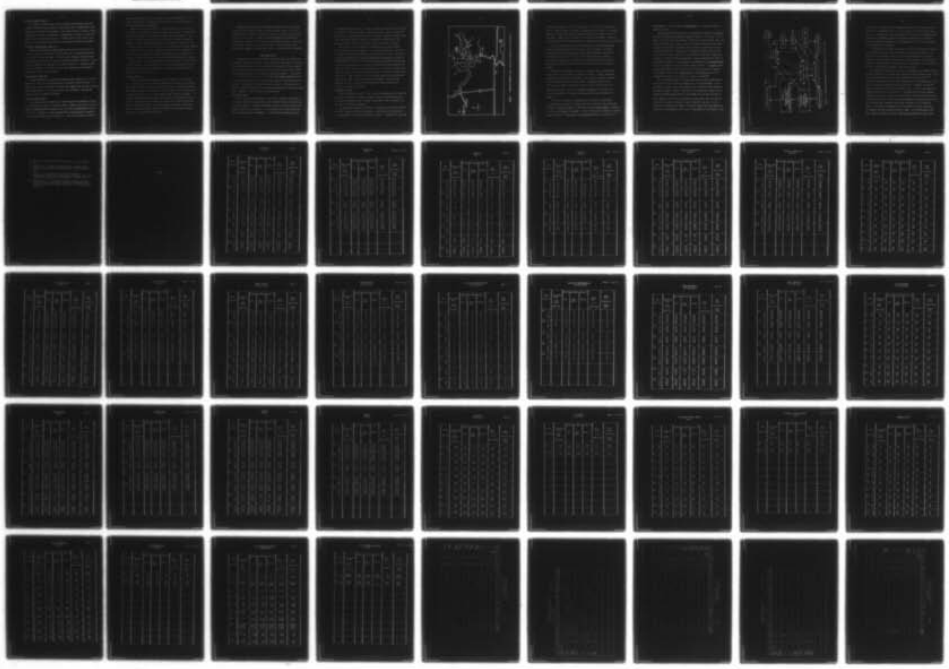
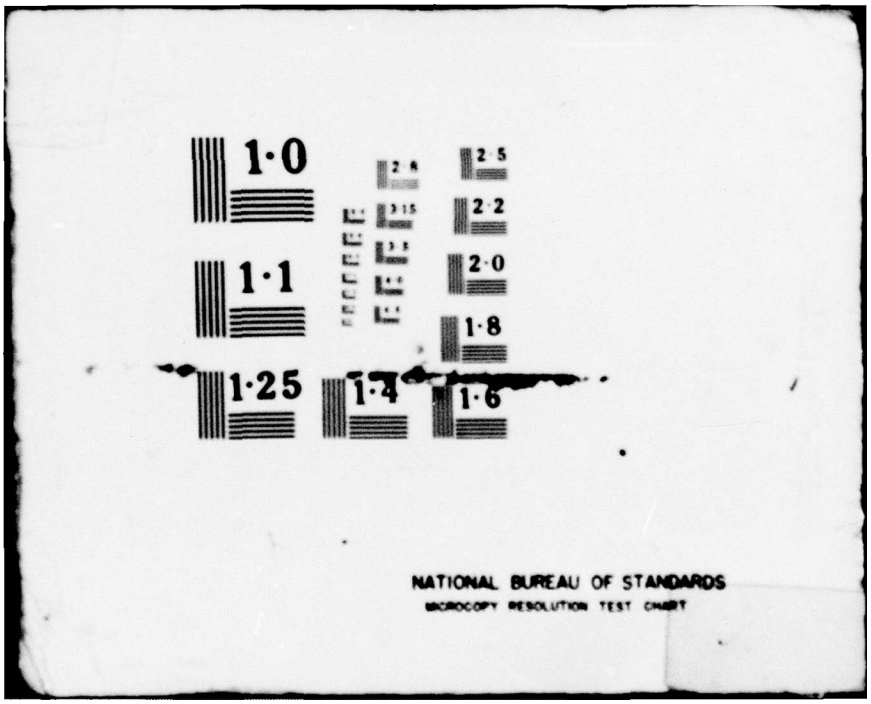
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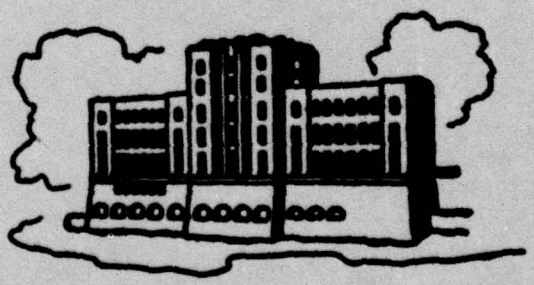
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CORALVILLE RESERVOIR

WATER QUALITY STUDY

WATER YEAR OCTOBER 1, 1977 to SEPTEMBER 30, 1978

August 1979

Project Supervisor:

Donald B. McDonald
Professor of Energy Engineering

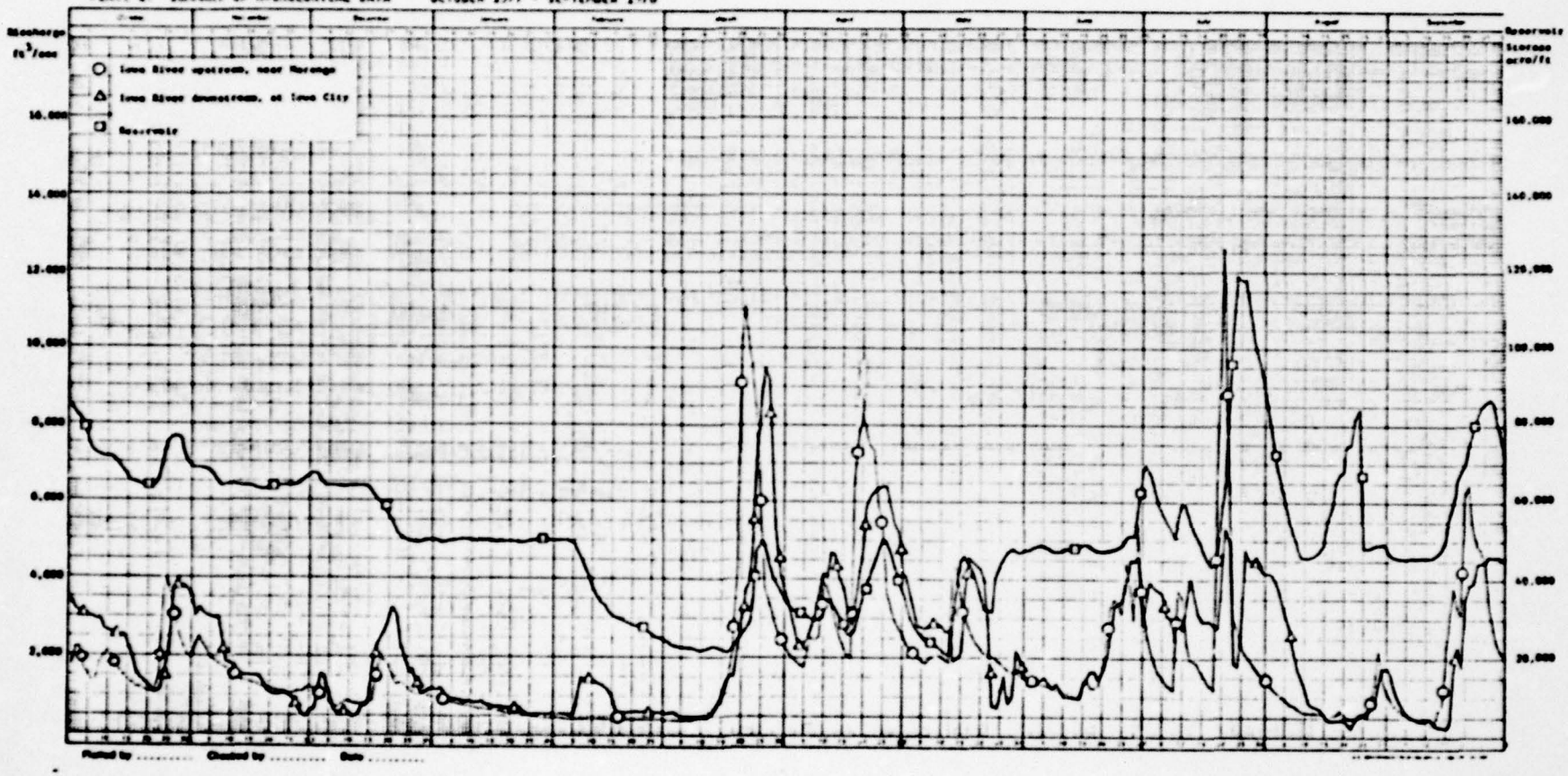
Research Assistants (Part-time):

Kathy Cartwright
Karen Hagelstein
Mike Haselhuhn
Cyrus Jones
Chris Scarpellino
Mary Beth Watson
Barry Wilson

Data for plotting hydrological graph (Plate 1)
furnished by U.S. Geological Survey

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PLATE 1: SUMMARY OF HYDROLOGICAL DATA OCTOBER 1977 - SEPTEMBER 1978



GENERAL

Description of the Area and Scope of the Project

The Coralville flood control dam is located in Johnson County, Iowa, about three miles north of Iowa City. At conservation pool level, 680 feet msl, it forms a lake 21.7 miles long with a surface area of 4,900 acres. At spillway level, 712 feet msl the lake extends 35.1 miles upstream from the dam. Surface area of the lake at this elevation is 24,800 acres. During a period in the late winter and early spring the level of the pool is reduced to 670 feet msl in anticipation of the use of the impoundment for flood control. At this level the reservoir has an area of 1,820 acres.

Surveys conducted in 1974 and 1975 indicate that at spillway level (712 feet msl) reservior capacity is 469,400 acre feet; 40,300 acre feet at conservation pool level (680 feet msl); and 10,600 acre feet at 670 feet msl.

The Coralville Reservoir Water *Quality* Project was initiated in 1964 and has continued without interruption since that time. The purpose of the study has been the determination of the effects of a flood control reservoir on the chemical and biological characteristics of its parent river. Samples were collected from the Iowa River upstream from the reservoir; at Johnson County Road W-48 (formerly "O"); from the top, mid-depth and bottom at the reservoir at the Mehaffey Bridge downstream from the Lake MacBride spillway; and from the Iowa River at two points downstream from the reservior about one mile below the Coralville dam and at the University of Iowa Water Treatment Plant. During the current water year, samples were collected on a weekly basis and analyzed for temperature, conductivity, turbidity, dissolved oxygen, pH, carbon dioxide, alkalinity, ammonia and orthophosphate. All other parameters, including plankton, were determined on a twice monthly basis.

Determinations of pH, carbon dioxide, alkalinity, dissolved oxygen and temperature were made in the field at the time of collection. Turbidity, conductivity, phosphate, ammonia nitrogen, nitrate nitrogen, solids, threshold odor, 5-day 20°C biochemical oxygen demand and total and fecal coliform and fecal streptococcus populations were determined in the laboratory. Plankton counts were made to determine genera and numbers present.

During the current year two special studies were also carried out: 1) to determine the concentrations of several organochlorine pesticides in fish from the Coralville Reservoir and the Iowa River upstream and downstream of the impoundment, and 2) to evaluate the zooplankton community of the reservoir. These studies are described in detail in the "special studies" portion of this report.

Administrative and Fiscal

The project was continued under the same arrangement as during the preceding year. The U.S. Army Corps of Engineers, Rock Island District, furnished the major portion of the financial support. The University of Iowa furnished the remainder of the funds for the project. Laboratory space was furnished by the University of Iowa.

METHODS

Routine water samples were collected throughout the year utilizing a Kemmerer water sampler. Laboratory work was performed in the water laboratory of the Energy Engineering Division, located in the University Water Treatment Plant. All of the water quality determinations were made in accordance with Standard Methods[1] or EPA[2] procedures.

Total and fecal coliform and fecal streptococcus counts were made by use of the Millipore Filter procedure. Plankton counts were made on centrifuged samples by use of the Whipple micrometer disc and the Sedgewick-Rafter slide. Both of these procedures are described in Standard Methods. A sample of uncentrifuged

water was also examined from each site in order to include those blue-green algae that are lighter than water and are eliminated by the centrifuging process. Determination of edible tissue pesticide residues in fish utilized extraction procedures and gas chromatographic techniques described in the Pesticide Analytical Manual.[3]

Quality Control

Quality control procedures were implemented for all laboratory analysis, field sampling techniques and data handling.

All biological procedures were performed in accordance with Standard Methods. Bacterial analyses were carried out utilizing sterilized collection bottles, sterile, disposable petri dishes and quality medias. Incubator temperatures were routinely monitored with thermometers with National Bureau of Standards certification.

Chemical procedures were performed in accordance with Standard Methods or EPA procedures. Standards were run within the matrix of the samples at all times. The bulk of the reagents used were American Chemical Society certified quality or top line reagents from reputable companies. All instruments involved in analyses were part of an annual or semi-annual preventive maintenance program.

Physical analyses were run in accordance with Standard Methods. Instruments utilized in the analysis were part of the preventive maintenance program. Residue weights were determined on balances which are calibrated yearly.

Sampling procedure included preservation and/or any required special handling as directed in the EPA Manual of Methods.[4]

OBSERVATIONS

PHYSICAL CONDITIONS

Hydrological (Plate 1):

During the 1978 water year flow into the impoundment as measured at the Marengo gauging station was near normal for the period and far above the 1977 water year

mean flow. From late January through early March inflow was low ranging from ca. 390 to 450 cfs. A maximum spring flow of 11,000 cfs was reported on March 21. During the remainder of the spring and most of the summer, flows into the impoundment were near normal. A maximum flow of 12,600 cfs occurred on July 21. Mean monthly flows during this period ranged from 3,745 cfs in April to 803 cfs in August. A low flow for the year of 318 cfs occurred on September 12. Inflow increased markedly during the latter half of September when river stage was above normal, ranging from ca. 2,000 to 6,000 cfs.

Reservoir level declined during early October from ca. 686 feet msl to ca. 683 feet msl and then remained relatively stable at ca. 683-684 feet msl until mid December when it was gradually reduced to 680 msl by the end of the month. Reservior elevation was maintained at ca. 680 feet msl until February 6 when drawdown to 670 feet msl was instituted in anticipation of spring runoff. Reservoir elevation varied from ca. 670-672 feet msl through mid March and then increased rapidly to 680 feet msl by March 25. During the April-June period reservoir level underwent considerable fluctuation, varying from ca. 672 on May 13 to 684 on June 30. A maximum impoundment elevation for the year of 690.45 feet msl occurred on July 24. Reservoir level declined to ca. 681 feet msl by early September and then rose to ca. 687' msl by the end of the water year.

Discharge from the dam varied from ca. 400 to 4,000 cfs until late March when a maximum of 9,000 cfs was released. During the remainder of the water year discharge rates varied from a high of 6,000 cfs in April to a low of 150 cfs in September.

Temperature (Table 1):

Water temperatures followed the seasonal pattern of previous years. River and reservoir temperatures were above 20°C (68°F) from late May through mid-September. Maximum upstream river temperatures of 27.5 °C (81.5°F) were observed on July 25 and August 15. A maximum downstream river temperature of 30.0°C (86°F) was

observed on August 15 at the University Water Plant Station.

A maximum reservoir temperature of 28.0°C (82.49°F) was observed at the surface of the impoundment on June 26. Intermittant thermal stratification was observed in the impoundment from late May through July. A maximum temperature differential of 2.5°C (4.5°F) was observed on June 26.

Turbidity (Table 2):

Turbidity values were generally higher than those of the previous year. Values above the impoundment ranged from <1 NTU in January and February to 2,900 NTU in late June. Values were lower in the reservoir. Maximum values ranging from 50 to 96 NTU were observed during April and May and in July while turbidity values of less than 1 NTU were frequently observed during January and February. Turbidity values below the impoundment were consistently lower than upstream values.

Specific Conductance (Table 3):

Specific conductance values in the reservoir ranged from 883 µmho/cm in February to 336 µmho/cm in late July. Values in the river above the impoundment ranged from 294 µmho/cm in July to 815 µmho/cm in November. Lowest specific conductance values accompanied the rapid increase in river and reservoir levels following rainfall in August while highest values occurred during low flow winter periods when ground water input accounted for a large proportion of the river flow.

Solids (Tables 4-6):

High suspended solids concentrations are characteristic of heavy runoff, particularly from agricultural land. Maximum suspended solids concentrations of 1,650 mg/l were observed in the upstream river in late April. Minimum suspended solids levels of 1 to 5 mg/l occurred in January and February.

Highest dissolved solids concentrations were generally present from November through February when river flows were low and ground water, high in dissolved

solids, made up a major portion of the river flow. Minimum values occurred in June and September.

CHEMICAL CONDITIONS

Dissolved Oxygen (Table 7):

Dissolved oxygen concentrations exhibited normal seasonal fluctuations during the current period. A maximum value of 15.7 mg/l (111% saturation) was observed in the reservoir in mid December. From mid November through mid January, dissolved oxygen values greater than 10 mg/l were found at all locations. Minimum dissolved oxygen concentrations in river and surface samples occurred in late July and at intervals in August and September when concentrations of 4.1 to 5.5 mg/l were freqnently observed. Severe oxygen depletion associated with spring runoff was not observed during the current year. Oxygen concentrations in the river and the reservoir surface remained at or above 6 mg/l throughout the February to April period when the minimum dissolved oxygen concentration observed at the reservoir bottom was 4.8 mg/l.

Chemical stratification and low dissolved oxygen values were present intermittantly at the reservoir mid-depth and bottom from June through September Minimum oxygen values ranging from less 0.1 to 0.5 mg/l were observed in mid-June and early September.

Carbon Dioxide (Table 8):

Free carbon dioxide was present in most river and reservoir samples throughout the year. Maximum carbon dioxide concentrations of 22 to 28 mg/l were observed in the upstream river and reservoir in early April.

Alkalinity, Hardness, pH (Tables 9-13):

These three factors are interrelated and influenced by climatic and hydrological conditions as well as the activities of aquatic organisms. Phenolphthalein alkalinity was absent from the river and reservoir throughout most of the year.

Maximum values of 14 mg/l (as $CaCO_3$) occurred in the downstream river in December. Concentrations of 16 to 20 mg/l occurred in the upstream river in August. Total alkalinity values in the upstream river ranged from 324 mg/l in Feburary to 116 mg/l in March. Values for the reservoir ranged from 318 mg/l in February to 94 mg/l in July.

Highest total hardness concentrations occurred in January. Lowest values generally occurred in March and August.

Values for pH exhibited little variation during the year. Values were generally low ranging from 7.1 in February to 8.5 in August.

Orthophosphate (Table 14):

Orthophospahte concentrations in the river and the impoundment were slightly higher than those observed during the 1977 water year when flows were well below normal but were generally lower than those observed in past years. Concentrations ranging from 0.02 to 0.85 mg/l were observed above the impoundment and were, as in previous years, slightly higher than downstream values which ranged from 0.03 to 0.62 mg/l. High orthophosphate concentrations occasionally accompanied increased runoff but a good deal of unexplained variation was observed.

Ammonia Nitrogen (Table 15):

Maximum concentrations of ammonia nitrogen of ca. 1.4 mg/l occurred in the reservoir and upstream river in mid March at the beginning of spring runoff. Relatively high values persisted through mid April. During the May to July period concentrations exhibited considerable variation ranging from <0.02 to 0.70 mg/l. Ammonia nitrogen concentrations were generally higher in August and September. High ammonia nitrogen values of ca. 1.1 mg/l were observed at the reservoir bottom in early September.

Nitrate Nitrogen (Table 16):

As a result of higher runoff, nitrate nitrogen concentrations were significantly greater than those observed in the previous year. Maximum values were observed in the upstream river samples in late June and early July when a maximum concentration of 13 mg/l was measured. Concentrations in excess of 5 mg/l were common at all locations during the year. Minimum values of less than 0.5 mg/l occurred in the upstream river during low flow periods in August and September.

Biochemical Oxygen Demand (Table 17):

Average 5-day biochemical oxygen demand values were relatively low at all locations during the year ranging from less than 1 mg/l in January and February to over 9 mg/l in June and August. High BOD values frequently observed during spring runoff periods were not observed in 1978 and a maximum spring value of only 7.1 mg/l occurred at the upstream river station on March 15. Increases in BOD values due apparently to the death of large algal populations were observed in the upstream river in June and August.

Threshold Odor (Table 18):

Average threshold odor values were relatively high ranging from 7.5 to 100. Maximum odor values of 100 were observed at the reservoir bottom in April. In general, odor values were higher in upstream river samples than at other locations where maximum values of 75 occurred in April, July and August. Minimum odor values occurred in December and January.

Bacteria (Tables 19-21):

As in previous years largest total coliform populations frequently occurred at the beginning of periods of increased runoff. Highest counts usually occurred above the impoundment where a maximum count of 230,000 organisms/100 ml occurred on June 26. A maximum of 35,000 organisms/100 ml occurred below the reservoir at the University Water Plant on October 24. Total coliform counts in reservoir

samples were generally lower than upstream river values ranging from <10 to 50,000 organisms/100 ml. Minimum counts occurred at all stations during low flow periods in August and September.

Highest fecal coliform levels (ca. 43,000 organisms/100 ml) occurred in the upstream river following a period of rainfall in late June. Increased numbers also accompanied runoff in December, March, April and September. Fecal coliform levels were low during the low flow periods in December, August and September. Samples taken during these periods frequently contained less than 10 organisms/100 ml. Fecal coliform counts at the University Water Plant sampling site ranged from <10 to 15,000 organisms/ml but were only rarely higher than at the site directly upstream. Reservoir and downstream river samples were consistently lower in fecal coliform concentrations than upstream river samples.

Fecal streptococcus levels exhibited fluctuations similar to those of fecal coliform organisms. Values ranged from less than 10 organisms/100 ml in many reservoir samples during low flow periods to 47,000 organisms/100 ml at the upstream river location on June 26.

Plankton (Table 22):

Plankton populations were generally smaller than those of the previous year. A maximum count of ca. 59,000 organisms/ml was observed in the upstream river sample on August 1 during a period of stable flow. Plankton populations were somewhat smaller in the reservoir than those observed in the upstream river. A maximum total count of ca. 31,400 organisms/ml was observed in November. In general, largest populations occurred in the upstream river during periods of stable or declining flows in November, May, August and September and declined sharply when flows increased. Low counts were also observed in January and February. Peaks in reservoir plankton in November, May and August coincided with stable or declining reservoir levels.

Plankton diversity declined from October through February then increased through mid-June and then decreased following increased inflow in late June. Maximum diversity occurred in August when a variety of diatoms, green and blue-green algae were present. Diatoms, especially Cyclotella and unidentified flagellates were generally the dominant forms throughout the year. Green algae were relatively common in the spring and summer. Blue-green algae, chiefly Oscillatoria, Anacystis and Chroococcus, were most common from May to September.

ADDITIONAL STUDIES

In addition to the routine studies previously discussed, two special investigations were also carried out. These included a continuation of the pesticide studies instituted in 1976 to determine concentrations of several organochlorine pesticides in fish collected from the Iowa River and Coralville Reservoir; and investigations of the reservoir zooplankton community. The results of the current pesticide analysis were compared with studies conducted in 1976 to determine temporal trends in fish pesticide residues in the river-reservoir system. The zooplankton study was conducted by Cyrus K. Jones[5] and was submitted as a Master's Thesis in the Environmental Engineering program in December 1978. Summaries of these studies are presented below:

Pesticide Studies

Special studies were instituted in June 1978 to determine concentrations of several organochlorine pesticides in fish collected from the Iowa River and Coralville Reservoir. November and December fish were collected during spring, summer and fall at two locations: 1) the Iowa River near County Road W-48 a short distance above the impoundment, 2) the Coralville Reservoir near the

Lake MacBride Fisheries Station. Species collected included typical bottom feeding forms, i.e., catfish, buffalo, carpsucker and carp, as well as carnivorous species, i.e., crappie, walleye and bass. Pesticides determined included aldrin and its metabolite dieldrin, DDT and its metabolites p,p'DDD and p,p' DDE, heptachlor and its metabolite heptachlor epoxide, and lindane and B-BHC.

The results of the fish pesticide determinations are given in Tables 23-25. When these data are compared to those obtained during 1976 and 1977 it is evident that marked reductions in residue values have occurred. During the current study maximum edible tissue dieldrin values were always less than the allowable limit of 300 parts per billion (ppb) and exceeded 100 ppb on only one occasion while concentrations of DDT and its metabolites never exceeded 60 ppb. During the 1976-77 studies a maximum dieldrin level of 496 ppb was observed and values in excess of 200 ppb were frequently present in buffalo and other bottom feeding fish. These reductions in fish pesticide residues are not unexpected since DDT was banned in 1970 and aldrin (which degrades to dieldrin) was phased out in 1975. Doubtlessly concentrations of these substances will continue to decline in the future.

Zooplankton Studies

During the summer and fall of 1978 a study was undertaken on the Coralville Reservoir to determine zooplankton abundance, species composition and spatial and temporal distribution and to examine interactions between zooplankton and the rest of the biologic community.

Zooplankton were sampled at six sites: the Iowa River above the Coralville Reservoir, three sites within the reservoir, a site just below the dam and a site approximately four miles below the dam (Figure 1). Samples were taken with

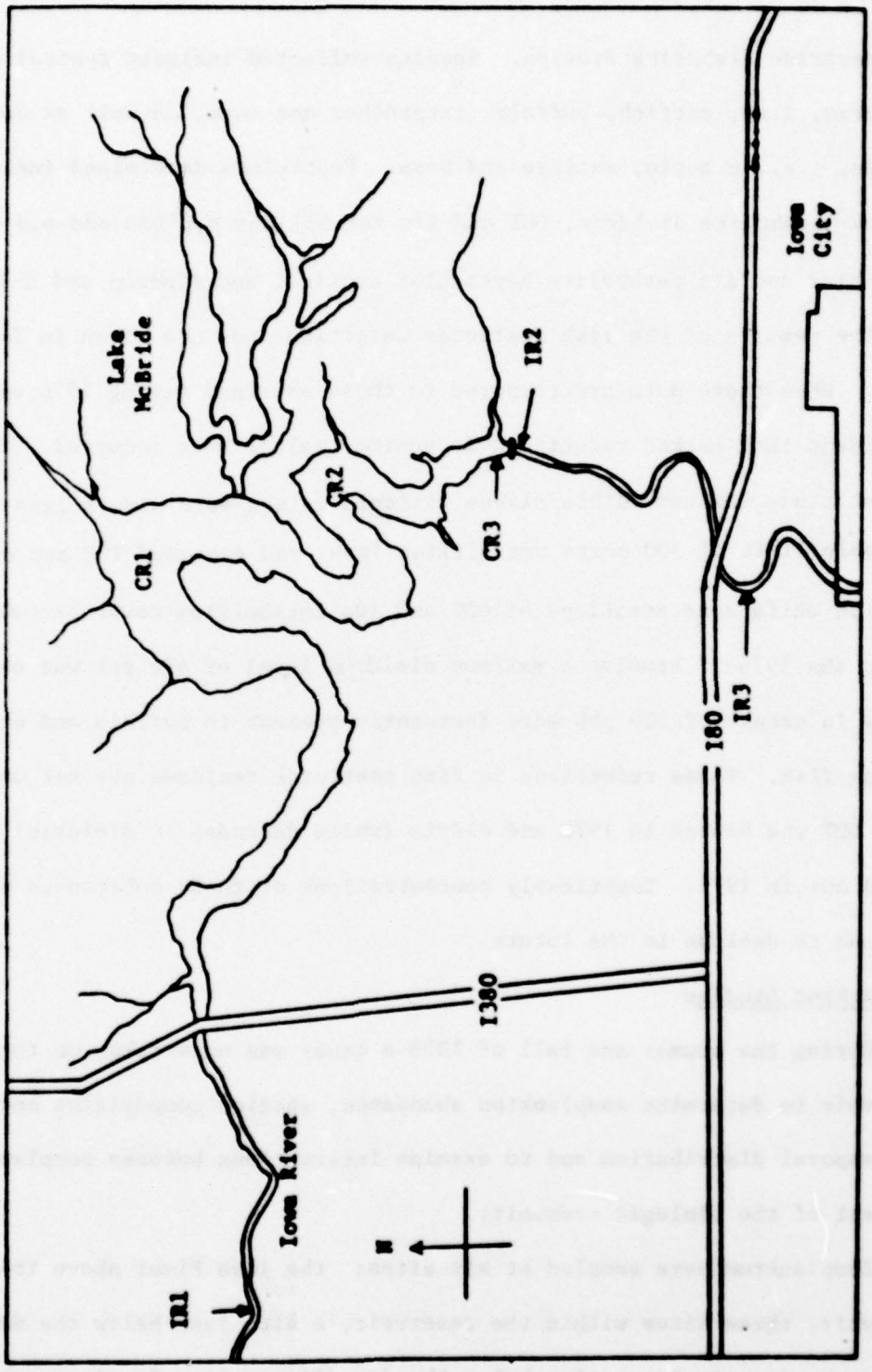


Figure 1. Coralville Reservoir and Zooplankton Sampling Sites (Diagrammatic)

a Wisconsin plankton net of No. 10 bolting silk. At river sites sampling was done by holding the mouth of the net perpendicular to the current for a measured interval. At lake sites vertical tows were made from just above the bottom of the surface. Samples were preserved in the field with 70% ethanol. Whole samples were analyzed in the lab and rotifers, copepods and cladocerans were enumerated.

The most significant result of the study was that the three zooplankton groups listed above existed in the reservoir only in extremely low numbers. The mean number of microcrustaceans (copepods and cladocerans) found in the reservoir was 3,817 per m^3 (only 3.81/liter, typical numbers reported in the literature range from 0 to 5,000/l). The mean number found in the Iowa River above the reservoir was 3,721/m^3 and in the river below the reservoir, 6,086/m^3.

The number of zooplankters found in the reservoir was not significantly higher than in the river above the reservoir. However, a stable zooplankton assemblage, incorporating the components of an interacting community, existed in the reservoir but not in the river above. Zooplankton numbers in the river below the dam were significantly higher than at upstream locations or within the reservoir. While the zooplankton assemblage was similar to the one in the reservoir, it was more stable and exhibited less fluctuation in number.

A total of 39 species of zooplankters was collected; 19 cladocerans, 11 copepods and 9 rotifers. Of these only six, two from each group, were ever present in significant numbers. These species were Cyclops vernalis, a predatory cyclopoid, and Diaptomus siciloides, a filter feeding calanoid among the copepods; Moina brachiata and Diaphanosoma leuchtenbergianum among the cladoerans; and

Brachionus sp., a filter feeder, and Asplanchna sp., a raptorial carnivore, among the rotifers.

These species, though occurring at low densities, constitute an important part of the interacting freshwater community (Figure 2). In a body of fresh water such as the Coralville Reservoir, algae are the lowest trophic level, the primary producers, and account for most of the energy inflow into the system. The algae are grazed by zooplankton, which in turn are preyed upon by macroinvertebrates and fish. Variations in the pathway of energy flow can occur as the result of local conditions. The six species listed above comprise the elements of a food web linking phytoplankton, macroinvertebrates and fish, as illustrated in Figure 2. D. siciloides, M. brachiata and D. leuchtenbergianum are filter feeders who feed on algae and organic detritus. C. vernalis, which was the most abundant organism collected, was the only significant predator in the system. The rotifers, Asplanchna sp., and Brachionus sp., were of insignificant biomass in the analysis of trophic relationships.

The relative importance of phythoplankton and particulate organic matter in the diet of filter feeding zooplankters has not been determined. At no time during the study could algae abundance have conceivably been limiting to zooplankton numbers. However, observation of zooplankton gut content during enumeration revealed that empty guts were common and that guts that were not empty appeared to more often contain detritus than algae. Hence it does not appear that an observed decrease of algae through the reservoir is due to grazing by zooplankton, and further, it does not appear that algae make up the main part of the zooplankton diet. Nor is fish predation on zooplankton a sig-

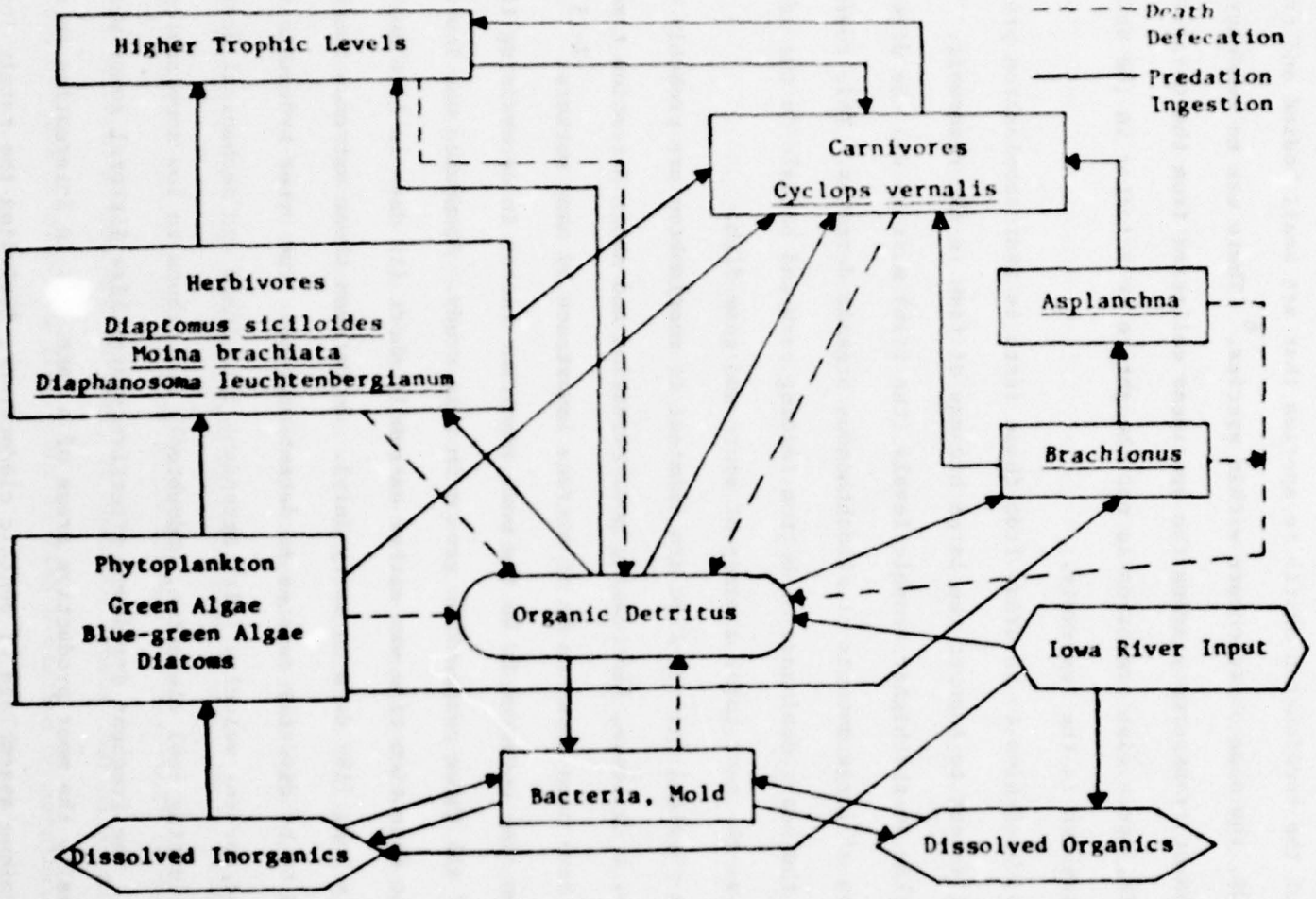


Figure 2. Trophic Relationships, Coralville Reservoir and Iowa River

nificant factor. When heavy fish predation pressure exists, the species composition of the zooplankton shifts to species that are small bodied and transparent. Or, the same shift occurs within species.[6] There was no tendency toward smallness or transparency among the specimens collected from the Coralville Reservoir, hence fish predation is not thought to be a factor in the abundance of zooplankton in the reservoir.

The conclusion to be drawn from these facts is that zooplankton production is insufficient to support the large biomass of fish in the reservoir. The energy flow to the higher trophic levels (the fish) must be via the direct ingestion of large amounts of allochthonous organic detritus. This could help explain the heavy dominance of bottom feeding carp and buffalo in the reservoir, as well as the near total absence of sport and game fish.

The physical factors that are inimical to zooplankton are probably current velocity, turbulence, fluctuating pool elevation and short detention time. These factors have been shown to be of extreme importance by many workers.[7-15] Detention time appeared to be the most important factor in determining the abundance of all three zooplankton groups in this study. Abundance was low when hydraulic detention time was either extremely short (11 days in late August) or extremely long (199 days in early July). In between these extremes abundance appeared to be directly related to detention time. The other hydraulic factors mentioned, current velocity (with attendant turbulence and mechanical destruction) and fluctuating pool elevation, undoubtedly contribute to low zooplankton numbers. The frequent drawdowns effectively sterilize littoral zones which are normally the most productive areas of a lake. It is interesting to note that a unique assemblage of benthic cladocerans, including the rarely found

Leydigia acanthocercoides, was found in the shallows just above the dam. This area of the reservoir undergoes less severe hydraulic fluctuations than the upper reaches. Turbidity is also lowest here. The presence of this community may be indicative of the zooplankton diversity that would be possible in the reservoir under stable hydraulic conditions. Further evidence suggests that the hydraulically sluggish stretch of the river from the Coralville dam to the Burlington Street power dam in Iowa City supports the greatest abundance of zooplankton.

CONCLUSIONS

Studies of the Coralville Reservoir and Iowa River have been conducted on a regular basis for 14 years. Data obtained during this period consistently have shown that the limnology and water quality of the Iowa River and Coralville Reservoir have been influenced primarily by four factors: 1) non-point source pollution resulting from agricultural activities in the drainage basin; 2) the hydrological characteristics of the Iowa River; 3) the morphometry of the Coralville Reservoir, and 4) the fluctuations in the storage and pool level of the reservoir. These four effects were evident during the previous water year.

Although the impact of non-point source pollution is apparent after a period of rainfall, the time of sampling relative to the onset of runoff is critical to determine peaks of affected parameters. In general, levels of those parameters associated with runoff from agricultural land, i.e., turbidity, suspended solids, phosphates, nitrates, ammonia, BOD and bacteria, show marked increases at the beginning of periods of runoff. These increases are particularly apparent if the runoff period has been preceded by a period of low

river flow. As runoff continues levels of the above-mentioned parameters begin to decline and may actually decrease to values below those observed prior to the beginning of the runoff episode.

One of the major problems resulting from agricultural land runoff is the impact of siltation on the biota of the reservoir. Studies of the benthic (bottom dwelling) community of the impoundment conducted in 1973 indicated that the reservoir supports a sparse benthic community dominated by the aquatic oligochaete Limnodrilus, a form commonly associated with mud bottoms containing large amounts of organic matter. In those areas of the reservoir where a shifting sand or silt bottom was present virtually no benthic organisms were observed. This paucity of benthic biota is characteristic of streams and reservoirs where siltation prevents the development of a bottom type suitable for colonization by desirable bottom fauna.

The impact of siltation is not confined to the benthic community. The shifting sand, silt and mud substrate in the reservoir provides a suitable spawning and nursery habitat for few fish of sport or commercial significance, contributing to a reservoir fishery composed primarily of rough fish. In addition, the considerable loss of storage capacity, resulting from siltation since the completion of the dam, tends to subject fish to additional stress during periods of reservoir drawdown.

In spite of the fact that siltation within the impoundment has adversely impacted the reservoir biota, the settling out of suspended materials has contributed to a reduction in the levels of several parameters in the Iowa River directly downstream of the impoundment. These reductions are especially evident in the case of turbidity, bacterial densities and phosphate. Although heavy metal analysis have not been carried out on water samples, analysis of sediment samples taken from the Iowa River upstream and directly downstream of the impoundment in 1976 indicate that in most cases the settling of these substances in the impoundment has resulted in reduced metal concentrations in

the downstream river samples as compared to samples taken upstream. Heavy metal concentrations were substantially higher in reservoir sediments than in either upstream or downstream river sediments and the possibility that high levels of heavy metals in Coralville Reservoir sediments might lead to biomagnification of these substances by reservoir fish should be considered.

Fluctuating water levels associated with the operation of the Coralville Reservoir for flood control purposes have a variety of effects on the limnology of the impoundment and the downstream river. Some of these effects, such as reduction in algal populations and the disruption of chemical stratification, may enhance water quality, while others, such as the lack of spawning and nursery areas due to the absence of a stable littoral zone and oxygen depletion frequently associated with winter drawdown, are detrimental to the development of a desirable sport and commercial fishery.

In spite of the small zooplankton and benthic population present in the impoundment the Coralville Reservoir supports an extremely productive fishery composed primarily of rough fish such as carp, gizzard shad and buffalo. Studies conducted by the Iowa Conservation Commission during the 5-year period 1966-1970 indicated that bigmouth buffalo were the most abundant fish in the reservoir with an estimated standing drop of 1,046 pounds/acre.[16] It is apparent that a conventional food chain supported by phytoplankton production and terminating in carniverous fish does not exist in Coralville Reservoir. This is not surprising considering the significant imput of allochthonous organic matter into the reservoir and the periodic stress of low dissolved oxygen concentrations and crowding resulting from late winter-early spring runoff and routine reservoir drawdown. These conditions are not conducive to the development of a desirable sport fishery, rather they tend to contribute to the predominance

of rough fish species that have enormous abilities to compensate for periodic kills and rely primarily on detritis as a source of food. In addition, the banning of commerical fishing on the Coralville Reservoir in 1975 because of high pesticide residues has greatly reduced the harvest of buffalo and other rough fish which also inhibits the development of a sport fishery in the reservoir. In view of the marked decline in fish pesticide residues which have occurred since the use of these substances was discontinued, serious consideration should be given to lifting the ban on commercial fishing in the Coralville Reservoir.

REFERENCES CITED

1. American Public Health Association, American Water Works Association and Water Pollution Control Federation, Standard Methods for the Examination of Water and Wastewater, 14th Ed. APHA New York, N.Y. (1976)

2. U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Wastes, Cincinnati, Ohio (1974).

3. U.S. Dept. of Health, Education and Welfare, Food and Drug Administration, Pesticide Analytical Manual Vol. 1 (1968).

4. U.S. Environmental Protection Agency, Handbook for Analytical Quality Control in Water and Wastewater Laboratories, Cincinnati, Ohio (1972).

5. Jones, C.K., The Distribution, Abundance and Community Structure of Zooplankton in the Iowa River and Coralville Reservoir, Iowa. Unpublished M.S. thesis. University of Iowa. 112 pp. 1978.

6. Brooks, J.L. and S.I. Dodson, Predation, body size and composition of plankton. Science 150:28-35. 1965.

7. Asch, R.L., Copepoda and Cladocera Populations of Red Rock Reservoir, Iowa from April to November. Unpublished M.S. Thesis Drake University. 1971.

8. Berner, L.M., Limnology of the Lower Missouri River. Ecology 32:1-12. 1951.

9. Brook, A.J. and W.B. Woodward. Some observations on the effects of water inflow and outflow on the plankton of small lakes. J. Anim. Ecol. 25:22-35. 1956.

10. Czajkowski, G.P., Zooplankton Studies in: Operational environmental monitoring in the Mississippi River near Quad Cities Station. Industrial Bio-Test Laboratories, pp. 363-400. 1975.

11. Dickman, M., Some effects of lake renewal on phytoplankton productivity and species composition. Limno. Oceangr. 14:660-666. 1969.

12. Fruh, E.G. et al, Before and after studies on the effects of a power plant installation on Lake Lyndon B. Johnson. Lower Colorado River Authority. Vol. 1-111. 1974.

13. Jewell, M.E., Aquatic biology of the praire. Ecology 8:289-298. 1927.

14. Williams, L.G., Possible relationships between plankton-diatom species numbers and water quality estimates. Ecology 45:809-823. 1964.

15. Wright, J.C., The limnology of Ferry Canyon Reservoir. 1. Phytoplankton-Zooplankton relationships in the euphotic zone during September and October 1956. Limno. Oceangr. 3:150-159. 1958

16. Mitzner, Larry. 1972 Population studies of bigmouth buffalo in Coralville Reservoir with special reference to commercial harvest. Iowa Fisheries Research Technical Series #72-3. Iowa Conservation Commission.

TABLES

TEMPERATURE
(^{o}C)

Table 1

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Oct. 4	17.0	16.8	16.4	16.4	16.8	20.0
10	11.4	12.8	12.4	12.4	14.2	18.5
17	10.2	10.9	10.6	10.6	11.2	16.4
25	10.6	11.0	10.6	10.6	10.8	16.0
31	11.9	12.4	12.2	12.2	12.0	17.6
Nov. 8	11.9	12.0	11.8	11.6	11.8	16.4
15	6.2	7.2	7.0	6.8	7.8	13.6
21	4.1	4.2	3.8	3.8	6.0	9.9
30	0.4	1.4	2.0	2.4	2.2	8.4
Dec. 7	0.0	0.0	0.0	0.0	1.4	7.2
12	0.4	1.2	1.4	2.2	2.4	9.4
19	1.0	2.0	2.0	2.0	3.0	11.0
28	0.1	0.1	0.1	0.1	0.2	7.9
Jan. 4	0.1	0.4	0.4	0.6	1.2	8.4
10	1.0	0.1	1.0	1.0	1.0	7.0
17	0.2	0.0	0.6	0.4	0.6	8.0
24	0.0	0.0	0.2	0.1	1.0	8.0
31	0.0	0.0	0.0	0.1	0.0	5.8
Feb. 7	0.0	0.0	0.0	0.0	0.0	9.0
14	0.0	0.0	0.0	0.0	0.4	7.0
20	0.0	0.0	0.0	0.0	0.0	7.0
28	0.0	0.0	0.0	0.0	0.1	6.9
Mar. 7	0.1	0.0	0.0	0.0	0.6	8.1
15	0.2	0.6	0.4	0.4	0.6	8.2
21	2.1	2.8	-	-	1.2	12.1
29	8.7	9.1	7.2	7.2	6.0	11.7
April 4	12.5	13.2	12.4	12.4	12.4	15.8
12	12.2	11.9	11.8	11.8	11.4	17.4
19	8.0	8.5	8.5	6.9	8.6	15.0
25	13.3	11.0	11.1	11.2	10.9	11.1

TEMPERATURE
(°C)

Table 1 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
May 2	12.8	14.6	12.8	12.8	13.4	16.9
9	11.2	11.6	11.6	11.8	11.2	15.2
16	14.8	15.6	14.3	15.2	14.2	15.0
23	17.0	18.0	18.0	18.0	18.8	20.0
30	23.9	24.7	24.1	23.8	23.3	24.7
June 6	24.0	25.5	23.5	23.0	22.0	25.5
12	24.0	24.0	23.0	23.0	24.0	24.0
19	25.6	26.0	25.0	25.0	24.5	27.0
26	25.8	28.0	25.8	26.5		29.0
July 5	27.0	27.5	26.5	26.5	27.0	29.0
10	23.5	27.0	26.9	26.8	26.5	27.0
18	26.5	26.8	26.0	25.8	25.0	26.0
25	27.5	27.0	25.8	25.0	26.0	28.2
Aug. 1	25.0	25.9	25.0	24.8	25.2	26.8
8	25.7	26.2	25.2	25.0	26.0	27.0
15	27.5	27.5	27.3	27.0	26.9	30.0
22	23.0	25.5	25.0	24.8	27.2	27.0
28	25.0	25.0	25.0	24.9	25.0	26.5
Sept. 5	25.0	25.2	24.9	24.8	25.2	25.4
11	27.0	27.6	27.0	26.5	28.0	29.2
19	23.0	24.0	23.5	23.2	25.0	26.5
26	18.8	19.0	18.2	18.2	19.8	23.0

TURBIDITY
N.T.U.

Table 2

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 4	185	26	25	82	32	40
10	68	15	15	16	19	24
17	22	16	16	24	10	15
25	102	15	16	20	14	40
31	32	24	24	25	16	18
Nov. 8	30	15	20	38	15	16
15	14	10	10	38	10	13
21	15	10	10	15	6	5
30	6	4	5	8	5	5
Dec. 7	3	1	1	1	1	2
12	2	1	1	1	1	2
19	78	2	4	3	1	3
28	9	5	5	5	6	6
Jan. 4	6	1	1	5	3	3
10	105	2	1	30	< 1	1
17	< 1	< 1	1	3	< 1	< 1
24	25	< 1	< 1	< 1	< 1	< 1
31	4	< 1	< 1	< 1	< 1	< 1
Feb. 7	< 1	< 1	< 1	< 1	< 1	< 1
14	< 1	< 1	< 1	< 1	< 1	< 1
20	3	1	1	2	1	1
28	3	2	2	3	2	2
Mar. 7	9	2	3	5	3	3
15	10	10	11	12	4	8
21	85	65	-	-	42	49
28	70	30	34	40	21	30
Apr. 4	74	40	40	48	31	26
12	100	70	72	80	45	40
19	450	56	56	58	25	35
25	40	21	21	27	23	32

Table 2 (cont'd)

TURBIDITY
N.T.U.

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
May 1	28	20	30	46	30	25
9	45	56	58	-	32	30
16	60	40	42	56	42	49
23	38	25	36	96	34	25
30	50	14	20	48	10	19
June 6	35	9	10	60	18	20
12	50	25	27	86	16	12
19	55	25	20	34	20	20
26	2,900	30	30	35	30	30
July 5	80	50	60	90	50	60
10	1,500	20	25	80	30	80
18	50	30	40	80	40	45
25	35	55	55	70	45	50
Aug. 1	20	30	30	70	45	45
8	30	20	35	85	30	25
15	48	27	37	63	29	19
22	35	20	20	70	15	15
28	40	15	15	35	15	30
Sept. 5	10	15	25	-	10	15
11	20	10	15	-	15	15
19	200	20	25	30	15	35
26	50	25	30	-	30	25

SPECIFIC CONDUCTIVITY
(μmho/cm)

Table 3

Date 1977-78		County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
			Top	Mid-Depth	Bottom		
Oct.	4	495	577	577	577	462	495
	10	707	673	673	673	707	707
	17	814	692	692	692	692	659
	25	673	785	744	707	744	673
	31	769	692	602	602	629	692
Nov.	8	815	729	692	729	729	729
	15	815	769	769	815	769	769
	21	815	769	769	769	769	769
	30	815	729	729	769	692	769
Dec.	7	729	692	659	692	692	659
	12	628	629	577	577	577	577
	19	577	769	815	815	815	815
	28	629	478	513	813	513	478
Jan.	4	769	769	769	769	692	729
	10	659	692	659	659	629	659
	17	629	629	629	629	629	660
	24	554	577	602	577	554	577
	31	769	769	769	814	814	814
Feb.	7	629	629	602	629	602	629
	14	785	831	831	883	831	831
	20	785	785	831	785	831	831
	28	785	744	785	785	744	744
Mar.	7	673	642	642	642	673	642
	15	642	642	673	673	785	744
	21	372	442	-	-	505	471
	29	363	374	353	353	335	344
Apr.	4	513	495	495	462	477	477
	12	462	433	433	433	433	433
	19	364	495	495	495	602	602
	25	554	513	513	495	462	432

SPECIFIC CONDUCTIVITY
(μmho/cm)

Table 3 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
May 2	583	482	482	518	466	466
9	636	583	583	608	583	583
16	538	466	451	451	437	466
23	736	699	699	666	699	699
30	699	666	666	699	736	699
June 6	736	777	777	823	777	736
12	636	699	699	736	690	666
19	614	543	543	565	614	614
26	543	673	642	642	673	642
July 5	785	614	614	642	589	589
10	294	642	642	673	523	505
18	883	744	744	673	589	543
25	589	345	345	336	442	471
Aug. 1	533	416	416	416	307	314
8	565	673	673	707	673	673
15	447	428	424	422	413	415
22	627	614	614	627	614	614
28	543	589	614	614	589	614
Sept. 5	614	523	504	543	601	614
11	543	505	505	565	523	543
19	543	471	428	428	442	442
26	642	487	487	505	471	471

TOTAL SOLIDS
(mg/1)

Table 4

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	528	352	324	352	342	348
25	741	434	438	444	406	412
Nov. 8	558	440	468	486	452	476
21	458	426	444	443	414	400
Dec. 7	437	426	416	417	419	415
19	472	377	425	450	433	425
Jan. 17	684	424	432	446	432	443
31	416	434	431	433	441	439
Feb. 14	402	421	425	437	440	426
28	404	396	393	393	403	408
Mar. 15	374	347	354	280	399	377
29	352	337	322	331	312	310
Apr. 4	526	418	462	463	358	361
19	1,896	430	416	420	399	455
May 2	601	448	490	568	468	474
16	685	339	341	382	330	408
June 12	506	402	434	693	391	376
26	1,420	361	361	399	357	363
July 5	760	361	382	532	332	480
18	608	406	409	509	322	362

Table 4 (cont'd)

TOTAL SOLIDS
(mg/l)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	403	283	283	431	225	265
15	471	315	332	398	317	305
Sept. 11	364	289	300	-	286	298
26	354	207	214	-	260	296

SUSPENDED SOLIDS

mg/l

Table 5

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	246	60	78	54	44	66
25	409	24	29	37	25	70
Nov. 8	52	6	28	56	10	16
21	48	22	24	30	12	32
Dec. 7	8	4	3	2	3	2
19	177	11	5	5	4	4
Jan. 17	140	2	2	1	1	1
31	9	2	3	4	3	2
Feb. 14	7	7	8	24	3	4
28	2	2	3	5	2	2
Mar. 15	37	21	16	32	4	3
29	227	64	70	69	48	53
Apr. 4	178	84	81	144	52	38
19	1,650	117	110	118	52	109
May 2	188	48	84	157	67	72
16	416	58	70	115	56	120
June 12	214	59	59	318	36	37
26	1,294	54	51	80	52	53
July 5	342	78	94	216	71	173
18	217	90	70	174	49	97

SUSPENDED SOLIDS
mg/l

Table 5 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	70	26	39	145	22	48
15	274	47	67	138	39	19
Sept. 11	119	24	76	-	25	21
26	145	39	36	-	45	145

DISSOLVED SOLIDS
mg/1

Table 6

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	282	292	246	298	298	282
25	332	410	409	407	381	342
Nov. 8	506	434	440	430	442	460
21	410	404	420	413	402	368
Dec. 7	428	422	413	415	416	413
19	295	366	420	445	429	421
Jan. 17	544	422	430	445	429	421
31	407	432	428	429	438	437
Feb. 14	395	414	417	413	437	422
28	402	398	390	390	401	406
Mar. 15	337	326	348	348	395	374
29	325	273	252	262	264	257
Apr. 4	348	334	381	219	306	323
19	246	313	306	302	347	346
May 2	413	400	406	411	401	402
16	269	281	271	267	274	288
June 12	292	343	375	375	355	339
26	126	207	209	319	253	257
July 5	418	283	288	316	261	307
18	391	316	339	335	273	265

Table 6 (cont'd)

DISSOLVED SOLIDS
mg/l

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	333	257	244	286	203	217
15	197	268	265	260	278	286
Sept. 11	245	265	224	275	261	277
26	209	168	178	160	215	151

DISSOLVED OXYGEN
(mg/l)

Table 7

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 4	6.4	6.5	6.8	6.1	9.8	8.9
10	9.5	8.7	8.6	8.5	10.7	9.5
17	9.6	9.9	10.1	9.9	10.8	10.8
25	9.2	10.0	9.6	9.5	10.7	9.0
31	9.1	8.0	7.5	7.8	10.1	9.2
Nov. 8	9.6	8.5	8.3	8.1	10.8	10.1
15	11.8	11.5	11.3	10.6	11.7	11.2
21	11.9	12.8	12.8	12.7	12.7	11.9
30	12.5	14.3	12.3	11.9	13.1	13.0
Dec. 7	12.7	15.1	14.7	13.1	13.5	13.7
12	11.0	15.7	15.5	12.9	13.2	13.4
19	12.0	12.3	12.5	11.8	14.7	14.0
28	14.0	11.9	11.7	11.7	13.5	13.3
Jan. 4	10.6	11.3	11.5	11.3	13.3	13.3
10	10.6	11.3	11.0	10.7	13.6	13.7
17	8.4	9.8	9.3	8.8	12.6	13.2
24	7.2	8.8	8.5	8.6	11.9	12.7
31	7.5	8.0	-	-	11.7	12.8
Feb. 7	6.7	7.5	7.3	6.3	12.6	12.9
14	7.7	6.6	6.2	5.1	11.2	12.0
20	7.2	6.0	5.1	4.8	9.7	10.9
28	7.5	6.2	5.8	5.4	8.1	10.1
Mar. 7	8.5	6.6	6.0	5.8	9.0	10.5
15	9.4	8.0	7.3	7.2	10.3	11.2
21	9.4	7.3	-	-	1.0	10.6
29	10.8	10.0	10.3	10.4	12.9	12.5
Apr. 4	9.5	9.5	9.5	5.2	10.6	10.0
12	9.6	9.5	9.5	9.4	11.1	10.2
19	9.7	9.7	9.7	9.5	12.1	11.4
25	10.3	9.9	10.1	9.9	11.7	10.9

DISSOLVED OXYGEN
mg/l

Table 7 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
May 2	10.2	11.3	10.8	10.2	11.7	11.3
9	10.2	10.0	9.8	9.7	12.2	11.7
16	9.5	8.7	8.6	8.3	10.9	10.6
23	9.3	9.7	9.8	9.0	9.5	8.3
30						
June 6	12.0	11.2	6.5	3.5	8.2	7.6
12	13.3	6.4	3.0	0.4	8.3	6.1
19	9.9	5.1	4.5	4.2	8.0	6.0
26	5.4	6.1	6.3	6.0	7.8	5.6
July 5	7.0	4.7	4.1	3.8	7.7	6.7
10	6.1	7.0	6.0	5.4	8.2	6.7
18	7.1	6.3	5.6	3.1	7.1	6.8
25	4.8	5.0	4.3	3.7	8.1	6.6
Aug. 1	15.8	5.4	4.8	4.3	8.1	7.4
8	15.6	10.2	7.4	4.7	7.6	7.3
16	8.3	6.0	4.8	2.2	6.6	4.9
22	8.1	5.7	5.4	4.4	7.8	5.4
28	5.5	6.0	5.7	5.3	7.4	4.1
Sept. 5	7.9	5.5	2.2	0.2	7.3	5.5
11	12.3	10.4	5.0	0.1	7.1	6.2
19	6.8	4.5	4.5	4.3	8.2	6.8
26	7.1	6.1	5.8	3.8	9.2	8.0

CARBON DIOXIDE
as $CaCO_3$ (mg/ℓ)

Table 8

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 4	8	7	8	7	9	9
10	18	18	14	14	14	16
17	2	2	2	2	3	2
25	16	9	11	11	14	14
31	4	5	5	6	4	6
Nov. 8	16	18	16	13	18	14
15	14	10	11	11	14	14
21	14	7	7	7	11	11
30	9	0	0	0	0	0
Dec. 7	14	11	11	11	0	0
12	17	9	9	9	6	7
19	9	11	14	11	11	11
28	8	8	6	6	6	8
Jan. 4	14	11	11	11	9	11
10	8	14	10	6	4	6
17	12	10	10	12	10	10
24	12	10	12	10	12	16
31	16	16	14	14	10	10
Feb. 7	16	12	18	16	12	18
14	12	16	16	16	18	18
20	18	16	20	14	14	16
28	20	16	14	16	14	17
Mar. 7	16	14	16	20	8	12
15	16	14	14	16	20	16
21	8	10	--	--	10	12
29	12	10	14	10	10	8
Apr. 4	28	18	22	26	22	22
12	14	14	14	12	14	16
19	22	20	14	12	12	14
25	24	24	20	18	16	12

CARBON DIOXIDE
as $CaCO_3$ (mg/ℓ)

Table 8 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
May 2	18	10	14	14	18	14
9	10	8	10	10	4	4
16	28	14	14	14	8	14
23	14	8	8	8	14	14
30	10	6	6	6	4	8
June 6	0	0	6	16	6	6
12	0	8	10	12	8	10
19	0	12	10	12	8	10
26	16	10	12	12	12	14
July 5	10	16	16	16	14	14
10	18	10	12	16	12	14
18	10	12	12	14	14	12
25	20	22	24	24	16	16
Aug. 1	0	16	16	16	12	12
8	0	0	12	18	12	10
16	0	10	10	18	12	14
22	0	10	10	10	6	6
28	10	8	10	10	8	10
Sept. 5	2	10	14	24	12	12
11	0	0	4	20	14	12
19	14	8	10	10	8	10
26	14	14	12	14	10	12

ALKALINITY PHENOLPHTHALEIN
(as $CaCO_3$ mg/ℓ)

Table 9

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 4	0	0	0	0	0	0
10	0	0	0	0	0	0
17	0	0	0	0	0	0
25	0	0	0	0	0	0
31	0	0	0	0	0	0
Nov. 8	0	0	0	0	0	0
15	0	0	0	0	0	0
21	0	0	0	0	0	0
30	0	10	10	12	10	12
Dec. 7	0	0	0	0	14	14
12	0	0	0	0	0	0
19	0	0	0	0	0	0
28	0	0	0	0	0	0
Jan. 4	0	0	0	0	0	0
10	0	0	0	0	0	0
17	0	0	0	0	0	0
24	0	0	0	0	0	0
31	0	0	0	0	0	0
Feb. 7	0	0	0	0	0	0
14	0	0	0	0	0	0
20	0	0	0	0	0	0
28	0	0	0	0	0	0
Mar. 7	0	0	0	0	0	0
15	0	0	0	0	0	0
21	0	0	0	0	0	0
29	0	0	0	0	0	0
Apr. 4	0	0	0	0	0	0
12	0	0	0	0	0	0
19	0	0	0	0	0	0
25	0	0	0	0	0	0

Table 9 (cont'd)

ALKALINITY PHENOLPHTHALEIN
(as $CaCO_3$ mg/l)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
May 2	0	0	0	0	0	0
9	0	0	0	0	0	0
16	0	0	0	0	0	0
23	0	0	0	0	0	0
30	0	0	0	0	0	0
June 6	10	10	0	0	0	0
12	20	0	0	0	6	0
19	10	0	0	0	0	0
26	0	0	0	0	0	0
July 5	0	0	0	0	0	0
10	0	0	0	0	0	0
18	0	0	0	0	0	0
25	0	0	0	0	0	0
Aug. 1	20	0	0	0	0	0
8	20	10	0	0	0	0
16	16	0	0	0	0	0
22	20	0	0	0	0	0
28	0	0	0	0	0	0
Sept. 5	0	0	0	0	0	0
11	12	12	0	0	0	0
19	0	0	0	0	0	0
26	0	0	0	0	0	0

TOTAL ALKALINITY
(as $CaCO_3$ mg/ℓ)

Table 10

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 4	168	196	188	196	164	206
10	241	232	236	234	247	245
17	270	218	212	228	218	218
25	220	252	260	256	236	202
31	274	208	218	210	230	230
Nov. 8	248	252	242	242	232	240
15	278	262	272	272	266	260
21	286	284	286	294	276	274
30	296	260	262	272	254	258
Dec. 7	274	258	274	274	268	252
12	262	262	262	254	260	244
14	216	268	286	284	276	276
28	306	218	216	218	214	196
Jan. 4	272	262	272	270	242	242
10	274	274	274	262	264	264
17	276	264	266	264	268	278
24	256	282	280	282	268	278
31	270	288	288	294	290	302
Feb. 7	276	290	290	296	300	284
14	324	318	296	284	284	284
20	268	274	272	262	250	274
28	264	274	272	276	272	284
Mar. 7	240	248	246	244	260	238
15	200	292	200	200	230	220
21	116	134	-	-	146	148
29	166	154	152	154	144	142
Apr. 4	200	200	204	194	182	176
12	180	166	164	170	168	170
19	124	182	186	180	176	164
25	190	180	186	182	214	216

Table 10 (cont'd)

TOTAL ALKALINITY
(as $CaCO_3$ mg/l)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
May 2	220	220	230	230	222	206
9	190	180	186	180	176	164
16	176	154	148	148	156	168
23	210	210	214	214	202	210
30	208	196	196	184	186	194
June 6	210	208	222	226	192	200
12	180	208	214	216	212	206
19	220	158	164	162	190	182
26	148	166	164	166	166	172
July 5	234	190	146	156	136	136
10	132	210	218	222	164	172
18	252	194	194	200	160	154
25	158	96	96	94	122	124
Aug. 1	220	148	148	156	110	110
8	144	168	168	170	180	176
16	140	156	154	158	170	166
22	170	146	150	154	158	160
28	152	150	154	156	150	154
Sept. 5	170	132	136	156	160	164
11	176	154	162	186	154	154
19	184	168	174	158	160	162
26	232	154	160	158	152	152

CALCIUM HARDNESS
(as $CaCO_3$ mg/ℓ)

Table 11

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	232	220	220	228	216	244
25	188	224	220	224	200	184
Nov. 8	292	324	312	300	320	320
21	260	252	326	272	252	288
Dec. 7	264	272	288	268	248	260
19	216	308	288	312	328	280
Jan. 17	328	320	332	340	312	324
24	228	236	240	244	248	252
Feb. 14	220	228	228	232	244	236
28	216	216	220	216	216	212
Mar. 15	172	164	172	172	200	184
29	148	156	136	136	132	132
Apr. 4	184	184	184	192	176	164
19	140	168	176	172	200	200
May 2	212	212	212	212	212	212
16	168	132	140	140	144	148
June 12	260	228	220	220	212	220
26	184	184	196	204	200	200
July 5	300	228	224	232	212	200
18	296	280	280	252	220	208

CALCIUM HARDNESS
(as $CaCO_3$ mg/l)

Table 11 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	232	184	184	188	132	120
16	164	228	200	144	224	200
Sept. 11	172	160	152	184	129	136
26	300	180	152	228	204	200

TOTAL HARDNESS
(as $CaCO_3$ mg/ℓ)

Table 12

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	276	244	252	264	296	264
25	240	264	280	280	240	228
Nov. 8	320	224	320	312	340	320
21	300	324	344	288	336	312
Dec. 7	312	344	328	312	368	308
19	232	348	324	304	336	348
Jan. 17	352	324	340	348	336	340
31	312	324	324	336	340	344
Feb. 14	312	312	316	316	324	320
28	300	304	304	300	320	308
Mar. 15	240	228	232	244	280	256
29	220	196	192	196	192	184
Apr. 4	248	248	248	248	232	196
19	196	236	240	240	272	272
May 2	304	304	304	304	304	308
16	232	188	196	200	220	220
June 12	228	296	308	296	280	288
26	252	248	256	264	260	260
July 5	344	268	268	268	240	240
18	324	300	300	280	224	236

TOTAL HARDNESS
(as $CaCO_3$ mg/l)

Table 12 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	268	188	192	192	160	144
16	192	232	224	224	256	264
Sept. 11	212	196	195	264	184	196
26	328	264	248	328	232	228

pH

Table 13

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Oct. 4	7.8	7.8	7.7	7.8	7.6	7.5
10	7.6	7.7	7.8	7.8	7.7	7.8
17	8.2	8.1	8.1	8.1	8.1	8.1
25	7.9	7.9	7.9	7.9	7.8	7.7
31	7.8	7.7	7.7	7.7	7.8	7.9
Nov. 8	7.7	7.7	7.6	7.6	7.6	7.7
15	8.0	8.2	8.2	8.2	8.1	8.2
21	7.9	8.2	8.2	8.2	7.9	8.0
30	8.1	8.3	8.3	8.3	8.4	8.4
Dec. 7	7.5	7.8	7.8	7.8	8.3	8.3
12	7.4	8.1	8.0	8.0	8.0	8.1
19	7.8	7.7	7.7	7.7	7.9	7.9
28	7.8	7.5	7.5	7.6	7.6	7.4
Jan. 4	7.4	7.5	7.4	7.3	7.4	7.4
10	7.5	7.6	7.3	7.5	7.6	7.7
17	7.6	7.4	7.5	7.6	7.7	7.7
24	7.5	7.5	7.6	7.6	7.7	7.8
31	7.5	7.3	7.5	7.4	7.5	7.5
Feb. 7	7.2	7.3	7.4	7.3	7.5	7.5
14	7.2	7.2	7.1	7.1	7.1	7.2
20	7.2	7.1	7.1	7.1	7.2	7.4
28	7.4	7.3	7.3	7.3	7.3	7.3
Mar. 7	7.4	7.3	7.3	7.3	7.3	7.3
15	7.4	7.2	7.3	7.3	7.4	7.4
21	7.4	7.4	-	-	7.3	7.1
29	7.7	7.6	7.6	7.7	7.6	7.5
Apr. 4	7.6	7.7	7.7	7.7	7.8	7.7
12	7.7	7.7	7.5	7.7	7.7	7.7
19	7.4	7.7	7.8	7.8	7.9	8.0
25	7.5	7.6	7.7	7.8	7.8	7.8

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
May 2	7.9	8.0	8.0	8.0	8.0	8.0
9	7.9	7.9	7.9	7.9	8.1	8.2
16	7.5	7.7	7.7	7.7	8.1	8.2
23	7.9	8.1	8.1	8.0	8.0	7.9
30	8.0	8.0	8.0	7.9	8.1	8.0
June 6	8.4	8.3	8.0	7.7	7.9	7.9
12	8.3	7.9	7.8	7.8	8.3	7.8
19	8.3	7.7	7.5	7.5	7.8	7.6
26	7.2	7.6	7.6	7.6	7.6	7.6
July 5	7.9	7.5	7.5	7.4	7.5	7.5
10	7.2	7.9	7.9	7.9	7.8	7.8
18	7.9	7.8	7.7	7.5	7.5	7.6
25	7.5	7.4	7.3	7.3	7.5	7.5
Aug. 1	8.4	7.6	7.6	7.6	7.6	7.4
8	8.5	8.3	7.8	7.6	7.7	7.7
16	8.3	7.8	7.6	7.5	7.7	7.6
22	8.3	7.7	7.6	7.6	7.8	7.9
28	7.5	7.7	7.7	7.7	7.8	7.5
Sept. 5	8.3	7.8	7.5	7.3	7.8	7.6
11	8.4	8.4	7.8	7.4	7.6	7.6
19	7.7	7.8	7.6	7.6	7.9	7.8
26	7.8	7.8	7.7	7.6	7.7	7.7

ORTHOPHOSPHATE
(mg/ℓ)

Table 14

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Oct. 4	0.33	0.21	0.22	0.33	0.28	0.33
10	0.21	0.15	0.15	0.17	0.16	0.18
17	0.17	0.16	0.19	0.17	0.15	0.14
25	0.40	0.15	0.16	0.17	0.17	0.28
31	0.58	0.19	0.19	0.17	0.18	0.09
Nov. 8	0.20	0.16	0.17	01.9	0.13	0.17
15	0.21	0.09	0.12	0.12	0.13	0.13
21	0.13	0.09	0.12	0.12	0.13	0.12
30	0.09	0.10	0.08	0.07	0.08	0.08
Dec. 7	0.08	0.05	0.05	0.06	0.04	0.07
12	0.10	0.06	0.04	0.05	0.07	0.06
19	0.26	0.10	0.06	0.07	0.05	0.07
28	0.19	0.15	0.19	0.18	0.13	0.13
Jan. 4	0.16	0.14	0.16	0.15	0.14	0.16
10	0.31	0.09	0.11	0.14	0.10	0.08
17	0.14	0.08	0.08	0.09	0.10	0.11
24	0.11	0.08	0.08	0.10	0.10	0.12
31	0.09	0.07	0.08	0.10	0.07	0.08
Feb. 7	0.11	0.08	0.48	0.13	0.10	0.11
14	0.09	0.06	0.11	0.11	0.06	0.06
20	0.12	0.07	0.08	0.07	0.08	0.07
28	0.10	0.07	0.07	0.08	0.03	0.04
Mar. 7	0.18	0.12	0.11	0.12	0.06	0.08
15	0.70	0.19	0.19	0.23	0.08	0.17
21	0.39	0.30	-	-	0.30	0.31
29	0.24	0.13	0.15	0.15	0.16	0.14
Apr. 4	0.21	0.17	0.17	0.16	0.14	0.15
12	0.19	0.71	0.73	0.87	0.59	0.62
19	0.17	0.07	0.06	0.08	0.07	0.07
25	0.17	0.11	0.16	0.13	0.12	0.15

ORTHOPHOSPHATE
(mg/l)

Table 14 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
May 2	0.20	0.12	0.14	0.14	0.13	0.12
9	0.09	0.08	0.07	0.16	0.08	0.06
16	0.17	0.10	0.10	0.12	0.07	0.12
23	0.15	0.10	0.13	0.24	0.12	0.18
30	0.15	0.05	0.09	0.11	0.03	0.06
June 6	0.09	0.11	0.11	0.19	0.06	0.09
12	0.10	0.12	0.12	0.17	0.12	0.11
19	0.14	0.16	0.13	0.17	0.13	0.12
26	0.20	0.12	0.13	0.11	0.29	0.12
July 5	0.23	0.15	0.15	0.18	0.13	0.14
10	0.20	0.20	0.21	0.29	0.17	0.23
18	0.21	0.16	0.15	0.18	0.12	0.13
25	0.17	0.16	0.15	0.17	0.14	0.15
Aug. 1	0.04	0.14	0.14	0.17	0.14	0.15
8	0.02	0.02	0.04	0.11	0.08	0.10
16	0.07	0.10	0.14	0.15	0.16	0.11
22	0.05	0.07	0.08	0.16	0.06	0.06
28	0.20	0.09	0.08	0.10	0.07	0.11
Sept. 5	0.12	0.06	0.10	0.95	0.06	0.06
11	0.05	0.02	0.07	0.28	0.07	0.08
19	0.85	0.12	0.12	0.13	0.03	0.12
26	0.34	0.22	0.23	0.54	0.30	0.20

AMMONIA
(mg/ℓ)

Table 15

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Oct. 4	0.24	0.28	0.25	0.31	0.27	0.14
10	0.28	0.21	0.17	0.23	0.17	0.23
17	0.13	0.14	0.15	0.14	0.15	0.16
25	0.04	0.07	0.05	0.03	0.02	0.06
31	0.02	0.05	0.08	0.06	0.05	< 0.02
Nov. 8	< 0.02	0.08	0.11	0.07	0.04	0.02
15	0.11	0.13	0.05	0.07	0.04	0.07
21	0.10	0.10	0.10	0.10	0.09	0.08
30	0.17	0.07	0.11	0.13	0.11	0.11
Dec. 7	0.17	0.08	0.09	0.10	0.10	0.10
12	0.18	0.15	0.13	0.14	0.15	0.11
19	0.34	0.28	0.15	0.15	0.13	0.14
28	0.19	0.24	0.21	0.22	0.20	0.19
Jan. 4	0.24	0.30	0.27	0.27	0.28	0.29
10	0.22	0.15	0.13	0.14	0.10	0.13
17	0.32	0.22	0.26	0.20	0.22	0.09
24	0.16	0.15	0.17	0.14	0.13	0.09
31	0.37	0.33	0.31	0.38	0.22	0.17
Feb. 7	0.34	0.28	0.31	0.31	0.22	0.16
14	0.34	0.39	0.40	0.41	0.31	0.26
20	0.30	0.34	0.35	0.36	0.32	0.28
28	0.50	0.53	0.49	0.51	0.50	0.35
Mar. 7	0.44	0.50	0.60	0.60	0.46	0.45
15	1.35	1.38	1.32	1.34	0.61	1.06
21	0.25	0.28	-	-	0.30	0.22
29	0.56	0.76	0.78	0.82	0.72	0.57
Apr. 4	0.16	0.34	0.35	0.36	0.54	0.30
12	0.70	0.94	0.90	0.90	0.70	0.56
19	0.35	0.30	0.30	0.32	0.11	0.07
25	0.04	0.16	0.08	0.08	0.13	0.06

AMMONIA
(mg/l)

Table 15 (cont'd)

Date 1977-78		County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
May	2	0.04	0.03	0.02	0.03	0.04	0.04
	9	< 0.02	0.03	0.03	0.03	< 0.02	< 0.02
	16	0.16	0.22	0.22	0.27	0.27	0.15
	23	< 0.02	<0.02	< 0.02	<0.02	< 0.02	< 0.02
	30	0.08	0.16	0.22	0.28	0.10	0.10
June	6	< 0.02	<0.02	0.15	0.44	0.26	0.03
	12	0.02	0.33	0.50	0.44	0.21	0.64
	19	0.07	0.70	0.69	0.69	0.49	0.11
	26	0.14	0.15	0.13	0.11	0.29	0.07
July	5	0.09	0.22	0.27	0.21	0.21	0.11
	10	0.14	0.11	0.15	0.19	0.17	0.10
	18	0.09	0.12	0.14	0.26	0.20	0.07
	25	0.07	0.21	0.21	0.20	0.18	0.07
Aug.	1	0.16	0.30	0.32	0.38	0.30	0.20
	8	0.42	0.33	0.41	0.58	0.39	0.29
	16	0.11	0.33	0.42	0.64	0.41	0.12
	22	0.12	0.88	0.97	1.04	0.44	0.10
	28	0.39	0.89	0.96	0.93	0.48	0.11
Sept.	5	0.14	0.50	0.68	1.09	0.64	0.21
	11	0.11	0.19	0.43	1.12	0.66	0.20
	19	0.26	0.78	0.78	0.86	0.38	0.10
	26	0.10	0.10	0.04	0.28	0.24	0.12

NITRATES
(NO_3-N mg/ℓ)

Table 16

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	6.80	4.85	5.00	5.00	5.80	5.40
25	5.60	6.62	6.21	6.40	5.20	4.80
Nov. 8	7.28	6.65	7.18	7.24	7.20	7.24
21	8.12	8.12	8.12	8.40	7.28	8.12
Dec. 7	4.80	0.60	1.80	1.60	5.80	2.70
19	2.90	2.50	2.80	2.90	1.55	2.60
Jan. 17	2.40	2.10	1.90	2.12	1.51	1.60
31	3.34	4.77	5.05	4.27	5.13	4.84
Feb. 14	3.98	4.63	4.13	4.34	4.72	4.55
28	3.78	3.56	3.59	3.56	3.54	3.51
Mar. 15	3.04	3.26	3.53	3.70	3.48	3.70
21	2.45	2.75	-	-	3.00	2.20
Apr. 4	5.00	4.65	4.65	4.45	4.20	4.45
19	4.75	5.15	5.25	5.30	5.85	6.10
May 2	6.94	6.35	6.74	6.69	6.84	6.55
16	7.00	5.90	6.20	5.90	4.90	5.50
June 12	4.25	4.10	4,80	5.50	5.75	5.90
26	13.00	9.62	10.14	9.62	7.93	8.19
July 5	8.82	7.02	7.38	7.74	7.20	7.74
18	6.79	6.38	6.04	4.89	3.99	4.29

NITRATES
(NO_3-N mg/l)

Table 16 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	4.32	1.16	2.90	1.00	1.24	0.82
16	0.04	1.89	2.07	1.70	2.54	3.09
Sept. 11	0.25	2.00	2.48	3.10	0.91	1.14
26	7.25	6.76	5.82	7.53	6.51	5.33

BIOCHEMICAL OXYGEN DEMAND
(mg/ℓ)

Table 17

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	2.3	1.2	< 1.0	2.0	< 1.0	1.0
24	4.6	2.3	2.4	2.2	2.5	3.7
Nov. 8	1.8	1.7	2.0	2.1	1.6	1.6
21	1.5	2.5	2.2	2.5	1.2	< 1.0
Dec. 7	1.2	1.7	1.3	1.3	2.2	1.2
19	4.7	2.4	1.9	1.9	2.9	1.9
Jan. 17	3.3	2.9	< 1.0	<1.0	< 1.0	< 1.0
31	< 1.0	< 1.0	< 1.0	<1.0	1.2	< 1.0
Feb. 14	< 1.0	1.0	< 1.0	3.4	< 1.0	1.1
28	1.0	1.1	< 1.0	<1.0	3.1	< 1.0
Mar. 15	7.1	6.1	6.6	6.9	1.8	3.9
29	3.4	3.6	3.5	3.5	4.2	3.8
Apr. 4	2.1	2.1	1.7	2.0	2.2	1.7
19	6.1	3.7	3.2	3.5	2.7	1.5
May 2	2.5	3.5	1.9	3.0	1.9	2.6
16	3.2	3.9	2.5	4.2	4.4	4.2
June 12	9.0	3.5	3.0	4.2	2.3	1.5
26	3.2	1.7	1.9	1.7	1.7	1.3
July 5	2.3	3.2	2.9	3.5	3.7	3.3
18	2.4	2.0	1.3	2.2	1.5	< 1.0

BIOCHEMICAL OXYGEN DEMAND
(mg/l)

Table 17 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	9.3	2.5	1.3	2.8	2.3	1.6
15	8.5	6.1	4.5	5.1	4.6	2.1
Sept. 11	6.1	4.5	0.9	3.7	2.8	1.5
26	2.0	2.6	2.5	3.7	2.3	1.2

Table 18

THRESHOLD ODOR

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	24	42	42	42	13	24
25	56	56	32	32	42	56
Nov. 8	32	24	24	32	24	24
21	32	32	18	18	24	13
Dec. 7	24	18	15	15	-	18
19	18	18	24	24	24	18
Jan. 17	18	7.5	18	24	24	18
31	24	-	-	-	18	24
Feb. 14	24	18	18	24	24	24
28	42	42	42	42	32	42
Mar. 15	42	42	42	42	32	42
29	56	56	42	56	56	56
Apr. 4	75	56	56	100	56	42
19	42	42	32	42	56	42
May 2	24	18	18	24	32	42
16	42	32	32	32	24	24
June 12	56	32	42	42	42	42
26	42	56	56	56	56	56
July 5	75	56	56	42	42	42
18	32	42	56	75	24	32

Table 18 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Aug. 1	75	42	56	56	56	56
15	75	42	56	56	32	32
Sept. 11	24	56	42	42	32	32
26	56	56	32	32	42	56

TOTAL COLIFORMS
(org/100 ml)

Table 19

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2			Iowa River 1 mi. Downstream	Iowa River University Water Plant
		Top	Mid-Depth	Bottom		
Oct. 10	30,000	600	500	900	500	600
24	60,000	200	< 100	< 100	300	35,000
Nov. 8	1,400	300	100	400	300	100
21	12,000	< 100	< 100	< 100	< 100	< 100
Dec. 7	2,300	2,100	1,500	2,100	390	< 100
19	90,000	< 100	100	800	750	100
Jan. 17	6,800	8.500	2,800	5,500	2,700	900
31	4,000	1,400	800	500	400	100
Feb. 14	1,300	900	1,500	900	200	< 100
28	1,200	900	1,000	1,500	500	< 100
Mar. 15	39,000	35,000	23,000	36,000	2,300	1,300
29	5,300	5,300	4,800	5,100	2,400	900
Apr. 4	1,500	400	400	600	100	< 100
19	74,000	50,000	30,000	28,000	1,300	1,600
May 2	900	< 100	600	300	300	< 100
16	2,000	1,100	1,800	1,700	1,000	2,300
June 12	200	< 100	< 100	200	300	< 100
26	230,000	1,100	1,800	1,300	800	1,500
July 5	2,000	500	400	800	1,600	400
18	800	2,600	200	600	900	400

TOTAL COLIFORMS
(org/100 ml)

Table 19 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Aug. 1	500	300	100	< 100	300	500
15	200	100	< 100	< 100	200	< 100
Sept. 11	100	< 10	< 10	< 10	100	100
26	1,400	2,000	1,000	2,000	200	400

FECAL COLIFORMS
(org/100 ml)

Table 20

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Oct. 10	5,300	110	160	90	290	170
24	19,000	< 10	10	50	70	15,000
Nov. 8	900	140	140	200	160	90
21	1,300	< 10	< 10	10	10	60
Dec. 7	90	< 10	< 10	< 10	< 10	< 10
19	5,100	10	10	< 10	30	160
Jan. 17	1,300	70	60	60	< 10	20
31	840	20	< 10	< 10	< 10	< 10
Feb. 14	550	400	420	390	90	10
28	130	310	390	90	60	10
Mar. 15	4,800	2,000	2,500	1,600	270	1,500
29	160	50	40	10	10	20
Apr. 4	20	10	20	20	10	10
19	17,000	13,000	11,000	7,200	390	980
May 2	280	< 10	100	80	250	60
16	1,000	370	330	510	200	480
June 12	40	80	30	170	< 10	< 10
26	43,000	490	460	500	2,000	300
July 5	1,100	200	210	200	< 10	< 10
18	600	80	90	400	50	240

FECAL COLIFORMS
(org/100 ml)

Table 20 (cont'd)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Aug. 1	250	10	20	< 10	20	100
15	70	< 10	< 10	80	50	20
Sept. 11	80	< 10	< 10	< 10	< 10	30
26	1,300	400	160	700	300	100

FECAL STREPTOCOCCI
(org/ml)

Table 21

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Oct. 10	2,400	130	70	150	260	250
24	30,000	20	20	< 10	360	32,800
Nov. 8	470	190	230	260	190	110
21	580	< 10	< 10	10	< 10	60
Dec. 7	140	< 10	< 10	< 10	< 10	30
19	30,000	20	130	90	860	780
Jan. 17	2,800	80	100	80	50	40
31	240	150	50	70	60	20
Feb. 14	360	180	220	290	120	100
28	170	170	90	110	80	10
Mar. 15	14,000	14,000	14,000	11,000	830	3,600
29	800	130	230	150	80	140
Apr. 4	330	180	140	160	70	30
19	34,000	9,500	11,000	11,000	1,800	5,600
May 2	100	10	120	100	140	80
16	1,400	230	200	380	340	440
June 12	120	< 10	< 10	< 10	< 10	10
26	47,000	770	610	460	6,500	980
July 5	1,700	200	160	300	110	160
18	440	70	20	80	70	180

Table 21(cont'd)

FECAL STREPTOCOCCI
(org/ml)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Aug. 1	330	< 10	80	20	70	60
15	120	10	< 10	< 10	60	30
Sept. 11	100	< 10	< 10	< 10	60	90
26	1,600	280	400	600	800	400

TOTAL PLANKTON ORGANISMS
(organisms/ml)

Table 22

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Oct. 24	11,156	7,577	6,463	7,577	12,700	8,248
Nov. 8	10,692	8,242	8,465	6,014	6,914	11,806
21	17,375	18,043	28,515	31,408	5,132	5,792
Dec. 7	4,900	7,574	8,465	6,014	13,810	5,792
Jan. 17	4,010	891	891	2,228	1,559	1,337
31	1,114	1,337	1,114	2,228	-	1,114
Feb. 14	891	2,673	2,005	4,678	1,340	668
28	891	1,120	1,337	446	4,900	668
Mar. 14	2,005	1,797	2,673	6,237	16,709	13,588
29	6,010	4,678	2,676	5,123	5,123	3,119
Apr. 4	5,346	4,455	8,242	7,350	4,900	6,905
19	-	17,152	20,047	22,275	26,285	17,512
May 2	24,286	13,810	12,483	15,599	12,920	13,588
16	8,475	20,714	18,275	18,043	23,198	30,520
30	16,706	8,910	11,147	11,150	14,933	11,586
June 12	16,129	1,282	1,505	1,617	1,840	446
26	335	558	669	558	502	167
July 5	5,276	2,705	452	3,345	3,655	446
18	2,734	1,619	2,986	3,151	1,784	669

Table 22 (cont'd)

TOTAL PLANKTON ORGANISMS
(org/ml)

Date 1977-78	County Rd. W-48 Iowa River Upstream	Coralville Reservoir No. 2 Top	Mid-Depth	Bottom	Iowa River 1 mi. Downstream	Iowa River University Water Plant
Aug. 1	58,986	2,094	265	2,656	168	8,856
15	50,298	19,281	10,248	10,216	66	6,581
Sept. 11	15,698	4,848	4,525	-	1,723	2,561
26	2,724	4,032	1,826	3,393	1,579	1,356

PESTICIDE RESIDUES IN FISH ABOVE AND IN THE CORALVILLE RESERVOIR (ppb)

Table 23

Collected June 1978

SPECIES	Location	Length (mm)	Weight (grams)	Dieldrin	P,P'DDE	P,P'DDD	P,P'DDT	OP-DDT	Heptachlor	Heptachlor Epoxide	β-BHC	Aldrin	Lindane
Carp	In reservoir	330	454	5	2	7	-	-	-	3	-	-	-
Carp	"	514	1305	1	3	-	-	-	-	-	-	-	-
Carp	"	514	1646	9	6	-	-	-	-	-	-	-	-
Big mouth buffalo	"	445	1135	5	7	9	-	-	-	-	-	1	-
Big mouth buffalo	"	457	1419	6	3	-	-	-	-	-	-	-	-
Big mouth buffalo	"	514	1986	5	3	3	-	-	Trace	2	-	-	-
Flat head catfish	"	508	2270	4	2	2	-	-	-	3	-	1	-
Channel catfish	"	610	2270	10	6	-	-	-	Trace	9	-	-	-
White crappie	"	292	397	-	-	-	-	-	-	-	-	-	-
Walleye	"	584	1703	3	-	-	-	-	-	-	-	-	-

PESTICIDE RESIDUES IN FISH ABOVE AND IN THE CORALVILLE RESERVOIR (ppb)

Collected June 1978

Table 23 (cont'd)

SPECIES	Location	Length (mm)	Weight (grams)	Dieldrin	P,P'DDE	P,P'DDD	P,P'DDT	OP-DDT	Heptachlor	Heptachlor Epoxide	δ-BHC	Aldrin	Lindane
Big mouth buffalo	Above	419	908	2	-	-	-	-	-	Trace	-	-	-
Carp-sucker	"	419	908	156	14	-	Trace	-	2	Trace	-	1	-
Big mouth buffalo	"	368	681	19	-	-	5	-	-	-	-	-	-
Carp	"	495	1249	299	50	-	3	-	-	Trace	11	-	-
Carp	"	495	1022	4	14	16	-	-	-	Trace	-	-	-
Carp	"	440	908	11	9	7	-	-	2	Trace	-	-	-
White bass	"	326	378	15	1	2	-	-	1	-	-	-	-

PESTICIDE RESIDUES IN FISH ABOVE AND IN THE CORALVILLE RESERVOIR (ppb)

Table 24

Collected August and September 1978

SPECIES	Location	Length (mm)	Weight (grams)	Dieldrin	P,P'DDE	P,P'DDD	P,P'DDT	OP-DDT	Heptachlor	Heptachlor Epoxide	B-BHC	Aldrin	Lindane
Large mouth bass	In reservoir	335	541	9	3	-	-	-	-	1	-	-	-
Large mouth bass	"	223	160	6	4	-	-	-	-	2	-	-	-
Large mouth bass	"	265	272	12	5	-	-	-	-	1	-	-	-
Big mouth buffalo	"	500	2344	95	14	14	9	3	2	14	-	4	1
Small mouth buffalo	"	370	765	23	2	-	-	-	-	1	-	-	-
Carp	"	370	1021	8	-	-	-	-	-	-	-	-	-
Carp	"	305	667	34	-	-	-	-	-	2	-	-	-
Carp	"	245	340	5	-	-	-	-	-	-	-	-	-

PESTICIDE RESIDUES IN FISH ABOVE AND IN THE CORALVILLE RESERVOIR (ppb)

Table 24 (con'd)

Collected August 1978

SPECIES	Location	Length (mm)	Weight (grams)	Dieldrin	P,P'DDE	P,P'DDD	P,P'DDT	OP-DDT	Heptachlor	Heptachlor Epoxide	δ-BHC	Aldrin	Lindane
Big mouth buffalo	Above	370	1800	32	6	7	-	-	-	9	-	-	-
Big mouth buffalo	"	320	1200	24	5	5	-	-	1	6	-	1	1
Carp	"	315	680	3	-	-	-	-	-	1	-	-	-
Carp	"	210	225	15	3	-	-	-	-	3	-	-	1
Large mouth bass	"	260	450	-	-	-	-	-	-	-	-	-	-
Northern pike	"	220	225	2	1	-	-	-	-	-	-	-	-
Flat-head catfish	"	170	170	-	-	-	-	-	-	-	-	-	-
Striped bass	"	90	60	-	-	-	-	-	-	-	-	-	-

PESTICIDE RESIDUES IN FISH ABOVE AND IN THE CORALVILLE RESERVOIR (ppb)

Table 25

Collected November 1978

SPECIES	Location	Length (mm)	Weight (grams)	Dieldrin	P,P'DDE	P,P'DDD	P,P'DDT	OP-DDT	Heptachlor	Heptachlor Epoxide	B-BHC	Aldrin	Lindane
Walleye	In Reservoir	1476	525	13	2	-	-	-	-	3	-	-	-
Walleye	"	454	360	10	2	-	-	-	2	-	-	-	-
Centrarchidae	"	227	255	8	-	-	-	-	-	1	-	-	-
Carp	"	1192	520	16	17	7	-	-	1	2	2	-	1
Carp	"	625	445	Trace	-	-	-	-	-	-	-	-	Trace
Carp	"	454	370	3	1	-	-	-	-	-	-	-	Trace
River carpsucker	"	341	310	5	2	3	1	-	1	8	-	1	1