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200 MGD Activated Sludge Plant Removes Phosphorus By Pickle Liquor

Office of Research and Development
U.S. Environmental Protection Agency
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200 MGD ACTIVATED SLUDGE PLANT REMOVES PHOSPHORUS BY PICKLE LIQUOR

by

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ABSTRACT

The Milwaukee Sewerage Commission's Jones Island Waste Water Treatment Plant consists of a mutual primary treatment facility followed by two separate activated sludge plants. To enhance phosphorus removal in the 115 MGD East Plant, spent hot sulfuric acid pickle liquor (ferrous sulfate) was added for a one year test period in 1970 where the 85 MGD West Plant was operated as a control (1). In April 1971, the waste sludge from the East Plant was added to the West Plant to provide additional iron for phosphorus removal. This report discusses the 1971 operational period and data collection and relates this information to the 1970 demonstration period. Also some data is included from the first four months in 1972 to provide data for a complete 12 months of wasting East Plant sludge to the West Plant.

The major objective of the iron addition was to maintain an East Plant effluent total phosphorus concentration of 0.50 mg/l P and obtain a total plant phosphorus removal of 85% as required by the Wisconsin Department of Natural Resources by December 1972. The West and East Plant effluent total phosphorus concentrations during 1971 averaged 1.3 and 0.69 mg/l P respectively, representing an average overall 86.6% removal. The effluent total soluble phosphorus concentrations for the West and East Plants averaged 0.58 and 0.22 mg/l P.

Comparison of the efficiencies of the West and East Plants in removing BOD, COD and suspended solids as well as microscopic examination of the mixed liquors indicates that the addition of the unneutralized pickle liquor apparently did not affect plant purification.

Waste Pickle liquor has been added continuously since January 1970 at the Milwaukee Jones Island Plant to enhance phosphorus removal and the intent is to continue additions as required for control of phosphorus. The principle operational problem in maintaining a low effluent total phosphorus concentration was the control of effluent suspended solids containing an average 2.2% P.

This report was submitted in fulfillment of Project Number 11010 FLQ, by the Sewerage Commission of the City of Milwaukee, under the partial sponsorship of the Environmental Protection Agency.

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SECTION I

CONCLUSIONS

1. Waste pickle liquor (ferrous sulfate) as an iron source has been continuously and successfully added to precipitate phosphorus since January 1970 in the 115 MGD East Plant at the Milwaukee Sewerage Commission's Jones Island Activated Sludge Waste Water Treatment Plant. The 85 MGD West Plant receiving the same raw screened sewage was operated as a control for the first 15 months after which time, East Plant waste sludge was added to the West Plant return sludge as an iron source.

2. Based on an average 1971 screened sewage total phosphorus concentration of 7.1 mg/l P, the East Plant with iron addition, removed 90.3% (0.69 mg/l P effluent residual) while the West Plant removed 81.7% (1.3 mg/l P effluent residual). After the mixing of the East Plant waste sludge in the West Plant, the total phosphorus removal from May 1971 to April 1972 in the East and West Plants averaged 90.4 and 79.5% (0.70 and 1.5 mg/l P effluent residual), respectively. During certain months, the total phosphorus concentration was high because mixed liquor suspended solids were discharged into the effluent, therefore, the total soluble phosphorus concentrations are a better indication of the effectiveness of the iron addition.

3. Based on an average 1971 screened sewage total soluble phosphorus concentration of 2.3 mg/l P, the East Plant effluent had a residual concentration of 0.22 mg/l P, while the West Plant effluent concentration averaged 0.58 mg/l P. During the May 1971 to April 1972 period when the East Plant waste sludge was added to the West Plant return sludge, the total soluble phosphorus values for the East and West Plant effluents averaged 0.22 and 0.64 mg/l P.

4. An average of 8.0 mg/l iron was added to the East Plant mixed liquor (11,546 gallons/day at 0.74 pounds/gallon) to remove phosphorus. No minimum iron dose testing was conducted, but obviously, the 1971 minimum was below 8.0 mg/l iron at the Jones Island East Plant.

5. The pickle liquor addition increased the return sludge phosphorus concentration in 1970 from 2.29% as P in the control West Plant to 2.61% as P in the East Plant, and also increased the iron content from 1.86% as Fe in the West Plant to 5.08% as Fe in the East Plant.

6. The addition of iron to the East Plant mixed liquor increased the effluent iron concentration slightly. During the 1970 demonstration period, the West and East Plant effluent total iron concentrations averaged 0.51 and 1.2 mg/l Fe and the total soluble iron concentrations averaged 0.21 and 0.24 mg/l Fe, respectively. The difference in total iron concentrations was attributed to the increased concentration of iron in the East Plant suspended solids. In 1971, soluble iron concentrations averaged 0.18 and 0.15 mg/l Fe, respectively, in the West and East Plant effluents.

7. Comparison of the efficiencies of the West and East Plant in removing BOD, COD and suspended solids as well as microscopic examination of the mixed liquors indicated that the addition of unneutralized pickle liquor apparently did not affect purification.

8. The pickle liquor (ferrous sulfate) addition increased the East Plant effluent soluble sulfate concentration by about 12% (116 - 130 mg/l SO_4) during 1971 and decreased the total alkalinity by 21% (187 to 226 mg/l as $CaCO_3$). The two year average mixed liquor pH values were 7.0 for the East Plant and 7.1 for the West Plant.

9. The pickle liquor caused no apparent problems with the plant physical facilities.

10. Initially, the pickle liquor addition did not appear to affect ferric chloride requirements in the sludge conditioning phase (1970). However, the 1971 data indicates a reduction in ferric chloride requirements in the sludge conditioning phase.

SECTION II

RECOMMENDATIONS

The continuous addition of waste pickle liquor as an iron source for phosphorus precipitation and removal since January 1970, has been economical and practical at the Milwaukee Sewerage Commission's Jones Island Activated Sludge Plant.

At the present time, 85% phosphorus removal has been attained and, therefore, additional modifications to increase phosphorus removal are not necessary since State requirements have been met. Transfer of iron containing filtrate from the vacuum filters exclusively to the West Plant is being implemented to provide for a more stable operation and possibly increased phosphorus removal.

Future research should be directed towards finding exactly how phosphorus is tied up with the added cations and what other compounds are affected by cation addition.

SECTION III

INTRODUCTION

In 1967, the Sewerage Commission of the City of Milwaukee, initiated a three year research program to evaluate the phosphorus removal in the Jones Island Activated Sludge Plant (2). This research program, funded in part by the Environmental Protection Agency, included studying methods to enhance phosphorus removal. The theories of biological phosphate removal as stated by Levin and Shapiro (3), Vacker et al. (4), Borchardt and Azad (5) and Wells (6) along with the chemical precipitation theories contended by Menar and Jenkins (7) were reviewed and attempts were made to maximize biological precipitation of phosphorus in the activated sludge plants. The 200 MGD Jones Island Plant consisting of the 85 MGD West Plant and the 115 MGD East Plant, operated in parallel receiving a common screened sewage, was ideal for plant-wide variation of operating parameters to effect phosphorus removal.

Addition of iron directly to aeration tanks in the activated sludge process, was investigated in Wisconsin by Scott (8) in 1947. Many other investigators have researched chemical addition for phosphorus removal (9....34).

In 1968, the Sewerage Commission of the City of Milwaukee and the Water Pollution Control Corporation of Milwaukee, conducted a plant scale study to enhance phosphorus removal by chemical addition directly to the aeration tank using aluminum and iron salts at a small activated sludge plant (40-70,000 gallons per day) located in a contract area of the Metropolitan Sewerage District (24). This work, at a plant receiving only domestic wastes from a small subdivision, expanded the pilot plant work done by Barth and Ettinger (17). Following successful phosphorus removal with both sodium aluminate and alum, iron in the form of ferrous sulfate was added. The A. O. Smith Corporation, which joined the study at this point, supplied the iron in the form of a neutralized waste pickle liquor and also furnished laboratory services. The conclusions of the May 1968 to January 1969 study indicated that the aluminum or iron addition, to remove phosphorus was an effective and economical method to enhance phosphorus removal.

Concurrent research being conducted at the Sewerage Commission's Jones Island Plant (2) to relate operating parameters to phosphorus removal, indicated that 60 to 90% total phosphorus removal could be expected, but control of plant operations to consistently remove 85% of the phosphorus as required by the State of Wisconsin Department of Natural Resources, could not be accomplished. Supplementary cationic precipitation of phosphorus in conjunction with the activated sludge process was, therefore, investigated.

Iron was chosen as the cation to be used because:

1. Iron addition to the aeration tank would not create an extra sludge removal problem.

2. Iron was consistent with the existing method of sludge disposal.

3. Success was experienced at the small activated sludge plant study.

4. Pickle liquor was available from the A. O. Smith Corporation which had a cooperative attitude.

5. Iron in waste pickle liquor was inexpensive in comparison with other chemicals (delivered free).

In September 1968, Mr. George Hubbell(35) reported on his federal grant activities to remove phosphorus from Detroit's waste water. He indicated that phosphorus removal was achieved through chemical precipitation using iron in a pilot plant. In May 1969, representatives of the Milwaukee Sewerage Commission went to Detroit to observe the pilot operation and discuss the project with Dr. Albert M. Shannon, Chief of Water and Sewage Treatment. The observations and information obtained at Detroit combined with the previous Sewerage Commission work, indicated that experimental iron addition to a portion of the Jones Island Plant was the next logical step.

A decline in phosphorus removal occurred in June 1969 as a result of the Milwaukee Brewery strikes, and it was decided to add neutralized pickle liquor from the A. O. Smith Corporation to one East Plant aeration tank to observe the effects upon phosphorus precipitation and on the mixed liquor biota. This test indicated that the iron effectively reduced the effluent phosphorus concentration with no noticeable ill effects on the treatment process or equipment. An addition rate of 15 mg/l of iron to the mixed liquor was found to maximize phosphorus removal. At this dosage rate, neutralization of the pickle liquor free acid (2-5%) was not necessary.

After the plant returned to normal operation following the five week brewery strikes (June 9 to July 15), unneutralized waste pickle liquor was added to the entire 115 MGD East Plant from November 3 to November 14, 1969. The pickle liquor was trucked to the

Jones Island Plant by the A. O. Smith Corporation and about 20,000 gallons of the liquor was added to the mixed liquor aeration tank feed channel each day. The plant scale test confirmed the single tank studies. At this point, the Sewerage Commission of the City of Milwaukee applied for a federal demonstration grant to assist in covering the cost of a one year plant scale study to add pickle liquor to enhance phosphorus removal. It was proposed to add pickle liquor to the 115 MGD East Plant and to operate the 85 MGD West Plant as a control. The A. O. Smith Corporation agreed to construct and maintain pickle liquor storage and addition facilities and to deliver the waste pickle liquor to the Jones Island Plant. Findings of the one year demonstration project for 1970 have been published (1).

SECTION IV

OBJECTIVES

The 1971 objectives of the pickle liquor iron addition at the 200 MGD Jones Island Activated Sludge Plant included:

A. Evaluate the effectiveness of continuous iron addition to maintain an East Plant effluent total phosphorus concentration of 0.50 mg/l P or less. The minimum requirement is to remove 85% of the phosphorus for the total plant.

B. Compare the efficiency of the West and East Plants in removing phosphorus, BOD, COD and suspended solids.

C. Determine the optimum iron requirements to maximize phosphorus removal.

D. Determine the effects of iron addition on the mixed liquor biota and its settling characteristics.

E. Determine the effects of iron addition on the plant physical facilities.

F. Determine the effect of iron addition on the requirements of ferric chloride conditioning of waste sludge.

SECTION V

SEWERAGE COMMISSION OF THE CITY OF MILWAUKEE

JONES ISLAND PLANT

The Jones Island activated sludge waste water treatment plant (36, 37) was designed to treat 200 million gallons of sewage daily. The plant provides conventional activated sludge treatment in the original 85 MGD West Plant and a 115 MGD East Plant addition. The treatment plant has a connected population of about 1,000,000 people. The service area includes about 17,000 acres of a combined sewer system and about 83,000 acres having a separate sanitary sewer system.

The primary treatment facilities consist of conventional coarse screening (mechanically cleaned bar screens, 1" between bars) to remove hair, fleshings, garbage, rags, wood, etc. Following coarse screening, the waste water is directed to the grit chambers consisting of eight 8 x 8 x 90 foot long compartments to reduce the flow velocity to one foot per second. At this reduced flow rate the grit consisting of sand, gravel, coal, ashes and some organic solids, is deposited on the bottom.

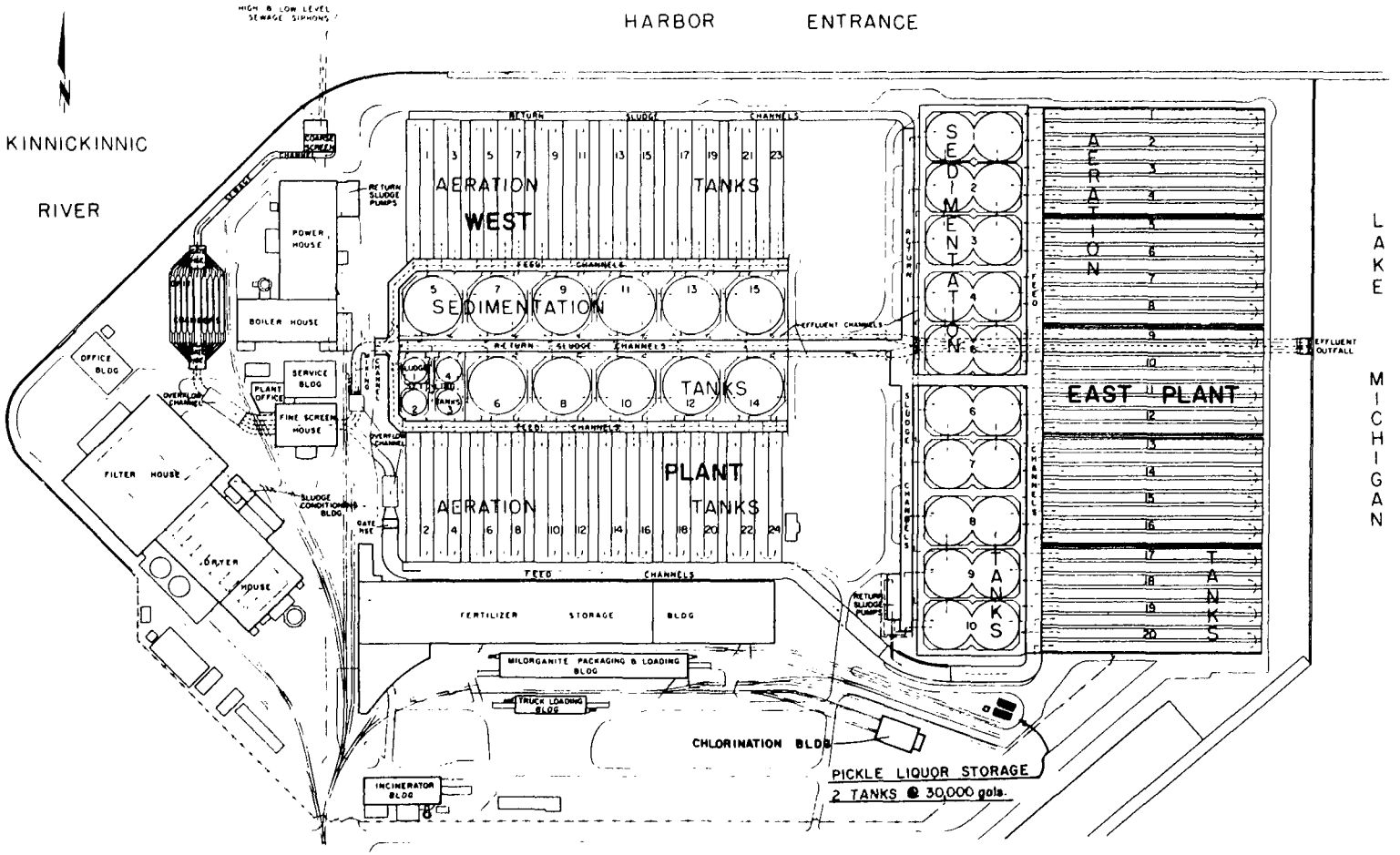
Following this treatment, the waste water is directed to rotary drum fine screens (3/32 inch slots - 2 inches long) to remove additional solids before the waste water is divided between the West and East conventional activated sludge plants for treatment.

The West Plant has a ridge and furrow-type aeration plate arrangement in the 24 aeration tanks. The tank arrangement allows the mixed liquor to travel through 472 feet of aeration tank (22 feet wide, 15 feet deep) prior to flowing into one of the 11 - 98 foot diameter sedimentation tanks. The East Plant has twenty aeration tanks where the mixed liquor travels through 740 feet of tank length (22 feet wide and 15 feet deep). These tanks have a longitudinal plate arrangement (38, 39). This plant has ten sedimentation tanks each consisting of two adjoining 84 foot diameter tanks. Each plant has its own return sludge pumping station where the entire volume of return sludge is pumped and mixed with the screened sewage. The normal return sludge volume added to the screened sewage is about 25% of the sewage volume, but periodically, the return sludge volume has been increased to 35% to compensate for changes in sludge settling rates.

The aeration tanks in both plants aerate the mixed liquor (screened sewage plus return sludge) for an average period of 7.0 hours. The aerated mixed liquor is then directed to the final sedimentation tanks for an average of a 2.4 hour detention time (the surface settling rate for West and East Plants are, respectively,

900 and 870 gpd/sq. ft. at design flow). The effluent is chlorinated and directed to Lake Michigan.

Prior to April 1971, the mixed liquor solids that were wasted from both the West and East Plants were directed to one of six gravity thickeners located in the West Plant. At the present time, the East Plant waste sludge is directed into the West Plant return sludge channel and only West Plant mixed liquor is thickened with periodic addition of the combined sludge from the West Plant return sludge channel. The thickened waste sludge is conditioned with ferric chloride, filtered on vacuum filters, dried in rotary dryers and sold as a fertilizer called Milorganite. This is the only way sludge can be removed from the plant. During 1970 and 1971, a yearly average of 72,000 tons (dry basis) of solids were removed in the dewatering plant. The physical layout of the Jones Island Plants is shown in Figures 1 and 2.



Jones Island Waste Water Treatment Plant

Figure 1

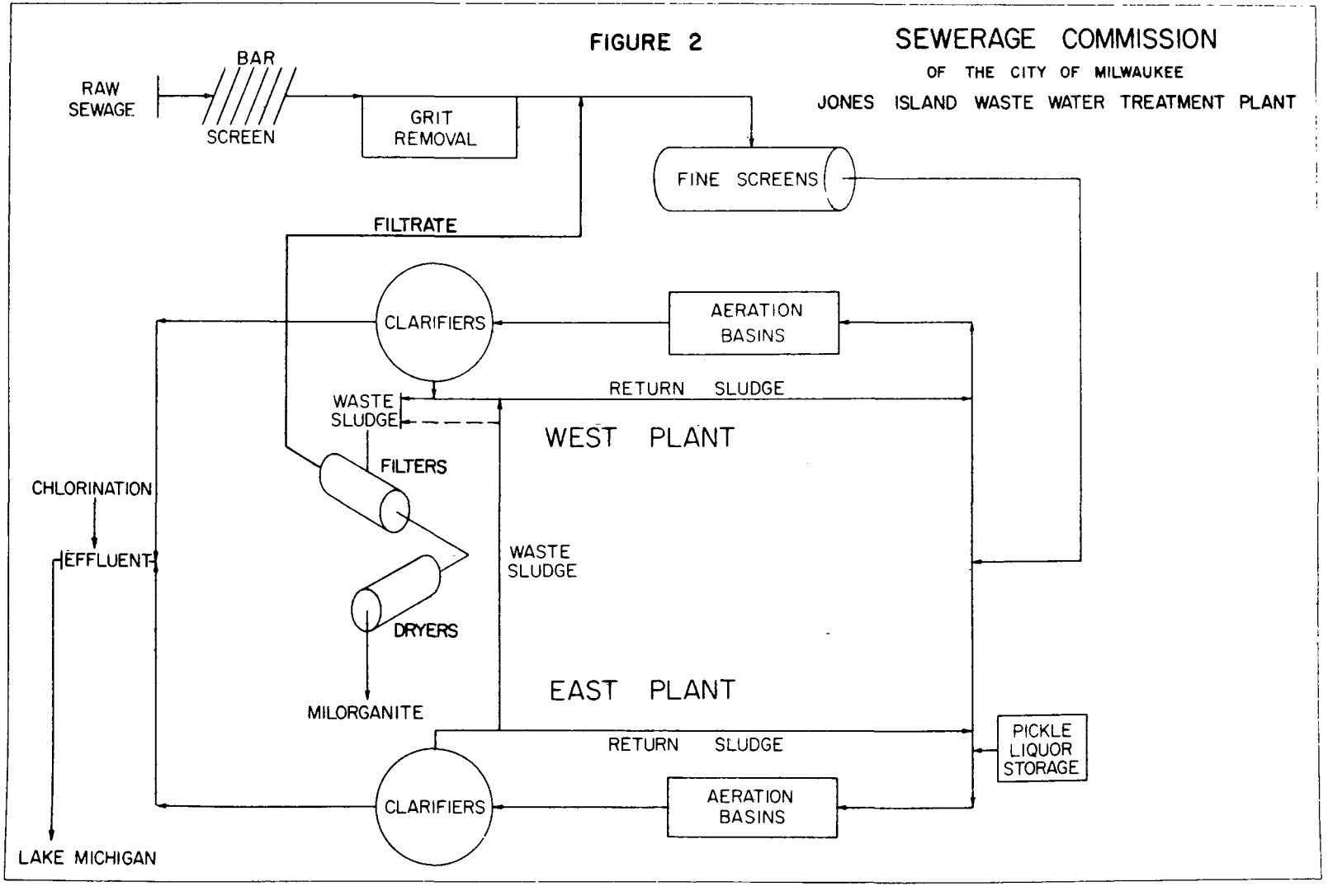


FIGURE 2
SEWERAGE COMMISSION
OF THE CITY OF MILWAUKEE
JONES ISLAND WASTE WATER TREATMENT PLANT
RAW SEWAGE
BAR
SCREEN
GRIT REMOVAL
FINE SCREENS
FILTRATE
CLARIFIERS
AERATION BASINS
RETURN SLUDGE
WASTE SLUDGE
WEST PLANT
FILTERS
CHLORINATION
EFFLUENT
WASTE SLUDGE
DRYERS
MILORGANITE
EAST PLANT
RETURN SLUDGE
PICKLE LIQUOR STORAGE
CLARIFIERS
AERATION BASINS
LAKE MICHIGAN

SECTION VI

JONES ISLAND PLANT OPERATION

The Milwaukee Metropolitan area as served by the Jones Island Waste Water Treatment Plant contains a variety of industries and the liquid wastes vary from low strength metal-working wastes to the concentrated organic wastes contributed by the large brewing industries.

During 1971, the average daily waste water volume received at the treatment plant was 176.8 mgd having a BOD content of 220 mg/l. The average workday (Monday - Friday) flow (industrial and domestic) was 185.2 mgd with a BOD of 254 mg/l and the Sunday and Holiday flow (essentially domestic) was 152.1 mgd with a BOD of 117 mg/l. Calculations from this data indicated that 14% of the weekly flow is from industry along with 54% of the weekly BOD contribution. On a workday basis, industry contributed 18% of the flow and 62% of the BOD.

With this type of load on a waste water treatment plant, many changes are necessary to maintain an efficient operation and many problems can be experienced. The following review discusses the 1971 operational conditions and changes as separated into four, three month periods:

January, February, March: The average sewage flow that entered the plant was 193.3 mgd which was divided by directing 46% to the West Plant and 54% to the East Plant. During this period, the plant clarifiers periodically became overloaded permitting mixed liquor suspended solids to be discharged. This problem resulted from major required maintenance on dryers in the sludge dewatering facilities.

Actinomycetaceae Genus Nocardia as present in 1969 and 1970 continued. (See Appendix A [2]). During January and February, traces of the froth lingered in both plants from the November 1970 outbreak. Another outbreak occurred in March in the East Plant, but only traces were noticed in the West Plant. The amount of froth on the aeration tanks and aerated channels decreased by the end of the month leaving a white foam.

April, May, June: The distribution of the average 179.4 mgd of sewage that entered the plant was 43% to the West Plant and 57% to the East Plant. On April 7, the East Plant waste sludge was directed into the West Plant return sludge channel to provide an iron source for the West Plant. Prior to this,

all the East Plant sludge was wasted directly to the dewatering plant thickeners. The Jones Island effluent chlorination facilities were activated June 21, initially using temporary facilities until the construction on the permanent facilities was finalized. Again during this period, clarifiers were overloaded resulting in higher effluent suspended solids. On May 7, the dryer system was at full capacity again to reduce the solids build up in the plant. However, on June 1 and 2 the entire dewatering facilities were shut down for repairs.

Traces of the Nocardia froth were evident at the beginning of April, but by the middle of the month the froth coverage of the aeration tanks increased, first in the East Plant and then in the West Plant. The froth coverage had decreased by the end of April but increased again at the end of May and decreased substantially by mid-June.

July, August, September: The average 180.4 mgd of sewage that entered the plant was distributed 42% to the West Plant and 58% to the East Plant. A vacuum filter cake cracking problem occurred on August 25 and the pickle liquor dose was decreased for a short period of time. The Nocardia froth reoccurred twice during this period, on August 3 for a few days and again on September 29.

During the month of August, the density of the Milorganite sharply decreased by about 15-20% in one week and then increased slowly for about 10 days, until a normal density was again obtained. A normal loose density will range from 40 to 42 lbs./cu. ft. and this value dropped to a low of 33.75. Special analyses were conducted during this period, but the reason for the occurrence was not determined.

October, November, December: The average sewage flow that entered the plant was 171.8 mgd with an average distribution of 43% to the West Plant and 57% to the East Plant. The plant sludge dewatering facilities were taken out of service twice for maintenance work on the dryer exhaut gas flume. The days out of service were November 14 and 15 and December 27, 28, 29 and 30. The Nocardia froth concentration present at the end of September decreased to a low level by mid-October, but by the end of October, the froth increased to a heavy concentration on the surface of the aeration tanks and channels which remained through December.

SECTION VII

IRON ADDITION EQUIPMENT AND OPERATION

The facilities proposed for addition of waste pickle liquor iron for enhancement of phosphorus removal were designed to make possible a precise and reliable operation. The equipment was comprised of two 30,000 gallon pickle liquor storage tanks insulated so that only a 1° F. maximum temperature drop per day would occur at an ambient temperature of minus 20° F. The automatic equipment would consist of an automatic feed valve, a specific gravity column, a calculator, a recirculation pump-heater combination and an equipment by-pass. The calculator would summate the mixed liquor flow from the existing meters, determine the iron concentration from the specific gravity, and control the iron addition to maintain the desired iron concentration. Deliveries on equipment were the only delaying factor. The A. O. Smith Corporation agreed to design, construct and maintain the pickle liquor facilities and deliver the waste pickle liquor to the Jones Island site.

On Wednesday, January 7, 1970, the first truck of pickle liquor from the A. O. Smith Corporation, which is 10 miles away, was delivered to Jones Island starting the first addition during the one-year grant period. Initially, prior to the installation of the automatic equipment and storage facilities, the 125° F. pickle liquor was drained from each truck tanker through an insulated, heated hose and a flow meter into the East Plant sewage channel. The average temperature for January and February 1970 was 18° F. The 15 days with below 0° F. temperatures created many problems with crystallization of ferrous sulfate. The construction of a shelter around the flow meter and addition of heat lamps failed to prevent crystals from plugging the meter.

During the second seek, one truck was set up as a feed source and was blanket insulated, covered with canvas and heaters were placed under the covered area to prevent cooling and crystallization. Compressed air was used to transfer the liquid from the delivery truck to the stationary tanker. The flow meter was replaced by a calibrated plastic garbage bucket and stop watch and this proved to be effective in maintaining the desired flow rates.

The permanent equipment was ordered early in 1970 and the storage tanks were available for use on June 1, 1970, but many problems were experienced with the instrumentation which was not in satisfactory operating condition until August, 1971. Figure 3 is a view of the pickle liquor control panel, and Figure 4 shows the equipment as located in the East Plant Gallery. Figure 5 shows the set up for transferring pickle liquor from the tank truck to the storage tank. At the present time, the pickle liquor addition is automatically controlled to add a specified concentration of iron based on the mixed liquor flow rate and the iron content of the pickle liquor.

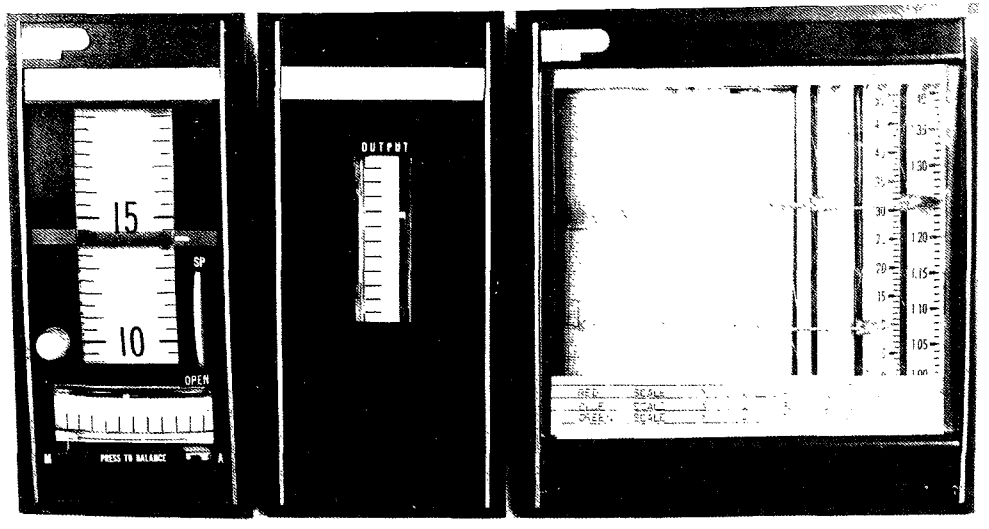


FIGURE 3

AUTOMATIC PICKLE LIQUOR ADDITION EQUIPMENT

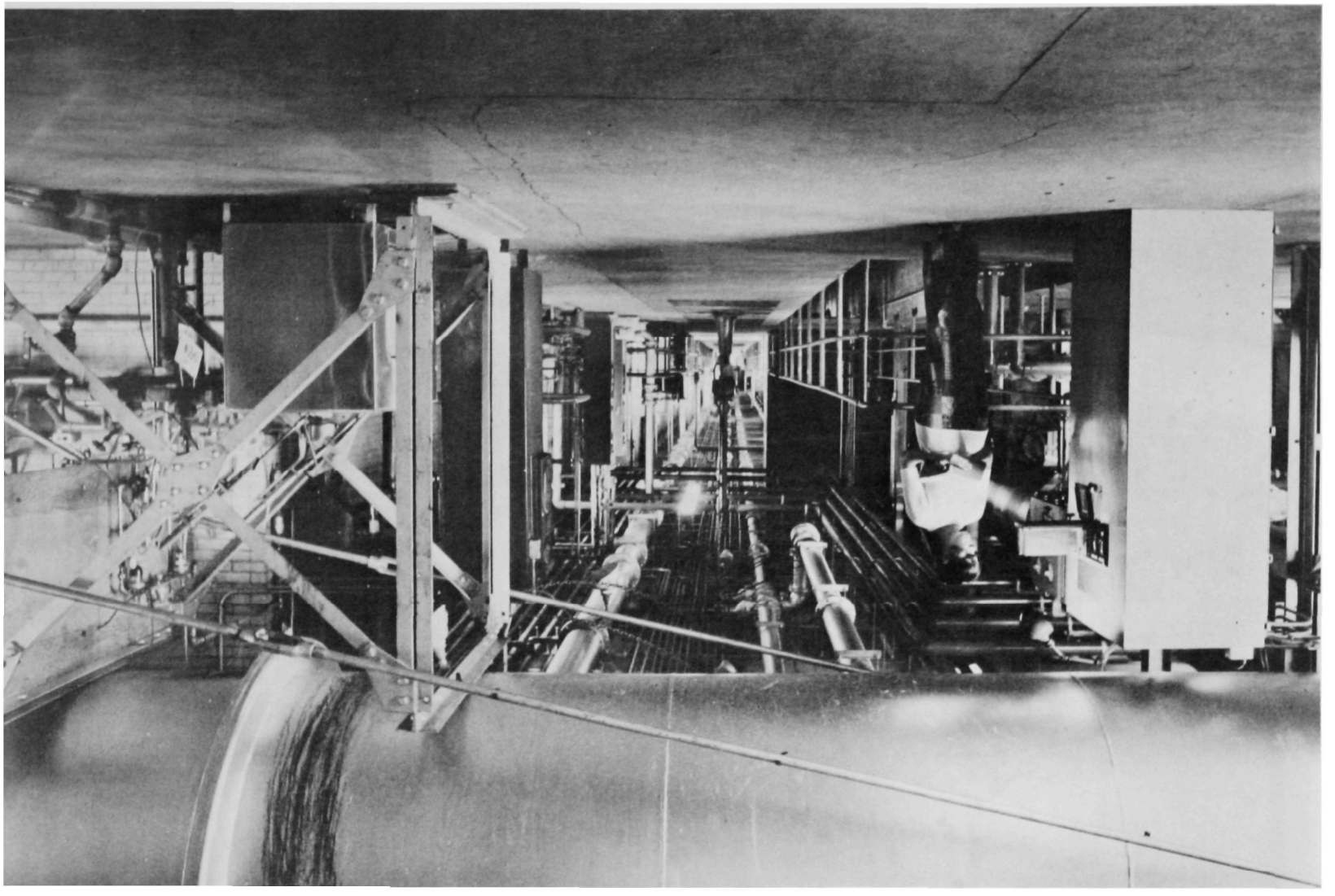


FIGURE 4

AUTOMATIC PICKLE LIQUOR EQUIPMENT AND EFFLUENT SAMPLER AS LOCATED IN EAST PLANT GALLERY

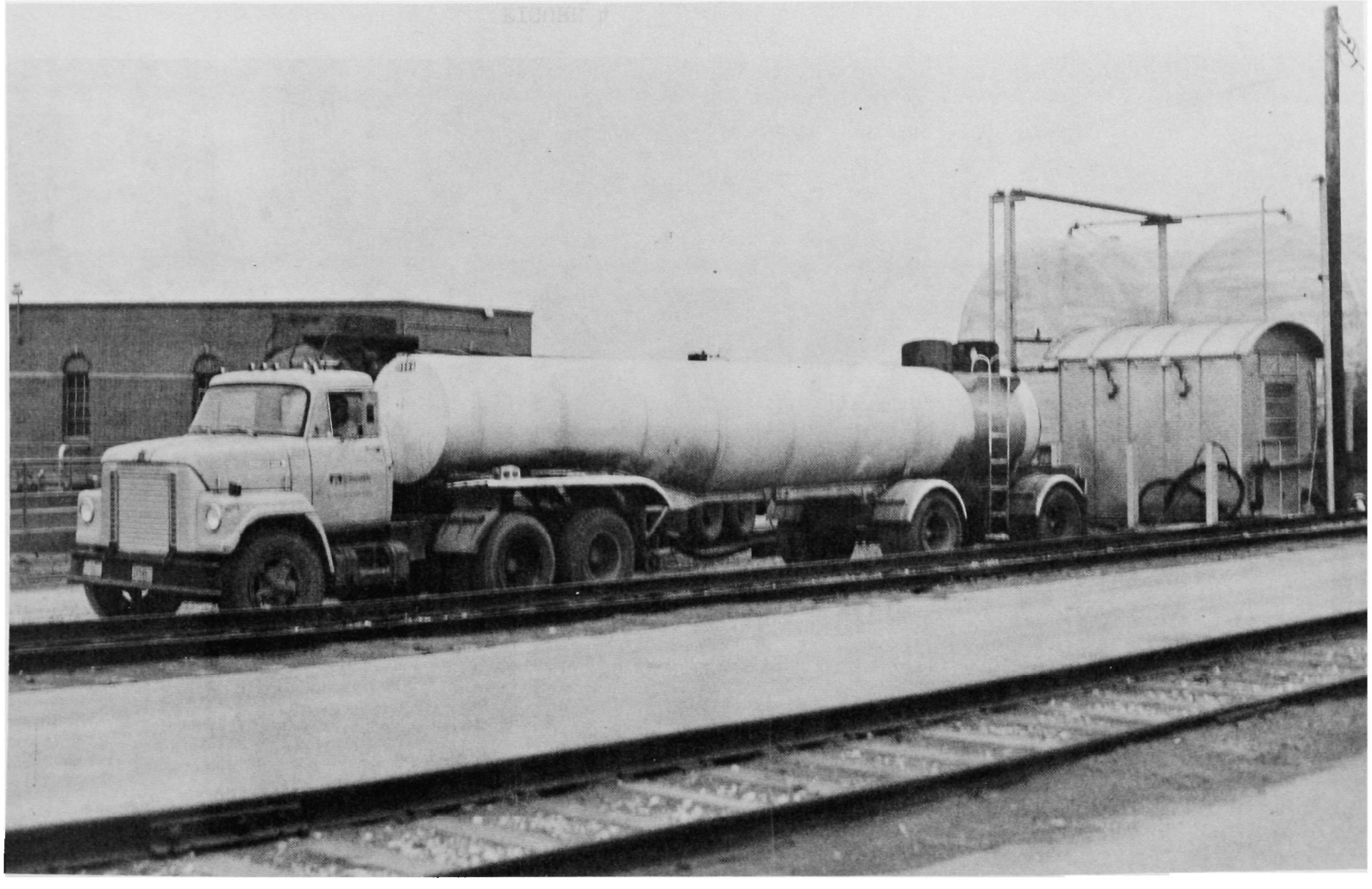


FIGURE 5

TRANSFERRING PICKLE LIQUOR INTO STORAGE TANK

The original equipment and materials used for the construction of the facilities designed for pickle liquor addition to the 115 MGD East Plant were:

1. Two 30,000 gallon steel tanks 12 feet in diameter and 36 feet long were rubber lined and the outside was insulated with a cover of urethane foam and painted aluminum. Both tanks were equipped with a low level alarm which actuates a red light and a high level alarm which activates a horn. The pickle liquor is transferred from the tanker to the storage tanks using air pressure.

2. All the piping and valves are 316 stainless steel which is resistant to the sulfuric acid pickle liquor. The piping from the tanks is 4 inches in diameter and is reduced to 2 inches as it passes through the equipment and then returns to a 4 inch diameter. The equipment by-pass line is 1 1/4 inches in diameter. An 8' x 10' heated building was constructed to house the automatic equipment. The piping located outside of the equipment building was insulated.

3. A Fischer & Porter Magnetic flow meter (teflon lined with Hastelloy C electrodes) was used to measure the pickle liquor flow rate (chart range of 0 - 50 gallons per minute).

4. A Saunders automatic rubber lined valve with a flexible diaphram which seats tightly against a weir in the body was used to control the pickle liquor flow rate.

5. The 316 stainless steel specific gravity column was used to obtain the iron content of the pickle liquor. A differential pressure density transmitter was used to determine the specific gravity which was recorded. The initial recorder range was 1.00 to 1.40.

6. A Vanton pump with a neoprene liner pumps a portion of the pickle liquor flow (0.3 gpm) to the specific gravity column.

7. The mixed liquor flow rate was determined by summating the resistance output of 20 potentiometers on the existing East Plant tank metering equipment. The recorder mixed liquor flow range was initially from 0 to 240 mgd.

8. The Fischer & Porter equipment has the capability to add 0 to 25 mg/l iron to the East Plant mixed liquor.

The cost of the equipment and materials was:

1.	Two 30,000 gallon rubber lined tanks ($23,500) urethane insulation, painted aluminum, so that only a 1° F. temperature drop would be realized at a -20° F. ambient temperature ($4,000) and the concrete foundations ($9,700)	$37,200
2.	Piping ($8,600), valves ($1,500), installation ($5,200), building ($850), piping installation ($750), heater ($1,800), compressor ($600), electric power and electrical installation ($6,900) and miscellaneous ($1,100)	$27,300
3.	Pickle liquor flow meter, automatic valve, specific gravity column and pump, mixed liquor response, and Fischer & Porter control unit equipment ($12,500), electrical installation ($6,000)	$18,500
	Sub Total	$83,000

Cost of Engineering and Operation are extra. Pickle liquor delivery costs of the A. O. Smith Corporation runs between 0.7 to 1¢/gallon of pickle liquor.

The original equipment has been modified to eliminate the need for the pumping. Operational experience established that the pump system for recirculation through the heater was not required due to the pickle liquor delivery temperature and the insulation of the storage tanks. The pickle liquor feed to the specific gravity column was modified to make it a complete gravity feed at a sacrifice of some of the head in the tanks. Figure 6 is an isometric of the modified system. Figure 7 is a picture of the piping inside the pickle liquor equipment building and Figure 8 shows the pickle liquor flowing into the mixed liquor channel.

SEWERAGE COMMISSION

OF THE CITY OF MILWAUKEE

JONES ISLAND WASTE WATER TREATMENT PLANT

PICKLE LIQUOR LAYOUT ISOMETRIC

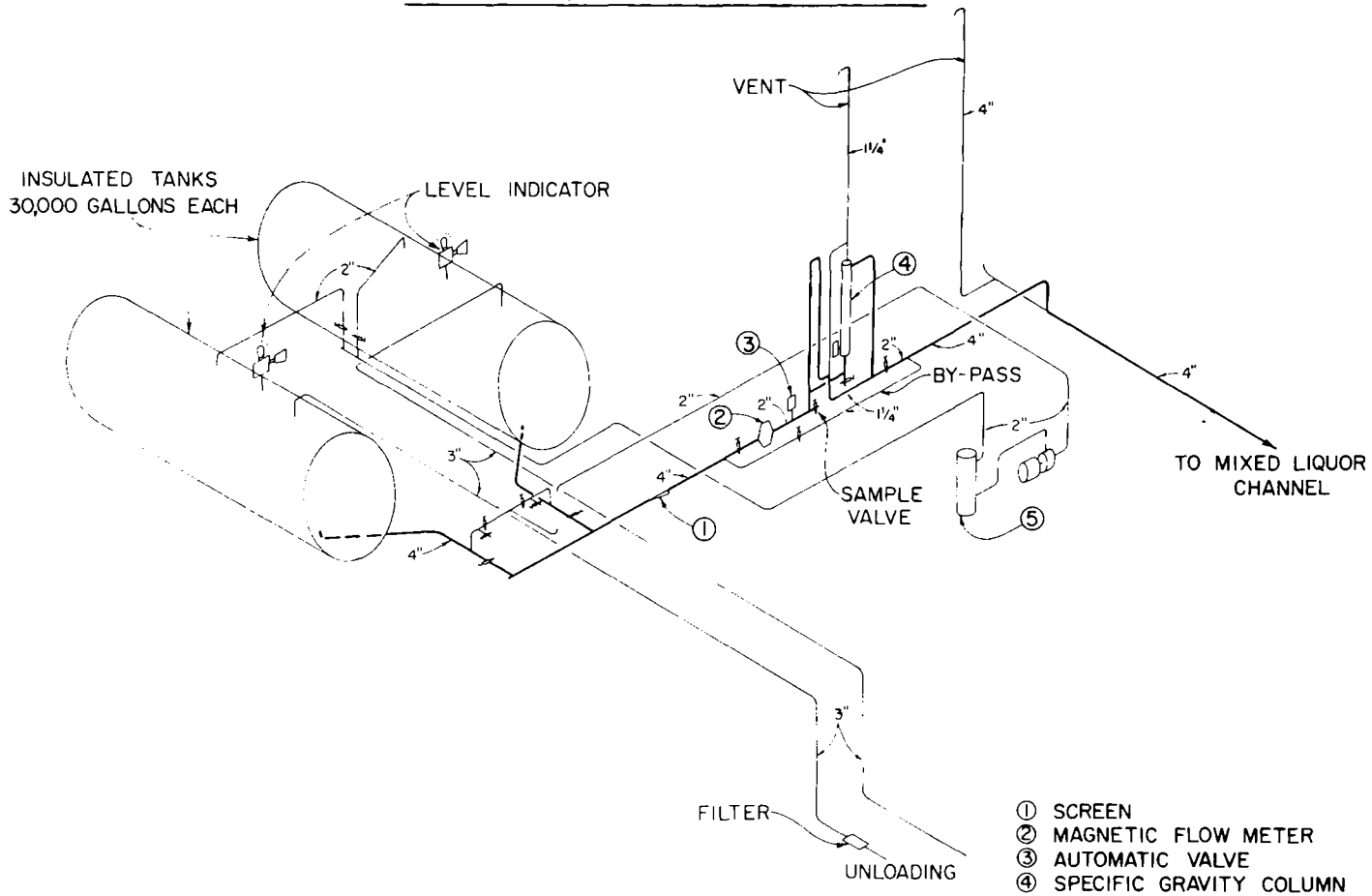


Figure 6

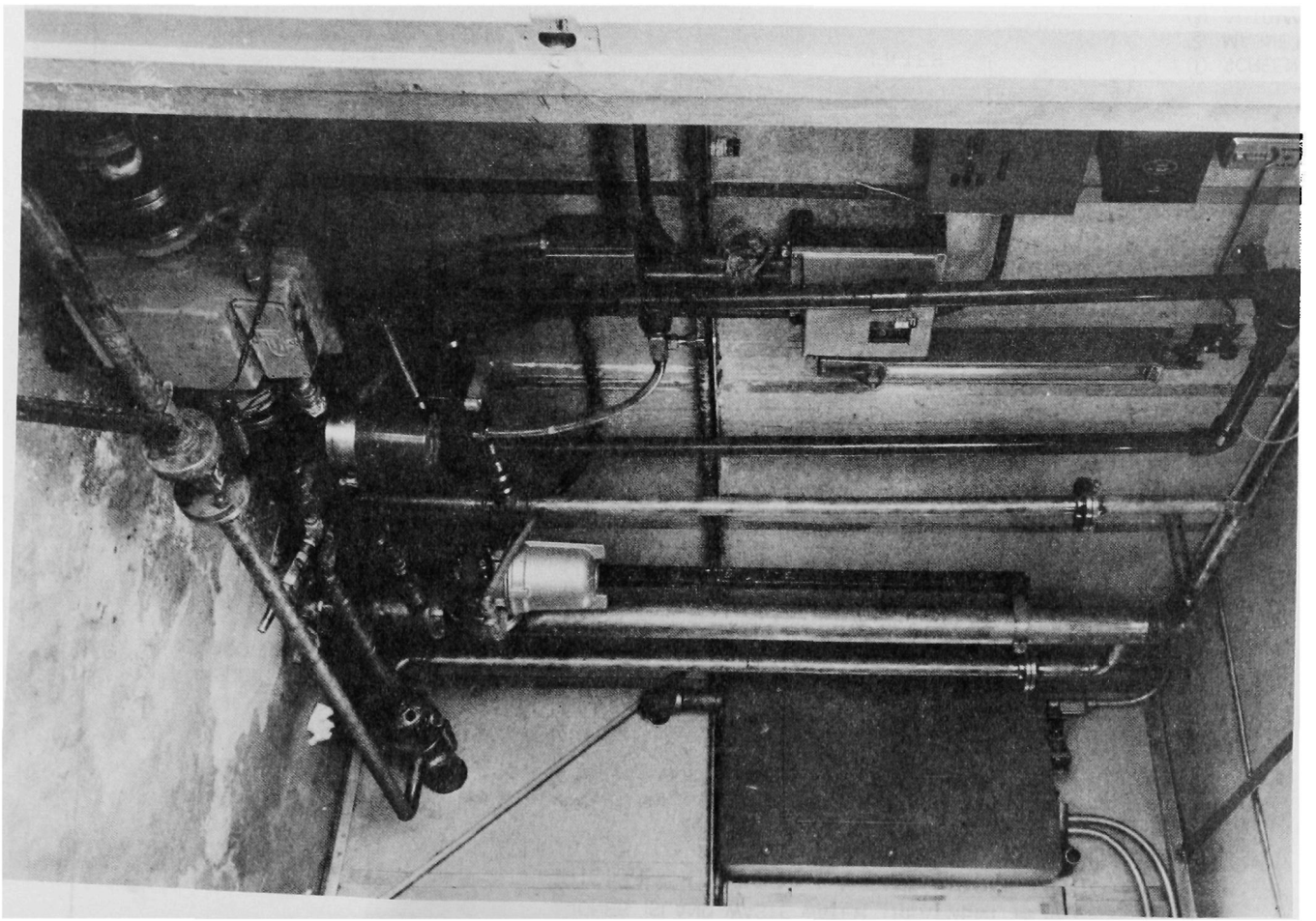


FIGURE 7

PICKLE LIQUOR PIPING

FIGURE 8

PICKLE LIQUOR FLOWING INTO EAST PLANT MIXED LIQUOR CHANNEL

SECTION VIII

SAMPLING & ANALYTICAL TECHNIQUES

SAMPLING:

Sewage:

The daily sewage samples analyzed represent 24 hour composite samples of fine screened sewage from 7:00 A. M. to 7:00 A. M. A Phipps-Bird sampler was used to collect samples to form hourly composites (30-200 ml portions per hour) which in turn, were composited to form a 24 hour composite in proportion to the screened sewage flow rate.

Effluents:

The West Plant effluent samples represent a 24 hour composite of hourly grab samples. Every hour the operator would take one dipper full of effluent from each weir channel on all of the eleven clarifiers. Each hourly sample was mixed and a volume in proportion to the sewage flow was added to the 24 hour sample bottle.

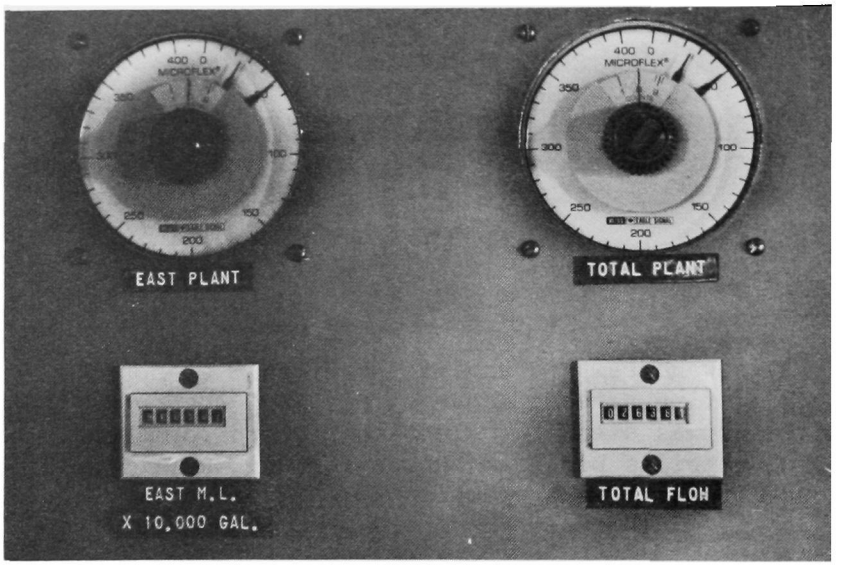
During 1971, the automatic Sanford sampler was placed in operation for sampling of the East Plant effluent. This sampler was activated by a counter so that samples would be automatically collected in proportion to the flow rate. A picture of the sampler is shown in Figure 9.

Mixed Liquor:

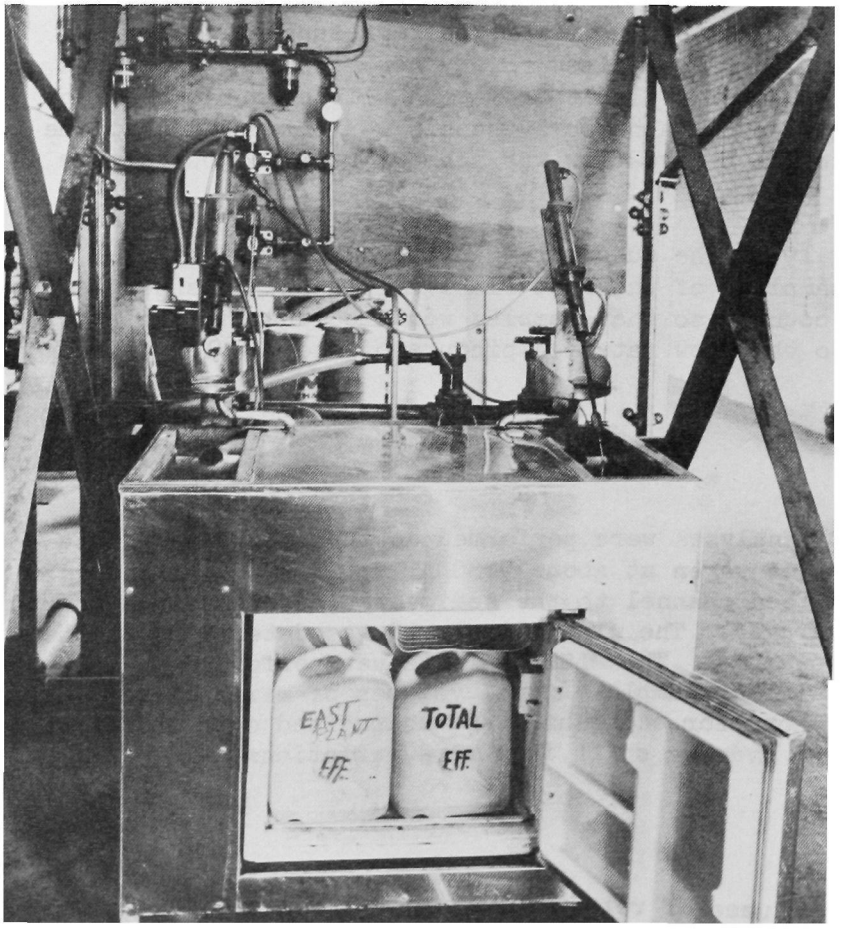
The SDI analyses were performed on the individual mixed liquor grab samples taken at about 9:30 A. M., 5:30 P. M. and 1:30 A. M. each day from a feed channel to the sedimentation basins and the three results were averaged. The mixed liquor pH was determined on the 9:30 A. M. grab sample. The MLSS analysis was performed on a 24 hour composite mixed liquor sample. Equal volumes of mixed liquor were collected every hour for each shift and composited on a shift basis in proportion to the average shift flow rate variations.

Return Sludge:

Equal volumes of return sludge were collected every two hours for each shift. At the end of the shift, the sample was mixed and a designated volume was added to the 24 hour return sludge sample bottle. This designated volume was proportional to the average flow variation for each shift.



SAMPLER COUNTER AND ACTIVATOR



SAMPLER AND REFRIGERATOR

FIGURE 9

Milorganite:

A Milorganite sample was collected in direct proportion to the rate of production to produce a 24 hour composite.

Phosphorus Determination:

Total, total soluble and soluble ortho phosphorus concentrations were determined on liquid samples. After the filtration of the total soluble and soluble ortho samples and the ternary acid digestion of the total and total soluble sample, the prepared samples were introduced into a Technicon Autoanalyzer for determination of the soluble ortho phosphorus concentration using the Aminonaphtholsulfonic Acid Method. For a detailed description of the method, refer to Appendix B. The return sludge phosphorus analyses were a gravimetric method as outlined in Appendix C.

Iron Determination:

The total iron and total soluble iron (analyses on filtrate) determination made on sewage and effluent samples were prepared by a nitric acid digestion. The digested samples were introduced into an Atomic Absorption instrument (Instrumentation Laboratory, Incorporated, Model No. 153) for analyses. The sewage sample for total iron was diluted 1 to 2, but the rest of the samples were run direct. This data is tabulated in Appendix H.

The iron concentration in the pickle liquor was determined using a volumetric titration-dichromate process. A description of the method is in Appendix D.

The return sludge iron was determined on dry centrifuged solids using a volumetric dichromate method as given in Appendix E until November 1, 1971. From November 2 to November 16, 1971, the digestate as generated by the method explained in Appendix E was analyzed using an Atomic Absorption unit. From November 16, 1971 through April 1972, the samples were digested using perchloric acid and analyzed using the Atomic Absorption unit as explained in Appendix F.

Mixed Liquor and Return Sludge Suspended Solids Concentration Determination:

A known volume of the sample was filtered through a weighed filter paper in a Buchner funnel (100 ml of ML through a S & S Sharkskin and 50 ml of return sludge through a Whatman No. 3). The sludge and paper were dried at 103° C. for one hour, cooled and weighed again. The difference in weight was used to determine the concentration.

Sludge Density Index Determination:

A relatively fresh mixed liquor sample was used for this analysis. The suspended solids concentration was determined on one part and a 30 minute settling test was determined on another part using a 1000 ml graduated cylinder.

$$SDI = \frac{\% \text{ MLSS} \times 100}{\% \text{ Cylinder volume occupied by solids after 30 minutes}}$$

Biochemical Oxygen Demand Determination:

This determination involved using the Azide Modification of the Iodometric method as given in Standard Methods, 12th Edition (14).

Total Solids Determination:

A 100 ml sample of sewage or effluent was placed in tared silica dish and the liquid was evaporated to dryness on a water bath. Then the dish was dried in an oven at 103° C. and was put in a desiccator to cool prior to being weighed again. The difference was the total solid weight per 100 ml of sample. The method is from Standard Methods, 12th Edition (14).

Suspended Solids Determination:

The sewage (50 ml) and effluent (200 ml) samples were filtered through a tared Gooch crucible with an asbestos pad. The crucible was dried at 103° C. for one hour, cooled in a desiccator and weighed again and the difference was the suspended solids weight. The method is from Standard Methods, 12th Edition (14).

Nitrogen Determination:

The total Kjeldahl nitrogen analysis on the liquid samples (sewage and effluents) is as indicated in Standard Methods, 12th Edition (14).

The nitrogen analyses on the Milorganite and the dry centrifuge return sludge solids is a method for total nitrogen on dried solids explained in Appendix G.

Ash Determination:

A three gram sample of the dried solids were put in a tared crucible and ignited at 600° C. for two and one half hours, cooled in desiccator and weighed.

Alkalinity Determination:

A 50 ml sample was titrated to a pH of 4.3 using N/50 H_2SO_4 using the following calculation as in Standard Methods, 12th Edition (14).

$$\text{Alkalinity as mg/l } CaCO_3 = \frac{\text{ml } H_2SO_4 \times \text{Normality } H_2SO_4 \times 50{,}000}{\text{ml sample}}$$

Sulfates Determination:

The sewage and effluent samples (20 ml diluted to 100 ml with distilled water) were analyzed for soluble sulfate by first filtering the sample through a glass fiber pad and running the analyses on the filtrate. The Turbidimetric Method in Standard Methods, 12th Edition (14) was used.

Specific Gravity Determination:

A standard 60° F. hydrometer was used to measure the specific gravity of the pickle liquor. The readings were not compensated for temperature.

% Free Acid Determination:

Initially, in 1970, a 10 ml aliquot of the pickle liquor was titrated with 1N NaOH until the formed floc turned from green to brown (pH about 6.0). This method was used for all the analyses on pickle liquor from the A. O. Smith Corporation. This method was later changed to titrate to a pH of 4.3 and all the pickle liquor from the U. S. Steel Corporation was analyzed in this fashion. The formula used in all determinations was:

$$\%\ H_2SO_4 = \frac{\text{ml titrant} \times \text{Normality of NaOH} \times .049}{\text{ml sample} \times \text{Specific Gravity}} \times 100$$

This equation varies from the one included in the report covering the 1970 data period (1) because of a typing error in the previous report.

SECTION IX

PRESENTATION AND DISCUSSION OF DATA

The performance of a waste water treatment plant is dependent upon the characteristics of the waste water that enters the plant. Some of these characteristics of the raw screened sewage entering the secondary or biological portion of the Jones Island treatment were:

TABLE I

Yearly Average Screened Sewage Characteristics

	1970	1971
Total Solids, mg/l	939	1042
Suspended Solids, mg/l	207	197
BOD, mg/l	209	220
COD, mg/l	431	-
Kjeldahl Nitrogen, mg/l N	28.3	28.2
Total Phosphorus, mg/l P	8.3	7.1
Total Soluble Phosphorus, mg/l P	3.1	2.3
Total Iron, mg/l Fe	7.2	6.7
Total Soluble Iron, mg/l Fe	0.6	0.4

These properties of the sewage entering the plant during 1971 are further broken down into monthly average concentrations in Table 2. The West and East Plant operations were similar except pickle liquor was added to the East Plant and East Plant return sludge was wasted to the West Plant return sludge channel. Table 2 also indicated the quality of the effluent from both plants along with the percent removal of the different properties listed. Appendix H has all the daily results of analyses.

This data highlights some very significant and interesting information. The sewage has a relatively high percent of insoluble phosphorus, 65% or an average 5.0 mg/l P. The pickle liquor iron, therefore, only has to interact and precipitate the smaller soluble portion or 35% of the phosphorus. Figures 10, 11 and 12 show the monthly variations in screened sewage BOD, suspended solids and total phosphorus over the last seven years.

TABLE 2

MONTHLY AVERAGE SCREENED SEWAGE
AND EFFLUENT CHARACTERISTICS

1971

MONTH	BIOCHEMICAL OXYGEN DEMAND					TOTAL SOLIDS				
	mg/l			% Removal		mg/l			% Removal	
	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE
January	229	18	23	92.1	89.9	1042	862	874	17.3	16.1
February	214	17	25	91.1	88.0	1120	933	951	16.7	15.1
March	200	13	17	92.7	89.9	1156	980	987	15.2	14.6
April	234	23	17	90.0	91.5	1123	971	951	13.5	15.3
May	249	34	23	86.8	89.3	1044	890	878	14.8	15.9
June	220	24	14	88.5	93.3	925	792	799	14.4	13.6
July	214	18	12	90.5	93.8	879	753	766	14.3	12.9
August	210	16	19	91.6	89.8	859	713	730	17.0	15.0
September	229	14	17	93.3	91.4	854	685	717	19.8	16.0
October	222	22	22	89.5	87.9	905	729	734	19.4	18.9
November	231	20	17	90.7	91.8	959	743	750	22.5	21.8
December	188	15	18	90.7	89.0	980	819	829	16.4	15.4
Average	220	20	19	90.6	90.5	987	823	831	16.8	12.9

MONTH	SUSPENDED SOLIDS					KJELDAHL NITROGEN		
	mg/l			% Removal		mg/l as N		
	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
January	204	24	39	88.4	82.1	31.8	13.9	12.3
February	200	28	36	85.4	83.0	27.3	10.9	9.6
March	197	18	31	90.5	83.0	25.9	9.7	9.3
April	204	45	33	78.7	84.2	27.9	10.6	8.9
May	218	64	45	71.6	78.2	30.7	13.5	11.0
June	194	32	20	84.2	89.4	26.5	6.1	3.8
July	174	18	17	89.4	89.8	25.1	5.6	3.4
August	187	19	15	89.3	91.7	26.0	8.2	5.6
September	194	16	13	90.8	92.8	27.8	8.8	5.7
October	199	21	16	89.8	91.4	30.0	11.3	6.9
November	214	19	11	91.6	94.3	32.3	10.8	5.7
December	180	17	18	89.9	90.2	26.6	9.1	8.2
Average	197	27	25	86.6	87.5	28.2	9.9	7.5

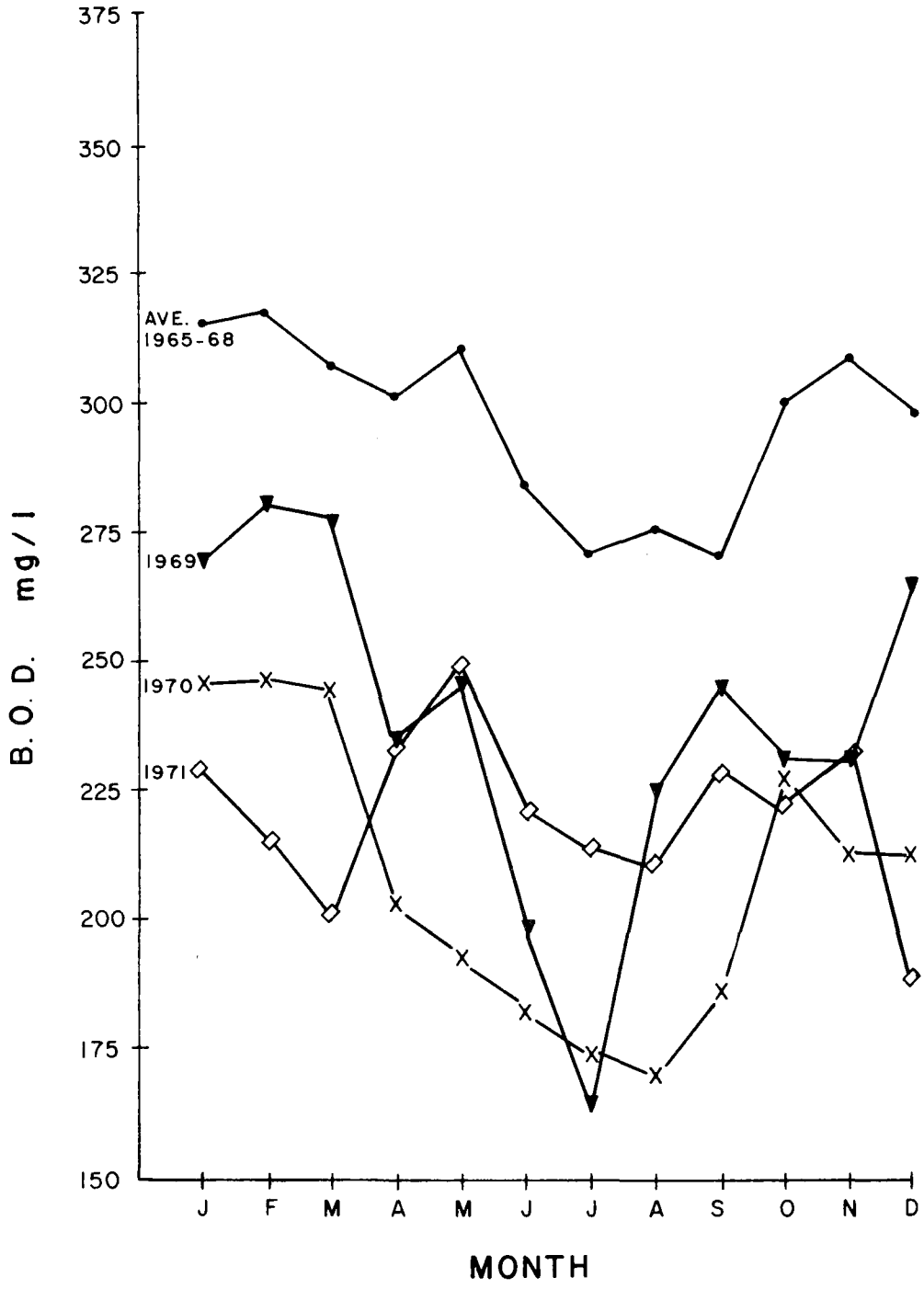
TABLE 2 (Cont'd.)

MONTHLY AVERAGE SCREENED SEWAGE
AND EFFLUENT CHARACTERISTICS

1971

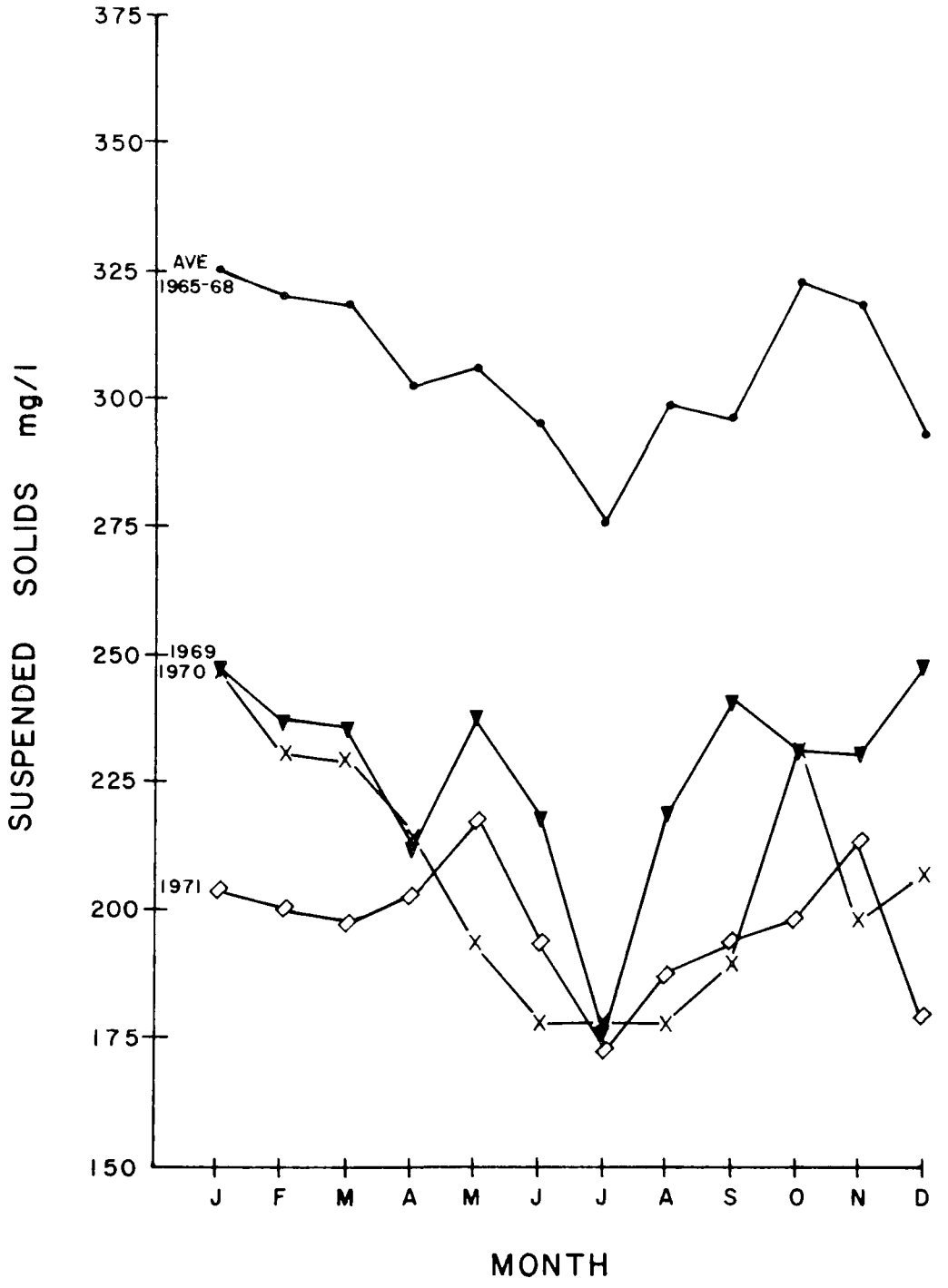
MONTH	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS				
	mg/l as P			% Removal		mg/l as P			% Removal	
	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE
January	7.9	1.7	0.93	79.7	88.5	3.1	1.1	0.23	65.7	92.6
February	6.8	1.2	0.94	81.7	85.7	2.7	0.69	0.22	74.7	91.0
March	6.3	0.73	0.84	88.4	86.7	2.6	0.38	0.19	85.3	92.5
April	6.2	1.6	0.75	76.2	88.5	2.2	0.33	0.18	85.7	91.7
May	7.4	2.2	1.1	71.7	85.6	2.2	0.27	0.19	87.8	91.1
June	6.8	0.94	0.51	86.4	92.4	1.9	0.18	0.13	90.7	92.3
July	7.1	0.92	0.47	86.8	93.2	2.0	0.34	0.15	84.5	92.1
August	7.4	1.4	0.65	81.0	91.2	2.1	0.87	0.37	57.3	82.3
September	7.6	1.2	0.47	83.4	93.8	2.2	0.77	0.27	65.7	87.8
October	7.6	1.4	0.58	81.5	92.2	2.0	0.67	0.23	68.0	87.9
November	7.7	0.96	0.39	87.2	94.8	1.8	0.36	0.15	78.1	90.6
December	6.6	1.4	0.61	79.0	90.8	2.7	0.95	0.28	66.4	89.6
Average	7.1	1.3	0.69	81.9	90.3	2.3	0.58	0.22	75.8	90.1

MONTH	TOTAL IRON					TOTAL SOLUBLE IRON				
	mg/l as Fe			% Removal		mg/l as Fe			% Removal	
	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE
January	6.11	0.43	2.09	93.2	76.2	0.52	0.15	0.09	72.7	83.1
February	6.67	0.75	3.10	88.1	52.1	0.52	0.18	0.18	64.4	60.1
March	4.80	0.45	2.11	90.6	54.9	0.37	0.16	0.10	55.2	74.3
April	5.57	1.37	2.74	75.0	52.0	0.46	0.30	0.33	36.8	37.7
May	6.85	3.47	3.59	49.4	47.9	0.51	0.33	0.35	43.4	53.6
June	6.81	1.23	1.27	82.3	79.9	0.47	0.24	0.13	50.6	72.7
July	6.57	0.96	1.01	85.3	84.9	0.46	0.24	0.14	46.8	68.1
August	6.83	1.03	1.08	84.7	84.0	0.47	0.15	0.16	68.2	66.2
September	8.14	0.94	0.74	88.4	91.1	0.40	0.11	0.07	71.7	81.2
October	8.25	0.92	1.22	89.0	85.5	0.43	0.10	0.09	76.2	79.5
November	9.06	1.23	0.93	86.5	89.8	0.29	0.09	0.08	69.0	70.4
December	4.70	0.75	0.91	83.7	79.0	0.26	0.12	0.09	53.2	62.8
Average	6.70	1.13	1.73	83.0	73.1	0.43	0.18	0.15	59.0	67.5



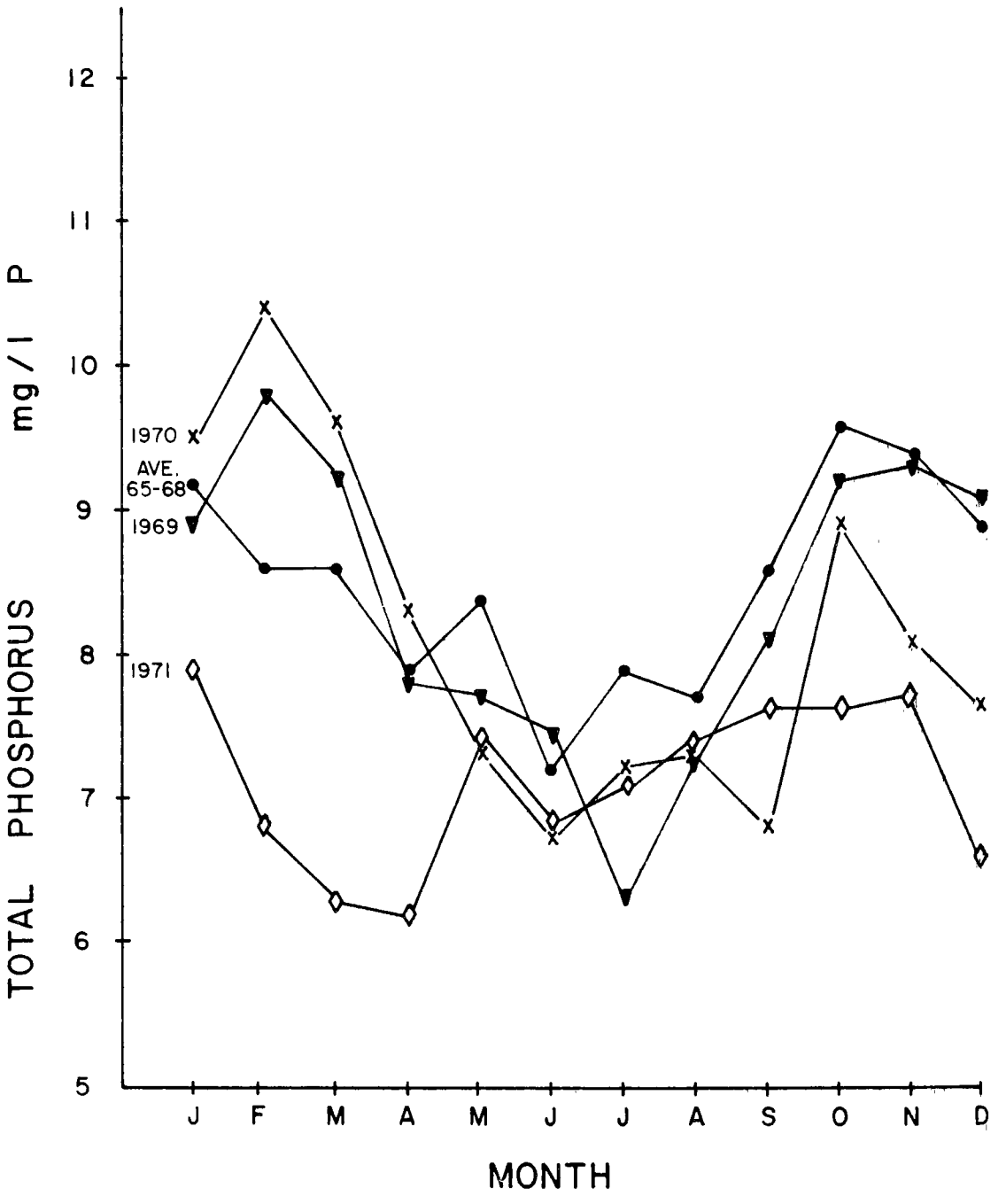
Monthly Sewage B.O.D. Variation

Figure 10



Monthly Sewage Suspended Solids Variation

Figure 11



Monthly Sewage Total Phosphorus Variation

Figure 12

The year 1971 is similar to 1970 but different from the 1965 to 1968 period. Changes in sewage sampling techniques instituted in 1967 may have contributed to this difference. The sewage properties in the future may continue as in the 1970-71 period. Figures 13 and 14 show the variation of phosphorus and iron concentrations in the raw screened sewage for the January 1970 to April 1972 period.

Initially, iron in the form of waste pickle liquor was added to the East Plant to demonstrate iron precipitation of phosphorus in an activated sludge plant and the West Plant, receiving the same screened sewage, was operated as a control with the sludges from each plant kept completely separate. After the one year demonstration grant period, the waste sludge from the East Plant was added to the West Plant as an iron source. Figures 15 and 16 show the iron and phosphorus concentration in the West and East Plant sludges.

The iron in the East Plant sludge at the start of the iron addition and in the West Plant after addition of East Plant sludge, more than doubled in concentration whereas a smaller increase in the phosphorus content occurred. During the 1970 demonstration period, the iron content of the East Plant return sludge solids was 5.08% as compared to 1.86% in the West Plant and the phosphorus content of the East Plant return sludge solids averaged 2.61% as compared to 2.29% in the West Plant. Future plans call for introduction of the vacuum filter filtrate directly to the West Plant to more effectively use this iron source for phosphorus removal.

The increased phosphorus concentration found in the return sludge confirmed the lower effluent phosphorus concentration. Figure 17 indicates the monthly average TP concentration in the plant effluents. The 1970 average East and West Plant Effluent TP averaged 0.70 mg/l and 1.4 mg/l, respectively. Considering the 354 day 1970 demonstration period, the objective of 0.50 mg/l was accomplished in the East Plant on 195 days (55.1% of the time), while in the West Plant the objective was met on only 60 days (16.9% of the time). Figure 18 shows the plant effluent total soluble phosphorus concentrations. In the 1970 demonstration period, the East Plant effluent TSP concentration averaged 0.30 mg/l and the West Plant averaged 1.1 mg/l. During the May 1971 - April 1972 period when East Plant waste sludge was added to the West Plant return sludge, the TSP values for the East and West Plant effluents averaged 0.22 and 0.64 mg/l. With low TSP concentrations, the problem is one of insoluble phosphorus. As noted, the phosphorus in the mixed liquor suspended solids increased resulting in a higher phosphorus content in the effluent suspended solids. Phosphorus removal, therefore, becomes an effluent suspended solids control problem. Figure 19 shows the monthly phosphorus variation and indicates the difference between the West and East Plant effluents.

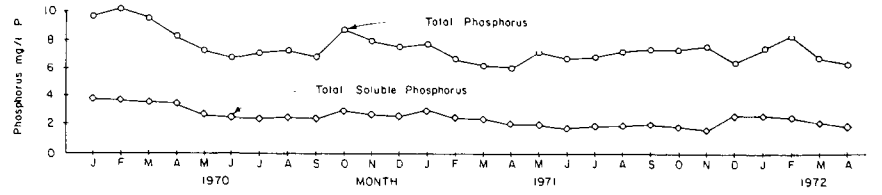


Figure 13

Sewage Phosphorus Variation

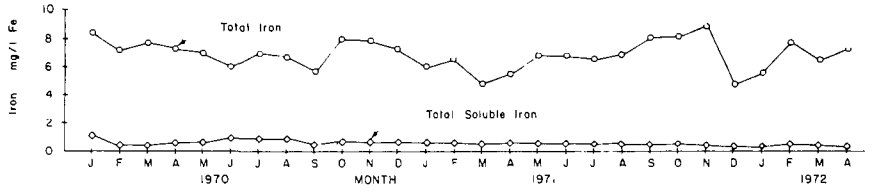


Figure 14

Sewage Iron Variation

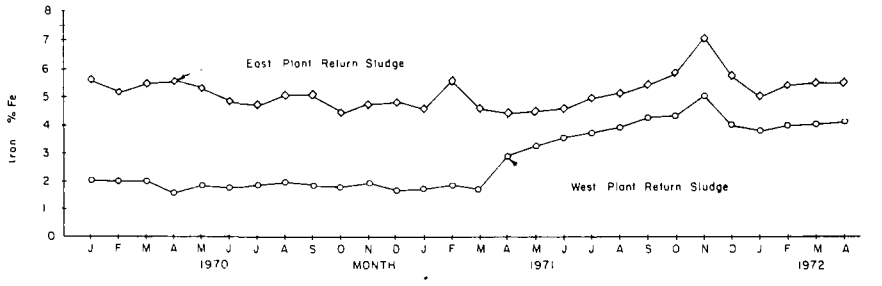


Figure 15

East and West Plant Return Sludge Iron

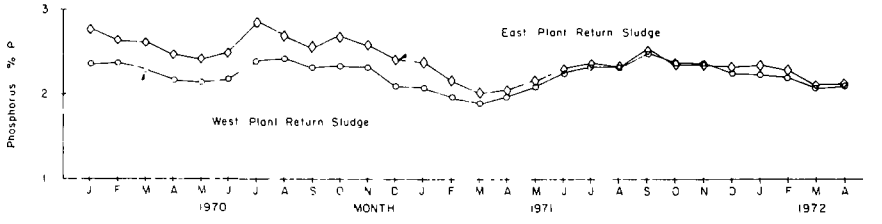


Figure 16

East and West Plant Return Sludge Phosphorus

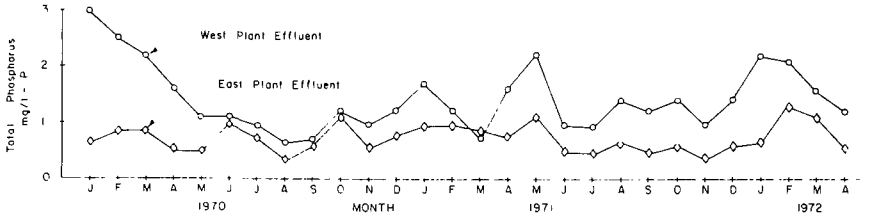


Figure 17

East and West Plant Effluent Total Phosphorus

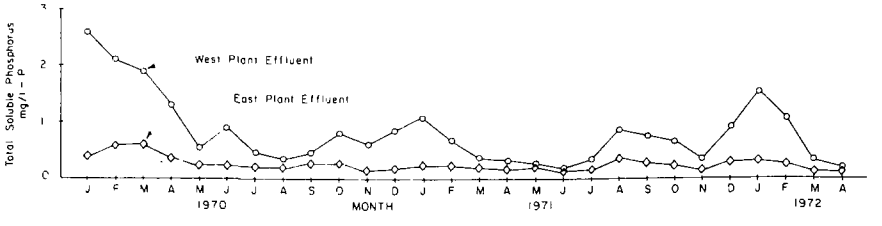


Figure 18

East and West Plant Effluent Total Soluble Phosphorus

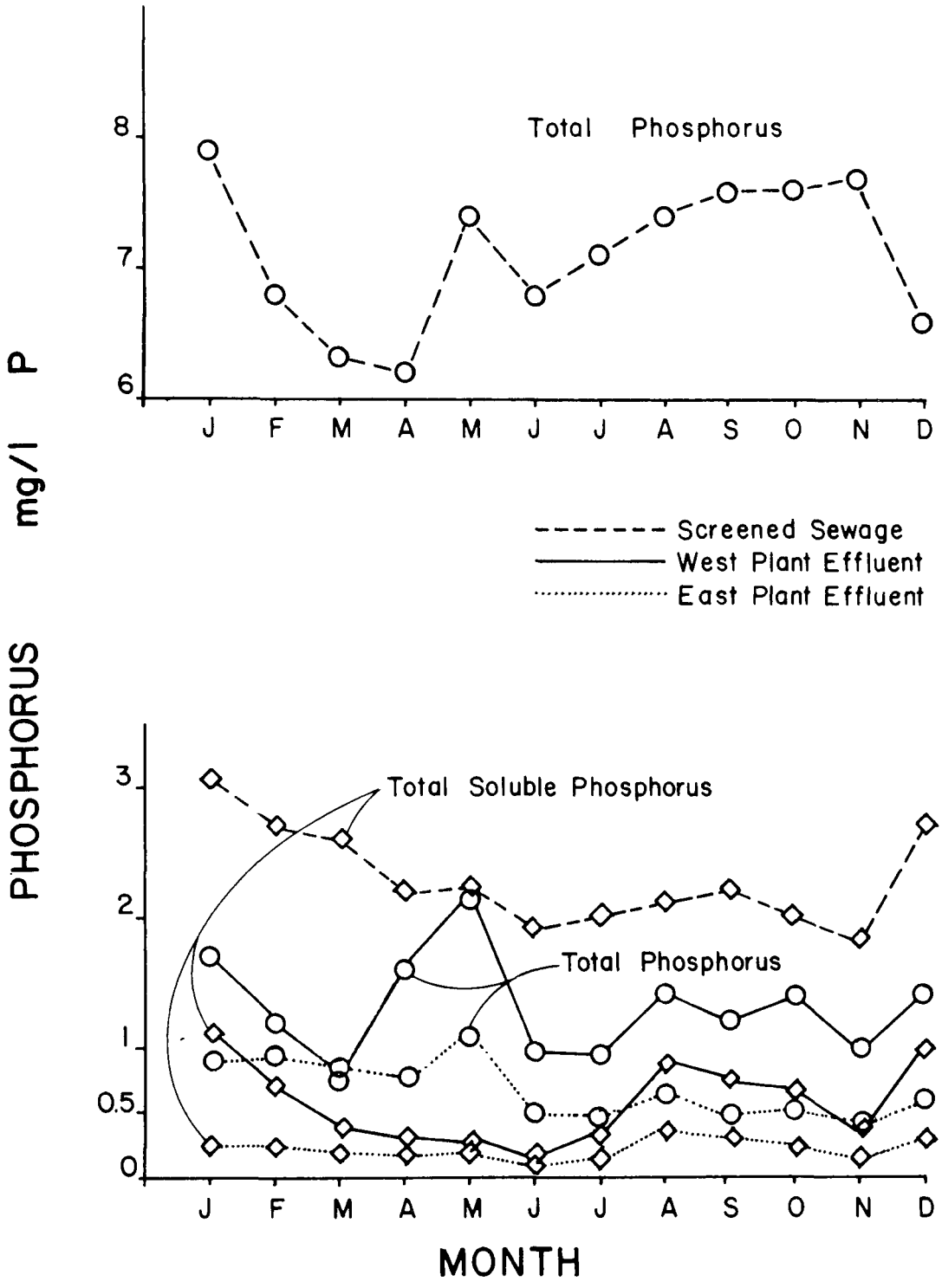


Figure 19

1971 Phosphorus Variation

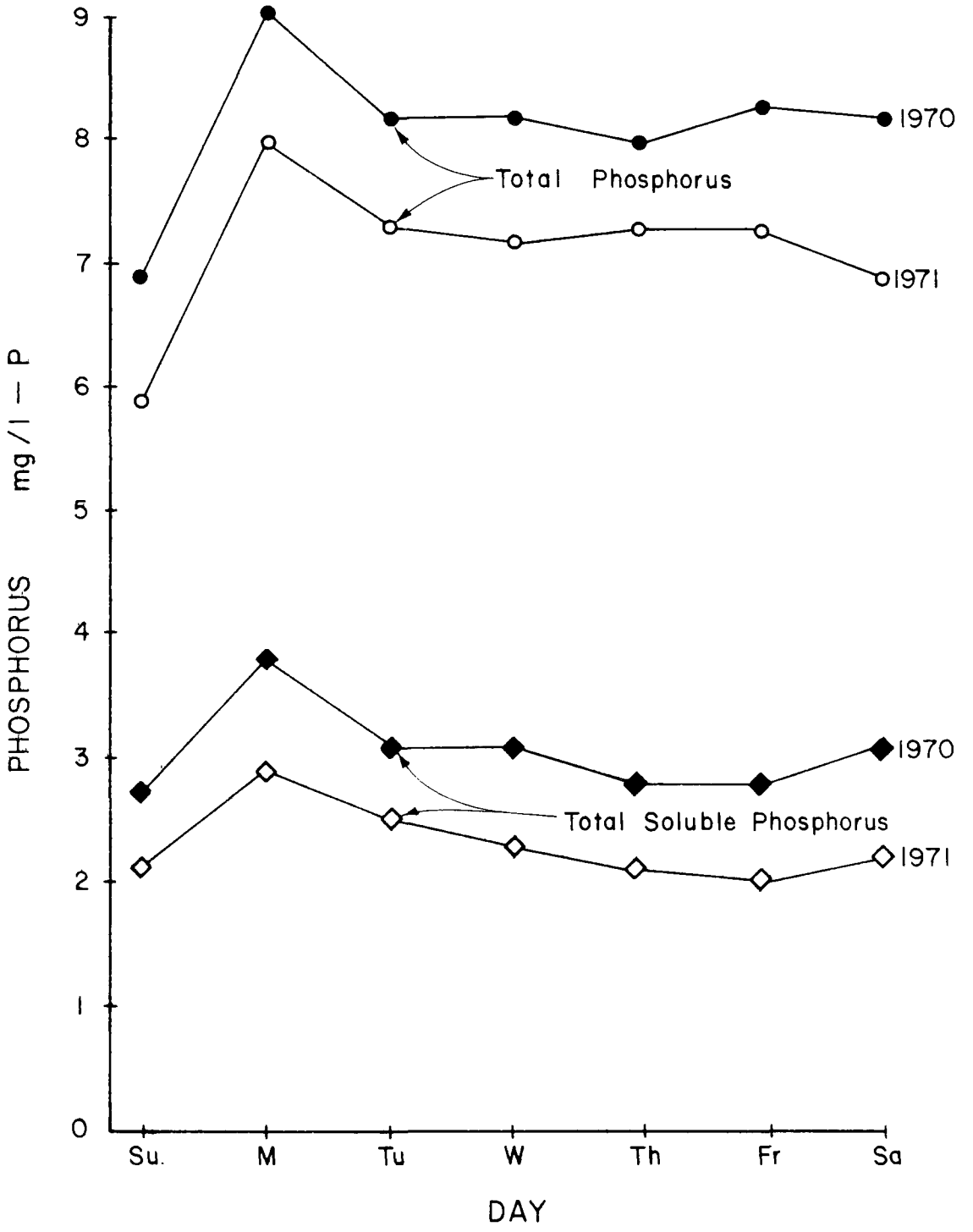
The week day variations are expressed in Figure 20 indicating a maximum sewage phosphorus on Mondays --- wash day, USA. As a result of this Monday shock load on the plant, the effluent total soluble phosphorus concentrations are higher in both plants. The rest of the week is fairly uniform in terms of sewage phosphorus content except for Sunday. Figure 21 shows the 1971 daily BOD variation, again showing a Monday shock load on the plant.

A review of the performance parameters of the West and East Plant as shown in Table 3, indicates that the BOD and suspended solids removals between the two plants were similar in 1970 and 1971.

Mixed Liquor and Return Sludge Characteristics:

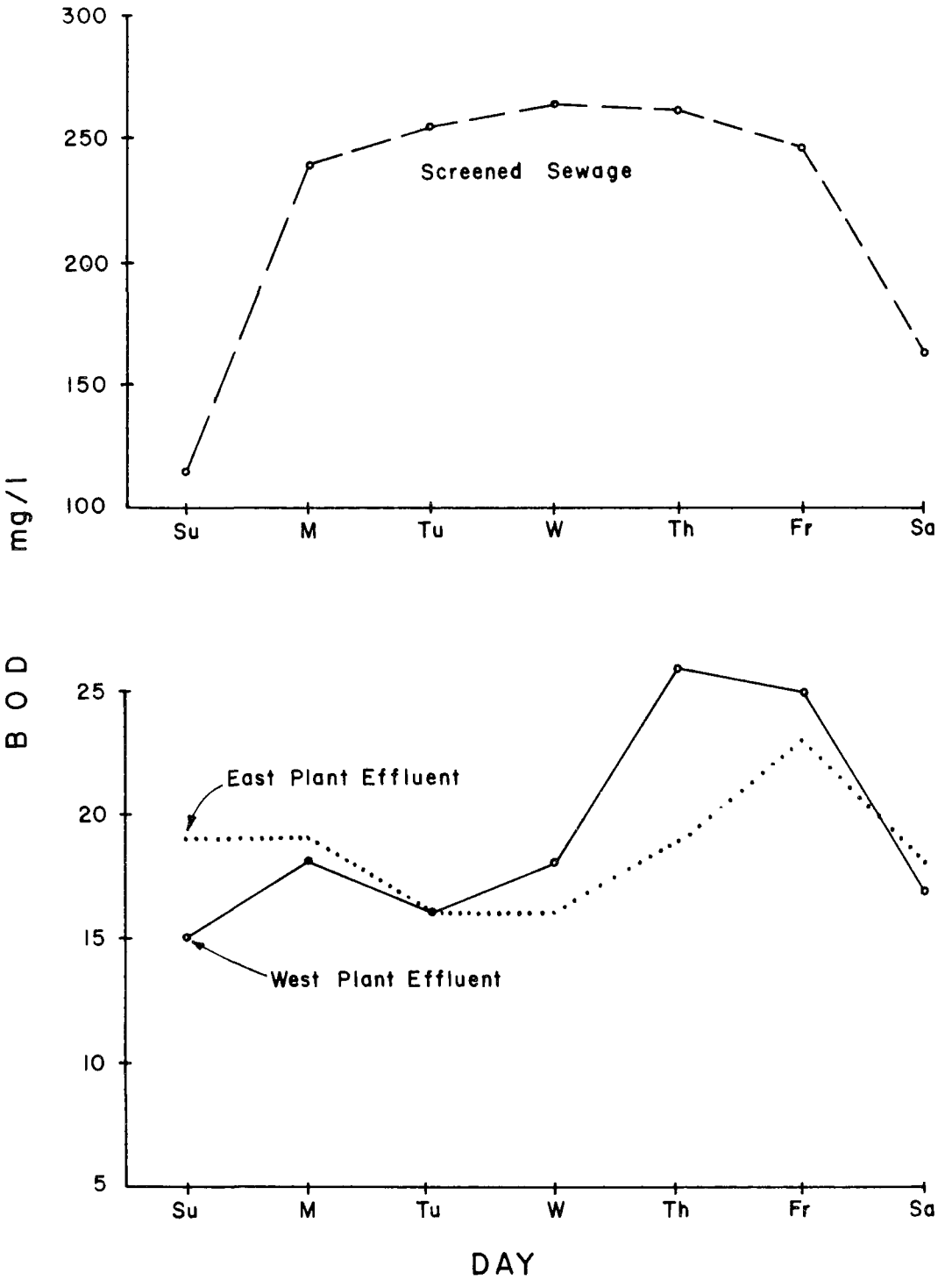
The addition of iron to the East Plant return sludge changed several properties, including the ash content. To compensate for this higher ash, attempts were made to keep the East Plant mixed liquor suspended solids 200 mg/l higher than in the West Plant from July 1970 to April 1971 to equalize the biomass or volatile suspended solids. During 1970, the average mixed liquor suspended solids for the West and East Plants were 2610 and 2700 mg/l and in 1971 averaged 2750 and 2860 mg/l, respectively. Table 4 shows the mixed liquor and return sludge yearly average characteristics. As previously mentioned and shown in Figures 15 and 16, the return sludge iron and phosphorus concentrations increased as expected and the ash free nitrogen values are the same. Figures 22 and 23 relate the 1971 West and East Plant return sludge phosphorus and iron concentrations with the effluent total soluble phosphorus. The West Plant results clearly indicate the concentration changes when the East Plant sludge was wasted to the West Plant return sludge starting in April 1971. Figures 24 and 25 show a diagram of the plan with various chemical concentrations for 1970 and 1971. The low iron concentration in the plant effluents indicated that the iron added is precipitated and almost completely tied up in the mixed liquor solids. During the 1970 demonstration period, the West and East Plant effluent total iron concentration averaged 0.51 and 1.2 mg/l and the total soluble iron concentration averaged 0.21 and 0.24 mg/l Fe. The low soluble iron concentration indicated that lower total iron concentrations would be obtained with a lower effluent suspended solids content.

The solids production in the mixed liquor was reviewed. A solids production difference between the West and East Plants could not be determined because the volume of sludge wasted from each plant individually was not accurately measured. The total sludge produced in both plants was obtained by adding the tons of dried solids removed and the solids present in the effluent. It should be remembered that the Jones Island Plant does not have conventional primary settling, only fine screening, and therefore, the sewage BOD and suspended solids fed to the biological process was high. This higher loading results in a greater



1970 – 1971 DAILY SEWAGE PHOSPHORUS VARIATION

FIGURE 20



1971 Daily BOD Variation

Figure 21

TABLE 3

PLANT PERFORMANCE PARAMETERS

1970

	SCREENED SEWAGE	WEST PLANT EFFLUENT	EAST PLANT EFFLUENT
BOD, MG/L	209	12.5	16.5
% REMOVAL		93.5	91.5
COD, MG/L	431	68	70
% REMOVAL		83.4	82.8
SUSPENDED SOLIDS, MG/L	207	18	23
% REMOVAL		90.9	88.5
TOTAL PHOSPHORUS, MG/L	8.2	1.4	0.70
% REMOVAL		83.3	91.3

1971

BOD, MG/L	220	20	19
% REMOVAL		90.6	90.5
SUSPENDED SOLIDS, MG/L	197	27	25
% REMOVAL		86.6	87.5
TOTAL PHOSPHORUS	7.1	1.3	0.69
% REMOVAL		81.9	90.3

TABLE 4

MONTHLY AVERAGE MIXED LIQUOR AND
RETURN SLUDGE CHARACTERISTICS

1971

MONTH	Iron Addition to East Plant		MIXED LIQUOR						
			E.P.	pH		Suspended Solids		S. D. I.	
	lbs/day	mg/l	MGD	WP	EP	WP	EP	WP	EP
January	8,399	8.5	118.6	-	-	2,614	2,821	0.88	0.80
February	10,225	10.0	122.8	-	-	2,856	2,920	1.11	1.03
March	8,145	7.1	136.7	-	-	2,743	2,839	1.12	1.03
April	7,143	6.3	136.2	-	-	2,968	3,024	1.07	0.99
May	8,878	8.3	125.1	7.1	7.1	2,824	2,992	1.01	0.89
June	6,377	5.5	138.6	7.0	7.0	2,911	3,073	1.16	1.19
July	7,722	7.0	133.0	7.1	7.1	2,514	2,722	1.04	1.05
August	8,619	8.0	128.2	7.2	7.1	2,530	2,643	1.70	1.61
September	8,616	8.1	127.5	7.1	7.0	2,496	2,644	1.47	1.48
October	10,139	10.0	121.9	7.1	7.0	2,638	2,764	1.09	1.04
November	9,126	9.3	120.3	7.2	7.1	3,379	3,294	1.14	1.19
December	7,847	7.3	129.7	7.1	7.0	2,523	2,590	1.25	1.24
Average	8,436	8.0	128.2	7.1	7.1	2,750	2,861	1.17	1.13

MONTH	RETURN SLUDGE - CENTRIFUGED SOLIDS - DRY BASIS							
	% Total - P		% Total - N		% Total - Fe		% Total - Ash	
	WP	EP	WP	EP	WP	EP	WP	EP
January	2.09	2.41	6.89	6.63	1.77	4.69	23.23	27.46
February	1.97	2.17	6.51	6.20	1.85	5.64	25.90	30.72
March	1.89	2.02	6.53	6.35	1.73	4.59	26.41	29.92
April	1.97	2.06	6.68	6.41	2.38	4.45	27.16	30.02
May	2.11	2.16	6.61	6.48	3.24	4.49	27.66	29.55
June	2.27	2.29	6.26	6.15	3.56	4.57	29.96	31.32
July	2.33	2.35	6.39	6.25	3.75	4.97	29.68	30.55
August	2.32	2.33	6.18	6.10	3.91	5.14	31.08	32.19
September	2.48	2.53	6.21	6.08	4.29	5.39	31.27	32.66
October	2.41	2.39	6.20	6.05	4.35	5.81	30.48	32.01
November	2.42	2.38	6.32	6.13	5.12	7.18	30.62	32.35
December	2.27	2.32	6.51	6.36	4.04	5.79	28.91	30.54
Average	2.21	2.28	6.44	6.26	3.33	5.23	28.53	30.77

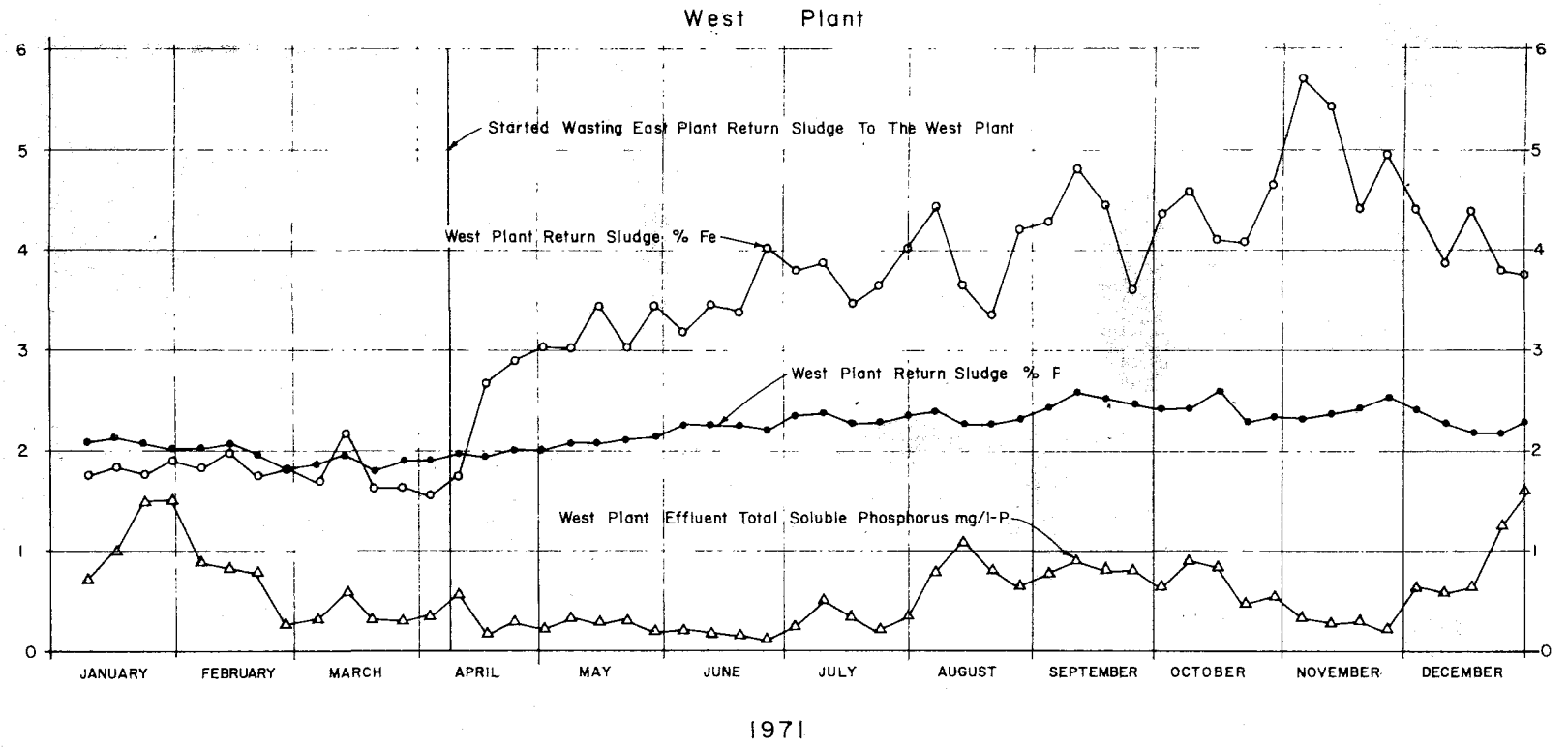

West Plant
Started Wasting East Plant Return Sludge To The West Plant
West Plant Return Sludge % Fe
West Plant Return Sludge % F
West Plant Effluent Total Soluble Phosphorus mg/l-P
0
1
2
3
4
5
6
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
1971

Figure 22

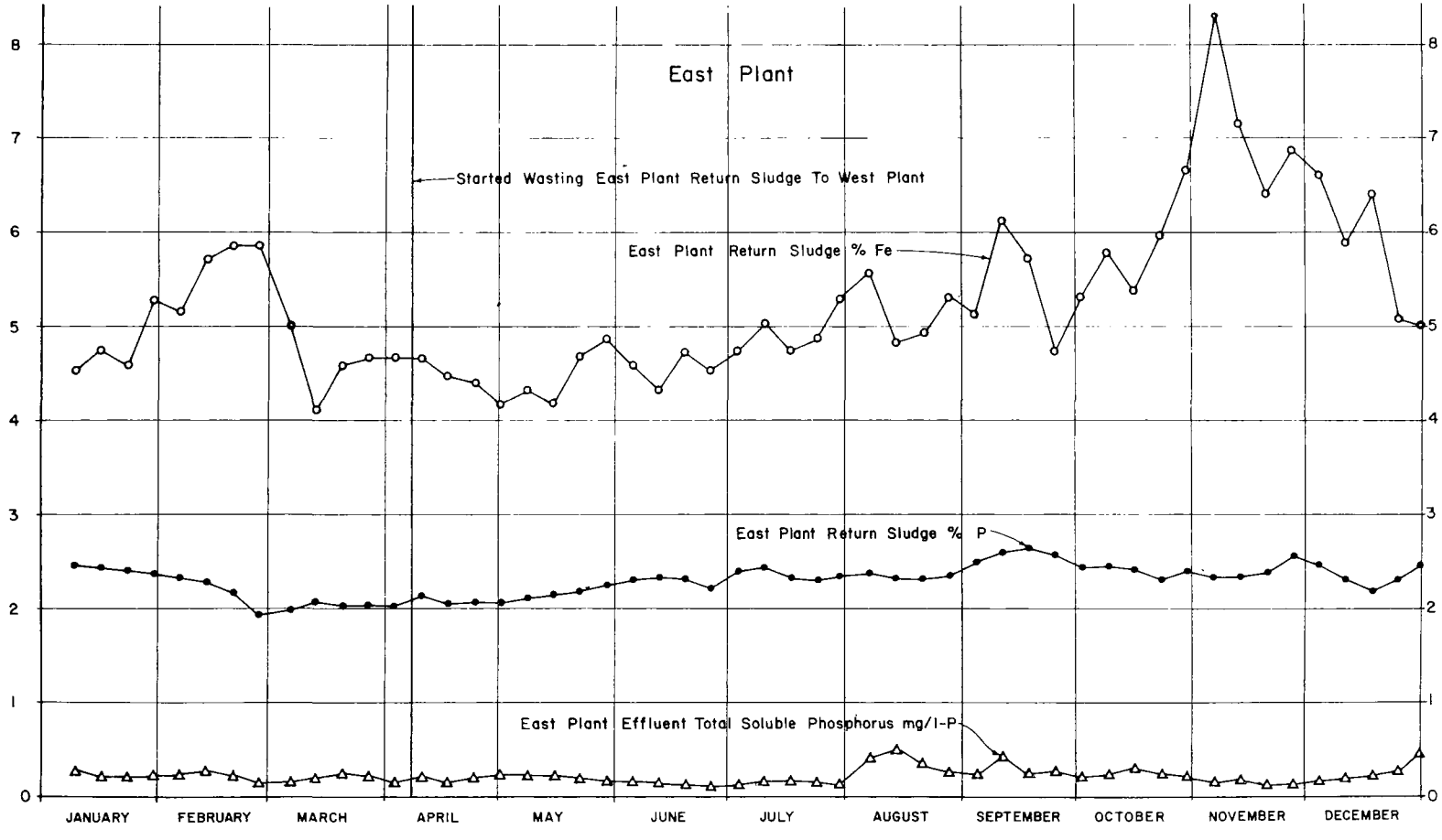

East Plant
Started Wasting East Plant Return Sludge To West Plant
East Plant Return Sludge % Fe
East Plant Return Sludge % P
East Plant Effluent Total Soluble Phosphorus mg/l-P
0
1
2
3
4
5
6
7
8
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
1971

Figure 23

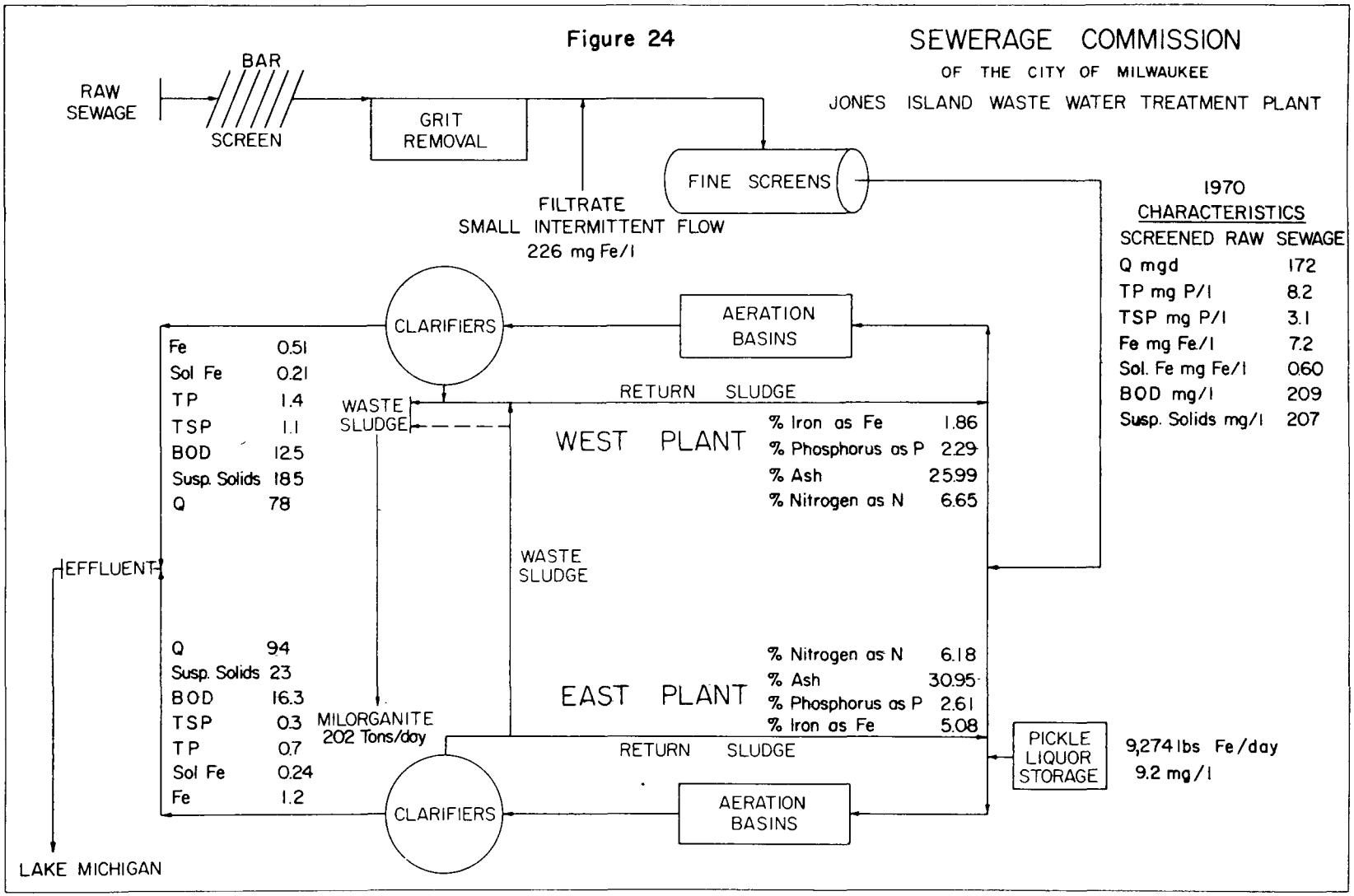
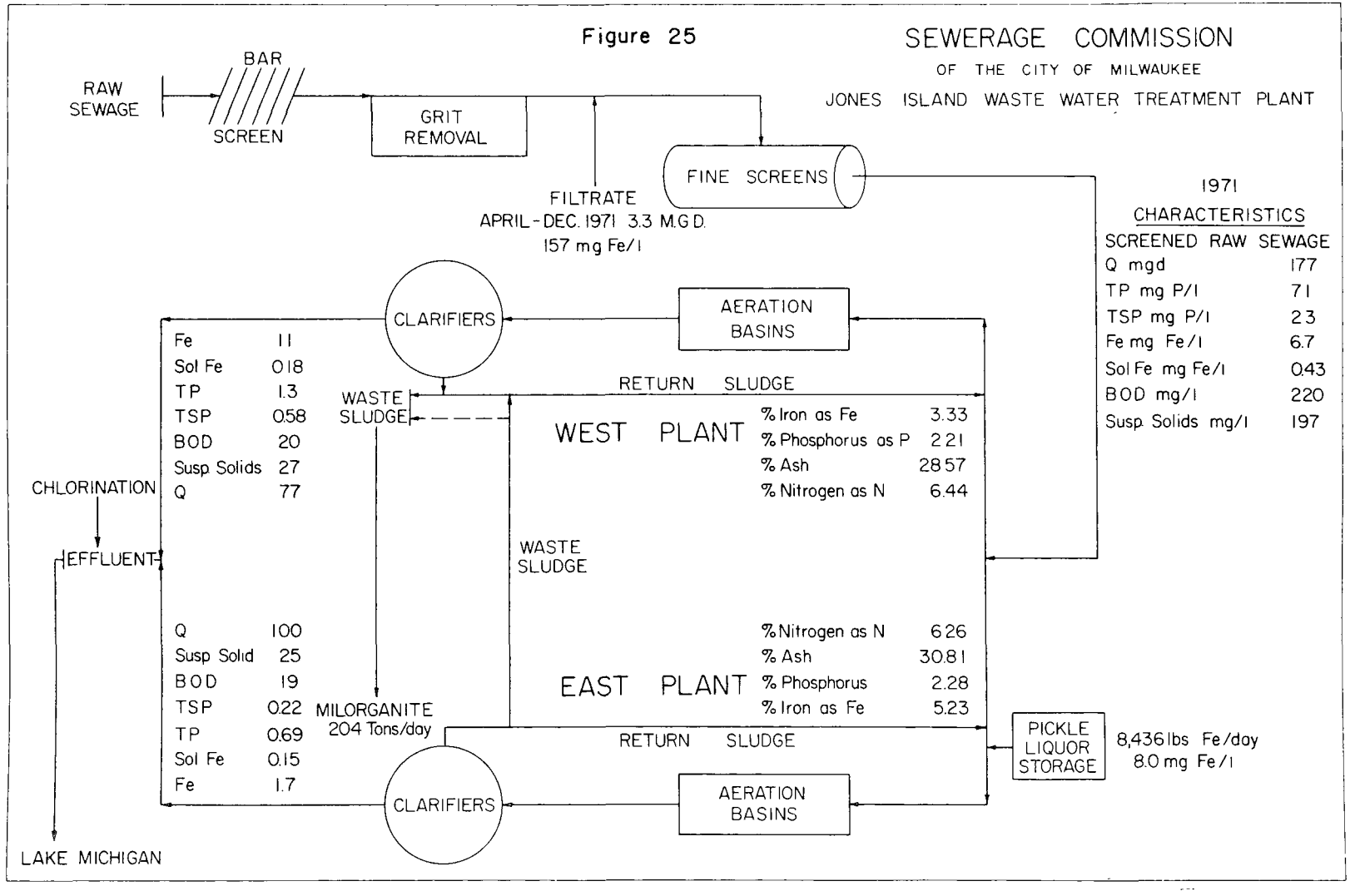


Figure 24
SEWERAGE COMMISSION
OF THE CITY OF MILWAUKEE
JONES ISLAND WASTE WATER TREATMENT PLANT
RAW SEWAGE
BAR SCREEN
GRIT REMOVAL
FINE SCREENS
FILTRATE
SMALL INTERMITTENT FLOW
226 mg Fe/l
1970
CHARACTERISTICS
SCREENED RAW SEWAGE
Q mgd 172
TP mg P/l 8.2
TSP mg P/l 3.1
Fe mg Fe/l 7.2
Sol. Fe mg Fe/l 060
BOD mg/l 209
Susp. Solids mg/l 207
CLARIFIERS
AERATION BASINS
Fe 0.51
Sol Fe 0.21
TP 1.4
TSP 1.1
BOD 125
Susp. Solids 185
Q 78
WASTE SLUDGE
RETURN SLUDGE
WEST PLANT
% Iron as Fe 1.86
% Phosphorus as P 2.29
% Ash 25.99
% Nitrogen as N 6.65
WASTE SLUDGE
EFFLUENT
Q 94
Susp. Solids 23
BOD 16.3
TSP 0.3
TP 0.7
Sol Fe 0.24
Fe 1.2
MILORGANITE
202 Tons/day
EAST PLANT
% Nitrogen as N 6.18
% Ash 30.95
% Phosphorus as P 2.61
% Iron as Fe 5.08
RETURN SLUDGE
PICKLE LIQUOR STORAGE
9,274 lbs Fe/day
9.2 mg/l
CLARIFIERS
AERATION BASINS
LAKE MICHIGAN

Figure 25

SEWERAGE COMMISSION
OF THE CITY OF MILWAUKEE
JONES ISLAND WASTE WATER TREATMENT PLANT



1971
CHARACTERISTICS

SCREENED RAW SEWAGE	
Q mgd	177
TP mg P/l	71
TSP mg P/l	23
Fe mg Fe/l	6.7
Sol Fe mg Fe/l	0.43
BOD mg/l	220
Susp. Solids mg/l	197

overall production of solids. Figure 26 shows the solids produced in conjunction with the BOD removed and shows the monthly variation of solids produced per 1000 pounds of BOD removed in 1970 and 1971. The increase in production of solids per BOD removed increased during periods of low BOD content of the sewage because the dewatering facilities were operated to remove as many solids as practical resulting in a lower sludge age.

Figure 27 shows the solids production per pound of BOD removed for the last seven years (the 1965 - 1968 data is represented as an average). Relating this data to Figure 10 (monthly sewage BOD variation), a greater production per pound of BOD removed occurs during periods of lower sewage BOD. During the lower BOD period, the solids were removed fast enough to maintain a lower sludge age and greater sludge production. In the 1965 - 1968 period, solids were not removed fast enough causing higher mixed liquor solids, a greater sludge age and lower solids production. Since the phosphorus content of the sludge is virtually constant, higher solids production and removal may be the reason for the increase noted in the ability of the West Plant to remove phosphorus. The greater the solids production, the greater the amount of phosphorus removed.

Miscellaneous Tests:

During the course of the project, additional tests were conducted to obtain a better understanding of the pickle liquor, the resultant changes in the plant, and phosphorus in general.

1. Pickle Liquor Free Acid:

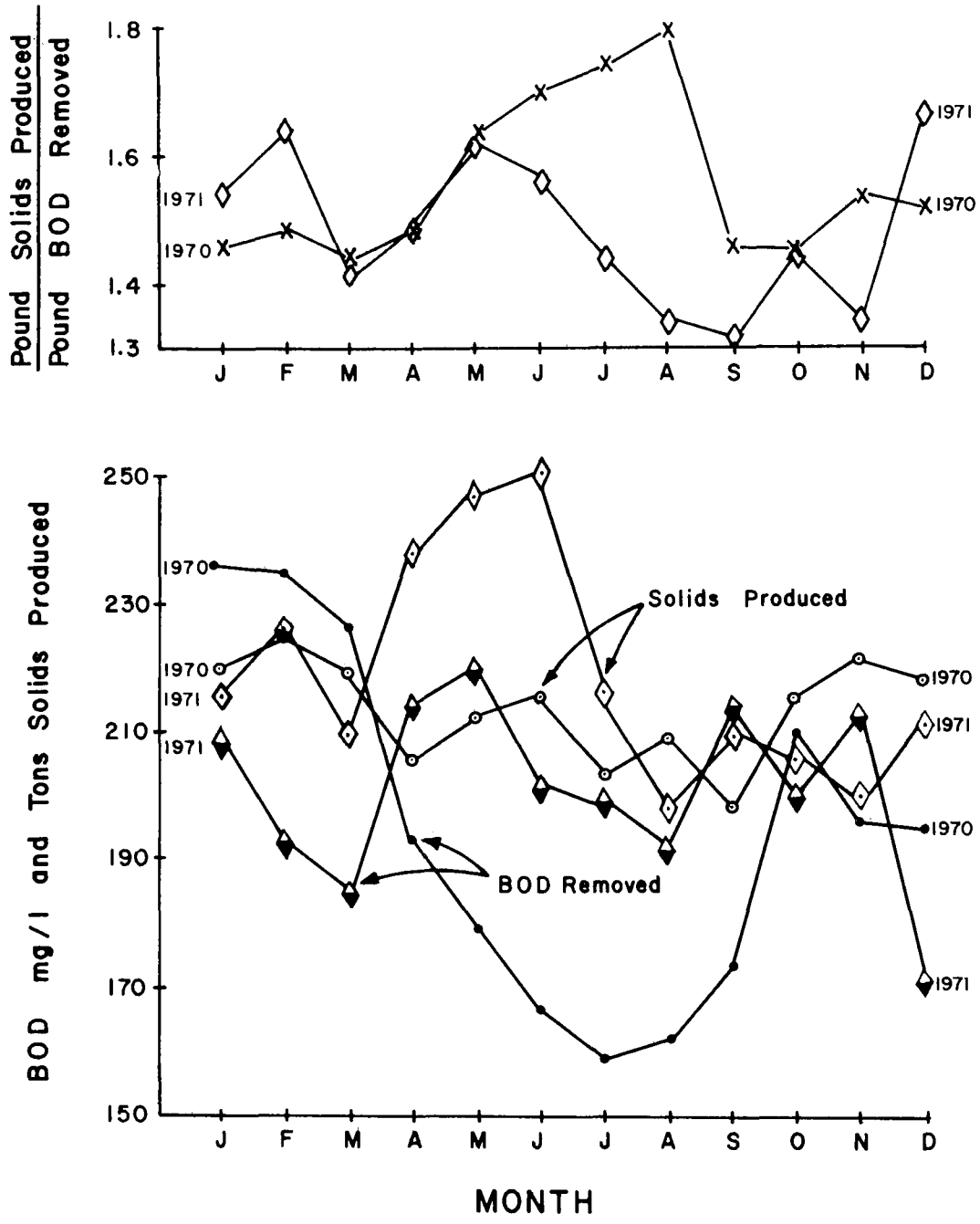
   The free acid in the pickle liquor from both the A. O. Smith Corporation and the U. S. Steel Corporation were periodically monitored and are shown in Table 5.

TABLE 5

Pickle Liquor Free Acid as % H_2SO_4

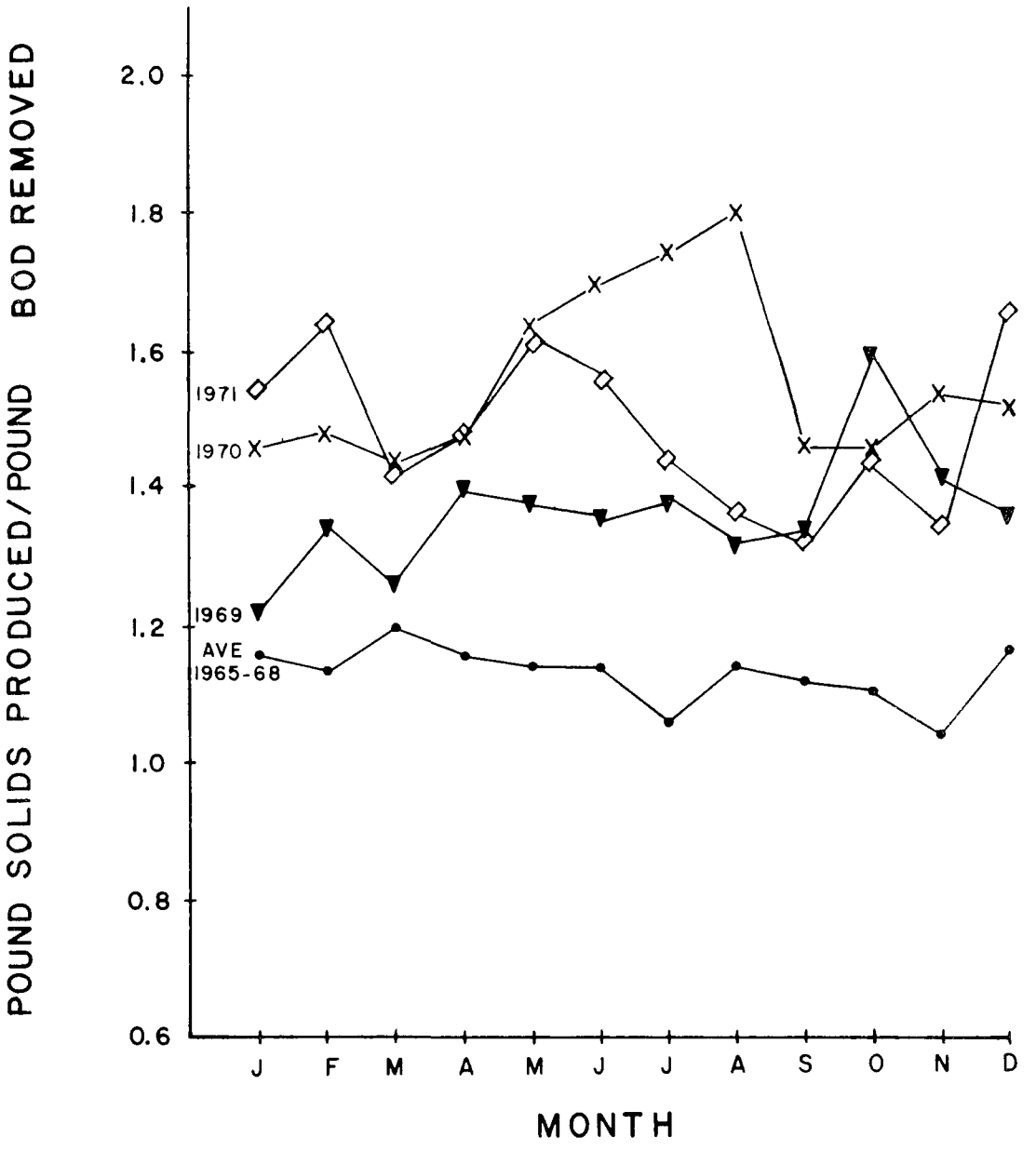
Type	A. O. Smith Sulfuric Acid	U. S. Steel Sulfuric-Hydrochloric
Ave.	4.5	7.8
Max.	5.8	9.3
Min.	2.1	6.6

NOTE: All tests for free acid were conducted in 1970 except for two on pickle liquor from A. O. Smith. U. S. Steel pickle was used from November 4, 1970 to December 1, 1970 because of a strike at General Motors and the resultant slowdown at A. O. Smith.



1970 and 1971 Solids Production per BOD Removed

Figure 26



Solids Production per BOD Removed

Figure 27

The addition of this acid to the East Plant mixed liquor has no apparent effect on the pH with the average 1970-1971 mixed liquor pH for the West and East plants being 7.1 and 7.0.

2. Alkalinities on Sewage, Effluents and Mixed Liquor:

   Throughout the year, alkalinities were run on samples of screened sewage, effluents and some mixed liquor filtrates, using 24 hour composites to determine the effect of pickle liquor acid on the alkalinity of the system. The sewage total alkalinity averaged 228 mg/l as $CaCO_3$ for the 1970-1971 period with the effluents averaging 226 in the West Plant and 187 in the East Plant (17% difference in the effluents). The mixed liquor filtrates averaged 208 for the West Plant and 172 for the East Plant and are shown in Table 6.

3. Soluble Sulfates on Sewage and Effluents:

   Sulfate analyses were performed on weekly composites made from daily 24 hour composites. The sewage soluble sulfate concentration averaged 108 mg/l SO_4 with the effluents having 116 and 130 mg/l SO_4, respectively, for the West and East Plants during the 1971 period. The sulfate concentration of the East Plant effluent was, therefore, 12% higher than that of the West Plant effluent. The data is shown in Table 7.

4. Iron Phosphorus Uptake and Release:

   Phosphorus uptake and release studies were conducted to further understand the effect of the pickle liquor iron addition. Samples of sewage, return sludge and mixed liquor throughout the aeration phase, were collected and analyzed for SOP (soluble ortho phosphate). The results of the uptake and release studies indicated a definite difference between the control West Plant and the East Plant. The 1970 data indicated that upon mixing the sewage and return sludge, SOP was released in both plants. In the East Plant less SOP was released and the SOP uptake rate was faster. A sharp drop in SOP concentrations was noted at the point of iron addition. Laboratory phosphorus release studies were conducted by allowing the mixed liquor, obtained from the aeration tank outlet, to settle and then sample the different layers as a function of time. The results indicated a much greater SOP release with the

TABLE 6

TOTAL ALKALINITY

Sewage Effluents and Mixed Liquor Filtrate

DATE		SEWAGE	WEST EFFLUENT	EAST EFFLUENT	TOTAL EFFLUENT	WEST M.L. FILTRATE	EAST M.L. FILTRATE
Wed.	1-13-71	230	234	202	204	---	---
Thurs.	1-21-71	244	208	188	210	---	---
Sun.	1-24-71	212	246	210	184	---	---
Mon.	2-1-71	240	242	192	182	---	---
Tues.	2-9-71	234	242	162	192	---	---
Wed.	2-17-71	226	224	166	186	---	---
Thurs.	2-25-71	194	222	220	200	---	---
Tues.	3-2-71	258	254	222	216	---	---
Mon.	3-8-71	250	220	266	232	---	---
Sun.	3-14-71	200	218	194	178	---	---
Fri.	3-26-71	216	258	230	234	---	---
Sun.	4-4-71	268	258	220	222	---	---
Wed.	4-14-71	228	229	184	190	---	---
Mon.	4-26-71	284	276	224	232	---	---
Tues.	5-4-71	276	256	212	260	---	---
Sun.	5-9-71	232	220	184	180	---	---
Mon.	5-11-71	210	218	188	190	---	---
Tues.	11-16-71	180	210	166	---	218	184
Wed.	11-17-71	198	206	158	---	192	182
Thurs.	11-18-71	188	204	168	---	206	172
Sun.	11-21-71	236	194	128	---	208	168
Mon.	11-22-71	234	194	122	---	220	160
Tues.	11-23-71	218	196	138	---	206	174
Thurs.	11-25-71	220	200	132	---	208	166
Ave.	24 Days	228	226	187	184	208	172
Max.		284	276	266	260	220	184
Min.		180	194	122	178	192	160

TABLE 7

SOLUBLE SULFATE CONCENTRATION

Reported as mg/l SO_4 in Weekly Composition

DATE	SEWAGE	WEST EFFLUENT	EAST EFFLUENT	TOTAL EFFLUENT
1-3 thru 1-9	130	138	158	---
1-10 thru 1-16	124	130	158	154
1-17 thru 1-23	135	125	158	146
1-24 thru 1-30	130	130	158	140
1-31 thru 2-6	135	124	154	140
2-7 thru 2-13	112	119	158	140
2-14 thru 2-20	105	103	145	125
2-21 thru 2-27	118	118	140	135
2-28 thru 3-6	130	131	146	145
3-7 thru 3-13	* 140	125	158	148
3-14 thru 3-20	110	118	140	135
3-21 thru 3-27	125	110	133	130
4-4 thru 4-10	135	131	148	138
4-11 thru 4-17	130	124	145	133
4-18 thru 4-21	130	* 165	* 165	* 170
4-25 thru 5-1	110	145	154	163
5-2 thru 5-8	112	163	158	163
5-9 thru 5-15	115	148	154	163
5-16 thru 5-22	108	146	154	163
5-23 thru 5-29	NS	NS	NS	NS
5-30 thru 6-5	NS	NS	NS	NS
6-6 thru 6-12	NS	NS	NS	NS
6-13 thru 6-19	95	145	139	146
6-20 thru 6-26	95	130	124	135
6-27 thru 7-3	90	138	130	133
7-4 thru 7-10	93	130	124	135
7-11 thru 7-17	105	91	103	125
7-18 thru 7-24	107	101	134	115
7-25 thru 7-31	103	105	139	108
8-1 thru 8-7	105	88	139	108
8-8 thru 8-14	98	93	121	112
8-15 thru 8-21	105	95	144	110
8-22 thru 8-28	93	98	Δ 102	107
8-29 thru 9-4	93	93	108	Δ 101
9-5 thru 9-11	107	108	115	108
9-12 thru 9-18	95	98	116	108
9-19 thru 9-25	102	108	107	112
9-26 thru 10-2	Δ 86	102	115	108
10-3 thru 10-9	91	102	115	105
10-10 thru 10-16	98	Δ 84	114	110
10-17 thru 10-23	91	108	121	116
10-24 thru 10-30	93	98	122	110
10-30 thru 11-6	95	103	137	114

DATE	SEWAGE	WEST EFFLUENT	EAST EFFLUENT	TOTAL EFFLUENT
11-7 thru 11-13	112	98	117	131
11-14 thru 11-20	119	110	135	121
11-21 thru 11-27	103	98	140	116
11-28 thru 12-4	119	108	138	115
12-5 thru 12-11	98	99	125	112
12-12 thru 12-18	121	115	133	122
12-19 thru 12-25	112	114	133	124
12-26 thru 1-1-72	122	117	140	124
Ave. 49 Weeks	108	116	130	122
Max. *	140	165	165	170
Min. Δ	86	84	102	101

West Plant mixed liquor, Figure 28 is a visual idea of the general characteristics of the system relative to SOP uptake and release. Similar testing in 1971 confirmed the SOP release results even though iron was being added via East Plant waste sludge.

During August and September, the total phosphorus in the West Plant effluent appeared to be increasing and phosphorus release from the mixed liquor was suspected to be the cause. On September 23 and 27, tests were conducted in both plants to determine the amount of phosphorus released within one hour.

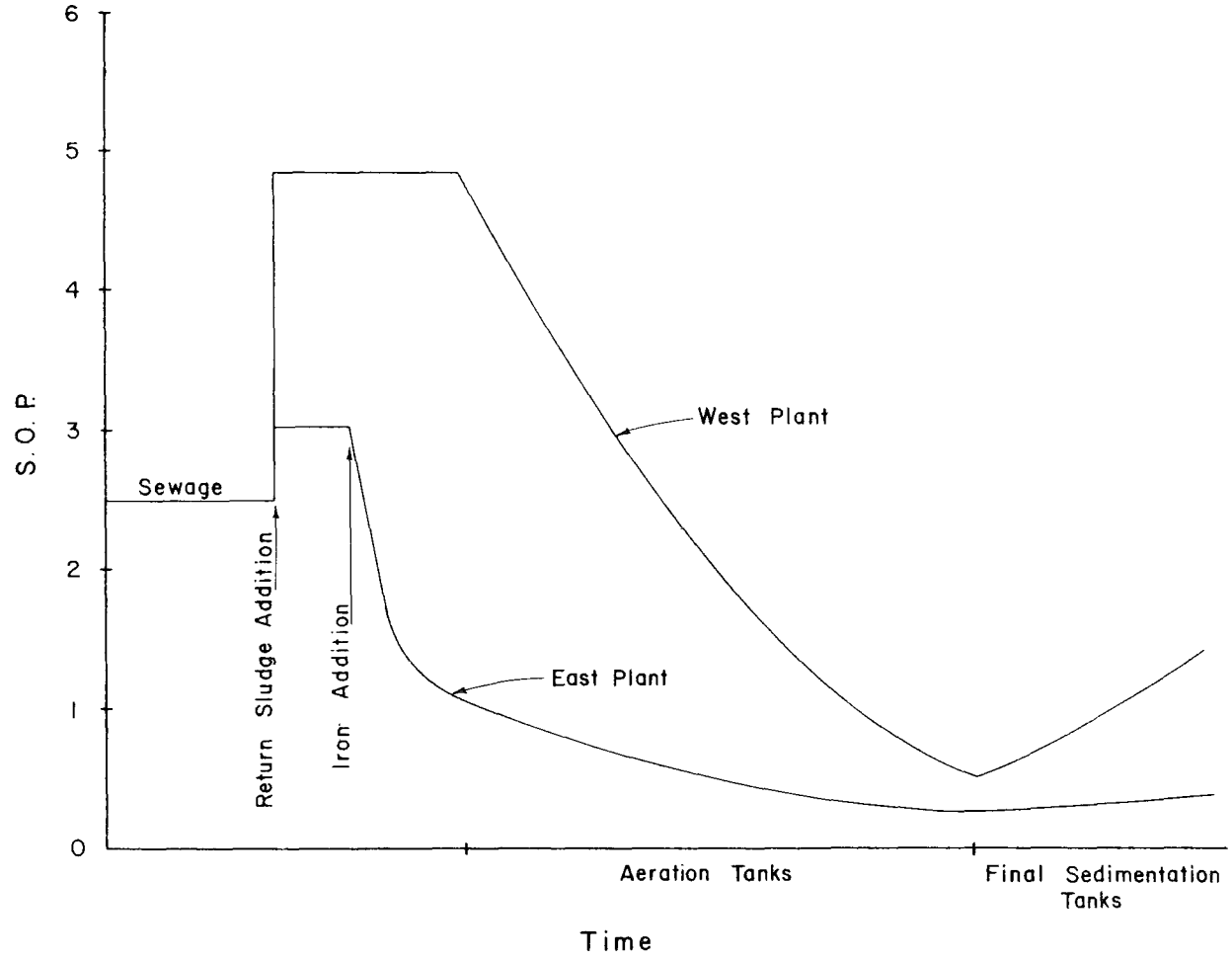
A sample was taken from the mixed liquor feed channel to a clarifier and a portion was immediately filtered and then brought to the laboratory. This coarse filtered sample was again filtered through a glass fiber pad and designated as zero time. Another portion of the original sample was filtered after 15 minutes and another after one hour. All samples were run on the autoanalyzer and the amount of phosphorus determined the results as shown in Figure 29.

On both days the release of phosphorus from the West Plant was higher than in the East Plant. The Monday sample, as expected, showed a higher concentration of phosphorus present at zero time in the West Plant. Phosphorus residuals on Mondays have been difficult to maintain due to the shock on the biomass by the sudden influx of nutrients.

Rate of Iron Addition:

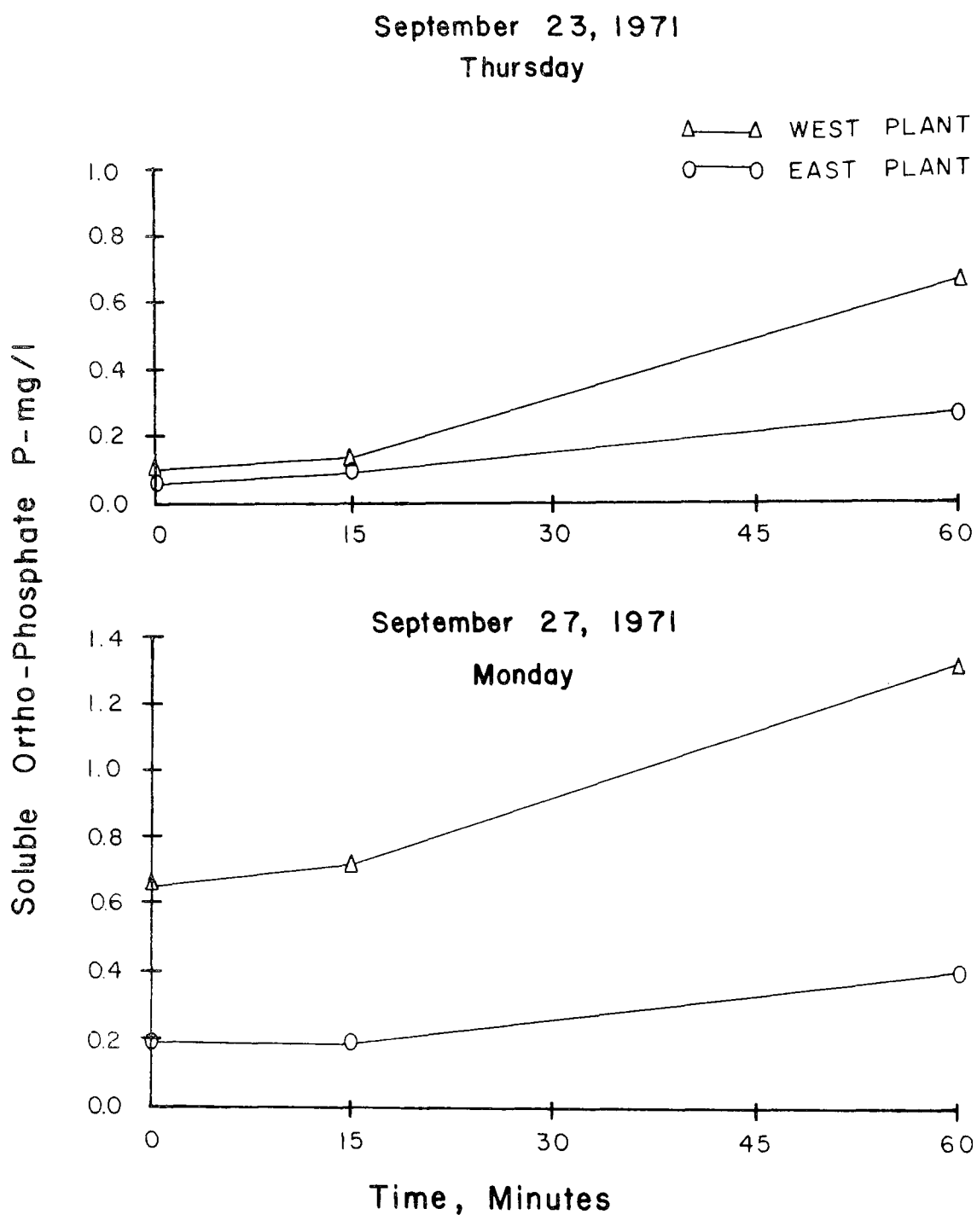
At the start of the iron addition project, it was proposed to determine the minimum, maximum and optimum iron requirements. As a result of the delay in the activation of the automatic equipment, this study was not initiated. At the present time, the iron addition is in proportion to the supply and thus far, we have utilized the entire production of pickle liquor from the A. O. Smith Corporation. Table 8 indicates the variation in the quantities of iron added to the East Plant and the concentrations are shown in Figure 30. The initial high dosage for the first five months in 1970 represents the acclimation period prior to reaching steady state along with a slight decrease in sewage total soluble phosphorus after this period as shown in Figure 10.

From January 1, 1971 to December 31, 1971 a total of 4,206,263 gallons of waste pickle liquor were added, averaging 11,546 gallons per day, or 8,436 lbs. per day to the East Plant. The specific gravity ranged from 1.095 (0.22 pounds of iron per gallon) to 1.302 (0.93 pounds of iron per gallon), averaging 1.246 (0.74 pounds of iron per gallon).



Soluble Ortho Phosphate Uptake & Release

Figure 28



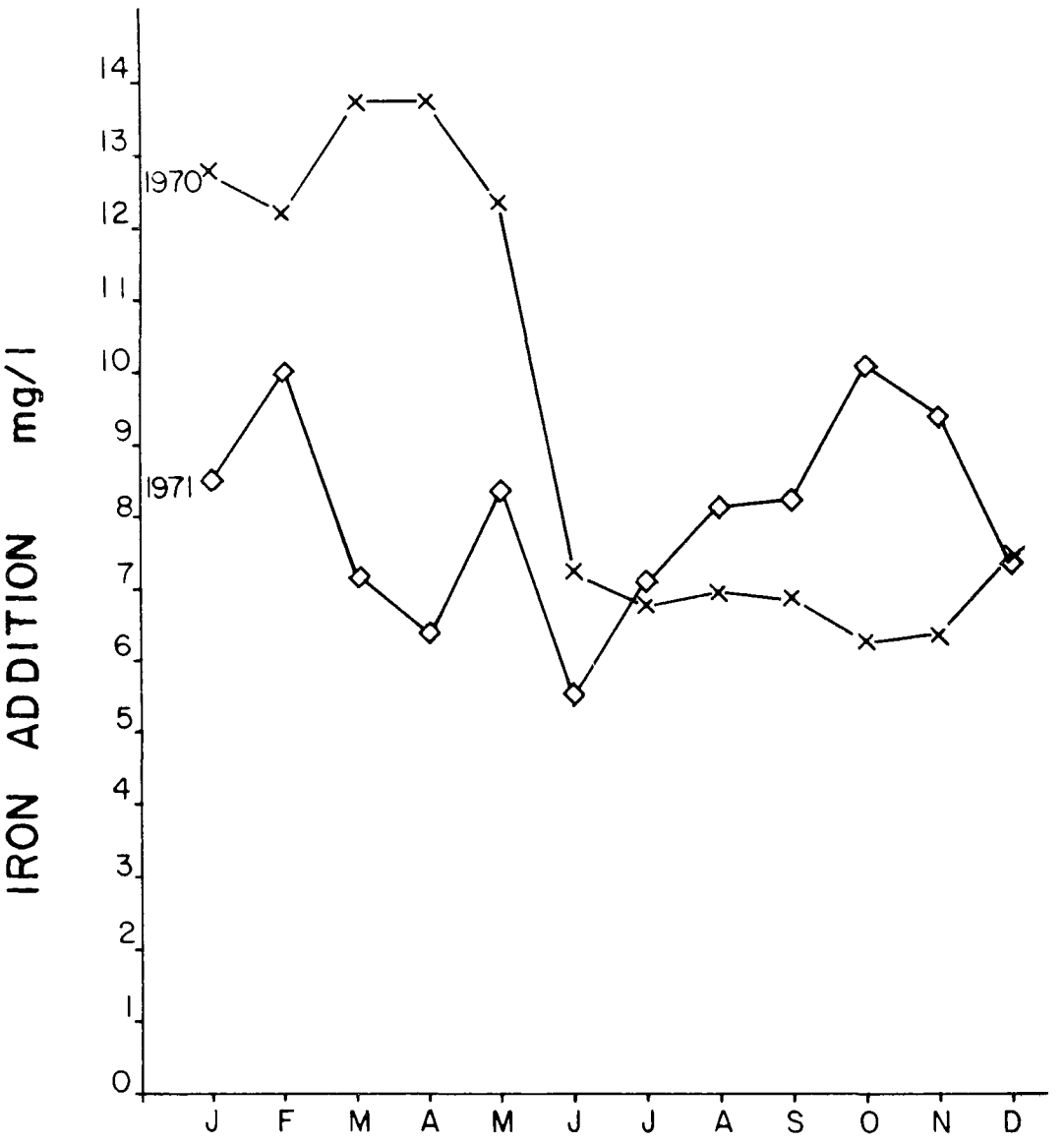
Soluble Ortho Phosphate Release

Figure 29

TABLE 8

IRON ADDITION TO EAST PLANT

MONTH	1970		1971	
	lbs/day	mg/l	lbs/day	mg/l
January	11,778	12.8	8,399	8.5
February	10,423	12.2	10,225	10.0
March	12,192	13.7	8,145	7.1
April	12,960	13.7	7,143	6.3
May	12,630	12.3	8,878	8.3
June	8,081	7.2	6,377	5.5
July	7,392	6.7	7,722	7.0
August	7,210	6.9	8,619	8.0
September	7,427	6.8	8,616	8.1
October	6,408	6.2	10,139	10.0
November	6,780	6.3	9,126	9.3
December	8,001	7.4	7,847	7.3
Average	9,274	9.4	8,436	8.0



EAST PLANT IRON ADDITION

FIGURE 30

Mixed Liquor Biota:

Microscopic examinations of the mixed liquor performed at least twice per week, have indicated no apparent change in the types and number of organisms as a result of iron addition.

Samples of algae from the West and East Plant sedimentation basins were collected for analysis. Generally, the types of algae that grew in the basins were the same with a much heavier concentration noted in the East Plant. This increase in growth was attributed to the increased iron content and possible greater sunlight penetration into the clearer East Plant effluent.

Effect of the Iron Addition on the Ferric Chloride Demand:

It was hypothesized that the addition of iron in an acid solution would presatisfy some of the requirements of the sludge. The results after the first year indicated that this iron addition apparently did not change the ferric chloride demand, however, 1970 was an unusual year with changing sewage characteristics from the last several years. The only observation in the sludge dewatering facilities that could be related to the iron addition was periodic cracking of the filter cake. This cracking resulted in a slight loss in filter dry vacuum, but did not occur frequently enough to cause serious problems.

In 1971, a significant reduction in the ferric chloride requirement was evident and is shown in Table 9. Extremely low requirements were obtained, especially in the spring of the year.

TABLE 9

FERRIC CHLORIDE REQUIREMENTS FOR SLUDGE CONDITIONING

YEAR	AVERAGE FERRIC CHLORIDE USE LBS. ANHYDROUS $FECL_3$ PER DRY TONS RECOVERED SOLIDS
1968	222
1969	226
1970	236
1971	206

SECTION X

ACKNOWLEDGEMENTS

This report was written by Raymond D. Leary, Chief Engineer and General Manager; Lawrence A. Ernest, Director of Laboratory; Roland S. Powell, Assistant Director of Laboratory; and Richard M. Manthe, Laboratory Supervisor of Research.

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SECTION XI

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SECTION XII

NOMENCLATURE AND GLOSSARY

Phosphorus Nomenclature

1. Total Phosphorus (TP).

   All the phosphorus present in sample (whether in the soluble or insoluble state and present as ortho, poly, organic, etc., phosphorus compounds) which is converted by ternary acid digestion to soluble ortho-phosphate.

2. Total Soluble Phosphorus (TSP).

   All the phosphorus compounds in the sample filtrate converted by ternary acid digestion to ortho-phosphate.

3. Soluble Ortho-Phosphate (SOP).

   All phosphorus measured by direct colorimetric analysis of sample filtrate. (Angel Reeve Glass Fiber Pad No. 934AB)

Iron Nomenclature

1. Total Iron.

   All the iron present in the sample.

2. Total Soluble Iron.

   All the iron compounds in the sample filtrate. (Filtered through Angel Reeve Glass Fiber Pad No. 934AB).

Glossary

1. BOD - five day biochemical oxygen demand.
2. COD - chemical oxygen demand.
3. DO - dissolved oxygen.
4. EP - East Plant.
5. EPE - East Plant effluent.
6. MGD - million gallons/day.
7. ML - mixed liquor.
8. MLSS- mixed liquor suspended solids.
9. MLVSS-mixed liquor volatile suspended solids.
10. N - nitrogen.

11. P - phosphorus.
12. SDI - sludge density index.
13. SOP - soluble ortho-phosphate.
14. SS - screened sewage.
15. TP - total phosphorus.
16. TSP - total soluble phosphorus.
17. WP - West Plant.
18. WPE - West Plant effluent.

SECTION XIII

APPENDIX

Appendix	Title	Page
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APPENDIX A

ACTINOMYCETACEAE, GENUS NOCARDIA

In February, 1969 following a reduction in plant loading the East Plant (a 115 mgd secondary portion of the 200 mgd Jones Island activated sludge waste water treatment) operated by the Sewerage Commission of the City of Milwaukee suddenly developed a heavy growth of floating solids and microorganisms. Microscopic examination of the floating material by personnel from the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Marquette University, University of Wisconsin - Madison, and the Commission indicated that the principal microorganism in the foam belonged to the ACTINOMYCETACEAE, Genus NOCARDIA, The predominant species of NOCARDIA were the proteolytic type commonly found in soils and frequently in sewage associated with the break down of paper cellulose.

This type of floating material, which had never been noted previously, appeared in all portions of the East Plant where mixed liquor or return sludge were being aerated. Chemical analysis on the floating material indicated that it contained 85 percent organic matter and 31 percent hexane soluble material.

Attempts made to reduce the floating material with regular defoaming agents were unsuccessful, and vacuum skimming of the aeration tanks and clarifier feed channels was instituted.

Surprisingly, no floating material appeared in the heavily loaded West Plant (85 mgd secondary portion of the 200 mgd Jones Island Plant) which received the same screened sewage as the East Plant. During this period (February 18th to March 10th) when the floating material first appeared in the East Plant, the food to microorganism ratio (lb BOD applied per day/lb mixed liquor volatile suspended solids under aeration) averaged 0.312 in the East Plant and 0.543 in the West Plant. During this period there were no reductions in the plant efficiencies as measured by the BOD and suspended solids removal.

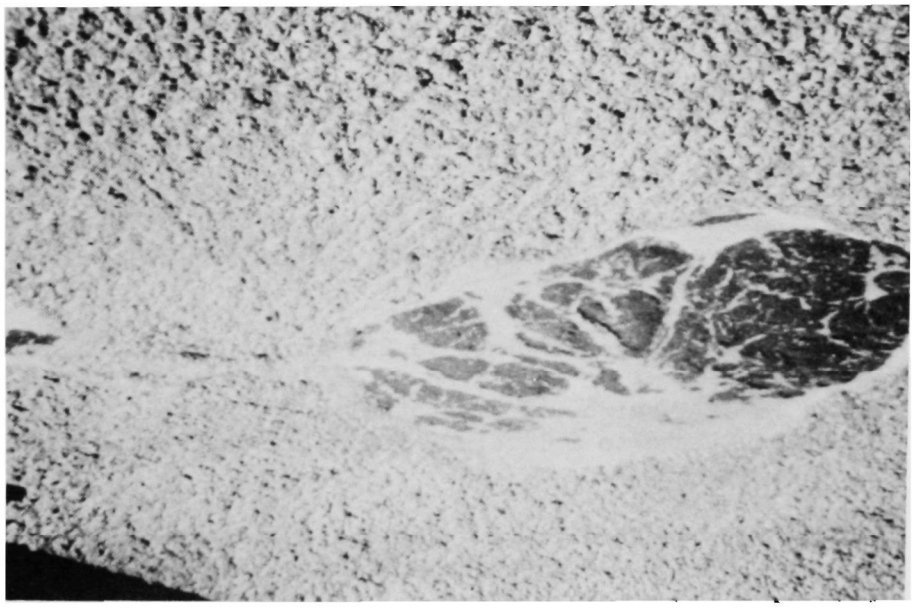
The settling characteristics of the mixed liquors were not affected as indicated by the average S.D.I. of 1.11 in the East Plant and 1.18 in the West Plant.

In an attempt to overcome this foam problem, the food to microorganism ratio in the East Plant was gradually increased by reducing the mixed liquor suspended solids and by increasing the BOD applied. The quantity of air applied was reduced from an average of 1.44 to 1.18 cu ft/per gal of sewage.

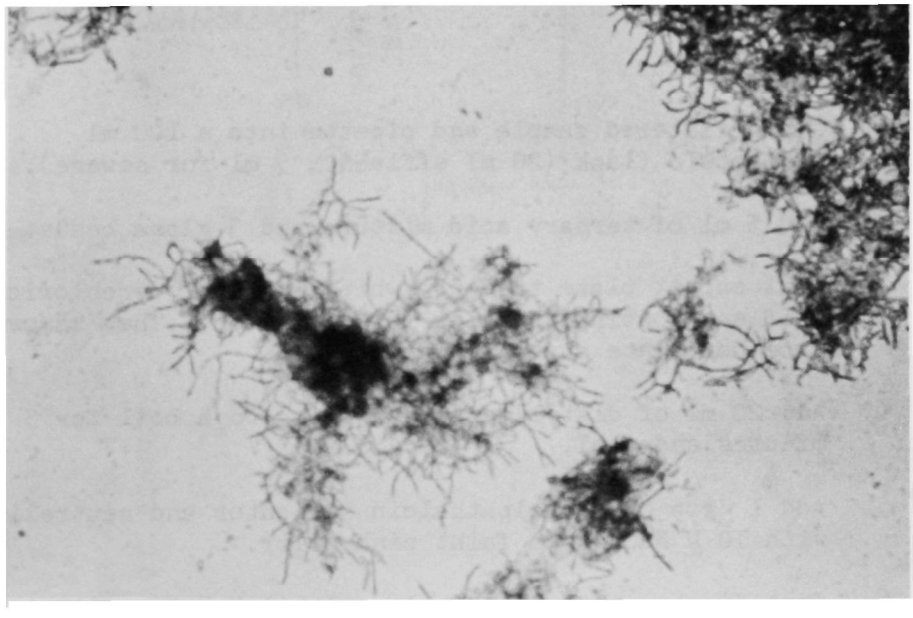
The quantity of the floating material has been greatly reduced by the skimming operation and/or by the changed loading and air rates or by the weather or other conditions beyond the control of the plant operators. Figures 31 and 32 are pictures of the froth.

FIGURE 31

ACTINOMYCETACEAE, GENUS NOCARDIA



MARCH 1970 NOCARDIA FROTH ON EAST PLANT AERATION TANK



MICROSCOPIC EXAMINATION (430 X), NOCARDIA FROTH FROM EAST PLANT, STAINED WITH MALCHITE GREEN-SAFRANIN

FIGURE 32
ACTINOMYCETACEAE, GENUS NOCARDIA

APPENDIX B

Phosphorus Determination with Technicon Autoanalyzer

Reagents:

A. Ammonium Molybdate - Dissolve 200 gm of $(NH_4)6\ Mo_7O_{24} - 4H_2O$ in 10 liters of distilled water. Add 1680 ml of c. H_2SO_4 and dilute to 20 liters.

B. ANSA Stock Solution - Dissolve 219 gm $Na_2S_2O_5$ and 8 gm Na_2SO_3 in 700 ml of distilled water (temperature <50° C), add 4 gm of 1-amino - 2 - naphthol - 4 - sulfonic acid (ANSA). Dilute to 2 liters. For daily use, prepare a 1:10 dilution.

C. Phosphorus Standard Curve - Use undigested standards from 0.1 to 1.2 mg/l - P in increments of 0.1 mg/l - P from a 1000 mg/l - P stock solution.

D. Ternary Acid Mixture - Add 100 ml of 96% H_2SO_4 to 500 ml of 70% HNO_3, mix. Add 200 ml 70% $HClO_4$, mix and cool.

Sample Preparation:

A. Total Phosphorus

1. Mix unfiltered sample and pipette into a 100 ml volumetric flask (20 ml effluent, 5 ml for sewage).

2. Add 5 ml of ternary acid mixture and 3 glass beads.

3. Heat on hot plate to dense white fumes of perchloric acid and continue heating for 5 minutes. Then remove from hot plate and allow to cool.

4. Add 20 ml of distilled water, bring to a boil for 5 minutes and cool.

5. Add 1 drop of phenolphthalein indicator and neutralize with 10 N NaOH to a faint pink color.

6. Just discharge the pink color with 1 N H_2SO_4, dilute to 100 ml and mix.

7. Transfer solution to the sampling cup of the autoanalyzer for analysis. See Figures 33 and 34 of a schematic and of laboratory equipment.

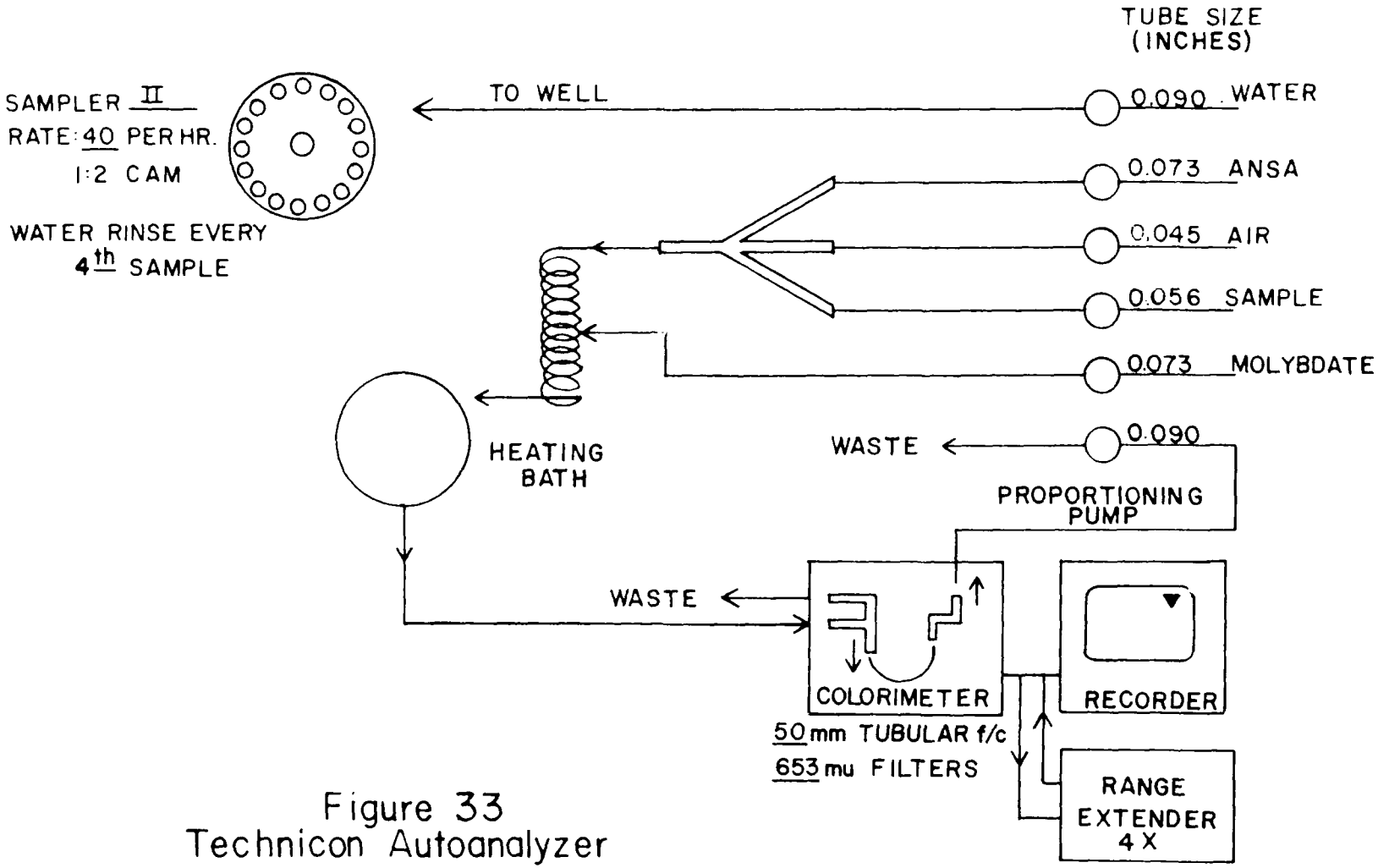
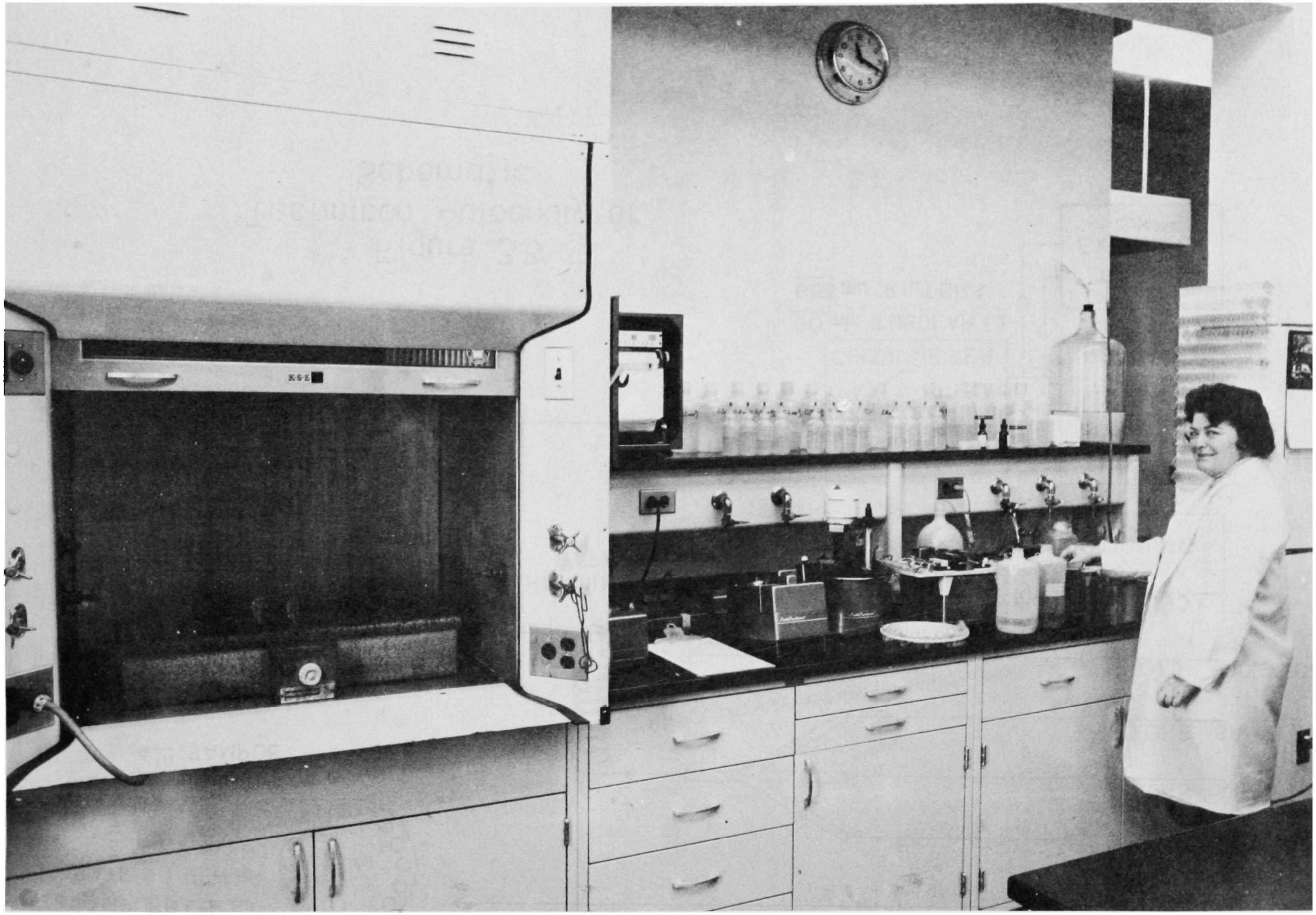


Figure 33
Technicon Autoanalyzer
Schematic


K·S·E

8. Obtain the phosphorus concentration of the sample from the standard curve.

B. Total Soluble Phosphorus

1. Filter aliquot through an Angel Reeves glass fiber pad 934 AH or Whatman GF/C glass fiber 2.4 cm pad.

2. Transfer 10 ml filtered sewage sample to 100 ml volumetric flask and proceed as in total phosphorus.

3. Transfer 50 ml filter effluent sample to 250 ml Erlenmeyer flask and proceed as in total phosphorus until sample is neutralized. Transfer to 50 ml volumetric flask, bring to volume.

C. Soluble Ortho-Phosphate

1. Filter through an Angel Reeves glass fiber pad 934 AH.

2. Dilute filtrate if needed.

3. Place in sampling cup of autoanalyzer.

APPENDIX C

Determination of Phosphorus in Sludges

by Gravimetric Quinoline Molybdate Method

Reagents:

A. Citric - Molybdic Acid Reagent.

1. Dissolve 54 gm 100% molybdic anhydride ($Mo\ O_3$) and 12 gm NaOH in 400 ml hot water and cool.

2. Dissolve 60 gm citric acid in 140 ml HCl and 200 ml water.

3. Gradually add molybdic solution to citric acid solution with stirring, cool, filter and dilute to 1 liter.

B. Quinoline Solution.

1. Dissolve 50 ml synthetic quinoline with stirring in mixture of 60 ml HCl and 300 ml water, cool and dilute to 1 liter.

Procedure:

Pipette a 50 ml aliquot from the remaining sample described in the iron procedure Appendix E, Part A "Treatment of Sample", to a 500 ml erlenmeyer flask. Add 30 ml citric molybdic acid, boil 3 minutes, remove from heat, add 10 ml of quinoline with continuous swirling and cool. Filter through a Gooch containing a glass fiber filter pad, and wash with 25 ml portions of water. Dry at 250°F, cool in desiccator to constant weight. Weigh as $(C_9H_7N)_3\ H_3[PO_4\ .\ 12\ Mo\ O_3]$.

Calculation:

$$\%P = \frac{(\text{Wt-Reagent Blk})\ (\text{Gravimetric factor } .01400)}{\text{Wt of Sample}}$$

APPENDIX D

Determination of Ferrous Iron in Pickle Liquor

by Volumetric Dichromate Method

Reagents:

A. Sulfuric Acid 1:4

B. Phosphoric Acid 1:4

C. Potassium Dichromate

D. Diphenylamine Sulfonate indicator
(See Appendix E)

Procedure:

Place a 100 ml aliquot of pickle liquor sample in a 1 liter flask and dilute to one liter. Pipette a 10 ml aliquot into a 250 ml beaker, add 10 ml of 1:4 sulfuric acid, 50 ml of 1:4 phosphoric acid and 0.3 ml of diphenylamine sulfonate indicator. Titrate immediately with 0.1N potassium dichromate to a permanent blue endpoint. Subtract 0.05 ml for an indicator correction.

Calculation:

lbs Fe/gal = ml 0.1N $K_2Cr_2O_7$ x factor of .0466

$$\text{factor} = \frac{1000 \times 3.785 \times .005585}{454}$$

APPENDIX E

Determination of Iron in Sludges by Volumetric Dichromate Method

Reagents:

A. Hydrochloric Acid 1:1

B. Sulfuric Acid 1:4

C. Phosphoric Acid 1:4

D. Mercuric Chloride (saturated)

E. Potassium Dichromate (standard 0.1 N)

F. Stannous Chloride solution

1. Dissolve 50 gm $SnCl_2$ in 100 ml of concentrated HCl, dilute with water to 500 ml. Store over clean metallic tin.

G. Diphenylamine Sulfonate indicator

1. Dissolve 0.32 gms of barium diphenylamine in 100 ml of water.

H. Magnesium Nitrate solution

1. Dissolve 950 gm P-free $Mg(NO_3)_2 \cdot 6H_2O$ in water and dilute to 1 liter.

Note: All reagents prepared with distilled water.

Procedure: Part A Treatment of Sample

1. Place a 1 gm sample in a silica dish, add 5 ml of $Mg(NO_3)_2$ solution, and evaporate. Then ignite at 500 to 600° for about 7 minutes. Add HCl and evaporate to dryness twice. Add HCl and wash solution into a 250 ml beaker with water, add 10 ml of HNO_3 and boil for at least three minutes. Cool solution in a water bath, filter into a 250 ml volumetric flask, wash filter paper and dilute to volume. This solution is used for both the iron and phosphorus determinations. Take a 100 ml aliquot for the iron determination and save the remaining solution for the phosphorus determination.

2. Place the 100 ml aliquot into a 250 ml beaker, neutralize with ammonium hydroxide and heat but do not boil. Filter the solution, wash the precipitate, and discard filtrate. Dissolve precipitate into a 250 ml beaker using a 1:1 HCl solution, and wash paper thoroughly.

Procedure: Part B Volumetric Dichromate Method

Concentrate the sample prepared in Part A on a hot plate to 100 ml, add stannous chloride drop by drop until sample is decolorized, cool and add 15 ml mercuric chloride solution. Let stand for three to five minutes, add 30 ml 1:4 phosphoric acid, 10 ml of 1:4 sulfuric acid, 4 to 5 drops of diphenylamine sulfonate indicator and titrate with 0.1N potassium dichromate to the purple end point.

Calculation:

$$\% \text{ Total Iron} = \frac{(\text{ml of } 0.1 \text{ N } K_2Cr_2O_7 - 0.05)\ (.005585)}{\text{wt of sample}} \times 100$$

(0.05 is indicator factor)

APPENDIX F

Determination of Iron in Sludges

by Atomic Absorption Method

A. Perchloric Acid Digestion.

Procedure - Taken from AOAC, 11th Edition, 2.016 (e).

1. Place 1.000 gm of dried sample into a 250 ml volumetric flask.
2. Add 5 ml Mg NO_3 and let soak 10 minutes.
3. Add 30 ml c. HNO_3, and bring to boil; gently boil for 30 minutes to oxidize easily oxidizable materials.
4. Cool, add 15 ml $HClO_4$, heat gently until material turns yellow-orange. Materials other than Milorganite turn colorless. After color change, continue heating for approximately 30 minutes. Heat in such a manner so that white fumes are retained within the body and neck of the volumetric flask, reduce heat, if necessary, to keep fumes in flask.

   CAUTION: Do not boil to dryness; during this boiling period, never leave the sample unattended.

5. Cool, add approximately 50 ml H_2O and boil for five minutes.
6. Cool, dilute to mark. Filter if necessary through S.S. No. 597 filter paper, or let settle overnight.
7. Rinse down Perchloric Hood after removing flask.
8. Use this digestate for determination of iron.

B. Iron Determination by Atomic Absorption:

1. Atomic Absorption:

Instrumental conditions:

Wavelength	371.9μ	Burner Height	4mm
Slit	80 μ	Aspiration rate	4-5 ml/min.
Scale	5	Hollow Cathode	62810
Fuel	C_2H_2 6-8 psig	Lamp Current	8 mA
Oxidant	N_2O 0.5 psig	Photomultiplier	1P28
Hi Solids Burner	5 cm light path	P.M. Voltage	700 V.

Standard Curve. Set instrument to readout following concentrations. All standards are in 1N $HClO_4$ matrix.

Standard mg Fe/L	Readout
Blank	000
50	125
100	250
200	500
300	750

This curve is set with calibration set with 200 mg Fe/L standard. Adjust curve correction to obtain desired reading for 300 mg Fe/L standard.

With the above curve, a 1 gm sample in a final vol. of 250 ml can be read directly from the instrument as % Fe.

APPENDIX G

Determination of Nitrogen in Milorganite and Sludges

Reagents:

A. Sulfuric Acid 93-98% H_2SO_4, N-free.

B. Mercuric Oxide, reagent grade, N-free.

C. Potassium Sulfate, reagent grade, N-free.

D. Salicylic Acid, reagent grade, N-free.

E. Thiosulfate solution

Dissolve 80 gm commercial $Na_2S_2O_3 \cdot 5\ H_2O$ in 1 L. H_2O.

F. Sodium Hydroxide

Dissolve 450 gm solid NaOH in water and dilute to 1 L. (sp. gr. of solution should be 1.36 or higher).

G. Methyl red indicator.

Dissolve 1 gm methyl red in 200 ml alcohol.

H. Sulfuric Acid Standard 0.1 N.

Procedure: Part A Treatment of Sample

Place a one gram sample in a Kjeldahl flask, add 40 ml H_2SO_4 containing 2 gm salicylic acid, swirl until well mixed and let stand. After sample has stood for a minimum of 20 minutes, add 5 gm $Na_2S_2O_3 \cdot 5\ H_2O$, swirl and let stand a minimum of 10 minutes. Place on an electric heater and heat sample with occasional swirling until in the liquid state; cool and add 15 gm K_2SO_4 and 0.7 gm HgO. Place back on the burner and boil briskly until sample turns a pale straw color. Wash down neck and sides of Kjeldahl flask with 5-10 ml conc. H_2SO_4 and continue burning for 2 hours.

Procedure: Part B Determination

Place cooled sample in a cooling bath and add 200 ml distilled water and let stand 10 minutes. Add 25 ml $Na_2S_2O_3$ solution plus two porcelain bumping disks and with the flask in an inclined position pour approximately 90 ml NaOH solution gently down sides so as to layer the NaOH. Immediately connect the flask to the distilling apparatus, agitate and distill into receiver containing the proper amount of 0.1N H_2SO_4. Collect about 150 ml of distillate and titrate excess standard 0.1N H_2SO_4 with standard 0.1N NaOH using methyl red indicator.

Calculation:

$$\% \text{ N} = \frac{(\text{ml Std. } H_2SO_4 \text{ x normality} - \text{ml NaOH x normality}) \text{ mol wt N}}{\text{wt of sample x 1000}} \text{ x 100}$$

APPENDIX H
PLANT OPERATIONAL DATA JANUARY 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	Fr	1203	999	949	17.0	21.1	119	8	4	93.3	96.6	150	10	13	93.3	91.3	23.2	14.7	10.5
2	Sa	888	1005	967	--	--	146	9	11	93.8	92.5	110	8	13	92.7	88.2	29.7	18.3	15.5
3	Su	869	759	802	12.7	7.7	169	17	12	89.9	92.9	120	10	15	91.7	87.5	26.5	20.2	15.4
4	M	1336	1164	1045	12.9	21.8	178	12	13	93.3	92.7	220	10	14	95.5	93.6	25.5	13.3	11.3
5	Tu	1179	1008	963	14.5	18.3	286	25	19	91.3	93.4	240	11	11	95.4	95.4	31.1	9.9	8.0
6	W	1092	909	859	16.8	21.3	242	17	13	93.0	94.6	260	12	14	95.4	94.6	31.8	9.4	6.6
7	Th	1120	862	850	23.0	24.1	251	25	20	90.0	92.0	280	14	13	95.0	95.4	32.6	10.1	5.7
8	Fr	1097	827	882	24.6	19.6	251	23	20	90.8	92.0	240	10	10	95.8	95.8	32.2	10.9	6.4
9	Sa	898	781	834	13.0	7.1	174	8	12	95.4	93.1	160	8	10	95.3	93.8	30.1	12.0	8.8
10	Su	806	803	775	0.4	3.8	102	13	6	87.3	94.1	120	12	13	90.0	89.2	27.6	16.2	12.9
11	M	1041	780	734	25.1	29.5	225	31	13	86.2	94.2	290	17	13	94.1	95.5	33.2	18.3	13.7
12	Tu	1122	894	907	20.3	19.2	219	22	10	90.0	95.4	280	17	12	93.9	95.7	32.6	14.3	9.0
13	W	1172	868	886	25.9	24.4	219	22	9	90.0	95.9	300	22	15	92.7	95.0	33.3	11.6	8.1
14	Th	1108	901	927	18.7	16.3	217	35	47	83.9	78.3	270	24	25	91.1	90.7	32.3	12.9	9.9
15	Fr	1063	830	941	21.9	11.5	224	21	148	90.6	33.9	280	20	80	92.9	71.4	33.5	9.8	15.7
16	Sa	882	852	836	3.4	5.2	175	13	54	92.6	69.1	170	9	24	94.7	85.9	31.1	11.5	10.6
17	Su	830	767	784	7.6	5.5	112	22	11	80.4	90.2	120	16	15	86.7	87.5	28.4	17.5	13.9
18	M	1043	776	822	25.6	21.2	225	27	4	88.0	98.2	250	17	10	93.2	96.0	33.9	18.3	14.4
19	Tu	1177	876	897	25.6	23.8	294	19	28	93.5	90.5	290	11	17	96.2	94.1	37.0	14.0	11.6
20	W	1194	915	970	23.4	18.8	152	3	53	98.0	65.1	290	16	36	94.5	87.6	37.1	13.0	14.4
21	Th	1194	917	942	23.2	21.1	245	76	110	69.0	55.1	290	43	40	85.2	86.2	35.0	15.7	15.7
22	Fr	1145	956	1095	16.5	4.4	284	33	177	88.4	37.7	310	19	64	93.9	79.4	36.1	12.7	17.8
23	Sa	925	796	850	13.9	8.1	191	20	33	89.5	82.7	170	13	17	92.4	90.0	31.4	10.8	21.0
24	Su	849	738	746	13.1	12.1	136	14	7	89.7	94.9	120	12	12	90.0	90.0	29.8	16.2	12.9
25	M	1113	781	830	29.8	25.4	212	21	91	90.1	57.1	300	23	54	92.3	82.0	32.3	18.3	22.0
26	Tu	1081	877	848	18.9	21.6	214	38	6	82.2	97.2	330	34	10	89.7	97.0	33.9	15.5	9.4
27	W	1057	833	866	21.2	18.1	234	49	64	79.1	72.6	290	36	29	87.6	90.0	34.3	15.4	10.6
28	Th	1091	838	869	23.2	20.3	273	74	53	72.9	80.6	290	43	22	85.1	92.4	35.1	16.1	9.4
29	Fr	1117	860	919	23.0	17.7	239	32	102	86.6	57.3	270	34	46	87.4	83.0	33.7	10.9	14.7
30	Sa	875	855	818	2.3	6.5	172	20	41	88.4	76.2	170	16	21	90.6	87.6	32.9	10.6	11.3
31	Su	738	700	676	5.1	8.4	135	8	15	94.1	88.9	130	13	18	90.0	86.2	29.8	13.9	15.0

PLANT OPERATIONAL DATA FEBRUARY 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	M	1001	734	690	26.7	31.1	194	9	24	95.4	87.6	290	12	27	95.9	90.7	32.6	17.2	17.2
2	Tu	1081	770	808	28.8	25.3	254	20	37	92.1	85.4	280	12	23	95.7	91.8	33.6	11.5	11.5
3	W	1291	847	875	34.4	32.2	272	14	47	94.9	82.7	310	12	29	96.1	90.6	33.6	10.2	9.4
4	Th	2302	1193	1422	48.2	38.2	318	28	114	91.2	64.2	280	16	58	94.3	79.3	29.7	10.2	12.2
5	Fr	1506	1827	1845	--	--	288	49	106	83.0	63.2	270	20	45	92.6	83.3	30.1	10.6	13.4
6	Sa	970	1107	976	--	--	182	21	28	88.5	84.6	190	16	27	91.6	85.8	29.4	10.5	8.1
7	Su	778	725	861	6.8	--	116	12	14	89.7	87.9	150	12	23	92.0	84.7	29.3	14.0	11.2
8	M	1051	754	765	28.3	27.2	191	19	11	90.1	94.2	270	15	26	94.4	90.4	32.2	17.2	13.3
9	Tu	1090	820	829	24.8	23.9	245	24	23	90.2	90.6	270	14	32	94.8	88.1	31.6	10.9	8.5
10	W	1134	864	825	23.8	27.2	217	19	17	91.2	92.2	300	13	27	95.7	91.0	33.9	9.9	7.6
11	Th	1295	1001	972	22.7	24.9	255	66	23	74.1	91.0	280	41	28	85.4	90.0	36.1	15.4	8.0
12	Fr	1164	971	971	16.6	16.6	274	64	44	76.6	83.9	290	32	34	89.0	88.3	34.4	12.6	6.6
13	Sa	876	824	829	5.9	5.4	209	21	23	90.0	89.0	200	13	29	93.5	85.5	31.9	8.4	7.7
14	Su	740	621	--	16.1	--	135	13	--	90.4	--	150	10	--	93.3	--	29.4	13.4	--
15	M	1091	715	751	34.5	31.2	248	11	36	95.6	85.5	280	8	25	97.1	91.1	34.3	16.9	18.6
16	Tu	1243	821	906	34.0	27.1	255	24	67	90.6	73.7	300	21	36	93.0	88.0	33.6	14.3	12.9
17	W	1382	1175	1157	15.0	16.3	268	42	60	84.3	77.6	240	25	22	89.6	90.8	28.4	11.3	10.6
18	Th	1113	1092	1062	1.9	4.6	276	59	41	78.6	85.1	200	22	21	89.0	89.5	21.7	9.0	8.3
19	Fr	828	748	756	9.7	8.7	192	67	53	65.1	72.4	90	25	18	72.2	80.0	14.6	8.0	7.1
20	Sa	945	762	760	19.4	19.6	133	33	25	75.2	81.2	120	14	21	88.3	82.5	17.6	6.0	4.7
21	Su	836	925	871	--	--	82	20	21	75.6	74.4	80	11	18	86.3	77.5	18.6	10.1	9.2
22	M	1342	1026	1062	23.5	20.9	148	11	35	92.6	76.4	150	11	21	92.7	86.0	24.8	12.0	11.2
23	Tu	1400	1263	1304	9.8	6.9	160	22	26	86.3	83.8	230	14	13	93.9	94.3	22.7	9.9	9.1
24	W	1171	1052	--	10.2	--	155	12	--	92.3	--	220	14	--	93.6	--	23.9	6.4	--
25	Th	1025	974	920	5.0	10.2	187	20	12	89.3	93.6	190	13	12	93.2	93.7	21.7	5.2	4.6
26	Fr	918	833	842	9.3	8.3	136	29	12	78.7	91.2	140	16	10	88.6	92.9	16.5	5.0	3.5
27	Sa	967	814	838	15.8	13.3	105	27	15	74.3	85.7	140	17	10	87.9	92.9	20.3	7.3	5.9
28	Su	807	862	836	--	--	94	24	18	74.5	80.9	90	17	10	81.1	88.9	18.1	11.6	8.8
29																			
30																			
31																			

PLANT OPERATIONAL DATA MARCH 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	M	1118	841	855	24.8	23.5	202	17	16	91.6	92.1	230	12	10	94.8	95.7	27.6	12.9	10.8
2	Tu	1092	893	847	18.2	22.4	205	18	9	91.2	95.6	210	12	8	94.3	96.2	26.3	10.2	7.1
3	W	1147	975	930	15.0	18.9	219	24	13	89.0	94.1	240	12	8	95.0	96.7	28.3	8.7	6.4
4	Th	1145	960	936	16.2	18.3	221	18	13	91.9	94.1	250	11	11	95.6	95.6	28.7	8.1	6.0
5	Fr	1126	946	981	16.0	12.9	216	18	52	91.7	75.9	240	11	23	95.4	90.4	27.4	7.8	9.5
6	Sa	1165	1030	1002	11.6	14.0	134	21	57	84.3	57.5	130	12	21	90.8	83.8	20.7	10.1	8.3
7	Su	973	1062	1013	--	--	108	17	19	84.3	82.4	80	14	12	82.5	85.0	22.1	12.6	12.0
8	M	1134	909	952	19.8	16.0	185	24	15	87.0	91.9	230	13	10	94.3	95.7	29.5	15.3	13.7
9	Tu	1160	887	926	23.5	20.2	217	22	13	89.9	94.0	270	12	10	95.6	96.3	29.4	11.8	9.8
10	W	1410	1220	1109	13.5	21.3	215	21	21	90.2	90.2	260	14	13	94.6	95.0	29.0	9.7	8.4
11	Th	1260	1073	1119	14.8	11.2	190	5	17	97.4	91.1	240	15	20	93.8	91.7	30.1	10.4	9.4
12	Fr	1224	984	1040	19.6	15.0	256	22	101	91.4	60.5	250	17	35	93.2	86.0	31.6	9.8	11.6
13	Sa	1012	983	1024	2.9	--	177	7	63	96.0	64.4	160	14	34	91.3	78.8	27.3	--	21.7
14	Su	912	858	890	5.9	2.4	182	4	44	97.8	75.8	100	8	24	92.0	76.0	18.9	10.5	12.5
15	M	1168	864	812	26.0	30.5	211	21	20	90.0	90.5	210	18	15	91.4	92.9	25.1	9.4	9.0
16	Tu	1215	962	920	20.8	24.3	238	12	18	95.0	92.4	210	12	15	94.3	92.9	28.1	8.0	8.3
17	W	1278	1025	1038	19.8	18.8	281	28	38	90.0	86.5	250	11	16	95.6	93.6	30.2	6.9	7.4
18	Th	1363	1029	1062	24.5	22.1	292	10	26	96.6	91.1	250	15	16	94.0	93.6	29.1	6.0	7.1
19	Fr	1290	965	1062	25.2	17.7	280	16	46	94.3	83.6	250	12	21	95.2	91.6	30.7	4.9	7.7
20	Sa	1173	1082	1196	7.8	--	178	16	99	91.0	44.4	140	10	42	92.9	70.0	23.2	6.2	12.6
21	Su	957	977	1005	--	--	91	11	38	87.9	58.2	80	10	19	87.5	76.3	17.2	10.4	10.9
22	M	1202	1011	969	15.9	19.4	154	11	28	92.9	81.8	200	13	24	93.5	88.0	24.6	11.9	11.8
23	Tu	1182	1021	1035	13.6	12.4	202	22	58	89.1	71.3	210	12	20	94.3	90.5	26.0	8.7	9.9
24	W	1197	1030	1049	14.0	12.4	192	8	18	95.8	90.6	240	15	16	93.8	93.3	27.2	13.6	7.0
25	Th	1172	1013	1018	13.6	13.1	170	15	22	91.2	87.1	230	17	17	92.6	92.6	26.6	17.6	6.3
26	Fr	1161	1003	932	13.6	19.7	184	43	23	76.6	87.5	210	30	11	85.7	94.8	23.9	7.4	5.5
27	Sa	996	988	949	0.8	4.7	134	26	11	80.6	91.8	100	15	9	85.0	91.0	21.1	7.7	6.7
28	Su	939	867	865	7.7	7.9	112	18	20	83.9	82.1	70	9	13	87.1	81.4	17.4	8.5	9.5
29	M	1174	835	990	28.9	15.7	197	10	17	94.9	91.4	200	9	16	95.5	92.0	24.2	10.2	9.4
30	Tu	1247	1014	1016	18.7	18.5	234	23	20	90.2	91.5	230	10	11	95.7	95.2	27.4	8.0	6.7
31	W	1240	1062	1063	14.4	14.3	224	18	21	92.0	90.6	220	10	14	95.5	93.6	25.1	6.4	5.0

PLANT OPERATIONAL DATA APRIL 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	Th	1251	1025	997	18.1	20.3	230	25	15	89.1	93.5	250	16	13	93.6	94.8	28.0	6.0	4.5
2	Fr	1196	1025	1008	14.3	15.7	232	33	21	85.8	90.9	220	18	10	91.8	95.5	28.1	6.2	4.9
3	Sa	1048	1021	1029	2.6	1.8	166	25	16	84.9	90.4	--	12	12	--	--	25.8	6.6	6.4
4	Su	921	848	855	7.9	7.2	115	13	14	88.7	87.8	130	9	13	93.1	90.0	23.8	11.8	17.1
5	M	970	916	906	5.6	6.6	192	17	14	91.1	92.7	240	18	15	92.5	93.8	29.4	14.3	12.0
6	Tu	1184	915	956	22.7	19.3	127	11	14	91.3	89.0	250	11	11	95.6	95.6	29.4	9.9	7.4
7	W	1179	956	1016	18.9	13.8	215	20	23	90.7	89.3	250	12	15	95.2	94.0	28.8	8.0	6.4
8	Th	1218	1096	1007	10.0	17.3	236	137	40	41.9	83.1	280	56	18	80.0	93.6	28.7	13.4	7.0
9	Fr	--	1002	1031	--	--	--	13	47	--	--	--	9	10	--	--	--	4.5	7.8
10	Sa	993	933	947	6.0	4.6	108	9	30	91.7	72.2	120	10	21	91.7	82.5	25.2	9.1	10.9
11	Su	848	851	831	--	2.0	99	5	11	95.0	88.9	100	8	21	92.0	79.0	23.1	14.2	--
12	M	962	872	814	9.4	15.4	193	17	20	91.2	89.6	180	7	18	96.1	90.0	21.8	15.0	12.2
13	Tu	1146	816	837	28.8	27.0	209	14	25	93.3	88.0	210	5	13	97.6	93.8	20.2	8.0	6.6
14	W	1256	1023	1038	18.6	17.4	251	17	27	93.2	89.2	240	8	13	96.7	94.6	26.3	6.0	6.2
15	Th	1214	973	982	19.9	19.1	195	5	13	97.4	93.3	260	13	14	95.0	94.6	27.3	6.4	4.8
16	Fr	1247	991	957	20.5	23.3	245	19	23	92.2	90.6	280	14	11	95.0	96.1	28.8	5.7	4.8
17	Sa	1214	1152	1032	5.1	15.0	263	182	60	30.8	77.2	190	58	13	69.5	93.2	25.9	12.5	6.2
18	Su	982	1049	1020	--	--	226	44	69	80.5	69.5	130	10	19	92.3	85.4	23.7	9.5	10.8
19	M	1144	922	946	19.4	17.3	197	15	24	92.4	87.8	270	11	15	95.9	94.4	27.0	13.6	12.7
20	Tu	1162	929	947	20.1	18.5	226	14	32	93.8	85.8	250	11	18	95.6	92.8	29.3	8.4	8.4
21	W	1251	1009	914	19.3	26.9	250	85	20	66.0	92.0	290	30	12	89.7	95.9	30.8	11.6	6.3
22	Th	1212	963	984	20.5	18.8	240	12	41	95.0	82.9	300	11	19	96.3	93.7	33.5	7.7	7.8
23	Fr	1195	1084	1027	9.3	14.1	231	183	97	20.8	58.0	270	71	42	73.7	84.4	30.4	19.3	11.9
24	Sa	1119	986	967	11.9	13.6	215	93	19	56.7	91.2	280	49	15	82.5	94.6	32.1	13.2	7.7
25	Su	887	808	853	8.9	3.8	110	16	20	85.5	81.8	130	16	19	87.7	85.4	25.2	11.1	11.2
26	M	1180	1012	987	14.2	16.4	224	107	84	52.2	62.5	300	56	31	81.3	89.7	30.8	21.0	18.1
27	Tu	1047	--	873	--	16.6	207	--	21	--	89.9	240	--	20	--	91.7	26.3	--	9.2
28	W	1235	992	--	19.7	--	215	16	--	92.6	--	300	16	--	94.7	--	30.5	8.5	--
29	Th	1121	1026	907	8.5	19.1	213	126	42	40.8	80.3	290	70	18	75.9	93.8	31.6	16.0	8.4
30	Fr	1193	--	918	--	23.1	303	--	94	--	69.0	290	--	36	--	87.6	36.0	--	12.6
31																			

PLANT OPERATIONAL DATA MAY 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	Sa	995	960	956	3.5	3.9	156	31	64	80.1	59.0	170	17	23	90.0	86.5	28.1	9.4	9.9
2	Su	788	711	789	9.8	--	141	21	103	85.1	27.0	120	12	25	90.0	79.2	24.5	13.3	16.2
3	M	1136	827	863	27.2	24.0	223	17	27	92.4	87.9	280	13	16	95.4	94.3	--	16.7	16.7
4	Tu	1181	963	954	18.5	19.2	216	17	22	92.1	89.8	300	15	13	95.0	95.7	28.7	9.9	8.4
5	W	1142	--	929	--	18.7	242	--	29	--	88.0	290	--	15	--	94.8	31.9	--	7.8
6	Th	1138	--	892	--	21.6	228	--	42	--	81.6	310	--	21	--	93.2	31.6	--	9.7
7	Fr	1137	1086	1012	4.5	11.0	202	147	75	27.2	62.9	280	63	24	77.5	91.4	32.1	17.4	12.0
8	Sa	993	985	964	0.8	2.9	180	88	64	51.1	64.4	190	35	26	81.6	86.3	27.6	11.6	11.1
9	Su	807	764	835	5.3	--	120	8	54	93.3	55.0	120	11	22	90.8	81.7	26.6	11.8	14.0
10	M	1127	780	799	30.8	29.1	265	13	17	95.1	93.6	300	13	13	95.7	95.7	34.0	15.4	15.3
11	Tu	1118	790	803	29.3	28.2	272	15	24	94.5	91.2	320	10	17	96.9	94.7	32.1	10.2	9.4
12	W	1208	907	913	24.9	24.4	262	64	23	75.6	91.2	320	36	19	88.8	94.1	35.6	11.5	7.7
13	Th	1175	1160	979	1.3	16.7	282	258	72	8.5	74.5	330	110	34	66.7	89.7	32.8	23.1	10.4
14	Fr	1210	1010	1028	16.5	15.0	304	128	126	57.9	58.6	360	52	36	85.6	90.0	34.6	14.0	12.7
15	Sa	1076	969	956	9.9	11.2	256	157	102	38.7	60.2	260	68	36	73.8	86.2	32.6	15.0	11.5
16	Su	837	860	911	--	--	138	16	66	88.4	52.2	120	10	27	91.7	79.2	28.8	11.5	13.9
17	M	1148	881	765	23.3	33.4	261	22	38	91.6	85.4	290	20	27	93.1	90.7	32.3	17.5	17.5
18	Tu	1062	914	881	13.9	17.0	271	62	33	77.1	87.8	270	29	25	89.3	90.7	30.0	9.7	7.7
19	W	1066	1013	883	5.0	17.2	215	184	29	14.4	86.5	290	92	19	68.3	93.4	31.6	20.2	7.7
20	Th	1123	--	903	--	19.6	252	--	61	--	75.8	320	--	21	--	93.4	34.0	--	9.9
21	Fr	1091	1043	970	4.4	11.1	210	189	78	10.0	62.9	330	98	28	70.3	91.5	32.9	21.3	10.6
22	Sa	1046	859	933	17.9	10.8	244	16	54	93.4	77.9	210	14	30	93.3	85.7	33.0	7.3	11.5
23	Su	833	787	851	10.9	3.6	177	19	32	89.3	81.9	130	13	29	90.0	77.7	30.2	15.7	17.2
24	M	901	697	737	22.6	18.2	243	13	19	94.7	92.2	210	13	30	93.8	85.7	25.2	16.2	16.8
25	Tu	1017	725	754	28.7	25.9	190	7	24	96.3	87.4	260	15	28	94.2	89.2	27.2	5.5	6.4
26	W	1151	910	759	20.9	34.1	237	28	16	88.2	93.2	290	16	20	94.5	93.1	31.9	6.6	5.0
27	Th	1101	915	869	16.9	21.1	221	51	23	76.9	89.6	300	28	13	90.7	95.6	32.2	9.4	5.5
28	Fr	1091	1012	874	7.2	19.9	242	202	28	16.5	88.4	290	102	20	64.8	93.1	32.9	18.5	6.6
29	Sa	979	918	859	6.2	12.3	198	22	24	88.9	87.9	200	16	19	92.0	90.5	30.1	8.7	7.8
30	Su	789	729	784	7.6	0.6	154	12	13	92.2	91.6	120	15	24	87.5	80.0	26.6	13.0	10.8
31	M	841	753	804	10.5	4.4	143	6	2	95.8	98.6	140	14	20	90.0	85.7	29.7	16.5	13.3

PLANT OPERATIONAL DATA JUNE 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	Tu	948	747	783	21.2	17.4	186	4	4	97.8	97.8	230	13	26	94.3	88.6	28.4	14.6	10.2
2	W	1031	786	765	23.8	25.8	226	12	35	94.7	84.5	270	13	25	95.2	90.7	29.7	7.4	3.5
3	Th	1053	1007	908	4.4	13.8	193	158	69	18.1	64.2	270	69	26	74.4	90.4	28.3	14.7	6.3
4	Fr	1051	877	841	16.6	20.0	230	20	104	91.3	54.8	270	12	35	95.6	87.0	30.2	3.6	8.4
5	Sa	863	854	772	1.0	10.5	175	14	38	92.0	78.3	190	9	23	95.3	87.9	26.2	2.5	3.5
6	Su	758	730	835	3.7	--	149	10	30	93.3	79.9	100	17	23	83.0	77.0	23.0	8.1	4.6
7	M	936	669	774	28.5	17.3	194	6	7	96.9	96.4	230	15	16	93.5	93.0	27.9	8.1	3.2
8	Tu	1014	789	771	22.2	24.0	215	7	7	96.7	96.7	280	9	10	96.8	96.4	29.8	2.9	2.7
9	W	1034	759	854	26.6	17.4	245	12	18	95.1	92.7	280	7	11	97.5	96.1	32.2	2.8	3.8
10	Th	1057	848	858	19.8	18.8	252	12	10	95.2	96.0	290	14	10	95.2	96.6	31.4	2.9	3.4
11	Fr	1000	971	876	2.9	12.4	243	138	25	43.2	89.7	260	69	24	73.5	90.8	29.5	10.8	2.8
12	Sa	821	846	842	--	--	182	21	13	88.5	92.9	130	20	8	84.6	93.8	23.7	2.0	3.9
13	Su	827	689	723	16.7	12.6	120	10	14	91.7	88.3	90	14	7	84.4	92.2	23.4	4.9	2.9
14	M	1014	812	871	19.9	14.1	206	23	12	88.8	94.2	280	34	11	87.9	96.1	29.4	10.6	4.1
15	Tu	1003	837	850	16.6	15.3	214	13	13	93.9	93.9	280	21	8	92.5	97.1	30.0	5.0	2.8
16	W	1021	814	831	20.3	18.6	244	22	11	91.0	95.5	250	19	10	92.4	96.0	29.4	3.8	2.8
17	Th	1032	956	814	7.4	21.1	218	170	12	22.0	94.5	230	90	9	60.9	96.1	27.6	14.8	5.9
18	Fr	897	839	778	6.5	13.3	243	109	43	55.1	82.3	250	66	26	73.6	89.6	24.1	9.0	4.2
19	Sa	775	741	800	4.4	--	169	20	43	88.2	74.6	160	24	20	85.0	87.5	19.7	3.8	3.6
20	Su	829	614	655	25.9	21.0	103	13	17	87.4	83.5	230	15	11	93.5	95.2	17.9	3.5	2.5
21	M	969	795	772	18.0	20.3	197	17	12	91.4	93.9	240	18	7	92.5	97.1	26.0	5.3	2.4
22	Tu	892	798	861	10.5	3.5	183	26	11	85.8	94.0	200	24	7	88.0	96.5	23.2	5.0	5.3
23	W	923	713	679	22.8	26.4	189	26	8	86.2	95.8	220	17	7	92.3	96.8	24.5	3.9	2.2
24	Th	919	846	836	7.9	9.0	194	22	19	88.7	90.2	220	15	8	93.2	96.4	23.7	4.3	2.4
25	Fr	868	715	707	17.6	18.5	186	16	4	91.4	97.8	220	16	5	92.7	97.7	23.8	3.8	2.1
26	Sa	782	670	745	14.3	4.7	190	1	1	99.5	99.5	150	8	5	94.7	97.3	25.9	3.6	3.6
27	Su	798	808	832	--	--	125	19	15	84.8	88.0	100	22	11	78.0	89.0	24.2	6.6	4.2
28	M	879	692	761	21.3	13.4	181	14	6	92.3	96.7	200	19	7	90.5	96.5	24.9	6.3	2.9
29	Tu	917	785	830	14.4	9.5	179	9	2	95.0	98.9	260	13	7	95.0	97.3	23.7	2.9	1.7
30	W	830	765	761	7.8	8.3	183	20	5	89.1	97.3	210	21	5	90.0	97.6	32.8	4.3	1.8
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PLANT OPERATIONAL DATA JULY 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	Th	960	793	746	17.4	22.3	196	21	6	89.3	96.9	260	21	6	91.9	97.7	26.6	5.0	3.2
2	Fr	994	845	862	15.0	13.3	261	23	32	91.2	87.7	330	14	18	95.8	94.5	29.4	4.8	4.9
3	Sa	784	779	735	0.6	6.3	151	17	25	88.7	83.4	140	15	14	89.3	90.0	24.5	5.9	3.9
4	Su	715	755	799	--	--	118	3	25	97.5	78.8	100	14	17	86.0	83.0	23.2	10.2	6.7
5	M	708	737	736	--	--	107	14	5	86.9	95.3	100	20	8	80.0	92.0	24.5	7.4	3.4
6	Tu	909	722	804	20.6	11.6	202	10	3	95.0	98.5	240	19	7	92.1	97.1	27.3	5.6	2.5
7	W	907	779	792	14.1	12.7	203	13	5	93.6	97.5	230	11	6	95.2	97.4	23.1	3.5	2.1
8	Th	772	653	624	15.4	19.2	144	85	1	41.0	99.3	180	53	5	70.6	97.2	17.1	7.0	1.3
9	Fr	816	655	687	19.7	15.8	111	7	6	93.7	94.6	180	24	7	86.7	96.1	22.3	12.5	4.9
10	Sa	687	766	690	--	--	106	--	4	--	96.2	150	--	5	--	96.7	23.7	10.9	2.7
11	Su	791	821	774	--	2.1	125	14	5	88.8	96.0	100	10	6	90.0	94.0	21.7	4.1	2.8
12	M	910	770	800	15.4	12.1	176	17	10	90.3	94.3	240	23	6	90.4	97.5	23.4	5.5	2.4
13	Tu	943	816	799	13.5	15.3	190	25	27	86.8	85.8	240	27	29	88.8	87.9	23.9	4.9	3.5
14	W	979	772	783	21.1	20.0	225	25	31	88.9	86.2	280	26	8	90.7	93.6	25.8	4.9	3.1
15	Th	986	806	--	18.3	--	202	21	--	89.6	--	280	20	--	92.9	--	28.4	5.3	--
16	Fr	909	729	863	19.8	5.1	166	9	96	94.6	42.2	270	18	60	93.3	77.8	25.3	5.9	9.1
17	Sa	859	744	811	13.4	5.6	159	14	27	91.2	83.0	220	16	15	92.7	93.2	23.5	4.5	3.2
18	Su	745	777	852	--	--	108	6	40	94.4	63.0	100	16	16	84.0	84.0	21.7	5.6	5.5
19	M	913	697	691	23.7	24.3	201	27	22	86.6	89.1	230	19	9	91.7	96.1	24.5	5.0	2.1
20	Tu	963	773	802	19.7	16.7	213	17	11	92.0	94.8	190	22	7	88.4	96.3	26.2	5.5	2.1
21	W	958	737	699	23.1	27.0	171	12	9	93.0	94.7	230	17	10	92.6	95.7	26.3	6.0	2.9
22	Th	926	778	817	16.0	11.8	206	22	19	89.3	90.8	270	21	12	92.2	95.6	25.2	5.5	2.5
23	Fr	854	762	696	10.8	18.5	208	18	15	91.3	92.8	210	12	6	94.3	97.1	25.1	3.9	2.7
24	Sa	824	637	793	22.7	3.8	174	23	22	86.8	87.4	150	12	6	92.0	96.0	24.2	4.5	2.8
25	Su	615	701	732	--	--	79	11	7	86.1	91.1	100	13	8	87.0	92.0	22.3	4.1	3.5
26	M	932	635	683	31.9	26.7	178	10	14	94.4	92.1	270	21	16	92.2	94.1	26.3	4.2	2.7
27	Tu	1027	782	781	23.9	24.0	216	19	12	91.2	94.4	300	17	13	94.3	95.7	27.7	3.4	2.0
28	W	1001	771	776	23.0	22.5	213	22	4	89.7	98.1	310	19	8	93.9	97.4	28.7	3.9	2.4
29	Th	1034	827	816	20.0	21.1	218	11	3	95.0	98.6	290	7	9	97.6	96.9	30.1	4.6	3.6
30	Fr	991	792	827	20.1	16.5	195	13	8	93.3	95.9	250	10	8	96.0	96.8	28.7	3.8	3.6
31	Sa	838	746	706	11.0	15.8	171	15	6	91.2	96.5	180	15	11	91.7	93.9	27.3	4.2	4.9

PLANT OPERATIONAL DATA AUGUST 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	Su	688	752	826	--	--	123	26	21	78.9	82.9	110	18	22	83.6	80.0	23.7	9.5	8.7
2	M	889	634	605	28.7	31.9	167	6	7	96.4	95.8	220	13	21	94.1	90.5	25.2	8.0	6.6
3	Tu	944	630	754	33.3	20.1	200	21	12	89.5	94.0	310	18	14	94.2	95.5	28.4	6.3	5.5
4	W	1073	807	792	24.8	26.2	252	30	18	88.1	92.9	290	15	17	94.8	94.1	31.8	8.0	5.9
5	Th	1013	769	795	24.1	21.5	266	35	36	86.8	86.5	290	15	21	94.8	92.8	30.9	7.1	6.0
6	Fr	1042	835	829	19.9	20.4	246	36	33	85.4	86.6	280	16	23	94.3	91.8	29.5	9.8	6.9
7	Sa	861	821	786	4.6	8.7	216	37	29	82.9	86.6	180	14	25	92.2	86.1	28.4	11.6	9.0
8	Su	732	758	761	--	--	170	46	30	72.9	82.4	130	23	36	82.3	72.3	25.5	17.2	14.3
9	M	910	705	740	22.5	18.7	228	37	16	83.8	93.0	250	21	33	91.6	86.8	26.6	17.4	9.5
10	Tu	868	640	638	26.3	26.5	201	10	12	95.0	94.0	220	16	21	92.7	90.5	25.2	8.8	4.9
11	W	972	749	759	22.9	21.9	195	15	10	92.3	94.9	260	17	19	93.5	92.7	28.1	5.9	4.6
12	Th	971	777	761	20.0	21.6	222	21	7	90.5	96.8	250	24	17	90.4	93.2	28.0	7.7	3.1
13	Fr	851	697	819	18.1	3.8	254	12	14	95.3	94.5	220	15	19	93.2	91.4	23.2	7.1	3.9
14	Sa	613	555	576	9.5	6.0	90	11	8	87.8	91.1	110	15	13	86.4	88.2	19.2	4.9	3.9
15	Su	764	723	786	5.4	--	129	20	19	84.5	85.3	120	22	21	81.7	82.5	23.0	10.6	7.8
16	M	905	684	719	24.4	20.6	201	20	19	90.0	90.5	210	19	24	91.0	88.6	25.9	9.8	6.0
17	Tu	986	758	790	23.1	19.9	212	21	17	90.1	92.0	250	11	13	95.6	94.8	27.3	4.1	2.7
18	W	982	801	820	18.4	16.5	208	19	14	90.9	93.3	230	15	15	93.5	93.5	26.9	5.3	3.6
19	Th	923	753	771	18.4	16.5	211	20	23	90.5	89.1	220	16	22	92.7	90.0	26.2	5.5	4.9
20	Fr	878	719	693	18.1	21.1	198	14	32	92.9	83.8	220	19	23	91.4	89.5	24.8	6.7	7.4
21	Sa	749	707	587	5.6	21.6	129	14	14	89.1	89.1	180	12	20	93.3	88.9	23.5	6.0	6.3
22	Su	617	661	687	--	--	99	29	6	70.7	93.9	100	17	24	83.0	76.0	20.2	10.4	8.4
23	M	834	589	685	29.4	17.9	142	6	5	95.8	96.5	210	12	16	94.3	92.4	24.9	8.4	5.6
24	Tu	821	712	756	13.3	7.9	168	5	5	97.0	97.0	220	11	8	95.0	96.4	23.0	7.4	2.8
25	W	839	693	723	17.4	13.8	189	6	8	96.8	95.8	200	7	7	96.5	96.5	26.6	11.6	2.1
26	Th	904	713	714	21.1	21.0	207	11	8	94.7	96.1	250	9	6	96.4	97.6	28.3	5.2	3.4
27	Fr	868	744	729	14.3	16.0	203	22	10	89.2	95.1	250	18	18	92.8	92.8	26.2	7.3	4.3
28	Sa	736	693	697	5.8	5.3	155	12	9	92.3	94.2	130	16	22	87.7	83.1	26.5	9.1	5.9
29	Su	670	689	740	--	--	117	13	14	88.9	88.0	100	12	17	88.0	83.0	23.9	8.5	5.3
30	M	870	668	680	23.2	21.8	203	8	5	96.1	97.5	250	15	11	94.0	95.6	27.3	5.7	2.8
31	Tu	852	672	625	21.1	26.6	199	11	12	94.5	94.0	250	10	8	96.0	96.8	26.7	3.8	2.1

PLANT OPERATIONAL DATA SEPTEMBER 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	W	982	801	827	18.4	15.8	217	9	4	95.9	98.2	230	12	9	94.8	96.1	28.8	4.5	2.5
2	Th	889	696	803	21.7	9.7	228	24	10	89.5	95.6	210	18	10	91.8	95.2	27.4	7.4	2.4
3	Fr	796	675	676	15.2	15.1	172	2	2	99.7	99.7	240	8	9	96.7	96.3	26.6	6.9	3.4
4	Sa	680	651	701	4.3	--	120	6	5	95.0	95.8	140	8	7	94.3	95.0	23.5	6.3	3.2
5	Su	646	625	618	3.3	4.3	124	20	20	83.9	83.9	100	12	8	88.0	92.0	24.1	6.2	3.1
6	M	717	665	721	7.3	--	136	13	17	90.4	87.5	250	10	13	96.0	94.8	26.2	4.2	3.8
7	Tu	870	716	757	17.7	13.0	157	7	6	95.5	96.2	240	14	8	94.2	96.7	26.6	4.5	2.2
8	W	911	684	730	24.9	19.9	216	8	7	96.3	96.8	270	13	8	95.2	97.0	27.6	3.9	2.1
9	Th	930	714	681	23.2	26.8	222	11	13	95.0	94.1	280	13	9	95.4	96.8	29.5	4.6	2.4
10	Fr	915	648	703	29.2	23.2	204	8	6	96.1	97.1	260	11	6	95.8	97.7	27.9	6.3	2.9
11	Sa	746	691	745	7.4	0.1	145	12	8	91.7	94.5	160	11	8	93.1	95.0	26.6	5.5	4.5
12	Su	651	601	693	7.7	--	118	8	8	93.2	93.2	120	9	7	92.5	94.2	26.3	7.3	3.8
13	M	858	587	678	31.6	21.0	205	18	14	91.2	93.2	270	15	9	94.4	96.7	28.0	9.5	4.2
14	Tu	861	646	677	25.0	21.4	175	5	4	97.1	97.7	270	10	10	96.3	96.3	27.3	5.7	2.9
15	W	942	666	695	29.3	26.2	241	24	18	90.0	92.5	250	13	9	94.8	96.4	29.4	4.1	6.9
16	Th	959	774	787	19.3	17.9	209	22	9	89.5	95.7	260	14	10	94.6	96.2	28.3	8.3	5.5
17	Fr	880	729	750	17.2	14.8	206	12	8	94.2	96.1	240	13	15	94.6	93.8	29.0	7.6	6.6
18	Sa	840	724	712	13.8	15.2	240	29	18	87.9	92.5	150	12	17	92.0	88.7	28.0	13.3	9.2
19	Su	533	560	556	--	--	90	30	10	66.7	88.9	100	25	25	75.0	75.0	20.2	13.3	9.1
20	M	978	666	686	31.9	29.9	218	15	11	93.1	95.0	300	16	24	94.7	92.0	30.1	12.9	9.4
21	Tu	912	661	735	27.5	19.4	239	11	10	95.4	95.8	280	15	20	94.6	92.9	29.4	8.7	6.3
22	W	947	719	756	24.1	20.2	254	13	22	94.9	91.3	290	12	30	95.9	89.7	30.1	9.2	6.0
23	Th	956	695	750	27.3	21.5	222	3	2	98.6	99.1	290	15	24	94.8	91.7	32.1	14.1	7.3
24	Fr	1009	713	744	29.3	26.3	263	17	13	93.5	95.1	320	10	10	96.9	96.9	32.5	10.8	7.7
25	Sa	730	703	688	3.7	5.8	161	6	13	96.3	91.9	170	11	30	93.5	82.4	26.2	11.5	9.8
26	Su	663	621	638	6.3	3.8	111	43	39	61.3	64.9	110	14	47	87.3	57.3	24.2	16.4	12.2
27	M	943	708	793	24.9	15.9	217	36	32	83.4	85.3	250	19	39	92.4	84.4	27.4	16.0	9.8
28	Tu	929	703	678	24.3	27.0	226	19	16	91.6	92.9	280	19	29	93.2	89.6	29.0	10.4	5.6
29	W	963	739	749	23.3	22.2	232	30	21	87.1	90.9	260	17	28	93.5	89.2	31.1	11.3	6.6
30	Th	992	789	783	20.5	21.1	249	28	21	88.8	91.6	280	18	41	93.6	85.4	31.1	12.7	8.8
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PLANT OPERATIONAL DATA OCTOBER 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	Fr	959	720	777	24.9	19.0	242	19	15	92.1	93.8	250	19	31	92.4	87.6	29.5	11.7	7.3
2	Sa	811	716	681	11.7	16.0	166	15	17	91.0	89.8	170	18	24	89.4	85.9	28.0	11.6	9.8
3	Su	551	633	618	--	--	128	34	16	73.4	87.5	80	17	33	78.8	58.7	20.6	16.7	10.5
4	M	986	533	663	45.9	32.8	241	17	13	92.9	94.6	270	17	32	93.7	88.1	31.4	14.8	8.5
5	Tu	958	653	692	31.8	27.8	259	6	15	97.7	94.2	280	11	20	96.1	92.9	30.0	9.7	4.2
6	W	1019	820	769	19.5	24.5	246	7	7	97.2	97.2	310	12	10	96.1	96.7	32.1	5.7	4.2
7	Th	1012	791	818	21.8	19.2	233	9	8	96.1	96.6	260	12	19	95.4	92.7	33.6	9.4	6.2
8	Fr	973	708	715	27.2	26.5	190	5	17	97.4	91.1	260	8	14	96.9	94.6	32.8	7.8	8.0
9	Sa	707	670	669	5.2	5.4	132	7	10	94.7	92.4	150	7	29	95.3	80.7	29.3	9.1	9.0
10	Su	668	601	--	10.0	--	112	6	--	94.6	--	130	10	--	92.3	--	28.8	15.7	--
11	M	920	628	725	31.7	21.2	154	4	4	97.4	97.4	270	14	20	94.8	92.6	30.9	16.2	11.8
12	Tu	1008	755	769	25.1	23.7	232	8	3	96.6	98.7	280	15	14	94.6	95.0	32.5	10.5	5.3
13	W	987	775	728	21.5	26.2	225	14	8	93.8	96.4	280	14	14	95.0	95.0	33.5	7.7	6.3
14	Th	1018	810	791	20.4	22.3	202	13	11	93.6	94.6	240	17	14	92.9	94.2	31.5	9.5	5.5
15	Fr	1009	848	837	16.0	17.0	236	26	14	89.0	94.1	250	21	15	91.6	94.0	31.5	7.7	5.2
16	Sa	840	789	741	6.1	11.8	198	18	20	90.9	90.0	140	10	27	92.9	80.7	30.5	7.8	7.6
17	Su	713	713	655	--	8.1	139	3	3	97.8	97.8	130	14	20	89.2	84.6	30.1	18.9	11.5
18	M	1042	677	723	35.0	30.6	173	18	10	89.6	94.2	300	25	30	91.7	90.0	33.2	17.9	12.2
19	Tu	970	878	742	9.5	23.5	263	67	--	74.5	--	220	39	31	82.3	85.9	27.6	13.3	4.1
20	W	1033	767	738	25.8	28.6	271	13	20	95.2	92.6	250	18	17	92.8	93.2	30.8	7.0	4.3
21	Th	1012	868	827	14.2	18.3	229	46	26	79.9	88.6	260	34	25	86.9	90.4	30.5	9.2	6.3
22	Fr	1022	844	812	17.4	20.5	195	19	16	90.3	91.8	270	32	27	88.1	90.0	29.0	9.2	6.0
23	Sa	754	714	715	5.3	5.2	160	16	37	90.0	76.9	140	13	28	90.7	80.0	25.3	9.0	6.9
24	Su	609	576	638	5.4	--	131	18	37	86.3	71.8	100	17	33	83.0	67.0	22.4	11.3	8.1
25	M	963	670	667	30.4	30.7	208	15	39	92.8	81.3	250	21	25	91.6	90.0	29.7	9.8	6.3
26	Tu	1000	742	732	25.8	26.8	209	12	7	94.3	96.7	250	20	13	92.0	94.8	29.4	7.7	3.2
27	W	982	746	719	24.0	26.8	204	16	2	92.2	99.0	280	28	13	90.0	95.4	30.7	9.1	5.0
28	Th	1043	856	752	17.9	27.9	231	125	3	45.9	98.7	290	80	19	72.4	93.4	33.3	16.8	4.9
29	Fr	1011	--	825	--	18.4	219	--	23	--	89.5	270	70	24	74.1	91.1	31.8	17.9	5.6
30	Sa	796	731	743	8.2	6.7	173	18	19	89.6	89.0	150	25	25	83.3	83.3	29.0	10.5	6.2
31	Su	675	644	732	4.6	--	156	22	38	85.9	75.6	110	23	24	79.1	78.2	30.0	12.5	6.9

PLANT OPERATIONAL DATA NOVEMBER 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	M	771	670	646	13.1	16.2	232	8	9	96.9	96.1	140	20	16	85.7	88.6	25.2	11.8	5.9
2	Tu	963	689	626	28.5	35.0	202	11	8	94.6	96.0	220	14	10	93.6	95.5	25.9	5.0	2.4
3	W	1107	787	743	28.9	32.9	248	7	5	97.2	98.0	290	13	10	95.5	96.6	32.3	5.2	2.5
4	Th	1086	801	765	26.2	29.6	252	8	14	96.8	94.4	280	14	11	95.0	96.1	31.8	6.3	3.4
5	Fr	1038	761	735	26.7	29.9	241	8	13	96.7	94.6	300	17	11	94.3	96.3	33.6	5.6	5.2
6	Sa	829	732	686	11.7	17.2	159	26	18	83.6	88.7	170	31	12	81.8	92.9	30.7	10.5	4.3
7	Su	730	684	727	6.3	0.4	133	15	3	88.7	97.7	120	27	15	77.5	87.5	28.7	11.2	6.6
8	M	1013	684	710	32.5	29.9	228	12	7	94.7	96.9	280	18	17	93.6	93.9	35.6	12.2	5.7
9	Tu	1024	767	755	25.1	26.3	202	11	2	94.6	99.0	270	26	12	90.4	95.6	34.6	10.1	4.1
10	W	1144	820	820	28.3	28.3	331	43	15	87.0	95.5	320	21	9	93.4	97.2	36.8	10.2	4.5
11	Th	1051	789	793	24.9	24.5	241	10	5	95.9	97.9	260	16	12	93.8	95.4	35.6	9.7	4.8
12	Fr	1014	768	782	24.3	22.9	170	10	7	94.1	95.9	290	16	12	94.5	95.9	33.9	11.3	6.0
13	Sa	874	635	709	27.3	18.9	218	16	6	92.7	97.2	220	13	12	94.1	94.5	33.7	12.0	5.9
14	Su	763	719	723	5.8	5.2	139	10	5	92.8	96.4	140	12	22	91.4	84.3	32.1	16.2	7.6
15	M	1040	871	711	16.3	31.6	299	130	3	56.5	99.0	290	66	14	77.2	95.2	37.5	23.2	9.7
16	Tu	1069	837	780	21.7	27.0	279	51	6	81.7	97.8	280	35	18	87.5	93.6	36.0	16.5	6.7
17	W	1081	778	816	28.0	24.5	282	10	10	96.5	96.5	280	12	23	95.7	91.8	36.8	11.8	6.3
18	Th	1011	721	723	28.7	28.5	254	4	7	98.4	97.2	310	20	40	93.5	87.1	34.9	10.9	7.0
19	Fr	1120	814	867	27.3	22.6	252	12	34	95.2	86.5	300	10	26	96.7	91.3	35.1	8.4	6.0
20	Sa	873	723	742	17.2	15.0	218	19	29	91.3	86.7	180	9	19	95.0	89.4	32.5	11.2	6.2
21	Su	744	722	722	3.0	3.0	125	4	12	96.8	90.4	150	20	18	86.7	88.0	32.1	15.3	9.5
22	M	1010	762	784	24.6	22.4	212	9	22	95.8	89.6	270	15	14	94.4	94.8	34.0	13.2	8.3
23	Tu	1074	711	755	33.8	29.7	262	36	14	86.3	94.7	300	22	13	92.7	95.7	33.3	9.1	3.8
24	W	1107	865	864	21.9	22.0	254	24	13	90.6	94.9	300	16	12	94.7	96.0	33.6	5.7	3.1
25	Th	774	739	701	4.5	9.4	114	4	5	96.5	95.6	160	13	18	91.9	88.8	33.3	8.3	4.8
26	Fr	842	668	740	20.7	12.1	203	22	10	89.2	95.1	170	21	23	87.6	86.5	30.7	13.3	9.0
27	Sa	787	600	662	23.8	15.9	177	20	20	88.7	88.7	130	12	18	90.8	86.2	29.4	10.2	6.2
28	Su	709	668	765	5.8	--	130	10	15	92.3	88.5	100	17	18	83.0	82.0	27.0	12.2	6.4
29	M	1039	702	816	32.4	21.5	153	19	24	87.6	84.3	180	23	30	87.2	83.3	21.8	10.1	4.5
30	Tu	1082	813	837	24.9	22.6	209	6	2	97.1	99.0	230	22	16	90.4	93.0	29.7	8.3	4.1
31																			

PLANT OPERATIONAL DATA DECEMBER 1971

Date	Day	TOTAL SOLIDS					SUSPENDED SOLIDS					BOD					KJELDAHL NITROGEN		
		mg/l			% Removal		mg/l			% Removal		mg/l			% Removal		mg/l as N		
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE
1	W	1153	927	854	19.6	25.9	262	19	28	92.7	89.3	290	21	19	92.8	93.4	31.6	3.4	7.7
2	Th	1140	928	910	18.6	20.2	256	29	24	88.7	90.6	290	23	16	92.1	95.5	32.9	6.7	3.4
3	Fr	1048	752	809	28.2	22.8	245	29	30	88.2	87.8	280	18	13	93.6	95.4	16.5	5.0	3.5
4	Sa	938	802	789	14.5	15.9	210	30	35	85.7	83.3	180	10	14	94.4	92.2	29.5	4.5	4.1
5	Su	774	736	691	4.9	10.7	124	6	11	95.2	91.1	130	16	25	87.7	80.8	25.8	11.1	7.7
6	M	1005	680	735	32.3	26.9	210	8	4	96.2	98.1	250	16	16	93.6	93.6	32.6	12.7	8.1
7	Tu	1037	757	835	27.0	19.5	209	5	6	97.6	97.1	240	14	18	94.2	92.5	32.1	8.4	4.9
8	W	1090	822	846	25.6	22.4	223	9	11	96.0	95.1	230	15	20	93.5	91.3	32.2	8.0	6.0
9	Th	994	863	--	13.2	--	208	15	--	92.8	--	220	20	--	90.9	--	28.4	9.0	--
10	Fr	748	668	--	10.7	--	156	39	--	75.0	--	120	20	--	83.3	--	16.7	5.0	--
11	Sa	865	816	779	5.7	9.9	112	11	1	90.2	99.1	90	14	13	84.4	85.6	18.9	5.0	5.0
12	Su	815	842	817	--	--	63	4	2	93.7	96.8	80	22	15	72.5	81.3	20.2	9.7	6.7
13	M	1044	717	766	31.3	26.6	178	12	6	93.3	96.6	190	13	18	93.2	90.5	28.4	10.8	8.0
14	Tu	979	852	844	13.0	13.8	193	4	5	97.9	97.4	180	11	18	93.9	90.0	24.4	6.2	5.2
15	W	784	536	541	31.6	31.0	175	31	30	82.3	82.9	110	12	16	89.1	85.5	16.1	2.4	2.8
16	Th	1043	831	830	20.3	20.4	177	13	15	92.7	91.5	230	9	13	96.1	94.3	23.0	3.4	2.9
17	Fr	1023	836	880	18.3	14.0	131	7	11	94.7	91.6	220	14	12	93.6	94.5	25.1	5.7	5.0
18	Sa	972	848	861	12.8	11.4	163	31	22	81.0	86.5	150	13	10	91.3	93.3	23.4	7.8	7.1
19	Su	959	928	910	3.2	5.1	146	28	30	80.8	79.5	100	12	16	88.0	84.0	21.7	11.3	10.4
20	M	1105	884	901	20.0	18.5	190	21	6	88.9	96.8	230	24	14	89.6	93.9	27.9	13.3	11.5
21	Tu	1074	882	856	17.9	20.3	210	16	14	92.4	93.3	200	15	15	92.5	92.5	30.0	9.4	8.4
22	W	1077	932	922	13.5	14.4	184	6	9	96.7	95.1	270	13	16	95.2	94.1	29.0	7.6	6.7
23	Th	1070	825	860	22.9	19.6	201	11	13	94.5	93.5	250	14	16	94.4	93.6	31.6	9.1	8.0
24	Fr	887	856	832	3.5	6.2	186	28	32	84.9	82.8	130	11	13	91.5	90.0	28.3	9.2	9.5
25	Sa	776	743	713	4.3	8.1	119	28	25	76.5	79.0	70	14	16	80.0	77.1	25.9	16.2	15.3
26	Su	813	757	766	6.9	5.8	152	29	23	80.9	84.9	130	17	15	86.9	88.5	30.9	20.6	18.6
27	M	978	851	813	13.0	16.9	175	9	10	94.9	94.3	200	18	19	91.0	90.5	29.3	17.4	17.8
28	Tu	1011	820	794	18.9	21.5	158	3	4	98.1	97.5	230	13	18	94.3	92.2	30.2	12.7	11.1
29	W	1101	848	892	23.0	19.0	208	19	35	90.9	83.2	230	14	26	93.9	88.7	31.4	11.3	9.1
30	Th	1011	882	1040	12.8	--	260	21	85	91.9	67.3	190	15	62	92.1	67.4	22.4	9.0	12.9
31	Fr	1088	967	074	11.1	10.5	104	19	7	81.7	93.3	130	12	27	90.8	79.2	27.3	9.7	10.2

PLANT OPERATIONAL DATA JANUARY 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	Fr	5.6	0.40	0.73	92.9	87.0	2.4	0.21	0.17	91.3	92.9	103.5			2810	2750	0.94	0.85
2	Sa	7.5	0.65	0.37	91.3	95.1	3.8	0.41	0.20	89.2	94.7	100.7			2410	2720	0.87	1.00
3	Su	6.3	1.8	0.66	71.4	89.5	2.9	1.5	0.45	48.3	84.5	118.8			2050	2380	0.97	0.98
4	M	6.5	2.1	0.88	67.7	86.5	3.2	1.8	0.63	43.8	80.3	131.1			2020	2250	1.22	1.16
5	Tu	7.3	1.2	0.43	83.6	94.1	2.6	0.65	0.31	75.0	88.1	124.9			2410	2620	1.09	1.23
6	W	7.2	0.62	0.33	91.4	95.4	2.7	0.32	0.13	88.1	95.2	125.2			2580	2830	1.08	1.08
7	Th	7.1	0.63	0.33	91.1	95.4	2.9	0.26	0.09	91.0	96.9	128.2			2620	2950	0.95	1.04
8	Fr	7.7	0.64	0.47	91.7	93.9	2.8	0.32	0.21	88.6	92.5	124.5			2550	2810	0.96	1.05
9	Sa	7.5	0.51	0.39	93.2	94.8	2.5	0.26	0.16	89.6	93.6	114.1			2560	2760	0.89	0.97
10	Su	6.7	0.66	0.29	90.1	95.7	2.7	0.32	0.14	88.1	94.8	101.7			2290	2670	0.88	0.95
11	M	8.4	2.6	0.44	69.0	94.8	4.0	2.0	0.27	50.0	93.3	124.6	7.3	7.1	2190	2480	0.97	1.02
12	Tu	8.5	2.5	0.48	70.6	94.4	3.8	1.9	0.35	50.0	90.8	123.3			2450	2620	0.94	0.96
13	W	7.7	1.6	0.46	79.2	94.0	3.2	0.93	0.29	70.9	90.9	126.4			2740	2660	0.90	0.89
14	Th	7.9	1.8	1.2	77.2	84.8	2.6	0.90	0.24	65.4	90.8	127.4			2860	2860	0.84	0.63
15	Fr	7.8	1.1	2.9	85.9	62.8	2.0	0.53	0.16	73.5	92.0	135.0			2880	3030	0.79	0.62
16	Sa	8.0	0.58	1.2	92.8	85.0	2.5	0.32	0.09	87.2	96.4	111.5			2690	3170	0.86	0.68
17	Su	7.0	0.97	0.35	86.1	95.0	3.2	0.42	0.16	86.9	95.0	97.5			2430	2990	0.85	0.79
18	M	10.8	2.7	0.50	75.0	95.4	4.3	2.0	0.30	53.5	93.0	119.0			2240	2670	0.87	0.79
19	Tu	9.4	2.7	0.92	71.3	90.2	3.9	2.4	0.28	38.5	92.8	123.8			2600	2810	0.92	0.73
20	W	8.8	2.6	2.3	70.5	73.9	3.4	2.2	0.23	35.3	93.2	125.8			2720	2820	0.86	0.55
21	Th	8.3	3.4	2.4	59.0	71.1	3.1	1.6	0.22	48.4	92.9	126.3			2790	2870	0.80	0.57
22	Fr	9.2	1.8	2.0	80.4	78.3	2.0	1.2	0.22	40.0	89.0	132.2			2850	3000	0.73	0.43
23	Sa	8.8	1.0	0.92	88.6	89.5	3.0	0.65	0.20	78.3	93.3	111.6			2860	3090	0.73	0.61
24	Su	7.3	0.63	0.40	91.4	94.5	2.6	0.26	0.20	90.0	92.3	91.6			2520	2950	0.75	0.72
25	M	9.2	2.4	2.6	73.9	71.7	3.7	1.7	0.23	54.1	93.8	123.2			2430	2810	0.85	0.70
26	Tu	8.9	4.1	0.44	53.9	95.1	3.7	2.9	0.22	21.6	94.1	113.0			2740	2890	0.87	0.56
27	W	8.2	3.7	1.5	54.9	81.7	3.2	2.2	0.19	31.3	94.1	116.4			3010	2920	0.78	0.52
28	Th	8.4	3.1	1.1	63.1	86.9	2.8	1.9	0.18	32.1	93.6	113.4			3000	3050	0.82	0.53
29	F	8.4	1.6	0.47	81.0	94.4	2.4	0.94	0.14	60.8	94.2	130.0			3130	2890	0.72	0.67
30	Sa	8.4	0.93	0.90	88.9	89.3	3.9	0.59	0.17	84.9	95.6	122.8			3040	3190	0.75	0.76
31	Su	7.6	0.51	0.60	93.3	92.1	3.3	0.25	0.17	92.4	94.8	109.0			2560	2940	0.78	0.78

PLANT OPERATIONAL DATA

FEBRUARY 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	M	9.3	1.5	0.92	83.9	90.1	4.4	1.1	0.23	75.0	94.8	116.6			2250	2820	0.85	0.84
2	Tu	8.8	1.2	1.1	86.4	87.5	3.6	0.85	0.28	76.4	92.2	117.1			2480	2980	0.98	0.89
3	W	8.4	1.7	1.3	79.8	84.5	3.0	1.4	0.32	53.3	89.3	123.9			2750	2880	0.99	0.98
4	Th	7.0	1.6	2.5	77.1	64.3	2.5	1.3	0.26	48.0	89.6	144.8			2670	2900	1.03	0.84
5	Fr	7.8	1.4	1.5	82.1	80.8	2.7	0.88	0.14	67.4	94.8	123.8			2990	2760	1.12	1.00
6	Sa	7.6	0.80	0.68	89.5	91.1	2.7	0.51	0.18	81.1	93.3	105.8			3100	3280	1.01	0.99
7	Su	7.0	0.57	0.60	91.9	91.4	2.6	0.25	0.23	90.4	91.2	93.5			2660	2960	1.01	0.99
8	M	9.2	1.1	0.56	88.0	93.9	4.1	0.61	0.30	85.1	92.7	117.6			2590	2710	1.05	1.01
9	Tu	8.1	1.4	0.59	82.7	92.7	2.8	1.0	0.30	64.3	89.3	116.8			2940	2950	1.09	1.02
10	W	8.5	1.3	0.66	84.7	92.2	3.2	0.99	0.27	69.1	91.6	117.6			2920	3010	1.02	0.99
11	Th	8.2	3.2	0.82	61.0	90.0	2.6	1.7	0.28	34.6	89.2	126.8			3430	3050	0.98	1.00
12	Fr	8.6	2.1	1.2	75.6	86.0	2.6	0.82	0.26	68.5	90.0	119.4			3350	3120	0.82	0.88
13	Sa	8.2	0.76	0.64	90.7	92.2	2.5	0.35	0.32	86.0	87.2	99.6			3320	2930	0.77	0.80
14	Su	7.3	0.51	--	93.0	--	2.6	0.22	--	91.5	--	90.4			2870	2950	0.94	0.89
15	M	10.0	0.85	1.1	91.5	89.0	4.2	0.59	0.23	86.0	94.5	116.5			2720	2920	1.02	0.93
16	Tu	8.8	2.7	2.1	69.3	76.1	3.7	2.0	0.21	45.9	94.3	122.0			2930	3250	1.00	0.70
17	W	6.6	2.7	1.7	59.1	74.2	2.5	1.8	0.24	28.0	90.4	133.9			3280	3150	1.11	0.89
18	Th	4.8	1.3	0.84	72.9	82.5	1.8	0.52	0.23	71.1	87.2	143.4			3290	2990	1.12	1.02
19	Fr	3.2	1.3	1.3	59.4	59.4	0.80	0.19	0.21	76.3	73.8	146.5			3050	2810	1.23	1.13
20	Sa	4.0	0.65	0.61	83.8	84.8	1.7	0.13	0.15	92.4	91.2	136.7			2870	2790	1.28	1.16
21	Su	4.3	0.51	0.48	88.1	88.8	2.2	0.15	0.16	93.2	92.7	110.0			2640	2850	1.29	1.13
22	M	6.2	0.64	0.97	89.7	84.4	2.5	0.21	0.22	91.6	91.2	139.5			2410	2710	1.45	1.36
23	Tu	5.5	0.76	0.88	86.2	84.0	2.4	0.26	0.23	89.2	90.4	136.3			2490	2810	1.43	1.35
24	W	5.6	0.92	--	83.6	--	2.4	0.56	--	76.7	--	132.6			2650	2840	1.32	1.31
25	Th	5.1	0.70	0.26	86.3	94.9	2.0	0.34	0.09	83.0	95.5	138.7			2850	2930	1.28	1.20
26	Fr	4.2	0.75	0.35	82.1	91.7	1.2	0.22	0.11	81.7	90.8	139.9			2820	2850	1.26	1.22
27	Sa	4.9	0.76	0.41	84.5	91.6	2.4	0.18	0.12	92.5	95.0	122.3			2920	2790	1.29	1.25
28	Su	4.4	0.67	0.39	84.8	91.1	2.6	0.21	0.13	91.9	95.0	107.0			2720	2760	1.26	1.19
29																		
30																		
31																		

PLANT OPERATIONAL DATA MARCH 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	M	6.6	0.64	0.36	90.3	94.5	2.8	0.29	0.15	89.6	94.6	136.3			2440	2620	1.31	1.20
2	Tu	6.1	0.69	0.30	88.7	95.1	3.0	0.33	0.15	89.0	95.0	130.1			2570	2640	1.33	1.17
3	W	6.6	0.68	0.33	89.7	95.0	2.6	0.33	0.15	87.3	94.2	132.5			2870	2850	1.28	1.22
4	Th	6.5	0.65	0.30	90.0	95.4	2.5	0.43	0.16	82.8	93.6	128.9			2870	2810	1.22	1.16
5	Fr	6.2	0.62	1.1	90.0	82.3	2.6	0.42	0.16	83.8	93.8	137.3			2810	2920	1.19	1.08
6	Sa	5.3	0.63	1.1	88.1	79.2	2.5	0.31	0.15	87.6	94.0	130.4			2650	2840	1.16	1.10
7	Su	5.4	0.50	0.55	90.7	89.8	3.1	0.21	0.14	93.2	95.5	106.9			2480	2990	1.13	1.07
8	M	7.2	0.94	0.38	86.9	94.7	3.6	0.57	0.20	84.2	94.4	127.7			2480	2630	1.15	1.03
9	Tu	6.9	0.81	0.33	88.3	95.2	3.4	0.45	0.14	86.8	95.9	130.7			2800	2650	1.17	1.03
10	W	6.4	0.99	0.58	84.5	90.9	3.0	0.60	0.32	80.0	89.3	133.3			2830	2750	1.16	1.11
11	Th	6.7	1.4	1.0	79.1	85.1	2.4	0.87	0.21	63.8	91.3	131.9			2860	2770	1.09	0.93
12	Fr	7.4	1.5	1.9	79.7	74.3	2.9	0.99	0.17	65.9	94.1	137.9			3010	3110	1.01	0.84
13	Sa	7.1	0.84	1.9	88.2	73.2	3.0	0.51	0.19	83.0	93.7	131.2			3040	3080	1.00	0.79
14	Su	6.6	0.46	1.3	93.0	80.3	1.6	0.24	0.23	85.0	85.6	138.9			2590	2760	1.02	0.95
15	M	6.9	0.80	0.73	88.4	89.4	2.8	0.23	0.20	91.8	92.9	142.2			2590	2790	1.20	1.00
16	Tu	6.9	0.76	0.82	89.0	88.1	2.8	0.46	0.35	83.6	87.5	144.2			2650	2830	1.13	1.03
17	W	7.4	0.68	0.77	90.8	89.6	2.6	0.45	0.29	82.7	88.8	142.3			2830	2900	1.19	0.97
18	Th	8.2	0.75	0.87	90.9	89.4	2.6	0.39	0.22	85.0	91.5	142.9			2970	3120	1.12	0.99
19	Fr	7.4	0.63	1.3	91.5	82.4	2.7	0.27	0.24	90.0	91.1	141.6			2880	2890	1.08	0.92
20	Sa	6.0	0.46	2.3	92.3	61.7	2.2	0.23	0.15	89.5	93.2	131.8			2840	3050	1.00	0.86
21	Su	4.1	0.39	0.88	90.5	78.5	2.0	0.18	0.17	91.0	91.5	132.5			2610	2880	1.10	0.97
22	M	6.3	0.54	1.2	91.4	81.0	2.2	0.21	0.15	90.5	93.2	142.7			2400	2690	1.12	1.05
23	Tu	6.1	0.55	0.80	91.0	86.9	2.6	0.26	0.22	90.0	91.5	138.3			2540	2650	1.10	1.05
24	W	6.7	0.85	0.98	87.3	85.4	3.0	0.45	0.15	85.0	95.0	137.6			2800	2800	1.07	0.92
25	Th	5.5	0.80	1.1	85.5	80.0	2.4	0.35	0.18	85.4	92.5	140.1			2850	2880	0.95	0.96
26	Fr	5.8	1.2	0.56	79.3	90.3	2.4	0.36	0.19	85.0	92.1	147.5			2850	2880	0.97	0.92
27	Sa	5.5	0.80	0.44	85.5	92.0	2.6	0.25	0.17	90.4	93.5	134.6			3030	2830	1.04	1.01
28	Su	4.4	0.44	0.44	90.0	90.0	2.3	0.19	0.11	91.7	95.2	138.7			2610	2660	1.07	1.10
29	M	6.6	0.34	0.49	94.8	92.6	2.7	0.19	0.17	93.0	93.7	148.7			2710	2770	1.10	1.13
30	Tu	6.0	0.66	0.47	89.0	92.2	2.4	0.38	0.22	84.2	90.8	145.8			2720	2970	1.11	1.08
31	W	5.6	0.73	0.45	87.0	92.0	2.0	0.53	0.20	73.5	90.0	153.2			2860	3000	1.13	1.14

PLANT OPERATIONAL DATA APRIL 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	Th	6.0	0.87	0.37	85.5	93.8	1.3	0.51	0.14	60.8	89.2	147.7			2980	2990	1.10	1.12
2	Fr	6.3	0.80	0.36	87.3	94.3	1.5	0.36	0.15	76.0	90.0	145.6			2960	2910	1.04	1.02
3	Sa	6.4	0.49	0.35	92.3	94.5	2.5	0.19	0.12	92.4	95.2	129.5			3000	2850	0.98	1.00
4	Su	5.5	0.42	0.34	92.4	93.8	3.0	0.16	0.11	94.7	96.3	115.4			2910	2770	1.02	1.06
5	M	7.9	0.76	0.37	90.4	95.3	3.1	0.38	0.16	87.7	94.8	138.1			2660	2700	1.03	1.07
6	Tu	7.2	0.91	0.38	87.4	94.7	3.0	0.63	0.17	79.0	94.3	141.3			2730	3100	1.03	1.01
7	W	6.4	1.3	0.48	79.7	92.5	2.6	0.95	0.23	63.5	91.2	137.0			3120	3430	0.93	0.95
8	Th	6.8	3.2	0.81	52.9	88.1	2.8	1.0	0.26	64.3	90.7	143.2			3210	3240	0.88	0.94
9	Fr	--	0.86	1.4	--	--	--	0.64	0.21	--	--	127.9			3210	3340	0.83	0.92
10	Sa	6.6	0.46	0.55	93.0	91.7	3.0	0.24	0.18	92.0	94.0	120.3			3120	3200	0.98	1.00
11	Su	4.9	0.33	0.98	93.3	80.0	1.9	0.17	0.20	91.1	89.5	120.4			2800	2560	1.11	0.96
12	M	4.4	0.41	0.55	90.7	87.5	1.6	0.23	0.15	85.6	90.6	146.9			2700	2680	1.14	1.27
13	Tu	4.6	0.27	0.35	94.1	92.4	1.6	0.19	0.13	88.1	91.9	147.8			2840	2840	1.34	1.27
14	W	5.0	0.22	0.39	95.6	92.2	1.9	0.13	0.13	93.2	93.2	147.7			2960	2810	1.28	1.36
15	Th	5.5	0.32	0.45	94.2	91.8	1.6	0.13	0.15	91.9	90.6	143.6			2610	3080	1.41	1.10
16	Fr	5.6	0.43	0.37	92.3	93.4	2.2	0.17	0.14	92.3	93.6	142.6			3070	3350	1.22	0.87
17	Sa	5.4	2.0	0.37	63.0	93.1	2.4	0.17	0.12	92.9	95.0	134.8			3240	3270	1.19	0.93
18	Su	5.4	0.45	0.49	91.7	90.9	2.2	0.13	0.11	94.1	95.0	124.9			3000	2730	1.08	1.08
19	M	7.1	0.54	0.75	92.4	89.4	2.6	0.23	0.23	91.2	91.2	140.2			3150	2870	1.18	1.09
20	Tu	6.8	0.60	0.81	91.2	88.1	1.7	0.30	0.23	82.4	86.5	138.2			3120	3120	1.22	0.97
21	W	7.0	2.1	0.46	70.0	93.4	2.1	0.35	0.20	83.3	90.5	139.6			2950	2960	1.14	0.95
22	Th	5.6	0.97	1.1	82.7	80.4	2.6	0.58	0.17	77.7	93.5	139.7			3510	3320	1.04	0.81
23	Fr	7.6	4.3	1.8	43.4	76.3	2.4	0.38	0.16	84.2	93.3	136.5			2950	3340	0.95	0.64
24	Sa	7.3	2.2	0.53	69.9	92.7	2.9	0.17	0.23	94.1	92.1	115.7			2910	3330	1.00	0.85
25	Su	5.4	0.49	0.81	90.9	85.0	1.8	0.11	0.20	93.9	88.9	113.7			2940	2870	1.01	0.94
26	M	6.6	3.1	1.2	53.0	81.8	2.7	0.19	0.18	93.0	93.3	134.5			2900	2800	1.02	0.98
27	Tu	5.9	6.2	1.3	--	78.0	1.8	0.21	0.24	88.3	86.7	144.3			2790	2930	1.01	0.97
28	W	6.0	0.81	--	86.5	--	2.0	0.26	--	87.0	--	136.7			2790	2950	1.04	0.79
29	Th	7.1	3.3	1.4	53.5	80.3	2.0	0.27	0.26	86.5	87.0	143.7			2870	3130	1.05	0.84
30	Fr	8.3	8.2	2.2	1.2	73.5	2.1	0.33	0.24	84.3	88.6	147.2			3030	3260	0.92	0.80
31																		

PLANT OPERATIONAL DATA MAY 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	Sa	7.1	0.80	1.6	88.7	77.5	2.6	0.20	0.27	92.3	89.6	124.8			2870	3260	0.96	0.83
2	Su	5.7	0.50	1.9	91.2	66.7	2.0	0.14	0.18	93.0	91.0	115.6			2640	2880	0.97	0.89
3	M	8.4	0.91	0.71	89.2	91.5	2.0	0.48	0.21	76.0	89.5	130.8			2630	2860	1.01	0.95
4	Tu	6.2	1.1	0.60	82.3	90.3	2.1	0.64	0.23	69.5	89.0	129.9			2870	2980	1.02	0.89
5	W	7.9	7.0	0.84	11.4	89.4	2.3	0.30	0.23	87.0	90.0	138.8			3010	3220	0.93	0.82
6	Th	7.6	10.3	0.91	--	88.0	2.2	0.45	0.21	79.5	90.5	138.6			2910	3250	0.90	0.71
7	Fr	7.2	2.8	1.1	61.1	84.7	2.0	0.20	0.20	90.0	90.0	132.8			3050	3340	0.84	0.66
8	Sa	7.9	2.3	2.7	70.9	65.8	1.8	0.13	0.20	92.8	88.9	116.5			2960	3380	0.80	0.66
9	Su	6.1	0.53	1.5	91.3	75.4	2.0	0.11	0.18	94.5	91.0	107.4			2780	2900	0.94	0.85
10	M	9.3	0.74	0.59	92.0	93.7	2.3	0.35	0.18	84.8	92.2	128.1			2590	2770	1.04	0.80
11	Tu	8.2	0.71	0.57	91.3	93.0	3.0	0.37	0.19	87.7	93.7	137.5			2810	2820	1.07	0.99
12	W	7.9	1.8	0.81	77.2	89.7	2.3	0.28	0.21	87.8	90.9	130.0			2860	2900	1.05	0.92
13	Th	8.6	5.0	1.8	41.9	79.1	2.1	0.34	0.28	83.8	86.7	133.3			2780	2970	1.01	0.91
14	Fr	8.9	2.8	2.5	68.5	71.9	2.0	0.36	0.24	82.0	88.0	128.6			2880	3130	1.00	0.94
15	Sa	7.9	2.8	2.1	64.6	73.4	2.1	0.13	0.28	93.8	86.7	116.8			2910	3300	0.94	0.74
16	Su	6.1	0.45	1.4	92.6	77.0	1.8	0.12	0.19	93.3	89.4	101.4			2710	2810	0.94	0.82
17	M	9.2	1.1	0.95	88.0	89.7	2.8	0.66	0.25	76.4	91.1	127.1			2630	2640	1.04	1.00
18	Tu	7.1	1.8	0.59	74.6	91.7	1.8	0.43	0.21	76.1	88.3	131.3			2820	3020	1.02	0.91
19	W	7.3	4.9	0.65	32.9	91.1	2.0	0.25	0.18	87.5	91.0	133.0			2790	2980	1.00	0.80
20	Th	7.5	6.1	1.3	18.7	82.7	2.3	0.29	0.18	87.4	92.2	132.2			2870	3110	0.90	0.73
21	Fr	7.6	4.9	1.8	35.5	76.3	2.4	0.16	0.14	93.3	94.2	133.2			2830	3180	0.98	0.73
22	Sa	7.8	0.50	1.0	93.6	87.2	2.2	0.17	0.19	92.3	91.4	116.5			2940	3230	0.99	0.89
23	Su	6.6	0.50	0.79	92.4	88.0	2.3	0.14	0.17	93.9	92.6	102.5			2900	2730	1.03	0.90
24	M	6.4	0.71	0.63	88.9	90.2	1.7	0.39	0.19	77.1	88.8	144.0			2360	2810	1.14	1.02
25	Tu	5.9	0.61	0.76	89.7	87.1	1.6	0.20	0.18	87.5	88.8	138.3			2660	3130	1.28	1.09
26	W	7.1	0.57	0.58	92.0	91.8	2.0	0.14	0.13	93.0	93.5	130.4	7.0	6.9	2930	3270	1.14	1.09
27	Th	7.6	1.5	0.39	80.3	94.9	2.5	0.21	0.14	91.6	94.4	133.3	6.9	6.9	3080	3240	1.15	0.98
28	Fr	7.9	4.4	0.65	44.3	91.8	2.7	0.15	0.16	94.4	94.1	134.0	7.1	7.2	3150	3240	1.04	1.02
29	Sa	7.1	0.58	0.48	91.8	93.2	2.9	0.18	0.13	93.8	95.5	111.9	7.1	7.1	3120	3010	1.06	1.01
30	Su	5.9	0.44	0.35	92.5	94.1	1.9	0.12	0.09	93.7	95.3	91.5	6.9	7.0	2780	2130	1.09	1.10
31	M	7.8	0.44	0.23	94.4	97.1	3.5	0.18	0.12	94.9	96.6	108.8	7.4	7.4	2420	2270	1.11	1.03

PLANT OPERATIONAL DATA JUNE 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	Tu	7.3	0.65	0.31	91.1	95.8	3.4	0.40	0.12	88.2	96.5	140.8	7.3	7.2	2750	3210	1.14	1.08
2	W	7.4	0.49	0.85	93.4	88.5	3.2	0.26	0.21	91.9	93.4	136.2	6.9	7.1	3170	3250	1.07	1.16
3	Th	6.9	4.1	1.7	40.6	75.4	2.3	0.25	0.21	89.1	90.9	136.7	7.2	7.1	3310	3290	1.13	1.05
4	Fr	7.8	0.41	2.5	94.7	67.9	2.1	0.16	0.21	92.4	90.0	140.7	7.0	6.9	3130	3390	1.12	1.08
5	Sa	6.6	0.30	0.66	95.5	90.0	2.0	0.12	0.18	94.0	91.0	125.2	7.0	7.0	3030	3220	1.09	1.08
6	Su	5.5	0.38	0.76	93.1	86.2	1.6	0.08	0.15	95.0	90.6	117.7	7.0	7.0	2780	2530	1.10	1.21
7	M	7.8	0.36	0.36	95.4	95.4	2.8	0.16	0.14	94.3	95.0	138.7	7.2	7.2	2700	2970	1.22	1.19
8	Tu	7.3	0.37	--	94.9	--	2.1	0.20	--	90.5	--	132.1	6.9	6.8	3060	2990	1.10	1.19
9	W	7.3	0.28	0.36	96.2	95.1	1.9	0.15	0.16	92.1	91.6	133.3	6.8	6.8	3060	3600	1.19	1.26
10	Th	8.0	0.33	0.37	95.9	95.4	1.8	0.11	0.13	93.9	92.8	135.4	7.1	6.8	3350	3610	1.18	1.12
11	Fr	7.9	3.2	0.49	59.5	93.8	1.8	0.18	0.12	90.0	93.3	139.7	7.2	6.9	3370	3500	1.15	1.11
12	Sa	6.3	0.62	0.32	90.2	94.9	1.2	0.10	0.11	91.7	90.8	134.1	--	--	3320	3440	1.06	1.15
13	Su	5.4	0.32	0.23	94.1	95.7	0.60	0.08	0.11	86.7	81.7	113.4	--	--	3110	3320	1.16	1.17
14	M	8.1	0.90	0.29	88.9	96.4	2.3	0.29	0.14	87.4	93.9	134.7	7.2	7.3	2930	3130	1.20	1.31
15	Tu	7.8	0.67	0.28	91.4	96.4	2.5	0.20	0.12	92.0	95.2	134.7	7.1	7.0	2950	3200	1.22	1.33
16	W	7.5	0.58	0.32	92.3	95.7	1.2	0.16	0.13	86.7	89.2	140.5	6.8	6.8	3180	3070	1.10	1.24
17	Th	7.2	4.1	0.30	43.1	95.8	1.4	0.10	0.11	92.9	92.1	146.9	6.9	6.9	3150	3030	1.07	1.25
18	Fr	6.0	2.6	0.91	56.7	84.8	1.0	0.10	0.12	90.0	88.0	152.8	6.9	6.8	2940	3140	1.07	1.19
19	Sa	5.0	0.58	0.92	88.4	81.6	1.1	0.08	0.11	92.7	90.0	151.0	--	--	2800	3190	1.18	1.16
20	Su	3.7	0.43	0.46	88.4	87.6	1.2	0.07	0.10	94.2	91.7	131.6	--	--	2620	2970	1.28	1.26
21	M	7.3	0.68	0.16	90.7	97.8	2.6	0.21	0.14	91.9	94.6	146.8	7.6	7.1	2780	2770	1.33	1.40
22	Tu	6.5	0.85	0.34	86.9	94.8	2.0	0.17	0.14	91.5	93.0	155.4	7.0	7.0	2890	2850	1.34	1.38
23	W	6.8	0.68	0.29	90.0	95.7	1.8	0.13	0.11	92.8	93.9	152.8	7.0	7.0	2890	2900	1.32	1.38
24	Th	7.0	0.49	0.23	93.0	96.7	2.0	0.11	0.09	94.5	95.5	154.3	7.0	7.0	2920	3010	1.23	1.24
25	Fr	6.4	0.50	0.21	92.2	96.7	1.4	0.10	0.11	92.9	92.1	150.8	6.9	7.0	2670	2920	1.18	1.17
26	Sa	6.4	0.29	0.21	95.5	96.7	1.6	0.10	0.09	93.8	94.4	124.0	--	--	2680	2950	1.15	1.26
27	Su	5.5	0.48	0.22	91.3	96.0	1.8	0.12	0.12	93.3	93.3	121.6	--	--	2540	2940	1.21	1.19
28	M	8.9	1.0	0.28	88.8	96.9	2.1	0.63	0.13	70.0	93.8	144.9	6.9	6.9	2290	2600	1.19	1.09
29	Tu	6.8	0.68	0.15	90.0	97.8	1.9	0.30	0.10	84.2	94.7	146.0	7.0	6.9	2440	2660	1.08	1.08
30	W	6.4	0.75	0.20	88.3	96.9	1.9	0.17	0.10	91.1	94.7	146.4	7.0	6.9	2530	2530	0.97	0.95
31																		

PLANT OPERATIONAL DATA JULY 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	Th	7.6	0.56	0.20	92.6	97.4	2.1	0.19	0.12	91.0	94.3	142.6	7.1	7.0	2640	2690	0.85	0.83
2	Fr	8.3	0.58	0.70	93.0	91.6	2.9	0.24	0.22	91.7	92.4	144.2	--	--	2560	2570	0.58	0.77
3	Sa	6.8	0.48	0.48	92.9	92.9	2.3	0.12	0.14	94.8	93.9	121.7	--	--	2540	2720	0.72	0.70
4	Su	5.4	0.40	0.44	92.6	91.9	1.6	0.18	0.13	88.8	91.9	106.5	--	--	2380	2690	0.71	0.79
5	M	7.0	1.4	0.37	80.0	94.7	3.2	1.0	0.28	68.8	91.3	108.0	7.1	7.0	2150	2440	0.90	0.86
6	Tu	8.9	2.3	0.40	74.3	95.5	3.0	1.5	0.33	50.0	89.0	140.4	7.1	7.0	2270	2420	0.92	0.88
7	W	7.8	0.94	0.20	87.9	97.4	2.0	0.51	0.13	74.5	93.5	150.6	7.2	7.2	2540	2580	0.79	0.81
8	Th	5.4	2.6	0.17	51.9	96.9	1.1	0.20	0.11	81.8	90.0	151.2	7.1	7.1	2520	2550	0.82	0.84
9	Fr	7.2	1.1	0.28	84.7	96.1	1.8	0.15	0.11	91.7	93.9	155.2	7.3	7.3	2510	2470	0.82	0.85
10	Sa	6.2	2.5	0.21	59.7	96.6	1.4	0.10	0.11	92.9	92.1	131.4	--	--	2520	2610	0.80	0.75
11	Su	5.4	0.47	0.19	91.3	96.5	1.2	0.12	0.09	90.0	92.5	124.0	--	--	2600	2860	0.87	0.77
12	M	7.3	1.3	0.16	82.2	97.8	4.2	0.95	0.13	77.4	96.9	144.1	7.4	7.3	2340	2650	1.02	0.95
13	Tu	6.4	1.3	0.97	79.7	84.8	3.0	0.69	0.16	77.0	94.7	141.9	7.1	7.0	2500	2590	0.93	0.96
14	W	7.1	0.78	0.93	89.0	86.9	2.7	0.21	0.15	92.2	94.4	143.6	7.2	7.1	2780	2930	0.91	0.94
15	Th	7.3	0.66	--	91.0	--	1.5	0.22	--	85.3	--	145.1	7.2	7.1	2660	2900	0.83	0.91
16	Fr	7.4	0.61	2.6	91.8	64.9	2.0	0.25	0.16	87.5	92.0	143.2	6.8	6.9	2520	2840	0.79	0.83
17	Sa	8.0	0.47	0.68	94.1	91.5	1.6	0.14	0.15	91.3	90.6	125.6	--	--	2640	3050	0.89	0.91
18	Su	5.4	0.49	1.0	90.9	81.5	1.3	0.12	0.15	90.8	88.5	120.7	--	--	2450	2910	1.00	0.99
19	M	7.4	0.85	0.33	88.5	95.5	1.8	0.31	0.12	82.8	93.3	135.2	7.2	7.1	2360	2680	1.20	1.22
20	Tu	7.4	0.78	0.32	89.5	95.7	1.9	0.33	0.13	82.6	93.2	137.8	7.1	7.1	2600	2650	1.16	1.16
21	W	6.8	0.62	0.34	90.9	95.0	1.7	0.21	0.15	87.6	91.2	141.6	7.0	7.1	2690	2660	1.12	1.26
22	Th	9.1	0.67	0.32	92.6	96.5	2.1	0.10	0.15	95.2	92.9	139.4	7.1	7.0	2740	2810	1.17	1.24
23	Fr	6.4	0.55	0.27	91.4	95.8	0.98	0.19	0.13	80.6	86.7	135.6	7.1	7.0	2780	2800	1.12	1.27
24	Sa	6.8	0.43	0.33	93.7	95.1	0.92	0.12	0.13	87.0	85.9	118.1	--	--	2590	2880	1.24	1.27
25	Su	5.2	0.44	0.32	91.5	93.8	1.0	0.14	0.14	86.0	86.0	110.8	--	--	2430	2980	1.39	1.41
26	M	7.9	1.1	0.55	86.1	93.0	2.6	0.63	0.19	75.8	92.7	130.3	7.4	7.1	2160	2630	1.48	1.43
27	Tu	7.8	1.1	0.35	85.9	95.5	2.5	0.58	0.16	76.8	93.6	130.1	7.0	7.0	2190	2670	1.52	1.40
28	W	7.8	1.0	0.25	87.2	96.8	2.1	0.47	0.13	77.6	93.8	129.9	7.2	7.2	2540	2620	1.41	1.38
29	Th	8.1	0.73	0.26	91.0	96.8	2.0	0.21	0.11	89.5	94.5	131.6	7.1	7.0	2710	2700	1.34	1.41
30	Fr	7.2	0.59	0.26	91.8	96.4	2.2	0.19	0.12	91.4	94.5	132.7	7.0	6.9	2440	2910	1.39	1.33
31	Sa	7.2	0.69	0.34	90.4	95.3	2.1	0.20	0.16	90.5	92.4	109.8	--	--	2580	2930	1.68	1.37

PLANT OPERATIONAL DATA AUGUST 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	Su	5.8	1.2	0.48	79.3	91.7	1.6	0.63	0.28	60.6	82.5	113.6	--	--	2190	2670	1.96	1,89
2	M	8.6	2.2	1.1	74.4	87.2	3.0	1.5	0.65	50.0	78.3	135.5	7.0	6.9	1990	2330	2.24	2.23
3	Tu	7.8	1.9	0.75	75.6	90.4	2.8	1.0	0.37	64.3	86.8	129.9	7.0	6.9	2070	2340	2.58	2.55
4	W	8.5	1.2	0.56	85.9	93.4	1.8	0.48	0.26	73.3	85.6	128.8	7.1	7.0	2380	2520	2.24	2.36
5	Th	8.8	1.0	0.77	88.6	91.3	2.6	0.44	0.30	83.1	88.5	128.8	7.0	7.1	2350	2800	2.37	2.21
6	Fr	9.0	1.4	0.92	84.4	89.8	2.9	0.67	0.38	76.9	86.9	130.9	--	--	2480	2840	2.47	2.01
7	Sa	7.9	1.4	0.92	82.3	88.4	3.1	0.74	0.49	76.1	84.2	111.7	--	--	2840	2840	2.12	2.02
8	Su	7.1	2.7	1.4	62.0	80.3	2.6	1.6	0.99	38.5	61.9	97.4	--	--	2630	2490	2.18	2.09
9	M	8.7	3.2	1.3	63.2	85.1	3.1	2.0	1.0	35.5	67.7	133.7	--	--	2070	2470	2.25	2.30
10	Tu	7.1	2.2	0.83	69.0	88.3	2.3	1.6	0.51	30.4	77.8	133.6	7.3	7.2	2060	2540	1.90	1.78
11	W	7.3	1.3	0.57	82.2	92.2	2.1	0.62	0.32	70.5	84.8	132.2	7.3	7.1	2470	2760	1.80	1.77
12	Th	8.0	1.4	0.63	82.5	92.1	2.2	0.57	0.28	74.1	87.3	133.1	7.3	7.2	2760	2730	1.68	1.54
13	Fr	6.6	0.91	0.51	86.2	92.3	1.5	0.56	0.23	62.7	84.7	144.0	7.3	7.2	2760	2540	1.45	1.31
14	Sa	5.3	0.81	0.60	84.7	88.7	1.5	0.51	0.23	66.0	84.7	135.8	--	--	2720	2720	1.61	1.49
15	Su	5.8	1.6	0.69	72.4	88.1	1.7	1.3	0.47	23.5	72.4	106.0	--	--	2360	2740	1.79	1.49
16	M	7.6	2.4	0.89	68.4	88.3	2.0	1.9	0.61	5.0	69.5	133.2	7.3	7.2	2210	2570	1.63	1.59
17	Tu	7.3	1.2	0.45	83.6	93.8	1.4	0.75	0.24	46.4	82.9	132.4	7.2	7.1	2370	2580	1.69	1.57
18	W	6.7	0.79	0.33	88.2	95.1	1.5	0.42	0.19	72.0	87.3	133.9	7.2	7.1	2640	2630	1.58	1.52
19	Th	7.6	0.83	0.72	89.1	90.5	1.3	0.41	0.32	68.5	75.4	136.7	7.2	7.2	2740	2810	1.50	1.32
20	Fr	6.8	0.95	0.87	86.0	87.2	1.5	0.41	0.41	72.7	72.7	143.8	7.2	7.1	2680	2850	1.31	1.15
21	Sa	7.1	0.73	0.40	89.7	94.4	1.8	0.41	0.20	77.2	88.9	117.2	--	--	2790	2940	1.21	1.26
22	Su	6.4	1.5	0.47	76.6	92.7	1.6	1.1	0.29	31.3	81.9	115.0	--	--	2320	2690	1.32	1.31
23	M	8.2	1.5	0.53	81.7	93.5	3.0	1.2	0.37	60.0	87.7	133.8	7.3	7.2	2290	2300	1.39	1.33
24	Tu	6.0	1.4	0.36	76.7	94.0	1.5	0.94	0.22	37.3	85.3	136.3	7.1	7.2	2720	2390	1.34	1.25
25	W	7.0	0.55	0.37	92.1	94.7	1.9	0.29	0.18	84.7	90.5	139.7	7.2	7.1	2750	2560	1.36	1.21
26	Th	8.8	0.56	0.30	93.6	96.6	3.1	0.28	0.19	91.0	93.9	136.0	7.2	7.1	2700	2520	1.18	1.15
27	Fr	7.3	0.89	0.44	87.8	94.0	1.6	0.49	0.22	69.4	86.3	138.7	7.2	7.1	2750	2740	1.17	1.05
28	Sa	7.4	0.68	0.43	90.8	94.2	2.2	0.32	0.18	85.5	91.8	116.4	--	--	2740	2870	1.16	1.12
29	Su	6.1	1.3	0.48	78.7	92.1	1.9	0.89	0.36	53.2	81.1	98.9	--	--	2510	2910	1.34	1.22
30	M	8.7	2.3	0.71	73.6	91.8	2.4	1.9	0.57	20.8	76.3	133.9	7.1	7.0	2530	2560	1.48	1.41
31	Tu	7.0	1.3	0.31	81.4	95.6	1.3	1.1	0.19	15.4	85.4	133.4	7.2	7.0	2560	2670	1.48	1.36

PLANT OPERATIONAL DATA SEPTEMBER 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	W	7.4	0.62	0.21	91.6	97.2	2.2	0.29	0.15	86.8	93.2	133.0	7.2	7.1	2570	2670	1.49	1.39
2	Th	7.4	1.1	0.17	85.1	97.7	1.8	0.49	0.14	72.8	92.2	140.1	7.1	7.0	2670	2700	1.21	1.19
3	Fr	8.8	0.59	0.27	93.3	96.9	1.7	0.39	0.15	77.1	91.2	145.2	7.1	7.1	2770	2370	1.19	1.17
4	Sa	6.6	0.50	0.28	92.4	95.8	2.3	0.33	0.15	85.7	93.5	131.0	--	--	2730	2780	1.25	1.22
5	Su	5.7	1.2	0.39	78.9	93.2	0.86	0.58	0.22	32.6	74.4	108.8	--	--	2450	2640	1.41	1.31
6	M	7.8	2.2	1.8	71.8	76.9	2.6	1.8	1.2	30.8	53.8	101.1	--	--	2070	2520	1.57	1.54
7	Tu	8.1	2.5	0.81	69.1	90.0	2.3	2.0	0.63	13.0	72.6	134.1	7.9	7.8	1970	2250	1.52	1.42
8	W	7.4	1.2	0.34	83.8	95.4	1.9	0.96	0.32	49.5	83.2	132.2	7.0	7.1	2130	2520	1.48	1.38
9	Th	7.8	0.66	0.31	91.5	96.0	1.9	0.31	0.17	83.7	91.1	135.5	--	--	2510	2610	1.44	1.40
10	Fr	7.3	0.56	0.24	92.3	96.7	1.2	0.26	0.15	78.3	87.5	128.3	--	--	2500	2600	1.35	1.47
11	Sa	7.7	0.55	0.23	92.9	97.0	2.2	0.35	0.13	84.1	94.1	107.1	--	--	2750	2790	1.38	1.44
12	Su	6.6	0.63	0.42	90.4	93.6	2.7	0.49	0.30	81.9	88.9	100.2	--	--	2310	2830	1.55	1.54
13	M	8.4	2.6	0.71	69.0	91.5	3.7	2.2	0.50	40.5	86.5	135.1	6.9	6.9	2160	2530	1.62	1.49
14	Tu	7.5	1.4	0.34	81.3	95.5	2.5	1.1	0.21	56.0	91.6	131.2	--	--	2290	2460	1.50	1.47
15	W	7.1	1.1	0.31	84.5	95.6	1.6	0.71	0.17	55.6	89.4	134.5	7.1	7.1	2660	2720	1.45	1.56
16	Th	8.0	0.86	0.34	89.3	95.8	2.4	0.35	0.17	85.4	92.9	134.9	7.1	6.9	2640	2790	1.38	1.35
17	Fr	7.5	0.79	0.31	89.5	95.9	2.5	0.45	0.24	82.0	90.4	124.7	7.2	7.0	2610	2870	1.26	1.21
18	Sa	7.3	0.90	0.34	87.7	95.3	2.5	0.38	0.19	84.8	92.4	117.3	--	--	2640	2900	1.32	1.33
19	Su	4.8	1.7	0.45	64.6	90.6	1.6	0.40	0.31	75.0	80.6	126.2	--	--	2290	2430	1.54	1.65
20	M	8.6	2.7	0.73	68.6	91.5	3.1	1.9	0.60	38.7	80.6	129.4	7.0	6.8	2120	2290	1.62	1.86
21	Tu	7.8	1.4	0.55	82.1	92.9	2.5	0.93	0.29	62.8	88.4	128.8	7.1	6.9	2370	2360	1.62	1.65
22	W	7.3	1.5	0.45	79.5	93.8	2.1	0.95	0.21	54.8	90.0	130.5	6.9	6.9	2510	2490	1.41	1.40
23	Th	7.6	1.3	0.36	82.9	95.3	2.0	0.77	0.17	61.5	91.5	131.0	7.0	7.1	2690	2790	1.29	1.40
24	Fr	10.9	0.79	0.52	92.8	95.2	2.1	0.38	0.14	81.9	93.3	130.1	7.1	7.0	2660	2920	1.34	1.48
25	Sa	8.7	0.75	0.60	91.4	93.1	2.0	0.35	0.12	82.5	94.0	122.2	--	--	2980	3070	1.36	1.47
26	Su	5.8	1.1	0.48	81.0	91.7	2.0	0.56	0.20	72.0	90.0	115.9	--	--	2710	2740	1.62	1.43
27	M	7.9	1.5	0.53	81.0	93.3	2.7	0.73	0.29	73.0	89.3	136.1	7.2	7.1	2430	2560	1.89	1.95
28	Tu	7.2	1.4	0.50	80.6	93.1	2.0	0.80	0.20	60.0	90.0	134.5	7.0	7.0	2480	2560	1.77	1.88
29	W	7.4	1.4	0.47	81.1	93.6	2.3	0.73	0.17	68.3	92.6	132.5	7.0	6.9	2570	2800	1.65	1.70
30	Th	9.9	1.9	0.58	80.8	94.1	2.9	1.2	0.17	58.6	94.1	134.5	6.9	6.9	2640	2750	1.49	1.61
31																		

PLANT OPERATIONAL DATA OCTOBER 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	Fr	9.0	1.5	0.58	83.3	93.6	1.7	0.74	0.18	56.5	89.4	131.8	6.9	6.8	2420	2630	1.44	1.43
2	Sa	8.0	0.92	0.69	88.5	91.4	2.6	0.28	0.21	89.2	91.9	113.8	--	--	2410	2620	1.48	1.63
3	Su	5.1	1.8	0.66	64.7	87.1	1.6	1.1	0.41	31.3	74.4	114.3	--	--	2000	2340	1.66	1.58
4	M	9.7	1.9	0.92	80.4	90.5	3.6	1.3	0.35	63.9	90.3	112.2	7.0	6.9	1930	2150	1.75	1.68
5	Tu	9.3	2.3	0.46	75.3	95.1	3.4	2.0	0.34	41.2	90.0	124.2	7.0	7.0	2420	2320	1.70	1.49
6	W'	7.1	0.91	0.33	87.2	95.4	2.5	0.56	0.20	77.6	92.0	123.0	7.1	7.0	2650	2500	1.29	1.29
7	Th	11.1	1.0	0.24	91.0	97.8	2.3	0.71	0.14	69.1	93.9	119.8	7.1	7.0	2780	2750	1.19	1.13
8	Fr	8.0	0.55	0.29	93.1	96.4	1.6	0.35	0.17	78.1	89.4	117.3	7.1	7.0	2420	2730	1.06	1.02
9	Sa	7.2	0.50	0.46	93.1	93.6	2.3	0.28	0.17	87.8	92.6	103.1	--	--	2430	2740	0.95	1.00
10	Su	6.4	1.3	--	79.7	--	2.2	0.52	--	76.4	--	92.4	--	--	2480	2710	1.11	1.16
11	M	8.4	2.7	0.74	67.9	91.2	3.1	2.4	0.72	22.6	76.8	119.5	7.2	7.1	2170	2420	1.17	1.14
12	Tu	8.0	1.4	0.38	82.5	95.3	2.2	1.2	0.34	45.5	84.5	119.2	7.0	7.0	2500	2690	1.14	1.12
13	W	7.2	0.71	0.32	90.1	95.6	1.9	0.43	0.26	77.4	86.3	123.0	7.0	6.9	2490	2720	1.04	0.88
14	Th	7.4	1.3	0.27	82.4	96.4	2.5	0.72	0.16	71.2	93.6	124.7	6.9	7.0	2720	2780	0.91	0.81
15	Fr	7.6	0.92	0.40	87.9	94.7	1.8	0.41	0.17	77.2	90.6	126.8	--	--	2800	2730	0.81	0.70
16	Sa	7.3	0.49	0.52	93.3	92.9	2.3	0.30	0.16	87.0	93.0	107.0	--	--	2940	2980	0.74	0.57
17	Su	6.8	0.66	0.32	90.3	95.3	1.4	0.41	0.18	70.7	87.1	94.9	--	--	3000	2770	0.88	0.78
18	M	9.2	1.6	0.41	82.6	95.5	2.4	1.4	0.29	41.7	87.9	125.4	7.3	7.3	2750	2690	0.93	0.91
19	T	6.6	2.7	1.3	59.1	80.3	1.0	0.65	0.38	35.0	62.0	139.5	7.3	7.2	2880	2830	0.94	0.96
20	W	7.0	0.55	0.48	92.1	93.1	1.5	0.24	0.14	84.0	90.7	139.1	7.2	7.1	2870	2930	1.05	0.90
21	Th	6.7	1.3	0.83	80.6	87.6	1.3	0.15	0.17	88.5	86.9	140.5	7.0	7.1	2920	2990	1.03	0.80
22	Fr	7.6	1.3	0.74	82.9	90.3	1.8	0.24	0.17	86.7	90.6	133.5	--	--	2800	3090	--	--
23	Sa	7.7	0.79	0.84	89.7	89.1	1.4	0.18	0.15	87.1	89.3	131.2	--	--	2780	2860	0.96	0.92
24	Su	5.3	0.74	0.68	86.0	87.2	1.4	0.26	0.18	81.4	87.1	128.2	--	--	--	2750	1.02	1.05
25	M	7.7	1.7	1.3	77.9	83.1	2.3	1.2	0.29	47.8	87.4	128.3	7.2	7.1	2550	2790	1.10	1.01
26	T	7.8	1.4	0.41	82.1	94.7	1.9	0.82	0.19	56.8	90.0	129.9	7.1	7.1	2570	2840	1.11	1.05
27	W	7.3	1.1	0.34	84.9	95.3	1.5	0.50	0.14	66.7	90.7	132.4	7.1	7.0	2660	2800	0.98	0.92
28	Th	7.8	3.5	0.33	55.1	95.8	1.2	0.28	0.14	76.7	88.3	132.3	7.0	7.0	3010	2960	0.82	0.77
29	Fr	8.0	4.2	0.72	47.5	91.0	1.6	0.46	0.14	71.3	91.3	137.4	7.1	7.2	2890	3130	0.78	0.80
30	Sa	7.5	0.89	0.52	88.1	93.1	1.7	0.29	0.18	82.9	89.4	120.0	--	--	2860	3380	0.81	0.77
31	Su	6.9	0.81	0.78	88.3	88.7	1.6	0.35	0.15	78.1	90.6	95.4	--	--	3040	3070	0.97	0.94

PLANT OPERATIONAL DATA NOVEMBER 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	M	6.8	1.2	0.42	82.4	93.8	1.0	0.81	0.21	19.0	79.0	138.8	7.2	7.0	2540	2780	1.04	0.98
2	Tu	6.3	0.64	0.29	89.8	95.4	1.1	0.30	0.13	72.7	88.2	133.9	7.2	7.1	2640	2790	1.16	1.15
3	W	8.0	0.61	0.26	92.4	96.8	1.4	0.21	0.11	85.0	92.1	131.4	7.2	7.1	2910	2930	1.16	1.14
4	Th	7.6	0.60	0.24	92.1	96.8	1.4	0.20	0.11	85.7	92.1	130.0	7.2	7.2	3050	3090	1.14	1.13
5	Fr	8.3	0.59	0.26	92.9	96.9	1.5	0.20	0.13	86.7	91.3	120.8	7.2	7.1	3120	3090	1.08	1.09
6	Sa	7.6	0.97	0.24	87.2	96.8	1.6	0.17	0.12	89.4	92.5	107.0	--	--	3220	3190	1.06	0.97
7	Su	6.7	0.85	0.33	87.3	95.1	1.3	0.23	0.20	82.3	84.6	99.8	--	--	3220	3010	1.05	1.05
8	M	8.2	0.99	0.37	87.9	95.5	2.0	0.54	0.25	73.0	87.5	127.6	7.2	7.1	2850	2940	1.13	1.11
9	Tu	7.5	0.95	0.31	87.3	95.9	1.6	0.34	0.14	78.8	91.3	127.8	7.1	7.1	2960	3030	1.13	1.04
10	W	6.6	0.20	0.42	97.0	93.6	1.7	0.12	0.25	92.9	85.3	127.2	7.0	7.0	3310	3200	1.04	0.87
11	Th	8.2	0.68	0.22	91.7	97.3	1.9	0.26	0.12	36.3	93.7	123.9	--	--	3560	3280	0.96	1.00
12	Fr	8.6	0.69	0.29	92.0	96.6	2.1	0.30	0.18	85.7	91.4	123.7	7.2	7.1	3710	3240	0.70	1.03
13	Sa	7.5	0.59	0.19	92.1	97.5	1.9	0.19	0.11	90.0	94.2	100.9	--	--	3730	3560	0.72	0.91
14	Su	6.9	0.40	0.23	94.2	96.7	2.8	0.15	0.11	94.6	96.1	90.0	--	--	3670	3790	1.03	1.07
15	M	9.8	3.7	0.29	62.2	97.0	3.7	0.45	0.17	87.8	95.4	123.7	7.3	7.2	3780	3630	1.02	1.05
16	Tu	8.4	2.0	0.33	76.2	96.1	1.4	0.51	0.14	63.6	90.0	125.4	7.1	7.1	4110	3770	0.93	1.14
17	W	8.0	0.58	0.45	92.8	94.4	1.5	0.35	0.12	76.7	92.0	129.5	7.1	7.1	4020	3620	1.02	1.19
18	Th	7.9	0.79	0.70	90.0	91.1	1.0	0.26	0.12	74.0	38.0	131.7	7.3	7.1	3950	3780	0.96	0.96
19	Fr	8.6	0.50	0.70	94.2	91.9	2.3	0.17	0.13	92.6	94.3	131.5	7.2	7.1	4060	3690	0.80	1.02
20	Sa	8.6	0.45	0.26	94.8	97.0	2.0	0.15	0.12	92.5	94.0	102.6	--	--	4140	3900	0.94	1.13
21	Su	7.8	0.85	0.58	89.1	92.6	1.2	0.12	0.13	90.0	89.2	97.9	--	--	4010	3690	1.14	1.28
22	M	9.6	0.80	0.59	91.7	93.9	2.5	0.33	0.16	86.8	93.6	123.8	7.2	7.1	3910	3460	1.25	1.29
23	Tu	8.3	0.92	0.40	88.9	95.2	1.9	0.26	0.13	86.3	93.2	126.2	7.1	7.0	3940	3710	1.17	1.33
24	W	9.4	0.69	0.38	92.7	96.0	2.1	0.16	0.08	92.4	96.2	121.5	7.0	6.9	3800	3700	1.24	1.28
25	Th	6.2	0.68	0.45	89.0	92.7	0.90	0.20	0.13	77.8	85.6	90.9	--	--	3630	3780	1.26	1.28
26	Fr	6.1	0.98	0.45	83.9	92.6	1.3	0.19	0.14	85.4	89.2	130.0	7.1	6.9	3270	3430	1.38	1.37
27	Sa	7.0	0.76	0.49	89.1	93.0	1.6	0.28	0.18	82.5	88.8	108.8	--	--	3230	2990	1.50	1.46
28	Su	6.3	1.5	0.51	76.2	91.9	1.9	1.0	0.20	47.4	89.5	114.7	--	--	2790	2640	1.59	1.66
29	M	5.7	2.3	0.52	59.6	90.9	2.1	1.5	0.24	28.6	88.6	134.6	7.2	7.0	2110	2490	1.66	1.68
30	Tu	7.2	1.4	0.59	80.6	91.8	2.0	0.87	0.17	56.5	91.5	134.3	7.0	6.9	2120	2610	1.80	1.95
31																		

PLANT OPERATIONAL DATA DECEMBER 1971

Date	Day	TOTAL PHOSPHORUS					TOTAL SOLUBLE PHOSPHORUS					MIXED LIQUOR						
		mg/l as P			% Removal		mg/l as P			% Removal		East Plant	pH		Suspended Solids mg/l		SDI	
		SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	MGD	WP	EP	WP	EP	WP	EP
1	W	7.6	0.81	0.68	89.3	91.1	1.4	0.27	0.23	80.7	83.6	129.1	7.1	7.0	2180	2610	1.46	1.62
2	Th	8.0	0.87	0.40	89.1	95.0	2.1	0.35	0.14	83.3	93.3	126.0	7.1	6.9	2450	2640	1.50	1.49
3	Fr	7.3	0.68	0.40	90.7	94.5	2.3	0.17	0.15	92.6	93.5	120.1	7.1	7.0	2500	2630	1.29	1.45
4	Sa	6.9	0.50	0.41	92.8	94.1	2.5	0.25	0.14	90.0	94.4	109.8	--	--	2660	2680	1.18	1.25
5	Su	6.1	0.86	0.39	85.9	93.6	2.8	0.53	0.17	81.1	93.9	99.2	--	--	2500	2560	1.32	1.32
6	M	8.9	1.8	0.41	79.8	95.4	3.2	1.4	0.27	56.3	91.6	123.7	7.2	7.0	2340	2470	1.39	1.39
7	Tu	7.6	1.3	0.37	82.9	95.1	2.4	0.87	0.22	63.8	90.8	127.0	7.1	7.0	2460	2680	1.37	1.34
8	W	7.2	0.76	0.31	89.4	95.7	2.9	0.40	0.16	86.2	94.5	137.4	7.0	7.0	2750	2700	1.26	1.28
9	Th	6.9	1.2	--	82.6	--	2.0	0.52	--	74.0	--	145.6	7.0	7.0	2860	2710	1.26	1.28
10	Fr	4.2	0.89	--	78.8	--	1.5	0.17	--	38.7	--	152.5	7.0	6.9	2880	2770	1.17	1.22
11	Sa	4.3	0.49	0.25	88.6	94.2	2.0	0.18	0.13	91.0	93.5	135.1	--	--	2810	2790	1.22	1.23
12	Su	4.9	1.2	0.30	75.5	93.9	2.0	0.53	0.14	73.5	93.0	127.1	--	--	2490	2750	1.31	1.35
13	M	7.7	1.7	0.48	77.9	93.8	3.1	1.3	0.28	58.1	91.0	136.7	7.1	7.0	2650	2550	1.49	1.24
14	Tu	7.9	1.2	0.45	84.8	94.3	3.4	1.0	0.32	70.6	90.6	151.5	--	--	2650	2800	1.31	1.31
15	W	4.3	0.72	0.47	83.3	89.1	1.3	0.45	0.21	65.4	83.8	143.2	6.9	7.0	2700	2630	1.35	1.31
16	Th	5.0	0.46	0.30	90.8	94.0	1.4	0.26	0.15	81.4	89.3	142.3	7.2	7.2	2380	2560	1.33	1.23
17	Fr	6.2	0.95	0.33	84.7	94.7	2.2	0.40	0.09	81.8	95.9	142.2	7.1	7.1	2360	2580	1.27	1.20
18	Sa	6.0	0.87	0.31	85.5	94.8	2.6	0.44	0.14	83.1	94.6	125.8	--	--	2560	2340	1.18	1.13
19	Su	5.0	1.2	0.36	76.0	92.8	2.7	0.77	0.23	71.5	91.5	125.6	--	--	2380	2200	1.24	1.18
20	M	7.8	2.4	0.70	69.2	91.0	3.5	2.1	0.53	40.0	84.9	137.5	7.3	7.2	2280	2130	1.28	1.27
21	Tu	6.8	1.8	0.50	73.5	92.6	3.2	1.5	0.35	53.1	89.1	136.3	7.0	7.0	2200	2440	1.28	1.16
22	W	6.4	1.5	0.35	76.6	94.5	2.8	1.2	0.22	57.1	92.1	131.5	7.1	7.0	2260	2600	1.16	1.15
23	Th	6.8	1.5	0.39	77.9	94.3	3.0	0.86	0.17	71.3	94.3	130.4	--	--	2420	2660	1.08	1.12
24	Fr	7.0	1.5	0.45	78.6	93.6	3.1	0.84	0.17	72.9	94.5	112.6	--	--	2200	2570	1.10	1.01
25	Sa	4.2	1.9	0.41	54.8	90.2	1.4	1.5	0.27	--	80.7	98.4	--	--	1970	2300	1.14	1.13
26	Su	6.1	2.1	0.71	65.6	88.4	3.0	1.5	0.39	50.0	87.0	98.1	7.1	7.0	1740	1940	1.19	1.19
27	M	7.7	2.1	0.96	72.7	87.5	4.0	2.0	0.59	50.0	85.3	125.1	--	--	2330	2050	1.16	1.13
28	Tu	8.7	2.9	1.1	66.7	87.4	4.4	2.5	0.77	43.2	82.5	135.9	7.3	7.2	3040	2670	1.18	1.14
29	W	8.9	2.9	1.4	67.4	84.3	4.6	2.5	0.68	45.7	85.2	145.1	7.2	7.1	3170	3070	1.19	1.09
30	Th	6.0	2.1	3.1	65.0	48.3	2.4	1.5	0.57	37.5	76.3	142.7	7.1	7.1	3080	3030	1.08	1.11
31	Fr	6.4	1.7	0.94	73.4	85.3	3.0	1.1	0.38	63.3	87.3	126.8	--	--	2970	3180	1.11	1.10

PLANT OPERATIONAL DATA

JANUARY 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	Fr	6084	7.0	189.0	6.58	26.10	3.1	1.47	229.5	238.8	278.7	223.1	0.06
2	Sa	5512	6.6	190.7	6.75	25.61	3.1	1.41	--	240.6	264.6	221.3	
3	Su	5522	5.6	185.7	6.68	26.25	3.1	1.38	54.9	220.9	265.3	214.1	0.73
4	M	7476	6.8	179.8	6.52	26.78	3.1	1.55	202.2	220.6	--	233.7	0.23
5	Tu	6967	6.7	189.4	6.26	26.72	3.1	1.76	218.3	234.4	--	220.0	
6	W	6264	6.0	185.4	6.24	26.38	3.1	1.80	177.3	--	--	240.4	
7	Th	7680	7.2	206.7	6.35	25.99	3.1	1.68	183.2	--	--	239.4	
8	Fr	6852	6.6	223.9	6.54	25.43	3.1	1.51	195.3	239.4	256.1	223.5	
9	Sa	5982	6.3	210.0	6.69	25.01	3.1	1.43	212.6	211.5	257.6	241.6	TR
10	Su	5178	6.1	204.6	6.75	24.93	3.1	1.42	217.4	285.3	251.0	220.7	
11	M	6676	6.4	153.9	6.58	25.80	3.1	1.45	222.4	204.7	270.5	251.7	
12	Tu	9442	9.2	203.1	6.57	26.02	3.1	1.59	232.1	206.6	218.4	217.2	0.03
13	W	10148	9.6	188.5	6.51	25.68	3.1	1.56	231.3	219.1	222.6	238.5	0.01
14	Th	10028	9.4	219.7	6.58	25.14	3.1	1.54	208.6	216.1	207.5	227.3	TR
15	Fr	12830	11.4	231.6	6.78	24.53	3.1	1.47	221.2	220.0	227.1	236.9	
16	Sa	11059	11.9	211.3	6.81	24.44	3.1	1.34	247.7	199.7	215.1	185.1	0.11
17	Su	9556	11.8	180.9	6.78	25.03	3.1	1.32	214.7	199.3	210.8	217.8	0.03
18	M	9385	9.5	175.9	6.63	25.89	3.1	1.40	216.8	206.7	225.5	240.9	
19	Tu	8974	8.7	176.9	6.52	26.61	3.1	1.52	216.8	209.9	228.4	236.7	TR
20	W	14152	13.5	176.7	6.46	26.01	3.1	1.55	207.9	197.6	204.2	245.9	
21	Th	12695	12.1	203.2	6.47	25.82	3.1	1.58	227.2	223.8	213.0	225.0	TR
22	Fr	8525	7.7	188.6	6.61	25.64	3.1	1.48	226.7	218.2	202.1	263.5	
23	Sa	7459	8.0	209.4	6.62	24.84	3.0	1.39	193.8	215.1	208.4	252.3	
24	Su	7459	9.8	230.3	6.73	24.73	3.0	1.37	209.1	183.0	207.2	236.8	
25	M	13392	13.0	178.2	6.60	25.74	3.1	1.32	213.5	186.5	225.5	254.7	TR
26	Tu	9562	9.8	183.7	6.42	26.09	3.1	1.49	218.4	205.2	230.9	228.7	0.06
27	W	8649	8.9	211.1	6.39	26.54	3.1	1.55	224.4	242.1	223.6	215.9	0.01
28	Th	6728	7.1	199.5	6.35	26.26	3.1	1.44	189.4	233.4	213.9	223.1	TR
29	Fr	8087	7.5	210.8	6.42	26.05	3.1	1.42	193.1	229.4	213.1	208.4	0.10
30	Sa	6843	6.7	211.4	6.46	25.74	3.1	1.40	188.7	214.9	219.2	188.4	
31	Su	5214	5.7	230.7	6.62	26.06	3.1	1.34	203.3	217.3	216.4	184.9	TR

PLANT OPERATIONAL DATA FEBRUARY 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	M	11287	11.6	240.9	6.65	26.39	3.1	1.36	201.9	220.4	210.4	188.8	
2	Tu	7834	8.0	236.0	6.48	26.29	3.1	1.45	199.3	217.0	217.0	197.9	0.03
3	W	8035	7.8	211.5	6.33	25.99	3.1	1.48	240.7	224.9	203.7	227.0	0.01
4	Th	13312	11.0	203.8	6.38	25.67	3.1	1.47	272.5	202.1	248.2	226.3	0.17
5	Fr	12261	11.9	234.5	6.32	26.14	3.1	1.51	206.5	203.6	231.6	207.1	0.08
6	Sa	10350	11.7	230.0	6.12	26.92	3.1	1.55	236.3	203.4	229.3	213.5	
7	Su	8052	10.3	164.4	6.35	27.77	3.1	1.57	222.3	179.7	223.3	306.4	
8	M	11560	11.8	187.0	6.30	28.43	3.1	1.56	238.1	201.9	237.9	199.3	
9	Tu	12464	12.8	216.1	6.23	28.76	3.1	1.50	234.1	211.0	233.4	200.0	TR
10	W	11573	11.8	189.9	6.20	28.28	3.1	1.49	226.2	228.1	222.9	226.8	TR
11	Th	12432	11.8	195.5	6.16	27.53	3.1	1.42	213.9	224.5	206.1	210.1	0.01
12	Fr	12168	12.2	224.5	6.33	27.71	3.1	1.42	209.9	198.3	210.7	206.2	0.01
13	Sa	8927	10.7	236.0	6.50	27.38	3.1	1.38	200.7	192.3	218.5	200.9	TR
14	Su	7742	10.3	203.5	6.44	26.87	3.1	1.32	202.5	184.6	200.3	225.5	
15	M	13260	13.6	211.5	6.53	27.69	3.2	1.34	207.7	183.7	233.4	189.8	TR
16	Tu	15150	14.9	197.1	6.41	27.87	3.2	1.39	209.2	189.3	254.8	200.4	0.04
17	W	15038	13.5	208.2	6.37	27.57	3.2	1.43	206.3	209.1	231.6	195.8	TR
18	Th	9882	8.3	203.5	6.24	27.32	3.2	1.51	203.4	209.5	249.0	181.6	0.74
19	Fr	9030	7.4	221.5	6.06	28.14	3.2	1.51	193.7	206.0	241.7	167.5	0.64
20	Sa	9690	8.5	230.0	5.84	29.36	3.2	1.55	202.7	207.4	238.8	151.6	0.06
21	Su	6916	7.5	226.4	5.72	30.40	3.2	1.60	218.5	206.8	246.4	152.0	TR
22	M	9870	8.5	181.7	5.68	31.58	3.6	1.65	229.0	223.7	272.2	152.2	0.65
23	Tu	9720	8.5	211.2	5.67	31.42	3.6	1.80	196.0	212.9	246.6	141.9	TR
24	W	10412	9.4	200.9	5.72	30.50	3.7	1.76	193.4	214.4	231.6	145.4	
25	Th	10920	9.4	173.8	5.81	29.17	3.7	1.71	190.9	215.9	224.7	138.2	
26	Fr	7980	6.8	183.0	6.04	29.41	3.6	1.56	246.4	219.7	214.9	135.4	0.06
27	Sa	5548	5.4	178.9	6.00	29.98	3.6	1.59	184.9	184.9	222.7	132.6	TR
28	Su	4899	5.5	206.3	6.12	30.10	3.7	1.50	194.1	202.3	237.8	132.6	
29													
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PLANT OPERATIONAL DATA MARCH 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	M	9690	8.5	190.1	6.16	30.74	3.6	1.47	224.0	210.6	251.8	149.4	
2	Tu	8256	7.6	187.6	6.13	30.69	3.8	1.49	228.0	207.5	232.2	150.2	
3	W	6764	6.1	197.8	6.16	29.78	3.8	1.55	209.3	202.6	219.7	150.3	TR
4	Th	6622	6.2	203.4	6.22	28.58	3.6	1.44	217.0	192.9	224.1	160.6	
5	Fr	7462	6.5	207.1	6.36	27.08	3.5	1.33	219.4	182.9	234.4	164.3	0.02
6	Sa	7224	6.6	208.5	6.47	27.00	3.4	1.25	236.1	194.8	244.8	173.2	0.21
7	Su	5848	6.6	187.4	6.59	27.57	3.4	1.21	236.6	182.9	241.2	168.2	0.03
8	M	12136	11.4	183.8	6.65	29.31	3.6	1.24	213.9	201.1	260.9	158.4	
9	Tu	9243	8.5	163.2	6.49	28.98	3.6	1.31	216.6	203.8	265.7	174.3	0.09
10	W	8100	7.3	206.2	6.41	27.64	3.4	1.35	221.0	248.2	249.4	164.1	0.10
11	Th	9095	8.3	190.9	6.45	26.70	3.3	1.28	192.6	229.8	230.3	170.4	
12	Fr	10234	8.9	188.4	6.41	26.43	3.3	1.23	198.0	205.0	233.7	163.6	0.05
13	Sa	8170	7.5	184.6	6.52	26.41	3.2	1.23	194.9	204.9	228.9	183.8	
14	Su	8148	7.0	173.8	6.64	26.93	3.2	1.22	225.7	216.3	264.6	192.9	0.54
15	M	8856	7.5	187.2	6.46	28.86	3.4	1.33	215.2	205.2	269.1	169.1	0.01
16	Tu	8395	7.0	199.5	6.16	30.55	3.5	1.36	234.7	219.8	247.2	162.0	TR
17	W	8769	7.4	202.6	6.13	29.93	3.5	1.39	212.5	224.4	240.2	161.3	
18	Th	6723	5.6	198.8	6.12	29.01	3.5	1.35	193.8	241.5	245.8	157.1	1.15
19	Fr	8840	7.5	183.8	6.15	27.93	3.3	1.31	206.8	219.3	236.4	188.8	0.53
20	Sa	8944	8.1	199.2	6.42	27.98	3.2	1.25	219.5	212.7	234.5	182.6	
21	Su	9044	8.2	183.6	6.50	28.16	3.2	1.28	221.4	208.4	237.1	191.8	TR
22	M	11899	10.0	180.8	6.44	29.36	3.5	1.29	210.9	211.0	250.1	163.8	0.02
23	Tu	8432	7.3	197.3	6.29	29.28	3.5	1.34	182.5	224.4	265.9	162.7	TR
24	W	8260	7.2	202.2	6.26	28.24	3.4	1.31	171.4	239.2	257.4	167.0	
25	Th	8284	7.1	196.6	6.33	26.99	3.4	1.27	176.8	219.8	220.8	159.8	
26	Fr	7171	5.8	199.6	6.49	27.22	3.5	1.15	195.0	203.4	216.6	158.8	
27	Sa	6141	5.5	181.5	6.60	27.06	3.5	1.21	177.7	220.2	207.4	165.5	0.08
28	Su	5796	5.0	193.1	6.69	27.20	3.5	1.17	182.3	218.4	215.9	155.8	
29	M	8662	7.0	208.3	6.71	28.15	3.5	1.22	168.3	187.7	220.8	152.8	
30	Tu	6106	4.3	215.5	6.50	27.47	3.7	1.26	194.8	186.7	237.5	165.6	TR
31	W	5168	4.0	208.1	6.49	27.34	3.7	1.36	203.7	155.9	210.3	165.6	

PLANT OPERATIONAL DATA APRIL 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	Th	5451	4.4	213.3	6.65	27.43	3.7	1.29	188.5	181.7	179.4	155.9	TR
2	Fr	8748	7.2	200.5	6.63	27.13	3.6	1.27	201.4	192.0	174.8	163.0	0.05
3	Sa	6992	6.5	196.2	6.76	27.22	3.7	1.26	218.7	175.3	159.5	166.0	TR
4	Su	6068	6.3	209.8	6.86	27.11	3.7	1.22	222.5	173.5	183.2	166.9	
5	M	9864	8.6	212.3	6.84	28.32	3.6	1.26	210.8	189.6	197.4	171.9	
6	Tu	10212	8.7	212.0	6.70	27.19	3.6	1.43	204.2	191.9	212.9	181.3	
7	W	5688	5.0	205.0	6.60	26.80	3.6	1.44	215.8	200.9	207.5	186.9	
8	Th	5776	4.8	192.3	6.48	26.49	3.5	1.42	226.8	202.2	181.8	196.0	
9	Fr	5776	5.4	225.6	6.70	25.80	3.3	1.37	221.1	189.0	179.6	195.6	TR
10	Sa	6232	6.2	226.2	6.71	26.15	3.3	1.33	204.6	174.8	181.0	209.8	
11	Su	5016	5.0	230.0	6.73	26.39	3.3	1.36	197.4	173.2	203.1	200.8	0.01
12	M	8736	7.1	218.2	6.66	28.12	3.3	1.51	199.9	172.7	197.5	205.9	0.72
13	Tu	6942	5.6	256.8	6.08	30.57	3.4	1.80	214.5	190.8	194.8	171.1	
14	W	6278	5.1	246.8	5.74	31.50	3.4	1.83	217.5	194.2	178.2	171.4	
15	Th	5865	5.0	212.7	5.89	30.73	3.4	1.75	215.1	193.3	189.1	188.8	
16	Fr	5624	4.7	229.2	6.01	29.73	3.4	1.55	223.9	206.6	198.9	178.2	0.06
17	Sa	5106	4.9	217.7	6.30	29.61	3.4	1.42	212.5	186.3	202.4	175.9	0.03
18	Su	4464	4.3	215.4	6.53	29.51	3.4	1.33	197.1	195.2	201.3	178.8	
19	M	10138	8.7	200.3	6.53	29.81	3.4	1.37	200.2	194.3	183.9	195.4	TR
20	Tu	6794	5.9	222.5	6.33	29.10	3.5	1.49	205.2	214.8	187.7	178.2	
21	W	9196	7.9	214.5	6.31	28.44	3.4	1.44	179.7	229.5	195.7	189.0	
22	Th	7081	6.1	210.6	6.48	27.56	3.3	1.51	198.3	235.0	182.9	188.2	
23	Fr	6204	5.4	197.8	6.51	26.87	3.2	1.30	210.6	208.9	199.2	197.4	TR
24	Sa	7935	8.2	203.9	6.53	26.69	3.2	1.20	192.6	199.6	195.0	188.7	
25	Su	7245	7.6	201.4	6.72	26.42	3.2	1.16	206.3	213.5	200.4	199.4	
26	M	9000	8.0	201.7	6.77	27.02	3.2	1.22	227.9	233.4	205.3	199.0	
27	Tu	8103	6.7	212.0	6.60	27.04	3.2	1.31	226.6	244.2	212.3	192.7	0.42
28	W	9975	8.7	204.0	6.50	26.81	3.2	1.44	231.2	208.3	202.7	198.2	0.02
29	Th	6408	5.3	201.3	6.56	26.45	3.2	1.32	196.2	206.1	219.9	209.1	
30	Fr	7358	6.0	206.0	6.61	26.69	3.2	1.25	217.9	210.2	226.7	192.1	TR
31													

PLANT OPERATIONAL DATA MAY 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	Sa	6129	5.9	199.4	6.73	26.61	3.1	1.28	220.2	209.6	243.7	212.0	0.01
2	Su	6238	6.5	196.0	6.89	26.98	3.1	1.32	202.2	223.3	225.3	226.8	0.12
3	M	9959	9.1	205.0	6.74	27.41	3.1	1.32	182.4	226.6	241.3	202.2	
4	Tu	8427	7.8	206.6	6.60	27.47	3.1	1.46	185.3	224.3	255.1	199.7	TR
5	W	9828	8.5	196.3	6.49	26.85	3.1	1.44	187.8	250.0	243.7	200.0	TR
6	Th	10835	9.4	207.8	6.57	26.82	3.1	1.35	203.9	246.7	229.0	202.3	
7	Fr	9792	8.8	206.0	6.60	26.28	3.1	1.35	216.6	227.3	222.5	199.3	
8	Sa	9006	9.3	228.5	6.75	26.58	3.1	1.26	194.4	209.1	220.8	186.7	
9	Su	8179	9.1	215.4	6.81	26.75	3.1	1.24	203.5	193.7	213.0	199.0	
10	M	13536	12.7	215.3	6.71	27.78	3.1	1.38	194.4	193.6	213.8	224.8	
11	Tu	10381	9.1	201.8	6.52	27.62	3.2	1.51	197.0	215.8	228.2	196.1	0.18
12	W	6912	6.4	210.3	6.47	27.76	3.2	1.58	200.7	209.9	196.5	196.2	
13	Th	8755	7.9	231.3	6.45	27.78	3.0	1.61	215.7	219.3	205.9	220.5	
14	Fr	9914	9.2	229.2	6.42	27.41	3.0	1.57	202.1	234.5	192.9	219.5	
15	Sa	7989	8.2	214.7	6.61	27.35	3.0	1.53	200.3	222.5	178.6	224.0	0.02
16	Su	7114	8.4	209.7	6.82	26.92	3.0	1.47	225.1	192.2	173.2	216.6	TR
17	M	10564	10.0	210.6	6.71	27.47	3.0	1.50	201.8	199.5	181.0	208.0	TR
18	Tu	12388	11.3	217.8	6.58	27.67	3.0	1.59	232.4	192.3	179.6	220.0	0.05
19	W	11388	10.3	236.2	6.55	27.75	3.0	1.58	199.5	196.3	195.3	190.3	TR
20	Th	9648	8.7	206.1	6.61	27.41	2.9	1.50	151.5	213.0	197.4	216.0	
21	Fr	9906	8.9	209.8	6.69	27.26	2.9	1.46	192.3	202.3	198.7	228.1	
22	Sa	8960	9.2	227.6	6.69	27.10	3.1	1.43	204.5	196.0	213.8	184.1	
23	Su	6290	7.4	211.9	6.75	27.96	3.0	1.52	210.6	187.1	203.1	198.7	
24	M	9047	7.5	211.5	6.50	28.11	3.1	1.59	215.2	202.6	209.0	219.7	0.40
25	Tu	9462	8.2	195.1	6.22	29.31	3.2	1.77	229.0	190.7	239.6	227.6	0.06
26	W	8424	7.7	236.3	6.13	29.34	3.2	1.89	196.9	214.1	223.2	184.1	TR
27	Th	8906	8.0	232.7	6.30	29.23	3.2	1.76	204.6	205.5	219.6	217.4	
28	Fr	8978	8.0	252.9	6.40	28.52	3.3	1.59	207.8	226.3	222.1	199.1	
29	Sa	8107	8.7	254.1	6.46	28.32	3.3	1.63	213.5	227.4	226.1	186.2	
30	Su	4602	5.2	238.6	6.58	28.82	3.3	1.55	211.9	210.2	243.5	205.0	
31	M	5561	6.1	123.1	6.57	29.41	3.3	1.53	203.2	193.1	245.9	211.7	0.06

PLANT OPERATIONAL DATA JUNE 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	Tu	5412	4.6	--	--	--	--	--	195.5	217.3	250.6	--	0.47
2	W	4836	4.3	57.6	6.29	29.01	3.3	1.75	203.4	--	241.4	--	0.07
3	Th	6175	5.4	246.5	6.33	29.00	3.2	1.72	221.0	--	197.8	204.3	
4	Fr	8704	7.4	240.5	6.22	28.10	3.2	1.69	225.0	214.9	212.8	208.3	
5	Sa	7200	6.9	241.5	6.45	27.70	3.1	1.57	218.6	211.6	236.8	206.1	
6	Su	7280	7.4	233.5	6.54	27.87	3.1	1.54	246.0	207.4	220.6	222.2	0.05
7	M	5180	4.5	163.1	6.38	29.11	3.1	1.57	241.7	212.4	205.1	297.9	0.02
8	Tu	6840	6.2	240.6	6.19	29.90	3.1	1.65	233.2	198.9	205.1	209.3	
9	W	3427	3.1	266.0	6.21	29.38	3.1	1.71	234.5	205.9	199.2	197.3	
10	Th	3840	3.4	255.0	6.31	28.74	3.1	1.61	208.0	239.6	216.9	208.8	
11	Fr	4512	3.9	246.5	6.30	28.47	3.1	1.59	234.4	256.7	228.3	212.5	0.05
12	Sa	3542	3.2	242.5	6.37	28.12	3.1	1.62	240.3	249.4	220.9	207.0	0.11
13	Su	1109	1.2	267.0	6.43	28.82	3.1	1.62	245.6	248.3	225.4	183.7	0.09
14	M	7439	6.6	269.9	6.33	30.30	3.1	1.66	224.5	252.6	212.8	161.5	
15	Tu	7392	6.6	182.2	6.17	29.59	3.2	1.71	218.7	260.0	231.3	217.7	
16	W	10800	9.2	259.5	6.21	28.95	3.1	1.72	204.9	275.6	240.8	178.1	
17	Th	7986	6.5	245.9	6.29	28.63	3.1	1.61	220.6	282.7	218.5	202.7	0.49
18	Fr	10640	8.4	218.9	6.25	28.45	3.1	1.50	228.3	253.2	218.7	239.6	0.53
19	Sa	6889	5.5	317.5	6.34	29.52	3.2	1.56	226.7	246.9	200.9	144.1	0.55
20	Su	4897	4.5	273.3	6.27	31.07	3.2	1.61	206.6	263.8	222.8	157.2	
21	M	5312	4.3	217.2	5.97	33.51	3.4	1.80	218.0	261.3	231.3	129.0	0.09
22	Tu	5934	4.6	248.0	5.80	32.82	3.5	1.90	196.6	275.4	237.1	170.8	
23	W	7040	5.5	240.6	5.80	31.27	3.5	1.87	188.0	249.1	222.1	162.0	0.15
24	Th	7140	5.5	245.6	5.99	30.46	3.5	1.85	212.2	250.7	242.6	171.6	TR
25	Fr	8181	6.5	252.8	6.17	30.13	3.5	1.71	229.1	248.6	245.8	163.5	
26	Sa	5928	5.7	236.3	6.32	29.49	3.5	1.62	228.2	236.0	239.0	169.0	
27	Su	4830	4.8	239.2	6.17	29.52	3.4	1.62	206.2	204.1	239.8	174.0	
28	M	7696	6.4	220.5	6.30	30.51	3.3	1.69	207.5	213.3	235.5	185.4	
29	Tu	7742	6.4	229.7	6.19	29.99	3.3	1.71	221.5	229.7	241.1	184.7	
30	W	7392	6.1	219.9	6.33	29.17	3.3	1.54	218.6	262.1	262.4	184.1	TR
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PLANT OPERATIONAL DATA JULY 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	Th	7735	6.5	214.0	6.49	28.54	3.3	1.45	217.3	229.6	244.2	194.2	
2	Fr	7644	6.4	209.3	6.62	28.78	3.3	1.28	254.7	254.7	231.8	194.1	
3	Sa	6942	6.8	254.1	6.68	28.01	3.3	1.24	229.0	200.8	253.7	143.7	
4	Su	6205	7.0	259.5	6.69	28.25	3.3	1.29	229.3	224.6	255.2	139.2	0.03
5	M	7209	8.0	222.8	6.65	29.22	3.3	1.35	219.6	277.8	293.1	146.6	0.01
6	Tu	9010	7.7	140.4	6.45	29.56	3.3	1.47	221.0	216.3	--	223.6	
7	W	9047	7.2	158.8	6.25	29.18	3.2	1.63	235.9	276.9	--	239.7	
8	Th	8424	6.7	165.3	6.31	29.07	3.2	1.50	237.8	267.2	--	237.9	1.80
9	Fr	9040	7.0	171.8	6.22	30.20	3.1	1.63	253.4	275.2	360.2	246.8	
10	Sa	5767	5.3	190.2	6.15	30.81	3.1	1.60	263.9	249.0	246.9	244.7	
11	Su	5624	5.4	215.1	6.04	31.27	3.1	1.52	245.3	241.3	335.4	213.2	
12	M	8832	7.3	203.8	6.12	30.95	3.1	1.51	240.7	263.9	282.7	220.0	TR
13	Tu	5896	5.0	202.9	6.12	31.14	3.1	1.58	221.2	236.5	256.8	220.5	
14	W	5984	5.0	187.6	6.22	30.35	3.1	1.50	250.1	262.0	242.2	244.8	
15	Th	6552	5.5	204.0	6.34	29.31	3.1	1.46	240.9	285.4	297.6	220.6	TR
16	Fr	7584	6.4	211.9	6.56	28.72	3.1	1.46	268.3	227.5	284.4	215.9	0.10
17	Sa	6966	6.6	205.3	6.56	28.50	3.0	1.36	260.7	189.5	228.7	225.2	
18	Su	5548	5.5	208.2	6.66	28.50	3.0	1.49	241.7	184.9	227.3	216.8	0.01
19	M	7268	6.4	185.6	6.50	29.78	3.0	1.52	253.3	199.2	230.6	242.4	0.38
20	Tu	6794	5.9	231.2	6.17	29.80	3.0	1.66	212.4	195.6	210.7	205.7	
21	W	6800	5.8	218.5	6.26	29.11	3.0	1.66	222.3	195.7	209.7	224.1	
22	Th	7956	6.8	224.8	6.37	28.56	3.0	1.64	212.0	194.6	291.5	244.9	TR
23	Fr	9047	8.0	235.4	6.46	27.67	3.0	1.58	226.2	218.2	335.4	233.7	0.11
24	Sa	7387	7.5	232.8	6.47	28.44	3.0	1.59	232.7	229.5	263.1	240.1	TR
25	Su	6804	7.4	206.4	6.47	28.90	3.0	1.63	212.4	243.5	277.6	221.4	0.16
26	M	7885	7.3	186.9	6.34	30.06	3.2	1.74	206.3	244.2	260.9	210.8	TR
27	Tu	7740	7.1	204.0	6.15	29.77	3.2	1.88	221.5	255.4	230.9	209.8	TR
28	W	7695	7.1	226.5	6.16	29.49	3.5	1.65	216.3	235.4	235.2	203.5	TR
29	Th	11583	10.5	235.5	6.35	28.56	3.2	1.59	227.9	215.6	226.1	191.7	
30	Fr	12236	11.1	218.9	6.41	28.38	3.1	1.55	234.3	217.1	237.7	206.6	TR
31	Sa	10184	11.1	226.0	6.46	29.12	3.1	1.57	247.0	208.2	232.9	205.4	

PLANT OPERATIONAL DATA AUGUST 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	Su	7300	7.7	185.4	6.48	29.24	3.2	1.65	217.3	211.4	255.8	225.8	0.09
2	M	9860	8.7	163.8	6.19	30.68	3.4	1.98	216.3	218.9	237.6	210.1	0.36
3	Tu	8352	7.7	150.3	5.80	30.61	3.5	2.26	211.9	235.8	246.4	229.7	
4	W	9000	8.4	187.2	5.86	29.82	3.5	2.27	212.0	231.4	242.2	234.1	
5	Th	6435	6.0	166.7	5.99	29.58	3.5	2.12	216.6	247.5	249.7	240.6	
6	Fr	7140	6.5	159.7	6.21	30.29	3.5	2.06	238.5	276.6	262.1	201.2	
7	Sa	6580	6.0	190.1	6.25	30.25	3.5	1.94	231.6	247.5	204.0	172.1	
8	Su	5390	4.9	178.8	6.25	30.02	3.5	1.96	229.3	228.8	227.1	196.1	
9	M	7600	6.8	190.5	6.06	30.74	3.5	2.03	224.8	253.8	243.3	192.9	
10	Tu	6720	6.0	207.5	5.87	28.93	3.4	2.01	210.0	247.4	267.3	195.4	0.72
11	W	8424	7.6	195.0	6.01	29.96	3.3	1.86	236.0	236.0	250.3	209.3	
12	Th	9200	8.3	177.5	6.08	29.86	3.3	1.67	237.0	243.6	229.0	212.7	
13	Fr	10270	8.6	218.5	6.19	29.59	3.2	1.51	242.9	218.5	223.9	195.1	0.04
14	Sa	9006	7.9	205.0	6.30	29.52	3.2	1.56	228.4	208.0	215.5	199.6	0.44
15	Su	7663	8.7	197.5	6.23	31.61	3.2	1.61	221.4	222.6	220.0	195.1	
16	M	9483	8.5	171.2	6.13	32.29	3.2	1.70	215.8	201.1	221.5	228.8	
17	Tu	9222	8.4	186.9	5.97	31.51	3.2	1.78	197.0	192.8	239.3	234.3	
18	W	9240	8.3	214.0	6.14	30.53	3.3	1.71	196.7	211.6	208.3	210.1	
19	Th	12245	10.7	203.1	6.27	30.01	3.3	1.60	217.7	211.2	242.5	234.5	TR
20	Fr	13193	11.0	214.0	6.28	29.42	3.3	1.57	208.9	207.1	222.1	214.4	0.04
21	Sa	10902	11.2	217.0	6.29	29.47	3.3	1.56	209.3	222.8	216.1	205.4	
22	Su	10033	10.5	187.0	6.59	30.06	3.3	1.54	227.9	208.9	217.7	206.6	0.43
23	M	11534	10.3	153.0	6.01	31.59	3.5	1.66	220.0	238.9	213.2	210.5	
24	Tu	10212	9.0	157.3	5.88	31.88	3.6	1.67	224.9	198.6	214.6	201.2	0.16
25	W	5688	4.9	164.3	5.87	31.57	3.9	1.57	241.3	221.0	243.2	183.1	
26	Th	6840	6.0	200.8	6.04	31.37	3.9	1.60	216.2	206.3	231.1	176.1	TR
27	Fr	6552	5.7	202.9	6.18	30.61	3.7	1.51	247.7	190.1	220.4	193.3	TR
28	Sa	6734	6.9	215.7	6.34	30.21	3.6	1.52	232.0	188.8	214.2	180.8	
29	Su	5616	6.8	190.5	6.37	30.50	3.6	1.60	221.0	201.2	209.6	202.8	
30	M	10270	9.2	176.2	6.17	30.80	3.6	1.73	225.7	185.5	218.1	235.0	
31	Tu	10498	9.4	201.1	6.13	30.30	3.5	1.87	252.4	191.2	260.4	226.5	

PLANT OPERATIONAL DATA SEPTEMBER 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	W	11520	10.4	206.8	6.17	29.57	3.5	1.77	215.4	207.6	257.6	211.8	
2	Th	12247	10.5	203.3	6.23	29.48	3.5	1.76	221.4	362.3	253.4	225.2	
3	Fr	10627	8.8	200.4	6.22	29.90	3.5	1.65	237.2	230.9	238.1	230.3	
4	Sa	9328	8.5	193.6	6.28	29.82	3.5	1.68	244.7	205.6	254.6	228.3	TR
5	Su	6765	7.5	189.9	6.22	30.54	3.5	1.70	241.1	218.3	255.9	226.2	0.09
6	M	6124	7.3	1843	6.16	31.85	3.5	1.76	233.1	208.7	265.2	190.9	
7	Tu	8204	7.3	165.7	5.84	32.37	3.7	1.95	225.1	213.8	269.1	217.6	
8	W	9435	8.6	183.1	5.80	31.66	3.8	2.00	227.7	238.6	327.4	190.3	
9	Th	7857	7.0	198.6	5.92	30.32	3.5	1.69	224.4	253.1	246.9	211.6	
10	Fr	7862	7.3	174.6	6.05	30.19	3.7	1.47	237.2	230.0	237.2	212.1	TR
11	Sa	6624	7.4	208.3	6.29	29.61	3.6	1.34	239.1	243.7	209.5	181.1	
12	Su	5962	7.1	192.3	6.26	29.38	3.7	1.40	214.9	236.2	234.4	189.9	
13	M	8611	7.6	202.9	6.28	30.51	3.8	1.58	214.2	268.8	222.7	184.3	
14	Tu	8813	8.1	201.6	6.16	30.18	3.8	1.55	219.8	235.8	240.3	192.1	TR
15	W	7690	6.9	201.5	6.24	29.82	3.8	1.48	251.0	292.7	230.8	192.1	TR
16	Th	7921	7.0	229.3	6.33	30.05	3.8	1.47	226.8	243.9	244.2	181.7	
17	Fr	8010	7.7	216.9	6.34	29.68	3.8	1.49	230.6	236.9	231.0	183.1	
18	Sa	6408	6.6	225.3	6.36	29.99	3.7	1.55	228.2	266.1	214.4	185.6	0.03
19	Su	6653	6.3	207.4	6.27	30.31	3.6	1.74	247.5	273.0	232.7	180.2	0.61
20	M	6790	6.3	165.0	6.15	31.19	3.5	2.04	220.7	279.7	243.9	217.5	
21	Tu	7358	6.9	170.9	5.89	30.95	3.5	2.04	233.5	273.1	253.0	223.5	
22	W	7291	6.7	192.0	5.98	30.29	3.5	1.84	240.9	269.3	264.5	208.3	
23	Th	9308	8.5	207.2	6.17	29.95	3.5	1.70	224.8	263.8	250.2	205.4	0.01
24	Fr	9556	8.8	215.7	6.10	29.65	3.5	1.55	226.2	232.0	225.8	201.6	
25	Sa	9196	9.0	204.7	6.24	29.21	3.5	1.69	175.7	276.4	227.6	200.6	0.34
26	Su	8986	9.3	211.5	6.23	30.23	3.4	1.80	199.1	269.9	243.2	185.4	TR
27	M	11275	9.9	190.0	5.87	31.23	3.4	2.03	219.8	286.1	251.4	219.1	0.17
28	Tu	10944	9.8	232.4	5.77	31.25	3.4	2.06	224.5	296.2	241.4	193.0	0.05
29	W	10287	9.3	242.7	5.98	30.72	3.6	1.88	217.3	271.8	241.6	184.7	
30	Th	10823	9.6	240.7	6.09	29.84	3.6	1.82	236.7	254.7	260.6	185.8	
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PLANT OPERATIONAL DATA

OCTOBER 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	Fr	9742	8.9	249.0	6.12	30.10	3.6	1.86	230.5	266.3	232.3	190.0	
2	Sa	8255	8.7	223.1	6.12	29.99	3.6	1.91	237.9	301.4	234.0	194.6	
3	Su	7690	8.1	180.7	6.16	30.82	3.6	1.97	231.5	298.9	229.5	195.9	0.71
4	M	8518	9.1	176.6	5.73	32.65	3.7	2.06	235.0	320.6	235.5	202.7	
5	Tu	8919	8.6	170.5	5.59	31.98	3.9	2.04	227.4	304.7	263.5	211.4	TR
6	W	11354	11.1	194.0	5.85	31.03	3.9	1.93	246.0	271.0	237.6	195.9	0.03
7	Th	9884	9.9	211.0	6.04	30.20	3.7	1.74	278.6	292.4	211.3	185.2	
8	Fr	8651	8.8	198.5	6.33	29.67	3.6	1.65	262.3	301.1	234.6	198.5	TR
9	Sa	6415	7.5	195.5	6.33	29.22	3.5	1.57	249.2	310.6	240.0	214.0	0.04
10	Su	5928	7.7	173.5	6.36	29.10	3.5	1.55	230.7	331.7	252.7	228.6	TR
11	M	8410	8.4	193.0	6.26	29.74	3.5	1.57	236.9	325.3	249.6	216.1	
12	Tu	9504	9.5	202.0	6.18	29.01	3.6	1.64	219.7	312.0	268.1	199.4	TR
13	W	10626	10.4	202.5	6.26	28.28	3.6	1.58	222.2	284.1	269.1	198.7	0.02
14	Th	9398	9.0	193.0	6.41	27.88	3.5	1.48	224.6	267.4	288.2	214.2	
15	Fr	11692	11.1	190.5	6.49	27.93	3.3	1.39	239.2	225.3	256.7	222.2	
16	Sa	11771	13.2	175.0	6.50	27.33	3.2	1.36	243.9	246.1	253.3	246.6	
17	Su	8532	10.8	167.0	6.62	27.97	3.2	1.39	243.4	238.3	293.5	263.4	
18	M	12264	11.7	174.5	6.46	28.31	3.2	1.42	254.0	217.8	295.8	264.4	
19	Tu	13376	11.5	181.7	6.28	28.54	3.2	1.44	260.3	229.5	284.4	267.2	0.69
20	W	9396	8.1	174.0	6.30	28.90	3.2	1.51	243.0	208.0	297.3	257.7	
21	Th	9750	8.3	189.7	6.28	29.55	3.2	1.54	249.2	200.9	288.0	260.2	0.06
22	Fr	10530	9.5	223.8	6.27	29.97	3.2	1.45	257.2	204.3	250.6	229.8	0.03
23	Sa	9758	8.9	213.6	6.33	29.72	3.2	1.37	231.3	210.5	278.4	242.5	0.07
24	Su	9720	9.1	210.4	6.47	29.72	3.3	1.34	223.8	222.8	317.5	210.7	0.17
25	M	9153	8.6	202.0	6.23	30.38	3.3	1.41	224.9	234.6	295.2	204.2	
26	Tu	10906	10.1	199.9	6.17	29.99	3.3	1.55	242.9	226.9	260.5	229.9	TR
27	W	11508	10.4	196.6	6.19	29.49	3.3	1.54	234.0	213.7	251.9	248.6	TR
28	Th	13440	12.2	206.1	6.32	30.03	3.1	1.46	240.4	223.5	256.5	258.9	
29	Fr	15834	13.8	195.7	6.31	29.14	3.1	1.41	220.6	235.3	241.3	265.4	TR
30	Sa	14616	14.6	198.2	6.33	29.02	3.1	1.39	247.7	236.2	281.2	273.0	0.08
31	Su	8763	11.0	180.1	6.44	28.90	3.1	1.40	243.7	211.5	295.5	276.2	

PLANT OPERATIONAL DATA NOVEMBER 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	M	12320	15.2	187.4	6.27	30.09	3.1	1.45	246.2	184.5	267.9	236.5	0.90
2	Tu	22500	20.1	203.7	6.15	30.74	3.1	1.61	257.8	197.6	255.4	215.3	TR
3	W	11136	10.2	198.4	5.85	27.75	3.1	1.69	254.8	196.1	211.1	224.6	TR
4	Th	12238	11.3	203.7	5.90	31.16	3.2	1.64	266.6	198.1	209.3	236.2	
5	Fr	9200	9.1	195.5	6.03	30.26	3.2	1.61	277.1	191.4	204.9	246.8	
6	Sa	5808	6.5	189.8	6.22	30.53	3.1	1.49	235.3	221.5	229.8	264.8	
7	Su	7520	9.0	188.1	6.35	30.32	3.0	1.40	195.8	189.8	225.4	262.2	
8	M	6660	6.3	188.4	6.22	30.70	3.0	1.48	195.4	202.4	237.5	261.6	TR
9	Tu	10498	9.8	184.0	6.16	30.74	3.0	1.53	226.4	214.4	266.6	264.6	0.08
10	W	12824	12.1	176.4	6.14	30.60	3.0	1.54	237.2	230.7	261.0	264.6	
11	Th	11772	11.4	194.3	6.21	29.70	3.0	1.53	229.1	233.2	241.6	243.3	
12	Fr	11948	11.6	189.2	6.21	29.17	2.9	1.48	238.7	232.0	264.4	258.2	
13	Sa	12288	14.6	184.5	6.25	29.84	2.9	1.49	253.3	244.5	269.9	274.3	
14	Su	7987	10.6	87.8	6.40	29.58	2.9	1.51	230.9	255.6	305.9	303.6	
15	M	6996	6.8	55.5	--	--	3.2	1.55	238.5	250.7	258.9	385.2	
16	Tu	7505	7.2	196.9	6.24	29.40	3.0	1.69	243.2	259.5	260.4	256.9	TR
17	W	8140	7.5	192.5	6.24	29.28	3.0	1.69	241.8	265.4	286.5	268.2	TR
18	Th	7392	6.7	201.0	6.30	29.21	3.0	1.67	270.0	254.5	249.2	256.7	0.18
19	Fr	8512	7.8	190.1	6.13	28.67	3.0	1.66	290.5	240.2	261.7	274.3	TR
20	Sa	7052	8.2	197.2	6.29	28.80	3.0	1.69	260.9	241.6	309.2	270.7	0.01
21	Su	7548	9.3	203.6	6.44	29.16	3.0	1.72	262.7	251.4	235.1	261.2	TR
22	M	4070	3.9	188.7	6.42	29.85	3.0	1.82	267.9	267.4	278.0	266.2	
23	Tu	10640	10.1	206.3	6.24	29.39	3.1	1.91	271.5	281.2	285.8	269.5	0.05
24	W	10960	10.8	232.0	6.21	29.28	3.1	2.01	282.1	280.1	283.4	238.5	TR
25	Th	8424	11.1	239.1	6.29	28.59	3.1	2.03	258.8	--	267.0	237.7	0.01
26	Fr	6396	5.9	219.1	6.37	29.17	3.1	2.01	259.0	238.3	273.8	250.6	0.47
27	Sa	7176	7.9	229.4	6.23	29.37	3.3	2.14	268.8	277.6	298.5	216.6	0.04
28	Su	6478	6.8	217.5	6.18	29.47	3.3	2.19	265.9	254.0	260.9	195.1	0.12
29	M	7222	6.4	201.0	6.17	29.95	3.5	2.33	266.0	242.5	234.2	182.5	0.59
30	Tu	4576	4.1	197.9	5.77	29.82	3.6	2.55	241.1	274.6	235.7	203.3	
31													

PLANT OPERATIONAL DATA

DECEMBER 1971

Date	Day	Iron Addition to East Plant Mixed Liquor		Milorganite as Received Basis			Average Ferric Chloride Use						Precipitation Water Equivalent Inches
		lbs/day	mg/l	Tons/ Day	Nitrogen % N	Ash %	pH	Waste Sludge % Solids	lbs. Anhydrous $FeCl_3$ Per Dry Tons Recovered Solids				
									1968	1969	1970	1971	
1	W	4382	4.1	246.7	5.87	29.14	3.7	2.38	242.0	289.2	226.8	179.7	
2	Th	7139	6.8	249.0	6.01	28.61	3.8	2.21	250.2	273.3	236.2	166.4	
3	Fr	7140	7.1	218.0	6.15	28.52	3.8	1.74	256.1	272.2	244.7	160.6	
4	Sa	7474	8.2	212.5	6.49	27.85	3.8	1.49	228.2	248.1	252.8	156.6	0.01
5	Su	7144	8.6	200.2	6.66	27.67	3.6	1.34	245.0	236.1	246.0	166.7	0.07
6	M	10033	9.7	196.6	6.60	28.24	3.6	1.35	241.7	221.5	250.5	177.3	0.02
7	Tu	10044	9.5	189.1	6.52	27.80	3.6	1.37	241.3	233.4	232.4	181.1	TR
8	W	10168	8.9	173.2	6.52	27.37	3.6	1.34	233.9	222.4	247.6	192.7	
9	Th	11288	9.3	187.8	6.58	27.78	3.5	1.31	207.5	207.9	244.2	186.6	0.10
10	Fr	11172	8.8	185.7	6.57	28.38	3.5	1.27	204.5	228.0	255.7	170.3	1.33
11	Sa	8875	7.9	190.5	6.47	29.00	3.3	1.29	222.8	235.8	244.1	188.2	
12	Su	8436	8.0	212.9	6.43	30.35	3.3	1.33	219.7	195.4	219.7	193.3	
13	M	9660	8.5	206.8	6.28	30.79	3.3	1.49	237.3	207.0	220.3	214.3	
14	Tu	6750	5.3	212.0	6.17	30.59	3.3	1.59	207.8	214.5	211.1	208.3	0.22
15	W	6199	5.2	203.5	6.14	29.73	3.3	1.55	221.9	208.4	233.5	185.9	1.32
16	Th	9559	8.1	195.3	6.16	30.59	3.3	1.54	244.0	187.0	229.7	193.7	
17	Fr	7548	6.4	206.6	6.28	31.19	3.7	1.50	266.1	186.7	207.3	177.1	TR
18	Sa	7752	7.4	205.4	6.40	30.20	3.8	1.46	242.1	193.2	232.2	175.5	0.06
19	Su	7400	7.1	200.4	6.59	29.71	3.7	1.44	236.8	203.9	216.8	178.9	
20	M	8208	7.2	201.8	6.59	29.63	3.7	1.47	210.0	190.5	235.6	190.8	
21	Tu	8122	7.7	208.0	6.45	28.75	3.7	1.61	207.6	201.2	262.8	183.0	
22	W	7884	7.2	209.6	6.51	27.82	3.6	1.55	215.3	196.8	237.9	186.5	
23	Th	9539	8.8	217.3	6.49	27.29	3.5	1.43	176.2	220.9	244.3	197.1	
24	Fr	7361	7.8	222.3	6.72	27.04	3.5	1.41	201.9	243.7	225.9	203.8	
25	Sa	6384	7.8	198.1	6.76	27.14	3.4	1.41	208.9	263.6	260.3	230.5	TR
26	Su	5691	7.0	115.1	6.78	28.10	3.4	1.37	230.3	264.0	304.2	225.0	TR
27	M	7569	7.3	--	--	--	--	--	222.7	248.2	270.9	--	0.06
28	Tu	10249	9.0	--	--	--	--	--	197.0	267.6	229.2	--	TR
29	W	5396	4.5	--	--	--	--	--	202.0	225.1	241.1	--	0.30
30	Th	4140	3.5	119.6	6.69	26.92	3.4	1.50	214.5	266.7	205.4	259.9	0.85
31	Fr	4554	4.3	214.5	6.73	25.95	3.4	1.56	203.4	257.0	209.9	182.8	

PLANT OPERATIONAL DATA 1971

Week	TOTAL IRON					TOTAL SOLUBLE IRON					RETURN SLUDGE (DRY BASIS)							
	mg/l as Fe			% Removal		mg/l as Fe			% Removal		%Total P		%Total N		%Total Fe		%Total Ash	
	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	WP	EP	WP	EP	WP	EP	WP	EP
1/4 - 1/9	6.47	0.39	0.60	94.0	90.7	0.53	0.10	0.07	81.1	86.8	2.10	2.40	6.96	6.71	1.62	4.37	23.37	26.99
1/10- 1/16	7.16	0.60	2.06	91.6	71.2	0.68	0.14	0.15	79.4	77.9	2.08	2.45	6.98	6.63	1.76	4.51	23.34	27.60
1/17- 1/23	7.40	0.54	3.43	92.7	53.6	0.58	0.17	0.11	70.7	81.0	2.14	2.42	7.03	6.58	1.83	4.72	22.78	27.06
1/24- 1/30	7.74	0.76	3.26	90.2	57.9	0.58	0.41	0.09	29.3	84.5	2.09	2.40	6.86	6.65	1.76	4.58	22.90	27.36
1/31- 2/6	7.52	0.40	2.85	94.7	62.1	0.61	0.12	0.08	80.3	86.9	2.03	2.36	6.63	6.58	1.90	5.28	23.77	28.31
2/7 - 2/13	7.92	0.77	2.13	90.3	73.1	0.58	0.18	0.07	69.0	87.9	2.04	2.33	6.79	6.44	1.83	5.14	24.50	28.95
2/14- 2/20	6.30	0.96	5.36	84.8	14.9	0.37	0.17	0.26	54.1	29.7	2.07	2.28	6.64	6.49	1.97	5.71	25.20	30.13
2/21- 2/27	4.94	0.86	2.07	82.6	58.1	0.50	0.23	0.32	54.0	36.0	1.96	2.16	6.43	6.08	1.76	5.85	26.16	30.83
2/28- 3/6	5.26	0.45	1.60	91.4	69.6	0.46	0.20	0.11	56.5	76.1	1.82	1.91	6.16	5.80	1.83	5.85	27.72	32.95
3/7 - 3/13	5.15	0.48	2.50	90.7	51.5	0.42	0.13	0.11	69.0	73.8	1.87	1.96	6.49	6.28	1.69	5.00	26.82	31.07
3/14- 3/20	4.75	0.42	1.58	91.2	66.7	0.30	0.15	0.09	50.0	70.0	1.97	2.06	6.58	6.44	2.18	4.09	25.96	28.32
3/21- 3/27	4.04	0.45	2.75	88.9	31.9	0.31	0.17	0.07	45.2	77.4	1.80	2.01	6.36	6.23	1.62	4.58	27.06	30.79
3/28- 4/3	4.84	0.45	0.98	90.7	79.8	0.29	0.23	0.07	20.7	75.9	1.90	2.02	6.70	6.44	1.62	4.65	25.79	29.48
4/4 - 4/10	4.66	2.11	2.85	54.7	38.8	0.34	0.49	0.24	--	29.4	1.91	2.03	6.86	6.58	1.55	4.65	25.51	29.16
4/11- 4/17	5.62	1.33	1.98	76.3	64.8	0.81	0.45	0.88	44.4	--	1.99	2.12	6.88	6.57	1.76	4.65	25.41	28.97
4/18- 4/24	6.34	2.17	3.83	65.8	39.6	0.39	0.26	0.39	33.3	--	1.94	2.03	6.40	6.09	2.68	4.44	29.78	31.53
4/25- 5/1	6.40	0.80	4.04	87.5	36.9	0.48	0.07	0.08	85.4	83.3	2.01	2.06	6.56	6.40	2.89	4.37	27.94	30.40
5/2 - 5/8	6.59	4.96	3.83	24.7	41.9	0.40	0.16	0.10	60.0	75.0	2.02	2.08	6.68	6.56	3.03	4.16	26.99	28.85
5/9 - 5/15	7.02	2.75	3.97	60.8	43.4	0.33	0.14	0.09	57.6	72.7	2.09	2.10	6.74	6.64	3.03	4.30	26.98	28.79
5/16- 5/22	7.11	4.50	5.05	36.7	29.0	0.82	0.77	1.06	6.1	--	2.08	2.13	6.53	6.46	3.45	4.16	28.03	29.63
5/23- 5/29	6.69	1.66	1.51	75.2	77.4	0.48	0.24	0.16	50.0	66.7	2.12	2.16	6.72	6.56	3.03	4.65	27.42	29.46
5/30- 6/5	5.48	1.12	2.37	79.6	56.8	0.38	0.20	0.19	47.4	50.0	2.15	2.23	6.39	6.16	3.45	4.86	28.90	31.02
6/6 - 6/12	7.50	1.15	1.04	84.7	86.1	0.60	0.32	0.18	46.7	70.0	2.26	2.29	6.37	6.23	3.17	4.58	28.88	30.83
6/13- 6/19	8.32	1.92	0.97	76.9	88.3	0.48	0.27	0.06	43.8	87.5	2.27	2.31	6.35	6.22	3.45	4.30	29.38	30.88
6/20- 6/26	5.94	0.72	0.70	87.9	88.2	0.42	0.15	0.07	64.3	83.3	2.26	2.30	6.28	6.14	3.38	4.72	29.57	31.05
6/27- 7/3	5.77	0.64	0.51	88.9	91.2	0.37	0.24	0.08	35.1	78.4	2.21	2.20	6.04	6.01	4.02	4.51	31.99	32.50
7/4 - 7/10	6.37	1.65	0.54	74.1	91.5	0.36	0.24	0.20	33.3	44.4	2.36	2.37	6.42	6.29	3.80	4.72	29.51	30.68
7/11- 7/17	6.89	1.00	2.47	85.5	64.2	0.59	0.29	0.19	50.8	67.8	2.39	2.43	6.36	6.16	3.87	5.00	29.92	31.27

PLANT OPERATIONAL DATA 1971

Week	TOTAL IRON					TOTAL SOLUBLE IRON					RETURN SLUDGE (DRY BASIS)							
	mg/l as Fe			% Removal		mg/l as Fe			% Removal		%Total P		%Total N		%Total Fe		%Total Ash	
	SS	WPE	EPE	WPE	EPE	SS	WPE	EPE	WPE	EPE	WP	EP	WP	EP	WP	EP	WP	EP
7/18- 7/24	7.03	0.75	0.92	89.3	86.9	0.49	0.23	0.11	53.1	77.6	2.28	2.33	6.40	6.28	3.45	4.72	29.90	31.33
7/25- 7/31	6.80	0.76	0.63	88.8	90.7	0.47	0.18	0.13	61.7	72.3	2.29	2.30	6.39	6.26	3.66	4.86	29.38	28.90
8/1 - 8/7	7.14	1.32	1.37	81.5	80.8	0.59	0.14	0.17	76.3	71.2	2.36	2.34	6.43	6.30	4.02	5.28	29.65	30.81
8/8 - 8/14	6.15	1.32	1.26	78.5	79.5	0.43	0.17	0.18	60.5	58.1	2.40	2.36	6.00	6.01	4.44	5.56	30.91	32.19
8/15- 8/21	6.48	0.81	0.96	87.5	85.2	0.45	0.20	0.18	55.6	60.0	2.27	2.31	6.21	6.11	3.66	4.79	30.81	31.62
8/22- 8/28	7.55	0.66	0.71	91.3	90.6	0.41	0.08	0.10	80.5	75.6	2.28	2.30	6.15	6.04	3.36	4.91	31.77	33.20
8/29- 9/4	8.06	0.74	0.42	90.8	94.8	0.38	0.09	0.06	76.3	84.2	2.34	2.34	6.12	6.02	4.19	5.31	32.28	33.15
9/5 - 9/11	8.39	0.80	0.69	90.5	91.8	0.33	0.11	0.10	66.7	69.7	2.43	2.47	6.22	6.15	4.28	5.12	30.89	32.41
9/12- 9/18	7.19	1.03	0.57	85.7	92.1	0.35	0.07	0.06	80.0	82.9	2.57	2.58	6.08	5.95	4.80	6.10	31.98	33.27
9/19- 9/25	7.92	0.92	0.75	88.4	90.5	0.42	0.15	0.09	64.3	78.6	2.52	2.61	6.28	6.16	4.44	5.70	31.31	32.60
9/26-10/2	9.15	1.22	1.25	86.7	86.3	0.52	0.15	0.05	71.2	90.4	2.47	2.54	6.26	6.04	3.61	4.71	30.90	32.35
10/3 -10/9	7.95	0.69	0.73	91.3	90.8	0.37	0.08	0.06	78.4	83.8	2.41	2.43	6.00	5.87	4.34	5.31	31.53	32.62
10/10-10/16	7.81	0.80	0.65	89.8	91.7	0.64	0.07	0.12	89.1	81.3	2.42	2.44	6.00	5.94	4.57	5.76	31.52	32.55
10/17-10/23	8.97	1.46	1.79	83.7	80.0	0.39	0.15	0.09	61.5	76.9	2.33	2.39	6.38	6.26	4.10	5.35	29.00	30.34
10/24-10/30	8.26	0.74	1.71	91.0	79.3	0.33	0.08	0.08	75.8	75.8	2.29	2.29	6.32	6.08	4.08	5.96	29.89	32.06
10/31-11/6	9.73	0.94	0.87	90.3	91.1	0.25	0.05	0.02	80.0	92.0	2.34	2.38	6.30	6.08	4.65	6.66	30.45	32.47
11/7 -11/13	8.24	0.89	0.41	89.2	95.0	0.25	0.14	0.09	44.0	64.0	2.33	2.31	6.15	5.93	5.69	8.32	31.87	33.93
11/14-11/20	9.31	1.90	1.18	79.6	87.3	0.35	0.08	0.10	77.1	60.0	2.37	2.31	6.26	6.14	5.43	7.14	30.37	31.90
11/21-11/27	8.95	1.18	1.27	86.8	85.8	0.32	0.08	0.11	75.0	65.6	2.43	2.36	6.46	6.21	4.41	6.39	30.09	31.85
11/28-12/4	6.99	0.98	0.93	86.0	86.7	0.25	0.08	0.09	68.0	64.0	2.54	2.54	6.39	6.23	4.95	6.85	30.13	31.70
12/5 -12/11	4.12	0.74	0.46	82.0	88.8	0.28	0.15	0.09	46.4	67.9	2.41	2.44	6.23	6.14	4.40	6.61	29.76	31.28
12/12-12/18	4.73	0.72	0.70	84.8	85.2	0.23	0.13	0.11	43.5	52.2	2.27	2.20	6.58	6.39	3.85	5.88	28.82	30.76
12/19-12/25	4.10	0.65	0.89	84.1	78.3	0.31	0.13	0.09	58.1	71.0	2.17	2.16	6.33	6.22	4.41	6.39	30.48	31.93
12/26- 1/1	3.54	0.66	1.55	81.4	56.2	0.22	0.11	0.09	50.0	59.1	2.19	2.29	6.67	6.49	3.79	5.06	28.53	30.11

*U.S. GOVERNMENT PRINTING OFFICE: 1973 546-312/154 1-3

SELECTED WATER RESOURCES ABSTRACTS
INPUT TRANSACTION FORM

1. Report No.

W

200 MGD Activated Sludge Plant Removes Phosphorus by Pickle Liquor

5. Report Date

6.

8. Performing Organization Report No.

Leary, Raymond D; Ernest, Lawrence A; Powell, Roland S; Manthe, Richard M.

11010 FLQ

Sewerage Commission of the City of Milwaukee
Milwaukee, Wisconsin

13. Type of Report and Period Covered 05D
1971 Operation

12. Sponsoring Organization

Environmental Protection Agency report number, EPA-670/2-73-050, September 1973.

The Milwaukee Sewerage Commission's Jones Island Waste Water Treatment Plant consists of a mutual primary treatment facility followed by two separate activated sludge plants. To enhance phosphorus removal in the 115 MGD East Plant, hot spent sulfuric acid pickle liquor (ferrous sulfate) was added for a one year test period in 1970 while the 85 MGD West Plant was operated as a control. This follow up report covers the 1971 operational period in detail and the first four months in 1972.

An average of 8.0 mg, Fe/l of pickle liquor iron (8436 lbs. Fe/day) was added in 1971 to the East Plant mixed liquor, producing an effluent total phosphorus concentration of 0.69 mg P/l and a total soluble phosphorus concentration of 0.15 mg P/l. This performance is based upon a raw screen sewage total and total soluble phosphorus concentration of 7.1 and 2.3 mg P/l, respectively. In an attempt to enhance phosphorus removal in the West Plant, East Plant waste sludge containing a higher iron content was added to the West Plant return sludge starting in April 1971 This procedure increased the iron content of the West Plant but did not substantially increase the West Plant phosphorus removal. During the 12 month period from May 1971 to April 1972, the West Plant effluent total and total soluble phosphorus concentrations averaged 1.5 and 0.64 mg P/l, respectively.

17a. Descriptors *Activated Sludge, *Biological Treatment, *Chemical Precipitation, *Iron, *Phosphorus, *Waste Treatment, Ferrous Sulfate, Pickle Liquor, Phosphorus Removal, Sewerage Commission of the City of Milwaukee

17b. Identifiers

17c. COSATI Field/Group

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