Exelon Generation.

Michael P. Gallagher
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10 CFR 50
10 CFR 51
10 CFR 54

RS-14-051

February 11, 2014

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. 50-454 and 50-455

Subject: Response to NRC Request for Additional Information – Additional Request, dated January 29, 2014, related to the Byron and Braidwood Stations, Units 1 and 2 License Renewal Application, Byron Station Applicant's Environmental Report

References:

1. Exelon Generation Company, LLC letter from Michael P. Gallagher to NRC Document Control Desk, "Application for Renewed Operating Licenses", dated May 29, 2013

2. Letter from Lois M. James (NRC) to Michael P. Gallagher (Exelon), "Requests for Additional Information for the Environmental Review of the Byron Nuclear Station, Units 1 and 2, License Renewal Application – Additional Request, dated January 29, 2014

In the Reference 1 letter, Exelon Generation Company, LLC (Exelon Generation) submitted the License Renewal Application (LRA) for the Byron and Braidwood Stations, Units 1 and 2. In the Reference 2 letter, the NRC requested additional information to support the Staff's review of the Byron Station Applicant's Environmental Report (Appendix E, Item E-2 to the LRA).

The enclosure to this letter provides the additional information requested by the Staff.

This letter and its enclosures contain no regulatory commitments.

A035
IE25
NRR

If you have any questions, please contact Mr. Al Fulvio, Manager, Exelon Generation License Renewal, at 610-765-5936.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 2-11-2014

Respectfully,

Michael P. Gallagher

Michael P. Gallagher
Vice President - License Renewal Projects
Exelon Generation Company, LLC

Enclosure: Hard copies of Response Sheets plus other Relevant Documents

cc: Regional Administrator - NRC Region III (w/ Response Sheets only)
NRC Project Manager (Environmental Review), NRR-DLR (w/ Response Sheets only)
NRC Project Manager (Safety Review), NRR-DLR (w/ Response Sheets only)
NRC Project Manager, NRR-DORL Byron Station (w/ Response Sheets only)
NRC Senior Resident Inspector, Byron Station (w/ Response Sheets only)
Illinois Emergency Management Agency – Division of Nuclear Safety

bcc: (all w/ Response Sheets only)

BYR Site VP – F. Kearney
BYR Plant Manager – B. Youman
BYR Manager Chemistry, Rad Waste & Environmental – A. Corrigan
BYR Environmental Chemist – N. Gordon
Mid-West Mgr Environmental Programs – R. Beem
Mid-West Principal Environmental Specialist – J. Petro
Mid-West Senior Environmental Specialist – F. Bevington
Corp Dir Environmental Programs & Reg Policy – Z. Karpa
Corp VP Fleet Support – P. Orphanos
Corp Dir Licensing – G. Kaegi
Corp Mgr Licensing, Braidwood and Byron Stations – P. Simpson
Corp License Renewal Mgr – A. Fulvio
Corp License Renewal Technical Lead – D. Warfel
Corp License Renewal Engineering Mgr – A. Piha
Corp License Renewal BYR Site Lead – D. Brindle
Corp License Renewal Environmental Lead – N. Ranek
Corp License Renewal Licensing Lead – J. Hufnagel
Exelon Document Control Desk Licensing

Exelon Generation

RS-14-051

Enclosure

Responses to Additional RAIs

AQ-1e and AQ-1f

Byron Station License Renewal Environmental Review

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Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-1e Category: Aquatic

Statement of Question:

Provide the following information:

e. (ComEd 1981b) Commonwealth Edison Company. 1981. Byron Station Environmental Report Operating License Stage. Vol. 2. Amendment No. 4 January 1983 – coversheet and Section 3.4

Response:

The requested information is attached. Please note that Exelon Generation is providing the excerpted section 3.4 from Volume 2 of the Byron Station Environmental Report Operating License Stage, as amended. There were four amendments to the Byron Station Environmental Report Operating License Stage, which are listed below.

Amendment No. 1, July 1981

Amendment No. 2, September 1981

Amendment No. 3, March 1982

Amendment No. 4, January 1983

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   - Vol. 2 – Cover Sheet,
     - Chapter 3 Front Material and Section 3.4, Heat Dissipation System

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Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-1f Category: Aquatic

Statement of Question:

Provide the following information:

f. Commonwealth Edison Company. 1981. Byron Station Environmental Report Operating License Stage. Vol. 2. Amendment No. 4. January 1983. [Audit Reference Material]"

i) coversheet
ii) Section 2.2.1, Aquatic Ecology
iii) Section 4.1.4.2, Aquatic Studies
iv) Section 5.1.3, Biological Effects [on the Rock River]
v) Section 5.2.1.1.2, Aquatic Pathways for Biota Other Than Man
vi) Section 6.1.1, Pre-Operational Monitoring of Surface Water
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1. Commonwealth Edison Company. 1981. Byron Station Environmental Report Operating License Stage, as amended through January 1983. Front material and excerpted sections 2.2.1, 4.1.4.2, 5.1.3, 5.2.1.1.2, 6.1.1, and 6.2.1
   - Vol. 1 – Cover Sheet and Overview Table of contents;
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   - Vol. 2 – Cover Sheet;
     - Chapter 4 Front Material and Section 4.1.4.2, Aquatic Studies
     - Chapter 5 Front Material, Section 5.1.3, Biological Effects [on the Rock River], and Section 5.2.1.1.2, Aquatic Pathways for Biota Other Than Man
     - Chapter 6 Front Material, Section 6.1.1 Pre-Operational Monitoring of Surface Water, Section 6.2.1 Aquatic Monitoring, and 6.3 Related Environmental Measurement and Monitoring Programs

Exelon Generation

RS-14-051 Enclosure

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AQ-1e and AQ-1f

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Response:

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BYRON STATION

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

VOLUME 1

COMMONWEALTH EDISON COMPANY

BYRON NUCLEAR GENERATING STATION - UNITS 1 & 2

ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

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CHAPTER 3.0 - THE STATION

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1

CHAPTER 3.0 - THE STATION

LIST OF TABLES

3.4 HEAT DISSIPATION SYSTEM

3.4.1 Natural Draft Cooling Towers

At the Byron Nuclear Generating Station - Units 1 & 2 (Byron Station), natural draft towers were chosen for primary cooling and mechanical draft towers for essential service water cooling and for the ultimate heat sink. The use of cooling towers minimizes both the land area used for cooling purposes and the effects of heat dissipation. The operational effects of the cooling towers, with respect to meteorology, is discussed in Subsection 5.1.4.

The two natural draft towers are located as shown in the property diagram, Figure 2.1-4. Each tower consists of a 495-foot high concrete hyperbolic shell, a 605-foot diameter basin, and a 272-foot exit diameter. The towers are designed to dissipate approximately 15.2×10^9 Btu/hr of heat absorbed by the circulating water system during a 13.1-second time-of-travel across the main condensers of the two units.

The design parameters that significantly affect the temperature of the blowdown are those that affect the performance of the natural draft towers. Each tower circulates 662,000 gallons per minute of cooling water, of which 35,000 gal/min is service water. At the design conditions of 89° F dry bulb temperature and 76° F wet bulb temperature, the towers cool the water from 116° F to 92° F. | 3

In a natural draft tower the cooling water being circulated through the plant falls through a draft of air; heat is carried away mostly by evaporation and partly by sensible heat transfer. The rest of the water is collected at the bottom of the tower and returned to the cooling cycle. The flow of air through the tower is caused by a "chimney effect:" the density difference between the cool outside ambient air and the less dense inside air warmed by the water. At the design conditions, the ratio of the water flow to the air flow is approximately 2.35:1 by weight. This ratio decreases in cooler weather; i.e., more air will pass through the tower.

The evaporation rate for the two natural draft towers when the plant is operating at full load varies between seasonal averages of 38.7 cubic feet per second (cfs) of water in the winter and 53.4 cfs in the summer. The maximum monthly evaporation has been calculated to be approximately 54.6 cfs. The maximum drift loss has been specified as 0.002% of the circulating water flow or 0.06 cfs.

To keep the total dissolved solids (TDS) concentration within the limits set by water pollution regulations and operating requirements, water has to be continuously withdrawn from the tower basin. This water is called blowdown. For these purposes, an average blowdown rate of about 30.1 cfs is required. The quantity of blowdown is dependent upon the water chemistry considerations and the evaporation rate of the cooling tower. The evaporation rate at any one time is dependent on the heat load and the ambient conditions at that time.

Blowdown from the natural draft towers is returned to the Rock River through a discharge structure (see Figure 3.4-1) at an average rate of 30.1 cfs and a maximum velocity of 4.3 feet per second. There are two modulating valves on the blowdown line so that blowdown can be stopped during shutdown or refueling. The TDS concentration of the blowdown averages about 1555 mg/liter. | 3

As a result of the discharge of the blowdown into the flowing Rock River, a thermal plume is established downstream whose detailed temperature profile depends on river conditions and the blowdown characteristics. The extent and effect of this plume are discussed in Section 5.1. A discussion of the blowdown temperature is included in Subsection 5.1.2.

The total water loss attributable to evaporation, drift, and blowdown has to be replaced to maintain a constant cooling water flow. This quantity is called makeup and amounts to an average of approximately 68.1 cfs in the winter and 86.3 cfs in the summer for full load operation.

Table 3.4-1 shows the median monthly temperatures for the blowdown with both units operating at 100% load factor. The predicted temperature ranges from 60.4° F in January to 87.0° F in July.

3.4.2 Mechanical Draft Cooling Towers

In addition to the two natural draft towers, two mechanical draft towers, which cool the essential service water, have been built at the site. The mechanical draft towers are located as shown in Figure 2.1-4. Each tower consists of 4 cells. The overall dimensions of each tower are 50 feet high, 174 feet long, and 45 feet wide. Each tower is designed to cool 52,000 gal/min of water from 138° F to 98° F under post-accident conditions concurrent with a 78° F wet-bulb temperature. The guaranteed water flow to each tower is 48,000 gal/min. The cooling range under normal operating conditions, however, will be approximately 10° F. The evaporation rate for these towers is a maximum of 2 cfs, with a maximum blowdown of 1.56 cfs; drift losses are negligible. The maximum required makeup for these towers is therefore 3.56 cfs. | 3

3.4.3 Intake and Discharge Structures

Makeup is withdrawn from the Rock River through an intake structure as shown in Figure 3.4-2. The location of the intake (river screen house) and discharge structures is shown on Figure 3.4-3. The intake structure operating floor is located at an elevation of 687 feet above mean sea level (MSL), which is above the 1973 flood (flood of record) elevation of 683.6 feet MSL.

The mean annual flow and 1-day low flow at the intake are 4730 and 400 cfs, and the corresponding water surface elevations are 672 and 670.4 feet MSL. The pump invert elevation of the intake channel is 663.6 feet and the velocity in the intake channel is between 0.43 and 0.55 feet per second. The structure contains three circulating water pumps, two for normal operation and one for standby, each of which has a capacity of about 53.5 cfs. The structure also contains two diesel-engine-driven essential service water makeup pumps, one for each mechanical draft tower. Each pump has a capacity of about 3.5 cfs.

The intake is protected by bar grills and traveling screens. The velocity at the intake is between 0.43 and 0.55 feet per second and decreases considerably with distance toward the center of the river. This velocity exists from the mouth of the intake at the bar racks to within a few feet of the traveling screens. The velocity through the traveling screens increases approximately two-fold because of the presence of the screens themselves. Debris removed from these screens is disposed of off the site by an independent contractor.

These heat dissipation systems are summarized in the plant water usage diagram, Figure 3.3-1.

TABLE 3.4-1

ESTIMATED MONTHLY VARIATION IN

DISCHARGE TEMPERATURE OF BLOWDOWN

MONTH	DISCHARGE TEMPERATURE (°F)
Jan.	60.4
Feb.	61.1
Mar.	66.0
Apr.	73.0
May	78.5
June	84.0
July	87.0
Aug.	86.5
Sept.	81.7
Oct.	75.3
Nov.	66.0
Dec.	62.0

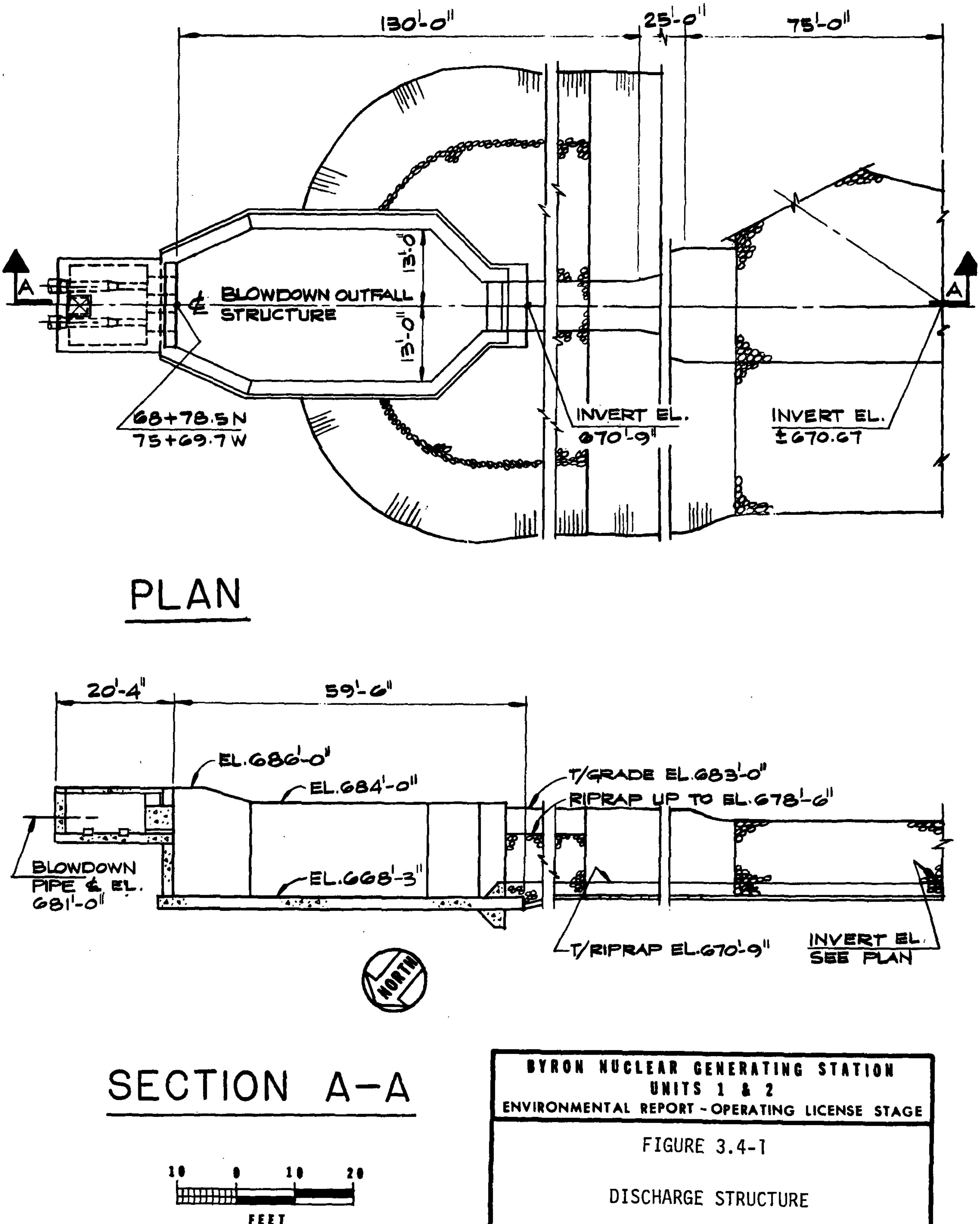

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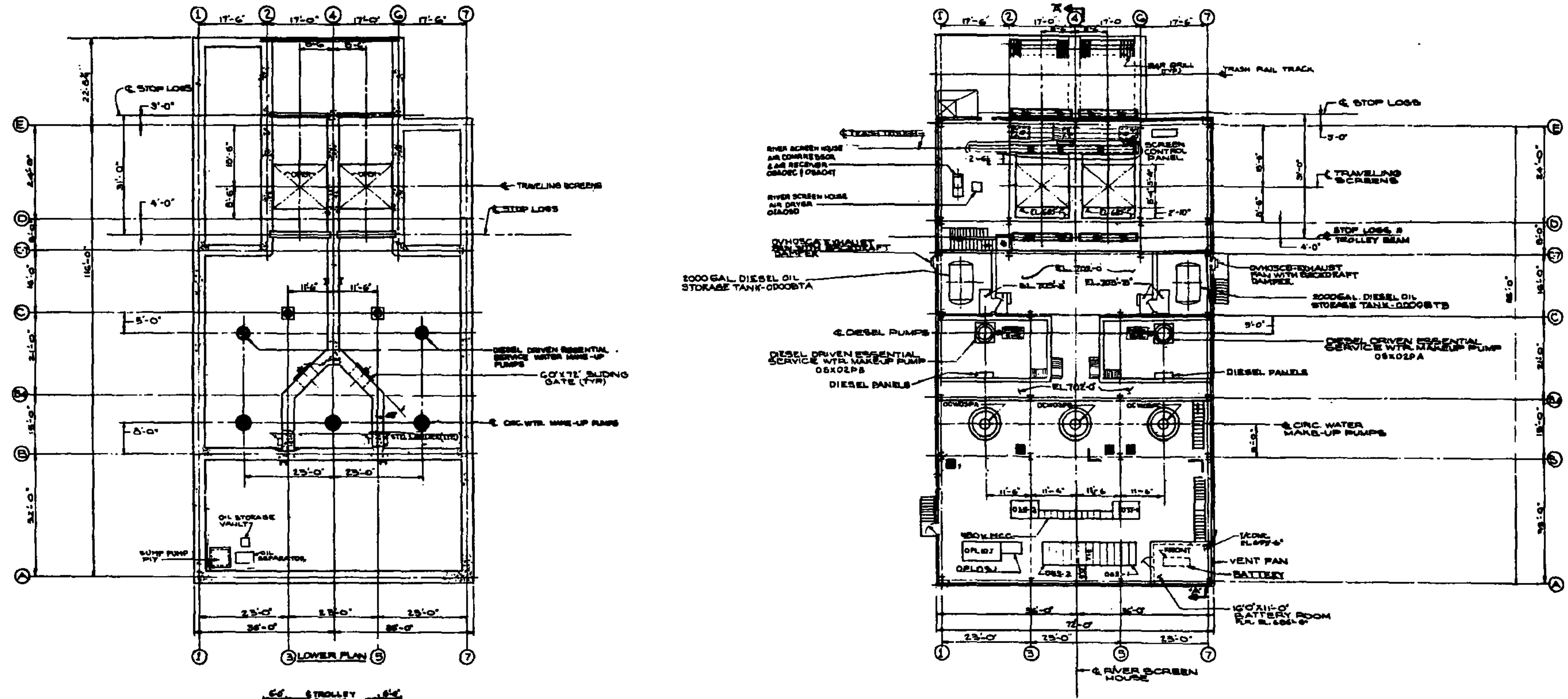
FIGURE 3.4-1

DISCHARGE STRUCTURE



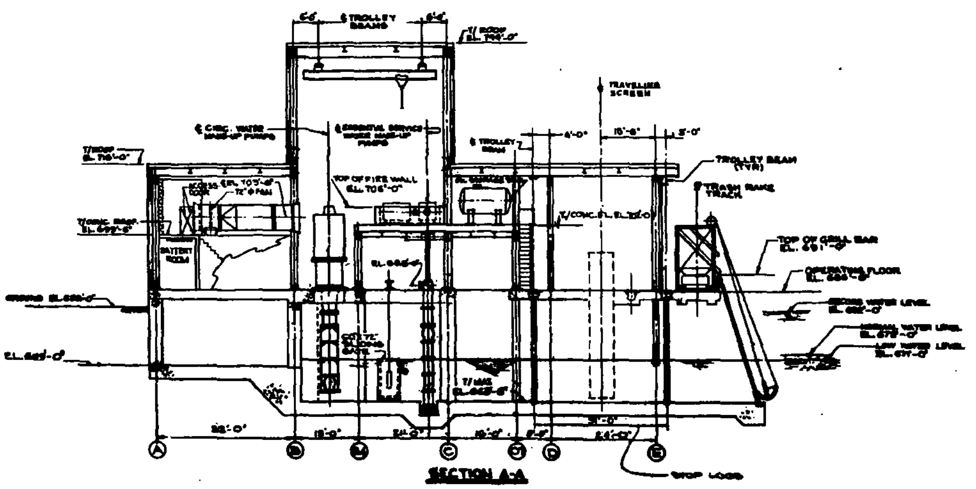


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FIGURE 3.4-2

INTAKE STRUCTURE

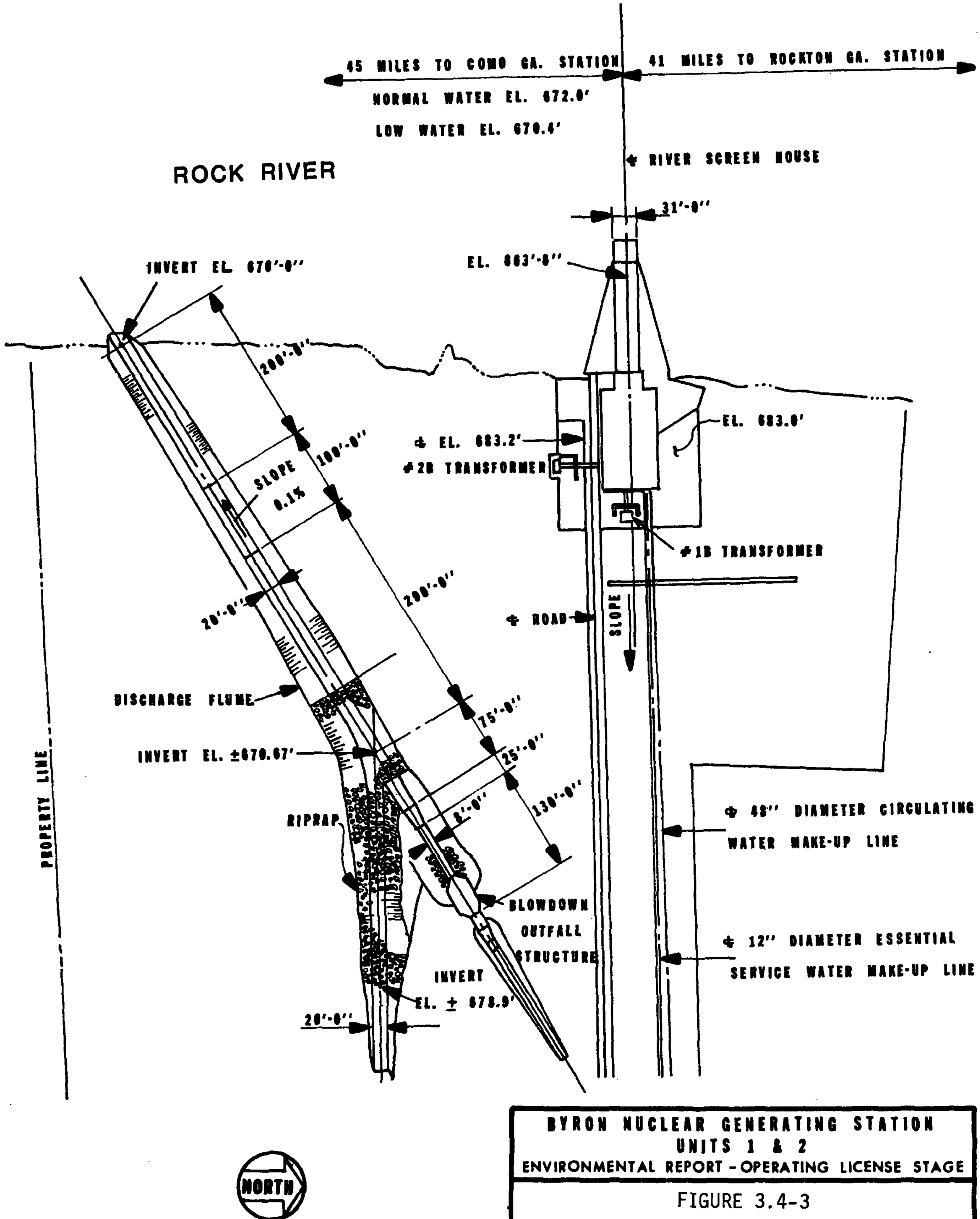

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FIGURE 3.4-3

LOCATION OF INTAKE AND DISCHARGE STRUCTURES

Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-1f **Category: Aquatic**

Statement of Question:

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f. Commonwealth Edison Company. 1981. Byron Station Environmental Report Operating License Stage. Vol. 2. Amendment No. 4. January 1983. [Audit Reference Material]"

i) coversheet
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BYRON STATION

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COMMONWEALTH EDISON COMPANY

BYRON NUCLEAR GENERATING STATION - UNITS 1 & 2

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CONTENTS

CONTENTS (Cont'd)

2.2 ECOLOGY

2.2.1 Aquatic Environment

2.2.1.1 Introduction

The baseline aquatic monitoring program on the Rock River and six creeks in the area (Stillman, Mill, Woodland, Leaf, Spring, and Silver creeks) was initiated by Environmental Analysts, Inc. (EAI) in April 1972 for the Commonwealth Edison Company (CECo). The 1972 through 1973 program was designed to describe the existing Rock River aquatic environment and provide a basis for assessing the impact of construction and operation of the proposed Byron Nuclear Generating Station Units 1 & 2 (Byron Station).

Table 2.2-1 summarizes the physical, chemical, and biological parameters measured during the 1972 through 1973 program. The results and projections of construction impact concluded from the 1972 through 1973 studies are included in the Byron Station Construction Phase Environmental Report (ER-CPS), Subsections 2.7.1, 5.1.1, 5.1.2, and 5.1.3 (Docket Nos. STN 50-454 and STN 50-455).

After the July 1973 field survey, a review was initiated that resulted in the definition of the 1973 through 1974 aquatic monitoring program, which was initiated in September 1973. The purpose of the 1973 through 1974 monitoring program was to provide a second year of data to supplement observations made during the 1972 through 1973 program. Table 2.2-2 summarizes the physical, chemical, and biological parameters measured during the 1973 through 1974 program. Field surveys for the 1973 through 1974 program began on the Rock River and six creeks in the area (Stillman, Mill, Woodland, Leaf, Spring, and Silver creeks) in September 1973 and were conducted through October 1974. The following subsections present the results of the 1973 through 1974 aquatic monitoring program.

2.2.1.2 Objectives

The objectives of the 1973 through 1974 aquatic monitoring program were the following:

a. to continue monitoring chemical and biological parameters, using the sampling stations previously included in the baseline (1972 through 1973) monitoring program;

b. to document the species composition, distribution, and abundance of ecologically important aquatic organisms in the Rock River and several tributary streams;

c. to continue observation of the seasonal trends of the water quality and biota of the study area; and

d. to verify the predicted impact of the Byron Station on the water quality and biota of the Rock River.

2.2.1.3 <u>Location of Sampling Stations</u>

The locations of the sampling stations are shown in Figure 2.2-1. The Rock River was sampled at five stations, which were all transects, from a point 2.4 miles upstream of Byron, Illinois, to just upstream of the dam at Oregon, Illinois. These transects were selected to yield data indicative of conditions in zones of the Rock River that could potentially be influenced by the construction and operation of the Byron Station. The transect areas for this study reflected some of the ranges of habitats between the Oregon and Rockford dams.

River transect R-1 was located 2.4 miles upstream of Byron, Illinois. This station was chosen to represent conditions well above the intake of the proposed station. Transect R-2, chosen to represent conditions in the vicinity of the proposed station's intake structure, was located approximately 300 yards above R-3, the discharge location. Transect R-3, located 4.9 miles downstream from the town of Byron, was chosen to correspond with the discharge area. Transect R-4, located 0.7 mile below R-3, was chosen to include the area within the proposed station's thermal plume. Transect R-5, located about 1000 yards above the dam at Oregon, Illinois, was chosen to represent an area well below the outfall of the proposed station.

In addition to the Rock River sampling stations, sampling sites were established in the mouths of tributary streams leading to the Rock River in the Byron site area. During the 1972 through 1973 program, there were initially nine creek sampling locations: Stillman Creek (S-1); Mill Creek (S-2); Woodland Creek (S-3), (W-1), (W-2), and (W-3); Leaf River (S-4); Spring Creek (S-5); and Silver Creek (S-6). During the 1973 through 1974 program, Stations S-3, S-4, S-5, S-6, W-1, and W-2 were retained.

2.2.1.4 <u>Summary</u>

The following results were based on data obtained from the Rock River and tributary streams near the Byron Station:

a. Changes observed in the chemistry of the Rock River and tributary streams resulted primarily from seasonal changes in temperature, precipitation, and river discharge rates.

b. With the exception of phosphorus and, in one instance, copper, all trace metal concentrations were within the Illinois Pollution Control Board's (IPCB) Water Quality Standards.

c. The levels of algal nutrients in the Rock River were generally high, reflecting the agricultural practices in the surrounding area and the discharges of treated domestic waste further upstream of the Byron Station site.

d. Total bacteria, fecal coliform, and fecal streptococcus for the river stations fluctuated seasonally, with the highest counts occurring in April 1974 and the lowest in October 1974. Stream stations had a more varied response to seasonal changes.

e. Total coliform counts for the river stations exceeded the federal recommended level of 10,000 per 10 milliliters of sample on four of the six sampling dates.

f. Seasonal fluctuations in fecal streptococcus numbers corresponded closely with the numbers of total bacteria and fecal coliform bacteria at the river stations and the fecal coliform at the stream stations.

g. Diatoms dominated the Rock River phytoplankton community during all the months sampled, composing between 76% and 100% of the total phytoplankton community. Members of five other algal divisions were also present.

h. The highest phytoplankton standing crop values were noted in the September 1973 sampling and the lowest in the January 1974 sampling, which is typical of the seasonality of phytoplankton populations.

i. Many of the dominant phytoplankton species that were present in the Rock River are indicative of eutrophic conditions.

j. Zooplankton populations and species diversity ranged from a low of 2 organisms per liter (at Station R-2) in January 1974 to a high of nearly 50 per liter (at Station R-2) in April 1974.

k. The zooplankton community was dominated by rotifers at the Rock River stations on five of the six sampling occasions and on one of the two periods of sampling in the tributary streams.

l. The periphyton community was dominated by diatoms throughout the study period, constituting between 90% to 100% of the total periphyton community.

m. Periphyton populations ranged from a low of 7 x 10^6 cells/m^2 in March 1974 to a high of 1644 x 10^6 cells/m^2 in September 1974.

n. Benthic organisms collected in the Rock River included dipterans, mayflies, caddisflies, snails, clams, and flatworms. The pollution-tolerant tubificids, however, dominated the benthic invertebrate community.

o. Seven benthic substrate bottom types were described, with coarse gravel collected most often, followed by sand, muck, silt/sand, and muck/sand. Other combinations were collected less frequently.

p. During the 1974 through 1975 study period, 31 species of fish were collected, with carpsuckers, channel catfish, and carp the most numerous.

q. Condition factors, age class information, and length frequency analysis provided no unexpected or abnormal results.

r. The results of the creel survey indicated that the fishermen's highest success rate was in June, followed closely by May and July, with the Oregon dam area being the most popular fishing site.

s. Sixty fish larvae (predominantly from the minnow family) and two fish eggs were collected from the study area.

t. No threatened or endangered fish species was collected.

2.2.1.5 Water Quality

Physical, chemical, and bacteriological parameters were sampled in the Rock River and six creeks in the area (Stillman, Mill, Wooodland, Leaf, Spring, and Silver creeks). The results of the water quality sampling program are described in this subsection with respect to observed seasonal variations, ranges of values, how they compare with the Illinois Pollution Control Board Water Quality Standards (IPCB 1975), and any unusual values or conditions noted during the study period.

2.2.1.5.1 General Physical and Chemical Parameters

Water samples for chemical analysis were collected September 11 and October 16, 1973, and January 28, April 30, July 30, and October 8, 1974, from the mid-channel of five river stations (R-1 through R-5), two tributary streams (S-3 and S-5), and two Woodland Creek pools (W-1 and W-3). Samples were taken from tributary stream Station S-6 only in 1974. All parameters, with the exception of pH, were analyzed in duplicate and averaged. The results are presented in Table 2.2-3. Trace metal analyses are presented in Table 2.2-4. Measurements of physical parameters taken in conjunction with water sample collection are presented in Table 2.2-5.

The changes observed in the chemistry of the Rock River and tributary streams from September 1973 through October 1974 resulted mainly from seasonal changes in temperature, precipitation, and river discharge rates. The chemical parameters analyzed tended to correspond with results of the 1972 through 1973 sampling program (Byron ER-CPS). The concentrations of all parameters were within the Illinois standards (IPCB 1975) with the exception of phosphorus and, in one instance, copper. Nutrient concentrations (nitrate, nitrite, and phosphates) normally followed a fluctuating pattern, with decreasing concentrations generally occurring during the winter months, as was the case for the 1972 through 1973 baseline study.

The section of the Rock River adjacent to the Byron Station and the tributary streams draining this area appeared to be in a state of moderate eutrophication. The chemistries of both the river and tributary streams were similar on most sampling dates with the exception of stream Stations W-1 and W-3. The intermittent nature of the streams appeared to be the major factor affecting the observed differences.

2.2.1.5.2 Bacteria

Samples for bacterial analysis were collected September 11 and October 16, 1973, and January 28, April 30, July 30, and October 8, 1974, from the five Rock River stations (R-1 through R-5) and three tributary stream stations (S-3, S-5, and S-6). Duplicate samples were cultured using three serial dilutions; the counts are presented in Table 2.2-6 as numbers per 100 milliliters of sample.

Total bacteria, fecal coliform, and fecal streptococcus for the Rock River stations fluctuated seasonally, with the highest counts occurring in April 1974 during peak runoff and the lowest counts in October 1974. This relationship was also noted during the 1972 through 1973 baseline study. Similar fluctuations in total coliform counts were observed, but the highest counts occurred in January (1974) rather than April 1974. The stream stations had a more varied response to seasonal changes than the river stations.

Total coliform counts for the river stations exceeded the federal recommended level of 10,000 per 10 milliliters of sample on four of the six sampling dates. Station S-3 exceeded the recommended level four of the six times, whereas Stations S-5 and S-6 exceeded the level two of six times and two of four times, respectively. The lowest counts for all the stations were reported for October 1974 and the next to the lowest on September 11, 1973.

Although the fecal coliform samples collected were too few to allow number comparisons with the Illinois stream standard counts, the samples obtained exceeded the numerical standard in four of the six samples collected for all the river stations and for stream Stations S-3 and S-5. Fecal coliform was analyzed only four times at Station S-6 and exceeded the numerical standard each time. The counts were generally highest in April and lowest in July for all stations except S-5 and S-6, which had their lowest counts in September 1973.

Seasonal fluctuations in fecal streptococcus numbers corresponded closely with total bacteria and fecal coliform bacteria counts in the river stations and fecal coliform counts in the stream stations. To date, there is no Illinois or federal standard for fecal streptococcus.

Fecal coliform to fecal streptococcus ratios (FC:FS) varied appreciably on a seasonal basis. Ratios for the five Rock River stations indicated contributions by domestic wastes. Ratios greater than 4.0, which occurred in September and October 1973, indicated recent pollution by domestic wastes. Ratios between 0.6 and 4.0, which occurred during the remaining sampling dates, also indicated the presence of domestic wastes. A varied response to FC:FS ratios was observed in the stream stations. In most instances, the ratios indicated contamination from domestic sources.

2.2.1.6 Phytoplankton

Phytoplankton samples were collected at river Stations R-2 and R-5 from September 11, 1973, through October 8, 1974, by immersing several 1-liter polypropylene bottles beneath the surface of the water. Phytoplankton samples were collected for the last time at Rock River Transects R-1, R-3, and R-4, and at stream Transects S-3, S-4, and S-5 on September 11, 1973. Table 2.2-7 presents a cumulative taxonomic list of the organisms collected during the 1973 through 1974 study. A summary of the average numbers of species per milliliter and the relative abundance by major groups for each sampling period is given in Table 2.2-8. Species-diversity values for the phytoplankton community are listed in Table 2.2-9. These findings are comparable to the range of values found during a corresponding time period during the 1972 through 1973 baseline study.

A total of 118 taxa were identified during the 1973 through 1974 sampling program. These included 59 diatoms, 43 green algae, 9 blue-green algae, 4 euglenoids, 2 pyrrophytes, and 1 cryptophyte.

Numerically, diatoms dominated the community throughout the 1973 through 1974 study, ranging from 76.38% on October 8, 1974, to 100% on January 28, 1974. Dominant forms encountered during the study included Cyclotella meneghiniana, Melosira ambigua, M. granulata, M. granulata var. angustissima, Stephanodiscus hantzschii, S. minutus, S. subtilus, and Nitzschia palea. These forms are commonly found in eutrophic waters.

During the 1973 through 1974 study, standing crop values ranged from 176 cells per milliliter to 18,361 cells per milliliter. The highest standing crop values for phytoplankton were noted in the September 11, 1973, sampling and the lowest in the January 28, 1974, sampling. Variation in the phytoplankton standing crop values between the two river stations was not appreciably large. The data indicated that the phytoplankton community was fairly uniform along this segment of the Rock River.

Relative species-diversity values ranged from 0.2296 at Station R-2 on October 16, 1973, to 0.7567 at R-2 on July 30, 1974 (see Table 2.2-9).

2.2.1.7 Zooplankton

Zooplankton samples were collected on six occasions from September 1973 through October 1974. Samples were taken September 11 and October 16, 1973, from Stations R-1 through R-5 and tributary streams S-4, S-5, and S-6. Samples collected during the remaining periods (January 28, April 30, July 30, and October 8, 1974) were taken only from Rock River Stations R-2 and R-5. Duplicate samples were taken at each location, and each sample was the concentrate of 60 liters of surface water poured through a #20 mesh plankton net. A cumulative taxonomic list of the zooplankton collected from September 1973 through October 1974 is given in Table 2.2-10. Table 2.2-11 summarizes average numbers per liter with relative abundance by major groups for each sampling period. During the 1973 through 1974 program, seasonal trends of zooplankton production at the Rock River sampling locations reflected spring and fall maxima, with low production in the winter and summer. Zooplankton numbers corresponded to numbers encountered during the 1972 through 1973 baseline study.

Total zooplankton numbers throughout the study (on river stations) ranged from a low of 2 organisms per liter for Station R-2 on January 28, 1974, to a high of nearly 350 per liter for Station R-2 on April 30, 1974. The taxonomic composition of zooplankton collected during the study included 3 copepod species, 7 cladoceran species, 14 protozoa genera, and 18 rotifer genera.

Rotifers were the numerically dominant taxa in the Rock River stations on five of the six sampling occasions and on one of the two periods in the stream sampling during the 1973 through 1974 program. Rotifers were also the most numerous organisms encountered during the 1972 through 1973 baseline study. The most commonly occurring forms included the juvenile copepod stages (nauplii and copepodites), the cladocerans Bosmina and Chydorus, and the rotifer genera Brachionus, Keratella, and Synchaeta.

There were no noticeable differences in either the zooplankton composition or numbers between Station R-2 at the proposed outfall area and the other Rock River sampling stations.

2.2.1.8 Periphyton

Artificial substrate samplers were used to sample the periphyton community at five river stations (R-1 through R-5), three tributary stream stations (S-3, S-4, and S-5 from September through December 1973, and S-3, S-5, and S-6 from January through September 1974), and two Woodland Creek pool stations (W-1 and W-2) from September 1973 through September 1974. Table 2.2-12 is a cumulative taxonomic listing of algae identified in the periphyton samples collected.

Analyses included species composition, relative abundance, biovolume, biomass, and numbers per unit area. The periphyton data collected during the 1973 through 1974 monitoring program did not deviate markedly from the information collected during the corresponding seasons of the 1972 through 1973 baseline study.

A total of 266 algae taxa were identified from the September 1973 through September 1974 samples. These included 181 diatoms, 64 green algae, 1 chrysophyte, 12 blue-green algae, 7 euglenoids, and 1 pyrrophyte. Throughout the 1973 through 1974 sampling program, the community was dominated by diatoms, which constituted 90% to 100% of the total units counted. Numerically, diatom lows in the river ranged from 7.15 x 10^6 cells/m^2 on March 29, 1974, to 1644.53 x 10^6 cells/m^2 on September 27, 1974 The dominant diatom forms during the 1973 through 1974 program included Melosira ambiqua, Melosira granulata var. angustissima, Nitzschia linearis, Navicula viridula var. avenacea, Gomphonema olivaceum, and Gomphonema parvulum, all of which are commonly found in eutrophic waters.

2.2.1.9 Benthos

2.2.1.9.1 Ponar Dredge Samples

Benthos samples were collected on September 5 and October 19, 1973, and on February 1, April 10, July 24, and October 28, 1974, from Rock River Transects R-1 through R-5 and tributary stream Stations S-3, S-5, W-1, and W-3.

Table 2.2-13 displays the monthly distribution of benthic taxa by major invertebrate groups. The benthcs collected during the period of September 1973 through October 1974 were separated into approximately 101 taxa from five invertebrate phyla (see Table 2.2-14). Tubificidae (aquatic worms) were separated into 13 species, Naididae (aquatic worms) into 2 species, and Hirudinea (leeches) into 2 species. Chironomidae (midgeflies) were separated into 32 genera, other Diptera (true flies) into 7 families, Ephemeroptera (mayflies) into 7 genera, and Trichoptera (caddisflies) and Odonata (dragonflies) into 5 genera each. Coleoptera (beetles) were separated into 9 genera within 3 families, Crustacea into 3 orders, and Mollusca into 2 classes (Gastropoda [snails] with 5 genera and Pelecypoda [clams] with 4 genera). Other organisms collected included Turbellaria (flatworms), Nematoda (roundworms), and Acari (water mites).

Samples studied for benthic substrate characteristics revealed eight bottom types collected during the 6 sampling months. Table 2.2-14 depicts the distribution of benthic taxa by date and substrate type. Samples containing coarse gravel (cGr) supported the greatest number of invertebrate taxa (93). Samples containing sand (sd) supported the next highest (77 taxa), followed by fine gravel (fGr; 43 taxa), silt (St; 40 taxa), muck (Mk; 40 taxa) fine rubble (FR; 17 taxa), detritus (D; 11 taxa), and mollusk shells (3 taxa). The bottom type definitions were adapted from Lagler (1956) (see Table 2.2-15). Table 2.2-16 shows the occurrence of substrate type combinations in benthos samples collected from September 1973 through October 1974. Coarse gravel was collected most often (55 times), followed by sand, muck, silt/sand, and muck/sand. Other combinations were collected less frequently.

2.2.1.9.2 Artificial Substrate Samples

Macroinvertebrate samples were collected on September 26, October 25, November 28, and December 27, 1973, and on January 28, February 28, March 29, April 24, May 31, June 27, July 31, and September 3, 1974. Modified Hester-Dendy multiplate samplers were used in assessing the macroinvertebrate drift community structure. Two steel plates, each holding five multiplate samples, were positioned on the bottom of each side of Transects R-2, R-3, and R-4.

The macroinvertebrates collected during the period of September 1973 through September 1974 in artificial substrate samples were separated into approximately 115 taxa from 4 invertebrate phyla (see Table 2.2-17). Tubificidae (aquatic worms) were separated into 12 species, Naididae (aquatic worms) into 7 species, and Hirudinea (leeches) into 4 species. Crustacea were separated into 4 taxa, Ephemeroptera (mayflies) into 16 taxa, Trichoptera (caddisflies) into 5 genera, Chironomidae (midgeflies) into 33 genera, and other Diptera (true flies) into 4 taxa. Coleoptera (beetles) and Odonata (dragonflies) were separated into 7 genera each, Plecoptera (stoneflies) into 5 species, Gastropoda (snails) into 4 genera, and Pelecypoda (clams) into 1 genus. Turbelleria (flatworms), Hemiptera (true bugs), and Acari (water mites) were among the other organisms collected. Table 2.2-18 displays the monthly distribution of macroinvertebrate taxa listed by major invertebrate groups.

A comparison of the numerical distributions, by taxa, of macroinvertebrates collected from September 1973 to September 1974 is given in Table 2.2-19, which also presents the total numerical occurrence for the entire sampling period. Diptera accounted for the largest number of organisms collected (4868), followed by Ephemeroptera (4244) and Oligochaeta (2120). On a per-month basis, however, Oligochaeta was the most abundant group, occurring in greatest numbers during 6 of the 12 months sampled: October, November, and December 1973, and January, April, and June 1974. Ephemeroptera, the second most abundant group reported during the study period, was found to be the most abundant group during February, May, and July 1974. Diptera, the third most abundant group, was numerically dominant in September 1973 and in March and September 1974. Odonata was found sporadically. In February 1974, Ephemeroptera and Oligochaeta were collected the most often. Fifteen Plecoptera (stoneflies) were found in the March samples and thirty were present in the April samples.

2.2.1.10 Fish

Results of the fish sampling by all methods from September 12, 1973, through November 1, 1974, are presented in Table 2.2-20. A total of 31 species, representing 8 families of fish, were collected during the 1973 through 1974 monitoring program, compared with a total of 42 species collected during the 1972 through 1973 baseline study.

Carpsuckers (Carpiodes sp.) were the predominant species collected during the 1973 through 1974 program, accounting for 40.3% of the total number of fish collected. Channel catfish (Ictalurus punctatus), most of which were collected by hoop nets, accounted for 19.1% of the total catch, and carp (Cyprinus carpio) accounted for 13.0%.

The greatest differences between the 1973 through 1974 monitoring program collections and the 1972 through 1973 baseline study were the greater numbers and relative abundance of channel catfish collected during the 1973 through 1974 program and the greater variety of minnows (Pimephales sp.), catfishes, and sunfishes (Lepomis sp.) collected during the 1972 through 1973 study.

Commercial fish accounted for 62.4% of the total number of fish collected during the 1973 through 1974 monitoring program (see Table 2.2-21). The classification of species into commercial, game, and forage types followed a classification of Illinois species presented by Lopinot (1968). Commercial fishing is restricted on the Rock River. The river is divided into five sections by the Illinois Department of Conservation, and only one commercial fisherman of partnership receives approval to fish in a section.

Of the 31 species of fish collected in the 1973 through 1974 sampling program, 14 were game species. Although game fish accounted for over 30% of the total number of fish collected, 62% of the game fish (or 19% of the total number of all the species caught) were channel catfish. The composition of fish samples taken from river Stations R-2, R-3, and R-4 did not differ substantially by station in numbers of either species or fish. The percentage of forage fish in samples from river Stations R-1 through R-5 was only 7.6% during the 1973 through 1974 monitoring program, as compared with 47.8% forage fish reported in the 1972 through 1973 baseline study. The decrease in the relative abundance of forage fish was due in part to a decrease in seining effort at a variety of shallow areas and to the increase in the relative abundance of channel catfish in the 1974 river samples that resulted from the addition of hoop netting to the sampling program.

Station S-3 samples were composed of a greater number of species, particularly game species, than any other stream station samples. Most of the species collected from the stream stations were also collected from the river stations (see Table 2.2-20) because the stream stations were close to the river and the tributary mouth areas are used by many river species for feeding, spawning, and protection from river currents. Only two species, the sand shiner (Notropis stramineus) and the hog sucker (Hypentelium nigricans), were collected exclusively at stream stations. Both of these species also occurred in the main river, however, as observed during the 1972 through 1973 baseline study.

Seasonal changes in the distribution of fish within the study area may be indicated by the sampling results; however, daily fish movements due to weather and river flow conditions would also influence sample size and composition. Since all fish sampling was conducted in shoreline areas, the absence or decline in the number of a fish species may be attributable either to local movements from shallow to deep water or to movements to upstream or downstream areas of the river for purposes such as spawning or feeding. Carp and carpsuckers were generally present at the sampling stations throughout the 1973 through 1974 study. Game fish, other than channel catfish, were not collected in sufficient numbers to indicate seasonal changes in distribution. Channel catfish appeared to inhabit deeper mid-channel areas of the river during the cooler months and to inhabit shoreline areas or the entire river during the warmer months, as indicated by the catfish catches per unit effort shown in Table 2.2-22.

Condition factors (K) were determined for individuals of 14 species of game fish (including catfishes) collected from the river and stream stations from September 12, 1973, through November 1, 1974. To present the data, K values were reported by season and by the total length range for each species (see Table 2.2-23). The low numbers of fish collected within each season and the length range for most species made valid interpretations of condition factor data difficult. During the spawning season (March and April), more variability in condition factors would be expected within each length group because of probable groupings of gravid males and females, and gravid males and spent fish. In most length groups, catfish collected in March and April 1974 had the greatest range in K values for all months represented (see Table 2.2-23). Available literature on condition factors of channel catfish is conflicting with regard to sex differences and seasonal differences (Carlander 1969). Differences in reported data appeared to be caused by a variety of ecological conditions, including food availability and the standing crop of fish. In the Rock River, mean K values for channel catfish were higher in October and November 1974 than in September and October 1973. Seasonal trends in mean K values were not indicated for channel catfish collected in this study.

Other fish species were not collected in sufficient numbers to allow for a discussion of the condition of the fish; however, the range, mean, and standard deviation of K values for all the game fish collected were calculated; these appear in Table 2.2-23.

The ages of 237 fish of 10 game species (including channel catfish) were determined from annular rings on scales, or in the case of channel catfish, on cross sections of pectoral spines. All the fish were collected from January 21 through November 1, 1974. For each determination, January 1 was assumed to be the beginning of each age class. The roman numerals in Table 2.2-24 indicate the number of winters the fish had passed through. A sufficient number of channel catfish were collected and aged to allow for the construction of length-frequency graphs for each collection period (see Figures 2.2-2 through 2.2-6). The total length ranges of each determined age group were superimposed on the length-frequency graphs. The results may be compared with the total length-age group data for each species as reported in published literature; these data are presented in Table 2.2-25.

The average lengths of channel catfish at calculated age groups (see Table 2.2-24) were slightly greater than those reported by Appelget and Smith (1951) for channel catfish collected in the vicinity of Lansing, Iowa (see Table 2.2-25). Although the channel catfish collected from the Rock River appeared to have a relatively fast growth rate, the oldest catfish collected was in age group IV and the maximum catfish total length was 38.5 centimeters. The greatest number of age group IV catfish were collected in April 1974. Age group II catfish predominated in the July 1974 samples. Age group 0 catfish (larvae catfish), as well as young-of-the-year (less than 1 year old) of other species, were probably not collected because the hoop-net mesh size was too large to retain them. Length-frequency and age data for nine game species other than channel catfish are also presented in Table 2.2-24.

2.2.1.10.1 Creel Survey

A creel survey was conducted along both sides of the Rock River between Byron and Oregon, Illinois, from May 5 through September 28, 1974. Figure 2.2-7 shows the fishing sites that were surveyed. The survey area was covered 5 days per week during June, July, and August 1974, and 2 days per week during May and September 1974. During these periods, 965 anglers were interviewed (see Table 2.2-26). Based on data presented in Table 2.2-26, 0.204 fish were caught per rod-hour of fishing. This catch rate is one-half that determined during the 1972 through 1973 baseline study, when creels were surveyed along the same stretch of river from August 19 through September 16, 1972, and from March 28 through August 31, 1973. During the 1974 survey, the highest success rate was in June, followed closely by May and July (see Table 2.2-27). Over one-third of the total 3980 rod-hours were reported for August even though fishing success was relatively low during that month. The most heavily fished sites in the survey area were below the dam at Oregon and near the mouth of Mud Creek (see Table 2.2-28). Success rates varied considerably along the river. The Woodland Creek mouth area had the highest fishing success rate although it represented only 0.4% of the total number of rod-hours included in the survey. Sites that were both relatively heavily fished and had high catch rates were all located either just above or below the Oregon dam. The Oregon dam area was also a popular fishing site during the 1972 through 1973 baseline survey (it represented 67.9% of the total number of rod-hours).

Table 2.2-29 lists the fish species caught by fishermen surveyed during the 1974 creel survey. Eight species reported during the 1972 through 1973 baseline creel survey were not reported in 1974. Of those listed in Table 2.2-29, the redear sunfish (Lepomis microlophus), black crappie (Pomoxix nigromaculatus) white bass (Morone chrysops), yellow bass (M. mississippiensis), walleye (Stizostedion vitreum), hog sucker (Hypentelium nigricans), mooneye (Hiodon tergisus), and American eel (Anguilla rostrata) were not reported during the 1972 through 1973 baseline creel survey. The redear sunfish, mooneye, and American eel were not collected by sampling methods in either the 1972 through 1973 baseline study or the 1973 through 1974 monitoring study. The mooneye and American eel were present in fish collections taken from the Rock River from 1961 to 1969 (Rock 1969). The American eel however, is reported to exist there only as an oddity. The redear sunfish occurs sporadically in southern and central Illinois, mostly through human introduction (Smith 1965). It is suspected, therefore, that this species has been similarly introduced to the Rock River system. Channel catfish and carp were predominant fish in the creels, accounting for 35.8% and 32.3% of the catch, respectively (see Table 2.2-30). Suckers, yellow bullhead (Ictalurus natalis), and bluegill (Lepomis macrochirus) were also important sport fish, based on the 1973 through 1974 survey. The order of abundance of fish species for this survey was very similar to the results of the 1972 through

1973 baseline survey. Most species were caught in greatest numbers near the Oregon dam, although catfish, carp, sucker, bullhead (Ictalurus natalis), buffalos (Ictiobus bubalus), and sunfish were also relatively abundant in the Mud Creek mouth area (see Table 2.2-31). Buffalo were not caught in the area immediately above or below the Oregon dam. The total lengths for each species (or closely related species) caught by fishermen were within the same length ranges as those of the fish collected during the quarterly biological sampling program (see Table 2.2-32). Very few channel catfish over 38.1 centimeters were present either in creels or in quarterly samples. Catfish were by far the most preferred species by fishermen (see Table 2.2-26).

2.2.1.10.2 Eggs and Larvae

Fish eggs and larvae were sampled monthly at Stations R-1 through R-5, S-3, S-5, and S-6 from April 23 through July 3, 1974. The results of each sampling are presented in Table 2.2-33. Sixty fish larvae (see Table 2.2-34) and two fish eggs were collected from the study area. The predominant larvae collected belonged to the minnow family. Carp accounted for 40% of the total number of larvae collected. In addition to minnows, fish larvae included white suckers (Catostomus commersoni), sunfish, temperate bass (Morone sp.), and log perch (Percina caprodes). The presence of a high relative abundance of carp larvae in the samples was probably a result of the large number of eggs that each mature female is capable of depositing and the spawning habits of carp. Fish larvae samples indicated that carp larvae did not enter the drift component of the river biota in 1974 until after the May 15 sampling. Although Rock (1969) listed the log perch as occurring in the Rock River, based on collections made between 1961 and 1969, adult log perch were not collected in either the 1972 through 1973 baseline study or the 1973 through 1974 monitoring program. The higher numbers of larvae collected at the river Stations R-2, R-3, and R-4 may reflect the greater amount of water filtered at those stations or the presence of suitable spawning sites upstream of these stations. Several emergent and submergent weed beds were present in the section of the river just upstream of Station R-2. In addition, three tributaries enter the river between the Byron Station and Station R-2. Many species of fish require or prefer weedbed areas or tributaries for spawning.

2.2.2 Terrestrial Environment

2.2.2.1 Introduction

Although a detailed study of food habits, trophic relationships, and energy flow patterns was not part of the monitoring study, generalized food webs were constructed based on site-specific faunal data gathered from the baseline survey and the monitoring study to date. Two such food webs, for forest and meadow habitats during the growing season, were constructed for

TABLE 2.2-1

SUMMARY OF THE 1972-1973 AQUATIC ECOLOGICAL BASELINE SURVEY PROGRAM

BIOLOGICAL PARAMETERS	SAMPLING FREQUENCY	SAMPLING METHOD	ANALYSES	SAMPLING LOCATION	ANCILLARY PHYSICAL AND CHEMICAL MEASUREMENTS
Phytoplankton	Twice monthly	Midriver dip sample, 2 liter sample volume	Species composition, relative abundance, biovolume, biomass	Five river transects and near the mouths of 6 streams	Velocity and depths
Zooplankton	Twice monthly	Straining 60 liters through #20 mesh net	Species composition, relative abundance, total counts	Five river transects and near the mouths of 6 streams	Velocity and depths
Benthic Invertebrates	Every other month	Ponar dredge in river, Eckman dredge in streams	Species composition, relative abundance; diversity indices will be computed, biomass -- dry-weight	On each river transect 4 samples midriver and 4 samples 25 yards off each bank; two samples near each stream mouth	Velocity, depth, and bottom type
Periphyton	Twice monthly	Diatometers, Ruth Patrick design, Charles Reimer design drain tiles, substrates	Species composition, relative abundance, biomass, biovolume/unit area; emphasis will be on diatoms; biovolume will be converted to biomass	One 10-slide sampler on 2 locations on transects 1, 3, and 5; one 10-slide diatometer near mouth of 6 streams; 3 slides per sampler will be examined. Two drain tiles per transect and 1 near 6 stream mouths will be placed in August. Three areas on each substrate equal to areas on slides will be examined	Light penetration, velocity, depth of diatometer
Fish: Direct Sampling	May 1972 to July 1973 10 electrofishing surveys	Electrofishing, seining	Species composition, length-weights, relative abundance, catch per unit effort, and food habits of the 5 most important species (10 fish per species totaling 50 fish)	Surveys are made along the shoreline of each transect	Temperature, velocity, secchi readings, general habitats described

TABLE 2.2-1 (Cont'd)

BIOLOGICAL PARAMETERS	SAMPLING FREQUENCY	SAMPLING METHOD	ANALYSES	SAMPLING LOCATION	ANCILLARY PHYSICAL AND CHEMICAL MEASUREMENTS
Fish Eggs and Larvae	Net tows as of June 13, 1972. Prior to that period 60 liter dip samples collected for zooplankton were examined	15 minute net tows and 60 liter dip samples	Total counts for eggs and larvae-counts per units of volume of water	Midriver tow at midriver on transects 1, 2, 3, 4 and 5	Velocity and depth
Emergent Aquatic Vascular Plants	Throughout study period	Weedbeds were mapped and acreages determined; beds were photographed.	Species composition, relative abundance	Throughout river study area	Depth
Bacteria	Monthly, fecal strep counts initiated in August 1972; fecal coliforms initiated December 1972	Standard methods	Coliform counts, total counts and fecal streptococcus counts	One midriver dip sample on each transect, 1 dip sample near mouth of 6 streams	Standard water chemistry measurement
Fish:					
Creel Census	Continuous since late August 1972	Fishermen interviews while other work is being done	Species composition, catch per unit rod hour, lengths and weights of fish caught	Throughout study area	None
Fish Diseases: Bacterial Infections	Sampling during fish die-off	Trypticase soy agar plates	Presence of systemic infections will be assessed by streaking of tissue on TSA.	If dieoffs occur or if fish collected during the study appear to be diseased, tests will be performed.	None
Fish Diseases: Ectoparasitic Infections	Sample from fish collected by electrofishing	Examination of gills	Microscopic examination of gills, counts per gill arch; incidence will be compared to levels associated with disease problems.	Adult fish collected by electrofishing on river transects will be examined. For the 5 most important species, 10 fish per species totaling 50 fish will be examined.	None

TABLE 2.2-2

SUMMARY OF THE 1973-1974 AQUATIC MONITORING PROGRAM

PARAMETER	LOCATION	FREQUENCY 1973	FREQUENCY 1974
Phytoplankton & Zooplankton			
Quantitative	R-1 through R-5, S-3, S-4, and S-5	September and October	January, April July, and October
Quantitative	R-1 through R-5, S-3, S-4, and S-5		Bi-Weekly, June through September
Periphyton	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Diatometers	R-2, R-3, R-4		January, March, May, July, September, and November
Benthos	R-1 through R-5 S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Artificial Substrates	R-2, R-3, and R-4	Monthly, beginning in September	Monthly, January to August
Fish	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Fish Eggs and Larvae	R-1 through R-5, S-3, S-4 and S-5		April, May, June, and July
Fish Creel Census	Study Area		May through September
Bacteria	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Fish Muscle and Liver Tissue	R-1 through R-5, S-3, S-4, S-5, W-1 and W-3	October	April and October
Water Chemistry (22 parameters)	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Quality Control Analyses	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	October	July
Diurnal Dissolved Oxygen	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3		May, July, and September
Trace Metals (Cd, CO, Fe, Cu, Hg, Zn, Pb, Cr)	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Physical Parameters (Temperature, current velocity, turbidity, depth, light penetration, transparency)	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October

TABLE 2.2-3

CUMULATIVE CHEMISTRY DATA

(All Values are in mg/liter Unless Otherwise Noted)

SAMPLING LOCATION: ROCK RIVER STATION R-1

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	19.0	66.2	8.6	92	0.6	8.62	573	32.0	280	285.4	0.92	6.9	30.0	28.4
16 Oct 73	15.0	59.0	9.8	92	2.1	8.04	405	33.0	266	349.6	0.68	8.1	29.0	40.0
28 Jan 74	1.0	33.8	12.5	88	7.0	7.51	274	39.0	164	198.7	0.55	8.8	26.5	30.0
30 Apr 74	15.5	59.9	9.1	90	3.6	8.20	404	32.0	216	252.7	0.50	4.6	28.0	40.0
30 Jul 74	22.5	72.5	8.2	84	4.4	8.29	521	34.0	194	285.8	0.48	6.1	34.5	29.2
8 Oct 74	12.0	53.6	10.9	100	2.8	8.21	492	12.0	150	301.6	0.67	6.1	33.0	28.0

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	4.17	0.12	0.03	<0.03	0.20	26.0	75	196	229	57.8	34.2	14.0	63
16 Oct 73	2.98	0.18	0.16	<0.03	1.46	31.8	194	159	144	70.8	41.9	12.2	112
28 Jan 74	2.70	0.12	0.66	0.04	1.62	36.7	226	254	166	44.7	21.1	8.5	31
30 Apr 74	3.73	0.15	0.66	0.05	1.07	32.0	234	208	128	50.0	31.0	7.3	45
30 Jul 74	1.28	0.10	0.06	0.03	0.87	20.0	94	366	62	55.0	36.0	11.1	36
8 Oct 74	1.54	0.11	<0.03	<0.03	1.00	21.6	30	205	178	58.0	38.0	11.9	16

Note: Abbreviations used in this table are as follows: CONC = Concentration; SAT = Saturation; BOD = Biological Oxygen Demand; JTU = Jackson Turbidity Units; ALK = Alkalinity; APHA = American Public Health Association; TOC = Total Organic Carbon.

[a] Mean of two determinations.

[b] Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: ROCK RIVER STATION R-2

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	20.0	68.0	8.7	95	1.4	8.63	572	26.0	281	286.3	0.86	6.5	30.0	28.6
16 Oct 73	14.5	58.1	9.4	91	2.9	8.02	429	27.0	262	353.2	0.74	8.4	29.0	25.6
28 Jan 74	1.0	33.8	12.3	86	6.1	7.54	276	46.0	164	194.0	0.57	8.8	26.5	27.8
30 Apr 74	15.5	59.9	9.0	90	3.0	8.20	434	35.0	216	252.7	0.45	4.3	32.0	42.8
30 Jul 74	23.0	73.4	7.8	90	4.0	8.28	540	32.5	184	240.8	0.54	9.1	33.0	30.0
8 Oct 74	13.0	55.4	10.4	98	2.0	8.21	493	11.5	138	323.6	0.66	6.2	30.5	28.0

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	2.66	0.08	<0.03	<0.03	0.20	24.0	51	200	231	58.3	34.1	14.0	51
16 Oct 73	3.62	0.21	0.13	<0.03	1.52	30.9	180	154	200	72.7	41.6	12.4	98
28 Jan 74	2.98	0.12	0.67	0.03	1.61	39.0	289	196	175	44.8	19.9	8.2	29
30 Apr 74	3.53	0.14	0.44	0.05	1.04	34.5	248	214	148	50.0	31.0	7.2	37
30 Jul 74	2.44	0.12	0.05	<0.03	0.95	17.0	88	324	66	57.0	36.0	12.2	37
8 Oct 74	1.62	0.11	<0.03	<0.03	<0.94	19.1	21	196	198	66.0	38.5	13.9	19

[a]Mean of two determinations.

[b]Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: ROCK RIVER STATION R-3

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	20.0	68.0	8.5	93	1.5	8.67	580	30.0	280	289.5	0.92	6.6	31.5	27.2
16 Oct 73	14.5	58.1	9.4	91	2.9	8.02	451	28.0	253	355.7	0.70	8.7	26.5	53.6
28 Jan 74	1.0	33.8	12.4	86	5.2	7.56	281	48.0	158	192.5	0.52	8.7	26.0	27.8
30 Apr 74	15.5	59.9	8.8	87	4.2	8.17	432	33.0	216	255.2	0.51	4.4	30.5	42.8
30 Jul 74	23.0	73.4	7.8	90	3.6	8.29	530	26.0	184	306.6	0.50	7.9	34.0	28.8
8 Oct 74	13.0	55.4	10.5	99	2.1	8.22	498	12.0	137	318.2	0.67	6.3	29.5	28.4

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	4.41	0.14	<0.03	<0.03	0.18	27.0	72	170	244	58.6	34.7	14.0	49
16 Oct 73	3.65	0.17	0.15	<0.03	1.50	38.0	154	151	207	75.5	40.5	12.3	74
28 Jan 74	3.26	0.12	0.58	<0.03	1.61	39.6	283	224	164	44.2	19.9	8.2	31
30 Apr 74	3.80	0.14	0.45	0.04	1.10	34.7	238	220	130	51.0	31.0	7.2	36
30 Jul 74	2.37	0.13	0.06	0.03	0.91	17.0	68	287	70	60.0	38.0	12.1	37
8 Oct 74	2.15	0.12	<0.03	<0.03	0.94	19.0	22	200	193	63.0	39.0	12.1	19

[a]Mean of two determinations.

[b]Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: ROCK RIVER STATION R-4

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	20.5	68.9	8.7	96	1.2	8.69	575	26.0	284	287.9	0.87	6.3	32.0	28.4
16 Oct 73	14.5	58.1	9.2	89	1.9	7.94	451	26.5	259	359.2	0.67	8.7	26.0	47.6
28 Jan 74	1.0	33.8	12.3	86	5.0	7.62	286	53.0	160	187.5	0.54	8.7	26.0	27.4
30 Apr 74	15.5	59.9	8.6	86	4.2	8.15	439	30.0	216	200.5	0.80	4.6	30.0	46.0
30 Jul 74	23.0	73.4	7.9	91	5.0	8.28	534	24.5	194	299.1	0.53	6.6	34.0	27.2
8 Oct 74	13.0	55.4	10.4	98	1.8	8.29	501	12.5	143	319.5	0.66	6.5	33.0	23.2

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	3.38	0.12	0.03	<0.03	0.20	28.5	63.0	174	269	58.8	34.2	13.9	54
16 Oct 73	3.63	0.20	0.14	0.03	1.47	38.8	112	153	209	76.6	40.7	12.4	90
28 Jan 74	2.80	0.12	0.62	0.03	1.60	37.8	216	232	176	43.2	19.3	8.2	23
30 Apr 74	4.07	0.16	0.59	0.04	0.98	29.3	252	224	116	39.0	25.0	6.0	31
30 Jul 74	2.03	0.12	0.06	0.03	0.83	18.4	63.5	264	72	57.0	38.0	11.5	38
8 Oct.74	1.35	0.12	<0.03	<0.03	1.02	18.8	26.0	206	185	66.0	37.5	15.5	15

[a] Mean of two determinations.

[b] Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: ROCK RIVER STATION R-5

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	21.0	69.8	8.6	96	1.6	8.59	571	12.0	281	289.4	0.92	6.4	31.8	27.5
16 Oct 73	14.0	57.2	9.1	87	2.0	8.00	441	30.0	264	361.0	0.71	8.6	30.0	41.8
28 Jan 74	1.0	33.8	12.2	85	6.4	7.64	263	68.0	156	191.2	0.54	8.6	26.0	26.4
30 Apr 74	15.5	59.9	8.9	88	5.1	8.11	438	29.0	216	252.7	0.50	4.6	30.0	47.6
30 Jul 74	24.0	75.2	8.6	101	3.4	8.31	534	23.0	184	294.9	0.54	6.5	32.0	29.6
8 Oct 74	12.5	54.5	10.9	101	2.0	8.27	456	13.8	143	312.0	0.60	5.9	34.5	27.2

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	3.55	0.12	<0.03	<0.03	0.19	36.0	93.5	146	222	58.7	34.6	14.0	56
16 Oct 73	3.78	0.23	0.1	<0.03	1.60	37.2	174	161	213	73.2	43.2	12.4	143
28 Jan 74	2.76	0.12	0.62	<0.03	1.68	43.0	242	202	168	43.7	19.9	7.7	26
30 Apr 74	3.82	0.16	0.69	0.04	1.13	33.5	272	232	140	50.0	31.0	7.1	29
30 Jul 74	2.00	0.15	0.07	<0.03	0.85	19.7	63	316	57	57.0	37.0	11.3	21
8 Oct 74	2.50	0.12	<0.03	<0.03	1.03	19.8	24	202	192	63.0	37.5	13.7	17

[a]Mean of two determinations.
[b]Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: WOODLAND CREEK STATION S-3

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHOPHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	16.0	60.8	9.4	95	1.3	8.40	620	6.2	339	314.4	0.58	11.9	12.0	28.4
16 Oct 73	11.5	52.7	9.3	84	1.6	7.90	466	14.5	326	373.2	0.57	12.1	20.5	48.0
28 Jan 74	2.0	35.6	11.9	85	4.4	7.67	261	43.5	171	170.6	0.52	9.0	21.2	26.8
30 Apr 74	14.5	58.1	9.2	89	3.4	8.14	480	21.0	240	277.6	0.55	6.6	28.2	49.4
30 Jul 74	21.5	70.7	7.9	88	4.6	8.23	532	19.5	190	297.4	0.55	8.1	32.0	34.8
8 Oct 74	12.5	54.5	10.5	97	1.8	8.13	528	21.5	150	330.7	0.66	6.6	38.0	33.2

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	2.70	0.060	<0.03	<0.03	0.08	10.0	7	138	325	65.3	36.7	8.0	55
16 Oct 73	2.70	0.13	0.09	<0.03	1.02	18.3	76	67	216	78.1	43.2	7.0	61
28 Jan 74	2.50	0.10	0.28	<0.03	1.35	31.2	102	186	200	43.7	14.9	5.4	38
30 Apr 74	4.07	0.15	0.39	0.04	0.95	12.4	78	190	204	55.0	34.0	7.1	32
30 Jul 74	2.89	0.18	0.08	0.04	0.86	22.6	44	208	164	58.0	37.0	12.6	25
8 Oct 74	3.21	0.10	0.10	<0.03	1.03	21.6	94	219	183	68.0	39.0	14.5	49

[a]Mean of two determinations.
[b]Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: SPRING CREEK STATION S-5

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	15.0	59.0	9.9	98	1.5	8.30	610	14.0	319	325.3	0.62	10.9	16.0	28.0
16 Oct 73	9.5	49.1	10.6	92	1.5	7.88	442	10.5	302	353.8	0.54	11.3	21.0	38.0
28 Jan 74	3.0	37.4	12.1	89	2.5	7.67	280	47.0	168	201.2	0.52	8.8	22.0	27.8
30 Apr 74	12.0	53.6	10.2	94	1.4	8.05	530	20.0	280	331.4	0.59	8.4	25.0	45.2
30 Jul 74	17.0	62.6	9.6	98	2.0	8.01	526	17.0	196	324.8	0.52	7.2	21.0	29.6
8 Oct 74	10.4	50.8	10.3	91	2.1	7.96	530	12.0	117	366.0	0.56	6.5	20.8	32.0

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	6.94	0.10	<0.03	<0.03	0.09	7.5	56.0	172	286	68.8	37.2	8.1	57
16 Oct 73	3.00	0.10	<0.03	<0.03	0.66	15.0	32	158	258	73.1	41.5	4.2	53
28 Jan 74	2.80	0.10	0.36	<0.03	1.36	26.0	146	130	164	45.7	21.1	6.0	23
30 Apr 74	5.84	0.14	0.36	0.04	0.84	8.8	44	228	208	65.0	41.0	4.4	38
30 Jul 74	1.85	0.08	0.07	0.05	0.72	15.8	71	220	141	64.0	40.0	3.7	38
8 Oct 74	3.20	0.09	0.03	0.03	0.73	14.1	62	244	171	78.0	41.5	4.2	8

[a] Mean of two determinations.
[b] Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: SILVER CREEK STATION S-6

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
28 Jan 74	2.5	36.5	11.9	86	2.8	7.71	318	23.0	220	229.6	0.58	10.70	23.9	28.0
30 Apr 74	13.0	55.4	10.3	97	1.0	8.10	580	18.0	292	343.0	0.60	13.0	24.0	41.6
30 Jul 74	19.0	66.2	9.5	100	0.6	8.08	550	14.5	184	326.4	0.53	10.2	20.5	29.6
8 Oct 74	11.0	51.8	11.1	100	2.2	8.00	541	8.0	136	359.7	0.59	6.5	25.8	35.2

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
28 Jan 74	2.90	0.10	0.39	<0.03	1.35	26.0	84	152	100	54.1	22.9	6.0	28
30 Apr 74	5.78	0.10	0.42	<0.03	0.85	8.0	50	228	242	68.0	42.0	5.2	38
30 Jul 74	3.10	0.13	0.06	<0.03	0.69	21.3	34	210	149	63.0	41.0	5.5	6
8 Oct 74	2.86	0.10	<0.03	<0.03	0.79	19.8	20	253	170	73.0	43.0	6.7	49

[a]Mean of two determinations.
[b]Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: WOODLAND POOL STATION W-1

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	21.0	69.8	10.2	112	1.5	8.36	576	2.8	386	184.2	0.68	15.4	27.0	50.6
16 Oct 73	13.0	55.4	12.2	115	1.8	7.86	595	1.6	352	444.3	0.60	15.3	28.5	84.2
28 Jan 74	4.5	40.1	12.0	92	0.9	7.67	386	6.9	252	286.55	0.53	12.6	21.1	38.6
30 Apr 74	13.0	55.4	15.0	140	1.8	8.16	631	5.0	324	391.9	0.56	8.6	26.25	60.4
30 Jul 74	20.0	68.0	11.5	125	2.8	7.95	616	3.4	207	372.8	0.52	8.2	32.0	47.2
8 Oct 74	9.4	49.0	11.4	100	1.9	7.89	640	1.7	154	442.6	0.59	5.8	29.0	52.0

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	2.90	0.08	0.04	<0.03	0.11	15.0	3.0	310	341	86.4	39.6	3.6	72
16 Oct 73	2.43	0.10	<0.03	<0.03	0.93	13.0	2.0	282	302	89.4	53.6	5.9	108
28 Jan 74	3.43	0.07	0.058	<0.03	1.36	19.2	36.0	198	118	61.9	32.0	6.7	38
30 Apr 74	7.75	0.17	0.34	<0.03	0.76	15.0	4.0	276	246	76.0	49.0	7.6	38
30 Jul 74	4.08	0.23	<0.03	<0.03	0.68	16.2	37.5	248	186.5	70.0	48.0	8.6	41
8 Oct 74	3.26	0.	<0.03	<0.03	0.76	14.5	9.0	260	198	93.0	51.0	4.0	44

[a] Mean of two determinations.
[b] Mean of three determinations.

TABLE 2.2-3 (Cont'd)

SAMPLING LOCATION: WOODLAND POOL STATION W-3

DATE	TEMPERATURE[a] °C	TEMPERATURE[a] °F	DISSOLVED OXYGEN CONC	DISSOLVED OXYGEN % SAT	BOD[a]	pH	CONDUCTIVITY[a] (μmho)	TURBIDITY[a] (JTU)	TOTAL ALK[a] as $CaCO_3$	HARDNESS[a]	ORTHO-PHOSPHATE[a]	SiO_2[a]	CHLORIDE[a] as Cl^-	SO_4[a]
11 Sept 73	21.0	69.8	9.4	104	0.6	8.18	598	4.3	340	339.6	0.63	11.9	11.0	30.0
16 Oct 73	13.0	55.4	11.2	105	1.8	7.82	494	3.3	334	364.4	0.59	13.0	16.0	36.4
28 Jan 74	5.0	41.0	11.1	86	.6	7.66	367	7.6	208	289.8	0.55	12.2	17.0	28.2
30 Apr 74	12.0	53.6	10.8	99	0.8	7.86	582	7.86	316	366.3	0.60	13.0	17.75	37.6
30 Jul 74	16.0	60.8	10.6	106	2.1	7.67	536	2.8	210	314.8	0.52	10.2	17.5	30.4
8 Oct 74	10.0	50.0	10.9	96	1.0	7.50	508	1.8	112	361.0	0.56	8.0	18.2	34.4

DATE	NO_3[a] as N	NO_2[a] as N	NH_4+NH_3[a] as NH_3	NH_3	TOTAL PO_4[a]	COLOR APHA UNITS[a]	SUSPENDED SOLIDS[a]	TOTAL ORGANIC SOLIDS[a]	DISSOLVED SOLIDS[a]	Ca[b]	Mg[b]	Na[b]	TOC
11 Sept 73	1.85	0.10	0.04	<0.03	0.11	12.0	1.5	222	260	73.2	38.0	12.0	51
16 Oct 73	1.25	0.07	<0.03	<0.03	0.83	11.0	10	162	260	76.7	41.9	6.0	67
28 Jan 74	2.05	0.05	0.072	<0.03	1.33	16.8	54	148	126	63.2	32.0	4.5	34
30 Apr 74	6.65	0.04	0.351	<0.03	0.76	12.0	2.0	190	254	74.0	44.0	4.4	39
30 Jul 74	1.00	0.06	<0.03	<0.03	0.67	19.0	11.0	232	85.0	60.0	40.0	4.2	5
8 Oct 74	1.18	0.06	<0.03	<0.03	0.69	16.6	7.0	214	180	76.0	41.5	10.3	18

[a] Mean of two determinations.
[b] Mean of three determinations.

TABLE 2.2-4

TRACE METAL ANALYSIS OF WATER SAMPLES COLLECTED FROM

ROCK RIVER AND TRIBUTARY STREAMS

(All Values in μg/liter or ppb)

	TRACE METALS									
STATION	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
April 30, 1974										
R-1	30.0	<100	10.0	<10.0	60.0	<0.2	20.0	220.0	15.0	<10.0
R-2	40.0	<100	10.0	<10.0	< 50.0	<0.2	20.0	240.0	27.0	<10.0
R-3	30.0	<100	<10.0	<10.0	< 50.0	<0.2	<10.0	230.0	25.0	<10.0
R-4	10.0	<100	<10.0	<10.0	100.0	<0.2	10.0	210.0	19.0	<10.0
R-5	20.0	<100	10.0	<10.0	110.0	<0.2	<10.0	210.0	24.0	<10.0
S-3	30.0	<100	<10.0	<10.0	< 50.0	<0.2	20.0	220.0	25.0	<10.0
S-5	10.0	100	10.0	<10.0	110.0	<0.2	50.2	150.0	15.0	<10.0
S-6	30.0	<100	20.0	<10.0	80.0	<0.2	30.0	140.0	44.0	<10.0
W-1	20.0	<100	10.0	<10.0	110.0	<0.2	30.0	160.0	55.0	<10.0
W-3	30.0	<100	<10.0	<10.0	< 50.0	<0.2	60.0	200.0	25.0	<10.0
July 30, 1974										
R-1	10.0	100.0	30.0	<10.0	< 50.0	<0.2	10.0	190.0	20.0	<10.0
R-2	30.0	100.0	10.0	<10.0	170.0	<0.2	20.0	160.0	19.0	<10.0
R-3	20.0	<100.0	<10.0	<10.0	130.0	<0.2	<10.0	230.0	15.0	<10.0
R-4	20.0	<100.0	<10.0	<10.0	90.0	<0.2	<10.0	180.0	15.0	<10.0
R-5	20.0	<100.0	10.0	<10.0	< 50.0	<0.2	<10.0	200.0	15.0	<10.0
S-3	<10.0	<100.0	10.0	<10.0	< 50.0	<0.2	10.0	240.0	19.0	<10.0
S-5	<10.0	<100.0	<10.0	<10.0	140.0	<0.2	30.0	150.0	19.0	<10.0
S-6	10.0	<100.0	<10.0	<10.0	90.0	<0.2	10.0	160.0	27.0	<10.0
W-1	30.0	100.0	<10.0	<10.0	< 50.0	<0.2	70.0	190.0	19.0	<10.0
W-3	<10.0	<100.0	10.0	<10.0	< 50.0	<0.2	40.0	220.0	15.0	<10.0
October 8, 1974										
R-1	<0.2	<100.0	<10.0	<10.0	260.0	0.2	70.0	200.0	9.0	17.0
R-2	0.4	<100.0	<10.0	<10.0	360.0	<0.2	60.0	240.0	15.0	39.0
R-3	0.2	<100.0	<10.0	20.0	260.0	<0.2	40.0	210.0	6.0	<10.0
R-4	1.3	<100.0	<10.0	90.0	510.0	<0.2	70.0	250.0	12.5	17.0
R-5	0.7	<100.0	<10.0	30.0	370.0	<0.2	90.0	260.0	10.0	11.0
S-3	0.9	<100.0	60.0	<10.0	470.0	<0.2	90.0	200.0	9.0	<10.0
S-5	<0.2	<100.0	<10.0	<10.0	490.0	<0.2	50.0	180.0	9.0	13.0
S-6	0.5	<100.0	<10.0	<10.0	230.0	<0.2	90.0	180.0	10.0	<10.0
W-1	<0.2	100.0	<10.0	<10.0	130.0	<0.2	70.0	210.0	10.0	<10.0
W-3	<0.2	<100.0	<10.0	<10.0	50.0	<0.2	60.0	160.0	6.0	<10.0

TABLE 2.2-5

CUMULATIVE PHYSICAL DATA

DATE	MID-CHANNEL DEPTH (ft)	CURRENT SURFACE VELOCITY (ft/sec)	SECCHI DEPTH[a] (in)	LIGHT PENETRATION DEPTH[a] (in)	
				50%	25%
SAMPLING LOCATION:	ROCK RIVER STATION R-1				
11 Sept 73	7.0	2.75	10.6	18.6	26.0
16 Oct 73	6.6	3.0	9.7	11.7	17.7
28 Jan 74	10.8	2.95	7.7	6.3	12.0
30 Apr 74	9.9	3.47	4.3	6.0	8.0
30 Jul 74	7.0	2.66	9.7	18.3	27.0
8 Oct 74	4.0	2.46	15.0	22.0	35.0
SAMPLING LOCATION:	ROCK RIVER STATION R-2				
11 Sept 73	6.6	1.40	13.0	25.0	34.0
16 Oct 73	9.2	2.00	14.6	18.0	27.0
28 Jan 74	11.4	3.05	6.3	6.0	8.0
30 Apr 74	10.1	2.73	4.0	6.8	9.0
30 Jul 74	12.0	1.05	10.3	24.3	32.0
8 Oct 74	9.0	1.02	16.0	30.0	42.0
SAMPLING LOCATION:	ROCK RIVER STATION R-3				
11 Sept 73	7.6	1.30	13.7	24.0	33.4
16 Oct 73	8.0	2.20	12.3	18.0	26.3
28 Jan 74	14.2	3.58	6.3	5.7	7.7
30 Apr 74	11.0	2.49	4.0	7.7	9.7
30 Jul 74	11.0	1.02	11.7	24.7	34.7
8 Oct 74	12.0	0.82	15.0	35.0	43.0
SAMPLING LOCATION:	ROCK RIVER STATION R-4				
11 Sept 73	8.7	1.30	14.7	24.0	33.7
16 Oct 73	10.3	1.75	14.3	19.0	30.3
28 Jan 74	14.4	3.38	7.7	5.7	8.0
30 Apr 74	12.8	2.73	4.4	6.7	8.4
30 Jul 74	11.0	0.98	11.7	22.7	35.3
8 Oct 74	11.0	0.92	16.0	29.0	38.0
SAMPLING LOCATION:	ROCK RIVER STATION R-5				
11 Sept 73	7.9	1.00	12.0	25.0	34.7
16 Oct 73	7.2	1.70	13.3	18.0	24.0
28 Jan 74	11.4	2.95	5.7	3.3	6.0
30 Apr 74	9.0	2.09	3.8	6.0	8.7
30 Jul 74	10.0	0.85	10.3	24.0	30.0
8 Oct 74	8.0	0.62	14.0	25.0	36.0

[a]Mean of three determinations at mid-channel.

TABLE 2.2-5 (Cont'd)

DATE	MID-CHANNEL DEPTH (ft)	CURRENT SURFACE VELOCITY (ft/sec)	SECCHI DEPTH[a] (in)	LIGHT PENETRATION DEPTH[a] (in) 50%	25%
SAMPLING LOCATION: TRIBUTARY STREAM STATION S-3					
11 Sept 73	0.5	<0.10	c	c	c
16 Oct 73	1.6	<0.10	15.7	12.0	16.0
28 Jan 74	b	b	b	b	b
30 Apr 74	5.1	<0.10	6.3	10.4	12.7
30 Jul 74	4.0	<0.10	12.3	7.3	12.0
8 Oct 74	2.0	<0.10	14.0	23.0	c
SAMPLING LOCATION: TRIBUTARY STREAM STATION S-5					
11 Sept 73	4.0	0.50	14.0	NA[d]	NA
16 Oct 73	2.8	1.00	18.3	e	e
28 Jan 74	7.4	0.13	7.3	5.3	7.0
30 Apr 74	3.9	<0.10	9.7	24.3	Bottom
30 Jul 74	5.0	<0.10	13.0	6.7	10.0
8 Oct 74	1.5	<0.10	16.0	c	c
SAMPLING LOCATION: TRIBUTARY STREAM STATION S-6					
28 Jan 74	7.0	0.10	9.7	7.0	16.7
30 Apr 74	4.2	0.14	9.0	15.7	22.3
30 Jul 74	6.0	<0.10	14.0	25.0	Bottom
8 Oct 74	1.5	<0.10	25.0	c	c
SAMPLING LOCATION: WOODLAND POOL W-1					
11 Sept 73	<0.5	<0.10	c	c	c
16 Oct 73	0.5	0.10	c	c	c
28 Jan 74	0.7	1.50	c	c	c
30 Apr 74	0.7	<0.10	c	c	c
30 Jul 74	0.2	<0.10	c	c	c
8 Oct 74	0.5	<0.10	c	c	c
SAMPLING LOCATION: WOODLAND POOL W-3					
11 Sept 73	<0.5	<0.10	c	c	c
16 Oct 73	0.5	0.10	c	c	c
28 Jan 74	0.5	1.5	c	c	c
30 Apr 74	0.5	0.10	c	c	c
30 Jul 74	0.3	0.10	c	c	c
8 Oct 74	0.4	<0.10	c	c	c

[a] Mean of three determinations at mid-channel.

[b] Physical conditions at time of sampling prevented obtaining data.

[c] Water too shallow to obtain reading.

[d] NA = Not Available.

[e] Stream completely shaded by trees.

TABLE 2.2-6

CUMULATIVE BACTERIA DATA

(Counts Presented as Numbers per 100 milliliters of Sample)

DATE	TOTAL BACTERIA[a]	TOTAL COLIFORM[a]	FECAL STREPTOCOCCUS[a]	FECAL COLIFORM[b]	FC/FS[c]
SAMPLING LOCATION: ROCK RIVER STATION R-1					
11 Sept 73	980,000	1,560	10	78	7.8
16 Oct 73	235,000	19,000	54	1,250	23.2
28 Jan 74	735,000	45,000	605	1,700	2.8
30 Apr 74	1,820,000	27,500	695	3,900	5.6
30 Jul 74	1,290,000	15,500	105	165	1.6
8 Oct 74	10,700	600	80	55	0.7
SAMPLING LOCATION: ROCK RIVER STATION R-2					
11 Sept 73	975,000	3,600	15	1,800	12.0
16 Oct 73	340,000	14,000	109	1,100	10.1
28 Jan 74	800,000	49,500	595	1,300	2.2
30 Apr 74	1,650,000	22,000	765	2,450	3.2
30 Jul 74	1,990,000	16,500	90	125	1.4
8 Oct 74	15,900	1,300	140	195	1.4
SAMPLING LOCATION: ROCK RIVER STATION R-3					
11 Sept 73	1,090,000	4,000	10	200	20.0
16 Oct 73	465,000	14,000	139	1,150	8.3
28 Jan 74	755,000	42,000	755	1,300	1.7
30 Apr 74	2,265,000	34,500	765	2,400	3.1
30 Jul 74	1,150,000	19,500	90	45	0.5
8 Oct 74	18,150	2,200	90	185	2.0
SAMPLING LOCATION: ROCK RIVER STATION R-4					
11 Sept 73	805,000	2,300	10	115	11.5
16 Oct 73	245,000	10,500	99	1,100	11.1
28 Jan 74	820,000	45,500	635	1,750	2.8
30 Apr 74	1,765,000	24,000	850	2,500	2.9
30 Jul 74	1,140,000	12,000	75	105	1.4
8 Oct 74	18,950	2,000	280	1,200	4.3
SAMPLING LOCATION: ROCK RIVER STATION R-5					
11 Sept 73	630,000	880	20	44	2.2
16 Oct 73	350,000	11,500	114	650	5.7
28 Jan 74	765,000	36,500	695	2,100	3.0
30 Apr 74	2,465,000	28,500	1,230	1,450	1.2
30 Jul 74	630,000	7,500	35	55	1.6
8 Oct 74	13,750	3,400	70	605	8.6
SAMPLING LOCATION: TRIBUTARY STREAM STATION S-3					
11 Sept 73	1,150,000	840	570	42	0.07
16 Oct 73	215,000	7,000	167	320	1.9
28 Jan 74	840,000	40,500	810	1,100	1.4
30 Apr 74	910,000	12,000	700	2,250	3.2
30 Jul 74	1,150,000	12,500	190	60	0.3
8 Oct 74	14,400	11,000	310	1,230	4.0
SAMPLING LOCATION: TRIBUTARY STREAM STATION S-5					
11 Sept 73	3,900,000	1,850	490	37	0.08
16 Oct 73	240,000	7,000	335	1,300	3.9
28 Jan 74	580,000	34,500	795	975	1.2
30 Apr 74	2,285,000	10,500	695	2,950	4.2
30 Jul 74	800,000	7,000	1,165	975	0.8
8 Oct 74	7,100	250	260	90	0.3
SAMPLING LOCATION: TRIBUTARY STREAM STATION S-6					
28 Jan 74	355,000	27,500	440	775	1.8
30 Apr 74	1,925,000	51,000	905	2,950	3.3
30 Jul 74	370,000	8,000	1,150	1,585	1.4
9 Oct 74	13,000	5,600	2,300	3,595	1.6

[a] Mean of two determinations.

[b] Mean of two determinations after October 16 sampling.

[c] Fecal Coliform to Fecal Streptococcus ratio.

TABLE 2.2-7

CUMULATIVE TAXONOMIC LIST OF PHYTOPLANKTON IN SAMPLES COLLECTED FROM ROCK RIVER AND TRIBUTARY STREAM STATIONS, SEPTEMBER 1973 THROUGH OCTOBER 1974

TAXA

Bacillariophyta

Centrales

Cyclotella atomus
C. meneghiniana
C. pseudostelligera
Melosira ambigua
M. distans
M. granulata
M. granulata v. angustissima
M. varians
Microsiphona potamos
Stephanodiscus astrea
S. dubius
S. hantzschii
S. niagarae
S. minutus
S. subtilis

Pennales

Achnanthes minutissima
Amphora ovalis
A. ovalis v. pediculus
Caloneis lewisii
Cocconeis placentula
Cymbella prostrata
C. tumida
Cymatopleura solea
Diatoma vulgaris
Epithemia sp.
Fragillaria capucina
Gomphonema olivaceum
G. parvulum
Gomphonema sp.
Gyrosigma scalproides
Hantzschia sp.
Navicula cryptocephala
N. cryptocephala v. veneta
N. pupula
N. pymea
N. rhyncocephala
N. rhyncocephala v. germani
N. tripunctata
N. tripunctata v. schizonemoides
N. viridula v. avenacea
Navicula sp.
Nitzschia acicularis
N. amphibia
N. dissipata
N. hungarica
N. holsatica
N. linearis

Pennales (Cont'd)

N. palea
N. sigmoidea
N. tryblionella
N. tryblionella v. victoriae
Nitzschia sp.
Nitzschia sp.$_{1}$
Nitzschia sp.$_{2}$
Surirella ovata
Synedra actinastroides
S. acus
S. ulna
Synedra sp.

Chrysophyta

Dinobyron divergens

Chlorophyta

Actinastrum hantzschii
Ankistrodesmus convolutus
A. falcatus
Ankistrodesmus sp.
Centractus sp.
Chlamydomonas sp.$_{1}$
Chlamydomonas sp.$_{2}$
Chlorella vulgaris
Chlorella sp.
Coelastrum sp.
Cosmarium sp.
Dictyosphaerium sp.
Elakatothrix sp.
Eudorina sp.
Gloeoactinium limnecticum
Golenkinia sp.
Ophiocytium sp.
Oocystis sp.$_{1}$
Oocystis sp.$_{2}$
Pandorina sp.
Pediastrum duplex
P. simplex
Scenedesmus acuminatus
S. anomalus
S. arcuatus
S. carinatus
S. falcatus
S. perforatus
S. opoliensis
S. smithii
S. sooi v. verrucosa
S. spinosus
Scenedesmus sp.$_{1}$
Scenedesmus sp.$_{2}$

Chlorophyta (Cont'd)

Scenedesmus sp.$_{3}$
Scenedesmus sp.$_{4}$
Scenedesmus sp.$_{5}$
Schroederia spiralis
Selanastrum sp.
Sphaerocystis schroeteri
Staurastrum sp.
Tetrastrum staurogeniaeforme
Treubaria sp.

Cyanophyta

Anabaena sp.
Chroococcus sp.
Gomphosphaeria lacustris
Gomphosphaeria sp.
Oscillatoria sp.
Oscillatoria sp.
Microcystis sp.
Rhaphiopsis mediterranea
Rhaphiopsis sp.

Euglenophyta

Euglena sp.
Phacus sp.
Strombomonas sp.
Trachelomonas sp.

Pyrrophyta

Ceratium sp.
Gymnodinium sp.

Cryptophyta

Cryptomonas sp.

TABLE 2.2-8

AVERAGE NUMBERS AND RELATIVE ABUNDANCE OF PHYTOPLANKTON BY MAJOR GROUPS FOR SAMPLES

COLLECTED FROM ROCK RIVER AND TRIBUTARY STREAM SAMPLING STATIONS

TAXA	SEPTEMBER 11, 1973 RIVER STATIONS[a] No./ml	SEPTEMBER 11, 1973 RIVER STATIONS[a] %RA	SEPTEMBER 11, 1973 STREAM STATIONS[a] No./ml	SEPTEMBER 11, 1973 STREAM STATIONS[a] %RA	OCTOBER 16, 1973 RIVER STATIONS[b] No./ml	OCTOBER 16, 1973 RIVER STATIONS[b] %RA	JANUARY 28, 1974 RIVER STATIONS[b] No./ml	JANUARY 28, 1974 RIVER STATIONS[b] %RA
Bacillariophyta	17,791	96.89	314	62.05	5,723	97.84	176	100
Chrysophyta	-	-	175	34.58	-	-	-	-
Chlorophyta	259	1.41	17	3.35	90	1.53	-	-
Cyanophyta	291	1.58	-	-	26	0.44	-	-
Euglenophyta	18	0.09	-	-	9	0.15	-	-
Pyrrophyta	2	0.01	-	-	-	-	-	-
TOTAL	18,361		506		5,849		176	

TAXA	APRIL 30, 1974 RIVER STATIONS[b] No./ml	APRIL 30, 1974 RIVER STATIONS[b] %RA	JULY 30, 1974 RIVER STATIONS[b] No./ml	JULY 30, 1974 RIVER STATIONS[b] %RA	OCTOBER 8, 1974 RIVER STATIONS[b] No./ml	OCTOBER 8, 1974 RIVER STATIONS[b] %RA
Bacilliariophyta	5,206	97.29	5,327	84.95	1,830	76.38
Chrysophyta	-	-	-	-	-	-
Chlorophyta	126	2.35	564	8.99	107	4.47
Cyanophyta	-	-	380	6.06	444	18.53
Euglenophyta	12	0.22	-	-	15	0.63
Cryptophyta	7	0.13	-	-	-	-
TOTAL	5,351		6,271		2,396	

Note: No./ml = numbers per milliliter; %RA = percent relative abundance.

[a]Values represent average of three sampling stations.

[b]Values represent average of two sampling stations.

TABLE 2.2-9

PHYTOPLANKTON SPECIES-DIVERSITY VALUES FOR SAMPLES COLLECTED FROM ROCK RIVER AND TRIBUTARY STREAM SAMPLING STATIONS

SPECIES-DIVERSITY INDICES[a]	SEPTEMBER 11, 1973 STATION						
	R-1	R-2	R-3	R-4	R-5	S-4	S-5
H	0.5696	0.5019	0.3534	0.3909	0.5775	0.5929	0.2215
H_{max}	1.5314	1.3979	1.3424	1.4313	1.4771	0.6989	0.4771
J	0.3719	0.3590	0.2632	0.2731	0.3909	0.8483	0.4642

SPECIES-DIVERSITY INDICES	OCTOBER 16, 1973 STATION		APRIL 30, 1974 STATION		JULY 30, 1974 STATION		OCTOBER 8, 1974 STATION	
	R-2	R-5	R-2	R-5	R-2	R-5	R-2	R-5
H	0.2826	0.4930	0.8517	0.9095	0.0304	1.0850	0.7165	0.8575
H_{max}	1.2304	1.3010	1.3010	1.3802	1.3617	1.5051	1.5563	1.7242
J	0.2296	0.3789	0.6546	0.6589	0.7567	0.7208	0.4603	0.4973

[a] H = Calculated species-diversity indices.
H_{max} = Maximum diversity possible for a community of a given number of species (Brower and Zar 1970).
J = Calculated species-diversity indices to the maximum diversity H/H_{max} (may be interpreted as relative diversity).

TABLE 2.2-10

CUMULATIVE TAXONOMIC LIST OF ZOOPLANKTON
IN SAMPLES COLLECTED FROM ROCK RIVER AND TRIBUTARY STREAM STATIONS,
SEPTEMBER 1973 THROUGH OCTOBER 1974

TAXA

Arthropoda
- Crustacea
  - Copepoda
    - Nauplius
    - Copepodid (cyclopoids)
    - Cyclops bisuspidatus thomasi
    - Cyclops vernalis
    - Eucyclops agilis
  - Cladocera
    - Alonella sp.
    - Bosmina longirostris
    - Chydorus sphaericus
    - Daphnia galeata mendotae
    - Diaphanosoma brachyurum
    - Macrothrix laticornis
    - Scapholeberis kingi
  - Ostracoda
    - Immature

Rotifera
- Asplanchna priodonta
- Brachionus angularis
- Brachionus bidentata
- Brachionus budapestinensis
- Brachionus calyciflorus
- Brachionus caudatus
- Brachionus quadridentata
- Brachionus urceolaris
- Brachionus sp.
- Cephalodella sp.
- Euchlanis dilatata
- Filinia longiseta
- Gastropus stylifer
- Kellicottia bostonensis
- Kellicottia longispina
- Keratella cochlearis
- Keratella quadrata
- Lecane bulla
- Lecane sp.
- Lepadella sp.
- Philodina sp.
- Polyarthra spp.
- Pompholyx sulcata
- Rotaria sp.
- Synchaeta stylata
- Synchaeta sp.
- Testudinella patina
- Trichocerca sp.
- Trichotria tetractis

Protozoa
- Arcella sp.
- Carchesium sp.
- Centropyxis aculeata
- Codonella cratera
- Colpoda sp.
- Cucurbitella mespiliformis
- Difflugia acuminata
- Difflugia oblonga
- Difflugia sp.
- Epistylis sp.
- Paramecium sp.
- Pleurotricha sp.
- Strombidium sp.
- Tokophyra sp.
- Vaginicola sp.
- Vorticella sp.

Other organisms found

Tardigrada
- Echiniscus sp.
- Macrobiotus sp.

Nematoda

Annelida
- Oligochaeta

Arthropoda
- Insecta
  - Chironomidae

TABLE 2.2-11

AVERAGE NUMBERS AND RELATIVE ABUNDANCE OF ZOOPLANKTON BY

MAJOR GROUP FOR SAMPLES COLLECTED SEPTEMBER 1973 THROUGH OCTOBER 1974

TAXA	SEPTEMBER 11, 1973 RIVER STATIONS[a] No./l	%RA	SEPTEMBER 11, 1973 STREAM STATIONS[b] No./l	%RA	OCTOBER 16, 1973 RIVER STATIONS[a] No./l	%RA	OCTOBER 16, 1973 STREAM STATIONS[b] No./l	%RA
Arthropoda (Crustacea)	16.2	25.8	14.0	57.4	2.8	11.4	6.3	37.9
Rotifera	38.0	60.5	5.7	23.4	13.6	55.3	8.0	48.2
Protozoa	6.8	10.8	3.7	15.2	7.0	28.4	2.3	13.9
Other[c]	1.8	2.9	1.0	4.0	1.2	4.9	0.0	0.0
Total	62.8	100.0	24.4	100.0	24.6	100.0	16.6	100.0

TAXA	JANUARY 28, 1974 RIVER STATIONS[d] No./l	%RA	April 30, 1974 RIVER STATIONS No./l	%RA
Arthropoda (Crustacea)	1.50	17.1	28.4	13.3
Rotifera	2.25	25.7	173.4	81.3
Protozoa	4.75	54.3	6.4	3.0
Other	0.25	2.9	5.0	2.4
Total	8.75	100.0	213.2	100.0

TAXA	July 30, 1974 RIVER STATIONS No./l	%RA	October 8, 1974 RIVER STATIONS No./l	%RA
Arthropoda (Crustacea)	6.0	20.3	0.3	0.8
Rotifera	19.0	64.4	23.8	64.2
Protozoa	4.5	15.3	12.7	34.2
Other	0.0	0.0	0.3	0.8
Total	29.5	100.0	37.1	100.0

Note: No./l = Numbers per liter; % RA = % relative abundance.

[a] River station numbers represent average of five sampling stations.

[b] Stream station numbers represent average of three sampling stations.

[c] Other includes chironomids, oligochaetes, nematodes, and tardigrades.

[d] River sampling stations beginning January 1974 were reduced from five to two and stream stations were not sampled.

TABLE 2.2-12

CUMULATIVE LIST OF ALGAE INHABITING PERIPHYTON COMMUNITY IN ROCK RIVER AND TRIBUTARY STREAMS, SEPTEMBER 1973 THROUGH SEPTEMBER 1974

TAXA

Bacillariophyta

Centrales

Coscinodiscus laustris
C. rothii
Cyclotella atomus
C. glomerata
C. meneghiniana
C. pseudostelligera
C. stelligera
Melosira ambigua
M. binderana
M. distans
M. granulata
M. granulata var. angustissima
M. italica
M. varians
Stephanodiscus astraea
S. astraea var. intermedia
S. hantzschii
S. invisitatus
S. minutus
S. niagarae

Pennales

Achnanthes exigua
A. hauckiana
A. hungarica
A. lanceolata
A. lanceolata var. dubia
A. minutissima
Amphiprora ornata
Amphora normani
A. ovalis
A. ovalis var. pediculus
Amphora sp.
Anomoeoneis sphaerophora
A. sphaerophora var. sculpta
Asterionella formosa
Caloneis amphisbaena
C. bacillaris
C. bacillum
Caloneis lewisii
C. lewisii var. inflata
C. ventricosa
C. ventricosa var. subundulata
C. ventricosa var. truncata
Cocconeis diminuta
C. pediculus
C. placentula
Cymatopleura solea
Cymbella hyalina

Pennales (Cont'd)

C. obtusiucula
C. parva
C. sinuata
C. tumida
C. ventricosa
Diatoma tenue
D. tenue var. elongatum
D. vulgare
Epithemia sorex
Epithemia sp.
Eunotia curvata
E. pectinalis
Fragilaria
F. brevistriata var. capitata
F. construens
F. crotonesis
F. leptostauron var. dubia
F. pinnata
Frustulia rhomboides
F. vulgaris
Gomphonema abbreviatum
G. acuminatum
G. acuminatum var. brebissonii
G. acuminatum var. coronata
G. constrictum
G. gracilis
G. lanceolatum
G. olivaceum
G. parvulum
G. subtile
G. sphaerophorum
Gyrosigma attenuatum
Gyrosigma scalproides
G. spencerii
Gyrosigma sp.
Hantzschia amphioxys
Hantzschia sp.
Meridion circulare
Navicula accomoda
N. capitata
N. capitata var. hungarica
Navicula closterium
N. confervacea
N. cryptocephala
N. cryptocephala var. veneta
N. cuspidata
N. elginensis
N. exigua
N. gastrum
N. graciloides

Pennales (Cont'd)

N. heufleri
N. heufleri var. leptocephala
N. integra
N. meniscula
N. minima
N. mutica
N. pelliculosa
N. protracta
N. pseudoreinhardtii
N. pupula
N. Pygmea
N. radiosa
N. radiosa var. tenella
N. reinhardtii
N. reinhardtii var. elliptica
N. reinhardtii var. reinhardtii
N. rhyncocephala
N. sanctaecrucis
N. scutiformis
N. scutelloides
N. symetrica
N. tenera
N. tripunctata var. schizonemoides
N. viridula
N. viridula var. avenacea
Neidium dubium
N. iridis
Nitzschia acicularis
N. acuminata
N. amphibia
N. angustata
N. apiculata
N. clausii
N. dissipata
N. filiformis
N. fonticola
N. holsatica
N. hungarica
N. linearis
N. obsidialis
N. palea
N. paradoxa
N. punctata
N. sigmoidea
N. spiculoides
N. sublinearis
N. thermalis
N. tryblionella
N. tryblionella var. victoriae

TABLE 2.2-12 (Cont'd)

Pennales (Cont'd)

N. vermicularis
Opephora martyi
Pinnularia biceps
P. borealis
P. brebissonii
P. brebissonii var. diminuta
P. interrupta
P. subcapitata
P. subcapitata var. paucistriata
P. sudetica
P. viride
Pinnularia sp.
Rhoicosphenia curvata
Rhopalodia gibba
Stauroneis anceps
S. smithii
S. phoenicenteron
Surirella angustata
S. biseriata
S. brightwellii
S. linearis
S. ovata
S. spiralis
Synedra actinastroides
S. acus
Synedra delicatissima
S. incisa
S. parasitica
S. pulchella
S. radians var. radians
S. rumpens
S. rumpens var. soctica
S. socia
S. ulna
Tabellaria flocculosa

Chlorophyta

Actinastrum hantzschii
A. hantzschii var. fluviate
Ankistrodesmus falcatus
A. convolutus
Characium ambignum
C. simneticum
C. stipidium
Characium sp.1
Characium sp.2
Chlamydomonas spp.
Chodatella
Cladophora sp.
Closterium acerosum
C. sphaericum
Cosmarium sp.
Crucigenia quadrata
Dictyosphaerium pulchellum
Dictyosphaerium sp.
Dinobryon sp.
Eudorina elegans
Eudorina sp.
Gleocystis major

Chlorophyta (Cont'd)

G. vesiculosa
Gleocystis sp.
Gleobotrys limneticus
Golenkinia radiata
Gongrosira debaryana
Micractinium pusillum
Microspora sp.
Oedogonium sp.
Oocystis spp.
Pandorina morum
Pandorina sp.
Pediastrum duplex
P. simplex
Protoderma tetras
P. virde
Pseudulvella americana
Radiofilum sp.
Scenedesmus abundans
S. abundans var. longicauda
S. acuminatus
S. bijuga
S. bijuga var. alternans
S. dimorphus
S. opoliensis
S. quadricauda
S. quadricauda var. alternans
S. quadricauda var. westii
S. quadricauda var. maximus
Sphaerocystis schroeteri
Staruastrum paradoxum
Staurastrum sp.
Stigeocolonium nanum
Stigeocolonium sp.1
Stigeocolonium sp.2
Tetraedron sp.
Tetrastrum staurogeniaeforme
Treubaria sp.
Ulothrix subconstricta
U. zonata
Ulothrix sp.1
Ulothrix sp.2
Westella linearis
Green filament
Unidentified coccoid green

Chrysophyta

Chrysococcus rufescens var. tripora

Cyanophyta

Anabaena sp.
Chroococcus minutus
Chroococcus sp.
Cylindrospermum sp.
Gleocystis sp.
Gomphosphaeria sp.
Lyngbea sp.
Merismopedia sp.
Microcystis sp.

Cyanophyta (Cont'd)

Oscillatoria sp.1
Oscillatoria sp.2
Phormidium tenue
Unidentified blue-green

Euglenophyta

Euglena acus
Euglena sp.
Phacus
Trachelomonas sp.1
Trachelomonas sp.2
Trachelomonas sp.3
Trachelomonas sp.4

Pyrrhophyta

Peridinium sp.

TABLE 2.2-13

MONTHLY DISTRIBUTION OF BENTHIC TAXA AT ROCK RIVER

AND TRIBUTARY STREAM STATIONS FROM SEPTEMBER 1973 THROUGH OCTOBER 1974

	DATE					
MAJOR GROUP	9/73	10/73	2/74	4/74	7/74	10/74
Oligochaeta	9	8	8	7	9	9
Ephemeroptera	6	4	5	4	3	6
Trichoptera	3	2	3	3	2	2
Odonata	1	1	1	2	1	3
Chironomidae	11	3	9	14	21	19
Other	13	5	8	7	10	17

TABLE 2.2-14

PRESENCE AND DISTRIBUTION OF BENTHIC TAXA IN SAMPLES COLLECTED AT ROCK RIVER TRANSECT AND TRIBUTARY STREAM STATIONS, SEPTEMBER 1973 THROUGH OCTOBER 1974

TAXA	DATE						SUBSTRATE TYPE[a]							
	9/73	10/73	2/74	4/74	7/74	10/74	Mk	D	St	Sd	fGr	cGr	FR	Shell
Platyhelminthes														
Turbellaria	X										X			
Nematoda		X		X		X			X			X		
Annelida														
Oligochaeta														
Tubificidae														
Limnodrilus cervix	X	X	X	X	X	X	X		X	X	X	X	X	
L. cervix var.		X	X		X		X		X		X			
L. spiralis	X	X	X	X	X	X	X	X	X	X	X	X	X	
L. hoffmeisteri	X	X	X	X	X	X	X	X	X	X	X	X	X	
L. hoffmeisteri var.	X				X		X		X	X	X	X	X	
L. udekemianus	X	X	X	X	X	X	X	X	X	X	X	X		
L. maumeensis	X	X	X	X	X	X	X		X	X	X	X		
L. claparedianus				X					X					
Ilyodrilus templetoni					X		X			X	X			
Aulodrilus americanus		X	X							X		X		
Tubifex tubifex		X							X	X				
Potamothrix moldaviensis	X						X	X		X				
Branchiura sowerbyi	X		X			X	X	X	X	X	X		X	
Immature without capilliform chaetae	X	X	X	X	X	X	X	X	X	X	X	X	X	
Immature with capilliform chaetae	X				X		X		X	X	X			
Naididae	X													
Nais variabilis						X	X	X	X	X		X		
Paranais frici						X	X			X		X		
Lumbriculidae				X								X		
Enchytraeidae						X				X		X		
Unidentifiable oligochaete										X				
Terrestrial oligochaeta					X					X				
Hirudinea														
Erpobdella punctata		X					X							
Dina parva			X				X				X			
Arthropoda														
Insecta														
Diptera														
Chironomidae														
Cryptochironomus sp.	X	X	X	X	X	X	X	X	X	X	X	X		X
Orthocladius sp.				X		X						X		
Rheotanytarsus sp.				X	X	X				X		X	X	
Paracladopelma sp.				X	X	X			X	X		X		
Diamesa sp.				X								X		
Cricotopus sp.				X	X	X				X		X		
Conchapelopia sp.						X	X		X	X	X	X	X	
Paratanytarsus sp.					X					X		X		
Psectrotanypus sp.					X					X		X		
Psectrocladius sp.						X			X	X		X		
Tanypus sp.					X							X		
Stictochironomus sp.					X					X				
Labrundinia sp.					X							X		
Cladotanytarsus sp.						X						X		
Endochironomus sp.						X				X	X	X		
Clinotanypus sp.						X						X		

[a]See Table 2.2-18 for substrate type abbreviation explanation.

TABLE 2.2-14 (Cont'd)

TAXA	DATE						SUBSTRATE TYPE[a]							
	9/73	10/73	2/74	4/74	7/74	10/74	Mk	D	St	Sd	fGr	cGr	FR	Shell
Parachironomus sp.					X							X		
Coelotanypus sp.	X	X			X		X		X	X				
Ablabesmyia sp.		X	X	X	X	X	X		X	X		X		
Eukiefferiella sp.			X	X	X	X	X			X	X	X		
Calopsectra sp.			X	X						X	X	X		
Polypedilum sp.	X		X	X	X	X	X		X	X	X	X	X	
Chironomus sp.	X		X	X	X	X	X	X		X	X		X	X
Micropsectra sp.	X		X	X	X	X			X	X	X	X		
Tricholadius sp.			X			X				X		X		
Trissocladius sp.			X							X		X		
Dicrotendipes sp.	X			X	X	X	X		X	X	X	X		
Brillia sp.	X					X				X		X		
Tanytarsus sp.	X				X					X	X	X		
Glyptotendipes sp.	X			X	X		X		X	X	X	X		
Paralauterborniella sp.	X						X				X	X		
Procladius sp.	X				X	X	X	X		X	X	X		X
Pentaneurini	X				X		X			X	X	X		
adult	X										X	X		
pupa			X	X	X	X				X		X		
Tabanidae immature	X		X		X		X			X	X	X		
Psychodidae	X									X	X	X		
Ceratopogonidae	X		X	X		X	X		X	X	X	X	X	
Tipulidae	X				X				X	X	X	X		
Limnophila sp.			X							X		X		
Tipula sp.			X			X				X		X		
Simuliidae			X		X					X		X		
Prosimulium sp.				X								X		
Empididae	X		X		X	X				X		X		
Anthomyiidae						X			X	X		X		
Adult dipteran					X	X								
Ephemeroptera														
Potamanthus sp.	X	X	X	X		X	X		X	X	X	X		
Stenonema sp.	X	X	X	X	X	X				X	X	X	X	
Baetis sp.	X					X			X	X	X	X		
Caenis sp.	X		X	X	X		X			X	X	X	X	
Tricorythodes sp.	X				X	X	X		X		X	X	X	
Baetisca sp.		X	X			X	X			X		X		
Hexagenia sp.	X	X	X				X	X	X	X	X			
Hexagenia limbata				X		X	X		X	X		X		
Heptageniidae					X							X		
Trichoptera														
Leptocella sp.			X							X	X			
Cheumatopsyche sp.	X	X	X	X	X	X	X		X	X	X	X	X	
Hydropsyche sp.	X	X	X	X	X	X	X			X	X	X	X	
Polycentropus sp.	X											X		
Triaenodes sp.				X			X		X			X		
pupa	X										X	X		
adult	X				X						X	X		
Odonata														
Dromogomphus sp.			X	X		X	X		X	X	X	X		
Stylurus sp.		X								X		X		
Gomphus sp.	X						X	X						
Arigomphus sp.				X		X			X	X		X		
Somatochlora sp.					X	X			X	X				
Hemiptera														
Lygaeidae		X										X		
Homoptera														
Aphididae (terrestrial)						X						X		

[a]See Table 2.2-18 for substrate type abbreviation explanation.

TABLE 2.2-14 (Cont'd)

TAXA	DATE 9/73	10/73	2/74	4/74	7/74	10/74	SUBSTRATE TYPE[a] Mk	D	St	Sd	fGr	cGr	FR	Shell
Coleoptera														
Elmidae														
Dubiraphia sp.			X			X	X			X	X	X		
Stenelmis sp.				X		X			X	X		X	X	
Unidentifiable	X									X	X	X		
Hydrophilidae														
Derosus sp.					X							X		
Hydrophilus sp.					X							X		
Unidentifiable	X									X				
Dytiscidae														
Agabus sp.						X			X	X		X		
Dytiscus sp.						X			X	X				
Agabinus sp.				X								X		
Laccophilus sp.					X							X		
Rhantus sp.					X					X		X		
Unidentifiable	X									X	X	X		
Hydroporinae					X							X		
Crustacea														
Ostracoda					X	X						X		
Amphipoda														
Gammarus sp.						X						X		
Isopoda														
Asellus intermedius				X					X				X	
Arachnida														
Ctenizidae		X										X		
Acari	X					X				X		X		
Mollusca														
Gastropoda														
Amnicola sp.		X										X		
Lymnaea sp.	X									X	X	X		
Physa sp.										X		X		
Physa gyrina				X		X			X	X	X	X		
Campeloma sp.						X						X		
Pleurocera acuta						X						X		
Pelecypoda														
Quadrula sp.	X						X			X				
Ferrisia sp.	X											X		
Sphaerium transversum					X							X		
Lasmigonia compressa						X				X				
TOTAL	43	24	33	37	48	56	40	11	40	77	43	93	17	3

[a]See Table 2.2-18 for substrate type abbreviation explanation.

TABLE 2.2-15

KEY TO BOTTOM TYPES

SYMBOL	DEFINITION	CHARACTERISTICS
BR	Bed rock	Rock strata
Bo	Boulders	Rocks over 12 inches in diameter
CR	Coarse rubble	Rocks 6 to 12 inches in diameter
FR	Fine rubble	Rocks 3 to 6 inches in diameter
cGr	Coarse gravel	1 to 3 inches in diameter
fGr	Fine gravel	0.125 to 1.0 inches in diameter
Sd	Sand	Smaller than fGr
St	Silt	Very fine grittiness
D	Detritus	Undecomposed plant debris
P	Peat	Partially decomposed plant material
Mk	Muck	Black, decomposed organic matter
C	Clay	Compact, sticky

Source: Adapted from Lagler (1956).

TABLE 2.2-16

OCCURRENCE OF SUBSTRATE TYPES IN BENTHOS SAMPLES COLLECTED AT ROCK RIVER, SEPTEMBER 1973 THROUGH OCTOBER 1974

SUBSTRATE TYPE[a]	9/73	10/73	2/74	4/74	7/74	10/74	TOTAL
Mk	14	12	18				44
Mk/Sd	13	10	1			3	27
Mk/St				9	2		11
Mk/fGr	3				3		6
Mk/D	6						6
Mk/Sd/fGr					3		3
D							0
St				7	2	9	18
St/Sd		14		3	5	13	35
Sd	9	14	6	3	11	9	52
Sd/fGr	1				1	2	4
Sd/cGr	3	10	4	2			19
Sd/fGr/cGr	7						7
fGr	8		8		3		19
fGr/cGr	2						2
cGr	9	12		12	12	10	55
FR			1	6		1	8
Shells						1	1

[a]Adapted from Lagler (1956). Explanation of abbreviations in Table 2.2-15.

TABLE 2.2-17

MACROINVERTEBRATE TAXA IN SAMPLES COLLECTED AT ROCK RIVER FROM

SEPTEMBER 1973 THROUGH SEPTEMBER 1974

TAXA	DATE OF SAMPLING 9/73	10/73	11/73	12/73	1/74	2/74	3/74	4/74	5/74	6/74	7/74	9/74
Platyhelminthes												
Turbellaria	X	X	X					X				X
Annelida												
Oligochaeta												
Tubificidae												
Tubifex tubifex										X		
Ilyodrilus templetoni									X	X		
Limnodrilus hoffmeisteri	X	X	X	X	X	X	X	X	X	X	X	X
L. hoffmeisteri var.							X					X
L. spiralis	X	X	X	X	X	X	X	X	X	X	X	X
L. udekemianus	X	X	X	X	X	X		X	X	X	X	X
L. claparedianus			X	X								
L. cervix	X	X	X		X		X	X	X	X	X	X
L. cervix var.		X			X					X		
Aulodrilus americanus			X			X	X					
Branchiura sowerbyi				X			X					
Potamothrix moldaviensis	X											
Immature without capilliform chaetae	X	X	X	X	X	X	X	X	X	X	X	X
Immature with capilliform chaetae	X	X	X				X		X	X	X	
Enchytraeidae							X					
Naididae												
Nais sp.			X	X		X						
Nais communis						X		X				
Nais variabilis		X							X	X	X	
Paranais frici			X	X	X	X	X	X		X		
Paranais litoralis		X										
Homochaeta naidina		X										
Pristina osborni		X						X				
Pristina longiseta leidyi								X				
Lumbriculidae							X	X	X			
Enchytraeidae				X								
Unidentifiable oligochaete									X	X		
Hirudinea												
Placobdella montifera		X										
Erpobdella punctata							X		X			
Helobdella stagnalis									X			
Placobdella rugosa												X
Arthropoda												
Crustacea												
Amphipoda												
Hyalella azteca		X	X		X		X	X				
Gammarus sp.		X				X	X	X	X			
Isopoda												
Asellus sp.		X	X	X	X	X	X					
Asellus intermedius								X	X	X	X	X
Decapoda												
Astacidae	X									X	X	X
Insecta												
Ephemeroptera												
Heptagenia sp.								X	X			
Stenonema sp.	X	X				X	X	X	X		X	X
Stenonema ares			X	X	X							
S. tripunctatum			X	X	X							
S. heterotarsale			X	X								

Note: X = taxa found during specified time.

TABLE 2.2-17 (Cont'd)

TAXA	DATE OF SAMPLING 9/73	10/73	11/73	12/73	1/74	2/74	3/74	4/74	5/74	6/74	7/74	9/74
Ephemeroptera (Cont'd)												
S. gildersleevei			X									
S. carolina			X									
S. frontale					X							
Potamanthus sp.	X	X			X	X	X	X	X	X	X	
Caenis sp.	X	X					X	X	X	X	X	X
Hexagenia sp.		X	X				X					
Hexagenia limbata								X	X	X	X	X
Baetis sp.	X	X										X
Baetisca sp.		X					X					
Leptophlebia sp.		X										
Tricorythodes sp.	X					X			X		X	
Trichoptera												
Oecetis sp.			X					X				
Cheumatopsyche sp.	X	X			X		X	X	X	X	X	X
Hydropsyche sp.		X				X	X	X	X			
Triaenodes sp.	X	X				X	X	X	X		X	
Neureclipsis sp.		X						X	X			X
Diptera												
Chironomidae												
Calopsectra sp.			X			X	X					
Polypedilum sp.	X	X	X				X	X	X	X	X	X
Cryptochironomus sp.	X	X	X	X			X	X	X	X	X	X
Dicrotendipes sp.	X	X	X					X			X	X
Paracladopelma sp.	X	X	X					X	X	X	X	X
Micropsectra sp.			X						X	X		
Tanytarsus sp.								X	X	X		X
Cladotanytarsus sp.								X	X			X
Brillia sp.								X				
Trichocladius sp.								X				
Larsia sp.									X	X	X	X
Clinotanypus sp.											X	
Paralauterborniella sp.											X	
Einfeldia sp.											X	X
Procladius sp.	X	X	X	X			X	X	X	X	X	X
Glyptotendipes sp.	X	X	X	X							X	X
Abiabesmyia sp.	X	X	X	X			X	X		X	X	X
Tanypus sp.			X									X
Chironomus sp.	X	X		X			X	X	X	X	X	X
Endochironomus sp.		X						X				
Rheotanytarsus sp.		X				X	X	X	X			X
Parachironomus sp.	X	X						X		X	X	X
Psectrocladius sp.	X					X	X	X	X		X	X
Eukiefferiella sp.						X	X	X				X
Trissocladius sp.						X	X					
Phaenopsectra sp.	X						X	X		X		
Orthocladius sp.							X					
Cricotopus sp.	X				X		X			X	X	X
Zavrelimyia sp.	X											
Conchapelopia sp.	X								X	X	X	X
Labrundinia sp.	X										X	X
Coelotanypus sp.												X
Cryptotendipes sp.												X
Macropelopiini	X											
Pentaneurini											X	
pupa	X					X		X	X		X	X
Ceratopogonidae	X	X				X	X	X	X		X	
Empididae					X						X	X
Tipulidae												
Limnophila sp.						X						
Simuliidae												
Prosimulium sp.								X				
Coleoptera												
Elmidae	X											
Dubiraphia sp.		X	X	X	X	X	X	X	X		X	X
Macronychus sp.			X									
Microcylloepus sp.		X										
Stenelmis sp.		X						X	X	X	X	X
Optioservus sp.						X						

Note: X = taxa found during specified time.

TABLE 2.2-17 (Cont'd)

TAXA	DATE OF SAMPLING 9/73	10/73	11/73	12/73	1/74	2/74	3/74	4/74	5/74	6/74	7/74	9/74
Hydrophilidae												
Helophorus							X					
Byrrhidae		X										
Gyrinidae												
Dineutes sp.											X	X
Plecoptera												
Taeniopteryx maura			X									
Isoperla bilineata							X	X				
I. marlynia							X					
I. dicala								X				
Pteronarcys dorsata								X				
Odonata												
Dromogomphus sp.	X	X	X		X	X	X	X	X	X	X	X
Stylurus sp.		X										
Macromia sp.		X										
Argia sp.	X	X	X			X	X	X	X	X	X	X
Ishnura sp.	X	X	X									
Enallagma sp.	X	X										
Arigomphus sp.									X		X	
Lepidoptera							X					
Hemiptera												
Hebrus sp.				X								
Arachnida												
Acari							X	X		X		
Arachnida (terrestrial)				X								
Mollusca												
Gastropoda												
Physa sp.	X	X										
Physa gyrina			X			X	X	X	X		X	
Physa elliptica										X		
Lymnaea sp.							X			X		
Lymnaea catascopium				X								
Pleurocera acuta												X
Pelecypoda												
Ligumia sp.		X										
TOTAL	36	48	35	21	17	26	43	51	41	34	41	44

Note: X = taxa found during specified time.

TABLE 2.2-18

MONTHLY DISTRIBUTION OF MACROINVERTEBRATE TAXA AT ROCK RIVER
AND TRIBUTARY STREAM STATIONS FROM SEPTEMBER 1973 THROUGH SEPTEMBER 1974

	DATE											
MAJOR GROUP	9/73	10/73	11/73	12/73	1/74	2/74	3/74	4/74	5/74	6/74	7/74	9/74
Oligochaeta	5	9	8	7	6	9	9	8	7	8	4	5
Ephemeroptera	5	7	6	3	4	3	5	5	6	3	5	4
Trichoptera	2	4	1	0	1	2	3	5	4	1	2	2
Odonata	4	6	3	0	1	2	2	2	3	2	3	2
Chironomidae	15	11	10	5	1	5	13	17	12	13	17	22
Other	5	12	7	5	4	7	13	13	8	6	8	9

Note: Numbers show actual number of Taxa found per major group.

TABLE 2.2-19

MACROINVERTEBRATE NUMERICAL DISTRIBUTION BY GROUP FOR SAMPLES

COLLECTED AT ROCK RIVER TRANSECT STATIONS R-2, R-3, AND R-4

	STATION						
	R-2		R-3		R-4		
TAXA	E	W	E	W	E	W	TOTAL
SEPTEMBER 26, 1973							
Oligochaeta	6	17	7	4	9	7	50
Ephemeroptera	16	20	23	14	9	19	101
Trichoptera	3	3	6	0	0	0	12
Odonata	12	7	21	5	7	12	64
Diptera	118	135	83	318	87	100	841
Coleoptera	1	2	1	2	1	0	7
Other	8	6	4	2	5	2	27
SUBTOTAL	164	190	145	345	118	140	
GRAND TOTAL	354		490		258		1102
OCTOBER 25, 1973							
Oligochaeta	108	71	26	39	54	49	347
Ephemeroptera	8	31	36	35	23	49	182
Trichoptera	0	2	1	1	3	8	15
Odonata	3	25	15	14	13	33	103
Diptera	3	16	13	9	20	23	84
Coleoptera	1	8	9	1	8	3	30
Other	12	15	8	3	15	1	54
SUBTOTAL	135	168	108	102	136	166	
GRAND TOTAL	303		210		302		815
NOVEMBER 28, 1973							
Oligochaeta	54	26	4	23	7	4	118
Ephemeroptera	9	16	13	3	14	61	116
Trichoptera	0	0	0	0	0	1	1
Odonata	2	6	2	8	1	17	36
Diptera	1	2	3	2	7	3	18
Coleoptera	1	2	0	1	0	0	4
Other	8	12	3	3	15	6	47
SUBTOTAL	75	64	25	40	44	92	
GRAND TOTAL	139		65		136		340
DECEMBER 27, 1973							
Oligochaeta	36	31	5	0	16	0	88
Ephemeroptera	1	0	2	2	0	3	8
Trichoptera	0	0	0	0	0	0	0
Odonata	0	0	0	0	0	0	0
Diptera	3	3	1	0	2	0	9
Coleoptera	1	0	0	0	0	0	1
Other	1	1	0	0	0	2	4
SUBTOTAL	42	35	8	2	18	5	
GRAND TOTAL	77		10		23		110
JANUARY 28, 1974							
Oligochaeta	53	1	0	0	6	0	60
Ephemeroptera	3	3	0	3	0	0	9
Trichoptera	1	0	0	0	0	0	1
Odonata	1	0	0	0	0	0	1
Diptera	1	1	1	0	0	0	3
Coleoptera	0	0	0	1	0	0	1
Other	2	1	0	0	0	0	3
SUBTOTAL	61	6	1	4	6	0	
GRAND TOTAL	67		5		6		78
FEBRUARY 28, 1974							
Oligochaeta	15	1	4	6	2	11	39
Ephemeroptera	21	4	4	0	8	4	41
Trichoptera	3	0	0	0	3	0	6
Odonata	1	6	0	0	3	2	12
Diptera	4	2	7	0	2	0	15
Coleoptera	0	0	0	0	2	2	4
Other	4	27	0	7	8	13	59
SUBTOTAL	48	40	15	13	28	32	
GRAND TOTAL	88		28		60		176

Note: Numbers expressed are actual counts of organisms found on east and west ends of river transects.

TABLE 2.2-19 (Cont'd)

TAXA	STATION R-2 E	R-2 W	R-3 E	R-3 W	R-4 E	R-4 W	TOTAL
MARCH 29, 1974							
Oligochaeta	14	15	12	22	18	17	98
Ephemeroptera	11	11	31	10	6	4	73
Trichoptera	2	3	26	0	0	0	31
Odonata	1	12	1	3	12	3	32
Diptera	14	12	77	19	14	14	150
Coleoptera	0	1	3	0	2	1	7
Plecoptera	2	4	9	0	0	0	15
Other	6	29	3	19	6	17	80
SUBTOTAL	50	87	162	73	58	56	
GRAND TOTAL	137		235		114		486
APRIL 24, 1974							
Oligochaeta	342	70	15	19	98	8	552
Ephemeroptera	46	23	45	15	21	55	205
Trichoptera	7	3	7	0	0	7	24
Odonata	7	14	4	2	7	4	38
Diptera	61	38	75	8	47	60	289
Coleoptera	1	3	5	0	10	1	20
Other	7	6	7	7	10	10	47
SUBTOTAL	471	157	158	51	193	145	
GRAND TOTAL	628		209		338		1175
MAY 31, 1974							
Oligochaeta	27	13	7	58	45	3	153
Ephemeroptera	61	26	46	57	38	32	260
Trichoptera	6	5	20	2	4	13	50
Odonata	12	11	8	3	3	2	39
Diptera	12	11	11	4	0	9	47
Coleoptera	1	0	0	1	0	1	3
Other	13	13	4	57	48	9	144
SUBTOTAL	132	79	96	182	138	69	
GRAND TOTAL	211		278		207		696
JUNE 27, 1974[a]							
Oligochaeta	36	-	155	192	77	15	475
Ephemeroptera	6	-	8	0	0	15	29
Trichoptera	0	-	0	0	0	1	1
Odonata	9	-	2	0	0	28	39
Diptera	8	-	12	0	0	11	31
Coleoptera	0	-	0	0	0	3	3
Other	8	-	1	1	1	21	33
SUBTOTAL	67	-	178	193	78	94	
GRAND TOTAL	67		371		172		610
JULY 31, 1974							
Oligochaeta	53	4	15	12	2	20	106
Ephemeroptera	137	263	154	274	122	109	1059
Trichoptera	3	0	13	1	1	1	19
Odonata	2	7	5	2	3	11	30
Diptera	187	78	65	65	212	122	729
Coleoptera	2	7	3	4	1	1	18
Other	1	2	1	2	2	4	12
SUBTOTAL	385	361	256	360	343	268	
GRAND TOTAL	746		616		611		1973
SEPTEMBER 3, 1974							
Oligochaeta	0	0	13	6	15	0	34
Ephemeroptera	417	793	61	365	222	303	2161
Trichoptera	20	1	0	0	0	1	22
Odonata	10	34	9	18	18	155	244
Diptera	245	233	206	190	196	1582	2652
Coleoptera	1	22	0	2	7	7	39
Other	2	0	1	3	1	2	9
SUBTOTAL	695	1083	290	584	459	2050	
GRAND TOTAL	1778		874		2509		5161

[a] Samples lost at R-2E2, R-2W1, R-2W2.

TABLE 2.2-20

NUMBERS, DISTRIBUTION, AND PERCENT RELATIVE ABUNDANCE OF FISH COLLECTED FROM ROCK RIVER STATIONS AND STREAM STATIONS BY ALL SAMPLING METHODS FROM SEPTEMBER 12, 1973, THROUGH NOVEMBER 1, 1974

COMMON NAME	SCIENTIFIC NAME	STATION R-1[a]	R-2	R-3	R-4	R-5[a]	S-3	S-4[a]	S-5	S-6	TOTAL	PERCENT RELATIVE ABUNDANCE
Pikes	Esocidae											
Northern Pike	Esox lucius	1	-	-	-	-	1	1	1	1	5	0.5
Minnows	Cyprinidae											
Goldfish	Carassius auratus	-	-	-	-	1	-	-	-	-	1	0.1
Carp	Cyprinus carpio	7	26	30	35	6	2	3	25	9	143	13.0
Silver Chub	Hybopsis storeriana	-	-	1	-	-	-	-	-	-	1	0.1
Emerald Shiner	Notropis atherinoides	-	6	31	3	-	-	-	-	6	46	4.2
Spottail Shiner	Notropis spilopterus	-	-	-	-	-	-	-	-	1	1	0.1
Sand Shiner	Notropis stramineus	-	-	-	-	-	2	-	-	-	2	0.2
Bluntnose Minnow	Pimephales notatus	-	5	-	-	-	-	-	-	1	6	0.5
Bullhead Minnow	Pimephales vigilax	-	5	2	-	1	1	-	-	2	11	1.0
N. Creek Chub	Semotilus atromaculatus	1	-	1	-	-	-	-	-	-	2	0.2
Suckers	Catostomidae											
River Carpsucker	Carpiodes carpio	5	32	45	53	22	16	14	66	22	275	25.0
Quillback Carpsucker	Carpiodes cyprinus	-	24	22	30	-	6	-	52	34	168	15.3
White Sucker	Catostomas commersoni	2	1	6	10	3	1	2	7	1	33	3.0
Hog Sucker	Hypentelium nigricans	-	-	-	-	-	1	-	-	-	1	0.1
Smallmouth Buffalo	Ictiobus bubalus	-	-	-	-	-	-	-	-	1	1	0.1
Bigmouth Buffalo	Ictiobus cyprinellus	-	-	1	2	-	-	-	-	-	3	0.3
N. Shorthead Redhorse	Moxostoma macrolepidotum	5	17	15	12	4	6	-	3	-	62	5.6
Redhorse	Moxostoma sp.	-	1	-	1	-	-	-	-	-	2	0.2
Catfishes	Ictaluridae											
Black Bullhead	Ictalurus melas	-	-	-	1	-	-	-	-	-	1	0.1
Channel Catfish	Ictalurus punctatus	6	80	61	58	1	2	-	2	-	210	19.1
Temperate Basses	Percichthyidae											
White Bass	Morone chrysops	-	1	2	2	1	-	-	-	-	6	0.5
Yellow Bass	Morone mississippiensis	-	-	1	1	-	-	-	-	-	2	0.2

[a]Station was deleted from scope before January 1974 sampling.

TABLE 2.2-20 (Cont'd)

COMMON NAME	SCIENTIFIC NAME	STATION									TOTAL	PERCENT RELATIVE ABUNDANCE
		R-1[a]	R-2	R-3	R-4	R-5[a]	S-3	S-4[a]	S-5	S-6		
Sunfishes	Centrarchidae											
Green Sunfish	*Lepomis cyanellus*	-	-	1	-	-	-	-	-	-	1	0.1
Orangespotted Sunfish	*Lepomis humilis*	-	-	1	1	-	1	-	-	-	3	0.3
Bluegill	*Lepomis macrochirus*	-	5	3	-	-	2	-	2	4	16	1.5
Smallmouth Bass	*Micropterus dolomieui*	-	-	-	2	-	1	-	-	-	3	0.3
Largemouth Bass	*Micropterus salmoides*	1	3	1	-	-	2	-	-	1	8	0.7
White Crappie	*Pomoxis annularis*	-	5	15	8	-	3	-	3	1	35	3.2
Black Crappie	*Pomoxis nigromaculatus*	-	8	16	14	-	3	1	4	1	47	4.3
Perches	Percidae											
Johnny Darter	*Etheostoma nigrum*	-	-	1	1	-	-	-	2	-	4	0.4
Walleye	*Stizostedion vitreum*	-	-	1	-	-	1	-	-	-	2	0.2
Drums	Sciaenidae											
Freshwater Drum	*Aplodinotus grunniens*	-	1	-	-	-	-	-	-	-	1	0.1
TOTAL		28	220	257	234	39	51	21	167	85	1102	100.0

[a]Station was deleted from scope before January 1974 sampling.

TABLE 2.2-21

COMPOSITION OF FISH SAMPLES TAKEN FROM EACH STATION BY ALL SAMPLING METHODS FROM SEPTEMBER 12, 1973, THROUGH NOVEMBER 1, 1974

	STATION									
CLASSIFICATION[a]	R-1	R-2	R-3	R-4	R-5	S-3	S-4	S-5	S-6	TOTAL
Commercial Fish										
No. Species	4 (50.0)	5 (31.2)	6 (28.6)	6 (35.3)	4 (50.0)	6 (35.3)	3 (60.0)	5 (45.5)	5 (35.7)	8 (25.8)
No. Fish	19 (67.9)	101 (45.9)	119 (46.3)	143 (61.1)	35 (89.7)	32 (62.7)	19 (90.5)	153 (91.6)	67 (78.8)	688 (62.4)
Game Fish										
No. Species	3 (37.5)	7 (43.7)	10 (47.6)	8 (47.0)	2 (25.0)	9 (52.9)	2 (40.0)	5 (45.5)	5 (35.7)	14 (45.2)
No. Fish	8 (28.6)	103 (46.8)	102 (39.7)	87 (37.2)	2 (5.1)	16 (31.4)	2 (9.5)	12 (7.2)	8 (9.4)	340 (30.9)
Forage Fish										
No. Species	1 (12.5)	3 (18.7)	5 (23.8)	2 (11.8)	2 (25.0)	2 (11.8)	0 (0.0)	1 (9.1)	4 (28.6)	9 (29.0)
No. Fish	1 (3.6)	16 (7.3)	36 (14.0)	4 (1.7)	2 (5.1)	3 (5.9)	0 (0.0)	2 (1.2)	10 (11.8)	74 (6.7)
TOTAL										
No. Species	8	16	21	17	8	17	5	11	14	31
No. Fish	28	220	257	234	39	51	21	167	85	1102

Note: Numbers in parentheses represent percent of the total by station.

[a]The three general classifications are based on Lopinot (1968).

TABLE 2.2-22

CATCH PER UNIT EFFORT DATA FOR FISH COLLECTED FROM ROCK RIVER

STATIONS R-2, R-3, AND R-4 BY HOOP-NETTING FROM JANUARY 21 THROUGH NOVEMBER 1, 1974

STATION COMMON NAME	SCIENTIFIC NAME	CATCH PER UNIT EFFORT[a] JAN 1974	APR 1974	JUL 1974	OCT-NOV 1974
R-2 (EAST)					
Shorthead Redhorse	Moxostoma macrolepidotum	0.50 (1)	0.25 (1)	9.5 (38)	-
Channel Catfish	Ictalurus punctatus	0.50 (1)	4.75 (19)	9.5 (38)	-
Black Crappie	Pomoxis nigromaculatus			0.5 (2)	0.25 (1)
Total		1.00 (2)	5.00 (20)	10.0 (40)	0.25 (1)
Net-Hours of Effort		48	96	96	96
R-2 (WEST)					
Carp	Cyprinus carpio	0.25 (1)	-	-	-
Shorthead Redhorse	Moxostoma macrolepidotum	0.25 (1)	-	0.25 (1)	-
Channel Catfish	Ictalurus punctatus	0.50 (2)	0.25 (1)	3.50 (14)	0.25 (1)
Bluegill	Lepomis macrocnirus	-	-	0.25 (1)	-
White Crappie	Pomoxis annularis	-	-	1.25 (5)	-
Black Crappie	Pomoxis nigromaculatus	-	-	1.25 (5)	0.25 (1)
Total		1.00 (4)	0.25 (1)	6.50 (26)	0.50 (2)
Net-Hours of Effort		96	96	96	96
R-3 (EAST)					
Carp	Cyprinus carpio	-	-	0.25 (1)	-
River Carpsucker	Carpiodes carpio	-	-	0.25 (1)	-
Shorthead Redhorse	Moxostoma macrolepidotum	-	-	-	-
Channel Catfish	Ictalurus punctatus	-	3.00 (12)	0.25 (2)	1.00 (4)
Yellow Bass	Morone mississippiensis	-	-	-	0.25 (1)
White Crappie	Pomoxis annularis	-	-	1.50 (6)	0.25 (1)
Black Crappie	Pomoxis nigromaculatus	-	-	0.75 (3)	1.00 (4)
Total		0.00 (0)	3.00 (12)	3.00 (12)	2.50 (10)
Net-Hours of Effort		48	96	96	96
R-3 (WEST)					
Carp	Cyprinus carpio	-	0.25 (1)	0.25 (1)	-
River Carpsucker	Carpiodes carpio	-	-	0.50 (2)	0.25 (1)
White Sucker	Catostomus commersoni	0.25 (1)	0.25 (1)	-	-
Shorthead Redhorse	Moxostoma macrolepidotum	-	0.25 (1)	0.25 (1)	0.50 (2)
Channel Catfish	Ictalurus punctatus	-	3.25 (13)	2.75 (11)	1.25 (5)
White Bass	Morone chrysops	-	-	-	0.25 (1)
White Crappie	Pomoxis annularis	-	-	1.25 (5)	-
Black Crappie	Pomoxis nigromaculatus	-	-	1.25 (5)	0.75 (5)
Total		0.25 (1)	4.00 (16)	6.25 (25)	3.00 (12)
Net-Hours of Effort		96	96	96	96
R-4 (EAST)					
River Carpsucker	Carpiodes carpio	-	-	0.75 (3)	-
Black Bullhead	Ictalurus melas	-	-	0.25 (1)	-
Channel Catfish	Ictalurus punctatus	-	1.00 (4)	2.50 (10)	-
White Crappie	Pomoxis annularis	-	-	1.50 (6)	-
Black Crappie	Pomoxis nigromaculatus	-	-	0.75 (3)	-
Total		0.00 (0)	1.00 (4)	5.75 (23)	0.00 (0)
Net-Hours of Effort		48	96	96	96
R-4 (WEST)					
River Carpsucker	Carpiodes carpio	-	-	0.75 (3)	-
White Sucker	Catostomus commersoni	-	-	-	0.25 (1)
Channel Catfish	Ictalurus punctatus	0.25 (1)	1.50 (6)	4.00 (16)	0.75 (3)
White Crappie	Pomoxis annularis	-	-	0.25 (1)	-
Black Crappie	Pomoxis nigromaculatus	-	-	1.00 (4)	0.50 (2)
Total		0.25 (1)	1.50 (6)	6.00 (24)	1.50 (6)
Net-Hours of Effort		96	96	96	96

[a] Numbers in parentheses are actual numbers of fish. Numbers outside parentheses correspond to fish per net per 24 hours.

TABLE 2.2-23

RANGE, MEAN, AND STANDARD DEVIATION OF CONDITION FACTORS

FOR GAME FISH COLLECTED FROM ROCK RIVER AND TRIBUTARY STREAM STATIONS

FROM SEPTEMBER 12, 1973, THROUGH NOVEMBER 1, 1974

GAME FISH	MONTHS COLLECTED	TOTAL LENGTH RANGES (cm) 1-5	4-10	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
Channel Catfish	Sept/Oct 1973											
(Ictalurus	range				0.75-1.66	0.49-0.89	0.54-0.80	0.63-0.81	0.74-0.89	0.72		
punctatus)	mean				1.20	0.64	0.67	0.72	0.81	0.72		
	S.D.				0.64	0.14	0.13	0.07	0.07	0		
	N			0	2	7	5	5	3	1		
	Jan 1974											
	range					0.87-0.89	0.50-0.77					
	mean					0.88	0.63					
	S.D.					0.01	0.19					
	N			0	0	2	2	0	0	0		
	Mar/Apr 1974											
	range			0.49-0.92		0.39-0.76	0.51-1.12	0.59-1.53	0.71-1.22	0.76-0.93		
	mean			0.70		0.54	0.70	0.88	0.90	0.86		
	S.D.			0.17		0.14	0.17	0.27	0.15	0.06		
	N			4	0	5	13	22	12	5		
	July 1974											
	range			0.91-1.46	0.85	0.58-1.04	0.57-0.89	0.65-0.87	0.68-0.99	0.54-0.86		
	mean			1.09	0.85	0.74	0.72	0.75	0.82	0.75		
	S.D.			0.23	0	0.11	0.07	0.05	0.08	0.12		
	N			5	1	13	35	36	13	5		
	Oct/Nov 1974											
	range					0.72-0.96	0.62-0.92	0.82-0.84		0.96		
	mean					0.85	0.74	0.83		0.96		
	S.D.					0.12	0.10	0.01		0		
	N			0	0	3	7	2	0	1		

Note: S.D. = Standard Deviation and N = Absolute number of fish collected.

TABLE 2.2-23 (Cont'd)

GAME FISH	MONTHS COLLECTED	TOTAL LENGTH RANGES (cm) 1-5	4-10	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
White Crappie (*Pomoxis annularis*)	Jan 1974											
	range				0.87		0.97					
	mean				0.87		0.97					
	S.D.				0		0					
	N			0	1	0	1	0				
	Mar/Apr 1974											
	range			1.06-1.11	1.40-1.46		1.35					
	mean			1.09	1.43		1.35					
	S.D.			0.02	0.04		0					
	N			3	2	0	1	0				
	July/Aug 1974											
	range				0.80-1.48	0.83-1.37	1.17-1.52	1.26				
	mean				1.18	1.12	1.27	1.26				
	S.D.				0.24	0.15	0.12	0				
	N			0	5	10	7	1				
	Oct 1974											
	range					1.10						
	mean					1.10						
	S.D.					0						
	N			0	0	1	0	0				
Black Crappie (*Pomoxis nigromaculatus*)	Sept/Oct 1973											
	range			1.22		1.28						
	mean			1.22		1.28						
	S.D.			0		0						
	N			1	0	1	0	0				
	Mar/Apr 1974											
	range			1.28	1.26-1.30	1.60-1.70						
	mean			1.28	1.28	1.65						
	S.D.			0	0.02	0.07						
	N			1	2	2	0	0				
	July 1974											
	range			0.81-2.10	0.66-1.75	1.03-1.43	1.04					
	mean			1.41	1.35	1.25	1.04					
	S.D.			0.64	0.28	0.17	0					
	N			3	17	6	1	0				
	October 1974											
	range				1.45-1.96	1.22-1.70						
	mean				1.63	1.43						
	S.D.				0.16	0.24						
	N			0	8	3	0	0				

TABLE 2.2-23 (Cont'd)

GAME FISH	MONTHS COLLECTED	TOTAL LENGTH RANGES (cm) 1-5	4-10	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
Bluegill (Lepomis macrochirus)	Sept/Oct 1973											
	range			1.37-3.21								
	mean			2.47								
	S.D.			0.97								
	N	0		3	0							
	April 1974											
	range				2.00							
	mean				2.00							
	S.D.				0							
	N	0		0	1							
	July/Aug 1974											
	range	1.27-7.81		0.80-3.64	1.63							
	mean	3.50		2.27	1.63							
	S.D.	2.96		1.42	0							
	N	4		3	1							
Largemouth Bass (Micropterus salmoides)	Sept/Oct 1973											
	range		0.91			1.81	1.25	1.39	1.47	1.46		
	mean		0.91			1.81	1.25	1.39	1.47	1.46		
	S.D.		0			0	0	0	0	0		
	N		1		0	1	1	1	1	1		
	July/Aug 1974											
	range		4.05					1.49				
	mean		4.05					1.49				
	S.D.		0					0				
	N		1 1		0	0	0	1	0	0		
Smallmouth Bass (Micropterus dolomieui)	Sept/Oct 1973											
	range					1.66						
	mean					1.66						
	S.D.					0						
	N		0		0	1	0	0				
	July/Aug 1974											
	range		0.96					1.33				
	mean		0.96					1.33				
	S.D.		0					0				
	N		1		0	0	0	1				
Green Sunfish (Lepomis cyanellus)	Sept/Oct 1973											
	range		1.56-2.44		2.14-2.44							
	mean		2.00		2.29							
	S.D.		0.62		0.21							
	N		2		2							

TABLE 2.2-23 (Cont'd)

GAME FISH	MONTHS COLLECTED	TOTAL LENGTH RANGES (cm) 1-5	4-10	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
Green Sunfish	Apr 1974											
(Lepomis cyanellus)	range		1.57									
	mean		1.57									
	S.D.		0									
	N		1		0							
Orangespotted Sunfish	Sept/Oct 1973											
(Lepomis humilis)	range		1.50		2.56							
	mean		1.50		2.56							
	S.D.		0		0							
	N		1		1							
White Bass	Sept/Oct 1973											
(Morone chrysops)	range			0.94	1.28-1.50							
	mean			0.94	1.39							
	S.D.		0	0	0.15							
	N		1	1	2	0						
	October 1974											
	range					0.87-1.25						
	mean					0.08						
	S.D.					0.19						
	N			0	0	3						
Yellow Bass	October 1974											
(Morone mississippiensis)	range					1.09-1.31						
	mean					1.20						
	S.D.					0.15						
	N					2						
Freshwater Drum	Sept/Oct 1973											
(Aplodinotus grunniens)	range							0.77				
	mean							0.77				
	S.D.							0				
	N							1				
Walleye	Sept/Oct 1973											
(Stizostedion vitreum)	range					0.72						
	mean					0.72						
	S.D.					0						
	N					1						
	March 1974											
	range					0.95						
	mean					0.95						
	S.D.					0						
	N					1						
Northern Pike	Sept/Oct 1973											
(Esox lucius)	range				0.41					0.45		
	mean				0.41					0.45		
	S.D.				0					0		
	N				1	0	0	0	0	1	0	0

TABLE 2.2-23 (Cont'd)

GAME FISH	MONTHS COLLECTED	TOTAL LENGTH RANGES (cm) 1-5	4-10	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
Northern Pike (*Esox lucius*)	Sept/Oct 1973											
	range				0.41					0.45		
	mean				0.41					0.45		
	S.D.				0					0		
	N				1	0	0	0	0	1	0	0
	Jan 1974											
	range							0.69				
	mean							0.69				
	S.D.							0				
	N				0	0	0	1	0	0	0	0
	Oct 1974											
	range									0.57		0.52
	mean									0.57		0.52
	S.D.									0		0
	N				0	0	0	0	0	1	0	1
Black Bullhead (*Ictalurus melas*)	July/Aug 1974											
	range					1.58						
	mean					1.58						
	S.D.					0						
	N					1						

TABLE 2.2-24

LENGTH-FREQUENCY DISTRIBUTION ARRANGED BY AGE GROUPS FOR TEN SPECIES OF GAME FISH COLLECTED FROM THE ROCK RIVER, JANUARY THROUGH NOVEMBER 1974

GAME FISH DATE	LENGTH RANGES (cm)	NUMBER OF FISH	AGE GROUP I	II	III	IV	V
Northern Pike (*Esox lucius*)							
Jan 74	30.0-34.5	1		1	-		
	Total Number	1		1	-		
	Average Length			30.1	-		
Oct 74	35.0-39.9	1		-	1		
	40.0-44.9	-		-	-		
	45.0-49.9	1		-	1		
	Total Number	2		-	2		
	Average Length			-	44.0		
Channel Catfish (*Ictalurus punctatus*)							
Jan 74	17.0-17.9	1		1	-		
	18.0-18.9	1		1	-		
	19.0-19.9	-		-	-		
	20.0-20.9	1		1	-		
	21.0-21.9	-		-	-		
	22.0-22.9	-		-	-		
	23.0-23.9	1		-	1		
	Total Number	4		3	1		
	Average Length			18.5	23.4		
Mar 74	5.0-5.9	1	1	-			
	6.0-6.9	-	-	-			
	7.0-7.9	2	2	-			
	8.0-8.9	1	1	-			
	9.0-16.9	0	-	-			
	17.0-17.9	1	-	1			
	Total Number	5	4	1			
	Average Length		7.3	17.8			
Apr 74	19.0-19.9	1		1	-	-	
	20.0-20.9	2		2	-	-	
	21.0-21.9	2		2	-	-	
	22.0-22.9	2		1	1	-	
	23.0-23.9	3		1	2	-	
	24.0-24.9	-		-	-	-	
	25.0-25.9	3		2	1	-	
	26.0-26.9	4		1	3	-	
	27.0-27.9	8		-	8	-	
	28.0-28.9	4		-	4	-	
	29.0-29.9	3		-	1	2	
	30.0-30.9	2		-	1	1	
	31.0-31.9	1		-	-	1	
	32.0-32.9	2		-	-	2	
	33.0-33.9	3		-	-	3	
	34.0-34.9	-		-	-	-	
	35.0-35.9	1		-	-	1	
	36.0-36.9	1		-	-	1	
	37.0-37.9	1		-	-	1	
	Total Number	43		10	21	12	
	Average Length			22.6	26.9	32.8	

TABLE 2.2-24 (Cont'd)

GAME FISH DATE	LENGTH RANGES (cm)	NUMBER OF FISH	AGE GROUP I	II	III	IV	V
Channel Catfish (Cont'd)							
Jul 74	18.0-18.9	1	1	-	-	-	
	19.0-19.9	3	2	1	-	-	
	20.0-20.9	7	5	2	-	-	
	21.0-21.9	10	6	4	-	-	
	22.0-22.9	11	4	7	-	-	
	23.0-23.9	9	4	4	1	-	
	24.0-24.9	2	-	2	-	-	
	25.0-25.9	3	-	2	1	-	
	26.0-26.9	5	3	2	-	-	
	27.0-27.9	9	-	9	-	-	
	28.0-28.9	8	-	5	3	-	
	29.0-29.9	6	-	4	2	-	
	30.0-30.9	5	-	2	2	1	
	31.0-31.9	2	-	-	1	1	
	32.0-32.9	5	-	-	5	-	
	33.0-33.9	1	-	-	1	-	
	34.0-34.9	3	-	-	3	-	
	35.0-35.9	2	-	-	2	-	
	36.0-36.9	-	-	-	-	-	
	37.0-37.9	2	-	-	1	1	
	38.0-38.9	3	-	-	-	3	
	Total Number	97	25	44	22	6	
	Average Length		22.0	25.3	31.2	35.7	
Oct/Nov 74	20.0-20.9	1	1	-	-	-	
	21.0-21.9	-	-	-	-	-	
	22.0-22.9	-	-	-	-	-	
	23.0-23.9	1	-	1	-	-	
	24.0-24.9	1	-	1	-	-	
	25.0-25.9	-	-	-	-	-	
	26.0-26.9	1	-	-	1	-	
	27.0-27.9	-	-	-	-	-	
	28.0-28.9	-	-	-	-	-	
	29.0-29.9	1	-	-	1	-	
	30.0-35.9	0	-	-	-	-	
	36.0-36.9	1	-	-	-	1	
	Total Number	6	1	2	2	1	
	Average Length		20.3	23.9	27.6	36.0	
White Bass (*Morone chrysops*)							
Oct 74	20.0-24.9	2		2			
	Total Number	2		2			
	Average Length			20.0			
Yellow Bass (*Morone mississippiensis*)							
Oct/Nov 74	15.0-19.9	1		1			
	20.0-24.9	1		1			
	Total Number	2		2			
	Average Length			18.5			
Green Sunfish (*Lepomis cyanellus*)							
Apr 74	8.0-8.5	1	1				
	Total Number	1	1				
	Average Length		8.3				
Bluegill (*Lepomis macrochirus*)							
Jul 74	10.0-14.9	1		1			
	Total Number	1		1			
	Average Length			13.5			

TABLE 2.2-24 (Cont'd)

GAME FISH DATE	LENGTH RANGES (cm)	NUMBER OF FISH	AGE GROUP I	II	III	IV	V
Smallmouth Bass (*Micropterus dolomieui*)							
Jul 74	25.9-29.9	1				1	
	Total Number	1				1	
	Average Length					27.1	
Largemouth Bass (*Micropterus salmoides*)							
Aug 74	30.0-34.5	1				1	
	Total Number	1				1	
	Average Length					30.9	
White Crappie (*Pomoxis annularis*)							
Jan 74	15.0-15.9	1		1	-	-	-
	16.0-16.9	-		-	-	-	-
	17.0-17.9	-		-	-	-	-
	18.0-18.9	-		-	-	-	-
	19.0-19.9	-		-	-	-	-
	20.0-20.9	-		-	-	-	-
	21.0-21.9	1		-	1	-	-
	Total Number	2		1	1	-	-
	Average Length			15.1	21.0	-	-
Mar/Apr 74	11.0-11.9	1		1	-	-	-
	12.0-12.9	-		-	-	-	-
	13.0-13.9	1		1	-	-	-
	14.0-14.9	1		1	-	-	-
	15.0-15.9	-		-	-	-	-
	16.0-16.9	-		-	-	-	-
	17.0-17.9	1		-	1	-	-
	18.0-18.9	1		-	1	-	-
	19.0-19.9	-		-	-	-	-
	20.0-20.9	-		-	-	-	-
	21.0-21.9	1		-	1	-	-
	Total Number	6		3	3	-	-
	Average Length			12.9	18.8	-	-
Jul/Aug 74	14.0-14.9	2		2	-	-	-
	15.0-15.9	4		3	1	-	-
	16.0-16.9	3		3	-	-	-
	17.0-17.9	-		-	-	-	-
	18.0-18.9	2		-	2	-	-
	19.0-19.9	1		-	1	-	-
	20.0-20.9	3		-	3	-	-
	21.0-21.9	2		-	2	-	-
	22.0-22.9	-		-	-	-	-
	23.0-23.9	2		-	-	1	1
	24.0-24.9	3		-	2	1	-
	25.0-25.9	-		-	-	-	-
	26.0-26.9	1		-	-	1	-
	Total Number	23		8	11	3	1
	Average Length			15.7	20.5	24.7	23.0
Oct/Nov 74	17.0-17.9	1		1	-	-	-
	Total Number	1		1	-	-	-
	Average Length			17.1	-	-	-

TABLE 2.2-24 (Cont'd)

GAME FISH DATE	LENGTH RANGES (cm)	NUMBER OF FISH	AGE GROUP I	II	III	IV	V
Black Crappie (*Pomoxis nigromaculatus*)							
Mar/Apr 74	10.0-10.9	1		1	-		
	11.0-11.9	2		2	-		
	12.0-12.9	-		-	-		
	13.0-13.9	-		-	-		
	14.0-14.9	-		-	-		
	15.0-15.9	-		-	-		
	16.0-16.9	-		-	-		
	17.0-17.9	2		1	1		
	Total Number	5		4	1		
	Average Length			12.8	17.0		
Jul/Aug 74	11.0-11.9	1		1	-		
	12.0-12.9	1		1	-		
	13.0-13.9	1		1	-		
	14.0-14.9	11		9	2		
	15.0-15.9	3		1	2		
	16.0-16.9	1		1	-		
	17.0-17.9	2		2	-		
	18.0-18.9	2		-	2		
	19.0-19.9	-		-	-		
	20.0-20.9	1		-	1		
	21.0-21.9	-		-	-		
	22.0-22.9	-		-	-		
	23.0-23.9	1		-	-		
	Total Number	24		16	8		
	Average Length			14.6	17.4		
Oct/Nov 74	11.0-11.9	1		1	-		
	12.0-12.9	-		-	-		
	13.0-13.9	1		1	-		
	14.0-14.9	2		2	-		
	15.0-15.9	3		3	-		
	16.0-16.9	2		2	-		
	17.0-17.9	-		-	-		
	18.0-18.9	-		-	-		
	19.0-19.9	1		-	1		
	Total Number	10		9	1		
	Average Length			14.7	19.6		

TABLE 2.2-25

AVERAGE TOTAL LENGTHS AT EACH AGE GROUP FOR TEN SPECIES OF GAME FISH AS REPORTED IN AVAILABLE LITERATURE

SPECIES	TIME OF COLLECTION	LOCATION	NO. FISH	AVERAGE TOTAL LENGTHS AT EACH AGE GROUP (cm) I	II	III	IV	V	REFERENCE
Northern Pike (Esox lucius)	Fall 1955-1967	N. Wisconsin Lakes	942	21.6	35.1	44.2	50.3	56.1	Snow 1969
Channel Catfish (Ictalurus punctatus)	Unknown	Lower Salt River, Mo.	124	13.5	20.6	25.9	29.7	34.0	Purkett 1958
	Summers 1945-1946	Mississippi River (Iowa)	221	-	25.0	29.8	34.8	39.9	Appelget and Smith 1951
	1955-1956	Des Moines River (Iowa)	1467	12.4	19.6	25.7	31.2	-	Carlander 1969
White Bass (Morone chrysops)	11 Year Period	33 bodies of water in Oklahoma	>3000	19.1	31.0	36.6	40.9	43.4	Calhoun 1966
Yellow Bass (Morone mississippiensis)	Unknown	Clear Lake, Iowa	Unknown	10.1	17.8	22.9	-	25.4	Harlan and Speaker 1969
Green Sunfish (Lepomis cyanellus)	1952-1960	Illinois Conservation Lakes	337	6.9	9.4	11.9	15.5	17.2	Lopinot 1964
	Unknown	Michigan	Unknown	6.1	9.4	12.2	13.7	15.0	Calhoun 1966
	Unknown	Lower Salt River, Mo.	15	4.0	9.1	11.9	15.2	-	Purkett 1958
Bluegill (Lepomis macrochirus)	1952-1960	Illinois Conservation Lakes	3576	6.6	11.4	14.7	16.0	17.5	Lopinot 1964
	Fall 1955-1967	N. Wisconsin Lakes	8722	3.8	7.8	10.9	14.2	16.5	Snow 1969
	Unknown	Lower White River, Mo.	94	4.6	8.9	13.7	16.3	18.0	Purkett 1958

TABLE 2.2-25 (Cont'd)

SPECIES	TIME OF COLLECTION	LOCATION	NO. FISH	AVERAGE TOTAL LENGTHS AT EACH AGE GROUP (cm)					REFERENCE
				I	II	III	IV	V	
Smallmouth Bass (*Micropterus dolomieui*)	1952-1960	Illinois Conservation Lakes	243	10.9	19.0	29.0	37.1	40.6	Lopinot 1964
	Unknown	Lower Gasconade River, Mo.	113	10.4	21.1	30.7	37.6	41.7	Purkett 1958
	Unknown	Iowa Streams	-	9.4	14.5	19.8	24.9	29.7	Calhoun 1966
Largemouth Bass (*Micropterus salmoides*)	1952-1960	Illinois Conservation Lakes	3873	12.2	18.8	24.9	30.5	37.3	Lopinot 1964
	Fall 1955-1967	N. Wisconsin Lakes	521	7.9	16.0	23.1	31.5	33.3	Snow 1969
	Unknown	Lower Gasconade River, Mo.	51	11.2	21.6	27.2	31.2	33.5	Purkett 1958
White Crappie (*Pomoxis annularis*)	Nov. 1934	Sterling Pool, Rock R., Ill.	10	-	-	22.1	27.4	29.2	Hansen 1951
	Apr. 1938	Sterling Pool, Rock R., Ill.	13	-	20.1	22.6	24.1	-	Hansen 1951
	Unknown	Lower St. Francis River, Mo.	50	6.4	13.2	19.6	25.4	26.9	Purkett 1958
	1952-1960	Illinois Conservation Lakes	504	9.9	19.0	23.1	25.9	27.9	Lopinot 1964
Black Crappie (*Pomoxis nigromaculatus*)	1952-1960	Illinois Conservation Lakes	165	10.7	18.8	23.9	23.6	27.4	Lopinot 1964
	Fall 1955-1967	N. Wisconsin Lakes	1837	6.1	12.4	17.3	20.3	22.9	Snow 1969
	Unknown	Lower Gasconade River, Mo.	41	7.8	16.3	21.3	19.6	22.6	Purkett 1958

TABLE 2.2-26

RESULTS OF PERSONAL INTERVIEWS WITH FISHERMEN

ON ROCK RIVER FROM MAY 5 TO SEPTEMBER 28, 1974

PARAMETER	STATISTICAL VALUE
Number of Fishermen Interviewed	965
Hours Fished	2585
Total Number of Rods Used	1381
Average Number of Rods Used	1.43
Number of Fish Caught	812
Total Number of Rod-Hours	3980
Number Fish/Rod-Hour	0.204

SPECIES PREFERENCE	PERCENT PREFERRED
Catfish	60.0%
Carp	3.8%
Bass	4.5%
Bullhead	1.3%
Crappie and Bluegill	1.3%
Walleye and Northern Pike	5.5%
Buffalo	0.3%
No Preference	23.5%

TABLE 2.2-27

MONTHLY CATCH STATISTICS FOR FISH CAUGHT FROM ROCK RIVER

BY FISHERMEN INTERVIEWED FROM MAY 5 TO SEPTEMBER 28, 1974

MONTH	NUMBER OF FISH CAUGHT	PERCENT OF TOTAL CATCH	ROD-HOURS FISHED	PERCENT OF TOTAL ROD-HOURS	FISH PER ROD-HOUR
May	38	4.7	149.5	3.8	0.254
June	128	15.8	434.5	10.9	0.295
July	411	50.6	1639	41.2	0.251
August	195	24.0	1443	36.3	0.135
September	40	4.9	314	7.9	0.127
TOTAL	812	100.0	3980	100.0	

TABLE 2.2-28

FISHING SUCCESS AT SITES ALONG ROCK RIVER BY FISHERMEN INTERVIEWED

FROM MAY 5 TO SEPTEMBER 28, 1974

FISHING SITE	ROD-HOURS FISHED	PERCENT ROD-HOURS PER SITE	NUMBER OF FISH CAUGHT	FISH PER ROD-HOUR
Byron Area (R-1)	25	0.6	9	0.360
Woodland Creek Mouth Area (S-3)	17.5	0.4	9	0.514
Leaf River Mouth Area (S-4)	65	1.6	6	0.092
Rock River Terrace Area	115	2.9	31	0.269
R-3 Area	46.5	1.2	10	0.215
Mud Creek Area	801	20.1	100	0.124
Stronghold Area	294	7.4	43	0.146
Blackhawk Statue Area	64	1.6	8	0.125
R-5 Area	63	1.6	22	0.349
Oregon Boat Launch Area	504	12.7	114	0.226
Area Above Oregon Dam	371	9.3	43	0.116
Below Oregon Dam (east end)	1132	28.4	246	0.218
Below Oregon Dam (west end)	482	12.1	171	0.355
TOTAL	3980	100.0	812	0.204

TABLE 2.2-29

FISH SPECIES CAUGHT BY FISHERMEN INTERVIEWED

ON ROCK RIVER FROM MAY 5 TO SEPTEMBER 28, 1974

COMMON NAME	SCIENTIFIC NAME
Smallmouth Bass	Micropterus dolomieui
Bluegill	Lepomis macrochirus
Orange-spotted Sunfish	Lepomis humilis
Redear Sunfish	Lepomis microlophus
White Crappie	Pomoxis annularis
Black Crappie	Pomoxis nigromaculatus
White Bass	Morone chrysops
Yellow Bass	Morone mississippiensis
Walleye	Stizostedion vitreum
Northern Pike	Esox lucius
Channel Catfish	Ictalurus punctatus
Yellow Bullhead	Ictalurus natalis
Freshwater Drum	Aplodinotus grunniens
Smallmouth Buffalo	Ictiobus bubalus
White Sucker	Catostomus commersoni
Redhorse	Moxostoma sp.
Hog Sucker	Hypentelium nigricans
Carp	Cyprinus carpio
Mooneye	Hiodon tergisus
American Eel	Anquilla rostrata

TABLE 2.2-30

NUMBERS AND PERCENT OF TOTAL CATCH OF FISH TAKEN FROM ROCK RIVER BY FISHERMEN INTERVIEWED FROM MAY 5 TO SEPTEMBER 28, 1974

COMMON NAME	TOTAL CAUGHT	PERCENT OF TOTAL CATCH
Channel Catfish	291	35.8
Carp	262	32.3
Suckers	80	9.9
Yellow Bullhead	73	9.0
Bluegill	59	7.3
Drum	10	1.2
White Bass	10	1.2
Smallmouth Buffalo	8	1.0
Crappie	7	0.9
Walleye	5	0.6
Smallmouth Bass	1	0.1
Redear Sunfish	1	0.1
Orange-Spotted Sunfish	1	0.1
Yellow Bass	1	0.1
Northern Pike	1	0.1
Mooneye	1	0.1
American Eel	1	0.1
TOTAL	812	99.9

TABLE 2.2-31

PERCENT OF EACH FISH SPECIES CAUGHT AT SITES ALONG ROCK RIVER BY FISHERMEN INTERIVEWED FROM MAY 5 TO SEPTEMBER 28, 1974

FISHING SITES	CATFISH	CARP	SUCKERS	BULLHEAD	DRUM	BUFFALO	SMALLMOUTH BASS, BLUEGILL, CRAPPIE	WHITE BASS	WALLEYE AND NORTHERN PIKE
Byron Area (R-1)	1.4	0.4	2.5	0	0	0	2.9	0	0
Woodland Creek Mouth Area (S-3)	3.1	0	0	0	0	0	0	0	0
Leaf River Mouth Area (S-4)	0.3	1.1	0	2.7	0	0	0	0	0
Rock River Terrace Area	5.8	3.8	1.3	0	10.0	12.5	1.4	0	0
R-3 Area	1.7	0.4	1.3	0	0	0	2.9	0	0
Mud Creek Area	11.3	14.9	10.0	17.8	0	25.0	5.8	10.0	0
Stronghold Area	7.2	5.7	5.0	1.4	0	0	1.4	0	0
Blackhawk Statue Area	0.7	1.1	0	1.4	10.0	0	0	10.0	0
R-5 Area	0.7	3.8	7.5	2.7	0	25.0	0	0	0
Oregon Boat Launch Area	9.3	20.2	33.8	1.4	10.0	37.5	0	20.0	0
Area Above Oregon Dam	3.8	9.2	8.8	0	0	0	0	10.0	0
Below Oregon Dam (east end)	21.3	26.3	18.8	4.1	40.0	0	59.4	20.0	50.0
Below Oregon Dam (west end)	33.3	13.0	11.3	68.5	30.0	0	26.1	30.0	50.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 2.2-32

NUMBER AND PERCENT OF FISH IN EACH LENGTH RANGE CAUGHT FROM THE ROCK RIVER

BY FISHERMEN INTERVIEWED FROM MAY 5 TO SEPTEMBER 28, 1974

COMMON NAME	RANGE TOTAL LENGTH 0-12.7 cm (0-5 in)	12.7-25.4 cm (5-10 in)	25.4-39.1 cm (10-15 in)	38.1-50.8 cm (15-20 in)	50.8-63.5 cm (20-25 in)	TOTAL MEASURED[a]	PERCENT OF MEASURED CATCH
Catfish	1 (0.4)	98 (37.0)	159 (60.0)	7 (2.6)		265	36.8
Carp	-	8 (3.5)	104 (45.4)	99 (43.2)	18 (7.9)	229	31.8
Suckers	-	5 (6.3)	55 (68.7)	20 (25.0)	-	80	11.1
Drum	-	1 (11.1)	7 (77.8)	-	1 (11.1)	9	1.2
Bullhead	16 (27.1)	34 (57.6)	9 (15.3)	-	-	59	8.2
Smallmouth Bass	-	1 (100.0)	-	-	-	1	0.1
Other Sunfish, Bluegill, Crappie, etc.	2 (0.7)	52 (96.3)	-	-	-	54	7.5
White and Yellow Bass	-	7 (100.0)	-	-	-	7	1.0
Smallmouth Buffalo	-	-	5 (62.5)	3 (37.5)	-	8	1.1
Walleye	-	1 (20.0)	2 (40.0)	2 (40.0)	-	5	0.7
Northern Pike	-	1 (100.0)	-	-	-	1	0.1
American Eel	-	-	1 (100.0)	-	-	1	0.1
Mooneye	-	1 (100.0)	-	-	-	1	0.1
TOTAL						720	100.0

Note: Values in partheses are percentages of fish in each size range.

[a]Circumstances did not allow measurements to made on all of the fish caught.

TABLE 2.2-33

FISH EGGS AND LARVAE COLLECTED FROM ROCK RIVER STATIONS R-1 THROUGH R-5 AND S-3, S-5, AND S-6 BY TOW NET FROM APRIL 23 THROUGH JULY 3, 1974

STATION DATE	TOTAL GALLONS FILTERED	FISH EGGS AND LARVAE	TOTAL NUMBER COLLECTED	AVERAGE NO./10,000 GAL
R-1				
23 APR 74	[a]	Eggs	0	
		Larvae	0	
15 MAY 74	15,254	Eggs	0	0
		Cyprinidae[b]	2	1.3
		Catostomidae	1	0.7
		Total Larvae	3	2.0
10 JUN 74	9,683	Eggs	0	0
		Cyprinus carpio	3	3.1
		Culaea inconstans	1[c]	1.0
		Total Larvae	4	4.1
3 JUL 74	13,347	Eggs	0	0
		Larvae	0	0
R-2				
23 APR 74	[a]	Eggs	0	
		Larvae	0	
15 MAY 74	17,773	Eggs	0	0
		Cyprinidae[a]	2	1.1
		Total Larvae	2	1.1
10 JUN 74	12,733	Eggs	0	0
		Cyprinidae[b]	2	1.6
		Cyprinus carpio	3	2.4
		Total Larvae	5	3.9
3 JUL 74	[a]	Eggs	0	
		Cyprinus carpio	1	
		Total Larvae	1	
R-3				
23 APR 74	[a]	Eggs	0	
		Larvae	0	
15 MAY 74	12,999	Eggs	0	0
		Catostomus commersoni	1	0.8
		Percina caprodes	2	1.5
		Unidentifiable[d]	1	0.8
		Total Larvae	4	3.1
10 JUN 74	[a]	Fertilized Eggs	1	
		Unfertilized Eggs	1	
		Cyprinidae[c]	1	
		Cyprinus carpio	4	
		Catostomidae	1	
		Lepomis sp.	1	
		Total Larvae	9	
3 JUL 74	[a]	Eggs	0	
R-4				
23 APR 74	[a]	Eggs	0	
		Larvae	0	
15 MAY 74	17,774	Eggs	0	0
		Cyprinidae[b]	2	1.1
		Catostomus commersoni	1	0.6
		Total Larvae	3	1.7

[a]Data unavailable due to flowmeter failure.

[b]Minnows other than carp.

[c]Juvenile.

TABLE 2.2-33 (Cont'd)

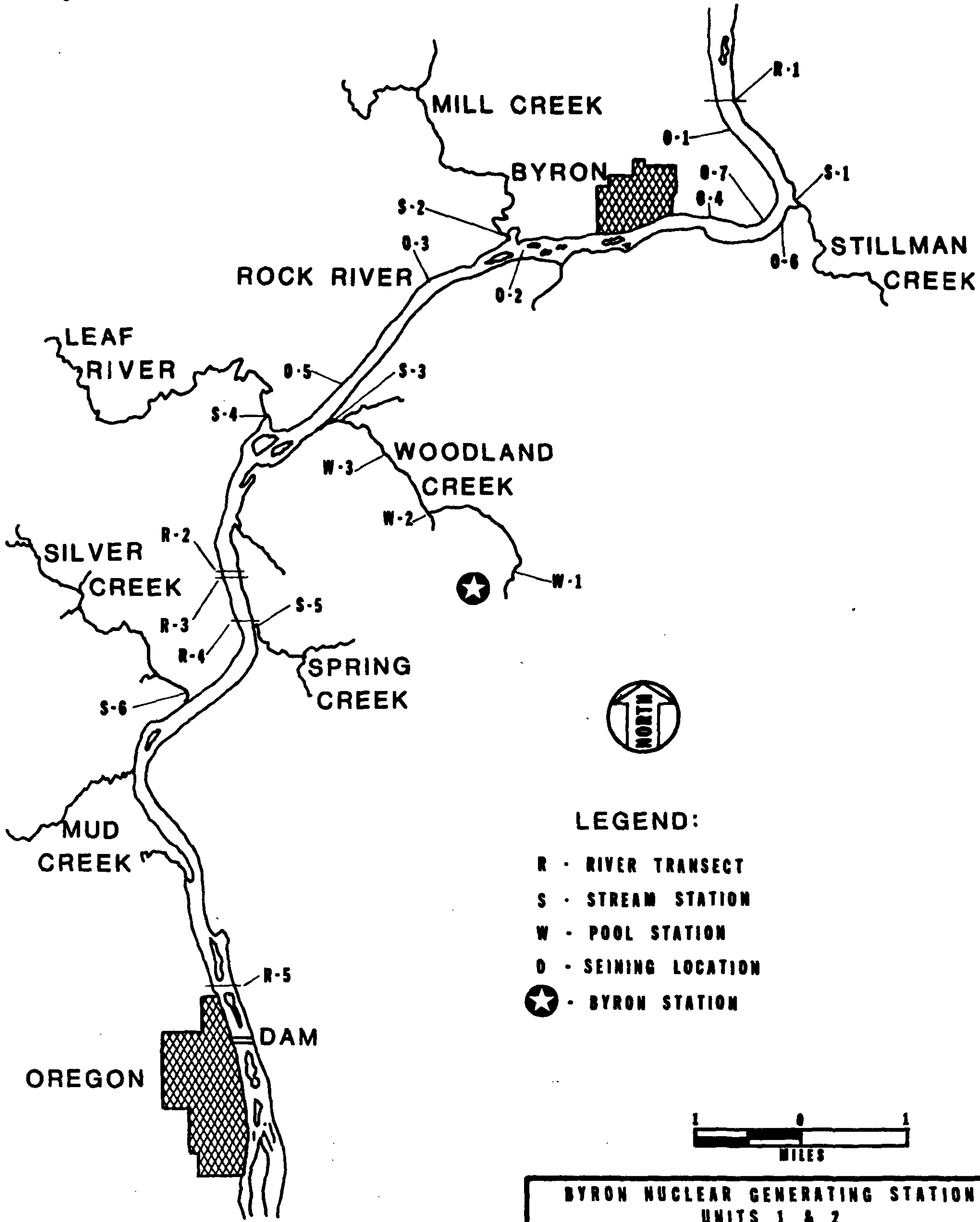
STATION DATE	TOTAL GALLONS FILTERED	FISH EGGS AND LARVAE	TOTAL NUMBER COLLECTED	AVERAGE NO./10,000 GAL
R-4 (Cont'd)				
10 JUN 74	a	Eggs	0	
		Cyprinus carpio	3	
		Morone sp.	1	
		Lepomis sp.	1	
		Total Larvae	5	
3 JUL 74	12,468	Eggs	0	0
		Cyprinus carpio	5	4
		Lepomis sp.	1	0.8
		Total Larvae	6	4.8
R-5				
23 APR 74	a	Eggs	0	
		Larvae	0	
15 MAY 74	8,887	Eggs	0	0
		Cyprinidae[b]	1	1.1
		Catostomidae	1	1.1
		Percina caprodes	1	1.1
		Total Larvae	3	3.3
10 JUN 74	6,234	Eggs	0	0
		Cyprinus carpio	1	1.6
		Total Larvae	1	1.6
3 JUL 74	a	Eggs	0	
		Cyprinidae	2	
		Total Larvae	2	
S-3				
23 APR 74	100	Eggs	0	0
		Larvae	0	0
15 MAY 74	100	Eggs	0	0
		Larvae	0	0
10 JUN 74	100	Eggs	0	0
		Cyprinus carpio	1	100
		Catostomus	1	100
		Total Larvae	2	200
3 JUL 74	100	Eggs	0	0
		Cyprinidae[b]	2	200
		Total Larvae	2	200
S-5				
23 APR 74	100	Eggs	0	0
		Larvae	0	0
15 MAY 74	100	Eggs	0	0
		Cyprinidae[b]	4	400
		Total Larvae	4	400
10 JUN 74	100	Eggs	0	0
		Catostomidae	1	100
		Total Larvae	1	100
3 JUL 74	NOT SAMPLED (too shallow)			
S-6				
23 APR 74	100	Eggs	0	0
		Larvae	0	0
15 MAY 74	100	Eggs	0	0
		Catostomus commersoni	1	100
		Unidentifiable[d]	1	100
		Total Larvae	2	200
10 JUN 74	100	Eggs	0	0
		Larvae	0	0
3 JUL 74	100	Eggs	0	0
		Lepomis sp.	1	100
		Total Larvae	1	100

[a]Data unavailable due to flowmeter failure.
[b]Minnows other than carp.
[c]Too yound to identify.

TABLE 2.2-34

CHECKLIST, NUMBERS, AND DISTRIBUTION OF FISH LARVAE COLLECTED BY TOW NET FROM APRIL 23 THROUGH JULY 3, 1974

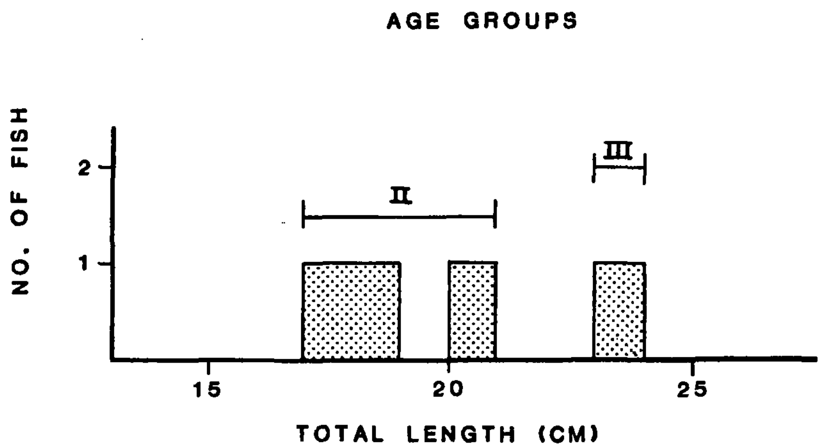
FAMILY GENUS SPECIES	R-1	R-2	R-3	R-4	R-5	S-3	S-5	S-6	TOTAL
Cyprinidae									
Cyprinus carpio	3	4	7	8	1	1	-	-	24
other cyprinids	2	4	1	2	3	2	4	-	18
Catostomidae									
Catostomus commersoni	-	-	1	1	-	1	-	1	4
other catostomids	1	-	1	-	1	-	1	-	4
Centrarchidae									
Leopomis sp.	-	-	1	2	-	-	-	1	4
Percichyidae									
Morone sp.	-	-	-	1	-	-	-	-	1
Percidae									
Percina caprodes	-	-	2	-	1	-	-	-	3
Unidentifiable	-	-	1	-	-	-	-	1	2
TOTAL	6	8	14	14	6	4	5	3	60



BYRON NUCLEAR GENERATING STATION
UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 2.2-1

AQUATIC SAMPLING SITES NEAR THE BYRON STATION



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UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 2.2-2

LENGTH AND AGE FREQUENCY FOR
4 CHANNEL CATFISH COLLECTED FROM
ROCK RIVER DURING JANUARY 1974

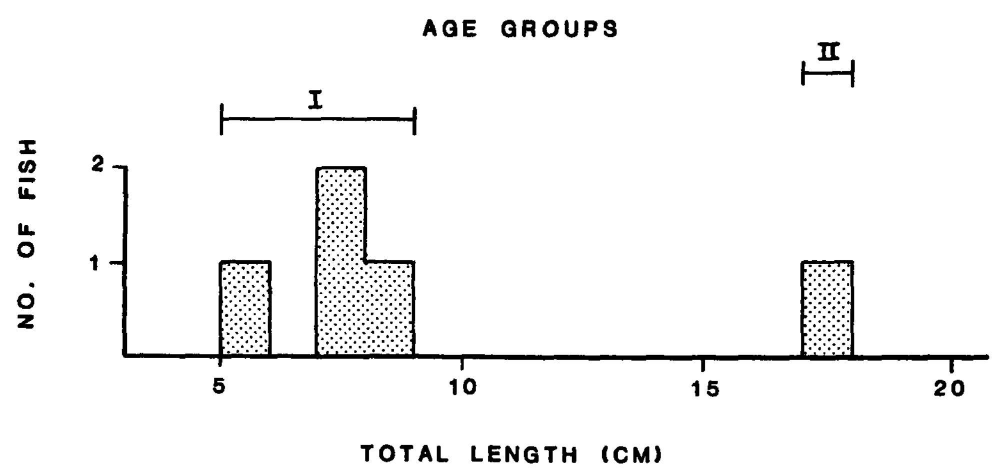

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FIGURE 2.2-3

LENGTH AND AGE FREQUENCY FOR
5 CHANNEL CATFISH COLLECTED FROM
ROCK RIVER DURING MARCH 1974

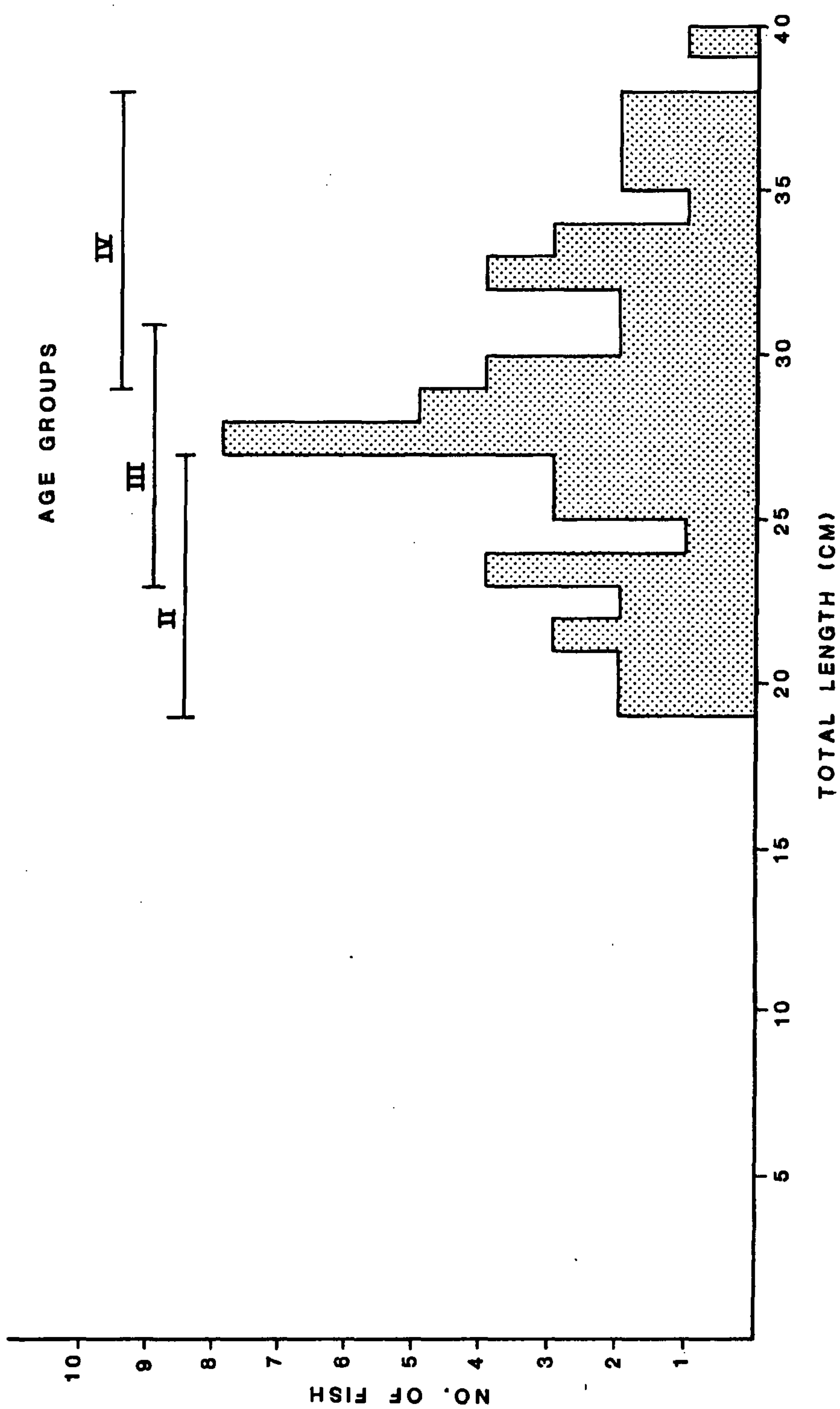

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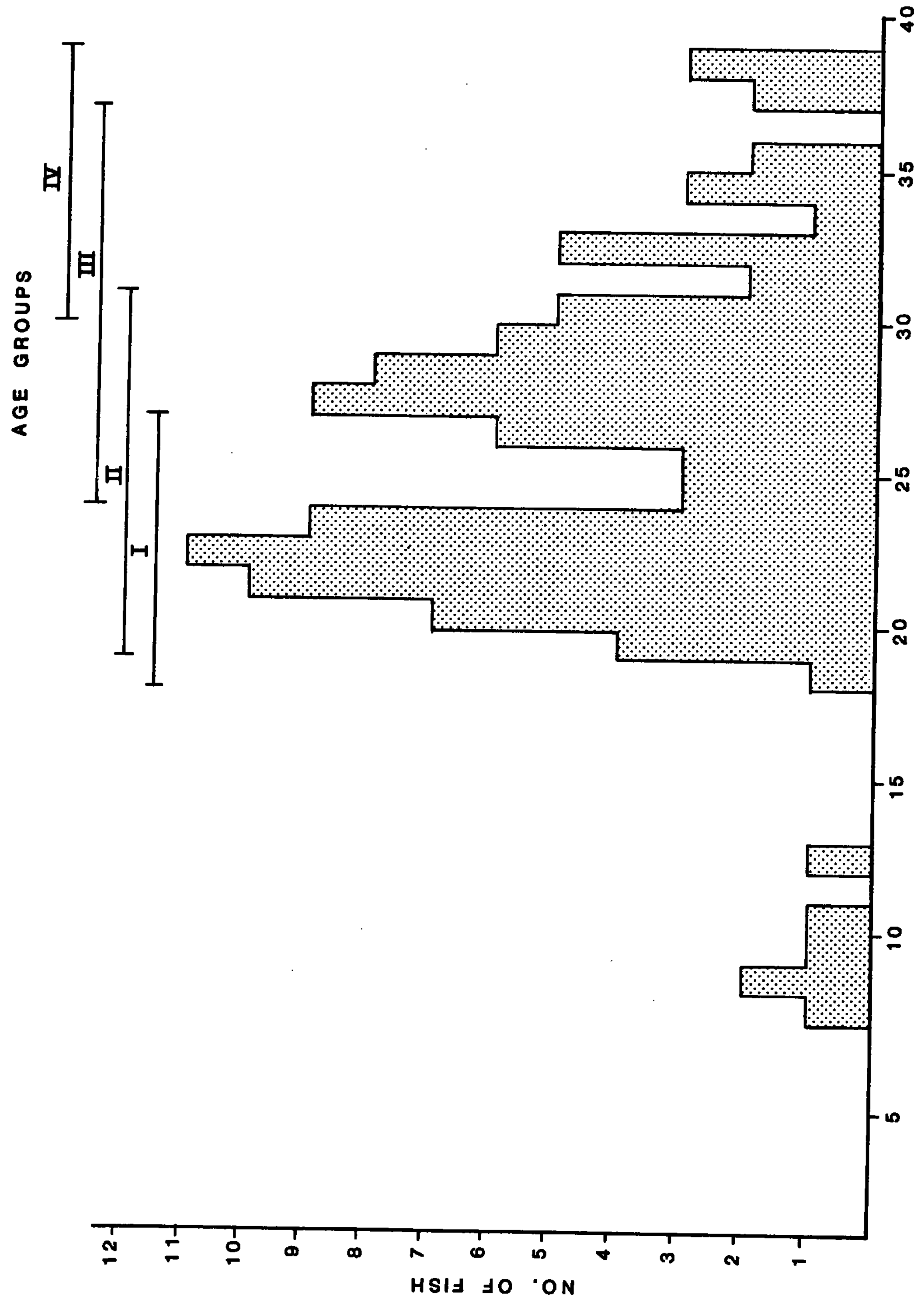
FIGURE 2.2-4

LENGTH AND AGE FREQUENCY FOR
56 CHANNEL CATFISH COLLECTED FROM
ROCK RIVER DURING APRIL 1974



BYRON NUCLEAR GENERATING STATION
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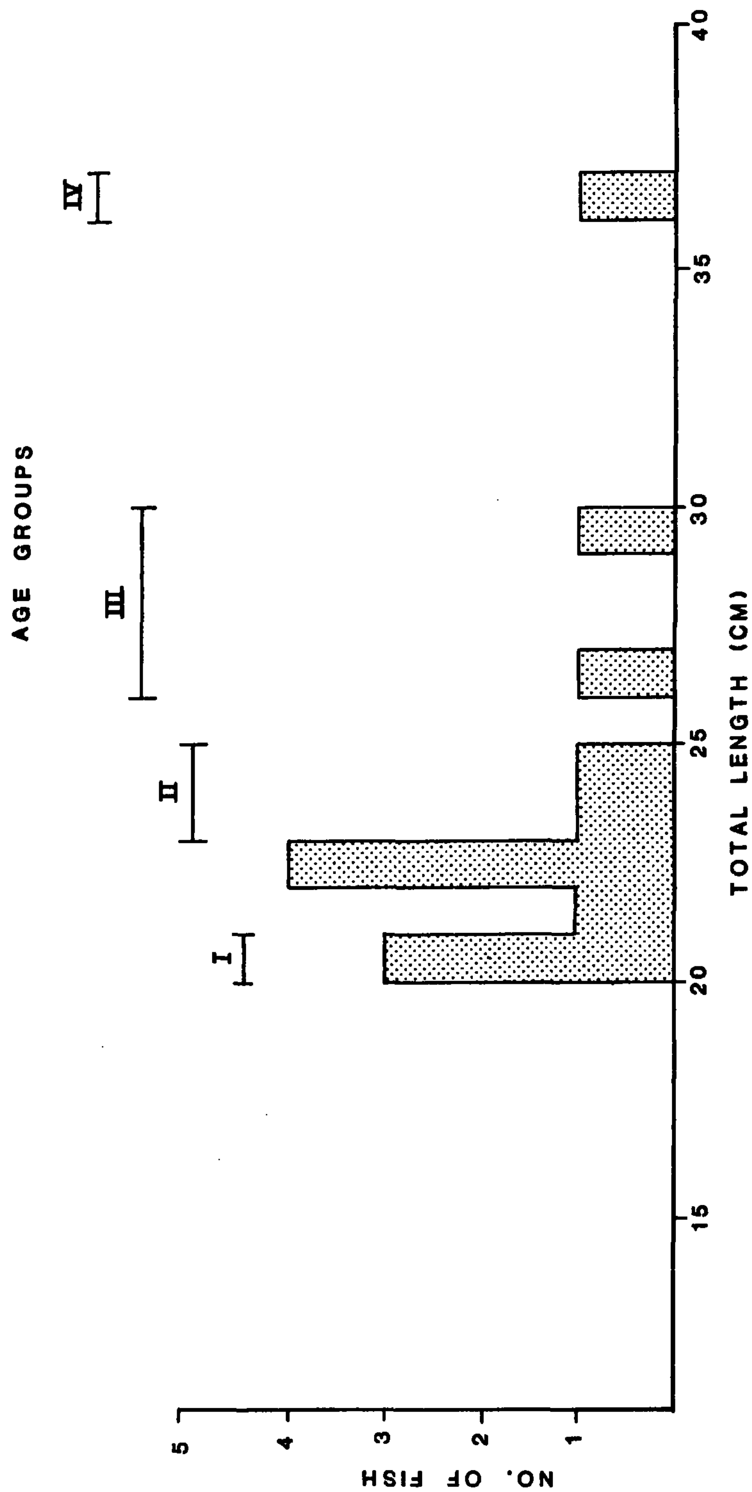
FIGURE 2.2-5

LENGTH AND AGE FREQUENCY FOR
106 CHANNEL CATFISH COLLECTED FROM
ROCK RIVER DURING JULY 1974



BYRON NUCLEAR GENERATING STATION
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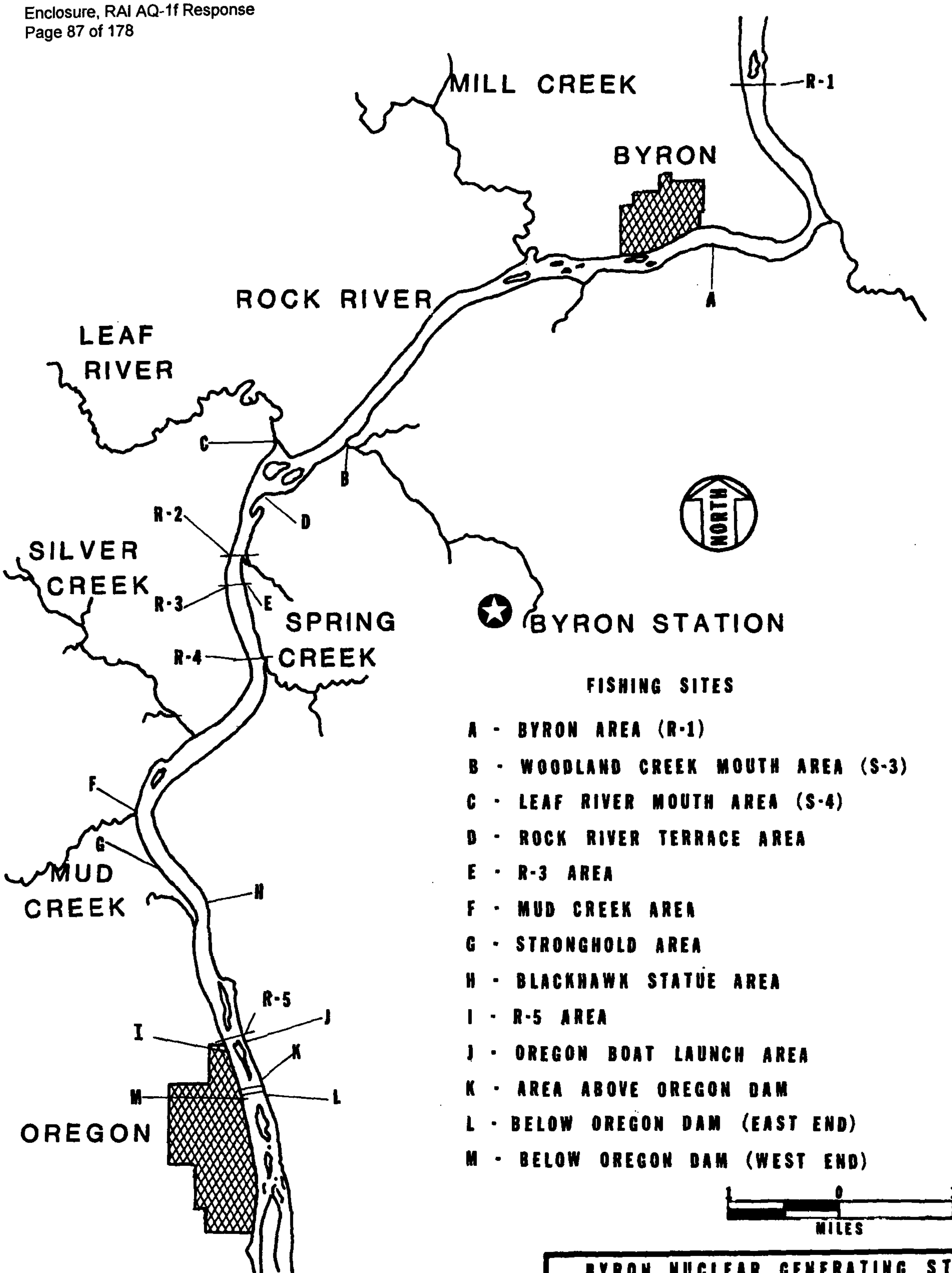
FIGURE 2.2-6

LENGTH AND AGE FREQUENCY FOR
13 CHANNEL CATFISH COLLECTED FROM ROCK
RIVER DURING OCTOBER AND NOVEMBER 1974



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ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 2.2-7

ROCK RIVER FISHING SITES WHERE FISHERMEN WERE INTERVIEWED BETWEEN MAY 5 AND SEPTEMBER 28, 1974

BYRON STATION

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

VOLUME 2

COMMONWEALTH EDISON COMPANY

CHAPTER 4.0 - ENVIRONMENTAL EFFECTS OF SITE PREPARATION, STATION CONSTRUCTION, AND TRANSMISSION FACILITIES CONSTRUCTION

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CHAPTER 4.0 - ENVIRONMENTAL EFFECTS OF SITE PREPARATION, STATION CONSTRUCTION, AND TRANSMISSION FACILITIES CONSTRUCTION

LIST OF FIGURES

endangered faunal species were observed on the site or are expected to reside there.

Comparisons of the survey results for Years 1 and 2 show no detectable faunal changes except for the preemption of some additional habitat because of station site expansion, and the planting of several acres of former cropland and pasture in wildlife-food species. Comparisons of seasonal bird faunas showed high similarities between the data for Years 1 and 2, especially with regard to the more dominant species. Common mammalian species detected onsite were generally the same during the 2 years. For both mammals and birds, some yearly variation appeared in the relative abundances of common species. This variation, however, was the result of sampling methodology and normal variation. None of the variations observed can be reasonably attributed to station construction activities.

No adverse impacts of construction activities on the fauna of the site were detectable.

4.1.4.1.4 Summary of 1977-1981 Bird Impaction Surveys

The avifaunal survey to document any migratory bird fatalities that may result from direct collision with the meteorological tower, cooling towers, or containment and turbine buildings began in August 1977. During the 1977 to 1979 survey periods, no dead or injured birds were observed. During the 1980 survey, nine dead birds were documented during the fall migratory season (October). There were five golden-crowned kinglets, one long-billed marsh wren, one white-throated sparrow, one tennessee warbler, and one warbler that could not be more completely identified due to its condition. All of these birds were collected from around the bases of the natural draft cooling tower structures. During the 1981 survey period, no impaction mortalities were reported. The results as briefly described here were reported to the U. S. Fish and Wildlife Service and the Illinois Department of Conservation. 3

4.1.4.2 Aquatic Studies

Aquatic monitoring sampling locations are shown in Figure 4.1-5.

4.1.4.2.1 Summary of 1974 Sampling Results

These data are derived from the "Sixth Quarterly Report" of EAI.

Water Chemistry:

Changes observed in the chemistry of the Rock River and its tributary streams from September 1973 through October 1974 resulted mainly from seasonal changes in temperature, precipitation, and river discharge rates. The section of the Rock River adjacent to the Byron Station and the tributary streams draining this area appeared to be in a state of moderate eutrophication. Concentrations of all chemical parameters were within Illinois standards with the exception of phosphorus and, in one instance, copper. Nitrate and phosphate were consistently above levels reported capable of producing nuisance algal blooms. The chemistries of the river and tributary streams were similar on most dates sampled at all nine stream stations except W-3 and W-1. The intermittent nature of the streams appeared to be the major factor affecting the observed differences.

Bacteria:

Total bacteria, fecal coliform, and fecal streptococcus counts for the five Rock River stations fluctuated seasonally with the highest counts occurring in April during peak runoff and the lowest counts occurring in October 1974. Similar fluctuations in total coliform counts were observed, but the highest counts occurred in January rather than April. Stream stations had a more varied response to seasonal changes than the river stations.

Seasonal fluctuations in fecal streptococcus numbers corresponded closely with total bacteria and fecal coliform bacteria counts at the river stations and fecal coliform counts at the stream stations. Fecal coliform to fecal streptococcus ratios (FC:FS) varied appreciably on a seasonal basis. Ratios for the five Rock River stations were indicative of contributions from domestic wastes. Ratios greater than 4.0, which occurred in September and October 1973, were indicative of recent pollution by domestic wastes. Ratios between 0.6 and 4.0, which occurred during the remaining sampling dates, were also indicative of domestic wastes.

Phytoplankton:

Phytoplankton was sampled at two river stations from September 8, 1973, through October 8, 1974. A total of 118 taxa were identified during the study. Taxa included 59 diatoms, 43 green algae, 9 blue-greens, 4 euglenoids, 2 pyrrophytes, and 1 cryptophyte.

Numerically, diatoms dominated the community throughout the study, ranging from 76.38% on October 8, 1974 to 100% on January 28, 1974. Dominant forms occurring during the course of the study included Cyclotella meneghiniana, Melosira ambigua, M. granulata, M. granulata var. angustissima, Stephanodiscus hantzschii, S. minutus, S. subtilus, and Nitzschia palea. These forms are commonly found in eutrophic waters.

Zooplankton:

Zooplankton samples were collected on six occasions from September 1973 through October 1974. Samples were taken September 11 and October 16, 1973, from river stations R-1 through R-5 and from tributary stream stations S-4, S-5, and S-6. Samples collected during the remaining periods (January 28, April 30, July 30, and October 8, 1974) were taken from R-2 and R-5 only.

Total zooplankton numbers throughout the study (at river stations) ranged from a low of 2 organisms per liter from station R-2 on January 28, 1974, to a high of nearly 350 per liter from station R-2 on April 30, 1974. Taxonomic composition of zooplankton collected during the study included 3 copepod and 7 cladocerau species, 14 genera of protozoans, and 18 rotifer genera.

Rotifers were the numerically dominant taxa in Rock River samples on five of six occasions and in one of two periods of stream sampling. Most commonly occurring forms included juvenile copepod stages (nauplii and copepodites), cladoceraus Bosmina and Chydorus, and rotifer genera Brachionus, Keratella, and Synchaeta.

Periphyton:

The periphyton community was sampled at five river stations (R-1 through R-5), three tributary stream stations (S-3, S-4, and S-5 from September through December 1973 and S-3, S-5, and S-6 from January through September 1974), and two woodland pool stations (W-1 and W-2) from September 1973 through September 1974.

A total of 266 algae taxa were identified in September 1973 through September 1974 samples. Taxa included 181 diatoms, 64 green algae, 1 chrysophyte, 12 blue-green algae, 7 euglenoids, and 1 pyrrhophyte.

Throughout the study, the community was dominated by diatoms comprising from 90% to 100% of the total units counted. Dominant forms occurring during the study included Melosira granulata var. angustissima, Nitzschia linearis, Navicula viridula var. avenacea, Gomphonema olivaceum, and Gomphonema parvulum, all of which are commonly found in eutrophic waters.

Benthos and Macroinvertebrates:

Benthos collected during the six sampling months in the period of September 1973 through October 1974 were separated into approximately 101 taxa from five invertebrate phyla. Eight types of benthic substrates were described from samples collected during this study period. Samples containing coarse gravel were found to support the greatest number of invertebrate taxa. Correspondingly, coarse gravel was the substrate type most often collected in benthos samples. Seventeen substrate types and combinations were described from the samples.

Macroinvertebrates collected during the 12 months from September 1973 to September 1974 were separated into approximately 115 taxa from four invertebrate phyla. Diptera accounted for the largest number of macroinvertebrates collected over the whole sampling period (4868), followed by Ephemeroptera (4244), and Oligochaeta (2120).

Fish:

Sampling stations in the Rock River and in three tributaries to the river were sampled for adult fish by electroshocking, seining, and hoop-netting. Based on fish sampling from September 12, 1973, through November 1, 1974, sizable populations of carp (Cyprinus carpio), carpsucker (Carpiodes spp.), redhorse (Moxostoma spp.), and channel catfish (Ictalurus punctatus) exist in the section of the Rock River that includes the area just above the Byron Station to the dam at Oregon, Illinois. Channel catfish, for which the river is best known, were most abundant in the July 1974 samples. The channel catfish population appeared to be restricted in age and size of individuals.

A 5-month creel survey indicated that channel catfish and carp were the most abundant. Fishing pressure was greatest below the dam at Oregon and near the mouth of Mud Creek; fishing success was greatest at the Woodland Creek mouth area and at the Oregon dam.

Sixty fish larvae and two fish eggs, predominantly minnow species, were collected from river and stream stations between April 23 and July 3, 1974, inclusive.

4.1.4.2.2 Summary of 1975-1976 Sampling Results

These data for the first year of a 5-year aquatic ecology monitoring survey, which was conducted on the Rock River adjacent to the Byron Station and on the tributary streams draining this area, are derived from the annual report of the construction and preoperational aquatic ecology monitoring program.

Water Chemistry:

The field-measured parameters studied (pH, light penetration, transparency, and turbidity) are presented in Table 4.1-2, and profiles of temperature, dissolved oxygen, current velocity, and conductivity are presented in Table 4.1-3. The results of the routine water chemistry analyses are given in Tables 4.1-6 through 4.1-7, and the trace analyses are in Table 4.1-8. Table 4.1-9 summarizes the results of the bacteriological studies.

A number of water quality parameters were found to exceed the Illinois Pollution Control Board Rules and Regulations that became effective March 20, 1975 under the terms of the Illinois Environmental Protection Act.

General Standards:

Ammonia (NH_4 as N): The limit of 1.5 mg/liter was exceeded during the spring at all stations but W-2.

Phosphate (PO_4 as P): Ortho-phosphate levels exceeded the limit of 0.05 mg/liter at all stations during the summer and winter. In the spring, all stations but W-2 exceeded the limit, and in the fall all stations except R-2, R-4, S-6, and W-2 exceeded the limit.

pH: Stations R-1 and R-2 fell below the range of 6.5-9.0 pH units during the summer.

Iron (Fe): The limit of 1.0 mg/liter was exceeded at all stations during the spring and summer. During the fall, Station S-6 exceeded the limit, and Stations R-2, S-6, and W-2 exceeded it in the winter.

Copper (Cu): The limit of 0.02 mg/liter was exceeded only at Station S-4 during the spring.

Public and Food Processing Water Supply Standards:

Iron (Fe): The limit of 0.3 mg/liter was exceeded at all stations during all quarters.

Total Dissolved Solids (TDS): The limit of 500 mg/liter was exceeded only at Station W-2 during the spring.

All other parameters specified in these two standards categories that were tested for were within permissible limits.

Comparison of the 1975 through 1976 survey results with those of Environmental Analysts, Inc. (CECo 1973, EAI 1975) revealed only a few differences. Summer pH values were generally found to be higher in previous studies than those recorded in the 1975 through 1976 survey. Nitrate concentrations were often much higher in the previous studies. Turbidity values recorded by EAI were uniformly lower than those measured during the 1975 through 1976 study, and Secchi disk depths were greater in the EAI data.

The most striking difference between these two data sets was in the reported levels of trace metals. The concentrations of iron, copper, cadmium, and zinc have all apparently increased since the EAI studies were conducted. Increases in levels of cadmium, copper, and particularly zinc were also noted in fish liver samples over the same period.

Phytoplankton:

Studies by EAI (CECo 1973, EAI 1975) covering the period from May 1972 through October 1974 as well as the 1975 through 1976 study showed that the phytoplankton of the Rock River was dominated by centric diatoms, with species of the pennate type present as occasional dominants. Species found to be dominant during the 1975 through 1976 program were in most cases the same as those reported as dominants in the previous studies. Phytoplankton densities (both numbers and biovolume) during the 1975 through 1976 program were considerably higher than those reported by EAI during the same seasonal periods.

Zooplankton:

The structure of the zooplankton community in the Rock River, as exhibited in 1975 through 1976 quarterly samples taken in the vicinity of the Byron Station, is quite typical of lotic systems. River zooplankton is usually noted for extreme dominance by rotiferan species (EH&A 1976b). Most zooplankton groups are better adapted to either littoral or pond habitats, but a number of rotifer species are able to exploit the lotic systems and reach high population densities, particularly in large slow-flowing rivers with dense phytoplankton communities (EH&A 1976b).

A number of species of copepods are adapted to open waters, but relatively few species are abundant in flowing waters.

The Rock River clearly satisfies Williams' (EH&A 1976b) criteria, and the results of zooplankton sampling in the 1975 through 1976 study and previous ones (CECo 1973, EAI 1975) were typically riverine. The number of species found in this and the previous studies were virtually the same. Spring and fall samples yielded the greatest densities of zooplankton, and rotifers usually predominated except when copepod nauplii were at their maximums in winter and early spring.

Periphyton:

During the 1975 through 1976 study, all stations were heavily dominated by diatoms. Other groups, notably the Chlorophyta and Cyanophyta, were locally important during the summer. Although centric diatoms were important in the periphyton communities, they did not dominate as completely as they did in the phytoplankton community.

Standing crop sizes and seasonal patterns of abundance in this study were considerably different from those found by EAI, although the species recorded as dominants in both studies were very similar.

Species diversity and redundancy values, and the species noted as dominants in this survey indicated that the communities are probably subjected to at least a moderate degree of enrichment.

Benthos and Macroinvertebrates:

Dredge samples showed that the benthic fauna at all Rock River stations except R-1 were dominated by the Tubificidae. Station R-1, and to a lesser extent S-3, had a fauna that was distinct from those of the remaining Rock River stations. This difference was apparently due to the coarser sediments sampled at these stations. The fauna of W-2 was different from that of any other station, probably because of the nature of the small stream habitat. The results of the artificial substrate program showed that all stations were similar in this respect and were dominated by organisms characteristic of erosional habitats.

Fish:

The 1975 through 1976 fish study produced 38 species of fish from the Rock River. Estimates from the literature (CECo 1973, EAI 1975) showed that 74 fish species occur in the system.

Rough fish populations (suckers, carp, and buffalo) dominated the system both by number and weight. Game fish populations except for *Ictalurus punctatus* (channel catfish) consisted of relatively few individuals.

The condition factor, age class information, length frequency analysis, and incidence of parasitism provided no unexpected or abnormal survey results. Samples collected above and below the Byron Station discharge point gave no clear indication of differences in productivity.

Creel census data indicated lower catches than those of the previous EAI survey.

4.1.4.2.3 Summary of 1976-1977 Sampling Results

These data for the second year of a 5-year aquatic ecology monitoring survey, which was conducted on the Rock River adjacent to the Byron Station and on the tributary streams draining this area, are derived from the annual report of the construction and preoperational aquatic ecology monitoring program.

Water Chemistry:

The field-measured parameters studied (pH, light penetration, transparency, and turbidity) are presented in Table 4.1-10, and profiles of temperature, dissolved oxygen, current velocity, and conductivity are presented in Table 4.1-11. The results of water chemistry analyses are given in Tables 4.1-12 through 4.1-15, and the trace metal analyses in Table 4.1-16. Table 4.1-17 summarizes the results of the bacteriological studies.

Some water quality parameters were found to exceed the Illinois Pollution Control Board Rules and Regulations that became effective March 20, 1975, under the terms of the Illinois Environmental Protection Act.

General Standards:

Ammonia (NH_4 as N): The limit of 1.5 mg/liter was exceeded during the winter at Stations R-1, R-2, R-3, R-5, and S-3.

Phosphate (PO_4 as P): Ortho-phosphate levels exceeded the limit of 0.05 mg/liter at all stations sampled in spring except R-1 and W-2, at all but W-2 in summer, at no stations in fall, and at all but S-5 in winter (Station W-2 was frozen).

Iron (Fe): The limit of 1.0 mg/liter was exceeded at Station R-2 in spring, and at Station R-3 in summer.

Copper (Cu): Concentrations of copper exceeded the limit of 0.02 mg/liter in winter at Stations R-1, R-3, S-3, and S-6.

Public and Food Processing Water Supply Standards:

Iron (Fe): The limit of 0.3 mg/liter was exceeded at all stations in spring and summer and at Stations R-4, S-5, and S-6 in fall.

<u>Total Dissolved Solids</u> (TDS): The limit of 500 mg/liter was exceeded in fall at all stations but W-2, and in winter at all but Station S-6 (Station W-2 was frozen).

All other parameters specified in these two standards categories that were tested for were within the standard limits.

Comparison of data collected during Year 2 with data of Year 1 (1975 through 1976) and with that of EAI (CECo 1973, EAI 1975) shows that several of the parameters that had shown an increase from EAI values in Year 1 of the current study declined to levels more comparable with the previous data. The high summer pH values of Year 1 were not repeated. Nitrate values remained well below the high values recorded by EAI. Under the much-reduced flow regime, water clarity improved greatly, as evidenced by turbidity and Secchi disk measurements. The amount of total dissolved solids increased considerably, however.

The marked differences between EAI's trace metal concentrations and those of Year 1, especially concentrations of iron, copper, cadmium, and zinc, were less during the 1976 through 1977 sampling. Cadmium levels were now comparable to those of the EAI study. Iron was still present in notably higher concentrations than in the EAI study, although much lower than in Year 1 of the monitoring program. Copper and zinc concentrations were still generally higher than those found by EAI, but had dropped considerably and were now comparable in some quarters.

It is possible that the many large differences between the results reported by EAI and those found in the Year 1 of the 5-year monitoring study were due in part to floods in the spring of 1975, which may have leached deposits of chemicals from bottom deposits. With lower flows from the fall of 1975 through the end of the 1976 through 1977 study year, this leaching declined, and with it the levels of metal concentrations.

<u>Phytoplankton</u>:

No consistent differences in phytoplankton standing crop or production parameters were evident between Stations R-2 and R-5. Diversities were generally slightly higher during the 1976 through 1977 study year and followed a different seasonal pattern than during 1975 through 1976. Dominant species and their seasonal patterns of abundance, on the other hand, tended to be quite similar in the two years, with the greatest differences occurring during the summer samples. Phytoplankton community structure and production parameters continued to indicate, as in previous studies (CECo 1973, EAI 1975, EH&A 1976b), that the Rock River is at least moderately enriched.

Zooplankton:

In Year-2 samples, zooplankton were again typical of riverine systems, dominated strongly by rotifers, except in winter. The alteration in sampling schedule may be responsible for many of the differences in the seasonal composition of the zooplankton, with samples collected at different points in the successional cycle. These variations within comparable seasons are indicative of the magnitude of variation that can be expected within a season. Some differences among stations may be due to short-lived pulses in abundance that coincide with a water quality change downstream. Severe winter weather provokes the greatest changes in community composition and density, as seen in comparisons between winter and other quarters, and between winters.

Periphyton:

The periphyton community of the Rock River was heavily dominated by diatoms. Other algal groups were important only during the warmest months. Species diversity and redundancy were similar to those encountered during 1975 through 1976. These values and the dominant species present indicate that the Rock River continues to be at least moderately enriched. Species composition, standing crops, and seasonal patterns of abundance were generally similar to those of the previous year. As in the 1975 through 1976 study year, the biomass values measured during the 1976 through 1977 study year did not consistently correlate with density by count or biovolume.

Benthos and Macroinvertebrates:

Both the natural and the artificial substrate communities observed in Year 2 were generally similar to those observed in the 1975 through 1976 study. The natural substrates continued to be dominated by the Tubificidae and Chironomidae, particularly at those stations having the softest or finest grained sediments. Species diversity was stable during the Year 2, relative to that of the previous year, and was at an intermediate level between the low diversities found in spring and summer (1975) and high diversities of the fall. The species present in the sediment varied little between years. Although the rank order of dominant species was somewhat different in the two years, no particular significance could be ascribed to the changes.

The artificial substrate communities showed few differences between Year 1 and Year 2. Relative to 1975, elevated standing crops and lowered summer-fall (July, August, September) diversity was a result of large dipteran (Tanytarsus sp.) populations that peaked in August and September. These changes may have resulted from an increase in food supply, represented by the increased periphyton standing crop observed during the second year.

Although total standing crops did not show any consistent pattern among stations, differences in dominant species and associated standing crops were encountered between left and right bank stations with much greater frequency than were differences between stations located along the same bank. The right bank artificial substrate communities appeared to contain a greater proportion of Diptera and fewer Ephemeroptera than the left bank communities.

Fish:

The 1976 through 1977 fish study found 40 species of fish, 5 of which were not found during the 1975 through 1976 sampling. Rough fish such as carp, suckers, and buffalo continued to dominate the system by weight, although forage species, primarily minnows, generally had the largest number of individuals. Channel catfish was again the most abundant game fish. Adult game fish collected were a higher percentage of the total population during the 1976-1977 sampling than during the 1975-1976 sampling.

Condition factors, year class data, and parasitism data yielded no abnormal results. Creel census data indicated poorer fishing during the 1976-1977 census period than during the 1975-1976 period. The differences between years were significant, however, only in the fall hoop nets when much lower temperatures and flows occurred during the 1976-1977 sampling period and no fish were caught. No rare and endangered species of fish were caught during the 1976-1977 sampling.

4.1.4.3 Special Surface Water and Groundwater Studies

A detailed site geotechnical investigation identified an area of surface water and groundwater contamination by toxic materials that existed before the property was purchased by CECo.

An initial investigation of the contamination problem was performed by Dames & Moore from May 25 through July 5, 1974, and the results are contained in the "Report, Investigation - Buried Toxic Materials and Extent of Contamination Near Byron, Illinois", dated July 22, 1974 (Dames & Moore 1974). A spring 1975 sampling and measuring program was conducted from April 8 through April 20, and the results of this program are presented in the "Report, Results of Spring 1975 Sampling and Measuring Program: Addendum to July 22, 1974 Report", dated May 7, 1975 (Dames & Moore 1975).

The July 22 report concluded that drums and barrels containing toxic chemical wastes, such as cyanide, arsenic, and cadmium, and bulk lots of solid wastes, such as those containing zinc and lead, and other refuse had been placed on and adjacent to the Dirk farm before its purchase by CECo. CECo employed Conservation Chemical Company of Kansas City, Missouri, a licensed waste disposal firm, to remove the drums and barrels,

TABLE 4.1-2

FIELD PARAMETERS FOR 1975-1976 SAMPLING

SAMPLE	STATION	pH	LIGHT PENETRATION (Secchi) (cm)	TRANSPARENCY (extinction coeff. /cm)	TURBIDITY (JTU)
Spring 1975 (April 29)	R-1	7.8	12.00	0.140	289
	R-2	7.2	12.00	0.140	254
	R-3	7.6	12.00	0.140	248
	R-4	7.9	13.00	0.130	232
	R-5	a	14.00	0.120	a
	S-5	7.9	10.00	0.170	274
	S-6	7.8	13.00	a	233
	W-1	7.2	b	b	b
	W-2	a	b	b	b
Summer 1975[c] (July 7 and 10)	R-1	6.4	22.00	0.080	364
	R-2	6.4	22.00	0.080	190
	R-3	6.6	24.00	0.070	19
	R-4	6.8	25.00	0.070	189
	R-5	6.9	19.00	0.100	135
	S-3	6.8	17.00	0.100	171
	S-5	7.0	19.00	0.090	194
	S-6	7.0	a	a	a
	W-2	7.4	b	b	b
Fall 1975[c] (October 7)	R-1	8.5	16.00	0.110	338
	R-2	8.7	18.00	0.090	334
	R-3	8.7	16.00	0.110	406
	R-4	8.7	13.00	0.130	348
	R-5	8.7	13.00	0.130	282
	S-3	8.5	18.00	0.090	320
	S-5	8.7	9.00	0.190	353
	S-6	8.7	10.00	0.180	282
	W-2	b	b	b	b
Winter 1976[c] (February 12)	R-2	7.8	48.30	0.001	8
	R-3	7.8	45.80	0.001	14
	R-4	7.7	55.30	0.007	9
	R-5	7.8	45.80	0.001	10
	S-3	7.8	60.90	0.003	9
	S-6	7.8	a	a	12
	W-2	7.9	b	b	b

[a]Not sampled due to field error.

[b]Not part of sample program.

[c]Station W-1 was dry.

TABLE 4.1-3

IN-SITU WATER QUALITY PROFILES FOR 1975-1976 SAMPLING

SAMPLE	STATION	DEPTH (m)	TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/liter)	VELOCITY[a] (m/sec)	CONDUCTIVITY (μmho)
Spring 1975 (April 29)						
	R-1	0.0	10.5	10.30		315
		2.2	10.2	10.40		290
	R-2	0.0	13.0	10.20	0.82	368
		1.0	13.0	10.20	0.85	370
		2.0	13.0	8.50	0.60	370
	R-3	0.0	9.5	10.90		310
		4.0	9.0	11.10		329
	R-4	0.0	9.5	10.90		311
		4.0	9.1	10.70		320
	R-5	0.0	13.0	10.40	0.80	360
		1.0	13.0	10.20	0.65	360
		2.0	13.0	9.40	0.60	365
	S-3	0.0	9.0	10.70		330
		3.0	9.0	10.70		340
	S-5	0.0	9.5	11.00		300
		1.8	9.2	10.90		305
	S-6	0.0	10.6	11.00		320
		2.5	9.5	10.00		360
	W-1[b]	0.0	19.0	9.40		300
	W-2[b]	0.0	16.2	10.80		458
Summer 1975[c] (July 7 and 10)						
	R-1	0.0	24.2	6.40	0.60	550
		1.0	24.0	7.20	0.70	550
		1.5	24.0	7.00	0.20	550
	R-2	0.0	26.1	7.30	0.50	600
		1.0	26.3	7.00	0.50	600
		2.0	26.3	7.30	0.40	600
	R-3	0.0	26.0	7.10	0.50	600
		1.0	26.0	7.10	0.50	590
		2.0	26.0	7.00	0.40	600
	R-4	0.0	26.0	7.00	0.60	600
		1.0	26.5	6.80	0.60	570
		2.0	26.5	6.90	0.40	590
		3.0	26.5	6.80	0.40	590
	R-5	0.0	25.4	6.80	0.50	590
		1.0	25.1	6.50	0.40	590
		2.0	25.1	6.20	0.30	550
	S-3	0.0	26.0	7.00	0.40	610
		1.0	26.0	7.20	0.30	600
	S-5	0.0	26.0	7.80	0.40	600
		1.0	26.0	7.60	0.20	610
	S-6[d]	0.0	26.0	7.40	0.00	590
		1.0	25.8	7.40	0.00	650
	W-2	0.0	24.0	7.20	0.00	600

[a] Blanks in column headed "VELOCITY" indicate data not taken, except where footnoted.

[b] At Stations W-1 and W-2 the velocity was unmeasurable.

[c] Station W-1 was dry.

[d] Velocity was not measured at Station S-6.

TABLE 4.1-3 (Cont'd)

SAMPLE	STATION	DEPTH (m)	TEMPERATURE (°C)	DISSOLVED OXYGEN[e] (mg/liter)	VELOCITY (m/sec)	CONDUCTIVITY (µmho)
Fall 1975[c] (October 7)						
	R-1	0.0	16.2	15.00	0.40	486
		1.0	16.0	15.00	0.40	600
	R-2[g]	0.0	15.0	14.40	0.30	
		1.0	15.0	13.80	0.20	
		2.0	15.0	14.00	0.20	
	R-3	0.0	15.8	15.00	0.20	492
		1.0	15.4	15.00	0.20	650
		2.0	15.2	15.00	0.20	620
	R-4	0.0	15.5	15.00	0.20	482
		1.0	15.0	14.50	0.20	580
		2.0	15.0	14.20	0.20	550
	R-5	0.0	15.2	15.00	0.10	455
		1.0	14.2	15.00	0.20	580
		2.0	14.8	14.80	0.10	580
	S-3	0.0	16.0	15.00	0.20	670
	S-5	0.0	17.5	15.00	0.10	492
	S-6	0.0	16.9	15.00	0.10	455
		1.0	13.6	12.00	0.10	490
	W-2[h]	0.0	15.4	8.70		
Winter 1976[fi] (February 12)						
	R-2	0.0	-0.2	12.40	0.12	530
		1.0	-0.2	12.40	0.18	
		1.8	-0.5	12.80	0.10	
	R-3	0.0	0.0	14.00	0.15	530
		1.0	-0.3	14.20	0.15	
		1.5	-0.3	14.40	0.10	
	R-4	0.0	-0.5	11.20	0.15	550
		1.0	-0.5	11.00	0.20	
		2.0	-1.0	11.00	0.20	
		3.0	-1.0	11.00	0.15	
	R-5	0.0	-0.8	14.80	0.15	550
		1.0	-0.8	14.80	0.18	
		2.0	-0.8	14.40	0.10	
	S-3	0.0	0.0	13.80	0.08	550
		1.0	-0.5	14.20	0.10	
	S-6	0.0	-0.5	10.80	0.00	408
		1.0	-0.5	10.50	0.00	
	W-2[j]	0.0	4.2	11.80	0.00	283

[e] Value of 15.00 is upper limit of detection.

[f] Station W-1 was dry.

[g] Conductivity data not taken at Station R-2 in fall.

[h] Velocity unmeasurable and conductivity not measured at Station W-2 in fall.

[i] For winter 1976, the conductivity meter was broken, so all surface water samples were analyzed in the lab, and Stations R-1 and S-5 were inaccessible because of ice.

[j] Velocity not measured at Station W-2 in winter.

TABLE 4.1-4

FALL WATER CHEMISTRY AT BYRON STATION ON OCTOBER 7, 1975

(All Values in mg/liter)

STATION[a]	REPLI-CATE	HARD-NESS	ALKA-LINITY	Cl	SO_4	Ca	Mg	COLOR	SiO_2	TOTAL PHOS-PHATE	ORTHO-PHOS-PHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED SOLIDS	BIOCHEMICAL OXYGEN DEMAND	TOTAL ORGANIC CARBON
R-1	1	308	243	24.0	36	63	38.4	85	2.6	0.27	0.11	0.9	0.055	0.44	18.0	70	12.0	386	10.10	12
	2	292	235	25.0	38	66	38.3	85	3.7	0.28	0.10	1.1	0.047	0.44	18.0	76	14.8	410	11.30	12
mean		300	239	24.5	37	64	38.6	85	3.1	0.27	0.10	1.0	0.051	0.44	18.0	73	13.4	398	10.70	12
R-2	1	296	239	36.0	39	59	38.0	75	2.7	0.27	0.05	1.0	0.048	0.42	17.0	70	12.0	410	9.80	12
	2	292	239	12.0	40	61	38.8	75	2.8	0.19	0.04	1.1	0.048	0.43	16.0	64	11.6	416	9.60	11
mean		294	239	24.0	39	60	38.4	75	2.8	0.23	0.04	1.1	0.048	0.42	16.5	67	11.8	413	9.70	11
R-3	1	312	245	26.0	43	64	39.0	80	3.6	0.27	0.10	1.2	0.061	0.44	18.0	88	13.2	390	9.30	12
	2	300	253	28.0	37	63	39.3	80	3.6	0.23	0.10	1.1	0.058	0.42	18.0	68	10.8	392	9.20	13
mean		306	249	27.0	40	63	39.1	80	3.6	0.25	0.10	1.1	0.059	0.43	18.0	78	12.0	391	9.25	13
R-4	1	284	237	26.0	36	59	37.3	95	2.4	0.27	0.05	1.4	0.064	0.47	18.0	76	10.8	400	10.80	12
	2	336	259	34.0	39	62	39.2	80	2.4	0.20	0.05	1.1	0.057	0.46	18.0	84	13.6	408	10.00	12
mean		310	248	30.0	37	60	38.2	88	2.4	0.23	0.05	1.2	0.060	0.46	18.0	80	12.2	404	10.40	12
R-5	1	280	243	20.0	38	65	39.0	90	1.3	0.27	0.07	0.9	0.046	0.45	18.0	86	11.2	400	9.60	15
	2	304	251	24.0	36	63	39.1	85	1.4	0.24	0.07	1.0	0.050	0.40	16.0	70	12.0	400	9.50	13
mean		292	247	22.0	37	64	39.0	88	1.3	0.25	0.07	1.0	0.048	0.42	17.0	78	11.6	400	9.55	14
S-3	1	308	263	28.0	47	65	39.2	80	4.6	0.24	0.12	1.1	0.085	0.40	19.0	50	10.4	424	9.10	10
	2	300	263	28.0	45	64	39.4	80	4.7	0.25	0.11	1.1	0.082	0.50	19.0	58	11.2	406	13.30	11
mean		304	263	28.0	46	64	39.3	80	4.6	0.25	0.11	1.1	0.083	0.45	19.0	54	10.8	415	11.20	10
S-5	1	284	233	26.0	43	64	39.0	90	2.5	0.22	0.06	1.0	0.040	0.43	18.0	58	11.2	394	9.60	12
	2	276	243	26.0	43	63	38.8	85	2.4	0.20	0.06	0.9	0.058	0.42	18.0	79	11.6	392	8.80	12
mean		280	238	26.0	43	63	38.9	88	2.5	0.21	0.06	1.0	0.049	0.42	18.0	68	11.4	393	9.20	12
S-6	1	268	235	22.0	36	56	37.9	100	1.2	0.19	0.02	0.9	0.042	0.44	16.0	78	13.2	366	10.60	13
	2	268	221	20.0	34	55	37.7	95	1.2	0.24	0.02	0.8	0.040	0.45	17.0	82	13.2	392	10.90	11
mean		268	228	21.0	35	55	37.8	98	1.2	0.21	0.02	0.9	0.041	0.44	16.5	80	13.2	389	10.75	12
W-2	1	300	261	4.0	35	50	42.7	10	15.9	0.04	0.02	0.7	0.310	0.48	5.1	4	8.4	348	6.90	4
	2	304	261	4.0	33	51	42.8	12	16.0	0.05	0.01	0.9	0.033	0.48	5.0	2	11.6	368	5.70	4
mean		302	261	4.0	34	50	42.7	11	15.9	0.04	0.02	0.8	0.171	0.48	5.0	3	10.0	358	6.30	4

[a]Station W-1 was dry.

TABLE 4.1-5

WINTER WATER CHEMISTRY AT BYRON STATION ON FEBRUARY 12, 1976

(All Values in mg/liter)

STATION[a]	REPLICATE	HARDNESS	ALKALINITY	Cl	SO_4	Ca	Mg	COLOR	SiO_2	TOTAL PHOSPHATE	ORTHOPHOSPHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED SOLIDS	BIOCHEMICAL OXYGEN DEMAND	TOTAL ORGANIC CARBON
R-2	1	308	246	29.0	56	62	35.1	20	9.9	0.40	0.39	5.0	0.069	0.64	17.1	18	116.0	436	4.00	8
	2	308	250	30.0	48	62	35.4	20	9.8	0.40	0.38	4.4	0.063	0.60	17.7	20	92.0	404	4.00	7
mean		308	248	29.5	52	62	35.2	20	9.8	0.40	0.38	4.7	0.066	0.62	17.4	19	104.0	420	4.00	8
R-3	1	320	246	30.0	51	62	34.9	175	9.9	0.39	0.37	3.8	0.076	0.72	17.7	12	96.0	472	3.00	8
	2	160	246	30.0	48	62	35.5	120	10.2	0.37	0.37	4.4	0.094	0.66	18.1	16	100.0	460	4.00	10
mean		240	246	30.0	49	62	35.2	147	10.0	0.38	0.37	4.1	0.085	0.69	17.9	14	98.0	466	3.50	9
R-4	1	320	252	30.0	51	63	35.6	15	10.2	0.35	0.35	5.2	0.085	0.60	18.1	8	112.0	480	3.00	7
	2	312	254	31.0	49	64	36.0	20	9.8	0.37	0.35	3.7	0.071	0.58	18.1	4	64.0	452	3.00	7
mean		316	253	30.5	50	63	35.8	18	10.0	0.36	0.35	4.4	0.078	0.59	18.1	6	88.0	466	3.00	7
R-5	1	312	254	38.0	51	63	35.5	20	9.9	0.40	0.38	4.3	0.071	0.68	21.2	24	88.0	460	4.00	9
	2	320	256	38.0	50	63	35.8	15	10.0	0.38	0.37	4.4	0.066	0.67	21.0	22	84.0	462	3.00	8
mean		316	255	38.0	50	63	35.6	18	9.9	0.39	0.38	4.3	0.068	0.68	21.1	23	86.0	461	3.50	9
S-3	1	320	242	34.0	62	66	35.4	10	9.5	0.30	0.29	3.8	0.092	0.54	20.0	8	120.0	468	3.00	5
	2	322	240	33.0	63	66	35.0	20	10.0	0.31	0.30	4.0	0.088	0.60	19.8	6	76.0	458	3.00	6
mean		321	241	33.5	63	66	35.2	15	9.8	0.30	0.29	3.9	0.090	0.57	19.9	7	98.0	463	3.00	6
S-6	1	284	204	6.0	33	53	29.4	25	10.4	0.16	0.15	5.5	0.057	0.42	5.3	38	92.0	364	3.00	6
	2	264	204	6.0	39	53	29.6	20	10.6	0.18	0.14	5.4	0.047	0.37	5.3	52	100.0	384	3.00	5
mean		274	204	6.0	36	53	29.5	23	10.5	0.17	0.14	5.4	0.052	0.39	5.3	45	96.0	374	3.00	6
W-2	1	196	146	5.0	21	38	21.2	10	8.6	0.29	0.28	4.2	0.054	0.62	3.0	70	52.0	322	5.00	7
	2	200	146	5.0	20	39	21.4	20	8.5	0.31	0.26	4.2	0.058	0.41	2.9	70	84.0	316	4.00	7
mean		198	146	5.0	20	38	21.3	15	8.6	0.30	0.27	4.2	0.056	0.52	3.0	70	68.0	319	4.50	7

[a]Stations R-1 and S-5 were inaccessible because of ice, and W-1 was dry.

TABLE 4.1-6

SPRING WATER CHEMISTRY AT BYRON STATION ON APRIL 29, 1975

(All Values in mg/liter)

STATION	REPLI-CATE	HARD-NESS	ALKA-LINITY	Cl	SO_4	Ca	Mg	COLOR	SiO_2	TOTAL PHOS-PHATE	ORTHO PHOS-PHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED SOLIDS	BIOCHEMICAL OXYGEN DEMAND	TOTAL ORGANIC CARBON
R-1	1	256	88	18.0	42	71	30.0	125	6.4	0.68	0.09	2.2	0.029	1.76	5.5	286	170.0	332	8.80	22
	2	248	88	20.0	46	72	30.7	120	7.4	0.13	0.09	2.8	0.026	2.11	5.6	398	90.0	524	9.70	19
mean		252	88	19.0	44	71	30.4	122	6.9	0.40	0.09	2.5	0.027	1.93	5.5	342	130.0	428	9.25	20
R-2	1	256	96	17.0	43	64	28.4	70	7.6	0.35	0.08	2.4	0.027	1.90	4.9	292	112.5	296	8.60	24
	2	244	96	16.0	48	70	36.1	98	8.5	0.67	0.08	2.2	0.023	1.10	5.5	250	55.0	312	4.50	17
mean		250	96	16.5	45	67	32.2	84	8.0	0.51	0.08	2.3	0.025	1.50	5.2	271	83.8	304	6.55	20
R-3	1	244	88	21.0	43	64	28.2	82	6.6	0.89	0.08	2.8	0.024	1.62	5.2	380	135.0	304	26.20	23
	2	240	92	17.0	43	65	28.6	95	5.6	0.58	0.08	1.8	0.011	1.41	5.1	396	65.0	644	11.60	23
mean		242	90	19.0	43	64	28.4	88	6.1	0.73	0.08	2.3	0.017	1.51	5.1	388	100.0	474	18.90	23
R-4	1	252	100	18.0	43	65	29.8	98	5.4	0.38	0.08	1.9	0.024	1.78	5.1	236	120.0	380	5.20	22
	2	260	96	17.0	43	65	30.3	98	5.5	0.67	0.08	2.8	0.025	1.76	5.1	260	85.0	340	5.40	23
mean		256	98	17.5	43	65	30.0	98	5.4	0.52	0.08	2.3	0.024	1.77	5.1	248	102.5	360	5.30	23
R-5	1[b]	260	86	17.0	15	69	26.8	*[a]	6.5	0.57	0.10	2.4	*	1.91	*	190	*	344	9.40	20
mean	-	260	88	17.0	15	69	26.8	*	6.5	0.57	0.10	2.4	*	1.91	*	190	*	344	9.40	20
S-3	1	248	92	19.0	46	70	30.7	75	6.5	0.75	0.08	2.8	0.032	1.98	5.5	238	105.0	336	4.20	21
	2	260	100	20.0	44	68	34.8	90	5.6	0.47	0.08	2.5	0.029	2.01	5.5	212	130.0	512	4.60	21
mean		254	96	19.5	45	69	32.7	83	6.0	0.61	0.08	2.6	0.030	1.99	5.5	225	117.5	424	4.40	21
S-5	1	244	92	19.0	48	64	21.5	145	6.1	0.49	0.09	2.6	0.027	1.78	5.3	262	65.0	304	6.90	22
	2	252	92	16.0	44	64	27.2	136	5.3	0.54	0.11	2.5	0.031	1.44	5.2	226	145.0	316	8.90	22
mean		248	92	17.5	46	64	24.4	140	5.7	0.51	0.10	2.5	0.029	1.61	5.3	244	105.0	310	7.90	22
S-6	1	252	96	16.0	42	63	28.6	90	5.7	0.16	0.08	1.5	0.022	1.52	4.8	226	160.0	516	8.90	12
	2	244	92	15.0	41	63	28.6	95	5.2	0.67	0.08	1.6	0.027	1.69	4.9	226	130.0	584	7.60	12
mean		248	94	15.5	41	63	28.6	93	5.4	0.42	0.08	1.5	0.024	1.60	4.8	226	145.0	550	8.25	12
W-1	1	204	80	14.0	32	43	21.7	110	7.2	0.29	0.08	4.8	0.086	3.04	4.2	190	55.0	320	6.70	11
	2	196	72	15.0	32	43	21.6	118	7.7	0.32	0.08	4.4	0.086	2.84	4.3	202	70.0	352	2.10	9
mean		200	76	14.5	32	43	21.6	114	7.4	0.30	0.08	4.6	0.086	2.94	4.3	196	62.5	336	4.40	10
W-2	1	368	140	8.0	36	76	39.5	2	12.3	0.10	0.01	1.2	0.041	0.86	3.1	186	68.0			
	2	260	148	10.0	35	78	40.0	40	12.1	0.10	0.01	1.5	0.042	0.53	3.0	92	70.0			
mean		314	144	9.0	35	77	39.7	21	12.2	0.10	0.01	1.4	0.041	0.70	3.0	139	69.0			

[a] Asterisk (*) indicates analysis not done because of lab error.

[b] Replicate 2 was lost in transit.

TABLE 4.1-7

SUMMER WATER CHEMISTRY AT BYRON STATION ON JULY 8, 1975

(All Values in mg/liter)

STATION[a]	REPLICATE	HARDNESS	ALKALINITY	Cl	SO_4	Ca	Mg	COLOR	SiO_2	TOTAL PHOSPHATE	ORTHOPHOSPHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED SOLIDS	BIOCHEMICAL OXYGEN DEMAND	TOTAL ORGANIC CARBON
R-1	1	346	238	26.0	17	90	31.0	350	16.8	0.30	0.22	1.7	0.060	1.17	8.1	334	96.0	282	3.00	12
	2	330	250	24.0	13	87	31.0	425	14.4	0.28	0.22	2.1	0.047	1.53	8.2	305	108.0	299	3.00	11
mean		338	244	25.0	15	88	31.0	388	15.6	0.29	0.22	1.9	0.053	1.35	8.1	319	102.0	290	3.00	11
R-2	1	369	246	25.0	8	93	33.0	285	11.8	0.40	0.22	1.7	0.049	1.10	9.0	151	112.0	329	3.00	8
	2	367	243	23.0	7	92	33.0	160	9.6	0.36	0.23	1.5	0.048	1.20	8.5	153	100.0	315	3.00	10
mean		368	244	24.0	8	93	33.0	222	10.7	0.38	0.22	1.6	0.048	1.15	8.8	152	106.0	322	3.00	9
R-3	1	349	244	25.0	17	88	31.0	225	13.0	0.24	0.22	1.4	0.049	1.17	8.3	231	96.0	261	2.00	9
	2	362	237	25.0	23	90	33.0	400	10.9	0.28	0.23	1.6	0.049	1.09	8.9	154	112.0	350	2.00	12
mean		355	240	25.0	20	89	32.0	313	11.9	0.26	0.22	1.5	0.049	1.13	8.6	192	104.0	305	2.00	10
R-4	1	386	244	25.0	9	98	34.0	300	12.9	0.28	0.21	1.8	0.047	1.06	8.9	133	104.0	351	3.00	11
	2	384	246	25.0	13	94	33.0	240	12.4	0.28	0.22	1.7	0.052	1.05	9.1	129	116.0	355	2.00	9
mean		385	245	25.0	11	96	33.5	270	12.6	0.28	0.21	1.8	0.049	1.05	9.0	131	110.0	353	2.50	10
R-5	1	344	228	26.0	23	87	32.0	185	12.2	0.40	0.29	1.5	0.096	0.82	8.3	133	100.0	323	3.00	10
	2	346	230	24.0	12	87	31.0	215	12.4	0.44	0.30	1.9	0.089	1.06	8.3	112	108.0	324	7.00	8
mean		345	229	25.0	18	87	31.5	200	12.3	0.42	0.29	1.7	0.092	0.94	8.3	122	104.0	323	5.00	9
S-3	1	386	252	26.0	15	95	33.0	180	13.1	0.23	0.18	2.7	0.050	1.10	8.5	203	104.0	277	2.00	9
	2	374	244	27.0	11	98	33.0	220	13.1	0.24	0.19	2.3	0.051	1.11	8.6	193	108.0	323	3.00	11
mean		380	248	26.5	13	96	33.0	200	13.1	0.24	0.18	2.5	0.050	1.10	8.6	198	106.0	300	2.50	10
S-5	1	386	244	28.0	12	98	34.0	240	12.2	0.35	0.29	1.9	0.057	1.12	9.3	170	128.0	370	3.00	10
	2	374	250	24.0	17	95	33.0	225	13.3	0.38	0.26	1.3	0.086	1.00	9.0	138	128.0	370	3.00	8
mean		380	247	26.0	14	96	33.5	232	12.7	0.37	0.27	1.6	0.071	1.06	9.1	154	128.0	370	3.00	9
S-6	1	368	258	20.0	21	91	34.0	225	18.7	0.28	0.23	2.3	0.092	0.83	6.1	152	128.0	348	3.00	7
	2	378	252	22.0	19	93	35.0	225	18.8	0.22	0.13	1.8	0.046	0.84	5.4	180	116.0	360	2.00	6
mean		373	255	21.0	20	92	34.5	225	18.7	0.25	0.18	2.0	0.069	0.83	5.8	166	122.0	354	2.50	7
W-2	1	388	272	26.0	10	97	35.0	160	13.3	0.30	0.15	1.6	0.061	1.12	7.5	161	92.0	351	3.00	9
	2	385	262	23.0	11	96	35.0	180	14.3	0.32	0.16	1.7	0.052	1.07	8.1	179	124.0	353	3.00	7
mean		386	267	24.5	10	96	35.0	170	13.8	0.31	0.16	1.6	0.056	1.09	7.8	170	108.0	352	3.00	8

[a]Station W-1 was dry.

TABLE 4.1-8

TRACE METALS ANALYSIS FOR 1975-1976 SAMPLING

(All Values in mg/liter)

STATION	REPLI-CATE	SPRING: APRIL 29, 1975							
		Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
R-1	1	0.002	0.022	7.10	0.010	0.0001	0.046	0.03	0.015
	2	0.003	0.014	7.41	0.010	0.0001	0.047	0.02	0.010
mean		0.003	0.018	7.25	0.010	0.0001	0.046	0.03	0.013
R-2	1	0.002	0.014	6.08	0.010	0.0001	0.041	0.02	0.013
	2	0.002	0.014	6.32	0.010	0.0001	0.066	0.02	0.012
mean		0.002	0.014	6.20	0.010	0.0001	0.053	0.02	0.013
R-3	1	0.003	0.013	5.37	0.010	0.0001	0.034	0.01	0.011
	2	0.002	0.010	5.94	0.010	0.0001	0.039	0.01	0.009
mean		0.003	0.012	5.66	0.010	0.0001	0.036	0.01	0.010
R-4	1	0.001	0.011	5.68	0.010	0.0001	0.041	0.02	0.006
	2	0.003	0.014	5.53	0.010	0.0001	0.040	0.01	0.009
mean		0.002	0.013	5.60	0.010	0.0001	0.040	0.02	0.008
R-5[a]	1	0.002	*[b]	7.00	0.010	0.0001	0.031	0.02	0.012
mean		0.002	*	7.00	0.010	0.0001	0.031	0.02	0.012
S-3	1	0.003	0.019	7.12	0.010	0.0001	0.046	0.04	0.011
	2	0.003	0.019	7.15	0.010	0.0001	0.046	0.03	0.014
mean		0.003	0.019	7.13	0.010	0.0001	0.046	0.03	0.013
S-5	1	0.002	0.008	6.49	0.010	0.0001	0.036	0.02	0.007
	2	0.005	0.016	6.53	0.010	0.0001	0.038	0.03	0.011
mean		0.004	0.012	6.51	0.010	0.0001	0.037	0.03	0.009
S-6	1	0.001	0.013	5.10	0.010	0.0001	0.166	0.03	0.009
	2	0.003	0.020	5.07	0.010	0.0001	0.077	0.02	0.010
mean		0.002	0.016	5.08	0.010	0.0001	0.122	0.03	0.010
W-1	1	0.002	0.011	3.33	0.010	0.0001	0.029	0.01	0.006
	2	0.002	0.013	3.42	0.010	0.0001	0.027	0.01	0.008
mean		0.002	0.012	3.38	0.010	0.0001	0.028	0.01	0.007
W-2	1	0.002	0.009	1.62	0.010	0.0001	0.013	0.02	0.004
	2	0.001	0.008	1.87	0.010	0.0001	0.029	0.01	0.003
mean		0.002	0.009	1.74	0.010	0.0001	0.021	0.02	0.004

[a] Replicate 2 was lost in transit.

[b] Asterisk (*) indicates analysis not done because of lab error.

TABLE 4.1-8 (Cont'd)

STATION[c]	REPLICATE	SUMMER: JULY 7, 1975 Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
R-1	1	0.002	0.015	7.26	0.008	0.0001	0.033	0.01	0.017
	2	0.002	0.011	7.13	0.008	0.0001	0.031	0.01	0.010
mean		0.002	0.013	7.19	0.008	0.0001	0.032	0.01	0.014
R-2	1	0.002	0.011	4.36	0.005	0.0001	0.028	0.01	0.004
	2	0.002	0.011	4.66	0.007	0.0001	0.028	0.01	0.007
mean		0.002	0.011	4.51	0.006	0.0001	0.028	0.01	0.006
R-3	1	0.002	0.008	4.56	0.005	0.0001	0.027	0.01	0.005
	2	0.002	0.008	4.26	0.006	0.0001	0.020	0.01	0.007
mean		0.002	0.008	4.41	0.006	0.0001	0.023	0.01	0.006
R-4	1	0.003	0.009	4.16	0.004	0.0001	0.019	0.01	0.004
	2	0.003	0.007	3.75	0.006	0.0001	0.017	0.01	0.006
mean		0.003	0.008	3.95	0.005	0.0001	0.018	0.01	0.005
R-5	1	0.002	0.006	3.53	0.005	0.0001	0.017	0.01	0.008
	2	0.002	0.009	2.90	0.007	0.0001	0.022	0.01	0.004
mean		0.002	0.008	3.22	0.006	0.0001	0.019	0.01	0.006
S-3	1	0.003	0.006	3.79	0.006	0.0001	0.015	0.01	0.005
	2	0.002	0.009	3.96	0.004	0.0001	0.019	0.01	0.007
mean		0.003	0.008	3.88	0.005	0.0001	0.017	0.01	0.006
S-5	1	0.003	0.008	4.76	0.006	0.0001	0.022	0.01	0.012
	2	0.002	0.008	4.14	0.007	0.0001	0.021	0.01	0.006
mean		0.003	0.008	4.45	0.007	0.0001	0.021	0.01	0.009
S-6	1	0.002	0.006	3.16	0.005	0.0001	0.014	0.01	0.006
	2	0.002	0.011	3.04	0.007	0.0001	0.011	0.01	0.008
mean		0.002	0.009	3.10	0.006	0.0001	0.013	0.01	0.007
W-2	1	0.001	0.007	3.58	0.007	0.0001	0.014	0.01	0.005
	2	0.002	0.007	3.80	0.006	0.0001	0.018	0.01	0.003
mean		0.002	0.007	3.69	0.007	0.0001	0.016	0.01	0.004

[c] Station W-1 was dry.

TABLE 4.1-8 (Cont'd)

STATION[c]	REPLI-CATE	FALL: OCTOBER 7, 1975							
		Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
R-1	1	0.001	0.011	0.74	0.003	0.0001	0.024	0.01	0.004
	2	0.001	0.009	0.89	0.003	0.0001	0.020	0.01	0.004
mean		0.001	0.010	0.81	0.003	0.0001	0.022	0.01	0.004
R-2	1	0.001	0.009	0.85	0.003	0.0001	0.024	0.01	0.004
	2	0.001	0.011	0.94	0.003	0.0001	0.027	0.01	0.005
mean		0.001	0.010	0.89	0.003	0.0001	0.025	0.01	0.005
R-3	1	0.001	0.008	0.65	0.003	0.0001	0.20	0.01	0.005
	2	0.001	0.009	1.00	0.003	0.0001	0.23	0.01	0.005
mean		0.001	0.009	0.82	0.003	0.0001	0.21	0.01	0.005
R-4	1	0.001	0.011	0.77	0.003	0.0001	0.024	0.01	0.005
	2	0.001	0.011	0.85	0.003	0.0001	0.028	0.01	0.006
mean		0.001	0.011	0.81	0.003	0.0001	0.026	0.01	0.006
R-5	1	0.001	0.011	1.09	0.003	0.0001	0.030	0.01	0.005
	2	0.001	0.011	0.64	0.003	0.0001	0.023	0.01	0.005
mean		0.001	0.011	0.87	0.003	0.0001	0.026	0.01	0.005
S-3	1	0.001	0.011	0.83	0.003	0.0001	0.028	0.02	0.005
	2	0.001	0.011	0.78	0.011	0.0001	0.026	0.02	0.003
mean		0.001	0.011	0.80	0.007	0.0001	0.027	0.02	0.004
S-5	1	0.001	0.011	0.78	0.003	0.0001	0.026	0.02	0.003
	2	0.001	0.010	0.80	0.003	0.0001	0.026	0.01	0.004
mean		0.001	0.011	0.79	0.003	0.0001	0.026	0.02	0.004
S-6	1	0.001	0.009	1.16	0.003	0.0001	0.024	0.01	0.004
	2	0.001	0.015	1.29	0.003	0.0001	0.026	0.01	0.004
mean		0.001	0.012	1.22	0.003	0.0001	0.025	0.01	0.004
W-2	1	0.001	0.007	0.24	0.003	0.0001	0.010	0.01	0.003
	2	0.001	0.009	0.22	0.003	0.0001	0.011	0.01	0.002
mean		0.001	0.008	0.23	0.003	0.0001	0.011	0.01	0.003

[c]Station W-1 was dry.

TABLE 4.1-8 (Cont'd)

STATION[cd]	REPLICATE	Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
		WINTER: FEBRUARY 2, 1976							
R-2	1	0.001	0.008	2.17	0.010	0.0001	0.025	0.01	0.009
	2	0.001	0.007	0.67	0.010	0.0001	0.018	0.01	0.013
mean		0.001	0.008	1.42	0.010	0.0001	0.021	0.01	0.011
R-3	1	0.001	0.010	0.65	0.010	0.0001	0.016	0.01	0.014
	2	0.001	0.200	0.65	0.010	0.0001	0.016	0.01	0.012
mean		0.001	0.105	0.65	0.010	0.0001	0.016	0.01	0.013
R-4	1	0.001	0.010	0.56	0.010	0.0001	0.020	0.01	0.010
	2	0.001	0.009	0.53	0.010	0.0001	0.016	0.01	0.008
mean		0.001	0.010	0.54	0.010	0.0001	0.018	0.01	0.009
R-5	1	0.001	0.007	0.66	0.010	0.0001	0.016	0.01	0.018
	2	0.001	0.010	0.63	0.010	0.0001	0.016	0.01	0.011
mean		0.001	0.009	0.64	0.010	0.0001	0.016	0.01	0.015
S-3	1	0.001	0.006	0.49	0.010	0.0001	0.018	0.01	0.005
	2	0.001	0.009	0.47	0.010	0.0001	0.020	0.01	0.005
mean		0.001	0.009	0.48	0.010	0.0001	0.019	0.01	0.005
S-6	1	0.001	0.005	1.56	0.010	0.0001	0.008	0.01	0.005
	2	0.001	0.007	1.71	0.010	0.0001	0.010	0.01	0.006
mean		0.001	0.006	1.63	0.010	0.0001	0.009	0.01	0.006
W-2	1	0.001	0.012	2.91	0.010	0.0001	0.024	0.01	0.006
	2	0.001	0.006	3.06	0.010	0.0001	0.019	0.01	0.005
mean		0.001	0.009	2.98	0.010	0.0001	0.021	0.01	0.006

[c]Station W-1 was dry.

[d]Stations R-1 and S-5 were inaccessible because of ice.

TABLE 4.1-9

BACTERIOLOGY ANALYSIS FOR 1975-1976 SAMPLING

(All Values in No. of Colonies/100 ml Except Where Noted)

	SPRING: APRIL 29, 1975				SUMMER: JULY 8, 1975			
STATION	REPLICATE	STANDARD PLATE COUNT[a]	T-COLI	F-STREP	REPLICATE	STANDARD PLATE COUNT[a]	T-COLI	F-STREP
R-1	1	46,000	5,900	7,400	1	76,000	11,000	5,500
	2	49,000	55,000	30,000	2	59,000	14,000	5,200
mean		47,500	30,450	18,700		67,500	12,500	5,350
R-2	1	46,000	6,000	3,100	1	52,000	10,000	1,000
	2	33,000	21,000	68,000	2	49,000	17,000	1,200
mean		39,500	13,500	35,550		50,500	13,500	1,100
R-3	1	48,000	32,000	6,200	1	42,000	10,000	700
	2	62,000	47,000	4,000	2	32,000	9,000	300
mean		55,000	39,500	5,100		37,000	9,500	500
R-4	1	48,000	20,000	3,500	1	44,000	20,000	900
	2	33,000	19,000	41,000	2	25,000	10,000	1,100
mean		40,500	19,500	22,250		34,500	15,000	1,000
R-5[b]	1	*[c]	9,800	5,800	1	41,000	11,000	2,000
			9,800	5,300	2	78,000	10,000	1,700
mean						59,500	10,500	1,850
S-3	1	50,000	15,000	26,100	1	34,000	13,000	1,600
	2	90,000	23,000	10,600	2	34,000	16,000	1,400
mean		70,000	19,000	18,350		34,000	14,500	1,500
S-5	1	57,000	38,000	124,000	1	41,000	10,000	2,500
	2	50,000	23,000	9,200	2	40,000	14,000	2,500
mean		53,500	30,500	66,600		40,500	12,000	2,500
S-6	1	36,000	6,100	7,800	1	30,000	13,000	4,200
	2	36,000	4,800	3,700	2	37,000	12,000	4,500
mean		36,000	5,400	5,750		33,500	12,500	4,350
W-1[d]	1	35,000	23,000	1,100				
	2	58,000	18,000	1,140				
mean		16,500	20,500	1,120				
W-2	1	3,800	1,200	860	1	50,000	12,000	1,000
	2	3,500	100	100	2	21,000	14,000	1,200
mean		3,650	650	480		35,500	13,000	1,100

[a]Values in no. of colonies/ml.

[b]Spring Replicate 2 was lost in transit.

[c]Asterisk (*) indicates analysis not done because of lab error.

[d]Station W-1 was dry during summer, fall, and winter sampling.

TABLE 4.1-9 (Cont'd)

	FALL: OCTOBER 7, 1975				WINTER: FEBRUARY 12, 1976			
STATION	REPLICATE	STANDARD PLATE COUNT[a]	T-COLI	F-STREP	REPLICATE	STANDARD PLATE COUNT[a]	T-COLI	F-STREP
R-1[e]	1	17,000	6,000	300				
	2	11,000	8,000	400				
mean		14,000	7,000	350				
R-2	1	15,000	7,000	300	1	16,000	4,000	410
	2	13,000	8,000	600	2	28,000	5,000	220
mean		14,000	7,500	450		23,000	4,500	315
R-3	1	17,000	7,000	300	1	21,000	5,000	290
	2	14,000	7,000	400	2	25,000	1,000	210
mean		15,500	7,000	350		23,000	3,000	250
R-4	1	31,000	6,000	300	1	26,000	2,000	410
	2	15,000	6,000	500	2	17,000	6,000	210
mean		23,000	6,000	400		21,500	4,000	310
R-5	1	12,000	5,000	300	1	26,000	4,000	120
	2	13,000	9,000	400	2	31,000	5,000	180
mean		12,500	7,000	350		28,500	4,500	150
S-3	1	20,000	7,000	200	1	23,000	3,000	130
	2	22,000	8,000	300	2	19,000	3,000	110
mean		21,000	7,500	250		21,000	3,000	120
S-5[e]	1	36,000	5,000	200				
	2	23,000	7,000	200				
mean		29,500	6,000	200				
S-6	1	18,000	6,000	200	1	24,000	3,000	200
	2	13,000	6,000	300	2	18,000	2,000	130
mean		15,500	6,000	250		21,000	2,500	165
W-2	1	21,000	7,000	400	1	31,000	3,000	140
	2	19,000	5,000	200	2	33,000	2,000	220
mean		20,000	6,000	300		32,000	2,500	180

[a] Values in no. of colonies/ml.

[e] Station inaccesible during winter sampling because of ice.

TABLE 4.1-10

FIELD PARAMETERS FOR 1976-1977 SAMPLING

SAMPLE	STATION[a]	pH	LIGHT PENETRATION (Secchi) (cm)	TRANSPARENCY (extinction coeff./cm)	TURBIDITY (JTU)
Spring 1976 (May 24)	R-1	8.1	31.00	0.008	75
	R-2	8.1	38.20	0.009	38
	R-3	8.1	40.00	0.003	64
	R-4	8.2	32.00	0.004	68
	R-5	8.2	44.00	0.003	*[b]
	S-3	8.1	38.00	0.001	78
	S-5	*	35.00	0.003	68
	S-6	8.1	26.00	0.014	86
	W-2	*	+[c]	+	+
Summer 1976 (August 2)	R-1	8.7	30.00	0.004	21
	R-2	9.0	26.00	0.009	23
	R-3	8.6	30.50	0.005	22
	R-4	8.6	33.50	0.003	21
	R-5	8.7	27.00	0.017	21
	S-3	8.8	31.00	0.006	23
	S-5	8.8	31.00	0.004	20
	S-6	9.0	23.00	0.009	22
	W-2	8.8	+	+	8
Fall 1976 (November 1)	R-1	8.0	93.00	0.000	4
	R-2	8.1	68.00	0.001	4
	R-3	8.1	74.00	0.001	4
	R-4	8.0	74.00	0.002	5
	R-5	7.0	57.00	0.001	5
	S-3	8.0	77.00	0.001	4
	S-5	7.9	26.00	0.002	5
	S-6	8.2	59.00	0.003	5
	W-2	8.1	+	+	1
Winter 1977 (February 9)	R-1	8.0	137.00	0.001	2
	R-2	7.9	158.00	0.002	2
	R-3	7.9	163.00	0.004	2
	R-4	7.9	154.00	0.008	2
	R-5	7.9	176.00	0.001	2
	S-3	7.8	50.00	0.001	2
	S-5	7.6	+	+	2
	S-6	7.8	130.00	0.005	4

[a]Station W-1 was dry during all four sampling programs; Station W-2 was dry during winter sampling.

[b]Asterisk (*) indicates analysis not done because of field error.

[c]Cross (+) indicates analysis not done because water too shallow to measure.

TABLE 4.1-11

IN-SITU WATER QUALITY PROFILES FOR 1975-1976 SAMPLING

SAMPLE	STATION[a]	DEPTH (meters)	TEMPERATURE (°C)	DISSOLVED OXYGEN[b] (mg/liter)	VELOCITY (m/sec)	CONDUCTIVITY (umho)
Spring 1976 (May 24)						
	R-1	0.0	16.0	9.60	0.75	500
		1.0	15.5	9.50	0.60	550
	R-2	0.0	17.0	9.40	0.40	470
		1.0	17.0	9.20	0.35	475
		2.0	16.8	8.00	0.30	470
	R-3	0.0	17.2	10.80	0.45	465
		1.0	17.2	10.70	0.40	470
		2.0	17.3	10.70	0.30	480
		2.8	17.3	10.80	0.30	480
	R-4	0.0	17.5	11.40	0.20	460
		1.0	17.3	11.20	0.30	470
		2.0	17.3	11.20	0.30	470
		3.0	17.3	11.00	0.30	470
	R-5	0.0	17.4	10.40	0.20	450
		1.0	17.3	10.50	0.25	475
		2.0	17.3	10.40	0.20	480
		3.0	17.3	10.40	0.10	480
	S-3	0.0	17.0	9.70	0.20	490
		1.0	17.0	9.50	0.10	500
	S-5	0.0	17.8	11.10	0.25	478
		1.0	17.5	10.60	0.20	600
	S-6	0.0	17.6	10.30	0.10	460
		1.0	17.6	9.90	0.10	475
	W-2	0.0	15.5	9.10	0.20	485
Summer 1976 (August 2)						
	R-1	0.0	24.8	15.00	0.45	490
		1.0	24.8	13.50	0.40	490
	R-2	0.0	25.0	14.90	0.20	498
		1.0	25.0	14.20	0.25	500
		2.0	25.0	12.80	0.15	510
	R-3[c]	0.0	24.5	14.00	0.20	475
		1.0	24.5	14.00	0.20	-0
		2.0	24.5	12.40	0.15	-0
	R-4	0.0	25.0	13.20	0.28	495
		1.0	25.0	10.60	0.20	450
		2.0	24.5	8.90	0.10	450
	R-5	0.0	24.0	11.80	0.15	470
		1.0	24.0	11.80	0.15	480
		2.0	24.0	11.10	0.15	485
		3.0	24.0	10.70	0.10	490
	S-3	0.0	25.0	15.00	0.20	498
		1.0	24.8	15.00	0.15	495
	S-5	0.0	26.0	14.00	0.15	490
		0.5	23.0	12.80	0.10	450
	S-6	0.0	24.8	15.00	0.10	490
		1.0	20.5	9.00	0.10	450
	W-2	0.0	21.0	9.40	0.30	490

[a]Station W-1 was dry during all four sampling programs.
[b]Upper limit of detection is 15.00 mg/liter.
[c]Subsurface conductivity not measured because of field error.

TABLE 4.1-11 (Cont'd)

SAMPLE	STATION[a]	DEPTH (meters)	TEMPERATURE (°C)	DISSOLVED OXYGEN[b] (mg/liter)	VELOCITY (m/sec)	CONDUCTIVITY (μmho)
Fall 1976 (November 1)						
	R-1	0.0	6.3	11.80	0.30	405
		1.0	6.0	12.10	0.20	410
	R-2	0.0	6.8	13.10	0.00	450
		1.0	6.5	13.40	0.00	460
		2.0	6.5	13.60	0.00	460
	R-3	0.0	7.0	12.20	0.00	420
		1.0	7.0	12.20	0.00	420
		2.0	7.0	12.20	0.00	420
	R-4	0.0	7.0	12.40	0.00	420
		1.0	7.0	12.50	0.00	420
		2.0	7.0	12.40	0.00	425
		2.5	7.0	12.40	0.00	425
	R-5	0.0	6.5	12.30	0.00	400
		1.0	6.3	12.20	0.00	405
		2.0	6.3	12.20	0.00	408
		2.7	6.2	7.80	0.00	350
	S-3	0.0	6.8	12.20	0.00	410
		1.0	6.8	12.20	0.00	420
		1.5	6.8	12.20	0.00	420
	S-5	0.0	8.0	11.20	0.00	430
		0.5	8.0	11.10	0.00	430
	S-6	0.0	7.0	14.20	0.00	410
		1.0	7.0	14.80	0.00	410
	W-2	0.0	2.0	13.50	0.10	400
Winter 1977[c] (February 9)						
	R-1	0.0	-1.5	10.50	0.20	375
		1.0	-1.5	10.40	0.30	380
		2.0	-2.0	10.40	0.25	380
	R-2	0.0	-1.5	11.10	0.10	370
		1.0	-1.5	11.10	0.12	370
		2.0	-1.5	11.00	0.10	370
	R-3	0.0	-1.5	11.10	0.10	390
		1.0	-1.5	11.10	0.10	395
		2.0	-1.5	11.00	0.10	395
	R-4	0.0	-1.5	10.90	0.10	380
		1.0	-1.5	10.80	0.10	385
		2.0	-1.5	10.80	0.10	390
	R-5	0.0	-2.0	10.70	0.10	375
		1.0	-2.0	10.60	0.10	380
		2.0	-2.0	10.60	0.10	380
		3.0	-2.0	10.50	0.05	380
	S-3	0.0	-1.5	8.80	0.00	385
		0.5	-1.5	8.80	0.00	390
	S-5	0.0	1.5	12.50	0.00	350
	S-6	0.0	-1.5	11.20	0.00	340
		1.0	-1.5	11.20	0.00	350

[a]Station W-1 was dry during all four sampling programs.

[b]Upper limit of detection is 15.00 mg/liter.

[c]Station W-2 was frozen during winter sampling.

TABLE 4.1-12

SPRING WATER CHEMISTRY AT BYRON STATION ON MAY 24, 1976

(All Values in mg/liter Except Where Noted)

STATION[a]	REPLICATE	HARDNESS	ALKALINITY	Cl	SO_4	Ca	Mg	COLOR (apha)	SiO_2	TOTAL PHOSPHATE	ORTHO-PHOSPHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED SOLIDS	BIOCHEMICAL OXYGEN DEMAND	TOTAL ORGANIC CARBON	CHLORINATED BIPHENYLS (ug/liter)
R-1	1	296	238	16.0	40	63	33.0	21	4.2	0.33	0.05	2.02	0.030	0.05	17.0	76	108.0	460	8.0	14	1.1
	2	294	238	20.0	44	63	32.5	21	4.1	0.33	0.04	1.83	0.020	0.05	16.0	86	112.0	460	8.0	14	0.0
mean		295	238	18.0	42	63	32.7	21	4.1	0.33	0.04	1.92	0.025	0.05	16.5	81	110.0	460	8.0	14	0.6
R-2	1	296	236	37.0	43	64	32.5	28	3.9	0.29	0.13	1.68	0.080	0.90	14.0	88	140.0	400	9.0	14	0.1
	2	296	237	36.0	40	64	33.0	33	3.8	0.31	0.12	1.80	0.080	0.77	14.0	78	112.0	444	8.0	11	0.0
mean		296	236	36.5	41	64	32.7	30	3.8	0.30	0.13	1.74	0.080	0.83	14.0	83	126.0	422	8.5	13	0.1
R-3	1	300	238	33.0	47	66	32.7	25	4.1	0.28	0.13	2.40	0.090	0.66	15.0	68	76.0	460	8.0	13	0.0
	2	300	234	30.0	44	68	32.9	30	4.2	0.31	0.12	2.71	0.080	0.61	14.0	66	100.0	492	6.0	12	0.4
mean		300	236	31.5	45	67	32.8	28	4.1	0.29	0.13	2.55	0.085	0.63	14.5	67	88.0	476	7.0	13	0.2
R-4	1	296	234	34.0	41	55	34.7	32	3.8	0.28	0.13	1.20	0.007	0.65	15.0	74	108.0	452	8.0	14	0.1
	2	296	236	36.0	38	56	35.8	30	3.6	0.27	0.12	1.32	0.070	0.55	15.0	70	128.0	448	9.0	15	0.5
mean		296	235	35.0	39	56	35.2	31	3.7	0.27	0.13	1.26	0.038	0.60	15.0	72	118.0	450	8.5	14	0.3
R-5	1	300	234	32.0	44	64	33.2	30	4.1	0.26	0.12	2.51	0.080	0.66	14.0	52	96.0	496	6.0	7	0.8
	2	298	234	32.0	45	65	34.6	25	3.9	0.27	0.11	2.63	0.080	0.63	14.0	52	96.0	472	5.0	12	0.3
mean		299	234	32.0	44	65	33.9	28	4.0	0.26	0.11	2.57	0.080	0.64	14.0	52	96.0	484	5.5	10	0.6
S-3	1	316	242	30.0	51	70	37.0	22	4.8	0.30	0.11	3.65	0.100	0.63	15.0	74	108.0	472	9.0	10	2.1
	2	316	242	30.0	53	67	37.9	21	4.6	0.26	0.12	3.23	0.100	0.68	15.0	68	140.0	440	8.0	12	0.5
mean		316	242	30.0	52	69	37.5	21	4.7	0.28	0.11	3.44	0.100	0.65	15.0	71	124.0	456	8.5	11	1.3
S-5	1	312	238	30.0	51	67	36.2	22	4.6	0.18	0.10	3.11	0.100	0.82	15.0	56	116.0	444	7.0	10	0.1
	2	310	238	32.0	49	63	37.7	27	4.4	0.18	0.11	3.11	0.100	0.69	15.0	72	144.0	472	7.0	11	0.6
mean		311	238	31.0	50	65	37.0	24	4.5	0.18	0.10	3.11	0.100	0.75	15.0	64	130.0	458	7.0	10	0.3
S-6	1	316	266	24.0	35	64	38.6	20	6.8	0.25	0.07	3.65	0.100	0.39	12.3	82	124.0	444	5.0	32	0.9
	2	320	264	22.0	37	64	39.5	23	7.4	0.27	0.08	3.37	0.110	0.46	12.4	74	108.0	428	6.0	9	0.4
mean		318	265	23.0	36	64	39.0	21	7.1	0.26	0.07	3.51	0.105	0.43	12.3	78	116.0	436	5.5	20	0.6
W-2	1	340	304	4.0	24	73	37.5	17	14.6	0.03	0.01	0.92	0.020	0.12	5.1	8	120.0	384	6.0	15	0.0
	2	340	300	4.0	25	73	37.5	14	14.6	0.03	0.01	1.06	0.020	0.12	5.1	14	84.0	380	6.0	5	0.1
mean		340	302	4.0	24	73	37.5	15	14.6	0.03	0.01	0.99	0.020	0.12	5.1	11	102.0	382	6.0	10	0.1

[a] Station W-1 was dry during spring sampling.

TABLE 4.1-13

SUMMER WATER CHEMISTRY AT BYRON STATION ON AUGUST 2, 1976

(All Values in mg/liter Except Where Noted)

STATION[a]	REPLI-CATE	HARD-NESS	ALKA-LINITY	Cl	SO_4	Ca	Mg	COLOR (apha)	SiO_2	TOTAL PHOS-PHATE	ORTHO-PHOS-PHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED SOLIDS	BIOCHEMICAL OXYGEN DEMAND	ORGANIC CARBON	POLYCHLORINATED BIPHENYLS (µg/liter)
R-1	1	270	224	32.0	39	57	32.0	35	4.1	0.47	0.19	0.00	0.050	0.46	30.7	62	104.0	408	15.0	9	0.0
	2	268	222	32.0	36	55	31.8	28	4.1	0.45	0.20	1.19	0.050	0.50	31.4	66	88.0	400	12.0	10	0.0
mean		269	223	32.0	37	56	31.9	31	4.1	0.46	0.20	0.59	0.050	0.48	31.0	64	96.0	404	13.5	10	0.0
R-2	1	272	216	30.0	36	56	32.4	35	3.8	0.48	0.17	0.00	0.040	0.36	29.1	58	100.0	412	12.0	10	0.0
	2	272	224	31.0	39	56	33.2	25	3.3	0.46	0.16	0.75	0.040	0.53	28.6	52	96.0	408	12.0	10	0.0
mean		272	220	30.5	37	56	32.8	30	3.5	0.47	0.17	0.38	0.040	0.45	28.9	55	98.0	410	12.0	10	0.0
R-3	1	272	218	43.0	34	55	33.4	39	3.6	0.47	0.17	0.90	0.040	0.30	28.9	68	104.0	404	16.0	11	0.0
	2	272	222	31.0	35	56	31.5	29	3.4	0.47	0.16	1.95	0.040	0.39	29.4	56	100.0	376	12.0	9	0.0
mean		272	220	37.0	34	55	32.5	34	3.5	0.47	0.17	1.42	0.040	0.35	29.1	62	102.0	390	14.0	10	0.0
R-4	1	270	224	29.0	34	56	32.0	32	2.9	0.48	0.18	0.50	0.040	0.52	22.9	66	92.0	400	10.0	9	0.0
	2	270	224	25.0	34	56	32.3	35	3.8	0.47	0.19	1.71	0.040	0.56	19.7	48	104.0	408	9.0	9	0.0
mean		270	224	27.0	34	56	32.1	33	3.3	0.47	0.18	1.10	0.040	0.54	21.3	57	98.0	404	9.5	9	0.0
R-5	1	248	205	31.0	34	50	30.8	35	1.2	0.45	0.04	0.39	0.030	0.66	29.1	60	112.0	376	13.0	10	0.0
	2	248	204	32.0	34	51	30.3	32	1.3	0.42	0.08	0.49	0.040	0.57	28.9	50	96.0	376	14.0	10	0.0
mean		248	204	31.5	34	50	30.1	33	1.3	0.43	0.06	0.44	0.035	0.61	29.0	55	104.0	376	13.5	10	0.0
S-3	1	272	212	29.0	39	60	32.0	27	2.1	0.39	0.14	0.80	0.050	0.54	29.5	88	88.0	388	15.0	10	0.0
	2	276	210	31.0	41	60	30.8	31	2.6	0.43	0.12	0.57	0.050	0.48	29.4	76	100.0	408	16.0	7	0.0
mean		274	211	30.0	40	60	31.4	29	2.3	0.41	0.13	0.68	0.050	0.51	29.4	82	94.0	398	15.5	9	0.0
S-5	1	272	226	31.0	36	56	33.9	33	3.2	0.46	0.15	0.78	0.040	0.54	32.8	60	76.0	424	13.0	12	0.0
	2	272	226	30.0	40	55	33.7	38	2.9	0.45	0.15	0.79	0.040	0.41	30.6	48	108.0	412	14.0	11	0.0
mean		272	226	30.5	38	55	33.8	35	3.0	0.46	0.15	0.79	0.040	0.47	31.7	54	92.0	418	13.5	11	0.0
S-6	1	254	209	30.0	33	50	32.0	47	1.9	0.49	0.14	0.53	0.040	0.44	28.2	70	92.0	392	13.0	8	0.0
	2	252	210	30.0	34	51	31.8	47	1.9	0.48	0.14	0.84	0.040	0.57	28.8	68	92.0	388	15.0	7	0.0
mean		253	209	30.0	33	50	31.9	47	1.9	0.48	0.14	0.68	0.040	0.50	28.5	69	92.0	390	14.0	8	0.0
W-2	1	310	266	5.0	34	64	38.2	5	6.0	0.06	0.02	2.28	0.020	0.40	9.9	16	92.0	384	4.0	4	0.0
	2	312	268	5.0	35	63	37.7	2	5.7	0.06	0.02	1.66	0.020	0.48	9.1	20	72.0	380	2.0	6	0.0
mean		311	267	5.0	34	63	38.0	4	5.8	0.06	0.02	1.97	0.020	0.44	9.5	18	82.0	382	3.0	5	0.0

[a]Station W-1 was dry during summer sampling.

TABLE 4.1-14

FALL WATER CHEMISTRY AT BYRON STATION ON NOVEMBER 1, 1976

(All Values in mg/liter Except Where Noted)

STATION[a]	REPLI-CATE	HARD-NESS	ALKA-LINITY	Cl	SO_4	Ca	Mg	COLOR (apha)	SiO_2	TOTAL PHOS-PHATE	ORTHO-PHOS-PHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED DEMAND	BIOCHEMICAL OXYGEN DEMAND	TOTAL ORGANIC CARBON	POLYCHLORINATED BIPHENYLS (µg/liter)
R-1	1	322	276	35.0	34	68	39.6	0	7.0	0.46	0.04	3.70	0.120	0.56	26.8	12	92.0	544	4.0	3	0.0
	2	322	275	35.0	36	65	78.0	0	7.1	0.47	0.04	3.50	0.120	0.48	27.3	10	80.0	538	4.0	5	0.0
mean		322	275	35.0	35	66	58.8	0	7.0	0.46	0.04	3.60	0.120	0.52	27.0	11	86.0	541	4.0	4	0.0
R-2	1	324	273	34.0	33	67	39.2	0	6.8	0.43	0.04	4.29	0.110	0.34	25.5	20	96.0	560	5.0	3	0.0
	2	322	274	34.0	36	67	39.5	0	6.8	0.43	0.04	4.07	0.120	0.37	25.4	25	84.0	551	7.0	3	0.0
mean		323	273	34.0	34	67	39.3	0	6.8	0.43	0.04	4.18	0.115	0.36	25.4	23	90.0	555	6.0	3	0.0
R-3	1	322	274	34.0	34	63	36.6	0	7.2	0.63	0.04	3.79	0.110	0.35	25.7	10	100.0	542	4.0	4	0.0
	2	322	274	34.0	35	68	39.5	0	6.8	0.43	0.04	3.36	0.120	0.46	24.0	26	96.0	558	5.0	3	0.0
mean		322	274	34.0	34	65	38.0	0	7.0	0.53	0.04	3.58	0.115	0.40	24.9	18	98.0	550	4.5	4	0.0
R-4	1	320	273	32.0	35	68	39.9	1	6.6	0.41	0.04	4.64	0.110	0.28	24.9	18	92.0	538	5.0	3	0.0
	2	320	272	32.0	33	67	39.9	0	6.6	0.43	0.04	4.14	0.110	0.34	24.0	20	84.0	540	4.0	3	0.0
mean		320	272	32.0	34	68	39.9	1	6.6	0.42	0.04	4.39	0.110	0.31	24.4	19	88.0	539	4.5	3	0.0
R-5	1	322	272	34.0	35	65	38.8	1	5.8	0.37	0.03	5.07	0.120	0.29	26.2	20	116.0	532	7.0	5	0.0
	2	320	273	34.0	36	66	39.1	1	5.8	0.38	0.03	4.36	0.120	0.29	25.9	19	104.0	533	7.0	5	0.0
mean		321	272	34.0	35	65	38.9	1	5.8	0.38	0.03	4.72	0.120	0.29	26.0	19	110.0	532	7.0	5	0.0
S-3	1	328	274	32.0	45	70	39.5	0	6.6	0.36	0.03	3.93	0.110	0.44	25.8	16	56.0	524	4.0	2	0.0
	2	328	273	34.0	42	69	39.4	0	6.6	0.36	0.03	4.00	0.110	0.25	25.8	6	60.0	518	4.0	2	0.0
mean		328	273	33.0	43	69	39.5	0	6.6	0.36	0.03	3.97	0.110	0.34	25.8	11	58.0	521	4.0	2	0.0
S-5	1	326	273	36.0	42	69	39.7	1	6.4	0.36	0.03	4.21	0.120	0.56	27.0	14	96.0	566	5.0	3	0.0
	2	326	274	36.0	40	70	39.3	1	6.5	0.35	0.03	3.07	0.120	0.58	28.0	19	96.0	569	5.0	3	0.0
mean		326	273	36.0	41	69	39.5	1	6.4	0.35	0.03	3.64	0.120	0.57	27.5	16	96.0	567	5.0	3	0.0
S-6	1	326	276	24.0	31	68	40.0	1	7.2	0.28	0.02	4.50	0.100	0.25	19.0	21	92.0	491	5.0	5	0.0
	2	322	271	30.0	35	66	39.4	0	6.9	0.38	0.03	5.07	0.010	0.21	22.5	22	120.0	510	6.0	4	0.0
mean		324	273	27.0	33	67	39.7	1	7.0	0.35	0.03	4.78	0.055	0.23	20.7	21	106.0	500	5.5	5	0.0
W-2	1	354	315	4.0	39	70	44.2	0	8.9	0.04	0.01	1.14	0.030	0.14	5.0	1	92.0	439	3.0	4	0.0
	2	354	313	4.0	38	69	44.4	0	8.8	0.03	0.00	1.50	0.030	0.09	5.0	0	128.0	435	3.0	4	0.0
mean		354	314	4.0	38	69	44.3	0	8.8	0.03	0.01	1.32	0.030	0.11	5.0	1	110.0	437	3.0	4	0.0

[a]Station W-1 was dry during fall sampling.

TABLE 4.1-15

WINTER WATER CHEMISTRY AT BYRON STATION ON FEBRUARY 9, 1977

(All Values in mg/liter Except Where Noted)

STATION[a]	REPLICATE	HARDNESS	ALKALINITY	Cl	SO_4	Ca	Mg	COLOR (aphe)	SiO_2	TOTAL PHOSPHATE	ORTHO-PHOSPHATE	NO_3	NO_2	NH_4	Na	TOTAL SUSPENDED SOLIDS	TOTAL ORGANIC SOLIDS	TOTAL DISSOLVED SOLIDS	BIOCHEMICAL OXYGEN DEMAND	TOTAL ORGANIC CARBON	POLY-CHLORINATED BIPHENYLS µg/liter
R-1	1	342	295	38.0	36	69	39.1	9	11.7	0.58	0.52	2.98	0.040	1.65	29.0	2	80.0	568	4.0	11	0.0
	2	341	285	42.0	36	74	40.3	8	11.8	0.60	0.55	3.08	0.040	1.61	30.1	2	110.0	578	3.0	10	0.0
mean		341	290	40.0	36	71	39.7	9	11.7	0.59	0.54	3.03	0.040	1.63	29.5	2	95.0	573	3.5	10	0.0
R-2	1	344	297	42.0	33	70	40.2	12	11.7	0.60	0.54	2.59	0.040	1.66	30.0	2	100.0	638	3.0	13	0.0
	2	345	297	42.0	40	76	39.9	8	11.8	0.59	0.54	2.69	0.040	1.75	29.1	2	140.0	678	3.0	13	0.0
mean		344	297	42.0	36	73	40.0	10	11.7	0.59	0.54	2.64	0.040	1.70	29.5	2	120.0	658	3.0	13	0.0
R-3	1	345	296	38.0	35	73	39.9	9	11.9	0.65	0.61	2.69	0.040	1.78	33.1	2	100.0	578	3.0	10	0.0
	2	343	297	40.0	38	71	39.6	8	12.1	0.66	0.63	2.20	0.040	1.93	34.2	2	60.0	548	3.0	11	0.0
mean		344	296	39.0	36	72	39.7	9	12.0	0.65	0.62	2.44	0.040	1.85	33.6	2	80.0	563	3.0	10	0.0
R-4	1	344	288	44.0	34	70	39.5	17	11.8	0.64	0.63	2.79	0.040	1.70	30.3	4	80.0	536	3.0	10	0.0
	2	342	289	42.0	36	69	39.4	5	11.8	0.62	0.58	4.06	0.040	0.85	30.9	0	90.0	559	4.0	9	0.0
mean		343	288	43.0	35	69	39.5	11	11.8	0.63	0.60	3.42	0.040	1.27	30.6	2	85.0	547	3.5	10	0.0
R-5	1	343	294	40.0	33	70	39.2	6	11.6	0.57	0.52	2.98	0.040	1.67	29.8	4	130.0	636	4.0	15	0.0
	2	343	295	40.0	33	70	39.3	17	11.7	0.57	0.52	3.76	0.040	1.71	29.5	2	120.0	618	4.0	14	0.0
mean		343	294	40.0	33	70	39.2	11	11.6	0.57	0.52	3.37	0.040	1.69	29.6	3	125.0	627	4.0	14	0.0
S-3	1	350	291	42.0	43	74	38.8	15	12.0	0.52	0.49	2.49	0.050	1.60	30.1	0	100.0	569	3.0	14	0.0
	2	350	295	42.0	44	73	39.0	5	12.0	0.52	0.49	2.97	0.050	1.62	29.5	0	130.0	579	2.0	8	0.0
mean		350	293	42.0	43	74	38.9	10	12.0	0.52	0.49	2.73	0.050	1.61	29.8	0	115.0	574	2.5	11	0.0
S-5	1	333	271	8.0	23	69	37.3	10	10.0	0.02	0.04	5.15	0.020	0.15	5.5	2	120.0	558	2.0	8	0.0
	2	333	273	6.0	23	69	37.5	8	10.2	0.02	0.03	5.05	0.020	0.13	3.8	2	110.0	518	2.0	8	0.0
mean		333	272	7.0	23	69	37.4	9	10.1	0.02	0.03	5.10	0.020	0.14	4.7	2	115.0	538	2.0	8	0.0
S-6	1	353	287	14.0	33	73	39.4	7	11.8	0.13	0.11	4.18	0.020	0.47	8.4	10	60.0	410	3.0	7	0.0
	2	349	292	14.0	31	73	40.6	20	12.0	0.11	0.10	4.47	0.020	0.37	9.2	14	70.0	476	2.0	10	0.0
mean		351	289	14.0	32	73	40.0	13	11.9	0.12	0.10	4.32	0.020	0.42	8.8	12	65.0	443	2.5	9	0.0

[a]Station W-1 was dry, and Station W-2 was frozen during winter sampling.

TABLE 4.1-16

TRACE METALS ANALYSIS FOR 1976-1977 SAMPLING

(All Values in mg/liter)

STATION[a]	REPLI-CATE	SPRING: MAY 24, 1976 Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
R-1	1	0.000	0.006	0.53	0.000	0.0000	0.023	0.01	0.006
	2	0.000	0.007	0.38	0.000	0.0000	0.220	0.01	0.006
mean		0.000	0.007	0.46	0.000	0.0000	0.121	0.01	0.006
R-2	1	0.002	0.013	1.48	0.000	0.0000	0.017	0.00	0.011
	2	0.001	0.012	1.35	0.000	0.0000	0.018	0.01	0.012
mean		0.002	0.013	1.41	0.000	0.0000	0.017	0.01	0.012
R-3	1	0.000	0.006	0.35	0.000	0.0000	0.076	0.01	0.008
	2	0.000	0.007	0.75	0.000	0.0000	0.022	0.01	0.006
mean		0.000	0.007	0.55	0.000	0.0000	0.049	0.01	0.007
R-4	1	0.002	0.008	0.86	0.000	0.0000	0.032	0.01	0.006
	2	0.001	0.014	0.87	0.000	0.0000	0.030	0.01	0.008
mean		0.002	0.011	0.86	0.000	0.0000	0.031	0.01	0.007
R-5	1	0.001	0.009	0.61	0.000	0.0000	0.025	0.00	0.009
	2	0.001	0.012	0.70	0.000	0.0000	0.054	0.00	0.004
mean		0.001	0.011	0.65	0.000	0.0000	0.039	0.00	0.007
S-3	1	0.000	0.012	0.83	0.000	0.0000	0.079	0.02	0.012
	2	0.000	0.010	0.77	0.000	0.0000	0.096	0.01	0.011
mean		0.000	0.011	0.80	0.000	0.0000	0.087	0.02	0.012
S-5	1	0.000	0.010	1.02	0.000	0.0000	0.036	0.00	0.005
	2	0.000	0.011	0.82	0.000	0.0000	0.046	0.00	0.007
mean		0.000	0.011	0.92	0.000	0.0000	0.041	0.00	0.006
S-6	1	0.000	0.005	0.87	0.000	0.0000	0.016	0.01	0.003
	2	0.000	0.007	0.90	0.000	0.0000	0.590	0.01	0.003
mean		0.000	0.006	0.88	0.000	0.0000	0.303	0.01	0.003
W-2	1	0.000	0.012	0.39	0.000	0.0000	0.018	0.00	0.004
	2	0.000	0.011	0.34	0.000	0.0000	0.017	0.00	0.005
mean		0.000	0.012	0.37	0.000	0.0000	0.017	0.00	0.005

[a]Station W-1 was dry during spring sampling.

TABLE 4.1-16 (Cont'd)

STATION[a]	REPLI-CATE	SUMMER: AUGUST 2, 1976							
		Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
R-1	1	0.001	0.011	0.97	0.000	0.0000	0.024	0.00	0.009
	2	0.001	0.016	0.90	0.000	0.0000	0.026	0.00	0.008
mean		0.001	0.014	0.93	0.000	0.0000	0.025	0.00	0.009
R-2	1	0.000	0.008	0.79	0.000	0.0000	0.011	0.00	0.008
	2	0.000	0.013	0.76	0.000	0.0000	0.011	0.00	0.002
mean		0.000	0.011	0.77	0.000	0.0000	0.011	0.00	0.005
R-3	1	0.000	0.006	0.98	0.000	0.0000	0.024	0.01	0.009
	2	0.000	0.008	1.05	0.000	0.0000	0.013	0.00	0.009
mean		0.000	0.007	1.01	0.000	0.0000	0.018	0.01	0.009
R-4	1	0.000	0.010	0.80	0.000	0.0000	0.016	0.00	0.008
	2	0.000	0.007	0.84	0.000	0.0000	0.011	0.00	0.007
mean		0.000	0.009	0.82	0.000	0.0000	0.014	0.00	0.008
R-5	1	0.001	0.009	1.13	0.000	0.0000	0.036	0.01	0.008
	2	0.000	0.006	0.83	0.000	0.0000	0.001	0.00	0.012
mean		0.001	0.008	0.98	0.000	0.0000	0.018	0.01	0.010
S-3	1	0.000	0.006	1.03	0.000	0.0000	0.016	0.00	0.003
	2	0.000	0.013	0.95	0.000	0.0000	0.013	0.00	0.002
mean		0.000	0.010	0.99	0.000	0.0000	0.015	0.00	0.003
S-5	1	0.000	0.012	0.90	0.000	0.0000	0.015	0.01	0.002
	2	0.000	0.005	0.72	0.000	0.0000	0.007	0.00	0.002
mean		0.000	0.009	0.81	0.000	0.0000	0.011	0.01	0.002
S-6	1	0.001	0.018	1.05	0.000	0.0000	0.030	0.02	0.016
	2	0.000	0.015	0.91	0.000	0.0000	0.025	0.01	0.009
mean		0.001	0.016	0.98	0.000	0.0000	0.027	0.02	0.013
W-2	1	0.000	0.006	0.61	0.000	0.0000	0.014	0.00	0.000
	2	0.000	0.004	0.57	0.000	0.0000	0.008	0.00	0.000
mean		0.000	0.005	0.59	0.000	0.0000	0.011	0.00	0.000

[a]Station W-1 was dry during summer sampling.

TABLE 4.1-16 (Cont'd)

STATION[a]	REPLI-CATE	FALL: NOVEMBER 1, 1976 Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
R-1	1	0.000	0.012	0.22	0.000	0.0000	0.024	0.00	0.003
	2	0.000	0.010	0.33	0.000	0.0000	0.029	0.00	0.002
mean		0.000	0.011	0.27	0.000	0.0000	0.026	0.00	0.003
R-2	1	0.000	0.012	0.31	0.000	0.0000	0.020	0.00	0.001
	2	0.000	0.012	0.29	0.000	0.0000	0.021	0.00	0.002
mean		0.000	0.012	0.30	0.000	0.0000	0.020	0.00	0.002
R-3	1	0.000	0.021	0.29	0.000	0.0000	0.024	0.00	0.004
	2	0.000	0.016	0.32	0.000	0.0000	0.022	0.00	0.004
mean		0.000	0.018	0.30	0.000	0.0000	0.023	0.00	0.004
R-4	1	0.000	0.022	0.35	0.000	0.0000	0.022	0.00	0.000
	2	0.000	0.011	0.27	0.000	0.0000	0.021	0.00	0.000
mean		0.000	0.016	0.31	0.000	0.0000	0.021	0.00	0.000
R-5	1	0.000	0.015	0.29	0.000	0.0000	0.018	0.00	0.003
	2	0.000	0.011	0.26	0.000	0.0000	0.022	0.00	0.001
mean		0.000	0.013	0.27	0.000	0.0000	0.020	0.00	0.002
S-3	1	0.000	0.027	0.28	0.000	0.0000	0.021	0.00	0.004
	2	0.000	0.011	0.27	0.000	0.0000	0.020	0.00	0.004
mean		0.000	0.019	0.27	0.000	0.0000	0.020	0.00	0.004
S-5	1	0.000	0.017	0.32	0.000	0.0000	0.022	0.00	0.005
	2	0.000	0.020	0.32	0.000	0.0000	0.026	0.00	0.004
mean		0.000	0.018	0.32	0.000	0.0000	0.024	0.00	0.005
S-6	1	0.000	0.011	0.34	0.000	0.0000	0.014	0.00	0.003
	2	0.000	0.010	0.34	0.000	0.0000	0.020	0.00	0.003
mean		0.000	0.011	0.34	0.000	0.0000	0.017	0.00	0.003
W-2	1	0.000	0.006	0.14	0.000	0.0000	0.010	0.00	0.003
	2	0.000	0.006	0.09	0.000	0.0000	0.010	0.00	0.000
mean		0.000	0.006	0.11	0.000	0.0000	0.010	0.00	0.002

[a]Station W-1 was dry during fall sampling.

TABLE 4.1-16 (Cont'd)

STATION[a]	REPLI-CATE	WINTER: FEBRUARY 9, 1977							
		Cd	Cu	Fe	Co	Hg	Zn	Pb	Cr
R-1	1	0.000	0.018	0.10	0.000	0.0000	0.048	0.00	0.005
	2	0.000	0.038	0.15	0.000	0.0000	0.068	0.02	0.004
mean		0.000	0.028	0.13	0.000	0.0000	0.058	0.01	0.005
R-2	1	0.000	0.007	0.12	0.000	0.0000	0.040	0.02	0.011
	2	0.000	0.019	0.10	0.000	0.0000	0.038	0.03	0.006
mean		0.000	0.013	0.11	0.000	0.0000	0.039	0.03	0.009
R-3	1	0.000	0.055	0.11	0.000	0.0000	0.049	0.00	0.010
	2	0.000	0.019	0.11	0.000	0.0000	0.047	0.03	0.007
mean		0.000	0.037	0.11	0.000	0.0000	0.048	0.02	0.009
R-4	1	0.000	0.017	0.11	0.000	0.0000	0.052	0.02	0.004
	2	0.000	0.021	0.12	0.000	0.0000	0.042	0.01	0.010
mean		0.000	0.019	0.11	0.000	0.0000	0.047	0.02	0.007
R-5	1	0.000	0.016	0.11	0.000	0.0000	0.041	0.00	0.015
	2	0.000	0.017	0.10	0.000	0.0000	0.072	0.03	0.013
mean		0.000	0.016	0.10	0.000	0.0000	0.056	0.02	0.014
S-3	1	0.000	0.013	0.13	0.000	0.0000	0.038	0.02	0.006
	2	0.000	0.051	0.14	0.000	0.0000	0.100	0.03	0.007
mean		0.000	0.320	0.13	0.000	0.0000	0.069	0.03	0.007
S-5	1	0.000	0.020	0.15	0.000	0.0000	0.001	0.01	0.000
	2	0.000	0.000	0.14	0.000	0.0000	0.001	0.03	0.000
mean		0.000	0.010	0.14	0.000	0.0000	0.001	0.02	0.000
S-6	1	0.000	0.039	0.22	0.000	0.0000	0.022	0.03	0.006
	2	0.000	0.018	0.22	0.000	0.0000	0.014	0.03	0.002
mean		0.000	0.028	0.22	0.000	0.0000	0.018	0.03	0.004

[a]Station W-1 was dry and Station W-2 was frozen during winter sampling.

TABLE 4.1-17

BACTERIOLOGY ANALYSIS FOR 1976-1977 SAMPLING

(All Values in No. of Colonies/100 ml Except Where Noted)

STATION[a]	SPRING: MAY 24, 1976 REPLICATE	SPRING: STANDARD PLATE COUNT[b]	SPRING: T-COLI	SPRING: F-STREP	SUMMER: AUGUST 2, 1976 REPLICATE	SUMMER: STANDARD PLATE COUNT[b]	SUMMER: T-COLI	SUMMER: F-STREP
R-1	1	18,000	4,700	40	1	22,000	3,300	37
	2	18,000	4,100	35	2	26,000	3,300	41
mean		18,000	4,400	37		24,000	3,300	39
R-2	1	17,000	2,800	38	1	35,000	3,100	36
	2	16,000	3,500	36	2	39,000	2,900	27
mean		16,500	3,150	37		37,000	3,000	31
R-3	1	25,000	3,500	37	1	68,000	2,800	22
	2	26,000	3,300	55	2	27,000	3,200	31
mean		25,500	3,400	46		47,500	3,000	26
R-4	1	29,000	3,600	57	1	32,000	3,100	27
	2	21,000	3,500	60	2	37,000	3,700	32
mean		25,000	3,550	58		34,500	3,400	29
R-5	1	29,000	3,800	44	1	32,000	4,000	29
	2	28,000	3,700	38	2	29,000	4,200	32
mean		28,500	3,750	41		30,500	4,100	30
S-3	1	32,000	3,700	53	1	18,000	4,000	18
	2	34,000	3,800	51	2	28,000	3,200	10
mean		33,000	3,750	52		23,000	3,600	14
S-5	1	27,000	4,200	38	1	26,000	2,200	30
	2	28,000	4,300	39	2	18,000	2,100	24
mean		27,500	4,250	38		22,000	2,150	27
S-6	1	27,000	3,800	31	1	25,000	5,200	22
	2	23,000	3,900	37	2	34,000	2,200	33
mean		25,000	3,850	34		29,500	3,700	28
W-2	1	33,000	4,200	41	1	15,000	15,000	70
	2	34,000	3,900	38	2	22,000	10,000	170
mean		33,500	4,050	39		18,500	12,500	120

[a]Station W-1 was dry during all four sampling periods.

[b]Values in no. of colonies/ml.

TABLE 4.1-17 (Cont'd)

	FALL: NOVEMBER 1, 1976				WINTER: FEBRUARY 9, 1977			
STATION[a]	REPLICATE	STANDARD PLATE COUNT[b]	T-COLI	F-STREP	REPLICATE	STANDARD PLATE COUNT[b]	T-COLI	F-STREP
R-1	1	57,000	400	320	1	8,900	2,300	115
	2	98,000	900	240	2	13,200	1,960	130
mean		77,500	650	280		11,050	2,130	122
R-2	1	30,000	500	180	1	6,340	1,240	35
	2	51,000	400	210	2	15,200	1,340	15
mean		40,500	450	195		10,770	1,290	25
R-3	1	43,000	1,200	280	1	7,500	1,740	10
	2	28,000	200	100	2	4,200	1,540	35
mean		35,500	700	190		5,850	1,640	23
R-4	1	52,000	800	500	1	8,200	1,920	20
	2	38,000	600	300	2	7,400	2,100	35
mean		45,000	700	400		7,800	2,010	28
R-5	1	72,000	1,200	140	1	7,700	1,420	35
	2	94,000	1,100	200	2	2,980	1,680	20
mean		83,000	1,150	170		5,340	1,550	28
S-3	1	75,000	1,500	100	1	6,800	320	10
	2	26,000	600	240	2	1,190	380	10
mean		50,500	1,050	170		3,995	350	10
S-5	1	31,000	1,200	100	1	7,200	1,760	25
	2	50,000	800	200	2	6,100	1,680	45
mean		40,500	1,000	150		6,650	1,720	35
S-6	1	87,000	1,300	210	1	5,700	1,180	15
	2	89,000	1,400	300	2	6,600	720	30
mean		88,000	1,350	255		6,150	950	23
W-2[c]	1	36,000	2,100	200				
	2	80,000	1,700	100				
mean		58,000	1,900	150				

[a]Station W-1 was dry during all four sampling periods.

[b]Values in no. of colonies/ml.

[c]Station W-2 was frozen during winter sampling.

TABLE 4.1-18

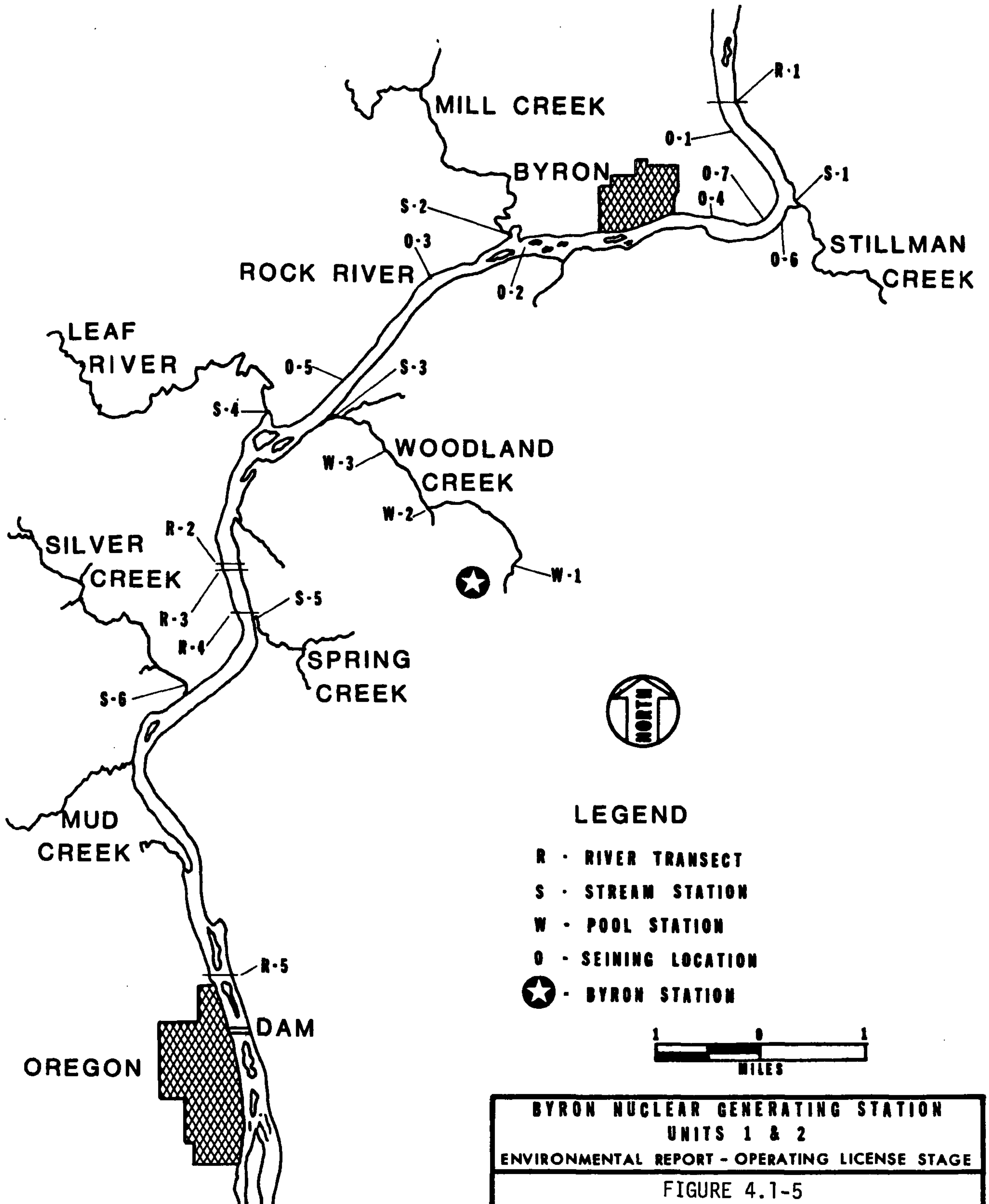
SURFACE WATER CHEMISTRY AT BYRON STATION

(All Values in mg/liter)

SAMPLING DATE	CADMIUM (TOTAL), Cd	CYANIDE (TOTAL), CN	LEAD (TOTAL) Pb	ZINC (TOTAL), Zn
SURFACE WATER SAMPLING STATION 1				
5 May 77	0.03	0.002	0.4	1.28
18 Jul 77	0.02	0.080[a]	0.2	0.39
9 Aug 77	<0.02	0.177	0.2	0.41
15 Sept 77	<0.02	0.049[b]	<0.1	0.41
		0.023		
SURFACE WATER SAMPLING STATION 2				
5 May 77	<0.02	<0.002	<0.1	0.25
18 Jul 77	0.02	0.006	0.1	0.25
9 Aug 77	<0.02	0.008	<0.1	0.10
15 Sept 77	0.02	<0.002	<0.1	0.10
SURFACE WATER SAMPLING STATION 3				
5 Apr 77	<0.02	0.016	<0.1	1.10
28 Apr 77	<0.02	0.010	<0.1	1.24
5 May 77	<0.02	0.002	<0.1	1.31
18 Jul 77	0.02	0.011	0.1	0.51
15 Sept 77	<0.02	<0.002	<0.1	1.60

[a]This cyanide value seems high but because of the small sample submitted the test could not be repeated.

[b]Duplicate samples were taken to confirm the high values found in previous months.



BYRON NUCLEAR GENERATING STATION
UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 4.1-5

AQUATIC SAMPLING SITES NEAR THE BYRON STATION

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CHAPTER 5.0 - ENVIRONMENTAL EFFECTS OF STATION OPERATION

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examined the two worst cases of the Paily report: 1500 cfs and 2200 cfs with an initial excess temperature of 39.3° F and 44.7° F, respectively.

An examination of the two reports reveals a difference between the areas contained within the excess 5° F isotherms for the side canal discharge. The difference is caused by the phenomenon known as shore attachment. Shore attachment is when the maximum water temperatures of the discharge plume are found along the bank of a stream instead of at some distance offshore and when the flow within the discharge plume is fully mixed (no stratification) both with respect to thermal and density factors. The result, shore attachment, is that no diffusion or mixing with cooler water occurs on the bank side or along the bottom. Because of this reduced mixing, a greater area exists within the same excess isotherms than exists in the non-shore-attached jets examined by Paily (1975a).

The difference in areas within any excess isotherm reported in the Paily and Giaquinta reports may be considered a result of shore attachment assumptions versus non-shore attachment assumptions. The Giaquinta report gives the greatest area that is possible and the Paily report yields the minimum. At a river flow of 1500 cfs and discharge temperature of 39.3° F above ambient, the area contained within the excess 5° F isotherm would range from 0.3 to 6.6 acres and the maximum width would range from 90 to 160 feet; for a river flow of 2200 cfs and discharge temperature of 44.7° F above ambient would range from 2.5 to 4.2 acres and the maximum width from 175 to 140 feet. A comparison of the excess 5° F plume sizes for the extreme conditon flows are given in Table 5.1-5.

The academic study of shore attachment is relatively new, and was therefore not studied in the original Paily report (Appendix 5.1B). The distinctive behavior of a jet of water undergoing shore attachment was recognized and developed concurrently and more or less independently by the Massachusetts Institute of Technology (Jirka et al. 1975) and IIHR (Pailly 1975b), and field work and application of those data was accomplished by Sayre during the latter part of 1975, after the work of the Paily report (Appendix 5.1B) had been accomplished.

5.1.3 Biological Effects

This subsection describes the predicted thermal impact of the cooling tower blowdown on the Rock River biota, the effect of removing a portion of the river's aquatic organisms in the makeup water, and the potential for entrapment and impingement of fish on the traveling screens at the river intake structure. For a description of the intake structure's operating characteristics, see Section 3.4.

5.1.3.1 Effects of Released Heat on the Rock River

The thermal discharge to the Rock River from the Byron Station will result in a thermal plume that will be well within the Illinois thermal limits (see Subsection 5.1.2) and therefore should not adversely affect biota outside the mixing zone. The 5° isotherms under extreme weather and river water conditions have been calculated (see Tables 5.1-2, 5.1-3, and 5.1-4). For Case 1, which describes conditons of minimum river flow, data is presented in Table 5.1-2 of this Environmental Report. For Case 2, which encompases maximum water temperatures, the worst case 5° F isotherm (91° F) will occur during July/August and will cover an area of 0.06 acres, when water temperature is 86° F and discharge temperature is 93.5° F (see Table 5.1-3). For Case 3, low river flows, high wet bulb temperatures, and low river water temperatures are assumed. The maximum difference between river water and blowdown temperatures (44.7° F) will occur during March/April (see Table 5.1-4). The predicted 5° isotherm, which is 37° F when minimum water temperature is 32° F, will cover an area of 23 acres, which is less than the approximately 26 acre mixing zone allowed in Illinois.

Based on the data presented in Subsection 5.1.2 of this ER, it is concluded that the majority of plankton species will be unaffected by the thermal plume. Those killed by the temperature increase will become part of the organic material available in the food web. Furthermore, only a short period of time would be required to reestablish normal plankton population numbers and diversity below the outfall.

Projected temperatures for the plume areas (see Subsection 5.1.2) should not adversely affect macroinvertebrate productivity. Chironomids, which are the most common benthic insects found in the biological studies (see Subsection 2.2.1.9), are tolerant to elevated temperatures. Gammon (1969) reported that the number of chironomids found in samplers placed in effluents with temperatures ranging from 85° F to 95° F were not reduced in comparison to control areas. Coutant (1962) reported that chironomids of a riffle of the Delaware River, which were exposed to heated effluents from a steam electric generating plant, were tolerant to temperatures exceeding those projected for Byron Station. Coutant (1962) found chironomids survived temperatures in excess of 93° F, and Walche (1948) reported that some members of the most common invertebrates in benthos samples should not be adversely affected by elevated temperatures at the outfall. Markowski (1959) found oligochaetes living and reproducing in the effluents of power plants with discharge temperatures in excess of 85° F. Species of Hexagenia have been found on artificial substrates at the mouth of the discharge canal from the Dresden Nuclear Power Station (NALCO Environmental Science 1976).

The thermal effects of blowdown discharge will not adversely affect Rock River fishes (Byron Station ER-CPS Subsection 5.1.3) because plume temperatures will remain within the thermal tolerance limits of most Rock River species and the thermal plume is restricted to a minor width and area of the river. Even if lethal temperatures should occur in a limited area of the discharge plume, fish mortalities are unlikely since fish ordinarily avoid lethal temperatures and seek preferred temperatures that are optimum for various physiological or ecological processes.

5.1.3.2 Effects of Entrapment and Impingement of Juvenile and Adult Fish on the Rock River

Byron Station's makeup water intake on the Rock River is designed as a shoreline structure without a canal or other physical features that would attract juvenile or adult fish.

The normal operational makeup rate will range from 61 to 98 cfs; it is predicted, however, that during a small portion of the station's operating time a makeup rate of 107 cfs will be required. Approach velocities will range from 0.48 to 0.55 feet per second (fps) depending upon river levels, at the maximum makeup rate of 107 cfs.

It has been calculated that at the unusual intake flow of 107 cfs (one half of which passes through each of the two screens), the velocity of the water passing through the traveling screens ranges from 1.52 fps to 1.74 fps depending on river level.

At these approach velocities (0.48 to 0.55 fps) most of the healthier adult fish found in the Rock River are expected to be able to swim away from the intake and avoid impingement (Schuler 1967).

Since swimming speed generally increases with size within a species, more small than large fish are expected to be impinged. Temperatures as well as size influence impingement frequency. As water cools down during fall and early winter, increased impingement losses may occur because colder water temperatures reduce swimming speeds (Hocutt 1970).

There will be no heated water, or other discharges, to attract fish around the intake. No deicing operation in the winter is required, and no deicing facilities have been installed. There are no provisions for the addition of biocides to the makeup water. The blowdown structure is located approximately 600 feet downstream of the intake site. The distance between the makeup and blowdown structures should ensure that recirculation of discharge water into the intake does not occur.

The engineering design and operation of the river intake structure for the Byron Station ensures that there will be no significant entrapment of adult fish at the intake. What entrapment occurs will have no measurable influence on fish population dynamics in the Rock River.

5.1.3.3 Entrainment Effects on the Rock River

At the station intake, the average Rock River flow is 4580 cfs. Planktonic organisms will be entrained in numbers proportional to their frequency of occurrence in the volume of makeup water. During the summer this maximum loss is about 2% of the plankton passing the plant intake under average flow and 7% under 7-day 10-year low flow conditions. As indicated in the FES (see Subsection 5.4.2.1), since the generation time of plankters is short (hours to days) and the proportion lost is small, the plankton productivity in the river should recover rapidly.

The spawning and egg characteristics of Rock River fishes indicate that the eggs of the majority of the species of interest (game and commercial) should be only slightly affected by entrainment because they are not normally drifting in the current. Many of the game species have adhesive eggs that may be demersal or found in nests. Adhesive and/or demersal eggs found floating in the water column are usually there as a result of the river current or some other physical force sweeping them away from their substrate. Of these eggs, those that are fertilized may experienced high mortalities because they are not in their normal environment. Many larvae of the species involved do occur in the water column, although often they are still confined to backwater and headwater streams and do not occur in significant numbers in the mainstream of the river. Furthermore, under natural conditions, only a fraction of the larvae that hatch survive, and it is highly questionable that the numbers entrained could have any measurable impact on the fish population.

5.1.3.4 Effects of Reactor Shutdown on the Rock River

There would be a potential for a lethal effect due to thermal shock if a total reactor shutdown were to occur during winter periods when the thermal differential with the river water is high. The normal refueling shutdown schedule is once per year per unit, when the unit has operated continuously at a 100% load factor, with only one reactor shut down at a time. If the associated tower were shut down, the volume of heated water reaching the river would be reduced by about half with a concomitant reduction in plume size. Such a reduction would probably concentrate the fish as they follow the forming gradient to their acclimation levels, but it is likely that they would reacclimate to a lower temperature when the population density got too high. Normal reactor shutdown usually proceeds at a pace that would allow fish to acclimatize.

5.1.3 Terrestrial Effects of Operation of Heat Dissipation System

The potential for possible adverse effects of cooling tower salt draft deposition upon the biota near the Byron Station has resulted in a modification to the terrestrial monitoring program. Infrared aerial photographs are currently being taken to ensure

5.2 RADIOLOGICAL IMPACT FROM ROUTINE OPERATION

During normal operation of the Byron Nuclear Generating Station - Units 1 & 2 (Byron Station), very small amounts of liquid and gaseous radioactive effluents will be released into the environment. This section discusses possible radiological effects of these releases on persons and biota other than man.

5.2.1 Exposure Pathways

Radioactive effluents from the Byron Station are a potential source of radiation exposure. The possible radiation exposure pathways to biota other than man are identified in Subsection 5.2.1.1. Radiation exposure pathways for persons are discussed in Subsection 5.2.1.2.

5.2.1.1 Exposure Pathways to Biota Other Than Man

The possible radiation exposure pathways for species of local flora and local and migratory fauna are shown in Figure 5.2-1. These exposure pathways are evaluated in this Subsection.

5.2.1.1.1 Terrestrial Pathways

Radioactive effluents from the Byron Station may enter the terrestrial environment in the form of liquid, gaseous, or particulate material. Terrestrial animals in the vicinity of the Byron Station site may receive an external radiation dose as the result of submersion in air containing beta- and gamma-emitting radionuclides. The exposure rate will be approximately equal for all organisms exposed to the radionuclides in air. Inhalation of the gaseous effluent cloud will also result in a dose to terrestrial animals. The most critical organ for exposure in this latter pathway is the thyroid, which is capable of concentrating radioiodines present in air. Direct radiation from contaminated surfaces, another possible exposure route, includes direct exposure from radionuclides deposited on vegetation, soil, and exposed surfaces. This pathway, however, is less important than pathways in which uptake and concentration can occur. Other important exposure pathways include exposure to contaminated shoreline sediments and ingestion of foods contaminated by irrigation with water containing diluted effluents.

5.2.1.1.2 Aquatic Pathways

Small amounts of liquid radioactive effluent will be discharged into the Rock River with the cooling tower blowdown. The liquid releases will be diluted by the blowdown, and the radionuclides will either be dissolved or become suspended in the water. Biota found in this area or those that reside in this area during migratory movements may be exposed to the radiation emitted by these radionuclides.

Radionuclides released to the river may be adsorbed on suspended particles and bottom sediment. The suspended matter will settle to the bottom of the river, with the point of settling and the time of settling depending on the size of the particles and the flow rate of the river. As a result, radionuclides may accumulate in the sediment in the vicinity of the Byron Station discharge for the life of the station. Benthic organisms that live on or in this sediment could be exposed to the emitted radiation. In addition, gamma radiation from such sedimentary deposits, which accumulate near the bank and have only a shallow covering of water, may result in shoreline exposures of terrestrial organisms.

Some aquatic organisms may accumulate radionuclides in their body tissues as a result of diet and direct absorption from river water. The radionuclides may then be transferred to birds or other terrestrial organisms that derive all or part of their diet from the river. Transfer in the terrestrial food chain is considered to be through successive trophic levels.

5.2.1.2 Exposure Pathways to Man

The various possible pathways of radiation exposure to persons are shown in Figure 5.2-2.

5.2.1.2.1 Terrestrial Pathways

Radioactive effluents could be distributed in the terrestrial environment as discussed in Subsection 5.2.1.1.1. The critical terrestrial pathways for persons are listed as follows:

a. submersion in a cloud of gaseous effluents;

b. inhalation of gaseous effluents;

c. direct radiation exposure from radionuclide deposition on vegetation, soil, and exposed surfaces; and

d. ingestion of contaminated food chain components.

Some of the most important gaseous effluents include radioactive noble gases and halogens released during normal operation of the Byron Station. These effluents would attach themselves to particles in the air and deposit on vegetation, on the ground, or on a body of water. These radioactive materials could then be assimilated by land plants or animals. Human consumption of these plants or animals would result in radiation exposure to the individual. Because a milk cow concentrates iodine in its milk and the human thyroid can also concentrate iodine, the air-grass-cow-milk pathway can be used to evaluate the thyroid dose from deposition of halogens.

CHAPTER 6.0 - EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

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6.1 APPLICANT'S PREOPERATIONAL MONITCRING PROGRAMS

6.1.1 Surface Waters

This subsection describes the field and laboratory methods employed by Environmental Analysts, Inc. (EAI) of Garden City, New York, during the preconstruction aquatic baseline environmental studies at the Byron Nuclear Generating Station - Units 1 & 2 (Byron Station) as reported in Section 2.2. The text contains technical descriptions of the analytical and field techniques and procedures, and the field and laboratory equipment used in assessing aquatic conditions. Sampling design, frequency, and locations for each specific phase of the overall program are described in each individual subsection, and information is provided on the precision and accuracy of instrumentation used to collect or analyze the data.

The baseline surveys established sampling transects and inventoried benthos, phytoplankton, zooplankton, periphyton, fish, bacteria, water chemistry, and physical measurements.

The first year (1972 through 1973) baseline survey, conducted from April 1972 through July 1973 by EAI, was designed to determine the identification and abundance of phytoplankton, zooplankton, periphyton, and benthos; to assess species composition and size distributions of fishes; and to take replicate samples of water chemistry, bacteria, and physical measurements in the intake and discharge areas. The results and projections of construction impact concluded from the 1972 through 1973 studies were included in the Byron Nuclear Generating Station Construction Phase Environmental Report (Docket Nos. STN 50-454 and STN 50-455), Subsections 2.7.1; 5.1.1; 5.1.2; and 5.1.3.

After the July 1973 field survey, a review was initiated that resulted in defining the 1973 through 1974 aquatic monitoring program, which was initiated in Septemter 1973 and conducted through October 1974. The purpose of the 1973 through 1974 monitoring program was to provide a second year of data to supplement observations made during the first-year (1972 through 1973) program. Tables 6.1-1 and 6.1-2 summarize the physical, chemical, and biological parameters measured during the 1973 through 1974 program.

Locations of the sampling stations are shown on Figure 6.1-1. Sampling of the Rock River was undertaken on five transects (R-1, R-2, R-3, R-4, and R-5) from a point 2.4 miles upstream of Byron, Illinois, to just upstream of the dam at Oregon, Illinois. These transects were selected to yield data indicative of conditions in zones of the Rock River that could potentially be influenced by the construction and operation of the Byron Station. The transect areas for this study reflected some of the ranges of habitats between the Oregon and Rockford dams. In addition to the sampling on the Rock River, sampling stations were established in the mouths of tributary streams to the Rock River in the site area. During the 1972 through 1973 program, there were initially nine creek sampling locations: Stillman Creek (S-1), Mill Creek (S-2), Woodland Creek (S-3, W-1, W-2, and W-3), Leaf River (S-4), Spring Creek (S-5), and Silver Creek (S-6). During the 1973 through 1974 program, Stations S-3, S-4, S-5, S-6, W-1, and W-2 were retained.

This subsection also describes a construction stage monitoring program conducted by Espey, Huston & Associates, Inc. (EH&A) of Austin, Texas, that will continually assess the biotic communities in the Byron Station site area and document any macroscopic changes that result from plant construction activities (see Section 4.1). Particularly important to this program are those aquatic species that either are sensitive indicators of biotic stability or require additional examination to document their composition and abundance because of seasonal or annual population fluctuations. The data from these construction stage monitoring studies, added to previous baseline data collections, will reflect the natural biotic fluctuations in the Rock River and the six creeks in the area (Stillman, Mill, Woodland, Leaf, Spring, and Silver creeks) before plant operation. Operational data can then be compared with these data.

6.1.1.1 Physical and Chemical Parameters

The programs and methods for measuring the physical and chemical parameters of surface waters that may be affected by the construction and operation of the Byron Station are described in this subsection.

6.1.1.1.1 Baseline Program

Physical and chemical parameters measured in the field during the 1973 through 1974 baseline surveys included light penetration, current velocity, water temperature, turbidity, alkalinity, pH, and dissolved oxygen (DO). Water samples were collected in 1-gallon containers from mid-channel at five Rock River stations, three tributary streams, and two Woodland Creek stations (see Figure 6.1-1). Each sample was preserved with chloroform at 10 ml/gallon. All water samples were refrigerated at 4° C before analysis. The parameters described in Table 6.1-2 were analyzed according to Standard Methods, 13th Edition (American Public Health Association [APHA] 1971), except for trace metals, calcium, magnesium, sodium, and total hardness, which were analyzed according to Methods for Chemical Analysis of Water and Wastes (U.S. EPA 1971). All parameters, with the exception of pH, were analyzed in duplicate and averaged, with values presented in milligrams per liter (mg/liter). The U. S. Environmental Protection Agency Analytical Quality Control

Laboratory provided reference samples that served as independent within-the-laboratory checks on reagents, instruments, and techniques. Sample analysis checks were made by an independent laboratory, Illinois Water Treatment Company of Rockford, Illinois. Standard deviations for most parameters were calculated from 25 tests for each parameter to indicate any variability in the laboratory techniques. Dissolved oxygen concentrations were measured at mid-depth in the center of the river and the tributary stream channels.

In conjunction with the chemical analysis, selected physical measurements were recorded (see Table 6.1-2). The following paragraphs describe the methods and instrumentation used to make physical measurements.

Two instruments were used to determine flow rates of the water in the Byron Station site area. The first instrument was a G. M. digital flowmeter (G.M. Manufacturing and Instruments Corporation El Cajon, California), which is a propeller-driven device with a digital counter. This meter was calibrated to a known flow rate and gave readings as units per given period of time. To obtain velocities, readings were taken just below the surface for three 60-second immersions with the front of the meter pointed against the current.

The second method instrument was a Marsch-McBirney Model 711 water current meter (Marsch-McBirney, Kensington, Maryland) with a solid-state water velocity sensor operating on the principle of electromagnetic induction. The meter had a probe that can measure two orthogonal components of water flow, the side flow and the normal current. The meter gave readings directly in feet per second. Water conductivity variations did not affect the meter calibration.

Air and water temperatures were normally taken during all sampling periods of the 1973 through 1974 baseline surveys. Water temperatures were determined at mid-depth in the center of the river and stream channels. The Yellow Springs oxygen meter was equipped with an oxygen temperature probe to double its function. In addition, a standard centigrade thermometer was used to periodically check meter accuracy.

Transparency was determined using an 8-inch diameter (20 cm) Secchi disk with alternating black and white quadrants. The disk was lowered into the water on a calibrated line. When the demarcation between the black and white quadrants became obscure, the distance was recorded. Three readings were taken at each sampling station.

In addition to taking Secchi readings during periphyton sampling, an Inter-Ocean Model 510 submarine illuminance meter (Inter-Ocean Systems, Inc., San Diego, California) was used to record light penetration at this time. The instrument is designed to measure comparative illuminance between the surface and various subsurface levels. This device employs battery operated photocells enclosed in a deck (or surface) unit, and a submersible unit. Readings were taken from a meter as illumination in lux units. Measurements for the survey included a deck reading and two subsurface readings that were recorded as the depths in inches at which 50% and 25% of the available light penetrated the water. Three measurements per station were taken.

6.1.1.1.2 Construction Stage Monitoring Program

Duplicate water chemistry samples for the parameters listed in Table 6.1-3 were taken quarterly at Stations R-1 through R-5, S-3, S-5, S-6, W-1, and W-2. Each sample was drawn from a 481-liter composite sample, as outlined in the phytoplankton program (see Subsection 6.1.1.2.2). Water chemistry samples from Stations R-2 and R-5 were taken from the same composites as replicates 1 and 2 of the phytoplankton program (see Subsection 6.1.1.2.2). All water chemistry and bacteriology samples were stored in sterile polyethylene bottles, precharged (when appropriate) with preservative, kept on ice, and transported on the day of collection to Aqualab, Inc., for analysis. The specific analytical techniques used for each parameter are referenced in Table 6.1-3.

Temperature and oxygen profiles were taken at each monitoring station with a YSI model 51-A oxygen meter and a 5419 oxygen/temperature pressure compensating probe on a 50-foot lead.

Current velocity profiles at 1-meter intervals were taken at all Rock River stations with a Price-type meter (W & L. E. Gurley Co., Model 665) fitted with a streamlined 30-pound weight.

Light penetration and transparency were measured at all Rock River stations using, respectively, a Secchi disk (Welsh 1948) and a 4π light meter constructed as outlined in Maddux (1966) and Rich and Wetzel (1969).

Turbidity was measured at all Rock River stations, in the field, using a Jackson Turbidimeter (APHA 1971) if turbidities were in excess of 40 JTU. If turbidities were less than 40 JTU, they were measured in the lab with a Hach[R] Nephelometer.

Field measurements of pH were made at all stations using a Chemtrix[R] type 40, battery operated pH meter.

6.1.1.2 Ecological Parameters

The programs and methods for measuring the biological parameters of surface waters that may be affected by the construction and operation of the Byron Station are described in this subsection.

6.1.1.2.1 Baseline Program

The second year (1973 through 1974) baseline survey is summarized in Table 6.1-1. Sampling frequency varied from parameter to parameter in an attempt to correlate frequency with life histories. The frequencies are included in Table 6.1-1 as well as in the discussion of survey methods that follows.

Bacteria samples were collected from the five Rock River stations (R-1, R-2, R-3, R-4, and R-5), three tributary streams (S-3, S-4, and S-5), and two Woodland Creek pools (W-1 and W-3).

Samples were collected underwater in sterile BOD bottles, and plates were made the same day. Bacteria samples were analyzed according to procedures outlined in Standard Methods (APHA 1971). Two plates per bacteria sample were made for each test, and the counts were averaged.

Total coliform and total bacteria tests were conducted using premade milliliter ampoules of ENDO and TOTAL agar. After an incubation of 22 to 24 hours at 35° ± 0.5° C, counts were made and numbers reported per 100 ml of water sampled. The fecal streptococcus test involved preparing an agar medium using M-Enterococcus agar, which has a high selectivity of recovery of all fecal strep species. Streptococcus plates were incubated 48 hours at 35° ± 0.5° C The fecal coliform test involved their incubation in M-FC broth at 44.5° ± 0.2° C for 22 ± 2 hours.

Equipment for bacterial analysis included a vacuum pump, sterile membrane filters of 0.45 μm pore size, sterile agar pads, disposable sterile petri dishes and pipettes, and a Napco constant temperature apparatus for incubation.

Phytoplankton samples were collected on September 11, 1973 from the five Rock River stations (R-1, R-2, R-3, R-4, and R-5) and three tributary streams (S-3, S-4, and S-5). Beginning October 16, 1973, phytoplankton sampling was conducted at river stations P-2 and R-5 only. Duplicate samples were taken from mid-channel sampling locations by immersing 1-liter polypropylene bottles under the surface of the water. The phytoplankton samples were preserved with formaldehyde at a 1:20 ratio. The preserved samples were transported to the laboratory, where they were concentrated 10 to 20 times by adding 1 to 2 drops of acid Lugol's solution, which caused the organisms to settle to the bottom of the container. Samples were allowed to settle for 48 hours, after which the supernatant was siphoned off. The concentrate was then stored in 50-ml containers. Permanent mounts (for diatom classification) and semi-permanent mounts (for non-diatom identification) were prepared.

Phytoplankton were reported in units per milliliter using the following system:

Algal Form	Unit
Diatom	Each Frustule
Single celled	Each cell
Colony	Every four cells (except for the genera Aphanocapsa, Aphanothece, and Microcystis, which were reported in 50-cell units).
Filament	100-micrometer lengths

The following taxonomic references were used to identify phytoplankton species: Bourrelley (1968, 1970), Cleve-Euler (1968), Hustedt (1930), Patrick and Reimar (1966), and Prescott (1962). Samples were then examined for relative abundance, species diversity, biovolume, and biomass. Relative abundance was expressed as the number of individual species per liter and as the percent of total number of organisms present. The seven most abundant species present were selected as the dominant species.

Species diversity was measured using the Shannon-Weaver (Shannon 1948) index, which is described by the following equations (Lloyd et al. 1968):

$$H = \frac{1}{N} \left(N \log N - \sum_{i=1}^{s} n_i \log n_i\right) \qquad (6.1\text{-}1)$$

where:

- H = community diversity
- N = total number of individuals present
- n_i = number of individuals of species i
- s = total number of species

and:

$$H_{max} = \log s \qquad (6.1\text{-}2)$$

where:

- H_{max} = maximum diversity possible in a community composed of s species

Biovolume was determined using the analytical method presented by Prescott (1951), which is described by the following equations:

$$N/1 = \frac{N_s \; A_c \; . \; 10^3}{D_F \; L_c \; V_d \; N_d \; C_f} \qquad (6.1\text{-}3)$$

where:

N/l = number of individuals per liter

N_s = number of individuals of species per transect of coverslip

D_F = diameter of field of microscope in centimeters

L_c = length of coverslip in centimeters

V_d = volume of drop of sample

N_d = number of drops of sample

A_c = area of coverslip

C_f = concentration factor

and:

$$\mu l/\text{liter} = \frac{N_1 V_i}{10^9} = \text{biovolume} \qquad (6.1\text{-}4)$$

where:

N_1 = number of individuals

V_i = volume of individual species examined

Biomass was calculated from biovolume using the conversion factor of 1 gm = 1 cm^3.

Zooplankton samples were collected September 11 and October 16, 1973, from mid-channel of the five Rock River stations (R-1, R-2, R-3, R-4, and R-5) and three tributaries (S-3, S-4, and S-5). Beginning January 28, 1974, zooplankton sampling was conducted at river stations R-2 and R-5 only. For each sample, 60 liters of surface water was concentrated by passing it through a No. 20 mesh nylon plankton net (approximately 50 µm). For more efficient and accurate measurement of water volume through the net, water was poured through the net by bucket (UNESCO 1968). The concentrate, representing 60 liters of water, was preserved in bottles by adding formalin in a 1:10 ratio. Duplicate samples were taken at each location. The zooplankton were examined by using a Sedgewick-Rafter counting slide, which holds 1 cm^3 of water. Three slides per sampling station were examined in full. Analyses were made of species composition, relative abundance, and total plankton count. Numbers of plankton per liter were calculated using the following equation:

$$\frac{\text{Number counted}/(cm^3) \times \text{volume of concentrate } (cm^3)}{60} = \text{Number/liter}$$

Zooplankton were identified using the taxonomic publications of Eddy and Hodson (1961), Edmondson (1959), Kudo (1966), Needham and (1938), and Pennak (1953).

Periphyton samples were collected at the five Rock River stations (R-1, R-2, R-3, R-4, and R-5), three tributary stream stations (S-3, S-4, and S-5 from September through December 1973, and S-3, S-5, and S-6 from January through September 1974), and two Woodland Pool stations (W-1 and W-2) from September 1973 through September 1974.

Two diatometers of the Ruth Patrick (Patrick and Reimer 1966) and J. W. Foerster (1969) design were placed at river transects R-1, R-2, R-3, R-4, and R-5, approximately 20 feet from shore. One diatometer was placed at mid-channel near the mouth of each of the three tributary streams. The other diatometer was placed at each of two stations (W-1 and W-2) established further upstream on Woodland Creek. Each diatometer contained ten 25 x 75 mm microscope slides. Three slides were selected from each diatometer for analysis. Samples were analyzed for species composition, relative abundance, species diversity, community similarity, biovolume, biomass, and chlorophyll a.

Additional diatometers were placed at transects R-2, R-3, and R-4, two per transect, one diatometer on each side of the river. The additional samples were collected every other month, beginning in January 1974, and were analyzed for species diversity, community similarity, biovolume, and biomass. The periphyton communities present at each transect were compared using non-parametric analyses for differences on the same transect and for differences between transects. Light penetration, temperature, velocity, and depth of the diatometer were conducted as ancillary measurements.

Species composition and relative abundance were determined by methods described in the previous section for phytoplankton. Species diversity was determined using the Shannon-Weaver diversity index just discussed for phytoplankton. Community similarity was determined by Morisita's index of overlap, which is described by the following equation as modified by Horn (1966):

$$I = \frac{2 \sum_{i=1} (a_i)\ (b_i)}{AB\left[\sum_{i=1}^{s} \frac{a_i^2}{A^2} + \sum_{i=1}^{s} \frac{b_i^2}{B^2}\right]} \qquad (6.1\text{-}5)$$

where:

I = the index of overlap

i = the species number

a_i = the density of species i in sampling site A

b = the density of i in sampling site B

s = the total number of different species in both sites

A = the total number of individuals in sampling site A

B = the total number of individuals in sampling site B

The periphyton communities present at each transect were compared to determine degrees of similarity and difference. The index is not only a measure of similarity, however, it is also a measure of the probability that two individuals drawn at random from different communities will belong to the same species relative to the probability of finding two randomly chosen individuals of the same species from the same community.

Biovolume was determined using the Prescott (1951) method of analysis. Results were expressed as biovolume per square millimeter of slide area. Biomass was determined by the conversion factor of 1 gm = 1 cm^3 biovolume.

<u>Benthic</u> communities were sampled at the five Rock River transects, the six stream mouth stations, and the two Woodland Creek stations. River stations were sampled using a Ponar grab sampler that is designed to cover a 9 x 9-inch area of substrate surface. A winch system was employed to lower and raise the 60-pound sampler. This type of sampler is well adapted for use on sand, gravel, or rock bottoms. The jaws are machined-tapered and have an attached underlip that enables the jaws to avoid most stones and gravel, which jam other bottom samplers.

Twelve samples were taken in each river transect, four from near shore on each side and four from mid-river during September and October 1973. Only six grab samples were taken at each river transect during February 1974 and each subsequent sampling month. As each sample was taken, grab size (light, medium, or full) and bottom type (sand, fine gravel, silt, muck, etc.), as outlined by Lagler (1970), were recorded.

Two samples were taken at a point near the mouth of the six streams in the study area. The sampler used in these locations was a Birge-Ekman grab sampler that covered a 6 x 6-inch area. This sampler was used because soft sediment is commonly present in the stream mouths and because, according to a study comparing the Ponar and Birge-Ekman dredges, the Birge-Ekman model is more effective with soft substrates, such as silt and muck (Howmiller 1971).

Benthos were sampled at two stations in Woodland Creek (W-1 and W-3), with three samples taken at each station. All samples were washed in a screen-bottom wash bucket. They were subsequently placed in plastic bags, marked for identification, and packed in ice or refrigerated until the analyses were performed. In the laboratory, each sample was sorted by hand using a series of U.S. Standard sieves. The organisms present were removed and preserved for identification in vials containing 70% alcohol. Analyses included species composition, relative abundance, and weight (biomass). Species composition of benthos will provide a basis for evaluating water quality in the study area (Hynes 1963). The keys used for benthos identification were those of Eddy and Hodson (1961), Edmondson (1959), Pennak (1953), Needham and Needham (1938), and Mason (1968).

Fish egg and larvae sampling was conducted monthly during April, May, June, and July, beginning in 1974, at river transects R-1 through R-5 and stream transects S-3, S-4, and S-5 using a No. 10 mesh nylon plankton net with a 0.5-meter diameter opening. The boat was anchored at each transect, with the flow of the river determining the amount of water filtered through the net. Flow rates just below the water surface, where the net was suspended, were measured at each station using a G. M. digital flowmeter. The amounts of water filtered through the net in a given period of time were thus determined.

The net was left in the water for 15 minutes at each transect. The flow rates of the river averaged from 1 to 2.5 ft/sec, or less than 3 knots (1 knot = 0.5 m/sec). These speeds are generally considered equal to or slower than a low-speed tower; thus, a low filtration pressure, or pressure drop, across the meshes of the net was attained to better prevent damage to the fish eggs and larvae (Tranter 1968).

Upon completion of a 15-minute sampling period, the collected material was transferred to jars from the plankton bucket attached to the net, and formalin was added in a 1:10 ratio for preservation. In the laboratory, each sample was picked through by hand, and the numbers of fish eggs and larvae were recorded. These numbers were then used as an indication of abundance for a given volume of water.

Fish sampling was conducted by seining and electrofishing. Seine samples were collected either with a 10-foot or a 50-foot beach seine with 0.25 inch mesh. The seining catch was expressed in numbers of fish caught per square foot of net coverage.

As the least selective of all active fish sampling methods (Ricker 1968), electrofishing allows maximum coverage of a habitat, a necessity in survey work. Each river station was electrofished for 15 minutes on each side of the river. The electroshocking unit uses a Homelite 2000-watt, 230-volt, 3-phase generator. Each of the three leads was run from the generator, past a series of toggle switches and a dead-man microswitch assembly, to lightning rod electrodes suspended from a boom approximately 6 feet in front of the boat. A distance of 6 feet between electrodes ensures complete coverage of the unit when it is in operation. The generator and shocking assembly was modeled after the electrofishing units used by the Illinois Department of Conservation.

Length-weight curves were computed for certain species by using the following length-weight equation (Lagler 1970):

$$\log W = \log a + n \log L \qquad (6.1\text{-}6)$$

where:

L = length

W = weight

a = interception of the y-axis

$$\log a = \frac{\sum \log W \cdot \sum (\log L)^2 - \sum L \cdot \sum (\log L \cdot \log W)}{n \cdot \sum (\log L)^2 - (\sum \log L)^2}$$

$$n = \frac{\sum \log W - (N \cdot \log a)}{\sum \log L}$$

Condition factors for 10 individuals of each of the 5 most important species were computed from parameters from sexed fish to provide indexes of physical condition. The condition factor (K) is defined mathematically as:

$$K = \frac{W}{L^3} \qquad (6.1\text{-}7)$$

where:

W = weight of an individual fish

L = length of an individual fish

Analyses of stomach contents and ectoparasites of 10 individuals of each of the 5 most important species were documented. Stomach contents for specific foods were reported as percentages of total numbers of ingested material. For ectoparasite work, the anterior gill arch was examined, and parasites were counted and identified using publications by Inman and Hambric (1970) and Amlacher (1970).

Fish were identified with the aid of keys developed by Eddy (1969), Hubbs and Lagler (1959), and the Illinois Department of Conservation (1970).

A creel census was conducted by interviewing fishermen who use the Rock River within the study area. A questionnaire was prepared, and a fieldworker interviewed bank fishermen. Information sought in the interview included data relating to species preference, hours fished on day of census, numbers of fishing trips to Rock River per year, and average catch per trip.

other data such as species caught, lengths and weights of fish on their stringer, numbers of rods used, and suitability of the day for fishing were also recorded. Creel census data will be projected for use in estimating fishing pressure in the study area and to define zones in the study area most heavily used by sport fishermen. A sample creel census questionnaire is shown in Figure 6.1-2.

6.1.1.2.2 Construction Stage Monitoring Program

The construction stage aquatic monitoring program described in this subsection is part of a 5-year study that began in March 1975. Table 6.1-4 presents a summary of the program. All sampling programs are conducted quarterly at specified stations among those identified and located in Figure 6.1-1.

The term "dominant" refers to any species or taxonomic unit that constitutes 5% or more of the total standing crop at the location(s) under consideration.

Bacteria samples were collected at Stations R-1 through R-5, S-3, S-5, S-6, W-1, and W-2 on a quarterly schedule. Each sample was drawn from a 48-liter composite sample taken as outlined in the phytoplankton section that follows. Bacteria samples from Stations R-2 and R-5 were taken from the same composites as replicates 1 and 2 of the phytoplankton program. All bacteriology samples were stored in sterile polyethylene bottles, precharged (when appropriate) with preservative, kept on ice, and transported on the day of collection to Aqualab, Inc. for analysis. The analytical techniques used are referenced in Table 6.1-3.

Phytoplankton samples were collected quarterly from Stations R-2 and R-5. Four replicate samples were taken, each consisting of eight 6-liter, plastic kemmerer bottle hauls from a depth of 1 meter. The 48-liter replicate was accumulated in a polyethylene container and continuously mixed as the required subsamples were withdrawn. Sampling at Stations R-2 and R-5 was conducted simultaneously, using two crews, to ensure the comparability of the results.

Phytoplankton enumeration was accomplished using a 2-liter phytoplankton sample drawn from each replicate and preserved with "M^3" (Meyers 1971) at a final concentration of 3%.

Lab processing included the identification and enumeration of preserved material. Approximate phytoplankton densitities were first estimated in order to calculate the number of fields to be censused for a given collection date.

Total plankton were counted starting with a suitable volume, determined in a preliminary examination, of fixed material placed in a sedimentation chamber to concentrate the plankton. Settling was facilitated by the addition of a small amount of detergent

(APHA 1971), and sedimentation was assumed to take place at a maximum rate of 3 hr/cm (Vollenweider 1969). That is, the minimum sedimentation time for a sample was equal (in hours) to three times the height of the water column in centimeters. The concentrated sample was enumerated at 400x magnification in a counting chamber that was shallow enough to allow the use of a high-dry (40x) lens (Palmer and Maloney 1954). All organisms encountered in these water mounts were enumerated with non-diatoms identified and measured and diatoms simply counted and lumped under "centric" and "pennate" categories. The number of fields counted within each of the four replicates was adjusted for each collection date to ensure that at least the minimum of 500 individuals was counted in the least dense sample for that date. The same number of microscope fields (at 400x) was used to count each replicate.

Biovolumes for the species present in a sample were estimated by first measuring the dimensions of all the individuals encountered, up to a maximum of 10, 10 being the number of individuals usually considered adequate (APHA 1971). Biovolumes were then calculated on the basis of geometrical formulae appropriate to each species.

Diatoms were enumerated by separate counts to identify, measure, and enumerate diatom species because they were usually not distinguishable in the water mount preparations. An aliquot from each sample was taken, concentrated by centrifuging, acid cleaned, mounted in Hyrax^R, and enumerated using the methods outlined in Patrick and Reimer (1966) and APHA (1971) to obtain relative abundances. A minimum of 300 individuals was counted from each replicate. These proportional counts were then applied to the total counts of combined diatom taxa enumerated in the water mounts to break down the total counts into individual species abundances. Less error was introduced into the censuses by this method than would have been introduced by an attempt to equate absolute abundances (density and biovolume) of diatoms and other algae using entirely different sample treatments.

Biovolume was expressed in µl/liter units. Density was expressed as No. cells/ml where possible. Filamentous forms were expressed as standard length units of 100 µm/ml, colonial forms with consistent cell numbers were recorded as a single unit, and large colonies with variable cell numbers were reported in terms of cell groups. The biovolume formula of single counting units is listed for each taxon in Appendix 6.1A, Table 6.1A-1. Species diversity (H') and redundancy (r) were calculated according to the methods outlined in Wilhm and Dorris (1968). The following equation was used to calculate species diversity (H'):

$$H' = \sum p_i \ln p_i \qquad (6.1\text{-}8)$$

where:

p_i = the proportion of the i^{th} species

Redundancy (r) was then calculated using the following equation:

$$r = (H'_{max} - H') / (H'_{max} - H'_{min}) \quad (6.1\text{-}9)$$

Chlorophyll a was analyzed from a 2-liter subsample from each replicate. These subsamples were placed in 1-liter polyethylene bottles and immediately frozen on dry ice. The samples were kept frozen and in darkness until analysis.

Samples taken for chlorophyll a analysis were concentrated by filtration through AA (1.0μm) Millipore[R] filters (Creitz and Richards 1955), and the pigments were extracted in 90% acetone. Optical density (O.D.) was measured on a spectrophotometer using an absorption cell with a path long enough to produce an O.D. reading between 0.2 and 0.5. The exact procedures followed were those outlined in Stickland and Parsons (1968). Chlorophyll a concentrations were calculated using the Chlorophyll-Pheophytin Method (Strickland and Parsons 1968; APHA 1971; Moss 1967; Lorenzen 1967). This method was preferred over the trichromatic method (Parsons and Strickland 1968), which is standard in oceanographic work, because fresh waters often contain significant quantities of the chlorophyll degradation product pheophytin which, if present, can lead to serious overestimates of chlorophyll a.

Primary production was measured using the carbon-14 technique outlined in Section 601f of Standard Methods (APHA 1971) and in Strickland and Parsons (1968). This method results in an estimate near the net production, since the quantity measured is the amount of radiocarbon residing in the particulate phase of the sample at the end of the incubation period. This value represents the total carbon fixed during incubation, minus the carbon released in respiration or excreted from the algal population.

The radiocarbon source used consisted of a C-14 labeled sodium bicarbonate solution of 5 μCi total activity sealed in 1-ml ampoules, which were obtained in standardized lots from New England Nuclear Corporation. Incubations were performed in 300-ml Wheaton[R] BOD bottles that were sterilized before each use.

Two three-bottle sets, each consisting of two light (clear) bottles and one dark (to correct for heterotrophic fixation and adsorption) bottle, were filled with water from the first two 48-liter composite samples taken at the appropriate stations (one set for each sample). The two three-bottle sets were thus taken from the same samples as replicates 1 and 2 for water chemistry, phytoplankton, and chlorophyll a determinations. The contents of a 1-ml C-14 ampoule were added to each bottle, and all bottles were suspended at a standard depth of 1 meter from an anchored float at the station from which the sample water was collected. Samples were allowed to incubate from 2 to 6 hours. Incubation was terminated by the addition of 2 ml of 37% formaldehyde. In the lab, the entire contents of each bottle was filtered through a 0.45 μm membrane filter that was then dried and dissolved in a dioxane cocktail. The rate of β-decay (as counts per minute) was then determined in a liquid scintillation counter. At this time the background radioactivity and total activity of the lot of ampoules were also determined. The calculations were performed as outlined in Standard Methods (APHA 1971).

Zooplankton samples were collected quarterly at Stations R-2 and R-5 (see Figure 6.1-1). At each station, the quarterly sample consisted of four replicates, each a composite of eight vertical hauls with a No. 20 (80 μm) mesh plankton net. The samples were immediately preserved by adding a sufficient amount of 37% formaldehyde to yield a final concentration of about 5%.

In the lab, sample volumes were standardized to 1 liter and surveyed to determine the volume to be processed in order that the least dense replicate from the two stations would yield a count of at least 300 zooplankters. The subsamples were then counted in Sedgwick-Rafter cells at 100x magnification. Cladocerans and adult copepods were identified to species, as were rotifers when possible. Immature copepodite stages of copepods were identified as cyclopoid, calanoid, or harpacticoid. Copepod nauplii were identified as such, without further differentiation.

Densities were calculated as number per cubic meter. Species diversity (H') and redundancy (r) indexes were calculated as outlined by Wilhm and Dorris (1968). The following equation was used to calculate species diversity (H'):

$$H' = \sum p_i \ln p_i \qquad (6.1\text{-}8)$$

where:

p_i = the proportion of the i^{th} species

Redundancy (r) was then calculated as follows:

$$r = (H'_{max} - H') / (H'_{max} - H'_{min}) \qquad (6.1\text{-}9)$$

Station differences in abundance of categories and dominants were tested by one-way analysis of variance (ANOVA), and subsequent pair-wise testing of station means was done by Scheffe's multiple comparison. Before testing, a ln (x + 1) transform was applied to the density data. For all statistical tests, an a priori level of significance of 5% ($P<0.05$) was chosen.

Periphyton samples were collected in two separate programs, the "quarterly" series and the "bimonthly" series. Laboratory processing for the two programs was identical. It is discussed in the following paragraphs.

The quarterly periphytor samples were collected from natural substrates at Stations R-1, R-5, S-3, S-5, W-1, and W-2 during May and July. All samples were taken at an approximately 0.25-meter depth using a toothbrush and a series of acetate templates to remove all growth from 10 cm^2 on each of eight replicate substrates at each station.

Beginning with the October sample, this program was changed in two ways. First, periphyton was no longer collected from natural substrates but from plexiglass slides identical to those used in the bimonthly collections. The following discussion of the bimonthly series thus applies to the quarterly series beginning with the October 1975 samples. Second, three more stations, R-2, R-3, and R-4, were added to the quarterly series. Eight replicate substrates were taken from a single diatometer at each station.

The bimonthly (artifical substrate) series of periphyton samples were taken at stations on either side of the river at Stations R-2, R-3, and R-4. A diatometer was positioned on each side of the river at these locations. These locations (stations) were designated 2R and 2L, 3R and 3L, and 4R and 4L with the R and L representing the right (west) and left (east) sides of the river, facing downstream. After approximately 1 month's exposure, four of the eight replicate samples were removed from each diatometer. The sample surfaces consisted of plexiglass slides having a total surface area of 20 cm^2. These were held in a vertical position in the diatometer to minimize siltation. The diatometers were floating plexiglass platforms designed to hold the substrate slides at a constant depth of 0.25 meter (modified from APHA 1971). Collections were made by placing each replicate slide (four per station) in a labeled Whirl-Pak^R bag with a small amount of distilled water and M^3 perservative (Meyers 1971). The periphyton was subsequently scraped from the substrates in the lab.

Lab processing for all periphyton samples was carried out in the same way regardless of the program it came from. Scrapings from half of the replicates from each station were suspended in 50 ml of water and M^3 fixation. From this point on, identification and biovolume estimates followed the procedures outlined in the phytoplankton paragraphs except that concentration by settling was generally not necessary. The results were expressed on an areal basis as specified (i.e., density as No./10 cm^2 and biovolume as μl/10 cm^2). The geometrical formulae used to calculate biovolumes, and the taxa to which they were applied, are listed in Appendix 6.1A, Table 6.1A-1. Species diversity and redundancy values were calculated according to the methods of Wilhm and Dorris (1968) (see Appendix 6.1A, Table 6.1A-2). The following equation was used to calculated species diversity (H'):

$$H' = \sum p_i \ln p_i \qquad (6.1\text{-}8)$$

where:

p_i = the proportion of the i^{th} species

Redundancy (r) was then calculated using the following equation:

$$r = (H'_{max} - H') / (H'_{max} - H'_{min}) \quad (6.1\text{-}9)$$

Scrapings from the remaining substrates at each station (both programs) were placed in separate crucibles, dried to constant weight at 105° C, and ignited for 1 hour at 500° C in a muffle furnace. The ash was then rewetted with a few drops of distilled water and again dried to constant weight at 105° C (APHA 1971). The purpose of the rewetting procedure was to ensure that the water of hydration of clay and other minerals, driven off at 500° C, but not at 105° C, was reintroduced and thus would not be reported as organic matter. Biomass was reported as the difference in sample weights before and after ignition per 10 cm^2 (ash-free dry weight). "Constant weight" was defined (APHA 1971) as a change of 0.5 mg or less between two successive series of operations (heating, cooling in a desicator, and weighing). All weighings were to the nearest 0.1 mg. A Mettler^R H6 balance was used for all of the weighings.

<u>Benthic macroinvertebrate</u> populations were assessed in two separate programs that sampled different portions of the total community.

The "dredge benthos" program consisted of samples of organisms and sediments taken directly from the river bottom. In the "Hester-Dendy" program, artificial substrate samplers were used to provide habitat space for benthic organisms.

<u>Dredge Benthos</u>:

<u>Field processing</u> required four replicate benthos samples to be collected at Stations R-1 through R-5, S-3, S-5, W-1, and W-2 during each quarterly sampling period, using a Ponar grab. Immediately after collection, the samples were split by quartering, and portions were retained for total organic carbon and particle-size analysis. The portion intended for organic carbon analysis was frozen and transported to the lab for further processing (see water chemistry section). Particle size and organism aliquots were preserved by adding a 37% formaldehyde solution.

<u>Lab processing</u> included washing and sorting dredge samples using a standard No. 30 mesh sieve and a binocular microscope. After washing and sorting, all macroinvertebrates (from both programs) were preserved in a 70% ethanol -5% glycerine solution until final disposition. Organisms requiring examination with a compound microscope (e.g., Oligochaeta and Diptera) were permanently mounted in Berlese's medium (Galigher and Kozloff 1971). Organisms were identified to species where possible and the results reported as density (No./m^2).

Particle size analysis was carried out using the methods outlined in Folk (1968). U. S. Standard No. 4 and No. 200 sieves were used to separate the following particle size categories:

Gravel = >4.75 mm

Sand = 4.75 mm>d>0.074 mm

Silt + Clay = d>0.074 mm

The silt and clay fractions were separated and their contributions estimated by using the pipette technique.

Hester-Dendy Sampling Program:

Benthic organisms were collected from four replicate artificial substrates every month (March through August in 1975; from April through September beginning in 1976) at Transects R-2, R-3, and R-4. Two samplers were located on each side of the river at these transects. The substrates used were modified Hester-Dendy samplers. These were constructed of nine circular, hardboard plates 6.3 cm in diameter. The plates were arranged in sequence so that the spacing of the plates varied from 0.3 to 1.3 cm. The total surface area exposed in these samplers was about 0.06 m^2. The samplers were exposed for a 2-month period, suspended just below the water surface from an anchored float. They were collected with a dip net, and the entire sampler was stored in a quart mason jar containing 10% formalin for transport to the lab.

The Hester-Dendy substrates were brushed and washed on No. 30 mesh sieves and examined using a binocular microscope. The results were expressed as No./m^2 for each species. As with the dredge samples, identification was to species where possible.

Species diversity and redundancy were calculated according to the methods outlined in Wilhm and Dorris (1968).

Fish were sampled quarterly at six stations by electroshocking, seining, and hoop netting. Drift net samples at eight stations were collected monthly from May through August (see Figure 6.1-3). A creel census was conducted from Byron to the Oregon dam roughly every three days during June, July, and August 1975 (see Figure 6.1-4).

The 1975 through 1976 quarterly seine, electroshock, and hoop net samples were collected from April 28 through May 1 (spring), July 7 through 10 (summer), and October 10 through 16 (fall), 1975. No February 1976 (winter) sample was collected due to ice conditions on the river.

Drift net collections at Stations R-1, R-2, R-3, R-4, R-5, S-3, S-5, and S-6 were made over a 4-month period on April 30 and May 1, June 6 through 7, July 8 and 14, and August 5 through 7, 1975.

The samples collected included those from three river transect stations (R-2, R-3, and R-4) and three creek mouth stations (S-3, S-5, and S-6). The west bank of the Rock River in the vicinity of the transects is largely comprised of a gravel bottom whereas the east bank has primarily a silty mud bottom. Because of the dichotomous habitat, samples were collected along both shorelines at the three transect stations. Creek stations were generally sampled by seining once up the creek from the mouth and once in the river itself at the mouth. The duplicate 2000 ft^2 seine hauls were made on two consecutive days at each station using a 50-foot long by 12-foot wide keep seine of 1/2-inch Ace mesh.

Hoop net collections were made at six stations with the nets generally placed in 5 to 6 feet of water. The hoop nets used were 7-ring nets, 4 feet in diameter and 16 feet long with 2-inch square mesh. A net was placed at each creek mouth (S-3, S-5, and S-6) and on each side of the river at the three transect stations (R-2, R-3, and R-4). Nets were attached to stakes driven into the bottom and oriented downstream. Bait was canned dog food during the spring and dog food plus cheese during the summer and fall. Nets were left in place for 24 hours on each of two consecutive sampling days.

Electroshocking was done with a 220-volt, a-c pulsed signal delivered through two 5-foot electrodes. The electrodes were boom-mounted on the front of the collection boat. Two netters swept each station for 30 minutes shocking time on each of two consecutive days. At the river transect stations, each shoreline was shocked for 15 minutes per day.

Drift net samples were collected monthly from May through August at nine stations (R-1 through R-5, S-3, S-5, S-6, and W-1). The nets were No. 0 mesh 5:1 drift nets with 0.5-meter diameters. A General Oceanics Model 2030 flow meter was installed in the mouth of each net. Each flow meter was calitrated against the instrument's calibration curve and found to be within acceptable limits of variation from the standard curve. The threshold velocity for this model, equipped with the low-speed rotor, is 3 cm/sec with a linear response range of 5 cm/sec to 1 meter/sec for the low-speed rotor. Nets were anchored in place facing upstream for 24 hours. Collected samples were immediately preserved in formalin.

For fish taken by seines, hoop nets, and electroshocking, the following procedures were used:

a. Each fish was identified to the lowest possible taxon (species level with few exceptions for larval fishes).

b. Total catch was enumerated.

c. Total length was recorded in millimeters.

d. Individual body weight was recorded in grams after weighing on a milk-scale type balance, accurate to 1 ounce, for larger specimens or on an 0 Haus Dial-O-Gram[R] balance, accurate to within 0.1 gram, for smaller specimens.

e. Scale samples were taken from fish examined for length and weight with the exception of minnows and catfish. Carp scales were also collected and aged. Ten or more scales were removed from each specimen and placed into appropriately labeled scale envelopes for later analysis. For analysis, scales were soaked in water and brushed to remove residual tissue. Annuli were counted by direct observation with a stereoscope. Age estimates were confirmed by reading a minimum of three scales per individual.

f. The gill chambers and external body surface of all specimens were checked for evidence of parasites and disease. Inspection included surveying the specimen for the presence of, or damage due to, the following organisms: bacteria, viruses, fungi, protozoans, copepods, roundworms, flatworms, leeches, mollusks, and lampreys.

g. A maximum of 10 adults of each species taken each day at each station by each gear type were eviscerated and their sex determined. Cyprinids, other than carp, were an exception as their sex was not determined.

h. The stomachs collected in the previous step were examined and their contents recorded for all adult game fish, ictalurids, and carp. The stomach contents were analyzed for relative abundance of various food items.

i. During the spring and fall sample periods, muscle and liver tissue from each of the two numerically most important carnivorous and herbivorous species was collected for heavy metal and insecticide analysis. Tissue from fish taken from a number of sample stations was composited for analysis wherever possible. Game fish species were usually present in low numbers and consequently tended to be represented from only one or two stations. Tissue samples were analyzed for trace metals (copper, cadmium, lead, zinc, and mercury) and pesticides (dieldrin, endrin, DDT, heptachlor, lindane, and aldrin) by an independent Illinois State certified laboratory.

During the months of June, July, and August 1975, a creel census was performed approximately every 3 days during daylight hours on the Rock River from Byron to Oregon, Illinois. Nine areas accessible from the roads paralleling the Rock River on the east (rural route) and on the west (State Hwy 2) were sampled during each separate creek census effort (see Figure 6.1-4). The usual survey took approximately 4 hours to accomplish.

On four occasions (June 6 and 26, July 29, and August 29) the creek census was conducted from a boat starting at Byron and finishing at the Oregon Dam. Thirty of the total of 207 interviews were obtained on these occasions.

Figure 6.1-2 is an example of a creel census questionnaire. Whenever possible, the length and weight of all fish caught by the fisherman were recorded; however, on numerous occasions permission to measure the fish was not granted.

6.1.2 Groundwater

The groundwater regime of the Byron Station site was investigated on a regional and site basis through an integrated program of office studies, field investigation, and laboratory testing. The objectives of the regional survey were to determine the occurrence, movement, use, and general quality of groundwater. As a part of this investigation, the regional hydrogeological system and available piezometric surface maps were reviewed. Groundwater pumpage data were collected on a county-wide basis. Data for all water wells within 2.25 miles of the site, and public groundwater supplies within 10 miles, were tabulated.

The site-area survey refined the regional data and provided site-specific physical and chemical parameters from borehole log analyses, observation wells, piezometers, pumping tests, water pressure tests, and water sample analyses. These data were useful in evaluating the groundwater resources and developing predictive models. The properties and configurations of the local aquifers at the site are described in Subsection 2.4.2.

6.1.2.1 Physical and Chemical Parameters

The monitoring program for groundwater quality and levels in the vicinity of the site began in December 1975 and was modified in April 1980. This modification involved the establishment of action guides. The guides determine that action should be taken when specific values of the monitored parameters no longer fall within the guide limits (action levels). 1

Water quality analyses are performed in accordance with Standard Methods for Examination ofWater and Wastewater, 15th Edition (APHA 1979) and Methods for Chemical Analysis of Water and Wastes (U.S. EPA 1979). Water levels are determined using a meter connected to a probe that is lowered into the well. The meter 1

TABLE 6.1-1

SUMMARY OF THE 1973-1974 AQUATIC MONITORING PROGRAM

PARAMETER	LOCATION	FREQUENCY 1973	FREQUENCY 1974
Phytoplankton & Zooplankton Quantitative	R-1 through R-5, S-3, S-4, and S-5	September and October	January, April July, and October
Quantitative	R-1 through R-5, S-3, S-4, and S-5		Bi-Weekly, June through September
Periphyton	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Diatometers	R-2, R-3, R-4		January, March, May, July, September, and November
Benthos	R-1 through R-5 S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Artificial Substrates	R-2, R-3, and R-4	Monthly, beginning in September	Monthly, January to August
Fish	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Fish Eggs and Larvae	R-1 through R-5, S-3, S-4 and S-5		April, May, June, and July
Fish Creel Census	Study Area		May through September
Bacteria	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Fish Muscle and Liver Tissue	R-1 through R-5, S-3, S-4, S-5, W-1 and W-3	October	April and October
Water Chemistry (22 parameters)	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Quality Control Analyses	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	October	July
Diurnal Dissolved Oxygen	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3		May, July, and September
Trace Metals (Cd, CO, Fe, Cu, Hg, Zn, Pb, Cr)	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October
Physical Parameters (Temperature, current velocity, turbidity, depth, light penetration, transparency)	R-1 through R-5, S-3, S-4, S-5, W-1, and W-3	September and October	January, April, July, and October

TABLE 6.1-2

SUMMARY OF CHEMICAL AND PHYSICAL PARAMETERS MONITORED

DURING SECOND YEAR (1973-1974) AQUATIC MONITORING PROGRAM

CHEMICAL PARAMETERS

Total Suspended Solids	Sulfates
Total Organic Solids	Calcium
Total Dissolved Solids	Magnesium
Biochemical Oxygen Demand 5-Day	Color
Total Organic Carbon	Silica
Dissolved Oxygen	Total Phosphate
pH	Orthophosphate
Conductivity	Nitrate
Hardness	Nitrite
Alkalinity	Ammonia
Chlorides	Sodium

TRACE METALS

Cadmium	Lead
Chromium	Manganese
Cobalt	Mercury
Copper	Nickel
Iron	Zinc

PHYSICAL PARAMETERS

Temperature	Depth
Current Velocity	Light Penetration
Turbidity	Transparency

TABLE 6.1-3

SUMMARY OF WATER CHEMISTRY METHODS

PARAMETER	UNITS	METHOD	S.M.[a]	ASTM[b]	EPA[c]
Hardness	$mgCaCO_3$/liter	EDTA	p. 179	p. 170	p. 76
Total Alkalinity	$mgCaCO_3$/liter	Methyl-orange	p. 526	p. 43	p. 246
Chlorides	$mgCl^-$/liter	Argentometric	p. 96	p. 23	p. 29
Sulfates	$mgSO_4^=$/liter	Gravimetric	p. 331	p. 51	p. 286
Calcium	mgCa/liter	Atomic Absorption	p. 210	p. 692	p. 102
Magnesium	mgMg/liter	Atomic Absorption	p. 210	p. 692	p. 112
Color	APHA units	Spectrophotometric	p. 392	-	-
Silica	$mgSiO_2$/liter	Heteropoly Blue	p. 306	-	-
Total Phosphate	mgP/liter	Persulfate Digestion	p. 526	p. 42	p. 246
		Ascorbic Acid	p. 532	-	p. 259
Orthophosphate	mgP/liter	Ascorbic Acid	p. 532	-	p. 259
Nitrate	mgN/liter	Brucine	p. 461	-	p. 259
Nitrate	mgN/liter	Diazotization	p. 240	-	p. 185
Ammonia	mgN/liter	Nesslerization	p. 226	-	p. 134
Total Suspended Solids (non-filterable residue)	mg/liter	Filtration	p. 291	-	p. 278
Total Organic Solids	mg/liter	Ash-Free Dry Weight	p. 292	-	p. 278
Biochemical Oxygen Demand	mg/liter	5-Day	p. 489	-	-
Total Organic Carbon (TOC)	mgC/liter	Combustion-Infrared	p. 257	p. 702	p. 221
TOC (sediments)	%C	Combustion-Infrared	p. 257	p. 702	p. 221
TRACE METALS					
Cadmium	mgCd/liter	Atomic Absorption	p. 210	p. 692	p. 101
Copper	mgCu/liter	Atomic Absorption	p. 210	p. 692	p. 106
Iron	mgFe/liter	Atomic Absorption	p. 210	p. 692	p. 108
Zinc	mgZn/liter	Atomic Absorption	p. 210	p. 691	p. 120
Lead	mgPb/liter	Atomic Absorption	p. 210	p. 692	p. 110
Chromium	mgCr/liter	Atomic Absorption	p. 210	p. 692	p. 104
Mercury	mgHg/liter	Atomic Absorption	p. 210	-	-
Sodium	mgNa/liter	Atomic Absorption	p. 210	-	p. 118
BACTERIOLOGY					
Total Bacteria	Colonies/ml	Standard Plate Count	p. 660	-	-
Total Coliform	Colonies/ml	Membrane Filter	p. 679	-	-
Fecal Streptococci	Colonies/ 100 ml	Membrane Filter	p. 690	-	-

[a] Standard Methods (APHA 1971)

[b] Annual Book of Standards (American Society for Testing and Materials 1972)

[c] Methods for Chemical Analysis of Water and Wastes (EPA Water Quality Office 1971)

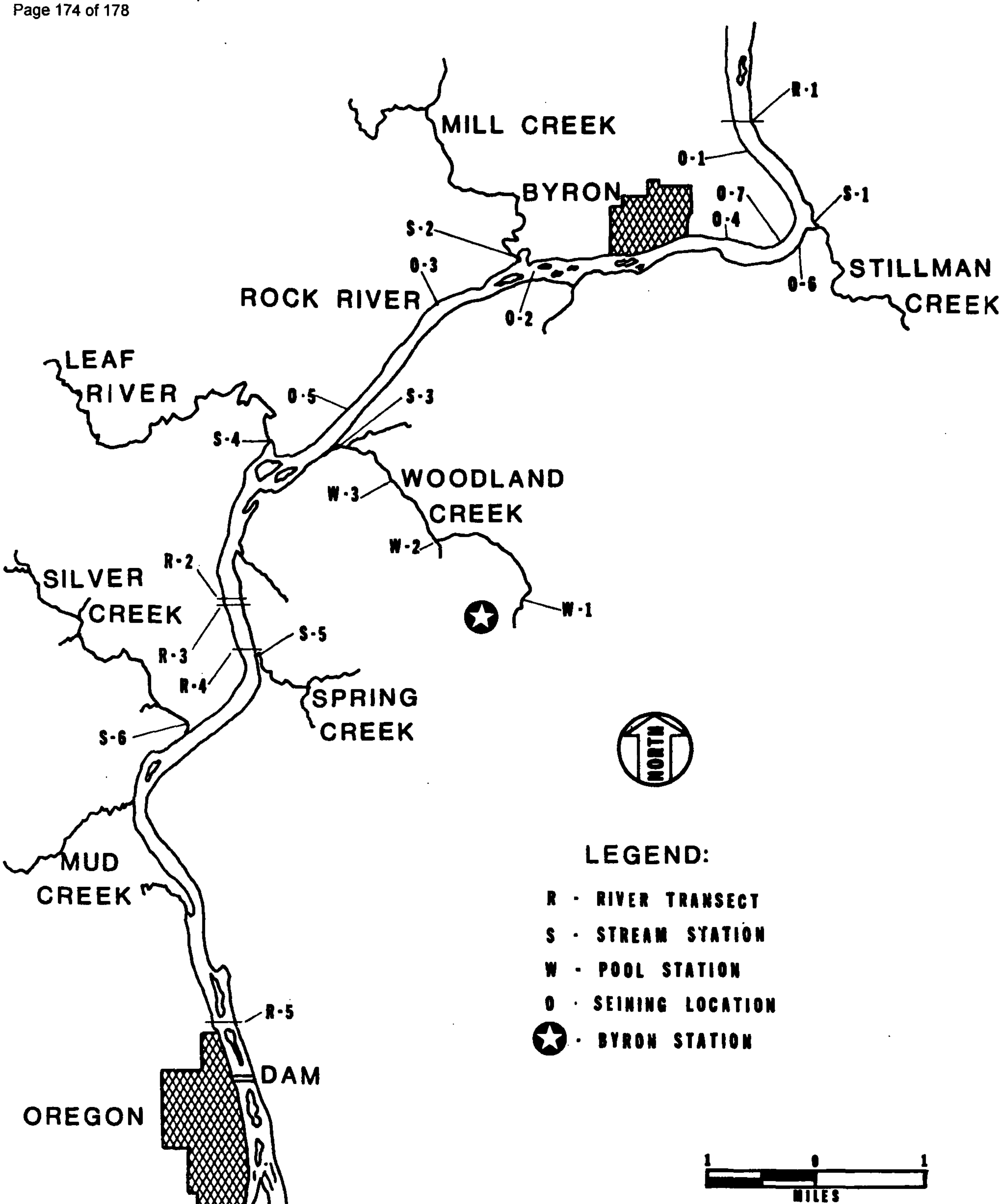
TABLE 6.1-4

SUMMARY OF AQUATIC BIOLOGY PREOPERATIONAL

MONITORING PROGRAM AFTER 1974

AT BYRON STATION

PARAMETERS	FREQUENCY	LOCATION
Phytoplankton and Zooplankton	February, May, August, November	Mid-channel R-2 and R-5
Periphyton Diatometers (Quarterly Program)	February, May, August, November	Mid-channel R-1 through R-5, S-3, S-4, S-5, W-1, and W-2(1)
Periphyton Diatometers (Bi-monthly)	January, March, May, July, September, November	2L, 2R, 3L, 3R, 4L, and 4R(2)
Benthos (grab samples)	February, May, August, November	R-1 through R-5, S-3, S-5, W-1, and W-2(1)
Benthos (artificial substrates)	April, May, June, July, August, September	2L, 2R, 3L, 3R, 4L, and 4R(2)
Fish		
Electrofishing and Seining	February, May, August, November	R-2, R-3, R-4, S-3, S-5, and S-6
Hoop Nets	February, May, August, November	R-2, R-3, R-4, S-3, S-5, and S-6
Creel Census	May, June, July, August	Study Area
Fish Eggs and Larvae	April, May, June, July, August	Mid-channel R-1 through R-5, S-3, S-5, S-6, and W-1
Water Chemistry (21 parameters, see Subsection 2.7.1.1.1)	February, May, August, November	R-1 through R-5, S-3, S-5, S-6, W-1, and W-2(1)
Trace Metals (Cd, Co, Fe, Cu, Hg, Zn, Pb, Cr)	February, May, August, November	R-1 through R-5, S-3, S-5, S-6, W-1, W-2(1)



BYRON NUCLEAR GENERATING STATION
UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 6.1-1

LOCATIONS OF AQUATIC SAMPLING STATIONS

6.2 APPLICANT'S PROPOSED OPERATIONAL MONITORING PROGRAMS

6.2.1 Aquatic Monitoring Program

Operational monitoring will be initiated when Byron Unit 1 becomes operational. The monitoring program will be conducted in accordance with the requirements specified in Byron Station NPDES Permit Number IL0048313 and with an agreement with the Illinois Department of Conservation. This agreement consists of an 1
evaluation, by an acceptable third party, of past and proposed aquatic monitoring programs for validity and reliability to detect gradual changes that could have an effect on the general ecology of the Rock River.

6.2.2 Terrestrial Monitoring Program

The monitoring programs described in Subsection 6.1.4.3.2.4 will continue for 1 year after the beginning of commercial operation of the Byron Station. Since the noise levels due to the operation of the station were predicted using standard acoustic methodology for environmental noise emmissions from power plants, a confirmatory monitory program will be implemented. This program will consist of actual measurements of the noise levels 1
at the four locations identified in Figure 5.6-1, and also at the two locations identified in Figure 2.7-1. These measurements will be taken first when Unit 1 and again when both Units 1 and 2 are operational.

6.2.3 Radiological Monitoring Program

The preoperational radiological monitoring program described in Subsection 6.1.5, with the addition of 40 other TLD sites distributed about the site boundary and at 5 miles, will continue 1
for 2 years after commercial operation of the Byron Station begins. Thereafter, the monitoring program that will be used will be the one described in Table 6.2-1.

6.2.4 Meteorological Monitoring Program

The meteorological measurement program currently used at the Byron Station site is described in Subsection 6.1.3.1.1. It is proposed that this program continue through the operational phase of the Byron Station. Any change in plans will be reported in a supplement to this Environmental Report.

1

TABLE 6.2-1

STANDARD RADIOLOGICAL MONITORING PROGRAM

SAMPLE MEDIA	COLLECTION SITES	TYPE OF ANALYSIS	FREQUENCY
Air Monitoring	Near Field	Filter - Gross Beta	Weekly
	Nearsite #1 (East) Nearsite #2 (West) Byron	Charcoal - I-131	Bi-Weekly
		Sampling Train - Test and Maintenance	Weekly
	Far Field	Filter Exchange	Weekly
	Nearsite #3 (South) Oregon Stillman Valley Paynes Point Mt. Morris	Charcoal Exchange	Bi-Weekly
		Sampling Train - Test and Maintenance	Weekly
TLD	Same As For Air Monitoring Sites plus to other sites distributed about the site boundary and at 5 miles	Gamma Radiation	Quarterly
Milk	2 Dairy Farms	I-131	Weekly during Grazing Season - May to Oct. Monthly - Nov. to Apr.
Surface Water	Downstream of discharge	Gamma isotopic	Monthly analysis of Weekly Composite
Cooling Water Sample	Inlet Discharge	Gross Beta Tritium	Weekly Quarterly Composite
Fish	Oregon Pool of Rock River	Gamma isotopic	Semiannually
Sediment	Downstream of discharge Upstream of intake	Gamma isotopic	Annually

1

<u>Fish Eggs and Larvae</u>:

Fish egg and larvae data will be collected at one river transect upstream of the Byron Station intake and in the intake forebay to contrast intake with river numbers. Sampling will be conducted for one full spawning period after Unit 2 is declared commercially operational by CECo.

6.2.1.1.2 <u>Temperature</u>

When CECo has declared both Byron Units 1 and 2 to be in commercial operation with licenses to operate at full power output, plume studies will be conducted at 3-month intervals that will terminate when four plume studies representing the four seasonal river conditions have been completed.

6.2.1.1.3 <u>Water Chemistry</u>

Water chemistry samples will be taken upstream of the river screen house, in the outfall of the Byron Station blowdown structure, and downstream from the blowdown structure. Samples will be taken quarterly at mid-channel at each designated station. Table 6.2-1 shows the water quality parameters that will be measured during the Byron Station operational-phase program.

6.2.2 <u>Terrestrial Monitoring Program</u>

The operational-phase terrestrial ecological monitoring program will focus on the possibility of Byron Station cooling tower impacts. An avifaunal survey will begin when the containment buildings and/or cooling towers reach 30 feet or more in height. This monitoring program will document any migratory avifaunal fatalities that result from direct collision with these station structures. The program will continue through 1980 as an integral part of the 5-year construction and preoperational monitoring program.

In addition, a 15-square-mile, aerial infrared photogrammetric monitoring program was implemented in July 1977. This program is designed to document any vegetational changes that result from plant construction and operation. This program will be continued through and after plant operation to ensure complete documentation of any conceivable postoperational impacts from cooling tower salt drift.

6.2.3 <u>Radiological Monitoring Program</u>

The monitoring program described in Table 6.~~1~~2-1 will continue for 2 years after commercial operation of the Byron Station begins. Thereafter, the monitoring program that will be used will be the one described in Table 6.2-2.

6.3 RELATED ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

The Byron Nuclear Generating Station - Units 1 & 2 (Byron Station) aquatic monitoring area is shown in Figure 2.2-1. The intake and discharge points of Byron Units 1 and 2 are located near Rock River mile 115. Agencies and/or groups known to have conducted environmental studies in this area are described in the following paragraphs.

The Illinois Department of Conservation conducted extensive sampling of the Rock River in Illinois including the area near the plant during 1965, 1973, 1974, 1976, and 1977 to assess the general status of fish populations. They also conducted restricted sampling for selected parameters during 1971 and 1976. Samples were collected by electroshocking at 6 stations during 1965, 11 stations during 1974, 5 stations during 1976, and 11 stations during 1977. In 1973, two 4-mile sections of the Rock River were sampled intensively by electroshocking, basket trap, and trap net. One of the stations during the 1974 sampling was also sampled by basket trap. Some of the stations sampled during 1977 will be sampled annually to measure changes in population. Special samples were collected by seining with a 30-foot bag seine at two stations during 1971 to determine general reproductive success and by electroshocking at four stations during 1976 to determine walleye abundance. Stations in the immediate vicinity of the Byron Station discharge were sampled by net, basket, and electroshocking in 1973 and 1974 and by electroshocking in 1976 and 1977. A summary table of catch per unit effort for each species for these years is included as Table 6.3-1. 1

The Illinois Department of Nuclear Safety (IDNS) is expected to conduct a small radiological monitoring program at and near the Byron Station once station operation begins. In addition, it is expected that IDNS will conduct independent effluent measurements both on and off site. 1

TABLE 6.3-1

FISH COLLECTED BY THE ILLINOIS DEPARTMENT OF CONSERVATION FROM THE ROCK RIVER NEAR THE BYRON STATION SITE IN 1973, 1974, 1976 AND 1977

COMMON NAME	1973			1974			1976	1977
	TRAP NET (no./net day)	BASKET (no./net day)	ELECTRO-FISHING (no./hr)	TRAP NET (no./net day)	BASKET (no./net day)	ELECTRO-FISHING (no./hr)	ELECTRO-FISHING (no./hr)	ELECTRO-FISHING (no./hr)
Grass Pickerel							0.5	
Northern Pike	0.12		0.4			2	0.5	
Carp	0.98	2.33	10.3	0.10	0.5	37	18.0	23
Misc. Minnows								11
Silver Chub				0.20				
River Chub			0.1					
Redfin Shiner			0.4					
Fathead Minnow			0.1					
River Carpsucker	1.42		13.3			11	3.5	25
Quillback	0.60		5.5			29	7.5	7
Highfin Carpsucker	0.12		1.4			1	0.5	2
White Sucker	0.34		0.6					
Smallmouth Buffalo	0.48	0.04	6.1	0.05		6	4.0	5
Bigmouth Buffalo	0.02							
Silver Redhorse	0.30		5.5			8		
Golden Redhorse	0.54		12.0			6	3.5	29
Shorthead Redhorse	0.62		11.5			6	4.5	17
Black Bullhead	0.34	0.04	0.3					
Yellow Bullhead	0.12							
Channel Catfish	0.24	7.73	39.9	8.35	2.45	28	3.5	19
Stonecat	0.02			0.05	0.05			
Flathead Catfish	0.02		0.1				0.5	3
White Bass						1	0.5	
Rock Bass	0.02			0.05			0.5	2
Green Sunfish	0.02		0.9				0.5	
Pumpkinseed	0.02		0.1			1		
Orangespotted Sunfish	0.02		1.4	0.05		1		
Bluegill	0.24			0.15		12	3.5	1
Smallmouth Bass			0.8			2	1.0	12
Largemouth Bass			0.3			3	0.5	
White Crappie	0.66		0.4	0.20		4	1.5	1
Black Crappie	0.82		0.8	0.15		11	1.0	1
Walleye			0.4				0.5	
Freshwater Drum						1		