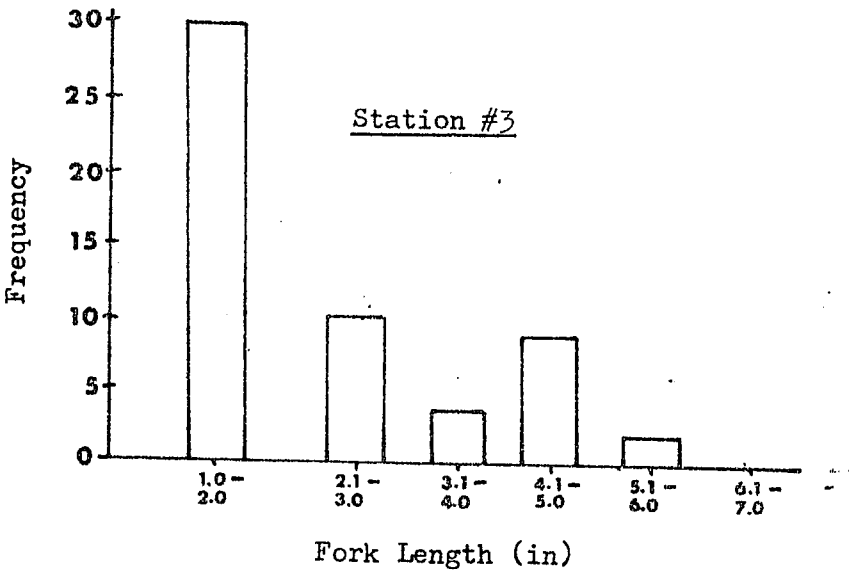


Figure 1. Size frequency for fish collected at Stations 2 and 3 on Janes Creek, July 26, 1977.

Chemical parameters are tabulated below:

	July 26, 1977			July 27, 1977		
Parameter	Upstream	Downstream	Outfall	Upstream	Downstream	Outfall
Formaldehyde	< 1 mg/l	1.4 mg/l	3.0 mg/l	< 1 mg/l	1.9 mg/l	3.4 mg/l
pH	7.35	7.30	7.35	7.35	7.40	7.30
Ammonia-N	< 0.1	8.3	14.0	< 0.1	9.3	13.7
COD	34	41	65	16	40	57
Fecal Coliform	33	49	2	920	8.2	110

Fecal coliform values for July 27 are elevated due to people in the stream upstream of the sampling point.

Conclusions

1. Numbers of cutthroat trout upstream of the outfall were higher than downstream of the outfall: 57 $\pm$ 1 upstream and 38 $\pm$ 12 downstream.

2. There were more fish in the young-of-the-year age class (1.0 - 2.7) inches FL) upstream of the outfall than downstream.

3. Young-of-the-year fish comprised 77% of the population upstream of the outfall, and 41% downstream of the outfall. In a natural population, one would expect a larger number of young-of-the-year than older fish--such is the case upstream of the outfall.

4. Ammonia-nitrogen was higher downstream of the discharge. Unionized ammonia was 0.042 and 0.065 mg/l on July 26 and 27, respectively. Although these levels were not acutely toxic, they may decrease growth and reproductive capabilities of fish.

Bob Klant

Reference:

Seber, G.A.F. and E.D. LeCren

1967. Estimating population parameters from catches large relative to the population. J. Anim. Ecol., 36:631-643.

APPENDIX D

BRELJE AND RACE

LABORATORIES 425 SOUTH E STREET P. O. BOX 1895 SANTA ROSA, CALIFORNIA 95403 TELEPHONE (707) 544-8807

May 11, 1977

California Regional Water Quality Control Board
North Coast Region
1000 Coddingtown Ctr. Suite F
Santa Rosa, CA 95406

Gentlemen:

The results of analyses performed on samples submitted on March 16, 1977, are complete and tabulated below:

Analyses Number	Sample Description	Total ml Collected	Identifiable Major Organisms	No. Organisms/ml Sample Collected
3-51	Janes Crk. #1	146	1. Diatoms - Fragilaria	6
3-52	Janes Crk. #2	142	1. Diatoms - Fragilaria	5
3-53	Janes Crk. #3	150	1. Closteriopsis* 2. Trachelomonas 3. Halteria 4. Paramecium	240
3-54	Janes Crk. #4	141	1. Closteriopsis* 2. Trachelomonas 3. Halteria	190
3-55	Janes Crk. #5	134	1. Closteriopsis* 2. Trachelomonas 3. Euglena 4. Paramecium	160

*Difficulty in identification; most probable organism.

Very truly yours,

BRELJE AND RACE LABORATORIES

J. AMUNDSEN, Director

JA:ym

Benthic invertebrates at Station # 1, Janes Creek on 2/16/77.

Taxon	# 1		# 2		#3		Total		Average	
	Volume	Nos.	Volume	Nos.	Volume	Nos.	Volume	Nos.	Volume	Nos.
Gammarus sp.	0.5	62	0.3	43	0.3	52	1.1	157	0.37	52
Oligochaeta	---	7	---	19	---	6	---	32	----	11
Ephemeroptera	0.1	106	0.2	112	0.1	148	0.4	366	0.13	122
Heptageniidae	0.1	86	0.2	105	0.1	142	0.4	333	0.13	111
Baetidae	---	20	---	7	---	6	---	33	----	11
Trichoptera	---	1	---	8	---	5	---	14	----	5
Plecoptera	---	7	---	6	---	10	---	23	----	8
Diptera	---	1	---	2	---	---	---	3	----	1
Simuliidae	---	1	---	1	---	---	---	2	----	<1
Chironomidae	---	---	---	1	---	---	---	1	----	<1
Coleoptera	---	---	---	1	---	1	---	2	----	<1
Elmidae	---	---	---	1	---	1	---	2	----	<1
						Totals =	1.5	597	0.50	198

Benthic invertebrates at Station # 2, Janes Creek on 2/16/77.

Taxon	# 1 Volume	# 1 Nos.	#2 Volume	#2 Nos.	# 3 Volume	# 3 Nos.	Total Volume	Total Nos.	Average Volume	Average Nos.
Gammarus sp.	---	4	0.25	21	0.25	28	0.50	53	0.17	18
Oligochaeta	---	2	0.5	6	----	4	0.50	12	0.17	4
Ephemeroptera	---	32	0.25	58	----	11	0.25	101	0.08	34
Heptageniidae	---	17	----	3	----	1	----	21	----	7
Baetidae	---	15	----	55	----	10	----	80	----	27
Trichoptera	0.25	4	----	2	----	--	0.25	6	0.08	2
Plecoptera	---	1	----	--	----	--	----	1	----	<1
Diptera	---	--	----	1	----	1	----	2	----	<1
Chironomidae	---	--	----	1	----	1	----	2	----	<1
Coleoptera	---	--	----	--	----	1	----	1	----	<1
Hemiptera	---	1	----	--	----	--	----	1	----	<1
Gerridae	---	1	----	--	----	--	----	1	----	<1
						Totals =	1.50	177	0.50	58

Benthic invertebrates at Station # 3, Janes Creek on 2/16/77.

Taxon	# 1 Volume	# 1 Nos.	# 2 Volume	# 2 Nos.	# 3 Volume	# 3 Nos.	Total Volume	Total Nos.	Average Volume	Average Nos.
Gammarus sp.	---	4	---	2	----	5	----	11	----	4
Oligochaeta										
Tubificidae	4.0	1350	3.0	960	1.2	420	8.2	2730	2.7	910
Other	---	----	---	---	0.25	1	0.25	1	0.08	<1
Ephemeroptera										
Baetidae	---	1	0.05	2	----	2	0.05	5	0.02	2
Trichoptera	---	----	0.1	1	----	----	0.1	1	----	<1
Diptera										
Chironomidae	3.0	620	3.35	514	6.5	1053	12.85	2187	4.3	729
Liriopeidae	---	----	----	---	0.1	2	0.1	2	----	<1
Other	---	5	----	3	---	10	-----	18	----	6
Hemiptera	---	1	----	---	---	----	-----	1	----	<1
Mollusca	---	---	----	---	---	3	-----	3	----	1
Lamprey ammocoete	---	---	0.35	1	---	----	0.35	1	0.12	<1
						Totals =	21.90	4960	7.30	1652

Benthic invertebrates at Station # 4, Janes Creek on 2/16/77.

Taxon	# 1 Volume	# 1 Nos.	# 2 Volume	# 2 Nos.	# 3 Volume	# 3 Nos.	Total Volume	Total Nos.	Average Volume	Average Nos.
Gammarus sp.	----	13	----	4	----	3	-----	20	-----	7
Oligochaeta										
Tubificidae	----	50	2.0	288	0.45	94	2.45	432	0.82	144
Hirudinea	2.0	7	----	----	0.3	1	2.3	8	0.77	3
Diptera										
Chironomidae	11.5	1748	12.5	1118	6.25	605	30.25	3471	10.08	1157
Other	----	----	----	5	----	---	-----	5	-----	2
Mollusca	----	11	----	2	----	1	-----	14	-----	5
					Totals =		35.0	3950	11.67	1318

Benthic invertebrates at Station # 5, Janes Creek on 2/16/77.

Taxon	# 1 Volume	# 1 Nos.	# 2 Volume	# 2 Nos.	# 3 Volume	# 3 Nos.	Total Volume	Total Nos.	Average Volume	Average Nos.
Gammarus sp.	---	---	---	1	---	---	---	1	---	<1
Oligochaeta										
Tubificidae	3.0	630	3.5	1140	4.0	1500	10.5	3270	3.5	1090
Hirudinea	0.4	1	0.8	2	---	---	1.2	3	0.4	1
Ephemeroptera										
Baetidae	---	2	---	1	---	1	---	4	---	1
Trichoptera	---	---	---	---	---	1	---	1	---	<1
Diptera										
Chironomidae	1.0	820	1.0	832	1.2	722	3.2	2374	1.1	791
Other	---	---	---	---	---	1	---	1	---	<1
Coleoptera	---	1	---	---	---	---	---	1	---	<1
Mollusca	---	1	---	4	---	5	---	10	---	3
					Totals =		14.9	5664	5.0	1886

APPENDIX E

APPENDIX E

Stream flow measurement of Janes Creek by dye injection on April 6, 1977.
Turner Model 111 fluorometer with flow-thru door - flow rate was 1 gallon per minute.
Dye drip was begun at 1320 using 2.108 ppt Rhodamine-WT at 100 ml per minute 0.2 miles upstream of Station 2.
Background fluorescence was zeroed on the fluorometer at each station.
Calibration of dye concentration vs fluorescence was performed using dilution water from the two stations.
Discharge of the log pond outfall was determined by gage height on the outfall weir.

Station 2 - 20 feet upstream of the discharge.

Time	Sensitivity	Fluorescence
1340	30x	9.5
1348	"	48.0
1351.5	10x	41.5
1355	"	98.0
1357	3x	38.0
1400	"	53.0
1403	"	61.0
1407	"	68.0
1411	"	70.0
1415	"	70.0
1420	"	70.0

Station 5 - 0.2 mi. downstream of the discharge.

Time	Sensitivity	Fluorescence
1444	10x	66.5
1450	"	72.0
1455	"	78.0
1500	"	84.5
1505	"	90.5
1510	"	95.0
1512	3x	34.5
1517	"	35.0
1522	"	35.0
1527	"	35.0

Flow calculation = $Q_1 x D_1 = (Q_1+Q_2)D_2$, where Q1 = upstream flow
Q2 = outfall flow(0.37mgd)
D1 = upstream dye(0.195ppm)
D2 = downstream dye(0.122ppm)

$Q1(0.195) = (Q1 + 0.37)\ 0.122 = 0.62$ mgd

$Q1 + Q2 = 0.99$ mgd $Q2/(Q1+Q2) = 0.37/0.99 = 0.37$

Log pond outfall is 37% of the flow of Janes Creek downstream of the outfall.