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D.H. Hall, et al

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by

Dempsey H. Hall
Joel E. Shelton
Oklahoma State Department of Health
Oklahoma City, Oklahoma 73152

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Project Officer

William R. Duffer
Wastewater Management Branch
Robert S. Kerr Environmental Research Laboratory
Ada, Oklahoma 74820

ROBERT S. KERR ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
ADA, OKLAHOMA 74820

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16. ABSTRACT

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An analysis of the wastewater quality data assembled during the two experimental phases revealed moderate reductions in suspended solids under the condition-1 phase which could have been attributed to the presence of the fish. No distinguishable reductions in five-day biochemical oxygen demand (BOD_5) were statistically supported that could be attributed to the fish stock. Under the analyses for the nutrient parameters for the condition-1 phase no distinguishable reductions due to fish were observed. During the condition-2 phase, high mortality due primarily to oxygen stress revealed no observable impact on the quality of wastewater that could be attributed to the fish. Retention time of the wastewater within each cell of the raceway appeared to play a strong role in the observed percentage reductions in most of the regulatory and nutrient parameters.

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FOREWORD

EPA is charged by Congress to protect the Nation's land, air, and water systems. Under a mandate of national environmental laws focused on air and water quality, solid waste management and the control of toxic substances, pesticides, noise, and radiation, the Agency strives to formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life. In partial response to these mandates, the Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma, is charged with the mission to manage research programs: to investigate the nature, transport, fate, and management of pollutants in ground water; to develop and demonstrate technologies for treating wastewater with soils and other natural systems; to control pollution from irrigated crop and animal production agricultural activities; and to develop and demonstrate cost-effective land treatment systems for the environmentally safe disposal of solid and hazardous wastes.

Aquaculture processes could provide a simple and effective alternative to conventional systems for treatment and management of wastewater. Finfish culture is an area of wastewater aquaculture requiring exploratory research efforts with several species to determine the feasibility of establishing effective and economical treatment systems. In addition, water reuse aspects of finfish culture systems utilizing municipal sewage should be evaluated. This project was designed to test the treatment effectiveness of one species of native finfish for two pretreatment levels of municipal waste effluent. Results indicate that implementation of a culture system oriented toward water reuse rather than wastewater treatment is more feasible for the species of finfish tested.

Clinton W. Hall

Clinton W. Hall, Director
Robert S. Kerr Environmental Research Laboratory

ABSTRACT

This research project was initiated with the overall objectives of: (a) assessing the potential of aquaculture as a suitable means of treating municipal sewage in a mid-temperate latitude on an annual basis, (b) to provide a set of design criteria for implementation of aquaculture as an advanced wastewater treatment method, and (c) to achieve an effluent quality amenable to PL-92-500 and the 1977, 1983 and 1985 standards and goals.

The studies were conducted using two four-celled raceways constructed in series, adjacent to a primary wastewater stabilization pond. One raceway functioned as the experimental system, while the other served as a control condition-1 experimental phase, which used a source of wastewater from the primary wastewater stabilization pond, and (2) condition-2 experimental phase, which used a source of wastewater from the primary clarifier of an activated sludge treatment plant, that also provided the source of wastewater to the primary wastewater stabilization pond. Under both experimental conditions the experimental raceway was stocked with a native Oklahoma fish, <u>Pimephales</u> <u>promelas</u> Raf., at two stocking densities, one for each experimental phase.

An analysis of the wastewater quality data assembled during the two experimental phases revealed moderate reductions in suspended solids under the condition-1 phase which could have been attributed to the presence of the fish. No distinguishable reductions in five-day biochemical oxygen demand (BOD_5) were statistically supported that could be attributed to the fish stock. Under the analyses for the nutrient parameters for the condition-1 phase no distinguishable reductions due to fish were observed. During the condition-2 phase, high mortality due primarily to oxygen stress revealed no observable impact on the quality of wastewater that could be attributed to the fish. Retention time of the wastewater within each cell of the raceway appeared to play a strong role in the observed percentage reductions in most of the regulatory and nutrient parameters.

A marked reduction in fecal coliform organisms was attributed to the retention time of the wastewater rather than due to influences of the fish present in the cells.

Biological studies of fish growth and reproductive capabilities revealed moderate successes with respect to reproduction, while the analysis of growth revealed exceptional potentials for production of biomass over a relatively short period of time.

This report covers the period of March, 1977, through August 1979.

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TABLES (Continued)

LIST OF ABBREVIATIONS

BOD_5	--five day biochemical oxygen demand
COD	--chemical oxygen demand
Contr.	--control
D.O.	--dissolved oxygen
Exp.	--experimental
g	--grams
gpm	--gallons per minute
kg	--kilograms
l	--liter
lbs	--pounds
l/sec	--liters per second
mg	--milligrams
ml	--milliliters
mm	--millimeters
TOC	--total organic carbon

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SECTION 1

INTRODUCTION

The current demand for advanced wastewater treatment practices, arising from the enactment of PL 92-500, the Federal Water Pollution Control Act of 1972 (1), coupled with a demand for energy conservation and the underlying economic implications, is rapidly creating a dilemma in the field of wastewater treatment. In Oklahoma alone, approximately 80 percent of the communities are currently utilizing wastewater stabilization ponds as a means of treating municipal sewage. Such conventional treatment practices have not adequately produced effluents of a quality amenable to established standards provided for by PL 92-500.

The definition of effluent quality adopted pursuant to PL 92-500 requires that all sewage treatment facilities meet minimum secondary treatment standards. The standards are: (a) five-day biochemical oxygen demand (BOD_5) of 30 milligrams/liter (mg/l), (b) suspended solids of 30 mg/l, and fecal coliform of 200/100 milliliters (ml). Based on the classification of Oklahoma streams as water quality limited segments and on waste load allocation studies performed by the Oklahoma State Department of Health, many treatment facilities face a more stringent BOD_5 requirement of 20 mg/l.

The problem that currently exists in finding an equitable solution arises not from a lack of advanced waste treatment technology but from cost effective implementation of advanced physical-chemical treatment processes in areas where the serviced population is inadequate to finance and maintain such facilities. Such a problem establishes a strong premise for investigating the potentials of utilizing existing conventional treatment methods and supplementing physico-chemical and biological treatment processes with extended biological activity in the form of aquaculture.

The practices of aquaculture, although relatively ancient in origin, are rapidly gaining worldwide recognition in terms of the potential for conversion of primary nutrients to protein-rich products readily usable by man. Until recently much of the emphasis has been on protein elaboration and very little has been on the association of aquatic husbandry with wastewater treatment or the potential of integrating the two ideas. The Oklahoma State Department of Health has determined through preliminary studies that such an integration of ideas presents sound realistic objectives for an advanced wastewater treatment technique and is thus a basis for the current study (2).

The basic approach to wastewater treatment through aquaculture involves the conversion of available nutrients to a harvestable biomass, thus producing a reduction in nutrients discharged to receiving waters. This is accomplished by: (a) aerobic and anaerobic bacterial decomposition of organic wastes to primary nutrients (carbon, nitrogen and phosphorus), (b) algal utilization of nutrients, and (c) conversion of algal biomass to fish biomass. The conversion of plankton biomass to fish biomass is accomplished by the use of filter feeding type fish that feed primarily on phytoplankton and zooplankton populations.

The primary objectives of this study were to: (a) assess the potential of aquaculture as a suitable means of treating municipal sewage in a mid-temperate latitude on an annual basis, (b) to provide a set of design criteria for implementation of aquaculture as a wastewater treatment method, and (c) to achieve an effluent quality amenable to PL 92-500 and the 1977, 1983, and 1985 standards and goals. Subordinate objectives included a quantitative determination of the degree of sewage treatment during major seasons, and an evaluation of practical uses and economic potentials of biological products of the system.

The scope of this study was somewhat broad in context yet limited in application due to the limited amount of background information available and the physico-chemical nature of the wastewater environment. Such limitations necessitated the use of certain criteria in selection of a suitable test organism, namely: (a) a species of fish native to Oklahoma waters, (b) a species known to have a high tolerance for unstable conditions which exist at various intervals in wastewater stabilization ponds, primarily dissolved oxygen (D.O.), and (c) a species of fish readily available and easily handled. For these reasons the fathead minnow (Pimephales promelas Raf.), although not the most efficient filter feeder, was selected as the test organism. The fathead minnow has been classified as an opportunistic feeder, utilizing small invertebrate organisms as well as algae, and its long intestinal tract suggest an ability to function efficiently as a herbivore (3, 4, 5, 6, 7).

It was the intent of the investigators through use of the fathead minnow, to obtain valuable background information, along with the primary objectives of the study, concerning the response of the fish in terms of its ability to maintain a viable population within the wastewater community. Such information is important in defining the limitations that exists in the production and maintenance of fish populations within the wastewater stabilization pond.

SECTION 2

SUMMARY AND CONCLUSIONS

WASTEWATER ANALYSIS

Condition 1 Experimental Phase

1. The analysis of the regulatory parameter suspended solids, under the wastewater and stocking conditions employed in the first experimental phase, revealed an apparent contribution of the fish present within the test cells. Such a contribution was reflected in a comparison between the concentration of suspended solids within the effluent in the final cell of the experimental versus control series raceways.

2. Unlike the suspended solids parameter, another regulatory parameter, BOD_5, showed no statistically significant contrast between experimental and control cells, with respect to concentrations monitored. Such results suggest that the direct reduction in suspended solids was insignificant to indirectly stimulate a reduction in BOD_5. The observed percentage reduction in BOD_5 from influent to effluent of each raceway (control and experimental) was apparently related directly to the retention time of wastewater rather than the presence of the fish within the wastewater.

3. Similarly, the magnitude of the observed reductions in suspended solids reflects little, if any, effect on nutrient parameters as suggested by the results of the analyses for these parameters.

4. In summary, the presence of Pimephales promelas Raf. within the wastewater community, investigated within this study, produced observable changes in the quality of wastewater discharged from the experimental raceways. Although the observed changes were detectable with respect to only one parameter, suspended solids, such an indicator is sufficient to justify further investigations.

Condition 2 Experimental Phase

1. The analyses of regulatory parameters (BOD_5 and suspended solids) and nutrient parameters, under wastewater and stocking conditions in the second experimental phase, revealed no apparent contribution of the fish to a reduction in concentrations.

2. Considering the nature of the wastewater tested under the condition-2 experimental phase (wastewater of primary treatment quality), it is apparent that if culture of fathead minnows is to be implemented as a cost effective means of supplemental wastewater treatment, it should be considered as an adjunct to the wastewater stabilization pond and not as a substitute for the secondary treatment afforded by the wastewater stabilization pond processes.

BIOLOGICAL ANALYSIS

1. Under the wastewater conditions provided in the condition-1 experimental phase, wastewater from a primary wastewater stabilization pond, the fathead minnow exhibited the ability to live and reproduce successfully, with only limited threat from disease.

2. Under the wastewater conditions provided in the condition-2 experimental phase, wastewater of primary treatment quality, the fathead minnow was able to survive, but under extreme stresses initiated by wastewater with a high oxygen demand, such an existence is extremely limited and prohibits reproductive rigor and success.

3. In summary, the wastewater community provides an extremely opportunistic environment that if managed and monitored closely may provide a very cost effective approach to utilization of nutrients that conventionally are carried away by receiving stream waters and very often ends up overloading and upsetting the balance of nutrients provided for in the natural stream environment. Finfish within the wastewater environment provides an opportunity for recycling nutrients, capturing fundamental elements within protein-rich products usable in numerous ways by man. Such an approach can be feasibly implemented as a valuable water reuse technique.

SECTION 3

RECOMMENDATIONS

1. Based on the results observed in this study a definite potential exists with the integration of aquaculture techniques and wastewater treatment. If such a goal is to be implemented, further studies are necessary to more clearly define the intricate food web that exists within the waste stabilization pond. Such a definition would provide a much stronger basis for selection of the appropriate species of fish to be cultured.

2. The unstable nature of raw and even primarily treated municipal wastewater limits the potential of introducing a population of finfish due to the high level of competition for oxygen; therefore, if finfish culture in the wastewater environment is to be a successful integration of productivity and wastewater treatment, such operations should focus on supplementing the secondary treatment mode.

3. Due to the wide range of diurnal flucuations in oxygen and temperature within the wastewater stabilization pond, finfish culture practices should include: (1) a source of emergency aeration to provide a means of quickly stabilizing septic conditions often experienced during the year-round operation of the lagoon, particularly during late summer and early spring seasons, (2) adequate manpower and equipment for handling of fish stock to limit the stresses imposed on the fish during handling, (3) disease control protocol to insure minimal stock loss, and (4) alternative planning for wastewater flows, including multiple raceway designs, which allow the operator a means of alternating flow and thus eliminate problems with overloading.

4. The successful implementation of aquaculture practices with wastewater treatment will rely heavily on interdisciplinary skills of biologists and wastewater treatment specialists particularly in organization and establishment of such an operation. Proper initial organization will insure a smooth operation which should require only minimal skills to maintain following initial installation.

SECTION 4

STUDY SITE DESCRIPTION

The study was conducted at the Bethany-Warr Acres sewage treatment facility which serves a portion of the northwest Oklahoma City municipal complex. The treatment phases of the facility consisted of: (a) screening, (b) grinding (comminutor), (c) aeration, (d) primary and secondary clarification, and (e) sludge digestion. Following these treatment phases the effluent was discharged to primary and secondary wastewater stabilization ponds, where the wastewater underwent biological oxidation processes before being discharged to the adjacent receiving stream (Bluff Creek, a first-order stream location on the Cottonwood Creek drainage basin).

In order to obtain the necessary controls, with respect to flow and retention of wastewater, a separate small scaled series of wastewater stabilization ponds were constructed adjacent to the existing primary wastewater stabilization pond. This facility, as shown in Figure 1, consisted of eight earthen cells, arranged in two series with four cells in each series. Each cell had a surface area of approximately 0.1 hectare (0.25 acres). The two series of cells were constructed in parallel, with each individual cell within one series corresponding to the same numbered cell within the adjacent series, with respect to location, flow, and retention time. This design allowed for one series to serve as an experimental control for the other series. All cells within a single series were constructed as identically as possible to its corresponding cell of the adjacent series, and all ponds were designed with the same general specifications with respect to depth, areas, and distribution receptacles. At the end of the two series of treatment cells, one large cell was constructed to receive flows from both series of cells. The effluent was periodically used for irrigation purposes or was pumped back into the secondary wastewater stabilization pond of the permanent treatment facility.

The experimental facilities were designed to maintain maximum achieveable control on flow of wastewater through use of distribution receptacles equipped with 30° V-notch weirs. The arrangement of these receptacles was designed to allow the investigator an alternate means of distributing flow of wastewater throughout the entire series of experimental cells. This arrangement provided a means for wide variation in experimental approach.

Each of the experimental cells were equipped with a means of receiving flows from two sources: (a) an inlet which obtained wastewater by gravitational flow from the cell located in prior sequence of the same series

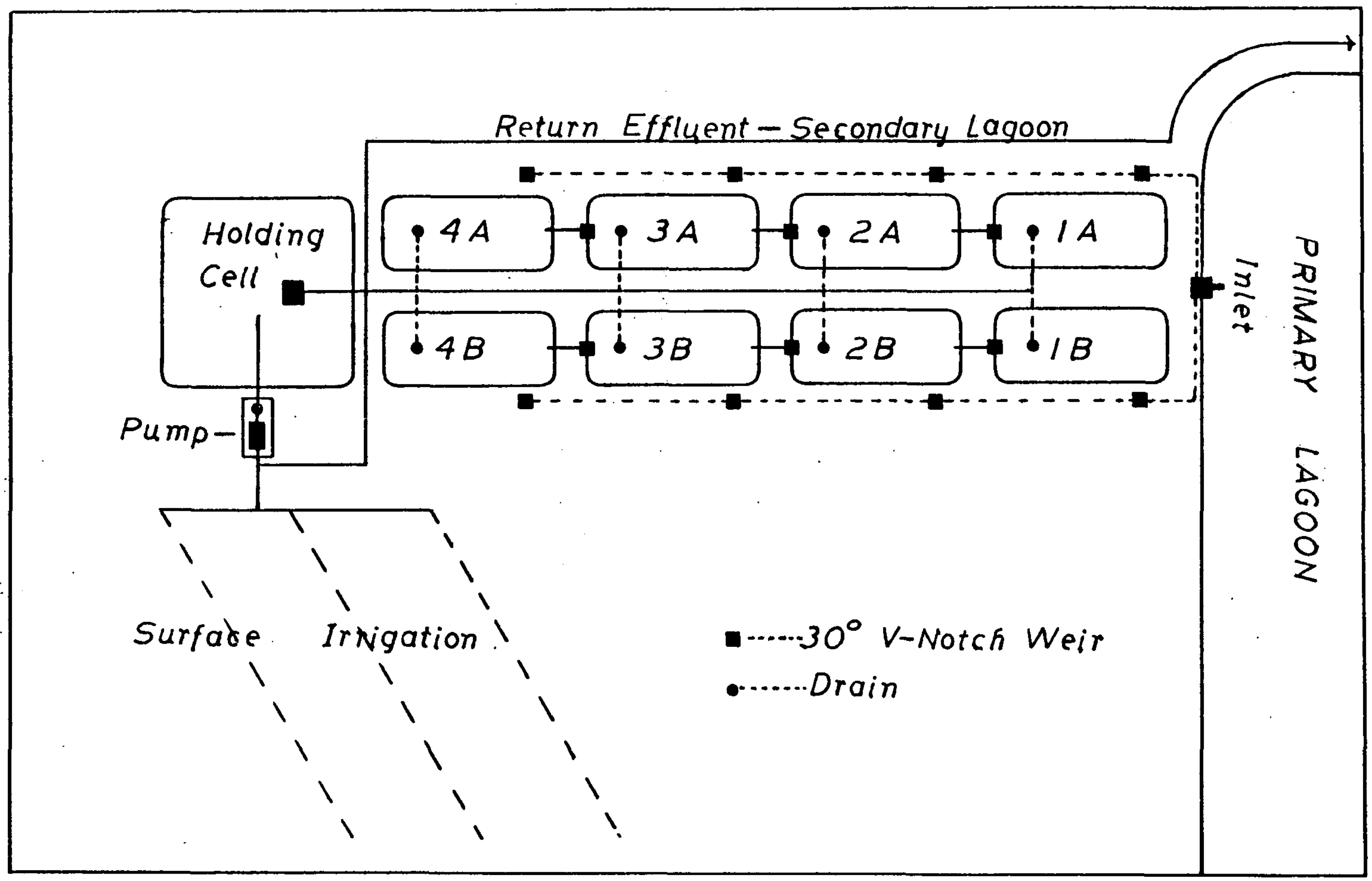

Figure 1. Diagram of Oklahoma State Department of Health, Aquaculture research facilities located at the Bethany-Warr Acres Municipal Wastewater treatment plant.

(Figure 2), and (b) an alternate inlet which received wastewater by gravitational flow from the initial source of wastewater. Likewise, each pond was equipped with two means of discharge: (a) across a V-notch weir (30^{o}) into the next cell in sequence of the same series, and (b) through a main drain line which emptied directly into the holding cell located at the lower end of the two series. This arrangement of inlets and outlets allowed the investigators a means of operating the system with serial flow utilizing four cells as a raceway, or by utilizing the main drain discharge point and the alternate inlet source, each cell could function independently, receiving wastewater from the initial source and discharging directly into the holding cell. The latter flow pattern reduces the raceway effect, allowing for retention and treatment of wastewater through one cell versus retention and treatment of wastewater through four cells, as was possible in the serial flow pattern.

Due to the nature of the wastewater received by the experimental system, the serial flow pattern was selected as the most appropriate design for experimentation, as it allowed for optimum retention time which in turn produced a quality of wastewater suitable for fish culture.

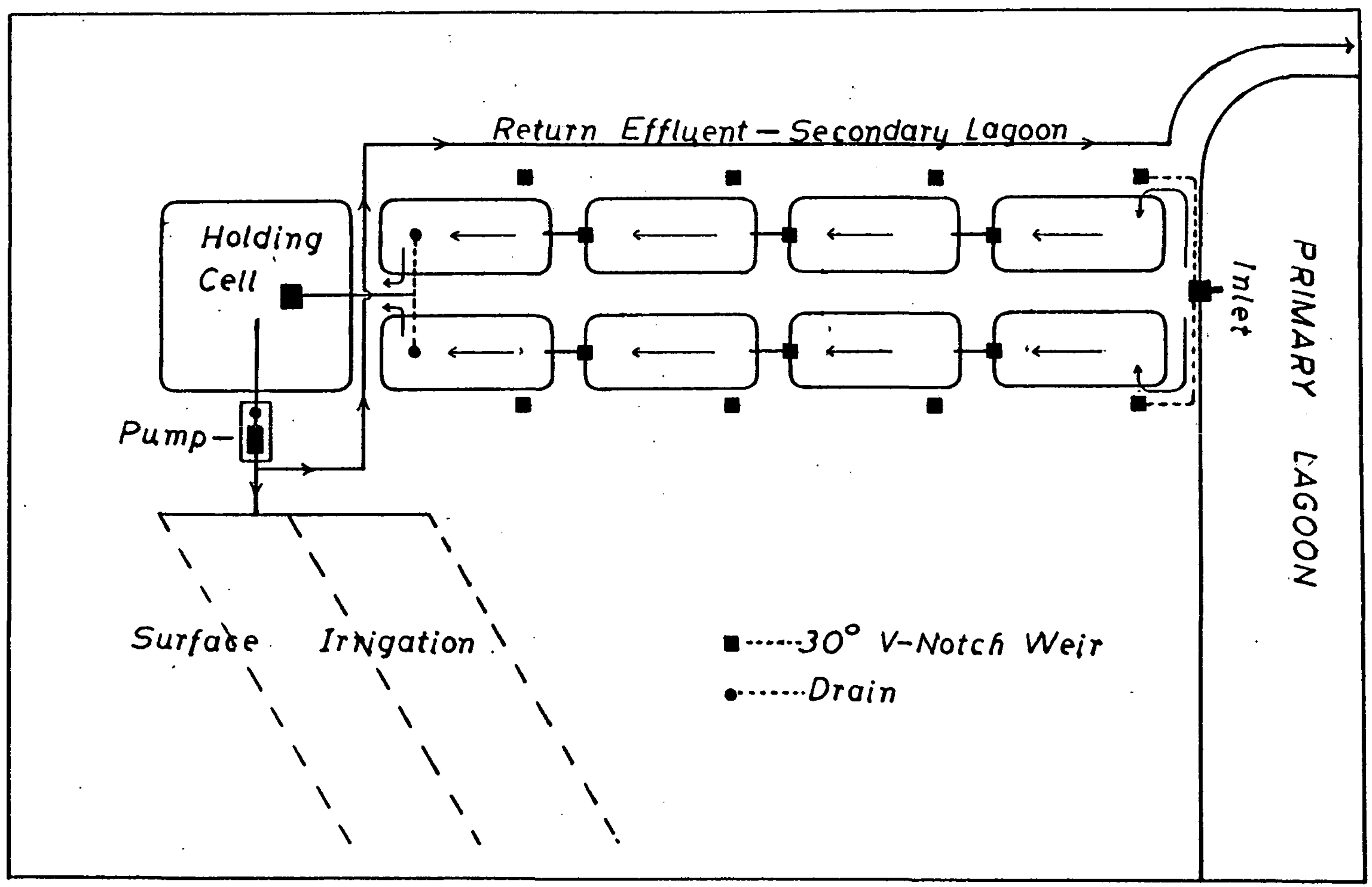

Figure 2. Flow diagram of aquaculture raceways

SECTION 5

METHODS

EXPERIMENTAL DESIGN

During the course of the study, the existing treatment facility underwent reconstruction and modification which necessitated the use of two experimental phases utilizing two separate sets of conditions. The two sets of conditions differed primarily with respect to wastewater characteristics and stocking density of fish. The physical characteristics of flow and retention were the same for both experimental phases.

Under both experimental phases, wastewater was received by a centrally located distribution receptacle (Figure 1) and was distributed to each of the two series raceways at an average flow of 0.95 liters/second (l/sec) (15 gallons per minute). The flow rate varied from 0.63 l/sec (10 gpm) to 1.26 l/sec (20 gpm) depending on several uncontrollable factors inherent to gravitational distribution. This variation in flow necessitated daily monitoring and correction by adjustment of the V-notch weirs in the distribution receptacles of the first cell in each series. The flow between each cell within each series varied somewhat from the flow to the first cell in each series, depending on the evaporation rate and the amount of rainfall. Without compensating for input from rainfall or loss from evaporation, the retention time of wastewater in each cell was approximately 15-20 days.

For purposes of identifying sample locations each of the cells in the two series was assigned numbers sequentially through the series. Along with the numbered location, subscripts were assigned to designate the control series and the test series; A - designating the control series with no fish and B - designating the experimental series which contained fish (Figure 1).

Condition-1 Experimental Phase

During the condition-1 experimental phase, from October 19, 1977, through May 17, 1978, primary lagoon effluent was provided as the source of wastewater for experimentation. Each of the four cells within the test series were stocked with *Pimephales promelas* Raf. at a density of approximately 38(Kilograms/liter) hectare (83 pounds/0.25 acres).

Condition-2 Experimental Phase

During the condition-2 experimental phase, from August 2, 1978, through May 9, 1979, the wastewater source was supplied directly from the primary clarifier of the existing treatment facility, by means of a submersible pump transmitting wastewater to the centrally located collection point and distributing the wastewater to the two series raceways. Due to the high suspended solids and low D.O. content of the wastewater received from the primary clarifier, it was necessary to provide retention to the wastewater, allowing time for stabilization and production of phytoplankton. This was accomplished by eliminating fish stock from the first cell in the experimental series, which provided a much more stable environment for the finfish in the remaining cells of this series. The remaining three cells were stocked at a density of 151 kg/0.1 hectare (334 lbs./0.25 acres).

WASTEWATER ANALYSIS

During the course of study, under condition-1 and -2 phases, wastewater samples were collected weekly from the discharge point at each cell within the two series and a sample was collected from the initial wastewater supplied to the system. All samples were collected on the same weekday at approximately the same time of day (1100-1200 hour). Along with the wastewater samples, temperature and dissolved oxygen data were collected at each sampling location. Upon collection, samples were preserved (one aliquot was placed on ice and one acidified with H_2SO_4 to a pH of 2) and transported to the Oklahoma State Department of Health, Water Quality Laboratory, in Oklahoma City, for analysis. Separate aliquots were sampled at all locations for bacteriological analyses and placed on ice for transporting to the laboratory.

In the laboratory, wastewater samples were analyzed employing methods and procedures in accordance with those specified by EPA (8), and Standard Methods for the Examination of Water and Wastewater (9). A total of 19 parameters were analyzed in addition to the two field parameters, D.O., and temperature. The 18 parameters analyzed in the laboratory included: BOD_5, (COD) Chemical Oxygen Demand, (TOC) Total Organic Carbon, suspended solids, dissolved solids, settleable solids, volatile suspended solids, ammonia nitrogen, nitrates and nitrites, organic nitrogen, Kjeldhal nitrogen, total nitrogen, total phosphorus, ortho-phophates, total alkalinity, phosphate alkalinity, pH and fecal coliform. The data were aggregated according to laboratory analyses, categorized according to influent and stocking conditions, and tabulated by date and concentration found in the influent to the two series of raceways and the effluents from the four experimental and the four matching control cells (Tables 1 through 20 in Appendices A through B). Each group was then inspected for the contribution of that parameter to the overall description of the performance of the system. Based on this inspection, more detailed analyses of the regulatory parameter (BOD_5 and suspended solids) and the nutrient parameters (organic nitrogen, ammonia, nitrate-nitrite and orotho and total phosphates) were conducted.

Statistical Analysis

The performance of the system under two operational modes was evaluated by determining the mean effluent levels from each cell for each of the selected parameters and by comparing changes in the character of the flow as it moved through the experimental series of cells with the character of the flow at the corresponding points in the control series. In addition, overall performance of each series was determined by comparing the effluent concentration from the last cell in each series with the level of that parameter in the influent to the series.

In order to minimize the variability due to the day-to-day changes in the character of the influent and variability due to seasonal influences on temperature, statistical comparison of each cell in the experimental series with the corresponding cell in the control series, was conducted utilizing a t-test of observations paired according to sample date. This permitted the use of alpha level of 0.05.

PHYSICO-CHEMICAL AND BIOLOGICAL ASSESSMENT

Diurnal Oxygen Analysis

During the onset of the study it was necessary to estabilsh a physico-chemical profile of the wastewater, within the experimental facility, primarily to provide background information relating to the maintenance of viable fish populations. The D.O. concentrations are an important factor in predicting the overall success of sustaining biological activity within the wastewater environment. The overall success of fish populations, as indicated by their growth and reproductive vigor, was highly dependent on the stability of D.O. concentrations, and the range of diurnal fluctuation in oxygen levels.

In the early stages of this study, after the raceways were filled and stabilized, a diurnal oxygen survey was conducted on each cell within each series to determine the range of fluctuation in oxygen concentration. The survey was conducted over a 24-hour period using a YSI, Model 57, Dissolved Oxygen Analyzer. Each cell was sampled at three points within the water column: surface, 1 meter depth and 2 meter depth.

It is recognized by the investigators that, due to day-to-day changes in the nature of the municipal wastewater effluents, one such analysis would be insufficient and inconclusive to evaluate the suitability of the wastewater for the production of fish. For this reason, emphasis was placed on the frequent monitoring of oxygen, temperature, and pH parameters throughout the entire study.

Due to the observed critical periods of low oxygen concentrations encountered during the study, a means of supplementing photosynthetic oxygen production was provided, using forced air blowers and perforated distribution lines for diffusers. The supplemental aeration supply was designed to provide aeration to experimental and control cells concurrently to minimize bias to the experimentation. Most of the supplemental aeration was necessary during the winter months when extended periods of ice cover jeopardized the existence of sufficient dissolved oxygen concentrations.

Biological Assessment

In addition to the monitoring of physico-chemical parameters, biological activity of fish was monitored visually and through analysis of growth patterns. Factors monitored visually included, reproductive activity, movement and congregation of fish due to oxygen stress, mortality, disease and periodic inventory of fish stock.

Growth analyses were conducted over a 15-week period from July 21, 1978, through October 31, 1978 (condition-2, experimental phase). Samples were collected on a bi-weekly basis for the first six weeks of the analysis. The last two samples were collected at monthly intervals, with the last sample corresponding to the fall harvest and population inventory. Of the three experimental cells stocked with fish during the condition-2 experimental phase, the last cell in the series displayed the most favorable conditions for fish production, with the least amount of disease and mortality, and the most vigorous reproductive activity. For this reason, growth analyses were limited to the fish stocked within the last experimental cell. The samples were collected utilizing a nylon seine (1/8 inch mesh) to obtain grab samples at various points across the experimental cell. The grab samples were composited to obtain a representative cross-section of the population. The fish samples collected were transported to the laboratory where they were weighed and measured to obtain length of individuals and total sample biomass. A total of approximately 500 fish were used for the analysis for each unit of sampling.

The periodic inventory and harvesting of fish throughout the entire study was conducted using a nylon seine (1/8-inch mesh, 100 feet in length). To insure that each cell was thoroughly inventoried, each cell was seined until the catch/unit of effort had declined to approximately one percent of the known stocking density. Due to the nature of the movement patterns of the fathead minnow, approximately 70 to 80 percent of the stock were obtained in the first two units of effort. The measurement of quantity was made as fish were removed from the seine. The fish were then transferred to holding troughs and held until completion of inventory of the cell. Supplemental aeration was provided to the holding tanks to minimize oxygen stress to the fish during handling. Since only minimal disease problems were observed during the course of the study, no chemical or antibiotic treatment was necessary.

With respect to visual monitoring of reproductive activity, artificial spawning substrates were placed in the experimental cells, which allowed the investigators a means of determining the onset of spawning activity and a comparison of activity between each stage or cell of the experimental raceway. Although spawning success is a determinable factor through standing crop measurements, the quantification of spawns, with respect to numbers and size of egg masses produced and their fertility rates were not determinable due to the scale of the operation and the quantity of fish initially stocked.

SECTION 6

RESULTS AND DISCUSSION

WASTEWATER ANALYSIS

During the condition-1 experimental phase, the statistical analysis of BOD_5 data (Table 1) indicated a significantly lower concentration in the first experimental cell than in the first control cell, both at the 0.1 and 0.05 alpha levels. The only other cells which maintained any significant differences were the second cells of the raceway series, which displayed significant differences at the 0.1 level only. Considering the real differences in mean effluent concentrations and the relatively narrow range of percent reduction values, it was assumed that no real differences existed between the control cell effluent BOD_5 levels and the experimental cell, BOD_5 levels. Although the fish present in the first and second experimental cells could have contributed to the measured differences found between the experimental cell and its corresponding control, careful consideration should be given to the actual observed differences in numbers before drawing any definitive conclusions.

Under the condition-2 experimental phase, the results of the BOD_5 analyses (Table 1) indicated no statistically significant differences in effluent concentrations for each of the experimental and control cells of the first three stages in the raceway series. The last experimental cell containing fish (cell 4B), displayed significantly higher effluent BOD_5 than its corresponding control cell. Also, the observed percentage reduction was much higher for all control cells than for all experimental cells containing fish. Unlike the condition-1 phase experimentation, the fish stock showed no tendency towards a reduction in BOD_5 concentrations. Considering the nature of the effluent received by the experimental system under the condition-2 experimental phase, which had much less oxidation time prior to experimental use and lower algal populations, the results appear less conflicting. In addition, finfish wastes resulting from the much higher stocking densities utilized under this phase may have attributed to the BOD_5 level of the experimental pond.

Statistical analysis of the suspended solids data under condition-1 experimental phase, reveals a somewhat different trend from that of BOD_5 concentration within the first two experimental cells showing no significant difference in effluent suspended solids concentration between their corresponding control cells (Table 2). The third experimental cell showed a significantly lower concentration of suspended solids at an alpha level of 0.1 than its corresponding control and the fourth experimental cell showed a significantly lower concentration at the 0.1 and the .05 alpha levels. Comparison of the overall 20 percent reduction in suspended solids from the point of introduction of influent into the raceway to the effluent from the number four experimental cell, and the 11 percent increase in suspended solids observed across the control cells indicates that a real difference exists. This difference can be attributed to the high finfish population present in the third and fourth experimental cells and their role in reducing suspended solids. Also, the absence of significant reductions in the first two cells of the series likely resulted from the low finfish population levels (Table E-1). During the condition-1 experimental phase, all of the fish were lost in the first experimental cell over the course of the study due to undeterminable mortality factors. Only 10 percent survived the study in the second experimental cell and 30 percent survived in the third cell. The fourth cell displayed a 30 percent increase in standing crop from initial stocking to harvest. These population levels serve to support the results observed under the condition-1 experimental phase, with respect to suspended solids concentrations.

The results seen in Table 2 for statistical analyses of suspended solids data under condition-2 experimental phase tends to reflect the same pattern discussed earlier for BOD_5 data under condition-2. Experimental cells three and four were found to contain significantly higher concentrations of suspended solids than the corresponding control cells. In fact, a 94 percent increase in suspended solids was observed from the influent into the raceway series to the effluent of the fourth experimental cell, and a four percent increase was observed over the control cells. Such results support the view that a large proportion of the suspended solids present in the primary clarifier waste stream were not suitable for consumption by the finfish population levels contributed to the suspended solids load.

Experimental results for the six nutrient parameters revealed a somewhat contradictory pattern (Tables 3 through 7). Statistical analysis of ammonia data, as shown in Table 3, indicate that a considerable reduction in ammonia concentrations occurred from the point of introduction of the influent into the first experimental cell to the point of discharge from the last cell in the series, under both experimental phases of operation. During the condition-1 phase experimentation, the ammonia concentrations were significantly higher in the experimental cells 2 through 4 than the concentrations found in their corresponding control cells. During the condition-2 phase of experimentation, the data does not reveal meaningful differences between experimental and control cell concentrations. The first cell in the series displayed a significantly higher concentration than its corresponding control, but this statistical significance diminished throughout the remaining cells within the series. Considering the actual observed mean concentrations, the observed significance does not lend itself to a practical conclusion.

Statistical analyses of the nitrate-nitrite data, as shown in Table 4, revealed a substantial increase in concentrations from the beginning of the raceway to the end, under both experimental phases. The differences in concentrations between experimental cells containing fish and the control cells were significantly lower under the condition-1 phase, while no significant differences were observed under the condition-2 phase.

The remaining three nutrient parameters analyzed (organic nitrogen, total phosphorus, and ortho phosphates, Table 5 through 7, respectively) all show reductions in concentration from the beginning concentrations found in the first cell of the raceway, indicating the apparent value of retention time of wastewater in the lagooning process. Observed differences in concentrations of the three parameters between experimental cells and corresponding controls; however, failed to reveal any pattern of significance that would lend itself to a sound conclusion in terms of a reduction in nutrients due to removal of solids by the fish living within the cells.

BIOLOGICAL ANALYSIS

The results of the growth analyses are represented according to percent frequency of occurrence of individuals within eight body length classifications, as observed on six sampling dates (Figure 3). During the interval between the first and second sampling dates a slight change in population structure was reflected by the change of percent frequency of occurrence of individuals within the 30-39 mm class, from 38 percent for the initial sample of July 21, 1978,to 53.5 percent for the sample of August 3, 1978. Such a change indicates the growth of some individuals during this initial interval. The absence of individuals in the largest length classification (80-89 mm) on August 3, 1978, likely was due to mortality initiated by stocking stress. Sampling error which could have affected the capture of these individuals; however, since the technique employed readily lent itself to errors of this nature.

The most predominant shift in population structure was detected on the third sampling date of August 17, 1978. At this time, none of the individuals in the first two length classifications observed prior to the sample date were present in the samples. Such results tend to reflect the maturation of individuals within the sewage environment.

The structure of the population remained relatively constant during the final three sampling intervals, reflecting slow growth patterns. The continued growth of some individuals was indicated in the latter samples by much better representation within the 80-89 mm length classification.

During the course of study,visual inspection of the general condition of the fish within the wastewater environment revealed a healthy and reproductively viable population with only a moderate amount of disease, apparently initiated by handling during seining operations. Although spawning was observed during the study, the apparent success of such reproductive activity was low as reflected by standing crop harvested during the condition-2 experimental phase. Low oxygen concentrations experienced throughout the course of the study probably contributed the single most detrimental impact on the ability of the young minnows to survive the embrionic stages of development.

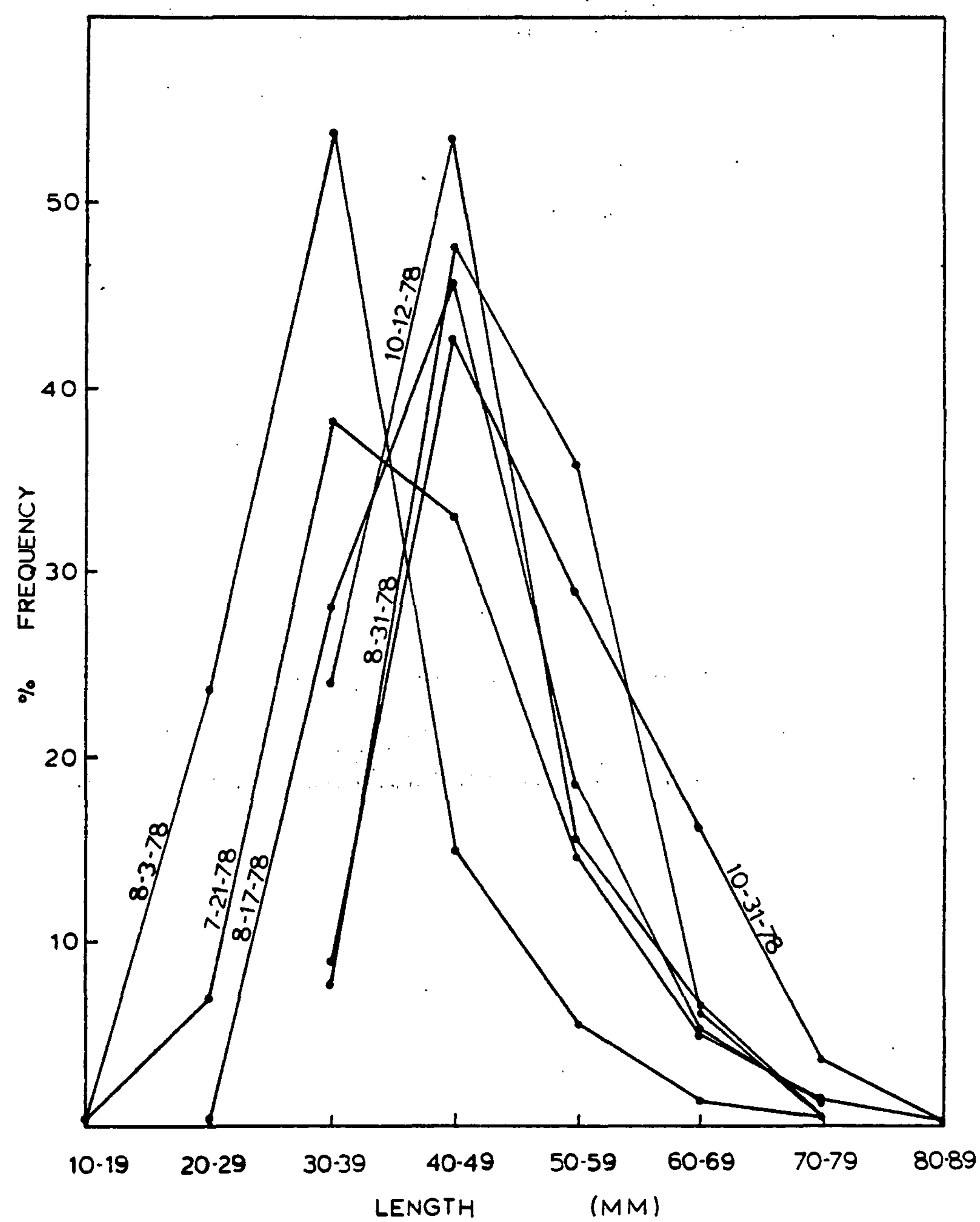

Figure 3. Population structure in relation to total body length of Pimephales promelas Raf., monitored from July 21, 1978, through October 31, 1978.

TABLE 1. ANALYTICAL RESULTS FOR REGULATORY PARAMETER, BOD_5, SAMPLED DURING CONDITIONS-1 and-2 EXPERIMENTAL PHASES

Stat. Para.	Infl.	Cell	Effluent 1	2	3	4	% Red.
			CONDITION 1				
$\bar{x}$ mg/l	57.8		24.6	27.0	27.5	22.4	61
S	34.0	Contr.	12.6	17.2	15.9	13.2	
N			25.0	25.0	24.0	24.0	
$\bar{x}$ mg/l			19.9	21.5	24.6	21.5	63
S		Exp.	11.6	14.1	14.7	11.1	
N			24.0	25.0	24.0	22.0	
t (paired observations)			a,b	b			
			CONDITION 2				
$\bar{x}$ mg/l	60.9		42.8	32.5	30.3	26.7	41[c]
S	41.7	Contr.	23.8	17.8	20.4	14.6	
N	31		33.0	33.0	33.0	33.0	
$\bar{x}$ mg/l			47.2	31.7	28.4	30.1	33[c]
S		Exp.	28.3	21.3	15.7	14.0	
N			33.0	32.0	32.0	33.0	
t (paired observations)						a,b	

a. Indicates statistical significance at X = 0.05.

b. Indicates statistical significance at X = 0.10.

c. Composite of cell 1 (X = 15.0, S = 26.1, N = 66) was used to calculate % reduction.

TABLE 2. ANALYTICAL RESULTS FOR REGULATORY PARAMETER, SUSPENDED SOLIDS SAMPLED DURING CONDITION-1 and-2 EXPERIMENTAL PHASES

Stat. Para.	Infl.	Cell	Effluent 1	2	3	4	% Red.
CONDITION 1							
$\bar{x}$ mg/l	32.8		24.2	34.3	34.1	36.5	-11
S	19.2	Contr.	21.7	20.8	20.5	23.4	
N	25		24.0	26.0	25.0	26.0	
$\bar{x}$ mg/l			22.5	30.3	26.3	26.4	20
S		Exp.	17.0	23.8	11.7	8.5	
N			26.0	25.0	25.0	25.0	
t (paired observations)					b	a,b	
CONDITION 2							
$\bar{x}$ mg/l	45.1		30.1	26.5	29.6	28.6	4[c]
S	31.3	Contr.	21.2	15.5	23.1	13.0	
N	32		32.0	34.0	34.0	34.0	
$\bar{x}$ mg/l			20.3	28.6	37.8	57.5	-94
S		Exp.	14.2	19.2	20.8	28.4	
N			34.0	33.0	34.0	34.0	
t (paired observations)					a,b	a,b	

a. Indicates statistical significance at X = 0.05.

b. Indicates statistical significance at X = 0.10.

c. Composite of cell 1 ($\bar{x}$ = 29.7, S = 17.9, N = 66) was used to calculate % reduction.

TABLE 3. ANALYTICAL RESULTS FOR NUTRIENT PARAMETER, AMMONIA, SAMPLED DURING CONDITIONS-1 and-2 EXPERIMENTAL PHASES

Stat. Para.	Infl.	Cell	Effluent 1	2	3	4	% Red.
CONDITION 1							
x̄ mg/l	24.6		22.40	14.30	8.79	4.86	80
S	3.14	Contr.	3.99	6.37	6.75	5.41	
N	26		26.00	26.00	25.00	26.00	
x̄ mg/l			22.70	17.50	11.00	6.57	73
S		Exp.	3.58	4.30	5.66	5.23	
N			26.00	26.00	26.00	26.00	
t (paired obs.)				a,b	a,b	a,b	
CONDITION 2							
x̄ mg/l	17.4		17.60	11.30	6.42	2.77	85[c]
S	6.08	Contr.	5.14	6.02	6.06	4.35	
N	33		34.00	34.00	34.00	34.00	
x̄ mg/l			18.60	12.50	7.27	3.05	83
S		Exp.	5.16	6.04	5.66	3.60	
N			34.00	34.00	33.00	34.00	
t (paired obs.)			a,b	b			

a. Indicates statistical significance at X = 0.05.

b. Indicates statistical significance at X - 0.10.

c. Composite of Cell 1 (X̄ - 18.1, S = 5.15, N = 68) was used to calculate % reduction.

TABLE 4. ANALYTICAL RESULTS FOR NUTRIENTS PARAMETERS, NITRATES-NITRITES SAMPLED DURING CONDITION-1 and-2 EXPERIMENTAL PHASES

Stat. Para.	Infl	Cell	Effluent 1	2	3	4	% Red.
CONDITION 1							
x̄ mg/l	0.10		0.24	2.66	4.77	4.89	4790
S	0.02	Contr.	0.20	2.05	4.21	3.78	
N	26		26.00	26.00	26.00	26.00	
x̄ mg/l			0.31	1.83	3.16	3.50	3400
S		Exp.	0.54	1.81	2.39	2.35	
N			26.00	26.00	26.00	26.00	
t (paired obs.)				a,b	a,b	a,b	
CONDITION 2							
x̄ mg/l	0.26		0.28	1.28	1.72	1.21	332[c]
S	0.48	Contr.	0.43	1.01	1.37	1.12	
N	34		33.00	34.00	34.00	34.00	
x̄ mg/l			0.28	1.57	1.56	0.99	254
S		Exp.	0.49	1.32	1.11	0.80	
N			33.00	34.00	34.00	34.00	
t (paired obs.)							

a. Indicates statistical significance at X = 0.05.

b. Indicates statistical significance at X = 0.10.

c. Composite of Cell 1 ($\bar{X}$ = 0.28, S = 0.46, N = 66) was used to calculate % increase.

TABLE 5. ANALYTICAL RESULTS FOR NUTRIENT PARAMETER, ORGANIC NITROGEN, SAMPLED DURING CONDITION-1 and-2 EXPERIMENTAL PHASES

Stat. Para.	Infl.	Cell	Effluent 1	2	3	4	% Red.
CONDITION 1							
$\bar{x}$ mg/l	9.06		5.45	6.05	6.16	5.69	37
S	3.48	Contr.	3.35	3.09	1.96	1.99	
N	25		26.00	25.00	24.00	26.00	
$\bar{x}$ mg/l			5.75	5.32	5.42	5.81	36
S		Exp.	3.13	2.73	2.86	1.49	
N			26.00	26.00	26.00	26.00	
t (paired obs.)				a,b			
CONDITION 2							
$\bar{x}$ mg/l	8.91		6.57	5.29	4.67	4.67	30 [c]
S	7.24	Contr.	4.25	2.92	1.92	1.23	
N	30		32.00	34.00	33.00	33.00	
$\bar{x}$ mg/l			6.82	6.19	4.69	5.97	11
S		Exp.	4.25	5.47	1.74	1.88	
N			33.00	33.00	32.00	33.00	
t (paired obs.)						a,b	

a. Indicates statistical significance at X = 0.05.

b. Indicates statistical significance at X = 0.10.

c. Composite of Cell 1 ($\bar{X}$ = 6.70, S = 4.25, N = 65) was used to calculate % reduction.

TABLE 6. ANALYTICAL RESULTS FOR NUTRIENT PARAMETER, TOTAL PHOSPHORUS, SAMPLED DURING CONDITION 1 and 2 EXPERIMENTAL PHASES

Stat. Para.	Infl.	Cell	Effluent 1	2	3	4	% Red.
CONDITION 1							
$\bar{x}$ mg/l	11.68		10.47	10.02	9.51	9.54	19
S	1.16	Contr.	2.29	1.86	2.50	3.29	
N	23		24.00	23.00	24.00	24.00	
$\bar{x}$ mg/l			10.95	9.95	9.73	9.35	20
S			1.24	2.55	2.68	2.87	
N		Exp.	23.00	24.00	23.00	24.00	
t (paired obs.)					b		
CONDITION 2							
$\bar{x}$ mg/l	9.80		11.63	9.48	7.48	4.88	57[c]
S	5.44	Contr.	6.13	4.28	3.33	2.94	
N	34		33.00	34.00	33.00	34.00	
$\bar{x}$ mg/l			11.32	10.38	7.55	4.34	62
S		Exp.	4.57	4.46	3.66	2.12	
N			34.00	34.00	34.00	33.00	
t (paired obs.)				a,b		b	

a. Indicates statistical significance at X = 0.05.

b. Indicates statistical significance at X = 0.10.

c. Composite of Cell 1 ($\bar{X}$ = 11.47, S = 5.39, N = 67) was used to calculate % reduction.

TABLE 7. ANALYTICAL RESULTS FOR NUTRIENT PARAMETER, ORTHO-PHOSPHATES, SAMPLED DURING CONDITION-1 and-2 EXPERIMENTAL PHASES

Stat. Para.	Infl.	Cell	Effluent 1	2	3	4	% Red.
			CONDITION 1				
$\bar{x}$ mg/l	10.37		9.88	8.75	8.73	8.52	18
S	0.82	Contr.	1.18	1.68	1.88	2.93	
N	25		25.00	25.00	25.00	25.00	
$\bar{x}$ mg/l			10.18	9.47	9.90	8.38	19
S		Exp.	1.21	2.13	1.83	2.11	
N			25.00	25.00	24.00	24.00	
t (paired obs.)				b			
			CONDITION 2				
$\bar{x}$ mg/l	7.75		8.41	7.56	5.91	3.90	59[c]
S	5.00	Contr.	3.49	3.62	2.58	2.68	
N	33		34.00	34.00	33.00	34.00	
$\bar{x}$ mg/l			9.29	7.99	5.89	3.33	62
S		Exp.	4.30	3.15	2.65	1.94	
N			34.00	34.00	34.00	33.00	
t (paired obs.)			a,b	a,b		a,b	

a. Indicates statistical significance at X = 0.05.

b. Indicates statistical significance at X = 0.10.

c. Composite of Cell 1 ($\bar{X}$ = 8.85, S = 3.92, N = 68) was used to calculate % reduction.

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APPENDIX A

TABLE A-1. BOD_5 DATA SAMPLED DURING OPERATIONAL CONDITION-1

		SAMPLING LOCATION							
Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	35**	32	28	31	27	67	43	49	42
10/26	23	15	22	24	13	13	14	25	19
11/2	43	14	8	21	31	27	21	23	29
11/9	29	23	14	56	25	24	44	24	46
11/16	19	15	23	40	27	24	54	24	25
11/30	12	5	5	5	5	5	6	5	5
12/7	44	17	9	13	7	5	21	19	15
12/14	13	9	9	9	5	27	35	14	14
12/21	63	7	5	20	13	19	27	10	10
1/4/78	117	55	38	27	25	38	54	24	-
1/11	45	9	8	6	5	10	9	24	21
1/25	52	34	28	22	18	18	-	-	-
2/1	84	35	31	24	25	18	15	15	22
2/8	113	32	23	14	17	35	23	39	13
2/15	70	23	7	4	2	8	3	2	5
2/22	104	19	15	16	8	27	5	4	11
3/1	110	44	40	44	35	38	36	36	36
3/8	114	29	24	30	21	20	17	17	15
3/15	88	40	34	41	31	46	30	31	33
3/29	38	33	43	40	35	40	25	44	27
4/5	60	27	22	39	28	30	13	23	13
4/12	17	27	10	11	8	12	15	10	14
4/19	38	12	12	45	27	30	14	18	17
2/26	-	-	-	-	-	-	-	-	-
4/10	66	32	19	74	34	50	39	41	32
5/17	49	29	-	19	66	-	28	7	-

*Sampling location 3 represents the influent to the aquaculture treatment system. Subsamples A & B represent: A - Experimental cells containing fish, B - Corresponding control cells without fish.

**All values expressed as mg/l.

TABLE A-2. COD DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	75	68	57	46	61	89	82	82	86
10/26	65	53	57	-	61	46	65	46	46
11/2	128	72	60	79	75	83	75	79	75
11/9	79	49	-	-	43	-	-	-	-
11/16	82	68	72	75	68	97	82	72	90
11/30	69	44	45	53	47	66	59	65	52
12/7	109	68	68	76	49	38	57	68	60
12/14	54	62	54	66	58	73	46	70	58
12/21	-	38	42	61	38	49	53	46	38
1/4/78	211	80	77	77	65	130	66	103	42
1/11	119	80	80	69	61	100	65	119	80
1/25	153	101	112	78	75	78	60	71	60
2/1	140	92	120	92	85	81	65	80	77
2/8	225	123	100	123	58	138	-	123	59
2/15	160	78	41	49	17	41	11	3	18
2/22	231	87	81	104	71	117	57	54	61
3/1	232	116	112	94	86	94	52	66	75
3/8	221	117	117	112	91	106	69	95	73
3/15	202	157	152	146	146	131	112	105	112
3/29	122	212	209	242	201	157	146	100	103
4/5	185	120	143	104	100	103	60	97	58
4/12	192	87	96	98	75	100	70	85	71
4/19	-	94	87	128	87	98	68	84	94
4/26	119	63	71	119	41	119	52	48	45
5/10	119	90	67	116	82	112	-	108	108
5/17	141	85	82	96	96	71	108	63	115

TABLE A-3. TOC DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	32.0	30.0	29.0	30.0	29.0	48.0	37.0	37.0	44.0
10/26	34.0	23.0	33.0	31.0	32.0	43.0	25.0	31.0	30.0
11/2	-	3.0	4.0	4.0	5.0	8.0	4.0	15.0	11.0
11/9	-	-	-	-	-	-	-	-	-
11/16	-	-	-	-	-	-	-	-	-
11/30	31.0	29.0	23.0	22.0	22.0	27.0	26.0	26.0	25.0
12/7	31.0	-	-	-	24.0	19.0	10.0	16.0	-
12/14	36.0	20.0	25.0	18.0	17.0	25.0	21.0	20.0	30.0
12/21	21.0	12.0	12.0	20.0	12.0	24.0	18.0	25.0	18.0
1/4/78	40.0	19.0	19.0	16.0	16.0	28.0	22.0	33.0	33.0
1/11	29.0	20.0	20.0	21.0	20.0	29.0	23.0	36.0	37.0
1/25	58.0	46.0	44.0	44.0	45.0	35.0	31.0	28.0	20.0
2/1	59.0	-	46.0	36.0	29.0	31.0	38.0	24.0	-
2/8	15.0	-	-	-	-	-	-	-	17.0
2/15	-	31.0	-	24.0	-	-	-	-	-
2/22	60.0	30.0	24.0	26.0	21.0	34.0	21.0	14.0	31.0
3/1	-	22.0	17.0	-	8.0	-	1.0	12.0	15.0
3/8	75.0	29.0	41.0	46.0	34.0	43.0	637.0	-	22.0
3/15	66.0	67.0	67.0	53.0	55.0	46.0	54.0	41.0	40.0
3/29	31.0	84.0	64.0	75.0	67.0	90.0	89.0	71.0	73.0
4/5	110.0	96.0	90.0	88.0	74.0	68.0	20.0	38.0	15.0
4/12	116.0	33.0	39.0	40.0	27.0	44.0	25.0	34.0	24.0
4/19	14.0	14.0	14.0	-	14.0	13.0	14.0	13.0	12.0
4/26	82.0	25.0	28.0	81.0	16.0	82.0	19.0	16.0	14.0
5/10	66.0	27.0	21.0	35.0	24.0	37.0	30.0	33.0	31.0
5/17	100.0	27.0	23.0	29.0	29.0	17.0	33.0	17.0	41.0

TABLE A-4. SUSPENDED SOLIDS DATA SAMPLED
DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	12	12	19	17	15	33	23	49	27
10/26	12	12	11	15	20	26	26	36	33
11/2	19	14	11	29	30	35	23	35	28
11/9	18	24	26	31	33	31	36	41	35
11/16	9	9	14	30	21	29	40	23	32
11/30	222	15	27	22	43	38	55	27	
12/7	40	18	15	23	10	21	200	20	24
12/14	29	9	8	19	15	21	28	47	37
12/21	19	15	17	27	44	25	22	38	26
1/4/78	53	-	8	15	-	20	12	13	17
1/11	16	15	18	20	41	23	11	40	31
1/25	48	28	31	25	24	14	27	26	23
2/1	74	32	26	20	19	16	19	29	22
2/8	40	10	9	8	5	17	7	22	6
2/15	48	23	13	40	15	20	19	15	20
2/22	28	14	5	18	14	44	15	7	19
3/1	38	6079	14	19	16	7066	6	14	2080
3/8	37	18	29	51	17	49	25	76	12
3/15	42	37	34	73	48	103	34	78	39
3/29	14	113	89	82	66	19	37	33	31
4/5	47	20	34	59	31	57	52	101	27
4/12	85	40	42	64	29	75	34	71	27
4/19	31	51	39	61	116	44	19	25	39
4/26	20	25	30	58	67	42	26	22	16
5/10	20	13	15	35	22	29	44	17	39
5/17	22	14	13	17	18	17	35	16	24

TABLE A-5. DISSOLVED SOLIDS DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	742	762	743	783	779	811	802	835	826
10/26	789	771	737	751	757	812	785	811	786
11/2	719	691	631	745	764	755	727	782	755
11/9	678	681	695	742	693	740	743	743	725
11/16	726	707	705	737	721	812	747	719	773
11/30	694	703	697	806	710	739	768	743	743
12/7	765	756	776	763	782	750	777	777	757
12/14	712	729	738	763	755	807	768	790	793
12/12	694	771	761	756	766	776	795	794	787
1/4/78	770	743	725	760	781	806	460	755	807
1/11	790	691	823	819	802	831	834	826	743
1/25	824	776	791	831	813	810	856	803	834
2/1	735	724	833	763	732	775	842	738	771
2/8	708	677	660	681	656	602	765	600	657
2/15	798	706	576	409	445	369	654	372	588
2/22	716	740	671	574	667	568	661	511	706
3/1	751	670	614	557	563	729	476	586	619
3/8	856	726	603	726	676	584	637	662	514
3/15	792	752	628	658	706	641	673	669	637
3/29	802	774	770	724	758	692	694	664	659
4/5	785	810	714	772	797	751	710	693	727
4/12	808	824	749	806	819	757	779	705	627
4/19	787	824	829	825	852	396	819	742	714
4/26	809	845	839	848	883	792	831	734	769
5/10	799	800	807	807	807	791	822	755	787
5/17	773	810	797	944	841	820	844	787	816

TABLE A-6. SETTLEABLE SOLIDS DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	0.1	00.1	753	0.1	0.1	0.3	0.1	0.1	0.1
10/26	0.1	0.1	0.1	0.1	0.1	0.1	26.0	0.1	0.1
11/2	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
11/9	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.3	0.2
11/16	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
11/30	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12/7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12/14	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12/21	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1/4/78	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1/11	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1/25	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2/1	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1
2/8	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1
2/15	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
2/22	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
3/1	2.0	0.1	0.1	0.1	0.1	0.4	0.4	0.2	0.4
3/8	0.7	0.1	0.1	0.8	0.1	0.5	0.5	0.9	0.7
3/15	1.0	0.1	0.2	1.1	1.4	1.4	0.9	1.0	0.1
3/29	0.1	0.2	0.1	0.1	0.5	0.1	0.2	0.4	0.3
4/5	0.1	0.2	0.1	0.5	0.5	0.6	0.4	0.9	0.3
4/12	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1
4/19	0.4	0.2	0.1	0.4	0.2	0.2	0.1	0.3	0.3
4/26	0.1	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.2
5/10	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2
5/17	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.2

TABLE A-7. VOLATILE SUSPENDED SOLIDS DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	5	5	8	10	5	22	10	40	18
10/26	12	8	9	13	12	16	19	26	25
11/2	16	9	9	23	25	31	17	33	20
11/9	-	-	-	-	-	-	-	-	-
11/16	-	-	-	9	5	17	15	7	12
11/30	200	10	10	-	16	28	26	34	23
12/7	17	3	1	7	8	6	179	8	10
12/14	22	4	5	8	5	10	13	23	18
12/21	6	7	7	15	24	13	14	23	13
1/4/78	43	-	4	14	-	19	10	10	13
1/11	15	14	13	16	32	16	10	28	23
1/25	33	15	17	9	9	10	15	13	17
2/1	51	29	24	19	14	15	18	20	21
2/8	41	22	12	36	14	19	15	13	17
2/22	20	12	4	16	10	29	11	2	14
3/1	30	6070	11	16	15	6140	2	13	2076
3/8	26	11	19	14	10	17	11	17	5
3/15	33	29	25	33	21	42	23	30	21
3/29	13	57	53	49	52	16	32	22	21
4/5	39	20	27	26	25	32	12	35	11
4/12	69	25	28	42	20	45	19	41	17
4/19	25	19	18	48	34	29	12	11	25
4/26	10	7	8	40	15	32	14	14	6
5/10	10	7	8	40	15	32	14	14	6
5/17	17	13	9	15	17	11	28	10	19

TABLE A-8. AMMONIA NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	18.94	19.09	19.01	15.86	15.99	9.20	10.52	3.16	6.06
10/26	28.79	22.53	23.27	19.01	20.01	11.89	13.13	4.65	8.44
11/2	30.32	28.21	23.04	19.94	18.42	6.71	10.24	0.20	5.26
11/9	24.86	23.07	23.90	14.54	17.57	2.95	5.44	0.29	1.64
11/16	22.62	21.49	22.53	11.66	15.37	1.89	4.42	0.65	0.19
11/30	27.87	26.56	25.96	14.43	18.14	1.93	7.58	0.23	2.01
12/7	29.34	28.54	28.54	17.99	20.66	5.05	11.39	0.46	4.11
12/14	23.28	27.76	27.44	19.32	21.74	8.50	12.57	1.75	5.36
12/21	22.35	24.47	24.18	18.42	19.54	9.42	11.85	2.43	4.74
1/4/78	30.04	29.46	28.43	23.53	24.76	14.20	17.43	5.55	9.24
1/11	25.46	26.80	26.07	21.91	22.35	15.86	16.83	7.15	9.57
1/25	22.89	24.67	24.09	22.00	22.47	20.09	20.57	14.77	14.43
2/1	24.28	22.98	23.43	24.18	24.86	23.25	23.16	17.43	17.03
2/8	24.57	21.40	22.09	20.66	19.62	20.74	19.09	16.37	15.92
2/15	19.09	19.39	15.25	10.16	11.39	-	10.78	5.57	9.36
2/22	20.49	20.74	19.32	12.67	19.32	13.60	17.30	9.57	13.39
3/1	22.44	20.17	20.74	14.60	14.77	13.71	12.57	10.44	11.43
3/8	24.67	20.82	21.74	14.77	17.37	12.13	14.72	10.44	12.47
3/15	27.01	22.44	22.98	15.25	17.71	12.18	11.89	9.06	8.50
3/29	22.71	17.78	19.47	10.08	12.72	5.58	7.15	1.83	3.39
4/5	23.34	15.92	17.16	6.08	11.52	3.17	7.46	1.04	4.54
4/12	22.00	14.54	15.13	4.78	7.67	2.34	4.49	0.28	2.23
4/19	25.96	21.49	22.00	4.00	12.62	1.29	3.94	1.71	0.12
4/26	28.09	23.81	24.36	2.89	18.06	0.15	3.83	0.10	0.40
5/10	23.62	21.07	25.96	9.61	18.28	1.99	6.40	0.20	0.51
5/17	22.53	16.18	22.18	4.33	12.18	1.90	2.16	0.91	0.19

TABLE A-9. NITRATE AND NITRITE DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	0.1	0.4	0.3	1.6	1.2	7.0	3.5	8.1	3.0
10/26	0.1	0.1	0.1	1.0	0.1	6.3	1.9	9.3	3.2
11/2	0.1	0.3	0.1	8.5	7.4	16.6	1.3	14.4	1.5
11/9	0.1	0.2	0.1	4.6	1.8	10.3	9.1	8.4	7.0
11/16	0.0	0.3	0.3	6.4	3.0	11.7	8.0	7.5	9.4
11/30	0.1	0.2	0.3	6.3	3.8	11.1	6.3	8.1	5.7
12/7	0.1	0.3	0.3	4.1	2.8	2.7	4.7	8.1	5.0
12/14	0.1	0.5	0.7	3.9	3.4	8.4	4.6	7.8	4.9
12/21	0.1	0.9	1.0	5.0	4.5	8.8	5.4	9.8	5.1
1/4/78	0.1	0.2	0.3	3.0	2.7	8.1	6.4	9.5	5.0
1/11	0.1	0.3	2.8	2.5	5.0	3.9	5.7	4.0	4.6
1/25	0.2	0.1	0.1	0.4	0.4	1.8	1.7	3.8	2.8
2/1	0.1	0.1	0.1	0.2	0.2	0.8	1.0	2.3	1.9
2/8	0.1	0.1	0.1	1.1	0.2	1.6	1.6	3.6	2.9
2/15	0.1	0.1	0.2	0.9	0.5	1.1	1.2	1.8	1.8
2/22	0.1	0.1	0.1	1.5	0.4	1.6	1.1	3.1	2.4
3/1	0.1	0.1	0.1	1.4	1.3	2.0	1.2	2.8	1.6
3/8	0.1	0.1	0.1	2.1	1.2	3.0	1.6	3.4	1.8
3/15	0.1	0.1	0.1	1.2	0.9	2.5	1.7	2.6	1.5
3/29	0.1	0.2	0.1	1.6	0.9	3.8	1.4	4.0	1.4
4/5	0.1	0.6	0.2	1.3	0.8	2.7	0.8	2.6	0.5
4/12	0.1	0.1	0.1	1.3	1.4	1.9	1.7	1.3	0.6
4/19	0.1	0.1	0.1	2.3	0.4	1.6	1.6	0.5	0.1
4/26	0.1	0.1	0.1	2.1	0.2	0.7	1.5	0.1	5.4
5/10	0.1	0.1	0.1	2.6	2.2	1.8	4.0	0.1	4.4
5/17	0.1	0.1	0.1	2.6	2.2	1.8	4.0	0.1	4.4

TABLE A-10. ORGANIC NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19	8.56	7.53	8.48	8.60	8.21	7.84	6.52	5.64	7.69
10/26	4.67	4.70	4.52	4.25	4.16	0.07	6.19	6.98	5.34
11/2	0.20	1.65	4.04	0.15	3.21	4.02	3.81	6.54	5.36
11/9	4.30	4.18	3.00	3.01	4.02	4.89	15.80	3.86	7.24
11/16	10.15	5.29	4.93	6.19	5.31	4.89	5.41	5.44	6.02
11/30	4.90	3.01	3.53	4.10	3.78	4.84	4.50	4.28	4.11
12/7	4.93	2.26	2.93	4.52	3.31	4.13	3.95	5.24	4.84
12/14	6.95	2.45	2.31	3.70	2.88	3.46	4.30	5.08	5.01
12/21	3.07	0.33	0.86	2.28	1.53	3.47	2.90	2.89	4.55
1/4/78	4.27	0.32	0.78	1.00	0.61	3.38	0.85	3.94	2.95
1/11	10.75	5.03	6.20	4.81	5.24	5.77	5.07	8.47	6.63
1/25	3.65	0.53	1.55	1.18	1.38	0.07	2.49	8.27	7.97
2/1	13.22	9.42	9.72	6.86	6.49	6.15	1.59	5.96	7.72
2/8	12.03	8.75	7.92	8.76	8.05	9.27	7.99	11.59	7.38
2/15	10.94	6.63	3.91	4.56	3.19	-	3.33	1.99	3.84
2/22	11.69	7.46	5.07	7.21	5.63	9.24	5.40	3.25	5.36
3/1	11.49	6.52	6.09	5.42	4.96	6.87	3.59	4.74	6.38
3/8	10.12	6.85	6.97	7.27	5.71	8.01	4.98	6.60	2.23
3/15	8.87	7.63	8.07	8.07	6.85	6.58	6.05	6.12	7.08
3/29	11.02	14.63	13.82	16.30	14.14	10.19	8.47	6.93	6.98
4/5	11.76	8.19	9.77	7.59	6.09	6.13	5.36	8.12	5.32
4/12	15.12	7.79	9.23	6.24	6.82	6.50	5.37	5.37	5.07
4/19	12.33	5.33	5.86	5.98	5.11	6.59	5.59	5.85	5.98
4/26	9.38	7.06	5.95	8.27	5.74	7.05	5.71	4.59	4.73
5/10	9.45	6.71	5.20	8.03	7.44	7.80	8.08	5.61	7.72
5/17	12.85	1.52	8.70	7.12	7.53	3.74	7.75	4.93	6.51

TABLE A-11. KJELDAHL NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	27.5	26.6	27.5	24.4	17.0	17.0	8.8	8.8	13.7
10/26	33.1	33.4	33.3	23.3	24.2	17.0	19.3	11.3	13.8
11/2	30.5	29.9	27.0	20.0	21.6	10.7	14.0	6.7	10.6
11/9	29.1	27.2	26.9	17.5	21.6	7.8	21.2	4.1	8.9
11/16	30.1	26.8	27.4	17.8	20.7	6.8	9.8	6.1	6.2
11/30	32.8	29.6	29.5	18.5	21.9	6.8	12.1	4.5	7.1
12/7	34.3	30.8	31.5	22.5	23.0	9.2	15.3	5.7	8.0
12/14	31.2	30.2	29.7	23.0	24.6	11.0	16.9	6.8	10.4
12/21	25.5	24.8	25.0	20.7	21.1	12.9	14.7	5.3	9.3
1/4/78	34.3	29.8	29.2	24.5	25.4	17.6	18.3	9.5	12.2
1/11	36.2	31.8	32.3	26.7	27.6	22.6	21.9	15.6	16.2
1/25	26.5	25.2	25.6	23.2	23.8	20.2	23.1	23.0	22.4
2/1	37.5	32.4	33.1	31.0	31.3	29.4	24.7	23.4	24.7
2/8	36.6	30.1	30.0	29.4	27.7	30.0	27.0	27.0	23.3
2/15	30.0	26.0	19.2	14.7	14.6	12.6	14.0	7.5	13.3
2/22	32.2	28.2	24.4	19.9	24.9	22.8	22.7	12.8	18.7
3/1	33.9	26.7	26.8	20.0	20.7	20.6	16.1	15.2	17.8
3/8	34.8	27.7	28.7	22.0	23.1	20.0	19.7	17.0	14.7
3/15	35.9	30.1	31.0	23.3	24.6	18.8	17.9	15.2	15.6
3/29	33.7	32.4	33.3	26.3	26.9	15.8	5.2	8.7	10.4
4/5	35.1	24.1	26.9	13.7	17.7	9.3	12.8	9.2	9.9
4/12	37.1	22.3	24.4	11.0	14.5	8.8	9.9	5.6	7.4
4/19	38.3	26.8	27.9	9.0	17.7	7.9	9.5	7.3	6.1
4/26	37.8	30.9	31.3	11.2	23.8	7.2	9.5	4.7	5.1
5/10	33.1	27.8	31.2	17.6	25.7	9.8	14.5	5.8	8.2
5/17	35.4	17.7	30.9	11.4	19.7	5.6	9.9	5.8	6.7

TABLE A-12. TOTAL NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	27.10	27.02	27.80	26.02	25.40	24.05	20.55	16.90	16.75
10/26	33.44	27.33	27.89	24.27	24.28	24.26	21.22	20.43	16.98
11/2	30.55	30.12	27.23	28.59	29.06	27.39	15.33	21.18	18.09
11/9	29.23	27.44	27.00	22.15	23.39	18.15	30.34	12.55	15.89
11/16	32.79	27.05	27.81	24.21	23.68	18.50	17.87	13.60	15.60
11/30	-	29.80	29.79	24.83	25.72	17.88	18.39	12.62	12.83
12/7	34.27	31.10	31.77	26.61	26.77	11.88	20.04	13.81	13.96
12/14	31.23	30.71	30.45	26.92	28.02	20.37	21.47	14.64	15.27
12/21	25.42	25.70	26.04	25.70	25.58	21.69	20.15	15.13	14.40
1/4/78	34.31	29.97	29.51	27.53	28.08	25.68	24.69	19.00	17.19
1/11	36.21	32.13	35.07	29.22	32.59	26.53	27.60	19.62	20.81
1/25	26.74	25.30	25.64	23.58	24.25	20.96	24.77	26.85	25.20
2/1	37.50	32.40	33.15	31.25	31.55	30.20	25.75	25.70	26.65
2/8	36.80	30.45	30.01	30.32	28.97	31.61	28.68	31.50	26.20
2/15	30.03	26.12	19.36	15.62	14.98	13.68	15.21	9.37	15.10
2/22	32.18	28.20	24.49	21.38	25.35	24.44	23.80	15.93	21.15
3/1	33.93	26.79	26.93	21.42	22.03	22.58	17.26	17.98	19.41
3/8	34.78	27.77	28.81	24.15	24.28	23.14	21.30	20.45	16.50
3/15	35.88	30.08	31.05	24.52	25.46	21.26	19.64	17.78	17.09
3/29	33.73	32.61	33.39	27.88	27.76	19.57	17.02	12.76	11.77
4/5	35.20	24.71	27.13	14.97	18.42	12.00	13.63	11.76	10.37
4/12	37.12	22.43	24.46	12.32	15.90	10.74	11.56	6.95	7.99
4/19	38.39	26.92	27.96	12.28	18.13	9.49	11.13	7.80	6.20
4/26	37.48	30.97	31.41	13.27	24.01	7.90	11.05	4.80	10.54
5/10	33.17	28.28	31.26	20.04	26.62	11.99	17.58	5.92	9.73
5/17	-	-	30.98	14.05	21.92	7.45	13.92	5.84	11.11

TABLE A-13. TOTAL PHOSPHORUS DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	10.8	11.3	11.3	11.3	11.3	11.2	12.0	12.7	12.7
10/26	12.0	12.0	11.3	12.3	10.2	11.5	9.0	12.7	12.2
11/2	10.9	10.5	11.2	12.3	11.2	11.2	11.3	15.2	11.0
11/9	11.2	11.1	11.0	11.4	11.0	10.9	12.3	13.5	11.3
11/6	10.6	10.3	9.8	9.4	10.1	9.9	10.8	8.7	12.3
11/30	10.9	10.0	10.6	9.5	10.4	9.6	10.1	10.8	9.1
12/7	12.9	12.7	13.0	12.3	12.5	11.6	12.3	13.2	12.3
12/14	9.9	9.2	9.2	9.2	9.4	8.0	9.4	9.0	9.7
12/21	9.0	8.9	9.0	9.0	9.5	8.9	9.6	9.0	9.8
1/4/78	11.0	10.4	11.3	9.9	10.0	9.6	10.0	9.8	10.0
1/11	12.1	11.5	11.3	11.2	10.9	10.9	11.2	10.4	10.7
1/25	11.6	12.5	11.9	11.1	11.3	1.0	10.7	10.3	10.5
2/1	12.6	11.9	11.4	11.1	11.2	11.4	11.9	10.3	10.8
2/8	12.2	10.4	10.5	10.3	10.2	10.5	-	11.0	9.8
2/15	10.5	9.6	8.7	6.2	6.8	6.0	6.3	3.5	7.0
2/22	10.0	10.8	9.2	8.4	10.2	8.8	9.5	6.3	9.9
3/1	12.2	10.3	10.6	9.1	8.5	9.7	7.8	9.2	10.7
3/8	11.4	10.1	10.1	9.2	9.5	8.6	8.8	9.1	8.0
3/15	12.4	10.6	11.4	9.3	10.2	8.9	9.2	9.3	9.1
3/29	11.0	10.7	12.4	10.1	10.1	9.1	8.8	9.2	6.5
4/5	12.0	11.1	11.5	9.7	12.0	9.0	10.3	9.8	8.9
4/12	15.5	14.5	13.7	13.6	13.5	13.4	14.5	9.4	7.6
4/19	-	-	-	-	-	-	-	-	-
4/26	-	-	-	-	-	-	-	-	-
5/10	0.3	1.5	0.3	0.5	1.6	1.7	1.7	1.5	2.2
5/17	11.7	9.0	11.5	5.3	4.6	4.4	4.8	2.6	1.1

TABLE A-14. ORTHO PHOSPHATE DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	10.65	11.19	11.25	10.92	11.20	11.00	11.64	12.50	9.50
10/26	11.18	11.75	11.20	11.39	10.20	10.88	9.54	12.42	11.41
11/2	10.60	9.92	10.66	10.52	12.13	10.80	10.80	14.50	10.79
11/9	10.12	9.84	9.94	9.94	9.85	10.12	11.42	10.79	10.06
11/16	10.26	9.25	9.45	9.04	9.38	8.58	10.26	8.10	11.47
11/30	10.43	9.85	10.48	9.04	9.72	9.23	9.65	10.39	8.57
12/7	8.98	9.22	9.31	8.03	9.52	8.84	8.96	9.11	8.45
12/14	8.57	8.17	8.50	8.23	8.50	8.44	8.77	9.04	8.98
12/21	9.87	8.71	8.95	8.96	4.59	8.46	9.27	9.58	9.72
1/4	11.00	10.42	10.23	9.15	9.75	9.23	9.51	9.07	9.48
1/11	10.99	10.93	10.33	10.10	10.53	9.45	9.81	9.67	7.01
1/25	10.42	11.74	10.96	11.07	11.34	10.31	10.60	10.12	10.04
2/1	10.35	9.38	9.79	9.56	10.19	10.10	10.58	9.15	7.79
2/8	10.30	8.84	9.57	9.50	9.34	10.18	-	9.58	8.87
2/15	8.51	8.18	6.95	5.22	5.46	4.22	5.87	3.08	6.56
2/22	9.42	10.30	9.18	8.06	9.45	8.59	9.04	6.01	9.42
3/1	11.03	8.94	9.18	7.10	7.22	7.87	6.61	8.29	8.68
3/8	10.17	9.57	10.03	7.79	8.73	8.26	8.09	8.07	8.45
3/15	11.02	9.06	9.91	9.13	9.17	7.91	8.01	8.49	7.96
3/29	11.49	9.88	10.68	8.79	10.00	8.63	8.05	8.29	5.67
4/5	10.81	9.79	10.93	8.69	10.61	9.36	5.41	8.99	8.57
4/12	11.43	11.74	10.80	10.19	10.18	10.03	9.36	7.90	6.91
4/19	10.75	11.74	12.34	6.84	12.15	7.75	9.21	5.06	3.10
4/26	11.20	12.01	12.89	6.41	12.96	4.66	8.77	2.36	3.58
5/10	-	-	-	-	-	-	-	-	-
5/17	9.90	9.00	10.87	5.01	4.43	4.42	4.32	2.50	0.35

TABLE A-15. TOTAL ALKALINITY DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	198	207	210	192	201	159	183	136	165
10/26	212	206	228	207	217	179	200	163	189
11/2	198	190	198	185	166	86	109	103	148
11/9	208	201	210	156	178	108	147	108	144
11/16	221	198	201	137	170	80	128	121	90
11/30	229	224	226	149	187	91	140	100	128
12/7	217	220	223	162	192	83	141	83	123
12/14	219	225	228	184	202	123	172	111	87
12/21	240	235	237	195	215	149	189	130	171
1/4/78	230	233	233	202	227	152	180	114	170
1/11	234	237	234	234	217	175	194	147	178
1/25	232	250	256	247	256	219	235	185	210
2/1	206	193	204	204	211	204	205	167	180
2/8	245	222	222	228	239	228	236	216	210
2/15	191	186	140	107	115	90	124	78	137
2/22	197	155	155	83	138	105	128	83	128
3/1	263	221	233	169	177	180	151	166	189
3/8	233	200	215	115	171	130	146	138	141
3/15	223	199	208	150	169	125	135	119	138
3/29	209	187	196	149	171	112	132	107	114
4/5	258	159	162	109	123	103	103	106	106
4/12	219	205	208	133	188	135	152	138	147
4/19	168	148	155	62	117	59	77	74	59
4/26	119	145	148	151	287	140	127	111	176
5/10	234	229	259	183	211	129	134	146	140
5/17	207	160	191	81	124	87	57	87	61

TABLE A-16. "P" ALKALINITY SAMPLED DURING OPERATIONAL CONDITION

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	0	0	0	0	0	0	0	0	1
10/26	0	0	0	0	0	0	0	0	2
11/2	0	0	0	0	0	0	0	0	0
11/9	0	0	0	0	0	0	0	0	0
11/16	0	0	0	0	0	0	0	4	0
11/30	0	0	0	0	0	0	0	3	0
12/7	0	0	0	0	0	0	0	0	0
12/14	0	0	0	0	0	0	0	0	0
12/21	0	0	0	0	0	0	0	0	2
1/4/78	0	0	0	0	0	0	0	1	1
1/11	0	0	0	0	0	0	0	0	0
1/25	0	0	0	0	0	0	0	0	0
2/1	0	0	0	0	0	0	0	0	0
2/8	0	0	0	0	0	0	0	0	0
2/15	0	0	0	0	0	0	0	0	0
2/22	0	0	0	0	0	0	0	4	0
3/1	0	0	0	0	0	0	0	0	0
3/8	0	0	0	0	0	0	0	0	0
3/15	0	0	0	0	0	0	0	0	0
3/29	0	0	0	0	0	0	0	0	0
4/5	0	0	0	0	0	0	0	0	0
4/12	0	0	0	0	0	0	0	0	0
4/19	0	0	0	0	0	0	0	0	0
4/26	0	0	0	0	0	0	0	5	0
5/10	0	0	0	0	0	2	0	36	13
5/17	0	0	0	0	0	0	0	2	11

TABLE A-17. pH DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	8.1	7.7	7.6	7.8	7.8	7.6	8.0	7.1	8.4
10/26	7.5	7.6	7.6	7.8	7.7	7.7	8.1	7.6	8.4
11/2	7.3	7.6	7.6	7.2	7.2	7.0	7.5	7.4	7.3
11/9	7.3	7.5	7.6	7.2	7.6	7.2	7.0	7.5	7.3
11/16	7.8	7.9	7.8	7.8	7.7	7.6	8.8	8.4	8.1
11/30	7.5	7.5	7.5	7.4	7.7	7.6	7.9	8.5	8.3
12/7	7.5	7.8	7.8	7.9	7.7	7.7	7.7	7.9	7.9
12/14	7.6	7.7	7.8	7.8	7.8	7.8	7.9	7.9	8.1
12/21	7.5	7.8	7.9	8.0	7.9	8.1	8.1	8.1	8.5
1/4/78	7.4	7.6	7.6	7.8	7.7	8.1	8.0	8.4	8.4
1/11	7.7	7.8	7.9	7.9	8.0	8.0	8.0	7.8	7.9
1/25	7.4	7.4	7.5	7.8	7.7	8.0	7.9	7.8	8.2
2/1	7.2	7.7	7.7	7.7	7.6	7.7	7.8	7.9	7.9
2/8	7.2	7.7	7.8	7.8	7.7	7.7	7.8	7.7	7.4
2/15	7.5	7.5	7.6	7.6	7.7	7.6	8.0	7.5	7.8
2/22	6.9	7.3	7.6	7.9	7.7	7.5	7.4	8.5	7.9
3/1	7.0	7.2	7.1	7.1	7.5	7.0	7.0	7.1	7.0
3/8	7.5	7.7	7.7	7.5	7.6	7.5	7.5	7.6	7.1
3/15	7.2	7.3	7.3	7.3	7.5	7.2	8.2	7.3	8.3
3/29	7.6	7.4	7.3	7.3	7.2	7.2	7.2	7.3	7.7
4/5	7.3	7.5	7.5	7.3	7.4	7.1	7.4	7.2	7.4
4/12	7.4	7.4	7.5	7.5	7.5	7.9	7.5	8.1	8.1
4/19	7.2	7.5	7.5	7.3	7.5	7.4	7.5	7.5	8.3
4/26	7.6	7.5	7.5	7.4	7.6	7.7	7.4	8.5	7.8
5/10/78	7.2	7.7	7.6	8.0	8.1	8.5	8.0	9.6	9.1
5/17	7.1	7.0	7.2	7.3	7.1	7.3	7.4	8.4	9.1

TABLE A-18. DISSOLVED OXYGEN DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	19.8	4.4	3.9	5.9	6.0	9.9	13.8	12.2	15.6
10/26	1.4	1.2	1.6	4.0	4.0	4.0	6.0	4.0	10.0
11/2	0.2	3.4	3.1	2.3	4.9	2.5	4.9	7.4	6.8
11/9	3.6	11.2	4.4	7.2	6.9	6.9	6.8	8.6	9.2
11/16	3.0	4.8	2.8	6.3	5.5	7.3	8.8	9.3	10.8
11/30	3.8	2.8	3.1	6.0	6.4	9.0	9.8	11.2	11.6
12/7	5.7	6.6	7.2	11.2	10.8	11.6	12.0	13.5	13.6
12/14	5.5	5.9	6.1	9.6	8.4	10.4	10.6	11.4	12.2
12/21	6.6	7.2	7.7	11.2	9.9	11.8	12.2	11.8	12.0
1/4/78	4.9	5.8	5.8	10.6	7.5	13.3	13.8	14.4	16.4
1/11	8.1	7.2	6.8	11.4	9.6	14.4	16.4	7.2	0.5
1/25	2.9	2.3	2.4	5.3	3.1	9.1	13.2	13.8	20.0
2/1	2.3	1.7	1.4	0.5	1.7	7.4	8.9	11.8	17.2
2/8	1.9	6.3	10.4	9.8	19.6	15.2	13.1	15.4	15.2
2/22	1.5	14.0	-	20.1	11.8	20.1	16.2	20.1	20.1
3/1	1.9	3.8	6.0	13.8	20.1	13.6	18.6	14.8	-
3/8	2.3	2.8	4.2	3.0	11.8	12.6	13.0	12.4	12.6
3/15	1.4	7.7	7.5	12.8	12.0	3.0	15.5	4.4	16.4
3/29	0.9	20.1	16.2	17.1	17.5	14.9	16.4	17.0	13.2
4/5	1.3	17.0	6.9	6.7	8.4	4.7	5.8	6.6	5.2
4/12	10.6	4.4	5.8	8.0	8.8	7.6	11.0	9.2	11.6
4/19	1.9	2.8	2.6	9.5	3.8	9.3	9.2	9.1	10.2
4/26	7.6	2.5	1.7	20.1	3.3	20.1	15.2	12.5	18.2
5/10	1.2	6.9	1.8	11.4	13.4	10.4	11.2	15.6	12.4
5/17	3.6	3.6	2.6	10.2	10.8	24.0	12.4	4.3	11.8

TABLE A-19. TEMPERATURE DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
10/19/77	19	15	15	16	16	16	17	17	16
10/26	63	63	63	63	63	63	63	63	62
11/2	15	13	14	12	13	13	13	13	13
11/9	12	11	11	10	11	11	11	10	9
11/16	15	14	14	14	13	13	14	13	13
11/30	10	9	7	7	6	6	6	5	5
12/7	5	2	2	2	1	0	1	1	2
12/14	9	10	7	7	6	6	6	6	6
12/21	4	2	2	2	2	2	2	1	1
1/4/78	5	3	3	2	2	2	1	2	1
1/11	4	3	2	1	1	1	1	1	1
2/1	5	1	1	0	1	0	0	0	0
2/8	4	0	0	0	0	0	0	0	0
2/15	4	2	0	0	0	0	0	0	0
2/22	5	1	8	1	15	1	0	1	1
3/1	6	3	4	2	2	2	2	3	7
3/8	5	5	3	3	2	2	2	2	2
3/15	11	9	9	9	9	9	9	9	10
3/29	17	17	17	17	17	17	17	17	17
4/5	19	18	18	18	18	18	18	18	19
4/12	17	18	16	16	15	15	15	14	14
4/19	15	14	14	14	14	14	14	14	14
4/26	21	20	19	21	21	21	21	31	21
5/10	19	19	19	19	19	19	19	19	19
5/17	23	25	24	25	24	24	23	23	23

TABLE A-20. FECAL COLIFORM DATA SAMPLED DURING OPERATIONAL CONDITION-1

Date	Infl $x10^5$	$1A_4$ $x10^4$	$1B_4$ $x10^4$	$2A_3$ $x10^3$	$2B_3$ $x10^3$	$3A_2$ $x10^2$	$3B_2$ $x10^2$	$4A_2$ $x10^2$	$4B_2$ $x10^2$
10/19/77	0.61	2.20	1.70	2.10	0.90	2.00	2.00	0.16	0.36
10/26	0.66	1.20	1.10	2.30	1.50	5.00	2.00	6.80	1.50
11/2	7.00	4.00	1.50	1.30	1.30	2.80	1.40	0.20	0.20
1/0	2.30	3.40	2.30	2.20	3.70	6.70	10.70	2.70	2.70
11/16	1.20	1.20	2.70	2.60	5.50	11.00	9.40	0.70	1.60
11/30	0.20	0.70	0.30	1.40	1.20	3.20	1.70	0.10	0.10
12/7	0.31	0.21	1.90	0.80	1.90	1.60	0.70	0.48	0.10
12/14	0.80	1.40	0.90	2.00	0.30	20.00	0.60	3.80	0.32
12/21	0.10	0.10	0.10	0.10	0.10	1.80	0.10	0.16	0.26
1/4/78	0.66	1.90	1.40	8.50	5.10	25.00	6.80	6.80	8.50
1/11	0.11	0.24	0.01	-	0.10	28.00	0.10	0.24	0.60
1/25	1.20	1.20	0.86	7.60	6.80	40.00	28.00	2.10	4.20
2/1	130.00	1.50	4.30	3.30	6.70	21.00	15.00	0.12	20.00
2/8	17.00	0.21	0.22	0.60	0.40	9.00	1.00	0.90	4.50
2/15	15.00	7.20	0.03	0.10	0.40	1.00	1.00	0.10	0.10
2/22	-	-	-	-	-	-	-	-	-
3/1	15.60	2.20	5.00	9.20	20.00	42.00	50.00	0.10	12.00
3/8	15.00	1.80	2.90	1.40	8.00	37.00	10.00	3.10	23.00
3/15	18.00	2.10	2.20	4.50	17.00	78.00	16.00	1.00	36.00
3/29	6.70	2.90	2.60	3.10	11.00	60.00	7.00	3.40	9.00
4/5	-	-	-	-	-	-	-	-	-
4/12	1.90	3.30	3.00	1.60	5.50	100.00	3.00	7.00	2.00
4/19	2.60	0.24	0.54	0.10	0.10	18.00	1.00	0.06	1.00
4/26	8.00	3.10	1.00	0.90	2.10	1.00	1.00	0.02	1.00
5/10	19.00	1.70	0.15	0.76	0.27	2.30	0.56	0.04	0.30
5/17	0.70	0.60	0.36	0.32	0.90	0.82	0.62	0.84	0.02

APPENDIX B

TABLE B-1. BOD_5 DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
5/24/78	38	44	31	58	73	26	54	15	40
6/28	36	56	52	54	80	33	34	37	34
7/5	54	22	27	17	14	10	10	10	19
7/12	94	43	51	35	30	41	24	32	37
7/24	-	-	-	-	-	-	-	-	-
7/26	63	101	96	51	46	64	46	48	47
8/2	67	78	84	32	22	31	33	21	37
8/9	32	53	44	64	57	51	34	47	38
8/16	31	53	67	40	39	26	-	23	20
8/23	50	40	49	40	38	37	44	40	52
8/30	83	39	52	42	40	25	35	22	37
9/6	48	38	13	15	21	10	24	21	35
9/13	30	27	16	11	16	11	20	16	20
9/27	24	16	17	15	9	10	17	6	20
10/4	285	94	142	122	123	97	116	121	131
10/11	14	24	32	29	29	89	35	25	26
10/18	8	8	8	10	11	11	17	15	19
10/25	20	12	8	6	13	13	20	14	23
11/1	8	41	49	46	50	57	60	50	53
11/8	68	40	47	43	41	41	53	35	44
11/15	102	32	30	32	32	36	38	32	38
11/29	10	10	10	10	10	10	10	10	10
12/6	13	10	10	10	10	10	10	10	10
12/13	37	10	14	10	10	10	10	10	10
12/20	10	10	10	10	10	10	10	10	10
1/3/79	61	30	37	13	19	16	19	28	26
1/10	136	50	46	27	28	25	14	22	18
1/17	59	59	61	34	35	19	26	19	22
1/24	148	54	63	27	24	23	22	14	19
1/31	112	55	60	50	22	29	17	28	16
2/28	50	55	68	16	10	17	10	11	17
3/7	98	61	80	39	34	20	19	37	38
3/14	56	40	66	45	85	53	76	46	26
3/21	60	48	60	47	87	22	39	24	41

(Continued)

TABLE B-1

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
3/28/79	128	84	76	50	52	31	49	26	48
4/4	93	33	76	74	65	36	25	26	37
4/11	76	74	96	48	54	76	29	64	57
4/18	420	42	87	53	137	37	30	36	33
4/25	140	77	100	47	30	40	28	35	37
5/9	34	99	19	45	11	67	37	59	55

TABLE B-2. COD DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
5/24/77	98.0	95.0	87.0	114.0	106.0	98.0	98.0	72.0	117.0
6/28	143.0	103.0	88.0	103.0	77.0	77.0	58.0	73.0	96.0
7/5	135.0	85.0	88.0	73.0	108.0	42.0	69.0	54.0	40.0
7/12	140.0	132.0	117.0	113.0	68.0	94.0	71.0	94.0	102.0
7/24	75.0	160.0	164.0	82.0	112.0	108.0	71.0	75.0	119.0
7/26	82.4	187.3	187.3	142.3	112.4	183.5	119.9	116.1	153.1
8/2	78.0	182.0	163.0	89.0	89.0	63.0	74.4	71.0	164.0
8/9	112.0	112.0	134.0	87.0	123.0	97.0	138.0	153.0	112.0
8/16	109.0	158.0	155.0	98.0	136.0	102.0	102.0	143.0	162.0
8/23	155.0	123.0	143.0	111.0	95.0	91.0	115.0	95.0	147.0
8/30	143.0	89.0	109.0	74.0	109.0	-	74.0	-	97.0
9/6	122.0	122.0	85.0	85.0	85.0	66.0	96.0	111.0	122.0
9/13	61.0	103.0	103.0	76.0	92.0	73.0	99.0	114.7	95.6
9/27	88.6	66.4	77.5	73.8	62.7	59.0	66.4	84.9	125.5
10/4	108.1	75.1	108.1	89.7	89.7	78.9	86.1	93.4	104.4
10/11	82.1	85.8	111.9	85.8	82.1	89.6	108.2	93.3	104.5
10/18	99.6	73.8	70.1	73.8	70.1	73.8	88.6	77.5	88.6
10/25	70.0	66.3	73.7	62.6	62.6	62.6	66.3	88.4	84.7
11/1	110.3	74.1	81.4	92.2	84.0	99.5	121.2	74.1	85.0
11/8	109.1	69.8	69.8	85.1	66.2	91.2	80.5	84.1	80.5
11/15	139.9	73.4	73.4	73.4	69.6	69.9	73.4	69.9	76.9
11/29	50.0	30.8	38.5	53.9	34.6	53.9	46.2	50.0	53.9
12/6	96.9	54.3	58.1	46.5	81.4	65.9	65.9	65.9	85.3
12/13	100.4	50.2	57.9	46.3	54.1	50.2	54.1	50.2	54.1
12/20	103.5	61.3	84.3	46.0	61.3	61.3	80.5	72.8	95.8
1/3/79	142.9	109.0	109.0	67.7	89.5	75.2	82.7	90.2	105.3
1/10	338.4	154.1	154.1	116.5	97.7	97.7	86.5	97.7	101.5
1/17	70.6	66.9	81.8	74.4	104.1	85.5	145.0	145.0	185.9
1/24	229.0	133.5	148.9	84.0	80.2	72.5	80.2	49.6	87.8
1/31	245.8	136.1	158.8	121.0	104.0	94.5	83.2	117.2	75.6
2/28	139.3	127.7	139.3	88.9	65.8	69.6	54.2	46.4	61.9
3/7	160.5	145.1	164.4	118.0	129.6	75.4	83.2	75.4	94.8
3/14	153.0	145.3	168.3	141.5	141.5	88.0	126.2	76.5	122.4
3/21	136.4	132.6	136.4	140.2	200.8	60.6	128.8	64.4	132.6
3/28	223.7	145.9	138.1	95.3	130.4	56.3	114.8	60.3	134.2
4/4	168.6	137.9	137.9	134.1	118.8	91.9	57.5	61.3	107.3
4/11	126.7	134.5	157.9	134.5	122.8	126.7	68.2	107.2	95.5
4/18	701.2	127.0	158.2	99.6	228.5	111.3	68.4	95.7	84.0
4/25	175.3	186.8	183.0	117.5	102.1	113.7	86.7	90.6	82.9
5/9	-	172.0	-	76.0	-	115.0	-	99.0	92.0

TABLE B-3. TOC DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	27	60	49	34	34	24	48	28	54
8/9	39	46	45	38	47	41	36	39	52
8/16	126	146	90	102	150	95	80	133	135
8/23	97	75	97	75	72	62	77	71	108
8/30	137	36	50	892	81	73	66	68	91
9/6	50	43	22	24	25	-	27	33	48
9/13	14	24	30	20	21	18	22	32	30
9/27	29	18	22	23	22	14	18	20	38
10/4	32	15	22	23	19	18	21	23	26
10/11	40	24	32	24	23	26	32	27	35
10/18	28	16	15	22	16	6	18	21	41
10/25	16	18	13	20	14	13	23	27	24
11/1	28	16	16	22	22	27	31	30	23
11/8	27	15	14	23	13	18	25	18	17
11/15	59	14	15	20	14	23	22	18	22
11/29	30	8	13	20	11	19	21	11	18
12/6	10	7	12	7	9	9	15	11	16
12/13	32	12	16	11	14	10	12	11	12
12/20	25	11	17	8	10	12	13	11	24
1/3/79	40	30	30	13	17	16	21	20	26
1/10	101	43	47	33	32	24	21	23	22
1/17	13	12	18	13	25	17	27	30	48
1/24	85	45	52	22	26	18	22	10	25
1/31	80	54	55	44	30	34	35	37	32
2/28	44	38	35	28	34	14	13	12	18
3/7	39	31	39	25	26	49	78	23	27
3/21	40	41	114	63	13	34	13	40	63
4/4	35	30	33	92	5	66	27	60	25
4/11	31	62	72	37	30	49	13	35	20
4/18	170	35	46	34	79	29	13	17	47
4/25	47	50	49	31	17	20	11	20	19
5/9	16	42	25	13	65	24	13	22	17

TABLE B-4. SUSPENDED SOLIDS DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
5/24/78	28	12	10	23	20	14	46	14	13
6/28	27	21	30	19	29	30	11	53	44
7/5	74	22	22	24	35	22	27	38	28
7/12	65	36	41	40	49	39	44	75	63
7/24	-	-	-	-	-	-	-	-	-
7/26	24	173	61	50	33	107	57	123	150
8/2	26	98	53	28	22	20	19	28	83
8/9	23	13	15	22	7	4	5	10	47
8/16	22	23	26	19	22	17	24	19	55
8/23	44	17	29	14	20	16	32	13	62
8/30	69	14	22	17	17	35	11	13	25
9/6	52	30	17	17	20	11	32	30	37
9/13	21	39	40	25	30	22	41	49	47
9/27	30	17	23	24	12	14	28	22	74
10/4	51	32	45	50	32	40	42	42	67
10/11	21	29	43	25	21	20	43	35	51
10/18	20	11	24	17	13	23	27	25	36
10/25	25	26	22	23	22	26	51	45	53
11/1	40	21	27	26	35	40	60	44	73
11/8	12	-	10	39	29	15	41	35	40
11/15	-	-	8	22	13	29	43	38	47
11/29	17	7	8	15	13	31	27	17	37
12/6	46	11	16	12	17	22	36	15	62
12/13	32	18	25	16	22	19	24	26	26
12/20	34	15	17	13	15	18	30	17	75
1/2/79	41	21	41	13	18	13	32	29	41
1/10	170	33	20	20	46	16	19	23	34
1/17	83	25	34	15	24	14	21	22	22
1/24	81	19	29	14	10	26	33	9	27
1/31	40	21	19	15	13	15	13	13	20
2/28	45	20	24	38	23	21	28	15	24
3/7	41	27	29	39	38	33	33	20	64
3/14	30	24	31	28	52	34	58	32	75
3/21	48	50	36	61	93	17	62	36	61
3/28	108	41	44	49	64	84	109	36	124
4/4	28	47	36	69	22	50	23	34	77
4/11	63	70	73	59	62	121	84	48	143
4/15	269	13	29	6	202	40	49	47	108
4/25	54	45	57	32	34	39	49	47	108
5/9	25	85	23	19	63	71	57	59	67

TABLE B-5. DISSOLVED SOLIDS DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	774	893	849	847	870	863	869	890	824
8/9	683	799	796	806	820	830	828	836	830
8/16	867	842	816	860	836	1115	828	860	859
8/23	786	836	831	859	872	883	883	986	416
8/30	813	846	829	892	858	886	1117	908	881
9/6	375	835	825	868	849	880	841	920	876
9/13	790	807	801	838	822	875	830	877	854
9/27	721	776	761	801	801	845	772	893	849
10/4	767	1720	814	867	867	879	858	911	894
10/11	733	737	744	785	771	827	785	845	812
10/18	797	789	780	794	798	819	807	880	814
10/25	738	778	846	812	798	832	816	875	826
11/1	764	775	774	783	793	833	777	836	783
11/8	739	781	77	800	81	794	846	818	770
11/15	977	748	748	769	749	803	768	831	787
11/29	717	729	724	770	749	782	776	827	802
12/6	744	745	759	768	759	786	773	845	784
12/13	764	752	738	745	766	743	764	815	787
12/20	770	790	784	812	789	820	800	860	810
1/3/79	795	845	834	880	874	897	882	957	912
1/10	772	778	786	847	843	913	905	960	943
1/17	567	707	662	769	996	847	861	962	785
1/14	631	728	726	588	676	666	724	639	778
1/31	635	696	705	697	711	781	732	702	783
2/28	737	693	699	650	637	636	819	635	708
3/7	803	721	716	660	692	658	634	863	685
3/14	824	811	776	776	725	712	696	937	732
3/21	829	847	797	842	792	744	707	764	950
3/28	843	792	827	778	750	794	700	685	731
4/4	758	802	818	779	744	731	706	750	815
4/11	510	799	796	796	783	771	739	807	715
4/18	862	809	818	803	845	770	746	736	712
4/24	827	815	813	799	794	791	759	817	817
5/9	782	714	734	713	739	702	688	680	630

TABLE B-6. SETTLEABLE SOLIDS DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	0.1	98.0	0.1	0.2	0.3	0.2	0.1	0.3	0.5
8/9	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
8/16	0.1	0.1	0.1	0.6	0.1	0.1	0.3	0.1	0.6
8/23	0.2	0.2	0.1	0.1	0.1	0.4	0.1	0.1	0.3
8/30	0.3	0.1	0.1	0.1	0.2	0.1	0.4	0.1	0.2
9/6	0.3	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.4
9/13	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3
9/27	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5
10/4	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2
10/11	0.4	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1
10/18	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5
10/25	0.5	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
11/1	0.5	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.5
11/15	3.5	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.3
11/29	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12/6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
12/13	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12/20	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.3
1/3/79	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1/17	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1/24	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1/31	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2/28	0.0	0.3	0.2	0.1	0.1	0.5	0.1	0.1	0.2
3/7	0.4	0.2	0.4	0.1	0.1	0.3	0.1	0.1	0.1
3/14	1.0	1.0	1.0	1.0	0.1	1.0	0.1	0.1	0.1
3/28	1.8	0.1	0.3	0.4	0.4	0.4	0.7	0.4	0.6
4/4	0.5	0.2	0.1	0.1	0.1	0.5	0.1	0.1	0.4
4/11	0.7	0.3	0.3	0.1	0.1	0.3	0.3	0.1	0.1
4/18	1.2	0.1	0.1	0.2	9.5	0.1	0.1	0.1	0.1
4/25	0.3	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2
5/9	1.0	0.1	0.1	0.1	0.1	1.0	0.1	0.1	1.0

TABLE B-7. VOLATILE SUSPENDED SOLIDS DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	16	44	35	7	8	13	14	11	69
8/9	16	20	11	4	6	12	3	4	33
8/16	18	8	19	15	18	11	7	13	44
8/23	34	12	23	9	14	8	17	7	20
8/30	54	14	22	18	15	25	10	9	18
9/6	40	23	13	11	15	7	20	20	31
9/13	14	33	33	19	22	14	27	36	31
9/27	22	12	17	16	7	8	17	15	53
10/4	34	20	32	27	18	18	23	28	45
10/11	19	28	42	25	20	18	30	30	39
10/18	18	10	23	13	11	17	21	23	25
10/25	15	17	14	14	10	13	27	31	30
11/1	40	20	27	26	35	39	51	50	47
11/8	9	1	5	16	6	8	14	2	11
11/15	-	-	2	10	3	15	11	9	13
11/29	15	6	9	12	10	17	15	13	1
12/6	14	6	10	7	9	8	14	6	17
12/13	18	1	11	2	8	6	7	9	7
12/20	33	15	17	13	15	11	16	11	27
1/3/79	33	16	33	7	15	8	23	11	25
1/10	145	30	17	17	17	13	14	19	26
1/17	58	18	27	11	18	8	15	6	13
1/24	69	15	24	10	7	13	19	4	18
1/31	31	18	16	13	10	11	8	10	13
2/28	32	16	20	19	18	11	17	8	14
3/7	26	10	15	15	25	15	19	9	25
3/14	21	18	20	20	37	19	47	8	48
3/21	27	42	25	44	72	7	54	11	34
3/28	93	44	62	58	63	34	56	20	72
4/4	32	54	29	59	20	31	22	16	30
4/11	42	60	61	58	45	68	21	30	40
4/18	213	13	26	5	145	29	14	29	23
4/25	41	40	58	28	21	28	18	34	32
5/9	25	83	22	16	24	61	20	56	37

TABLE B-8. AMMONIA NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	18.14	10.61	8.22	0.88	4.22	0.61	1.82	1.06	3.38
8/9	17.16	16.83	14.77	10.82	10.48	4.69	7.06	0.92	1.33
8/16	14.77	10.04	11.25	9.13	8.81	5.46	5.47	0.81	0.62
8/23	13.60	8.59	12.27	3.50	8.02	0.71	3.11	0.14	0.28
8/30	16.43	13.90	11.52	4.92	5.00	0.58	2.46	0.12	1.62
9/6	18.72	13.13	16.83	7.71	6.61	0.42	1.63	0.12	0.14
9/13	7.70	13.60	13.40	8.67	7.47	1.49	2.98	0.12	0.50
9/27	17.44	15.92	15.13	6.71	5.40	0.85	1.38	0.10	0.10
10/4	12.28	12.72	12.28	2.98	4.44	0.16	0.52	0.13	0.24
10/11	15.61	15.80	13.87	7.21	7.47	1.17	2.35	0.15	0.38
10/18	39.90	16.24	16.18	7.71	9.73	2.88	3.26	0.19	0.73
10/25	17.57	14.20	15.86	7.24	8.99	1.85	3.39	0.11	0.85
11/1	15.55	11.89	13.39	4.51	8.34	0.48	2.26	0.10	0.51
11/8	25.56	15.67	18.43	4.62	10.44	0.67	3.70	0.24	1.23
11/15	19.32	17.44	21.07	4.38	13.44	0.71	5.51	0.31	1.18
11/29	14.77	18.28	19.70	9.17	14.20	1.83	7.62	0.24	2.31
12/6	-	20.33	20.90	11.04	15.67	2.54	-	0.27	2.55
12/13	27.33	20.17	23.43	14.49	18.07	5.16	10.28	1.12	4.23
12/20	20.25	21.92	22.26	14.15	15.67	5.83	10.95	3.20	3.95
1/3/79	20.41	24.76	25.96	17.50	18.64	6.87	11.48	1.11	4.80
1/10	20.33	25.86	26.38	27.01	27.44	15.49	19.32	7.01	9.65
1/17	9.06	6.77	18.14	15.25	23.53	19.24	20.99	21.57	14.54
1/24	18.00	23.50	23.40	17.60	20.00	12.10	16.50	6.30	10.20
1/31	20.25	24.10	24.67	23.43	22.35	14.10	18.43	11.43	11.89
2/28	18.10	25.10	23.90	19.50	18.70	13.50	13.80	5.00	6.50
3/7	19.80	24.10	27.80	16.20	18.10	16.20	12.90	6.00	5.30
3/14	20.20	25.10	27.20	18.20	12.70	16.00	8.70	5.70	4.30
3/21	15.00	19.20	20.00	14.70	9.70	13.10	4.20	4.70	2.10
3/28	18.90	19.10	21.10	14.30	18.30	17.10	7.00	5.30	1.00
4/4	17.10	19.70	23.10	12.40	7.70	12.70	4.70	4.50	1.40
4/11	8.90	20.30	20.10	10.00	5.30	7.10	3.70	4.30	1.70
4/18	12.60	19.02	17.30	9.39	8.54	4.44	3.56	0.51	0.68
4/25	6.11	20.49	20.09	15.31	13.87	6.33	6.85	1.02	1.73
5/9	16.00	13.00	14.00	14.00	16.50	6.00	12.00	0.24	1.90

TABLE B-9. NITRATE AND NITRITE DATA SAMPLED DURING OPERATIONAL CONDITION 2.

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	0.1	0.1	0.1	0.5	0.5	0.4	0.3	0.2	0.1
8/9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1
8/16	0.2	0.4	0.4	0.4	1.0	0.5	1.0	0.4	0.4
8/23	0.1	0.2	0.3	1.0	2.0	1.5	0.2	0.4	0.1
8/30	0.1	0.1	0.2	0.4	1.2	0.9	0.1	0.1	0.1
9/6	0.1	0.4	0.3	0.6	0.8	0.9	1.0	0.4	0.5
9/13	0.1	0.2	0.1	0.3	0.9	0.8	0.6	0.1	0.2
9/27	0.2	4.7	10.0	2.1	4.7	2.3	3.0	0.1	0.1
10/4	0.1	0.1	0.4	1.8	1.6	0.4	1.0	0.1	0.1
10/11	0.1	0.3	0.7	1.9	1.5	1.7	1.3	0.1	0.5
10/18	0.1	0.5	0.3	2.5	1.6	2.4	1.4	0.7	0.8
10/25	2.6	1.8	2.8	2.1	0.6	1.8	1.3	0.2	.7
11/1	0.2	0.8	0.4	3.6	2.5	3.4	2.8	0.2	3.9
11/8	0.1	0.1	0.1	2.5	1.6	2.6	1.9	0.1	0.1
11/15	0.1	0.1	0.1	2.6	1.2	2.4	1.4	0.1	0.1
11/29	0.4	0.1	0.1	1.9	1.6	3.2	1.6	1.3	1.4
12/6	0.1	0.1	0.1	2.4	2.3	4.0	2.2	2.0	1.6
12/13	0.1	0.1	0.1	1.5	1.9	3.6	2.3	2.2	2.0
12/20	0.1	0.1	0.1	2.5	3.3	4.1	2.4	2.2	1.9
1/3/79	0.1	0.1	0.1	2.9	4.5	6.0	3.9	2.5	2.1
1/10	0.1	0.3	0.3	0.5	0.7	2.0	1.6	2.1	1.7
1/17	1.2	1.9	0.9	1.4	0.3	0.5	0.2	0.2	0.2
1/24	0.1	0.1	0.1	0.1	0.1	1.1	0.5	1.1	0.8
1/31	0.1	0.1	0.1	0.1	0.1	1.0	0.4	1.3	0.9
2/28	0.1	0.1	0.1	0.1	0.4	0.5	0.7	0.9	0.9
3/7	0.3	0.1	0.1	2.3	0.8	0.5	1.5	1.4	1.3
3/14	0.1	0.1	0.1	0.9	3.7	1.0	3.0	1.8	1.1
3/21	0.1	0.1	0.1	0.3	2.9	0.2	4.1	2.1	1.8
3/28	0.1	0.1	0.1	1.5	3.9	0.4	3.8	2.8	1.8
4/4	0.1	0.1	0.1	1.3	2.7	1.1	2.2	3.3	1.1
4/11	1.1	0.1	0.3	0.9	2.1	2.0	2.3	4.3	1.1
4/18	0.1	0.1	0.1	0.3	0.1	1.2	1.1	1.8	0.7
4/25	0.1	0.1	0.1	0.1	0.1	1.2	0.5	2.1	0.9
5/9	0.1	0.1	0.1	0.1	0.1	2.8	0.6	2.4	0.7

TABLE B-10. ORGANIC NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	5.97	12.49	13.07	6.72	6.88	4.86	5.93	5.48	6.65
8/9	0.43	4.75	2.82	5.87	9.03	6.63	5.60	5.18	6.12
8/16	5.04	8.69	7.74	4.87	6.07	1.82	5.39	4.90	6.65
8/23	7.00	6.60	8.21	4.90	5.30	3.76	5.73	5.12	7.33
9/6	4.99	6.10	2.75	3.02	3.42	3.47	4.38	4.83	8.00
9/13	0.60	3.68	4.68	2.51	2.70	2.69	6.39	4.73	6.16
9/27	-	-	0.45	1.10	-	-	0.56	0.78	-
10/4	21.38	19.87	17.98	8.20	8.85	3.98	5.29	3.88	5.60
10/11	4.92	3.95	6.33	4.99	4.95	5.93	7.41	4.62	7.27
10/18	3.40	2.46	2.82	3.59	2.57	3.02	5.04	5.51	6.27
10/25	9.04	13.40	3.67	3.32	4.40	4.02	5.32	5.65	5.99
11/1	8.95	5.11	6.81	5.79	5.86	6.78	7.94	6.15	5.49
11/8	5.19	1.43	2.23	3.82	2.77	5.43	5.40	4.52	4.17
11/15	5.78	0.10	1.00	3.45	1.00	4.19	2.99	3.72	4.49
11/29	4.49	1.32	1.58	2.48	2.49	3.32	3.31	3.46	4.19
12/6	-	4.37	15.20	6.17	0.85	8.16	-	3.24	4.70
12/13	5.77	0.37	9.81	9.81	1.34	1.34	2.32	2.08	2.37
12/20	4.05	2.59	2.94	1.95	2.03	3.07	2.50	1.37	4.71
1/3/79	6.65	4.27	2.86	2.63	3.26	3.80	3.70	4.94	4.99
1/10	11.03	3.48	2.85	0.77	0.44	4.01	1.51	3.97	4.35
1/17	2.26	2.78	1.84	2.07	2.22	2.07	5.34	5.44	11.46
1/24	10.20	6.45	7.31	2.41	4.92	4.16	5.01	2.73	3.02
1/31	3.95	6.80	4.53	3.47	4.15	7.20	2.87	6.57	3.76
2/28	12.40	7.80	9.40	8.20	6.30	5.60	4.80	4.80	6.10
3/7	9.40	7.30	6.10	7.40	8.60	4.50	5.10	6.10	7.00
3/14	4.10	3.60	3.00	6.80	6.70	2.30	6.10	3.50	6.70
3/21	10.20	11.70	12.90	14.60	16.90	7.20	9.60	6.30	9.70
3/28	15.20	8.10	11.00	5.30	7.70	3.10	3.60	4.80	8.60
4/4	10.30	9.50	8.40	6.90	6.50	5.40	3.20	3.90	6.50
4/11	5.80	7.65	10.62	9.31	8.67	9.22	4.30	4.34	5.34
4/18	20.17	10.80	9.71	5.97	14.12	5.06	3.15	4.73	4.73
5/9	5.51	12.73	9.39	8.96	6.73	7.64	3.41	6.75	5.64

TABLE B-11. KJELDAHL NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	23.1	23.1	21.3	7.6	11.1	5.5	7.7	6.5	10.0
8/9	17.6	21.6	17.6	16.7	19.5	11.3	12.7	6.1	7.4
8/16	19.8	18.7	18.0	14.0	14.9	7.3	10.9	5.7	7.3
8/23	20.6	15.6	20.5	8.4	13.3	4.5	8.8	5.3	7.6
8/30	17.7	18.7	11.1	12.4	6.1	7.3	4.7	9.0	7.9
9/6	23.7	18.5	0.9	0.4	0.9	0.9	0.9	0.8	0.9
9/27	18.5	0.9	0.4	0.9	0.9	0.9	0.5	0.8	0.9
10/4	21.4	19.9	18.2	8.2	8.8	3.0	5.3	3.9	5.6
10/11	20.5	19.7	20.2	12.2	12.4	7.1	9.8	4.8	7.6
10/18	43.3	18.7	19.0	11.3	12.3	6.5	8.3	5.7	7.0
10/25	21.2	18.5	19.5	10.6	13.4	5.9	8.7	5.8	6.9
11/1	24.5	17.0	20.2	10.3	14.2	7.2	10.2	6.2	6.0
11/8	25.1	18.0	20.9	8.8	13.9	4.9	8.5	4.0	5.7
11/29	19.3	19.6	21.3	11.6	16.7	5.1	10.7	3.7	6.5
12/6	12.3	24.7	39.1	17.2	16.5	10.7	1.0	3.5	7.2
12/13	24.3	24.5	24.2	16.1	17.7	8.9	13.4	4.5	8.7
12/20	24.3	23.5	25.2	16.1	17.7	8.9	13.4	4.6	8.7
1/3/79	27.1	29.0	28.8	20.1	21.9	10.7	15.2	6.0	9.8
1/10	31.4	29.3	29.2	27.8	26.9	19.5	20.9	10.0	14.0
1/17	11.3	9.5	19.0	17.3	25.7	21.3	26.3	27.0	26.0
1/24	28.2	29.9	31.7	20.0	24.9	16.3	21.4	9.1	13.2
1/31	24.2	30.9	29.2	26.9	26.5	21.3	21.3	18.0	15.6
2/28	139.3	32.9	33.3	27.7	25.0	19.1	18.6	10.3	12.6
3/7	29.2	31.7	33.9	23.6	26.7	20.7	18.0	12.1	12.3
3/14	24.3	28.7	30.2	25.0	19.4	18.3	14.8	9.2	11.0
3/21	25.2	30.9	32.9	28.1	26.6	20.3	13.8	11.0	11.8
3/28	34.1	29.2	32.1	19.6	16.0	20.2	10.6	10.0	9.6
4/4	27.4	29.2	31.5	19.3	14.2	18.1	7.9	8.4	7.9
4/11	14.6	27.9	30.7	19.3	13.0	16.3	8.0	8.6	7.0
4/18	51.2	25.8	25.6	15.8	37.6	9.4	6.5	5.7	5.3
4/25	26.3	31.3	29.8	21.3	27.0	11.4	10.0	5.7	6.1
5/9	21.5	25.7	23.4	22.0	23.2	13.6	15.4	6.0	7.5

TABLE B-12. TOTAL NITROGEN DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	23.20	23.20	21.38	8.10	11.59	5.87	8.05	6.74	10.03
8/9	17.59	21.57	17.69	16.78	19.61	11.42	12.76	6.30	7.55
8/16	20.01	19.13	19.39	14.40	15.89	7.78	11.86	6.11	7.68
8/23	20.70	15.75	20.79	9.40	15.32	5.98	9.04	5.66	7.71
8/30	23.12	17.71	18.90	11.47	13.62	6.95	8.16	4.77	9.96
9/6	23.81	19.63	19.88	11.33	10.83	4.79	7.01	5.35	8.64
9/13	18.30	17.28	18.18	11.38	11.07	4.98	9.97	4.95	6.86
9/27	-	-	-	-	11.10	-	-	-	-
10/4	21.38	19.97	18.46	10.00	10.45	4.39	6.29	3.88	6.61
10/11	20.53	20.05	20.90	14.11	13.93	8.80	11.06	4.77	8.15
10/18	43.40	19.20	19.30	13.80	13.90	8.90	9.70	6.40	7.80
10/25	23.80	20.33	22.33	12.67	14.00	7.68	10.02	5.97	7.56
11/1	24.70	17.80	20.60	13.90	16.70	10.60	13.00	6.40	9.90
11/8	30.85	17.20	20.66	10.94	14.81	8.70	11.00	5.76	12.60
11/15	45.10	18.10	21.10	11.43	15.15	7.30	9.90	4.13	6.67
11/29	19.66	19.60	21.28	13.55	18.29	8.34	12.36	6.00	7.90
12/6	12.40	24.70	39.10	19.60	18.80	14.70	2.22	5.51	8.85
12/13	33.10	23.80	24.30	25.80	21.30	10.10	15.90	5.40	8.60
12/20	24.30	24.50	25.20	18.60	21.00	13.00	15.85	6.76	10.56
1/3/79	27.06	29.04	28.92	23.03	26.39	16.76	19.08	8.55	11.89
1/10	31.96	29.94	29.53	28.28	27.58	21.49	22.43	13.08	15.70
1/17	12.52	11.45	20.88	18.72	26.05	21.81	26.53	27.21	26.20
1/24	28.30	29.95	31.81	20.01	24.92	17.36	21.91	10.23	14.02
1/31	24.30	31.00	29.20	26.20	26.50	22.30	21.70	19.30	16.55
2/28	30.60	33.00	33.30	27.70	25.40	19.60	19.30	11.20	13.50
3/7	29.50	31.80	34.00	25.90	27.50	21.20	19.50	23.00	13.60
3/14	24.40	28.80	30.30	25.90	24.10	19.30	17.80	11.00	12.10
3/21	25.30	31.00	33.00	28.40	29.50	20.50	17.90	13.10	13.60
3/28	43.20	29.30	32.30	21.10	19.90	20.60	14.40	12.90	11.40
4/4	27.50	29.30	31.60	20.70	16.90	19.20	10.10	11.70	9.00
4/11	15.82	28.05	31.02	20.21	16.07	18.32	10.30	12.94	8.14
4/18	51/30	25.80	25.60	16.10	37.70	10.60	7.50	7.50	6.00
4/25	26.38	31.39	29.90	21.38	28.09	12.59	10.50	7.85	19.00
5/9	21.61	25.83	23.49	23.06	23.33	16.44	16.01	9.39	8.24

TABLE B-13. TOTAL PHOSPHORUS DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	9.0	10.7	8.9	3.7	3.5	5.7	3.7	3.1	1.6
8/9	8.7	6.3	10.6	11.7	9.8	4.6	7.1	1.0	3.3
8/16	5.9	9.6	10.4	9.6	9.8	7.0	7.0	3.1	2.5
8/23	7.8	33.5	13.0	6.9	12.0	3.5	8.5	8.4	1.3
8/30	5.7	18.5	15.2	9.0	9.7	4.5	6.4	1.5	2.8
9/6	4.1	8.5	9.0	8.9	8.8	4.5	4.4	1.3	2.1
9/13	4.2	7.1	7.5	8.6	8.4	7.6	6.4	1.7	2.7
9/27	5.9	6.5	6.6	6.9	7.6	7.6	5.2	2.0	2.9
10/4	3.2	5.7	5.2	6.3	6.6	4.4	3.2	1.8	1.9
10/11	2.1	3.2	3.2	4.2	4.1	4.0	3.3	1.0	1.8
10/18	12.2	4.5	3.8	4.2	4.3	6.5	3.9	2.3	2.5
10/25	3.3	3.2	3.6	3.5	3.8	4.8	3.9	2.3	2.5
11/1	1.3	3.1	4.0	2.3	2.9	3.2	2.5	1.2	1.5
11/8	6.3	0.1	6.0	3.5	4.9	4.2	3.8	1.8	2.9
11/15	3.9	5.8	9.0	3.5	5.4	3.9	3.0	2.0	3.4
11/29	7.0	5.8	6.3	3.5	5.8	3.3	3.7	3.6	3.6
12/6	11.3	8.3	8.4	4.3	6.7	-	3.3	3.4	-
12/13	17.5	13.0	12.7	10.0	9.5	3.3	4.9	3.6	3.3
12/20	13.3	14.7	14.7	16.0	12.9	4.2	4.7	4.2	3.8
1/3/79	14.1	17.0	17.0	13.2	13.6	5.8	6.1	4.8	4.3
1/10	9.8	12.8	13.1	12.8	13.6	8.9	9.8	6.2	6.2
1/17	7.8	12.0	-	11.8	14.3	9.7	10.6	6.3	5.5
1/24	9.2	13.5	16.0	9.4	13.0	7.9	9.0	4.8	6.0
1/31	12.0	14.0	14.5	14.0	14.5	9.3	12.0	7.8	6.7
2/28	15.0	16.5	18.0	15.0	15.0	9.5	12.5	7.1	6.8
3/7	17.0	16.0	16.5	13.5	14.0	12.0	9.8	7.1	6.3
3/14	13.0	20.0	16.5	13.5	13.5	12.5	9.8	7.6	6.5
3/21	13.0	15.0	16.5	15.0	14.5	13.0	10.0	8.4	6.5
3/28	17.5	14.0	15.5	11.0	12.0	12.0	9.5	8.7	6.1
4/4	11.5	13.5	15.0	12.0	13.0	12.0	12.5	8.7	6.9
4/11	5.5	13.0	14.5	12.0	12.5	9.7	12.0	8.4	8.1
4/18	27.0	13.0	14.5	14.0	20.0	11.0	12.5	11.0	6.8
4/25	13.0	13.5	15.0	15.0	17.5	13.0	15.0	9.6	8.2
5/9	13.0	9.9	12.0	13.0	14.5	11.5	14.0	7.3	5.2

TABLE B-14. ORTHO PHOSPHATE DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	7.97	8.96	6.76	2.64	2.31	4.29	2.91	2.20	0.51
8/9	4.62	7.97	8.69	8.19	8.52	2.47	6.71	2.03	1.32
8/16	5.50	8.36	9.02	8.80	8.19	4.95	6.65	1.76	0.86
8/23	5.10	9.35	22.00	7.00	8.50	3.50	3.80	1.10	0.63
8/30	4.35	10.05	9.15	8.10	8.55	4.05	5.55	0.92	2.05
9/6	1.50	4.75	4.95	5.30	4.15	2.55	2.10	0.54	0.98
9/13	3.35	6.60	6.35	7.95	7.95	6.65	5.70	1.25	1.10
9/27	2.54	4.52	4.52	5.68	6.52	6.40	4.20	1.09	1.58
10/4	1.31	4.96	4.39	6.06	6.71	3.73	2.34	0.85	0.88
10/11	1.40	2.65	2.38	3.79	3.61	3.72	2.96	1.37	1.31
10/18	9.97	4.21	3.44	3.85	3.90	4.88	3.67	2.68	2.30
10/25	3.07	2.80	3.39	3.17	3.59	4.26	3.69	1.82	2.03
11/1	0.98	2.92	3.57	1.94	2.34	2.82	2.14	0.38	1.38
11/8	3.93	4.81	5.79	2.85	4.30	3.43	3.24	0.97	2.24
11/15	2.85	5.25	6.80	2.69	5.84	3.03	3.12	1.34	2.48
11/29	-	5.47	6.20	2.89	5.79	2.45	3.16	2.94	2.89
12/6	10.19	6.69	7.50	4.30	6.67	-	2.49	3.44	-
12/13	21.17	8.72	8.72	7.18	7.06	2.74	4.76	4.20	3.58
12/20	13.14	14.53	14.53	5.86	7.85	4.10	4.64	4.20	3.58
1/3/79	14.07	17.34	16.87	13.14	12.67	5.76	6.10	4.69	4.32
1/10	8.14	9.49	10.59	11.41	10.86	7.33	8.14	5.38	4.95
1/17	6.05	9.43	8.86	9.43	9.71	7.45	8.30	5.33	4.74
1/24	8.25	11.50	13.00	8.20	9.70	6.75	7.75	4.45	5.10
1/31	8.15	9.65	11.50	9.55	9.95	7.10	6.80	6.80	5.40
2/28	12.50	12.00	14.50	9.95	10.10	8.30	8.65	5.91	5.41
3/7	14.00	13.50	13.00	11.00	11.50	8.90	9.30	6.80	5.40
3/14	9.95	12.50	14.00	10.10	9.95	9.80	8.20	6.90	5.60
3/21	8.90	12.00	12.00	11.00	9.75	10.10	8.15	7.20	4.95
3/28	12.50	9.85	10.50	8.25	8.95	8.90	7.80	7.00	4.60
4/4	7.80	9.50	11.00	8.10	8.80	8.30	8.80	6.80	5.50
4/11	3.40	7.90	9.60	8.10	8.50	7.40	8.70	6.50	4.90
4/18	18.00	9.80	11.00	18.50	15.50	10.00	10.20	10.10	5.75
4/25	10.50	10.50	11.00	12.50	9.75	7.95	8.10	8.10	6.75
5/9	10.50	8.40	8.40	10.30	11.00	12.00	9.30	6.40	4.50

TABLE B-15. TOTAL ALKALINITY DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	206	106	148	136	148	172	166	169	99
8/9	189	219	214	203	209	181	206	172	154
8/16	190	199	204	203	200	189	180	183	150
8/23	218	185	210	152	185	146	158	170	120
8/30	194	208	196	177	168	150	159	165	153
9/6	194	194	207	178	176	154	151	151	156
9/13	210	198	207	189	183	171	162	159	156
9/27	203	203	200	180	183	169	155	151	158
10/4	181	194	191	158	171	161	155	171	168
10/11	175	172	166	148	157	139	145	148	151
10/18	291	184	172	144	158	138	144	144	144
10/25	204	180	195	133	159	133	146	143	146
11/8	510	192	203	133	160	133	142	124	136
11/15	200	194	214	136	176	136	151	151	147
11/29	184	132	134	100	95	95	88	120	108
12/6	208	201	204	149	171	111	142	129	124
12/13	227	196	198	153	162	111	130	124	10
12/20	192	119	125	56	70	81	77	114	96
1/3/79	198	212	210	172	170	126	132	132	130
1/10	217	207	201	212	210	176	184	157	159
1/17	188	194	184	199	212	178	194	161	151
1/24	179	191	193	151	171	137	160	107	143
1/31	207	202	202	193	191	169	176	157	149
2/28	208	212	199	186	175	157	144	136	131
3/7	200	207	220	164	182	162	131	137	129
3/14	213	228	240	190	158	171	122	130	122
3/21	193	219	234	196	170	176	103	122	101
3/28	220	198	218	138	126	136	109	114	106
4/4	168	186	203	141	116	138	114	106	91
4/11	153	214	214	161	133	141	119	110	113
4/18	289	203	206	171	152	132	144	109	130
4/25	232	229	224	222	201	121	146	132	124

TABLE B-16. "P" ALKALINITY DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2	0	0	0	0	1	0	0.1	1	1
8/9	0	0	0	0	0	0	0	0	7
8/16	0	0	0	0	0	0	0	0	9
8/23	9	0	0	0	0	5	4	47	58
8/30	0	0	0	0	0	7	2	38	9
9/6	0	2	0	0	0	11	20	58	25
9/13	0	0	0	0	0	0	2	38	20
9/27	0	0	0	8	0	0	1	1	3
10/4	1	1	8	1	1	4	20	58	3
10/11	0	0	0	0	0	18	11	2	1
10/18	0	0	0	0	0	0	7	22	33
10/25	0	0	0	0	0	0	0	22	9
11/1	0	0	0	0	0	0	0	2	16
11/8	1	1	0	0	0	0	0	33	4
11/15	0	0	0	0	0	0	0	38	0
11/29	0	0	0	0	0	0	0	0	0
12/6	0	0	0	0	0	0	0	0	0
12/13	0	0	0	0	0	0	0	0	0
12/20	0	0	0	0	0	0	0	0	0
1/3/79	0	0	0	0	0	0	0	0	0
1/10	0	0	0	0	0	0	0	0	0
1/17	0	0	0	0	0	0	0	0	0
1/24	0	0	0	0	0	0	0	0	0
1/31	0	0	0	0	0	0	0	0	0
2/28	0	0	0	0	0	0	0	0	0
3/7	0	0	0	0	0	0	0	0	0
3/14	0	0	0	0	0	0	0	0	0
3/21	0	0	0	0	0	0	0	0	0
3/28	9	0	0	0	0	0	0	0	0
4/4	0	0	0	0	0	0	0	0	0
4/11	0	0	0	0	0	0	0	0	0
4/18	0	0	0	0	0	0	0	0	0
4/25	0	0	0	0	0	0	0	0	0
5/9	0	0	0	-	0	0	0	-	0

TABLE B-17. pH DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
5/24	7.5	7.9	7.7	7.5	7.6	7.7	8.1	7.7	8.1
6/28	7.0	7.1	7.1	7.1	7.2	7.2	7.3	7.2	7.9
7/5	7.2	7.6	7.6	7.7	7.6	7.9	7.9	7.4	9.4
7/26	7.4	8.7	8.1	8.2	7.9	8.4	8.2	-	9.6
8/9	7.2	7.1	7.9	7.4	7.2	7.4	7.2	7.6	8.6
8/16	7.1	7.2	7.2	7.3	7.4	7.4	7.4	7.7	8.8
8/23	7.1	7.8	7.7	8.1	7.9	8.4	8.4	9.2	9.5
8/30	7.2	7.4	7.9	8.2	8.3	8.7	8.5	9.5	8.8
9/6	7.4	8.6	7.9	8.3	8.6	8.9	9.1	9.8	9.5
9/13	7.4	8.0	8.1	8.0	8.0	8.2	8.6	9.7	9.2
9/27	7.2	7.9	8.0	8.5	8.0	8.5	9.0	9.5	9.6
10/4	7.2	7.5	7.6	8.0	7.9	8.9	9.1	9.6	9.6
10/11	7.1	7.9	7.9	8.1	8.2	8.7	8.8	9.3	9.2
10/25	7.2	7.6	7.5	7.4	7.7	7.5	7.9	8.8	8.5
11/1	7.1	7.7	7.5	7.5	7.7	7.8	8.3	9.6	9.1
11/8	7.1	7.3	7.2	10.0	7.4	7.8	7.9	9.3	8.6
11/15	7.1	7.5	7.4	7.4	7.7	7.4	7.6	9.1	8.1
11/29	7.2	7.4	7.4	7.4	7.5	7.5	7.7	7.9	8.0
12/6	7.2	7.4	7.4	7.4	7.5	7.4	7.6	8.1	7.8
12/13	7.0	7.2	7.3	7.3	7.3	7.5	7.7	8.3	6.9
12/20	6.9	6.8	7.0	6.6	6.8	6.7	6.9	7.2	6.8
1/3/79	7.0	7.1	7.1	7.1	7.1	6.9	-	7.1	7.0
1/10	6.9	6.9	6.9	7.1	7.1	7.0	7.1	7.0	7.1
1/17	6.9	7.0	7.0	7.2	7.2	7.3	4.2	7.9	7.4
1/24	6.7	7.0	6.9	7.0	7.0	7.0	7.0	7.2	6.8
1/31	6.8	6.9	6.9	7.0	7.1	7.1	7.2	7.0	7.1
2/28	6.7	6.7	6.5	6.7	6.7	6.7	6.7	6.8	6.9
3/7	6.5	6.7	6.6	6.9	7.2	6.9	7.2	7.0	7.1
3/14	6.9	6.9	6.9	7.3	7.1	7.1	8.1	7.4	7.5
3/21	6.6	6.7	6.9	6.8	6.7	6.9	6.9	6.8	6.7
3/28	6.5	6.8	6.8	6.6	6.7	6.7	6.6	6.7	6.6
4/4	5.8	7.0	7.0	6.9	6.8	6.8	6.8	6.7	6.8
4/11	6.9	7.7	8.0	7.6	7.6	7.8	7.4	8.0	7.4
4/18	6.2	6.9	6.9	6.9	6.6	6.9	7.0	7.0	7.2
4/25	6.9	6.9	6.8	6.9	7.0	7.0	7.1	7.1	7.1
5/9	7.0	7.3	7.1	7.2	7.3	7.0	7.3	7.3	7.4

TABLE B-18. DISSOLVED OXYGEN DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date	Infl	1A	1B	2A	2B	3A	3B	4A	4B
8/2/78	2.9	3.1	4.9	7.2	5.0	6.2	6.6	25.0	25.0
8/9	1.8	6.5	6.0	8.4	10.5	14.2	10.2	12.6	17.2
8/16	26.5	16.4	16.0	5.0	15.0	14.2	13.4	18.0	19.0
8/23	1.4	8.1	12.2	7.2	7.7	6.1	9.4	8.2	9.0
8/30	1.2	2.0	11.4	8.3	12.0	9.0	9.6	10.2	4.5
9/6	1.0	12.0	8.5	10.2	17.0	9.8	19.2	17.4	17.6
9/13	21.5	28.5	13.8	7.6	10.2	8.0	12.0	14.4	12.2
9/27	0.6	6.4	11.0	17.4	8.2	6.8	15.2	11.8	18.4
10/4	2.9	5.8	8.4	9.0	8.5	11.8	10.6	10.4	10.6
10/11	2.5	11.2	14.6	14.6	14.0	14.2	17.0	15.4	14.8
10/18	2.2	9.9	7.4	8.3	9.5	9.3	12.2	10.6	11.2
10/25	3.5	8.1	6.7	7.3	8.2	9.2	10.8	11.2	11.0
11/1	2.1	12.4	11.4	10.8	13.0	14.8	16.4	17.0	14.0
11/8	1.7	9.4	5.8	10.8	9.6	12.0	12.8	13.6	12.6
11/15	1.3	3.0	2.5	6.3	6.2	7.8	8.4	9.0	9.5
11/29	1.5	4.1	4.2	8.8	8.1	10.8	10.5	11.4	11.8
12/6	1.9	4.6	6.6	9.7	10.6	12.6	12.8	13.2	13.9
12/13	1.9	4.5	-	5.0	6.4	9.8	11.6	13.2	11.8
12/20	0.3	5.2	4.8	5.4	6.0	7.1	7.3	9.8	9.9
1/3/79	2.7	7.0	2.0	9.5	9.8	15.0	15.9	17.0	16.5
1/10	0.6	0.7	0.6	1.0	1.2	11.0	7.0	15.2	12.0
1/17	0.0	0.8	0.8	1.7	1.7	9.5	4.2	18.4	9.3
1/24	0.3	0.7	0.7	1.0	3.9	12.5	8.5	19.5	11.6
1/31	0.4	0.6	0.6	10.0	1.3	9.9	8.2	18.2	10.2
2/28	0.6	0.3	0.3	1.5	5.3	11.2	11.9	11.3	10.5
3/7	0.1	0.1	0.2	12.2	14.7	4.3	11.5	13.3	12.1
3/14	0.8	0.3	0.3	8.7	6.3	9.2	12.0	8.8	9.7
3/21	0.3	2.2	0.4	13.5	12.4	1.9	15.7	6.9	16.0
3/28	-	14.5	7.2	7.2	9.0	5.9	9.3	7.8	9.9
4/4	0.3	1.5	2.2	6.7	6.9	7.4	4.9	5.0	6.7
4/11	0.3	6.2	9.1	7.2	7.6	8.4	7.2	9.2	6.5
4/18	0.0	0.2	0.2	1.2	1.3	3.2	3.8	4.7	10.1
4/25	0.1	0.2	0.2	2.3	1.7	7.2	6.7	7.7	8.0
5/9	0.6	7.8	0.8	1.6	2.6	5.8	-	5.3	7.0

TABLE B-19. TEMPERATURE DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date									
8/2/78	25.5	25.0	25.0	26.0	25.5	26.0	25.5	25.0	25.0
8/9	26.0	26.5	26.5	27.5	28.0	28.5	28.0	28.5	29.0
8/16	26.5	29.0	29.0	29.0	29.0	29.0	28.5	28.5	28.5
8/23	27.0	28.0	27.5	28.0	27.5	28.0	27.5	28.0	28.0
8/30	26.0	26.0	26.0	26.5	26.0	26.0	26.0	25.5	25.0
9/6	27.5	29.5	29.0	31.5	31.0	30.5	21.0	29.5	29.0
9/13	27.5	28.5	28.5	28.0	28.0	27.5	27.5	27.0	27.0
9/27	25.5	24.0	24.5	25.5	25.0	25.0	26.0	24.5	25.0
10/4	24.0	21.0	21.0	20.0	20.0	21.0	20.5	20.5	20.0
10/11	24.0	23.0	23.0	22.0	22.0	22.0	22.0	22.0	22.0
10/18	22.0	17.0	17.5	16.0	16.0	16.0	16.0	16.0	15.5
10/25	21.5	17.5	17.5	17.5	17.5	17.5	18.0	17.5	18.5
11/8	20.5	14.5	15.0	13.5	13.5	13.5	13.5	14.0	13.5
11/15	17.5	9.0	9.0	8.0	8.0	8.0	8.0	9.0	8.0
11/29	17.0	-	9.0	-	8.0	8.0	8.0	8.0	8.0
12/6	15.5	5.0	5.0	3.5	3.5	4.0	3.5	5.0	5.0
12/13	14.5	-	-	4.5	4.0	4.0	3.5	4.0	3.0
12/20	14.0	9.0	9.0	9.0	9.0	8.0	8.0	9.0	9.0
1/3/79	14.0	3.0	3.0	1.0	1.0	1.0	-	1.0	1.0
1/10	13.5	-	3.5	1.5	1.5	1.0	1.0	1.0	2.0
1/17	11.5	2.5	3.0	1.0	1.5	1.0	-	2.0	1.5
1/24	12.0	2.7	2.8	1.5	1.3	1.0	1.0	1.0	1.0
1/31	10.5	10.5	2.5	3.0	-	10.0	10.0	10.0	10.0
2/28	12.0	9.0	9.0	8.0	8.0	7.0	-	8.0	8.0
3/7	12.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
3/14	14.0	12.5	12.5	12.0	12.0	12.0	12.0	12.0	12.0
3/21	15.0	13.5	13.5	13.5	13.5	13.5	13.5	13.0	13.0
3/28	-	10.4	14.5	14.5	14.5	14.0	14.0	14.0	14.0
4/4	13.0	9.5	9.5	9.0	9.0	9.0	9.0	9.0	9.0
4/11	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
4/18	17.0	18.5	18.5	19.0	19.0	19.0	19.0	19.0	19.0
4/25	19.5	21.0	21.0	21.0	1.0	21.0	6.7	20.0	20.0
5/9	19.0	20.5	20.5	21.0	21.0	21.0	-	21.0	21.0

TABLE B-20. FECAL COLIFORM DATA SAMPLED DURING OPERATIONAL CONDITION-2

Date									
8/2/78	0.11	70.00	3.00	0.10	0.30	0.10	0.10	1.80	0.70
8/9	0.20	17.00	23.00	0.25	1.20	0.20	0.10	0.40	1.30
8/16	-	-	-	-	-	-	-	-	-
8/23	5.20	2.70	2.00	0.45	0.87	0.14	0.30	0.20	0.30
8/30	7.50	2.80	2.20	0.57	0.88	0.14	0.20	1.10	0.80
9/6	5.90	0.40	6.50	0.21	0.15	0.10	0.23	0.20	1.20
9/13	5.90	1.10	0.30	0.20	0.12	0.16	0.16	0.10	1.10
9/27	2.70	0.40	0.42	0.12	0.06	0.46	0.00	0.76	0.74
10/4	5.40	8.70	6.80	8.50	2.40	0.51	2.00	0.20	1.30
10/11	2.40	7.00	8.40	5.40	10.00	2.80	6.60	2.70	15.00
10/18	0.70	0.30	1.00	1.20	0.90	0.40	0.60	1.40	1.00
10/25	1.00	1.00	0.60	0.20	0.60	0.20	0.30	15.00	1.40
11/1	5.00	1.20	3.10	0.80	1.90	0.90	0.70	0.10	0.10
11/8	2.20	0.60	2.20	0.60	4.20	1.10	2.30	0.10	1.30
11/15	1.50	0.40	1.40	0.30	1.40	0.20	0.10	0.20	1.20
11/29	2.10	0.60	2.10	0.40	1.90	0.30	1.30	0.20	1.80
12/6	3.50	0.20	4.20	1.70	3.80	3.00	1.00	1.00	30.00
12/13	3.90	0.17	1.20	0.10	0.90	0.10	0.80	0.10	0.10
12/20	7.00	0.07	0.30	0.01	0.02	0.01	0.02	0.04	1.00
1/3/79	3.80	2.50	0.90	2.60	1.80	2.80	1.80	11.00	7.00
1/10	6.80	10.00	12.00	15.00	12.00	10.00	12.00	20.00	44.00
1/17	4.80	150.00	160.00	700.00	870.00	3.20	9.90	0.30	7.00
1/24	0.80	10.00	46.00	10.00	10.00	0.60	1.60	0.10	0.20
1/31	5.00	20.00	16.00	90.00	37.00	23.00	46.00	55.00	22.00
2/28	9.00	20.00	16.00	2.00	3.00	1.60	1.00	0.70	0.20
3/7	85.00	10.00	5.00	0.70	1.20	1.00	0.60	0.10	0.30
3/14	8.40	20.00	16.00	3.30	3.90	0.60	1.90	0.50	2.30
3/21	3.20	10.00	9.00	5.60	0.70	1.00	-	-	1.40
3/28	-	-	-	-	-	-	-	-	-
4/4	9.20	6.00	1.00	11.00	0.10	10.00	0.10	5.40	0.10
4/11	5.60	5.00	0.50	4.20	0.25	3.50	0.14	5.80	0.14
4/18	16.00	19.00	4.00	11.00	0.24	1.90	0.21	31.00	47.00
4/25	-	-	-	-	-	-	-	-	-
5/9	-	-	-	-	-	-	-	-	-

APPENDIX C

TABLE C-1. STATISTICAL TABULATIONS FOR ANALYSIS OF REGULATORY PARAMETER, BOD_5 SAMPLED DURING CONDITION-1 AND -2 EXPERIMENTAL PHASES

		Cell 1	Cell 2	Cell 3	Cell 4
	$\bar{d}$	4.52	5.50	3.20	1.53
BOD_5	sd	7.11	14.90	14.10	9.58
Run Condition 1	N	24.00	25.00	23.00	22.00
	t	3.11	1.85	1.09	0.75
	$\bar{d}$	-4.35	0.19	2.02	-3.44
BOD_5	sd	20.70	13.30	16.90	9.05
Run Condition 2	N	33.00	32.00	32.00	33.00
	t	-1.21	0.08	0.68	-2.18

TABLE C-2. STATISTICAL TABULATIONS FOR ANALYSIS OF REGULATORY PARAMETER, SUSPENDED SOLIDS, SAMPLED DURING CONDITION-1 AND -2 EXPERIMENTAL PHASES

		Cell 1	Cell 2	Cell 3	Cell 4
	$\bar{d}$	0.75	4.80	7.50	10.90
Suspended Solids	sd	7.81	19.60	20.00	23.40
Run Condition 1	N	24.00	25.00	24.00	25.00
	t	0.47	1.22	1.84	2.33
	$\bar{d}$	-0.22	-1.48	-7.94	-28.20
	sd	16.60	15.90	16.30	25.20
	N	32.00	33.00	34.00	34.00
	t	-0.07	-0.53	-2.84	6.53

TABLE C-3. STATISTICAL TABULATIONS FOR ANALYSIS OF NUTRIENT PARAMETER AMMONIA, SAMPLED DURING CONDITION-1 AND -2 EXPERIMENTAL PHASES

		Cell 1	Cell 2	Cell 3	Cell 4
	$\bar{d}$	-0.30	-3.17	-2.29	-1.71
NH_3	sd	2.17	3.69	1.99	1.86
Cond. 1	N	26.00	26.00	25.00	26.00
	t	-0.03	-4.38	-5.75	-4.69
	$\bar{d}$	-1.07	-1.15	0.73	0.29
NH_3	sd	2.57	3.39	4.18	2.22
Cond. 2	N	34.00	34.00	33.00	34.00
	t	-2.43	-1.98	-1.00	-0.76

TABLE C-4. STATISTICAL TABULATIONS FOR ANALYSIS OF NUTRIENT PARAMETER NITRATES-NITRITES, SAMPLED DURING CONDITION-1 AND -2 EXPERIMENTAL PHASES

		Cell 1	Cell 2	Cell 3	Cell 4
	$\bar{d}$	-0.07	0.83	1.61	1.39
$NO_3 + NO_2$	sd	0.51	1.12	3.43	2.84
Cond. 1	N	26.00	26.00	26.00	26.00
	t	-0.70	3.78	2.39	2.50
$NO_3 + NO_2$	$\bar{d}$	-0.01	-0.29	0.16	0.22
Condition 2	sd	0.28	1.16	1.34	1.06
	N	33.00	34.00	34.00	34.00
	t	-0.21	-1.46	0.70	1.21

TABLE C-5. STATISTICAL TABULATIONS FOR ANALYSIS OF NUTRIENT PARAMETER ORGANIC NITROGEN, SAMPLED DURING CONDITION-1 AND -2 EXPERIMENTAL PHASES

	-	Cell 1	Cell 2	Cell 3	Cell 4
	$\bar{d}$	-0.29	0.64	0.53	-0.11
Organic N	sd	1.84	0.88	2.99	1.94
Cond. 1	N	26.00	25.00	24.00	26.00
	t	-0.80	3.64	0.87	0.29
	$\bar{d}$	-0.16	-0.77	-0.12	-0.31
Org. N	sd	3.14	4.72	2.27	1.77
Cond. 2	N	32.00	33.00	32.00	33.00
	t	-0.29	-0.94	-0.30	-4.25

TABLE C-6. STATISTICAL TABULATIONS FOR ANALYSIS OF NUTRIENT PARAMETER TOTAL PHOSPHORUS, SAMPLED DURING CONDITION-1 AND -2 EXPERIMENTAL PHASES

		Cell 1	Cell 2	Cell 3	Cell 4
	$\bar{d}$	-0.09	-0.29	-0.26	0.19
Total Phosphorus	sd	0.87	0.88	0.72	1.87
Cond. 1	N	23.00	23.00	23.00	23.00
	t	-0.50	-1.58	-1.73	0.50
	$\bar{d}$	0.16	-0.90	-0.20	0.59
Total P	sd	3.96	1.78	1.85	1.71
Cond. 2	N	33.00	34.00	33.00	33.00
	t	0.23	-2.95	-0.62	1.98

TABLE C-7. STATISTICAL TABULATIONS FOR ANALYSIS OF NUTRIENT PARAMETER, ORTHO-PHOSPHATES, SAMPLED DURING CONDITION-1 AND-2 EXPERIMENTAL PHASES

		Cell 1	Cell 2	Cell 3	Cell 4
	$\bar{d}$	-0.20	-0.72	-0.23	0.40
Ortho Phosphates	sd	0.75	1.98	1.39	1.90
Cond. 1	N	25.00	25.00	24.00	24.00
	t	-1.33	-1.82	-0.81	1.03
	$\bar{d}$	-0.88	-0.44	-0.08	0.58
Ortho P	sd	2.46	1.14	1.38	1.17
Cond. 2	t	-2.09	-2.25	-0.33	2.85

APPENDIX D

TABLE D-1. DIURNAL OXYGEN AND TEMPERATURE DATA ON AQUACULTURE RACEWAYS, COLLECTED ON JUNE 29, and JUNE 30, 1977

Sample Location	Depth (m)	D. O. (ppm)	Temp °C	Time
1A	Surface	10.8	29.0	1820
	1	4.5	27.5	
	2	0.6	26.5	
1B	Surface	8.4	29.0	2010
	1	3.9	27.5	
	2	0.5	26.0	
2A	Surface	10.6	29.0	2025
	1	4.8	27.5	
	2	0.5	27.0	
2B	Surface	9.2	29.0	2030
	1	8.8	28.0	
	2	0.6	26.5	
3A	Surface	9.7	29.0	2040
	1	8.5	28.0	
	2	0.4	26.5	
3B	Surface	8.4	29.0	2035
	1	7.8	28.5	
	2	0.7	26.5	
4A	Surface	9.5	29.0	2045
	1	7.5	28.0	
	2	7.5	28.0	
4B	Surface	8.1	29.0	2050
	1	7.5	29.0	
	2	0.5	27.0	
1A	Surface	9.2	28.0	2210
	1	9.0	28.0	
	2	0.6	26.5	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D. O. (ppm)	Temp °C	Time
1B	Surface	8.2	28.0	2205
	1	8.1	28.0	
	2	0.7	26.0	
2A	Surface	9.8	28.0	2215
	1	10.0	28.0	
	2	0.5	26.8	
2B	Surface	8.7	28.0	2220
	1	8.8	28.0	
	2	0.5	26.8	
3A	Surface	10.6	28.0	2230
	1	10.6	28.0	
	2	0.4	26.5	
3B	Surface	8.4	28.0	2225
	1	8.1	28.0	
	2	0.5	26.5	
4A	Surface	10.6	28.0	2235
	1	10.6	28.0	
	2	0.4	26.0	
4B	Surface	7.8	28.0	2240
	1	7.6	28.0	
	2	0.4	26.5	
1A	Surface	8.6	27.5	2410
	1	8.7	27.5	
	2	0.5	26.5	
1B	Surface	7.6	27.0	2415
	1	7.5	27.0	
	2	0.4	25.5	
2A	Surface	8.1	27.5	2425
	1	8.0	27.5	
	2	0.4	26.5	
2B	Surface	6.9	27.0	2420
	1	6.6	27.0	
	2	0.4	26.0	
3A	Surface	8.9	27.0	2430
	1	9.0	27.0	
	2	0.4	36.0	
3B	Surface	6.3	27.5	2435
	1	6.1	27.5	
	2	0.8	26.5	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D. O. (ppm)	Temp °C	Time
4A	Surface	9.1	27.0	2445
	1	9.2	27.0	
	2	0.5	26.0	
4B	Surface	5.9	27.5	2440
	1	5.6	27.5	
	2	0.4	26.5	
1A	Surface	6.2	27.0	0215
	1	6.1	27.0	
	2	4.1	26.5	
1B	Surface	8.7	26.5	0210
	1	5.4	26.5	
	2	0.7	25.5	
2A	Surface	5.4	27.0	0220
	1	5.4	27.0	
	2	4.8	27.0	
2B	Surface	4.7	26.5	0225
	1	4.5	27.0	
	2	4.2	26.5	
3A	Surface	6.3	26.5	0235
	1	6.0	26.5	
	2	5.8	26.5	
3B	Surface	4.2	26.5	0230
	1	3.9	26.5	
	2	3.8	26.5	
4A	Surface	5.7	26.5	0240
	1	5.5	26.5	
	2	5.3	26.5	
4B	Surface	3.2	26.5	0242
	1	3.1	26.5	
	2	2.9	26.5	
1A	Surface	2.9	26.0	0410
	1	2.7	26.0	
	2	2.6	26.0	
1B	Surface	2.9	26.0	0415
	1	2.7	26.0	
	2	2.6	26.0	
2A	Surface	4.8	26.0	0425
	1	4.7	26.0	
	2	4.4	26.0	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D.O. (ppm)	Temp °C	Time
2B	Surface	3.7	26.0	0420
	1	3.5	26.0	
	2	3.4	26.0	
3A	Surface	4.9	26.0	0430
	1	4.8	26.0	
	2	4.8	26.0	
3B	Surface	3.4	26.0	0435
	1	3.3	26.0	
	2	3.1	26.0	
4A	Surface	4.0	26.0	0440
	1	3.9	26.0	
	2	3.8	26.0	
4B	Surface	2.6	26.0	0430
	1	2.5	26.0	
	2	2.5	26.0	
1A	Surface	1.9	26.0	0615
	1	1.8	26.0	
	2	1.7	26.0	
1B	Surface	1.6	25.5	0610
	1	1.5	25.5	
	2	1.4	25.5	
2A	Surface	4.1	25.5	0620
	1	4.0	25.5	
	2	3.6	25.5	
2B	Surface	2.9	25.5	0625
	1	2.7	25.5	
	2	2.1	25.5	
3A	Surface	4.3	25.5	0632
	1	4.1	25.5	
	2	3.8	25.5	
3B	Surface	3.2	25.5	0630
	1	3.0	26.6	
	2	2.5	25.5	
4A	Surface	3.1	25.5	0635
	1	3.0	26.6	
	2	2.9	25.5	
4B	Surface	2.3	25.5	0638
	1	2.2	25.5	
	2	2.1	25.5	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D. O. (ppm)	Temp °C	Time
1A	Surface	3.2	25.5	0810
	1	2.4	25.5	
	2	2.3	25.5	
1B	Surface	8.0	25.5	0812
	1	2.7	25.5	
	2	2.4	25.5	
2A	Surface	5.4	25.5	0820
	1	4.9	25.0	
	2	4.6	25.0	
2B	Surface	4.3	25.5	0815
	1	4.1	25.5	
	2	3.9	25.5	
3A	Surface	5.3	25.5	0825
	1	4.8	25.5	
	2	4.9	25.5	
3B	Surface	5.0	25.5	0830
	1	4.7	25.5	
	2	4.5	25.5	
4A	Surface	4.5	25.5	0840
	1	4.1	25.5	
	2	4.0	25.5	
4B	Surface	4.3	25.5	0835
	1	4.0	25.5	
	2	3.8	25.5	
1A	Surface	7.0	26.0	1012
	1	6.7	26.0	
	2	6.3	26.0	
1B	Surface	7.2	26.0	1017
	1	6.9	26.0	
	2	6.8	26.8	
2A	Surface	8.1	26.0	1025
	1	7.8	26.0	
	2	7.8	26.0	
2B	Surface	7.3	26.0	1020
	1	7.1	26.0	
	2	6.9	26.0	
3A	Surface	8.0	26.0	1030
	1	7.9	26.0	
	2	7.7	26.0	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D. O. (ppm)	Temp °C	Time
3B	Surface	7.9	26.0	1035
	1	7.8	26.0	
	2	7.4	26.0	
4A	Surface	7.4	26.0	1042
	1	7.1	26.0	
	2	7.0	26.0	
4B	Surface	7.5	26.0	1037
	1	7.3	26.0	
	2	7.0	26.0	
1A	Surface	8.7	27.0	1215
	1	8.7	27.0	
	2	6.3	26.0	
1B	Surface	7.9	27.0	1210
	1	7.9	27.0	
	2	3.4		
2A	Surface	9.3	27.0	1220
	1	9.3	27.0	
	2	8.5	27.0	
2B	Surface	8.8	27.0	1225
	1	8.8	27.0	
	2	8.4	27.0	
3A	Surface	9.9	27.0	1235
	1	9.9	27.0	
	2	9.5	27.0	
3B	Surface	9.3	27.0	1230
	1	9.3	27.0	
	2	8.1	27.0	
4A	Surface	9.4	27.0	1237
	1	9.3	27.0	
	2	9.1	27.0	
4B	Surface	9.4	27.5	1245
	1	9.4	27.5	
	2	7.4	26.5	
1A	Surface	8.0	29.0	1415
	1	6.3	27.0	
	2	0.3	26.0	
1B	Surface	8.6	28.0	1420
	1	8.0	27.0	
	2	0.6	26.0	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D.O. (ppm)	Temp °C	Time
2A	Surface	10.2	28.5	1430
	1	9.8	27.5	
	2	5.8	27.0	
2B	Surface	9.1	28.0	1425
	1	7.9	27.0	
	2	2.6	26.0	
3A	Surface	10.8	28.0	1435
	1	10.2	28.0	
	2	3.9	26.5	
3B	Surface	10.2	28.5	1440
	1	8.1	27.0	
	2	3.1	26.0	
4A	Surface	11.0	28.5	1450
	1	8.1	27.0	
	2	4.4	26.5	
4B	Surface	10.2	28.5	1445
	1	8.3	27.5	
	2	4.3	26.5	
1A	Surface	9.0	30.0	1630
	1	7.0	27.5	
	2	0.6	26.0	
1B	Surface	7.8	30.0	1625
	1	7.5	27.0	
	2	0.3	26.0	
2A	Surface	9.8	29.5	1635
	1	7.6	27.0	
	2	1.3	26.5	
2B	Surface	9.0	29.5	1640
	1	7.6	27.5	
	2	0.9	26.5	
3A	Surface	10.8	30.0	1650
	1	8.3	27.5	
	2	1.0	26.5	
3B	Surface	9.8	29.5	1645
	1	7.9	27.5	
	2	0.5	26.5	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D. O. (ppm)	Temp °C	Time
4A	Surface	10.6	30.0	1700
	1	7.2	27.0	
	2	0.3	26.5	
4B	Surface	10.0	29.5	1703
	1	8.6	27.5	
	2	0.3	26.5	
1A	Surface	8.6	29.5	1820
	1	6.2	27.5	
	2	0.3	26.0	
1B	Surface	7.2	29.0	1815
	1		28.0	
	2	0.4	26.0	
2A	Surface	9.3	29.0	1825
	1	7.8	27.5	
	2	0.3	27.0	
2B	Surface	7.7	29.0	1835
	1	5.0	27.0	
	2	0.3	26.0	
3A	Surface	9.4	29.0	1845
	1	7.3	27.5	
	2	0.9	26.0	
3B	Surface	8.3	29.0	1840
	1	7.1	27.5	
	2	0.3	26.0	
4A	Surface	9.8	29.0	1850
	1	6.3	27.0	
	2	0.3	26.5	
4B	Surface	9.2	29.0	1900
	1	8.9	27.5	
	2	0.5	26.5	
1A	Surface	8.6	28.5	2015
	1	3.8	26.5	
	2	0.3	26.0	
1B	Surface	7.2	28.0	2018
	1	5.2	27.0	
	2	0.3	25.5	

(Continued)

TABLE D-1.

Sample Location	Depth (m)	D. O. (ppm)	Temp °C	Time
2A	Surface	9.4	28.0	2030
	1	3.7	27.0	
	2	0.4	26.5	
2B	Surface	8.4	28.0	2035
	1	6.5	27.5	
	2	0.2	26.0	
3A	Surface	9.9	28.0	2045
	1	7.1	27.0	
	2	0.3	26.5	
3B	Surface	8.8	28.0	2040
	1	7.3	28.0	
	2	0.4	26.0	
4A	Surface	9.5	28.0	2055
	1	4.5	27.0	
	2	0.3	26.5	
4B	Surface	8.9	28.0	2100
	1	7.2	27.5	
	2	0.3	26.5	

APPENDIX E

TABLE E-1. STOCKING AND HARVESTING UNITS OF PIMPHALES PROMELAS RAF. UNDER CONDITIONS-1 AND -2 EXPERIMENTAL PHASES

Location Cell	Stocking density *(kg/.1 hec.)	Standing crop harvested (kg/.1 hec.)	% reduction in numbers	% Increase in numbers
		CONDITION-1		
	Summer-1977	Spring-1978		
1B	38	0	100	-
2B	38	4	90	-
3B	38	11	70	-
4B	38	49	-	30
		CONDITION-2		
	Summer-1978	Spring-1978		
1B	-	-	-	-
2B	151	30	80	-
3B	151	87	43	-
4B	151	151	-	-
	Fall-1978	Spring-1978		
1B	-	-	-	-
2B	30	**4	88	-
3B	87	100	-	15
4B	151	104	31	-

*All biomass determinations based on measurements of fish by the displacement of a volume of water (3.8 liters) by the same volume and the biomass equal to the weight of the volume of water displaced: 3.8 liters = 3.78 kg (4 kg).

**Less than 30 individuals remained at the harvest sampling unit, therefore a 4 kg unit was used for ease in computation.