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Laboratory*



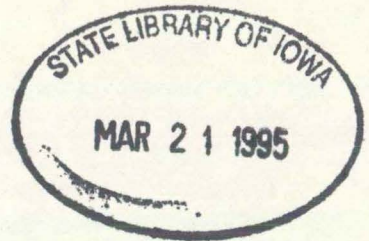
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THE UNIVERSITY OF IOWA
IOWA CITY, IOWA 52242

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Winter Water Quality Survey
of the
Rock River

No. 79-42

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

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ABSTRACT

A water quality study of the Rock River was conducted during January 1979. Water samples from 15 stream stations were collected in assessing the winter water quality and evaluating water quality changes that may have occurred since previous studies. In addition to the stream sampling, five municipal wastewater effluents were sampled. Results of the survey indicate below average water quality throughout much of the river reach. Two violations of the Iowa water quality standard for dissolved oxygen occurred below Rock Valley and were probably due to the cumulative effect of several waste dischargers. The town of Hull was the only wastewater treatment facility not in compliance with its discharge permit limitations. Based on the current wastewater treatment plant effluent limitations, winter water quality of the Rock River is not expected to change except during high flow periods.

INTRODUCTION

The Rock River originates in Pipestone County, Minnesota and enters Iowa in Lyon County just north of Rock Rapids in extreme northwest Iowa. The Iowa reach of the Rock River (approximately 64 kilometers - 40 miles) extends from the Iowa-Minnesota state line to its juncture with the Big Sioux River near Hawarden, Iowa. Total draining area for the Rock River is 4,372 square kilometers, (1,688 square miles) with over 2,395 square kilometers (925 square miles) in Iowa. Most of the Iowa drainage area of the Rock River is utilized in the production of agricultural products, i.e., row crops, pasture, and animal feeding operations.

The Rock River flows through a rather narrow flat valley, and, according to Iowa Fish and Fishing (1) offers the best habitat for fish of any stream tributary to the Missouri River within Iowa. Major tributaries to the Rock are the Little Rock River, Otter Creek, and Burr Oak Creek. The Rock is classified by the Iowa Water Quality Standards (2) as a class B fresh warm water stream from its mouth to the Iowa-Minnesota state line and protected by the appropriate standards.

Two previous water quality studies (3,4) have been conducted on the Rock River by the University Hygienic Laboratory. One survey was performed during late summer low flow conditions and one during winter ice cover. Results from those surveys indicated a "deterioration in water quality downstream from several small towns as a result of the introduction of wastes from their municipal wastewater treatment plants." The major objectives of the present survey were to determine if winter water quality had improved as compared to the previous study and to assess the impact of the waste discharges on the receiving stream. Water samples were collected 9 and 10 January 1979. Figure 1 is a map representing the sampling area, and a list of the sampling station locations will be found in Table 1. A listing of all the waste dischargers located in the Rock River Basin, respective plant information, and status in the construction grants program has been included in Table 2.

TABLE 1
 Rock River Basin Sampling Locations
 8,9,10 January 1979

| <u>Stream Station</u> | <u>Location</u> |
|-----------------------|---|
| 1. Otter Creek | Osceola County Road A22 Bridge, T99N R42W, Section 11/14 |
| 2. Otter Creek | Osceola Co. Rd. Br., T99N, R42W, Sec. 25/30 |
| 3. Otter Creek | Lyon Co. Rd. Br., T98N, R44W, Sec. 21/28 |
| 4. Little Rock River | Lyon Co. Hwy. 9 Br., T100N, R43W, Sec. 3/34 |
| 5. Little Rock River | Lyon Co. Rd. Br., T98N, R44W, Sec. 10/15 |
| 6. Little Rock River | Lyon Co. Rd. K42 Br., T98N, R46W, Sec. 35/36 |
| 7. Rock River | Lyon Co. Rd. A16 Br., T100N, R45W, Sec. 20 |
| 8. Rock River | Lyon Co. Rd. A22 Br., T99N R45W, Sec. 10/15 |
| 9. Rock River | Lyon Co. Rd. K42 Br., T98N, R46W, Sec. 23/24 |
| 10. Burr Oak Creek | Sioux Co. Rd. K42 Br., T97N, R46W, Sec. 1/2 |
| 11. Rock River | Sioux Co. Rd. K30 Br., T97N, R46W, Sec. 16/17 |
| 12. Rock River | Sioux Co. Hwy. 18 Br., T97N, R47W. Sec. 24/25 |
| 13. Rock River | Sioux Co. Rd. B40 Br., T95N, R48W, Sec. 6 |
| 14. Big Sioux River | Sioux Co. Rd. Br., T96N, R48W, Sec. 30 |
| 15. Big Sioux River | Sioux Co. Hwy. 10 Br., T95N, R48W, Sec. 15 |

Wastewater Dischargers

| | |
|----------------------------|-----------------------------------|
| Sibley Municipal WWTP | Final effluent, grab sample |
| Little Rock Municipal WWTP | Final effluent, grab sample |
| Rock Rapids Municipal WWTP | Final effluent, 24 hour composite |
| Hull Municipal WWTP | Final effluent, grab sample |
| Rock Valley Municipal WWTP | Final effluent, 24 hour composite |

WWTP = Wastewater Treatment Plant

TABLE 2
Rock River Basin Wastewater Dischargers

| <u>Discharger</u> | <u>1970 Population</u> ¹ | <u>Wastewater Plant Type</u> ¹ | <u>Average Flow (mgd)</u> ¹ | <u>Design Capacity (mgd)</u> ¹ | <u>Status in Construction Grants Program</u> ² | <u>Stream Receiving Discharge</u> ² |
|-------------------|---|---|--|---|---|--|
| Rock Rapids | 2,632 | Trickling filter | 0.181 | 0.480 | Step III. Construction 80% complete | Rock River |
| Lester | 238 | 1-cell lagoon | 0.028 | 0.030 | Not in program | Mud Creek |
| Alvord | 204 | 1-cell lagoon | 0.016 | 0.023 | Step II. Plans and specifications not yet received | Mud Creek |
| Little Rock | 531 | Trickling filter | -- | 0.040 | Step I. Facility plan submitted and awaiting review | Little Rock River |
| George | 1,194 | 2-cell lagoon | 0.071 | 0.110 | Step I. Application being reviewed | Otter Creek |
| Sibley | 2,749 | Trickling filter | 0.390 | 0.500 | Step III. Awaiting construction permit | Otter Creek |
| Ashton | 483 | 2-cell lagoon | 0.031 | 0.045 | Not in program | Otter Creek |
| Matlock | 89 | NEMTF | -- | -- | Not in program | Little Rock River |
| Hull | 1,523 | Trickling filter | 0.121 | 0.130 | Step I. Revising I/I analysis portion of facility plan | Burr Oak Creek |
| Rock Valley | 2,205 | Trickling filter (and digester) | 0.113 | 0.260 | Step I. Facility plan submitted and awaiting review | Rock River |

1. Information from the Western Iowa Basin Plan

2. Information from the Iowa Department of Environmental Quality

mgd = millions of gallons per day

NEMTF = no existing municipal treatment facility

I/I = Inflow and Infiltration

Flow data for the Rock River were obtained from the United States Geological Survey (USGS) gaging stations and by a direct flow measurement. The USGS gaging station near Rock Valley recorded a flow of 0.85 cubic meters per second (m^3/sec) or 30 cubic feet per second (cfs) on 10 January 1979. This value is provisional and subject to correction for ice cover. Stream flow measured near the mouth of the Rock River on 8 January 1979 was $0.33 \text{ m}^3/\text{sec}$ (11.5 cfs). Even at $0.33 \text{ m}^3/\text{sec}$, stream flow was considerably greater than (over fifty times) the seven day ten year low flow ($7Q_{10}$) of $0.006 \text{ m}^3/\text{sec}$ (0.20 cfs).

SAMPLING AND ANALYTICAL METHODOLOGY

Procedures used in sample collection, preservation and analysis are described in Standard Methods (5), and Manual of Methods for Chemical Analysis of Water and Wastes (6). Grab samples were collected using a high density polyethylene sampling bucket and a weighted stainless steel dissolved oxygen sampler. Composite samples were collected by Instrumentation Specialties Company (ISCO) automated samplers. Provisional stream flow data were obtained from the U.S. Geological Survey. Stream flow measurements were conducted using the USGS method of computing cross sectional area (7). A Price AA current meter and a top-setting wading rod were used to measure velocity and depth.¹

RESULTS AND DISCUSSION

For ease of review, selected data from this survey will be tabulated in the text by tributaries and major rivers. All data obtained from the survey are included in the Appendix.

1. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the University Hygienic Laboratory

Otter Creek

Three sampling stations were located on Otter Creek (Figure 1). Station 1, located above Sibley, was frozen to the bottom; therefore, no sample could be collected. The two previous surveys also reported difficulty in collecting at this site. Values for selected parameters from stations 2 and 3 are listed below:

Otter Creek
9,10 January 1979
(all values in mg/l unless indicated otherwise)

| <u>Station</u> | <u>Specific Conductance</u> ¹ | <u>Ammonia Nitrogen</u> | <u>Total Phosphate</u> | <u>Dissolved Oxygen</u> | <u>BOD</u> | <u>Chloride</u> |
|----------------|--|-------------------------|------------------------|-------------------------|------------|-----------------|
| 1 | No sample | | | | | |
| 2 | 4,000 | 15 | 8.4 | 10.4 | 16 | 42 |
| 3 | 16,000 | 0.65 | 0.16 | 7.5 | 2 | 29 |

1. micromhos per cm at 25°C

Water quality approximately 1.6 km (1 mile) downstream from Sibley (station 2) was poor. Maximum levels for conductance, ammonia nitrogen, total phosphate, and biochemical oxygen demand (BOD) were found at station 2. Several other parameters were also elevated, due to the organic waste loading from the Sibley municipal wastewater treatment plant. The dissolved oxygen was higher than expected and was probably a result of aeration in the open water created by the heated discharge. Station 3, located upstream from the confluence of Otter Creek and the Little Rock River, displayed more typical winter water quality with a substantial improvement in water quality as compared with station 2. Stream assimilation, in conjunction with dilution, probably accounted for the improvement in water quality. This same trend was observed in the two previous studies, indicating the ability of the stream to recover from the Sibley waste discharge.

Little Rock River

Three sampling stations were located on the Little Rock River. Selected data for these stations are listed below:

Little Rock River

9,10 January 1979

(all values in mg/l unless designated otherwise)

| <u>Station</u> | <u>Specific Conductance</u> ¹ | <u>Ammonia Nitrogen</u> | <u>Total Phosphate</u> | <u>Dissolved Oxygen</u> | <u>BOD</u> | <u>Chloride</u> |
|----------------|--|-------------------------|------------------------|-------------------------|------------|-----------------|
| 4 | 1,000 | 0.28 | 0.15 | 0.0 | 3 | 30 |
| 5 | 960 | 0.45 | 0.14 | 7.8 | 2 | 12 |
| 6 | 1,200 | 0.66 | 0.11 | 9.0 | 2 | 23 |

1. micromhos per cm at 25°C

Station 4 was located downstream from the Little Rock municipal wastewater treatment plant and, except for the absence of dissolved oxygen (0.0 mg/l), had average winter water quality. The biochemical oxygen demand from the Little Rock treatment plant (45 mg/l) was most probably responsible for the dissolved oxygen depletion found at station 4.

By station 5, dissolved oxygen had increased to 7.8 mg/l, indicating a slight improvement in water quality as compared to station 4. Minor changes in water quality occurred at station 6 as compared to station 5 and were probably caused by the poorer quality water from Otter Creek merging with the Little Rock River just upstream from station 6.

Rock River

Six sampling stations were located on the mainstream of Rock River and one station on a small tributary, Burr Oak Creek. The Burr Oak Creek station (Station 10) was frozen to the bottom, making it impossible to collect a water sample. Although the town of Hull was discharging into

Burr Oak Creek during the survey, the effluent water was freezing before it could reach station 10, due to the extreme cold encountered during the survey. Selected data for the six Rock River stations are given below:

| Rock River | | | | | | |
|--|--|-------------------------|------------------------|-------------------------|------------|-----------------|
| 9,10 January 1979 | | | | | | |
| (all values in mg/l unless designated otherwise) | | | | | | |
| <u>Station</u> | <u>Specific Conductance</u> ¹ | <u>Ammonia Nitrogen</u> | <u>Total Phosphate</u> | <u>Dissolved Oxygen</u> | <u>BOD</u> | <u>Chloride</u> |
| 7 | 1,100 | 0.92 | 0.27 | 5.1 | 3 | 37 |
| 8 | 1,400 | 3.4 | 1.2 | 7.2 | 6 | 83 |
| 9 | 1,100 | 0.79 | 0.28 | 5.9 | 2 | 41 |
| 10 | Burr Oak Creek, no sample | | | | | |
| 11 | 1,200 | 0.51 | 0.15 | 4.9 | 1 | 31 |
| 12 | 1,200 | 1.7 | 0.22 | 3.3 | 3 | 40 |
| 13 | 1,200 | 0.79 | 0.23 | 3.7 | 1 | 32 |

1. micromhos per cm at 25⁰C

Station 7, located on the Rock River upstream from Rock Rapids, demonstrated typical winter water quality as the stream entered Iowa. No stream standards violations were observed at station 7, and all values were within expected winter ranges.

Between stations 7 and 8, the Rock Rapids municipal wastewater treatment plant discharge enters the Rock River. The impact of that discharge on the Rock River was demonstrated by increases in conductance, ammonia, phosphate, BOD, and chloride. Although elevated values of these parameters were reported, no stream violations were observed. For winter ice cover, the Rock Rapids municipal wastewater treatment plant discharge impact on the Rock River was minimal.

By station 9, some 20 kilometers (13 miles) downstream, water quality had returned to background levels similar to that found at station 7.

Station 11 was located just upstream from Rock Valley and downstream from the Rock River's confluence with the Little Rock River. Except for a decline in dissolved oxygen (4.9 mg/l), overall water quality was average and similar to that of station 9. The minor differences in water quality probably represent a dilution effect due to the Little Rock River and/or possible ground water discharge to the river.

Water quality declined at station 12, located downstream from Rock Valley, as a result of the Rock Valley municipal waste discharge. Elevated levels of fecal coliforms (74,000 organisms/100 ml) and ammonia nitrogen (1.7 mg/l) were observed while dissolved oxygen was 3.3 mg/l. Although the differences in water quality between station 11 and 12 were minimal, the addition of Rock Valley's waste to an already stressed environment resulted in a violation of the dissolved oxygen standard.

By station 13, located just upstream from the mouth of the Rock River, several indicator parameters (ammonia, conductance, BOD, and chloride) had returned to background levels while dissolved oxygen (3.7 mg/l) was still in violation of the Iowa water quality standard.

According to the Iowa Water Quality Standards, the dissolved oxygen shall not be less than 5.0 mg/l during at least 16 hours of any 24-hour period and not less than 4.0 mg/l at any time during the 24-hour period (2). This variable standard was established to allow for the natural diel fluctuations of dissolved oxygen when, for short periods of time, the dissolved oxygen may fall below 5.0 mg/l. Previous summer studies have demonstrated that diel fluctuations are real and occur quite frequently in Iowa streams. In a study designed to determine the daily variations in dissolved oxygen during winter ice and snow covered conditions, dissolved oxygen samples were collected during different time periods of the day from

four Rock River stations. The values for those samples are listed below:

| | <u>Noon</u> | <u>6:00 p.m.</u> | <u>Midnight</u> | <u>6:00 a.m.</u> | <u>Average</u> |
|-------------|-------------|------------------|-----------------|------------------|----------------|
| Station 7 | 5.1 | 4.6 | 4.3 | 5.0 | 4.8 |
| Station 8 | 7.2 | 7.6 | 6.6 | 5.3 | 6.7 |
| Station 8A* | 6.1 | 6.2 | 5.4 | 5.6 | 5.8 |
| Station 13 | 3.7 | NC | 3.1 | 2.8 | 3.2 |

NC = not collected

*Station 8A was located on the Rock River 8 kilometers (5 miles) downstream from station 8.

Dissolved oxygen values (in mg/l) varied less than 1 mg/l at three of the four stations' samples. Station 8, which had the largest variation (2.3 mg/l), was located downstream from the Rock Rapids wastewater treatment plant. The heated effluent from Rock Rapids may have resulted in ice-free areas in the river causing reaeration and a chance for more variation in dissolved oxygen values. The diel-dissolved oxygen results indicate that in winter, during ice and snow cover, there is little fluctuation in dissolved oxygen. As a result, once the dissolved oxygen level is depressed, it remains so until the stream conditions change.

In addition to the previously discussed analyses, three samples for trace metals analysis were collected at station 4, 7, and 13. A low background level of barium (0.1 mg/l) found at all three stations was the only incidence of trace metals observed during the survey.

During the Rock River study, all wastewater discharge facilities (Table 2) were visited and grab samples collected if they were discharging. In addition, 24-hour composite effluent samples were collected from the municipalities of Rock Rapids and Rock Valley, Iowa. Data from those samples have been compared to their discharge permit limitations, and both may be found in Table 3.

TABLE 3

Discharge Permit Limitations And Sample Values For Municipal Wastewater Treatment Facilities

Discharging in the Rock River Basin

9,10 January 1979
(all values in mg/l)

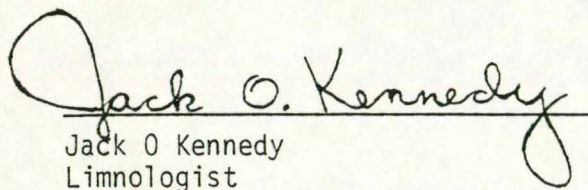
| | <u>Biochemical Oxygen Demand</u> | | | | <u>Suspendend Solids</u> | | | |
|-------------|----------------------------------|----------------|-------------------------|-------------|---------------------------|----------------|-------------------------|-------------|
| | <u>Permit Limitations</u> | | <u>Sample Values</u> | | <u>Permit Limitations</u> | | <u>Sample Values</u> | |
| | <u>Average</u> | <u>Maximum</u> | <u>24-Hr. Composite</u> | <u>Grab</u> | <u>Average</u> | <u>Maximum</u> | <u>24-Hr. Composite</u> | <u>Grab</u> |
| Rock Rapids | 50 | 75 | 75 | 60 | 50 | 75 | 54 | 46 |
| Rock Valley | 50 | 75 | 65 | 55 | 50 | 75 | 64 | 57 |
| Sibley | 50 | 75 | * | 55 | 50 | 75 | * | 43 |
| Little Rock | 100 | 150 | * | 45 | 100 | 150 | * | 39 |
| Hull | 40 | 60 | * | 200 | 40 | 60 | * | 180 |

* Not collected

During the composite sampling at Rock Rapids, a ruptured pipe caused the municipal plant to bypass directly to the river for approximately three hours. The Rock Rapids composite sample was collected after the plant was returned to full operation. A review of Table 3 indicates that all of the discharges except Hull were in compliance with their discharge limitations. Hull has a trickling filter system that was having icing problems at the time of sampling. Icing of trickling filters is a common winter problem, especially in northwest Iowa, and was most probably the cause of the poor quality effluent from Hull.

SUMMARY AND CONCLUSIONS

Results of a winter water quality survey of the Rock River and its tributaries indicated below average water quality. A previous winter study was conducted during a very low flow period (zero flow recorded at Rock Valley) and, compared to that study, water quality has improved in the Rock River Basin. While some water quality improvement was noted and is probably related to higher stream flows, certain areas continued to experience problems. Minor declines in water quality were observed downstream from Rock Rapids and Rock Valley and may be attributed to their municipal discharges. Two violations of the Iowa water quality standard for dissolved oxygen occurred below Rock Valley and were probably caused from the cumulative effect of several waste discharges. Of the several waste discharge facilities sampled, only the town of Hull was not in compliance with its discharge permit limitations.


Jack O Kennedy
Limnologist

LITERATURE CITED

1. Harlan J.R., and E.B. Speaker, 1969. Iowa fish and fishing. 4th ed. State of Iowa, Des Moines, Iowa.
2. Iowa Water Quality Commission. 1978. Water quality standards. Iowa Administrative Code, chapter 16.
3. Kennedy, J.O. 1976. Water quality survey of the Rock River during low flow (No. 77-17). University Hygienic Laboratory. Iowa City, Iowa.
4. Kennedy, J.O. 1977. Winter water quality survey of the Rock River (No. 77-28). University Hygienic Laboratory, Iowa City, Iowa.
5. American Public Health Association. 1975. Standard methods for the examination of water and wastewater, 14th ed. Washington, D.C.
6. U.S. Environmental Protection Agency. 1976. Methods for chemical analysis of water and wastes. Cincinnati, Ohio.
7. Buchanan, T.J., and William P. Somers. 1976. Discharge measurements at Gaging Stations. U.S. Geological Survey Techniques Water Resources Inventory, Book 3, chapter A8.

APPENDIX

WATER QUALITY REPORT

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

| | | | |
|--|---|--|--|
| Town | Rock Rapids | Rock Rapids | Doon |
| Source | Rock River | Rock River | Rock River |
| Specific Location | Lyon Co. Rd. T100N, R45W, Sec. 20 | Lyon Co. Rd. A-22, T99N, R45W, Sec. 10/15 | Lyon Co. Rd. K-42, T98N, R46W, Sec. 23/24 |
| Date Collected | 1/09/79 | 1/09/79 | 1/09/79 |
| Date Received | 1/10/79 | 1/10/79 | 1/10/79 |
| Lab Number | 3974 | 3975 | 3976 |
| Collection Time | 1315 | 1420 | 1200 |
| pH | | FIELD DATA | |
| Temperature | 0°C | 0°C | 0°C |
| Dissolved Oxygen | | | |
| | BACTERIOLOGICAL EXAMINATION | | |
| Fecal Coliform/100 ml | 10 | 210,000 | 1100 |
| | CHEMICAL ANALYSIS (as mg/l unless designated otherwise) | | |
| Conductance (micromhos) | 1100 | 1400 | 1100 |
| MBAS (as LAS) | | | |
| pH (units) | 7.6 | 7.6 | 7.6 |
| Alkalinity: P | none | none | none |
| T | 338 | 371 | 331 |
| NITROGEN: Organic N | 0.33 | 0.99 | 0.36 |
| Ammonia N | 0.92 | 3.4 | 0.79 |
| Nitrite N | | | |
| Nitrate N | 3.9 | 5.0 | 3.5 |
| Nitrate as NO ₃ | | | |
| RESIDUE: Total | | | |
| Fixed | | | |
| Volatile | | | |
| Filtrable Residue T | | | |
| F | | | |
| V | | | |
| Nonfiltrable Residue T | 8 | 7 | 7 |
| F | | | |
| V | | | |
| Settleable Matter (ml/l) | | | |
| PHOSPHATE: Filtrable P | 0.27 | 0.93 | 0.27 |
| Total P | 0.27 | 1.2 | 0.28 |
| Dissolved Oxygen | 5.1 | 7.2 | 5.9 |
| BOD | 3 | 6 | 2 |
| COD | 19 | 32 | 28 |
| Grease or Oil | | | |
| Turbidity (JTU) | 2.3 | 2.9 | 2.1 |
| Total Hardness (as CaCO ₃) | | | |
| Calcium (Ca ⁺⁺) | | | |
| Magnesium (Mg ⁺⁺) | | | |
| Chloride (Cl ⁻) | 37 | 83 | 41 |
| Sulfate (SO ₄ ⁻²) | | | |
| Total Organic Carbon | 6 | 9 | 5 |

REMARKS:

COLLECTOR
REPORT TO

Limnology Division
UHL
Des Moines, Ia.

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

FEB 08 1970

WATER QUALITY REPORT

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

| | | | |
|--|---|---|--|
| Town | Little Rock | Little Rock River | Sibley |
| Source | Little Rock River | Little Rock River | Otter Creek |
| Specific Location | Lyon Co. Hwy 9, T100N, R43W, Sec. 34/3 | Lyon Co. Rd., T98N, R44W, Sec. 10/15 | Osceola Co. Rd., T99N, R42W, Sec. 25/30 |
| Date Collected | 1/10/79 | 1/09/79 | 1/10/79 |
| Date Received | 1/11/79 | 1/10/79 | 1/11/79 |
| Lab Number | 4028 | 3977 | 4029 |
| Collection Time | 0915 | 1530 | 1135 |
| pH | | FIELD DATA | |
| Temperature | 0°C | 0°C | 0°C |
| Dissolved Oxygen | | | |
| | BACTERIOLOGICAL EXAMINATION | | |
| Fecal Coliform/100 ml | 200 | 30 | 8700 |
| | CHEMICAL ANALYSIS (as mg/l unless designated otherwise) | | |
| Conductance (micromhos) | 1000 | 960 | 4000 |
| MBAS (as LAS) | | | |
| pH (units) | 7.4 | 7.6 | 8.0 |
| Alkalinity: P | none | none | none |
| T | 282 | 284 | 506 |
| NITROGEN: Organic N | 0.62 | 0.44 | 5.1 |
| Ammonia N | 0.28 | 0.45 | 15 |
| Nitrite N | | | |
| Nitrate N | 1.1 | 0.3 | 7.5 |
| Nitrate as NO ₃ | | | |
| RESIDUE: Total | | | |
| Fixed | | | |
| Volatile | | | |
| Filtrable Residue T | | | |
| F | | | |
| V | | | |
| Nonfiltrable Residue T | 104 | 110 | 74 |
| F | | | |
| V | | | |
| Settleable Matter (ml/l) | | | |
| PHOSPHATE: Filtrable P | 0.15 | 0.14 | 7.0 |
| Total P | 0.15 | 0.14 | 8.4 |
| Dissolved Oxygen | 0.0 | 7.8 | 10.4 |
| BOD | 3 | 2 | 16 |
| COD | 25 | 18 | 110 |
| Grease or Oil | | | |
| Turbidity (JTU) | 19 | 25 | 26 |
| Total Hardness (as CaCO ₃) | | | |
| Calcium (Ca ⁺⁺) | | | |
| Magnesium (Mg ⁺⁺) | | | |
| Chloride (Cl ⁻) | 30 | 12 | 42 |
| Sulfate (SO ₄ ⁻²) | | | |
| Total Organic Carbon | 7 | 7 | 29 |

REMARKS:

COLLECTOR
REPORT TOLimnology Division
UHL
Des Moines, Ia.W.J. HAUSLER, JR., Ph.D.
DIRECTOR

FEB 08 1979

WATER QUALITY REPORT

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

| | | | |
|---|--|--|---|
| Town | | Doon | Rock Valley |
| Source | | Little Rock River | Rock River |
| Specific Location | Otter Creek Lyon Co. Rd., T98N, R44W, Sec. 21/28 | Lyon Co. Rd. K-42, T98N, R46W, Sec. 35/36 | Co. Rd. K-30 Br., T97N, R46W, Sec. 16/17 |
| Date Collected | 1/09/79 | 1/09/79 | 1/09/79 |
| Date Received | 1/10/79 | 1/10/79 | 1/10/79 |
| Lab Number | 3979 | 3978 | 3981 |
| Collection Time | 1550 | FIELD DATA | |
| pH | | 1145 | 1140 |
| Temperature | 0°C | 0°C | 0°C |
| Dissolved Oxygen | | | |
| BACTERIOLOGICAL EXAMINATION | | | |
| Fecal Coliform/100 ml | 170 | 230 | 140 |
| CHEMICAL ANALYSIS (as mg/l unless designated otherwise) | | | |
| Conductance (micromhos) | 1600 | 1200 | 1200 |
| MBAS (as LAS) | | | |
| pH (units) | 7.7 | 7.6 | 7.5 |
| Alkalinity: P | none | none | none |
| T | 366 | 352 | 332 |
| NITROGEN: Organic N | 0.45 | 0.39 | 0.20 |
| Ammonia N | 0.65 | 0.66 | 0.51 |
| Nitrite N | | | |
| Nitrate N | 2.5 | 2.0 | 4.0 |
| Nitrate as NO ₃ | | | |
| RESIDUE: Total | | | |
| Fixed | | | |
| Volatile | | | |
| Filtrable Residue T | | | |
| F | | | |
| V | | | |
| Nonfiltrable Residue T | 41 | 11 | 5 |
| F | | | |
| V | | | |
| Settleable Matter (ml/l) | | | |
| PHOSPHATE: Filtrable P | 0.16 | 0.11 | 0.14 |
| Total P | 0.16 | 0.11 | 0.15 |
| Dissolved Oxygen | 7.5 | 9.0 | 4.9 |
| BOD | 2 | 2 | 1 |
| COD | 26 | 44 | 33 |
| Grease or Oil | | | |
| Turbidity (JTU) | 8.6 | 3.5 | 2.2 |
| Total Hardness (as CaCO ₃) | | | |
| Calcium (Ca ⁺⁺) | | | |
| Magnesium (Mg ⁺⁺) | | | |
| Chloride (Cl ⁻) | 29 | 23 | 31 |
| Sulfate (SO ₄ ⁻) | | | |
| Total Organic Carbon | 6 | 5 | 4 |

REMARKS:

COLLECTOR
REPORT TO

Limnology Division
UHL
Des Moines, Ia.

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

FEB 08 1979

WATER QUALITY REPORT

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

| | | | |
|---|---|-----------------------------------|---|
| Town Source Specific Location | Rock Valley Rock River Hwy 18 bridge | Rock River Co. Rd. B-40 bridge | Rock Rapids WWTP Final effluent, grab |
| Date Collected | 1/09/79 | 1/09/79 | 1/10/79 |
| Date Received | 1/10/79 | 1/10/79 | 1/11/79 |
| Lab Number | 3982 | 3983 | 4035 |
| Collection Time | 1015 | 0940 | 1130 |
| pH | | | |
| Temperature | 0°C | 0°C | 2°C |
| Dissolved Oxygen | | | |
| | FIELD DATA | | |
| | BACTERIOLOGICAL EXAMINATION | | |
| Fecal Coliform/100 ml | 74,000 | 1200 | |
| | CHEMICAL ANALYSIS (as mg/l unless designated otherwise) | | |
| Conductance (micromhos) | 1200 | 1200 | |
| MBAS (as LAS) | | | |
| pH (units) | 7.5 | 7.5 | 7.9 |
| Alkalinity: P | none | none | |
| T | 336 | 340 | |
| NITROGEN: Organic N | 0.51 | 0.36 | |
| Ammonia N | 1.7 | 0.79 | 30 |
| Nitrite N | | | |
| Nitrate N | 3.5 | 3.7 | |
| Nitrate as NO ₃ | | | |
| RESIDUE: Total | | | |
| Fixed | | | |
| Volatile | | | |
| Filtrable Residue T | | | |
| F | | | |
| V | | | |
| Nonfiltrable Residue T | 6 | 6 | 46 |
| F | | | |
| V | | | |
| Settleable Matter (ml/l) | | | |
| PHOSPHATE: Filtrable P | 0.40 | 0.22 | |
| Total P | 0.43 | 0.23 | |
| Dissolved Oxygen | 3.3 | 5.4 | |
| BOD | 3 | 1 | 60 |
| COD | 37 | 21 | |
| Grease or Oil | | | |
| Turbidity (JTU) | 2.6 | 2.5 | |
| Total Hardness (as CaCO ₃) | | | |
| Calcium (Ca ⁺⁺) | | | |
| Magnesium (Mg ⁺⁺) | | | |
| Chloride (Cl ⁻) | 40 | 32 | |
| Sulfate (SO ₄ ⁻) | | | |
| Total Organic Carbon | 6 | 4 | 49 |

REMARKS:

COLLECTOR
REPORT TO

Limnology Division
UHL
Des Moines, Ia.

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

FEB 08 1979

WATER QUALITY REPORT

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

| | | | |
|---|--|---|--|
| Town Source Specific Location | Rock Rapids WWTP Final effluent (24 hr. time composite) | Rock Valley WWTP Final effluent, grab | Rock Valley WWTP Final effluent (24 hr. time composite) |
| Date Collected | 1/09-1/10/79 | 1/10/79 | 1/09-1/10/79 |
| Date Received | 1/11/79 | 1/11/79 | 1/11/79 |
| Lab Number | 4034 | 4032 | 4033 |
| Collection Time | 1200 1/09-1200 1/10 | 1000 | 1000 1/09-1000 1/10 |
| pH | | FIELD DATA | |
| Temperature | | 2°C | |
| Dissolved Oxygen | | | |
| | BACTERIOLOGICAL EXAMINATION | | |
| Fecal Coliform/100 ml | | | |
| | CHEMICAL ANALYSIS (as mg/l unless designated otherwise) | | |
| Conductance (micromhos) | | | |
| MBAS (as LAS) | | | |
| pH (units) | 7.8 | 8.0 | 7.9 |
| Alkalinity: P | | | |
| T | | | |
| NITROGEN: Organic N | | | |
| Ammonia N | 26 | 23 | 18 |
| Nitrite N | | | |
| Nitrate N | | | |
| Nitrate as NO ₃ | | | |
| RESIDUE: Total | | | |
| Fixed | | | |
| Volatile | | | |
| Filtrable Residue T | | | |
| F | | | |
| V | | | |
| Nonfiltrable Residue T | 54 | 57 | 64 |
| F | | | |
| V | | | |
| Settleable Matter (ml/l) | | | |
| PHOSPHATE: Filtrable P | | | |
| Total P | | | |
| Dissolved Oxygen | | 8.3 | |
| BOD | 75 | 55 | 65 |
| COD | | | |
| Grease or Oil | | | |
| Turbidity (JTU) | | | |
| Total Hardness (as CaCO ₃) | | | |
| Calcium (Ca ⁺⁺) | | | |
| Magnesium (Mg ⁺⁺) | | | |
| Chloride (Cl ⁻) | | | |
| Sulfate (SO ₄ ⁻) | | | |
| Total Organic Carbon | 53 | 49 | 53 |

REMARKS:

COLLECTOR
REPORT TO

Limnology Division
UHL
Des Moines, Ia.

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

WATER QUALITY REPORT

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

| | | | |
|---|---|------------------|--------------------------|
| Town | Sibley | Little Rock | Hull |
| Source | Sibley WWTP final eff. | Little Rock WWTP | Hull WWTP final effluent |
| Specific Location | | final effluent | |
| Date Collected | 1/10/79 | 1/10/79 | 1/09/79 |
| Date Received | 1/11/79 | 1/11/79 | 1/10/79 |
| Lab Number | 4031 | 4030 | 3980 |
| Collection Time | 1100 | 0950 | 1110 |
| pH | | | |
| Temperature | | | |
| Dissolved Oxygen | | | |
| | FIELD DATA | | |
| Fecal Coliform/100 ml | 3,800,000 | 3,800,000 | 21,000,000 |
| | BACTERIOLOGICAL EXAMINATION | | |
| | CHEMICAL ANALYSIS (as mg/l unless designated otherwise) | | |
| Conductance (micromhos) | | | |
| MBAS (as LAS) | | | |
| pH (units) | 8.0 | 7.6 | 7.7 |
| Alkalinity: P | | | |
| T | | | |
| NITROGEN: Organic N | | | |
| Ammonia N | 18 | 43 | 54 |
| Nitrite N | | | |
| Nitrate N | | | |
| Nitrate as NO ₃ | | | |
| RESIDUE: Total | | | |
| Fixed | | | |
| Volatile | | | |
| Filtrable Residue T | | | |
| F | | | |
| V | | | |
| Nonfiltrable Residue T | 43 | 39 | 180 |
| F | | | |
| V | | | |
| Settleable Matter (ml/l) | | | |
| PHOSPHATE: Filtrable P | | | |
| Total P | | | |
| Dissolved Oxygen | 4.9 | 4.7 | 2.1 |
| BOD | 55 | 45 | 200 |
| COD | | | |
| Grease or Oil | | | |
| Turbidity (JTU) | | | |
| Total Hardness (as CaCO ₃) | | | |
| Calcium (Ca ⁺⁺) | | | |
| Magnesium (Mg ⁺⁺) | | | |
| Chloride (Cl) | | | |
| Sulfate (SO ₄ ⁻) | | | |
| Total organic carbon | 57 | 44 | 145 |

REMARKS:

COLLECTOR
REPORT TO

Limnology Division
Hygienic Laboratory
Des Moines, Ia.

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

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Historical Building
DES MOINES, IOWA 50319

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THE UNIVERSITY OF IOWA
HYGIENIC LABORATORY, Des Moines Branch
H.A. WALLACE BUILDING
DES MOINES, IOWA 50319

WATER QUALITY REPORT

| | | | |
|---|---|------------------------------------|------------|
| Town | Big Sioux River | Hawarden | |
| Source | Co. Rd. Br., T96N, | Big Sioux River | |
| Specific Location | R48W, Sec. 30 | Hwy 10 Br., T95N, R48W, Sec. 15 | |
| Date Collected | 1/10/79 | 1/10/79 | |
| Date Received | 1/11/79 | 1/11/79 | |
| Lab Number | 4020 | 4021 | |
| Collection Time | 1400 | 1450 | FIELD DATA |
| pH | | | |
| Temperature | 0°C | 0°C | |
| Dissolved Oxygen | | | |
| | BACTERIOLOGICAL EXAMINATION | | |
| Fecal Coliform/100 ml | <10 | 110 | |
| | CHEMICAL ANALYSIS (as mg/l unless designated otherwise) | | |
| Conductance (micromhos) | 1800 | 1600 | |
| MBAS (as LAS) | | | |
| pH (units) | 7.6 | 7.55 | |
| Alkalinity: P | none | none | |
| T | 402 | 377 | |
| NITROGEN: Organic N | 0.81 | 1.1 | |
| Ammonia N | 4.7 | 3.3 | |
| Nitrite N | | | |
| Nitrate N | 3.0 | 3.1 | |
| Nitrate as NO ₃ | | | |
| RESIDUE: Total | | | |
| Fixed | | | |
| Volatile | | | |
| Filtrable Residue T | | | |
| F | | | |
| V | | | |
| Nonfiltrable Residue T | 8 | 9 | |
| F | | | |
| V | | | |
| Settleable Matter (ml/l) | | | |
| PHOSPHATE: Filtrable P | 2.5 | 1.8 | |
| Total P | 2.6 | 2.0 | |
| Dissolved Oxygen | 2.4 | 2.8 | |
| BOD | 2 | 1 | |
| COD | 47 | 27 | |
| Grease or Oil | | | |
| Turbidity (JTU) | 4.3 | 4.1 | |
| Total Hardness (as CaCO ₃) | | | |
| Calcium (Ca ⁺⁺) | | | |
| Magnesium (Mg ⁺⁺) | | | |
| Chloride (Cl ⁻) | 160 | 130 | |
| Sulfate (SO ₄ ⁻) | | | |
| Total organic carbon | 12 | 7 | |

REMARKS:

COLLECTOR
REPORT TOLimnology Division
Hygienic Laboratory
Des Moines, IowaW.J. HAUSLER, JR., Ph.D.
DIRECTOR

WATER QUALITY REPORT
METALS

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

| | | | |
|-------------------------------|---|--|-----------------------------------|
| Town Source Specific Location | Rock Rapids Rock River Lyon Co. Rd. T100N, R45W, Sec. 20 | Little Rock Little Rock River Lyon Co. Hwy 9, T100N R43W, Sec. 34/3 | Rock River Co. Rd. B-40 bridge |
| Date Collected | 1/09/79 | 1/10/79 | 1/09/79 |
| Date Received | 1/10/79 | 1/11/79 | 1/10/79 |
| Lab Number | 3974 | 4028 | 3983 |

METALS ANALYSIS (as mg/l unless designated otherwise)

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

REMARKS:

COLLECTOR
REPORT TO

Limnology Division
UHL
Des Moines, Ia.

Date Reported

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

FEB 08 1979