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Environmental Protection Technology Series

WINERY WASTEWATER CHARACTERISTICS AND TREATMENT

Industrial Environmental Research Laboratory
Office of Research and Development
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WINERY WASTEWATER CHARACTERISTICS AND TREATMENT

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It evaluates the characteristics of winery wastewaters and a method of wastewater treatment, a difficult problem facing the Wine Industry. The report explains a long-term activated sludge treatment system followed by a tertiary sand filter for use in treatment of wastewater from a winery. It describes this treatment system, which proved to be a viable means to treat winery wastewaters, and characterizes the waste flows. The study demonstrates the use of activated sludge type treatment systems for treating variable waste loadings of winery wastewaters.

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ABSTRACT

This report has been prepared to fulfill a Research, Development and Demonstration Grant #12060 EUZ. The grant was awarded to investigate the characteristics of winery wastewaters and a method of wastewater treatment, a difficult problem facing the Wine Industry. In brief - grapes are harvested in the fall and are immediately pressed to release their juice. The juice is placed in bulk storage and the solid residue is spread out in the vineyards and tilled into the soil.

Fermentation of the juice is completed during and shortly after the pressing period. During the remainder of the year the wine is carefully aged, blended and packaged for shipment. Wastewater is generated from the washing of the processing equipment, tanks, floors, etc. The wastewater is low in pH and high in carbohydrates (sugars). More wastewater is produced daily during the short pressing season than during processing. Due to these variations a winery wastewater treatment facility needs to have flexibility in treating varying sizes of waste loads. Temperature is also a factor, as there is no heating of the water during pressing or processing. Consequently, the wastewater exits the plant at about the same temperature as it was obtained which is usually quite low. Winters in this area of New York State are very cold.

With these variables in mind, Harnish & Lookup Associates of Newark, New York, proposed a long-term activated sludge treatment system followed by a tertiary sand filter. Influent BOD_5 and solids concentration of 1370 and 182 mg/l resprecively, are reduced 96%, which are impressive reductions at temperatures of 1 to 2°C. Treatment costs of \$0.964/lb of BOD_5 removed were established. This paper describes this treatment system, which proved to be a viable means to treat winery wastewaters, and characterizes the waste flows. The study demonstrates the use of activated sludge type treatment systems for treating variable waste loadings of winery wastewaters.

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SECTION I

INTRODUCTION:

The finger lakes region of New York State is a beautiful area of steep hills separated by five long narrow lakes oriented in a north-south direction. The land is fertile and the climate of temperate summers and cold winters favors the growth of hardy grapes giving them a very select flavor. Grapes grown in this area include the favorites, Concord, Catawba, Niagara, Delaware, Elvira and Ives.

Naples is located about three miles south of Lake Canandaigua. Widmer's Wine Cellars, nestled in the gentle slopes of the hills and surrounded by vineyards in this picturesque village, has been producing fine wines since 1888. Figure 1 - Photograph of Waste Treatment Facility.

Design Factors - Wine Making

During the fall, beginning about the middle of September and continuing for about six weeks, the grapes are harvested and brought to the winery. The grapes are placed in a crusher/stemmer where the stems are removed and the skins are broken, releasing the juice. The juice and skins are pumped to a storage tank that acts as a surge tank for the pressing operation. The pressing operation is a batch process, but they do operate as continuously as possible. Sometimes for color control the crushed grape and juice is heated prior to pressing. After pressing the semi-dry cake is conveyed with the stems from the stemming operation to a storage hopper for subsequent disposal. The juice from the press is screened and then pumped to fermenters where it will remain until processed to wine. Small bits and pieces of skins and pomace removed by the screen are added to the stems and semi-dry cakes for disposal. All cleanup water used in the crushing/stemming and pressing operation is also screened prior to discharge to the waste treatment plant. The solids from this screening operation are also added to the stems, pomace, etc. for land disposal.

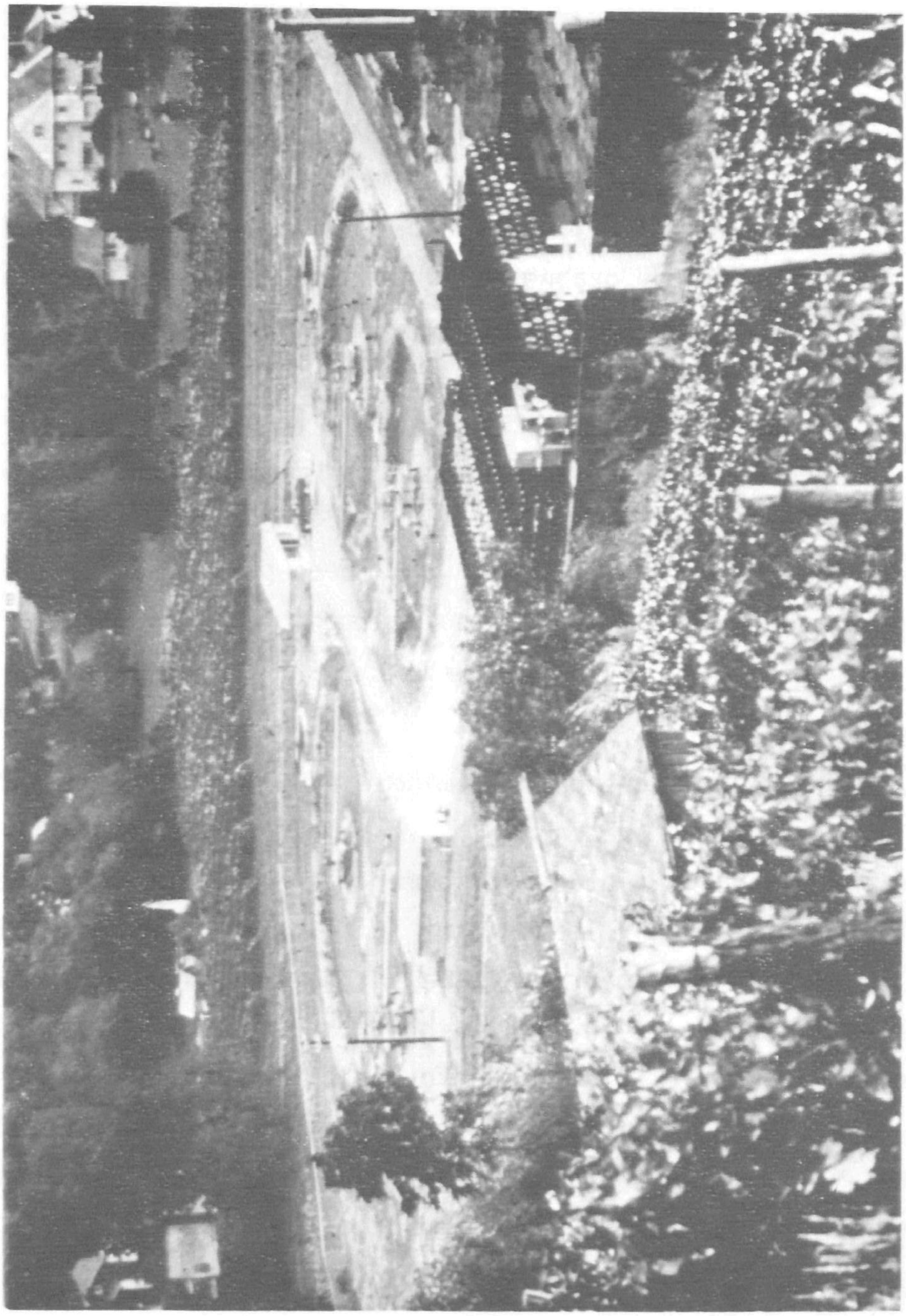


Figure 1   Photograph of the Waste Treatment Facility

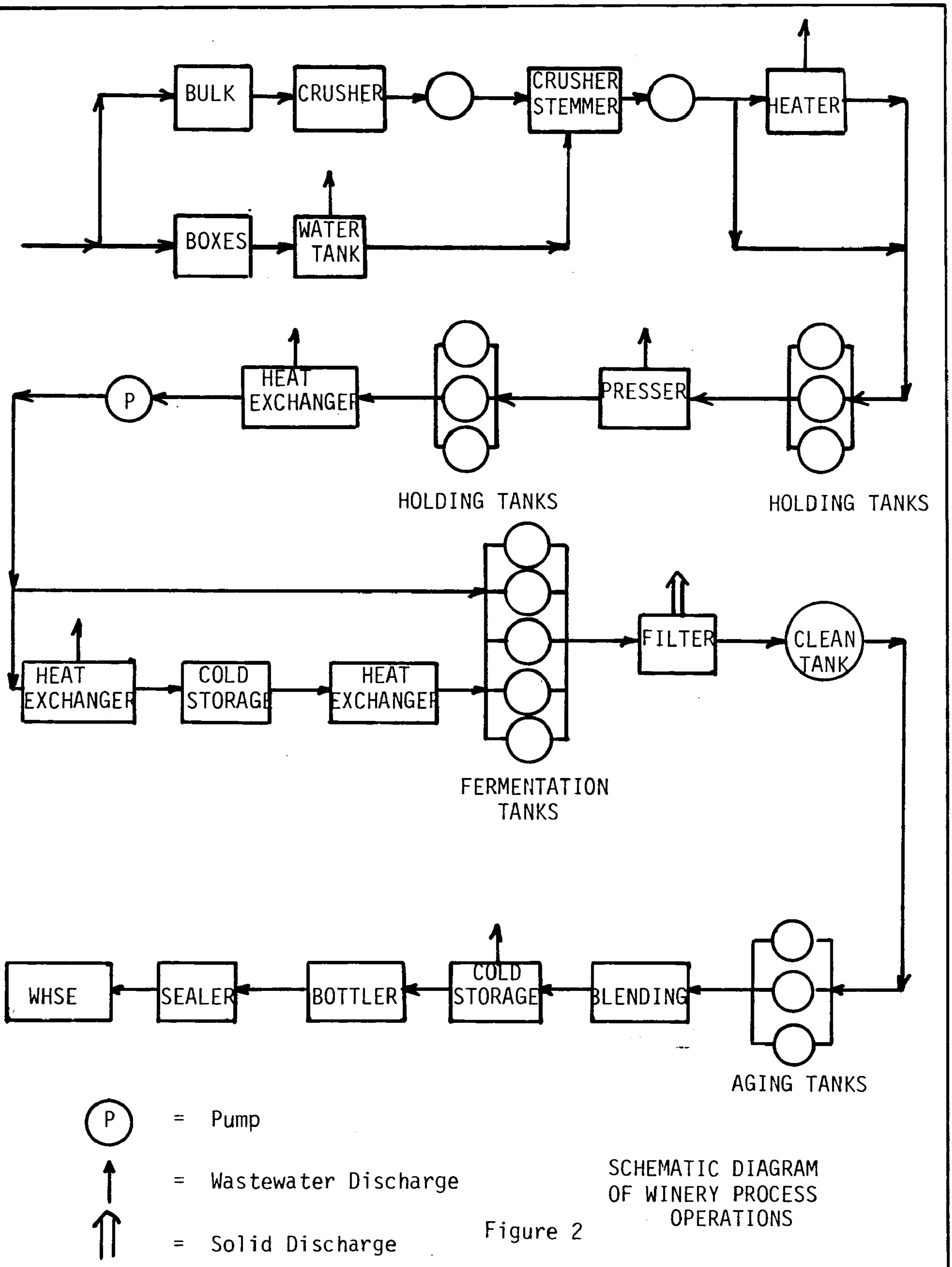


Figure 2

SCHEMATIC DIAGRAM OF WINERY PROCESS OPERATIONS

As various fermenters are placed into operation the juice is fermented for about a month dependent upon the type grape juice it is and the particular wine being produced and the temperature. When the fermentation is finished, the wine is removed from the fermentation tanks and filtered. It is then placed into aging tanks. These tanks may be the traditional wooden casks used in solera aging or other various large casks and steel tanks. Following the aging process the wines are blended to produce the variety desired. The blended wine may go directly to bottling or returned to storage in preparation for bottling at a future date. The bottled wine is sealed, cased and shipped to markets. A schematic diagram of the wine-making process is shown in Figure 2.

As mentioned previously the pressing period is from the start of harvesting and runs for about six weeks (September 15th through October 31st). The processing season runs from October 31st to September 15th of the following year.

The wastewater characteristics vary somewhat between the pressing and processing periods. During the 1971 season the winery wastewater characteristics are as shown in Table 1, while Table 2 shows the characteristics of the wastewater in 1975. (1972 data is similar to 1971, while 1973-74 data is similar to 1975.)

Table 1 - Pressing and Processing Season Wastewater Characteristics
(1971 Average Data)

	1971 Pressing Period	1971 Processing Period
BOD_5 Concentration	1010 mg/l	1370 mg/l
BOD_5 Discharge	611.7 Kg/day (1348 lb/day)	414.6 Kg/day (914 lb/day)
Suspended Solids	150 mg/l	182 mg/l
Daily Flow	0.38×10^6 l/day (0.10 mgd)	0.3×10^6 l/day (0.08 mgd)
pH	7.4 to 7.9	6.5 to 6.8

BOD_5 Discharge	4.8 Kg/1000 Kg (10.6 lb/ton of grapes pressed)	.26 Kg/case of wine (0.57 lb/case of wine)
Daily Flow/Ton	4769 l/1000 Kg (1260 gal/ton of of grapes pressed)	499.6 l/case of wine (132 gal/case of wine)

Table 2 - Pressing and Processing Season Wastewater Characteristics (1975 Average Data)

	Pressing Season	Processing Season
BOD_5 Concentration	1821 mg/l	1526 mg/l
BOD_5 Kg/day	424 (192.7 lb/day)	133 (60.5 lb/day)
Suspended Solids	362 mg/l	522 mg/l
Daily Flow	121,133 l/day (32,000 gal/day)	87,064 l/day (23,000 gal/day)
pH	5.8 to 6.7	6.3 to 7.4

Design Factors - Effluent Requirements

In New York State, treatment plant efficiencies required are based upon the ability of the receiving stream to assimilate the pollutants discharged. Since the stream and lakes are classified according to the "best use" the water quality of various streams will differ. Therefore, the treatment plant would have to be designed to treat the wastewater to a sufficient degree to maintain a specific water quality standard in the receiving stream.

The receiving stream at the winery is an un-named tributary to Naples Creek, a well-known trout stream. Oxygen levels in Naples Creek must be maintained at 4.0 mg/l to support the trout. Since this tributary is a small intermittent stream (a dry stream channel part of the time), the effluent discharged from the treatment plant is often the only flow in the channel. The operating permit conditions established for the plant by the State are shown in Table 3.

Table 3 - Effluent Limitations Set by New York State DEC

Average BOD_5 Concentration	60 mg/l
Average Suspended Solids Concentration	20 mg/l

In addition to the effluent requirements, the winery operation has to be looked at for design purposes. It has already been shown that the wastewater during the pressing season differs from the wastewater during the processing season. To further complicate the design, the winery only operates five days/week, eight hour/day. Consequently, the wastewater treatment system would need to be able to sustain periods of starvation. Very little heat is used in the winery process operations. The water exits the plant at about the same temperature that it is received. The raw water supply comes from the Village of Naples, the Village receives it from springs, chlorinates and distributes it to the residents, businesses and the winery. The raw water supply is usually quite cool; during the winter it reaches the winery with a temperature near freezing.

SECTION II

CONCLUSIONS:

The activated sludge process, using long term aeration, is a viable treatment system for the treatment of winery waste.

BOD_5 and suspended solids reduction of 96% were experienced during the pressing and processing season. Low water temperatures greatly affected the oxygen transfer and mixing capabilities of the aerators. Ice was a major problem with the operation of the mechanical aerators.

Due to the aerator icing problems during the winter, it was impossible to vary the F/M ratios under the projected outline for the demonstration grant. However, while operating at F/M ratios ranging from 0.05 to 0.1 excellent BOD_5 reductions (96+%) were experienced.

Nutrient additions of nitrogen and phosphorous were necessary for proper sludge formation, treatment and settling. A BOD_5:N:P ratio of approximately 100:5:1 produced good BOD_5 reductions (96+%). A BOD_5:N:P ratio of 100:3:3 is indicated by the data to perhaps be more beneficial than the customary 100:5:1 ratio of nutrients. Raising the phosphorous content while maintaining sufficient amounts of nitrogen seemed to increase the BOD_5 reductions up to 98 to 99%.

The winery only operated on day shift (8 hrs) five days/week. The waste system therefore only received a flow about a third of the day and none on weekends. Considerable cooling of the aeration basins was experienced on weekends and during the evenings and nights when flow to the basins was stopped.

The system was able to handle the intermittent flow well. Treatment efficiencies remained good (96% BOD_5 removals), although at times exceptionally high (98 to 99% BOD_5 removals) treatment efficiencies were experienced but unfortunately they were not maintained.

Surface aerators were probably not the proper mode of aeration for the size of the facility from the winter operating standpoint.

The principle project objectives were fairly well completed, as the wastewater characteristics are defined. Nutrient requirements were evaluated and the need for neutralization investigated. The reaction rate k was found (0.0066 @ 20°C for the pressing season; 0.022 @ 20°C for the processing season). The only principle project objective not covered as well as planned was the variable F/M ratios previously discussed.

Designing extra flexibility into the system to provide study alternates for the demonstration grant resulted in operational problems, with low flows and icing during the winter. The system operated odor free. Sludge settling was a problem at times. When the aeration basin temperature dropped to 0 to 2° a pinpoint floc developed that passed through the clarification equipment and raised the TSS level of the effluent above the permit conditions. Modifications to the plant to improve the operating temperature will be required.

Even though the aerobic digester experienced severe winter icing problems and solids stabilization was not as complete during the winter months as desired, the digestion of the sludge was still successful. The digester only needed cleaning twice during the year. This was done during warm weather. The solids are pumped out of the digester into a tank truck and hauled to farmland where it is spread on the land and tilled into the soil. This method of sludge disposal appears to be a dependable method for a small plant where small quantities of sludge are generated.

Sand filter operation was associated with problems during the backwash cycle. Modifications of the under drain system has corrected the problem and made the filter a valuable piece of operating equipment to help control solids in the effluent. Only minor BOD_5 reductions through the filter were noticed. Aeration of the filter clear well with diffused air produced an effluent containing 10 to 12 mg/l of D.O.

SECTION III

RECOMMENDATIONS:

Winery wastewater can effectively be treated using the activated sludge treatment system. Some precautions should be taken in a new design. Some different construction materials are now available and should be considered.

At the time the facility was built clay sewer pipe seemed to be the best alternate for the collection pipeline. The clay tile joints are not as tight as desired. At the present one of the PVC pipe systems would be used.

The general construction of the project should be handled by a contractor with adequate experience in waste treatment plant construction and in size and scope commensurate with his capabilities.

The system should be kept as simple as possible. The flexibility designed into the Widmer's facility to meet grant objectives proved to be a hindrance. It would have been better to operate the system longer to fill the objectives than to have had parallel flows, because when the system was operated in the parallel flow mode the water flow was reduced to the point that freezing problems became more of a hindrance. The small basins, clarifier and flow diverters experienced a greater number of cold weather icing problems than we believe would have been experienced on a larger scale.

Earthen basins seem to be satisfactory. A means of weather protection should be considered over the aeration basins and clarifier or alternate measures for winter operation. Also adequate insulation should be provided in all shallow underground piping. Pump suction lines should be kept as short as possible. Diffused aeration should be considered for a small facility such as this.

Nutrient additions should be done in an isolated and separate room from the process control room. Ammonia fumes make the area difficult to work in.

Where high ground water conditions exist, precautions should be made to stop infiltration and seepage through concrete structure (floor and wall joints).

A more positive means of sludge recirculation control and measurement should be provided. Tachometers will indicate if the pump is running but not what the actual flow is. Also the tachometers were found to be faulty.

A single clarifier, and two aeration basins would be preferred. For tertiary treatment the single media sand filters proved to be very effective. The air blower for tertiary aeration should be properly muffled to prevent excessive noise, especially if the blower is housed in the filter building.

The aerobic digester did not operate satisfactorily due to inexperienced operators, lack of attention and very low temperatures (0 to 1°C) of the liquid during the cold winter weather. The intermittent flow to the digester due to the operating schedule of the winery and surface aerators contributes to the low operating temperature of the digester.

A moderate amount of aerobic stabilization and solids concentration may be provided by an aerobic digester if protected from the weather and operated under a systematic outline for detention time and periodic sludge removal.

Digested sludge removal via tank truck for land spreading appears to be a viable means of sludge disposal for a small plant if land is available.

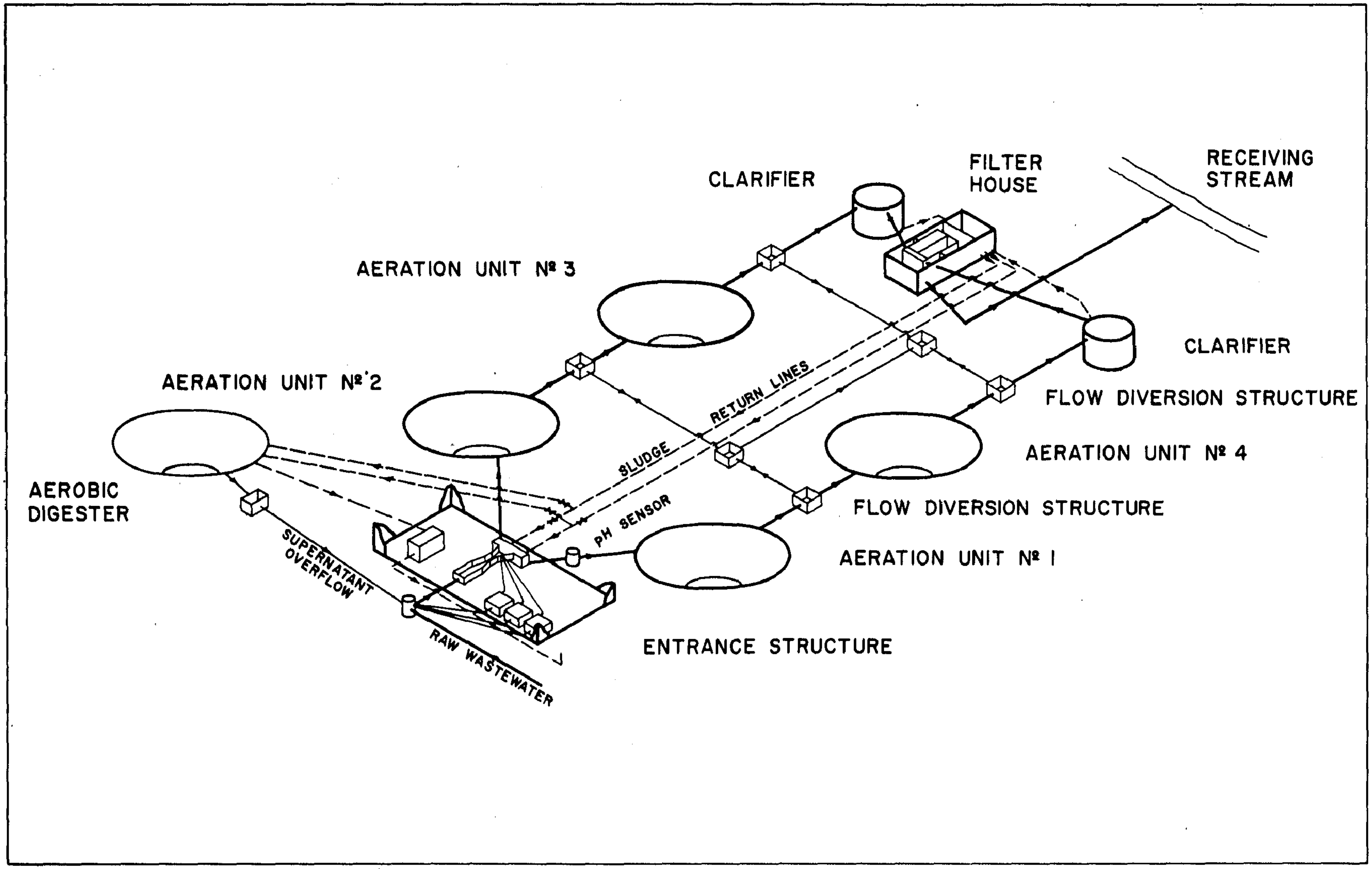


Figure 3 WASTEWATER PROCESS SCHEMATIC

SECTION IV

RESULTS & DISCUSSION:

Facilities Description

The water pollution control project included construction of an interceptor sewer and a water pollution control plant. The interceptor sewer was constructed parallel to the drainage ditch to intercept all the existing wastewater discharges. The interceptor sewer conveys the winery wastewaters to the water pollution control plant located near the processing plant. All domestic wastes at Widmers were disposed of utilizing septic tank and leach field facilities. (They have since been added [1973] to the winery wastewater for treatment at the waste plant. Effluent chlorination was also added at that time.)

The water pollution control plant includes an entrance structure, aeration units, final clarifier, tertiary sand filter, and an aerobic digester, as shown in the photograph (Figure 1) and schematically (Figure 3).

The entrance structure includes a Parshall flume with a flowmeter recorder, a sludge transfer pump, and wastewater conditioning facilities. The Parshall flume and flowmeter recorder allows the operator to determine the pattern of wastewater flow as well as the total flow into the plant. The sludge transfer pump is a plunger type pump used to transfer digested sludge from the digester to a tank truck for disposal in the vineyards. The wastewater conditioning facilities include three chemical feed pumps. pH control is accomplished using a pH probe which monitors the pH of the wastewater leaving the entrance structure. The probe signals a controller which combines it with the flowmeter signal and automatically adjusts the feed rate of the caustic soda. Caustic soda is metered into the wastewater flow as required to maintain a pH of the raw wastewater above 7.0. Nutrients required for the biological treatment system are provided by the addition of ammonia water and phosphoric acid. Chemical feed pumps are used to pump these chemicals into the wastewater stream at a rate directly proportional to the influent wastewater flow. A flow signal is received from the recording flowmeter and used to control the proportion of the nutrient materials fed by the pump. By manually adjusting the proportioner control, the flow signal can be amplified or reduced to control the nutrient feed rate.

There are four aeration units which can be operated in parallel or in series. Aeration units 1 and 2 are 19.5 meters (64 ft) in diameter with a 3 meter (10 ft) liquid depth, each providing a volume of 454,249 liters (120,000 gal). Aeration units 3 and 4 are 23.2 meters (76 ft) in diameter and 3 meters (10 ft) deep, each providing a total volume of 726,799 liters (192,000 gal). All aeration units are constructed as earthen lagoons and equipped with two-speed 7.46 Kw (10 hp) mechanical surface aerators. The detention time in the aeration units can be varied from approximately two to eight days at 454, 249 liters (0.12 mgd) wastewater flow.

Clarification is accomplished using two 4 meters (16 ft) diameter clarifiers with a 2.1 meters (7 ft) side water depth. These units provide 2.81 hour's detention of the design flow during pressing season (454,249 liters [0.12 mgd]). Each clarifier is equipped with rapid sludge removal (sludge draw-off tubes along the rakes) equipment in an effort to minimize the detention time of the sludge in the clarifier.

The tertiary filter includes two sand beds, each with an area of 6.27 sq meters (67.5 sq ft). Figure 4 shows a schematic diagram of the tertiary sand filter. The sand filter beds are very similar to rapid sand filters used in water treatment plants. The filters are located in the filter building (11.0 x 5.2 meters [39 ft x 17 ft]) along with sludge recycle pumps that are used to return the settled sludge to the entrance structure where it combines with the influent wastewater flow.

The aerobic digester is 18.3 meters (60 ft) in diameter with a 3 meter (10 ft) liquid depth constructed as an earthen pond. One two-speed 7.46 Kw (10 hp) mechanical surface aerator is installed to provide the required oxygen for the digestion process. The digested sludge is hauled off via tank truck and spread on nearby farmland.

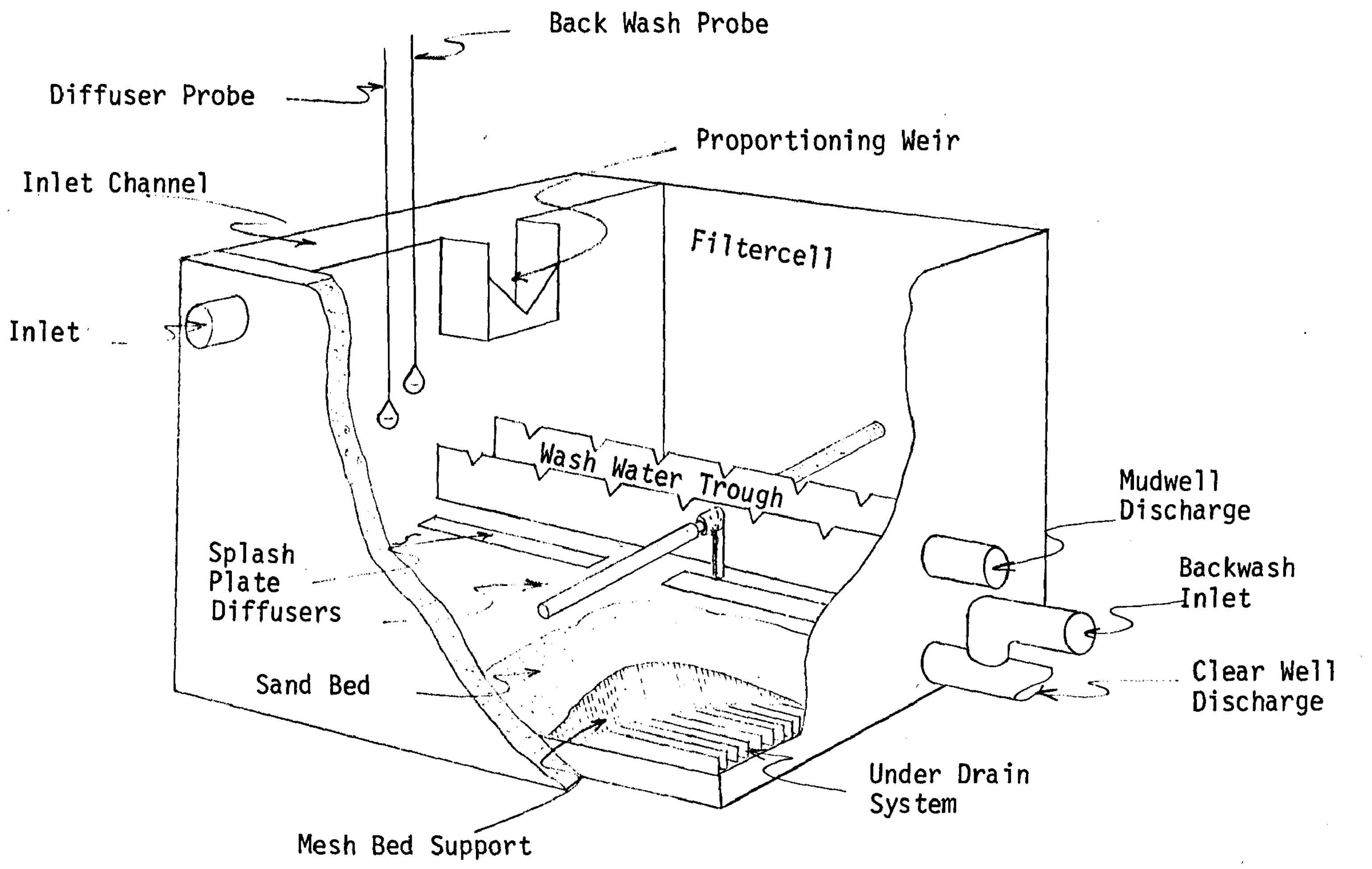


Figure 4 TERTIARY SAND FILTER SCHEMATIC

New laboratory equipment was purchased and a laboratory constructed adjacent to the existing wine laboratory to provide facilities to monitor the performance of the water pollution control plant. Lab equipment purchased consisted of:

1. Elconap Incubator, Model AH-1
2. Ohaus Triple Beam Balance
3. Corning pH Meter, Model 7
4. Corning Stirrer Hot Plate, Model P.C.-351
5. Corning Glass Still, Model AG-3
6. Lab Con Co. Fume Hood
7. Thelco Drying Oven, Model 16
8. Blue M. Lab Heat Muffle Furnace, Model M30A-1C
9. Mettler Balance, Model H-10
10. Baush & Lomb Spectronic 20
11. N-Con BOD-cubator Temperature Control
12. YSI Dissolved O_2 Meter, Model 51a
13. Miscellaneous Glassware and Chemical Reagents.

Screenhouse - This structure is 5.4 x 4.6 meters (18 ft x 15 ft) masonry building which houses the screen. The solids that are removed are conveyed to an adjacent solids storage hopper for disposal in the vineyards, where it is spread and tilled into the soil. The screens are stainless steel units manufactured by Sweco, Inc. - 1.22 meter (48 in.) diameter. The crushing/stemming pressing and screening operations are located some distance from the waste plant. Wastewater is conveyed to the waste plant by the interceptor sewer that was constructed as part of this project.

Entrance Structure - This structure is a masonry building 9.9 x 4.6 meters (32 ft 6 inc. x 15 ft) and houses the flow measuring equipment, samplers, chemical conditioning equipment and sludge transfer pump.

<u>Experimental Plan</u>

For years the wastes generated by man have been assimilated by Mother Nature. As the population increased and man's needs and life style changed he became more wasteful and the assimilative capacity of nature was exceeded. Even though these events have taken place the biological process of nature still offers some of the best methods of treatment.

By increasing the number of organisms utilizing the wastes and placing them in a more ideal or protected environment, nature's treatment system can be extended and given a greater capacity to utilize the wastes of man.

The activated sludge process accomplishes this, utilizing the capabilities of bacteria and other biological organisms to stabilize organic wastes. The system briefly consists of a container to contain the waste and biological organisms, a means of mixing the contents and aerating it. It also includes a means of separating the organisms from the wastewater and returning some of them back to maintain a specific concentration suitable for more rapid treatment.

We sometimes think of waste treatment as the purification of the water and hence all the pollutants are gone. But we merely change their form or concentrate them and then discharge them. Because we still discharge them, nature's processes are still utilized and we must keep in mind this fact or environmental degradation could still be accomplished.

The metabolism which occurs in the activated sludge process may be divided into three phases: (1) Oxidation, (2) synthesis, and (3) endogenous respiration. These phase reactions can be illustrated by the general equations, simplified from those formulated by Weston and Eckenfelder:[2]

(1) Organic matter oxidation

$$C_xH_yO_2 + aO_2 \longrightarrow xCO_2 + bH_2O \text{ energy}$$

(2) Cell synthesis

$$C_xH_yO_2 + NH_3 + cO_2 + \text{energy} \longrightarrow C_5H_7NO_2 + dCO_2 + eH_2O$$

(3) Cell oxidation

$$C_5H_7NO_2 + 5O_2 \longrightarrow 5CO_2 + 2H_2O + NH_3 + \text{energy.}$$

The Michaelis-Mention[3] relationship can be used to define the microbial growth rate and steady state substrate removal in the system. A simplified equation for substrate removal is;

$$kSe = \frac{So-Se}{Xvt}$$

where

k	=	Removal rate coefficient
Se	=	Soluble effluent BOD_5, mg/l
So	=	Influent BOD_5, mg/l
Xv	=	Average mixed liquor volatile suspended solids, mg/l
t	=	Aeration time, days

Excess solids are generated in the activated sludge process. These solids result from the non-biodegradable suspended solids in the influent and the biological cells synthesized in the system during BOD_5 removal. Some of the cell mass is broken down (oxidized) by endogenous respiration. In the system about one-third of the organic matter removed is oxidized to carbon dioxide and water to provide energy for the synthesis of the other two-thirds to cell material.[4] Some cell material is also oxidized to carbon dioxide and water by endogenous respiration. The excess sludge production can be expressed with the following equation.[3]

$$\Delta X = fXi + \frac{\Delta Xv}{fv} - Xe$$

where

ΔX	=	Total excess sludge production, lb SS/day
f	=	Non-biodegradable fraction of the influent suspended solids
Xi	=	influent suspended solids. lb SS/day
fv	=	volatile fraction of MLSS in the aeration basin, MLVSS/MLSS
Se	=	effluent suspended solids, lb SS/day
ΔXv	=	excess biological volatile sludge production, lb VSS/day

Oxygen used to provide energy for synthesis of cells and for endogenous respiration can be determined with the following equation:[3]

$$Rr = a'Sr-b'xXv + Rc + Rn$$

where

- Rr = total oxygen utilization, lb O_2/day
- a' = oxygen utilization coefficient for synthesis, lb O_2 utilized/lb of organics removed
- b' = oxygen utilization coefficient for endogenous respiration, lb O_2 utilized/day - lb MLVSS
- Sr = organics (BOD) removed, lb/day
- x = biodegradable fraction of MLVSS
- Xv = average MLVSS in the aeration basin, lb/day
- Rc = chemical oxygen demand, lb O_2/day
- Rn = oxygen utilized in oxidation of ammonia to nitrate, lb O_2/day.

There are many variations of the activated sludge process that all operate basically the same. However, some variations tend to lend themselves to be more compatible with certain circumstances. Most generally the variations are the result of unit arrangements, methods of introducing the air, loading (F/M), mixing methods, and aeration time.

The activated sludge process using the "complete mix" approach seems to have gained favor recently. Using the complete mixed system with long aeration times offers benefits in the treatment of high strength food processing wastes by giving a high degree of treatment and a slightly reduced and more stable waste activated sludge to dispose of. The systems may or may not be preceded by primary treatment. Most plants with substantial solids in the wastewater incorporate primary treatment.

In the facility discussed only screening preceded the activated sludge process.

Project Objectives

The principle objectives of the study were to establish the wastewater characteristics during the pressing season (September 15th through October 31st) and the processing season (November 1st to September 15th of the following year). To study the effect of variable F/M ratios, establish the reaction rate for winery wastewater and to evaluate the need for neutralization and nutrient additions.

The common parameters used to describe the pollutants in wastewaters are used for the winery wastes and are defined in the glossary which is included in the appendix.

Plant Performance

In general the wastewater contains inorganic solids from dust and silt washed off the grapes from harvest and from some filter aid used in clarification of the wine after fermentation, although these pollutants are quite minor.

The wastewater contains organic solids that includes bits and pieces of the grape that are not completely removed by the screening operation. The liquid fraction of the wastewater results from washing, cooling and general cleanup of the pressing and processing operations. From the fermentation of the grape juice some yeasts, potassium tartrate and alcohol are included in the wastewaters. The wastewater characteristics relate directly to the process in operation and during the pressing season the wastewater can also be related to the amount of grapes pressed.

Table 4 shows the average monthly volumes and strengths of the wastewater being treated during grant period (1972).

Table 4 - Monthly Average Data
Listing the Quantity and Concentration of Pollutants

Month	BOD5 mg/l	COD mg/l	TSS mg/l	Flow lpd	Flow (gpd)
Jan 72	1,160	1,553	412	141,196	(37,300)
Feb 72	1,131	1,517	458	128,230	(33,875)
March 72	1,126	2,972	289	243,591	(64,350)
April 72	922	1,402	92	208,955	(55,200)
May 72	884	1,311	178	337,185	(89,075)
June 72	833	1,032	117	286,556	(75,700)

July 72	446	645	112	330,466	(87,300)
Aug 72	812	1,034	97	271,861	(71,818)
Sept 72	615	1,247	168	326,302	(86,200)
Oct 72	581	888	225	343,241	(90,855)
Nov 72	1,876	1,580	303	163,246	(43,125)
Dec 72	2,078	2,168	380	204,867	(54,120)

The average daily flow for the 1972 pressing season was 338,049 liters (89,303 gal) while the average daily flow during the processing season was 231,652 liters (61,195 gal). However, this water flow includes storm water as several roof and parking drains tie into the system. The 1973, 1974 and 1975 seasons reflect a considerable reduction in water flow as most of the storm drains were taken out of the system. In 1973 the sanitary sewage was added along with chlorination of the final effluent. Table 5 reflects these changes in water flow.

Table 5 - Average Daily Water Consumption During Pressing and Processing for 1973, 74 & 75

	Pressing	Processing
1973	226,746 liters/day (59,900 gal/day)	196,084 liters/day (51,800 gal/day)
1974	203,655 liters/day (53,800 gal/day)	105,234 liters/day (27,800 gal/day)
1975	74,886 liters/day (46,200 gal/day)	88,957 liters/day (23,500 gal/day)

Numerous mechanical and cold weather operating problems hindered plant operation during the study. Good sludge wasting data was not obtained due to freezing problems and sludge pump operation difficulties. Sludge wasting data since the grant period is also lacking.

Figure 5 illustrates the probability of the wastewater (liters/1000 Kg of grapes pressed) plotted on arithmetic - probability paper. The probability shown on this and following similar figures is the percentage measurement

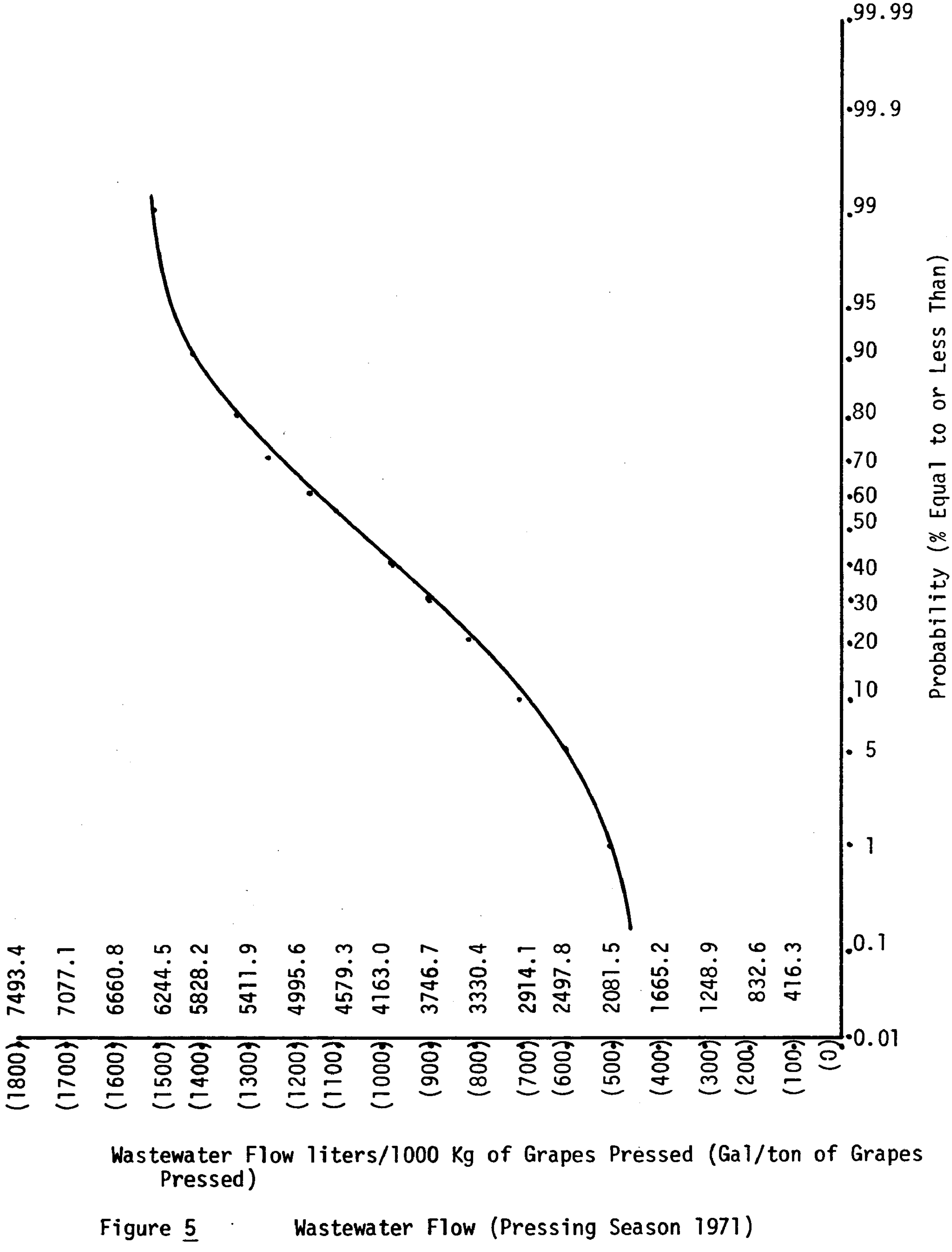


Figure 5 Wastewater Flow (Pressing Season 1971)

equal to or less than the stated class mean of the measured item. Figure 6 shows that 50% of the time the BOD_5 concentration was 900 mg/l or less during pressing. Figure 7 indicates that 50% of the time about 31.8 Kg (70 lb) of BOD_5 was discharged per ton of grapes pressed (1971 pressing season).

Figure 8 illustrates the probability of water flow in GPM (based on an 8 hour day) during the processing season. Figure 9 shows that the BOD_5 concentration in the waste plant effluent is about 30 mg/l 50% of the time. This concentration of BOD_5 with the corresponding water flow would yield about 14 lb of BOD_5 being discharged.

The effect of varying the food to micro-organism ratio (F/M) was accomplished by controlling the amount of sludge returned to the aeration basins. Although data in this area is limited due to cold weather operating problems, it is generally felt by the engineer (Harnish & Lookup Associates) that efficient plant operation was achieved at F/M ratios of 0.1 to 0.05. Figure 10 outlines what the concentration of MLVSS is required in Basins 1 and 4 (operated in series) to be in a good F/M operating range. F/M ratios of 0.03 yield excellent BOD_5 removals but care must be taken when operating in this range because solids settling problems may develop.

The aeration basins experienced a great deal of winter operating problems. During cold days and nights the basins would freeze partially over. When this happened the mixing ability of the aerators was affected to the point that solids would settle to the bottom of the basin. Also the aerators themselves would freeze up. A splash deflector was installed on the aerators which helped the freezing problem. During poor aerator operation it was difficult to keep the solids in suspension. Also when the solids did settle the aerators were not capable of resuspending them. Some type of weather protection should be considered for the aeration basins and clarifier. Maintaining adequate D.O. in the basins was not a problem. D.O. concentrations of 4 to 5 are not uncommon. D.O. concentrations of less than 0.8 are non-existent.

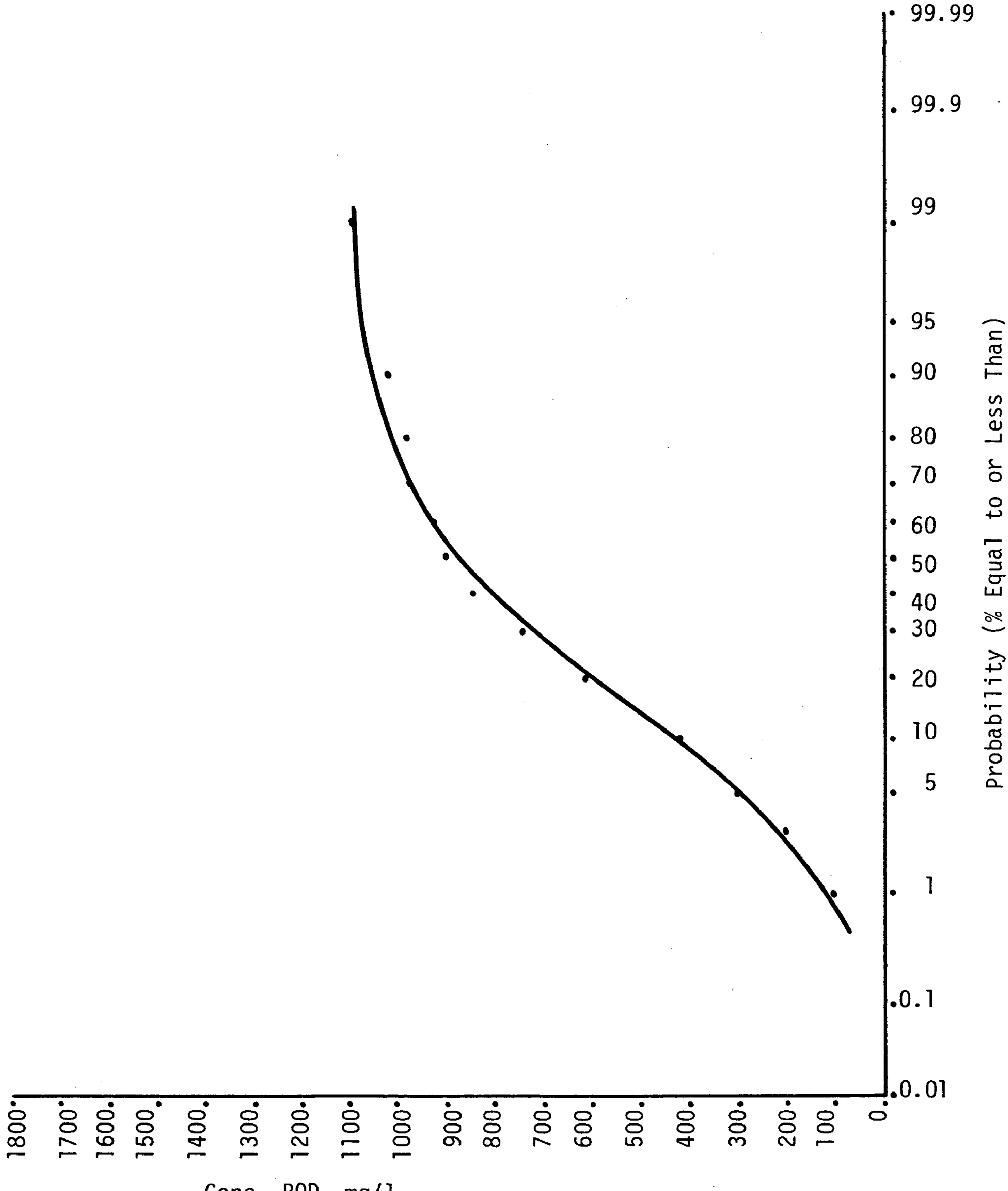


Figure 6 BOD_5 Concentration (Pressing Season 1971)

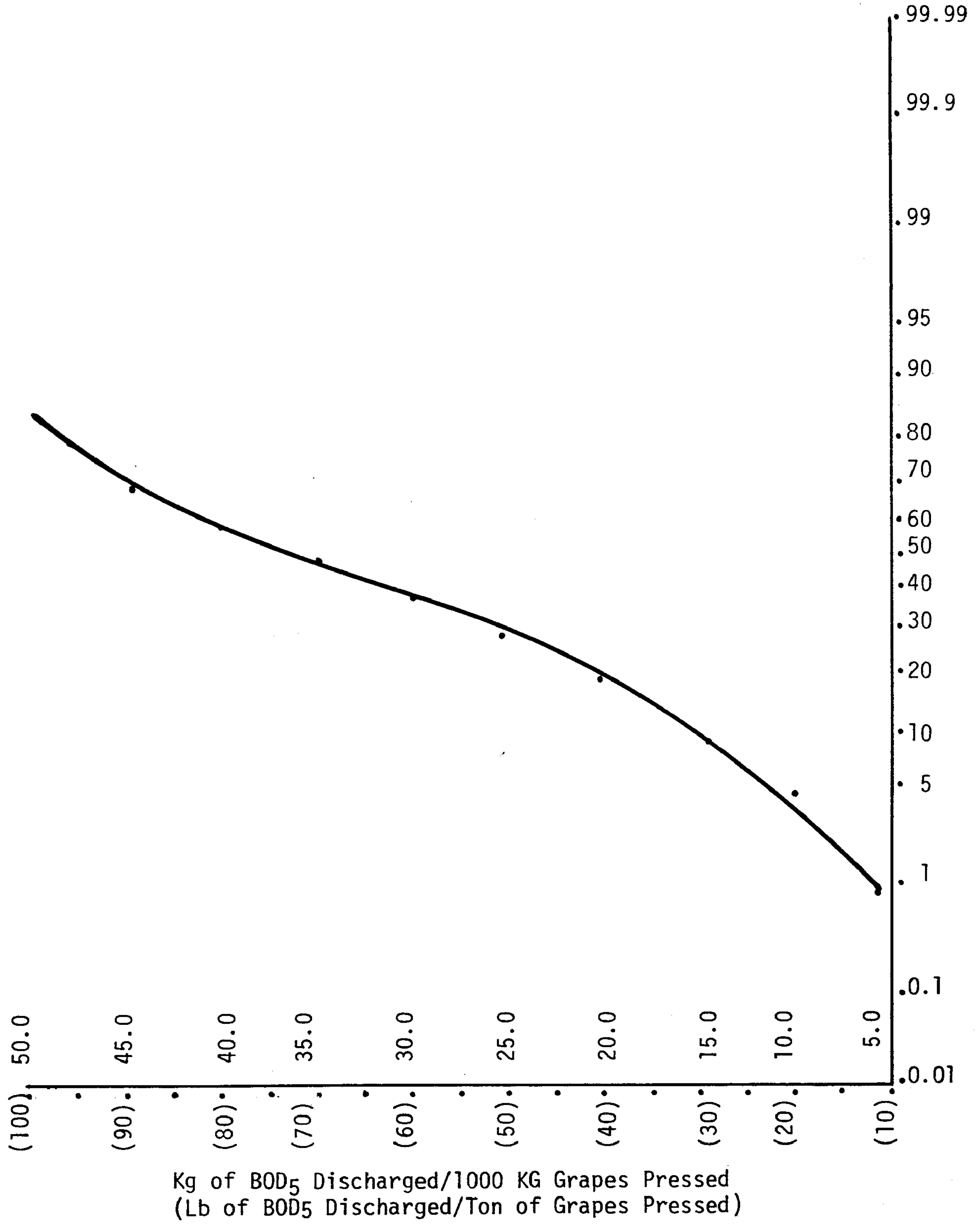


Figure 7 Lb of BOD_5 Discharged, Pressing Season 1971-72

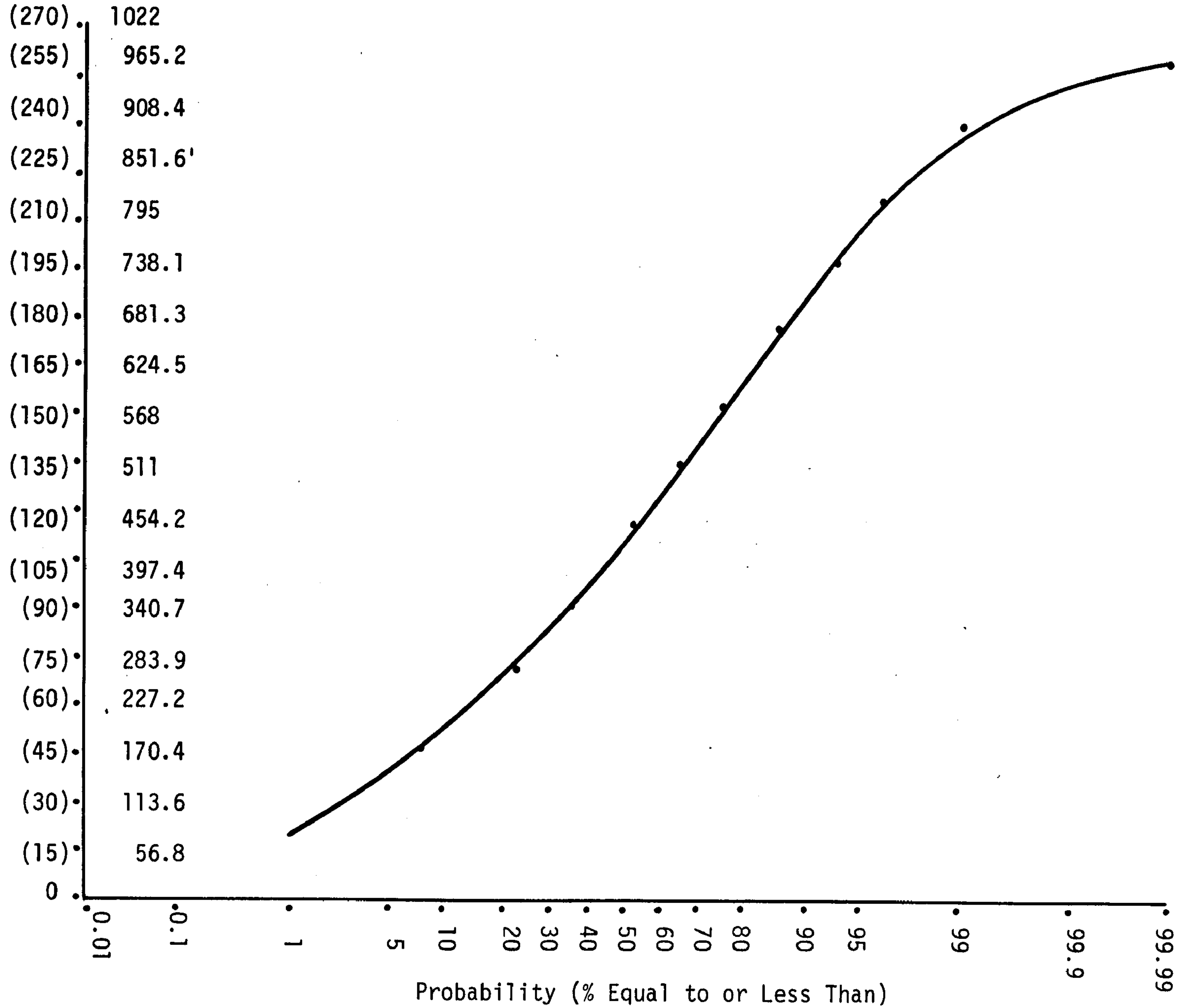


Figure 8 Wastewater Flow, Processing Season (1971-72)

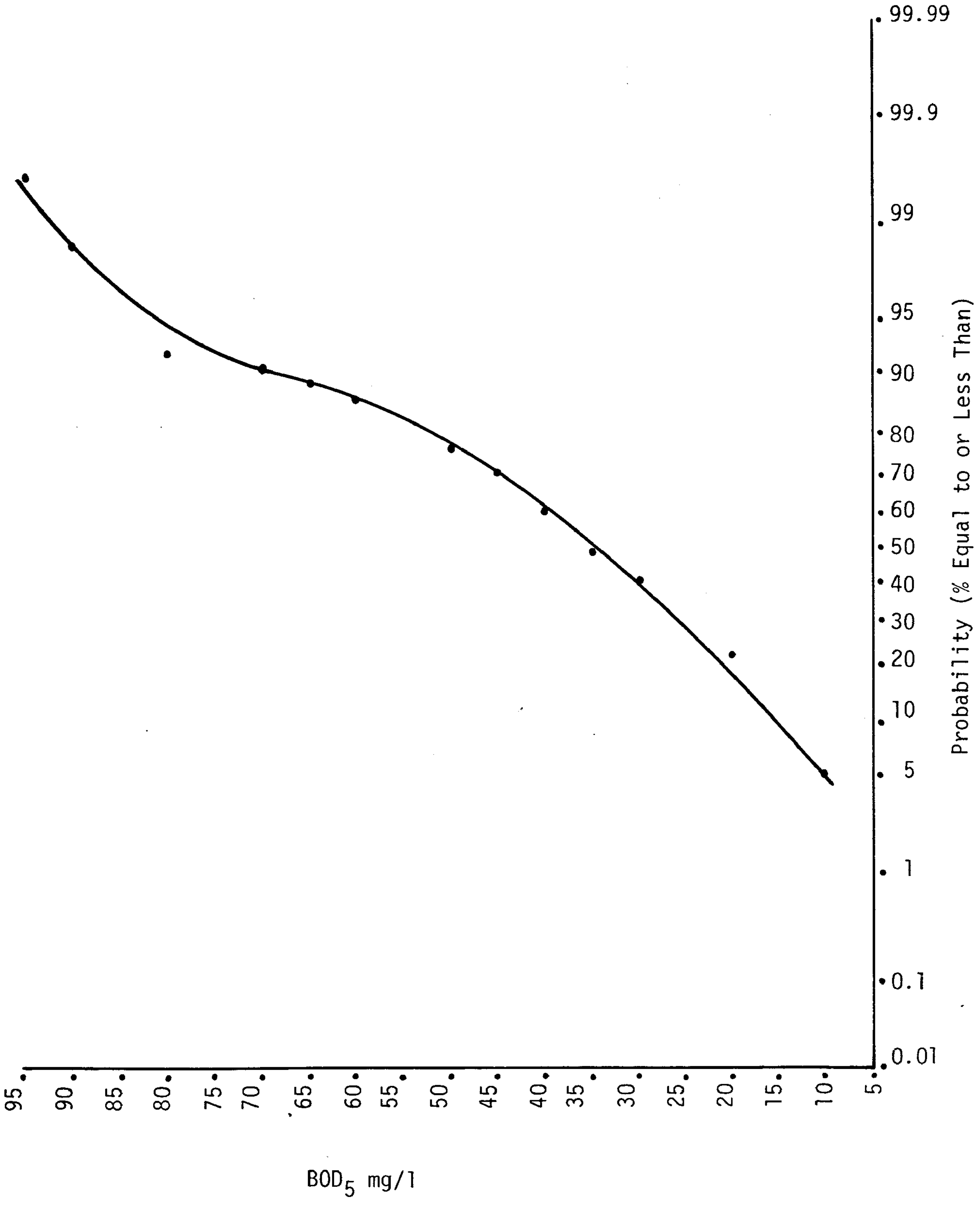
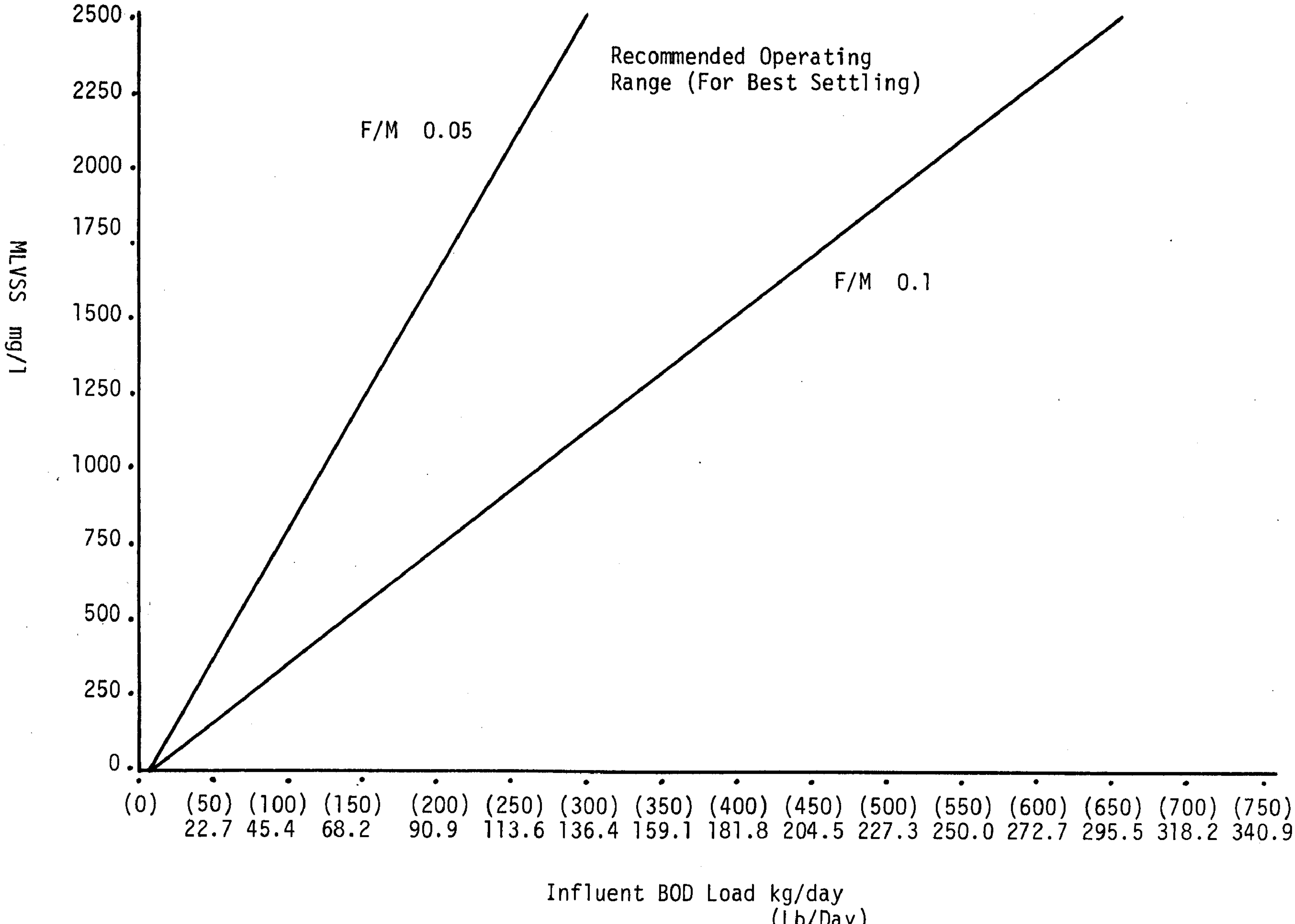


Figure 9 Concentration of BOD_5 in the Plant Effluent (Processing Season 1971-72)



(Basins 1 & 4 Operated in Series)

Figure 10 Aeration Basin Operation Guide (F/M)

The average BOD_5 concentration (mg/l) in the clarified effluent changed very little with changes in F/M ratios, Figure 11. However, by operator observation the system seemed most stable when operated within the range of 0.1 to 0.05. Sludge settling was affected when operating out of the suggested range although SVI data is limited. SVI's of under 100 are most generally seen. Figure 12 plots the effluent TSS as a function of the SVI. Some scattering of the data is seen. The SVI data indicates that most generally a good settling sludge is formed. On occasion filamentous organisms caused poor sludge settling. Most of the problems associated with solids in the effluent developed during the cold weather operation when the temperature of the basins was below 4°C. At this time, even though the SVI data indicated good sludge settling, a pinpoint floc would pass through the clarification equipment and raise the solids level of the effluent.

Figures 13 and 14 illustrate the BOD_5/COD ratio during pressing and processing season on the influent and effluent. A BOD_5/COD ratio of 0.42 and 0.51 respectively was found in the clarified effluent during the pressing and processing seasons. A BOD_5/COD ratio of 0.66 and 0.75 respectively was found on the influent during the pressing and processing season.

The influent pH averaged 7.4 while the effluent pH averaged 7.6. Preliminary data indicated a need for pH control due to low pH values found on the wastewater. Consequently, caustic metering equipment was installed. The equipment was seldom used as the influent pH was in a suitable range for treatment. A good explanation for this change in influent pH cannot be given but it is, most likely because of the caustic cleaners used in the cleanup of winery equipment.

Through the cold winter months, temperatures of 1° and 2°C were encountered in the aeration basins and on the final plant effluent. The effects of the low temperature can best be noted in the color of the aeration basin solids (MLSS). As winter comes on the color changes from a brown to a grey and as the weather breaks the color returns to brown. During the grey state the solids become dispersed and removal is difficult. Also problems are encountered in meeting the effluent solids requirements established by the

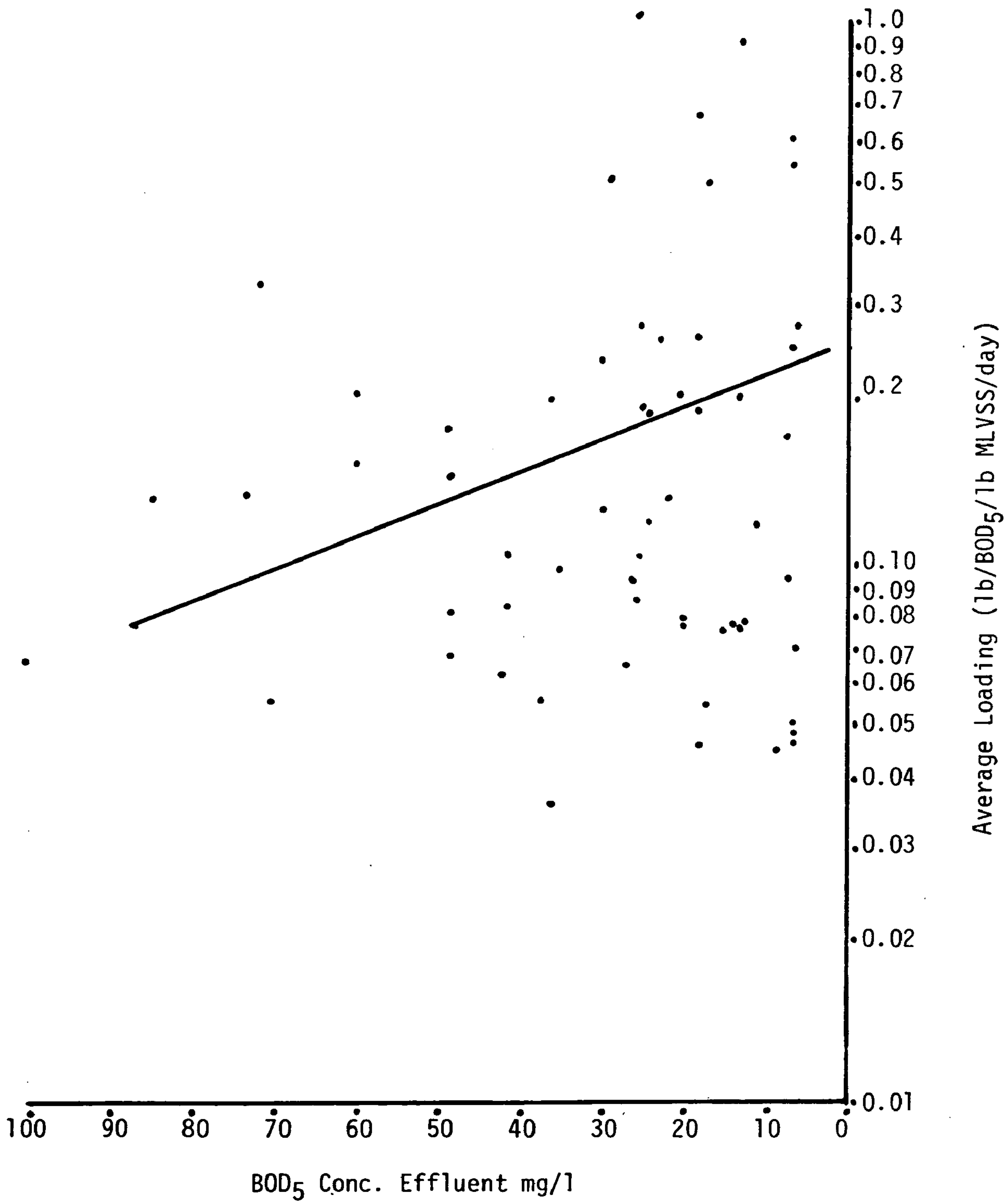


Figure 11 Effluent BOD_5 vs. BOD_5 Loading

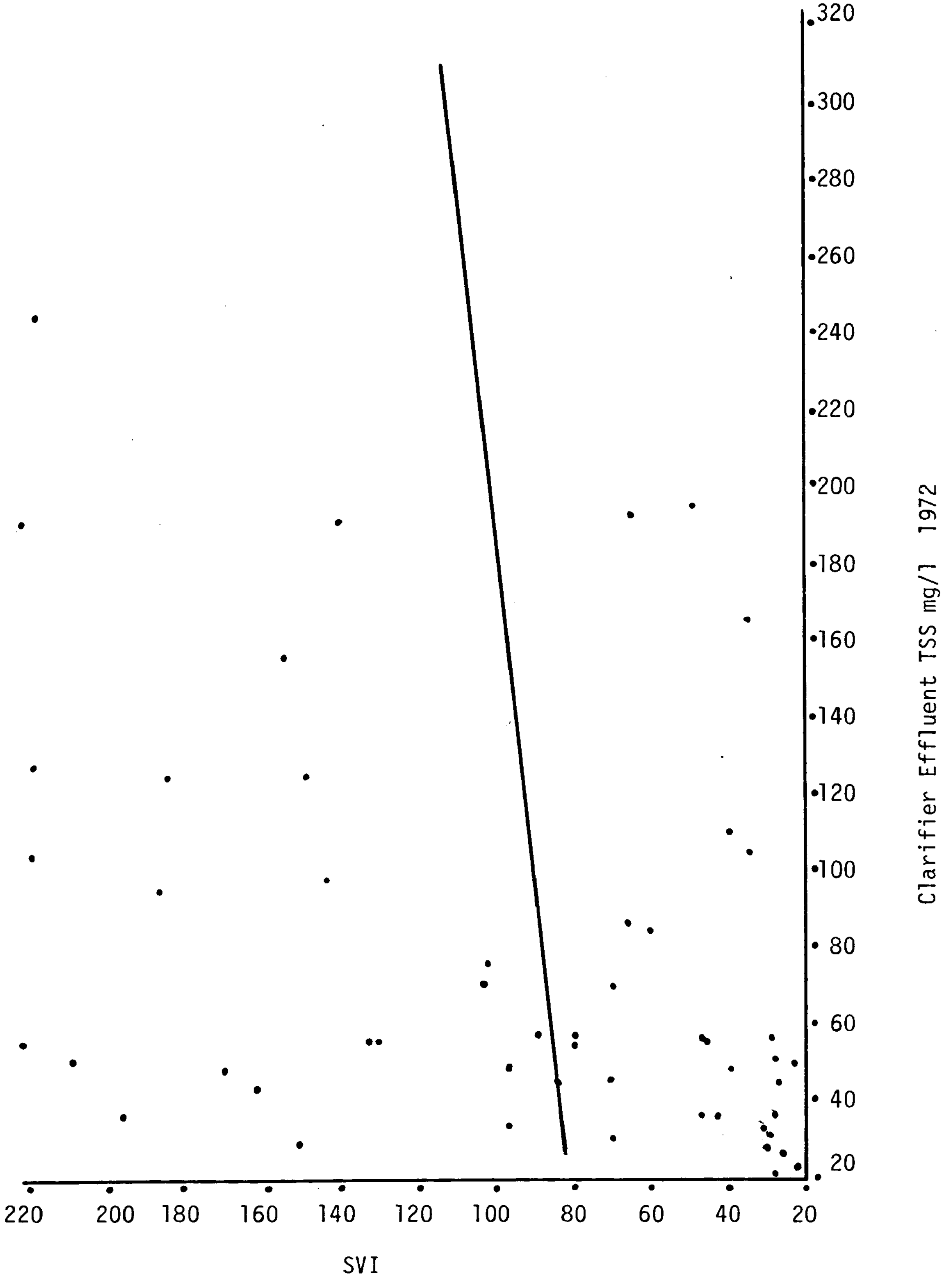


Figure 12 Clarifier Effluent TSS vs. SVI (1972)

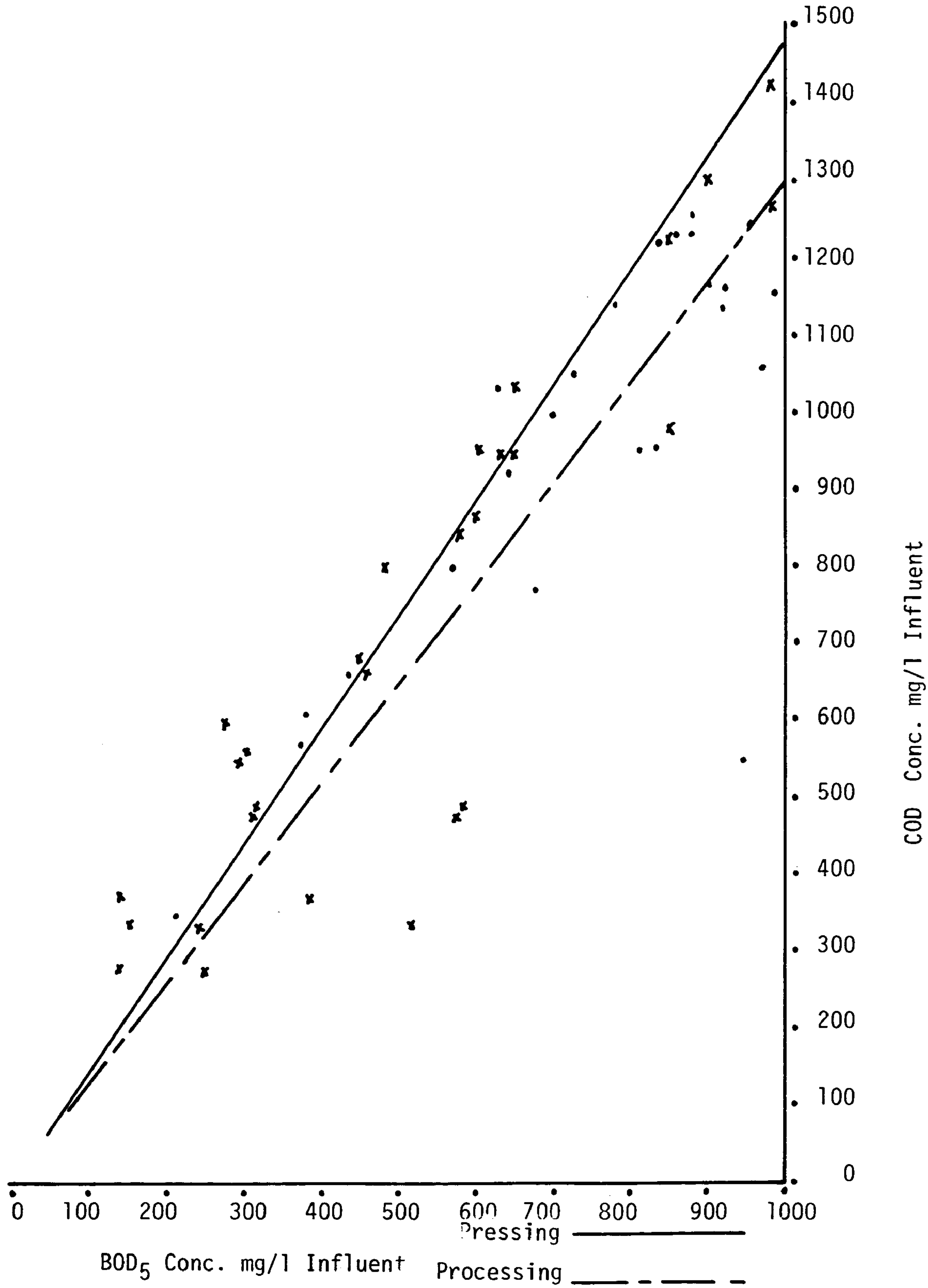


Figure 13 Influent COD mg/l vs. Influent BOD_5 mg/l

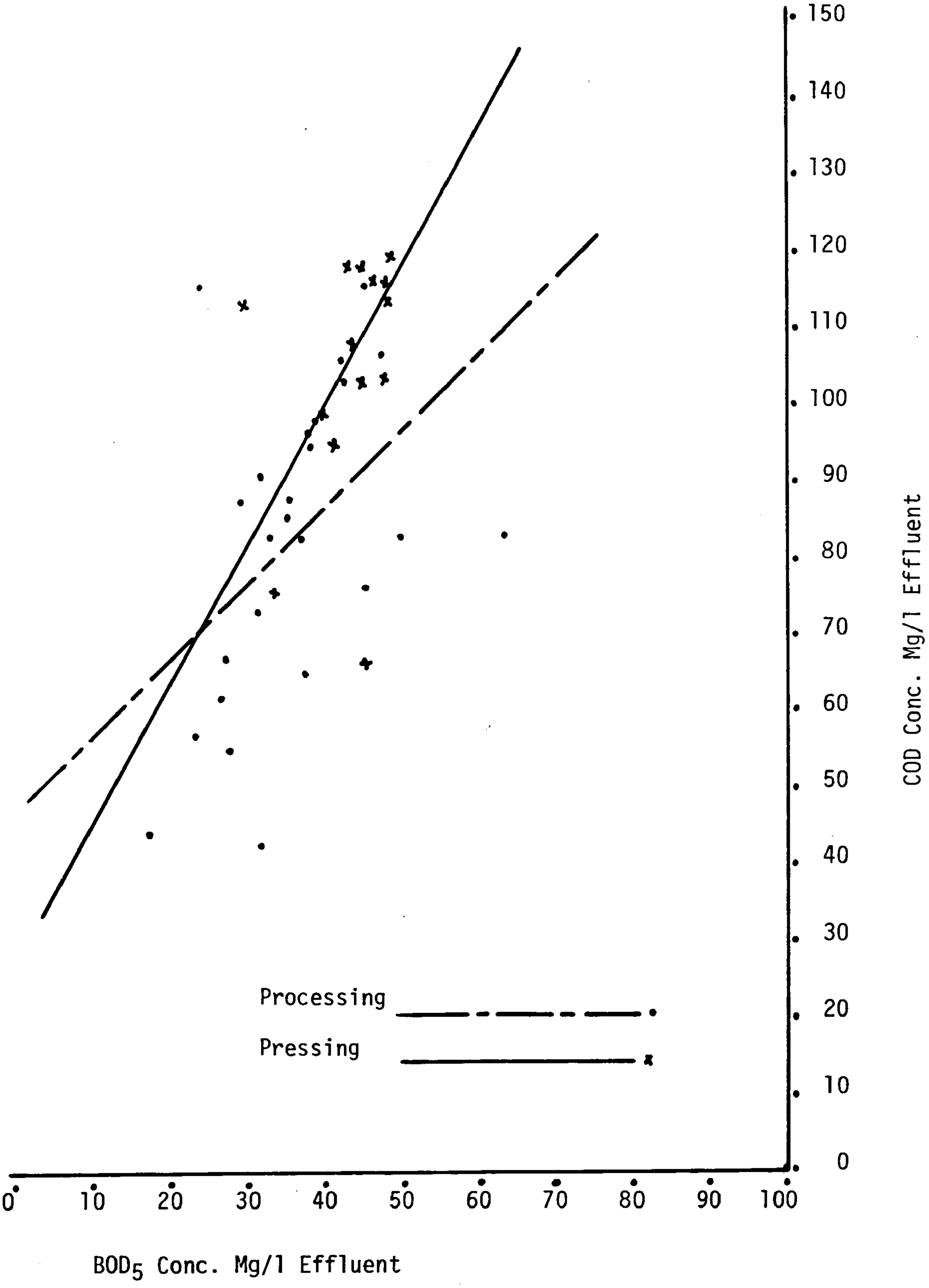


Figure 14 Effluent COD Mg/l vs. Effluent BOD_5 Mg/l (1971)

EPA permit shown in TAble 6. Most generally you would expect color of the MLSS to be affected by the F/M ratio or aeration. In this case the F/M was stable and temperature seemed to be the only significant variable other than the poor mixing ability of the aerators during the cold weather which may have caused poor sludge aeration, although basin D.O. measurements are satisfactory.

Table 6 - EPA Permit Requirements
EPA Permit No. NY0001147

Parameter	Daily Ave.Kg/Day (Lb/Day)	Daily Max. Kg/Day (Lb/Day)	Ave.	Max.
BOD_5				
Press. Season	27 (60)	55 (120)	60 mg/l	120 mg/l
Proc. Season	7 (15)	14 (30)	60 mg/l	120 mg/l
Total Suspended Solids				
Press. Season	9.1 (20)	18.2 (40)	20 mg/l	40 mg/l
Proc. Season	4.6 (10)	9.2 (20)	20 mg/l	40 mg/l

Figure 15 compares the average concentration of MLSS going to the clarifier with the clarifier effluent. The line is a regression line computed from all data at design flow 454,249 liters/day (0.12 MGD). The effluent suspended solids would have to be under 10 mg/l to meet the EPA permit requirements. Excellent control and operation of the plant is needed to achieve this goal. However, now that the plant water useage has been drastically reduced, as shown in Table 5 of 175,000 liters/day (46,200 gal/day) during pressing and 89,000 liters/day (23,500 gal/day) during operation, effluent solids levels of 26 mg/l and 51 mg/l respectively could be discharged and be in compliance with respect to the lb of solids/day discharged, but the concentration limitation of the solids in the effluent controls the allowable discharge of solids/day and makes efficient operation of the plant mandatory.

Figure 16 compares the solids loading on the clarifier with clarifier effluent quality. This data is comparable to other activated sludge facilities treating food type wastes, loadings of over 25 to 35 lb/sq ft/day tend to yield high effluent solids.

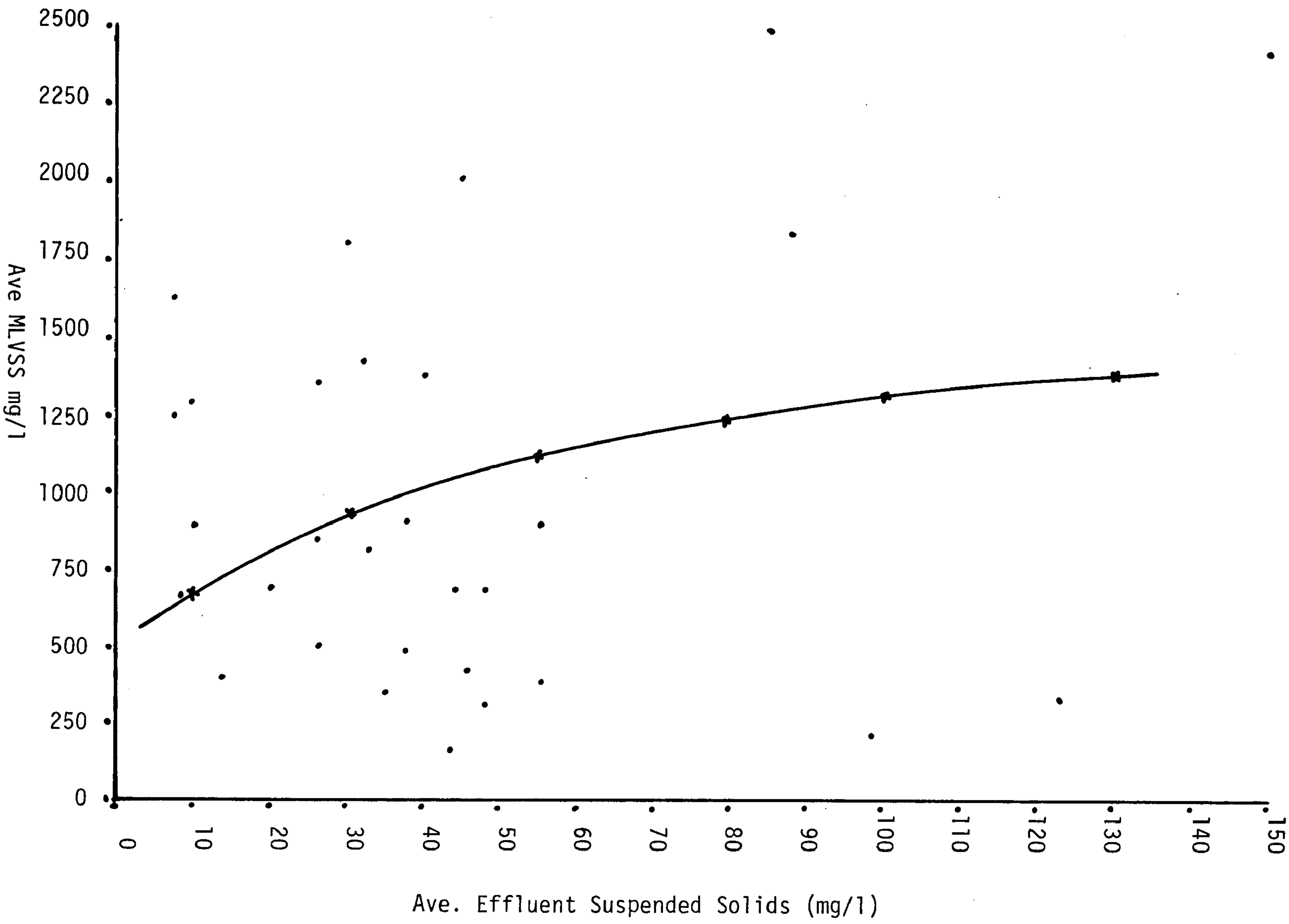


Figure 15 Average Basin MLVSS vs. Average Effluent SS

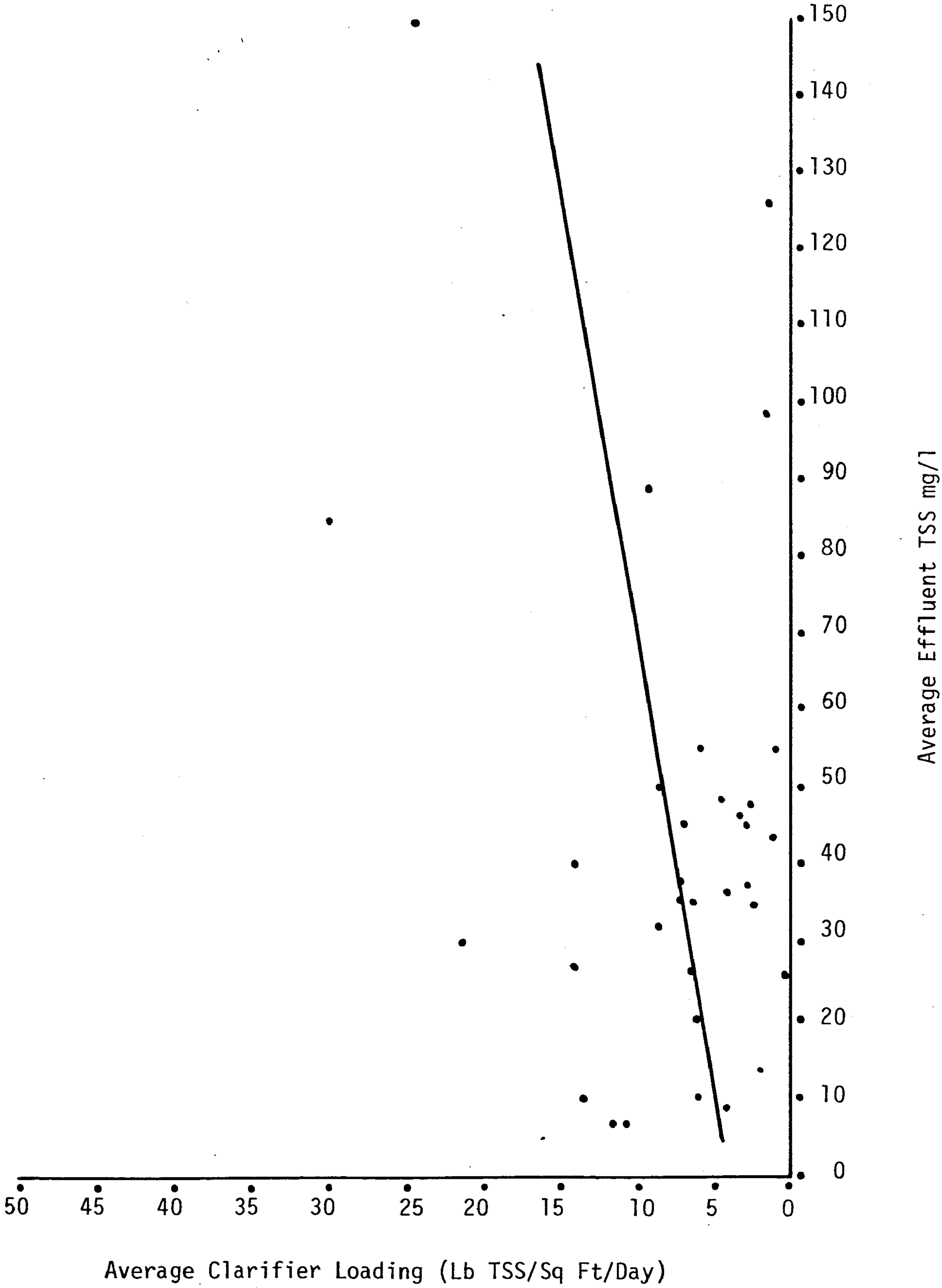


Figure 16 Average Clarifier Loading vs. Average Effluent TSS

Figure 17 illustrates the average BOD_5 removal (%) with aeration basin loading in lb/1000 ft^3/day. The line is linear over the area investigated while operating with F/M ratios of 0.1 to 0.05. Other variables such as MLSS concentration and F/M ratios need to be considered to give this data real value.

Since the wastewater was deficient in both nitrogen and phosphorous an evaluation of N/BOD_5 ratio was made. The data in this investigation is limited and the analysis is based on selected data. Poor nutrient feed pump operation and control is responsible for the limited data. Figure 18 illustrates the improvement in BOD_5 removal with increases in the amount of nitrogen present. The graph indicates that a BOD_5/N ratio of 100/2+ is needed for high BOD_5 removal rates.

With respect to P/BOD_5 ratios it appears that the lack of phosphorous hinders the BOD_5 removal more than does the nitrogen, Figure 19. This figure indicates that a BOD_5/P ratio of 100/3+ is needed for good BOD_5 (98+%) removal. These investigations would then tend to indicate that for winery wastewater treatment a BOD_5/N/P ratio of around 100/3/3 would yield higher BOD_5 removals than the usually considered ratio of 100/5/1. For short periods the facility was able to achieve very good BOD_5 removals. The BOD_5/N/P ratios at these times may have been in the range suggested above although conclusive data is not available.

Table 7 illustrates, by bar graph and comment, the average BOD_5 removal/month with associated problems during the grant (1972). Many of these problems have been corrected.

In general low settleable solids concentrations and high dissolved solids are typical for grape processing and pressing wastewaters. Grape juice normally contains about 10 to 16% sugar. The percentage of volatile solids in the activated sludge produced by the treatment system is lower than expected from sludge produced in a system treating a food type wastewater. This may be attributed to filter aid in suspension from the clarification of wine.

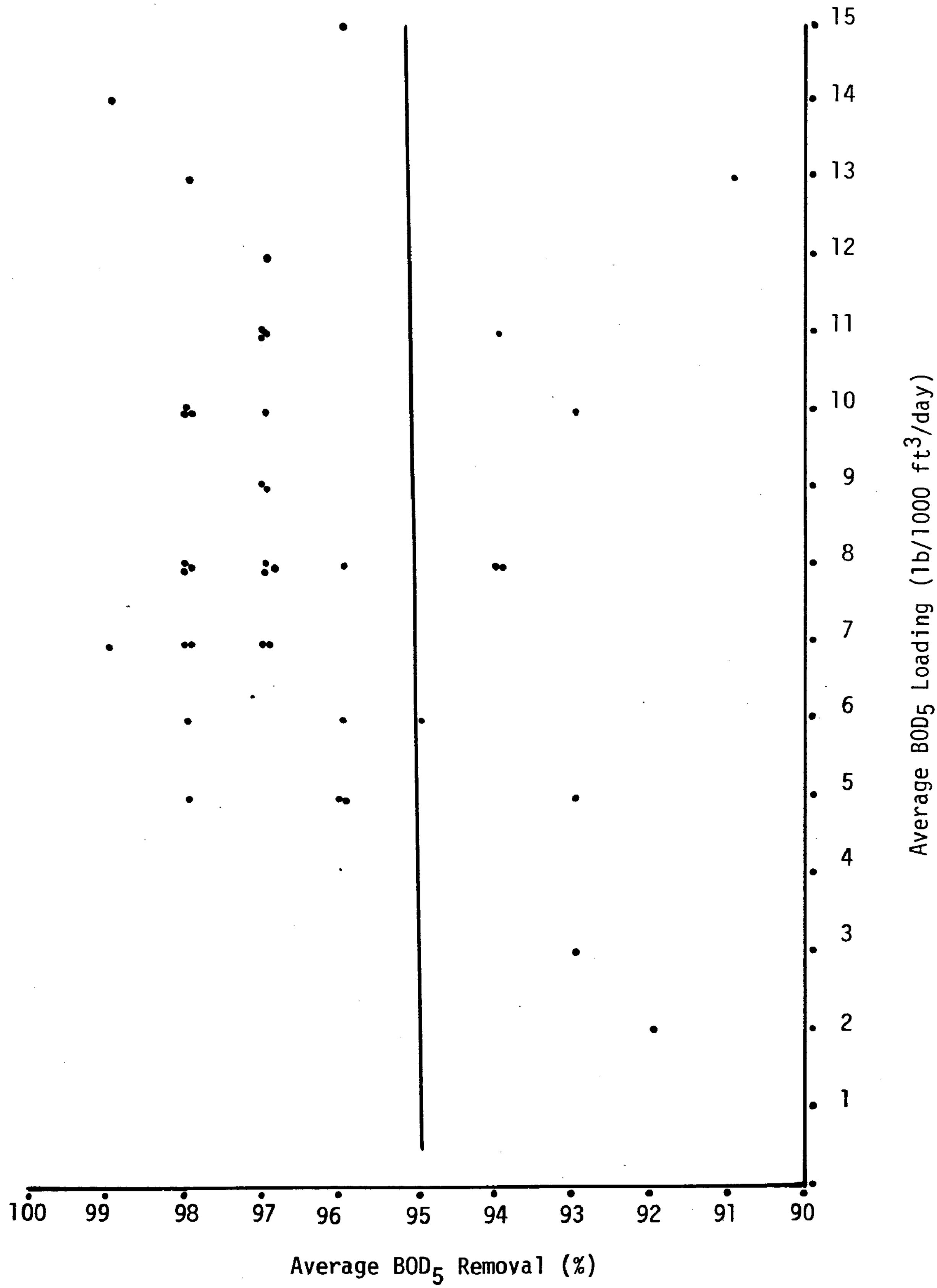


Figure 17 Average BOD_5 Removal vs. Average BOD_5 Loading

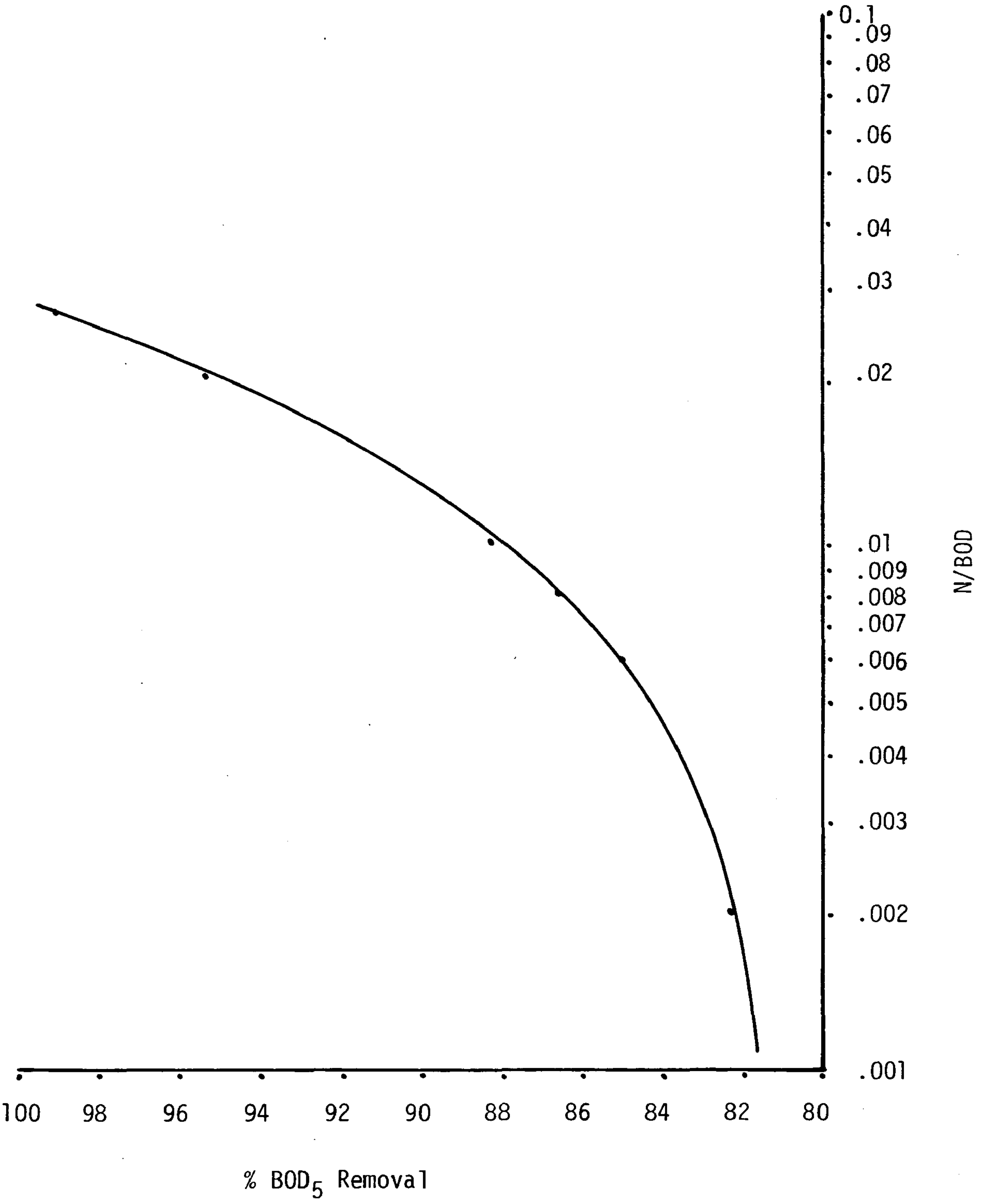


Figure 18 Average BOD_5 Removal vs. N/BOD

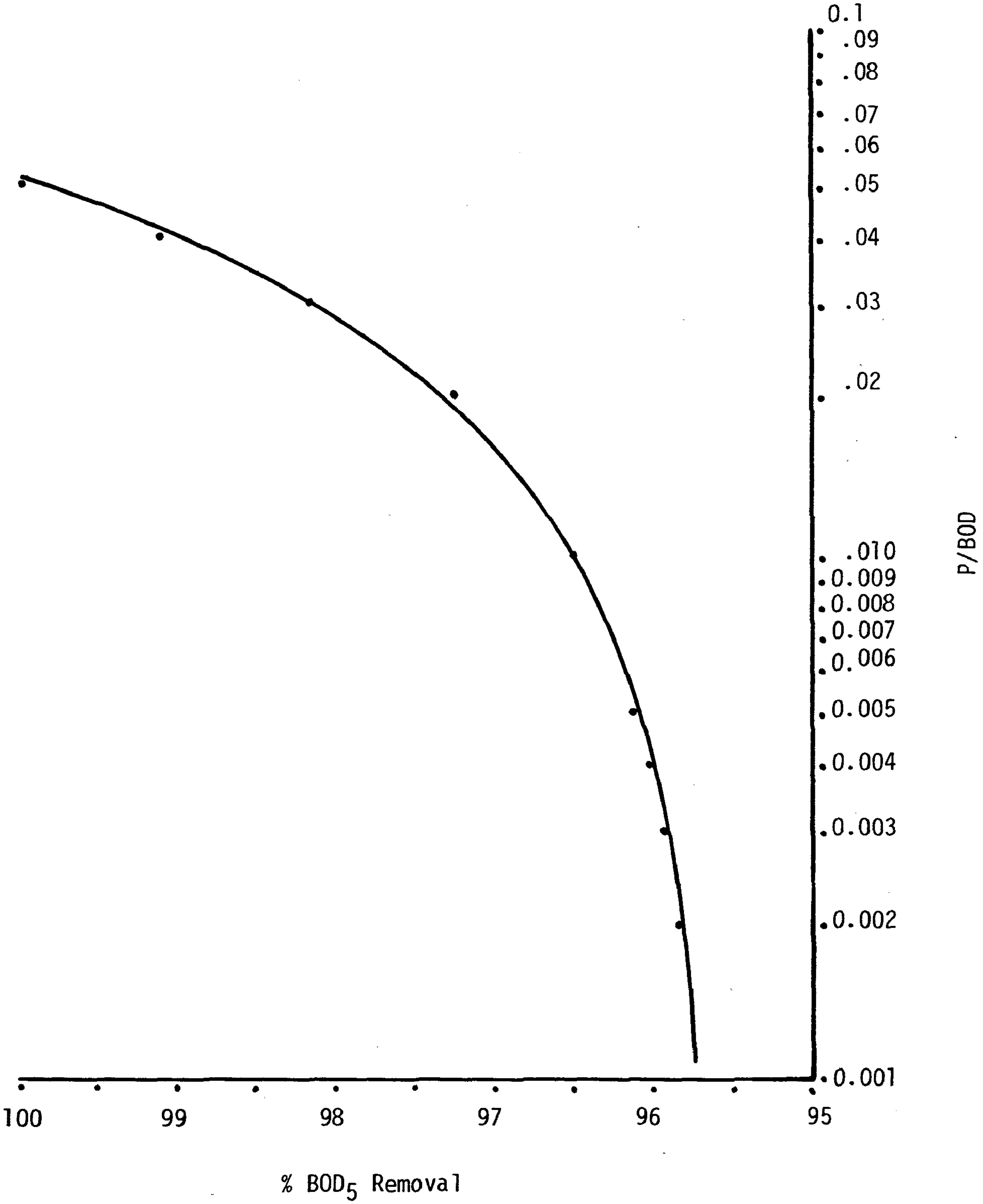
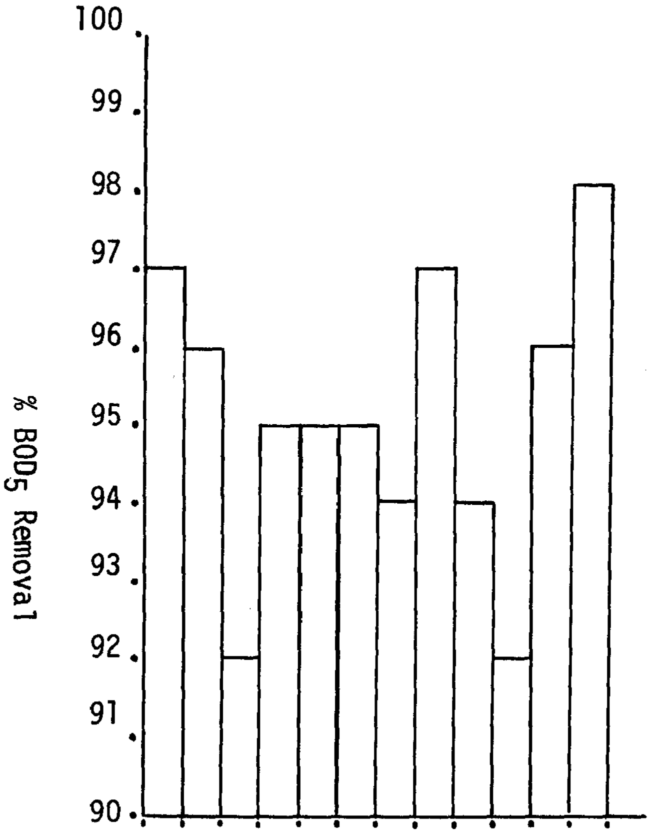


Figure 19 - Average BOD_5 Removal vs. P/BOD



Problem

Jan - Aeration basins frozen over, poor solids suspension

March - Spring breakup, color changed from grey to brown, gradual improvement.

April) May) June) - High water level in receiving stream, water backed up into filter clear well.

July - Sand filter problems

Sept - Basins upset, losing solids

Oct) Nov) - Back in control, improvement expected

Dec - Cold weather causing poor settling sludge, good BOD removal but decreases expected

Table 7

Average BOD_5 Removals by Month During the Grant Study Period with Comments on Problems

The reaction rate established from field data was calculated using the equation presented in Section IV and is shown below:

$$k = \frac{So - Se}{Xvt\ Se}$$

Reaction rates were established at 0.0066 at 20°C, Figure 20, for the pressing season and 0.022 at 20°C, Figure 21, for the processing season. k in these calculations is equivalent to mg/l of BOD_5 removed/day - mg/l of MLVSS - mg/l BOD_5

The operating temperature during the pressing season did not vary enough to make the reaction rate coefficient k valid outside of the 15 to 25°C area. This is due to the very short time (about 6 weeks) period for the pressing season and the beautiful weather usually experienced this time of year. The line is a straight line of regression using all data from the period. Values outside of the 15 to 25°C area are off the line. Interpolations outside this area would be in error. The regression line for the processing season covers the operation for the remainder of the year. Sufficient data was obtained to cover a wide temperature range (about 2°C to 25°C).

For design purposes a reaction coefficient of 0.003 was assumed. The reaction coefficient developed using units of concentration is discussed by Eckenfelder and Adams.[3]

The sand filter being used as the tertiary treatment step in the wastewater treatment plant was divided into two cells. As the filter was first placed into operation a backwash cycle of five minutes was employed about every other day, alternating the cells. Poor backwash was experienced,[5] and modification of the filter under drain system corrected this problem. Presently, backwash cycles of three minutes duration are completed as needed (reduced filter rates indicate when a backwash is necessary). The cycles are about every two days alternating the cells. During the summer a backwash is only needed once every two weeks. Figure 22 is a regression line through the scattering of points plotting filter influent (clarifier effluent) TSS vs. filter effluent TSS. The filter significantly (20 to 25%)

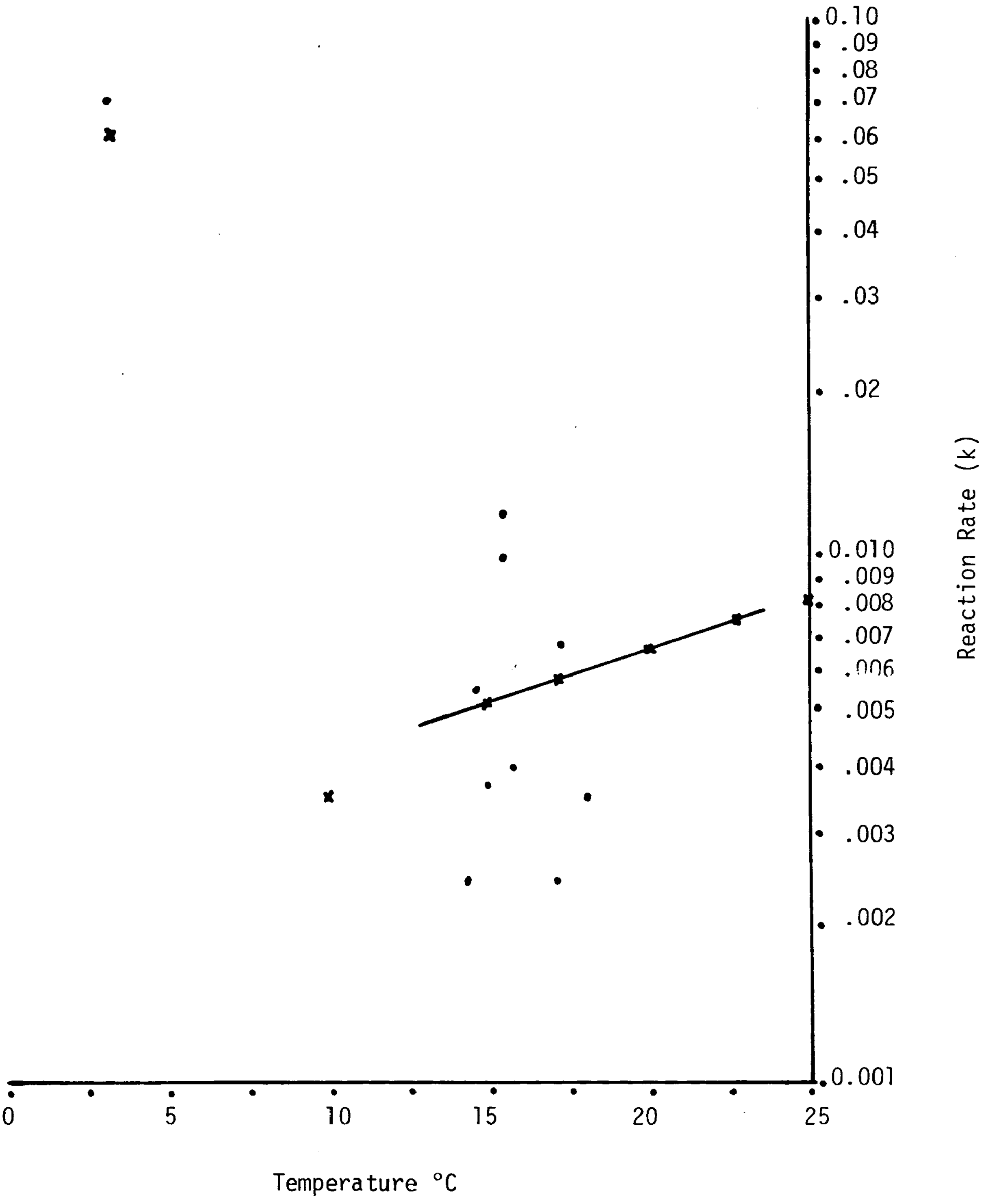


Figure 20 Substrate Removal Coefficient vs. Temperature
Pressing Season 1971

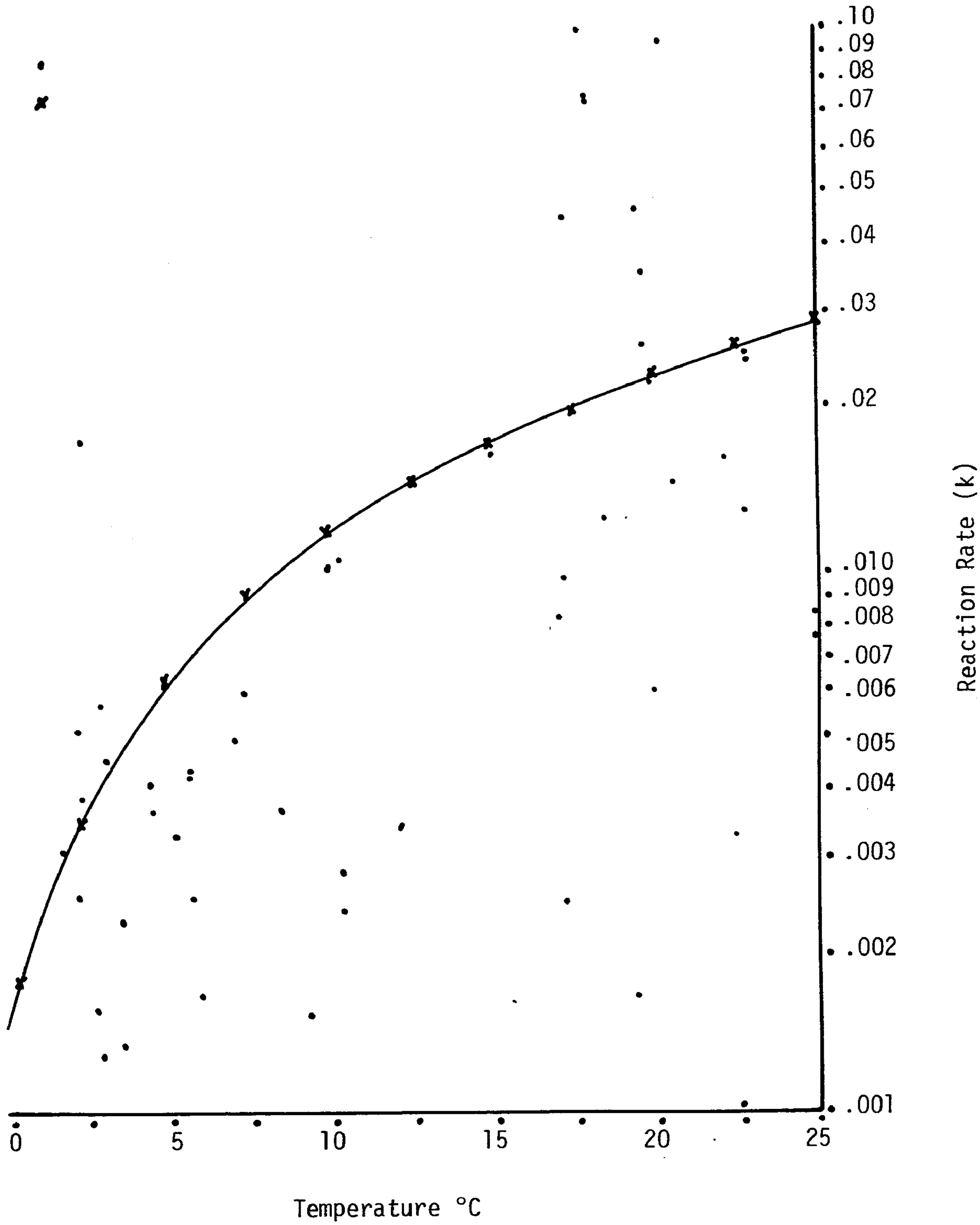


Figure 21 Substrate Removal Coefficient vs. Temperature
Processing Season 1971-72

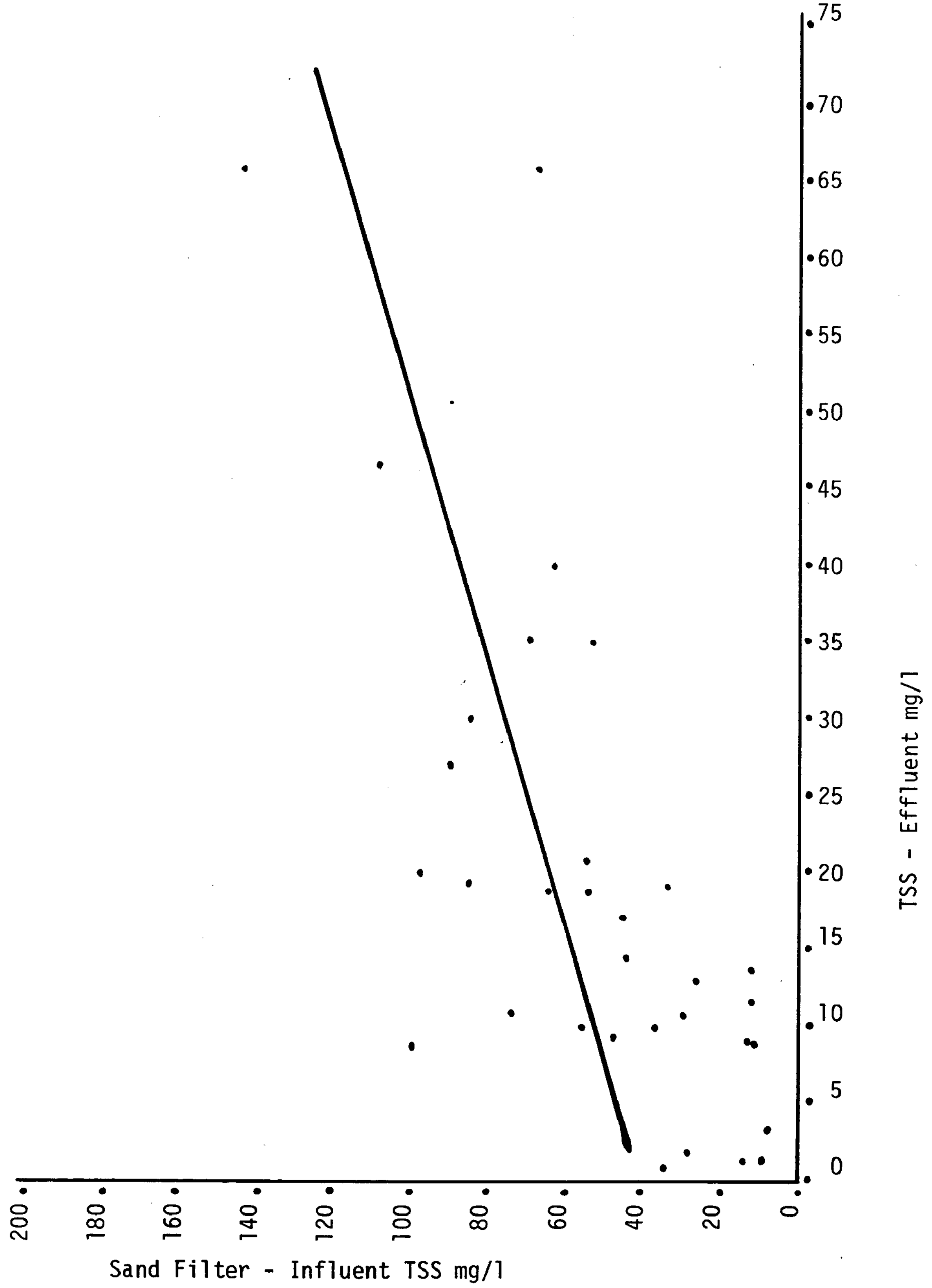


Figure 22 Sand Filter Performance

reduces the solids concentration in the filter influent, the amount of reduction dependent upon the feed concentration. Figure 23 plots the influent BOD_5 against the effluent BOD_5. Very small reductions in BOD_5 are seen through the filter indicating that the light, fine solids escaping is mostly inert matter. Figure 24 illustrates the concentration of the average effluent soluble BOD_5 as a function of effluent TSS. Referring back to Figure 23 and noting the considerable scattering of the data in Figure 24, a reliable correlation between effluent TSS and effluent soluble BOD_5 concentrations probably cannot be done. A regression line was calculated and perhaps could be used for estimations of one variable based on the concentration of the other.

Mode of Operation

During the grant period basins 1, 2, 3 & 4 were all used. The major part of the work was completed using basin 1 and 4 in series. Because of start-up problems and cold weather operation it was impossible to operate parallel flows for a significant period of time. All data reported on was taken from operating the facility using basin 1 and 4 in series with the south clarifier and following the clarifier is the sand filter. The filter was out of service during the summer of 1972.

Analytical Data

All analytical data was obtained using good laboratory techniques and following the analytical test procedures outlined in the 13th Edition of Standard Methods for the Examination of Water and Wastewater.

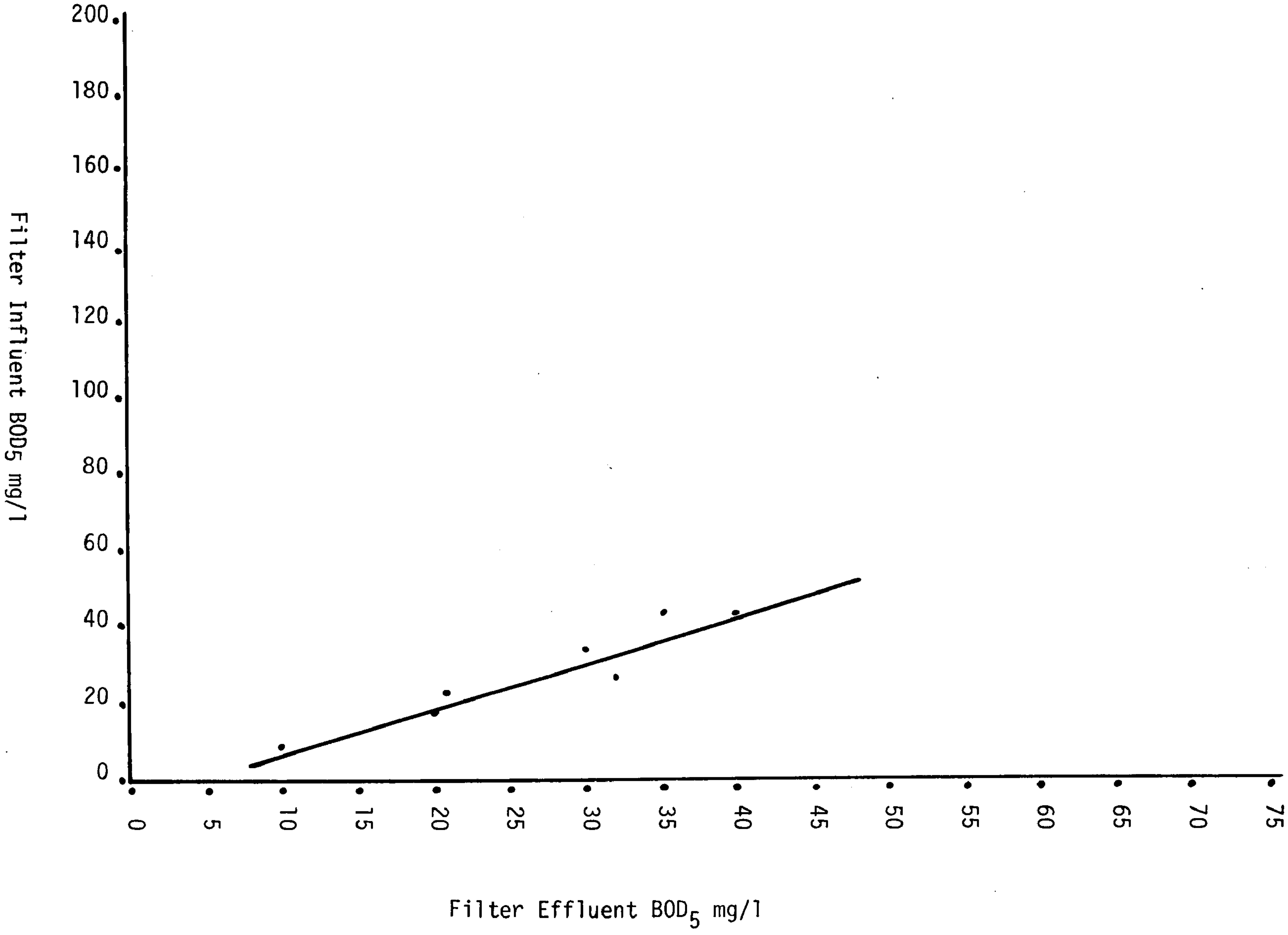


Figure 23 Sand Filter Performance

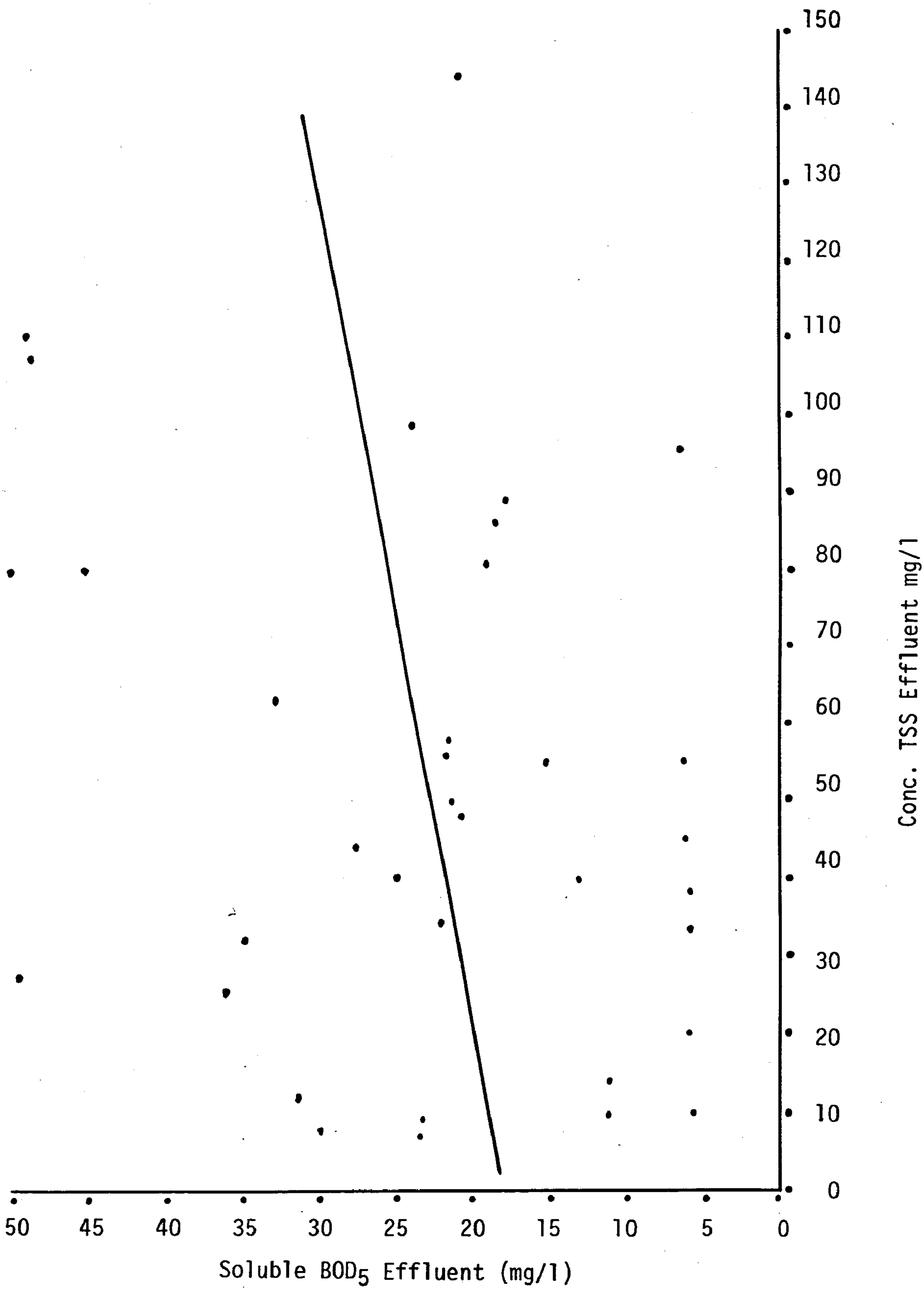


Figure 24 Average Soluble BOD_5 Effluent vs. Average Effluent TSS

SECTION V
OPERATING PROBLEMS

The system has proven to be reliable and quite stable when given the proper operator attention even though it is operated intermittently (no flow at night or on the weekends). EPA permit conditions can generally be met when the water temperature is above 4 to 6°C. During the cold months the water temperature drops to 0 to 2°C and solids in the effluent become a problem. Modifications will be required to increase the operating temperature in order to meet the permit conditions during the cold weather operation.

During the initial startup and operation, problems developed in several areas:

Aerators

The aerator drive motors would kick out on the slightest overload. They also seemed to run quite hot. Work by the aerator and motor manufacturer gave little improvement in operation. Apparently, the motors and aerators are designed right at the optimum hp leaving no variance for electrical surges or imbalances and momentary overload conditions.

The mixing ability of the aerators is poor under icing conditions. If the motors overload and kick out allowing the basin solids to settle, the aerators will not resuspend the solids upon starting. This condition may be the reason that during the cold months the color of the sludge changes while the basin D.O. is high and a dispersed floc forms.

Also, if the surface of the basin shows signs of freezing during winter weather conditions the aerators would accumulate ice around the drive shaft and paddles. Ice accumulation would cause aerator motor overload. Spray deflectors were installed above the paddles to prevent the freezing problem. The deflectors were quite successful.

Diverter Boxes

The diverter boxes experienced freezing problem. Better insulation should provided to prevent stoppage of the water during icing conditions.

Pipe Line Plugging

Various problems developed with pipe line plugging and debris. The pH probe was continually being fouled with debris. The sludge return lines were also plugged often. Clean out access needs to be provided and the lines should be kept as short as possible. The sludge pump suction line was quite long and experienced considerable plugging.

Nutrient Feed Pumps

The nutrient feed pumps were troublesome and unreliable. Also ammonia fumes in the control building was a nuisance, at times causing severe irritation to the operator. The nutrient feed area should be well ventilated and separated from the control room.

Sludge Metering

Sludge metering was based on the pumping rate of the sludge pumps at various RPM's. A tachometer was provided to measure the RPM of the pump for calibration and control. The tachometers were unreliable as was the variable drive on the pump.

Aerobic Digester

The aerobic digester never operated as expected partially due to the cold weather and inexperienced operators. Due to the physical size of the facility and the organic loading, the sludge being generated was relatively quite small and accumulations of the sludge in the digester was such that if the digester was cleaned out about twice a year it could handle the sludge produced. Cleaning was during the warm weather months (spring and fall). If the digester was protected from the cold weather, it would have been more efficient and would have required cleaning only once. Even though these problems were experienced this method of sludge digestion and disposal appears to be a good method for a small plant.

Sample Pumps

The sample pumps were plugged quite often. In view of the numerous plugging problems with debris, perhaps some thought should be given to improved rough screening of the wastewater prior to the secondary treatment system.

Winter Operation

The major problem was because of the freezing weather conditions during winter operation. The aeration basins, clarifier and diverter boxes and lines need to be protected from the weather or in the case of the aeration basins perhaps diffused aeration would be sufficient.

Sand Filter

The sand filter had a poorly designed underflow system. The filter experiences considerable problems with plugging and poor backwash. The manufacturer revised this system and the filter now seems to work well. [5]

Infiltration

Some problems were encountered with infiltration to the filter clear well by high water in the receiving stream. Better sealing of the concrete joints needs to be done, also check valves on the effluent line from the filter clear well should be installed (has now been done).

In summary it is evident that the cold weather and low water temperatures were and still are the major operating problems. The mechanical problems can be corrected and/or prevented through modifications and good preventative maintenance program.

Improving the operating conditions with respect to temperature is not an easy matter. A small plant such as this could be built more compactly or even a packaged plant used that could be enclosed from the weather. Diffused air system could be used in place of the surface aerators and a 5 to 7°C increase in water temperature realized. It is advisable to design a facility with operating temperature in mind realizing that temperature of at least 4°C or above should be maintained.

SECTION VI
CONSTRUCTION, EQUIPMENT AND OPERATING COSTS

Bids for the construction of the facility were opened July 24, 1970. The construction contract was awarded to Creekside Construction Company, Inc., Main Street, Honeoye, New York. The electrical contract was awarded to Bruce Mansfield Electric, Inc., 10 Jones Terrace, Holcomb, New York. Table 8 lists the construction, equipment and operating costs.

Table 8
Construction Costs

1.	3279 ft of 8" wastewater sewer line	$32,790,00
2.	16 - 4'0" dia. manholes	8,000.00
3.	Additional work for casing of wastewater line under railroad	5,000.00
4.	Connections of wastewater sewer to existing wastewater outlets	2,000.00
5.	Screen house structure	8,000.00
6.	Screen house equipment	14,000.00
7.	Solid waste storage bin	6,000.00
8.	Entrance structure	14,000.00
9.	Entrance structure equipment	17,000.00
10.	Aeration units 1-2-3-4 & aerobic digester	48,000.00
11.	Final clarifier structures	14,000.00
12.	Final clarifier equipment	6,000.00
13.	Filter house structure	22,000.00
14.	Filter house equipment	17,000.00
15.	Site work	20,000.00
16.	Yard piping	36,000.00
17.	R.O.B. sand & gravel (763 yd)	4,416.00
	Change Order 1	3,500.00
	Change Order 3	2,087.50
	Change Order 4	4,737.62

	Change Order 5	1,055.80	
	Change Order 6	3,468.74	
	Sub-Total Construction Costs		$284,455.66
18.	Electrical Work	$32,000.00	
	Change Order 1	70.80	
	Change Order 2	2,047.72	
	Change Order 3	3,191.95	
	Sub-Total Electrical		$37,310.47
	Total Construction		$321,766.13
19.	Laboratory		5,000.00
20.	Engineering		25,202.40
			$351,968.53
21.	Equipment		
	Wastewater screen	$3,532.00	
	Solid waste conveyor	4,504.21	
	Aerators	16,853.00	
	Sludge return pump	3,250.00	
	Flow metering equipment	2,580.00	
	Nutrient feed equipment	11,240.00	
	Sludge transfer pump	2,269.00	
	Final clarifier equipment	13,889.00	
	Tertiary filter	37,200.00	
	Portable pump	145.00	
	Total Equipment		$95,462.21
	TOTAL PROJECT COST		$447,430.74

22. Operation

Item	1971	1975
Labor	$5,094.77	$7,946.90
Utilities (Electrical)	3,850.00	5,650.00
Supplies	2,072.87	3,223.77
Maintenance	5,047.72	3,994.74
Total Operating Cost	$16,065.36	$20,815.41

23. Tons of Grapes Pressed	5,650	4,488
24. Volume of Wine Bottled	3.544×10^6 liters (936,353 gal)	3.576×10^6 liters (944,787 gal)
25. Operating Cost/Gal of Wine Bottled	$.017	$0.022
26. Operating Cost/Ton of Grapes Pressed	$2.92	$4.26
27. Operating Cost/Lb of BOD Removed	$0.064	$0.49
28. Amortization		
Buildings - 20 years	$200,043 Total $10,002 Annual	
Machinery & Equipment 15 years	$128,963 Total $8,596 Annual	

SECTION VII

REFERENCES:

1. Letter to Mr. Edwin R. Haynes, Widmer's Wine Cellars from Dr. Yong D. Hang, Research Associates, Cornell University, Geneva, New York

2. Weston, R. F., and Eckenfelder, W. W., "Application of Biological Treatment to Industrial Wastes, I. Kinetics of Equilibria of Oxidative Treatment." Sewage and Industrial Wastes 27, 802 (1955).

3. Adams, Carl E. Jr., and Eckenfelder, W. W., "Process Design Techniques for Industrial Waste Treatment" associated Water & Air Resources Engineers, Inc., p 53, 5-2

4. McKinney, R. F. "Biological Design of Waste Treatment Plants". Presented at Kansas City, Section of ASCE Seminar, Kansas City, Mo. (1961)

5. Letter to K. L. Sirrine from Jake Makepeace, Widmer's Wine Cellars concerning performance and modification of the hydro-clear sand filter - Appendix.

SECTION VIII

APPENDIX

CORNELL UNIVERSITY
NEW YORK STATE AGRICULTURAL EXPERIMENT STATION
GENEVA, NEW YORK 14456

A DIVISION OF THE NEW YORK STATE COLLEGE OF AGRICULTURE, ITHACA, NEW YORK
A STATUTORY COLLEGE OF THE STATE UNIVERSITY

CHARLES E. PALM, DEAN OF THE COLLEGE
DONALD W. BARTON, DIRECTOR OF THE STATION

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

January 11, 1971

Mr. Edwin R. Haynes, Vice President
Widmer's Wine Cellars, Inc.
Naples, New York 14512

Dear Mr. Haynes:

Enclosed please find the results of waste treatment experiments.

Table 1 shows the characteristics of waste waters from the pressing of different varieties of grapes. Only Concord grape pressing waste water (10/28/70) was used throughout this work because the concentrations of other grape pressing waste waters (COD) were extremely low.

The data presented in Figures 1 and 2 clearly show that the activated sludge treatment reduced the effluent concentration from 994 mg/l COD or 636 mg/l BOD to 82 mg/l COD or 42 mg/l BOD. The removal rates of COD and BOD were 91.2 and 93.4%, respectively.

During the period of treatment, the pH values of the influent, the mixed liquor and the effluent showed only little variation (Figure 3).

Both the mixed liquor volatile suspended solids (MLVSS) and the sludge volume index (SVI) increased during the first 5 days that the aeration chamber was operated (Figure 4). On the 5th day the maximum was reached, indicating that the system had been stabilized.

It is concluded from the results obtained in this work that the activated sludge process can be used in the removal of over 90% BOD from Winery waste water.

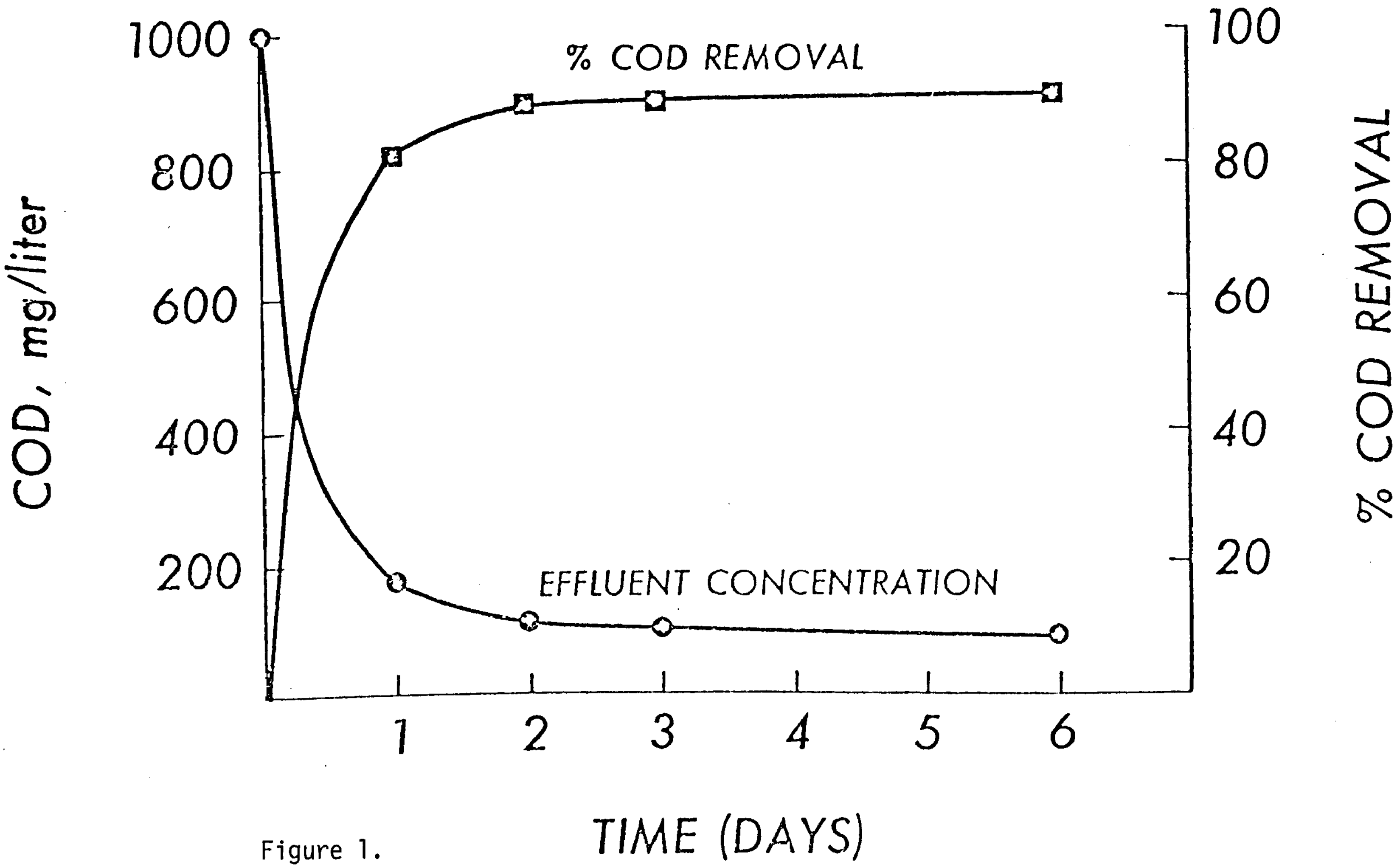
If I can be of further help, please let me know.

Sincerely yours,

Yong D. Hang, Ph.D.
Research Associate

TABLE 1. Characteristics of Wastew Waters from Pressing Different Varieties of Grapes

Varieties of grapes	COD mg/1	BOD mg/1	SS mg/1	VSS mg/1	pH
Concord (10/20/70)	560				6.35
Concord (10/23/70)	nil				7.5
Concord (10/28/70)	994	636	80	64	5.7
Niagara (10/20/70)	20				7.45
Ives (10/20/70)	82				6.8
S-1000 (10/20/70)	nil				7.9



% COD REMOVAL
EFFLUENT CONCENTRATION
COD, mg/liter
1000
800
600
400
200
100
80
60
40
20
% COD REMOVAL
1
2
3
4
5
6
TIME (DAYS)

Figure 1.

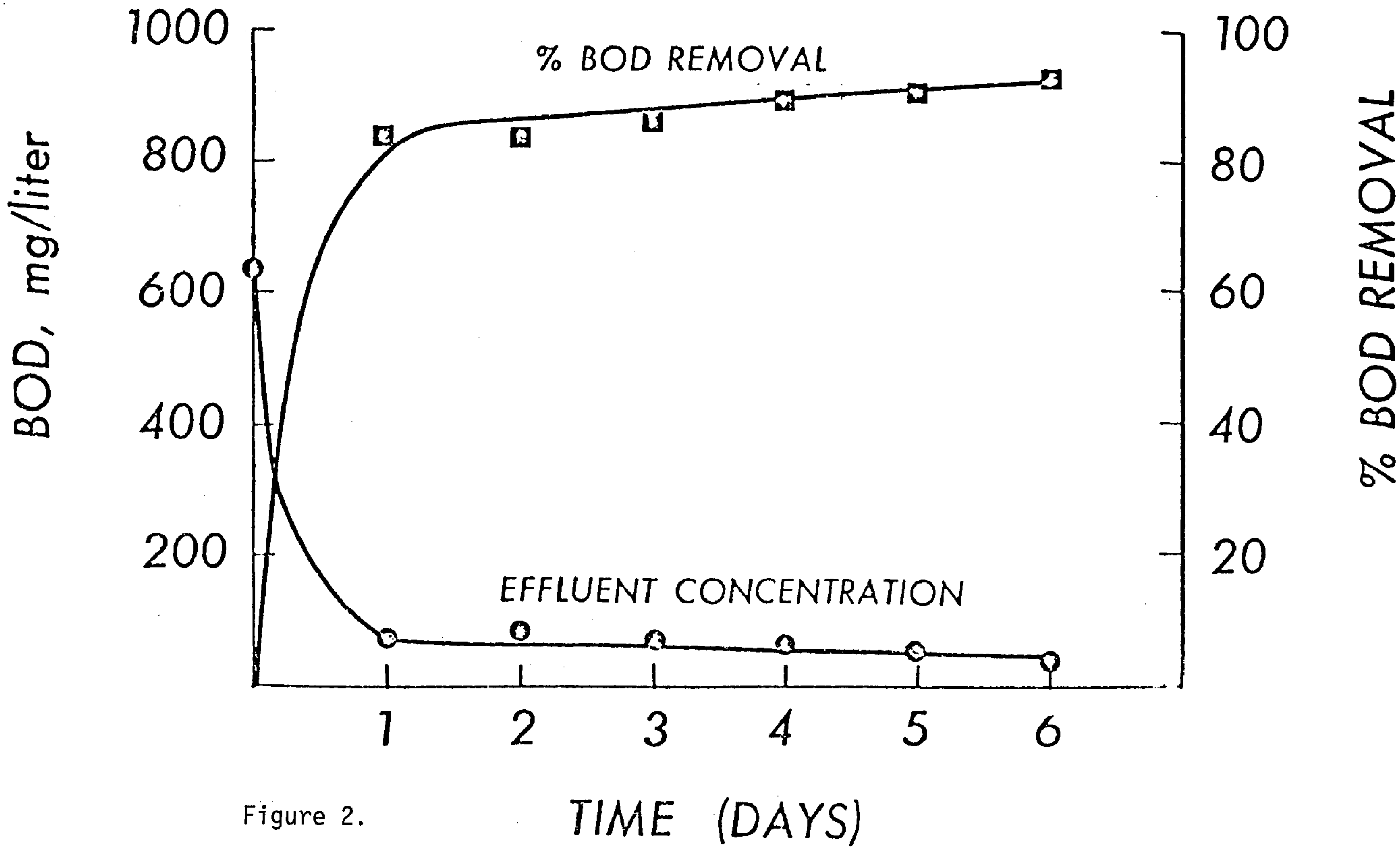

% BOD REMOVAL
EFFLUENT CONCENTRATION
BOD, mg/liter
% BOD REMOVAL
1000
800
600
400
200
100
80
60
40
20
1
2
3
4
5
6
TIME (DAYS)

Figure 2.

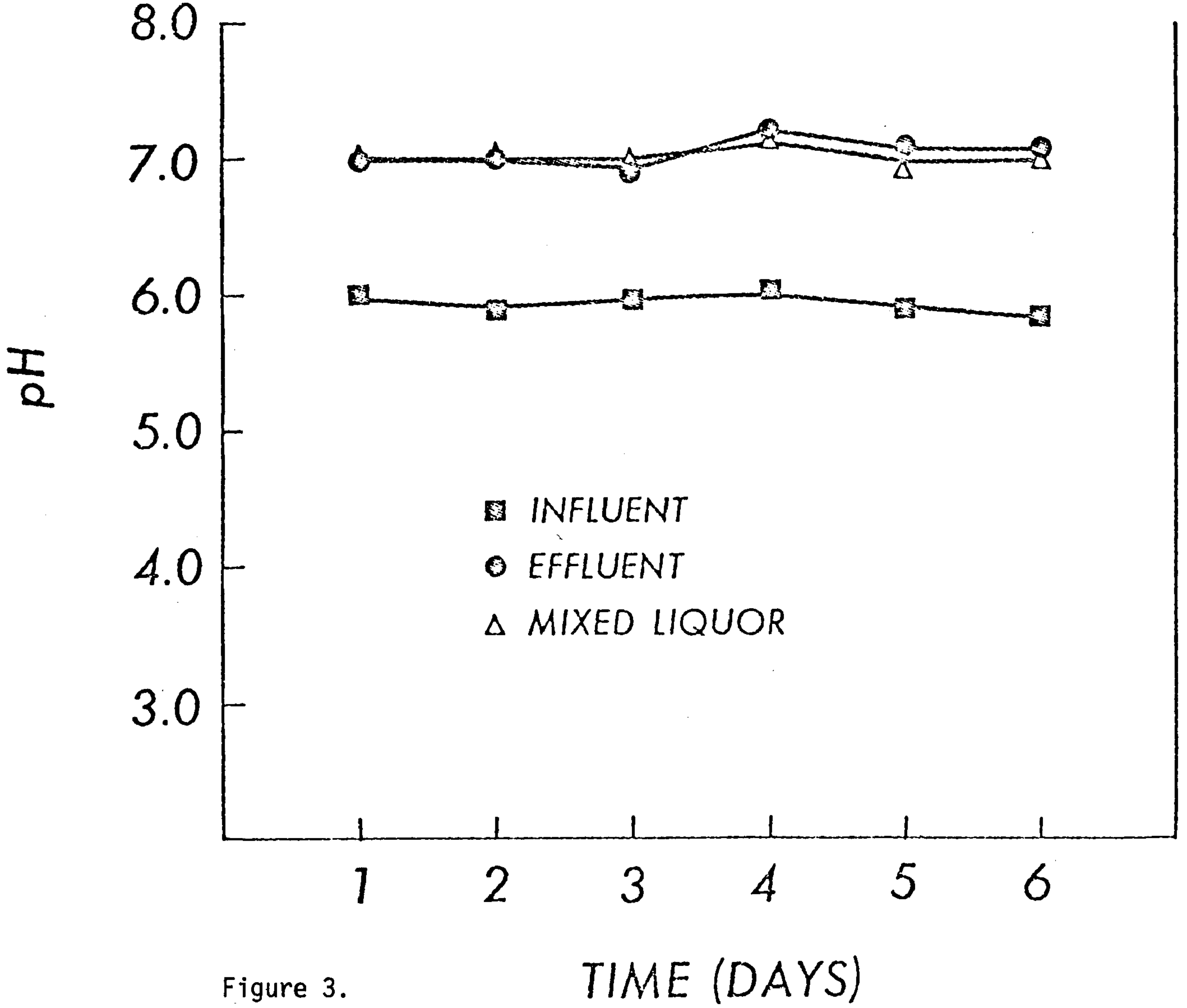

8.0
7.0
6.0
5.0
4.0
3.0
pH
INFLUENT
EFFLUENT
MIXED LIQUOR
1
2
3
4
5
6
TIME (DAYS)

Figure 3.

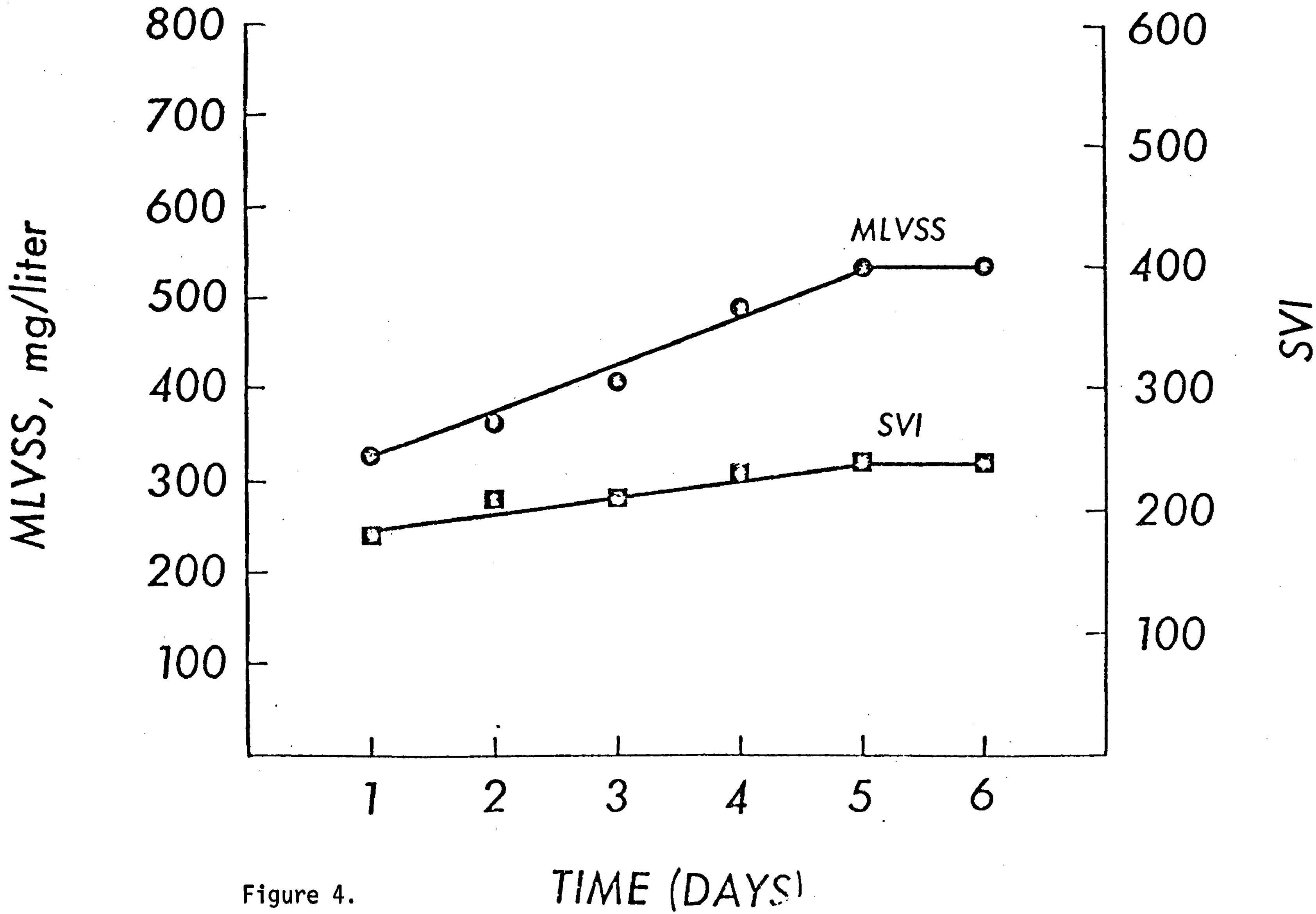

800
700
600
500
400
300
200
100
MLVSS, mg/liter
600
500
400
300
200
100
SVI
MLVSS
SVI
1
2
3
4
5
6
TIME (DAYS)

Figure 4.

TELEPHONE 315-374-6311

WIDMER'S WINE CELLARS, INC.

NAPLES, NEW YORK 14512

March 19, 1976

Mr. Lynn Sirrine
The R. T. French Company
434 South Emerson Avenue
Shelly, Idaho 83274

Re: Widmer's Water Pollution Control Project
Performance and Modification of
Hydro-clear Sand Filter

Dear Lynn:

It is my understanding that soon after the Hydro-clear sand filter was put into operation, problems with the backwash cycle were encountered. When I came to Widmer's in May of 1972 these problems were still affecting the operation of the filter.

The problem was most evident when the same filter had accumulated a large amount of suspended solids on the surface of the sand. When the unit would backwash, either automatically or manually, the backwash rinse would be very inconsistent. Usually all the backwash water would come through and break the surface of the sand in only two or three areas. As all the backwash pressure was concentrated in a comparatively small area, the sand from those areas would be thrown into the air with considerable force. In fact, at times the sand would be thrown completely out of the filter cell. Then after the backwash had ended and the cell drained, there would be areas of sand only two to three inches deep and other areas with sand 10 to 15 inches deep.

Upon removing the sand from the filter and examining the stainless steel screen beneath it, we found large areas of the screen which were blinded by an accumulation of solids, grease, sand, etc. We replaced the stainless screen and sand, which by this time was filthy, and put the filter back into operation. Within two months we experienced the same problems again. During this entire time since initial start-up, Hydro-clear Corporation was made aware of the problems.

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TELEPHONE 315-374-6311

WIDMER'S WINE CELLARS, INC.

NAPLES, NEW YORK 14512

Mr. Lynn Sirrine
The R. T. French Company

March 19, 1976
Page 2

Evidently we were not the only people who were experiencing similar problems with this particular type filter. Eventually, Hydro-clear developed a new, improved underdrain/backwash system. After an impressive demonstration, we elected to make the modification in our unit. This modification required a complete tear-down of the filter cells.

We made these modifications with the aid of a Hydro-clear representative (hopefully the photos from Hydro-clear will be a helpful aid). Since the modification, the filter backwash performance has been excellent. Periodically we do clean the sand with laundry bleach, but other filter maintenance is minimal. Several times since the modification I have dug into the sand and observed the stainless screen. There is only limited evidence of blinding. In all, I think the modification is quite satisfactory.

Hopefully this letter will shed some light on this particular problem we have experienced.

Yours truly,

Jake

James Makepeace

JM/jh

cc: P. Russell
    C. Strayhall
    P. Carp

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GLOSSARY

Some of the various terms frequently used in conjunction with wastewater systems and referred to in this report are defined as follows:

ACCLIMATION - Period during which the microorganisms become accustomed to their new environment and substrate.

ACTIVATED SLUDGE - A biological mass produced in wastewater by the growth of bacteria and other microorganisms in the presence of dissolved oxygen, and accumulated in sufficient concentration by returning floc previously formed.

ACTIVATED SLUDGE PROCESS - A method of secondary wastewater treatment in which a mixutre of wastewater and activated sludge is agitated and aerated. The activated sludge is subsequently separated from the treated wastewater (mixed liquor) by sedimentation, and wasted or returned to the process as needed.

AERATION - The bringing about of intimate contact between air and liquid by one of the following methods: Spraying the liquid in the air, bubbling air through the liquid, or agitation of the liquid to promote surface absorption of air.

AERATOR - A device which agitates the liquid and brings fresh surfaces of liquid into contact with the atmosphere, thereby introducing atmospheric oxygen into the liquid by mechanical means.

AEROBIC TREATMENT - A biological treatment process in which bacteria stabilize organic matter in the presence of dissolved oxygen.

ANEROBIC TREATMENT - A biological treatment process in which bacteria stabilize organic matter in the absence of dissolved oxygen.

AVERAGE DAILY FLOW - The average quantity of wastewater reaching a given point in a 24-hour period.

BIOCHEMICAL OXYGEN DEMAND (BOD) - A measure of the oxygen necessary to satisfy the requirements for the aerobic decomposition of the docomposable organic matter in a liquid by bacteria. The standard (BOD_5) is five days at 20 degrees C.

BUFFER - The action of certain solutions in opposing a change in composition, especially of pH.

CHEMICAL OXYGEN DEMAND (COD) - A measure of the oxygen required to approach total oxidation of the organic matter in the waste.

CLARIFIER - A tank or basin, in which wastewater is retained for a sufficient time, and in which the velocity of flow is sufficiently low to remove by gravity a part of the suspended matter.

COMPLETELY MIXED ACTIVATED SLUDGE - Treatment system in which the untreated wastewater is instantly mixed throughout the entire aeration basin.

COMPOSITE SAMPLE - Integrated sample collected by taking a portion at regular time intervals, with sample size varying with flow; or taking uniform portions on a time schedule varying with the total flow.

DETENTION TIME - Period of time required for a liquid to flow through a tank or unit.

DISSOLVED OXYGEN (DO) - Free or uncombined oxygen in liquid.

EFFLUENT - Liquid flowing out of a basin or treatment plant.

FLOC - Small gelatinous masses, formed in water or wastewater by the addition of coagulants, through biochemical processes, or by agglomeration.

FLOCCULATION - The bringing together of flocculating particles by hydraulic or mechnical means.

INDUSTRIAL WASTEWATER - Flow of waste liquids from industries using large volumes of water from processing industrial products, such as food processing plants.

INFLUENT - Liquid flowing into a basin or treatment plant.

MILLIGRAMS PER LITER (mg/l) - The weight of material in one liter of liquid.

MIXED LIQUOR (ML) - A mixture of sludge and wastewater in a biological reaction tank undergoing biological degradation in an activated sludge system.

NITRIFICATION - A biological process in which certain groups of bacteria, when in the presence of dissolved oxygen, convert ammonia nitrogen first to nitrites and then to nitrates.

NUTRIENT - Any substance absorbed by organisms which promotes growth and replacement of cellular parts.

OXYGEN UPTAKE RATE - Oxygen utilization rate or rate at which oxygen is used by bacteria in the decomposition of organic matter.

PEAK FLOW - The highest average daily flow occurring throughout a period of time.

pH - The logarithm of the reciprocal of the hydrogen ion concentration. It is used to express the intensity of the acid or alkaline condition of a solution.

PRIMARY TREATMENT - A wastewater treatment process that utilizes sedimentation and/or flotation to remove a substantial portion of the settleable or flotable solids and accompanying BOD of untreated wastewater.

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(Please read Instructions on the reverse before completing)

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This report has been prepared to fulfill a Research, Development and Demonstration Grant. The grant was awarded to investigate a method of treatment for winery wastewaters. In brief - the grapes are harvested in the fall and are immediately pressed of their juice. The juice is fermented, aged and blended to wines. The solid residue is tilled into the soil for disposal and fertilization. Wastewater is generated from washing of the equipment, cleaning tanks, spills, etc. The wastewater is low in pH and high in sugars. More waste is generated during the short pressing season than during the processing season.

A long term activated sludge treatment system followed by a tertiary sand filter is studied. BOD and solids removals are impressive. This paper describes this treatment system and characterizes the winery wastes.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Industrial wastes Acclimatization Biochemical oxygen demand Buffers (chemistry)	Winery treatment Aerobic treatment Anerobic treatment	13B

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