TECHNICAL REPORT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

INVESTIGATION OF THE WEST COLLEGE AVENUE
LAGUNA, SEBASTOPOL AND ROHNERT PARK
SEWAGE TREATMENT PLANTS

Surveillance and Analysis Division

United States Environmental Protection Agency
Region IX
San Francisco, CA 94111

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INVESTIGATION OF THE WEST COLLEGE AVENUE, LAGUNA, SEBASTOPOL AND ROHNERT PARK SEWAGE TREATMENT PLANTS

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I Introduction.

A. Statement of Problem

In a letter of 22 June, 1973, Bill B. Dendy of the California State Water Resources Control Board requested assistance from the Environmental Protection Agency (EPA) in the form of an engineering evaluation of four sewage treatment plants in the Santa Rosa Basin. This evaluation was specifically requested for the West College Avenue, Laguna, Sebastopol and Rohnert Park sewage treatment plants. Special emphasis was requested on the West College Plant to gather information that might be used in upcoming enforcement action on the part of the State.

The Program Evaluation Branch, Air and Water Division, EPA, is currently reviewing a FY 73-74 grant in the Santa Rosa Plain project. The project concept calls for the abandonment of the West College Avenue, Sebastopol and Rohnert Park plants and for wastewaters presently treated by these facilities to be conveyed to a regionalized Laguna Wastewater Treatment Plant. However, the cities of Santa Rosa and Sebastopol believe they can modify the West College Avenue and the Sebastopol Plants so as to meet all water quality requirements at less cost than the recommended regionalization concept.

B. Purpose of Investigation

The objectives of this investigation are:

1. To evaluate the existing facilities and determine overall performance with respect to removal efficiencies of each of the four wastewater treatment plants.

2. To perform an operation and maintenance evaluation of the four plants.

3. To characterize the influent waste strengths to the four plants.

4. To provide the North Coast Regional Water Quality Board with effluent data from the four plants for the purpose of making stream loading determinations from the respective plants.

C. Scope of Study

A sampling survey was conducted for 3 consecutive 24-hour periods by the EPA on August 21-24, 1973. Two 24-hour composite samples (2-hour interval sampling) were collected at 7 stations at the West College Avenue plant from 10:00 a.m., August 21 through 8:00 a.m., August 23. One 24-hour composite sample (3-hour interval sampling) was collected each at the influent and the final effluent of the Laguna, Sebastopol and the Rohnert Park plants from 11:00 a.m., August 23 through 8:00 a.m., August 24 (see sample schedule in the Appendix for parameters tested and location of sampling stations).

The basic purpose of the survey was to characterize the influent wastes to the four plants and to determine the subsequent performance and stream loadings resulting from the plant effluents. Internal samples were collected at the West College Avenue plant to determine loading rates and removal efficiency of various units within this plant. Major parameters of concern were solids (settleable and suspended), oxygen-demanding materials, nutrients (nitrogen and phosphorus) and effluent fecal coliform.

D. Acknowledgements

The project officer for this investigation was Daryl G. DeRuiter, Sanitary Engineer, Surveillance and Analysis Division (S & AD). Assistance in the form of plant evaluation and sample collection was respectively provided by James R. Jones, Sanitary Engineer, and Daniel Yee, Chemical Engineer, both of S & AD.

A special word of appreciation is extended to members of the North Coastal Regional Water Quality Control Board for their assistance in sampling the four plants and to the plant operators for their complete cooperation during the survey.

II Findings and Discussion.

A. West College Avenue STP

1. Physical Description

The Santa Rosa STP located at West College Avenue is a secondary treatment facility with a design flow of 18,925 cu m/day (5 mgd). The treatment process consists of pre-chlorination, comminution, preaeration, primary sedimentation, trickling filters, secondary clarification, oxidation ponds, and post-chlorination. Primary and secondary sludges are pumped to one of two primary digesters and ultimately to a sludge lagoon. See Appendix for a list of design factors. A piping diagram is also included in the Appendix.

Raw sewage is collected and transported via a separate sewer system and enters the plant through a 152.4-cm (60-inch) and a 91.4-cm (36-inch) gravity line. A raw sewage by-pass to the first oxidation pond is provided. Process water flows through the entire plant by gravity with the exception of the primary effluent and recirculation from the secondary clarifier which are pumped to the trickling filters and the Pond II water which is recycled to Pond I. Raw and waste secondary sludges are pumped to the digesters while digested sludge flows by gravity to the sludge lagoon.

The two influent lines enter a common channel where chlorine is added for odor control purposes. At approximately 9:00 a.m. the chlorine is turned on at a rate of 136 kg/day (300 lb/day), increased to 181 kg/day (400 lb/day) at 10:00 or 10:30 a.m., reduced to 136 kg/day at 8:30 or 9:00 p.m., and turned off at 10:30 or 11:00 p.m. for the remainder of the day.

The raw sewage then passes through a comminutor and a Parshall flume with a float recorder prior to the preaeration tanks. Grit is generally removed from the preaeration tanks only once per day by means of two water eductor type grit ejectors in each tank. These water eductors feed a grit washer with the overflow recycled back to the preaeration tanks. Approximately

0.056-0.084 cu m/day (2-3 cu ft/day) of grit is removed during the summer and 0.336-0.420 cu m/day (12-15 cu ft/day) during the winter.

The two primary sedimentation tanks (see Design Factors in the Appendix for sizes and loading rates) are equipped with a sludge scraping mechanism which returns the raw sludge to the influent end. Cross collectors deliver the sludge to a cone at the corner of each primary tank where air-lift pumps transfer the sludge to the sludge pit located adjacent to the primary tanks. These air-lift pumps normally operate 6 to 9 minutes every half hour. Scum is forced to the influent end by a series of surface sprays and then drained into the sludge pit with the raw sludge. Raw sludge is pumped to the digesters by means of two Moyno rotor-and-stator variable-speed pumps. The pumping frequency and duration is controlled by a bubbler level sensor in the sludge pit. The average influent flow rate for the 2-day survey of this plant was 2422 cu m/day (6.40 mgd). The corresponding surface overflow rate is 62.5 cu m/day/sq m (1532 gpd/sq ft), the weir overflow rate is 241.6 cu m/day/m (19,480 gpd/sq ft), the hydraulic detention time is 1.17 hours and the mean horizontal velocity is 0.476 m/sec (1.56 ft/sec).

Primary effluent is pumped to the trickling filters by means of one of two available Fairbanks-Morse propeller pumps, each driven by a 110-hp variable speed engine. Digester gas is generally used as fuel for these engines with the option of using propane or a combination of digester gas and propane. Each pump has a rated capacity of 68,100 cu m/day (18.0 mgd), but are operated at an engine speed of 1000 rpm which yields approximately 45,400 cu m/day (12.0 mgd) in one pump and 48,400 cu m/day (12.8 mgd) in the other pump as indicated by the meters in the trickling filter influent lines. 22,700 cu m/day (6.0 mgd) is the flow rate required to revolve each trickling filter arm at a velocity of approximately 1 revolution per minute. Since the influent flow rate is somewhat less than 45,400 cu m/day (12.0 mgd), sludge flow from the secondary clarifier is used as make-up water. The butterfly valve on this sludge line is set such that a maximum of approximately 22,700 cu m/day (6.0 mgd) will be returned. During the early morning hours, when plant influent flow drops below 22,700 cu m/day (6.0 mgd), additional make-up water is required. The plant operator then opens a gate valve in the by-pass structure and returns secondary clarifier effluent. Because of odor problems in the past, a chlorinator unit has been installed to inject chlorine to the combined primary effluent and recirculated flows in the wet well prior to pumping to the trickling filters. The rate of chlorine addition is 113.5 kg/day, or an equivalent of 2.50 p.p.m.

Each of the two high-rate trickling filters are 33.56 m (110 ft) in diameter, 1.295 m (4.25 ft) deep and contain 5.08-8.89 cm (2-3.5 in) rock media. These filters were not designed to allow flooding of the media. The filters are operated in parallel and each receives approximately 22,700 cu m/day (6.0 mgd) which yields a hydraulic loading rate of 25.8 cu m/day/sq m (27.5 mgd/acre).

Trickling filter effluent flows by gravity into two secondary clarifiers. Settled sludge is mechanically scraped to the sludge cones at the influent end and removed from the clarifiers by gravity through a telescopic valve from which the sludge is either returned to the trickling filters or wasted to the digesters. The surface overflow rate in the final clarifiers is 57.8 cu m/day/sq m (1416 gpd/sq ft) and the weir overflow rate is 232 cu m/day/m (18,700 gpd/ft).

Secondary clarifier effluent flows to the first cell of a two-cell oxidation pond system. These ponds were designed at 21.2 ha (52.4 acres) at a depth of 1.22 m (4.0 ft). This yields a total volume of 271,500 cu m (220 acre-ft) and at the observed flow the detention time would be 11.2 days. Flow is recirculated from Pond II to the influent end of Pond I to provide a seeding effect to the clarifier effluent entering Pond I. One of two pumps rated at 26,500 cu m/day (7 mgd) each runs continuously. Occasionally when algal concentrations reach relatively high levels, the recycle pumps are shut down for a time. The reasoning for this method of operation is not known and is questionable in terms of optimum treatment efficiency. Pond II effluent is chlorinated automatically at the head-end of a chlorine contact channel which discharges to the Santa Rosa Creek. The rate of chlorine addition is controlled by a chlorine residual detector which is located 1.83 m (6 ft) downstream from the diffuser. At the time of the survey, the automatic control was set to maintain approximately 7 p.p.m.

The two digesters (see Design Factors in Appendix for sizes and design criteria) are operated in parallel. Each is equipped with sludge heating and recirculation, floating gas collector covers (with gas storage in digester No. 2) and gas mixing by means of 8 gas shear boxes on a 10-foot diameter. Each digester is fed alternately on 2-day cycles. Just prior to loading, the gas mixing is terminated to allow the solids to settle, and the settled sludge is drained (generally from the center of the digester) by gravity to the sludge lagoon. Just enough volume is drained to allow for loading for the 2-day cycle (approximately 15.14 cu m (40,000 gal)). The hydraulic detention time is thus approxmately 43 days. Several loading, heating, recirculating and draw-off options are available to the operator. The total digester gas accumulation is metered before separation into use gas and excess gas. The excess gas is disposed of by means of a waste gas burner. The use gas passes through a scrubber and use gas meter before utilization by the main pump engines and the heat exchangers.

2. Operation and Maintenance

Personnel associated with the operation and maintenance of the West College Avenue sewage treatment facilities are identified as follows:

NUMBER	TITLE	DUTIES
1	Superintendent	Organization and supervision of all city sanitation facilities

1	Chief Operator	Supervision of sewage treatment plant
4 1	Operators Relief Operator	Routine operation and maintenance of sewage treatment plant
1	Maintenance Man	Repair equipment
1	Lab Technician	Performs lab analyses for effluent monitoring and process control

24-hour operation is provided with one operator on duty during each shift. The chief operator, maintenance man, and laboratory technician are normally present during the day shift. The plant grounds and equipment are generally well-groomed and well maintained, and most of the equipment is functioning reliably. Routine maintenance work is performed regularly and special maintenance problems are taken care of as they arise.

3. Monitoring

The monitoring and reporting program and the waste discharge requirements adopted for the West College Avenue plant by the North Coast Regional Water Quality Control Board are attached in the Appendix. Monthly operating reports are prepared by the plant personnel. These reports are relatively complete with respect to plant performance as the monitoring and reporting program requires and also contains a sufficient amount of plant operating information. Noticeably absent, however, are the fish bioassay data required according to the monitoring and reporting program.

4. Data Evaluation

All data collected during this survey are included in the Appendix to this report. The plant influent concentrations for the parameters measured are normal for municipal wastewaters.

The settleable solids values in the primary clarifier effluent during the peak-day flows were 0.45 ml/l/hr with an average value for the two-day survey period of 0.26 ml/l/hr. The suspended solids removal and the COD removal efficiencies were 56% and 27% respectively. These performance values are less than would be expected from a properly loaded and operated primary system. However, since the primary tanks are followed by a secondary system, these performance figures should not be of too much concern.

The organic loading rate to the trickling filters (not including recirculated flow) was 2.785 kg COD/day/cu m (172 lb COD/day/1000 FT_3), or an estimated 1.49 kg BOD_5/day/cu m (92 lb BOD_5/day/1000 FT_3). Neither the hydraulic loading rate nor the organic loading was excessive for high rate trickling filters. The BOD_5 removal efficiency of 73.4% through the trickling filters and final clarifiers was slightly better than that expected using the empirical design formula developed by the National Research Council (see the trickling filter evaluation in the Appendix). The overall removal efficiencies (raw influent through the final clarifiers) for suspended solids and BOD_5 were 77.9% and 80.6% respectively.

A 24-hour composite sample of the secondary sludge yielded a suspended solids concentration of only 123 mg/l. This is a very low value for settled sludge from a trickling filter system. It was observed that sloughing from the trickling filters was minimal and the solid material in the filter effluent was largely comprised of fly larvae. It is suspected that either the chlorine addition to the trickling filter influent is hindering the growth of bacterial organisms or the grazing organisms are ingesting the biomass almost as rapidly as it is produced or a combination of these two phenomena. Whatever the cause, the sludge production in the secondary treatment system is significantly below normal.

Pond I and Pond II are approximately 81,400 sq m (20.1 acres) and 130,700 cu m (32.3 acres) respectively. The surface organic loading rate based on the composite samples to Pond I was 11.06 gm/day/

sq m (98.7 lb/day/acre). This loading rate seems quite high for a facultative pond and it is felt that recirculation from Pond II to the influent of Pond I is beneficial to the condition of Pond I. The BOD_5 increased from 37 mg/l at the influent of Pond I to 75 mg/l (unfiltered sample) at the effluent of Pond II. The dissolved BOD_5 at the Pond II effluent was 46.5 mg/l (filtered sample).

A portion of this increase in dissolved BOD_5 may be attributed to conversion of solid material to dissolved organic material at the bottom of the ponds. But probably more significant is the BOD_5 introduced to Pond II from the sludge lagoon supernatant. Chlorine is added to the Pond II effluent at such a rate that it reduced the BOD_5 from 75 mg/l to 21 mg/l in the unfiltered sample and from 46.5 mg/l to 8.5 mg/l in the filtered sample.

An ultimate BOD analysis was performed on an unfiltered final effluent sample (after chlorination). The results of this test can be seen in Figure 1. The second stage demand may be due strictly to the nitrogenous demand or a combination of the nitrogenous demand and the demand attributed to the decomposition of algae.

The levels of inorganic and organic phosphorus are relatively unchanged throughout the treatment process. The reduction and conversion of nitrogen can be observed from Figure II. The decrease in total nitrogen observed between the influent and final clarifier effluent was probably due to removal of sludges. Essentially no nitrification occurs through these stages. The most significant decrease in nitrogen expectedly occurred in the stabilization ponds. It is hypothesized that ammonia nitrogen was utilized in the synthesis of algal cells and subsequently lost to the atmosphere in the form of nitrogen gas. Some nitrification of ammonia to nitrite occurred in this phase of the treatment process, but very little nitrification to the nitrate level. The most surprising aspect of the nitrogen transformations was the decrease in organic nitrogen in the ponds. It is suspected that this decrease occurred because the recirculation from Pond II to Pond I was shut off during the survey, thus reducing the rate of algae production. This reduction in algal concentration when recirculation was terminated was significant enough to be detected visually. The oxidation pond effluent was quite high in nitrogen, especially ammonia and total nitrogen. Little change in nitrogen form or concentration resulted from chlorination except that some of the nitrite was oxidized to nitrate nitrogen.

The effects of filtering on nutrient concentrations in the final effluent can be seen in the following table:

Parameter	FINAL EFFLUENT, mg/l Unfiltered	Filtered
NH_3-N	6.0	5.5
NO_2-N	1.2	1.1
NO_3-N	2.2	1.85
Organic N	5.5	1.6
Total N	14.9	10.05
Ortho-P	10.45	8.95
Total P	15	14

Filtering the oxidation pond effluent reduced the organic nitrogen by 51% and the total nitrogen by 20%. The total nitrogen concentration in the Pond II effluent was 14.7 mg/l before filtering and 11.8 mg/l after filtering. Filtering the final effluent reduced the organic nitrogran by 71% and the total nitrogen by 31.5%. The total nitrogen concentration in the final effluent was 14.9 mg/l before filtering and 10.05 mg/l after filtering.

The fecal coliform concentrations of less than 67/100 ml were well under the level of not more than 200 per 100 ml (geometric mean of 30 consecutive days) specified under the newly accepted definition of secondary treatment.

The overall plant performance is summarized in the following table:

PARAMETER	INFLUENT CONCENTRATION (mg/l)	EFFLUENT CONCENTRATION (mg/l)	% REMOVAL
Suspended Solids	196.5	35.5	82.0
$B.O.D._5$	190	21	88.9
COD	355	96	73.0
NH_3-N	21.5	6.0	72.1
NO_2-N	0.045	1.2	—
NO_3-N	0.11	2.2	
Organic N	7.5	5.5	26.7
Total N	29.1	14.9	48.7
Ortho P	7.25	10.45	—
Total P	14	15	—

5. Discussion

Infiltration in the sewer system is a significant problem of this facility. The highest average daily plant flow for a given month reported during the 1972-73 fiscal year was 44,300 cu m/day (11.72 mgd) and occurred during February, 1973 as compared to 25,500 cu m/day (6.73 mgd) during July, 1972. It is likely that actual wastewater flows exceed the metered flows due to a by-pass to Pond II which is located in the influent line. However, if flow exceeds the capacity of the main pumps, or if a breakdown occurs, two options are available: All or part of the raw influent can be by-passed to Pond I, or the flow can be sent through the primary sedimentation tanks and then by-passed to Pond I. Thus the raw sewage receives treatment from the stabilization ponds before reaching Santa Rosa Creek.

Home development in the near proximity of the plant site has imposed significant problems associated with odors in the past. The practice of chlorinating the influent flow to the trickling filters for odor control purposes could prove to be quite hazardous if not monitored frequently. Malfunction of the chlorination equipment or over-chlorination due to a significant period decrease in chlorine demand could cause a severe kill of the trickling filter bacteria which are essential to reduction of BOD_5 through this process. Chlorination of this type can also prove to be quite costly.

More effective treatment would probably be achieved by recirculating clarified effluent to the filters rather than settled sludge. The principle of the trickling filter process is to convert soluble BOD to solid material which can be settled out and removed in the final clarifiers. Returning the solids serves no real purpose and often results in excessive loadings to the filters. Returning the clarified effluent would result in greater contact time of the dissolved organic material with the active organisms in the filter and would result in higher organic removal efficiencies. This in turn would reduce the loading rate to the oxidation ponds.

The effluent launders in the final clarifiers extend very close to the turbulent zone at the influent end of the clarifiers. The solids carry-over was significantly higher at the influent end of the launders than at the effluent end. Surface skimmers were noticeably absent from the final clarifiers.

Operation of the digesters in series might prove to be more effective than parallel operation. Allowing the secondary digester to operate without mixing should result in better solids separation which means less draw-off volume to the sludge lagoon. Supernatant could be returned to the plant headworks.

It is suspected that the return of sludge lagoon supernatant to Pond II has a severe effect on the lagoon performance and thus final effluent quality. This supernatant contains a high amount of organic material which will not be completely oxidized or converted to algal cells in the relatively short retention period of Pond II.

B. Laguna Wastewater Treatment Plant

The Laguna Wastewater Treatment Plant was constructed in 1967 by the City of Santa Rosa in cooperation with the County of Sonoma. The facility, an activated sludge treatment plant, was designed and built with an initial capacity of 9460 cu m/day (2.5 mgd) and provisions for an ultimate capacity of 75,700 cu m/day (20mgd). During the survey, wastewater flow averaged about 7,600 cu m/day

(2.0 mgd) which was indicative of current weather flow. The plant as shown in Figure No. 4 consists primarily of a comminutor, aerated grit removal tanks, primary sedimentation tank, activate sludge unit, secondary sedimentation tanks, aerobic digester and chlorination unit.

The headworks, consisting of the comminutor, raw sludge pumps and sewage flow meter, is located in the bottom of an 11 meter (35 ft) deep influent structure. The comminutor may be by-passed by using one of two manually cleaned bar screens. Raw sludge is pumped to the grit chamber through the influent flow meters by two variable pumps each with a rated capacity 56,800 cu m/day (15 mgd) at a static head of 11 meters (35 ft). An aerated grit chamber, which is also refered to and acts much like a preaeration tank, has a detention time of 1.1 hours at design flow.

Three standard design rectangular primary clarifiers were built with the initial construction. In the initial stage only one of the clarifiers is being used as a primary clarifier while the other two are being used as final clarifiers. Each clarifier has a surface area of 256 sq m (2755 sq ft) and a volume of 694 cu m (24,800 cu ft). At design flow, the overflow rate for the single primary clarifier is 37.1 cu m/day/sq m (910 gal/day/sq ft) and the detention time is 1.8 hours. These loading rates seem adequate. At the time of the inspection the unit appeared to be operating in a satisfactory manner.

As with the clarifiers, the aeration tanks are of a conventional design but are being used in a modified nature in the initial phase of plant growth. Of the two existing, parallel aeration tanks, one unit is being used for activated sludge while the other is used for aerobic digestion. In future stages of plant growth, anaerobic digestion will be used, releasing the present aerobic digester for use as an activated sludge unit. The activated sludge unit has a volume of 3060 cu m (108,000 cu ft) with a design organic loading of 0.368 Kg BOD/cu m/day 23 lbs BOD/1000 cu ft/day). The units are quite flexible and may be operated in any one of several modes. Currently the unit is being operated in a modified contact stabilization regime. The return sludge is introduced at the south or head end of the unit with the raw sewage introduced about one-quarter of the way through the unit. Mixed liquor suspended solids is maintained at approximately 1000 mg/l with a solids retention time of about 5 days.

As stated earlier, final clarification is performed in two of the initially constructed primary clarifiers. The two clarifiers with a total area of 512 sq m (5510 sq ft) give an overflow rate of 18.5 cu m/day/sq m (453 gal/day/sq ft) and a detention time of 3.6 hours at design flow, both well within accepted design standards. At the time of the inspection, clarification was quite satisfactory with very little carry over of suspended solids.

Primary and final clarifier sludges are stabilized in an aerobic digestion tank. As the plant is enlarged, the aerobic digester will be converted to an activated sludge unit and anaerobic digestion will be employed. Digested sludge is spread on drying beds at the site and plowed into the ground after drying. Because of limited area of drying beds, the operator feels that he could not handle more sludge than is currently generated without incurring odor problems.

Final clarifier effluent is chlorinated at the effluent junction structure. Two chlorinators, one used as standby, are each capable of delivering 910 kg/day (2000 lbs/day). As no chlorine contact chamber was built in the initial phase of construction, chlorine contact time was obtained by backing up the effluent in the effluent outfall. At design flow the theoretical chlorine contact time is 41 minutes. The plant effluent is discharged to the Laguna de Santa Rosa.

Dry weather flow through the plant is averaging about 7570 cu m/day (2.0 mgd). At these flows, the Laguna plant has had little problems meeting most discharge requirements established by the Regional Board. A review of plant records for the past year indicates they are consistently discharging treated effluent with BOD_5 averaging about 5 mg/l and suspended solids averaging about 15 mg/l. Each is below the median of 30 mg/l required for both parameters. Settleable solids are normally no more than trace. However, total coliform counts average about 20 MPN/100 ml, greater than the required median of 2.2 MPN/100 ml.

Additionally, chlorine residuals, which average about 8 mg/l, exceed the required maximum of 0.1 mg/l. This is undoubtedly a result of poor mixing and will be remedied by installation of a chlorine contact basin. Results of E.P.A. 24-hour, flow weighted composite sample are comparable to Laguna STP data indicating BOD_5 of 2 mg/l, suspended solids of 7 mg/l and coliform count of 6.0 MPN/100 ml (See Table 2).

With the current overloading problem at the West College Plant, one proposal to solve the problem is to divert a portion of the flow for treatment to the Laguna Plant. Even though the Laguna Plant is designed for 9460 cu m/day (2.5 mgd), it is possible that with tight controls it could be pushed to treat a greater flow and still meet discharge requirements. Due to the nature of the process, precise predictions are difficult to make. However, using upper limits of accepted operational parameters and loading rates, a reasonable approximation can be established.

By increasing overflow rate in the primary clarifier from 37.1 cu m/day/sq m (910 gal/day/sq ft) for design to 61.2 cu m/day/sq m (1500 gal/day/sq ft) a flow of 15,600 cu m/day (4.1 mgd) might be handled. Assuming 63 per cent removal of BOD_5 in the primary clarifier and 1,200 kg/day/cu m (75 lbs/day/1000 cu ft) for a contact-stabilization regime, a flow of 26,500 cu m/day (7.0 mgd) might be treated in the one aeration tank. As a check, a minimum detention time of 3 hours would give a slightly higher flow of 27,200 cu m/day (7.2 mgd). For final clarification, if the overflow rate was raised from 18.6 cu m/day/sq m (455 gal/day/sq ft), to 40.8 cu m/day/sq m (1000 gal/day/sq/ft), the flow through the unit could be raised to 20,800 cu/m/day (5.5 mgd). It therefore appears, that of the major units, the primary clarifier would be the controlling unit with a flow of 15,600 cu m/day. Other minor units, pumps and piping appear to be adequate to accept that flow. It is possible that an interim solution to increase clarifier capacity might be the installation of settling tubes or modules in the clarifiers to increase their capacity. The only readily apparent limitation might be the lack of drying beds to adequately handle sludge from the aerobic digester.

In conclusion, the Laguna Wastewater Treatment Plant is operated and maintained in a satisfactory manner. Plant personnel are adequately trained and capable of operating this plant. The plant is relatively new and the equipment is in excellent shape so there is no apparent reason why they should not be able to adequately treat to design flows and possibly up to 60 per cent greater than design flows.

C. Sebastopol STP

The Sebastopol Sewage Treatment Plant was last modified in 1949. The plant is located east of the City of Sebastopol on the west bank of the Laguna de Santa Rosa River. The plant consists of a bar screen, two primary clarifiers, trickling filter, digesters, sludge drying beds, oxidation ponds and a chlorine contact basin. (See Figure 5). The treatment plant was designed theoretically to provide secondary treatment at a flow of 2650 cu m/day (0.7 mgd).

The treatment facility serves approximately 1800 sewer hook-ups with a total population of approximately 4000. No influent flow rate data are available; however, a meter at the chlorine contact basin measures the effluent flow. Dry weather effluent flows normally range from 1320 cu m/day (.35 mgd) to 1510 cu m/day (.40 mgd). Assuming an evaporation rate of 1.2 m (4 ft) per year, evaporation in the oxidation ponds would account for another 190 cu m/day (0.05 mgd) to the influent flow. The wastewater is principally of domestic origin.

The headworks, contained in a small three-story building, consist of a bar screen and raw sewage pumps. Located in the basement, the bar screen must be manually cleaned. Raw sewage pumps #1, #2 and #3 pump from a sump, which also receives recycled trickling filter effluent. Pump #1, rated at 2180 cu m/day (0.576 mgd), pumps to the No. 1 Clarifier. Pumps #3 (rated at 2180 cu m/day (0.576 mgd)) and #2 (rated at 1635 cu m/day (0.432 mgd)) pump to the No. 2 primary clarifier. The #4 pump, which by-passes the bar screen to pump directly to No. 1 clarifier, is not now being used because of constant plugging problems. Screening this flow of wastewater to pump #4 is difficult because it is pumped directly from a manhole upstream from the headworks building. Thus, the total pumping capacity of the headworks is 5450 cu m/day (1.44 mgd). With the varying flows, the pumps phase on in the following order: (1) No. 3, (2) No. 1 and (3) No. 2. When there is only enough flow to keep No. 3 pump operating, there is no flow to Clarifier No. 1.

The primary clarifiers, both Dorrco Squarex Clarifiers Type AZ, are of a square design with spring-loaded bottom scrapers. The No. 1 Clarifier is 7.9 m (26 ft) square and 2.1 m (7 ft) deep with a total volume of 134 cu m (4740 cu ft). The No. 2 Clarifier is 9.1 m (30 ft) square and 2.4 m (8 ft) deep with a total volume of 204 cu m (7200 cu ft). As noted above, the flow to the clarifiers is not equal or consistent. All flows up to 2180 cu m/day go to No. 2 Clarifier, with a maximum load of 26.3 cu m/sq m/day (640 gal/sq ft/day) which is within a range of reasonable loadings. However, under dry weather conditions, the No. 1 clarifier is normally quite under-loaded with periods of 12 hours or more at night with no flow at all. During the inspection period, neither unit appeared to be working satisfactorily. Floating material was present with bubbles rising to the surface indicating anaerobic conditions and poor sludge removal. Both units had been drained and cleaned in the past year but the operator had no knowledge of the present condition of the sludge scrapers.

The trickling filter is 20.7m (68 ft) in diameter and 1 m (3 ft) deep. Hydraulic loading without recycle to the filter is about 4.5 cu m/day/sq m (110 gal/sq ft/day) while the organic loading is about 360 g BOD/day/sq m (74 lbs BOD/day/sq ft). These rates are high for a conventional trickling filter which should be in the range of 1.0 to 4.0 cu m/day/sq m for hydraulic loading and 80 to 400 g/day/cu m for organic loading. A variable portion of the flow, perhaps up to one-half of the influent, is recycled at different times during the day. During the night-time hours, usually from about 11:00 p.m. to 8:00 a.m., the total flow is recycled. The recycle, all manually controlled, is for the most part to maintain enough water in the system to power the filter distribution arm. The distributor arm has, due to many years of use, become quite deteriorated and will need to be replaced soon. The unit still has the original mercury seal, which as a result of state regulations, will have to be replaced. At the time of the inspection, there appeared to be a viable bacterial growth on the media.

The trickling filter effluent flows to four unmixed oxidation ponds. The ponds, all approximately 1.5 m (5 ft) deep, cover a total of approximately 2.0 ha (5 acres). They are operated in series with a theoretical detention time of approximately 20 days. However, to reach a commonly accepted organic loading of 220 kg/day/ha (20 lbs/day/acre), approximately 87 percent of the 360 kg (800 lbs) of influent BOD_5 would need to be removed through the primary clarifiers and trickling filters. This seems unlikely considering the condition of the plant and in light of the lack of final clarifier.

Built into the final oxidation pond, using baffles, is the chlorine contact basin. At average flow the theoretical contact time would be about one hour. The only measurement of plant flow is at the influent to the contact basin. The effluent goes directly to the Laguna de Santa Rosa.

Treatment of sludge from the primary clarifiers is accomplished with a set of two-stage digesters. The primary digester is heated and mixed with a capacity of 174 cu m (6280 cu ft). At time of the inspection, the unit had just been cleaned and was ready to be put back into operation. The secondary digester is an unmixed, unheated unit of 222 cu m (8000 cu ft). Digested sludge is dried in sludge drying beds on the site. No data is available to evaluate operations but the units appear operable and in satisfactory condition. Assuming 50 percent removal in the clarifier, the organic loading to the digesters would be around 0.45 kg/day/cu m (0.028 lbs/day/cu ft) which is well below accepted loading factors of 1.6 to 6.4 kg/day/cu m (0.1 to 0.4 lbs/day/cu ft).

The plant is operated and maintained by one primary operator with an addition maintenance man to cover on days off and assist when needed. The operator, who lives in a house adjacent to the site, has been at the plant quite a few years. Considering the poor condition of the plant, he is able to keep the plant operating in an acceptable manner, but has little formal training or knowledge of treatment plant processes. Because of their age, the condition of most of the plant units is quite poor and requires more time than would normally be needed for maintenance. Several operational procedures, the recycle of trickling filter effluent for one, are not automated and require manual operation. This requires the operator to be available to make plant adjustments as flows fluctuate, particularly as the flow drops significantly during late evening hours.

The treatment facilities and oxidation ponds are located on the flood plain of the Laguna de Santa Rosa. Flooding which occurs almost annually with big storms causes operational problems as well as limits access to the plant. During the big floods of 1955 and 1964, the plant was almost completely inundated. A high water mark on one of the doors indicates the water level as about 2 meters (6 ft) above the pond embankments and about 1 meter (3 ft) above the trickling filter media, obviously making both useless.

D. Rohnert Park STP

The Rohnert Park wastewater treatment facility serves the cities of Rohnert Park, Cotati and the Sonoma State College with a total population of approximately 11,000. The treatment of wastes at the present site will be discontinued in the next several years with the completion of an interceptor line to transport the waste to the Laguna Sewage Treatment Plant. Existing facilities will then be used as an equilization or flow surge facility. These existing surge facilities were designed and built as a demonstration project by Yoder-Trotter-Orlob and Associates under a grant from EPA in 1972.

Major treatment units in the plant are a comminutor, flow metering device, primary sedimentation tank, digester, sludge drying beds, equilization pond, oxidation pond and chlorination facilities. The plant is capable of giving primary treatment to approximately 1890 cu m/day (0.5 mgd). Dry weather flow averages about 3780 cu m/day (1.0 mgd) with a daily range from 1890 cu m/day (0.5 mgd) to 6050 cu m/day (1.6 mgd). The maximum hydraulic capacity is 22,700 cu m/day (6 mgd). Treated wastewater is discharged to Hinebaugh Creek which flows to the Laguna de Santa Rosa.

The headworks facilities, which include the comminutor and the flow meter are capable of up to 22,700 cu m/day (6 mgd). However, the rectangular clarifier with a capacity of approximately 188 cu m (6700 cu ft) is capable of treating only 1890 cu m/day (0.5 mgd) which is almost always exceeded. The anaerobic digester is an unmixed, unheated unit operated at about 20°C (68°F) and 20-day retention. Because of the heavy overloading and short retention time at the existing temperature, operational problems have been present since initial start-up of the unit in 1971.

The surge facility, a sedimentation-equilization basin with a surface aerator, has a capacity of 2840 cu m (0.75 MG). This offers a 3-hour retention time at the maximum design flow of 22,700 cu m/day (6 mgd). Pool sweeps, used to keep solids suspended with water jets, were evaluated as part of the demonstration grant and appear to be infeasible in this situation. The oxidation pond, as the plant is converted to an equilization facility, will be used only during wet weather as a storage unit. The pond area is 4.86 ha (12 acres) with a depth of 1 meter (3 ft). At present, it is heavily overloaded at about 1750 kg/day/ha (150 lbs/day/acre), and flow appears to short circuit through the pond. Chlorination facilities and a chlorine contact basin are located in the southeast corner of the pond. Effluent is discharged directly to the Hinebaugh Creek, a tributary to the Laguna de Santa Rosa.

Even though the plant is heavily overloaded, the operator is doing as well as can be expected, and in general, the facilities are operated and maintained in an acceptable manner. With the exception of the clarifier and digester which are heavily overloaded, no significant operational problems were evident. The single operator is quite competent and has a good knowledge of treatment plant processes. The plant is manned 8 hours per day, 5 days per week and has an adequate alarm system to warn of any operational problems when the operator is not present.

III Conclusions and Recommendations.

A. Conclusions

1. Wastewater flows generated by the City of Santa Rosa exceeds the available treatment plant capacity. This

phenomemon is especially severe during the wet weather months.

2. During the 2-day survey of the West College Avenue STP, the plant was meeting federal standards for secondary treatment with respect to BOD_5 and fecal coliform. However, the effluent suspended solids were not within the secondary treatment requirements. The relatively high concentration of suspended solids in the final effluent can be attributed to the algal content of Pond II effluent.

3. Filtering the final effluent from the West College Avenue STP was not highly effective in removing the nutrient concentrations. The detention time in the oxidation ponds is not sufficient for complete transformation of nutrients into algal cells which can readily be filtered from the effluent flow.

4. The Laguna Wastewater Treatment Plant is being operated and maintained in a satisfactory manner. With the exception of total coliforms the plant is consistently meeting discharge requirements. With good control of operational parameters, which can be reasonably expected considering the caliber of operators and condition of the units, the plant might be able to achieve discharge requirements at flows up to 15,600 cu m/day (4.1 mgd).

5. Most of the treatment units at the Sebastopol STP are in a run-down condition stemming from the age of the plant. Many of these units do not function reliably and are overloaded. Effluent suspended solids do not meet secondary treatment requirements. The effluent is high in nitrogen and phosphorus. The frequency of flooding at the plant site creates a hazardous condition with respect to public health.

6. The Rohnert Park STP is overloaded and incapable of meeting secondary treatment requirements with respect to suspended solids and BOD_5. The effluent is high in nutrients, especially ammonia, organic nitrogen and phosphorus.

B. Recommendations

The following recommendations are interim improvements that should improve the performance of the West College Avenue STP:

1. If chlorination of the trickling filter influent is to be continued as a means of odor control, it is suggested that close monitoring of this flow for chlorine residual be practiced as a preventative measure against over-chlorination and subsequent kill of trickling filter organisms essential for optimum treatment.

2. It is suggested that secondary clarifier effluent be returned to the trickling filters in lieu of settled secondary sludge. This practice should improve the reduction of organic material through the trickling filter process.

3. It is recommended that the sludge lagoon supernatant be returned to the headworks of the plant rather than to Pond II. It is believed that this supernatant flow imposes an unusually heavy organic load to Pond II and is inadequately treated by the time it reaches the final effluent.

4. It is suggested that the recirculation pumps that return Pond II effluent to the influent end of Pond I be run continuously rather than intermittantly. This practice should stabilize the process and improve the performance of these ponds.

Recognizing that the previous recommendations are only interim improvements intended to improve the efficiency of the West College Avenue STP and that these improvements may not be sufficient to produce an effluent of such quality required to prevent further degradation of the stream to which this plant discharges, the following recommendations are offered with respect to the four plants discussed in this report and the proposed regionalization plan presently under consideration:

1. The Laguna wastewater treatment plant should be expanded as early as possible to provide the capa-

bility of treating the wastewaters from Rohnert Park and excess flows from the City of Santa Rosa.

2. In view of the fact that the Sebastopol STP is antiquated and a potential health hazard, it is recommended that this plant either be replaced in the near future or wastewaters from Sebastopol be diverted to the Laguna wastewater treatment plant.

3. Considering the fact that major modifications will be necessary to upgrade the West College Avenue STP, especially with respect to nutrient removal, additional studies should be undertaken immediately to determine the most feasible solution to the problems that presently exist. At the present time, the alternatives that should receive complete consideration are 1) upgrading the present facilities, 2) provide some means of effluent disposal, or 3) diversion of the wastewaters from the West College Avenue STP to an expanded Laguna Wastewater Treatment Plant.

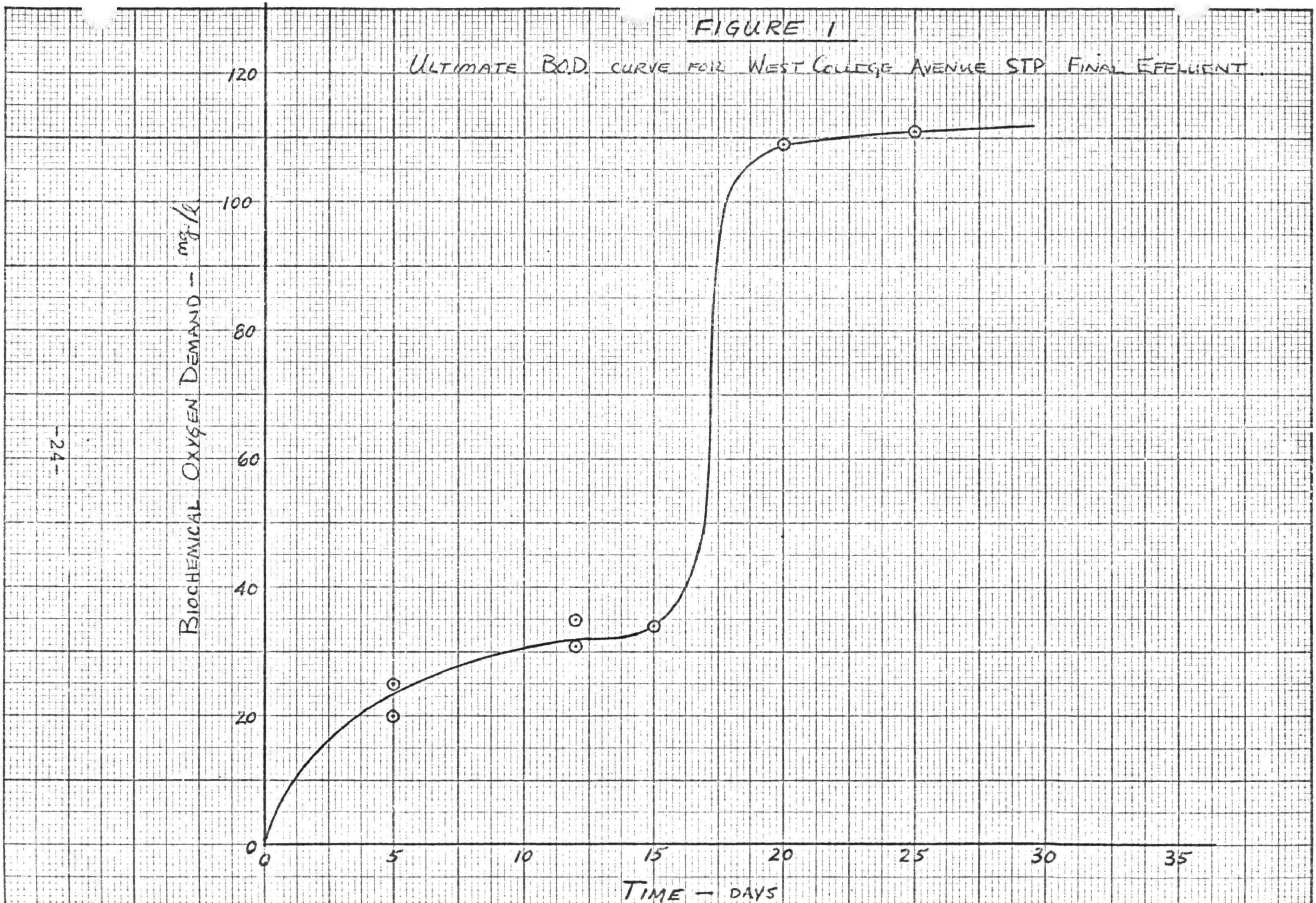


FIGURE 1

Ultimate B.O.D. curve for West College Avenue STP Final Effluent

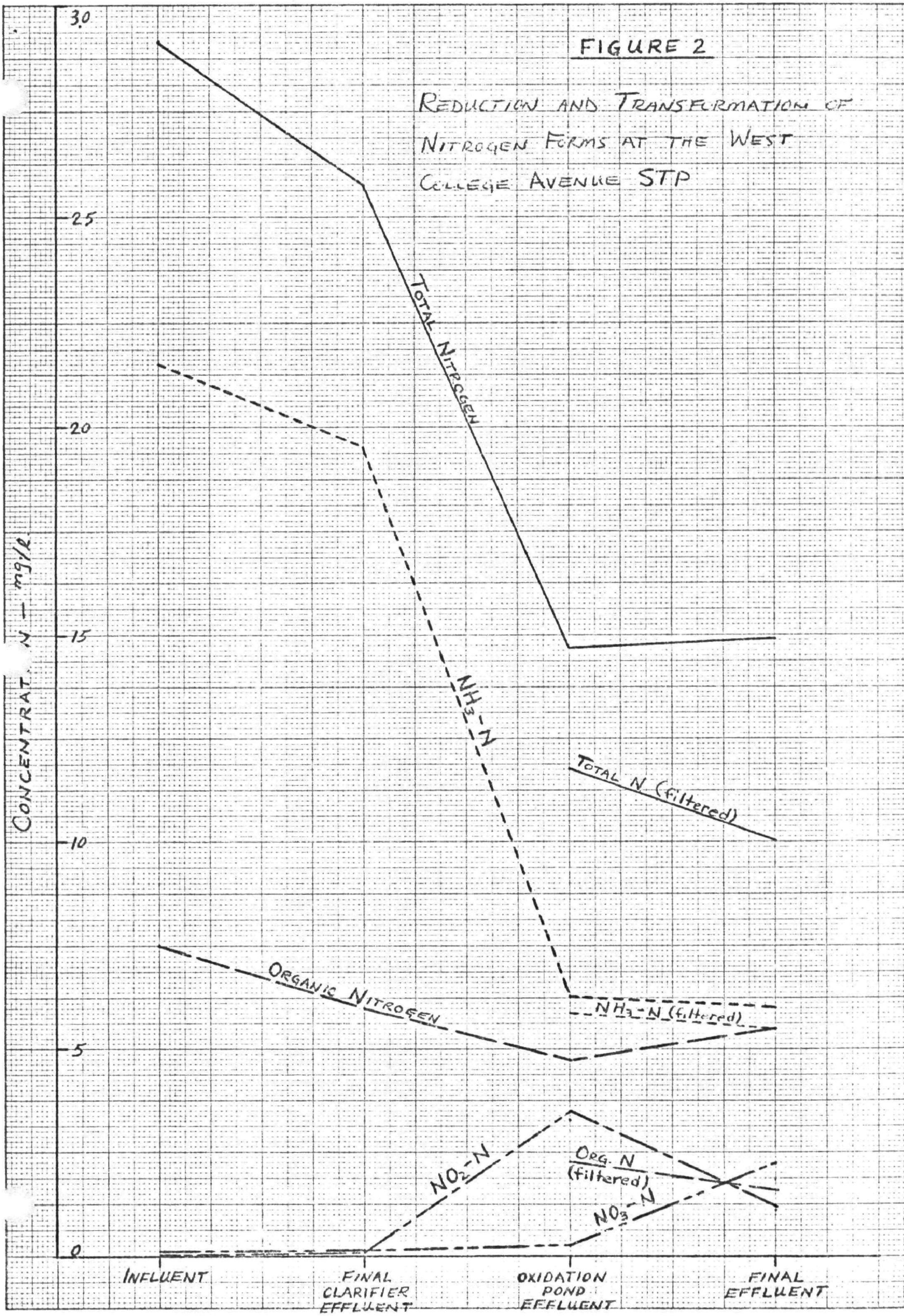


FIGURE 2
REDUCTION AND TRANSFORMATION OF NITROGEN FORMS AT THE WEST COLLEGE AVENUE STP
CONCENTRAT. N - mg/l
30
25
20
15
10
5
0
TOTAL NITROGEN
NH3-N
TOTAL N (filtered)
ORGANIC NITROGEN
NH3-N (filtered)
NO2-N
ORG. N (filtered)
NO3-N
INFLUENT
FINAL CLARIFIER EFFLUENT
OXIDATION POND EFFLUENT
FINAL EFFLUENT

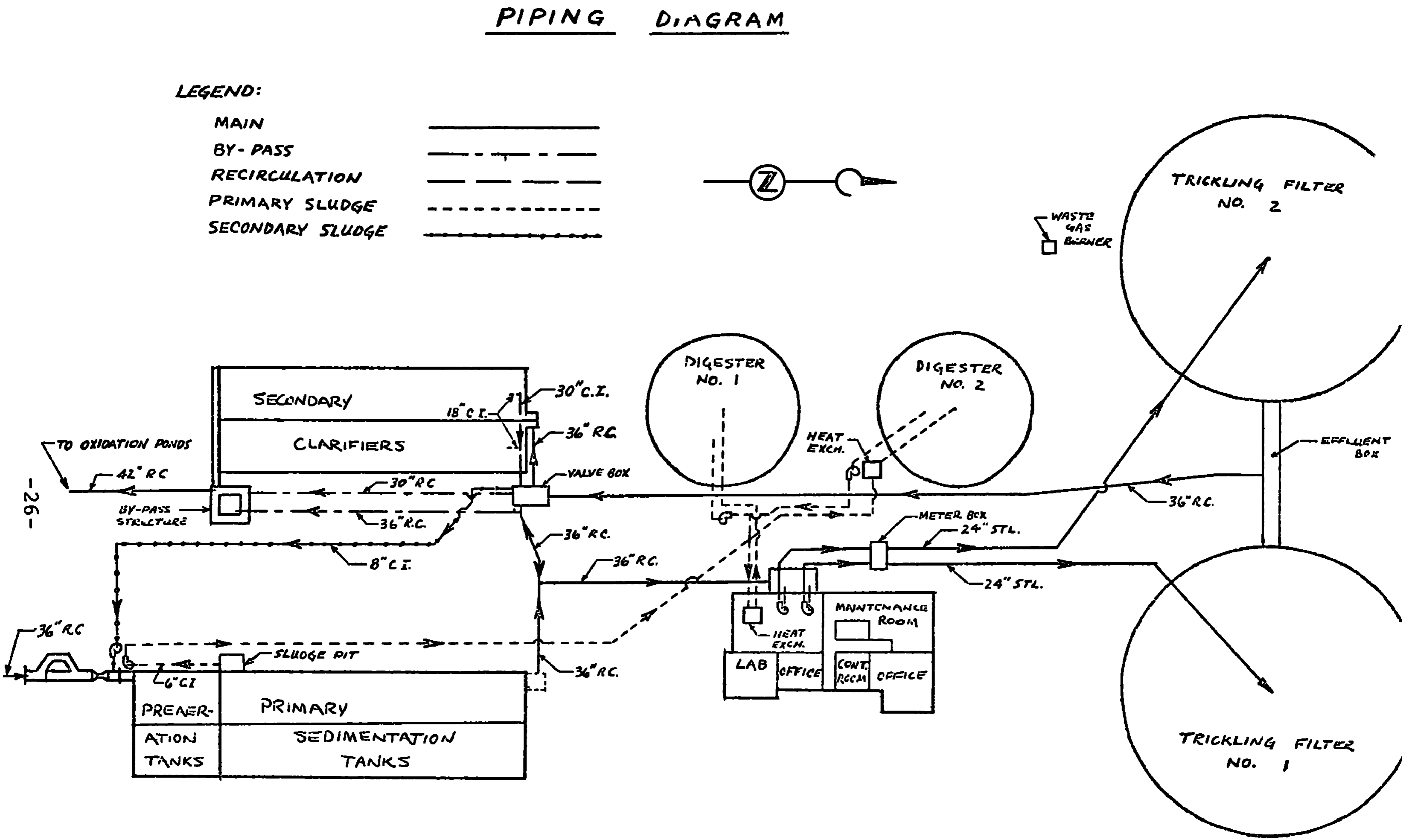


FIGURE 3

Flow Diagram for Santa Rosa-West College S.T.P.

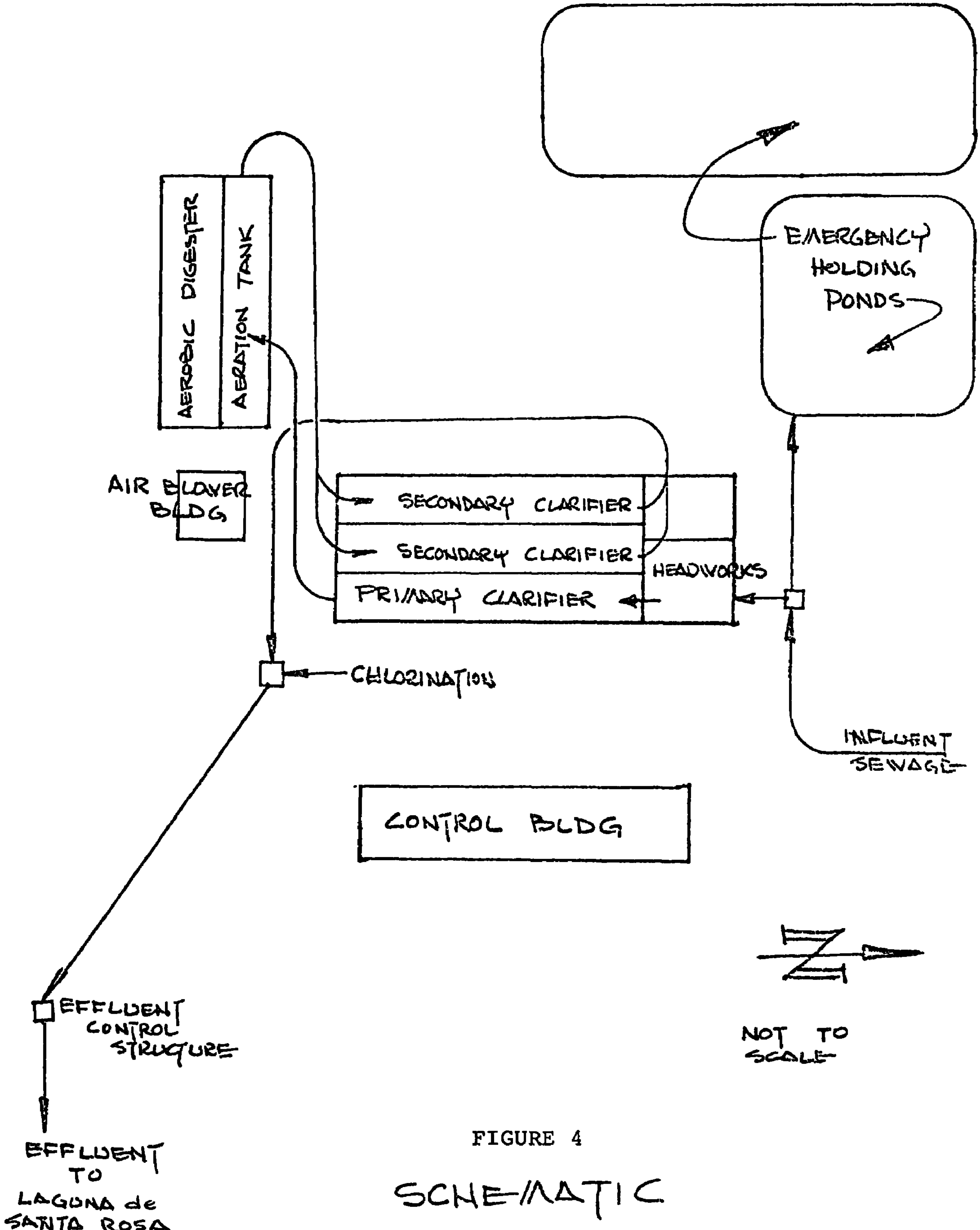


FIGURE 4

SCHEMATIC

LAGUNA WASTEWATER
TREATMENT PLANT

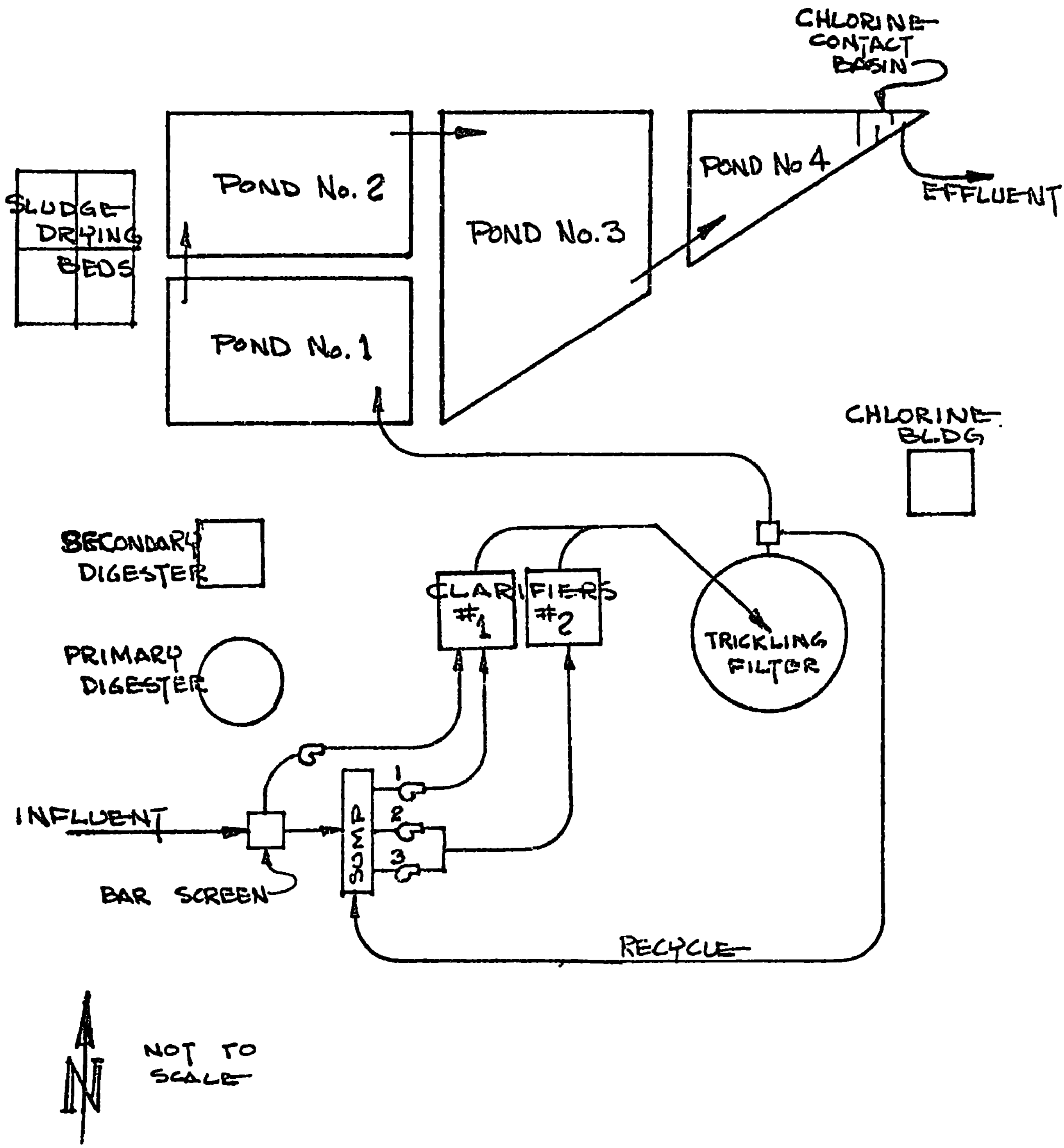


FIGURE 5

— SCHEMATIC —
SEBASTOPOL WASTEWATER
TREATMENT PLANT

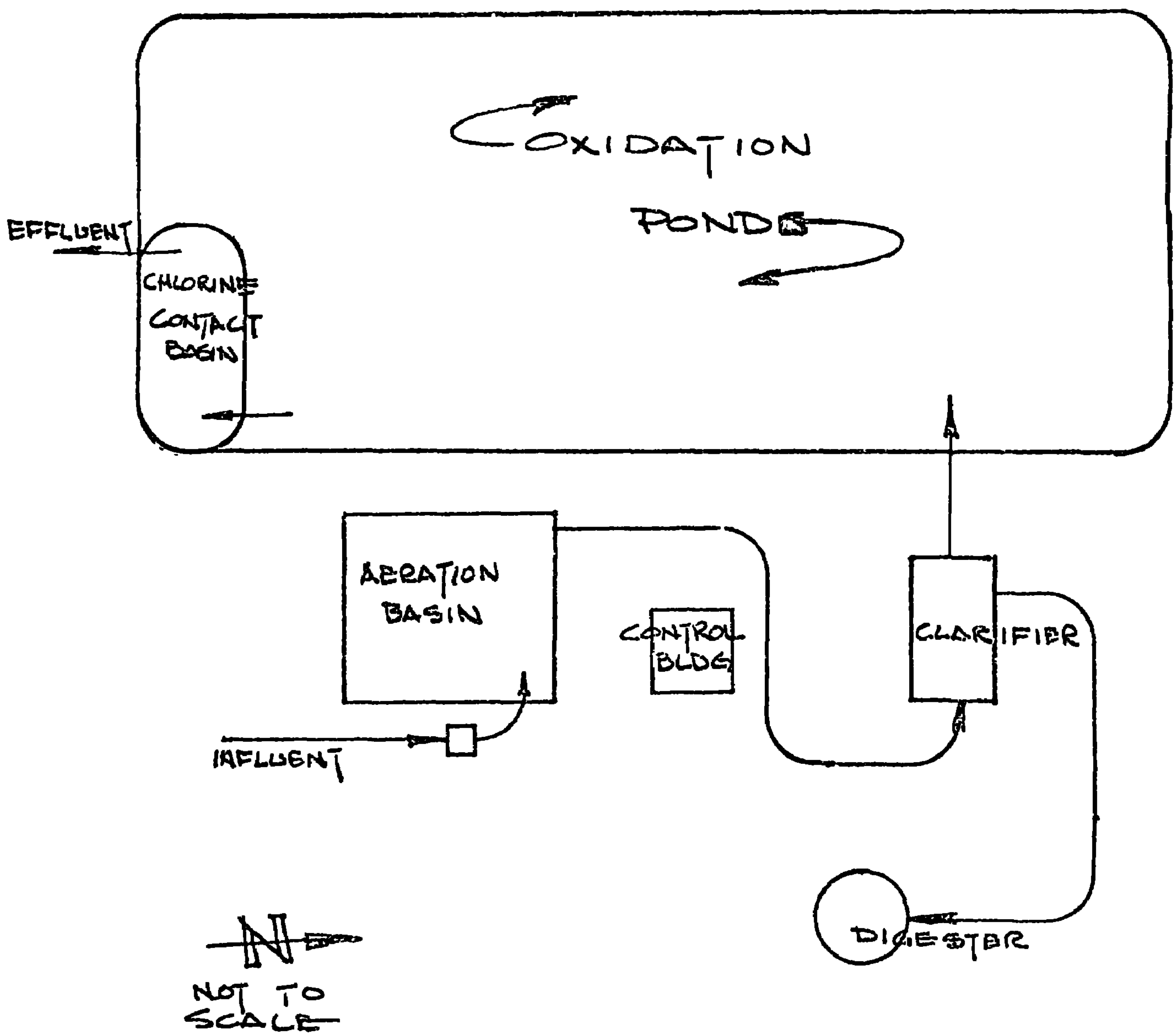


FIGURE 6

SCHEMATIC
ROHNERT PARK
SEWAGE TREATMENT PLANT

APPENDICES

A. Design Factors for the West College Avenue STP

B. Sampling Schedule for the Field Investigation

C. Data Collected from the Field Investigation

D. Monitoring and Reporting Program for the West College Avenue STP

E. Waste Discharge Requirements for the West College Avenue STP

F. Trickling Filter Evaluation for the West College Avenue STP

APPENDIX A

City of Santa Rosa, California
Sewage Treatment Plant

DESIGN FACTORS

ESTIMATED POPULATION	
Domestic	
Present (1950)	21,000
Design (1970)	36,000
Industrial Equivalent	
Present (1950)	11,000
Design (1970)	18,500
Total design	54,500

FLOW, Million Gallons Per Day	
Minimum	1.5
Design	5.0
Peak	9.0
Peak Storm	18.0

DESIGN LOADINGS	
Flow, million gallons per day	5.0
B.O.D., ppm	288
B.O.D., 1,000 lbs. per day	12.0
Suspended solids, ppm	216
Suspended solids, 1,000 lbs. per day	9.0

BAR SCREEN	
Channel width, feet	4.00
Channel depth, feet	4.83
Channel area, square feet	19.32
Clear opening between bars, inches	3/4
Screen opening area, square feet	12.88
Maximum head loss, feet	0.33
Velocity through screen, feet per second	
Minimum flow	0.76
Design flow	1.64
Peak flow	2.20
Peak storm flow	2.83

P ALL FLUME	
Throat width, inches	18
Discharge head, feet	
Minimum flow	0.53
Design flow	1.15
Peak flow	1.73
Peak storm flow	2.71
Submergence, per cent	
Minimum flow	53
Design flow	37
Peak flow	34
Peak storm flow	38

PREAERATION TANKS	
Number	2
Width, feet	19
Length, feet	35
Average water depth, feet	10.58
Detention time, hours	0.51
Number of air diffuser tubes per tank	50
Rated capacity per tube, cu. ft. per min	6.0
Air supplied per tank, cu. ft. per min.	300
Air supplied, cu. ft. per gpm	0.17
Air supplied, cu. ft. per foot of tank length	8.57
Maximum hydraulic capacity per tank, mgd	9.0

SEDIMENTATION TANKS (primary and secondary similar)	
Number	2
Width	19
Length, feet	110
Average water depth, feet	10.00
Effluent weir length per tank, feet	164.33
Detention time, hours	1.5
Mean velocity, ft. per min.	1.22
Overflow rate, gals. per sq. ft. per day	1,200
Overflow rate, gals. per ft. of weir per day	15,200
ximum hydraulic capacity per tank, mgd	9.0

I- AY TREATMENT	
Assumed B.O.D. reduction, per cent	25
B.O.D. reduction, ppm	72
B.O.D. reduction, 1,000 lbs. per day	3.0
Assumed suspended solids reduction, per cent	50
Suspended solids reduction, ppm	108
Suspended solids reduction, 1,000 lbs. per day	4.5

PRIMARY EFFLUENT	
B.O.D., ppm	216
B.O.D., 1,000 lbs. per day	9.0
Suspended solids, ppm	108
Suspended solids, 1,000 lbs. per day	4.5

MAIN PUMPS (Direct connected to engines)	
Number	2
Maximum capacity per pump, mgd	18.0
Maximum head, feet	18.5

TRICKLING FILTERS	
Number	2
Inside diameter, feet	110
Average depth of filtering material, feet	4.25
Size of filtering material, inches	2 to 3.5
Net area of filtering surface, acres	0.436
Volume, acre-feet	1.85
Recirculation ratio	
Peak flow, 9 mgd	1 1
Design flow, 5 mgd	1 1
Volumetric loading (peak flow)	
Per filter, mgd	9.0
Per acre, mgd	41.3
Per acre-foot, mgd	9.2
B.O.D. loading (design flow)	
1,000 lbs per day per filter	4.5
1,000 lbs per acre-foot per day	4.86
1,000 lbs. per equivalent acre-foot per day	2.96

SECONDARY TREATMENT	
Assumed B.O.D. reduction, per cent	68
B.O.D. reduction, ppm	147
B.O.D. reduction, 1,000 lbs. per day	6.1
Assumed suspended solids reduction, per cent	50
Suspended solids reduction, ppm	54
Suspended solids reduction, 1,000 lbs per day	2.25

PLANT EFFLUENT	
B.O.D., ppm	69
B.O.D., 1,000 lbs. per day	2.9
Suspended solids, ppm	54
Suspended solids, 1,000 lbs. per day	2.25

OXIDATION PONDS	
Number	2
Total area, acres	52.4
Average water depth, feet	4.0
Total volume, acre-feet	220
Detention time, days	14.3
B.O.D. loading, lbs. per acre-foot per day	13.2

DIGESTERS (2-stage digestion)	
Number	2
Inside diameter, feet	55
Side water depth, feet	24
Total volume, 1,000 cu. ft.	113.8
Volume, cu. ft. per capita (36,000 population)	3.16
Average temperature, °F	95
Loading, 1,000 lbs dry solids per day	6.75
Assumed moisture, per cent	95
Volume of wet sludge, cu. ft. per day	2,160
Detention time of wet sludge, days	52.5
Assumed volatile matter, per cent	70
Volatile matter, 1,000 lbs. per day	4.73
Assumed reduction in volatile matter, per cent	57
Volatile matter destroyed, 1,000 lbs. per day	2.70
Assumed gas production, cu. ft. per lb. volatile matter destroyed	18
Gas production, 1,000 cu. ft. per day	49
Assumed heat value of bas, btu per cu. ft.	650
Total heat, 1,000 btu per day	31,850
Estimated power available, brake hp	112

SLUDGE DRYING BEDS	
Number	8
Width, feet	50
Length, feet	100
Average depth per application, inches	12
Total area, square feet	40,000
Area, square feet per capita (36,000 population)	1.11
Added solids, lbs. per sq. ft. per year	37

APPENDIX B

Sampling Schedule for the Santa Rosa Survey

	21-23 Aug 1973							23-24 Aug 19	
	West College Avenue STP							Laguna STP Sebastopol ST Rohnert Park S	
	Influent	Primary Effluent	Trickling Filter Influent	Trickling Filter Effluent	Final Clarifier Effluent	Oxidation Pond Effluent	Final Effluent	Influent	Fina[l] Efflue[nt]
Temp	G_6				G_6		G_6		
Sett. Solids		G_6					G_6		G_6
Susp. Solids	C	C	C	C	C	GC	GC	C	C
BOD_5	C				C	GC*	GC* **	C	C
COD	C	C	C	C	C	GC*	GC*	C	C
NH_3	C				C	GC*	GC*		C
Kjeld. N	C				C	GC*	GC*		C
N	C				C	GC*	GC*		C
NO_3	C				C	GC*	GC*		C
Ortho-PO_4	C				C	GC*	GC*		C
Total PO_4	C				C	GC*	GC*		C
Fecal Coli.							G_1		G_1
[illegible]								***	***

G — Grab Sample (G_1 = 1 sample/day, G_6 = 6 samples/day)

C — Composite Sample (24-hour composite collected every 2 hours, flow weighted)

GC — Composite of equal volumes of grab samples collected every 4 hours).

* — Analyses to be performed on filtered and unfiltered portions of sample

** — Ultimate BOD to be performed on unfiltered portion.

*** — 24-hour composite sample at the Laguna STP only.

Note Final effluent samples at the Sebastopol and Rohnert Park STP... ...

APPENDIX C

Data Collected from Field Investigation

Table 1

Sample Point	Suspended Solids – mg/l			B.O.D.$_5$ – mg/l			COD – mg/l		
	8/21	8/22	Avg	8/21	8/22	Avg.	8/21	8/22	Av
West College Ave. STP:									
Influent	165	228	196.5	200	180	190	380	330	35.
Primary Effluent	75	98	86.5				260	260	26
Trick. Filter Influent	94	103	98.5				230	220	22:
Trick. Filter Effluent	72	80	76				160	160	16
Final Clarifier Effl.	42	45	43.5	37	37	37	130	130	13
Oxidation Pond Effl.	44	37	40.5	83	67	75	100	97	98.
Ox. Pond Effl (filtered)				57	36	46.5	43	46	44.
Final Effluent	37	34	35.5	20	22	21	95	97	96
Final Effl. (filtered)				8	9	8.5	44	46	45
Secondary Sludge		123							
			8/23			8/23			8/2
Laguna STP:									
Influent			250			160			310
Final Effluent			7			2			29
Sebastopol STP:									
Influent			193			200			380
Final Effluent			55			28			130
R[illegible]ert Park STP:									
Influent			169			150			380
Final Effluent			106			73			260

Table 2

Sample Point	NH_3-N (mg/l)			NO_2-N (mg/l)			NO_3-N (mg/		
	8/21	8/22	Avg.	8/21	8/22	Avg.	8/21	8/22	Avg
West College Ave. STP:									
Influent	22	21	21.5	0.03	0.06	0.045	0.00	0.22	0.1
Final Clarifier Effl.	18	21	19.5	0.11	0.10	0.105	0.17	0.13	0.15
Oxidation Pond Effl.	5.8	6.8	6.3	3.9	3.0	3.45	0.10	0.4	0.2
Ox. Pond Effl (filtered)	5.6	6.2	5.9	3.6	3.0	3.3	0.4	0.2	0.3
Final Effluent	5.9	6.1	6.0	1.3	1.1	1.2	2.5	1.9	2.2
Final Effl. (filtered)	5.0	6.0	5.5	1.2	1.0	1.1	2.0	1.7	1.85
Laguna STP Effluent			2.2			0.04			0.9
Si topol STP Effluent			5.9			0.04			0.5
Rohnert Park STP Effluent			12			0.04			0.0

Sample Point	Org N (mg/l)			Ortho-P (mg/l)			Total P (mg/l)		
	8/21	8/22	Avg	8/21	8/22	Avg.	8/21	8/22	Avg
West College Ave. STP:									
Influent	6	9	7.5	7.0	7.5	7.25	14	14	14
Final Clarifier Effl.	7	5	6.0	9.2	9.3	9.25	14	14	14
Oxidation Pond Effl.	4.2	5.2	4.7	10	9.9	9.95	15	15	15
Ox. Pond Effl (filtered)	2.7	1.9	2.3	8.3	9.6	8.95	15	14	14.5
Final Effluent	5.1	5.9	5.5	11	9.9	10.45	15	15	15
Final Effl. (filtered)	0.6	2.6	1.6	9.8	8.1	8.95	14	14	14
Laguna STP Effluent			0.8			7.5			12
Si stopol STP Effluent			10.1			9.0			12
Rohnert Park STP Effluent			12			10			18

Table 3

SPECIAL TESTS

WEST COLLEGE AVENUE STP

SAMPLE POINT	B.O.D. – mg/l.				
	5-DAY	12-DAY	15-DAY	20-DAY	25-DAY
FINAL EFFLUENT – 21-22 Aug. 73:					
50 ml sample / 300 ml.	20	31	34	48*	
20 ml sample / 300 ml.	25	35		109	111

* A questionable value because < 0.5 mg. O_2/l. was left after 20 days.

NOTE: A 32-DAY B.O.D. was run on the 20 ml sample / 300 ml. with a result of 123 mg/l., but < 0.5 mg. O_2/l. remained in the bottle.

Table 4

COPPER ANALYSES AT LAGUNA STP

SAMPLE POINT	DATE	Cu CONCENTRATION – mg/l.
INFLUENT	22-23 Aug. 73	0.28
EFFLUENT	22-23 Aug. 73	0.02

Table 5

Results of Bacteriological Examination of Effluent Discharges from Sewage Treatment Plants in Santa Rosa, California Area

Sewage Treatment Plant	Date	Coliform per 100 ml	
		Total	Fecal
West College Avenue	8/22/73	420	<67
West College Avenue	8/23/73	170	<67
Laguna	8/24/73	110	6
Sebastopol	8/24/73	120*	<20
Rohnert Park	8/24/73	3700	50*

*Estimate

Source: Laboratory Support Branch
EPA, Region IX
9/73

Table 6

FIELD DATA

WEST COLLEGE AVENUE STP

TIME	FLOW (mgd)	INFLUENT TEMP. (°C)	PRIMARY EFFLUENT SETT. SOLIDS (ml/l/hr.)	FINAL CLAR. EFFLUENT TEMP. (°C)	FINAL EFFLUENT TEMP. (°C)	FINAL EFFLUENT SETT. SOLIDS (ml/l/hr.)
21-22 Aug. 73:						
12:00 NOON	8.8	25.3	0.45	24.5	23.5	TR.
4:00 P.M.	7.8	25.5	0.45	25.5	23.5	TR.
8:00 P.M.	7.0	24.0	0.15	24.0	21.0	0.10
12:00 MIDNIGHT	6.8	24.5	0.30	23.5	21.0	0.10
4:00 A.M.	3.7	23.0	0.15	22.5	19.5	0.05
8:00 A.M.	4.0	23.0	0.05	23.0	20.0	0.02
23 Aug. 73:						
12:00 NOON	8.9	25.0	0.45	24.5	23.0	0.02
4:00 P.M.	8.0	25.0	0.45	25.0	24.0	0.05
8:00 P.M.	7.5	25.0	0.30	24.5	22.5	0.10
12:00 MIDNIGHT	6.9	24.0	0.30	24.0	21.5	0.20
4:00 A.M.	3.9	24.0	0.10	23.9	20.5	0.10
8:00 A.M.	4.5	23.0	TR.	22.5	20.0	0.10

Table 7

FIELD DATA

LAGUNA SEWAGE TREATMENT PLANT

TIME	FLOW (mgd)	INFLUENT TEMPERATURE (°C)	EFFLUENT TEMPERATURE (°C)	EFFLUENT SETT. SOLIDS (ml/l/hr)
22-23 AUG. 73:				
11:45 A.M.	2.2	23.0	22.5	0
2:55 P.M.	2.5	23.0	23.0	0
5:50 P.M.	2.4	23.5	23.0	0
8:52 P.M.	2.2	23.0	23.0	0
11:40 P.M.	2.2	23.0	23.0	TR.
2:55 A.M.	2.0	23.0	23.0	TR.
5:40 A.M.	1.6	23.0	23.0	TR.
3:45 A.M.	1.5	22.5	22.5	

Table 8

SEBASTOPOL SEWAGE TREATMENT PLANT

TIME	FLOW (mgd)	INFLUENT TEMPERATURE (°C)	EFFLUENT TEMPERATURE (°C)	EFFLUENT SETT. SOLIDS (ml/l/hr)
22-23 AUG. 73:				
12:05 P.M.	—	26.5	22.0	~0
2:30 P.M.	—	28.0	23.5	0.1
5:25 P.M.	—	26.5	23.5	0.1
8:30 P.M.	—	26.0	23.0	TR.
11:25 P.M.	—	25.0	22.0	0.05
2:35 A.M.	—	24.0	21.0	TR.
5:25 A.M.	—	23.5	21.0	TR.
8:18 A.M.	—	26.0	20.0	

Table 9

FIELD DATA

ROHNERT PARK SEWAGE TREATMENT PLANT				
TIME	FLOW (mgd)	INFLUENT	EFFLUENT	
		TEMPERATURE (°C)	TEMPERATURE (°C)	SETT. SOLIDS (ml/l/hr)
2-23 AUG. 73:				
11:06 A.M.	1.37	24	21.5	TR.
2:04 P.M.	1.58	24.0	22.5	TR.
5:00 P.M.	1.22	24.0	22.5	TR.
8:00 P.M.	1.37	25.0	22.0	TR.
11:00 P.M.	1.40	25.0	21.0	TR.
2:10 A.M.	1.01	23.5	20.0	TR.
4:55 A.M.	0.58	23.0	20.0	TR.
7:50 A.M.	0.50	23.0	19.5	

Table 10

CHLORINE RESIDUAL DATA AT TRICKLING FILTERS
WEST COLLEGE AVENUE STP

STATION	DATE & TIME	RAW SEWAGE FLOW (mgd)	CHLORINE ADDITION (lb/day)	CHLORINE RESIDUAL * (p.p.m.)
TRICKLING FILTER INFLUENT (IN W.W.)	8/22, 2:15 P.M.	8.5	240	0.0
TRICKLING FILTER EFFLUENT	8/22, 2:15 P.M.	8.5	240	0.0
TRICKLING FILTER INFLUENT (IN W.W.)	8/23, 8:50 A.M.	4.8	290	1.6
TRICKLING FILTER EFFLUENT	8/23, 8:50 A.M.	4.8	290	0.0
FILTER ARM DISCHARGE (T.F. No 1)	8/23, 1:35 P.M.	8.7	260	1.25
FILTER ARM DISCHARGE (T.F. No 2)	8/23, 6:00 P.M.	7.5		0.0

* ANALYSES PERFORMED BY CALIFORNIA DEPARTMENT OF FISH & GAME

APPENDIX D

California Regional Water Quality Control Board
North Coast Region

MONITORING AND REPORTING PROGRAM NO. 72-42

for

CITY OF SANTA ROSA
Sonoma County

WEST COLLEGE AVENUE SEWAGE TREATMENT PLANT

MONITORING

Treatment Plant Monitoring

Samples shall be collected at the point of discharge to the oxidation ponds. Composite samples may be taken by a proportional sampling device approved by the Executive Officer or by grab samples composited in proportion to flow. In compositing grab samples, the sampling interval shall not exceed one hour. The following shall constitute the monitoring program:

Constituent	Units	Type of Sample	Sampling Frequency
BOD(20°C, 5-day)	mg/l	8-hour composite	weekly
Settleable Matter	ml/l	grab	daily
Nonfilterable Residue	mg/l	8-hour composite	weekly
Hydrogen Ion	pH	grab	daily
Maximum Flow	mgd	—	daily
Average Daily Flow	mgd	—	daily

Final Effluent Monitoring

Samples shall be collected in the chlorine mixing channel at the last practical point before the effluent is discharged to Santa Rosa Creek. The following shall constitute the final effluent monitoring program:

Constituent	Units	Type of Sample	Sampling Frequency
BOD(20°C, 5-day)	mg/l	grab	weekly
Settleable Matter	ml/l	grab	daily
Nonfilterable Residue	mg/l	grab	weekly
Hydrogen Ion	pH	grab	daily
Coliform Organisms	MPN/100 ml	grab	weekly
Chlorine Residual	mg/l	grab	daily
Fish Bioassay	96-hr % survival	grab	monthly
Maximum Flow	mgd	—	daily
Average Daily Flow	mgd	—	daily

The three-spined stickleback, Gasterosteus acceleatus, shall be used as the test organism for the Fish Bioassay analysis.

REPORTING

Monthly monitoring reports shall be submitted to the Regional Board by the 15th day of the following month. In reporting the monitoring data, the discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner to illustrate clearly the compliance with waste discharge requirements. The monitoring and any necessary narrative reports shall be transmitted in accordance with specifications of Resolution No. 71-5 adopted by this Board on February 3, 1971.

Ordered by ____________________
David C. Joseph
Executive Officer

October 25, 1972

APPENDIX E

California Regional Water Quality Control Board
North Coast Region

Order No. 72-42

WASTE DISCHARGE REQUIREMENTS
for

CITY OF SANTA ROSA
WEST COLLEGE AVENUE SEWAGE TREATMENT PLANT

The California Regional Water Quality Control Board, North Coast Region, finds that:

1. Municipal waste from most of the City of Santa Rosa is treated at the West College Avenue Sewage Treatment Plant prior to discharge to Santa Rosa Creek. During dry weather, waste is treated to "secondary" level, disinfected and discharged to the relatively small creek flow. Because of infiltration, wet weather flows are extremely high and treatment efficiency is lowered.

2. The design "capacity" of the West College Avenue Sewage Treatment Plant is 5 mgd. However, oxidation ponds and disinfection facilities have enabled compliance with conventional effluent parameters at dry weather flow rates up to 6.5 mgd.

3. On June 14, 1971, the Regional Board adopted Interim Water Quality Control Plan for the North Coastal Basin which included a "Program of Implementation" calling for diversion of excess flows from the West College Avenue Sewage Treatment Plant in 1972; expansion of capacity at the Laguna Sewage Treatment Plant in 1973; and management of commingled natural and waste flows in the Laguna de Santa Rosa by May 15, 1974.

4. Beneficial uses of Santa Rosa Creek and Laguna de Santa Rosa include:

    a. agricultural water supply
    b. preservation and enhancement of fish and wildlife
    c. recreation
    d. aesthetic enjoyment

    Beneficial uses of the Russian River include:

    a. domestic water supply
    b. industrial water supply
    c. agriculaural water supply
    d. water contact recreation
    e. preservation and enhancement of fish and wildlife
    f. aesthetic enjoyment

5. On February 23, 1972, the Regional Board adopted Order No. 72-1, Waste Discharge Requirements for the City of Santa Rosa West College Avenue Sewage Treatment Plant.

6. The Bureau of Sanitary Engineering, California State Department of Public Health, has established "Uniform Guidelines for Sewage Disinfection" which require sewage effluent that is discharged to ephemeral streams such as Santa Rosa Creek to be disinfected to a median coliform level of 2.2 MPN/100 ml; the corresponding 80 percentile coliform level is 4.3 MPN/100 ml.

7. The State of California Department of Fish and Game has adopted a policy which calls for the prohibition of zones of acute toxicity in receiving waters.

8. The Board has notified the discharger and the interested agencies and persons of its intent to prescribe revised waste discharge requirements for the discharge.

9. The Board in a public meeting heard and considered all comments pertaining to the discharge.

THEREFORE, IT IS HEREBY ORDERED, that Order No. 72-1, Waste Discharge Requirements for the City of Santa Rosa West College Avenue Sewage Treatment Plant, adopted on February 23, 1972, be rescinded and the City of Santa Rosa shall comply with the following:

A. DISCHARGE SPECIFICATIONS

1. The discharge shall not contain constituents in excess of the following limits:

Constituent	Units	Median	80 Percentile	Maximum
a. BOD(20°C,5-day)	mg/l	30	50	--
b. Settleable Matter	ml/l	0.2	--	1.0
c. Nonfilterable Residue	mg/l	30	50	--
d. Coliform Organisms	MPN/100 ml	2.2	4.3	--
e. Total Chlorine Residual	mg/l	--	--	0.1

2. The discharge shall not have a pH less than 6.5 nor greater than 8.5 scalar units.

3. The mean daily dry weather flow shall not exceed 6.5 mgd.

4. The discharge shall not cause a pollution.

5. Neither the treatment nor the discharge of waste shall cause a nuisance.

6. The discharge shall not cause the dissolved oxygen at any point in Santa Rosa Creek to be less than 7.0 mg/l.

7. The discharge shall not cause visible evidence of any floatable material or oil and grease in the waters of Santa Rosa Creek.

8. The discharge shall not cause bottom deposits at any point in Santa Rosa Creek.

9. The discharge shall not significantly alter the color of the waters of Santa Rosa Creek.

10. The discharge shall not increase the turbidity of the waters of Santa Rosa Creek more than 20% above naturally occurring background levels.

11. The survival of test fishes in 96 hour static bioassays in undiluted effluent shall for any one determination equal or exceed 70 percent of the test fish. The average survival for any three or more consecutive determinations over a 21-day period shall equal or exceed 90 percent of the test fish.

12. No toxic or other deleterious substances shall be present in concentrations or quantities which will cause deleterious effects on aquatic biota, wildlife or water fowl or render any of these unfit for human consumption either at levels created in receiving waters or as a result of biological concentrations.

B. PROVISIONS

1. The discharger shall comply with the "Monitoring and Reporting Program No. 72-42" and the "General Provisions for Monitoring and Reporting" as specified by the Executive Officer.

2. Compliance with median and percentile values will be established by analysis of representative sampling results over the most recent 30-day period.

3. On or before May 15, 1974, the City of Santa Rosa shall eliminate its discharge of waste to the Russian River or any tributary flowing to the Russian River during the period of May 15 through September 30 and all other periods when the flow of the Russian River as measured at Healdsburg (USGS Gage No. 11-4640.00) is less than 1000 cfs.

4. The City of Santa Rosa shall comply with Discharge Specifications 1(a, b, c, d), and 2 through 10 of this order forthwith.

5. The City of Santa Rosa shall comply with the following time schedule to assure compliance with discharge specifications, 1(e), 11 and 12 of this Order.

Task	Completion Date	Report of Compliance Date
Conduct studies to determine facilities required to comply with requirements	May 1, 1973	May 15, 1973
Design and construct facilities and comply with requirements	May 15, 1974	May 15, 1974

Certification

I, David C. Joseph, Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of an order adopted by the California Regional Water Quality Control Board, North Coastal Region, on October 25, 1972.

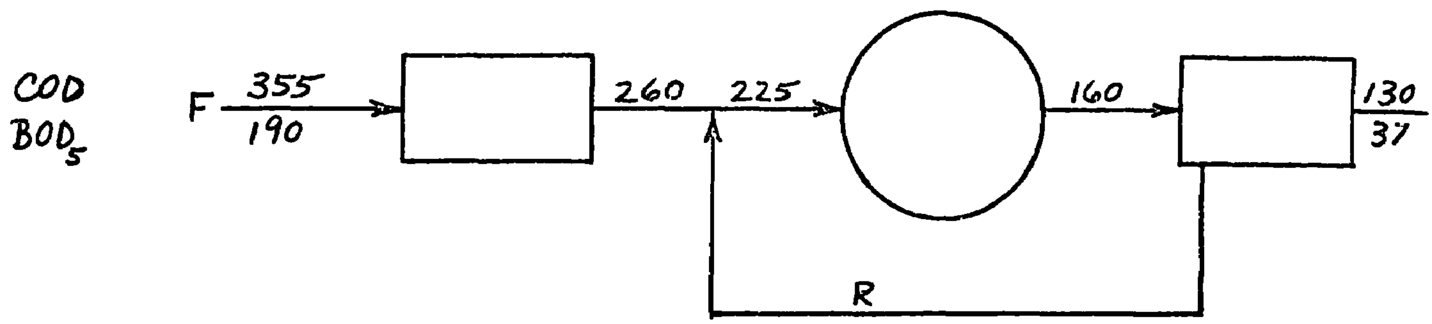
Original signed by

David C. Joseph
Executive Officer

APPENDIX F

SANTA ROSA-WEST COLLEGE S.T.P.

TRICKLING FILTER EVALUATION



SIZE OF EACH TRICKLING FILTER

DIAMETER = 110 FT.

DEPTH = 4.25 FT.

SURFACE AREA = 9505 FT^2 = 0.218 ACRE

VOLUME = 40,400 $FT.^3$ = 0.926 ACRE-FT.

HYDRAULIC LOADING RATE:

$$\frac{6.0 \text{ mgd}}{0.218 \text{ ACRE}} = 27.5 \text{ mgd/ACRE}, \text{ or } 257,600 \text{ cu m/day/ha}$$

ORGANIC LOADING RATE (COD):

$$\frac{260 \text{ mg COD}/\ell \times 3.2 \times 10^6 \text{ gal/day} \times 3.785 \ \ell/\text{gal}}{0.4536 \times 10^6 \text{ mg/lb}} = 6943 \text{ lb COD/day}$$

$$\frac{6943 \text{ lb COD/day}}{40.4 \times 1000 \text{ FT}^3} = 172 \text{ lb COD/day/1000 FT}^3, \text{ or } 2.785 \text{ kg COD/day/cu m}$$

ORGANIC LOADING RATE (BOD_5): (ASSUME THE PRIMARY EFFLUENT HAS THE SAME COD/BOD_5 RATIO AS THE INFLUENT WASTEWATER)

INFLUENT: $COD/BOD_5 = 355/190 = 1.87$

$$\frac{172 \text{ lb COD/day/1000 FT}^3}{1.87 \text{ lb COD/lb BOD}_5} = 92 \text{ lb BOD}_5\text{/day/1000 FT}^3, \text{ or } 1.49 \text{ Kg BOD}_5\text{/day/cu}$$

COMPARISON OF ACTUAL TRICKLING FILTER PERFORMANCE TO EMPIRICAL TRICKLING FILTER DESIGN FORMULAS:

PRIMARY EFFLUENT COD = 260 mg/l.

PRIMARY EFFLUENT $BOD_5 = \frac{260 \text{ mg/l}}{1.87} = 139$ mg/l.

FINAL CLARIFIER EFFLUENT $BOD_5 = 37$ mg/l.

$$\text{PER CENT REMOVAL} = \frac{139-37}{139} \times 100 = 73.4\%$$

EMPIRICAL FORMULAS: (SEE PROCESS DESIGN MANUAL FOR UPGRADING EXISTING WASTEWATER TREATMENT PLANTS, by ROY F. WESTON, INC., OCTOBER, 1971, CHAPTER 4, pp. 4-1 THRU 4-39)

NATIONAL RESEARCH COUNCIL FORMULA:

$$E_1 = \frac{100}{1 + 0.0085\left(\frac{W}{VF}\right)^{1/2}}$$

$$W = \frac{139\ \text{mg BOD}_5/\ell \times 3.2 \times 10^6\ \text{gal/day} \times 3.785\ \ell/\text{gal}}{0.4536 \times 10^6\ \text{mg/lb.}} = 3715\ \text{lb BOD}_5/\text{day}$$

$$V = 0.926\ \text{ACRE-FT.}$$

$$F = (1+R)/(1+0.1R)^2 \qquad R = 5.6/6.4 = 0.875$$

$$F = \frac{1.875}{(1.0875)^2} = 1.585$$

$$E_1 = \frac{100}{1 + 0.0085\left[\frac{3715}{(0.926)(1.585)}\right]^{1/2}} = 70.9\ \%$$