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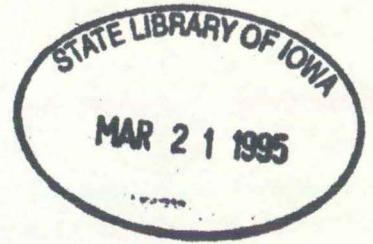


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WATER QUALITY SURVEY OF THE
YELLOW RIVER

#79-20

Prepared for the Iowa Department of Environmental Quality by the University of Iowa Hygienic Laboratory.

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October 6, 1978

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ABSTRACT

A water quality survey of the Yellow River was performed during July and August, 1978. The primary purpose of the survey was to develop background data and assess the impact of point source waste dischargers on water quality. Results of the survey indicated good water quality throughout the basin during average summer stream flows. Water temperatures in several of the class B coldwater trout streams were above 21°C which prohibited trout stocking. The elevated stream temperatures occur frequently every summer and are caused by a combination of high ambient temperatures and a reduction in low temperature ground water discharge. Although the chemical and bacteriological analysis indicated the point source waste dischargers from Postville and Luana had little impact on the receiving streams, biological analysis revealed a stressed environment. Most biological sampling stations had a healthy, diverse macroinvertebrate community reflecting the good water quality.

INTRODUCTION

The Yellow River, located in extreme northeastern Iowa, originates in Winneshiek County and flows 56 kilometers (35 miles) east through southern Allamakee County joining the Mississippi River just north of Marquette, Iowa (see Figure 1). The Yellow River Basin has over 624 square kilometers (241 square miles) of drainage area composed primarily of large forested areas, pastureland and a small amount of row-crop land. The stream receives its name from the yellow clay carried in suspension much of the time. An indication of the rugged topography of the area is demonstrated by the river slope which drops an average of fifteen feet per mile. Where the gradient is steep, the stream bottom is composed of rocks and gravel. Near the mouth, the gradient is reduced and as a result, the stream bottom is mud, several feet deep in places. Principal fishing in the Yellow River is provided by smallmouth bass and catfish, with the upper reaches containing some trout (1). Because of the rugged topography, the Yellow River Basin is sparsely populated, resulting in few waste dischargers. The towns of Postville (1970 pop. 1,546) and its associated turkey and beef packing plants and Luana with Mississippi Valley Milk Producers Association represent the major point-source waste discharges to the Yellow River. Table 1 lists the known Yellow River Basin waste dischargers and information regarding each wastewater treatment facility.

The Yellow River has been classified as a class B warmwater stream from its mouth to the Highway 51 bridge in western Allamakee County and, as a class B coldwater stream from the Highway 51 bridge upstream to

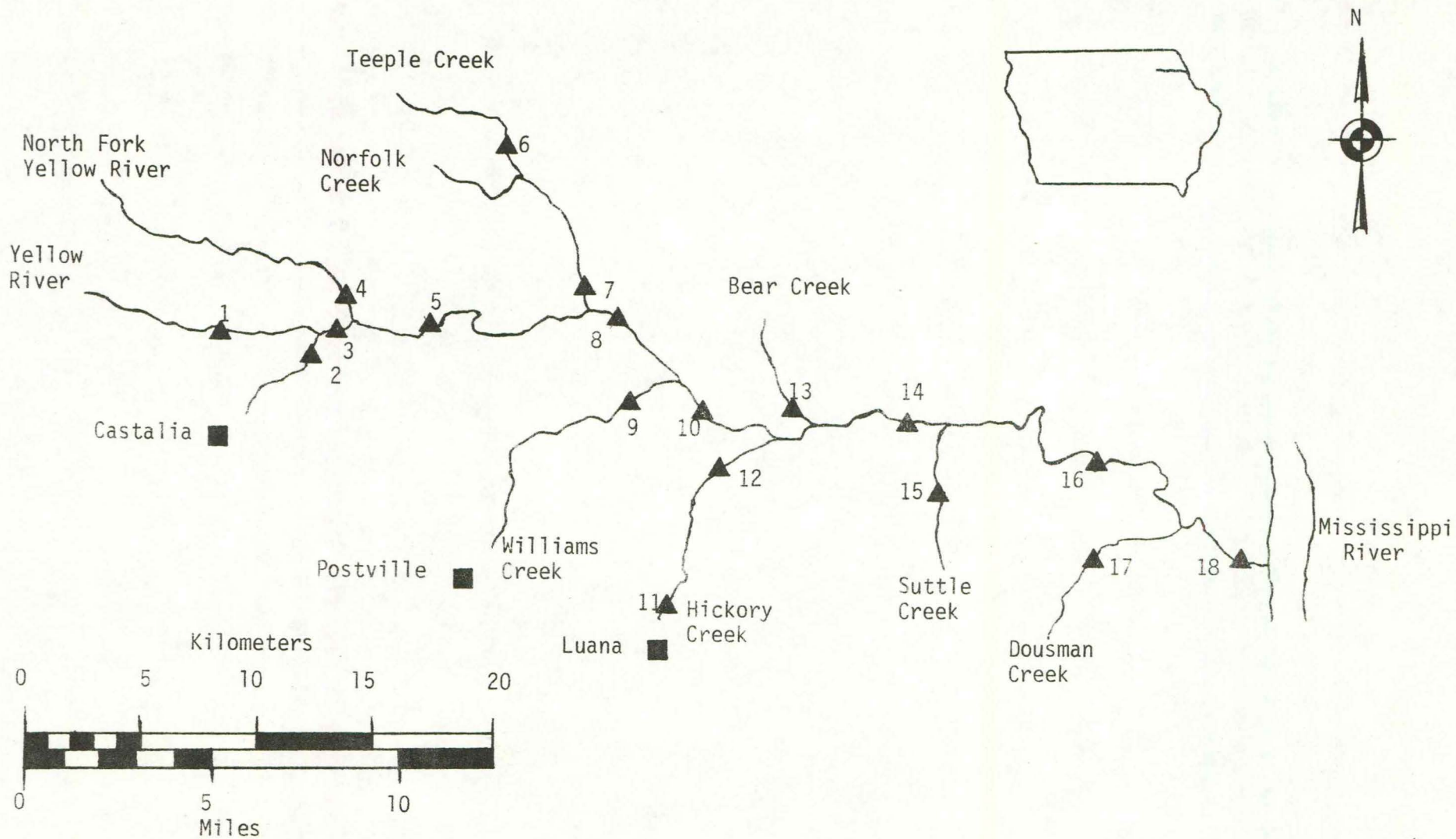


Figure 1. Map of the Yellow River and Tributaries Showing Sampling Locations

TABLE 1

YELLOW RIVER BASIN WASTEWATER TREATMENT FACILITIES

Discharger	1970 ¹ Pop.	Average ¹ Flow	Treatment ¹ Type	Receiving ¹ Stream	Construction Grants ² Program Status
Postville	1,546	.186 mgd	Trickling filter	Williams Creek	Has step 1 grant - work delayed until basin plan amended
Luana	225	.031 mgd	2 cell lagoon	Hickory Creek	Not in CGP
Voloney Cheese Company	--	Not Avail.	2 cell lagoon	Yellow River	Not eligible
Postville Industrial Lagoon	--	.485 mgd	3 cell lagoon	Williams Creek	Not eligible
Mississippi Valley Milk Producers Assoc. (Luana)	--	Not Avail.	Activated sludge	Hickory Creek	Not eligible

¹Information from Northeastern Iowa Basin plan

²Information supplied by Iowa Department of Environmental Quality

the confluence with the North Fork of the Yellow River and the Yellow River with the appropriate standards applying to each reach. Segments of Teeple, Norfolk, Hickory, Bear, Suttle, and Dousman Creeks have also been designated as class B coldwater streams. In addition the Yellow River has been designated as an anti-degradation stream from its mouth upstream to the Highway 51 bridge. Iowa's anti-degradation policy was established to provide that existing high quality waters be maintained and protected at or above existing water quality.

Several of the tributaries designated as class B coldwater are also included in the Iowa Conservation Commission trout-stocking program (personal communication - Dave Moeller, Manchester Fish Hatchery). Bear and Suttle Creeks are considered temperature marginal for trout and are only stocked with brown trout once a year. Hickory Creek is stocked with brown and rainbow trout once a week from April to October. Stocking is discontinued in any stream when the temperature exceeds 21°C (70°F).

A previous water quality survey of the upper Mississippi River tributaries (2) included several stations in the Yellow River Basin and was conducted during summer conditions. Results of that survey indicated that while the Yellow River chemical water quality was good, stream water temperatures exceeded 21°C .

The primary purpose of this survey was to develop additional water quality data during summer conditions and to assess the impact of the point source waste dischargers on the receiving stream.

On August 18, 1978, University Hygienic Laboratory personnel conducted a water quality survey of the Yellow River Basin, which included collection of water samples and measurements of stream flow. Macroinvertebrate samples

were collected at most stations on July 13, 1978 with Station 14 collected again on August 18, 1978. Approximate sampling locations are listed in Table 2. Stream flow was measured at Stations 5 and 14 and calculated to be 27 and 96 cubic feet per second (cfs) respectively. The seven day ten year low flow value calculated at Station 16 is 18 cfs, less than one-fifth of the flow encountered during this survey. Discharge data from the U.S. Geological Survey (3) indicates that a flow of 96 cfs is equalled or exceeded 40% of the time from April 1 to September 30, which suggests the August 18 flow was about average.

Methods

Procedures used in sample collection, preservation and analysis are described in Standard Methods (4) and Manual of Methods for Chemical Analysis of Water and Wastes (5). Grab samples were obtained using a high density polyethylene sampling bucket and a weighted stainless steel dissolved oxygen sampler. Stream flow measurements were calculated using the U.S. Geological Survey's method of computing cross section area (6). A Price type AA current meter and top setting wading rod were used to measure velocity and depth.

Results and Discussion

Selected chemical and bacteriological data for the Yellow River are presented in Table 3. All data collected are presented in Appendix 1.

Since many northeast Iowa streams are designated as class B coldwater streams and are included in the Iowa Conservation Commission trout-stocking program, water temperature is an important measurement. Out of a total of six stations on class B coldwater reaches, four (Stations 6, 7, 16

TABLE 2

YELLOW RIVER SAMPLING SITES

1. Yellow River	Winneshiek County Road W46	T96N, R7W, Section 9
2. Unnamed Creek	Winneshiek Co. Rd. Bridge	T96N, R7W, Sec. 14
3. Yellow River	Winneshiek Co. Rd. Br.	T96N, R7W, Sec. 13
4. N. Fork Yellow River	Winneshiek Co. Rd. Br.	T96N, R7W, Sec. 12/13
5. Yellow River	Allamakee Co. Rd. W60 Br.	T96N, R6W, Sec. 3
6. Teeple Creek	Allamakee Co. Rd. Br.	T97N, R6W, Sec. 13/14
7. Norfolk Creek	Allamakee Co. Rd. Br.	T96N, R5W, Sec. 6
8. Yellow River	Allamakee Co. Rd. X16 Br.	T96N, R5W, Sec. 5
Postville WWTP		
Postville Industrial Wastewater Lagoon		
9. Williams Creek	Allamakee Co. Rd. X16 Br.	T96N, R5W, Sec. 8
10. Yellow River	Allamakee Co. Rd. Br.	T96N, R5W, Sec. 15
11. Hickory Creek	Clayton Co. Rd. Br.	T95N, R5W, Sec. 5
12. Hickory Creek	Allamakee Co. Rd. Br.	T96N, R5W, Sec. 23
13. Bear Creek	Allamakee Co. Rd. X26 Br.	T96N, R5W, Sec. 13
14. Yellow River	Allamakee Co. Rd. Br.	T96N, R4W, Sec. 18
15. Suttle Creek	Allamakee Co. Rd. Br.	T96N, R4W, Sec. 30
16. Yellow River	Allamakee Co. Rd. X36 Br.	T96N, R4W, Sec. 24
17. Dousman Creek	Allamakee Co. Rd. Br.	T96N, R4W, Sec. 36
18. Yellow River	Allamakee Co. Hwy 76 Br.	T96N, R3W, Sec. 34

TABLE 3
 SELECTED CHEMICAL AND BACTERIOLOGICAL DATA FROM THE YELLOW RIVER BASIN
 AUGUST 15, 1978
 (all units are mg/l unless otherwise noted)

<u>Station</u>	<u>Stream Use Classification</u>	<u>Temperature</u>	<u>DO</u>	<u>Fecal Coliforms per 100 ml</u>	<u>Ammonia Nitrogen</u>	<u>TOC</u>	<u>BOD</u>	<u>Turbidity(NTU)</u>
1.Yellow River	-	23.0 ^o C	8.5	2,500	0.06	8	2	4.8
2.Unnamed Creek	-	21.0	9.0	2,600	<0.01	5	1	7.5
3.Yellow River	-	24	8.7	3,900	0.05	8	3	9.3
4.North Fork	-	24	8.8	15,000	0.09	8	2	8.9
5.Yellow River	B (warm)	17	12.0	600	<0.01	6	2	2.9
6.Teeple Creek	B (cold)	24	8.3	2,100	0.09	8	4	17
7.Norfolk Creek	B (cold)	23.5	11.3	600	0.02	7	2	2.9
8.Yellow River	B (warm)	20.5	12.6	460	<0.01	12	3	3.1
Postville WWTP	-	20	--	1,200,000	16	78	22	9.8
Postville Ind. Lagoon	-	25	--	400	0.65	54	50	34
9.Williams Cr.	-	20.5	12.9	3,100	0.05	6	1	1.6
10.Yellow River	B (warm)	21.5	12.1	300	0.02	7	3	3.4
11.Hickory Creek	-	23.5	7.4	3,200	0.08	8	2	14
12.Hickory Creek	B (cold)	18	10.8	1,200	0.01	5	4	2.7
13.Bear Creek	B (cold)	17	8.8	700	0.01	5	4	2.3
14.Yellow River	B (warm)	22	11.9	1,100	0.01	10	2	2.4
15.Suttle Creek	B (cold)	22	12.7	900	0.02	11	1	1.6
16.Yellow River	B (warm)	23.5	13.0	100	0.02	6	3	4.0
17.Dousman Creek	B (cold)	25.5	10.4	80	0.03	3	4	1.1
18.Yellow River	B (warm)	23.5	6.8	1,400	0.10	10	3	33

and 18) had water temperatures in excess of 21°C. The influx of low temperature ground water recharge to the stream was apparently not sufficient to maintain water temperatures below 21°C at a time of high summer air temperatures. Stream flows encountered during the survey were "about average" indicating the greater than 21°C water temperatures occur frequently during the summer months.

The dissolved oxygen concentrations ranged from 6.8 mg/l at Station 18 to 13.0 mg/l at Station 16, most adequate to support fish and other aquatic life. Several of the dissolved oxygen concentrations reflect supersaturation (above 100% saturation), a condition created by algal photosynthesis. Compared to upstream stations, the dissolved oxygen value at Station 18 was substantially lower. The mud bottom, sluggish flow and forest canopy covering the river at Station 18 all contributed to the low dissolved oxygen.

Fecal coliform values varied from 80 organisms/100 ml at Station 17 (Dousman Creek) to 15,000 organisms/100 ml at Station 4 (North Fork Yellow River). Except for Station 6, the high fecal coliform values were on the unclassified reaches and probably represent pastureland runoff. The fecal coliform value at Station 6 (2100 organisms/100 ml) may have been due to runoff from scattered thundershowers that occurred during the survey.

Organic nitrogen values were all less than 1 mg/l indicating little organic matter present. Ammonia nitrogen, the first step in the breakdown of organic nitrogen, was low ranging from <0.01 mg/l at Stations 2, 5 and 8 to 0.10 mg/l at Station 18. The nitrate nitrogen concentrations varied from 1.8 to 5.9 mg/l with the headwaters of the Yellow River and tributaries having the higher values. The decline in nitrate as the

river flowed downstream was probably due to dilution and utilization by plant life.

Total organic carbon (TOC), another measure of organic matter, had values ranging from 3 to 12 mg/l, typical of a clean coldwater stream. Results of additional chemical analysis (phosphate, BOD, COD, chloride, turbidity, etc.) were all low, exhibiting values within expected ranges. None of the point source waste dischargers had any measureable effect on chemical water quality of the receiving stream.

An analysis for trace metals in the Yellow River Basin yielded only a reportable barium value (0.1 mg/l) at Station 1. Barium is found in many Iowa surface waters, occurring naturally.

Biological sampling was performed during July and August at several of the stations where water samples were collected. The sample collection methods used in the biological survey utilized the Surber square foot sampler and the kicknet (4). The Surber sampler provides a method for determining the macroinvertebrate density by sampling a known area while the kicknet is used in habitats inaccessible to the Surber for supplemental data. All of the stations on the Yellow River were sampled except Stations 1 and 18. Station 9 on Williams Creek and 12 on Hickory Creek were sampled because of their locations downstream from Postville and Luana. Bear Creek, Station 13, was sampled as a control tributary. All macroinvertebrate data may be found in Appendix 2.

Station 3 located in an area of pastureland reflected a community composed of organisms that thrive in organic-enriched water. The population was dominated by filter feeding chironomidae (midge larvae) and hydropsychidae (caddisfly larvae). The source of the organic enrichment was most probably cattle waste from nearby pastures.

The macroinvertebrate community at Station 5 was more indicative of ambient or normal conditions than any of the other Yellow River stations. A wide diversity of organisms (19 taxa) in moderate numbers (over 1000 per square meter) usually reflects a healthy, stable community. Even so, an indication of organic enrichment was apparent from the presence of four different types of leeches, including Helobdella stagnalis, an indicator of organic enrichment (7) and a number of sludgeworms (Tubifex tubifex). Since there are no known point source waste dischargers upstream from Station 5, the organic enrichment was probably due to agricultural runoff.

Stations 8, 10, 14 and 16 had macroinvertebrate communities with relatively low densities (86 to 136 total organisms per square meter) on July 13, 1978. The low densities may have been due to extensive scouring during high stream flow which resulted from heavy thunderstorms in the basin one week before the survey. As Ryck (8) has reported, the dispersal of the macroinvertebrates by high flows was temporary, as demonstrated by Station 14 which was resampled on August 16, 1978. Macroinvertebrate density at Station 14 had increased from 136 organisms/square meter in July to 760 organisms/M² in August. The rapid recovery of the community was probably due to recolonization through reproduction and immigration from less affected habitats, e.g., tributaries or mainstream pools.

Stations 9 (Williams Creek) and 12 (Hickory Creek) were located downstream from Postville and Luana respectively. The macroinvertebrate populations reflect the impact of these dischargers, with more than 80% of the total number of organisms composed of organic pollution tolerant sludgeworms - Limnodrilus sp., midge larvae - Chironomidae, and blackfly

larvae - Simulium sp. (4). Although water quality at these stations based on chemical and bacteriological analysis from grab samples was good, the biological analysis indicated a stressed environment. Postville has a wastewater treatment plant that is both hydraulically and organically overloaded (personal communication - Iowa Department of Environmental Quality regional office) and its discharge was probably the cause of the atypical macroinvertebrate community in Williams Creek. The town of Luana has a two-cell lagoon wastewater treatment system, and according to the IDEQ records, has not discharged for over two years. However, The Mississippi Valley Milk Producers Association at Luana has constructed a new wastewater treatment facility that has had problems becoming operational and as a result has experienced poor effluent quality on several occasions. The intermittent poor water quality of Hickory Creek has resulted in a biological community reflecting the poor water quality. These results emphasize that biological sampling is an important tool which should be used as often as possible in the complete evaluation of stream water quality.

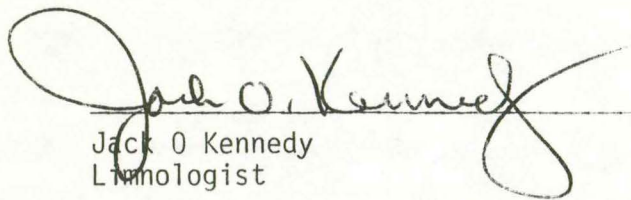
The Bear Creek (Station 14) macroinvertebrate community reflected the high water quality demonstrated by chemical analysis. The community structure was indicative of a healthy environment, and included nine types of mayfly nymphs and caddisfly larvae, the absence of sludgeworms and the highest total density of any station in the Yellow River Basin - 1435 organisms/square meter.

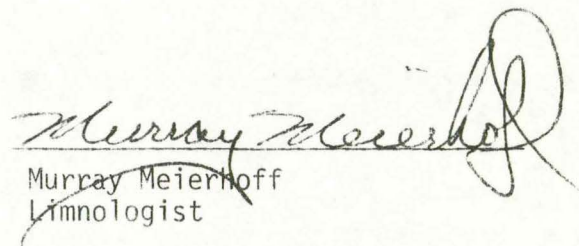
One unexpected result of the macroinvertebrate analysis from the Yellow River Basin was the common occurrence at all stations except 14 of the sludgeworms belonging to the family of Tubificidae (Limnodrilus

sp. and Tubifex tubifex). Although these organisms usually reflect high organic enrichment, their low densities indicate they may be a natural part of the Yellow River benthic community.

CONCLUSIONS

A survey of the Yellow River Basin in northeast Iowa was conducted during late summer. Results of that survey indicate good water quality throughout the basin. Water temperatures in several of the class B cold-water trout streams were above 21⁰C which prohibited trout stocking. Elevated stream temperatures occur frequently every summer and are caused by a combination of high ambient temperatures and a reduction in low temperature ground water discharge. Although the chemical and bacteriological analysis indicated the point source waste discharges from Postville and Luana had little impact on the receiving streams, biological analysis revealed a stressed environment. Most biological sampling stations had a healthy diverse macroinvertebrate community reflecting the good water quality.


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Limnologist


Murray Meierhoff
Limnologist

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APPENDIX 1

CHEMICAL AND BACTERIOLOGICAL DATA
FROM THE YELLOW RIVER BASIN

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
 H.A. WALLACE BUILDING
 DES MOINES, IOWA 50309

-16-

Town Source Specific Location	N Fork Yellow River Winneshiek Co. Rd. Br. T96N, R7W, Sec. 12/13 Station 4 8/15/78 8/16/78	Yellow River Winneshiek Co. W46 Br. T96N, R7W, Sec. 9 Station 1 8/15/78 8/16/78	Unnamed Creek Winneshiek Co. Rd. Br., T96N, R7W, Sec. 14 Station 2 8/15/78 8/16/78
Date Collected	8/15/78	8/15/78	8/15/78
Date Received	8/16/78	8/16/78	8/16/78
Lab Number	1112	1113	1114
Collection Time	1130	1100	1115
pH		FIELD DATA	
Temperature	24°C	23°C	21°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	15,000	2500	2600
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	600	640	660
MBAS (as LAS)			
pH (units)	8.3	8.1	8.1
Alkalinity: P	none	none	none
T	274	282	318
NITROGEN: Organic N	0.65	0.78	0.44
Ammonia N	0.09	0.06	<0.01
Nitrite N			
Nitrate N	4.4	5.8	3.3
Nitrate as NO ₃			
RESIDUE: Total	412	432	454
Fixed	302	274	338
Volatile	110	158	116
Filtrable Residue T	394	416	436
F	286	262	324
V	108	154	112
Nonfiltrable Residue T	20	16	18
F	16	12	14
V	4	4	4
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.09	0.07	0.05
Total P	0.13	0.10	0.08
Dissolved Oxygen	8.8	8.5	9.0
BOD	2	2	1
COD	14	9	21
Grease or Oil			
Turbidity (JTU)	8.9	4.8	7.5
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	11	16	10
Sulfate (SO ₄ ⁻)			
Total Organic Carbon	8	8	5

REMARKS:

COLLECTOR
 REPORT TO

Meierhoff/Prill
 Limnology Division
 UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
 DIRECTOR

OCT 6 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
 H.A. WALLACE BUILDING
 DES MOINES, IOWA 50309

-17-

Town	Yellow River	Yellow River	Teepie Creek
Source	Winneshiek Co. Rd. Br.	Allamakee Co. Rd. W60	Allamakee Co. Rd. Br.
Specific Location	T96N, R7W, Sec. 13	Br., T96N, R6W, Sec. 3	T97N, R6W, Sec. 13/14
Date Collected	Station 3 8/15/78	Station 5 8/15/78	Station 6 8/15/78
Date Received	8/16/78	8/16/78	8/16/78
Lab Number	1115	1116	1117
Collection Time	1125	1225	1235
pH		FIELD DATA	
Temperature	24.0°C	17°C	24°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	3900	600	2100
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	630	620	580
MBAS (as LAS)			
pH (units)	8.3	7.85	8.2
Alkalinity: P	none	none	none
T	288	288	258
NITROGEN: Organic N	0.89	0.31	0.91
Ammonia N	0.05	<0.01	0.09
Nitrite N			
Nitrate N	4.1	4.5	5.9
Nitrate as NO ₃			
RESIDUE: Total	444	406	436
Fixed	302	288	306
Volatile	142	118	130
Filtrable Residue T	418	392	390
F	282	282	268
V	136	110	122
Nonfiltrable Residue T	26	14	46
F	20	6	38
V	6	8	8
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.07	0.05	0.06
Total P	0.13	0.10	0.14
Dissolved Oxygen	8.7	12.0	8.3
BOD	3	2	4
COD	26	13	19
Grease or Oil			
Turbidity (JTU)	9.3	2.9	17
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	14	11	13
Sulfate (SO ₄ ⁻)			
Total Organic Carbon	8	6	8

REMARKS:

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WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
 H.A. WALLACE BUILDING
 DES MOINES, IOWA 50309

-18-

Town	Norfolk Creek	Yellow River	Postville
Source	Allamakee Co. Rd. Br.	Allamakee Co. Rd. X16	WWTP
Specific Location	T96N, R5W, Sec. 6	Br., T96N, R5W, Sec. 5	
Date Collected	Station 7 8/15/78	Station 8 8/15/78	8/15/78
Date Received	8/16/78	8/16/78	8/16/78
Lab Number	1118	1119	1120
Collection Time	1250	1255	1030
pH		FIELD DATA	
Temperature	23.5 ⁰ C	20.5 ⁰ C	20 ⁰ C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	600	460	1,200,000
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	490	580	1400
MBAS (as LAS)			
pH (units)	8.3	8.3	7.9
Alkalinity: P	none	none	none
T	229	274	328
NITROGEN: Organic N	0.68	0.42	2.7
Ammonia N	0.02	<0.01	16
Nitrite N			
Nitrate N	2.4	3.8	2.5
Nitrate as NO ₃			
RESIDUE: Total	336	376	806
Fixed	232	256	654
Volatile	104	120	152
Filtrable Residue T	326	364	780
F	226	250	648
V	100	114	132
Nonfiltrable Residue T	10	12	26
F	6	6	6
V	4	6	20
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.09	0.02	3.4
Total P	0.10	0.11	5.0
Dissolved Oxygen	11.3	12.6	
BOD	2	3	22
COD	4	6	56
Grease or Oil			
Turbidity (JTU)	2.9	3.1	9.8
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	8.0	10	210
Sulfate (SO ₄ ⁻)			
Total Organic Carbon	7	12	78

REMARKS:

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Meierhoff/Prill
 Limnology Division
 UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
 DIRECTOR

WATER QUALITY REPORT

**STATE HYGIENIC LABORATORY, Des Moines Branch
H.A. WALLACE BUILDING
DES MOINES, IOWA 50309**

-19-

Town	Williams Creek	Yellow River	Luana
Source	Allamakee Co. Rd. X-16	Allamakee Co. Rd. Br.	Hickory Creek
Specific Location	Br., T96N, R5W, Sec. 8 Station 9	T96N, R5W, Sec. 15 Station 10	Clayton Co. Rd. Br., T95N, R5W, Sec. 5 Station 11
Date Collected	8/15/78	8/15/78	8/15/78
Date Received	8/16/78	8/16/78	8/16/78
Lab Number	1121	1122	1123
Collection Time	1305	1315	0950
pH		FIELD DATA	
Temperature	20.5°C	21.5°C	23.5°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	3100	300	3200
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	630	570	690
MBAS (as LAS)			
pH (units)	8.4	8.3	8.25
Alkalinity: P	2.8	none	none
T	274	271	302
NITROGEN: Organic N	0.27	0.35	0.64
Ammonia N	0.05	0.02	0.08
Nitrite N			
Nitrate N	4.3	3.3	6.1
Nitrate as NO ₃			
RESIDUE: Total	390	354	464
Fixed	294	252	306
Volatile	96	102	158
Filtrable Residue T	384	338	440
F	294	242	290
V	90	96	150
Nonfiltrable Residue T	6	16	24
F	0	10	16
V	6	6	6
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.18	0.04	0.09
Total P	0.25	0.06	0.15
Dissolved Oxygen	12.9	12.1	7.4
BOD	1	3	2
COD	6	5	8
Grease or Oil			
Turbidity (JTU)	1.6	3.4	14
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	20	10	15
Sulfate (SO ₄ ⁻)			
Total Organic Carbon	6	7	8

REMARKS:

COLLECTOR
REPORT TO

Meierhoff/Prill
Limnology Division
UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
DIRECTOR

OCT 6 1978

WATER QUALITY REPORT

**STATE HYGIENIC LABORATORY, Des Moines Branch
H.A. WALLACE BUILDING
DES MOINES, IOWA 50309**

-20-

Town			
Source			
Specific Location	Hickory Creek Allamakee Co. Rd., T96N, R5W, Sec. 23	Bear Creek Allamakee Co. Rd. Br., T96N, R5W, Sec. 13	Yellow River Allamakee Co. Rd. Br., T96N, R4W, Sec. 18
Date Collected	Station 12 8/15/78	Station 13 8/15/78	Station 14 8/15/78
Date Received	8/16/78	8/16/78	8/16/78
Lab Number	1124	1125	1126
Collection Time	1330	1345	1350
pH			
Temperature	18 ^o C	17 ^o C	22.0 ^o C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	1200	700	1100
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	620	530	550
MBAS (as LAS)			
pH (units)	8.3	7.9	8.3
Alkalinity: P	none	none	none
T	288	257	266
NITROGEN: Organic N	0.69	0.12	0.40
Ammonia N	0.01	0.01	0.01
Nitrite N			
Nitrate N	4.2	1.6	3.0
Nitrate as NO ₃			
RESIDUE: Total	382	336	328
Fixed	270	234	212
Volatile	112	102	116
Filtrable Residue T	370	328	314
F	266	232	206
V	104	96	108
Nonfiltrable Residue T	12	8	14
F	4	2	6
V	8	6	8
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.02	0.03	0.01
Total P	0.10	0.08	0.18
Dissolved Oxygen	10.8	8.8	11.9
BOD	<1	<1	2
COD	10	7	10
Grease or Oil			
Turbidity (JTU)	2.7	2.3	2.4
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	11	3.0	10
Sulfate (SO ₄ ⁻²)	5	5	10
Total Organic Carbon			

REMARKS:

COLLECTOR
REPORT TO

Meierhoff/Prill
Limnology Division
UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
DIRECTOR

OCT 6 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
H.A. WALLACE BUILDING
DES MOINES, IOWA 50309

-21-

Town Source Specific Location	Yellow River Allamakee Co. Rd. Br. T96N, R4W, Sec. 18 Station 14	Yellow River 24 hr. composite	Suttle Creek Allamakee Co. Rd., T96N, R4W, Sec. 30 Station 15
Date Collected	8/15/78	8/15/78	8/15/78
Date Received	8/16/78	8/16/78	8/16/78
Lab Number	1127	1128	1129
Collection Time	1350	FIELD DATA 1400 (50 min. interval)	1415
pH			
Temperature	22.0°C		22°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	220	930	900
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	550	520	550
MBAS (as LAS)			
pH (units)	8.3	8.2	8.4
Alkalinity: P	none	none	5.8
T	256	237	263
NITROGEN: Organic N	0.55	0.40	0.26
Ammonia N	0.01	<0.01	0.02
Nitrite N			
Nitrate N	3.0	3.1	3.4
Nitrate as NO ₃			
RESIDUE: Total	340	318	344
Fixed	214	214	222
Volatile	126	104	122
Filtrable Residue T	324	306	338
F	202	206	218
V	122	100	120
Nonfiltrable Residue T	16	12	6
F	12	8	4
V	4	4	2
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.01	<0.01	0.02
Total P	0.05	0.05	0.04
Dissolved Oxygen	11.7		12.7
BOD	3	6	1
COD	8	10	4
Grease or Oil			
Turbidity (JTU)	3.6	2.6	1.6
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	10	10	7.0
Sulfate (SO ₄ ⁻²)			
Total Organic Carbon	12	8	11

REMARKS:

COLLECTOR
REPORT TO

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Limnology Division
UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
DIRECTOR

OCT 6 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
 H.A. WALLACE BUILDING
 DES MOINES, IOWA 50309

-22-

Town Source Specific Location	Yellow River Allamakee Co. Rd. X-36 Br., T96N, R4W, Sec. 24 Station 16	Dousman Creek Allamakee Co. Rd., T96N, R4W, Sec. 36 Station 17	Yellow River Allamakee Co. Hwy 76 Br., T96N, R3W, Sec. 34 Station 18
Date Collected	8/15/78	8/15/78	8/15/78
Date Received	8/16/78	8/16/78	8/16/78
Lab Number	1130	1131	1132
Collection Time	1450	1435 FIELD DATA	1510
pH			
Temperature	23.5°C	25.5°C	23.5°C
Dissolved Oxygen			
Fecal Coliform/100 ml	100	BACTERIOLOGICAL EXAMINATION	
		80	1400
Conductance (micromhos)	500	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)	
MBAS (as LAS)		490	460
pH (units)	8.25	8.3	8.0
Alkalinity: P	none	0.4	none
T	231	251	208
NITROGEN: Organic N	0.68	0.07	0.75
Ammonia N	0.02	0.03	0.10
Nitrite N			
Nitrate N	2.5	3.0	1.8
Nitrate as NO ₃			
RESIDUE: Total	342	302	362
Fixed	224	210	268
Volatile	118	92	94
Filtrable Residue T	316	296	286
F	208	208	206
V	108	88	80
Nonfiltrable Residue T	26	6	76
F	16	2	62
V	10	4	14
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.02	0.02	0.09
Total P	0.07	0.04	0.22
Dissolved Oxygen	13.0	10.4	6.8
BOD	3	<1	3
COD	42	2	27
Grease or Oil			
Turbidity (JTU)	4.0	1.1	33
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	9.0	4.0	8.0
Sulfate (SO ₄ ⁻²)			
Total Organic Carbon	6	3	10

REMARKS:

COLLECTOR
REPORT TO

Meierhoff/Prill
Limnology Division
UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
DIRECTOR

OCT 6 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
 H.A. WALLACE BUILDING
 DES MOINES, IOWA 50309

-23-

Town	Postville		
Source	Hygrade Lagoon		
Specific Location	Final effluent		
Date Collected	8/15/78		
Date Received	8/16/78		
Lab Number	1133		
Collection Time	1045	FIELD DATA	
pH			
Temperature	25 ^o C		
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	<100		
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	840		
MBAS (as LAS)			
pH (units)	9.2		
Alkalinity: P	45.2		
T	289		
NITROGEN: Organic N	21		
Ammonia N	0.65		
Nitrite N			
Nitrate N	0.03		
Nitrate as NO ₃			
RESIDUE: Total	652		
Fixed	426		
Volatile	226		
Filtrable Residue T	562		
F	418		
V	144		
Nonfiltrable Residue T	90		
F	8		
V	82		
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	1.8		
Total P	2.9		
Dissolved Oxygen			
BOD	50		
COD	150		
Grease or Oil			
Turbidity (JTU)	34		
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	110		
Sulfate (SO ₄ ⁻)			
Total Organic Carbon	54		

REMARKS:

COLLECTOR
 REPORT TO

Meierhoff/Prill
 Limnology Division
 UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
 DIRECTOR

OCT 6 1978

**WATER QUALITY REPORT
METALS**

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
515:281-5371

-24-

Town Source Specific Location	Yellow River Winneshiek Co. W46 Br. T96N, R7W, Sec. 9	Yellow River Allamakee Co. Rd. X36 Br., T96N, R4W, Sec. 24	
Date Collected	8/15/78	8/15/78	
Date Received	8/16/78	8/16/78	
Lab Number	1113	1130	

METALS ANALYSIS (as mg/l unless designated otherwise)

Arsenic	<0.01	<0.01	
Barium	0.1	<0.1	
Cadmium	<0.01	<0.01	
Chromium, Total	<0.01	<0.01	
Chromium, Hexavalent			
Copper	<0.01	<0.01	
Lead	<0.01	<0.01	
Mercury	<0.001	<0.001	
Nickel	<0.1	<0.1	
Selenium	<0.01	<0.01	
Silver	<0.01	<0.01	
Zinc	<0.01	<0.01	

REMARKS:

COLLECTOR
REPORT TO

Meierhoff/Prill
Limnology Division
UHL, Des Moines Branch

Date Reported

OCT 6 1978

W.J. Hausler Jr., Ph.D.
Director

APPENDIX 2. MACROINVERTEBRATE
IDENTIFICATIONS AND DENSITIES FROM THE
YELLOW RIVER, July and August 1978
(all numbers are per square meter)

Station 3. Yellow River Winneshiek Co. T96N, R7W, Sec 13
A small stream over gravel and rocks, through pastureland.

	7-13-78
Annelida	
Oligochaeta	
<u>Tubifex tubifex</u>	24.8
Hirudinea	
Erpobdellidae	6.5
Mollusca	
Gastropoda	*
<u>Physa</u> sp.	+
Pelecypoda	
Sphaeriidae	
<u>Musculium</u> sp.	3.2
Arthropoda	
Insecta	
Ephemeroptera	
<u>Baetis</u> sp.	32.3
<u>Caenis</u> sp.	3.2
<u>Stenacron</u> sp.	17.2
Trichoptera	
<u>Cheumatopsyche</u> sp.	100.1
<u>Hydropsyche betteni</u>	+
<u>Ochrotrichia</u> sp.	+
Diptera	
Chironomidae	132.4

Number of taxa	11
Number of individuals/m ²	322.9

* indicates presence in kick-net sample only, and therefore unquantifiable.

Station 5. Yellow River Allamakee Co. Rd. W-60 T96N, R6W, Sec 3
 A small stream over gravel and rocks in a wobded area.

7-13-78

Annelida	
Oligochaeta	
<u>Tubifex tubifex</u>	24.8
Hirudinea	
Glossiphoniidae	
<u>Helobdella stagnalis</u>	6.5
<u>Placobdella ornata</u>	+
<u>P. parasitica</u>	+
Erpobdellidae	
<u>Erpobdella punctata</u>	28.0
Mollusca	
Gastropoda	
<u>Physa sp.</u>	6.5
Arthropoda	
Insecta	
Ephemeroptera	
<u>Baetis sp.</u>	423.8
<u>Caenis sp.</u>	14.0
<u>Stenacron sp.</u>	53.8
Trichoptera	
<u>Cheumatopsyche sp.</u>	172.2
<u>Hydropsyche betteni</u>	3.2
<u>H. bifida (gp)</u>	71.0
<u>Ochrotrichia sp.</u>	17.2
Diptera	
<u>Atherix variegata</u>	78.6
Chironomidae	67.8
<u>Chrysops sp.</u>	+
<u>Tipula sp.</u>	3.2
Coleoptera	
<u>Helichus sp.</u>	3.2
<u>Stenelmis sp.</u>	32.3
	<hr/>
Number of taxa	19
Number of individuals/m ²	1011.8

Station 8. Yellow River Allamakee Co. Rd. X-16 T96N, R5W, Sec 5
 A medium sized stream over gravel and rocks, through pastureland.

7-13-78

Annelida	
Oligochaeta	
<u>Tubifex tubifex</u>	53.8
Hirudinea	
Erpobdellidae	+
Mollusca	
Gastropoda	
<u>Ferrissia sp.</u>	6.5
Arthropoda	
Insecta	
Ephemeroptera	
<u>Caenis sp.</u>	+
<u>Stenacron sp.</u>	3.2
Odonata	
<u>Aeschna (sitchensis?)</u>	+
Trichoptera	
<u>Cheumatopsyche sp.</u>	21.5
<u>Hydropsyche betteni</u>	+
Diptera	
Chironomidae	+
<u>Chrysozona sp.</u>	+
Number of taxa	10
Number of individuals/m ²	86.1

Station 9. Williams Creek Allamakee Co. Rd. X-16 T96N, R5W, Sec 8
 A small stream over gravel and rocks in pastureland
 (downstream from Postville WWTP).

	7-13-78
Annelida	
Oligochaeta	
<u>Limnodrilus</u> sp.	38.8
Mollusca	
Gastropoda	
<u>Physa</u> sp.	+
Arthropoda	
Insecta	
Ephemeroptera	
Baetis sp.	10.3
Trichoptera	
<u>Cheumatopsyche</u> sp.	175.5
<u>Hydropsyche betteni</u>	6.5
<u>Ochrotrichia</u> sp.	3.2
Diptera	
Chironomidae	678.1
<u>Simulium</u> sp.	135.6
Coleoptera	
Helichus sp.	+
<u>Stenelmis</u> sp.	3.2

Number of taxa	10
Number of individuals/m ²	1054.9

Station 10. Yellow River Allamakee Co. T96N, R5W, Sec 15
 A medium sized stream over gravel and rocks, surrounded by
 row-cropland.

7-13-78

Annelida	
Oligochaeta	
<u>Tubifex tubifex</u>	21.5
Hirudinea	
Erpobdellidae	3.2
Mollusca	
Gastropoda	
<u>Ferrissia</u> sp.	3.2
Arthropoda	
Crustacea	
Decapoda	
<u>Orconectes</u> sp.	+
Insecta	
Ephemeroptera	
<u>Caenis</u> sp.	3.2
<u>Stenacron</u> sp.	6.5
<u>Stenonema</u> sp.	+
Trichoptera	
<u>Cheumatopsyche</u> sp.	57.0
Diptera	
<u>Atherix variegata</u>	+
Chironomidae	10.8
<u>Simulium</u> sp.	14.0
Coleoptera	
<u>Stenelmis</u> sp.	3.2
	<hr/>
Number of taxa	12
Number of individuals/m ²	125.6

Station 12. Hickory Creek Allamakee Co. T96N, R5W, Sec 23
 A small stream over sand and gravel in pastureland
 (downstream from Luana WWTP).

7-13-78

Annelida	
Oligochaeta	
<u>Limnodrilus</u> sp.	190.2
Hirudinea	
Glossiphoniidae	
<u>Percymoorensis marmorata</u>	+
Erpobdellidae	
<u>Erpobdella triannulata</u>	+
Mollusca	
Gastropoda	
<u>Physa</u> sp.	6.5
Arthropoda	
Crustacea	
Decapoda	
<u>Orconectes</u> sp.	+
Insecta	
Ephemeroptera	
<u>Baetis</u> sp.	17.2
<u>Caenis</u> sp.	+
<u>Ephemerella</u> sp.	10.3
<u>Stenacron</u> sp.	+
Trichoptera	
<u>Cheumatopsyche</u> sp.	14.0
<u>Hydropsyche slossonae</u>	3.2
Diptera	
<u>Atherix variegata</u>	6.5
Chironomidae	401.9
<u>Chrysops</u> sp.	3.2
<u>Simulium</u> sp.	24.8
<u>Stratiomyia</u> sp.	3.2
Hemiptera	
<u>Belostoma</u> sp.	+
Diptera	
<u>Agabus</u> sp.	3.2
<u>Laccophilus</u> sp.	+
<u>Optioservus fastiditus</u>	3.2
<u>Stenelmis</u> sp.	+

Number of taxa	21
Number of individuals/m ²	692.5

Station 13. Bear Creek Allamakee Co. Rd. X-26 T96N, R5W, Sec 13
A small trickle over gravel and rocks in a wooded area.

8-16-78

Annelida	
Hirudinea	
Erpobdellidae	
<u>Erpobdelladae triannulata</u>	3.2
Mollusca	
Gastropoda	
<u>Physa</u> sp.	6.5
Arthropoda	
Crustacea	
Amphipoda	
<u>Gammarus pseudolimnaeus</u>	3.2
Insecta	
Ephemeroptera	
<u>Baetis</u> sp.	466.4
<u>Caenis</u> sp.	3.2
<u>Stenacron</u> sp.	3.2
<u>Stenonema</u> sp.	3.2
Trichoptera	
<u>Cheumatopsyche</u> sp.	240.4
<u>Hydropsyche bifida</u> (gp)	6.5
<u>H. slossonae</u>	21.5
<u>Hydatophylax</u> sp.	+
<u>Ochrotrichia</u> sp.	6.5
Diptera	
<u>Atherix variegata</u>	14.0
<u>Antocha</u> sp.	3.2
Chironomidae	556.1
<u>Simulium</u> sp.	75.3
<u>Tipula</u> sp.	3.2
Coleoptera	
<u>Agabus</u> sp.	+
<u>Helichus</u> sp.	10.8
<u>Stenelmis</u> sp.	3.2

Number of taxa	20
Number of individuals/m ²	1435.2

Station 14. Yellow River Allamakee Co. Rd. T96N, R4W, Sec 18
A small river over gravel and rocks, surrounded by row-cropland.

	7-13-78	8-16-78
Annelida		
Oligochaeta		
<u>Limnodrilus</u> sp.	28.0	
<u>Tubifex tubifex</u>		35.5
Hirudinea		
Erpobdellidae		+
Mollusca		
Gastropoda		
<u>Physa</u> sp.	3.2	+
<u>Ferrissia</u> sp.		3.2
Arthropoda		
Crustacea		
Amphipoda		
<u>Gammarus pseudolimnaeus</u>		+
Insecta		
Ephemeroptera		
<u>Baetis</u> sp.	6.5	89.3
<u>Caenis</u> sp.	3.2	3.2
<u>Isonychia</u> sp.		6.5
<u>Heptagenia</u> sp.		3.2
<u>Stenacron</u> sp.	+	6.5
<u>Tricorythodes</u> sp.		6.5
Trichoptera		
<u>Cheumatopsyche</u> sp.	21.5	75.3
<u>Hydropsyche bifida</u> (gp)		3.2
<u>Ochrotrichia</u> sp.		6.5
Diptera		
<u>Atherix variegata</u>	6.5	3.2
<u>Antocha</u> sp.		3.2
Chironomidae	32.3	444.9
<u>Simulium</u> sp.	3.2	60.3
<u>Tipula</u> sp.	3.2	+
Hemiptera		
<u>Sigara</u> sp.		+
Coleoptera		
<u>Dineutus</u> sp.		+
<u>Dubiraphia bivittata</u>		3.2
<u>D. vittata</u>		+
<u>Helichus</u> sp.	+	
<u>Peltodytes</u> sp.		+
<u>Stenelmis</u> sp.	32.3	
<u>Tropisteruus ellipticus</u>		+
Number of taxa	12	25
Number of individuals/m ²	136.3	760.6

Station 16. Yellow River Allamakee Co. Rd. X-36 T96N, R4W, Sec 24
 A medium size river over gravel and rocks, surrounded by
 wooded hills.

7-13-78

Annelida	
Oligochaeta	
<u>Tubifex tubifex</u>	35.5
Mollusca	
Pelecypoda	
Sphaeriidae	
<u>Musculium</u> sp.	3.2
<u>Pisidium</u> sp.	3.2
Arthropoda	
Insecta	
Ephemeroptera	
<u>Stenacron</u> sp.	21.5
Trichoptera	
<u>Cheumatopsyche</u> sp.	+
Diptera	
<u>Atherix variegata</u>	+
Chironomidae	6.5
<u>Tipula</u> sp.	+
Coleoptera	
<u>Helichus</u> sp.	+
<u>Hyperodes</u> sp.	3.2
<u>Optioservus fastiditus</u>	+
<u>Stenelmis</u> sp.	10.8

Number of taxa	12
Number of individuals/m ²	86.1