Publication No. 77-e29

WA-39-1030

Ellensburg Area Low Flow Survey

October 18-20, 1977

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December, 1977

INTRODUCTION

This memorandum documents the results of an October 18-20, 1977 receiving water study conducted by the Department of Ecology's Water and Wastewater Monitoring Section on an eight mile segment of the Yakima River drainage near Ellensburg, Washington. The goal of the survey was to assess the relative impacts of the Ellensburg Sewage Treatment Plant discharge and Wilson Creek on the water quality of the Yakima River during low flow conditions.

The Ellensburg treatment facilities consist of a relatively new (March, 1973) secondary level activated sludge plant whose flows range from near 2.5 mgd during the winter months to approximately 5 mgd in the spring. The facilities are located on the southern edge of the city of Ellensburg. Its discharge enters the Yakima River at mile 151.5. Wilson Creek is a stream of moderate size whose flow consists primarily of agricultural return waters originating over a substantial portion of the central Kittitas valley. The stream also receives various urban discharges from the communities of Ellensburg and Kittitas. Local weather conditions during the study were typified by cool mornings and warm sunny afternoons. No rain was encountered. Streamflows remained relatively stable with the Yakima River consistently near 200 cfs and Wilson Creek (at the mouth) ranging from 140-153 cfs.

Methods and Materials

The Ellensburg low flow survey consisted of stream and discharge sampling at a total of seven sites located along the Yakima River, at

the treatment plant, and on Wilson Creek near its mouth (see Appendix A for station locations and descriptions). Each of these sites were visited for grab sampling periodically during the daylight and evening hours (0800-2000) over a two day period. Twenty-four hour composite samples were also collected at the treatment plant. Grab sampling during the late night and early morning hours was not performed due to the fact that loading to the treatment plant would be minimal during these time periods. The following tabulation lists the study parameters utilized during this survey and their method of analysis.

A.) STREAM TEMPERATURE: measured in the field with a precision centigrade mercury thermometer.

B.) DISSOLVED OXYGEN: Samples collected in the field and analyzed via the azide modification of the Winkler method.

C.) HYDROGEN ION CONCENTRATION (pH): measured in the field with an Orion Research Ionalizer, Model 399A.

D.) CONDUCTIVITY: Measured in the field with a Beckman, solu-bridge conductivity meter, Model RB-3.

E.) TURBIDITY: Collected samples returned to the Department of Ecology laboratory and analyzed on a Hach 2100 A Nephelometer.

F.) TOTAL SUSPENDED SOLIDS: Collected samples returned to the DOE laboratory for analysis via Standard Methods for the Examination of Water and Wastewater, 14th Edition.

G.) NUTRIENTS: Samples collected and preserved in the field and returned to the DOE laboratory for analysis on a Technicon, Auto-Analyzer II.

H.) BIOCHEMICAL OXYGEN DEMAND (BOD): Collected samples iced and returned to the DOE laboratory for analysis via the 5 day test procedure outlined within DOE publication 77-24; Laboratory Test Procedure for Biochemical Oxygen Demand of Water and Wastewater, August 1977.

I.) CHEMICAL OXYGEN DEMAND (COD): Collected samples iced and returned to the DOE laboratory for analysis via Standard Methods for the Examination of Water and Wastewater, 14th Edition.

J.) BACTERIAL CONCENTRATIONS: Collected samples iced and returned to the DOE laboratory for analysis via the membrane filter procedure as specified in Standard Methods for the Examination of Water and Wastewater, 14th Edition.

K.) TOTAL RESIDUAL CHLORINE: Samples collected and analyzed in the field via a Lamotte chemical octet comparator.

L.) FLOW: 1. Treatment plant flows were obtained by reading a Sparling flow totalizer meter at the time of each sampling visitation.

2. Yakima River flows were obtained from the U. S. Bureau of Reclamation. USBR routinely obtains flow measurements a

number of times each day at the Weaver Road-Dollarway Bridge 2.8 miles above the low flow study area.

3. Wilson Creek flows were obtained by gaging both Wilson Creek and the Wipple Wasteway immediately above their confluence on the mornings of both study days. Gaging was conducted through the use of a Marsh-McBirney portable water current meter, model 201.

RESULTS AND DISCUSSION

A.) Bacterial Concentrations

Analysis of data obtained from bacterial samples collected at the treatment plant (EB 7) and on the Yakima River above (EB 2) and below (EB 3) its discharge revealed STP disinfection to be excellent. No detrimental impact on downstream Yakima River bacterial densities was observed (Appendix C, Tables 1 and 2). Mean total and fecal coliform values observed at the treatment plant were 133 (T) and < 10 (F) on October 18 and 27 (T) and 4 (F) on October 19. STP counts were seen to be typically less than those recorded on the river upstream of the plant discharge. Values recorded above (EB 1) and below (EB 2) the Schaake meat processing plant indicated that their operations had no significant impact on stream bacterial concentrations during the survey. Schaake's small discharge (average flow .1 mgd) is delivered to nearby non overflow lagoons which appeared to be dry during the study. Downstream of Schaake's and the treatment plant discharge bacterial densities were seen to be

quite low with only a slight increase in values noted at the Thrall sampling site (EB 4). Coliform values observed on lower Wilson Creek (EB 5) were substantially higher than those recorded at the Thrall station with mean concentrations being 1225 (T) and 128 (F) on October 18 and 630 (T) and 193 (F) on October 19. The detrimental impact of these relatively high counts on the bacterial quality of the river below its confluence with Wilson Creek is easily observable when comparing values between EB 4 at Thrall and EB 6 in the Yakima River canyon (See tables 1 and 2).

On October 18 a phenonemen was noted which makes interpretation of that days sample results more difficult than analysis of those obtained on the 19th. A "slug" of turbid water of unknown origin was seen to pass through the study area resulting in a substantial elevation of bacterial, nutrient, solids, and BOD data. The passage of this slug of contaminated water has been indicated on the data tables within Appendix C. Observation of bacterial concentrations arising from these waters gives a good indication of transit time through the study area (approximately 8 hours) as well as an opportunity to observe the progressive die-off of coliform organisms. The fact that ammonia concentrations were very high at sampling sites EB 1 and EB 2 on the morning of the 18th indicates a high probability that the contaminated "slug" of water was of recent origin. Because of the above noted occurrence water quality levels for October 19 are probably more typical for the study area. It is for this reason that nutrient loading has been calculated using only data from the 19th.

B.) Nutrient Concentrations

Analysis of collected samples for nutrient concentrations revealed the discharges of both the sewage treatment plant and Wilson Creek to have had an adverse effect on the water quality of the Yakima River at the time of the survey. The observed impact of the treatment plant was however, substantially less than that of Wilson Creek (Tables 9-12, Appendix C).

Nitrogen and phosphorus compounds which entered the study area at EB 1 are seen to have been at levels low enough to indicate the absence of any major contaminant sources upstream (excluding values influenced by the October 18 "slug" of pollutants discussed above). Data from station EB 2 indicates the Schaake processing plant to have had no significant impact on stream nutrients during the survey. Instream concentrations of major nutrients noted at sampling site EB 3 below the treatment plant revealed it to have had an observable detrimental impact on stream quality. The significance of this impact is however minimized when one takes into consideration the facts that STP effluent flow was at a normal level during the survey while Yakima River flow (and thereby dilution) was far below what could be considered typical. The impact of the treatment plant discharge on nutrient concentrations within the Yakima River has been graphically displayed by plotting loading values (lbs/day) in figures 2 and 3. Here it can be seen that the greatest increase below the STP was the result of total phosphorus input. Orthophosphates originating at the treatment plant did not result in a downstream increase corresponding to that observed with total phosphorus. Utilization of orthophosphates by stream plantlife between the STP discharge and EB 3 may have played a

major role in this occurrence. Nutrient levels observed at the Thrall monitoring site (EB 4) remained relatively stable and quite similar to those noted at EB 3.

Wilson Creek nutrient data reveals its waters to have been consistently very high in phosphorus and nitrogen compounds (Tables 9 through 12). This fact when coupled with substantial creek flow (150 cfs compared with only 200 cfs in the Yakima) resulted in a major adverse impact on Yakima River water quality. The magnitude of this impact can be seen via nutrient loading graphically presented in figures 2 and 3 (Appendix B). Comparison of this data above and below (EB 4 and EB 6) the Yakima's confluence with Wilson Creek reveals increases in orthophosphate and nitrate to have been 112% and 529% respectively. Instream concentrations typically rose from near .08 at EB 4 to .28 at EB 6 (mg/l, NO_3-N) and from .02 at EB 4 to .03 at EB 6 (mg/l, OPO_4.P) (See tables). These increases are much greater than those noted below the Ellensburg treatment plant where nitrates increased 29% while orthophosphates rose 39%. It should be noted however that this impact was measured during a time when river flows were atypically low and the consequences of any particular discharge would be accentuated. Also worthy of mention is the fact that the Ellensburg low flow study was conducted after the major irrigation season. Past monitoring efforts by the Department of Ecology on Wilson Creek have indicated that flows and nutrient concentrations typically peak during June, July and August.

C.) Water Temperature and Dissolved Oxygen

Analyses of survey results indicates the discharges of the Ellensburg treatment plant and Wilson Creek to have had no detrimental effect on

Yakima River temperatures or dissolved oxygen concentrations. Stream temperatures during the study were typically near 11°C with minor increases (of apparent natural origin) noted along the lower river. The relatively warm (15°C) discharge from the treatment plant had no apparent effect on stream temperature (dilution between the river and the STP was near 50/1). Dissolved oxygen concentrations were seen to be relatively stable at near 11 mg/l throughout the study area during the survey.

D.) Hydrogen Ion Concentration (pH) and Conductivity

Observation of study results for pH and conductivity reveal the treatment plant effluent to have had no significant impact on these two parameters within the Yakima River (Tables 5 and 6). Field analyses conducted on the STP discharge revealed effluent pH to have been stable at 7.2 SU throughout the survey. Receiving water hydrogen ion concentrations noted within the upper half of the study area were somewhat more alkaline with values typically near 8.0 SU. Conductivity of the treatment plant discharge during the study was near 450 (umhos) while Yakima River conductivities upstream of the STP effluent remained close to 124 umhos. Values on the river below the STP discharge rose only slightly to near 132 umhos.

The effects of Wilson Creek on Yakima River pH and conductivity levels can be seen by comparing data collected above and below their confluence (Appendix C, Tables 5 and 6). Hydrogen ion concentrations (pH) increased significantly on reception of Wilson Creek waters.

Observed values typically rose from near 7.8 SU on the river at the Thrall site to 8.4 SU at EB 6 in the Yakima canyon. Wilson Creek concentrations were usually near 8.3 SU. Yakima River conductivities rose in a similar manner below Wilson Creek with values increasing from approximately 131 umhos at EB 4 to near 202 umhos at EB 6. Wilson Creek conductivities were near 358 umhos during the survey.

E.) Solids and Turbidity

Data obtained through laboratory analysis of collected samples for turbidity and total suspended solids revealed no significant impact on receiving water quality from the discharges of either the treatment plant or Wilson Creek (see Appendix B, Tables 7 and 8). Values for both of these parameters remained quite low throughout the survey at all sampling stations. Wilson Creek solids data was however slightly higher than results noted at river sampling sites.

F.) Biological Oxygen Demand (BOD)

Survey data reveals BOD levels to have been consistently low at all sampling sites during the study period. Low values obtained from samples collected at the STP (EB 7) are further indication of excellent treatment.

SUMMARY AND RECOMMENDATION

Analysis of water quality information collected during the Ellensburg area low flow survey reveals the effects of the Ellensburg Sewage Treatment Plant discharge on the water quality of the Yakima River to have been relatively small when compared with the observed impact of Wilson Creek. Treatment at the STP appears to have been excellent throughout the survey. The consistently high quality of the treatment plant discharge was typified by a stable pH (7.2 SU), low bacterial content (mean of < 7 fecal coliform organisms/100 ml), low Biochemical Oxygen Demand (mean value of 3 mg/l) and nutrient concentrations at a level considered normal for a secondary treatment facility such as the Ellensburg plant. The effects of the STP discharge on the Yakima River are seen to have been largely restricted to an increase in the concentrations of nitrogen and phosphorus compounds. It was noted that the observed impact of the treatment plant effluent on water quality within the Yakima River was accentuated by the exceptionally low flow conditions existent along the Yakima drainage during the survey. The magnitude of the STP's impact on the quality of its receiving water would be minimized during a "normal flow year".

Water quality data obtained via sampling Wilson Creek and the Yakima River above and below their confluence reveals the creek's impact on the Yakima to have been substantially greater than that of the Ellensburg Treatment Plant. Wilson Creek waters were typified by a relatively high bacterial content (mean fecal coliform count of 160 org/ 100 ml), hydrogen ion concentrations (pH) which were significantly more

alkaline than those observed in the Yakima River, and nutrient concentrations which when coupled with relatively high creek flow resulted in a major input of nitrogen and phosphorus compounds to the Yakima River system. It was noted that the effects of Wilson Creek on the water quality of the Yakima River were accentuated during the survey by low streamflow in the Yakima River proper. Past water monitoring efforts by the Department of Ecology have however revealed the quality of Wilson Creek to typically be at its lowest level during the irrigation season (late summer to early fall). Because of this trend and the fact that the present low flow survey has indicated Wilson Creek to be a major contributor of contaminants to the Yakima River it is recommended that an intensive water quality study of the Wilson Creek drainage be performed. This survey should take place at the peak of the irrigation season. It is suggested that sampling sites include the Yakima River above and below Wilson Creek as well as strategically placed sites along the creek drainage. Data from the creek survey should outline the location, type, and magnitude of contaminant sources and allow the formulation of a plan for corrective action.

APPENDIX A

Study Area and Station Descriptions

ELLENSBURG LOW FLOW SURVEY- OCTOBER 18-20,1977

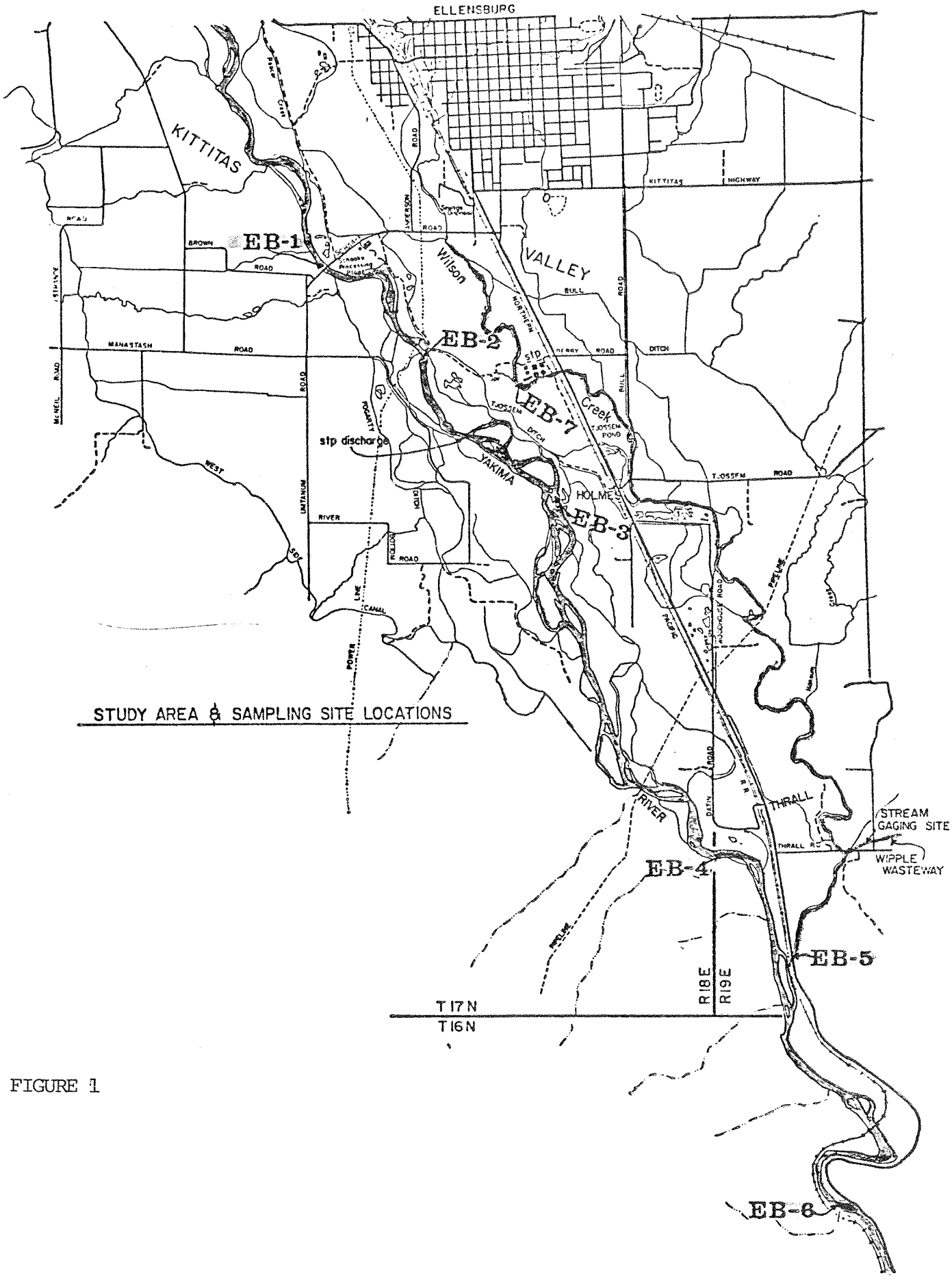


FIGURE 1

STATION DESCRIPTION

1.) EB-1 Located on the Yakima River at its intersection with the Schaake Road near Ellensburg, Washington (River mile 153.1).

2.) EB-2 Located on the Yakima River immediately below the Schaake Processing Plant and above the sewage treatment plant discharge (River mile 152.2).

3.) EB-3 Located on the Yakima River .6 miles below the sewage treatment plant discharge at the gravel pit ponds adjacent to the intersection of highway 97 and the Tjossem Road (River mile 150.9).

4.) EB-4 Located on the Yakima River at the Thrall boat launch one mile above Wilson Creek (River mile 148.1).

5.) EB-5 Located on Wilson Creek near its mouth at the highway 97 bridge (River mile .3).

6.) EB-6 Located on the Yakima River 1.7 miles below its confluence with Wilson Creek (River mile 145.3).

7.) EB-7 Located at the Ellensburg sewage treatment plant at the discharge end of the chlorine contact chamber.

APPENDIX B

Nutrient Graphics

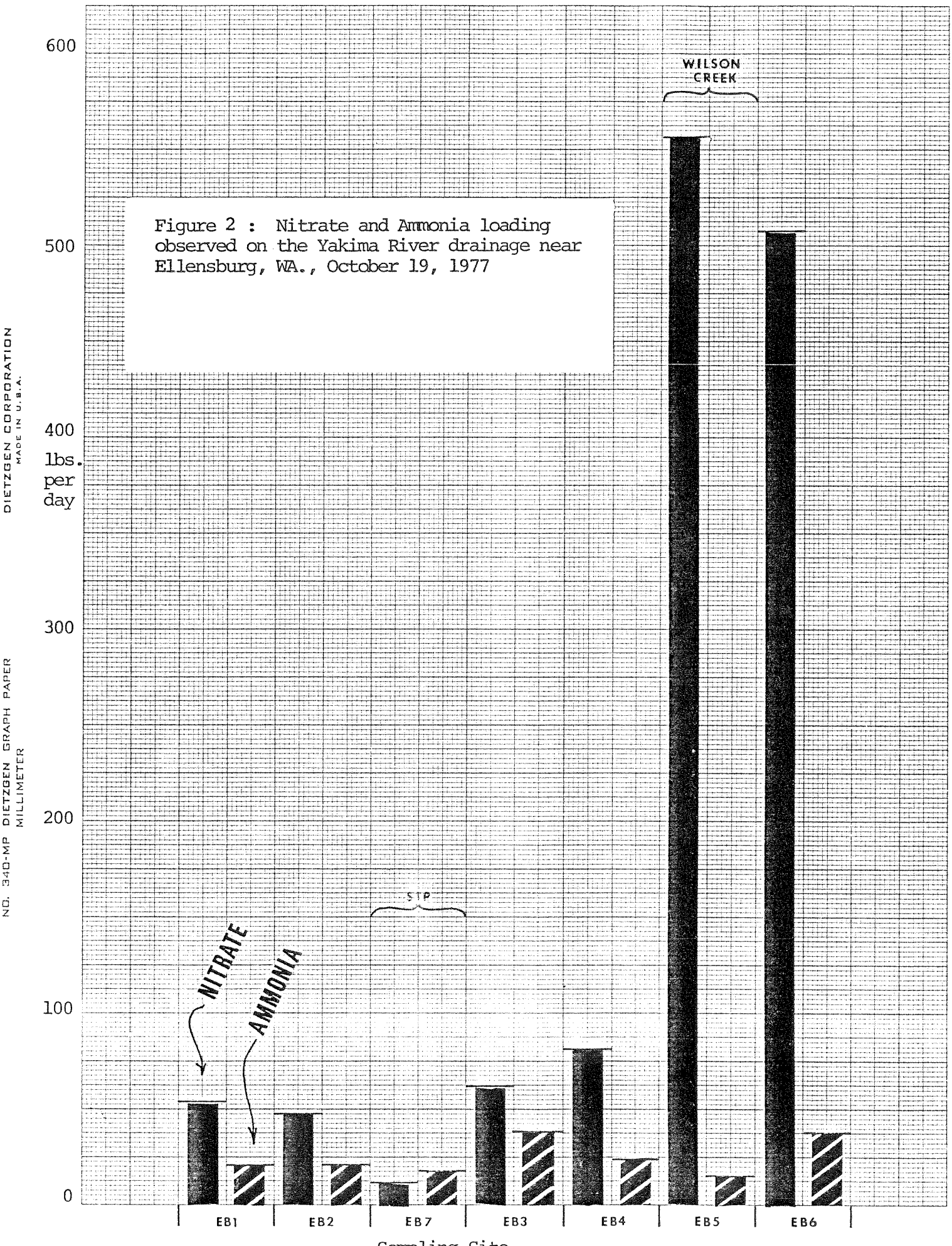
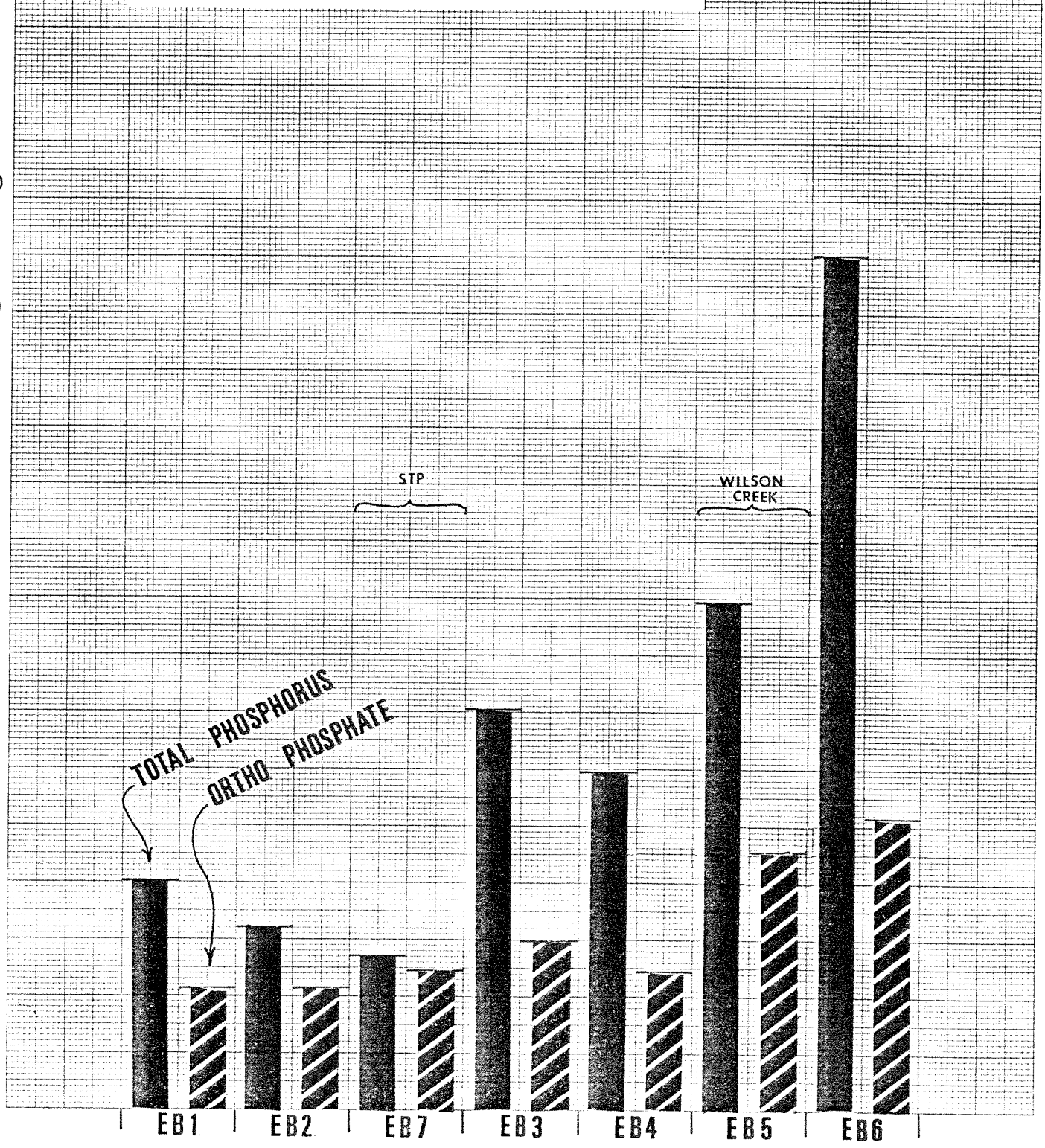


Figure 2 : Nitrate and Ammonia loading observed on the Yakima River drainage near Ellensburg, WA., October 19, 1977

Figure 3 : Total Phosphorus and Ortho-phosphate loading observed on the Yakima River drainage near Ellensburg, WA., October 19, 1977.



APPENDIX C

Data Tables

Tables 1 and 2 : Total and Fecal Coliform Bacterial Densities observed within the Yakima River Drainage near Ellensburg, Washington - October 18 and 19, 1977

Table 1 : Fecal Coliform (org/100 ml)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	>40,000	>30,000*	-	2	17 est.	150	68
10/18/77	1200	420	520	10 est.	42	4,100*	68 est.	15 est.
10/18/77	1555	160	120	<10	22 est.	190 est.	84	840*
10/18/77	1910	180 est.	220 est.	<10	68	68	[illegible]	160
Mean Value		10,190	7,715	<10	34	1,094	128	271
10/19/77	0815	35	33	2 est.	<1	17 est.	120 est.	52
10/19/77	1200	18 est.	9	2 est.	2 est.	4 est.	340	10 est.
10/19/77	1605	10 est.	10 est.	3 est.	2 est.	6 est.	140 est.	46
10/19/77	1945	22 est.	28 est.	8 est	10 est.	22 est.	170	54
Mean Value		21	20	4	4	12	193	40

*Underlined values during October 18 indicate the passage of unidentified "slug" of pollutants through the study area (see text and nutrient tables also).

Table 2 : Total Coliform (org/100 ml)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	85,000 est.	49,000	-	8 est.	90 est.	800 est.	300 est.
10/18/77	1200	480	620	250 est.	200 est.	3,900	400 est.	200 est.
10/18/77	1555	220 est.	120 est.	50 est.	50 est.	330	900 est.	1,200
10/18/77	1910	250	250	100 est.	260	200	2,800 est.	600 est.
Mean Value		21,488	12,498	133	130	1,130	1,225	575
10/19/77	0815	83 est.	180	8 est.	33 est.	200 est.	640 est.	180 est.
10/19/77	1200	200 est.	42 est.	30 est.	40 est.	70 est.	920	75 est.
10/19/77	1605	30 est.	<20	40 est	<20	80 est.	640	83 est.
10/19/77	1945	50 est.	130 est.	30 est.	40 est.	120 est.	320 est.	200
Mean Value		91	93	27	33	118	630	135

Tables 3 and 4 : Water Temperatures and Dissolved Oxygen Concentration Observed within the Yakima River Drainage near Ellensburg, Washington - October 18 and 19, 1977.

Table 3 : Water Temperatures (°F)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	7.9	8.2	15.2	8.6	9.2	8.1	8.5
10/18/77	1200	9.8	9.1	15.7	9.9	10.8	10.4	11.3
10/18/77	1555	11.9	11.4	16.0	11.4	11.5	12.0	11.5
10/18/77	1910	11.6	12.5	15.5	12.1	11.7	11.8	11.4
Mean Value		10.5	10.3	15.6	10.5	10.8	10.6	10.7
10/19/77	0815	9.9	9.7	15.3	10.1	10.5	10.4	10.9
10/19/77	1200	11.5	10.7	16.0	11.4	12.4	12.4	13.0
10/19/77	1605	12.3	12.2	15.5	12.1	12.3	12.6	12.3
10/19/77	1945	11.3	12.0	15.1	11.9	11.4	11.5	11.1
Mean Value		11.2	11.2	15.5	11.4	11.6	11.7	11.8

Table 4 : Dissolved Oxygen Concentration (mg/l)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	10.3	10.2	10.6	10.3	10.6	11.7
11/18/77	1200	12.6	12.2	12.1	11.8	12.0	13.5
10/18/77	1555	12.1	12.2	11.9	11.5	12.7	11.9
10/18/77	1910	9.9	10.4	10.0	10.0	9.5	10.0
Mean Value		11.2	11.2	11.2	10.9	11.2	11.8
10/19/77	0815	11.5	11.0	11.3	11.1	11.7	12.4
10/19/77	1200	12.7	12.4	12.4	12.2	15.0	13.5
10/19/77	1605	11.6	12.0	11.9	11.4	12.5	9.8
10/19/77	1945	11.9	10.9	10.0	10.1	9.6	10.2
Mean Value		11.9	11.6	11.4	11.2	12.2	11.5

Tables 5 and 6 : Hydrogen Ion Concentrations (pH) and Conductivities Observed within the Yakima River Drainage near Ellensburg, Washington - October 18 and 19, 1977

Table 5 : Hydrogen Ion Concentrations (Su)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	7.2	7.2	7.1	7.4	7.4	7.9	7.9
10/18/77	1200	8.0	8.0	7.2	7.7	7.9	8.7	8.7
10/18/77	1555	8.4	8.3	7.2	8.2	7.8	8.5	8.5
10/18/77	1910	7.5	8.2	7.2	7.8	7.4	8.1	8.2
Mean Value		7.8	7.9	7.2	7.8	7.6	8.3	8.3
10/19/77	0815	7.7	8.1	7.1	7.8	7.6	8.1	8.3
10/19/77	1200	8.2	8.3	7.2	8.2	8.2	8.6	8.7
10/19/77	1605	8.1	8.3	7.2	8.0	8.1	8.4	8.5
10/19/77	1945	7.3	8.0	7.2	7.7	7.8	8.0	8.2
Mean Value		7.8	8.2	7.2	7.9	7.9	8.3	8.4

Table 6 : Conductivity (μmhos)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	131	130	440	132	120	350	205
10/18/77	1200	121	121	515	138	140	361	190
10/18/77	1555	120	120	440	118	135	360	200
10/18/77	1910	125	125	490	131	130	330	210
Mean Value		124	124	471	130	131	350	201
10/19/77	0815	122	131	450	138	130	375	218
10/19/77	1200	125	125	420	135	132	360	211
10/19/77	1605	120	120	435	132	132	368	214
10/19/77	1945	120	120	410	135	132	365	168
Mean Value		122	124	429	135	132	367	203

Tables 7 and 8 : Total Suspended Solids and Turbidity Levels Observed within the Yakima River Drainage near Ellensburg, Washington - October 18 and 19, 1977

Table 7 : Total Suspended Solids (mg/l)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	5	5	2	1	1	10	2
10/18/77	1200	1	2	4	3	2	7	2
10/18/77	1555	1	1	3	2	2	8	3
10/18/77	1910	1	2	4	2	2	13	4
Mean Value		2	2	3	2	2	10	3
10/19/77	1200	2	2	3	2	1	6	3

Table 8 : Turbidity (NTU)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	5	4	2	1	1	2	1
10/18/77	1200	1	1	3	1	2	2	1
10/18/77	1555	1	1	2	1	1	2	2
10/18/77	1910	1	1	3	1	1	3	2
Mean Value		2	2	3	1	1	2	1
10/19/77	0815	1	1	1	1	1	2	1
10/19/77	1200	1	1	2	1	1	2	1
10/19/77	1605	1	1	2	1	1	2	1
10/19/77	1945	1	1	2	1	1	2	1
Mean Value		1	1	2	1	1	2	1

Tables 9 and 10 : Ammonia and Nitrate Concentrations Observed within the Yakima River Drainage near Ellensburg, Washington - October 18 and 19, 1977

Table 9 : Ammonia (mg/l as N)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	0.65	0.44	1.60	0.05	<0.02	<0.02	<0.02
10/18/77	1200	0.03	0.02	0.85	0.10	0.16	<0.02	0.04
10/18/77	1555	<0.02	<0.02	1.20	0.03	0.04	<0.02	0.08
10/18/77	1910	<0.02	<0.02	1.70	0.04	0.02	<0.02	0.02
Mean Value		0.18	0.13	1.34	0.06	0.06	<0.02	0.04
10/19/77	0815	0.02	<0.02	1.50	0.05	0.03	<0.02	<0.02
10/19/77	1200	0.02	<0.02	0.85	0.02	0.02	<0.02	<0.02
10/19/77	1605	<0.02	<0.02	1.60	0.03	<0.02	<0.02	0.02
10/19/77	1945	<0.02	<0.02	1.55	0.04	<0.02	0.02	<0.02
Mean Value		<0.02	<0.02	1.37	0.03	0.02	<0.02	<0.02

Table 10 : Nitrate (mg/l as N)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	0.06	0.05	0.60	0.04	0.07	0.76	0.29
10/18/77	1200	0.05	0.05	1.50	0.09	0.09	0.76	0.28
10/18/77	1555	0.05	0.04	1.35	0.07	0.10	0.74	0.31
10/18/77	1910	0.06	0.05	0.85	0.07	0.10	0.74	0.32
Mean Value		0.05	0.05	1.08	0.07	0.09	0.75	0.30
10/19/77	0815	0.06	0.06	0.70	0.06	0.08	0.78	0.31
10/19/77	1200	0.06	0.04	1.25	0.06	0.08	0.70	0.25
10/19/77	1605	0.05	0.04	1.05	0.06	0.07	0.63	0.25
10/19/77	1945	0.05	0.04	0.60	0.05	0.07	0.70	0.28
Mean Value		0.05	0.05	0.90	0.06	0.08	0.70	0.27

Tables 11 and 12 : Orthophosphate and Total Phosphorus Concentrations Observed within the Yakima River Drainage near Ellensburg, Washington - October 18 and 19, 1977

Table 11 : Orthophosphate (mg/l as P)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	0.24	0.19	2.1	0.06	0.02	0.07	0.03
10/18/77	1200	0.03	<0.02	1.7	0.07	0.13	0.03	0.02
10/18/77	1555	<0.02	<0.02	1.8	0.03	0.03	0.10	0.10
10/18/77	1910	<0.02	<0.02	1.9	0.03	0.02	0.06	0.03
Mean Value		0.08	0.06	1.9	0.05	0.05	0.07	0.05
10/19/77	0815	<0.02	<0.02	2.0	0.02	0.02	0.05	0.02
10/19/77	1200	<0.02	0.02	1.8	0.03	<0.02	0.07	<0.02
10/19/77	1605	<0.02	<0.02	1.8	0.04	<0.02	<0.02	0.03
10/19/77	1945	<0.02	<0.02	2.0	0.02	0.03	0.09	0.04
Mean Value		<0.02	<0.02	1.9	0.03	0.02	0.06	0.03

Table 12 : Total Phosphorus (mg/l as P)

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	0.27	0.26	2.35	0.08	0.04	0.12	0.07
10/18/77	1200	0.05	0.04	1.95	0.11	0.17	0.13	0.08
10/18/77	1555	0.05	0.03	2.00	0.07	0.08	0.12	0.17
10/18/77	1910	0.05	<0.02	2.15	0.06	0.06	0.10	0.10
Mean Value		0.11	0.09	2.11	0.08	0.09	0.12	0.11
10/19/77	0815	0.04	<0.02	2.35	0.07	0.04	0.11	0.07
10/19/77	1200	0.05	0.04	1.95	0.06	0.06	0.11	0.07
10/19/77	1605	0.04	0.03	2.00	0.06	0.07	0.11	0.09
10/19/77	1945	<0.02	0.03	2.00	0.07	0.05	0.12	0.09
Mean Value		0.04	0.03	2.08	0.07	0.06	0.11	0.08

Table 13 : Biochemical Oxygen Demand (BOD) Observed within the Yakima River Drainage near Ellensburg, Washington - October 18 and 19, 1977

Date	Beginning Time	Sampling Site EB-1	EB-2	EB-7	EB-3	EB-4	EB-5	EB-6
10/18/77	0800	10	9	4	<2	<2	3	<2
10/18/77	1200	<2	<2	3	3	3	<2	<2
10/18/77	1555	3	<2	<2	3	2	<2	3
10/18/77	1910	<2	<2	<2	<2	<2	<2	2
Mean Value		4	4	3	3	2	2	2
10/19/77	0815	2	<2	3	<2	<2	<2	<2
10/19/77	1200	<2	<2	3	<2	<2	<2	<2
10/19/77	1605	<2	<2	3	<2	2	2	2
10/19/77	1945	<2	2	<2	2	2	<2	<2
Mean Value		<2	<2	3	<2	<2	<2	<2

MISCELLANEOUS DATA

I. Flow

A.) Ellensburg Sewage Treatment Plant

October 18, 1977

0800 - 1225 hr. = .79 mg*
1225 - 1615 hr. = .32 mg
1615 - 1940 hr. = .42 mg

October 18-19, 1977

1940 - 0815 hr. = 1.32 mg

October 19, 1977

0815 - 1230 hr. = .59 mg
1230 - 1630 hr. = .51 mg
1630 - 2010 hr. = .47 mg

October 19-20, 1977

2010 - 0800 hr. = 1.32 mg

* = million gallons

B.) Yakima River at the Weaver Road - Dollarway Bridge (R.M. 155.9)

October 18, 1977

0800 hr. = 206 (cfs)
1600 hr. = 202 (cfs)
2400 hr. = 206 (cfs)

October 19, 1977

0800 hr. = 210 (cfs)
1600 hr. = 198 (cfs)
2400 hr. = 190 (cfs)

C.) Wilson Creek and the Wipple Wasteway

Wilson Creek: October 18, 1977 at 1035 hr. = 63.41 cfs
Wilson Creek: October 19, 1977 at 1025 hr. = 58.01 cfs
Wipple Wasteway: October 18, 1977 at 0945 hr. = 89.46 cfs
Wipple Wasteway: October 19, 1977 at 0945 hr. = 89.46 cfs

II. Treatment Plant 24 hr. Composite Samples

	EB 7 C1 0800, Oct. 18 - 0815 Oct. 19	EB 7 C2 0815 Oct. 19 - 0800 Oct. 20
Turbidity (NTU)	2	3
BOD_5 (mg/l)	4	3
Ammonia-N (mg/l)	1.5	1.75
Nitrite-N (mg/l)	<.02	<.02
Nitrate-N (mg/l)	.80	.70
Kjeldahl-N (mg/l)	.21	
Orthophosphate (mg/l)	1.95	2.05
Total Phosphorus (mg/l)	2.3	2.6
Total Suspended Solids (mg/l)	4	5

III. Chemical Oxygen Demand (COD)

October 18, 1977

Sampling Site	Time	mg/l COD
EB 1	1200	8
EB 2	1205	8
EB 3	1245	8
EB 4	1300	8
EB 5	1315	8
EB 6	1330	8
EB 7	1225	20

October 19, 1977

EB 1	1200	8
EB 2	1210	8
EB 3	1245	8
EB 4	1300	8
EB 5	1310	8
EB 6	1320	8
EB 7	1230	Insufficient Sample

IV. Total Residual Chlorine
-- measured at sampling site EB 7 via the DPD Method - -

October 18, 1977

Time	mg/l TRC
1225	.65
1615	.60

October 19, 1977

0815	1.0
1630	.7

V. Fecal Streptococcus*

October 18, 1977

Sampling Site	Time	Org/100 ml
EB 1	1200	100
EB 2	1205	150
EB 3	1245	8
EB 4	1300	110
EB 5	1315	45
EB 6	1330	15
EB 7	1225	42

* Fecal strep. data has not been utilized within the body of this report. Refer to the following memorandum from Janet Woodward, Department of Ecology microbiologist.