UTILITY STUDY
FOR
COURTHOUSE BAY

Utility Study for Courthouse Bay
Area, MCB CLNC

#34

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#34

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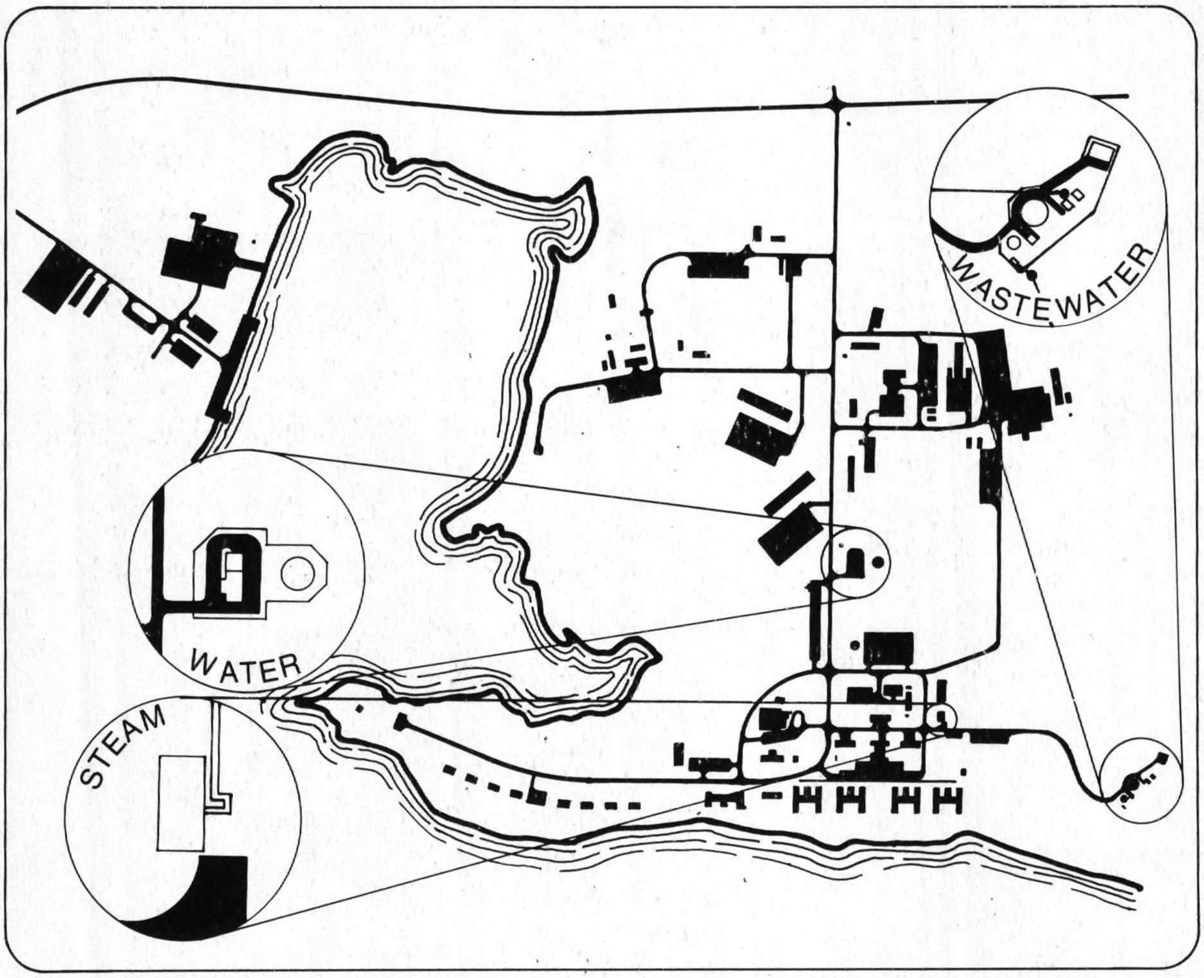
A UTILITY STUDY FOR COURTHOUSE BAY AREA MARINE CORPS BASE

CAMP LEJEUNE, NORTH CAROLINA

A-E CONTRACT NO. N 62470-78-C-3675



J. E. SIRRINE COMPANY

ARCHITECTS ENGINEERS PLANNERS

ARCHITECT - ENGINEER DIVISION

JANUARY 31, 1979

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

Marine Corps Base
Camp Lejeune, North Carolina

Prepared by: J. E. Sirrine Company
Greenville, South Carolina
5 February 1979

A-E Contract No. N62470-78-C-3675

Sirrine Job No. A-1086

FOREWORD:

The contents of this study are based on the scope forwarded to Sirrine by LANTDIV letter 09A21E:MLB, dated 17 July 1978, and that later determined at a meeting held at LANTDIV on 2 August 1978, covered by J. E. Sirrine's history of the meeting dated 24 August 1978. In addition to this scope, a total of 32 man days was spent in the Courthouse Bay Area gathering information necessary to establish existing conditions. A survey crew was also in the area for approximately four days establishing elevations, inverts, line lengths, etc., necessary for the accuracy of the study.

The study determines and evaluates the existing conditions at Courthouse Bay and the AMTRAC Area and makes recommendations for upgrading and increasing capacities of the following systems:

1. Water and Sanitary Sewer Distribution and Collector System
2. Water Treatment Plant
3. Wastewater Treatment Plant
4. Steam Generation and Distribution System

The study includes all projects scheduled for construction prior to FY-86. The exception to this would be the Mini Gym which has not been programmed, but the spare capacity of the steam generation plant is considered to be adequate to serve the addition of this building. According to the information given Sirrine by Mr. Al Auston and/or Mr. Bill Barnes, Base Facilities and Planning the projects scheduled through fiscal year 1986 include:

1. Bachelor Enlisted Quarters Project P-613; FY-80

2. Addition to existing Enlisted Men's Club, Building No. BB-54; FY-79. This project has no plumbing.
3. Mini Gym, to include basketball, handball, sauna, and showers. Size will be from 4000 to 6000 sq. ft. Unprogrammed and no information is available for this study.
4. Location Exchange, 7200 sq. ft.; FY-79.
5. Fresh waterline to AMTRAC Area; FY-79.
6. Oil collection project at AMTRAC Area; FY-80.

Note: It is recommended by this Study, Section 100, page 13, that a leak survey be performed on the existing water distribution system before proceeding with the other recommendations in the Study.

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A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

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-SECTION 100-

WATER AND SANITARY SEWER

DISTRIBUTION AND COLLECTOR SYSTEM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

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I. COURTHOUSE BAY SANITARY SEWER COLLECTOR SYSTEM - DESCRIPTION OF EXISTING SYSTEM

A. General

During the period of field measurement and site investigation, the Courthouse Bay and Amtrac Area was not operating at maximum capacity. There were two companies of Amtrac troops off on maneuvers (approximately 450 people) and only 400 of the 654 assigned engineering students on base. Information from the using agencies indicates that the present authorized capacity of the area is as follows:

1. Present:

(a)	Two existing engineering students barracks (BB-250 and BB-255)	=	654
(b)	Four existing substandard barracks (BB-11, 12, 13, and 14)	=	664
(c)	Bachelor Officers Quarters (BB-45)	=	30
(d)	Married Officers Housing (assuming 4 people per house) (BB-17, 18, 19, 20, 21, 22, 23, and 24)	=	32
(e)	Off base	=	825
	Total Daytime Capacity		2,025

When the B.E.Q. Project P-613 is completed, which is the only housing facility projected for the future, the authorized capacity of the area will be as follows:

2. Fiscal Year 1986:

(a)	Two existing engineering students barracks	=	654
(b)	Three new barracks (P-613)	=	882
(c)	Bachelor Officers Quarters	=	30
(d)	Married Officers Housing	=	32
(e)	Off base	=	607
	Total Daytime Capacity		2,025

The Courthouse Bay and Amtrac Area is adjacent to New River. The flood elevation of New River is ten feet above mean sea level. The site is basically flat and composed of sandy soil. The ground water table generally stabilizes at three to six feet below existing grade (information taken from soil report by Soil Systems, Inc. dated August 8, 1978, see Appendix I).

I. DESCRIPTION OF EXISTING SYSTEM - (Continued)

The untreated raw sewage in the Amtrac Area is pumped to Courthouse Bay. The sewage in Courthouse Bay Area is then pumped to the wastewater treatment plant.

B. Method of Making Flow Test

Manning Recorders were used for making flow test. This type recorder was best suited to get the type of information needed for this study. The Manning Recorder is designed to record on a graph the depth of flow through a manhole plus the time of day that it occurs. By knowing the depth and the time it occurs, the peak discharge time for that day can be determined. The recorders were installed in Manholes No. 422, No. 413, and No. 1000. They were left in the manholes for approximately one week to obtain some consistency in the peak discharge time. The recorder from Manholes No. 422 and No. 413 clearly indicated that the maximum discharge time occurs from 5:30 a.m. to 7 a.m.; during this time troops were getting dressed, showering, and eating. The recorders showed the next highest discharge time occurring from 6 p.m. to 7 p.m. This discharge was not as large as the one in the morning. The recorder in Manhole No. 1000 did not clearly indicate a maximum discharge time except for one particular day, from 4 p.m. to 4:30 p.m.; during this time span, the Amtrac Troops were washing up and getting ready to go back to the barracks.

C. Field Measurements

The existing maximum peak discharge for each line was obtained by field measuring each manhole with a yardstick during peak times and calculating the discharge rate from the depth of flow measured. The results of these measurements can be seen in Appendix I. These measurements cannot be used as existing peak discharges since the manpower at Courthouse Bay was not at its capacity as stated hereinbefore. The results were used to give an idea of sediment in the inlet and outlet pipes of the manhole and as a guide for the maximum existing peak discharge calculations.

D. Peak Discharge

Since the existing maximum peak discharges could not be determined by field measuring, they had to be calculated. The procedure used for calculating this flow was fixture units.

E. Design Parameter

The sanitary sewer design for sizing sewer pipes was based on Manning Formula of $n = 0.013$.

I. DESCRIPTION OF EXISTING SYSTEM - (Continued)

Manning Formula

$$Q = \frac{1.486}{n} R^{2/3} S^{1/2} A$$

Q = Flow through pipe in cubic feet per second (c.f.s)

n = Coefficient of roughness of pipe

R = Hydraulic radius; the cross-sectional area of waterway divided by the wetted perimeter

S = Slope of hydraulic gradient

A = Cross-sectional area of pipe

The coefficient of roughness from the sewer will be 0.013 per NAVFAC DM-5 Manual.

The new pipes were designed to insure a velocity of at least 2.5 feet per second when pipe is flowing full, per NAVFAC DM-5 Manual.

F. Infiltration Rate

The rate of infiltration of water into the sanitary sewer collector lines was found to be very high. There are several possible reasons for the high rate of infiltration, but the major reason could be as follows:

> Infiltration could be due to the high ground water table on this site (three to six feet below existing grade). The average depth of the sanitary sewer lines is approximately ten feet. This would indicate that the sanitary sewer lines are installed below the water table for most of the site and ground water is seeping in through joints or broken pipe.

The infiltration rate used in this study was not assumed. The rate was obtained by field measuring the flow through certain sanitary sewer manholes during hours of nonactivity in the area. Once the depth of flow was known, slope of pipe, total length of pipe to point of measurement and pipe size, the rate of infiltration can be calculated using Manning Formula.

G. Sanitary Sewer Collector System

1. Amtrac Area:

The Amtrac collection lines consist of approximately 976 feet of vitrified clay pipe and approximately 264 feet of cast iron pipe. The manholes on this system consist of precast

I. DESCRIPTION OF EXISTING SYSTEM - (Continued)

concrete and brick masonry. The precast manholes are in very good condition, but the brick manholes are only in fair condition.

The infiltration rate was obtained by field measuring the manholes during hours of nonactivity. The rate of infiltration was arrived from data taken from Manhole No. 1009. This rate was found to be 0.0224 gpm/linear foot of pipe. See Appendix I.

The existing flow through the collection system was obtained by using fixture units from each building and converting them into gallons per minute. The maximum existing flow is equal to the existing flow plus the infiltration rate at any length throughout the system. Appendix I indicates the system to be adequate.

2. Courthouse Bay:

The collection lines consist of approximately 6,840 linear feet of vitrified clay pipe and approximately 1,050 linear feet of cast iron pipe. The majority of manholes are brick masonry. The bottoms in several of the manholes are in very bad condition, due to settlement of the manholes and scouring from pipes that have been tied into the manhole without using an outside drop. The collection system is approximately 35 years old. Sediment of sand and waste was very evident in several manholes. The sand is probably due to new construction tying onto the system, while the waste is contributed to low velocity in the lines. The collection lines are constructed on a very flat slope (0.003 ft/ft approximate average). Appendix I gives a detailed picture of the characteristics of the collection system.

Courthouse Bay has basically two collection line systems that terminate at Manhole No. 412. The first system consists of Manhole Nos. 425 through 413. The eixsting flow through this system was arrived at by adding the fixture units per building at the manhole under consideration. Then the fixture units were converted into gpm. Most of the buildings connected to this collection system were considered contributing to the existing flow during peak discharge. It should be noted that the total existing flow through the system does not exceed the maximum design flow of the pipe.

The other collection system consists of Manhole No. 666 to Manhole No. 412. The existing flow through this system from Manhole No. 666 to Manhole No. 431-A was arrived at by adding the fixture units per building at the manhole under consideration. Then the fixture units were converted into gpm and added to the 275 gpm pumped by the sanitary sewer lift station

I. DESCRIPTION OF EXISTING SYSTEM - (Continued)

in the Amtrac Area. The existing flow from Manhole No. 431-A to Manhole No. 412 was arrived at by using the fixture units from Buildings Nos. 250 and 255. Since the peak discharge flow occurs from 5:30 a.m. to 7 a.m., the other buildings connecting to this system will not be considered contributing to the flow during peak discharge. Exhibit "A" describes the existing sanitary sewer layout system. The characteristics of this system are shown in Appendix I. Appendix I shows that the maximum existing flow during peak discharge only exceeds the maximum design flow of the system between Manholes No. 438 to No. 431-A and Manholes No. 429 to No. 428.

Due to peak discharge time of day, the Amtrac lift station should not be running, but since the effected storage capacity of the lift station is only 188 gallons and the rate of infiltration in the Amtrac Area is 27.8 gpm, it will take the station approximately 7 minutes to start up. Therefore, the lift station would come on several times during peak discharge time. Considering the flow from the lift station contributing to the peak discharge rate, it is evident that lines from Manholes Nos. 438 to 412 are undersized. Since the discharge from the lift station will last approximately one minute, it is our opinion that this flow will not be the deciding factor in peak discharge. What the system is experiencing during this flow is some back up of the system for a short period of time.

H. Lift Station

1. Amtrac Area:

The Amtrac Area has no facilities to treat the raw sewage; therefore, the sewage is pumped through a 6-inch cast iron pipe to Manhole No. 666 at Courthouse Bay.

The lift station is a one-story concrete building with a four-foot diameter concrete manhole as a wet well. The station is approximately one year old. The contents of the building consist of two 275 gpm pumps with 15 horsepower electrical motors.

The station has one diesel engine, used as a standby power supply. The pumps are designed to alternate during run time. The effective storage capacity of wet well consists of 188 gallons, which will produce a run time of less than one minute per pump. The infiltration rate coming into the lift station is 27.8 gpm. At this rate, it will take the wet well approximately 7 minutes to fill up. This means that every 7 minutes the pumps will come on during nonactive hours. See Appendix I. During active hours, the pumps will come on more frequently.

I. DESCRIPTION OF EXISTING SYSTEM - (Continued)

2. Courthouse Bay:

The existing sanitary sewer lift station at Courthouse Bay pumps the untreated sewage to the wastewater treatment plant. The station building consists of two floors. The main floor is the operating floor and the lower floor consists of valves, pumps, and discharge piping. The concrete building is approximately 35 years old. At present, the station has one 500 gpm pump with a 7-1/2 horsepower motor and one 300 gpm pump with a 5 horsepower motor. A gasoline engine in the station is used for auxiliary power to run the pump.

The Courthouse Bay waste flows by gravity to Manhole No. 412; while the Amtrac Area is pumped to Manhole No. 666 and then flows by gravity to Manhole No. 412. There is a 12-inch cast iron pipe leading from Manhole No. 412 to the wet well of the lift station. The capacity of the wet well up to the invert of the 12-inch cast iron pipe is 6,600 gallons. The waste is then pumped out of the wet well by vertical, dry pit, nonclog, centrifugal sewage pumps through approximately 1,000 feet of 8-inch cast iron pipe to the wastewater treatment plant.

The calculated maximum existing flow that the wet well is receiving is 776 gpm. Taking into consideration the storage capacity of the wet well and assuming the maximum pumping capacity with both pumps running is around 600 gpm; this would leave a difference of 176 gpm or 38 minutes before the wet well would back the flow up in Manhole No. 412. See Appendix I.

II. RECOMMENDATIONS FOR SANITARY SEWER COLLECTOR SYSTEM

A. General

The schedule of projects to be constructed during the next eight years consist of the following:

1. P-613, B.E.Q. Project. This project consists of constructing three new barracks. The three barracks will be located west of the existing engineering barracks and south of Grace Lane. The existing barracks (BB-11, 12, 13, and 14) will be demolished.

2. A 7,200 square foot Exchange Building will be located just north of Clinton Street and east of Marines Road.

3. An oil spill prevention plan is proposed for the Amtrac vehicles in the Amtrac Area. This plan will consist of concrete aprons and drainage system around Building A-3 to collect the oil spills. A 150,000 gallon storage tank and

oil separator are also included.

4. Under P-996, Industrial Waste Collection and Treatment Facilities, the filter backwash from the water treatment plant may be pumped into sanitary sewer Manhole No. 428 at 50 gpm from a holding tank.

B. Sanitary Sewer Collector System

1. Amtrac Area:

This system is capable of handling the additions in this area. Due to the high rate of infiltration in this system, we recommend a video test to determine where the cracks are in the lines and grouting the cracks. This recommendation has been included in our cost estimate.

2. Courthouse Bay:

The three new barracks are to be located west of the existing engineering barracks and south of Grace Lane. The new sanitary sewer collector line servicing these barracks will tie into existing Manhole No. 428. This collector line will consist of 8-inch and 10-inch Polyvinyl Chloride Pipe (PVC) per LANTDIV recommendations. Due to the terrain, the new collector line will have to be laid on a very flat slope, which contributes to the size of the pipes. The minimum required 2.5 feet per second velocity (NAVFAC DM-5) also contributes to the pipe size.

The infiltration rate was assumed to be 30,000 gpd/mile of sewer pipe. This rate is for average conditions where a portion of the length of the sewers is above the ground water table and a portion below. This rate is also based on the anticipated condition of the sewer when it is nearing the end of its useful life. This information was taken from the ASCE Manuals and Reports on Engineering Practice - No. 37 (WPCF Manual of Practice No. 9) entitled "Design and Construction of Sanitary and Storm Sewers." The flow characteristics of this system are shown in Appendix I. The alignment of this system is shown in Exhibit "B".

The proposed collector line will cross over a wet weather draw, which will require piers to support the sewer line. The material used for sewer line pipes where crossing on piers will be cast iron. The new collector line will consist of approximately 3,490 linear feet of Polyvinyl Chloride pipe and approximately 80 feet of cast iron pipe. Project No. P-613 will cover the cost of the new sanitary sewer collector line down to Manhole No. 428. This study will only address itself to the additional cost of collector lines beyond the P-613 Project. The study reveals only an addition of 1,355 feet of sanitary sewer collector lines will be needed.

II. RECOMMENDATIONS FOR SANITARY SEWER COLLECTOR SYSTEM - (Continued)

A new sanitary sewer collector line will be constructed out of existing Manhold No. 428, per LANTDIV recommendation, see Exhibit "B". This line will help relieve the existing line during surcharge.

Under P-996, Industrial Waste Collection and Treatment Facilities, the filter backwash from the water treatment plant will gravity drain into a surge storage tank and then pumped into sanitary sewer Manhole No. 428 at a rate of 50 gpm. Our recommendations are to pump the backwash from the holding tank during nonpeak discharge times.

The sanitary sewer lines between Manholes Nos. 438 to 431-A and 429 to 428 are experiencing surcharge. LANTDIV concurs with this conclusion. LANTDIV decided that the amount and frequency of surcharge between these manholes do not warrant replacing these lines at this time.

Our recommendation is to clean out all of the sanitary sewer lines and run a video test to determine where the cracks are in the lines and grout them.

C. Lift Station

1. Amtrac Area:

The only addition affecting the lift station is the proposed oil spill prevention plan for the Amtrac vehicles. This plan will consist of concrete pavement and drainage system around Building A-3, to collect the oil spills. The spills will then drain into a drainage system, which drains into a 150,000 gallon holding tank. The tank will have two 50 gpm pumps to pump the oil and water to a dual coalescing parallel plate separator. The water will then drain into the lift station.

Since the holding tank pumps can be turned on at any time to drain the tank, our recommendation is to run the pumps during nonpeak days for the wastewater treatment plant. Neither sanitary sewer collector system nor the wastewater treatment plant will be designed to handle this additional flow during peak hours or maximum days.

II. RECOMMENDATIONS FOR SANITARY SEWER COLLECTOR SYSTEM - (Continued)

Since the storage capacity of the lift station is only 188 gallons, it will only take approximately 3.5 minutes to fill the storage with one of the 50 gpm pumps running. It should take approximately two minutes for the 275 gpm lift station pump to pump the storage out and turn off while the 50 gpm pump is still on. This cycle will repeat itself until the 150,000 gallon holding tank is empty or the 50 gpm pumps are turned off. This kind of cycle time is not desirable from our view.

Our recommendation is to adjust the level indicator float switches to obtain more storage capacity in the wet well and install a 8' x 10' x 4' concrete wet well adjacent to the existing wet well and connect them with a 12" diameter concrete pipe. See Appendix I. This will increase the storage capacity from 188 gallons to approximately 2,000 gallons. This will also increase the run time of the pumps from one minute to seven minutes. During nonactive hours when the lift station will only see infiltration at a rate of 27.8 gpm, it will take the station approximately 72 minutes to start up.

2. Courthouse Bay:

The addition of the new Amtrac Troop Barracks will bring the maximum flow to the lift station up to 885.2 gpm and 1160.2 gpm if the lift station in the Amtrac Area is pumping. Since the combined pumping flow of the existing pumps is approximately 600 gpm, this would mean that the wet well will start backing up the flow into Manhole No. 412 in 23 minutes. See Appendix I. Since peak discharge time lasts over one hour and the maximum head that the existing pumps can pump against is 40 feet, it is our recommendation to replace both pumps and motors with two 700 gpm pumps at a pumping head of 50 ft. The same pumps must also be able to pump 625 gpm at a pumping head of 90 ft., when both are pumping. This recommendation would mean that the total combined pumping flow will be around 1250 gpm. The proposed expansion of the wastewater treatment plant is hydraulically designed to handle around 1250 gpm. The increase in flow should have very little effect on the existing 8-inch cast iron pipe force main to the treatment plant. The pipe should be able to handle the increase flow with a velocity of eight feet per second and a friction loss of 4.5 feet per one hundred feet of pipe.

III. COURTHOUSE BAY WATER DISTRIBUTION SYSTEM - DESCRIPTION OF EXISTING SYSTEM

A. General

The water treatment plant at Courthouse Bay obtains its raw water

III. COURTHOUSE BAY WATER DISTRIBUTION SYSTEM - DESCRIPTION OF EXISTING SYSTEM - (Continued)

from four wells. After the water is treated, it is then pumped to a 350,000 gallon underground storage tank and a 100,000 gallon elevated tank. The elevated tank is used to provide a maximum pressure of 52 psi and a minimum of 42 psi on the distribution system.

The water treatment plant has two 500 gpm pumps and one 750 gpm pump with the capability of pumping 1250 gpm of potable water into the distribution system. At present, only one of the two 500 gpm pumps can operate while the 750 gpm pump is running.

At present, the Courthouse Bay water treatment plant does not furnish potable water to the AMTRAC AREA. There is a well in the Amtrac Area that provides water for this area. There is an 8-inch treated water line being installed now under Construction Contract No. N62470-78-B-3001 to serve the Amtrac Area with potable water. See Exhibit "D". It is our understanding that the existing well in this area will be used as a standby only. It is also our understanding that the 8-inch treated water line will serve only what the existing well is now serving.

B. Water Demand

The existing water demand was arrived by using per capita figures from the "Naval Facilities Design Manual" DM-5 and some assumptions. The following assumptions were made: number of motor vehicles being washed, amount of lawn sprinkling, number of meals, and average number of engineering students in barracks.

The average daily demand of potable water before the engineering barracks BB-250 and BB-255 were added was calculated to be 224,450 gallons per day (gpd). The maximum 24-hour demand was calculated to be 445,515 gpd. The average of the calculated maximum 24-hour demand and the average calculated daily demand will be 334,980 gpd. Comparing this figure with the actual average daily demand of 318,900 gpd, it can be assumed that factors used and assumptions made are realistic. See Appendix I for calculation data.

After the construction of the two new engineering barracks, the average calculated flow became 324,000 gpd. Compared with 385,000 gpd as the actual average daily flow, the maximum 24-hour demand was calculated to be 656,400 gpd. This figure is very realistic, since the plant has exceeded 600,000 gpd. See Appendix I for calculations.

It is very important to note that a per capita figure of 225 gpd was used for the new engineering barracks. This figure was obtained by taking the maximum difference between what the sanitary sewage treatment plant was recording before the new engineering barracks

III. COURTHOUSE BAY WATER DISTRIBUTION SYSTEM - DESCRIPTION OF EXISTING SYSTEM - (Continued)

were constructed and the recording after construction. The difference was divided by the average days per month, which would give a figure in gallons per day. The assumption was made that the barracks averaged 500 students per day. Dividing the gallons per day by the number of students, one can obtain a figure of 212.88 gpd/person. Therefore, 225 gpd/person will be a good figure to use for the Engineering Barracks and the B.E.Q. P-613 since they will be similar to the Engineering Barracks. This figure does not include infiltration rate, since the Engineering Barracks tie-in line is very short. See Appendix I for calculations.

C. Wells

The Courthouse Bay Area has four wells supplying raw water to the water treatment plant. The location of these wells can be seen on Exhibit "D". Well data is listed as follows:

Well Numbers	BB-221	BB-220	BB-44	BB-43
Motor Horsepower	10.0	7.5	5.0	5.0
Rated Gallon Per Minute	300	150	190	175
Designed Head (Ft.)	82	78	60	63
Age of Well (Approx. Years)	3	3	35	35
Depth of Well (Approx. Feet)	200	200	62	60
Type of Building	Prefab	Prefab	Masonry	Masonry

Johnston vertical turbine pumps are used for Wells Nos. BB-43 and BB-44. Layne and Bowler pumps are used for Wells Nos. BB-220 and BB-221.

It is our understanding that most of the raw water supplied to the treatment plant is obtained from Wells Nos. 220 and 221. Well No. 44 is used occasionally, and Well No. 43 is not used at all.

D. Fire Protection

1. Water Demand for Unsprinklered Facilities:

The classification of occupancies rating for building and the water demand required for each classification was taken from the Naval Facilities Design Manual DM-8 "Fire Protection". Courthouse Bay consists of four types of occupancies. The four types of rating are listed below:

III. COURTHOUSE BAY WATER DISTRIBUTION SYSTEM - DESCRIPTION OF EXISTING SYSTEM - (Continued)

OCCUPANCY	HOSE STREAM	DURATION
Light Hazard Occupancies	750 gpm	60 minutes
Ordinary Hazard Group 1 Occupancies	1000 gpm	75 minutes
Ordinary Hazard Group 2 Occupancies	1250 gpm	90 minutes
Ordinary Hazard Group 3 Occupancies	1750 gpm	120 minutes

The above hose stream gpm and duration minutes were taken from NAVFAC DM-8 Table 7-2 under Favorable Conditions. The Favorable Condition column can be used since there is a well-trained fire department. See Appendix I for list of individual dwelling rating.

It should be noted that the above water demand for the fire rating must be accomplished with a pressure of not less than 20 pounds per square inch.

The existing pressure and flow rating was obtained by field testing of fire hydrants. The hydrants were tested with a pitot tube and pressure gages. See Appendix I for results.

2. Storage Requirements:

According to NAVFAC DM-8, the requirements for fire protection water storage are based on the assumption that there will be only one fire at a time. The total storage capacity required is equal to the peak fire flow demand plus 50 percent of the peak daily consumption. Therefore, a storage of 538,195 gallons is required. See Appendix I. The existing system only has 450,000 gallons of storage available, leaving the system short by 88,195 gallons. The 525,000 gpd capacity water treatment plant will only be able to supply approximately 44,000 gallons during the two-hour fire fighting period. This will leave the present storage system short by some 44,200 gallons according to NAVFAC DM-8. NAVFAC DM-8 requires that the storage replenishment shall reach required volume during normal consumption within 48 hours and within 24 hours by curtailing normal consumption. The existing system can meet these requirements. See Appendix I.

IV. RECOMMENDATIONS FOR WATER DISTRIBUTION SYSTEM

A. Water Demand

The water demand for fiscal year 1986 was arrived by using per capita figures from the "Naval Facilities Design Manual" DM-5 and

IV. RECOMMENDATIONS FOR WATER DISTRIBUTION SYSTEM - (Continued)

the same assumptions, as were used to calculate the existing water demand.

The calculated average daily flow of potable water for fiscal year 1986 is 462,950 gallons per day. See Appendix I. The calculated maximum 24-hour demand is 960,200 gallons per day or 670 gallons per minute, compared to the existing 525,000 gallons per day or 365 gallons per minute treatment plant. See Appendix I.

Our recommendation is to have a leak survey performed on the existing water distribution system. The results of this survey should be analyzed before proceeding with the other recommendations in this study.

B. Wells

Our recommendation is to install a new well in the Courthouse Bay Area. The location of the well would be subject to studies to determine a source with adequate supply and good quality. For the purpose of this study, the assumption was made that the well could be located approximately 2000 feet east of existing Well BB-221 along Sneads Ferry Road. The well should be able to produce 300 gpm. See Exhibit "E".

Our recommendation for the new well is based on the following reasons:

1. The maximum supply of raw water needed for fiscal year 1986 will be 670 gpm compared to the existing 365 gpm. To supply 670 gpm to the treatment plant, all four wells must be running to produce this quantity of flow, therefore, leaving the system without a standby well.

2. Wells No. 43 and No. 44 are used very little. The quality of water from these wells is not as good as the water obtained from Wells No. 220 and No. 221.

Due to the additional head on the existing pumps, caused by the new well, the following recommendations are also made:

1. Well No. 221: Add one more stage to the vertical turbine pump and replace the four existing impellers with the next largest size; also replace the existing 10 HP motor with a 15 HP motor.

2. Well No. 220: Add two more stages to the vertical turbine pump and replace the existing 7-1/2 HP motor with the 10 HP motor from Well No. 221.

IV. RECOMMENDATIONS FOR WATER DISTRIBUTION SYSTEM - (Continued)

C. Fire Protection

The existing fire distribution system should have no trouble accommodating the new projects to be built by fiscal year 1986.

It should be noted that the existing system fire flow for Building No. 51 is marginal. LANTDIV concurs with this conclusion. No cost estimate has been prepared for upgrading this fire line. See Appendix I.

The total storage capacity required for fire protection per NAVFAC DM-8 Manual is equal to the product of the fire protection water demand and the required duration. This must be added to 50 percent of the peak daily domestic consumption. The total storage required is 690,200 gallons. See Appendix I for calculations. The existing storage available is 450,000 gallons; therefore, there is a shortage of 240,200 gallons. Our recommendation is to install a new 250,000 gallon storage tank adjacent and similar to the existing 350,000 gallon tank.

The three pumps (one 750 gpm and two 500 gpm) in the treatment plant that pump potable water into the distribution system will have the capability of all running at the same time.

The water used for fire protection in the Amtrac Area comes from the bay. The fire trucks can drop their suction hoses into the bay and pump the water from the bay to the fire.

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-SECTION 200-

WATER TREATMENT PLANT

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

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COURTHOUSE BAY WATER TREATMENT PLANT

I. DESCRIPTION OF EXISTING FACILITIES

A. General

The existing water treatment plant at Courthouse Bay, Camp Lejeune, North Carolina was constructed in 1969. The facility had a design capacity of approximately 400 gallons per minute, with a daily production designed for 576,000 gallons per day. Raw water is supplied to the treatment plant from four wells designated by their well house numbers of BB43, BB44, BB220, and BB221. Their design pumping rates are respectively, 175 gpm, 190 gpm, 150 gpm, and 300 gpm. Normal operations have only two wells pumping at any one time supplying the treatment plant with raw water. The actual water production is considerably less than the design plant capacity of 576,000 gallons per day. Plant downtime during filter backwash and water used during the backwash cycles, and regeneration of the softeners totals approximately 50,000 gallons per day. This results in a net design production capacity of approximately 525,000 gallons per day.

The actual water production flows in the present plant show daily totals of approximately 400,000 gallons per day to a maximum of over 600,000 gallons per day. The extra flow over the design capacity was achieved through bypassing the treatment equipment, chlorinating raw well water, and pumping the raw well water into the distribution system.

B. Treatment Equipment Description

The treatment of the raw well water consists of the following processes in the order of treatment: decarbonation, lime addition, chlorination, pressure filtration, and brine regenerated water softening. A flow diagram is found in Exhibit G.

1. Decarbonation

The well water is pumped to the decarbonator which reduces the excess carbonate and assists in oxidizing iron. The design capacity of the decarbonator is 750 gpm. As the water enters an approximately 25,000 gallon detention tank a lime slurry is added for pH adjustment. Chlorine is added to the detention tank at this point for bacteria removal. The chlorine addition had little effect on the total iron which is primarily in the suspended form.

I. DESCRIPTION OF EXISTING FACILITIES

B. Treatment Equipment Description - Contd

2. Pressure Filtration

The water is piped to the pump suction of the two filter pumps. Each pump has 400 gpm capacity; however, only one pump will operate with the other pump as an online standby. A bypass line connects the service water suction line and the filter feed pump suction piping. This permits bypassing the filters and softeners in the plant. The filter feed pump supplies the chlorinated water to the three sand and gravel filters which removes suspended solids and turbidity from the raw water. The filters are 7'-6" diameter with 6'-0" straight sides. The filter media consists of 12" graded gravel and 30" of graded sand. The filters operate at 400 gpm with a hydraulic loading of slightly over 3 gpm per square foot. From inlet and outlet pressure gauge readings the pressure drop is less than 4 psig. The units are backwashed once per day with treated water; each unit is backwashed individually while the other units are on a standby status. While the filters are backwashed no treated water is produced at the plant. The total backwash of the three existing filters takes 50 minutes.

3. Brine Regenerated Water Softening

A portion of the effluent from the filters is piped to the brine regenerated water softeners. The softeners remove calcium and magnesium ions which contribute to the hardness of the raw water. With the bicarbonate which is present in the raw water, calcium and magnesium carbonate scale could be formed in the distribution piping. The 400 gpm filter effluent flow is divided into 256 gpm for the softeners with 144 gpm bypassed to the softener effluent. This allows the treated water hardness range to be controlled to about 50 to 60 mg/l total hardness. The softeners are 5'-0" diameter with 6'-0" straight sides containing 49 cubic feet of ion exchange resin. At 256 gpm the softeners operate at a hydraulic loading of 6.5 gpm per square foot with both units on line. The units are equipped with individual brine measuring tanks with level controls controlling brine supply pumps. The brine is stored in a 46 ton salt storage and brine saturator structure. The softener backwash, regeneration, brine dilution and rinse water are supplied from the filter effluent piping. The two existing softeners undergo a total of three regeneration cycles per 24 hours during which a total of approximately 13,440 gallons of filtered water is used and discharged to drain.

I. DESCRIPTION OF EXISTING FACILITIES

B. Treatment Equipment Description - Contd

4. Treated Water System

The combination of softened and filtered water hereafter identified as treated water is piped to a 350,000 gallon ground level storage reservoir. Between the treatment plant building and the reservoir a chlorine dosing station is located, but it is not used at the present time due to operational history of the plant and operator preference. The three treated water distribution pumps take suction from the reservoir with the treated water pumped to a 100,000 gallon elevated storage tank for distribution. The three distribution pumps are 500, 500, and 750 gpm in capacity. The 750 gpm pump is also equipped with a water cooled gasoline engine for standby power as well as an electric motor. The two 500 gpm pumps are supplied only with electric motors.

5. Controls

The control systems for the operation of the water treatment plant are of the pushbutton fully automatic/manual type. The control of the well pumps, after manual selection, are governed by the level of the detention tank. The decarbonator air blower, lime slurry pump, and the filter feed pump are controlled by the level controls in the detention tank. The filter feed pumps are also controlled by the filter backwash controls and the level controls in the ground level storage reservoir. The service pumps are controlled by the level instrumentation in the elevated storage tank and the level of the ground level storage reservoir. The filters are backwashed automatically from a timer control. The softeners are also regenerated on the basis of a timer. The softeners and filters can be backwashed and regenerated by manual initiation of the cycles. The brine pumps are controlled by level controls in the brine measuring tanks.

The raw water and treated water flows and quantities are indicated, totalized and recorded. The levels of the detention tank, ground level reservoir, and the elevated tower are indicated and recorded on the control panel.

II. EVALUATION OF THE EXISTING FACILITIES

A. General

The present water treatment plant at Courthouse Bay is operating at a maximum capacity of 400 gpm with the present equipment. With all units on line the filters operate at a flow loading of 3 gpm per square foot, and the softeners operate at a loading of 6.5 gpm per square foot. The flow rate cannot be increased without a decrease in quality or operational problems such as: excessive pressure drop, short service runs, and a corresponding increase in chemical regenerant usages. The present overall quality of water produced in the plant is at design quality. Any raw water bypassing of the plant with only chlorine addition to increase water production is not recommended. The corresponding increase in total hardness, turbidity, iron, dissolved solids, and color would contribute to a worsening quality for the potable water supply.

Water samples were collected on September 20, and 21, 1978 from the following sources:

1. Raw well water - Well BB43
2. Raw well water - Well BB44
3. Raw well water - Well BB220
4. Raw well water - Well BB221
5. Plant raw water - Wells BB43 and BB220 combined
6. Detention tank surface water after lime addition and chlorination
7. Filter influent
8. Combined filter effluent after backwash
9. Softener effluents
10. Combined plant effluent

Copies of the analyses are enclosed, see Exhibit I. The analyses of the four well water sources show considerable calcium hardness, bicarbonate alkalinity, high dissolved solids, iron, turbidity, and color. The sample taken from Well No. BB43 shows significant differences from the other three wells; the following parameters are higher for Well No. BB43: calcium, bicarbonate, total hardness, solids, iron, turbidity, and color.

After decarbonation, lime addition and chlorination the following changes are noted: the pH was raised from 7.2 to 7.8; the free

II. EVALUATION OF THE EXISTING FACILITIES

A. General - Contd

carbon dioxide was decreased from 29 ppm to 7.2; some decrease in turbidity was noted but not a significant amount; before decarbonation the turbidity was 9.0 and after decarbonation it was 8.2. The total iron increased from 1.9 to 3.3 ppm. The decarbonation is effective at reducing the free carbon dioxide; however, the lime addition had only an effect on the pH but not on other parameters. The sample which was taken prior to the filter feed pumps showed little improvement in total dissolved solids and suspended iron due to the added detention tank time.

The pressure filter effluent sample was taken from the common effluent of the three filters after a backwash cycle had been completed. The total iron had decreased but total dissolved solids were not decreased. This could have occurred due to the filter beds not being compacted after the backwash cycle had been completed or an incomplete rinse cycle occurred. The reduction of the solids would improve with time after solids were trapped and the bed became more compacted.

The softener effluents were taken under two operating conditions. The effluent of No. 1 softener was taken prior to regeneration according to volume readings on the totalizing water meter. As seen in the analysis, hardness breakthrough had already occurred. The hardness was 23 mg/l as $CaCO_3$. After regeneration, no hardness was present in the effluent; however, 66 mg/l chlorides were present. With a more complete rinsing this figure would be lower. The No. 2 softener was sampled during its service run and showed no hardness and little chlorides present.

The final sample was taken from the service pumps which use the ground level reservoir for supply. The combined softener effluent and bypassed filter effluent form the treated product water. The hardness was 79 mg/l which is over the 50 - 60 mg/l criteria. All other criteria were within expected ranges. On the basis of the results from these samples we do not see any water quality problems at the Courthouse Bay plant.

B. Operational Evaluation

The operation of the water treatment equipment is conducted in a conscientious fashion by the operators who are working under certain operational handicaps. The operators run frequent routine hardness tests on the softener effluents using the soap test. This is not as accurate as the EDTA titration. The EDTA titration would allow closer monitoring for the hardness breakthrough.

II. EVALUATION OF THE EXISTING FACILITIES

B. Operational Evaluation - Contd.

Provision for adding chlorine is provided at three points in the water treatment plant: raw water detention tank; the piping leading to the ground level reservoir; and the piping from the ground level reservoir to the distribution pumps. Presently the chlorine is added only to the raw water detention tank. This is a preferred place for an effective bacteria kill but disadvantages are present. A free chlorine residual was checked on the No. 1 softener effluent with a 0.6 ppm result. This level of chlorine residual passing through a softener ion exchange resin leads to oxidation of the resin with corresponding loss of ion exchange capacity. This will be evidenced by shorter service times. A preferred site for chlorine addition would be prior to the ground level reservoir, and if needed, after ground level reservoir if the residuals were too low for the distribution system.

The amount of lime addition is approximately 50 pounds daily for 300,000 to 400,000 gallons of water treated. This dosing rate is approximately 15 mg/l at the 400,000 gallon per day rate. A Langelier Index determination was made to determine the corrosion rating. The raw water at pH 7.2 was determined to be slightly corrosive; therefore, lime addition is correctly used to raise the pH to 7.8. This places the Langelier Index to the slightly scaling phase which is desirable.

A problem is present in the method of reporting the raw incoming water and the service (treated) water produced in the plant. A study of the figures reported for the month of September indicates that more water is treated than the raw water coming into the plant. The instrumentation recording the water flows are in need of calibration.

Another point of error is the fact that the filter backwash water comes from the treated water supply in the elevated storage tank. This water has been recorded as treated water but it never is used in the distribution system. The actual distributed treated water is therefore less than what is reported.

Another point is that the water which is reported as softened water is also in error. During the backwash and regeneration cycles, the water used for backwash, rinse and dilution pass through the totalizing water meters. This inflates the softened water figures by those water quantities which actually goes to drain and not to the treated water storage.

The operators at present do not report the quantities of water softened between regenerations. This would give the operators an insight into the effectiveness of the regenerations and changes in the ion exchange capacities of the resin.

II. EVALUATION OF THE EXISTING FACILITIES - Contd

C. Equipment Evaluation

The major deficiencies in the equipment are the control systems and equipment maintenance requirements. Some equipment needs immediate replacement to maintain operations.

The control systems for the filter backwash cycles, softener regeneration, and brine tank level control are in need of replacement. The filter system currently operates under a "battery backwash" method. When the timer initiates backwash, all filters are removed from service and the plant does not produce any treated water until all the filters are backwashed. Each filter is backwashed individually while the other units are in a standby status awaiting return to service or awaiting backwash. This backwash period takes about 50 minutes to complete while the treatment plant is shutdown. This results in a loss of treated water of 20,000 gallons daily; this 20,000 gallons does not include the water used for backwash and rinse. The controls are unreliable and the operator must standby to ensure the cycles are initiated and completed. Some valves do not operate on the automatic mode and must be manually assisted. Several backwash valves currently leak and therefore, must be manually shut off during the service run. The flowmeters for the filter units are out of calibration or are inoperable.

The softener regeneration system is also in need of repair and maintenance. The regeneration is initiated from a timer, as in the case of the filters, and the operator must standby to ensure that the cycles are started and completed.

The brine injection cycle at the time of our inspection was out of adjustment. The brine drawdown in the measuring tank was only 21-1/4" where the operator's manual states a drawdown of 38-3/8" to ensure a complete regeneration of the resin takes place. Without a full salt regeneration the subsequent service times will be shortened. The brine tank level controls are inoperable due to rust penetrations. The brine supply pumps must be manually operated to refill the brine tanks.

In summary, the automatic control systems for operating the filters and softeners are inoperable or unreliable . The systems are essentially operated manually by the plant personnel in order to produce the treated water.

III. PROPOSED FACILITY EXPANSION

A. General

The purpose of this study is to expand the Courthouse Bay water treatment plant capacity to meet the projected water demands of 1986. It has been estimated that the average daily demand of 1986 will be approximately 463,000 gallons per day, and the maximum 24-hour demand will be approximately 960,000 gallons per day. The proposed expansion will increase the design daily production of the water treatment plant from 576,000 to approximately 960,000 gallons per day. The expansion will follow the guidelines established in Civil Engineering Design Manual NAVFAC DM-5, dated April, 1974.

B. Design Criteria

The existing filter system with all units on line operates at about 3 gpm per sq. ft. The DM-5 criteria is 2.0 gpm per sq.ft. for a daily maximum rate, and the criteria for a maximum rate is 3 gpm per sq.ft. The proposed filter system consisting of a total of seven filters is designed for a daily maximum rate of 2.01 gpm per sq.ft. with all units on line. During backwash with one unit off-line the flow loading will increase to 2.36 gpm per sq. ft. for the six remaining on line filters.

The original softeners were designed on a flow loading rate of 6.5 gpm per sq. ft. with both units on line; with one unit on-line during regeneration the flow loading is 13.0 gpm per sq.ft. The proposed softener system consisting of a total of four softeners was designed on a flow loading rate of 5.25 gpm per sq.ft. During regeneration of one unit, the flow loading for the system will increase to 7.44 gpm per sq.ft. which is well within the conservative design.

The design criteria as found in DM-5 was not followed in the present installation of the gasoline engine for the alternate power source for the 750 gpm service pump. DM-5 states that gasoline power sources are not to be installed in a below grade location. The alternate power source for the proposed filter feed pump is a diesel engine power unit installed in a below grade location.

C. Equipment Additions

The basic method of the treatment has not changed: decarbonation, pressure filtration, lime addition, chlorination and softening will still be conducted. The system will, however, be expanded to treat the increased flow where necessary.

D. Decarbonation and Lime Addition

The existing decarbonator has a design capacity of 750 gpm. No

III. PROPOSED FACILITY EXPANSION

D. Decarbonation and Lime Addition - Contd

expansion or modification will be necessary to treat the projected flow rate of 670 gpm. The lime slurry tank and feed pump currently use approximately 50 pounds of lime per 300,000 to 400,000 gallons of water daily. The pump is running at about 2/3 capacity, 60 gallons per hour. The additional flow would require additional lime to be added to the slurry tank and require adjustment of the pump to correctly adjust the pH to non-corrosive levels as determined by the Langelier Index. Replacement of the lime mix tank or the metering pump is not required. The practice of chlorine addition to the detention tank should be discontinued in order to protect the softener ion exchange resin from loss of capacity. Chlorine should be added to the piping leading to the ground level reservoir. If the chlorine residuals are low, as measured in the distribution piping, additional chlorine can be added in the piping from the ground level reservoir to the service pumps. There are three chlorine addition points presently at the plant: one at the detention tank and, one at the inlet of the ground level reservoir, and one at the outlet of the ground level reservoir. Those at the reservoir are not being used presently.

E. Pressure Filtration

The two existing 400 gpm filter feed pumps will be replaced with two new 670 gpm pumps. They will be powered by 20 hp electric motors. One of the units will have a small diesel water cooled engine for a standby power source in addition to an electric motor. One pump will be required to sustain the flow through the plant. The second pump will operate as an inline standby unit as is now the case.

The filter system will require major expansion and modifications to treat the increased flow rate. In addition to the existing three 7'-6" diameter by 6'-0" straight side units, the system will be expanded to include four additional 8'-0" diameter by 6'-0" straight side filters. These seven units will be installed in a parallel configuration served by common inlet and outlet interconnecting piping. The existing piping for the three unit filter system will be extensively modified. New face piping, automatic valves, and interconnecting piping will be necessary to incorporate the new operating conditions. The system will be designed in order that while one unit is off-line undergoing backwash, the remaining six units will continue carrying the load of the treatment plant. This eliminates the downtime which is currently a disadvantage at the plant causing lost water production. The present hydropneumatic valve controls and face piping will be replaced with electronic controls to handle all seven units. The existing control system and face piping cannot be modified to incorporate the expansion. The new filter units will use the same type filter media and depth as the existing units, and the tanks will be mounted on structural legs similar to the existing units. The existing piping from the present filter feed pumps will be retained and used for

III. PROPOSED FACILITY EXPANSION

E. Pressure Filtration - Contd

the expanded system. The existing piping for backwash will also be retained. The increased flow in the 8" piping at 670 gpm will result in less than 4.3 feet per second velocities which remains acceptable. The estimated backwash flow rates of 755 gpm in 8" piping is less than 4.8 feet per second which also remains acceptable.

The number of the new units could be decreased from four units if larger vessels were used. For an example, a 9'-6" or 10' diameter unit system would require only two units. However, larger units require larger volumes of treated water for backwash at a 15 gpm per sq.ft. rate. This greatly increases the wastewater flows, and in addition lowers the plant's treated water production. An additional disadvantage occurs when a large unit would be undergoing backwash. The other units on line would then experience a larger flow loading increase. The backwash piping would also need to be increased to handle the much higher backwash flow rates which would approach 1180 gpm for a 10' diameter unit. It is, therefore recommended to stay with smaller diameter units.

F. Softener System

The present two 5'-0" diameter units will be expanded to include two additional 6'-0" diameter units. The concept of a hardness bypass would be retained. The flow rate sent to the four unit softener system would be about 503 gpm; the hardness bypass will allow 167 gpm to bypass the softener units. The existing softeners and the new softeners will have a resin bed depth of 2'-6". The resin volumes will be 49 cubic feet each for the existing 5'-0" diameter units and 70.7 cubic feet for the new 6'-0" diameter units. The units will have service runs of about 20 hours. The units will be staged in startup as well as the controls being interlocked to prevent more than one unit regenerating at any one time. In addition to the two new units, it is recommended that a new 49 cubic feet quantity of resin be replaced in the No. 1 unit. The existing No. 2 unit has had the resin replaced recently. The capacity of cation resin tends to decrease after five years; and the high chlorine residuals are also deterimental to the exchange capacity.

Presently two brine measuring tanks serve the existing two 5'-0" diameter softeners. The tanks are in a severe state of corrosion. It is proposed to delete one of the tanks, to replace the other tank, and to connect the two 5'-0" diameter softeners to the new brine tank. New float controls would be included with the replaced tank. The two new 6'-0" diameter softeners will have their own single brine measuring tank supplying brine for regeneration.

III. PROPOSED FACILITY EXPANSION

F. Softener System

This brine tank will have level control equipment included. The brine piping from the existing brine pumps will be extended to the brine measuring tank for the new larger softeners.

G. Controls

The next major areas to be modified are the control systems for the filters, softeners, and the softener regeneration system. The existing control system for the control of the filter feed pumps, well pumps, detention tank level, ground level storage tank level, elevated storage tank level, and the service pumps will remain intact.

The new pushbutton automatic controls for the filter system will permit operation of the system with one unit off-line for backwash. The backwash will be initiated by a timer or by manual initiation. The automatic valves with electric operators, flowmeters, sample cocks, and pressure gauges will be included for all units. The automatic valves will have a manual operator in case of power failure and the system will be designed for failure in the normal operating positions.

The softener control system will be interlocked to prevent two softeners from a simultaneous regeneration; the regeneration can be started automatically from a timer or by manual initiation. The new softeners will be equipped with totalizing water meters, pressure gauges, and sample cocks. These features are present in the existing softeners. In addition, all softeners will be equipped with flowmeters. The brine measuring tanks will be equipped with level controls to allow automatic brine refilling at the completion of the brine injection cycle of regeneration.

The new control panel will house the control systems for the filters, softeners, and the regeneration equipment. The panel will include the status run lights, timers, sequencing controls, manual push-buttons, and interlocks to control the equipment. The panel will be protected from power surges which presently occur during thunder-storms.

H. Building Expansion

In order to house the necessary new water treatment equipment the existing building will need to be expanded by approximately 40 feet. Exhibit H shows the expansion and equipment arrangement. The salt storage area will not be expanded. With the present 46 tons of salt storage capacity, this will allow a 30 day supply.

III. PROPOSED FACILITY EXPANSION

H. Building Expansion - Contd

The raw water detention tank will not be enlarged; the approximately 25,000 gallon capacity will allow a detention time of 37 minutes at a 670 gpm flow rate. This will pose no problem for pH adjustment. It does, however, shorten the plant operating time in the event of well pump failure. At the present time with a 400 gpm flow rate 62 minutes of detention time exists.

I. Water Consumption

The present water treatment plant consumes water for the backwash and rinse of the filters, and the regeneration of the softener systems. The present system consumes approximately 27,200 gallons on a daily basis. This is an estimate based on daily backwash of the three filters and three softener regeneration cycles, assuming the cycle times are as specified in the operating manuals. This 27,200 gallons per day may be higher if during the manual operation longer cycle times and higher flow rates than specified are used.

The new system will consume approximately 65,000 gallons of water on a daily basis. The source of filter backwash water supply and softener regeneration water supply will not be changed. The filters will use treated water and the softeners will use filtered water. The system is sized to produce 670 gpm of treated water. This 670 gpm of water does not include the additional flow rate provisions for continuously making up the waste backwash, rinse, and regeneration water. It is assumed that during the off load hours this 65,000 gallons of water will be replaced in the storage facilities. At a flow rate of 670 gpm the 65,000 gallons will be made up in approximately 97 minutes.

-SECTION 300-

WASTEWATER TREATMENT PLANT

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

TABLE OF CONTENTS

COURTHOUSE BAY WASTEWATER TREATMENT PLANT

I. DESCRIPTION OF EXISTING FACILITIES

A. General

The Courthouse Bay Wastewater Treatment Plant was constructed in 1942 and consisted of one Imhoff tank and two sludge drying beds. This was a primary wastewater treatment plant with the Imhoff tank used for suspended solids removal and sludge stabilization. The sludge drying beds were used for sludge dewatering. The plant utilized prechlorination for odor control and postchlorination for disinfection. Postchlorination was accomplished in a manhole using the outfall to provide the required contact time.

The treatment plant was expanded in 1956 with the addition of another Imhoff tank, an additional sludge drying bed, and a new chlorine contact chamber. In 1968 the treatment plant was upgraded to the existing condition with the addition of a trickling filter and secondary clarifier. A new chlorine contact chamber was constructed to provide the required contact time due to increase wastewater flows.

B. Flow and Wastewater Characteristics

An accurate characterization of flow and raw wastewater parameters is necessary for the evaluation of the existing unit processes and also for the development of design criteria. Raw wastewater characteristics considered are the five day Biochemical Oxygen Demand (BOD_5) and suspended solids (S.S.) concentrations. Four sources of data were available: the Navy Facilities Design Manual (DM-5), sewer flow study conducted by the J. E. Sirrine Company, Courthouse Bay Wastewater Plant monitoring data, and wastewater samples collected by the J. E. Sirrine Company.

DM-5 provides typical wastewater concentrations for naval domestic waste

Characteristics	Concentrations (mg/l)
Total Solids	800
Violate Solids	420
Fixed Solids (highly variable)	380

I. DESCRIPTION OF EXISTING FACILITIES

B. Flow and Wastewater Characteristics - Contd

Characteristics	Concentrations (mg/l)
Total Suspended Solids	200
Volatile Suspended Solids	144
Fixed Suspended Solids	56
Floatable Solids (such as oil)	25-40
BOD_5 at 20^oC	200
Total Nitrogen as N	32
Organic Nitrogen	16
Ammonia Nitrogen	16
Total Phosphorus as P	12

Based on the sewer flow study, which was conducted in September 1978, when the AMTRAC personnel were on base, the average daily flow was approximately 397,000 pgd. Of this flow approximately 137,000 gpd is relatively uncontaminated wastewater, and consists of blowdown from the power plant and infiltration and inflow. This results in an estimated sewage flow of approximately 260,000 gpd. At an assumed BOD_5 concentration of 200 mg/l, based on DM-5, the average daily BOD_5 loading is 433 lbs./day. See Appendix III for detailed flow analysis. When the sewage and other wastewater flows are added together the resulting BOD_5 concentration is 130 mg/l.

Courthouse Bay Wastewater Treatment Plant monitoring data was obtained for an eight month period from January thru August 1978, see Appendix III. At Courthouse Bay weekly composite samples are taken as required by the EPA. Contained in the monitoring data were thirty-five composite samples varying as follows:

Parameter	Average Value	Range
Flow	0.45 MGD	0.143 - 0.505 MGD
BOD_5	223 mg/l	30 - 780 mg/l
S.S.	329 mg/l	26 - 2680 mg/l

The monitoring data was statistically analyzed to develop a probability of occurrence curve for BOD_5, Appendix III. The 50 percent occurrence BOD_5 was equal to 110 mg/l and the 90 percent occurrence was equal to 640 mg/l. This analysis indicates that 50 percent of the time the BOD_5 is less than 110 mg/l and 90 percent of the time less than 640 mg/l. The high average value for BOD_5, 230 mg/l, and for the 90 percent BOD_5, 640 mg/l, from the monitoring data was due to five samples ranging from 570 mg/l to 780 mg/l. These values all

I. DESCRIPTION OF EXISTING FACILITIES

B. Flow and Wastewater Characteristics - Contd

occurred during the month of July 1978. The high values were probably due to a specific activity which was not identifiable at this late date (December).

A sampling program and information gathering site visitation was carried out on September 18 thru 21, 1978. See Appendix III for sample analysis. Wastewater samples were collected at four points throughout the treatment plant with results as follows:

	BOD (mg/l)	COD (mg/l)	SS (mg/l)	Total % Reduction BOD_5	COD	SS
Inlet Structure	61	137	27	-	-	-
Imhoff Tanks Effluent	36	87	16	41	40	41
Trickling Filter Effluent	23	55	13	62	60	52
Chlorine Contact Chamber	30	125	9.4	51	9	65

Based on the sample analysis there appears to be an increase in BOD_5 and COD across the secondary clarifier. However, due to transportation delays the samples were held for 22 hours. This can result in BOD_5 sample results which are significantly less than actually exists. The low influent BOD at the inlet structure was probably the result of the AMTRAC personnel being deployed in the field. This corresponds to a sewage flow reduction of 100,000 gpd or 167 lbs. BOD_5/day at 200 mg/l. Deployed personnel resulted in the dilution water comprising a greater percentage of the total flow. This corresponds to a calculated BOD_5 concentration of 98 mg/l.

The above discussion indicates that the wastewater flows and composition vary significantly. This variation is caused by changing base populations due to personnel being deployed in the field, and also base operations, such as military vehicle washing.

C. Description of Existing Facility

The existing Courthouse Bay Wastewater Treatment Plant is a secondary treatment plant at a design average daily flow of 525,000 gpd. The plant consists of primary clarification, biological stabilization, secondary clarification and disinfection. Sludge is stabilized in Imhoff tanks then dewatered on sludge drying beds.

The influent to the plant is pumped to the inlet structure where it flows by gravity into Imhoff tanks. The Imhoff tanks are parallel units which are used for primary clarification and sludge digestion. Each unit has 416 sq. ft. of surface area, which results in an

I. DESCRIPTION OF EXISTING FACILITIES

C. Description of Existing Facility

overflow rate of 630 gpd/sq.ft. at the design flow, 525,000 gpd (average 24 hour flow). The effluent overflow from the Imhoff tanks' flows by gravity to the trickling filter lift pump sump located under the pump house.

There are three (3) existing trickling filter lift pumps used to pump wastewater through the reaction driven rotary distributor of the trickling filter. Two of the lift pumps are three (3) HP two-speed, 200 gpm - 400 gpm, vortex pumps. The third pump is a one (1) HP two-speed, 65 gpm - 130 gpm, vortex pump. The pumps are activated on level by a float system operating on the following pump schedule:

Water Level Elev. - Ft.	Rising Level-Read up Start Pump	Stop Pump	Falling Level-Read Down Start Pump	Stop Pump	GPM Total
8.0	#3 Hi		Pumps 2 & 3 Running		800
7.0	#2 Hi			#3	400
6.5	#2 Lo	#1	#2 Lo	#2 Hi	200
6.0	#1 Hi		#1 Hi	#2	130
5.5	#1 Lo		#1 Lo	#1 Hi	65
5.0	No Pumps Running			#1	0

The trickling filter is a 62 ft. diameter unit with a 7.5 ft. bed depth. Rock media is used to support the biological population responsible for the waste stabilization. At the average daily flow of 397,000 gpd, from Sirrine sewer survey, and a BOD concentration of 200 mg/l, from DM-5, the existing filter is hydraulically and organically loaded at 6.0 MGD/acre and 13 lbs. BOD/day/1,000 cu.ft. respectively. This is assuming that the Imhoff tanks are removing 30 percent of the BOD_5 associated with suspended solids, and neglecting recirculated flow and BOD_5. Based on present loading the existing trickling filter is operating as an intermediate - rate filter. Intermediate - rate trickling filters are generally designed to treat hydraulic loadings of 4 to 10 MGD/acre, including recirculation, and organic loadings range from 15 to 30 lbs. BOD/day/1000 cu.ft., excluding recirculation.

There is a provision for trickling filter effluent recirculation prior to secondary clarification, via a six (6) inch line connecting the trickling filter effluent line to the trickling filter lift pump sump. There is a Kennison Open Flow Nozzle located on the recirculation line in the pump sump; however, the necessary instrumentation, flow transmitter and indicator, were not installed. Therefore, there is no means of measuring this flow. The recycle flow can be regulated by manually opening or closing a plug valve.

I. DESCRIPTION OF EXISTING FACILITIES

C. Description of Existing Facility - Contd

The existing secondary clarifier is a 26 ft. diameter unit. Influent to the clarifier enters by way of a gravity line from the trickling filter. At the present average daily flow of 397,000 gpd the resulting overflow rate is 750 gpd/sq.ft. At the design 24 hour average daily flow, 525,000 gpd, the overflow rate is 990 gpd/sq.ft., which exceeds the DM-5 design criteria of 800 gpd/sq.ft. at average 24 hour design flow. Therefore, any flow in excess of 424,000 gpd will result in exceeding the recommended overflow rate resulting in deterioration of the effluent. The overflow from the secondary clarifier flows by gravity to the clarifier effluent box and then to the chlorine contact chamber. Settled solids are removed from the secondary clarifier by a six (6) inch sludge underflow pipe. The available head in the clarifier is used to move the sludge from the clarifier to the secondary sludge recirculation pump sump, located under the pump house. There is no provision for measuring the sludge underflow; however, the flow can be varied at the pump sump by manually opening or closing the existing plug valve. Secondary sludge is recirculated back to the Imhoff tanks where the solids settle and are stabilized. Sludge is periodically wasted via gravity lines to the sludge drying beds for dewatering.

There is presently 3150 sq.ft. of sludge drying bed area. The area is segregated into three (3) beds which are alternatingly dosed. The dryed sludge cake is removed to a landfill. Filtrate from the beds is collected in an underdrain system which flows by gravity to the filtrate pump sump. The filtrate is then pumped to the Imhoff tank effluent box.

The chlorine contact chamber contains a water volume of 1,050 cu.ft. At the design average daily flow of 525,000 gpd (49 cfm) the detention time is 21 minutes.

The existing chlorination system utilizes 150 lb. gas cylinders for chlorine storage. Two cylinders are connected with automatic switchover. A chlorine gas bubbler is used to deliver the gaseous chlorine to the contact chamber

The existing Courthouse Bay Wastewater Treatment Plant has achieved good treatment efficiencies, as observed from the monitoring data with only one violation of the BOD_5 weekly limit, 45 mg/l, noted. However, due to anticipated increases in flow and BOD_5 loadings the existing facility should be expanded.

1. Deviation of Existing Plant With DM-5

   a. Imhoff Tanks (primary clarification) - being an antiquated

I. DESCRIPTION OF EXISTING FACILITIES

C. Description of Existing Facility

1. Deviation of Existing Plant With DM-5

a. Contd

technology it is not addressed in DM-5.

b. Trickling Filter - no spare units as required in DM-5.

c. Secondary Clarifier - at the 24 hour average daily flow, 525,000 gpd, the overflow rate is 990 gpd/sq.ft. which is in excess of the 800 gpd/sq.ft. in DM-5. No spare unit as required in DM-5.

d. Chlorine Contact Chamber - only one tank is used to satisfy the detention requirements. DM-5 requires two tanks to allow for periodic cleaning.

e. Chlorination Equipment - only one feed system is installed. DM-5 requires two feed systems, each capable of handling the maximum required dosages.

f. Imhoff Tanks (sludge stablization) - DM-5 does not consider the Imhoff tanks as an available waste stabilization process.

g. Sludge Drying Beds (sand) - no deviation with DM-5. Based on DM-5 rational and per capita allowance design criteria there is adequate bed area.

D. Operational Deficiencies and Problems of the Existing Plant

Operational control of trickling filter plants can be achieved through the manipulation of solids underflows from the clarifier and recirculation of the wastewater around the trickling filter.

The lack of quantifying instrumentation on the secondary clarifier underflow lends itself to a higher underflow rate than is necessary for solids removal, which results in higher pumping costs.

The recirculated flow around the trickling filter is presently not measured. A Kennison Nozzle is installed on the recycle line; however, the associated instrumentation is absent. This limits the operators control over the hydraulic loading and to some extent the BOD loading on the trickling filter.

I. DESCRIPTION OF EXISTING FACILITIES

D. Operational Deficiencies and Problems of the Existing Plant - Contd

The existing office is located within the pump house. This results in nuisance noise levels which emanate from the trickling filter lift pumps and sludge recirculation lift pumps. The noise level probably violates OSHA noise level regulations and therefore, the office should be relocated.

II. BASIS FOR DESIGN

A. General

The basis for the design expansion of the existing treatment plant is made up of three components: future waste characteristics, unit process capabilities, and treated waste discharge limits.

1. Future Waste Characteristics

Future waste characteristics considered include flow, BOD_5, and suspended solids.

The development of design flows was based on the maximum population for the year 1986. The sewer flow analysis included in Appendix III establishes the average daily flow. Maximum, minimum, and peak flows were developed using DM-5 flow ratio factors. The DM-5 factors are only applied to the sewage flows and not to constant relatively non-contaminated wastewater flows. The projected average daily flow is 678,000 gpd of which 393,000 gpd is contaminated and 285,000 gpd is non-contaminated wastewater. Design flows are as follows:

Flow Measure	DM-5 Factor	Flow
Average Daily Flow	-	678,000 gpd
Maximum 24 hr. Flow	2.7	1,347,000 gpd
Minimum Flow	0.23	375,000 gpd
Peak Flow	3.8	1,779,000 gpd

The various flows were developed for the following design applications (from DM-5).

II. BASIS FOR DESIGN

A. General

1. Future Wastewater Characteristics - Contd

Flow Measure	Explanation	Design Application
Average 24 hr. flow	Annual average of daily flow	Estimate of annual cost
Maximum 24 hr. flow	Highest 24 hr. flow over year	Hydraulic design of process units
Minimum flow	Least instantaneous flow	Design of plant conduits
Peak flow	Highest instantaneous flow	Design of hydraulic elements of treatment plant

The development of a design BOD_5 was based on DM-5 domestic waste characteristic, which is 200 mg/l. This value is applied only to sewage flows and not non-contaminated wastewaters. The projected BOD_5 loading, at the average daily flow, is 656 lbs. BOD_5/day at a concentration of 116 mg/l. The reduction in BOD_5 from the existing average concentration of 223 mg/l to the future average concentration of 116 mg/l is due to the anticipated addition of relatively uncontaminated wastewater flows to the sewer system.

2. Unit Process Capabilities

Unit process capabilities are important considerations in the development of treatment efficiencies. Approximate process capabilities of the proposed units responsible for BOD_5 and suspended solids removal are as follows:

Unit Process	%BOD_5 removed	% of total suspended solids removed	% solids by weight in underflow
Primary Clarifier	30%	60%	3%
Trickling Filter	60%	-	-
Secondary Clarifier	-	38%	3%
Gravity Thickener	-	-	9%
Aerobic Digester	50% (Volatile solids oxidized)	50% (Volatile solids oxidized)	5%

II. BASIS FOR DESIGN

A. General

3. Discharge Limits

The existing NPDES permit sets the BOD_5 and SS concentrations at 30 mg/l, and fecal coliform bacteria at 200/100 ml. (See Appendix III for NPDES permit).

The existing permit will expire December 31, 1979. The new permit, which becomes effective January 1, 1980, will be upgraded with respect to bacterial concentrations in the effluent. The new discharge standard will be a total coliform bacteria concentration of 70/100 ml. The new bacteria standard will be imposed because the Courthouse Bay Wastewater Treatment Plant outfall is located in an existing shellfish area. The BOD_5 and SS discharge standards will remain at 30 mg/l.

III. PROPOSED FACILITY EXPANSION

A. General

The existing facility at Courthouse Bay is being expanded from 525,000 gpd to 678,000 gpd (average daily flow). See Exhibits J and K, for flow diagram and general arrangement drawings.

1. Proposed Expansion

It is proposed that the existing inlet structure, Imhoff tanks and the Imhoff tanks effluent structure be demolished and removed. A new dual barminutor system is proposed to be placed at the head of the plant for the purpose of screening and comminuting debris. The flow will then be split between two new primary clarifiers; 22 foot diameter. The overflow rate at the 24 hour maximum daily flow with one unit out of operation is 3600 gpd/sq.ft. The overflow rate at the average daily flow, with both units in operation, is 906 gpd/sq.ft.

The effluent overflow from the primary clarifiers will flow by gravity to a new flow splitter box. The flow splitter box is required to divide the flow prior to entering the trickling filter pump sumps.

A new trickling filter, 62 foot diameter, and secondary clarifier, 29 foot diameter, are proposed. The new trickling filter will have the flexibility to operate in parallel or series with the existing unit. The proposed piping arrangement allows the trickling filters and secondary clarifiers to be bypassed for maintenance.

III. PROPOSED FACILITY EXPANSION

A. General

1. Proposed Expansion - Contd

A new pump house and pumps are required for the operation of the new reaction type rotary distributor. These pumps are two speed vortex pumps as follows:

Trickling Filter Lifting Pump	HP	Low Speed	High Speed
No. 4	1	75 gpm	150 gpm
No. 5	3	200 gpm	400 gpm
No. 6	3	200 gpm	400 gpm

The pumps will be activated on level by mercury float switches on the following schedule:

Water Level Elev. - Ft.	Rising Level - Read Up Start Pump	Stop Pump	Falling Level-Read Down Start Pump	Stop Pump	GPM Total
8.0	#3 Hi		Pumps 2 & 3 Running		800
7.0	#2 Hi			#3	400
6.5	#2 Lo	#1	#2 Lo	#2 Hi	200
6.0	#1 Hi		#2 Hi	#2	150
5.5	#1 Lo		#1 Lo	#1 Hi	75
5.0	No Pumps Running			#1	0

It is proposed that the flow be split equally between the new and existing trickling filter at the average daily flow. The existing filter is hydraulically limited to 424,000 gpd, not including recycle, due to the secondary clarifier surface area. At 424,000 gpd the clarifier overflow rate is 800 gpd/sq.ft. Therefore, any increase in plant influent flow above 848,000 gpd should be diverted to the new trickling filter. This flow diversion can be accomplished at the flow splitter box, ahead of the trickling filter lift pumps. Both the new and existing trickling filters will utilize effluent recirculation around the filters to enhance BOD_5 removal and to maintain the minimum hydraulic loading. Both the new and existing trickling filters will utilize a manual plug valve and a Kennison Nozzle with a flow indicator and recorder for flow measurement and control of recirculated flow. At the average daily flow, 678,000 gpd, the hydraulic and BOD_5 loadings are as follows:

Recycle	Existing Trickling Filter Loadings BOD_5*	Existing Trickling Filter Loadings Hydraulic	New Trickling Filter Loadings BOD_5*	New Trickling Filter Loadings Hydraulic
0%	10 lbs./Day/1000 cu.ft.	4.8 MGD/acre	10 lbs./Day/1000 cu.ft.	4.8 MGD/acre
50%	10 lbs./Day/1000 cu.ft.	7.2 MGD/acre	10 lbs./Day/1000 cu.ft.	7.2 MGD/acre

III. PROPOSED FACILITY EXPANSION

A. General

1. Proposed Expansion - Contd

*BOD_5 loadings assuming 30 percent BOD_5 removed during primary clarification.

The BOD_5 removal as predicted by the National Research Council Equation (NRC) is as follows:

NRC EFFLUENT QUALITY FOR NEW & EXISTING TRICKLING FILTERS

PARALLEL OPERATION*

Recycle	%BOD_5 Removal	Influent BOD_5	Effluent BOD_5
0%	85%	116 mg/l	17.4 mg/l
50%	88%	116 mg/l	14.0 mg/l

NRC EFFLUENT QUALITY FOR NEW & EXISTING

TRICKLING FILTERS SERIES OPERATION*

Recycle	OVERALL %BOD_5 Removal	Influent BOD_5	Effluent BOD_5
0%	98%	116 mg/l	2.3 mg/l
50%	99%	116 mg/l	1.2 mg/l

*BOD_5 loadings assume 30 percent BOD_5 removed during primary clarification.

The new secondary clarifier was designed at an overflow rate of 2000 gpd/sq.ft. during the maximum 24 hour flow, 1,347,000 gpd, with the existing secondary clarifier out of service. Using this design criteria the new secondary clarifier is a 29 foot diameter unit with a 10 foot side water depth. At the average daily flow the overflow rates on the new and existing secondary clarifiers are 573 gpd/sq.ft. and 640 gpd/sq.ft. respectively.

The solids underflow from the new secondary clarifier will flow by gravity to the existing sludge pump sump. For operational control a manually operated plug valve and Kennison Open Flow Nozzle with flow indicator recorder, and totalizer are to be installed on both solids underflow lines.

III. PROPOSED FACILITY EXPANSION

A. General

1. Proposed Expansion - Contd

It is proposed that the existing Chlorine Contact Chamber be demolished and removed. A new Chlorine Contact Chamber is to be installed with a 30 minute detention time at the peak flow. (This is to insure that the total coliform bacteria effluent standard of 70/100 ml is not violated.) Two tanks are proposed, 18,540 gallons each, to allow periodic cleaning with the operational flexibility of diverting the flow to either chamber or both.

The existing chlorination system utilizes two 150 lb. chlorine gas cylinders with automatic switchover. The chlorine is added to the wastewater through a gas bubble diffuser located in the existing Chlorine Contract Chamber. It is proposed that two (2) new vacuum feed, flow proporational chlorination system be installed. These systems would utilize one-ton chlorine gas cylinders with two cylinders on line with automatic switchover. The new system will also differ from the existing system in that the chlorine will be delivered to the contact chambers in a gas-water solution through a distribution manifold. This is an important safety feature when handling a dangerous gas like chlorine. The new chlorination system will also utilize an automatic chlorine residual analyzer and recorder, with an alarm for low chlorine residual.

The existing chlorination system is to be removed.

The chlorine usage rate is 57 lbs/day based on the average daily flow, 678,000 gpd, and a dosage rate of 10 mg/l. This converts to a system run time, from full to empty, of approximately 70 days (two (2) cylinders).

Adjoining the new pump house there is to be a new chlorine storage building. Within this building the chlorine and chlorination equipment is to be located. An office will be partioned off within the chlorine storage building. A monorail with hoist will be installed for moving the chlorine cylinders. Scales incorporated in the cylinder stands will be provided to measure chlorine usage.

A new road will be required to allow a truck access to the chlorine storage building, see the general arrangement in Exhibit K.

Solids underflows from the secondary clarifiers will flow to the existing sludge pump sump as described above. The sludge is then pumped to the primary clarifiers. The mixed primary and

III. PROPOSED FACILITY EXPANSION

A. General

1. Proposed Expansion - Contd

secondary solids underflows from the primary clarifiers is pumped, using two new progressive cavity sludge pumps for each clarifier, to the gravity thickener. The new primary sludge pumps are 3HP, 280 RPM units in a lead lag configuration which operate on a timer and alternate each cycle.

The anticipated sludge volume from the primary and secondary clarifiers underflows is 2,500 gpd. This is based on a solids mass removed of 640 lbs/day, a specific gravity of 1.02, and a solids concentration of 3 percent by weight.

The new gravity thickener was sized on a solids loading of 15 lbs. dry solids/sq.ft./day. At this solids loading a 7.5 foot diameter vessel is required with a 10 foot side water depth. The gravity thickener is responsible for concentrating the waste sludge from 3% in the influent to 9% in the thickened underflow. This correspondence to a sludge volume reduction of 67%, from 2,500 gpd to 840 gpd.

Effluent from the chlorine contact chamber will be recirculated back through the gravity thickener to prevent possible septic conditions. Two vertical dry pit pumps capable of delivering 50 gpm can be utilized. The pumps are 1.5 HP, 1150 RPM units in a lead lag configuration which operate on a timer and alternated each cycle. The pumps can be used to drain either of the dual chlorine contact chambers should maintenance be required.

The thickened solids underflow from the gravity thickener is pumped using two new progressive cavity sludge pumps to the new aerobic digester. The new sludge pumps are 1.5 HP, 210 RPM units in a lead lag configuration which operate on a timer and alternate on cycle.

The effluent overflow from the gravity thickener flows by gravity back to the primary clarifiers.

The new aerobic digester was sized for a solids loading of 0.1 lb. volatile solids/cu.ft./day. This results in a 20 foot diameter unit with a 15 foot side water depth.

This corresponds to a 40 day hydraulic detention time for sludge stabilization. The oxygen requirement, based on 1.5 lb. O_2/lb BOD_5 reduced is 700 lbs./day. This requirement can be met with

III. PROPOSED FACILITY EXPANSION

A. General

1. Proposed Expansion - Contd

two 15 HP, 300 cfm air blowers each capable of 100 percent capacity. The air blowers will be arranged in a lead lag configuration and alternated daily. This arrangement will provide reliability should one of the blowers require maintenance. Periodically the blower is to be turned off and the solids allowed to settle. It is then possible to decant off the supernate and return it by gravity to the primary clarifiers. Also, with the blower off, solids can be wasted from the digester underflow, by gravity, to the sludge drying beds. Assuming 40 percent of solids are oxidized completely, sludge should be wasted to one of the three existing sludge drying beds once every 15 days.

There is no additional sludge drying bed area required.

2. Deviation of Proposed Expanded Plant with DM-5

a. Primary Clarifiers - no deviation with DM-5

b. Trickling Filters - no deviation with DM-5

c. Secondary Clarifiers - no deviation of new clarifier. Existing unit is overloaded at 24 hour maximum flow with the new clarifier off line the overflow rate is 2,540 gpd/sq.ft.

d. Chlorine Contact Chamber - 30 minute detention time. Longer contact time is required to protect shellfish beds.

e. Chlorination Equipment - no deviation with DM-5

f. Primary Clarifiers and Gravity Thickener Sludge Pumps - estimate is based on progressive cavity pumps in dry wells. DM-5 recommends plunger pumps in dry well. Progressive cavity pumps are proposed because of reliability and low maintenance costs.

g. Gravity Thickener - only one unit is proposed. If unit should require maintenance sludge can be wasted directly to the aerobic digester.

h. Aerobic Digester - DM-5 recommends anerobic digestion for primary or mixed sludges. Aerobic digestion is proposed because of operational reliability, low capital costs, and low maintenance costs.

III. PROPOSED FACILITY EXPANSION

A. General

2. Deviation of proposed Expanded Plant with DM-5 - Contd

i. Sludge Drying Beds - no deviation with DM-5

j. Effluent Recirculation Pumps - no deviation with DM-5.

-SECTION 400-

STEAM GENERATION AND DISTRIBUTION SYSTEM

A UTILITY STUDY FOR THE COURTHOUSE BAY AREA

TABLE OF CONTENTS

TABLE OF CONTENTS - (Continued)

I. DETERMINATION OF ADEQUACY OF STEAM GENERATING PLANT, BUILDING NO. BB-9

A. Boilers (Note: PPH is pounds per hour)

Boiler No.	Year Built	Mfgr.	Design PSIG	Design Capacity, PPH	Actual Capacity, PPH
55	1957	Erie City	160	12,000	10,000
54	1952	Orr-Sembower	Unknown	12,075	8,000
53	1978	Nebraska	200	15,000	15,000
				Total Actual Capacity:	33,000 PPH

B. Fuel Oil System

Type Fuel Oil: No. 6 Fuel Oil
List of Tanks and Capacities: 3 @ 10,000
Total Tank Capacity: 30,000 gal; usable tank capacity: 24,000 gal.

C. Feedwater System

Deaerating feedwater heater: 45,000 PPH, Cochrane (1962), adequate.
Percent of condensate returned: 33 to 40% in winter; 50% in summer.
Type and condition of softeners: Zeolite, Hungerford-Terry, adequate.
Ability of deaerator to hold dissolved oxygen below .005 cc/liter: satisfactory.

D. Plant Deficiencies

1. The new fuel oil pump-heater unit is of adequate capacity; however, in its present location, the long suction line from the storage tanks at times has caused the pump to lose suction and has required temporary changeover to the old fuel oil pump having the day-tank suction connection. This has occurred even with the fuel oil tank half full.

2. Two feedwater pumps are reported to be in need of replacement. The third pump is new.

3. The existing fuel oil storage capacity necessitates delivery of fuel oil twice a week during the coldest winter months. Additional storage capacity is outlined in I.G.6.

4. At present, there is a single pump (with no spare) for transferring condensate from the reciever up to the deaerating feedwater heater. If a breakdown of the single pump occurs, it becomes necessary to waste the condensate and to feed make-up water to the feedwater heater. Spare parts are not readily available for the existing pump.

5. There are orifices in the two 6" mains serving the distribution system, but no meters. The present meters record flow from each boiler. Additional meters would indicate the net export steam.

I. DETERMINATION OF ADEQUACY OF STEAM GENERATING PLANT, BUILDING NO. BB-9 (Continued)

6. The insulation in the plant is in need of repair.

E. Existing Steam Demand

24,400	PPH peak generation during extreme winter weather (Jan. 1978)
-2,928	PPH required for in-plant use (12% for deaerator, etc.)
21,472	PPH net export steam leaving plant
-2,147	PPH distribution losses = 10% of demand
19,325	PPH actual peak demand of facilities, with diversity

F. Steam Demands For New Construction: (Individual demands are interpolated from definitive designs, or from existing facilities.)

Project No.	Facility	PPH Individual Demands	PPH 80% Demands
P-613	BEQ (3)	5043	4035
U.P.	PX	1000 (Estimated)	800
U.P.	Bldg. 48	967	774
U.P.	Bldg. 49	1006	805
U.P.	BEQ (2)	3362	2690
	*Barracks	(7940)	(6352)
		3438	2752

Sum of individual demand: 3438 PPH

* To be removed upon completion of new BEQ (3)

G. Additional Steam Generation Required For New Construction

1. None required.

2. The excess generation available:

   Excess generation, PPH = (Total actual capacity (I.A)) - (Existing peak generation (I.E)) = 33,000 - 24,400 = 8,600 PPH

3. Some of the excess generation is required to meet the projected new construction; however, no new boilers are required at the present time.

4. A deficiency in steam generation capacity does not exist.

5. A deficiency in auxiliary equipment capacity does not exist.

I. DETERMINATION OF ADEQUACY OF STEAM GENERATING PLANT, BUILDING NO. BB-9 (Continued)

6. Provision for 30 days of fuel oil storage, based on the coldest period of the year.

85,576 gal. oil used, January 1977 (maximum)
24,000 gal. usable existing tank capacity
61,576 gal. additional usable storage required
3- 25,000 gal. tanks = 60,000 gal. additional usable storage

7. Not applicable.

8. Consideration of whether a coal-burning capability is required.

Conversion to coal-burning

(a) Boiler No. 55, Erie City (1957) water tube package boiler, is only unit that could be converted to stoker firing. Other units are limited to oil or gas firing.

(b) There is insufficient space in present plant for coal storage and handling, and ash handling and storage.

(c) An entire new site and plant would be required, designed for coal-burning and should include fly-ash removal.

(d) Conversion to coal-burning accordingly is not recommended.

II. DETERMINATION OF ADEQUACY OF THE STEAM DISTRIBUTION SYSTEM

A. Existing Steam Distribution System

Exhibit L shows plan of the existing steam distribution system at a scale of 1" = 200'. The plan shows all facilities served, building numbers, pipe sizes, and steam demand of each facility (in PPH). Proposed new construction is shown on Exhibit M with corresponding steam demands. The required steam utilization pressure (in PPH) is shown for each facility, using a combination number to show the demand and required pressure.

B. Individual Steam Demands

Each major branch, and trunkline, are marked to show the individual steam demands and to show the actual demands with 80% diversity.

C. Pipe Sizing

Based on the DM-3 steam-flow nomographs, the carrying capacities of each size pipe have been listed, using the optimum pressure drop as follows:

0.4 psi per 100' for pressures from 23 to 37 psig
0.5 psi per 100' for pressures from 40 to 75 psig
1.0 psi per 100' for pressures from 75 to 125 psig
1.0 psi per 100' for pressures from 127 to 180 psig

II. DETERMINATION OF ADEQUACY OF THE STEAM DISTRIBUTION SYSTEM (Continued)

D. Pressure Drop

Starting at the steam plant, and working toward the outlying facilities, each segment of piping has been evaluated for pressure drop. The calculated steam pressures are indicated for the mains, based on data from paragraph II.C and the DM-3 nomographs.

E. Minimum Pressure

The entire run of pipe has been determined satisfactory since it can deliver the diversified demand, with sufficient residual pressure; at least 15 PSI minimum above the required utilization pressure in each facility served.

F. Proposed New Construction

Future projected demands are shown on Exhibit M, as listed in paragraph I.F, and the piping system has been checked for adequacy in meeting these demands.

G. Proposed New Steam Mains

Proposed mains to serve the new construction are shown on Exhibit M. There is no other forecasted extension of main trunklines.

H. Deficiencies

1. Overhead condensate piping, between Boiler Plant BB-26 and Building BB-9, is now developing leaks from pitting. Sections of pipe have been repaired or replaced.

2. Steam is now being wasted (without return to system) at the wash rack near Building BB-52. A steam jenny could be provided for this purpose and the use of boiler steam be discontinued.

3. Existing 2" condensate line and underground conduit, from overhead steam condensate main to Building BB-50, is reported to be in need of replacement.

4. Three drips for the overhead distribution system serving BEQ Nos. 250 and 255, now discharge into dry wells, thus wasting condensate, instead of discharging into the pumped return condensate system. The present trap discharge pipes have, at times, frozen at ground level, stopping flow and backing up condensate in the steam mains.

5. Condensate from Building BB-16 is presently wasted instead of being collected and pumped back into the condensate return main.

III. RECOMMENDATIONS FOR STEAM DISTRIBUTION SYSTEM

A. Steam Distribution

Exhibit M shows a proposed overhead steam and condensate return system starting at the existing 6" - 3" overhead system at station 7+96 and continuing to the three BEQs, routed to clear the existing water treatment plant and parking areas. This is the system recommended. Connection into existing mains would be at one point and the new piping could be completed and hydraulically tested prior to the cut-in. An Alternate system is also shown on Exhibit M starting near the end of the existing 6" - 3" overhead system. This requires replacing the existing 4" - 2" overhead mains to the connection point of the branch line to BEQ-250. From this location, a new overhead system would extend to the three BEQs. This Alternate system is complicated in having to maintain steam for the existing buildings during installation of the larger mains on the existing poles; also there is a possibility of overloading the poles during construction. Adequate testing of the new mains and possible long periods of outage are other difficulties with the Alternate system. Therefore, the first proposed system is recommended, and it is estimated that the cost will be less than the Alternate (see the mechanical calculations in the Appendix).

SECTION 500

-SECTION 500-

COST ESTIMATE

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

15 February 1979

BASES OF CONTRACTOR MARKUPS

USED IN THIS COST ESTIMATE

A single markup of 29 percent was used for all work performed by the General Contractor and 49 percent for all work performed by Subcontractors. These markup percentages were based on 44 percent of the ECC being labor and 56 percent being materials.

The markups used include the following:

GENERAL CONTRACT WORK; markup= 29 %

A. Ins. & Tax on Labor	20 %	
B. Sales Tax on Material	4 %	
C. General Contr. OH&P	15 %	= 5 % OH + 10 % P
D. Bond	1 %	

Formula - A x B x C x D = Markup

1.088 x 1.022 x 1.15 x 1.01 = 1.289 or 29 %

SUBCONTRACT WORK ; markup = 49 %

A. Ins. & Tax on Labor	20 %	
B. Sales Tax on Material	4 %	
C. Subcontractor OH&P	25 %	= 10% OH + 15 % P
D. General Contractor Profit	6 %	
E. Bond	1 %	

Formula - A x B x C x D x E = Markup

1.088 x 1.022 x 1.25 x 1.06 x 1.01 = 1.488 or 49 %

The 1.088 represents 44 percent of the Ins. Tax on Labor, and the 1.022 represents 56 percent of the Sales Tax on Materials.

Since this is a study and the design is not complete enough to do an accurate material takeoff a contingency of 10 percent has been added in at the end of each takeoff.

Estimate of Contract Cost for Contract N62470-78-C-3675

TYPE OF ESTIMATE
No Design Prelim Final
(A)____ (B)____ (C) X

Title & Location: Utility Study - Courthouse Bay Area, MCB, Camp Lejeune, N. C.

J. E. Sirrine Co., Greenville, S.C.

Estimator: J. E. Sirrine Co.

Date Prepared: Jan. 31, 1979 Escalated To 1 Jan 1980

Contractors is ____ % of project

	Sh	SYS. QUAN.	COST/SYSTEM UNIT	TOTAL COST
EXISTING WELLS	2	L.S	-	$ 11,800
NEW WELL	5	L.S.	-	147,100
WATER DISTRIBUTION SYSTEM	11	12	606.63	7,300
SAN. SEWER COLL. SYSTEM	13	1,355	33.09	44,800
CLEAN OF SAN.SEW. COLL. SYSTEM	15	9,200	5.33	49,100
SAN. SEW. LIFT STATION (COURTHOUSE BAY AREA)	17	L.S.	-	21,900
SAN. SEW. LIFT STATION (AMTRAC AREA)	20	L.S.	-	7,500
WATER TREAT. PLANT	22	1280 S.F.	491.07	628,600
WASTEWATER TREATMENT PLANT	34	153000 GAL.	6.59	1,007,800

Base Bid	Item a.	$ 1,925,900
	Item b.	
	Item c.	
Total Estimated Contract Cost	Base Bid.	$ 1,925,900
Additive	Item 1.	
Additive	Item 2.	
Additive	Item 3.	
Additive	Item 4.	

TOTAL ESTIMATED CONTRACT COST $ 1,925,900

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING EXISTING WELLS | ESTIMATOR COX | CHECKED BY DUTTON

SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
EQUIPMENT	-	LS	-	-	-	-	$ 10,200
ELECTRICAL	-	LS	-	-	-	-	1,000
SUBTOTAL							11,200
SIOH	5.5%						616
TOTAL	-	LS	-	-	-	-	11,816

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING EXISTING WELLS | ESTIMATOR DUTTON | CHECKED BY COX

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
WELL NO. BB-220							
VERTICAL TURBINE							
PUMP STAGE	2	EA	350.	700	250.	500	$ 1,200
REPLACE EXIST. MOTOR							
W/MOTOR FROM WELL							
NO. BB-221	1	EA	400.	-		-	400
WELL NO. BB-221							
VERTICAL TURBINE							
PUMP STAGE	1	EA	650.	650	250.	250	900
REPLACE EXIST.							
PUMP IMPELLERS	4	EA	100.	400	150.	600	1,000
15 H.P. VERT. MOTOR	1	EA	400.	400	1700.	1,700	2,100
SUB-TOTAL							5,600
CONTRACTOR MARK-UP	49%						2,744
SUB-TOTAL							8,344
CONTINGENCY	10%						834
SUB-TOTAL							9,178
ESCALATION TO 1-1-80	11%						1,010
SUB-TOTAL							10,188
TOTAL							10,200

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING EXISTING WELLS			ESTIMATOR COX		CHECKED BY CUTTON		
ELECTRICAL MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
WELL NO. BB-220							
3P, 70A BREAKER	1	EA	11.	11	37.	37	$ 48
SIZE 2, 3P, STARTER	1	EA	20.	20	81.	81	101
REMOVING EXIST. BREAKER	1	EA	11.	11	-	-	11
REMOVING EXIST. STARTER	1	EA	20.	20	-	-	20
WELL NO. BB-221							
3P, 100A BREAKER	1	EA	15.	15	41.	41	56
SIZE 3, 3P STARTER	1	EA	30.	30	135.	135	165
REMOVING EXIST. BREAKER	1	EA	15.	15	-	-	15
REMOVING EXIST. STARTER	1	EA	30.	30	-	-	30
REMOVE EXIST. CONDUIT & WIRE	30	LF	.60	18	-	-	18
1/c #6 THW	100	LF	.09	9	.13	13	22
1/c #8 THW	35	LF	.07	2	.11	4	6
1"C	25	LF	.95	24	.70	18	41
SUB-TOTAL							533
CONTRACTOR MARK-UP	49%						262
SUB-TOTAL							795
CONTINGENCY	10%						80
SUB-TOTAL							875
ESCALATION TO 1-1-80	11%						96
TOTAL							1,000

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING NEW WELL | ESTIMATOR COX | CHECKED BY DUTTON

SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
CIVIL	-	LS	-	-	-	-	$ 56,500
STRUCTURAL	96	SF	@	30.21 L&M		-	2,900
EQUIPMENT & PIPING	-	LS	-	-	-	-	74,700
ELECTRICAL	-	LS	-	-	-	-	5,300
SUB-TOTAL							139,400
SIOH	5.5%						7,667
TOTAL	-	LS	-	-	-	-	147,067

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING NEW WELL			ESTIMATOR COX		CHECKED BY DUTTON		
CIVIL MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
CLEARING & GRUBBING							
TREES TO 6"DIA.CUT & CHIPS	.10	AC	507.	50	456.	45	$ 95
GRUB STUMPS & REMOVE	.10	AC	93.	10	305.	30	40
TOPSOIL:							
STRIPPING & STOCK							
PILING	120	CY	.40	50	.60	70	120
SPREADING	120	CY	.50	60	.60	70	130
GRADING:							
EXCAVATION	100	CY	.25	25	.35	35	60
ON SITE FILL	100	CY	.90	90	1.00	90	180
COMPACTION	100	CY	.75	75	.25	25	100
SEEDING: AROUND BLDG.							
FINE GRADING & SEEDING							
INCL. LIME, FERTILIZER							
W/EQUIPMENT	400	SY	.41	165	.17	70	235
18"øRCP CL III W/GASKETS	28	LF	2.54	70	5.80	160	230
TRENCH EXCAVATION	10	CY	.85	10	.90	10	20
BACK & COMPACTION	10	CY	.75	10	.25	5	15
STONE DRIVEWAY							
4" CRUSHED STONE	126	SY	.54	70	1.15	145	215
PREPARE & ROLL BASE	126	SY	.33	40	-	-	40
6"ø CIP CL 250	60	LF	1.73	105	6.80	410	515
8"ø CIP CL 250	2,000	LF	2.66	5,320	7.90	15,800	21,120
TRENCH EXCAVATION	2,000	CY	.85	1,700	.95	1,900	3,600
BACKFILL & COMPACTION	2,000	CY	.75	1,500	.25	500	2,000
SEEDING: ALONG PIPE LINE							
FINE GRADING & SEEDING	3,300	SY	.40	1,320	.17	560	1,880

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING NEW WELL			ESTIMATOR COX		CHECKED BY DUTTON		
	QUANTITY		LABOR		MATERIAL		
CIVIL MATERIAL DESCRIPTION	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	TOTAL COST
6"ø GATE VALVE & BOX	1	EA	75.	75	225.	225	$ 300
CONC. THRUST BLOCK	3	EA	10.	30	40.	120	150
SUB-TOTAL							31,045
CONTRACTOR MARK-UP	49%						15,212
SUB-TOTAL							46,257
CONTINGENCY	10%						4,626
SUB-TOTAL							50,883
ESCALATION TO 1-1-80	11%						5,597
SUB-TOTAL							56,480
TOTAL							56,500

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING NEW WELL | ESTIMATOR MYERS | CHECKED BY DUTTON

STRUCTURAL MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
BUILDING							
FLOOR	96	SF	.63	60	.63	60	$ 120
WALLS	320	SF	.95	305	1.00	320	625
ROOF	100	SF	.95	95	1.05	105	200
LIGHT GAGE FRAMING	150	LF	.27	40	1.27	190	230
FOUNDATION	8	CY	40.	320	40.	320	640
SUB-TOTAL							1,815
CONTRACTOR MARK-UP	29%						526
SUB-TOTAL							2,341
CONTINGENCY	10%						234
SUB-TOTAL							2,575
ESCALATION TO 1-1-80	11%						283
SUB-TOTAL							2,858
TOTAL							2,900
TOTAL	96	SF	@	30.21 L&M	=		2,900

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING NEW WELL			ESTIMATOR COX		CHECKED BY DUTTON		
EQUIPMENT AND PIPING MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
3/4"ø SCH. 40 STEEL							
ON HANGERS	5	LF	1.82	10	.80	5	$ 15
4"ø CIP	5	LF	1.58	10	5.10	25	35
6"ø CK. VALVE	1	EA	75.	75	180.	180	255
6"ø GATE VALVE	1	EA	75.	75	205.	205	280
4"ø GATE VALVE	1	EA	50.	50	160.	160	210
WELL BORING	L.S.			12,500		12,500	25,000
PUMP & MOTOR	1	EA	200.	1,700	7000.	5,500	7,200
3/4" ø AIR RELEASE VALVE	1	EA	25.	25	50.	50	75
PILOT HOLE	L.S.			4,000		4,000	8,000
SUB-TOTAL							41,070
CONTRACTOR MARK-UP	49%						20,124
SUB-TOTAL							61,194
CONTINGENCY	10%						6,119
SUB -TOTAL							67,313
ESCALATION TO 1-1-80	11%						7,404
SUB-TOTAL							74,717
TOTAL							74,700
Well boring price from Mr. Lee McCown, with Sydnor Hydro Dynamic,							
Oct. 25, 1978 (See enclosed Tele. Con.)							

TELEPHONE CALL CONFIRMATION

LOCAL_____ L.D. X PLACED X REC'D_____ DATE October 25, 1978

Lonnie Dutton TALKED WITH Mr. Lee McCown

OF Sydnor Hydro Dynamic ON SIRRINE JOB NO. A-1086

Utility Study for Courthouse Bay, Camp Lejeune, North Carolina

The writer asked Mr. McCown for estimated cost for the following items:

A. Pilot hole 10"ø at a depth of 200 feet with a series of electrical logs.

Price: $8,000 (this figure includes mobilization)

B. Drilling a well to a depth of 200 feet, with 40 feet of 18"ø outer casing and 8"ø inner casing.

Price: $25,000

T. Lonnie Dutton
Civil Department

TLD:es

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING NEW WELL | ESTIMATOR TCF | CHECKED BY BRUNS

ELECTRICAL MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
10 KVA, 120/208V TRANSF	3	EA	75.	225	300.	900	$ 1,125
100A PANEL MDP	1	EA	150.	150	275.	275	425
SIZE 2 STARTER	1	EA	25.	25	85.	85	110
#1 DIRECT BURIAL CABLE	820	LF	.27	221	.52	426	647
4" PVC DUCT	20	LF	.85	17	1.75	35	52
2" RIGID STEEL CONDUIT	30	LF	1.90	57	1.25	37	94
1 POLE SWITCH	1	EA	3.00	3	2.00	2	5
3 W DUPLEX RECPT	1	EA	3.00	3	2.00	200	5
#8 THW	30	LF	.13	4	.10	3	7
3/4" RIGID CONDUIT	30	LF	1.05	31	.44	13	44
1" RIGID CONDUIT	25	LF	1.25	31	.60	15	46
1/c #12 THW	350	LF	.10	35	.04	14	49
LIGHT FIXTURE	1	EA	12.	12	15.	15	27
MOTOR CONNECTION	1	EA	15.	15	12.	12	27
DITCHING, BACKFILL,	205	LF	1.30	266			266
COMPACTION FOR DIRECT							
BURIAL CABLE							
SUB-TOTAL							2,929
CONTRACTOR MARK UP	49%						1,435
SUB-TOTAL							4,364
CONTINGENCY	10%						436
SUB-TOTAL							4,800
ESCALATION TO 1-1-80	11%						528
SUB-TOTAL							5,328
TOTAL							5,300

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER DISTRIBUTION SYSTEM | ESTIMATOR DUTTON | CHECKED BY COX

SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
LEAKAGE TEST, SUB-TOTAL	12	EA	@	575	=		$ 6,900
SIOH	5.5%						380
TOTAL	12	EA	@	606.63			7,280

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER DISTRIBUTION SYSTEM			ESTIMATOR DUTTON		CHECKED BY COX		
LEAKAGE TEST	QUANTITY		LABOR		MATERIAL		TOTAL COST
MATERIAL DESCRIPTION	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
LEAK TEST ON							
DISTRIBUTION LINES	12	EA	300.	3,600	100.	1,200	$ 4,800
SUB-TOTAL							4,800
CONTRACTOR MARK UP	29%						1,392
SUB TOTAL							6,192
ESCALATION TO 1-1-80	11%						681
SUB TOTAL							6,873
TOTAL							$ 6,900

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING SANITARY SEWER COLLECTOR SYSTEM	ESTIMATOR COX				CHECKED BY DUTTON		
SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
CIVIL SUB-TOTAL	1,355	LF	@	31.37	=		$ 42,500
SIOH	5.5%						2,338
TOTAL	1,355	LF	@	33.09			44,838

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING SANITARY SEWER COLLECTOR SYSTEM			ESTIMATOR DUTTON		CHECKED BY COX		
	QUANTITY		LABOR		MATERIAL		
MATERIAL DESCRIPTION	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	TOTAL COST
10" ø P.V.C.	1,355	LF	1.50	2,035	3.95	5,350	$ 7,385
TRENCH EXCAVATION	3,970	CY	.85	3,375	.95	3,770	7,145
BACKFILL & COMPACTION	3,970	CY	.75	2,980	.25	995	3,975
SAN. SEWER MANHOLES							
STD 4' ø (10-12)	3	EA	275.	825	380.	1,140	1,965
FRAME & COVER	3	EA	30.	90	100.	300	390
TIE INTO EXIST. M.H. & REFORMING M.H. BOTTOMS	2	EA	250.	500	150.	300	800
SEEDING INCL. LIME &							
FERTILIZER W/EQUIP	3,010	SY	.40	1,205	.17	510	1,715
SUB TOTAL							23,375
CONTRACTOR MARKUP	49%						11,454
SUB TOTAL							34,829
CONTINGENCY	10%						3,483
SUB TOTAL							38,312
ESCALATION TO 1-1-80	11%						4,214
SUB TOTAL							42,526
TOTAL							42,500
TOTAL	1,355	LF	@	31.37	=		42,500

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING CLEANING OF SANITARY SEWER COLLECTOR SYSTEM | ESTIMATOR | CHECKED BY

SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
CLEANING & GROUTING	9,200	LF	@	5.05			$ 46,500
SIOH	5.5%						2,558
TOTAL	9,200	LF	@	5.33			$ 49,058

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING CLEANING OF SAN. SEWER COLLECTOR SYSTEM			ESTIMATOR DUTTON		CHECKED BY COX		
	QUANTITY		LABOR		MATERIAL		
MATERIAL DESCRIPTION	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	TOTAL COST
T.V. JOINTS AND							
GROUTING 25% OF							
THE JOINTS	L.S.						$ 32,500
CONTRACTOR MARKUP	29%						9,425
SUB TOTAL							41,925
ESCALATION TO 1-1-80	11%						4,612
SUB TOTAL							46,537
TOTAL	9,200	LF	@	$5.05		=	$ 46,500

I. E. SIRRINE COMPANY

TELEPHONE CALL CONFIRMATION

LOCAL______ L.D. X PLACED X REC'D______ DATE January 30, 1979

Lonnie Dutton TALKED WITH Mr. Bill McAndrew

OF McCullough and Associates ON SIRRINE JOB NO. A-1086

Utility Study for Courthouse Bay, Camp Lejeune, North Carolina

The writer asked Mr. McAndrew for an estimated cost of T.V. joints and grouting 25 percent of the joints on approximately 9200 linear feet of a sanitary sewer collection system.

Mr. McAndrew stated that this work could be accomplished for $32,500. This price includes mobilization, overhead and profit.

T. Lonnie Dutton

T. Lonnie Dutton
Civil Department

TLD:es

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING SANITARY SEWER LIFT STATION COURTHOUSE BAY			ESTIMATOR COX		CHECKED BY DUTTON		
SUMMARY MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
EQUIPMENT	-	LS	-	-	-	-	$ 15,100
ELECTRICAL	-	LS	-	-	-	-	5,700
SUB-TOTAL							$ 20,800
SIOH	5.5%						1,144
TOTAL	-	LS	-	-	-	-	$ 21,944

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING SANITARY SEWER LIFT STATION, COURTHOUSE BAY | ESTIMATOR DUTTON | CHECKED BY COX

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
REPLACE EXISTING PUMPS							
AND MOTORS WITH TWO 700							
gpm PUMPS WITH 25 H.P.							
MOTORS	L.S.	LS	1600.	1,600	LS	7,510	$ 9,110
SEE ATTACHED							
CONFIRMATION LETTERS FROM ENVIRONMENTAL PRODUCTS, INC.							
SUB TOTAL							9,110
CONTRACTOR MARKUP	49%						4,464
SUB TOTAL							13,574
ESCALATION TO 1-1-80	11%						1,493
SUB TOTAL							15,067
TOTAL							$ 15,100

WATER AND WASTE WATER EQUIPMENT, SALES AND SERVICE

ENVIRONMENTAL PRODUCTS, INC

P. O. BOX 2385 • HICKORY, N. C. 28601 • 704/322-7003

December 21, 1978

J. E. Sirrine Company
AE Division
SCN Bank Building
Eighth Floor
Greenville, South Carolina 29601

Attention: Mr. Lonnie Dutton

Subject: Fairbanks Morse Sewage Pumps

Dear Lonnie:

The best pump we can offer for conditions of 700 GPM @ 50' and 625 GPM @ 80' is our Fairbanks Morse 4" Figure 5413K with a bladeless impeller.

We can offer a pump that has a steeper curve, but both conditions hit the far left side of the curve. I feel that it would be better to throttle the pump we are recommending.

The cost for two (2) pumps complete with 25 HP motors, motor bases, flexible shafting, shaft guard, etc. is $7,510.

We are enclosing data covering the equipment recommended. If you need additional information, or if we can be of service at any time, please call on us.

Very truly yours,

ENVIRONMENTAL PRODUCTS, INC.

R. M. Wilkinson

R. M. Wilkinson
Sales Manager

RMW/jk

CC: Kip Lyon

Enclosure:

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING SANITARY SEWER LIFT STATION, COURTHOUSE BAY			ESTIMATOR TCF		CHECKED BY DUTTON		
ELECTRICAL MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
4" PVC	30	LF	.85	25	1.75	52	$ 77
4" RIGID STEEL CONDUIT	30	LF	2.25	67	4.60	138	205
#410 CABLE, 600V	200	LF	.25	50	.96	192	242
#2 CABLE, 600V	100	LF	.21	21	.33	33	54
100A FUSE SWITCH, 3P	2	EA	25.	50	100.	200	250
SIZE 3 STARTER	2	EA	30.	60	135.	270	330
#4 CABLE, 600V	200	LF	.11	22	.20	40	62
#6 CABLE, 600V	60	LF	.09	5	.13	8	13
1¼" CONDUIT	60	LF	1.28	77	.95	57	134
25KVA POLE TYPE TRANSF	3	EA	35.	105	475.	1,425	1,530
REMOVE EXIST TRANSF'S	3	EA	25.	75			75
REMOVE EXIST FUSE SWITCH	2	EA	20.	40			40
REMOVE EXIST STARTERS	2	EA	20.	40			40
REMOVE EXIST CONDUIT & WIRE	60	LF	.60	36			36
TRENCHING, BACKFILL,	30	LF	1.30	39			39
COMPACTION ECT FOR 4" DUCT							
SUB TOTAL							3,127
CONTRACTOR MARKUP	49%						1,532
SUB TOTAL							4,659
CONTINGENCY	10%						466
SUB TOTAL							5,125
ESCALATION TO 1-1-80	11%						564
SUB TOTAL							5,689
TOTAL							5,700

ALL EQUIP REMOVED TO BE TURNED OVER TO GOVERNMENT. THE ASSUMPTION IS MADE THAT THE 2400V PRIMARY POLE LINE IS ADEQUATE FOR THE ADDED LOAD.

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING SANITARY SEWER LIFT STATION AMTRAC AREA			ESTIMATOR COX		CHECKED BY DUTTON		
SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
STRUCTURES SUB-TOTAL	-	LS	-	-	-	-	$ 7,100
SIOH	5.5%						391
TOTAL	-	LS	-	-	-	-	$ 7,491

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

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A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

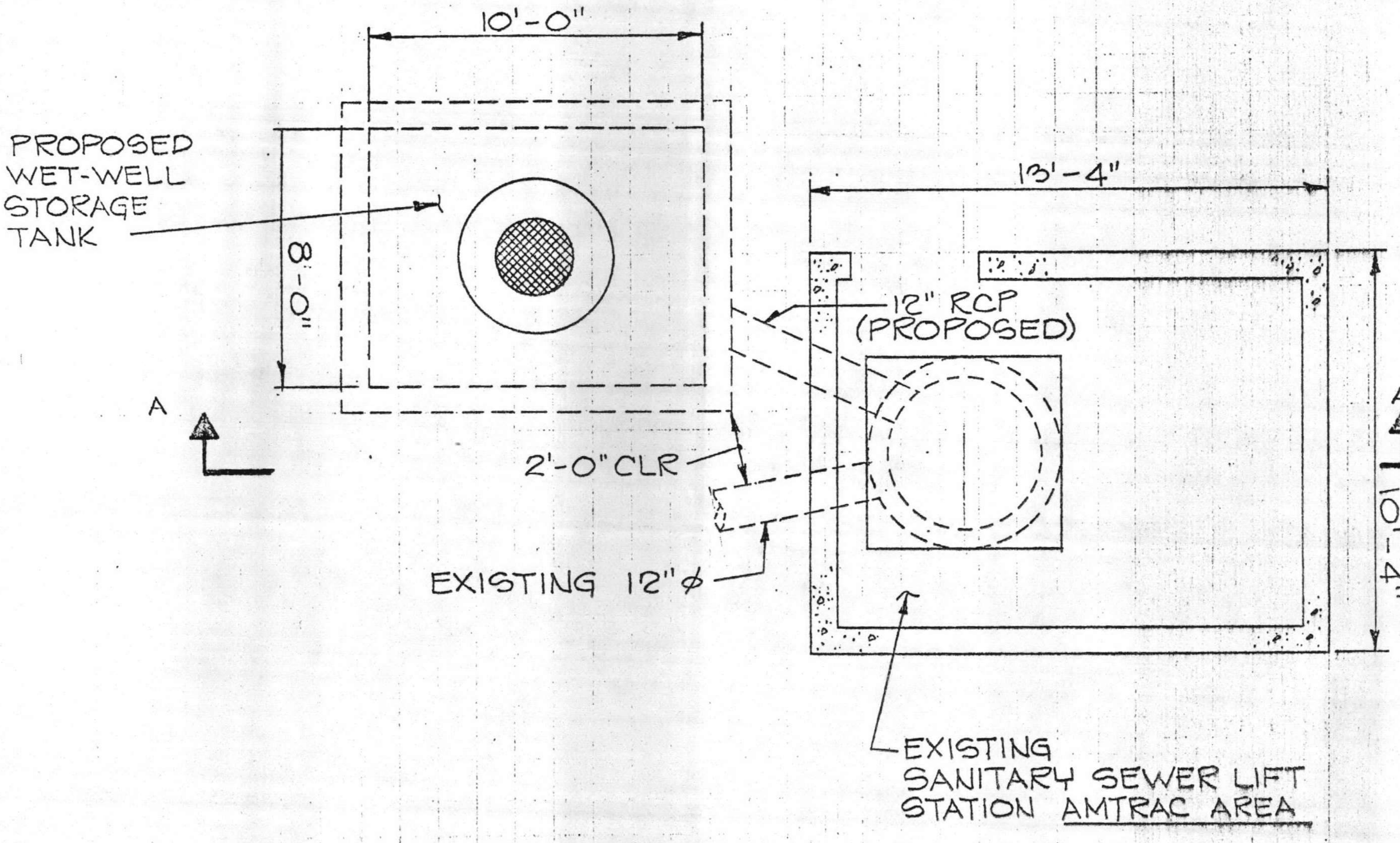
HEADING SANITARY SEWER LIFT STATION AMTRAC AREA | ESTIMATOR MYERS | CHECKED BY DUTTON

STRUCTURES MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
WET WELL							
REINF. CONC.	10	CY	40.	400	100.	1,000	$ 1,400
EXCAV & BACKFILL	25	CY	4.00	100	-	-	100
MANHOLE	8	CY	40.	320	100.	800	1,120
MH COVER & RING	1	EA	25.	25	275.	275	300
12" ø RCP CL V	20	LF	2.25	45	5.75	115	160
TIE INTO EXISTING							
S.S. LIFT STATION	1	EA	450.	450	100.	100	550
DEWATERING	4	DAY	200.	800	25.	100	900
SUB TOTAL							4,530
CONTRACTOR MARKUP	29%						1,314
SUB-TOTAL							5,844
CONTINGENCY	10%						584
SUB TOTAL							6,428
ESCALATION TO 1-1-80	11%						707
SUB TOTAL							7,135
TOTAL							7,100

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

DESIGN SHEET

JOB NO A-1086 DATE 12/28/78
COMPUTED BY AHG
WORKING STRESS



PLAN

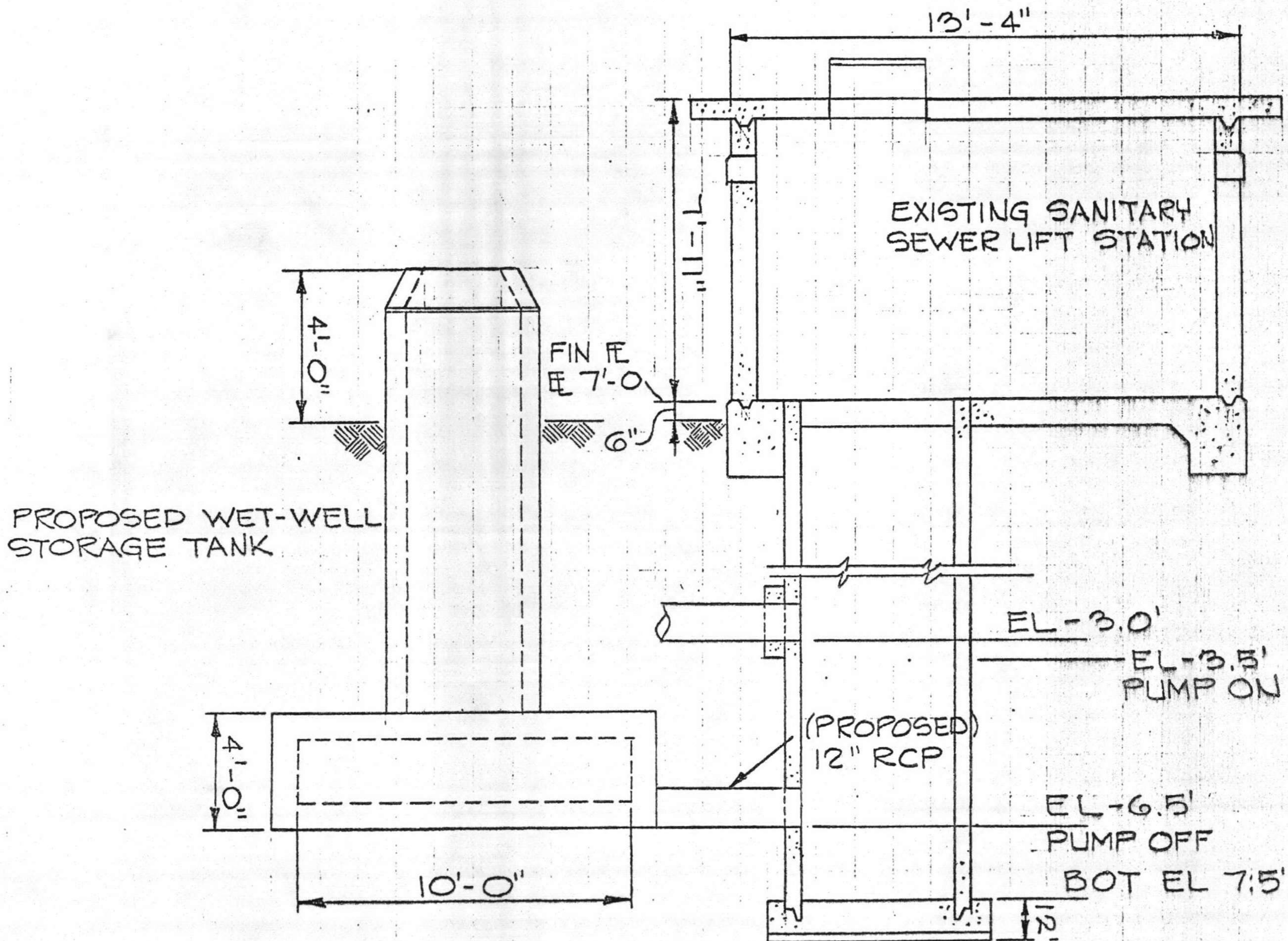
1/2

NOV 75-JES 22

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

DESIGN SHEET

JOB NO A-1086 DATE 12/28/78
COMPUTED BY AHG
WORKING STRESS



SECTION A-A

2/2

NOV 75-JES 22

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT | ESTIMATOR COX | CHECKED BY DUTTON

SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION	-	LS	-	-	-	-	$ 1,900
SITE PREP. & IMPROV.	-	LS	-	-	-	-	41,000
BUILDING	1,280	SF	@	34.22	=		43,800
STRUCTURE (250,000 GAL. TANK)	250000	GAL	@	.33	=		81,900
EQUIPMENT	270	GPM	@	1548.52	=		418,100
INSIDE BLDG. PIPING	155	LF	@	30.46	=		4,700
ELECTRICAL	1,280	SF	@	3.44	=		4,400
SUB-TOTAL							595,800
SIOH	5.5%						32,769
TOTAL	1,280	SF	@	491.07			628,569

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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Greenville, S.C. 29606

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT | ESTIMATOR COX | CHECKED BY DUTTON

DEMOLITION MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION OF M.H.	1	EA	100.	100	50.	50	$ 150
DEMOLITION OF							
ASPHALT PAVEMENT	120	SY	.45	55	.65	80	135
REMOVAL OF 6' HIGH							
FENCE TO BE REUSED	260	LF	.36	95	.49	130	225
REMOVAL OF 18" RCP	67	LF	1.35	90	.62	40	130
TRENCH EXCAVATION	80	CY	.85	70	.90	75	145
BACKFILL & COMPACTION	80	CY	.75	60	.25	20	80
OPENING IN EXISTING							
WALL	110	SF	1.50	165	-	-	165
SUB TOTAL							1,030
CONTRACTOR MARKUP	49%						505
SUB TOTAL							1,535
CONTINGENCY	10%						154
SUB TOTAL							1,689
ESCALATION TO 1-1-80	11%						186
SUB TOTAL							1,875
TOTAL							1,900

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT | ESTIMATOR COX | CHECKED BY DUTTON

SITE PREPARATION AND IMPROVEMENTS MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
PRECAST MANHOLE							
4' ø (6' - 8')	2	EA	120.	240	240.	480	$ 720
FRAME & COVER	2	EA	30.	60	100.	200	260
TIE-IN TO EXISTING							
MAN HOLE	2	EA	100.	200	100.	200	400
18" ø RCP CL III	130	LF	2.54	330	6.5	845	1,175
12" ø RCP CL III	60	LF	1.30	78	4.00	240	318
TRENCH EXCAVATION	190	CY	.85	160	.90	170	330
BACKFILL & COMPACTION	190	CY	.75	145	.25	50	195
6' HIGH CHAIN LINK							
FENCE W/BARBED WIRE	110	LF	1.00	110	4.50	495	605
REUSE 6' HIGH FENCE	260	LF	1.00	260	.75	195	455
PAVEMENT							
PREPARE & ROLL BASE	285	SY	.33	95	-	-	95
CRUSHED STONE 6"	285	SY	.40	115	1.70	485	600
PRIMER & SEAL COAT	285	SY	.10	30	.10	30	60
2" WEARING SURFACE	285	SY	.74	210	2.25	640	850
OFF SITE FILL	1,070	CY	2.00	2,140	2.50	2,675	4,815
COMPACTION	1,070	CY	.75	800	.25	270	1,070
SEEDING, INCL. LIME,							
& FERTILIZER	1,970	SY	.40	790	.17	335	1,125
10" ø DIP (M.J.)	200	LF	3.20	640	10.31	2,060	2,700
12" ø DIP (M.J.)	140	LF	4.00	560	12.29	1,720	2,280
TRENCH EXCAVATION	340	CY	.85	290	.90	305	595
BACKFILL & COMPACTION	340	CY	.75	255	.25	85	340
12" G.V. W/BOX	3	EA	190.	570	575.	1,725	2,295

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

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A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT			ESTIMATOR COX		CHECKED BY DUTTON		
SITE PREPARATION AND IMPROVEMENTS MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
CLEARING & GRUBBING							
TREES TO 6" DIA.							
CUT & CHIPS	.33	AC	507.	170	456.	150	320
GRUB STUMPS & REMOVE	.33	AC	93.	30	305.	100	130
TOPSOIL							
STRIPPING & STOCK							
PILING	265	CY	.40	105	.60	160	265
SPREADING	265	CY	.50	135	.60	160	295
CONC. THRUST BLOCKS	5	EA	10.	50	40.	200	250
SUB-TOTAL							22,543
CONTRACTOR MARK-UP	49%						11,046
SUB-TOTAL							33,589
CONTINGENCY	10%						3,359
SUB-TOTAL							36,948
ESCALATION TO 1-1-80	11%						4,064
SUB-TOTAL							41,012
TOTAL							41,000

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT			ESTIMATOR MYERS		CHECKED BY DUTTON		
BUILDING MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
BUILDING:							
FOUNDATIONS	60	CY	40.	2400	100.	6000	8,400
FLOOR	20	CY	29.	580	57.	1140	1,720
WALLS	1500	SF	1.55	2325	1.50	2250	4,575
ROOF	1280	SF	1.30	1665	1.30	1665	3,330
STRUCT. STEEL	6	TON	500.	3000	1000.	6000	9,000
GRAVEL STOP	112	LF	2.	225	1.	115	340
DOORS	24	SF	3.	75	8.	195	270
SASH	25	SF	2.	50	5.	125	175
SUB-TOTAL							27,810
CONTRACTOR MARK-UP	29%						8,065
SUB-TOTAL							35,875
CONTINGENCY	10%						3,588
SUB-TOTAL							39,463
ESCALATION TO 1-1-80	11%						4,341
SUB-TOTAL							43,804
TOTAL							43,800
TOTAL	1280	SF	@	34.22	=		43,800

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

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P. O. Box 5456
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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT | ESTIMATOR MYERS | CHECKED BY DUTTON

STRUCTURES (250,000 TANK) MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
WATER RESERVOIR							
REINF CONC.	276	CY	40.	11,040	100.	27600	38,640
EXCAVATION	200	CY	4.	800	-	-	800
BACKFILL	960	CY	8.	7680	5.	4800	12,480
GRAVEL (6" THICK AROUND SIDE OF TANK)	85	SF	.88	75	.18	15	80
SUB-TOTAL							52,010
CONTRACTOR MARK-UP	29%						15,083
SUB-TOTAL							67,093
CONTINGENCY	10%						6,709
SUB-TOTAL							73,802
ESCALATION TO 1-1-80	11%						8,118
SUB-TOTAL							81,920
TOTAL							81,900

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

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A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING ITEM 1 - PRIMARY FACILITY	ESTIMATOR T. HUECKER				CHECKED BY		
WATER TREATMENT EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	TOTAL	MATERIAL PER UNIT	TOTAL	TOTAL COST
670 GPM FILTER FEED	1	LS			1	$ 3,364	
PUMP NO. 1 INCL. BASE,	160	MH	10	$1,600			$ 4,964
COUPLING, COUPLING GUARD,							
& 20 HP 3Ø, 60 HZ 460 V.							
MOTOR, AND INSTALLATION							
S. W. CARROUTH-CAROTEK, INC. - VENDOR QUOTE DATED 12/4/78							
704-847-4406							
670 GPM FILTER FEED	1	LS			1	$10,876	
PUMP NO. 2, INCL. BASE	190	MH	10	$1,900			$12,776
COUPLING, GUARDS, &							
20 HP, 3Ø, 60 HZ, 460V							
MOTOR AND 64 HP WATER							
COOLED DISEL ENGINE, AND							
INSTALLATION							
S. W. CARROUTH-CAROTEK, INC. VENDOR QUOTE DATED 12/4/78							
704-847-4406							
REPIPE AND REVALVE THREE	1	LS				$26,000	
(3) EXISTING 7-1/2' Ø	460	MH	10	$4,600			$30,600
FILTERS AND CONNECT TO							
NEW CONTROL SYSTEM INCL.							
VALVES, PIPING AND							
CONTROLS AND INSTALLATION							
BILL MORRISON-BROWN & MORRISON - VENDOR QUOTE DATED 12/8/78							
704-333-0774							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING: ITEM 1 - PRIMARY FACILITY | ESTIMATOR: T. HUECKER | CHECKED BY:

WATER TREATMENT EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
4 NEW 8'Ø FILTERS INCL.	1	LS				$90,000	
FILTERS, PIPING, MEDIA,	835	MH	10	$8,350			$98,350
CONTROLS, VALVES, INTER-							
CONNECTING HEADER PIPING							
AND INSTALLATION							
BILL MORRISON - BROWN & MORRISON - VENDOR QUOTE DATED 12/8/78							
704-333-0774							
NEW BRINE TANK FOR	1	LS				$ 4,100	
EXISTING SOFTENERS INCL.	120	MH	10	$1,200			$ 5,300
NEW TANK, LEVEL CONTROLS,							
VALVES, PRESSURE GAUGES,							
ROTAMETERS, FOR EXISTING							
SOFTENERS, AND							
INSTALLATION							
BILL MORRISON - BROWN & MORRISON - VENDOR QUOTE DATED 12/8/78							
704-333-0774							
REPLACE SOFTENER RESIN	1	LS				$ 2,370	
49 CU.FT.	32	MH	10	$ 320			$ 2,690

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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Greenville, S.C. 29606

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING ITEM 1 - PRIMARY FACILITY			ESTIMATOR T.HUECKER		CHECKED BY		
WATER TREATMENT EQUIPMENT MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
2 NEW 6'Ø SOFTENER UNITS	1	LS				$56,000	
INCL. BRINE TANK, LEVEL	290	MH	10	$2,900			$58,900
CONTROLS, WATER METERS,							
VALVES, CONTROLS,							
PRESSURE GAUGES, ROTA-							
METERS, PIPING, VALVES,							
RESIN, SUBFILL, AND							
INSTALLATION							
BILL MORRISON - BROWN & MORRISON - VENDOR QUOTE DATED 12/8/78							
704-333-0774							
CONTROL PANEL FOR	1	LS				$14,000	
SOFTENERS & FILTERS INCL.	224	MH	10	$2,240			$16,240
TIE-IN OF PIPING AND							
CONTROLS TO EXISTING							
SYSTEM CONTROL OPERATION							
FOR MANUAL/AUTOMATIC AND							
INSTALLATION							
BILL MORRISON - BROWN & MORRISON - VENDOR QUOTE DATED 12/8/78							
704-333-0774							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING ITEM 1 - PRIMARY FACILITY | ESTIMATOR T. HUECKER | CHECKED BY

WATER TREATMENT EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUBTOTAL				$23,110		$206,710	$229,820
SUBCONTRACTOR MARKUP @ 49%				11,324		101,287	112,611
SUBTOTAL				34,434		307,997	342,431
ESCALATION TO 1 JANUARY 1980 @ 11%				3,787		33,880	37,667
SUBTOTAL				38,221		341,877	380,098
CONTINGENCY @ 10%				3,822		34,188	38,010
TOTAL				$42,043		$376,065	$418,108
270 GPM EXPANSION FROM 400 GPM TO 670 GPM							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT | ESTIMATOR DUTTON | CHECKED BY COX

INSIDE BUILDING PIPING MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
3/4" ø SCH. 40 STEEL	50	LF	1.30	65	.60	30	95
6" ø SCH. 40 STEEL	25	LF	7.60	190	11.40	285	475
8" ø SCH. 40 STEEL	80	LF	9.32	745	16.00	1280	2025
SUB-TOTAL							2595
CONTRACTOR MARK-UP	49%						1272
SUB-TOTAL							3867
CONTINGENCY	10%						387
SUB-TOTAL							4254
ESCALATION TO 1-1-80	11%						468
SUB-TOTAL							4722
TOTAL							4700
TOTAL	155	LF	@	30.46	=		4700

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WATER TREATMENT PLANT | ESTIMATOR TCF | CHECKED BY

ELECTRICAL MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SIZE 2 MAGNETIC STARTERS	4	EA	45.	180	140.	560	$ 740
1" RIGID STEEL CONDUIT	60	LF	1.25	75	.70	42	117
#8 THW	180	LF	.13	23	.11	8	31
#10 THW	80	LF	.10	8	.06	4	12
FLEXIBLE CONDUIT & FITTINGS	2	EA	20.	40	12.	24	64
50A, 3P, CIRCUIT BREAKERS	2	EA	15.	30	90.	180	210
LIGHTING FIXTURES	2	EA	13.	26	17.	34	60
1/2" RIGID STEEL CONDUIT	40	LF	1.10	44	.42	16	60
1 1/4" PVC	550	LF	.15	82	.17	94	175
1 1/4" R.S. CONDUIT	75	LF	1.30	98	.95	71	169
3 POLE RELAY	1	EA	10.	10	55.	55	65
FLOAT CONTROL	1	EA	100.	100	257.	257	357
1/C #10 THW	2400	LF	.10	240	.06	144	384
SUB-TOTAL							2444
CONTRACTOR MARK-UP	49%						1198
SUB-TOTAL							3642
CONTINGENCY	10%						364
SUB-TOTAL							4006
ESCALATION TO 1-1-80	11%						441
SUB-TOTAL							4447
TOTAL							4400
TOTAL	1280	SF	@	3.44			4400

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTEWATER TREATMENT PLANT			ESTIMATOR COX		CHECKED BY DUTTON		
SUMMARY MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
DEMOLITION	153000	GAL	@	.46	=		70,200
SITE PREP & IMPROV.	153000	GAL	@	.69	=		105,400
STRUCTURES	153000	GAL	@	1.47	=		224,200
EQUIPMENT	153000	GAL	@	3.60	=		550,300
ELECTRICAL	153000	GAL	@	.03	=		5,200
SUB-TOTAL	153000	GAL	@	6.24	=		955,300
SIOH	5.5%						52,541
TOTAL	153000	GAL	@	6.59			$ 1,007,842

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTEWATER TREATMENT PLANT	ESTIMATOR DUTTON				CHECKED BY COX		
DEMOLITION MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
IMHOFF TANKS	1014	CY	18.20	18,455	11.50	11,660	30,115
CHLORINE CONTACT							
CHAMBER	113	CY	18.20	2,055	11.50	1,300	3,355
CHLORINATION M.H.	21	CY	18.20	380	11.50	240	620
CLARIFIER EFFLUENT BOX	9	CY	18.20	165	11.50	105	270
IMHOFF EFFLUENT BOX	14	CY	18.20	255	11.50	160	415
8" ø PIPE (CIP)	605	LF	1.89	1145	.85	515	1660
10" ø PIPE (VCP)	180	LF	1.06	190	.47	85	275
4" ø PIPE (CIP)	105	LF	1.14	120	.52	55	175
TRENCH EXCAVATION	600	CY	.85	510	.95	570	1080
BACKFILL & COMPACTION	600	CY	.75	450	.25	150	600
SUB-TOTAL							38,565
CONTRACTOR MARK-UP	49%						18,897
SUB-TOTAL							57,462
CONTINGENCY	10%						5,746
SUB-TOTAL							63,208
ESCALATION TO 1-1-80	11%						6,953
SUB-TOTAL							70,161
TOTAL							70,200

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTEWATER TREATMENT PLANT			ESTIMATOR COX		CHECKED BY DUTTON		
SITE PREPARATION AND IMPROVEMENTS MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
4" ø C.I.S.P.	110	LF	3.28	360	3.06	337	697
6" ø C.I.S.P.	290	LF	3.78	1100	4.75	1380	2480
10" ø C.I.S.P.	50	LF	6.84	340	13.43	670	1010
12" ø C.I.S.P.	600	LF	7.88	4730	18.87	11,322	16,052
3" ø C.I.P. (CL52)	50	LF	1.40	70	4.20	210	280
4" ø C.I.P. (CL52)	385	LF	1.50	580	5.10	1965	2545
8" ø C.I.P. (CL52)	45	LF	2.66	120	7.90	355	475
10" ø C.I.P. (CL52)	35	LF	3.20	110	10.31	360	470
TRENCH EXCAVATION	1525	CY	.85	1295	.90	1375	2670
BACKFILL & COMPACTION	1525	CY	.75	1145	.25	380	1525
4" ø G.V. W/BOX C.I.	3	EA	55.	165	175.	525	690
6" ø G.V. W/BOX C.I.	4	EA	70.	290	225.	900	1190
8" ø G.V. W/BOX C.I.	2	EA	115.	230	305.	610	840
10" ø G.V. W/BOX C.I.	1	EA	145.	145	460.	460	605
12" ø G.V. W/BOX C.I.	14	EA	190.	2660	575.	8050	10710
PRIMARY CLARIFIER							
SLUDGE PUMPS							
3" ø GATE VALVE	4	EA	45.	180	115.	460	640
3" ø CHECK VALVE	4	EA	45.	180	155.	620	800
EFFLUENT RECIRCULATION							
PUMPS							
3" ø GATE VALVE	2	EA	45.	90	115.	230	320
3" ø CHECK VALVE	2	EA	45.	90	155.	310	400

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTEWATER TREATMENT PLANT			ESTIMATOR COX		CHECKED BY DUTTON		
SITE PREPARATION AND IMPROVEMENTS MATERIAL DESCRIPTION	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
TRICKLING FILTER							
LIFT PUMPS							
4" ø GATE VALVE	3	EA	45.	135	155.	465	600
4" ø CHECK VALVE	3	EA	45.	135	165.	495	630
GRAVITY THICKENER							
SLUDGE PUMPS							
3" ø GATE VALVE	2	EA	45.	90	115.	230	320
3" ø CHECK VALVE	2	EA	45.	90	155.	310	400
AEROBIC DIGESTER							
AIR BLOWERS							
3" ø GATE VALVE	2	EA	45.	90	115.	230	320
3" ø CHECKVALVE	2	EA	45.	90	155.	310	400
6' HIGH CHAIN LINK							
FENCE W/BARBED WIRE	120	LF	1.00	120	4.50	540	660
REUSE 6' HIGH FENCE	280	LF	1.00	280	.75	210	490
PAVEMENT							
PREPARE & ROLL BASE	225	SY	.33	75	-	-	75
CRUSHED STONE 6"	225	SY	.40	90	1.70	385	475
PRIMER & SEAL COAT	225	SY	.10	25	.10	25	50
2" WEARING SURFACE	225	SY	.74	165	2.25	505	670
SEEDING INCL. LIME &							
FERTILIZER W/EQUIP.	2700	SY	.40	1080	.17	460	1540

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTEWATER TREATMENT PLANT			ESTIMATOR COX		CHECKED BY DUTTON		
SITE PREPARATION AND IMPROVEMENTS MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
CLEARING & GRUBBING:							
TREES TO 6" ø CUT & CHIPS	.24	AC	507.	120	456.	110	230
GRUB STUMPS & REMOVE	.24	AC	93.	20	305.	75	95
OFF SITE FILL	1025	CY	2.00	2050	2.50	2,565	4,615
COMPACTION	1025	CY	.75	770	.25	255	1,025
TOPSOIL:							
STRIPPING & STUCK							
PILING	450	CY	.40	180	.60	110	290
SPREADING	450	CY	.50	225	.60	135	360
CONC THRUST BLOCK	10	EA	10.	100	40.	400	500
SUB-TOTAL							58,144
CONTRACTOR MARK-UP	49%						28,491
SUB-TOTAL							86,288
CONTINGENCY	10%						8,629
SUB-TOTAL							94,917
ESCALATION TO 1-1-80	11%						10,441
SUB-TOTAL							105,358
TOTAL							105,400

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTE WATER TREATMENT PLANT | ESTIMATOR MYERS | CHECKED BY DUTTON

STRUCTURES MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
2 PRIMARY CLARIFIER							
REINF. CONC.	150	CY	40.	6,000	100.	15,000	$ 21,000
EXCAV. & BACKFILL	250	CY	4.	1,000	-	-	1,000
CHLORINE CONTACT							
REINF CONC	75	CY	40.	3,000	100.	7,500	10,500
EXCAV & BACKFILL	125	CY	4.00	500	-		500
DIGESTER							
REINF CONC	100	CY	40.	4,000	100.	10,000	14,000
EXCAV. & BACKFILL	150	CY	4.	600	-	-	600
FLOW BOXES & PITS							
REINF. CONC.	40	CY	40.	1,600	100.	4,000	5,600
EXCAV. & BACKFILL	60	CY	4.	240	-	-	240
TRICKLING FILTER							
REINF. CONC.	230	CY	50.	11,500	100.	23,000	34,500
EXCAV. & BACKFILL	600	CY	4.	2,400	-	-	2,400
LADDER & STEPS	15	EA	3.	45	8.	120	165
GRATING	25	SF	2.	50	4.	100	150
SECONDARY CLARIFIER							
REINF. CONC.	100	CY	40.	4,000	100.	10,000	14,000
EXCAV. & BACKFILL	150	CY	4.	600	-	-	600
PUMP BASES							
CONC.	40	CY	40.	1,600	100.	4,000	5,600
EXCAV. & BACKFILL	40	CY	4.	160	-	-	160
BARMINUTORS							
REINF. CONC.	9	CY	40.	360	100.	900	1,260
EXCAV. & BACKFILL	10	CY	4.	40	-	-	40
PUMP & CHLORINE BLDG.	600	SF	20.	12,000	30.	18,000	30,000

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTEWATER TREATMENT PLANT			ESTIMATOR MYERS		CHECKED BY DUTTON		
STRUCTURES MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUB TOTAL							$ 142,315
CONTRACTOR MARKUP	29%						41,271
SUB TOTAL							183,586
CONTINGENCY	10%						18,359
SUB TOTAL							201,945
ESCALATION TO 1-1-80	11%						22,214
SUB TOTAL							224,159
TOTAL							224,200

CARROTEK, INC.

PROCESS ENGINEERS

QUOTATION

J. E. SIRRINE COMPANY
P. O. BOX 5456
GREENVILLE, SC 29606

NO. 5069

DATE DECEMBER 4, 1978

ATTENTION: MR. TOM HUECKER

SUBJECT: ALLIS-CHALMERS 8000 SERIES HORIZONTAL SPLIT-CASE PUMP

DEAR TOM,

PER OUR EARLIER TELEPHONE CONVERSATION AND LETTER WE HAVE SELECTED THE 6x4x12L AXIAL SPLIT-CASE PUMP FOR YOUR 670 GPM AT 80' TDH. PER YOUR REQUIREMENTS, ONE PUMP HAS BEEN SELECTED WITH A WATER COOLED DIESEL ENGINE AS WELL AS A 20 HP, 3 PHASE, 60 CYCLE, 460 VOLT MOTOR. THE PRICE FOR THIS UNIT COMPLETE WITH WATER COOLED DIESEL ENGINE AND ELECTRIC DRIVE WOULD BE $10,876.00. AS AN ALTERNATIVE, THIS SAME ARRANGEMENT SUPPLIED WITH AN AIR COOLED DIESEL WOULD BE $8,521.00. FOR YOUR ONE ELECTRICALLY DRIVEN PUMP ONLY, THE PUMP QUOTED WITH BASE, COUPLING, COUPLING GUARD AND 20 HP, 3 PHASE, 60 CYCLE, 460 VOLT MOTOR WOULD COST $3,364.00.

DELIVERIES WOULD BE APPROXIMATELY 18 TO 20 WEEKS; HOWEVER, SHOULD YOU REQUIRE QUICKER DELIVERIES PLEASE ADVISE AND WE MAY BE ABLE TO SPEED UP THIS DELIVERY. WE TRUST THIS LETTER WILL FURNISH YOU WITH THE NECESSARY INFORMATION BUT SHOULD YOU HAVE ANY QUESTIONS OR DESIRE ADDITIONAL INFORMATION PLEASE DO NOT HESITATE THIS OFFICE.

VERY TRULY YOURS,

Steve Carrouth /fw

STEVE W. CARROUTH
SWC/fw

Your order will be received subject to the acceptance of seller's home office at Charlotte, North Carolina, upon and subject to the terms stated on the reverse side hereof.

640 Sam Newell Road / P. O. Box 1395 / Matthews, North Carolina 28105 / Phone 704 847-4406

AREA CODE 704 333-0774

POWER & PROCESS EQUIPMENT

B & M BROWN & MORRISON

W. C. "BILL" MORRISON
HAROLD K. COUCH
DONALD H. JONES
ED B. MONTAGUE
DWIGHT W. WESSLER
DONALD G. MORRISON
GARY F. MORRISON
GARY H. JONES

1900 EAST 7TH STREET
P. O. BOX 4307
CHARLOTTE, N. C. 28204

December 8, 1978

J. E. Sirrine Company
Post Office Box 5456, Station B
Greenville, South Carolina 29606

Attention Mr. T. C. Huecker
S. C. Division

Gentlemen

Subject U. S. Marine Base
Courthouse Bay
Camp Lejeune, North Carolina
Your A-1086
Cochrane Equipment
Our Quotation No. 23220

We are pleased at this time to confirm our verbal pricing on the several items we have discussed on the updating of the Cochrane water treating equipment at this installation. We tabulate .. as follows:

Item #1 Modification of Existing Filters

There are three (3) existing pressure filters, 7'6" diameter by 6'0" straight side. These are arranged at the present time to be backwashed in sequence but with all units off the line. It appears desirable to repipe these so that each unit could be backwashed individually with the balance of the load to be handled by the remaining units. To do this, we would propose the following equipment to be furnished:

(a) New valve nest for each filter complete with butterfly valves (6"), actuators, with manual override.

(b) New front piping for each filter.

(c) New interconnecting headers for the three (3) filters

(d) Semi-automatic push button control for backwashing

(e) Pressure gauges for each unit, total of six (6)

(f) Sample cocks for each unit, total of three (3)

(g) Rotameters for each unit, total of three (3)

(h) Manual isolating valves for each unit, total of six (6)

ESTIMATED COST of the above would be----------------------$26,000.00

Item #2 New Filters

Under this arrangement we would offer the following:

(a) Four (4) new pressure filters, 8'0" diameter by 6'0" straight side, 75 psi, non-code construction.

(b) Four (4) automatic valve nests with manual override

(c) Semi-automatic push button control for backwashing

(d) Interconnecting headers for the four (4) units

(e) Pressure gauges for each unit, total of eight (8)

(f) Sample cocks for each unit, total of four (4)

(g) Rotameters for each unit, total of four (4)

(h) Manual isolating valves for each unit, total of eight (8)

ESTIMATED COST of the above would be----------------------$90,000.00

Item #3 Modification of Existing Softeners

There are two (2) existing softeners each 5'0" diameter by 6'0" straight side. We would propose to add the following equipment:

(a) Two (2) pressure gauges for each unit, total of four (4)

(b) Sample cocks for each unit, total of two (2)

(c) Rotameters for each unit, total of four (4)

(d) New brine combination salt storage and measuring tank of fiberglas construction.

(e) New set of brine level controls.

ESTIMATED COST of the above would be----------------------$ 4,100.00
In this figure is approximately $2,000.00 for brine tank and controls.

Item #4 New Softeners

Under this arrangement we would offer the following:

(a) Two (2) new Zeolite water softeners each 6'0" diameter by 6'0" straight side, 100 psi ASME code construction.

(b) Two (2) automatic valve nests with manual override

(c) Semi-automatic push button control for regeneration

(d) Front piping and interconnecting piping.

(e) Pressure gauges for each unit, total of four (4)

(f) Rotameters for each unit, total of two (2)

(g) Manual isolating valves for each unit, total of four (4)

(h) Brine regeneration system.

(i) Skid assembly of the above.

ESTIMATED COST of the above would be ----------------------$56,000.00

<u>Item #5 New Control System</u>

A new control panel to house all controls for filters and softeners including timers, switches, push button semi-automatic control for softeners with interlock and automatic brine tank refilling

ESTIMATED COST of the above would be----------------------$14,000.00

<u>Item #6 Additional Resin</u>

This would include forty-nine (49) cubic feet of cation resin for Softener #1.

ESTIMATED COST of the above would be ----------------------$ 2,370.00

All the above prices are current as of December 1, 1978. Freight charges are included.

We have not included start-up service. This could be furnished at a cost of $250.00 per day plus living and travel expenses from Philadelphia, Pa., to Jacksonville, N.C., and return.

Please advise if we have overlooked anything. Thank you.

Yours very truly,
BROWN & MORRISON, District Representatives
For: COCHRANE ENVIRONMENTAL SYSTEMS

W. C Morrison

W. C. Morrison

WCM:jb

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

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A&E FIRM & ADDRESS: J. E. Sirrine Company
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CONST. CONTRACT NO.

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING: WASTEWATER TREATMENT PLANT | ESTIMATOR: H. D. LIENERT | CHECKED BY:

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
BARIMUTER	2	EA	320	$ 640	13,000	$26,000	$26,640
ESHELMAN CAROLINAS INC. - MR. TOBIN - VENDOR QUOTE DATED 12/19/78							
704-376-6408							
PRIMARY CLARIFIER							
PRIMARY COLLECTOR W/ SKIMMER, WEIR AND							
BAFFLES - 22'Ø	2	EA	6,240	12,480	18,500	37,000	49,480
ROBERT L. CARLSON INC. - CHARLES R. HUNTER JR. - VENDOR QUOTE DATED 10/19/78							
704-332-9031							
SECONDARY CLARIFIER							
SECONDARY COLLECTOR							
W/SKIMMER, WEIR &							
BAFFLES - 29'Ø	1	EA	6,240	6,240	22,000	22,000	28,240
ROBERT L. CARLSON INC. - CHARLES R. HUNTER JR. - VENDOR QUOTE DATED 10/19/78							
704-332-9031							
ROTARY DISTRIBUTOR							
62'Ø, 200 - 800 GPM	1	EA	1,120	1,120	25,000	25,000	26,120
ROBERT L. CARLSON, INC. - CHARLES R. HUNTER JR. - VENDOR QUOTE DATED 10/19/78							
704-332-9031							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

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PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING: WASTEWATER TREATMENT PLANT
ESTIMATOR: H. D. LIENERT
CHECKED BY

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
GRAVITY THICKENER							
STEEL TANK, 7.5'Ø	1	EA	3,000	3,000	6,300	6,300	9,300
THICKENING RAKE,							
WEIR, & BAFFLES	1	EA	3,200	3,200	18,700	18,700	21,900
ROBERT L. CARLSON INC. - CHARLES R. HUNTER, JR. - VENDOR QUOTED 10/28/78							
704-332-9031							
AEROBIC DIGESTER							
BRIDGE, SUPPORTS,							
DIFFUSER ASSEMBLY,							
(2) AIR BLOWERS, 15 HP,							
CONTROL PANEL & TIMER	1	EA	2,560	2,560	25,000	25,000	27,560
JOHNSTON, INC. - MAC JOHNSTON - VENDOR QUOTED 12/21/78							
704-377-3785							
TRICKLING FILTER LIFT							
PUMPS							
VORTEX PUMPS, TWO (2)							
3 HP, ONE (1) 1 HP							
COMPLETE W/PANELS,							
FLOATS & STARTERS	3	EA	320	960	-	12,000	12,960
ROBERT E. MASON COMPANY - TERREL COOK - VENDOR QUOTED 10/23/78							
704-375-4464							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area   DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( )   FINAL ESTIMATE ( )   REVISED FINAL ESTIMATE (x)

HEADING: WASTEWATER TREATMENT PLANT   ESTIMATOR: H. D. LIENERT   CHECKED BY

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
PRIMARY CLARIFIER SLUDGE							
PUMPS							
PROGRESSIVE CAVITY							
COMPLETE W/TIMER, PANEL,							
MOTOR STARTERS TWO (2)							
3 HP, 280 RPM 22 GPM	4	EA	320	1,280	3,070	12,280	13,560
THE GREENLESS COMPANY - PETER PETERSON - VENDOR QUOTE DATED 11/6/78							
404-261-1781							
GRAVITY THICKENER							
SLUDGE PUMPS							
PROGRESSIVE CAVITY							
COMPLETE W/TIMER, PANEL,							
MOTOR STARTERS TWO (2)							
1.5 HP, 210 RPM, 10 GPM	2	EA	480	960	2,885	5,770	6,730
THE GREENLESS COMPANY - PETER PETERSON - VENDOR QUOTE DATED 11/6/78							
404-261-1781							
EFFLUENT RECIRCULATION							
PUMPS - VERTICAL DRY PIT,							
1.5 HP, 1150 RPM,							
50 GPM PANEL, W/TIMER,							
MOTOR STARTERS	2	EA	320	960	1,500	3,000	3,960
EQUIPMENT SALES COMPANY, INC. - VANCE MORROW - VENDOR QUOTE 12/21/78							
803-787-6342							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING: WASTEWATER TREATMENT PLANT | ESTIMATOR: H. D. LIENERT | CHECKED BY:

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
RECYCLE & SLUDGE UNDER-							
FLOW INSTRUMENTATION							
ONE (1) 6" KENNISON							
NOZZLE TWO (2) 6" HALF							
SECTION KENNISON NOZZLES							
FOUR (4) TRANSMITTERS							
FOUR (4) RECEIVERS							
TWO (2) TOTALIZERS							
FOUR (4) SEDIMENT TRAPS	1	EA	2,000	2,000	17,000	17,000	19,000
THE TAULMAN SALES COMPANY - PAUL WHITE - VENDOR QUOTE DATED 10/23/78							
704-554-7013							
FLOAT PIPE & PIPING FOR							
KENNISON NOZZLES	4	EA	200	800	300	1,200	2,000
TRICKLING FILTER MEDIA							
ROCK (2.5" - 4.0"Ø)	840	C.Y.	2.50	2,100	30	25,200	27,300
TRICKLING FILTER							
UNDERDRAIN BLOCKS	352	S.Y.	1.50	528	22	7,744	8,272
THE BOWERSTON SHALE COMPANY - FRANK H. MILLIKEN, JR. - VENDOR QUOTE DATED 10/26/78							
614-269-2921							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area   DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( )   FINAL ESTIMATE ( )   REVISED FINAL ESTIMATE (x)

HEADING: WASTEWATER TREATMENT PLANT | ESTIMATOR: H. D. LIENERT | CHECKED BY:

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
VACUUM-FEED CHLORINATOR							
1 TON Cl_2 CYL. SYSTEM							
AUTO SWITCHOVER							
Cl_2 RESIDUAL							
SAMPLER & RECORDER	2	EA	2,800	5,600	6,950	13,900	19,500
ROBERT E. MASON COMPANY - TERREL COOK - VENDOR QUOTE DATED 10/23/78							
704-375-4464							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTE WATER TREATMENT PLANT | ESTIMATOR H.D. LIENERT | CHECKED BY

EQUIPMENT MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUBTOTAL				$ 44,428		$258,044	$ 302,472
SUB-CONTRACTOR MARKUPS	49	%					148,211
SUBTOTAL							450,683
CONTINGENCY	10	%					45,068
SUBTOTAL							495,752
ESCALATION TO 1 JAN. 1980	11	%					54,533
SUBTOTAL							550,284
						COST/SYSTEM UNIT	
TOTAL	153,000	GAL.				3.60	$ 550,284
ADDITIONAL WASTE WATER TREATMENT PLANT CAPACITY							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED Jan. 31, 1979

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE ( ) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE (x)

HEADING WASTEWATER TREATMENT PLANT			ESTIMATOR TCF		CHECKED BY		
ELECTRICAL MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SIZE 0 MAGNETIC STARTERS	7	EA	50.	350	165.	1155	$ 1,505
1" PVC CONDUIT	425	LF	.55	233	.30	127	360
3/4" PVC CONDUIT	120	LF	.48	57	.20	24	81
#10 THW	1,750	LF	.10	175	.06	105	280
#12 THW	500	LF	.09	45	.04	20	65
DITCHING BACKFILL	265	LF	1.30	344			344
COMPACTION FOR BURIAL							
OF PVC CONDUIT							
FLEXIBLE CONDUIT & FITTINGS	7	EA	20.	140	12.	84	224
SUB TOTAL				1,344		612	2,859
CONTRACTOR MARK UPS	49%						1,401
SUB TOTAL							4,260
CONTINGENCY	10%						426
SUB TOTAL							4,686
ESCALATION TO 1-1-80	11%						515
SUB TOTAL							5,201
TOTAL	153000	GAL		@		29.42	5,200

ROBERT L. CARLSON, INC. — *Manufacturers' Representative*

WATER, WATER POLLUTION AND INDUSTRIAL PLANT EQUIPMENT

P. O. BOX 11031
CHARLOTTE, N. C. 28209
TEL.: 704-332-9031
-527-5644

October 19, 1978

Mr. Howard Linert
J. E. Sirrine Company
P. O. Box 5456, Sta. B
Greenville, South Carolina 29606

Subject: Sirrine Job # A-1086
Camp LeJune, N.C.

Dear Howard:

Confirmed estimating prices given to you today as follows:

One(1)	Walker Process Rotary Distributor 62 foot diameter 200 gpm min. 800 gpm max.size 10 M-center column 4-6" arms	Estimate: $25,000.00
One(1)	Walker Process Type C primary collector with skimmer and weir plates and baffles 27 foot diameter	Estimate: $22,000.00
One(1)	Walker Process Type C secondary collector (complete as above)	Estimate: $22,000.00
Two(2)	EPI floating aerators 10 HP complete with mooring hardware	Estimate: $ 8,500.00

Please let me know if you need any more information.

Thank you for your interest in our products.

Sincerely yours,

ROBERT L. CARLSON, INC.

Charles R. Hunter, Jr.

CRH:bl

Designed by those who know the best — for those who want the best.

Exclusive Sales Representative
ROBERT L. CARLSON, INC.
P. O. BOX 11031
CHARLOTTE, NORTH CAROLINA 28209
Phone: (704) 332-9031

TO Mr. Howard Linert
J. E. Sirrine Company
P.O. Box 5456, Sta. B
Greenville, South Carolina 29606

SUBJECT: Job #A-1086
Camp LeJune, N.C.

DATE: Oct. 23, 1978

FOLD

Dear Howard:

Confirming estimate on a 7.5 foot diameter WALKER PROCESS poly-thickener of $25,000.00 with steel tank. Deduct $6,300.00 for the outer tank.

If you need any further information, please let us know.

Very truly yours,

ROBERT L. CARLSON, INC.

Charles R. Hunter, Jr.

Charles R. Hunter, Jr.

CRH:bl

PLEASE REPLY TO ⟶ SIGNED

REPLY

DATE: SIGNED

GRAYARC CO., INC., BROOKLYN, N. Y. 11232

THIS COPY FOR PERSON ADDRESSED

USE THIS SIDE FOR YOUR REPLY—KEEP ONE COPY FOR YOUR FILE

JOHNSTON, INC.
SUITE 108 / 611 TEMPLETON AVE.
CHARLOTTE, N. C. 28203
Telephone: (704) 377-3785

Howard Lienert – J.E. Sirrine
Ref: Camp Le Jeune
Job # A-1086
Verbal estimate of 12/21/78

Our Message 2/5/79

Confirming estimate of $25,000 for aerobic digester, 20' diameter x 18' SLD. Concrete tankage. Dual blowers, 15 HP, 300 CFM. Solids loading = .1# volatile solids/cu.ft./day. 70 gpm/cfm air. Nozzles @ 12' submergence. 700#/day O2 – 30#/hour. Manufacturer – Suburbia Systems.

Best regards – Mac Johnston

Your Reply Date

RE-ORDER NO. B233TL © DAY-TIMERS, Allentown, Pa. 18001

THE BOWERSTON SHALE COMPANY

Drainage Material Specialists

BOWERSTON, OHIO

44695

614/269-2921

FACTORIES
BOWERSTON · HANOVER
OHIO

October 26, 1978

Howard Lienert
J. E. Sirrine Co.
Box 5456 Station B
Greenville, South Carolina 29606

Subject: Sewage Treatment Plant - Camp LeJeune, ~~Beaufort~~ Jacksonville, ~~South Carolina~~ N.C

Dear Mr. Lienert:

Thank you very much for your request for information on Bosco Trickling Filter Underdrain Block for the 62 foot filter to be constructed at Camp LeJeune, Parris Island, South Carolina.

352 Square Yards BOSCO ASTM C159-63 Type I-H Airflow High Rate Underdrain Block fob jobsite, truck delivery, if available to the truck under it's own power
$22.00 per Sq. Yd.

A 62 foot diameter trickling filter requires 335 square yards of block. Adding a 5% allowance for breakage would bring this to 352 square yards of block for the job.

This quotation includes the 7½x10x14 full size underdrain block required, half and quarter spacer block, angle block at the periphery of the filter and cover block up to 30 inches in length over a center effluent channel. It does not include reducer block for channels through concrete walls.

Bosco block are hard burned block which exceed the requirements of ASTM C159 in every way. They have been tested regularly for crushing strength and test at over 1100 lbs. per square inch while the standard asks for a minimum of 600 lbs. per square yard.

This quotation would be for shipment in 1979, and if shipment would be for 1980 or later as discussed an escalation should be added.

Please contact us if further information is desired.

Sincerely,

THE BOWERSTON SHALE COMPANY

Frank H. Milliken, Jr.

FHMjr/nb

REM SERVICES

ROBERT E. MASON COMPANY

PROCESS AND CONTROL EQUIPMENT FOR CAROLINA INDUSTRY
1726 NORTH GRAHAM STREET, P. O. BOX 1903
CHARLOTTE, NORTH CAROLINA 28233
TELEPHONE 704 375-4464

November 8, 1978

Mr. Howard Lienert
J. E. Sirrine Company
P. O. Box 5456
Greenville, SC 29606

Subject: Camp Lejuene Project

Dear Howard:

This letter is to confirm our discussions on the chlorination system, influent pumping system,and the floating aerator for the above project.

Chlorination System

The chlorination system will be a flow proportioning system with automatic switchover capable of supplying up to a maximum of 200 ppd of chlorine to a wastewater contact basin. The system will be ADVANCE Model 842 described in the enclosed Bulletin 1840-5 and specification No. 2840-4, including the following equipment:

2 - Manifold-mounted vacuum regulators
2 - Wall manifolds
1 - Wall mounted ejector
1 - Automatic switchover module
1 - Open channel diffuser

Total Budgetary Price - $4,100

Pumping System

The pumping system will be a tri-plex pump setup with two-speed motors on each pump and complete with sequencing control panel actuating from mercury float switches. Characteristic curves for the pumps and a brochure on the Series 8000 pump configuration are enclosed. The pumping system includes the following equipment:

(Cont'd on Page 2)

1 - Model MS-3, 3 HP, two-speed pump
2 - Model MM-3, 5 HP, two-speed pumps
1 - NEMA 4 tri-plex control panel
6 - Mercury float switches

Total Budgetary Price - $12,000

Floating Aerator

1 - LIGHTNIN Model LAR-90 floating aerator complete with 20 HP drive and floating platform. The unit is described further on the enclosed Drawing No. DS-E-338.

Total Budgetary Price - $23,000

We certainly appreciate the opportunity to work with you on this project. If you have any questions or need additional information, please do not hesitate to contact our office.

Very truly yours,

ROBERT E. MASON COMPANY

Terrell Cook

Terrell Cook

TC/lhb

Enclosures

REM SERVICES

ROBERT E. MASON COMPANY
PROCESS AND CONTROL EQUIPMENT FOR CAROLINA INDUSTRY
1726 NORTH GRAHAM STREET, P. O. BOX 1903
CHARLOTTE, NORTH CAROLINA 28233
TELEPHONE 704 375-4464

December 18, 1978

Mr. Howard Lienert
J. E. SIRRINE COMPANY
P. O. Box 5456
Greenville, South Carolina 29606

Subject: Camp Lejuene Project
Chlorine Residual Analyzer

Dear Howard:

Enclosed is Bulletin 1870-3 which describes the ADVANCE Series 870 Chlorine Residual Analyzers and Recorders. A typical installation for an application such as yours is shown on the third page of the brochure. In this type of installation, a sample is picked up from a chlorine contact chamber or from a suitable point at your discharge and pumped up to the analyzer. The analyzer measures the chlorine residual and sends a signal to the circular chart recorder for a permanent record of the residual level. Also, the recorder has switches for use with high and low level alarms.

As I mentioned during our telephone conversation, a budget price of $2,850.00 would cover the complete system. Included in this system would be a wall mounted analyzer, and initial supply of the reagent and buffer chemicals, a wall mounted recorder, and the sample pump.

I trust this information will be helpful to you. If you have any questions, please do not hesitate to give me a call.

Yours very truly,

ROBERT E. MASON COMPANY

Terrell Cook (cp)

Terrell Cook

TC/cp

Enclosure

THE TAULMAN SALES COMPANY
A DIVISION OF THE TAULMAN COMPANY
Suite 512, Two Fairview Plaza 5950 Fairview Road Charlotte, North Carolina 28210
704/554-7013

November 2, 1978

Mr. Howard Lienert
J. E. Sirrine Company
Post Office Box 5456, Sta. B
Greenville, South Carolina 29606

SUBJECT: U. S. Navy, Camp LeJeune
Jacksonville, North Carolina
Recycle Flow Indication
J. E. Sirrine #A1086

Dear Mr. Lienert:

Confirming our phone conversation, I propose the following standard BIF equipment;

One - 6" Kennison Nozzle for the new trickling filter. Maximum rate: 200 gpm/290,000 GPD.

Two - 6" half section, Kennison Nozzle for the two new clarifiers. Maximum rate: 90 GPM/130,000 GPD.

Four - "Chronoflo", time-pulse, float actuated flow transmitter for the existing and new trickling filters and new clarifiers.

Four - "Chronoflo" receivers with the function of indicating the flows from the above transmitters.

Four - Sediment traps, but no piping from Nozzle to stilling chambers for the float-flow transmitters.

I have arrived at a budget price for the above equipment which will include freight, FOB shipment point, service, recommended spare parts, and operative and maintenance manuals.

Budget Price $16,500

I have enclosed recommended specifications for the above equipment. Please do not hesitate in calling if I may be of further assistance.

Yours very truly,

THE TAULMAN SALES COMPANY

Paul M. R. White
sh

Paul M. R. White

PMRW/sh
Attachment

TSC
THE TAULMAN SALES COMPANY
A DIVISION OF THE TAULMAN COMPANY
Suite 512, Two Fairview Plaza 5950 Fairview Road Charlotte, North Carolina 28210
704/554-7013

November 21, 1978

Mr. Howard Lienert
J. E. Sirrine Company
Post Office Box 5456, Sta. B
Greenville, South Carolina 29606

SUBJECT: U. S. Navy, Camp LeJeune
Jacksonville, North Carolina
Recycle Flow Indication
J. E. Sirrine #A1086

Dear Mr. Lienert:

Please pardon the lateness of this confirmation. This letter confirms the addition of two totalizers for the two clarifier recycle flow indicators at a budget price of $500.00. Referring to my letter to you dated 11-2-78, the revised total budget price is $17,000.

Please call if I may be of further assistance. Thank you.

Yours very truly,

THE TAULMAN SALES COMPANY

Paul White

Paul M. R. White

PMRW/sh

QUOTATION

Mr. Howard Lienert

ES CO

Equipment Sales Company, Inc.

~~P. O. Box 31181~~
~~Raleigh, N. C. 27607~~
~~Phone (919) 781-5670~~

~~P. O. Box 15291~~
~~Charlotte, N. C. 28210~~
~~Phone (704) 525-7909~~

EQUIPMENT SALES CO. INC.
P. O. BOX 6321
COLUMBIA, S. C. 29260

Pg. ______ of ______

Subject: U.S. Navy
Camp Lejuene, N.C.
A-1086

Date: 12/21/78

Bid Due: ______

Engineer: J.E. SIRRINE CO.

GENTLEMEN: We are pleased to quote on the above subject job as follows subject to the engineers approval.

1- Duplex Weil Pump Co. Bull. C-900H
Vertical enclosed shaft non-clog pumps.
75GPM x 17' TDH
Unit consists of:
2- pumps for 5' deep sump complete with 20" dia. floor plates. [Sump by others]
2- 1½ H.P., 1150rpm, 230-460/3/60 dripproof motors.
1- High water alarm float with switch, 115V
1- 4", 115V, alarm bell
1- 48" steel sump cover with openings for floor plates; inspection plate; Mounting holes for high water alarm float
1- Duplex motor controller consisting of
2- Magnetic starters
2- Disconnect switches
1- Automatic alternator
1- Terminal strip

Contractors cost, FOB Chicago, Ill., -- $2758.—
Approx WT. 1570# Approx Freight -- 141.—

$2899.—

NO TAXES INCLUDED

ROBERT L. CARLSON, INC. — *Manufacturers' Representative*

WATER, WATER POLLUTION AND INDUSTRIAL PLANT EQUIPMENT

P. O. BOX 11031
CHARLOTTE, N. C. 28209
TEL.: 704 [illegible]

704/527-5644

December 28, 1978

Mr. Howard Lienert
J. E. Sirrine Company
P. O. Box 5456, Station B
Greenville, South Carolina 29606

Subject: Job A-1086
Camp LeJeune, N.C.

Dear Howard:

Confirming estimates given you today on WALKER PROCESS equipment, we offer the following:

1. WALKER PROCESS Primary Collector, Type CP-22 foot diameter, 8 foot SWD, bridge supported; complete with 14" worm gear, bridge and floor plate, collection arms, influent well and skimmer and scum box.

   Estimate Price $18,500.00

2. WALKER PROCESS Rollaer for 20' diameter 15' SWD. Use a 24" tube, 85 SCFM @ 7.5 psig Rollaer unit complete with 20 foot bridge and 24" tube for 15 SWD.

   Estimate Price $12,500.00

Howard, for air supply I'd recommend a positive displacement blower. I do not have this type equipment, but I would guess they would be about $3,500.00 each.

If you have any questions, let me know.

Sincerely yours,

WALKER PROCESS

Charles R Hunter

Charles R. Hunter, Jr.
ROBERT L. CARLSON, INC.

CRH:bl

ESHELMAN CAROLINAS, INC.

1127 COMMERCIAL AVE.
~~P.O. BOX 12646~~
CHARLOTTE, N.C. 28205
Phone 704/376-6408

December 28, 1978

J. E. Sirrine Company
P. O. Box 5456 - Station B
Greenville, SC 29606

Attention: Mr. Howard Lienert

SUBJECT: Camp Lejeune, North Carolina
Your Project Job# A-1086

Dear Mr. Lienert:

We are confirming our telephone discussion December 19, 1978.

Estimating price for FMC Environmental Division (Chicago Pump Co) Barminutor Model C-18, $13,000.00 each. This will include the Barminutor as described in the catalog, plus the special reversing type starter with the controls.

The Model C-18 unit is recommended for the flow conditions as given to us which were 350,000 GPD minimum and 1,400,000 gallons per day peak or maximum flow.

The above estimate does not include stop gates.

Very truly yours,

ESHELMAN CAROLINAS, INCORPORATED

David Tobin

DT/NEK

EXHIBIT A

- EXHIBIT A -

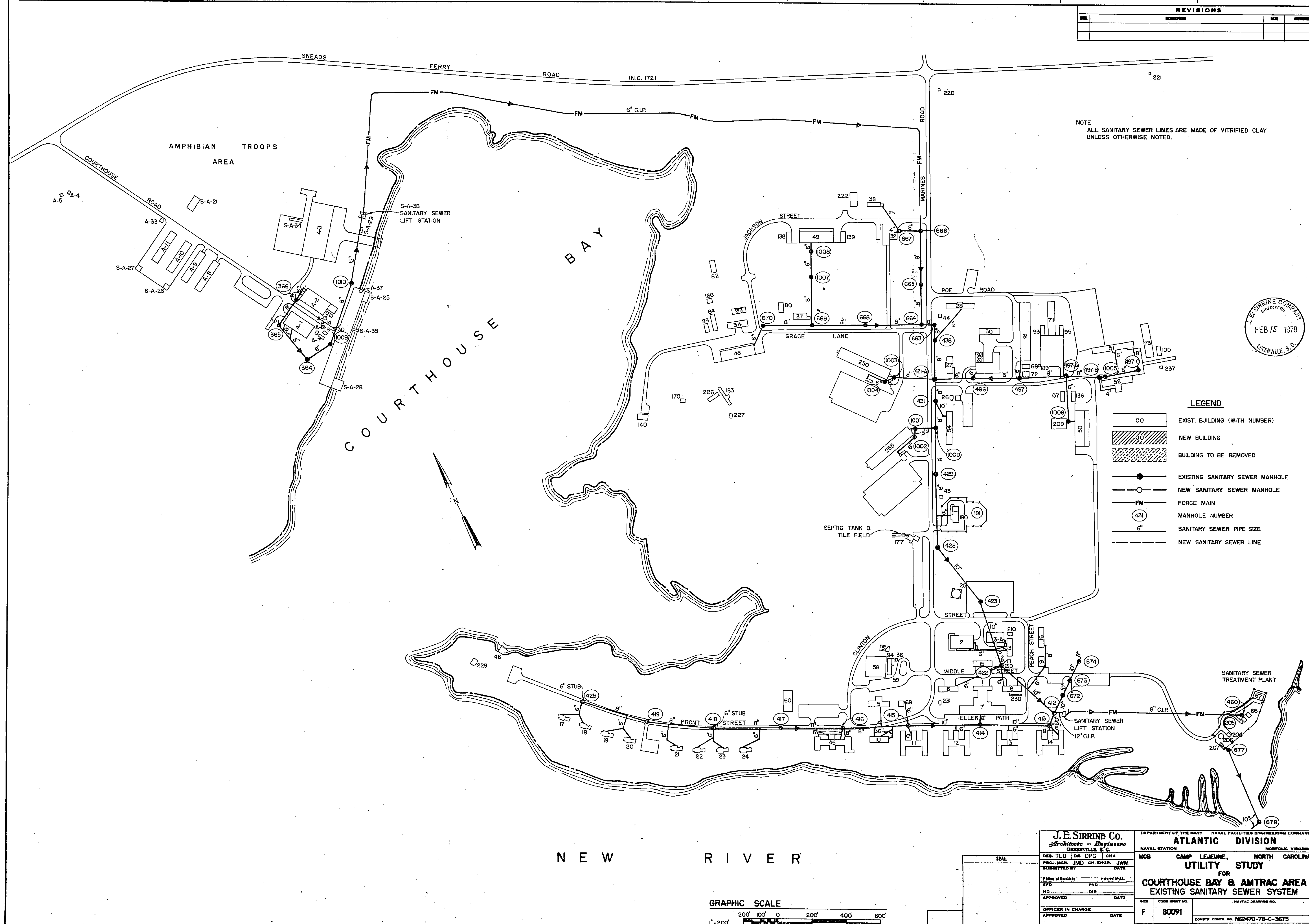
EXISTING

SANITARY SEWER SYSTEM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA



J. E. SIRRINE CO. Architects – Engineers GREENVILLE, S.C.	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND ATLANTIC DIVISION NAVAL STATION NORFOLK, VIRGINIA
DES. TLD / DR. DPC / CHK.	MCB CAMP LEJEUNE, NORTH CAROLINA
PROJ. MGR. JMD / CH. ENGR. JWM	UTILITY STUDY FOR COURTHOUSE BAY & AMTRAC AREA
SUBMITTED BY / DATE	EXISTING SANITARY SEWER SYSTEM
FIRM MEMBER / PRINCIPAL	SIZE F / CODE IDENT NO. 80091 / NAVFAC DRAWING NO.
EFD / RVD	CONSTR. CONTR. NO. N62470-78-C-3675
HD / DIR	SCALE 1" = 200' / SPEC. / SHEET OF
APPROVED / DATE	
OFFICER IN CHARGE	
APPROVED / DATE	
FOR EFD FOR COMMANDER NAVFAC	

SEAL

EXHIBIT 'A' 1

EXHIBIT B

- EXHIBIT B -

PROPOSED

SANITARY SEWER SYSTEM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

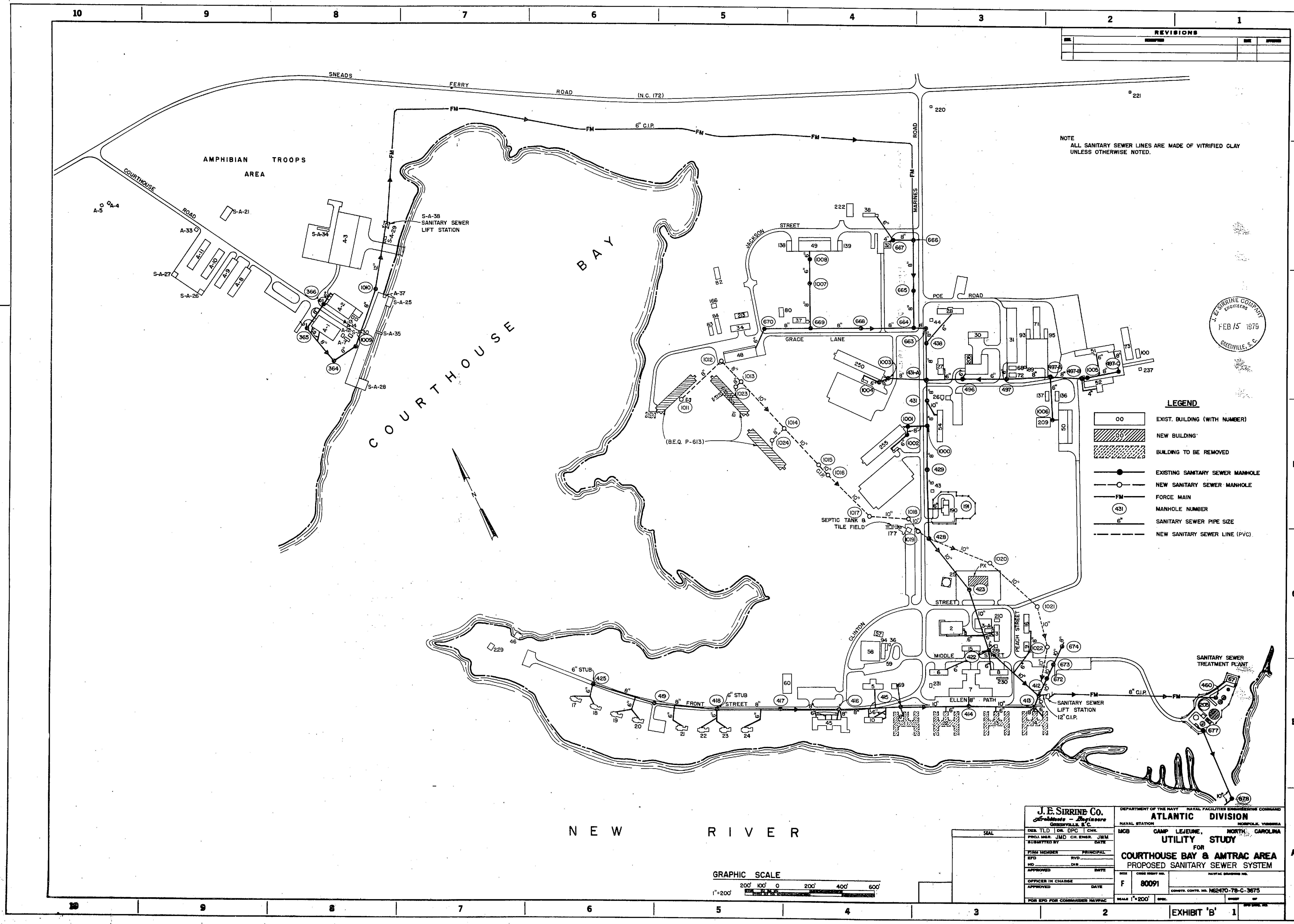

REVISIONS
SNEADS FERRY ROAD (N.C. 172)
AMPHIBIAN TROOPS AREA
COURTHOUSE ROAD
MARINES ROAD
S-A-38 SANITARY SEWER LIFT STATION
COURTHOUSE BAY
NEW RIVER
JACKSON STREET
GRACE LANE
POE ROAD
CLINTON STREET
MIDDLE STREET
PEACH STREET
FRONT STREET
ELLEN PATH
(B.E.Q. P-613)
SEPTIC TANK & TILE FIELD
SANITARY SEWER LIFT STATION 12" C.I.P.
SANITARY SEWER TREATMENT PLANT
6" C.I.P.
NOTE
ALL SANITARY SEWER LINES ARE MADE OF VITRIFIED CLAY UNLESS OTHERWISE NOTED.
J. E. SIRRINE COMPANY ENGINEERS
FEB 15 1979
GREENVILLE, S. C.
LEGEND
EXIST. BUILDING (WITH NUMBER)
NEW BUILDING
BUILDING TO BE REMOVED
EXISTING SANITARY SEWER MANHOLE
NEW SANITARY SEWER MANHOLE
FORCE MAIN
MANHOLE NUMBER
SANITARY SEWER PIPE SIZE
NEW SANITARY SEWER LINE (PVC)
GRAPHIC SCALE
1"=200'
SEAL
J. E. SIRRINE CO.
Architects – Engineers
GREENVILLE, S. C.
DES. TLD DR. DPC CHK.
PROJ. MGR. JMD CH. ENGR. JWM
SUBMITTED BY DATE
FIRM MEMBER PRINCIPAL
EFD RVD
HD DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
MCB CAMP LEJEUNE, NORTH CAROLINA
UTILITY STUDY
FOR
COURTHOUSE BAY & AMTRAC AREA
PROPOSED SANITARY SEWER SYSTEM
SIZE F
CODE IDENT NO. 80091
NAVFAC DRAWING NO.
CONSTR. CONTR. NO. N62470-78-C-3675
SCALE 1"=200'
EXHIBIT 'B' 1

EXHIBIT C

- EXHIBIT C -

SANITARY SEWER SYSTEM DATA CHARTS

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

EXISTING SANITARY SEWER SYSTEM DATA FOR COURTHOUSE • BAY AREA

MANHOLE NUMBER	DISTANCE BETWEEN MANHOLES	PIPE DIAMETER AND MATERIAL	SLOPE	INVERT ELEVATION UP STREAM	INVERT ELEVATION DOWN STREAM	TOP OF MANHOLE ELEVATION	CALCULATED MAX. EXISTING FLOW	EXISTING INFILTRATION	TOTAL FLOW DURING PEAK DISCHARGE	MAXIMUM DESIGN FLOW THRU PIPE
	FEET	INCHES	FT/FT	FEET	FEET	FEET	G.P.M.	G.P.M.	G.P.M.	G.P.M.
412				-0.88	-1.22	9.92				
	94.2	10 V.C.P.	.0023				390	25.1	415.1	471
413				-0.66	-0.66	11.34				
	355.4	10 V.C.P.	.0019				335	24.2	359.2	432
414				0.05	0.04	12.38				
	428.7	10 V.C.P.	.0029				270	21.0	291.0	529
415				1.34	1.28	12.73				
	365.8	10 V.C.P.	.0035				120	17.2	137.2	579
416				2.64	2.63	11.17				
	378.0	8 V.C.P.	.0040				68	13.9	81.9	343
417				4.09	4.16	10.94				
	391.5	8 V.C.P.	.0031				68	10.5	78.5	302
418				5.35	5.31	12.43				
	388.1	8 V.C.P.	.0036				53	7.0	60.0	326
419				6.78	6.73	12.82				
	385.3	8 V.C.P.	.0032				47	3.5	50.5	307
425				—	8.01	10.81				
412				-0.88	-1.22	9.92				
	402.0	10 V.C.P.	.0024				302	58.8	360.8*	481
422				0.18	0.08	15.50				
	399.0	10 V.C.P.	.0028				302	55.2	357.2*	519
423				1.22	1.28	11.44				
	402.4	10 V.C.P.	.0028				302	51.6	353.6*	519
428				2.48	2.34	11.84				
	428.6	8 V.C.P.	.0036				302	48.0	350.0*	326
429				4.03	4.03	13.03				
	245.1	8 V.C.P.	.0046				302	44.1	346.1*	369
1000				5.23	5.16	14.03				
	175.0	8 V.C.P.	.0027				195	40.2	235.2*	282
431				5.88	5.70	13.83				
	129.7	8 V.C.P.	.0040				195	38.6	233.6*	343
431-A				6.47	6.40	15.60				
	226.6	8 V.C.P.	.0021				372	21.8	393.8	249
438				6.91	6.95	15.85				
	101.3	8 V.C.P.	.0145				363	19.8	382.8	654
663				8.87	8.38	18.15				
	86.2	8 V.C.P.	.0065				363	18.9	381.9	438
664				10.33	9.43	18.23				
	250.9	8 V.C.P.	.0228				308	6.1	314.1	820
665				16.12	16.06	22.20				
	285.7	8 V.C.P.	.0119				308	3.8	311.8	592
666				20.79	19.51	27.01				
		6 C.I.P.					275		275	
LIFT STATION										
666				19.62	19.51	27.01				
	127.5	8 V.C.P.	.0045				33	1.2	34.2	364
667				—	20.20	25.08				
412				-0.27	-1.22	9.92				
	94.8	10 V.C.P.	.0005				—	3.1	3.1	220
672				0.20	-0.32	7.57				
	96.0	10 V.C.P.	.0066				—	2.2	2.2	798
673				0.91	0.83	8.99				
	139.7	10 V.C.P.	.0212				—	1.3	1.3	1430
674				—	3.87	10.97				

* LIFT STATION FLOW NOT INCLUDED

MANHOLE NUMBER	DISTANCE BETWEEN MANHOLES	PIPE DIAMETER AND MATERIAL	SLOPE	INVERT ELEVATION UP STREAM	INVERT ELEVATION DOWN STREAM	TOP OF MANHOLE ELEVATION	CALCULATED MAX. EXISTING FLOW	EXISTING INFILTRATION	TOTAL FLOW DURING PEAK DISCHARGE	MAXIMUM DESIGN FLOW THRU PIPE
	FEET	INCHES	FT/FT	FEET	FEET	FEET	G.P.M.	G.P.M.	G.P.M.	G.P.M.
1000				5.65	5.16	14.03				
	140.8	8 V.C.P.	.0063				180	1.7	181.7	431
1001				6.56	6.54	11.59				
	41.4	8 V.C.P.	.0186				—	0.4	0.4	740
1002				—	7.33	11.59				
431-A				7.11	6.40	15.60				
	245.0	8 V.C.P.	.0053				180	2.7	182.7	395
1003				8.54	8.40	12.57				
	55.1	8 V.C.P.	.0080				—	0.5	0.5	485
1004				—	8.98	13.55				
431-A				6.57	6.40	15.60				
	215.8	6 V.C.P.	.0108				65	12.9	77.9	262
496				8.24	8.89	18.28				
	288.1	6 V.C.P.	.0161				62	11.0	73.0	319
497				16.31	12.89	23.25				
	248.1	8 V.C.P.	.0090				52	8.4	60.4	515
497-A				18.51	18.55	25.22				
	175.2	8 V.C.P.	.0144				27	3.9	30.9	651
497-B				21.04	21.04	28.14				
	40.3	8 V.C.P.	.0238				13	2.3	15.3	837
1005				22.10	22.00	29.37				
	205.0	8 V.C.P.	.0146				13	1.9	14.9	656
497-C				—	25.10	32.10				
497-A				18.95	18.55	25.22				
	252.5	6 V.C.P.	.0044				42	2.3	44.3	167
1006				—	20.06	24.23				
664				9.43	9.43	18.23				
	313.2	8 V.C.P.	.0039				72	12.0	84.0	339
668				10.67	10.65	16.93				
	318.7	8 V.C.P.	.0041				72	9.2	81.2	348
669				12.44	11.99	16.97				
	280.3	8 V.C.P.	.0047				42	2.5	44.5	372
670				—	13.75	17.90				
669				12.52	11.99	16.97				
	278.8	8 V.C.P.	.0084				55	3.8	58.8	497
1007				14.85	14.86	20.32				
	149.1	6 V.C.P.	.0085				42	1.3	43.3	231
1008				—	16.11	21.42				

EXISTING SANITARY SEWER SYSTEM DATA FOR AMPHIBIAN TROOPS AREA

MANHOLE NUMBER	DISTANCE BETWEEN MANHOLES	PIPE DIAMETER AND MATERIAL	SLOPE	INVERT ELEVATION UP STREAM	INVERT ELEVATION DOWN STREAM	TOP OF MANHOLE ELEVATION	CALCULATED MAX. EXISTING FLOW	EXISTING INFILTRATION	TOTAL FLOW DURING PEAK DISCHARGE	MAXIMUM DESIGN FLOW THRU PIPE
	FEET	INCHES	FT/FT	FEET	FEET	FEET	G.P.M.	G.P.M.	G.P.M.	G.P.M.
366				—	6.60	11.36				
	185.3	8 V.C.P.	.0034				28	4.15	32.15	315
365				5.98	5.97	13.33				
	254.5	8 V.C.P.	.0036				47	9.85	56.85	326
364				5.06	5.03	8.49				
	165.2	8 V.C.P.	.0150				47	13.55	60.55	662
1009				2.56	2.33	11.76				
	370.1	8 V.C.P.	.0124				47	21.84	68.84	602
1010				-2.24	-2.24	10.54				
	264.3	12 V.C.P.	.0064				47	27.76	74.76	1208
LIFT STATION				-3.93						

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

PROPOSED SANITARY SEWER SYSTEM DATA FOR COURTHOUSE BAY AREA

MANHOLE NUMBER	DISTANCE BETWEEN MANHOLES	PIPE DIAMETER AND MATERIAL	SLOPE	INVERT ELEVATION UP STREAM	INVERT ELEVATION DOWN STREAM	TOP OF MANHOLE ELEVATION	CALCULATED MAX. EXISTING FLOW	ESTIMATED INFILTRATION	TOTAL FLOW DURING PEAK DISCHARGE	MAXIMUM DESIGN FLOW THRU PIPE
	FEET	INCHES	FT/FT	FEET	FEET	FEET	G.P.M.	G.P.M.	G.P.M.	G.P.M.
1011				—	9.96	14.75				
	340	8 P.V.C.	.0039				180	1.3	181.3	440
1012				8.63	8.53	14.50				
	175	8 P.V.C.	.0039				180	2.0	182.0	440
1013				7.85	7.75	14.50				
	395	10 P.V.C.	.0030				288	3.9	291.9	699
1014				6.56	6.46	12.25				
	300	10 P.V.C.	.0030				380	5.9	385.9	699
1015				5.56	5.46	11.00				
	80	10 C.I.P.	.0030				380	6.2	386.2	540
1016				5.22	5.12	12.00				
	350	10 P.V.C.	.0030				380	7.6	387.6	699
1017				4.07	3.97	12.00				
	250	10 P.V.C.	.0030				380	8.5	388.5	699
1018				3.22	3.12	12.00				
	100	10 P.V.C.	.0030				380	8.9	388.9	699
1019				2.82	2.72	12.00				
	80	10 P.V.C.	.0030				380	9.2	389.2	699
428				2.48	2.34	11.84				
	400	10 P.V.C.	.0023				380	10.8	390.8	612
1020				1.42	1.32	11.00				
	400	10 P.V.C.	.0023				380	12.4	392.4	612
1021				0.40	0.30	11.00				
	255	10 P.V.C.	.0023				380	13.4	393.4	612
1022				-0.29	-0.39	9.00				
	300	10 P.V.C.	.0023				380	14.6	394.6	612
412				-1.08	-1.22	9.92				
1023				—	8.21	14.50				
	40	8 P.V.C.	.0052				180	0.16	180.2	509
1013				8.00	7.75	14.50				
1024				—	7.25	12.25				
	105	8 P.V.C.	.0052				180	0.41	180.4	509
1014				6.70	6.46	12.25				

J. E. SIRRINE COMPANY ENGINEERS FEB 15 1979 GREENVILLE, S. C.

SEAL

J. E. SIRRINE CO.
Architects – Engineers
GREENVILLE, S. C.

DES. TLD | DR. DPC | CHK.
PROJ. MGR. JMD CH. ENGR. JWM
SUBMITTED BY DATE
FIRM MEMBER PRINCIPAL
EFD RVD
HD DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA

MCB CAMP LEJEUNE, NORTH CAROLINA
UTILITY STUDY
FOR
COURTHOUSE BAY & AMTRAC AREA
SANITARY SEWER SYSTEM DATA CHARTS

SIZE F | CODE IDENT NO. 80091 | NAVFAC DRAWING NO.
CONSTR. CONTR. NO. N62470-78-C-3675
SCALE | SPEC. | SHEET OF
EXHIBIT 'C' 1 | EFD DWG. NO.

EXHIBIT D

- EXHIBIT D -

EXISTING

WATER DISTRIBUTION SYSTEM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

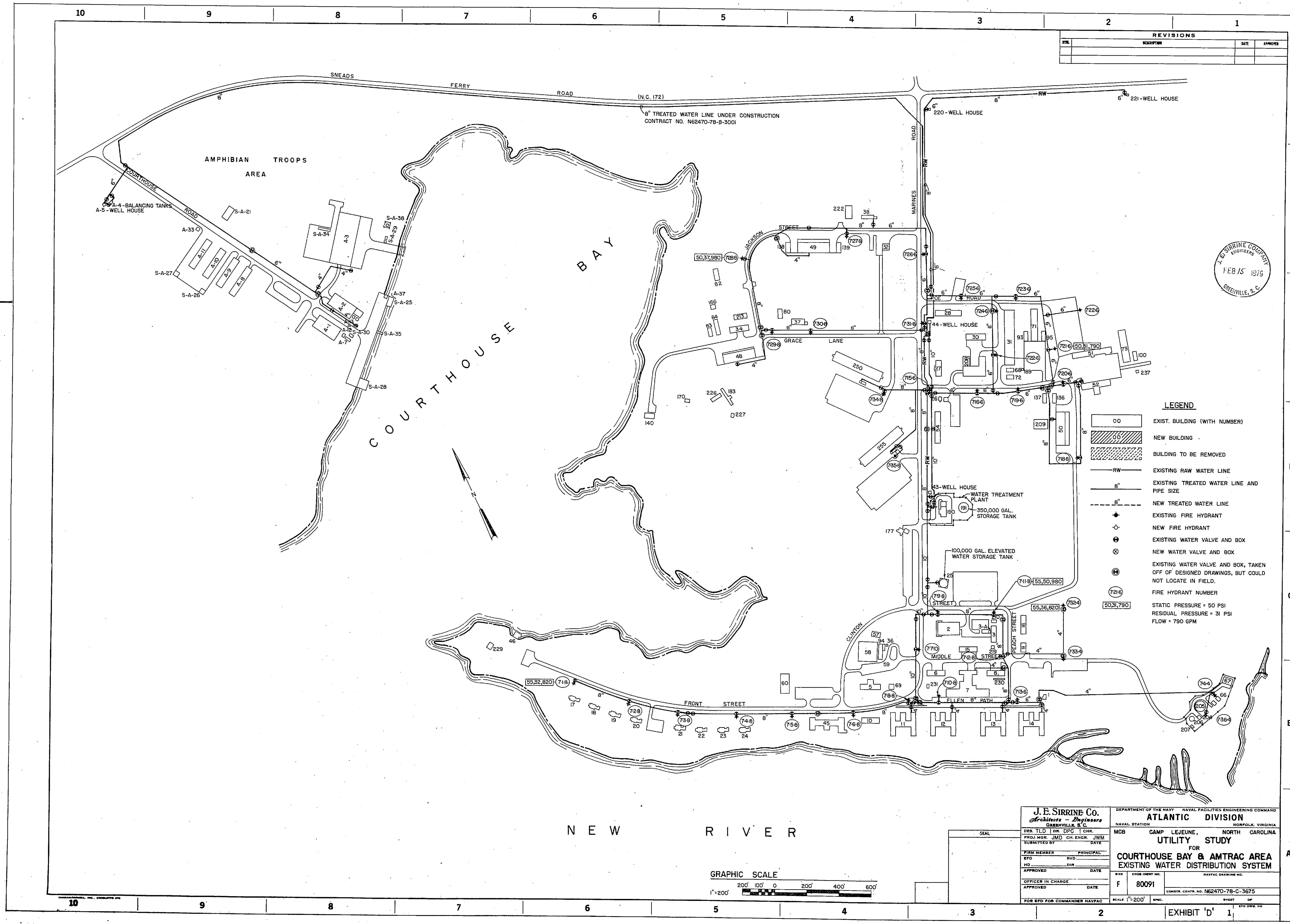

REVISIONS
SNEADS FERRY ROAD (N.C. 172)
8" TREATED WATER LINE UNDER CONSTRUCTION CONTRACT NO. N62470-78-B-3001
220-WELL HOUSE
221-WELL HOUSE
MARINES ROAD
AMPHIBIAN TROOPS AREA
COURTHOUSE ROAD
A-4-BALANCING TANKS
A-5-WELL HOUSE
COURTHOUSE BAY
JACKSON STREET
GRACE LANE
44-WELL HOUSE
43-WELL HOUSE
WATER TREATMENT PLANT
350,000 GAL. STORAGE TANK
100,000 GAL. ELEVATED WATER STORAGE TANK
CLINTON STREET
PEACH STREET
MIDDLE STREET
ELLEN PATH
FRONT STREET
NEW RIVER
GRAPHIC SCALE
1"=200'
LEGEND
EXIST. BUILDING (WITH NUMBER)
NEW BUILDING
BUILDING TO BE REMOVED
EXISTING RAW WATER LINE
EXISTING TREATED WATER LINE AND PIPE SIZE
NEW TREATED WATER LINE
EXISTING FIRE HYDRANT
NEW FIRE HYDRANT
EXISTING WATER VALVE AND BOX
NEW WATER VALVE AND BOX
EXISTING WATER VALVE AND BOX, TAKEN OFF OF DESIGNED DRAWINGS, BUT COULD NOT LOCATE IN FIELD.
FIRE HYDRANT NUMBER
STATIC PRESSURE = 50 PSI
RESIDUAL PRESSURE = 31 PSI
FLOW = 790 GPM
J. E. SIRRINE COMPANY ENGINEERS
FEB 15 1979
GREENVILLE, S. C.
J. E. SIRRINE CO.
Architects – Engineers
GREENVILLE, S. C.
SEAL
DES. TLD DR. DPC CHK.
PROJ. MGR. JMD CH. ENGR. JWM
SUBMITTED BY DATE
FIRM MEMBER PRINCIPAL
EFD RVD
HD DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
MCB CAMP LEJEUNE, NORTH CAROLINA
UTILITY STUDY
FOR
COURTHOUSE BAY & AMTRAC AREA
EXISTING WATER DISTRIBUTION SYSTEM
SIZE F
CODE IDENT NO. 80091
NAVFAC DRAWING NO.
CONSTR. CONTR. NO. N62470-78-C-3675
SCALE 1"=200'
SPEC.
SHEET OF
EXHIBIT 'D' 1
EFD DWG. NO

EXHIBIT E

- EXHIBIT E -

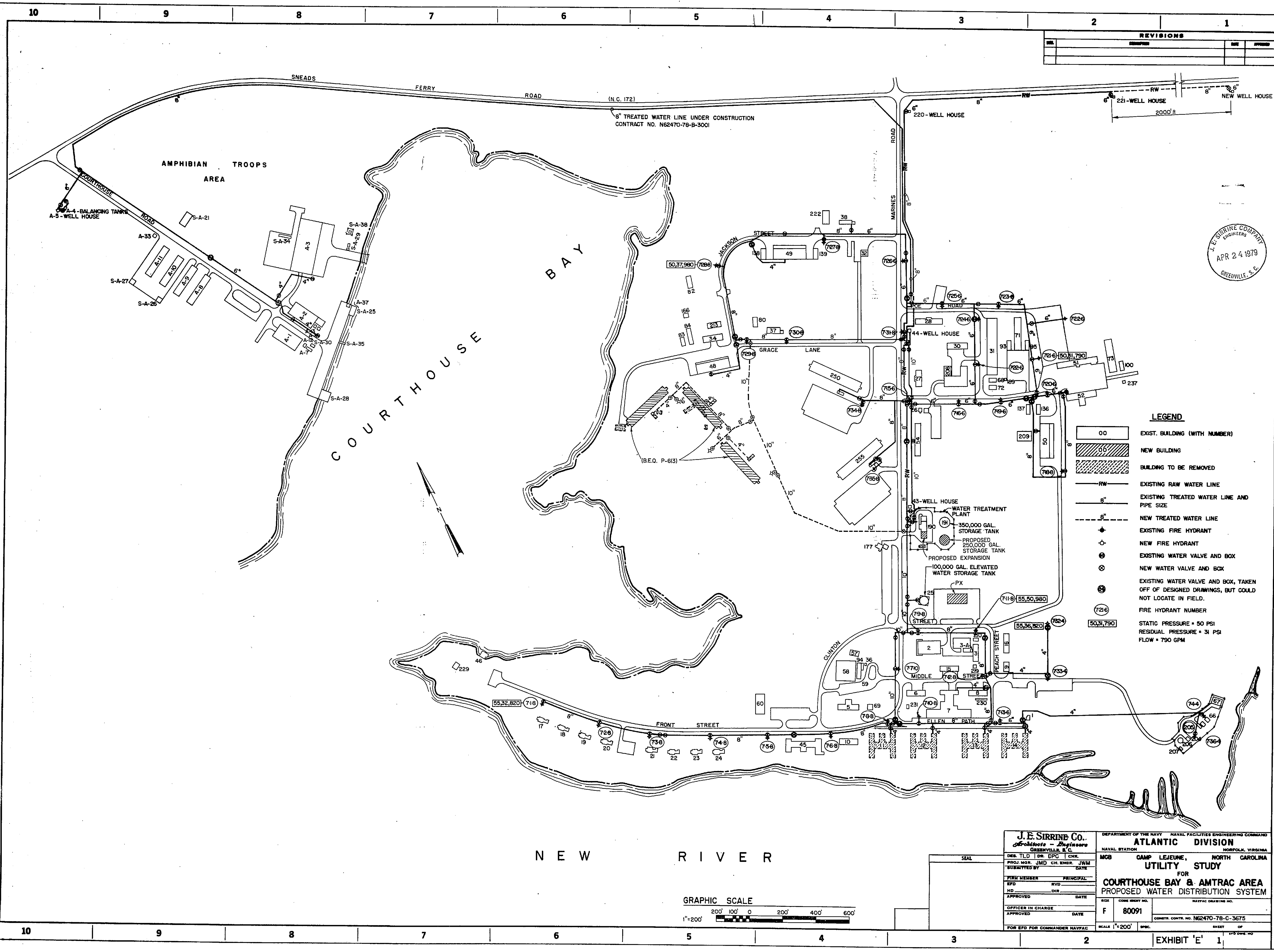
PROPOSED

WATER DISTRIBUTION SYSTEM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA


REVISIONS
SNEADS FERRY ROAD (N.C. 172)
8" TREATED WATER LINE UNDER CONSTRUCTION CONTRACT NO. N62470-78-B-3001
220-WELL HOUSE
221-WELL HOUSE
NEW WELL HOUSE
2000'±
AMPHIBIAN TROOPS AREA
A-4-BALANCING TANKS
A-5-WELL HOUSE
COURTHOUSE ROAD
COURTHOUSE BAY
MARINES ROAD
JACKSON STREET
GRACE LANE
(B.E.Q. P-613)
44-WELL HOUSE
43-WELL HOUSE
WATER TREATMENT PLANT
350,000 GAL. STORAGE TANK
PROPOSED 250,000 GAL. STORAGE TANK
PROPOSED EXPANSION
100,000 GAL. ELEVATED WATER STORAGE TANK
PX
CLINTON
MIDDLE STREET
PEACH STREET
ELLEN PATH
FRONT STREET
NEW RIVER
J. E. SIRRINE COMPANY ENGINEERS APR 24 1979 GREENVILLE, S. C.
LEGEND
EXIST. BUILDING (WITH NUMBER)
NEW BUILDING
BUILDING TO BE REMOVED
EXISTING RAW WATER LINE
EXISTING TREATED WATER LINE AND PIPE SIZE
NEW TREATED WATER LINE
EXISTING FIRE HYDRANT
NEW FIRE HYDRANT
EXISTING WATER VALVE AND BOX
NEW WATER VALVE AND BOX
EXISTING WATER VALVE AND BOX, TAKEN OFF OF DESIGNED DRAWINGS, BUT COULD NOT LOCATE IN FIELD.
7-21-6 FIRE HYDRANT NUMBER
50,31,790 STATIC PRESSURE = 50 PSI
RESIDUAL PRESSURE = 31 PSI
FLOW = 790 GPM
GRAPHIC SCALE
1" = 200'
SEAL
J. E. SIRRINE CO.
Architects – Engineers
GREENVILLE, S. C.
DES. TLD DR. DPC CHK.
PROJ. MGR. JMD CH. ENGR. JWM
SUBMITTED BY DATE
FIRM MEMBER PRINCIPAL
EFD RYD
HD DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
MCB CAMP LEJEUNE, NORTH CAROLINA
UTILITY STUDY FOR
COURTHOUSE BAY & AMTRAC AREA
PROPOSED WATER DISTRIBUTION SYSTEM
SIZE F
CODE IDENT NO. 80091
NAVFAC DRAWING NO.
CONSTR. CONTR. NO. N62470-78-C-3675
SCALE 1" = 200'
SPEC.
SHEET OF
EFD DWG. NO
EXHIBIT 'E' 1

- EXHIBIT F -

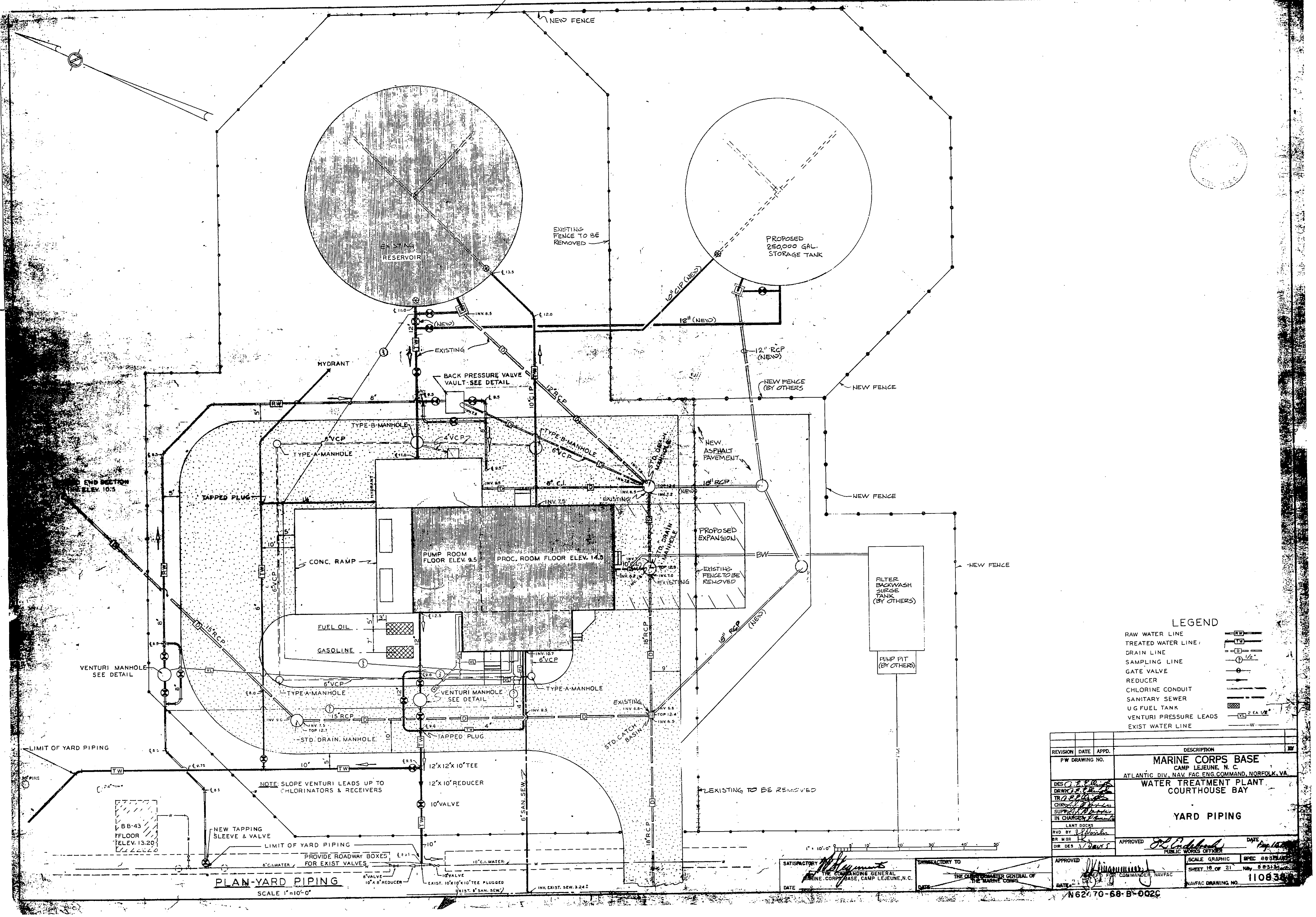
PROPOSED

WATER TREATMENT PLANT YARD PIPING

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA


NEW FENCE
EXISTING RESERVOIR
PROPOSED 250,000 GAL. STORAGE TANK
EXISTING FENCE TO BE REMOVED
12" (NEW)
10" C.I.P. (NEW)
12" RCP (NEW)
NEW FENCE (BY OTHERS)
HYDRANT
EXISTING
BACK PRESSURE VALVE VAULT-SEE DETAIL
TYPE-B-MANHOLE
TYPE-A-MANHOLE
6" VCP
4" VCP
8" C.I.
12" RCP
10" C.I.P.
NEW ASPHALT PAVEMENT
STD. DRAIN MANHOLE
18" RCP
TAPPED PLUG
CONC. RAMP
PUMP ROOM FLOOR ELEV. 9.5
PROC. ROOM FLOOR ELEV. 14.3
PROPOSED EXPANSION
EXISTING FENCE TO BE REMOVED
BW
FILTER BACKWASH SURGE TANK (BY OTHERS)
PUMP PIT (BY OTHERS)
FUEL OIL
GASOLINE
15" RCP
VENTURI MANHOLE SEE DETAIL
STD. DRAIN. MANHOLE
STD. CATCH BASIN
LIMIT OF YARD PIPING
NOTE: SLOPE VENTURI LEADS UP TO CHLORINATORS & RECEIVERS
12"x12"x10" TEE
12"x10" REDUCER
10" VALVE
6" SAN. SEW.
EXISTING TO BE REMOVED
BB-43 FLOOR ELEV. 13.20
NEW TAPPING SLEEVE & VALVE
PROVIDE ROADWAY BOXES FOR EXIST VALVES
EXIST. 10"x10"x10" TEE PLUGGED
PLAN-YARD PIPING
SCALE 1" = 10'-0"
LEGEND
RAW WATER LINE
TREATED WATER LINE
DRAIN LINE
SAMPLING LINE
GATE VALVE
REDUCER
CHLORINE CONDUIT
SANITARY SEWER
U G FUEL TANK
VENTURI PRESSURE LEADS
EXIST WATER LINE
REVISION
DATE
APPD.
DESCRIPTION
PW DRAWING NO.
MARINE CORPS BASE
CAMP LEJEUNE, N. C.
ATLANTIC DIV., NAV. FAC. ENG. COMMAND, NORFOLK, VA.
WATER TREATMENT PLANT
COURTHOUSE BAY
YARD PIPING
APPROVED
PUBLIC WORKS OFFICER
SCALE GRAPHIC
SHEET 16 OF 21
NAVFAC DRAWING NO. 1108358
SATISFACTORY
THE COMMANDING GENERAL MARINE CORPS BASE, CAMP LEJEUNE, N.C.
SATISFACTORY TO
THE QUARTERMASTER GENERAL OF THE MARINE CORPS
FOR COMMANDER, NAVFAC
N62470-68-B-0020

- EXHIBIT G -

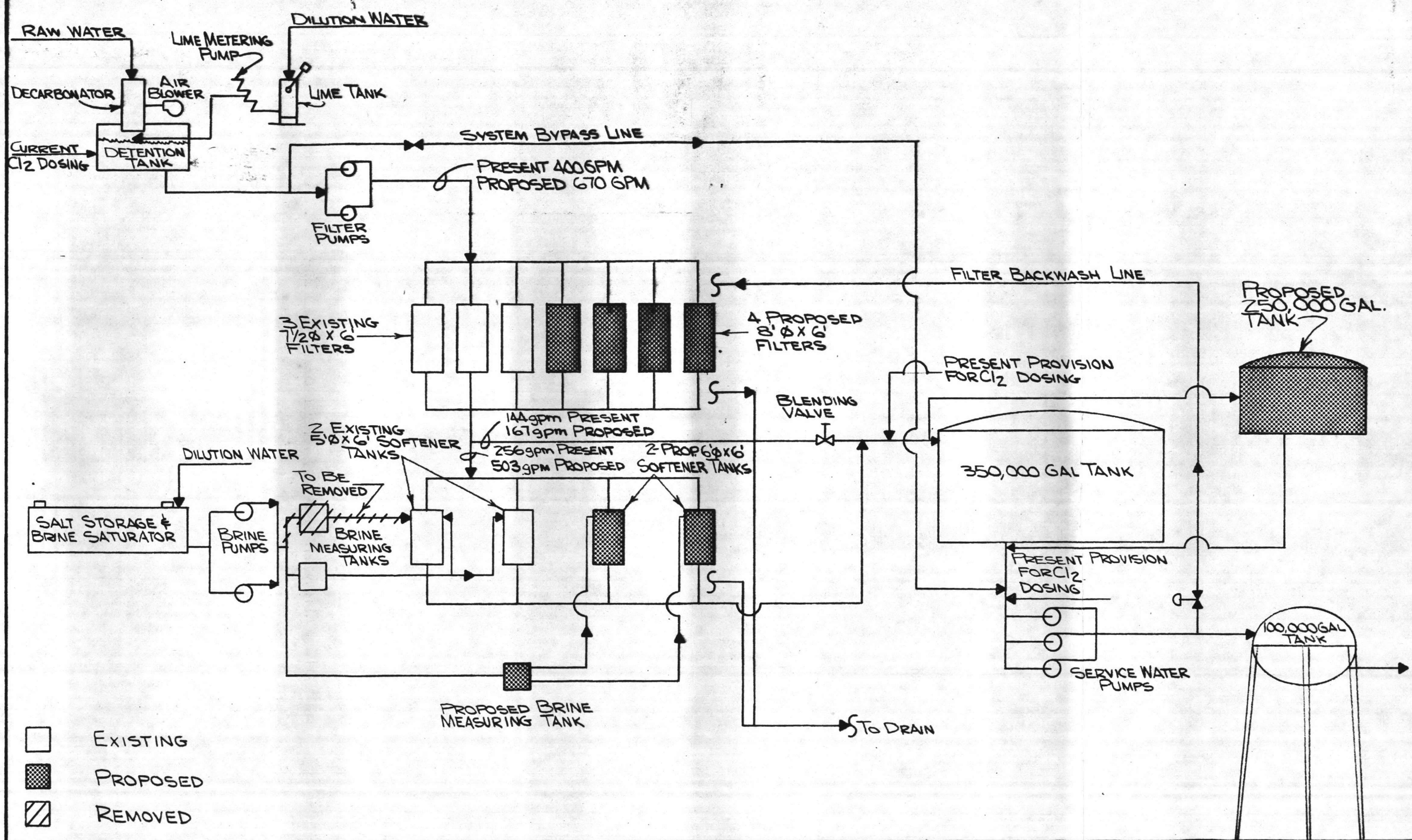
WATER TREATMENT FLOW DIAGRAM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

WATER TREATMENT PLANT



AE CONTRACT NO.
N 62470-78-C-3675

COURTHOUSE BAY WATER TREATMENT FLOW DIAGRAM

J. E. SIRRINE COMPANY

EXHIBIT G

EXHIBIT H

- EXHIBIT H -

WATER TREATMENT PLANT

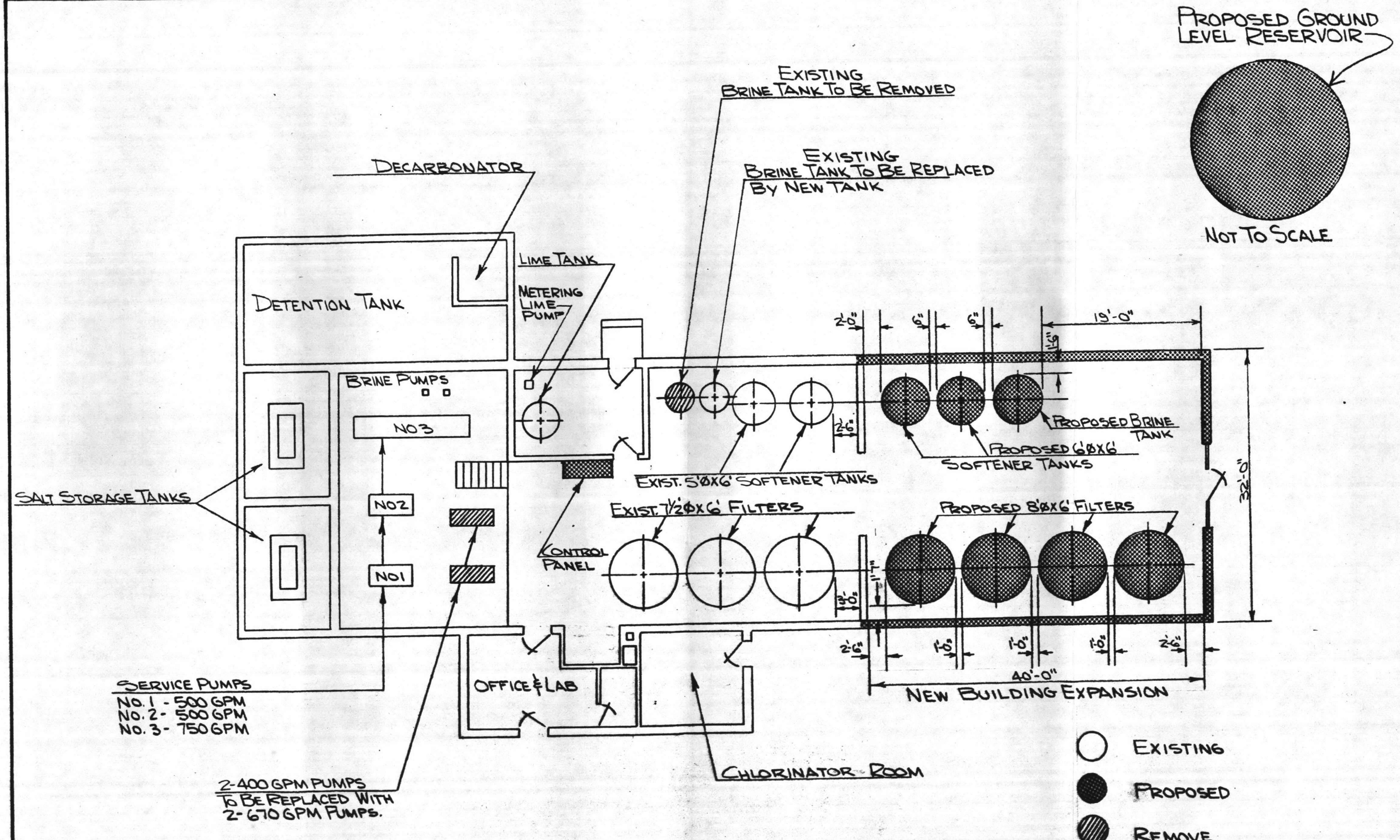
GENERAL ARRANGEMENT

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

WATER TREATMENT PLANT



AE CONTRACT NO. N62470-78-C-3675	COURTHOUSE BAY WATER TREATMENT PLANT GENERAL ARRANGEMENT	J. E. SIRRINE COMPANY	EXHIBIT H

- EXHIBIT I -

WATER SAMPLE ANALYSES

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

WATER TREATMENT PLANT

WATER SAMPLE ANALYSES

J. E. SIRRINE COMPANY
Engineers
GREENVILLE, S. C.

WATER ANALYSIS

Job No. A-1086-02

CLIENT	U. S. Navy	Date Received	9/22/78
ADDRESS	Courthouse Bay, Camp LeJeune, N. C.	Date Completed	10/09/78
		Date Transmitted	

Sample	Analysis No.	Identification
I	36578	Well BB-221, Raw Water Taken 9/20-21/78
II	36579	Well BB-43, Raw Water taken 9/20-21/78
III	36580	Well No. 44 Raw Water taken 9/20-21/78
IV	36581	Well No. 220 Raw Water taken 9/20-21/78
V	36582	Combined Wells (BB-43 and BB 220) Raw Water taken 9/20-21/78

APHA Standard Methods used unless otherwise noted.

	Constituents, ppm		as	I	II	III	IV	V
CATIONS	Calcium	Ca	$CaCO_3$	132	291	133	151	223
	Magnesium	Mg	" "	1	2	5	1	1
	Sodium	Na	" "	30.1	19.1	23	23.2	30.2
	Potassium	K	" "					
			" "					
	Total Cations		" "	163.1	312.1	161	175.2	254.2
ANIONS	Bicarbonate	HCO_3	" "	146	265	127	157	214
	Carbonate	CO_3	" "	0	0	0	0	0
	Hydroxide	OH	" "	0	0	0	0	0
	Chlorides	Cl	" "	15	15	21	15	18
	Sulfates	SO_4	" "	2	32	13	3	22
	Nitrates	NO_3	" "	0.14	0.10	0.04	0.17	0.17
			" "					
	Total Anions		" "	163.1	312.1	161	175.2	254.2
Total Hardness			" "	133	293	138	152	224
Alkalinity Methyl Orange			" "	146	265	127	157	214
Alkalinity Phenolphthalein			" "	0	0	0	0	0
pH				7.3	7.2	7.5	7.3	7.15
Total Solids (By Evaporation)				360	402	253	264	345
Free Carbon Dioxide			CO_2	15	36	8.2	16	29
Silica			SiO_2	19	12	13	17	15
Total Iron			Fe	2.9	3.1	1.8	1.6	1.9
Manganese			Mn	0.06	0.03	0.05	0.06	0.06
Aluminum			Al					
Phosphate			PO_4	0.20	0.20	0.21	0.074	0.17
Sulfite			SO_3					
Chemical Oxygen Demand (COD)			O					
Turbidity				21	41	9.0	5.0	9.0
Color				30	55	22	25	35
Specific Conductivity			mmhos/cm^2	290	550	290	310	450
Total Dissolved Solids				251	388	253	264	345
Dissolved Iron				0.01	0.01	0.01	0.01	0.017

Remarks:

By Babb and Davidson
Analyst

FORM NO. 4

J. E. SIRRINE COMPANY
Engineers
GREENVILLE, S. C.

WATER ANALYSIS

Job No. A-1086-02

CLIENT	U. S. Navy	Date Received	9/22/78
ADDRESS	Courthouse Bay, Camp LeJeune, N. C.	Date Completed	10/09/78
		Date Transmitted	

Sample	Analysis No.	Identification
I	36583	Detention Tank after Lime Addition Surface, 9/20-21/78
II	36584	After Detention Tank before Filter Pumps, 9/20-21/78
III	36585	Combined Filter Effluent after Backwash, 9/20-21/78
IV	36586	Softener No. 1 Effluent before Regeneration, 9/20-21/78
V	36587	Softener No. 1 Effluent after Regeneration, 9/20-21/78

APHA Standard Methods used unless otherwise noted.

	Constituents, ppm		as	I	II	III	IV	V
CATIONS	Calcium	Ca	$CaCO_3$	207	225	207	18	0
	Magnesium	Mg	" "	22	9	3	5	0
	Sodium	Na	" "	29.2	35.1	51.1	211.1	321.1
	Potassium	K	" "					
			" "					
	Total Cations		" "	258.2	269.1	261.1	234.1	321.1
ANIONS	Bicarbonate	HCO_3	" "	216	223	216	196	204
	Carbonate	CO_3	" "	0	0	0	0	28
	Hydroxide	OH	" "	0	0	0	0	0
	Chlorides	Cl	" "	21	22	22	22	66
	Sulfates	SO_4	" "	21	24	23	16	23
	Nitrates	NO_3	" "	0.15	0.13	0.12	0.14	0.14
			" "					
	Total Anions		" "	258.2	269.1	261.1	234.1	321.1
Total Hardness			" "	229	234	210	23	0
Alkalinity Methyl Orange			" "	216	223	216	196	232
Alkalinity Phenolphthalein			" "	0	0	0	0	14
pH				7.8	7.8	7.7	7.8	8.7
Total Solids (By Evaporation)				352	334	381	442	574
Free Carbon Dioxide			CO_2	7.2	7.6	8.8	11	<1.0
Silica			SiO_2	15	14	14	15	15
Total Iron			Fe	3.3	2.9	0.13	1.8	0.76
Manganese			Mn	0.06	0.07	<0.01	<0.01	0.04
Aluminum			Al					
Phosphate			PO_4	0.20	0.095	0.028	0.028	0.11
Sulfite			SO_3					
Chemical Oxygen Demand (COD)			O					
Turbidity				8.2	7.5	0.20	0.58	1.4
Color				35	35	<5.0	<5.0	12
Specific Conductivity			mmhos/cm^2	450	460	450	400	560
Total Dissolved Solids				333	334	371	417	547
Dissolved Iron				0.011	0.03	0.01	0.042	0.45

Remarks:

By Babb and Davidson
Analyst

FORM NO. 4

J.E. SIRRINE COMPANY
Engineers
GREENVILLE, S. C.

WATER ANALYSIS

Job No. A-1086-02

CLIENT U. S. Navy	Date Received 9/22/78
ADDRESS Courthouse Bay, Camp LeJeune, N. C.	Date Completed 10/09/78
	Date Transmitted

Sample	Analysis No.	Identification
I	36588	Softener No. 2 Effluent, taken 9/21-22/78
II	36589	Plant Effluent Combined Flows, taken 9/21-22/78
III		
IV		
V		

APHA Standard Methods used unless otherwise noted.

Constituents, ppm			as	I	II	III	IV	V
CATIONS	Calcium	Ca	$CaCO_3$	0	75			
	Magnesium	Mg	" "	0	4			
	Sodium	Na	" "	259.2	152.1			
	Potassium	K	" "					
			" "					
	Total Cations		" "	259.2	231.1			
ANIONS	Bicarbonate	HCO_3	" "	214	193			
	Carbonate	CO_3	" "	0	0			
	Hydroxide	OH	" "	0	0			
	Chlorides	Cl	" "	22	22			
	Sulfates	SO_4	" "	23	16			
	Nitrates	NO_3	" "	0.15	0.09			
			" "					
	Total Anions		" "	259.2	231.1			
Total Hardness			" "	0	79			
Alkalinity Methyl Orange			" "	214	193			
Alkalinity Phenolphthalein			" "	0	0			
pH				7.85	7.90			
Total Solids (By Evaporation)				497	381			
Free Carbon Dioxide			CO_2					
Silica			SiO_2	15	17			
Total Iron			Fe	0.23	0.27			
Manganese			Mn	0.02	0.01			
Aluminum			Al					
Phosphate			PO_4	0.046	0.025			
Sulfite			SO_3					
Chemical Oxygen Demand (COD)			O					
Turbidity				0.28	0.33			
Color				<5.0	<5.0			
Specific Conductivity			mmhos/cm^2	480	390			
Total Dissolved Solids				494	364			
Dissolved Iron				0.024	0.024			

Remarks:

By Babb and Davidson
Analyst

FORM NO. 4

EXHIBIT J

- EXHIBIT J -

WASTEWATER TREATMENT

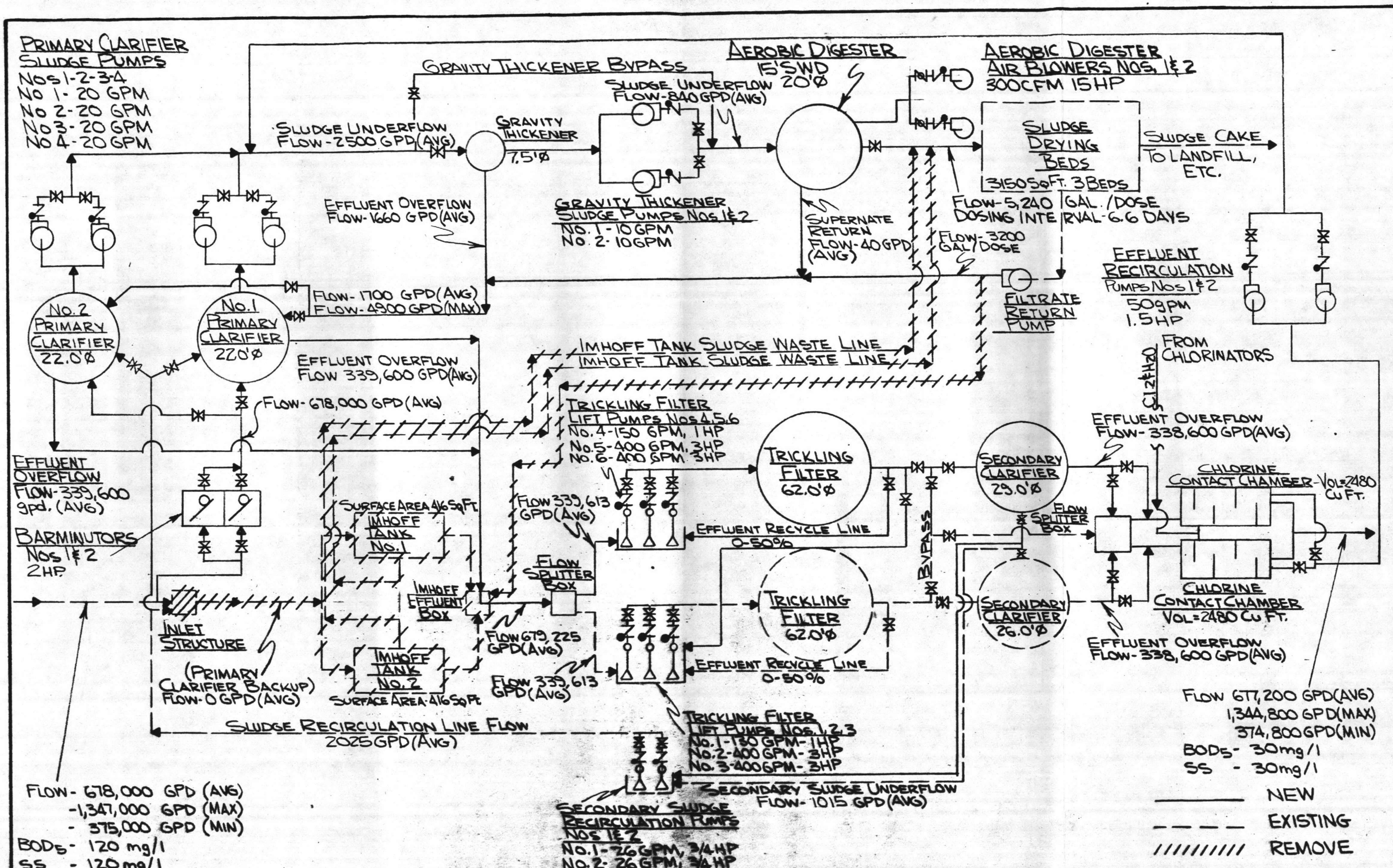
FLOW DIAGRAM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

WASTEWATER TREATMENT PLANT



AE CONTRACT NO. N62470-78-C-3675	COURTHOUSE BAY WASTEWATER TREATMENT FLOW DIAGRAM	J.E. SIRRINE COMPANY	EXHIBIT "J"

EXHIBIT K

- EXHIBIT K -

WASTEWATER TREATMENT PLANT

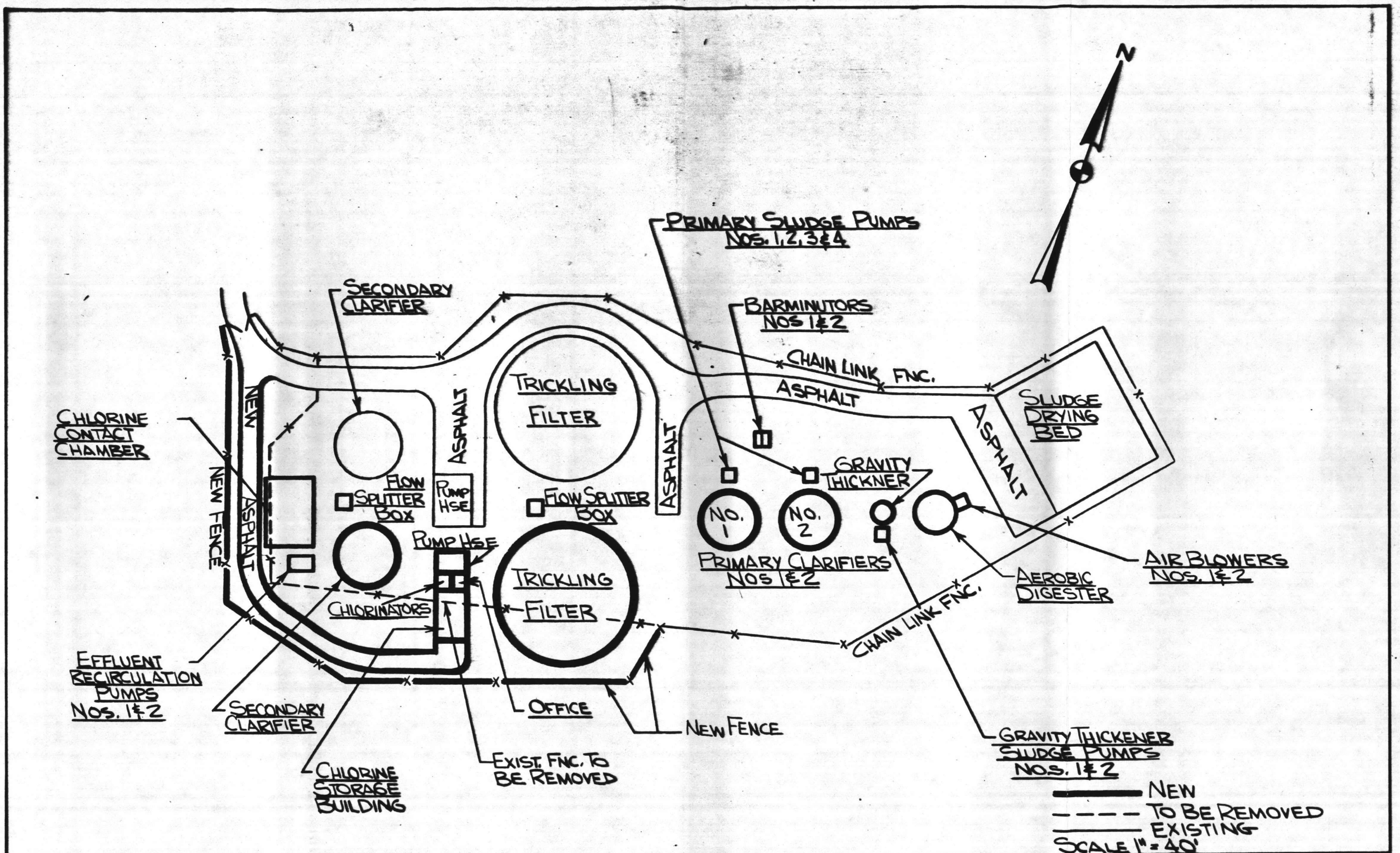
GENERAL ARRANGEMENT

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

WASTEWATER TREATMENT PLANT



A-E CONTRACT NO. N 62470-78-C-3675	COURTHOUSE BAY WASTEWATER TREATMENT PLANT GENERAL ARRANGEMENT	J.E. SIRRINE CO.	EXHIBIT "K"

- EXHIBIT L -

EXISTING
STEAM DISTRIBUTION

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

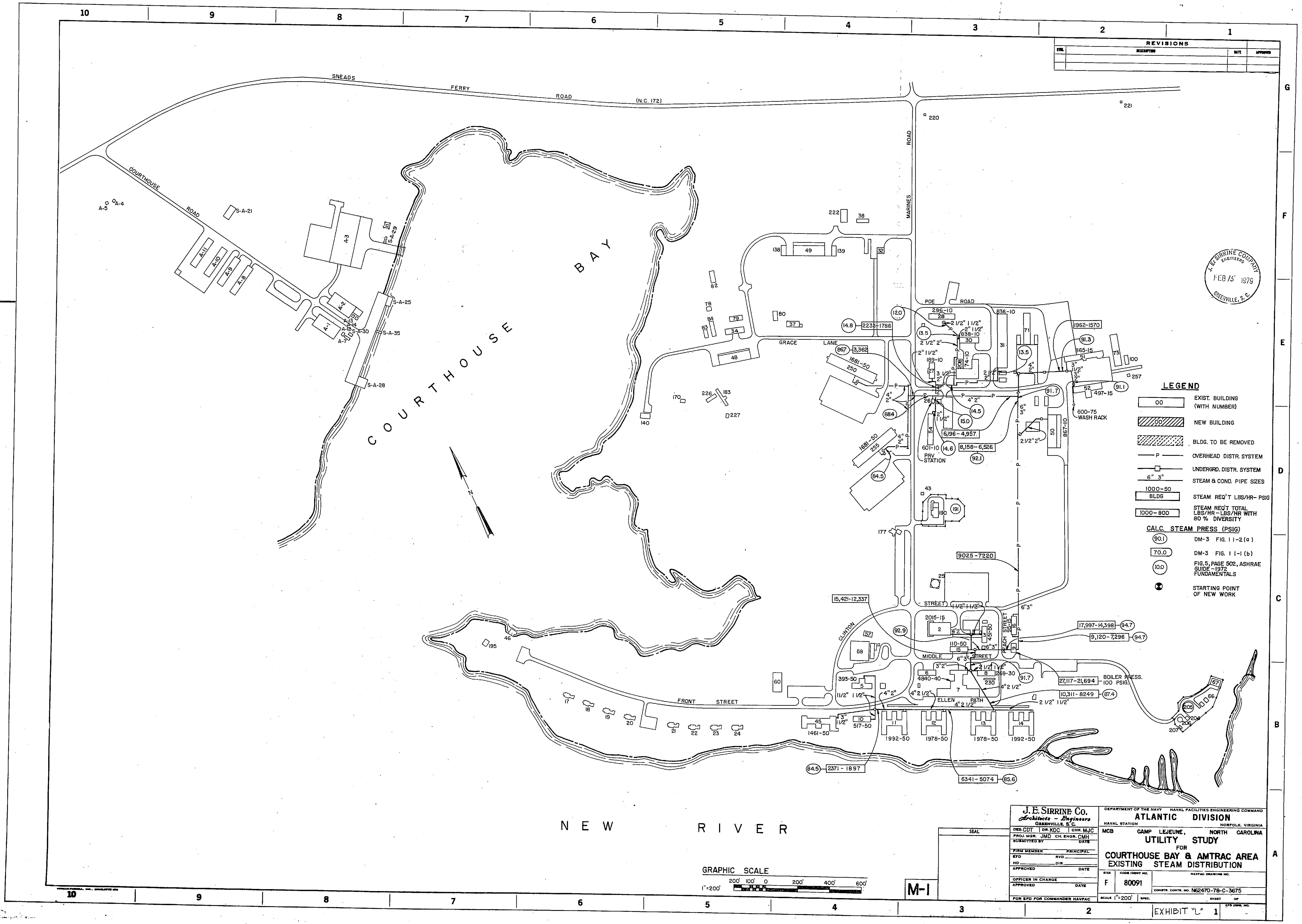

SNEADS FERRY ROAD (N.C. 172)
COURTHOUSE ROAD
MARINES ROAD
POE ROAD
GRACE LANE
CLINTON
MIDDLE STREET
FRONT STREET
ELLEN PATH
COURTHOUSE BAY
NEW RIVER
PRV STATION
BOILER PRESS. 100 PSIG
600-75 WASH RACK
LEGEND
EXIST. BUILDING (WITH NUMBER)
NEW BUILDING
BLDG. TO BE REMOVED
OVERHEAD DISTR. SYSTEM
UNDERGRD. DISTR. SYSTEM
STEAM & COND. PIPE SIZES
1000-50 BLDG
STEAM REQ'T LBS/HR- PSIG
1000-800
STEAM REQ'T TOTAL LBS/HR-LBS/HR WITH 80 % DIVERSITY
CALC. STEAM PRESS (PSIG)
90.1 DM-3 FIG. 11-2 (a)
70.0 DM-3 FIG. 11-1 (b)
10.0 FIG. 5, PAGE 502, ASHRAE GUIDE-1972 FUNDAMENTALS
STARTING POINT OF NEW WORK
REVISIONS
GRAPHIC SCALE
1"=200'
J. E. SIRRINE COMPANY ENGINEERS FEB 15 1979 GREENVILLE, S.C.
SEAL
M-1
J. E. SIRRINE Co.
Architects – Engineers
GREENVILLE, S. C.
DES. CDT DR. KDC CHK. MJC
PROJ. MGR. JMD CH. ENGR. CMH
SUBMITTED BY DATE
FIRM MEMBER PRINCIPAL
EFD RVD
HD DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
MCB CAMP LEJEUNE, NORTH CAROLINA
UTILITY STUDY
FOR
COURTHOUSE BAY & AMTRAC AREA
EXISTING STEAM DISTRIBUTION
SIZE F
CODE IDENT NO. 80091
NAVFAC DRAWING NO.
CONSTR. CONTR. NO. N62470-78-C-3675
SCALE 1"=200'
SPEC.
SHEET OF
EFD DWG. NO.
EXHIBIT "L"

EXHIBIT M

- EXHIBIT M -

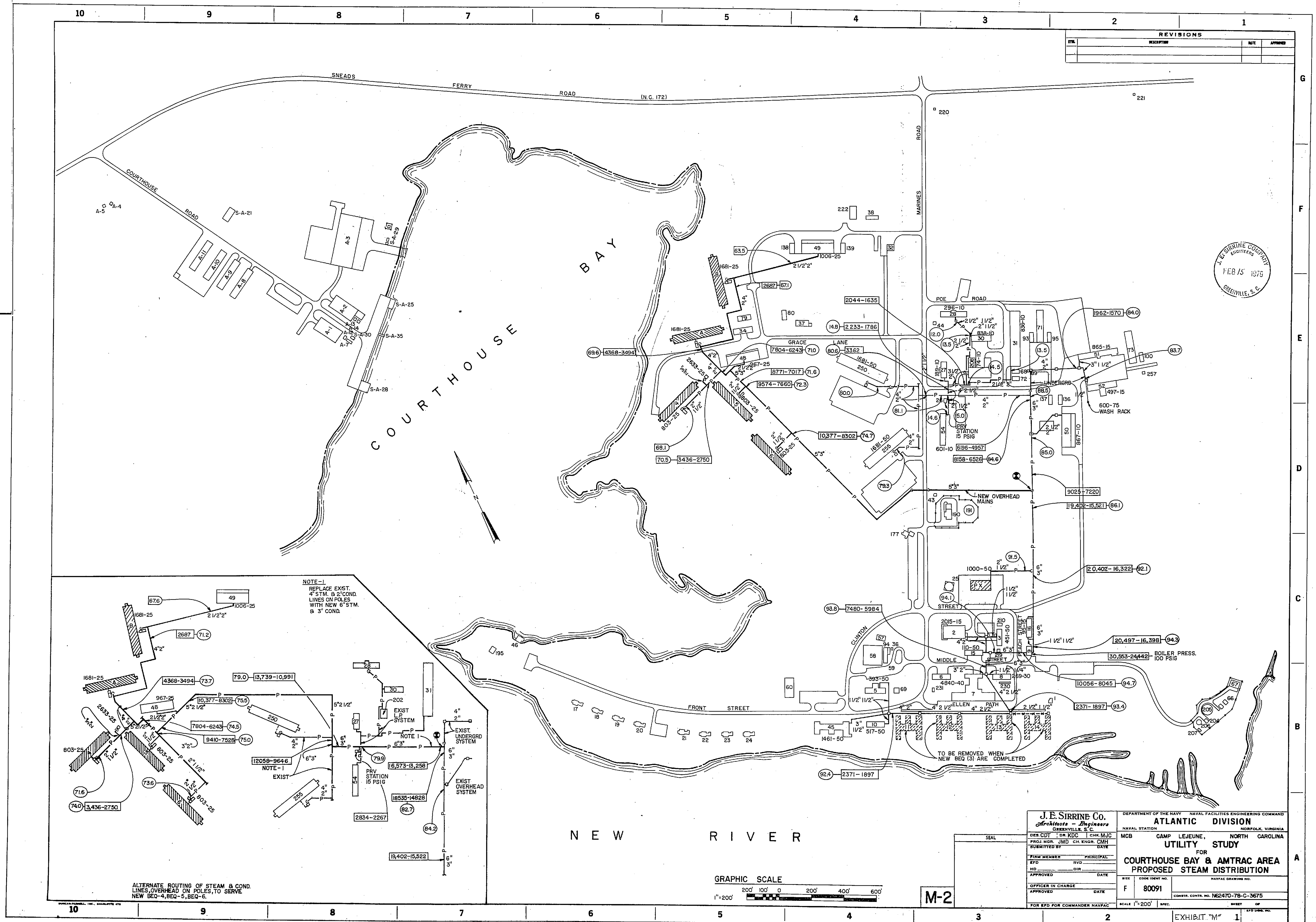
PROPOSED

STEAM DISTRIBUTION

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA



REVISIONS
SNEADS FERRY ROAD (N.C. 172)
COURTHOUSE ROAD
MARINES ROAD
COURTHOUSE BAY
NEW RIVER
GRACE LANE
POE ROAD
FRONT STREET
CLINTON STREET
MIDDLE STREET
ELLEN PATH
NEW OVERHEAD MAINS
PRV STATION 15 PSIG
600-75 WASH RACK
BOILER PRESS. 100 PSIG
TO BE REMOVED WHEN NEW BEQ (3) ARE COMPLETED
NOTE-1 REPLACE EXIST. 4" STM. & 2" COND. LINES ON POLES WITH NEW 6" STM. & 3" COND.
EXIST. L.P. SYSTEM
EXIST. UNDERGRD SYSTEM
EXIST. OVERHEAD SYSTEM
ALTERNATE ROUTING OF STEAM & COND. LINES, OVERHEAD ON POLES, TO SERVE NEW BEQ-4, BEQ-5, BEQ-6.
GRAPHIC SCALE
1"=200'
J.E. SIRRINE COMPANY ENGINEERS FEB 15 1979 GREENVILLE, S.C.
M-2
SEAL
J. E. SIRRINE Co.
Architects – Engineers
GREENVILLE, S. C.
DES. CDT DR. KDC CHK. MJC
PROJ. MGR. JMD CH. ENGR. CMH
SUBMITTED BY DATE
FIRM MEMBER PRINCIPAL
EFD RVD
HD DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
MCB CAMP LEJEUNE, NORTH CAROLINA
UTILITY STUDY
FOR
COURTHOUSE BAY & AMTRAC AREA
PROPOSED STEAM DISTRIBUTION
SIZE F
CODE IDENT NO. 80091
NAVFAC DRAWING NO.
CONSTR. CONTR. NO. N62470-78-C-3675
SCALE 1"=200'
SPEC.
SHEET OF
EFD DWG. NO.
EXHIBIT "M" 1

-APPENDIX I-

WATER AND SANITARY SEWER

DISTRIBUTION AND COLLECTOR SYSTEM

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

APPENDIX I

INDEX

Soil Systems, Inc.

1. SOIL

Report

SUBSURFACE INVESTIGATION

AND ENGINEERING EVALUATION

BEQ PROJECT P-613

CAMP LEJEUNE, NORTH CAROLINA

SIRRINE JOB NUMBER A-1085

OUR PROJECT NUMBER SSC-359

from that encountered at the remainder of the site in that a 2.5-foot thick lens of stiff clay is sandwiched within the upper sands at 3 to 5.5 feet below existing grade.

In the proposed parking areas serving the facilities at Hadnot Point, loose to firm sands (N = 6 to 39 blows per foot) were encountered in the 5-foot depth investigated.

Ground Water: The ground water table at Hadnot Point generally stabilized at 5 to 7 feet below the existing ground surface, or elevation 19.5 to 21.5. A tabulation of ground water table depths and elevations is presented on Table 1.

Additional subsurface data concerning Hadnot Point is summarized on Table 1 and presented on Subsurface Profile Sections A-A and B-B.

Courthouse Bay

Site Location and Description: The new BEQ facilities to be located at the Courthouse Bay site will be constructed on the west end of Grace Lane to a point as close as 300 feet to the bay. The site was generally heavily wooded at the time of our field investigation, with numerous power lines and unpaved roads crossing it, and several small structures scattered about the area. The ground surface within the proposed construction area ranges from elevation 18 to elevation 6, sloping downward toward the west end of the bay.

Subsurface Conditions: The subsurface conditions at the locations of Building #4/Solar Facility #4A, Building #5/Solar Facility #5A, and Building #6/Solar Facility #6A, were investigated by borings CH-7; CH-41 through CH-44, by borings CH-12; CH-37 through CH-40, and by borings CH-18; CH-45 through CH-48, respectively. The subsurface conditions at the Mechanical Building are described by boring CH-9, while in the access road and parking areas, the subsurface conditions are shown on Test Boring Records CH-1 through CH-5, CH-17, CH-21 through CH-23, CH-6, CH-8, CH-14, CH-15, CH-19, and CH-20. The steam line was investigated by borings CH-10, CH-11, CH-13, CH-16, and CH-23 through CH-36.

Soils: The borings drilled at the locations of the buildings/solar facilities and Mechanical Building generally encountered an upper sand zone which averages 10 to 12 feet in thickness and is underlain by an 8 to 25-foot thick strata of plastic clay soils. Sands are then again present below the clay soil strata.

Sands were also generally encountered to the depth of penetration of the steam line, access road and parking area borings.

The sands are very loose to very dense in consistency (N = 2 to 50 blows per foot), while the clays generally exhibit consistencies in the soft range (N = 2 to 4 blows per foot).

Ground Water: The ground water table at Courthouse Bay generally stabilized at 3 to 6 feet below existing grade but at elevations varying widely from 3 to 2.5 feet above sea level.

Additional subsurface data concerning Courthouse Bay is summarized on Table 2 and presented on Subsurface Profile Sections C-C through P-P.

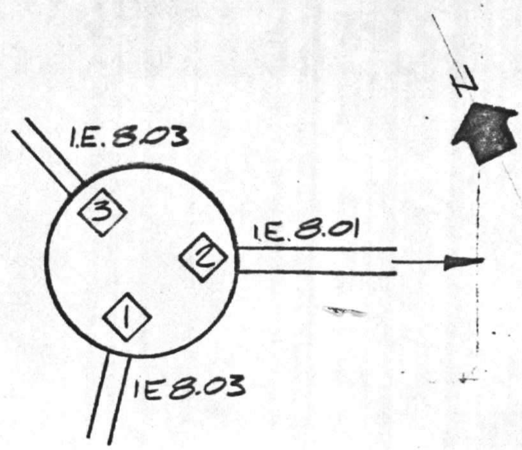
SANITARY SEWER MANHOLE NUMBER 425

TOP OF MANHOLE ELEV. 10.81
DEPTH OF MANHOLE 2.80 FT.

(1) PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 07:16

(2) PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 07:16

(3) PIPE SIZE 6 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN

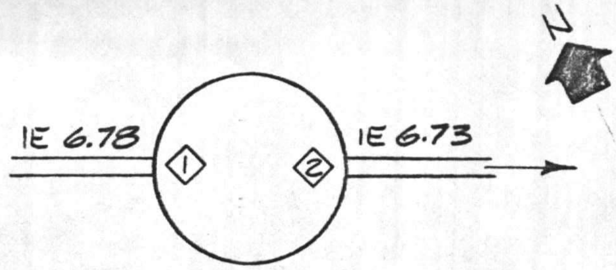


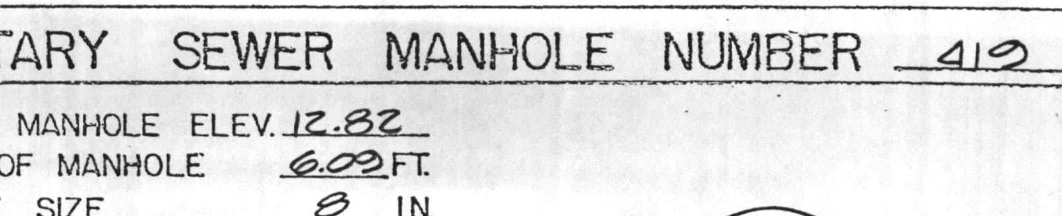
SANITARY SEWER MANHOLE NUMBER 419

TOP OF MANHOLE ELEV. 12.82
DEPTH OF MANHOLE 6.09 FT.

(1) PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 07:14

(2) PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 07:14





A-E CONTRACT NO. N62470-78-C-3675	J. E. SIRRINE COMPANY	PAGE 1 OF 24

SANITARY SEWER MANHOLE NUMBER 418

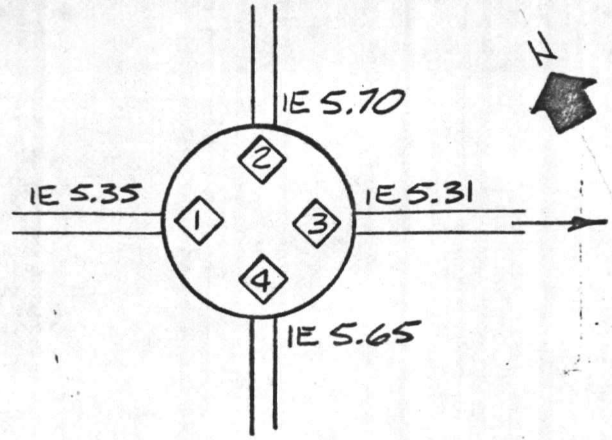
TOP OF MANHOLE ELEV. 12.43
DEPTH OF MANHOLE 7.12 FT.

① PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 3/4 IN.
TIME MEASURED 07:05

② PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 07:05

③ PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1 3/4 IN.
TIME MEASURED 07:05

④ PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 07:05

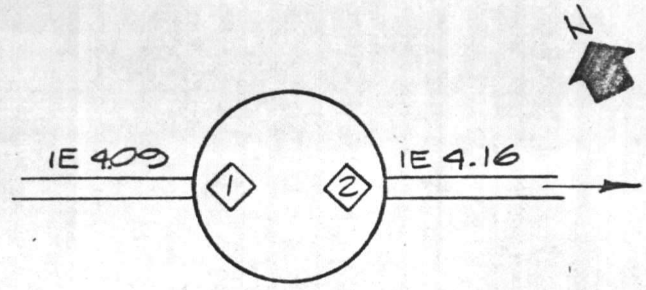


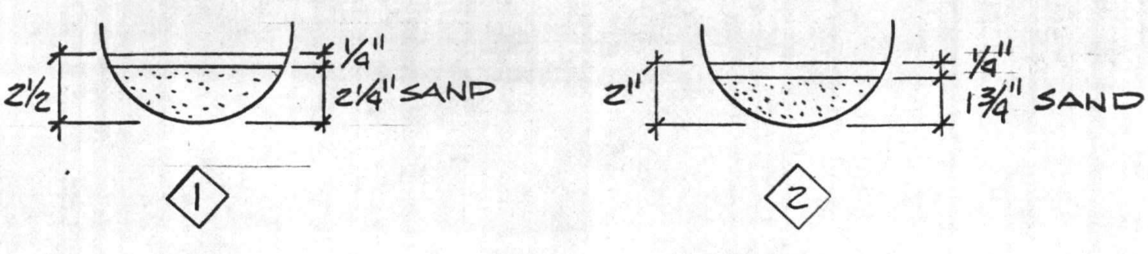
SANITARY SEWER MANHOLE NUMBER 417

TOP OF MANHOLE ELEV. 10.94
DEPTH OF MANHOLE 6.85 FT.

① PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 06:35

② PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 06:35





A-E CONTRACT NO. N62470-78-C-3675	J. E. SIRRINE COMPANY	PAGE 2 OF 24

SANITARY SEWER MANHOLE NUMBER 416

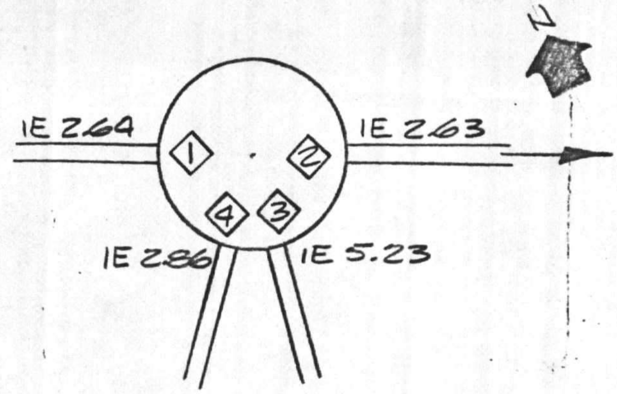
TOP OF MANHOLE ELEV. 11.17
DEPTH OF MANHOLE 8.54 FT.

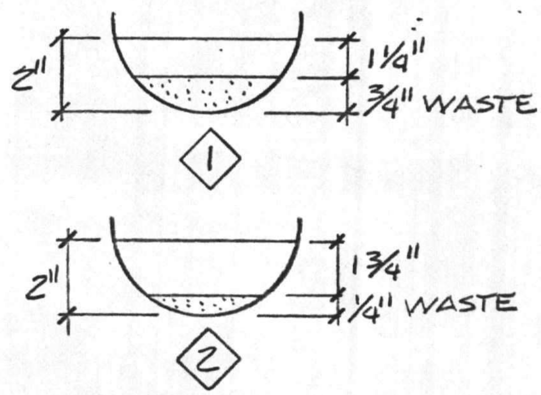
1. PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1¼ IN.
TIME MEASURED 06:25

2. PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1¾ IN.
TIME MEASURED 06:25

3. PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ½ IN.
TIME MEASURED 06:25

4. PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 06:25





SANITARY SEWER MANHOLE NUMBER 415

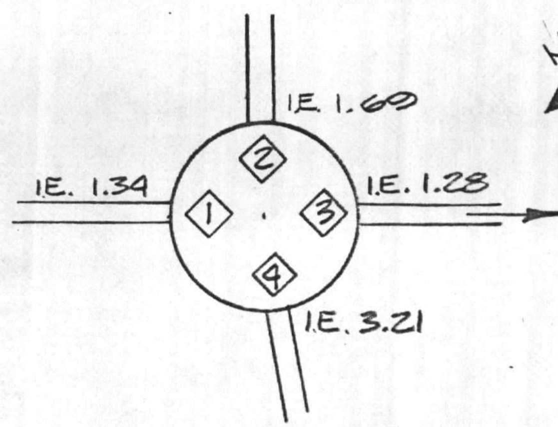
TOP OF MANHOLE ELEV. 12.73
DEPTH OF MANHOLE 11.95 FT.

1. PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1 IN.
TIME MEASURED 06:20

2. PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 06:20

3. PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1 IN.
TIME MEASURED 06:20

4. PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 06:20



A-E CONTRACT NO. N62470-78-C-3675	J. E. SIRRINE COMPANY	PAGE 3 OF 24

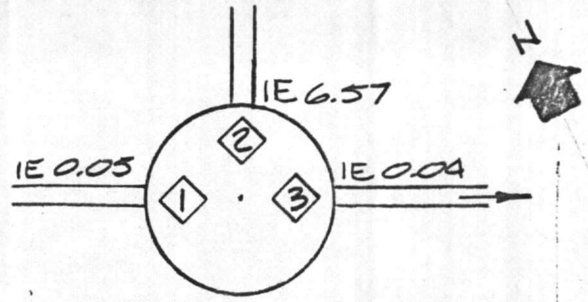
SANITARY SEWER MANHOLE NUMBER 414

TOP OF MANHOLE ELEV. 12.38
DEPTH OF MANHOLE 12.34 FT.

(1) PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ____ IN.
TIME MEASURED ____

(2) PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ____ IN.
TIME MEASURED ____

(3) PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ____ IN.
TIME MEASURED ____



SANITARY SEWER MANHOLE NUMBER 413

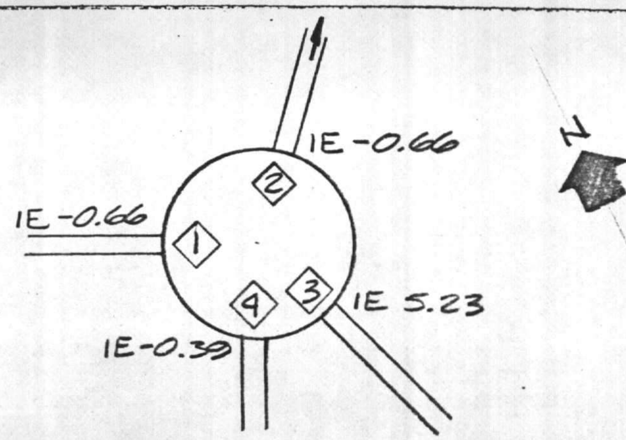
TOP OF MANHOLE ELEV. 11.34
DEPTH OF MANHOLE 12.00 FT.

(1) PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 6 IN.
TIME MEASURED 06:10

(2) PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 6 IN.
TIME MEASURED 06:10

(3) PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW -0 IN.
TIME MEASURED 06:10

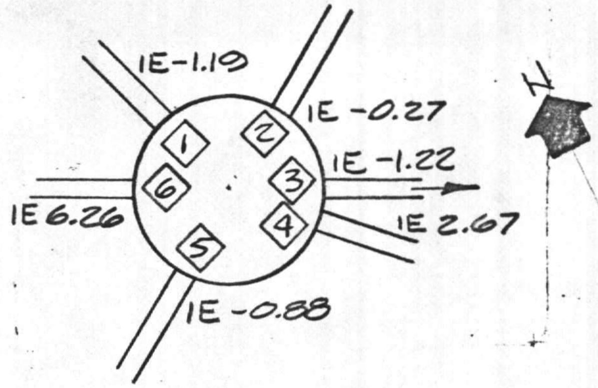
(4) PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW -0- IN.
TIME MEASURED 06:10



A-E CONTRACT NO. N62470-78-C-3675	J. E. SIRRINE COMPANY	PAGE 4 OF 24

SANITARY SEWER MANHOLE NUMBER 412

TOP OF MANHOLE ELEV. 9.92
DEPTH OF MANHOLE 11.14 FT.



1. PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 3½ IN.
TIME MEASURED 05:58

2. PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 05:58

3. PIPE SIZE 12 IN
TYPE OF MATERIAL CIP
DEPTH OF FLOW 7¼ IN
TIME MEASURED 05:58

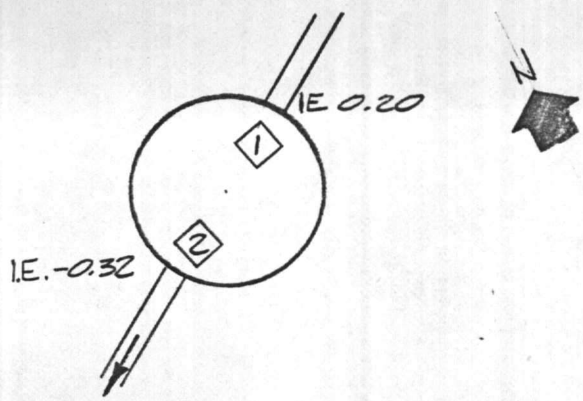
4. PIPE SIZE 12 IN
TYPE OF MATERIAL CIP
DEPTH OF FLOW 0 IN
TIME MEASURED 05:58

5. PIPE SIZE 10 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 2½ IN
TIME MEASURED 5:58

6. PIPE SIZE 6 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN
TIME MEASURED 5:58

SANITARY SEWER MANHOLE NUMBER 672

TOP OF MANHOLE ELEV. 7.57
DEPTH OF MANHOLE 7.89 FT.



1. PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED —

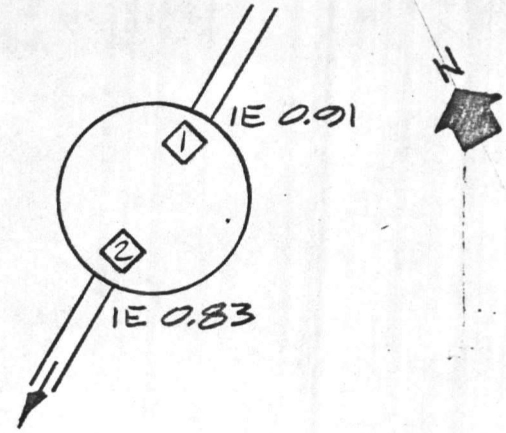
2. PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED —

SANITARY SEWER MANHOLE NUMBER 673

TOP OF MANHOLE ELEV. 8.99
DEPTH OF MANHOLE 8.16 FT.

① PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED —

② PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED —

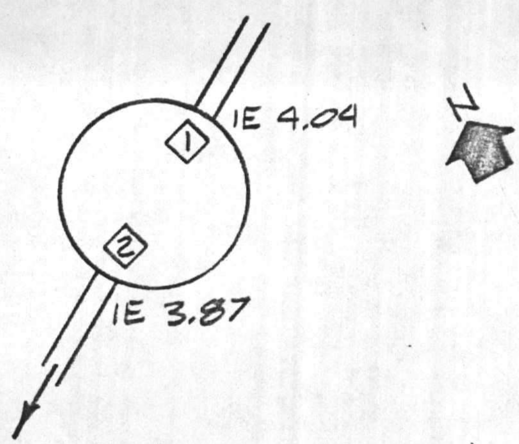


SANITARY SEWER MANHOLE NUMBER 674

TOP OF MANHOLE ELEV. 10.97
DEPTH OF MANHOLE 7.10 FT.

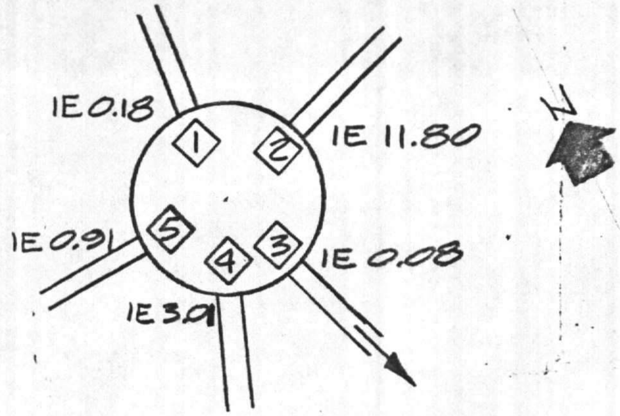
① PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED —

② PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED —



SANITARY SEWER MANHOLE NUMBER 422

TOP OF MANHOLE ELEV. 15.50
DEPTH OF MANHOLE 15.42 FT.



(1) PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 6 IN.
TIME MEASURED 06:48

(2) PIPE SIZE 4 IN.
TYPE OF MATERIAL CIP
DEPTH OF FLOW 0 IN.
TIME MEASURED 06:48

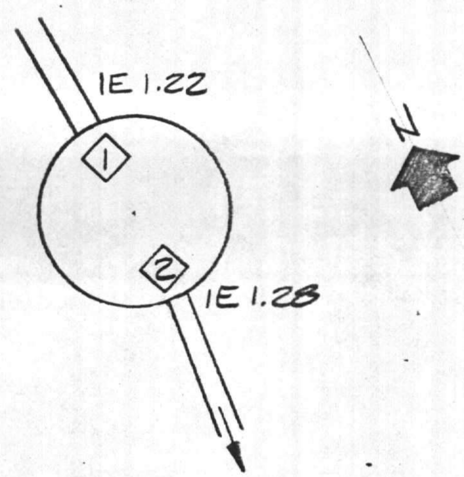
(3) PIPE SIZE 10 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 6 IN
TIME MEASURED 06:48

(4) PIPE SIZE 6 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN
TIME MEASURED 06:48

(5) PIPE SIZE 6 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN
TIME MEASURED 06:48

SANITARY SEWER MANHOLE NUMBER 423

TOP OF MANHOLE ELEV. 11.44
DEPTH OF MANHOLE 10.22 FT.



(1) PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 3¾ IN.
TIME MEASURED 06:52

(2) PIPE SIZE 10 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 3 IN.
TIME MEASURED 06:52

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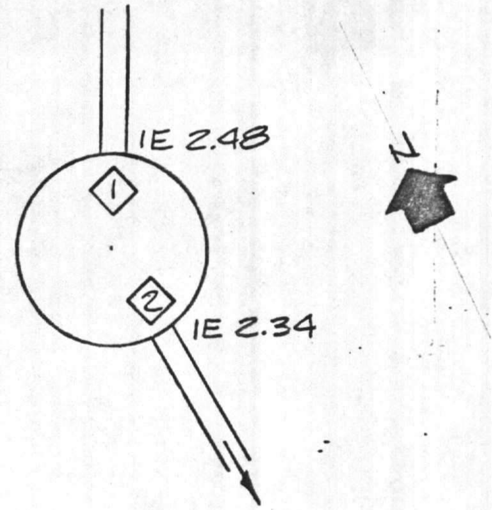
SANITARY SEWER MANHOLE NUMBER 428

TOP OF MANHOLE ELEV. 11.84
DEPTH OF MANHOLE 9.50 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 3 IN.
   TIME MEASURED 05:50

2. PIPE SIZE 10 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 2½ IN.
   TIME MEASURED 05:50

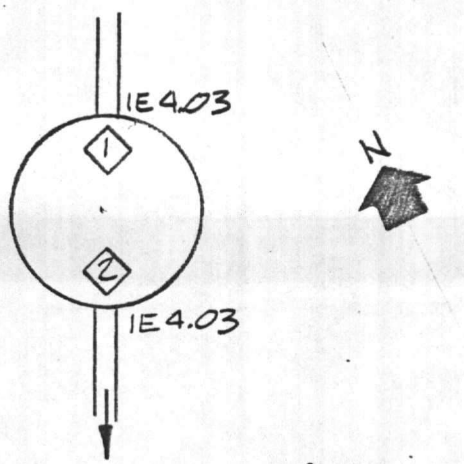


SANITARY SEWER MANHOLE NUMBER 429

TOP OF MANHOLE ELEV. 13.03
DEPTH OF MANHOLE 9.00 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 6¼ IN.
   TIME MEASURED 05:59

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 6½ IN.
   TIME MEASURED 05:59



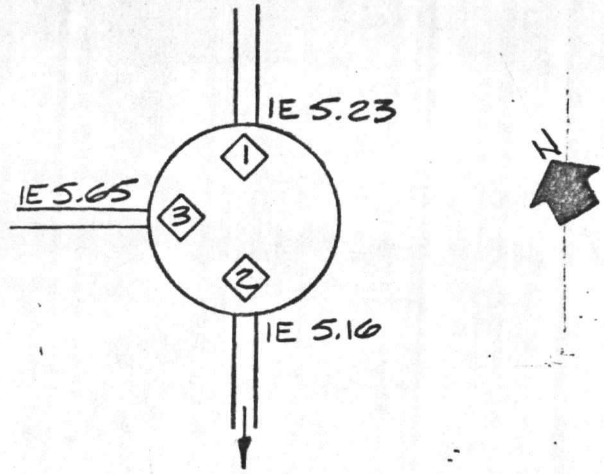
SANITARY SEWER MANHOLE NUMBER 1000

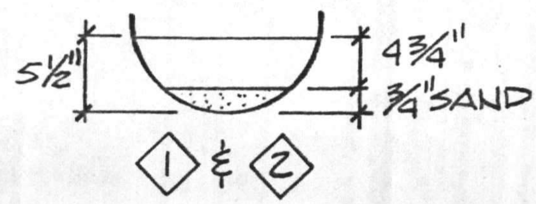
TOP OF MANHOLE ELEV. 14.03
DEPTH OF MANHOLE 8.87 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 4 3/4 IN.
   TIME MEASURED 06:03

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 4 3/4 IN.
   TIME MEASURED 06:03

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 2 1/4 IN
   TIME MEASURED 06:03





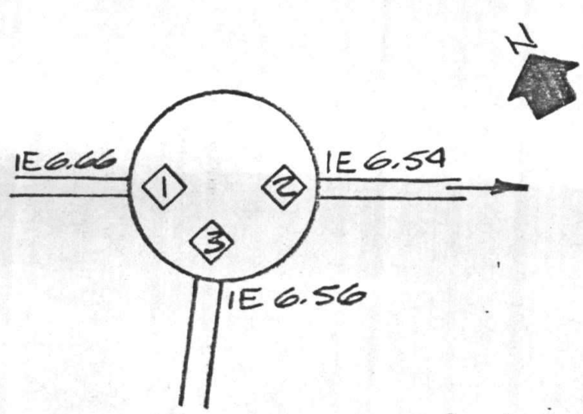
SANITARY SEWER MANHOLE NUMBER 1001

TOP OF MANHOLE ELEV. 11.59
DEPTH OF MANHOLE 5.05 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 2 IN.
   TIME MEASURED 06:45

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 2 IN.
   TIME MEASURED 06:45

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN
   TIME MEASURED 06:45

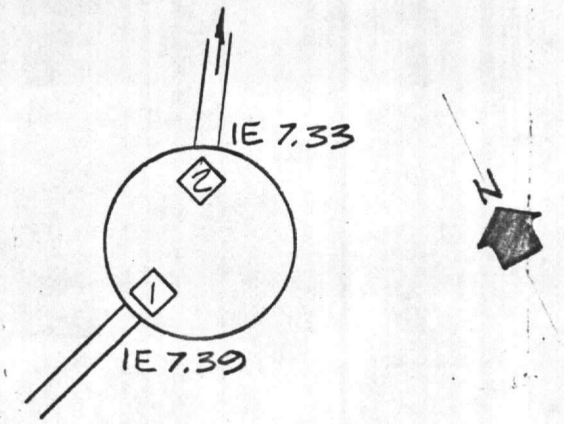


SANITARY SEWER MANHOLE NUMBER 1002

TOP OF MANHOLE ELEV. 11.59
DEPTH OF MANHOLE 4.26 FT.

1. PIPE SIZE 6 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 06:50

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 06:50



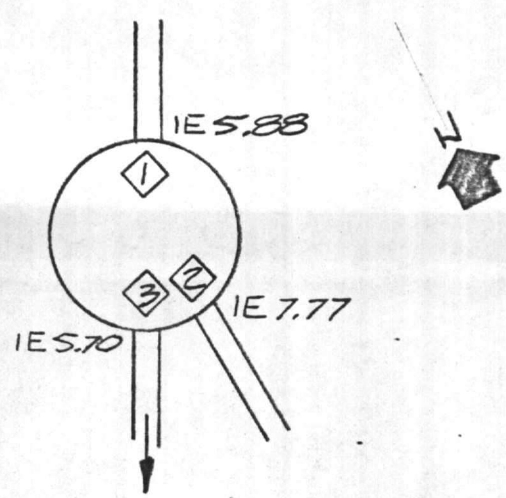
SANITARY SEWER MANHOLE NUMBER 431

TOP OF MANHOLE ELEV. 13.83
DEPTH OF MANHOLE 8.13 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 6½ IN.
   TIME MEASURED 06:08

2. PIPE SIZE 10 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 06:08

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 6¾ IN
   TIME MEASURED 06:08



SANITARY SEWER MANHOLE NUMBER 431-A

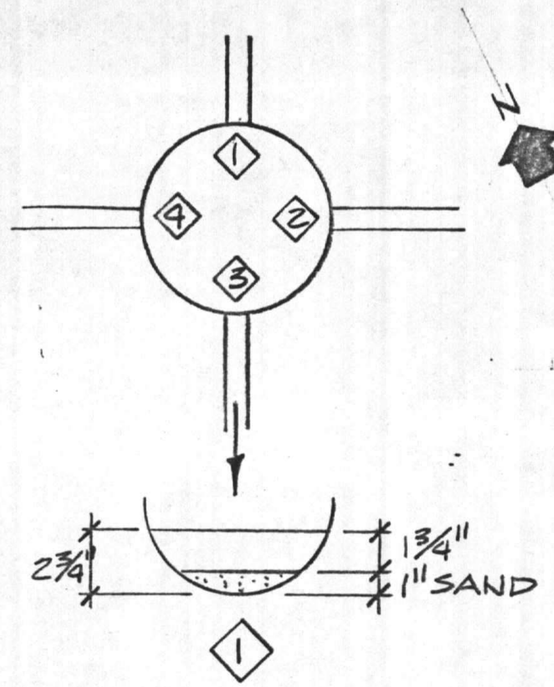
TOP OF MANHOLE ELEV. 15.60
DEPTH OF MANHOLE 9.20 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1¾ IN.
   TIME MEASURED 06:14

2. PIPE SIZE 6 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW ____ IN.
   TIME MEASURED 06:14

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 3 IN
   TIME MEASURED 06:14

4. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN
   TIME MEASURED 06:14



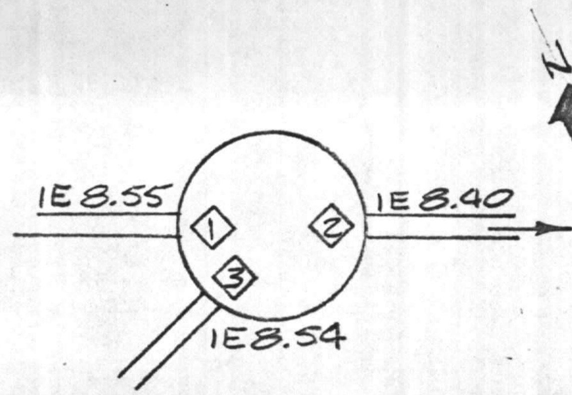
SANITARY SEWER MANHOLE NUMBER 1003

TOP OF MANHOLE ELEV. 12.57
DEPTH OF MANHOLE 4.17 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN.
   TIME MEASURED 06:18

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN.
   TIME MEASURED 06:18

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN
   TIME MEASURED 06:18



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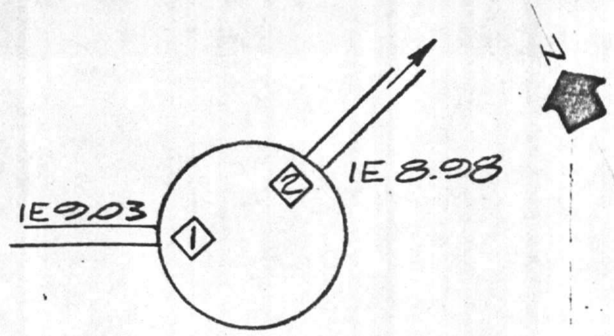
SANITARY SEWER MANHOLE NUMBER 1004

TOP OF MANHOLE ELEV. 13.55
DEPTH OF MANHOLE 4.57 FT.

① PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 06:23

② PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 0 IN.
TIME MEASURED 06:23



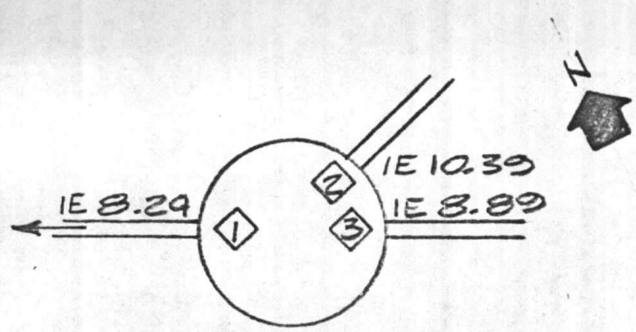
SANITARY SEWER MANHOLE NUMBER 496

TOP OF MANHOLE ELEV. 18.28
DEPTH OF MANHOLE 10.04 FT.

① PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ½ IN.
TIME MEASURED 10:05

② PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED 10:05

③ PIPE SIZE 6 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW ½ IN
TIME MEASURED 10.05



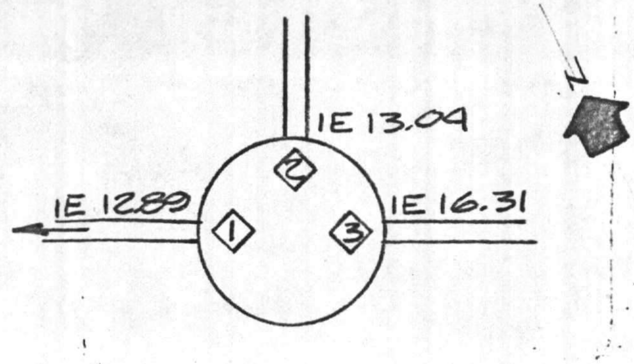
SANITARY SEWER MANHOLE NUMBER 497

TOP OF MANHOLE ELEV. 23.25
DEPTH OF MANHOLE 10.36 FT.

1 PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 3/4 IN.
TIME MEASURED 10:14

2 PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 10:14

3 PIPE SIZE 8 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/2 IN
TIME MEASURED 10:14



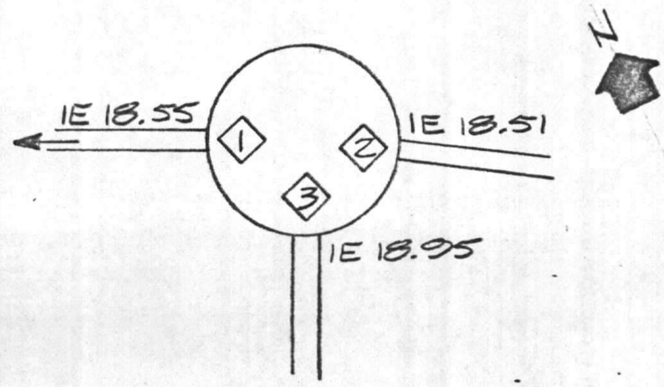
SANITARY SEWER MANHOLE NUMBER 497-A

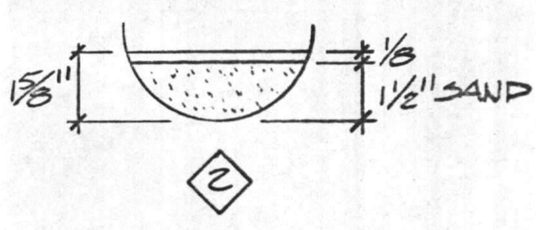
TOP OF MANHOLE ELEV. 25.22
DEPTH OF MANHOLE 6.71 FT.

1 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 10:20

2 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/8 IN.
TIME MEASURED 10:20

3 PIPE SIZE 6 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN
TIME MEASURED 10:20





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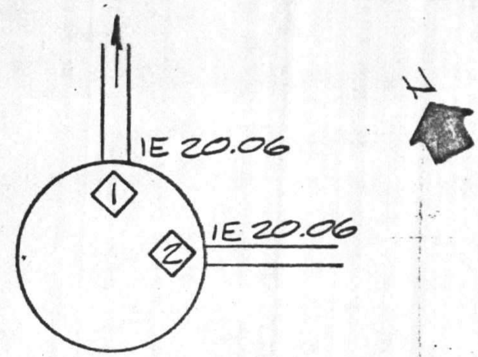
SANITARY SEWER MANHOLE NUMBER 1006

TOP OF MANHOLE ELEV. 24.23
DEPTH OF MANHOLE 4.17 FT.

1. PIPE SIZE 6 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1/8 IN.
   TIME MEASURED 10:25

2. PIPE SIZE 6 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1/8 IN.
   TIME MEASURED 10:25



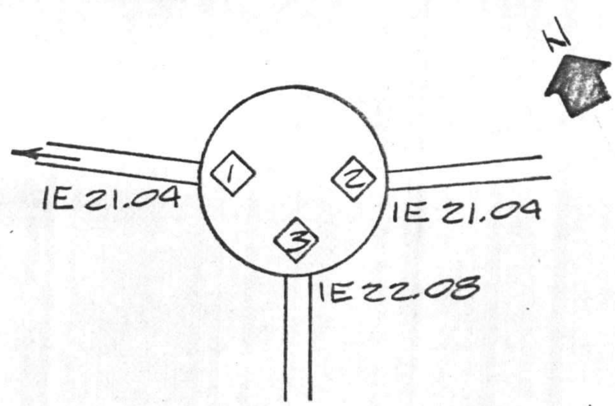
SANITARY SEWER MANHOLE NUMBER 497-B

TOP OF MANHOLE ELEV. 28.14
DEPTH OF MANHOLE 7.10 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1½ IN.
   TIME MEASURED 10:30

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 2 IN.
   TIME MEASURED 10:30

3. PIPE SIZE 4 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN
   TIME MEASURED 10:30



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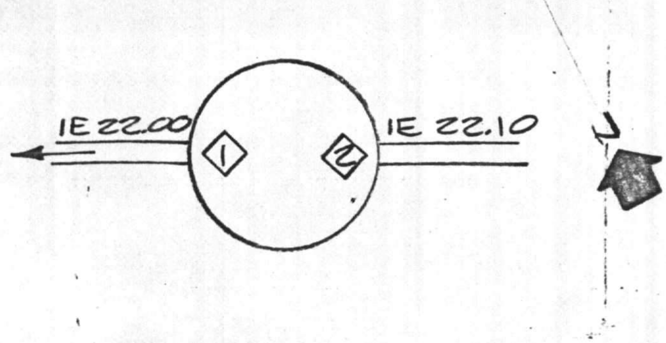
SANITARY SEWER MANHOLE NUMBER 1005

TOP OF MANHOLE ELEV. 29.37
DEPTH OF MANHOLE 7.37 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 10:37

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 10:37

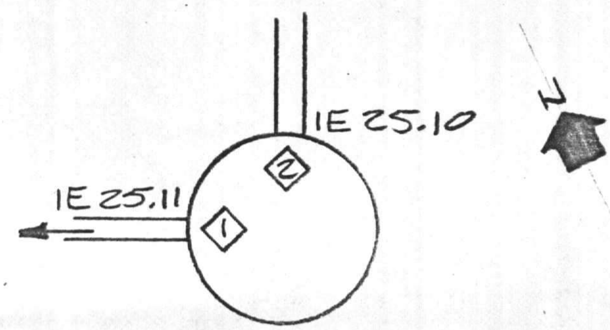


SANITARY SEWER MANHOLE NUMBER 497-C

TOP OF MANHOLE ELEV. 32.05
DEPTH OF MANHOLE 6.95 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1/8 IN.
   TIME MEASURED 10:50

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1/8 IN.
   TIME MEASURED 10:50



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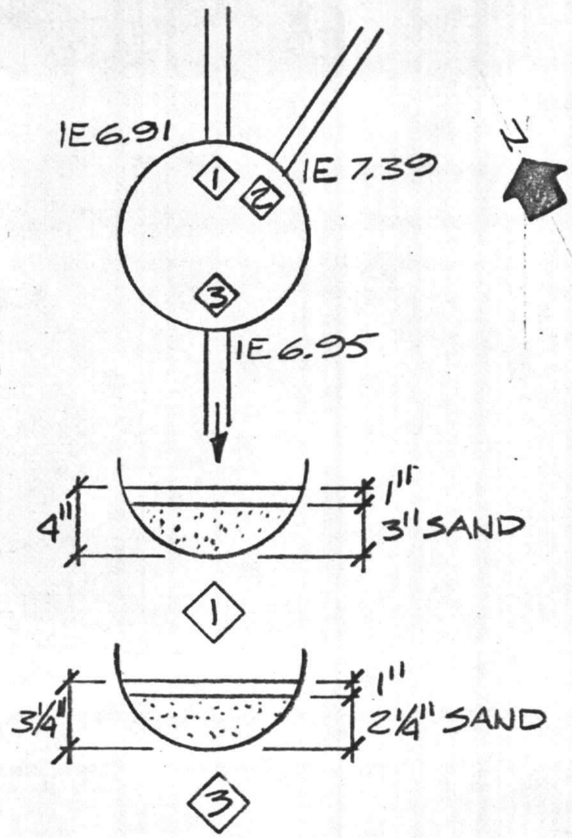
SANITARY SEWER MANHOLE NUMBER 438

TOP OF MANHOLE ELEV. 15.85
DEPTH OF MANHOLE 8.90 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN.
   TIME MEASURED 06:28

2. PIPE SIZE 6 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 06:28

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN
   TIME MEASURED 06:28

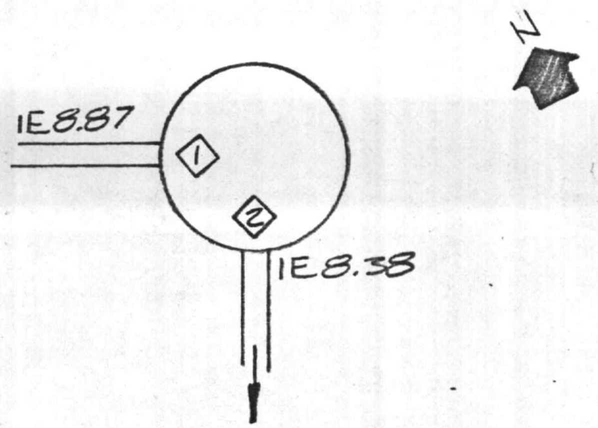


SANITARY SEWER MANHOLE NUMBER 663

TOP OF MANHOLE ELEV. 18.15
DEPTH OF MANHOLE 9.77 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN.
   TIME MEASURED 06:34

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 3½ IN.
   TIME MEASURED 06:34



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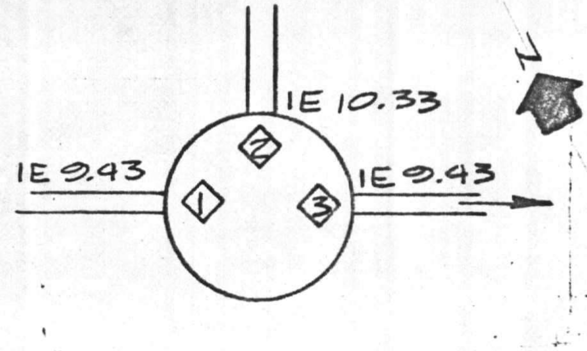
SANITARY SEWER MANHOLE NUMBER 664

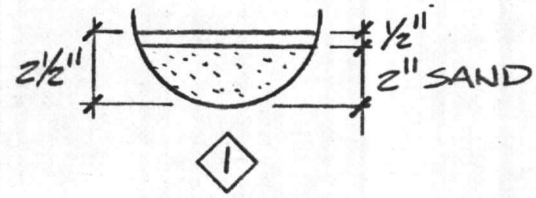
TOP OF MANHOLE ELEV. 18.23
DEPTH OF MANHOLE 8.80 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1/2 IN.
   TIME MEASURED 06:40

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1/2 IN.
   TIME MEASURED 06:40

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 2 1/2 IN
   TIME MEASURED 06:40



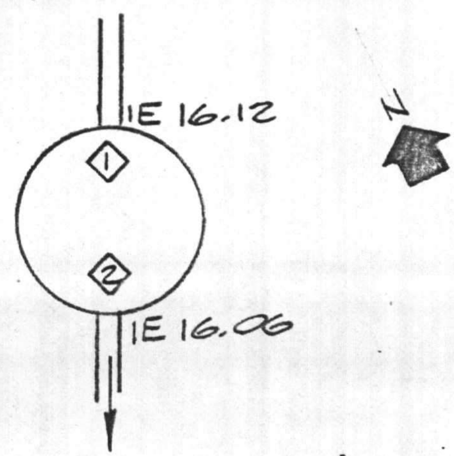


SANITARY SEWER MANHOLE NUMBER 665

TOP OF MANHOLE ELEV. 22.20
DEPTH OF MANHOLE 6.14 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1 IN.
   TIME MEASURED 15:13

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 2 IN.
   TIME MEASURED 15:13



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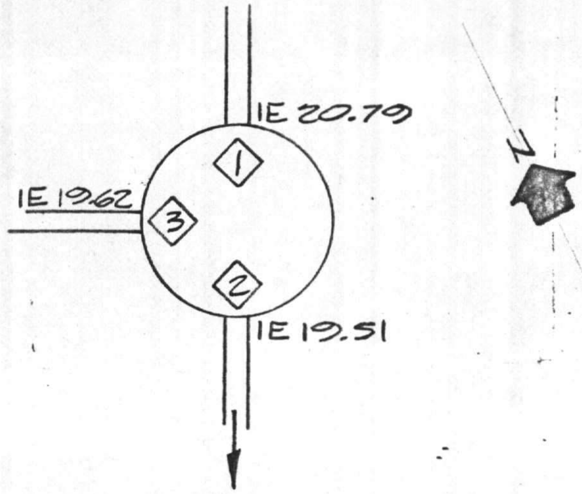
SANITARY SEWER MANHOLE NUMBER 666

TOP OF MANHOLE ELEV. 27.01
DEPTH OF MANHOLE 7.50 FT.

1. PIPE SIZE 6 IN.
   TYPE OF MATERIAL CIP
   DEPTH OF FLOW F.M. IN.
   TIME MEASURED 15:04

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 3/4 IN.
   TIME MEASURED 15:04

3. PIPE SIZE 8 IN
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW — IN
   TIME MEASURED 15:04



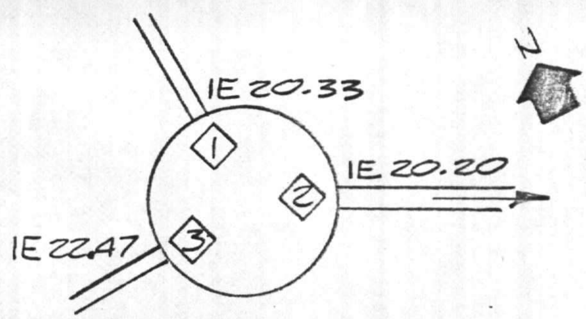
SANITARY SEWER MANHOLE NUMBER 667

TOP OF MANHOLE ELEV. 25.08
DEPTH OF MANHOLE 4.88 FT.

1. PIPE SIZE 6 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 15:00

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 0 IN.
   TIME MEASURED 15:00

3. PIPE SIZE 4 IN
   TYPE OF MATERIAL PVC
   DEPTH OF FLOW 0 IN
   TIME MEASURED 15:00



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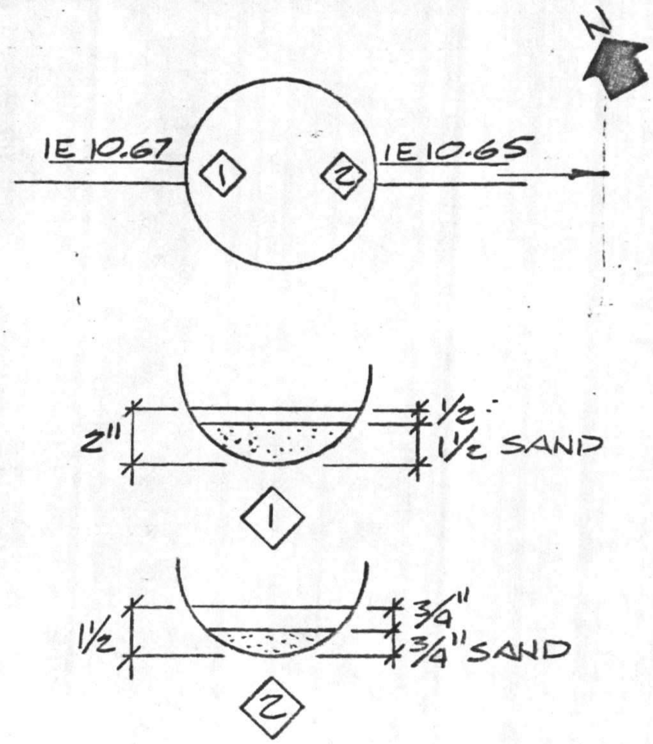
SANITARY SEWER MANHOLE NUMBER 668

TOP OF MANHOLE ELEV. 16.98
DEPTH OF MANHOLE 6.33 FT.

◇1 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/2 IN.
TIME MEASURED 09:15

◇2 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 3/4 IN.
TIME MEASURED 09:15



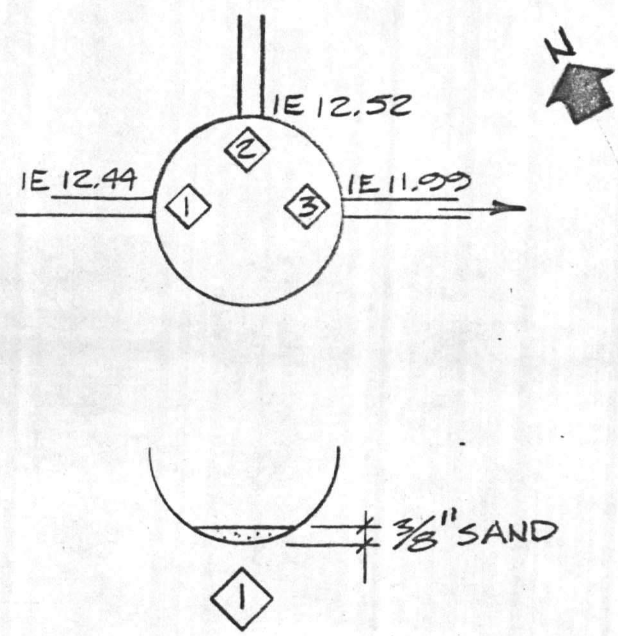
SANITARY SEWER MANHOLE NUMBER 669

TOP OF MANHOLE ELEV. 16.97
DEPTH OF MANHOLE 4.98 FT.

◇1 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW —— IN.
TIME MEASURED 08:58

◇2 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 3/4 IN.
TIME MEASURED 08:58

◇3 PIPE SIZE 8 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 2 1/2 IN
TIME MEASURED 08:58

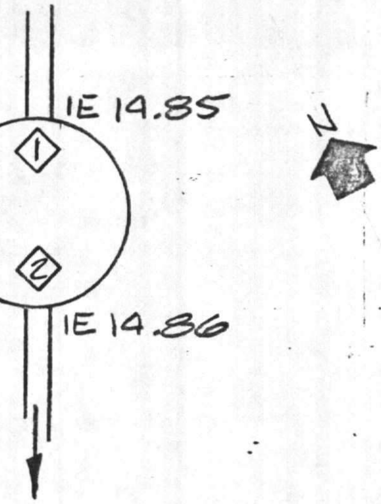


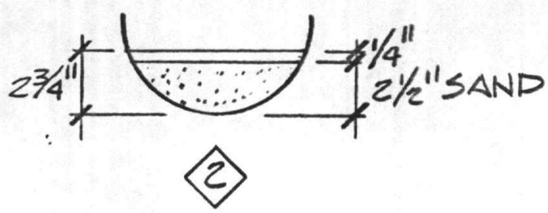
SANITARY SEWER MANHOLE NUMBER 1007

TOP OF MANHOLE ELEV. 20.32
DEPTH OF MANHOLE 5.47 FT.

① PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 2½ IN.
TIME MEASURED 09:04

② PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ¼ IN.
TIME MEASURED 09:04



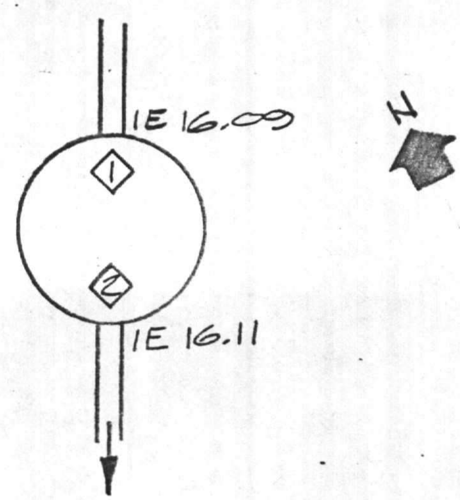


SANITARY SEWER MANHOLE NUMBER 1008

TOP OF MANHOLE ELEV. 21.42
DEPTH OF MANHOLE 5.33 FT.

① PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ½ IN.
TIME MEASURED 09:09

② PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW ½ IN.
TIME MEASURED 09:09



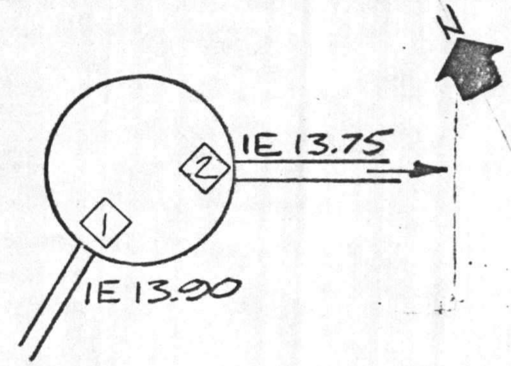
A-E CONTRACT NO. N62470-78-C-3675	J. E. SIRRINE COMPANY	PAGE 20 OF 24

SANITARY SEWER MANHOLE NUMBER 670

TOP OF MANHOLE ELEV. 17.90
DEPTH OF MANHOLE 4.15 FT.

1 PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/8 IN.
TIME MEASURED 0850

2 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/8 IN.
TIME MEASURED 08:50



SANITARY SEWER MANHOLE NUMBER 366

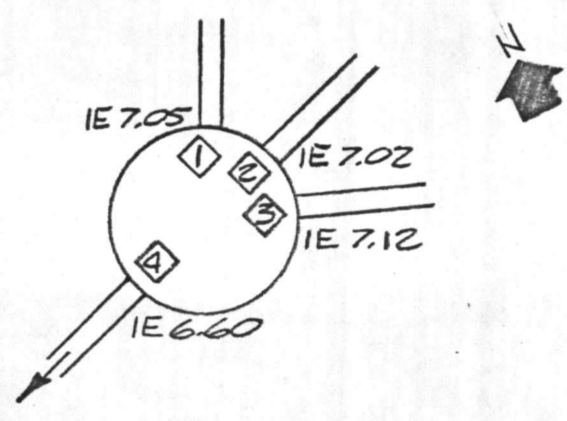
TOP OF MANHOLE ELEV. 11.36
DEPTH OF MANHOLE 4.76 FT.

1 PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN.
TIME MEASURED 14:20

2 PIPE SIZE 6 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN.
TIME MEASURED 14:20

PIPE SIZE 6 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW — IN
TIME MEASURED 14:20

PIPE SIZE 8 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1/4 IN
TIME MEASURED 14:20



A-E CONTRACT NO. N62470-78-C-3675	J. E. SIRRINE COMPANY	PAGE 21 OF 24

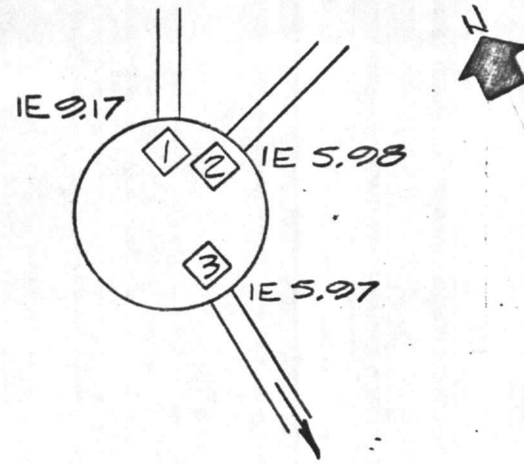
SANITARY SEWER MANHOLE NUMBER 365

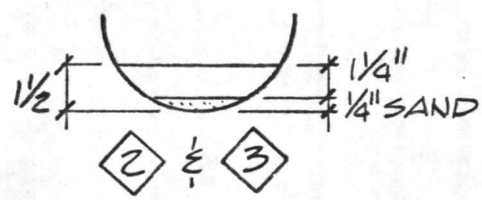
TOP OF MANHOLE ELEV. 13.33
DEPTH OF MANHOLE 7.36 FT.

① PIPE SIZE 6 IN.
TYPE OF MATERIAL CIP
DEPTH OF FLOW — IN.
TIME MEASURED 14:25

② PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1¼ IN.
TIME MEASURED 14:25

③ PIPE SIZE 8 IN
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1¼ IN
TIME MEASURED 14:25



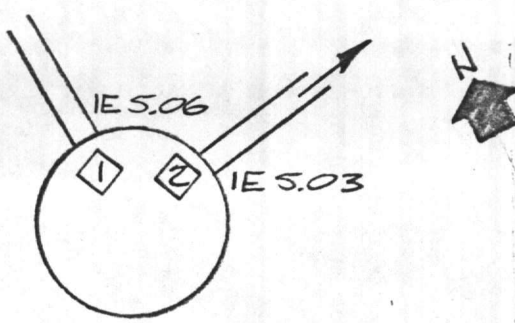


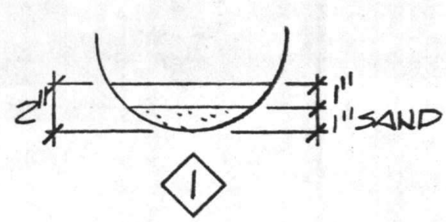
SANITARY SEWER MANHOLE NUMBER 364

TOP OF MANHOLE ELEV. 8.49
DEPTH OF MANHOLE 3.46 FT.

① PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1 IN.
TIME MEASURED 14:30

② PIPE SIZE 8 IN.
TYPE OF MATERIAL VCP
DEPTH OF FLOW 1¼ IN.
TIME MEASURED 14:30



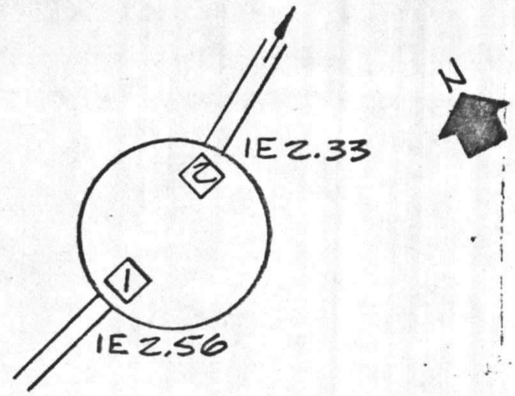


SANITARY SEWER MANHOLE NUMBER 1009

TOP OF MANHOLE ELEV. 11.76
DEPTH OF MANHOLE 9.43 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1¼ IN.
   TIME MEASURED 14:35

2. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW 1¼ IN.
   TIME MEASURED 14:35

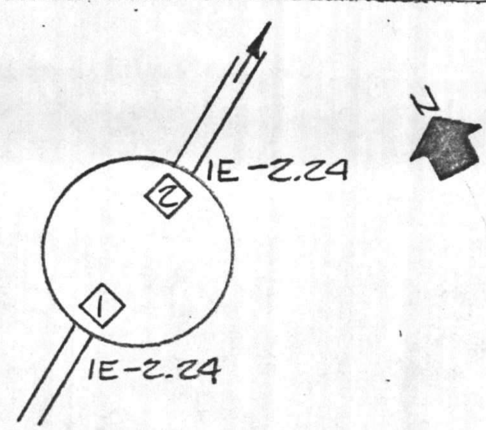


SANITARY SEWER MANHOLE NUMBER 1010

TOP OF MANHOLE ELEV. 10.54
DEPTH OF MANHOLE 12.78 FT.

1. PIPE SIZE 8 IN.
   TYPE OF MATERIAL VCP
   DEPTH OF FLOW ____ IN.
   TIME MEASURED 14:40

2. PIPE SIZE 12 IN.
   TYPE OF MATERIAL CIP
   DEPTH OF FLOW ____ IN.
   TIME MEASURED 14:40

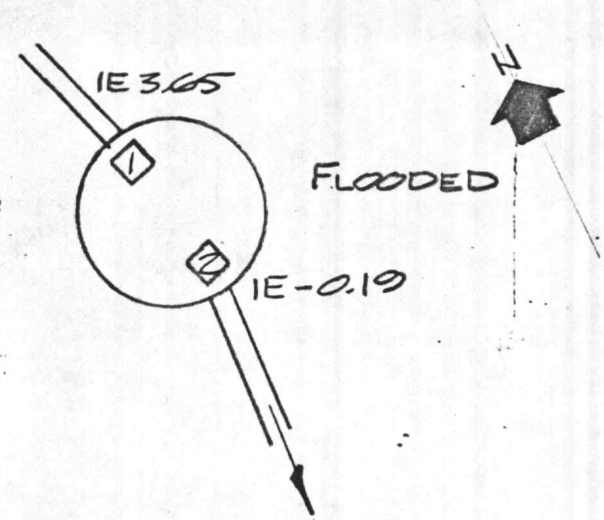


SANITARY SEWER MANHOLE NUMBER 677

TOP OF MANHOLE ELEV. 9.84
DEPTH OF MANHOLE 10.03 FT.

① PIPE SIZE 12 IN.
TYPE OF MATERIAL CIP
DEPTH OF FLOW — IN.
TIME MEASURED —

② PIPE SIZE 10 IN.
TYPE OF MATERIAL CIP
DEPTH OF FLOW — IN.
TIME MEASURED —

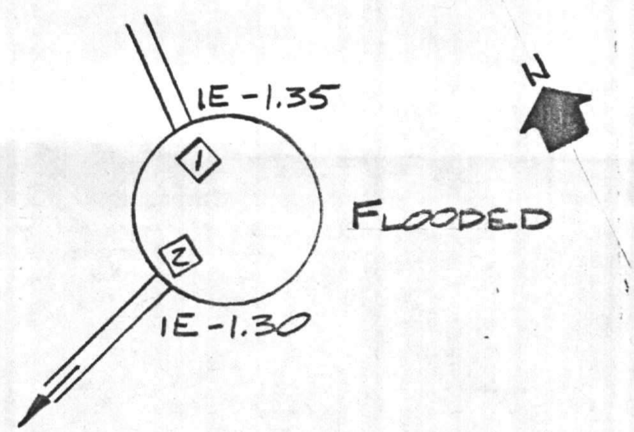


SANITARY SEWER MANHOLE NUMBER 678

TOP OF MANHOLE ELEV. 5.55
DEPTH OF MANHOLE 6.90 FT.

① PIPE SIZE 10 IN.
TYPE OF MATERIAL CIP
DEPTH OF FLOW — IN.
TIME MEASURED —

② PIPE SIZE 10 IN.
TYPE OF MATERIAL CIP
DEPTH OF FLOW — IN.
TIME MEASURED —



A-E CONTRACT NO. N62470-78-C-3675	J. E. SIRRINE COMPANY	PAGE 24 OF 24

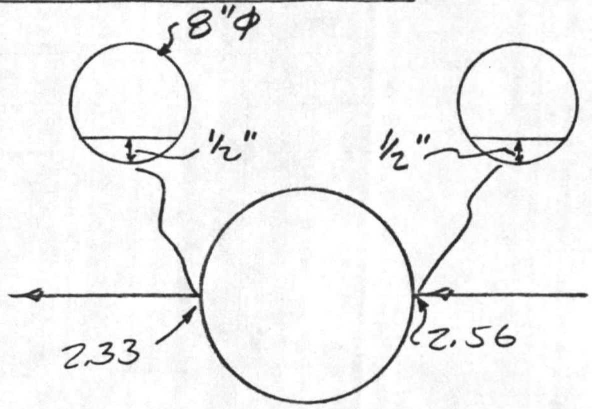
J. E. SIRRINE COMPANY

DESIGN SHEET

JOB AMTRAC AREA
JOB NO A-1086 DATE 12/20/78
STRUCTURE
COMPUTED BY TLD
LIVE LOAD PER SQUARE FOOT
WORKING STRESS

B. INFILTRATION RATE CALCULATIONS

S.S.M.H. #1009



$SLOPE = \left(\frac{2.56' - 2.33'}{4'}\right) = 0.0575 \qquad S^{1/2} = (0.0575)^{.5} = 0.2398$

$\frac{d}{D} = \frac{0.5}{8} = 0.06$ FROM CHART $\frac{WP_a}{WP_f} = 0.16 \qquad WP_a = WP_f(0.16) = 2\pi r(0.16) = 0.33 \text{ FT.}$

$= \frac{h}{6S}(3h^2 + 4S^2) = \frac{0.5}{6(3.85)}\left[3(0.5)^2 + 4(3.85)^2\right]$

$A_a = 1.2969 \text{ IN}^2$ OR 0.0090 FT^2

$R = \frac{X\text{-SECT}}{WP} = \frac{0.009}{0.33} = 0.0273 \qquad R^{2/3} = (0.0273)^{.667} = 0.0905$

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = \frac{1.486}{0.013}(0.0905)(0.2398) = 2.481 \text{ FT/SEC}$

$Q = VA_a = (2.481)(0.0090) = 0.0223 \text{ CFS} \times 449 \text{ gpm/CFS} = 10.02 \text{ gpm}$

SENCE THEIR WAS NO RAIN, ASSUME A FACTOR OF 1.35

10.02 gpm X 1.35 = 13.53 gpm

INFILTRATION RATE PER LENGTH OF PIPE = $\frac{13.53 \text{ gpm}}{605.0 \text{ FT}}$

= 0.0224 gpm / L.FT. OF PIPE

J. E. SIRRINE COMPANY

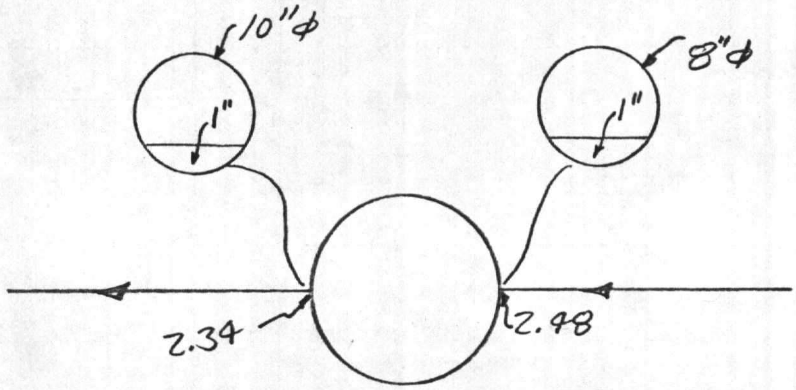
DESIGN SHEET

JOB: COURTHOUSE BAY JOB NO: A-1086 DATE: 12-19-78

STRUCTURE: ______ COMPUTED BY: TLD

LIVE LOAD PER SQUARE FOOT: ______ WORKING STRESS: ______

S.S.M.H. #428



1^{ST} USE SLOPE ACROSS MANHOLE

SLOPE = (2.48 − 2.34)/4' = 0.035 $S^{1/2} = (0.035)^{.5} = 0.1871$

$\frac{d}{D} = \frac{1''}{10''} = 0.10$ FROM CHART $\frac{WP_a}{WP_f} = 0.20$

$P_a = WP_f(0.20) = 2\pi(0.4167)(0.20) = 0.524$ FT

$A = \frac{h}{6S}(3h^2 + 4S^2) = \frac{1.0}{6(5.95)}\left[3(1)^2 + 4(5.95)^2\right] = 0.028\,[3 + 141.61]$

$A_a = 4.0491$ IN² OR 0.0281 FT²

$R = \frac{\text{X-SECT}}{\text{WP}} = \frac{0.0281}{0.524} = 0.0536$ $R^{2/3} = (0.0536)^{.667} = 0.1421$

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = \frac{1.486}{0.013}(0.1421)(0.1871) = 3.0391$ FT/SEC

Q = VA = (3.0391)(0.0281) = 0.0855 CFS × 449 gpm/CFS =

Q = 38.37 gpm OR 55,280.88 gpd

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
JOB NO A-1086 DATE 12-19-78
STRUCTURE
COMPUTED BY TLO
LIVE LOAD PER SQUARE FOOT
WORKING STRESS

INFILTRATION RATE

FLOW AT MANHOLE NUMBER 428 = 38.37 gpm
" FROM ENGINEERING BLDG #255 - 3.32 gpm
" " " " #250 - 3.04 gpm
32.01 gpm

SENCE THEIR WAS NO RAIN, ASSUME A FACTOR OF 1.35

32.01 gpm × 1.35 = 43.21 gpm

LENGTH OF S.S. PIPE, UP TO S.S.M.H. #428 = 2056.60 + ~~182.20~~ + ~~300.10~~ + 1172.50 + 252.5 + 912.20 + 427.90 = 4821.70 FT.

INFILTRATION RATE PER LENGTH OF PIPE = $\frac{43.21\ gpm}{4821.7\ FT}$

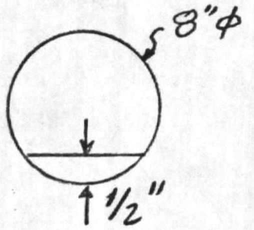
= 0.0090 gpm / L.FT. OF PIPE

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY JOB NO A-1086 DATE 12-19-78
STRUCTURE COMPUTED BY TCD
LIVE LOAD PER SQUARE FOOT WORKING STRESS

MINIMUM FLOW FROM ENGINEERING BARRACK



FROM M.H. 1001 TO 1000

SLOPE = 0.0063

$S^{1/2} = (0.0063)^{.5} = 0.0794$

$\frac{d}{D} = \frac{0.5}{8"} = 0.06$ FROM CHART $\frac{WP_a}{WP_f} = 0.16$

$WP_a = WP_f\,(0.16) = 2\pi r\,(0.16)$
$= 2(\pi)(0.333)(0.16) = 0.33\ FT$

$A = \frac{h}{6S}(3h^2 + 4S^2) = \frac{0.5}{6(3.85)}\left[3(0.5)^2 + 4(3.85)^2\right]$

$A_a = 1.2969\ IN^2$ OR $0.0090\ FT^2$

$R = \frac{X\text{-}SECT}{WP} = \frac{0.0090\ FT^2}{0.333\ FT} = 0.0273$ $R^{2/3} = (0.0273)^{.667} = 0.0905$

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = \frac{1.486}{0.013}(0.0905)(0.0794) = 0.82\ FT/SEC$

$Q = VA = (0.82)(0.0090) = 0.0074\ CFS \times 449\ gpm/CFS = 3.32\ gpm$
OR
4,781.58
gpd

FROM M.H. 1003 TO 431-A

SLOPE $= 0.0053$ $S^{1/2} = (0.0053)^{.5} = 0.0728$

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = \frac{1.486}{0.013}(0.0905)(0.0728) = 0.75\ FT/SEC$

$Q = VA = (0.75)(0.009) = 0.0068\ CFS \times 449\ gpm/CFS = 3.04\ gpm$ 4 OF 4
OR 4,382 gpd.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY | JOB NO A-1086 | DATE 10-4-78

STRUCTURE SEWER | COMPUTED BY TCD

LIVE LOAD PER SQUARE FOOT | WORKING STRESS

4. EXISTING SANITARY SEWER COLLECTOR SYSTEM CALCULATIONS

SANITARY SEWER PLANT

		MG/MO		MG/MO	MG/MO DIFF
JAN	1977 →	9.983	1978 →	12.010	2.027
FEB		7.927		11.174	3.247
MAR		9.545		13.031	3.486
APR.		9.182		12.596	3.414
MAY		9.328		13.662	4.334
JUNE		9.709		12.953	3.244
JULY		10.389		13.206	2.817
	AVG =	9.438	AVG =	12.662	AVG = 3.224

AVG. DAYS PER MO. = 30.29 DAYS

3,224,000 gpmo./30.29 DAYS = 106,438 gpd.

ASSUME AN AVERAGE OF 500 ENG. STUDENTS DURING THIS TIME.

106,438 gpd / 500 STUDENT = 212.88 gpcd

TO ADD SOME SAFETY FACTOR, USE 225 gpcd/NEW DORM.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE SEWER
LIVE LOAD PER SQUARE FOOT

EXISTING CALCULATED FLOW

JOB NO A-1086 DATE 10/19/78
COMPUTED BY TLD
WORKING STRESS

M.H. 497-C TO M.H. 1005

14 F.U. = 13 gpm

M.H. 1005 TO M.H. 497-B

13 gpm

M.H. 497-B TO M.H. 497-A

14 F.U. + 29 F.U. = 43 F.U. = 27 gpm

M.H. 1006 TO M.H. 497-A

88½ F.U. = 42 gpm

M.H. 497-A TO M.H. 497

43 F.U. + 88½ F.U. = 131.5 F.U. = 52 gpm

M.H. 497 TO M.H. 496

131.5 F.U. + 50 F.U. = 181.5 F.U. = 62 gpm

M.H. 496 TO M.H. 431-A

181.5 F.U. + 16 F.U. = 197.5 F.U. = 65 gpm

M.H. 670 TO M.H. 669

88½ F.U. = 42 gpm

M.H. 1008 TO M.H. 1007

88½ F.U. = 42 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE SEWER
LIVE LOAD PER SQUARE FOOT

EXISTING CALCULATED FLOW

JOB NO A-1086 DATE 10/19/78
COMPUTED BY TCD
WORKING STRESS

M.H. 1007 TO M.H. 669

88½ F.U. + 56½ F.U. = 145 F.U. = 55gpm

M.H. 669 TO M.H. 668

145 F.U. + 88½ F.U. = 233.5 F.U. = 72gpm

M.H. 668 TO M.H. 664

72gpm

M.H. 667 TO M.H. 666

56½ F.U. + 6. F.U. = 62½ F.U. = 33gpm

M.H. 666 TO M.H. 665

33gpm + LIFT STA.

M.H. 665 TO M.H. 664

33gpm + LIFT STA.

M.H. 664 TO M.H. 663

62½ F.U. + 233.5 F.U. = 296 F.U. = 88gpm + LIFT STA.

MH. 663 TO M.H. 438

88gpm + LIFT STA

M.H. 438 TO M.H. 431-A

296 F.U. + 62.5 F.U. = 358.5 F.U. = 97gpm + LIFT STA.

J. E. SIRRINE COMPANY

DESIGN SHEET

EXISTING CALCULATED FLOW

JOB COURTHOUSE BAY
STRUCTURE SEWER
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/19/78
COMPUTED BY TLD
WORKING STRESS

M.H. 1003 TO M.H. 431-A.

892 F.U. = 195 gpm

M.H. 431-A TO M.H. 431

35~~8.5~~ F.U. + 19~~7.5~~ F.U. + 892 F.U. = 195 gpm + LIFT STA.

IT SHOULD BE NOTED THAT THE PEAK DISCHARGE OCCURS AROUND 5:45 TO 7:30 O'CLOCK A.M., AT THIS TIME THE STUDENTS ARE IN THE BARRACKS OR MESS HALL.

M.H. 431 TO M.H. 1000

26~~.5~~ F.U. + 892 F.U. = 195 gpm + LIFT STA.

M.H. 1001 TO M.H. 1000

892 F.U. = 195 gpm + LIFT STA.

M.H. 1000 TO M.H. 429

892 F.U. + 892 F.U. = 1784 F.U. = 302 gpm + LIFT STA.

M.H. 429 TO M.H. 428

302 gpm + 98 gpm + LIFT STA

M.H. 428 TO M.H. 423

400 gpm + LIFT STA.

M.H. 423 TO M.H. 422

400 gpm + LIFT STA.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

LIVE LOAD PER SQUARE FOOT

EXISTING CALCULATED FLOW

JOB NO A-1086 DATE 10/19/78

COMPUTED BY TLD

WORKING STRESS

M.H. 422 TO M.H. 412

400 gpm + LIFT STA.

M.H. 425 TO M.H. 419

54 F.U. + 54 F.U. = 108 F.U. = 47 gpm

M.H. 419 TO M.H. 418

108 F.U. + 27 F.U. = 135 F.U. = 53 gpm

M.H. 418 TO M.H. 417

135 F.U. + 54 F.U. + 27 F.U. = 216 F.U. = 68 gpm

M.H. 417 TO M.H. 416

68 gpm

M.H. 416 TO M.H. 415

216 F.U. + 182 F.U. + 72 F.U. + ~~64~~ F.U. = 470 F.U. = 120 gpm

M.H. 415 TO M.H. 414

470 F.U. + 512.5 F.U + 512.5 F.U. = 1495 F.U. = 270 gpm

M.H. 414 TO M.H. 413

1495 F.U. + 50 F.U. + 512.5 F.U. = 2057.5 F.U. = 335 gpm

M.H. 413 TO M.H. 412

2057.5 F.U. + 512.5 F.U. = 2570 F.U. = 390 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9/28/78
COMPUTED BY TLD
WORKING STRESS

— MAXIMUM DESIGN FLOW THRU PIPE —

#412 TO #413:

$D = 10"$ $S = 0.0023$ $S^{1/2} = (0.0023)^{.5} = 0.048$

$A = 0.545$ $R^{2/3} = (0.208)^{.667} = 0.351$ $n = 0.013$

$Q = VA = \frac{1.486}{n} R^{2/3} S^{1/2} A$

$Q = \frac{1.486}{0.013} (0.351)(0.545)(0.048)$

$Q = (21.866)(0.048) = 1.050$ CFS $\times 449 = 471.45$ gpm

#413 TO #414:

$D = 10"$ $S = 0.0019$ $S^{1/2} = (0.0019)^{.5} = 0.044$

$Q = VA = 21.866\ S^{1/2} = (21.866)(0.044) = 0.962$ CFS OR 432.0 gpm

#414 TO #415:

$D = 10"$ $S = 0.0029$ $S^{1/2} = (0.0029)^{.5} = 0.054$

$Q = VA = 21.866\ S^{1/2} = (21.866)(0.054) = 1.178$ CFS OR 528.71 gpm

#415 TO #416:

$D = 10"$ $S = (0.0035)$ $S^{1/2} = (0.0035)^{.5} = 0.059$

$A = 0.545$ $R^{2/3} = (0.208)^{.667} = 0.351$ $n = 0.013$

$Q = VA = \frac{1.486}{0.013} (0.351)(0.545)\ S^{1/2}$

$Q = 21.866\ S^{1/2} = 21.866\ (0.059) = 1.29$ CFS OR 579 gpm

#416 TO #417:

$D = 8"$ $S = (.004)$ $S^{1/2} = (0.004)^{.5} = 0.063$

$Q = 12.088\ S^{1/2} = 12.088(0.063) = 0.765$ CFS OR 343.27 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9/28/78
COMPUTED BY TLD
WORKING STRESS

#417 TO 418:

$D = 8''$ $S^{1/2} = (0.031)^{.5} = 0.056$

$Q = 12.088\,S^{1/2} = 12.088(0.056) = 0.673$ CFS OR 302.19 gpm

#418 TO #419:

$D = 8''$ $S^{1/2} = (0.0036)^{.5} = 0.060$

$Q = 12.088\,S^{1/2} = 12.088(0.060) = 0.725$ CFS OR 325.65 gpm

#419 TO #425:

$D = 8''$ $S^{1/2} = (0.0032)^{.5} = 0.057$

$Q = 12.088\,S^{1/2} = 12.088(0.057) = 0.684$ CFS OR 307.03 gpm

#412 TO #422:

$D = 10''$ $S^{1/2} = (0.0024)^{.5} = 0.049$

$Q = 21.866\,S^{1/2} = 21.866(0.049) = 1.071$ CFS OR 480.97 gpm

#422 TO #423:

$D = 10''$ $S^{1/2} = (0.0028)^{.5} = 0.053$

$Q = 21.866\,S^{1/2} = 21.866(0.053) = 1.157$ CFS OR 519.11 gpm

#423 TO #428:

$D = 10''$ $S^{1/2} = (0.0028)^{.5} = 0.053$

$Q = 1.157$ CFS OR 519.11 gpm

I. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9-28-78
COMPUTED BY TCD
WORKING STRESS

#428 TO #429:

$D = 8''$ $S^{1/2} = (0.0036)^{.5} = 0.060$

$Q = 12.088\ S^{1/2} = 12.088\ (0.060) = 0.725$ CFS OR 325.65 gpm

#429 TO #1000:

$D = 8''$ $S^{1/2} = (0.0046)^{.5} = 0.068$

$Q = 12.088\ S^{1/2} = 12.088\ (0.068) = 0.820$ CFS OR 368.11 gpm

#1000 TO #431:

$D = 8''$ $S^{1/2} = (0.0027)^{.5} = 0.052$

$Q = 12.088\ S^{1/2} = 12.088\ (0.052) = 0.628$ CFS OR 282.02 gpm

#431 TO #A-431:

$D = 8''$ $S^{1/2} = (0.004)^{.5} = 0.063$

$Q = 12.088\ S^{1/2} = 12.088\ (0.063) = 0.765$ CFS OR 343.27 gpm

#431-A TO #438:

$D = 8''$ $S^{1/2} = (0.0021)^{.5} = 0.046$

$Q = 12.088\ S^{1/2} = 12.088\ (0.046) = 0.554$ CFS OR 248.72 gpm

#438 TO #663:

$D = 8''$ $S^{1/2} = (0.0145)^{.5} = 0.120$

$Q = 12.088\ S^{1/2} = 12.088\ (0.120) = 1.456$ CFS OR 653.56 gpm

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9-28-78
COMPUTED BY TLD
WORKING STRESS

#663 TO #664:

$D = 8''$ $S^{1/2} = (0.0065)^{.5} = 0.081$

$Q = 12.088\ S^{1/2} = 12.088(0.081) = 0.975$ CFS OR 437.58 gpm

#664 TO #665:

$D = 8''$ $S^{1/2} = (0.0228)^{.5} = 0.151$

$Q = 12.088\ S^{1/2} = 12.088(0.151) = 1.825$ CFS OR 819.53 gpm

#665 TO #666:

$D = 8''$ $S^{1/2} = (0.0119)^{.5} = 0.109$

$Q = 12.088\ S^{1/2} = 12.088(0.109) = 1.319$ CFS OR 592.07 gpm

#666 TO #667:

$D = 8''$ $S^{1/2} = (0.0045)^{.5} = 0.067$

$Q = 12.088\ S^{1/2} = 12.088(0.067) = 0.811$ CFS OR 364.09 gpm

#412 TO #672:

$D = 10''$ $S^{1/2} = (0.0005)^{.5} = 0.022$

$Q = 21.866\ S^{1/2} = 21.866(0.022) = 0.489$ CFS OR 219.53 gpm

#672 TO #673:

$D = 10''$ $S^{1/2} = (0.0066)^{.5} = 0.081$

$Q = 21.866\ S^{1/2} = 21.866(0.081) = 1.776$ CFS OR 797.61 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9-28-78
COMPUTED BY TLD
WORKING STRESS

#673 TO #674:

$D = 10''$ $S^{1/2} = (0.0212)^{.5} = 0.146$

$Q = 21.866\ S^{1/2} = 21.866(0.146) = 3.184$ CFS OR 1429.50 gpm

#1000 TO #1001:

$D = 8''$ $S^{1/2} = (0.0063)^{.5} = 0.079$

$Q = 12.088\ S^{1/2} = 12.088(0.079) = 0.959$ CFS OR 430.79 gpm

#431-A TO #1003:

$D = 8''$ $S^{1/2} = (0.0053)^{.5} = 0.0728$

$Q = 12.088\ S^{1/2} = 12.088(0.0728) = 0.880$ CFS OR 395.12 gpm

#1003 TO #1004:

$D = 8''$ $S^{1/2} = (0.0080)^{.5} = 0.089$

$Q = 12.088\ S^{1/2} = 12.088(0.089) = 1.081$ CFS OR 485.45 gpm

#431-A TO #496:

$D = 6''$ $S^{1/2} = (0.0108)^{.5} = 0.104$

$A = 0.196$ $R^{2/3} = (0.125)^{.667} = 0.250$ $n = 0.013$

$Q = VA = \frac{1.486}{0.013}(0.250)(0.196)\ S^{1/2}$

$Q = 5.601\ S^{1/2}$

$Q = 5.601(0.104) = 0.583$ CFS OR 261.55 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY   JOB NO A-1086   DATE 9/29/78

STRUCTURE   COMPUTED BY TLO

LIVE LOAD PER SQUARE FOOT   WORKING STRESS

#496 TO #497:

$D = 6''$ $S^{1/2} = (0.0161)^{.5} = 0.127$

$Q = 5.601(0.127) = 0.711$ CFS OR 319.10 gpm

#497 TO #497A:

$D = 8''$ $S^{1/2} = (0.009)^{.5} = 0.095$

$Q = 12.088\,S^{1/2} = 12.088(0.095) = 1.147$ CFS OR 514.90 gpm

#497-A TO #497B:

$D = 8''$ $S^{1/2} = (0.0144)^{.5} = 0.120$

$Q = 12.088\,S^{1/2} = 12.088(0.120) = 1.451$ CFS OR 651.30 gpm

#497B TO #1005:

$D = 8''$ $S^{1/2} = (0.0238)^{.5} = 0.154$

$Q = 12.088\,S^{1/2} = (12.088)(0.154) = 1.865$ CFS OR 837.32 gpm

#1005 TO #497C:

$D = 8''$ $S^{1/2} = (0.0146)^{.5} = 0.121$

$Q = 12.088\,S^{1/2} = 12.088(0.121) = 1.461$ CFS OR 655.81 gpm

#497A TO #1006:

$D = 6''$ $S^{1/2} = (0.0044)^{.5} = 0.066$

$Q = 5.601(0.066) = 0.372$ CFS OR 166.82 gpm.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9/29/78

COMPUTED BY TLD

WORKING STRESS

#664 TO #668:

$D = 8''$ $S^{1/2} = (0.0039)^{.5} = 0.062$

$Q = 12.088\ S^{1/2} = 12.088(0.062) = 0.755$ CFS OR 338.95 gpm

#668 TO #669:

$D = 8''$ $S^{1/2} = (0.0041)^{.5} = 0.064$

$Q = 12.088\ S^{1/2} = 12.088(0.064) = 0.774$ CFS OR 347.53 gpm

#669 TO #670:

$D = 8''$ $S^{1/2} = (0.0047)^{.5} = 0.069$

$Q = 12.088\ S^{1/2} = 12.088(0.069) = 0.829$ CFS OR 372.09 gpm

#669 TO #1007:

$D = 8''$ $S^{1/2} = (0.0084)^{.5} = 0.092$

$Q = 12.088\ S^{1/2} = 12.088(0.092) = 1.108$ CFS OR 497.44 gpm

#1007 TO #1008:

$D = 6''$ $S^{1/2} = (0.0085)^{.5} = 0.092$

$Q = 5.601\ S^{1/2} = 5.601(0.092) = 0.515$ OR 231.37 gpm

#1001 TO 1002:

$D = 8''$ $S^{1/2} = (0.0186)^{.5} = 0.136$

$Q = 12.088\ S^{1/2} = 12.088(0.136) = 1.649$ CFS OR 740.21 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

AMTRAC AREA
JOB NO A-1086 DATE 10/20/78
STRUCTURE
COMPUTED BY TLD
LIVE LOAD PER SQUARE FOOT
WORKING STRESS

— MAXIMUM DESIGN FLOW THRU PIPE —

#336 TO #365:

$D = 8''$ $S = 0.0034$ $S^{1/2} = (0.0034)^{.5} = 0.058$
$A = 0.349$ $R^{2/3} = (0.167)^{.667} = 0.303$ $n = 0.013$

$$Q = VA = \frac{1.486}{n} R^{2/3} S^{1/2} A$$

$$Q = \frac{1.486}{0.013}(0.303)(0.058)(0.349)$$

$Q = 0.701$ CFS $\times$ 449 = 315 gpm

#365 TO #364:

$D = 8''$ $S = 0.0036$ $S^{1/2} = (0.0036)^{.5} = 0.060$
$A = 0.349$ $R^{2/3} = 0.303$ $n = 0.013$

$$Q = \frac{1.486}{0.013}(0.303)(0.060)(0.349)$$

$Q = 0.725$ CFS $\times$ 449 = 326 gpm

#364 TO #1009:

$D = 8''$ $S = 0.0150$ $S^{1/2} = (0.0150)^{.5} = 0.122$
$A = 0.349$ $R^{2/3} = 0.303$ $n = 0.013$

$$Q = \frac{1.486}{0.013}(0.303)(0.122)(0.349)$$

$Q = 1.475$ CFS $\times$ 449 = 662 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB AMTRAC AREA
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/20/78
COMPUTED BY TLD
WORKING STRESS

— MAXIMUM DESIGN FLOW THRU PIPE —

#1009 TO #1010:

$D = 8''$ $S = 0.0124$ $S^{1/2} = (0.0124)^{.5} = 0.111$
$A = 0.349$ $R^{2/3} = 0.303$ $n = 0.013$

$$Q = \frac{1.486}{0.013}(0.303)(0.111)(0.349)$$

$Q = 1.342$ CFS $\times$ 449 = 602 gpm

#1010 TO LIFT STA.:

$D = 12''$ $S = (0.0069)$ $S^{1/2} = (0.0064)^{.5} = 0.080$
$A = 0.785$ $R^{2/3} = (0.250)^{.667} = 0.397$

$$Q = \frac{1.486}{0.013}(0.397)(0.080)(0.785)$$

$Q = 2.850$ CFS $\times$ 449 = 1,280 gpm

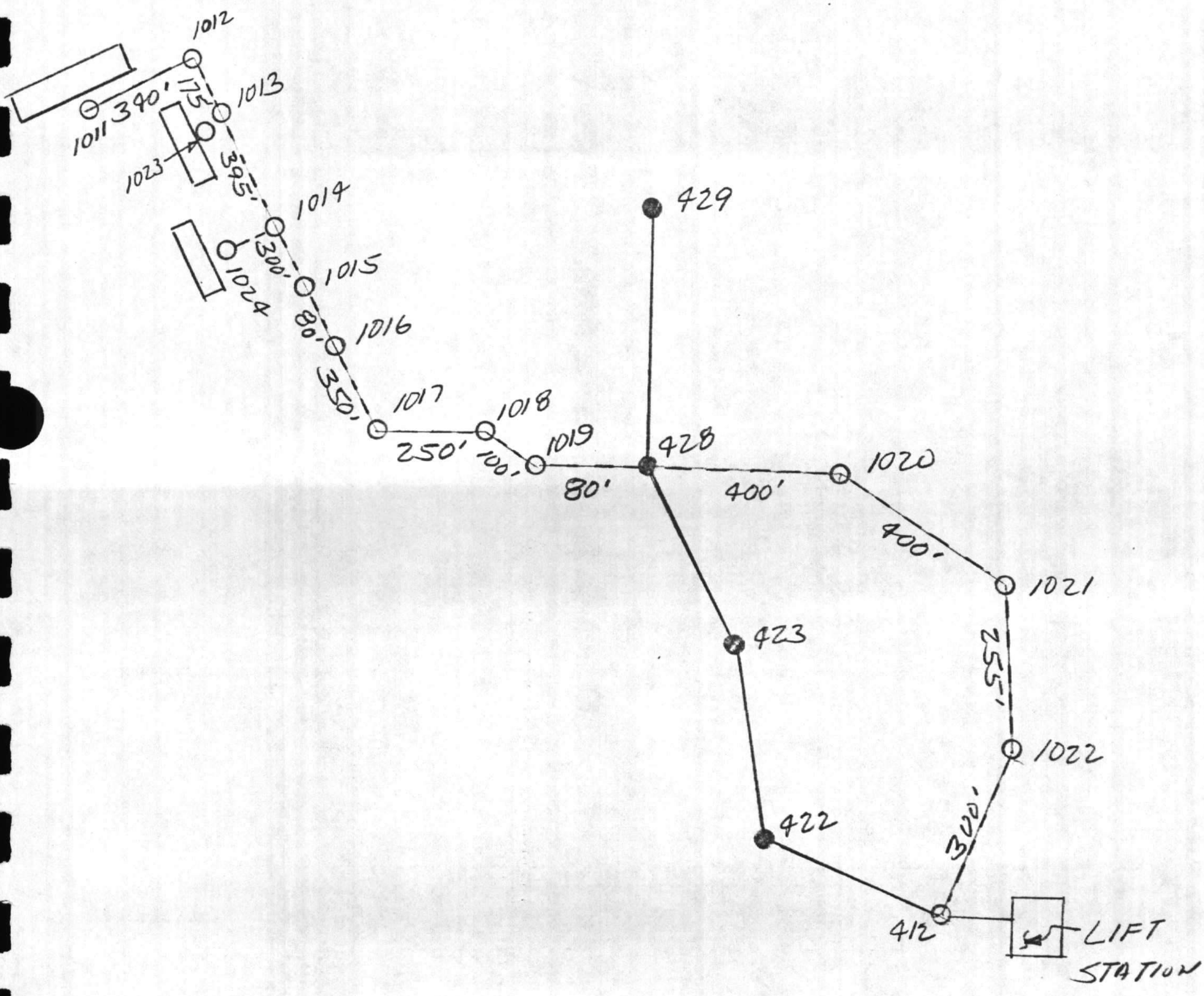
J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 2-5-79
COMPUTED BY TLO
WORKING STRESS

5. PROPOSED SANITARY SEWER COLLECTOR SYSTEM CALCULATIONS



DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 2-5-79
COMPUTED BY TLD
WORKING STRESS

INFILTRATION FOR NEW LINES: ASSUME 30,000 gpd/mile

$$30{,}000\,\frac{gpd}{MILE} \times \frac{MILE}{5280\,FT} \times \frac{DAY}{24\,HR} \times \frac{HR}{60\,MIN} = 0.00395\,gpm/FT$$

SOLVE FOR MIN. SLOPE TO MAINTAIN A 2.5 FPS. VELOCITY.

TRY D = 8" (n = 0.010)

$$V_f = \frac{1.486}{n} R^{2/3} S^{1/2} \qquad R = (D/4)$$

$$2.5 = \frac{1.486}{0.01}\left(\frac{0.67}{4}\right)^{.667} S^{1/2}$$

$$2.5 = 148.6\,(0.303)\,S^{1/2}$$

$$0.00308 = S$$

$$Q_f = V_f A = 2.5(0.349) = 0.873^{CFS} \text{ OR } 391.8\,gpm$$

TRY D = 10" (n = 0.010)

$$2.5 = \frac{1.486}{0.01}(0.208)^{.667} S^{1/2}$$

$$2.5 = 148.6\,(0.351)\,S^{1/2}$$

$$0.00230 = S$$

$$Q_f = V_f A = 2.5(0.545) = 1.3625\text{ CFS OR } 611.7\,gpm$$

TRY D = 8" (n = 0.013)

$$2.5 = \frac{1.486}{0.013}(0.167)^{.667} S^{1/2}$$

$$2.5 = 34.64\,S^{1/2}$$

$$.00521 = S$$

$$Q_f = V_f A = 2.5(0.349) = 0.872\text{ CFS OR } 391.75\,gpm$$

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 2-6-79

COMPUTED BY TLD

WORKING STRESS

TRY $D = 10''$ ($n = 0.013$)

$$2.5 = \frac{1.486}{0.013}(0.208)^{.667} S^{1/2}$$

$$2.5 = 40.107\ S^{1/2}$$

$$0.0039 = S$$

$Q_f = V_f A = 2.5(0.545) = 1.36$ CFS OR 612 gpm

GIVEN: $S = 0.39\%$ 8" ϕ PVC $Q = 182$ gpm $n = 0.01$

$$V_f = \frac{1.486}{n} R^{2/3} S^{1/2}$$

$$V_f = \frac{1.486}{0.01}(0.167)^{.667}(0.0039)^{.5} = 148.6(0.303)(0.062)$$

$V_f = 2.812$ FPS $Q_f = V_f A_f = (2.812)(0.349) = 0.981$ CFS OR 440.6 gpm

$\frac{Q_a}{Q_f} = \frac{182}{440} = 0.41$ FROM CHART $\frac{V_a}{V_f} = 0.95$ $V_a = 0.95(2.812) = 2.67$ FPS

GIVEN: $S = 0.30\%$ 10" ϕ PVC $Q = 291.9$ gpm $n = 0.01$

$$V_f = \frac{1.486}{n} R^{2/3} S^{1/2}$$

$$V_f = \frac{1.486}{0.01}(0.208)^{.667}(0.003)^{.5} = 148.6(0.351)(0.055)$$

$V_f = 2.857$ FPS $Q_f = V_f A_f = (2.857)(0.545) = 1.557$ CFS OR 699 gpm

$\frac{Q_a}{Q_f} = \frac{292}{699} = 0.42$ FROM CHART $\frac{V_a}{V_f} = 0.96$ $V_a = (0.96)(2.857) = 2.74$ FPS

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY JOB NO A-1086 DATE 2-12-79

STRUCTURE COMPUTED BY TLD

LIVE LOAD PER SQUARE FOOT WORKING STRESS

GIVEN: S = 0.30% 10" ϕ PVC Q = 380 gpm

$\frac{Q_a}{Q_f} = \frac{380}{699} = 0.54$ FROM CHART $\frac{V_a}{V_f} = 1.02$

$V_a = (1.02)(2.857) = 2.91$ FPS

GIVEN: S = 0.23% 10" ϕ PVC Q = 380 gpm n = 0.01

$V_f = \frac{1.486}{n} R^{2/3} S^{1/2}$

$V_f = \frac{1.486}{0.01}(0.208)^{.667}(0.0023)^{.5} = 148.6(0.351)(0.048)$

$V_f = 2.501$ $Q_f = V_f A_f = (2.501)(0.545) = 1.363$ CFS OR 612 gpm

$\frac{Q_a}{Q_f} = \frac{380}{612} = 0.62$ FROM CHART $\frac{V_a}{V_f} = 1.05$

$V_a = (1.05)(2.501) = 2.63$ CFS

GIVEN: S = 0.52% 8" ϕ PVC Q = 180 gpm n = 0.01

$V_f = \frac{1.486}{0.01}(0.167)^{.667}(0.0052)^{.5} = 148.6(0.303)(0.072) = 3.25$ FPS

$Q_f = V_f A_f = (3.25)(0.349) = 1.134$ CFS OR 509 gpm

$\frac{Q_a}{Q_f} = \frac{180}{509} = 0.35$ FROM CHART $\frac{V_a}{V_f} = 0.90$

$V_a = (0.90)(3.25) = 2.93$ FPS

J. E. SIRRINE COMPANY

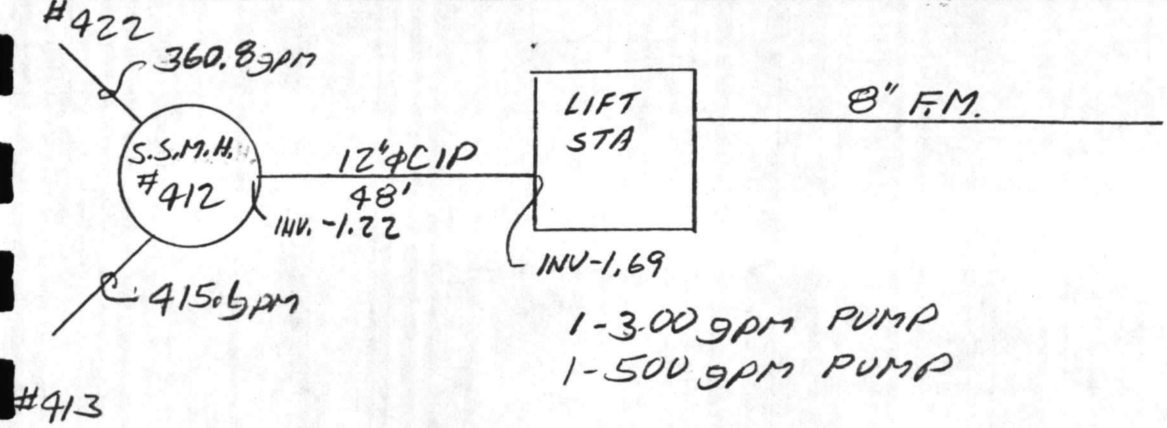
DESIGN SHEET

JOB COURTHOUSE BAY | JOB NO A-1086 | DATE 12/27/78

STRUCTURE | COMPUTED BY TCD

LIVE LOAD PER SQUARE FOOT | WORKING STRESS

6. EXISTING SANITARY SEWER LIFT STATION CALCULATIONS



FIND MAX FLOW OF 12" φ CIP

$Q = VA = \frac{1.486}{n} R^{2/3} S^{1/2} \frac{\pi D^2}{4}$ $S = \frac{0.47'}{48'} = 0.0098$

$S^{1/2} = (0.0098)^{1/2} = 0.099$

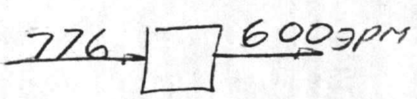
$R^{2/3} = (0.25)^{.667} = 0.397$ $A = 0.785'$

$Q = \underbrace{\frac{1.486}{0.013}(0.397)(0.099)}_{V_f =}(0.785) = 3.53$ CFS OR 1583.5 gpm

$\frac{Q_a}{Q_f} = \frac{415.1 + 360.8}{1583.5} = \frac{775.9}{1583.5} = 0.49$ FROM CHART $\frac{V_a}{V_f} = 0.98$

$V_a = 4.49(0.98) = 4.40$ FPS

ASSUME BOTH PUMPS ARE ON AND PEAK DISCHARGE OCCURS.



DIFF 776 - 600 = 176 REMAIN IN WET WELL

TIME TO TAKE WET WELL TO FILL UP, UNDER THESE CONDITIONS

$6,600 \text{ gal} / 176 \text{ gpm} = 37.50$ MIN.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE RAY

JOB NO A-1086 DATE 10/29/78

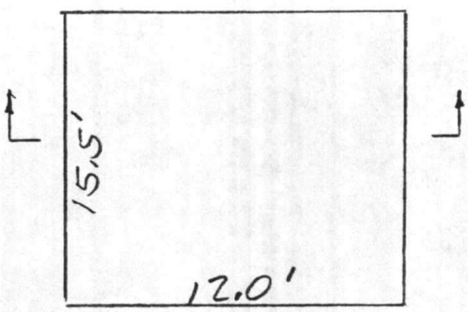
STRUCTURE

COMPUTED BY TLD

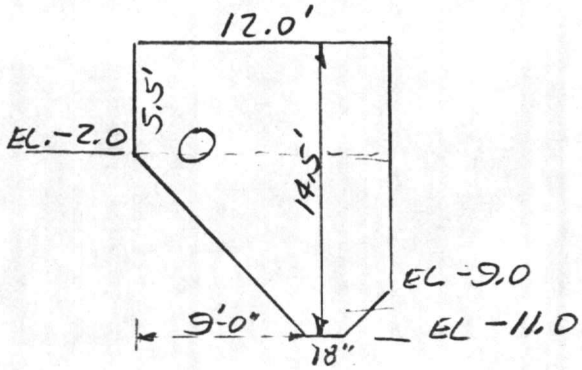
LIVE LOAD PER SQUARE FOOT

WORKING STRESS

VOLUME OF PIT AT SANITARY SEWER LIFT STATION



PLAN



SECTION

WET WELL

$$VOL. = \tfrac{1}{2}(9)(7)(15.5) + (1.5)(7)(15.5) + 10(1.5)(15.5)$$

$$= 488.25 + 162.75 + 232.50$$

$$= 883.50\ FT^3$$

$$1\ FT^3 = 7.48\ gal$$

$$\therefore\ 883.5\ FT^3 \times 7.48\ gal/FT^3 = 6{,}608.58\ gal$$

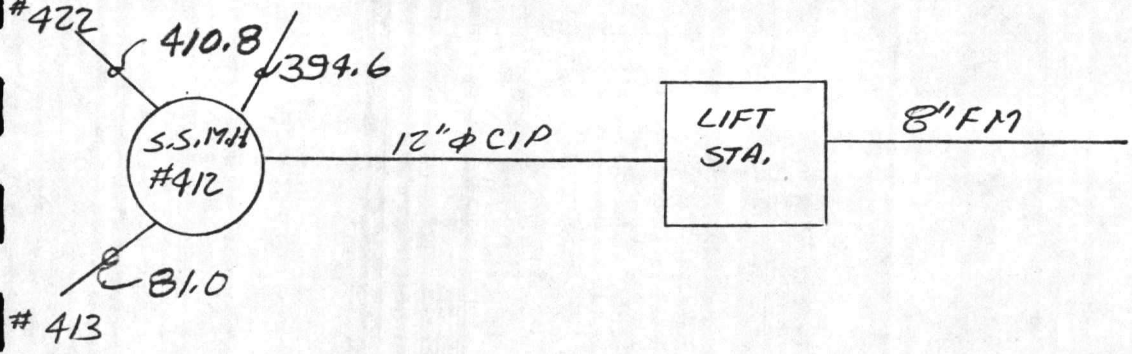
J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 12/27/78
COMPUTED BY TLD
WORKING STRESS

CONDITION BY F.Y. - 1986.



$Q_2 = 410.8 + 394.6 + 81.0 = 886.4$

ASSUME BOTH PUMPS ARE ON AND PEAK DISCHARGE OCCURS

886.4 → 600   DIFF. = 886 - 600 = 286 gpm RETAIN IN WET WELL

TIME TO TAKE WET WELL TO FILL UP, UNDER THESE CONDITIONS

6,600 gal / 286 gpm = 23 MIN.

RECOMMENDATION: TAKE OUT THE 300 gpm & 500 gpm PUMPS AND REPLACE THEM WITH TWO 700 gpm PUMPS.

J. E. SIRRINE COMPANY

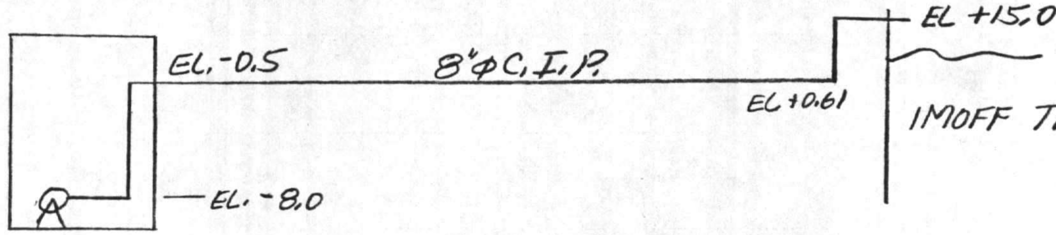
DESIGN SHEET

JOB COURTHOUSE BAY | JOB NO A-1086 | DATE 12/27/78

STRUCTURE | COMPUTED BY TLO

LIVE LOAD PER SQUARE FOOT | WORKING STRESS

SANITARY SEWER LIFT STATION AT COURTHOUSE BAY



TOTAL LENGTH OF PIPE	1000 FT + 100 FT (EXPANSION)	=	1100 FT
1- 6"x4" REDUCER	1 x 6'	=	6 FT
1- 6" CHECK VALUE	1 x 40'	=	40 FT
1- 6" GATE VALUE	1 x 20'	=	20 FT
1- 8" GATE VALUE	1 x 26'	=	26 FT
3- 45° BEND 8" PIPE	3 x 10'	=	30 FT.
1- 8"x6" REDUCER	1 x 10'	=	10 FT
2-90° BEND 6" PIPE	2 x 11'	=	22 FT
4-90° BEND 8" PIPE	4 x 14'	=	56 FT
			1310 FT.

PUMPING HEAD FOR 600 gPM

STATIC HEAD = 8 + 15 = 23

PIPE FRICTION = 1.16'/100' x 1310 = 15.2

23 + 15.2 = 38.20 + (38.20 x 10%) = 38.2 + 3.8 = 42.0 FT-HD.

PUMPING HEAD FOR 700 gPM

STATIC HEAD = 8 + 15 = 23

PIPE FRICTION = 1.54'/100' x 1310 = 20.17

23 + 20.17 = 43.17 + (43.17 x 10%) = 43.17 + 4.32 = 47.49 FT-HD

PUMPING HEAD FOR 900 gPM

STATIC HEAD = 8 + 15 = 23'

PIPE FRICTION = 2.46'/100' x 1310 = 32.23

23 + 32.23 = 55.23 + (55.23 x 10%) = 55.23 + 5.52 = 60.75 FT-HD

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 12/27/78
COMPUTED BY TLD
WORKING STRESS

SANITARY SEWER LIFT STATION AT COURTHOUSE BAY

PUMPING HEAD FOR 1250 gpm

STATIC HEAD = 8 + 15 = 23

PIPE FRICTION = 4.52'/100' × 1310' = 59.15

23 + 59.15 = 82.15 + (82.15 × 10%) = 82.15 + 8.21 = 90.36 FT-HD

600 gpm – APPROXIMATE MAXIMUM PUMPING DISCHARGE OF EXISTING PUMPS

700 gpm – PUMPING RATE OF PROPOSED PUMP

900 gpm – WHAT THE LIFT STATION WILL SEE FOR F.Y. 1986

1250 gpm – HYDRAULIC DESIGN OF PROPOSED WASTEWATER TREATMENT PLANT.

J. E. SIRRINE COMPANY

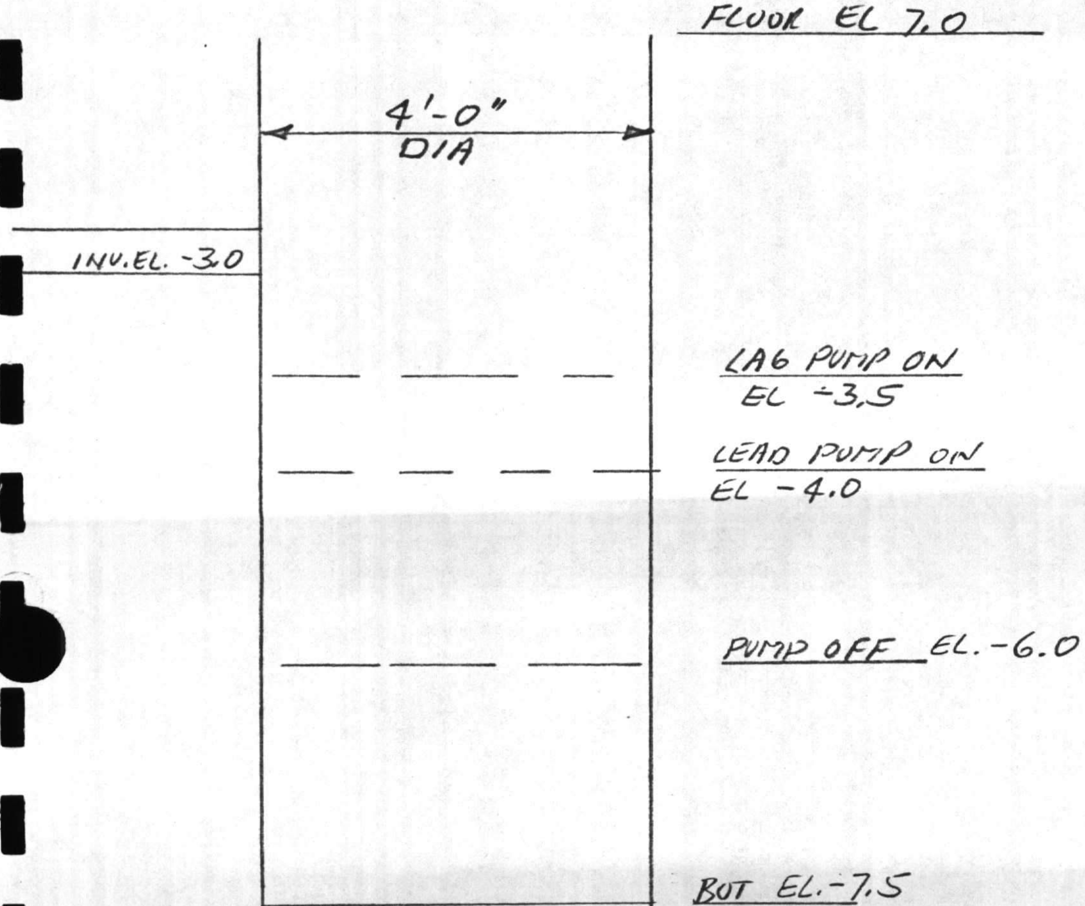
DESIGN SHEET

JOB COURTHOUSE BAY | JOB NO A-1086 | DATE 10/20/78

STRUCTURE | COMPUTED BY TLD

LIVE LOAD PER SQUARE FOOT | WORKING STRESS

7. CALCULATION FOR THE RECOMMENDATION TO THE EXISTING SANITARY SEWER LIFT STATION



VOL. BEFORE LEAD PUMP COMES ON $= 2 \times \pi(2)^2 = 25.13\ FT^3$

$1\ FT^3 = 7.48\ gal \quad \therefore\ 25.13\ FT^3 \times \frac{7.48\ gal}{FT^3} = 187.99\ gal$

MP RATED AT 80' HEAD @ 275 gpm & WITH 27.8 gpm INFICTRATION

$\frac{188}{275-27.8} = 0.76 \times 60\ SEC = \boxed{46\ SEC}$

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE AMTRAC AREA
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 12/29/78
COMPUTED BY TCD
WORKING STRESS

ADDITIONAL STORAGE FOR SANITARY SEWER LIFT STATION IN AMTRAC AREA.
(SEE ATTACHED SHEETS)

(INSIDE DIMENSIONS)
VOL. OF STORAGE = 3' × 10' × 8' = 240 FT^3
VOL. OF MANHOLE = 25 FT^3
265 FT^3

1 FT^3 = 7.48 gal.

265 FT^3 × 7.48 gal/FT^3 = 1982.20 GALLONS

$\frac{1982 \text{ GALLONS}}{(275 - 27.8)}$ = 8.02 MIN. FOR EXISTING 275 gpm PUMP TO PUMP STORAGE DOWN TO CUT OFF LEVEL.

$\frac{1982 \text{ GALLONS}}{27.8 \text{ gpm}}$ = 71.29 MIN. FOR INFILTRATIONS ALONE TO FILL LIFT STATION UP.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

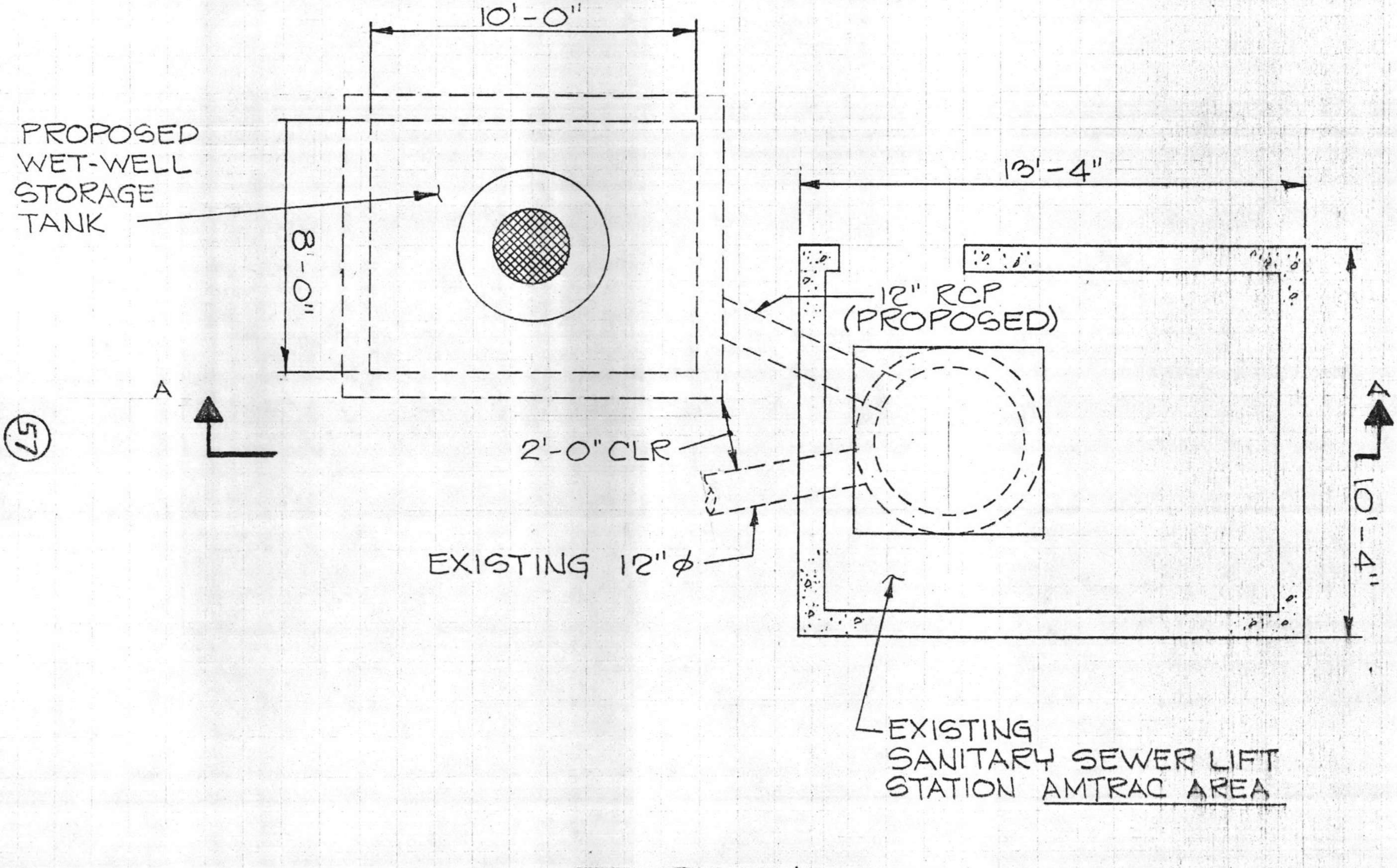
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 12/28/78

COMPUTED BY AHG

WORKING STRESS

57



PLAN

3 of 4

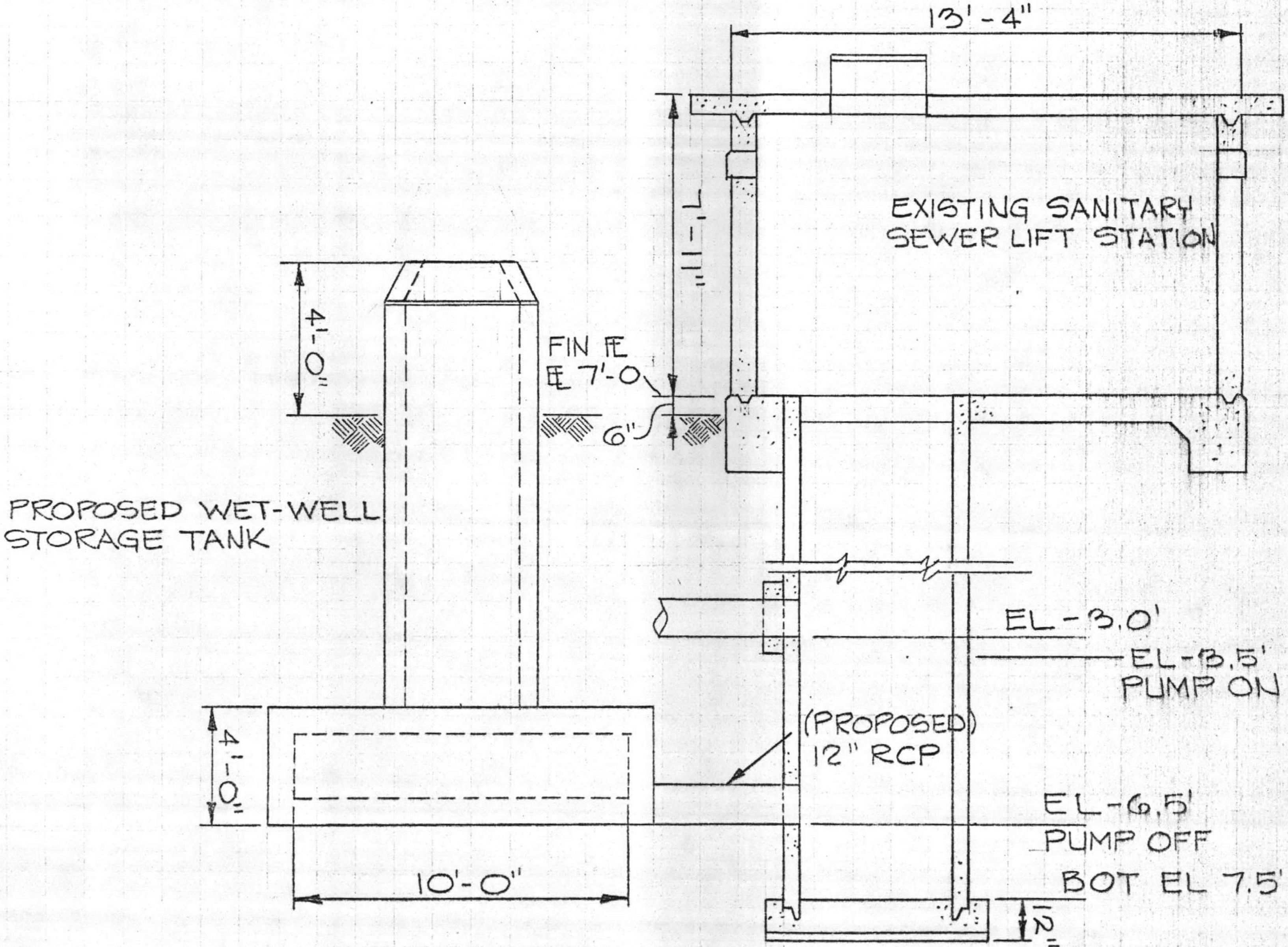
DESIGN SHEET

R. E. SIRRINE COMPANY

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 12/28/78
COMPUTED BY AHG
WORKING STRESS

58



SECTION A-A

4 OF 4

NOV 75-JES 22

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY — JOB NO A-1086 — DATE 10/5/78

STRUCTURE H_2O — COMPUTED BY TLD

LIVE LOAD PER SQUARE FOOT — WORKING STRESS

8. EXISTING WATER DEMAND CALCULATIONS

EXISTING FLOWS BEFORE ENGINEERING BARRACKS WERE ADDED

AMTRAC	664 X 150 gpd	=	99,600
ENGINEERING	500 X 50 gpd	=	25,000
OFFICERS	30 X 150 gpd	=	4,500
RESIDENT	25 X 100 gpd	=	2,500
OFF BASE	665 X 50 gpd	=	33,250
POWER PLANT		=	6,000
MOTOR VEHICLES	40 gal/car X 300	=	12,000
LAWN SPRINKLING	10,000 gal/AC X 3 AC	=	30,000
RESTAURANT	4.0 gal/meal X 3 meals X 700	=	8,400
	4.0 gal/meal X 1 " X 800	=	3,200
	AVG. DAILY DEMAND	=	224,450 gpd

1977

JAN	10.883 MGD/MO.
FEB	9.297
MAR.	9.594
APR	9.414
MAY	10.473
JUNE	10.480
JULY	10.389

AVG = 10.076

10,076,000 gal/30.29 DAYS = 332,651 gal - 13,680 gal FILTER

ACTURAL AVG. DAILY DEMAND = 318,897 gpd

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/5/78
COMPUTED BY TLD
WORKING STRESS

EXISTING FLOWS BEFORE ENGINEERING BARRACKS WERE ADDED

MAXIMUM 24-HOUR DEMAND

AMTRAC	99,600 X 2.25	=	224,100
ENGINEERING	25,000 X 2.25	=	56,250
OFFICERS	4,500 X 2.25	=	10,125
RESIDENT	2,500 X 2.25	=	5,625
OFF BASE	33,250 X 2.25	=	74,815
POWER PLANT		=	6,000
MOTOR VEHICLES	50 gal/CAR X 300	=	15,000
LAWN SPRINKLING	14,000 gal/AC X 3 AC	=	42,000
RESTAURANT		=	11,600
			445,515 gpd

(224,450 + 445,515)/2 = 334,982.5 gpd

CALCULATED AVERAGE / DAILY DEMAND = 334,982 gpd.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/5/78
COMPUTED BY TLD
WORKING STRESS

EXISTING CONDITIONS WHEN AMTRAC PEOPLE ARE ON BASE.

AMTRAC	664	x 150 gpd	=	99,600
ENGINEERING	500	x 225 gpd	=	112,500
OFFICERS	30	x 150 gpd	=	4,500
RESIDENTS	25	x 100 gpd	=	2,500
OFF BASE	665	x 50 gpd	=	33,250
POWER PLANT			=	6,000
MOTOR VEHICLES	40 gal/CAR x 500		=	20,000
LAWN SPRINKLING	10,000 gal/AC x 3 AC		=	30,000
RESTAURANTS	4.0 gal/MEAL x 3 MEALS x 1200		=	14,400
	4.0 gal/MEAL x 1 MEAL x 300		=	1,200

AVG. DAILY DEMAND = 323,950 gpd

1978

JAN	12.010 MGD/MO.
FEB	11.396
MAR.	12.344
APR.	11.764
MAY.	12.484
JUNE.	12.208
JULY	12.376
AVG	12.083

12,083,000 gal/30.29 DAYS = 398,910 gal − 13,680 gal (FILTERS)
= 385,230 gal PER DAY
(ACTURAL AVG. DAILY DEMAND.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/5/78
COMPUTED BY TLD
WORKING STRESS

EXISTING CONDITIONS WHEN AMTRAC PEOPLE ARE ON BASE

MAXIMUM 24-HOUR DEMAND

AMTRAC	99,600	x 2.25	=	224,100
ENGINEERING	112,500	x 2.25	=	253,125
OFFICERS	4,500	x 2.25	=	10,125
RESIDENT	2,500	x 2.25	=	5,625
OFF BASE	33,250	x 2.25	=	74,815
POWER PLANT			=	6,000
MOTOR VEHICLES	50 gal/car	x 500	=	25,000
LAWN SPRINKLING	14,000 gal/AC	x 3 AC	=	42,000
RESTAURANT			=	15,600
				656,390 gpd

THEY HAVE HAD A DAYS WHEN THE DEMAND EXCEEDED 600,000 gpd.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT
JOB NO A-1086 DATE 11/7/78
COMPUTED BY TLD
WORKING STRESS

CALCULATIONS BASED ON EXISTING CONDITIONS

(a) SOURCE OF SUPPLY: THE SUPPLY SHALL MEET THE MAXIMUM DAILY CONSUMPTION.

SUPPLY SOURCE: WELL #43 → 175 gpm
(DESIGNED)
#99 → 190 gpm
#220 → 150 gpm
#221 → 300 gpm
815 gpm

MAXIMUM DAILY CONSUMPTION = 656,390 gpd

656,390 gpd / 1440 = 455.8 gpm

AT PRESENT THE WELLS ARE DESIGNED TO SUPPLY 815 gpm OF RAW WATER TO THE TREATMENT PLANT. THIS IS GREATER THAN THE 456 gpm NEEDED FOR THE MAX. DAILY CONSUMPTION, THEREFORE THE SUPPLY IS O.K.

(b) TREATMENT PLANT: THE TREATMENT PLANT SHALL BE DESIGNED TO MEET THE MAXIMUM DAILY DEMAND. = 656,390 gpd. AT PRESENT IT CAN ONLY PRODUCE 525,000 gpd.

(c) TRANSMISSION MAINS: (LINES FROM WELLS TO PLANT)
(P.P. 5-9-63 MAX. VEL. = 15 FPS)
THESE LINES MUST BE ABLE TO HANDLE MAX. DAILY DEMAND.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 11/7/78
COMPUTED BY TCD
WORKING STRESS

CALCULATIONS BASED ON EXISTING CONDITIONS

(d) DISTRIBUTION SYSTEM (MUST MEET THE FOLLOWING)

(1) PEAK TRANSIENT DOMESTIC

$324{,}000 \times \frac{5.0}{1440} = 1125 \text{ gpm}$

(2) MAXIMUM FIRE DEMAND + 50% OF AVG. DOMESTIC DEMAND.

MAXIMUM FIRE DEMAND = 1750 gpm FOR TWO HOURS
= $1750 \times 120 = 210{,}000$ gal

$210{,}000 \text{ gpd} + \frac{324{,}000}{2} = 372{,}000 \text{ gpd}$

LINE SHALL BE CAPABLE OF HANDLING

$1750 \text{ gpm} + 162{,}000 \text{ gpd} \times \frac{1}{1440} = 1862.50 \text{ gpm}$

8" ϕ C.I. VEL = 11.8 FPS LOST = 9.1'/100'
10" ϕ C.I. VEL = 7.6 FPS LOST = 3.18'/100'

(3) REPLENISHMENT OF NORMAL STORAGE VOLUME WITHIN 48 HOURS OF NORMAL CONSUMPTION AFTER A FIRE.

$\frac{210{,}000}{2} \text{ gpd} + 324{,}000 = 429{,}000 \text{ gpd}$

AT PRESENT PLANT IS DESIGNED TO HANDLE: 525,000

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 11/7/78
COMPUTED BY TCD
WORKING STRESS

CALCULATIONS BASED ON EXISTING CONDITIONS

SQ. TANK THAT HOLDS WELL H_2O, BEFORE IT IS TREATED.

(e) EQUALIZING RESERVOIRS: THESE RESERVOIRS SHALL HAVE A MINIMUM CAPACITY EQUAL TO ONE DAY'S AVERAGE CONSUMPTION

AVG. DAILY CONSUMPTION = 324,000 gpd

EQUALIZING RESERVOIR ≈ 125,000 gpd

(f) DISTRIBUTION RESERVOIRS: (MUST MEET THE FOLLOWING)

(1) TOMS

(2) MIN. STORAGE FOR FIRE PROTECTION PLUS 50% OF AVG DAILY CONSUMPTION

$210{,}000 + \frac{324{,}000}{2} = 372{,}000$ gpd

STORAGE CAPACITY = 450,000 gpd.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/5/78
COMPUTED BY TCO
WORKING STRESS

9. PROPOSED WATER DEMAND CALCULATIONS
CALCULATIONS BASED ON MAXIMUM POPULATION
FOR YEAR 1986

AMTRAC	882 × 225 gpd	= 198,450
ENGINEERING	654 × 225 gpd	= 147,150
OFFICERS	30 × 150 gpd	= 4,500
RESIDENT	25 × 100 gpd	= 2,500
OFF BASE	615 × 50 gpd	= 30,750
POWER PLANT		= 6,000
MOTOR VEHICLES	40 gal/car × 600	= 24,000
LAWN SPRINKLING	10,000 gal/AC × 3AC	= 30,000
RESTAURANT	4 gal/MEAL × 3 MEALS × 1500	= 18,000
	" × 1 " × 415	= 1,660

AVG. DAILY DEMAND = 462,950 gpd

MAXIMUM 24-HOUR DEMAND

AMTRAC	198,450 × 2.25	= 446,515
ENGINEERING	147,150 × 2.25	= 331,090
OFFICERS	4,500 × 2.25	= 10,125
RESIDENTS	2,500 × 2.25	= 5,625
OFF BASE	30,750 × 2.25	= 69,190
POWER PLANT		= 6,000
MOTOR VEHICLES	50 gal/car × 600	= 30,000
LAWN SPRINKLING	14,000 gal/AC × 3 AC	= 42,000
RESTAURANTS		= 19,660

960,205 gpd

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 11/7/78
COMPUTED BY TLD
WORKING STRESS

CALCULATIONS BASED ON YEAR 1986

(a) SOURCE OF SUPPLY:

MAX DAILY CONSUMPTION = 960,205 gpd OR 670 gpm

SUPPLY FROM WELLS = 815 gpm × 1440 = 1,173,600 gpd

(b) TREATMENT PLANT:

DESIGNED FOR MAX DAILY DEMAND = 960,205 gpd

(c) TRANSMISSION MAINS:

THE LINES CAN HANDLE THE MAXIMUM DAILY DEMAND OF 670 gpm

(d) DISTRIBUTION SYSTEM: (MUST MEET THE FOLLOWING)

(1) PEAK TRANSIENT DOMESTIC

$$462,950 \times \frac{5.0}{1440} = 1607.5 \text{ gpm.}$$

8" LINE = VELOCITY OF 10.2 FPS LOSS = 7.12'/100'

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE H_2O
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 11/7/78
COMPUTED BY TLD
WORKING STRESS

CALCULATIONS BASED ON YEAR 1986

(2) MAX. FIRE DEMAND + 50% AVG. DOMESTIC DEMAND

$$1750 \text{ gpm} + \frac{462{,}950 \text{ gpd}}{2 \times 1440} = 1910.75 \text{ gpm}$$

8" ϕ C.I. V = 12.2 FPS LOSS = 9.85'/100'
10" ϕ C.I. V = 7.8 LOSS = 3.32'/100'

(3) REPLENISHMENT OF STORAGE WITHIN 48 HOURS AFTER FIRE.

$$\frac{210{,}000}{2} \text{ gpd} + 462{,}950 \text{ gpd} = 567{,}950 \text{ gpd}$$

PLANT WILL BE DESIGNED TO HANDLE 960,205 gpd.

(e) EQUALIZING RESERVOIRS:

AVG. DAILY CONSUMPTION = 462,950 gpd

EQUALIZING RESERVOIRS ≈ 25,000 gpd.

ACCORDING TO THIS WE NEED AN ADDITION OF 437,950 GALLONS.

(f) DISTRIBUTION RESERVOIRS; (MUST MEET THE FOLLOWING)

MIN. STORAGE (FIRE PROTECTION + 50% AVG. DAILY CONSUMPTION)

$$210{,}000 + \frac{462{,}950}{2} = 441{,}475 \text{ gpd}$$

STORAGE CAPACITY 68 = 450,000 gpd.

10. EXISTING RAW WATER SUPPLY CALCULATIONS

NOV 75-JES 22

F. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

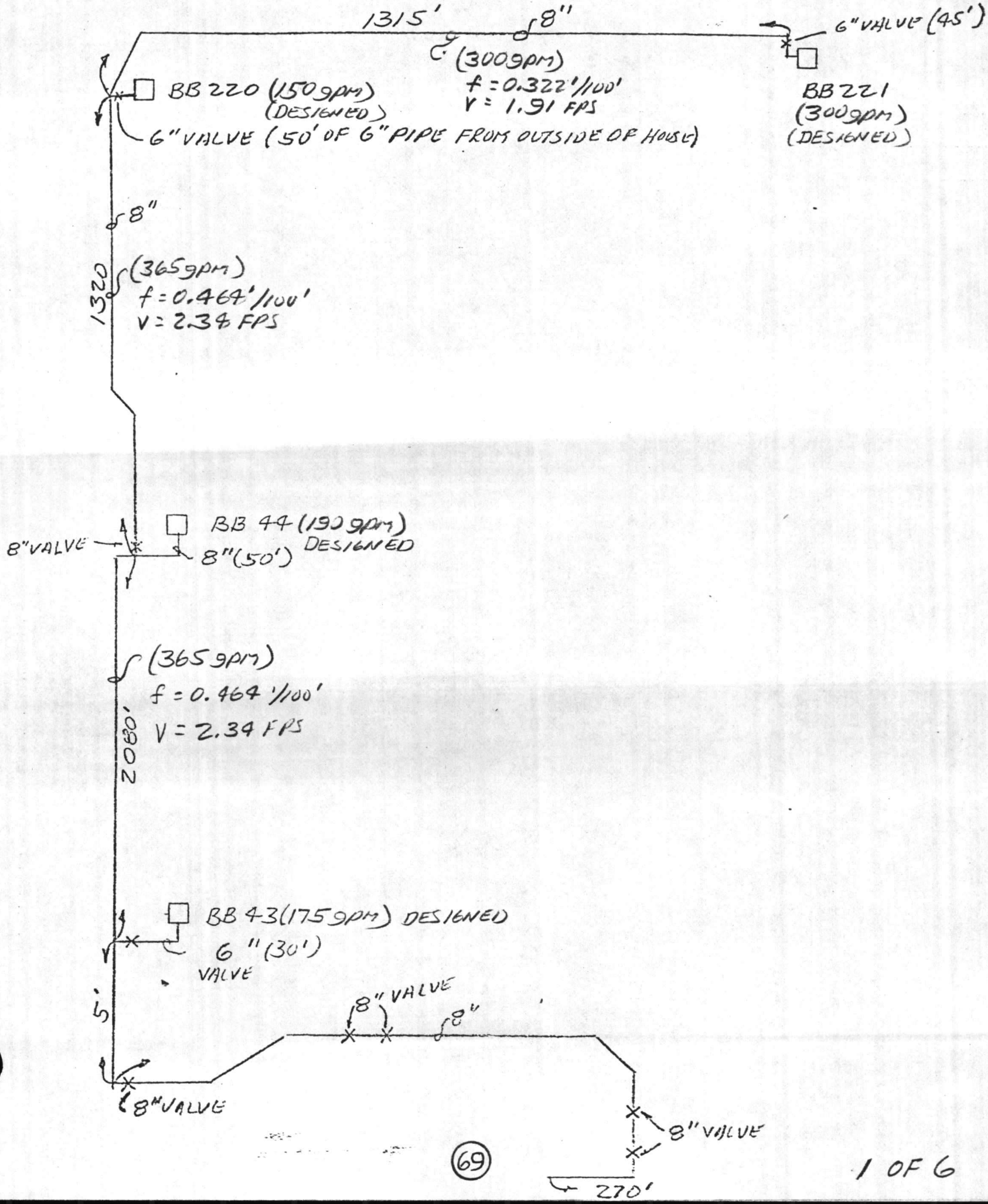
LIVE LOAD PER SQUARE FOOT

WORSE CASE
- RAW WATER -
- EXISTING -

JOB NO A-1086 DATE 10/6/78

COMPUTED BY TCO

WORKING STRESS



J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 11/7/78

COMPUTED BY TLD

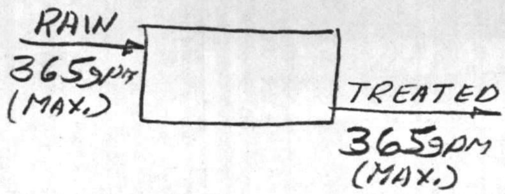
WORKING STRESS

— RAW WATER SUPPLY —
(EXISTING)

WELL NO.'S	PUMP DESIGNED CAPACITY
43	175 gpm
44	190
220	150
221	300
	815 gpm

ACTURAL AVG. DAILY DEMAND = 385,230 gal/DAY OR 267.5 gpm

MAX. PLANT DESIGN. 525,000 gal/DAY OR 365 gpm



THE MAXIMUM RAW WATER GOING THRU THE 8" PIPE IS 365 gpm. LESS SAY 400 gpm.

THE DAILY AVERAGE IS 267.5 gpm SAY 280 gpm.

WORSE CASE IN TRANSMISSION MAINS

ASSUMPTIONS:

(1) ASSUME 100 FT. OF PIPE PER PUMP HOUSE FOR VALVES & TURNS

(2) THE AVERAGE STATIC HEAD SHOULD BE AROUND 35 FT.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 1/29/79
COMPUTED BY TLD
WORKING STRESS

RAW WATER SUPPLY (EXISTING CONDITIONS)

PUMP IN WELL HOUSE NO. 220 WILL SEE THE FOLLOWING HEAD.

STATIC HEAD	= 35.00
LOSSES DUE TO PIPE FRICTION (365 gpm) 3775' X 0.464'/100'	= 17.52
	52.52 FT-HD

PUMP IN WELL HOUSE NO. 221 WILL SEE THE FOLLOWING HEAD.

LOSSES DUE TO PIPE FRICTION 300 gpm 1415' x 0.332'/100'	= 4.70
	57.22 FT-HD

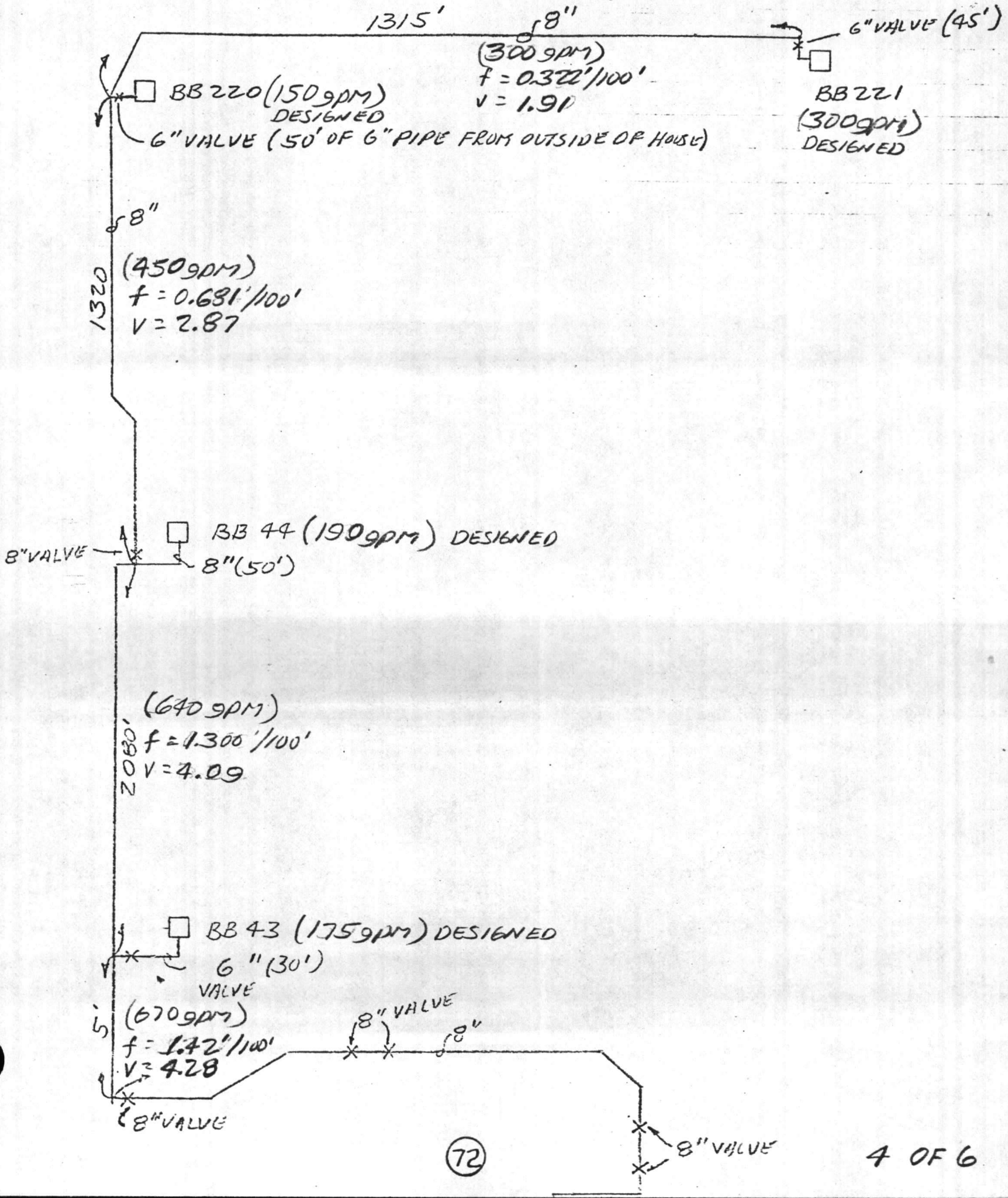
THE EXISTING PUMPS IN THE WELL HOUSES SHOULD HAVE NO PROBLEM PUMPING 365 GPM TO THE WATER TREATMENT PLANT

DESIGN SHEET

WORSE CASE
RAW WATER
EXISTING

JOB: COURTHOUSE BAY
STRUCTURE:
LIVE LOAD PER SQUARE FOOT:

JOB NO: A-1086
DATE: 10/6/78
COMPUTED BY: TCD
WORKING STRESS:



J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 1-29-79
COMPUTED BY TLD
WORKING STRESS

RAW WATER SUPPLY (EXISTING CONDITIONS)

PUMP IN WELL HOUSE NO. 43 WILL SEE THE FOLLOWING HEAD.

STATIC HEAD = 35.00
LOSSES DUE TO PIPE FRICTION
(670 gpm) 405 X 1.420'/100' = 5.75

40.75 FT-HD

PUMP IN WELL HOUSE NO. 44 WILL SEE THE FOLLOWING HEAD.

LOSSES DUE TO PIPE FRICTION
(690 gpm) 2230 X 1.300'/100' = 28.99

69.74 FT-HD

PUMP IN WELL HOUSE NO. 220 WILL SEE THE FOLLOWING HEAD

LOSSES DUE TO PIPE FRICTION
(450 gpm) 1470 X 0.681'/100' = 10.01

79.75 FT-HD

PUMP IN WELL HOUSE NO. 221 WILL SE THE FOLLOWING HEAD

5 OF 6

LOSSES DUE TO PIPE FRICTION
(300 gpm) 1460' X 0.322'/100' = 4.70

84.45 FT-HD.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 1-29-79

COMPUTED BY TLD

WORKING STRESS

IT APPEARS THAT THE EXISTING SYSTEM COULD HANDLE THE DEMAND OF 670 gpm, BUT THE SYSTEM WOULD HAVE NO STAND BY WELL SENCE IT WILL TAKE ALL FOUR EXISTING WELLS PUMPING AT THE SAME TIME. IF ANY ONE OF THE EXISTING WELLS WERE DOWN DURING THE 670 gpm DEMAND, THE WELLS COULD NOT MEET THIS DEMAND.

R. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

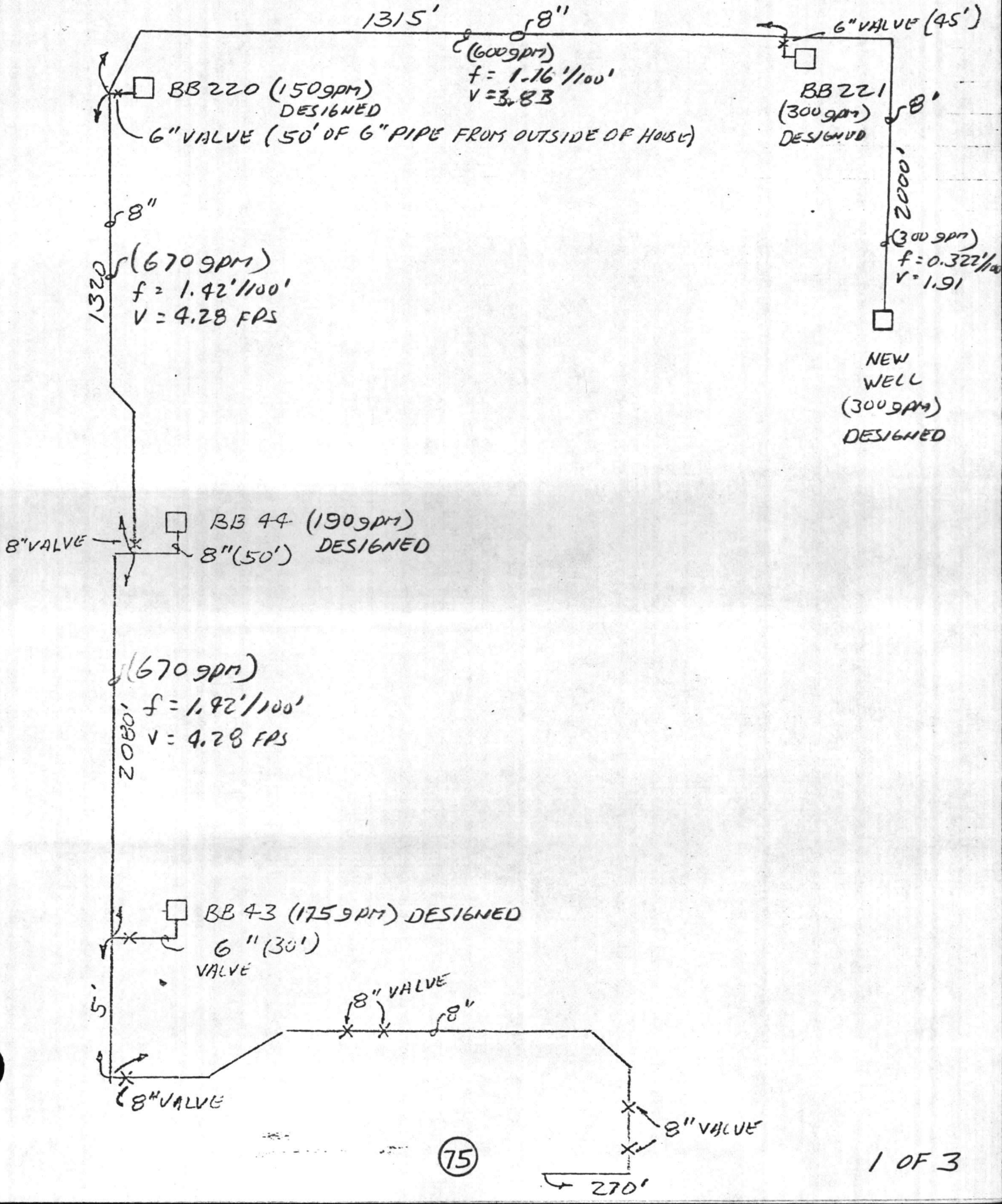
LIVE LOAD PER SQUARE FOOT

WORSE CASE
– RAW WATER –
– F.Y. 1986 –

JOB NO A-1086 DATE 10/6/78

COMPUTED BY TCO

WORKING STRESS



J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

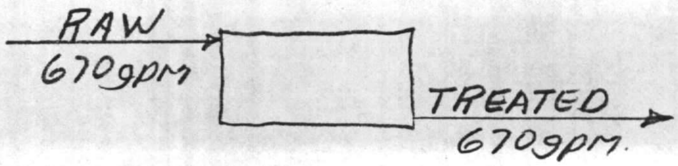
JOB NO A-1086 DATE 10/16/78
COMPUTED BY TLD
WORKING STRESS

—RAW WATER SUPPLY—
(F.Y. 1986)

WELL NO.'S	PUMP DESIGNED CAPACITY
43	175 gpm
44	190 "
220	150 "
221	300 "
NEW	300 "
	1115 gpm

CAL: AVG. DAILY DEMAND = 462,950 gal/DAY OR 321.5 gpm

MAX. PLANT DESIGN 960,200 gal/DAY OR 666.8 gpm



THE MAXIMUM RAW WATER GOING THRU THE 8" PIPE IS 670gpm

THE DAILY AVERAGE IS 325 gpm

WORSE CASE IN TRANSMISSION MAINS

ASSUMPTIONS:
(1) ASSUME 100 FT. OF PIPE PER PUMP HOUSE FOR VALVES & TURNS.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 1-29-79
COMPUTED BY TLD
WORKING STRESS

RAW WATER SUPPLY (NEW WELL ADDED)

PUMP IN WELL HOUSE NO. 220 WILL SEE THE FOLLOWING HEAD.

STATIC HEAD	= 35.00
LOSSES DUE TO PIPE FRICTION (670gpm) 3775' x 1.42'/100'	= 53.61
	88.61 FT-HD

PUMP IN WELL HOUSE NO. 221 WILL SEE THE FOLLOWING HEAD

LOSSES DUE TO PIPE FRICTION (600gpm) 1415' x 1.16'/100'	= 16.41 FT-HD
	105.02 FT-HD

THE NEW WELL HOUSE WILL SEE THE FOLLOWING HEAD

LOSSES DUE TO PIPE FRICTION (300gpm) 2100' x 0.322'/100'	= 6.76
	111.78 FT-HD.

THESE HEADS ARE HIGH FOR THE EXISTING PUMPS, THEREFORE, THE SYSTEM CAN NOT HANDLE THE WORSE CASE.

12. FIRE PROTECTION REQUIREMENT FOR COURTHOUSE BAY AREA (UNDER FAVORABLE CONDITIONS)

NUMBER	USE	HOSE STREAMS GPM	DURATION MIN.
S-BB-1	SEWAGE PUMPING STATION NO. 7	750	60
BB-2	THEATER	1000	75
BB-3	MARINE CORPS EXCHANGE	1250	90
BB-3A	MARINE CORPS EXCHANGE STOREHOUSE	1250	90
BB-5	ADMINISTRATION BUILDING	750	60
BB-6	ST CO/ ORG/OTH	750	60
BB-7	MESS HALL	1000	75
BB-8	FIRE STATION	750	60
BB-9	CENTRAL HEATING PLANT	1000	75
BB-10	DISPENSARY	750	60
BB-11	BARRACKS FOR AMTRAC	750	60
BB-12	BARRACKS FOR AMTRAC	750	60
BB-13	BARRACKS FOR AMTRAC	750	60
BB-14	BARRACKS FOR AMTRAC	750	60
BB-15	ST CO/ ORG/OTH	750	60
BB-16	" " " "	750	60
BB-17	OFFICERS QUARTERS, MARRIED	750	60
BB-18	OFFICERS QUARTERS, "	750	60
BB-19	OFFICERS QUARTERS, "	750	60
BB-20	OFFICERS QUARTERS, "	750	60
BB-21	OFFICERS QUARTERS, "	750	60
BB-22	OFFICERS QUARTERS, "	750	60
BB-23	OFFICERS QUARTERS, "	750	60
BB-24	OFFICERS QUARTERS, "	750	60
BB-25	(100,000 GAL) ELEVATED WATER TANK	-	-
BB-26	HEATING PLANT	1000	75
BB-27	STAFF NCO CLUB	750	60
BB-28	ADMINISTRATION BUILDING	750	60
BB-30	APPLIED INSTRUC. BUILDING	750	60
BB-31	STORAGE, OFFICE & CLASSROOM	750	60
BB-32	APPLIED INSTRUCTION BUILDING	750	60
BB-34	MAINTENANCE SHOP	1000	75
BB-36	STORAGE	750	60
BB-37	APPLIED INSTRUCTION BUILDING	750	60
BB-38	GUARDHOUSE	750	60
BB-43	PUMP HOUSE FOR WELL - W	750	60
BB-44	PUMP HOUSE FOR WELL - V	750	60
BB-45	BACHELOR OFFICERS QUARTERS	750	60
BB-46	BOAT HOUSE	750	60
BB-47	STORAGE BUILDING	750	60
BB-48	ACADEMIC & GENERAL INST. BUILDING	750	60
BB-49	" " " " "	750	60
BB-50	APPL. INST. BLDG.	750	60
BB-51	HEAVY EQUIP. & MAINT. TRANSPORT BLDG.	1250	90
BB-52	APPL INST BLDG.	750	60

FIRE PROTECTION REQUIREMENT
FOR
COURTHOUSE BAY AREA
(UNDER FAVORABLE CONDITIONS)

NUMBER	USE	HOSE STREAMS GPM	DURATION MIN.
S-BB-54	E M SERVICE CLUB	750	60
BB-57	VOLLEY BALL COURT	-	-
BB-58	TENNIS COURT	-	-
BB-59	BADMINTON AND HANDBALL COURT	750	60
BB-60	TENNIS COURT	-	-
BB-66	IMHOFF TANK	-	-
BB-67	SLUDGE DRYING BEDS	-	-
BB-68	STORAGE	750	60
BB-69	TELEPHONE EXCHANGE BUILDING	1000	75
BB-71	APPLIED INSTRUCTION BUILDING	750	60
BB-72	TOILET	750	60
BB-73	APPL INST BLDG	750	60
BB-80	ACADEMIC & GEN. INST. BUILDING	750	60
BB-82	TRNG BLDG/OTH	750	60
BB-83	ACD/GEN INS BLDG	750	60
BB-84	" " " "	750	60
BB-93	" " " "	750	60
BB-94	LUBRICATION FACILITY	750	60
BB-95	ACD/GEN INS BLDG	750	60
BB-100	ACAD. & GEN. INSTR. BLDG.	750	60
BB-136	ACADEMIC & GEN. INSTR. BLDG.	750	60
BB-137	ADMIN BLDG	750	60
BB-138	ACD/GEN INS BLDG	750	60
BB-139	" " " "	750	60
BB-140	BRIDGE STORAGE SHED	1000	75
BB-166	ST COV ORG/OTH	750	60
BB-170	ST COV ORG/OTH	750	60
BB-177	SERVICE STATION	1750	120
BB-183	SAWMILL	1750	120
BB-189	STORAGE BLDG	750	60
BB-190	WATER TREATMENT PLANT	750	60
BB-191	RESERVOIR (350,000 GALS)	-	-
BB-204	SEW PUMP STA	750	60
BB-205	SEW TREAT PLANT	750	60
BB-206	" " "	750	60
BB-207	" " "	750	60
BB-208	REC BLDG	750	60
BB-209	PLAYING COURT	-	-
BB-210	SNACK BAR	1250	90
BB-213	LUMBER STORAGE	1000	75
BB-219	BANK	750	60
BB-220	PUMP HOUSE FOR WELL	750	60
BB-221	" " " "	750	60
BB-222	TRAINING SUPPLY BLDG	750	60

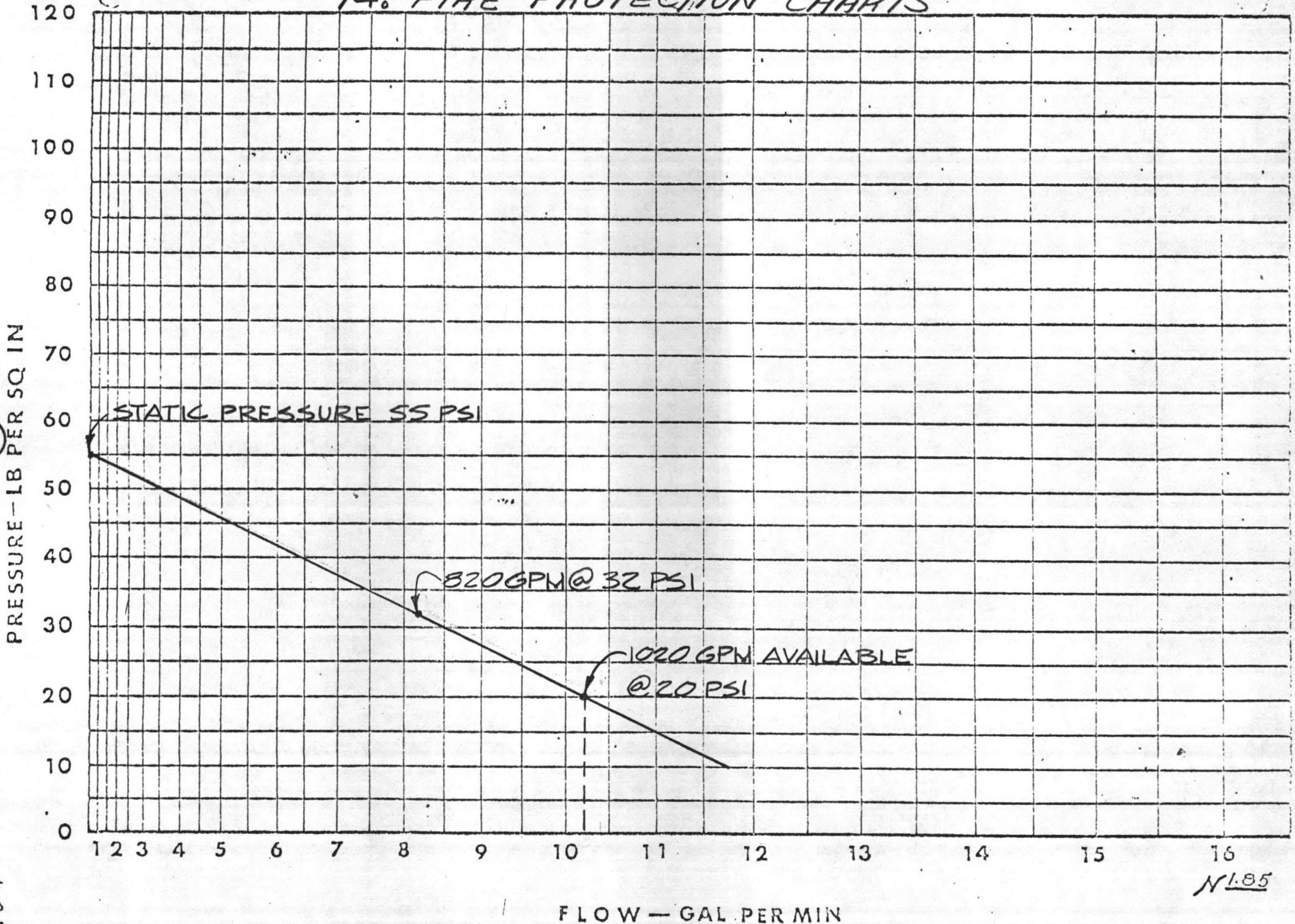
FIRE PROTECTION REQUIREMENT
FOR
COURTHOUSE BAY AREA
(UNDER FAVORABLE CONDITIONS)

NUMBER	USE	HOSE STREAMS GPM	DURATION MIN.
S-BB-229	PICNIC SHELTER	750	60
BB-230			
BB-231	STORAGE BLDG	750	60
BB-237	STORAGE BLDG	750	60
BB-250	BARRACKS FOR ENG. STUDENTS	1000	75
BB-255	BARRACKS FOR ENG. STUDENTS	1000	75

13. FIRE PROTECTION REQUIREMENT
FOR
AMTRAC AREA
(UNDER FAVORABLE CONDITIONS)

NUMBER	USE	HOSE STREAMS GPM	DURATION MIN.
A-1	AUTO VE MNT FAC	1750	120
A-2	AMPHIBIOUS TRACTOR SHOP	1750	120
A-3	" " "	1750	120
A-4	WATER BALANCING TANK & CNTL. BLDG.	750	60
A-5	PUMP HOUSE WELL V	750	60
A-7	ST. COV. ORG/OTH	750	60
A-8	" " " "	750	60
A-9	" " " "	750	60
A-10	" " " "	750	60
A-11	AUTO VE MNT FAC	1750	120
A-12	ST COV ORG/OTH	750	60
A-13	MAINT FAC/OTH	1250	75
A-14	ST COV ORG/OTH	750	60
S-A-21	FUEL DISPENSING FACILITY	2250	135
A-25	BOAT HOUSE	750	60
S-A-26	GREASE RACK	-	-
S-A-27	WASH RACK	-	-
S-A-28	BOAT HOUSE	750	60
S-A-29	LVT WASH RACK	-	-
S-A-30	FUEL DISP. FAC	2250	135
A-33	GATE/SENTRY HOUSE	750	60
S-A-34	GREASE RACK	-	-
S-A-35	BERTHING PIER	-	-
A-37	STORAGE BLDG	750	60
S-A-38	SEWAGE PUMPING STATION	750	60

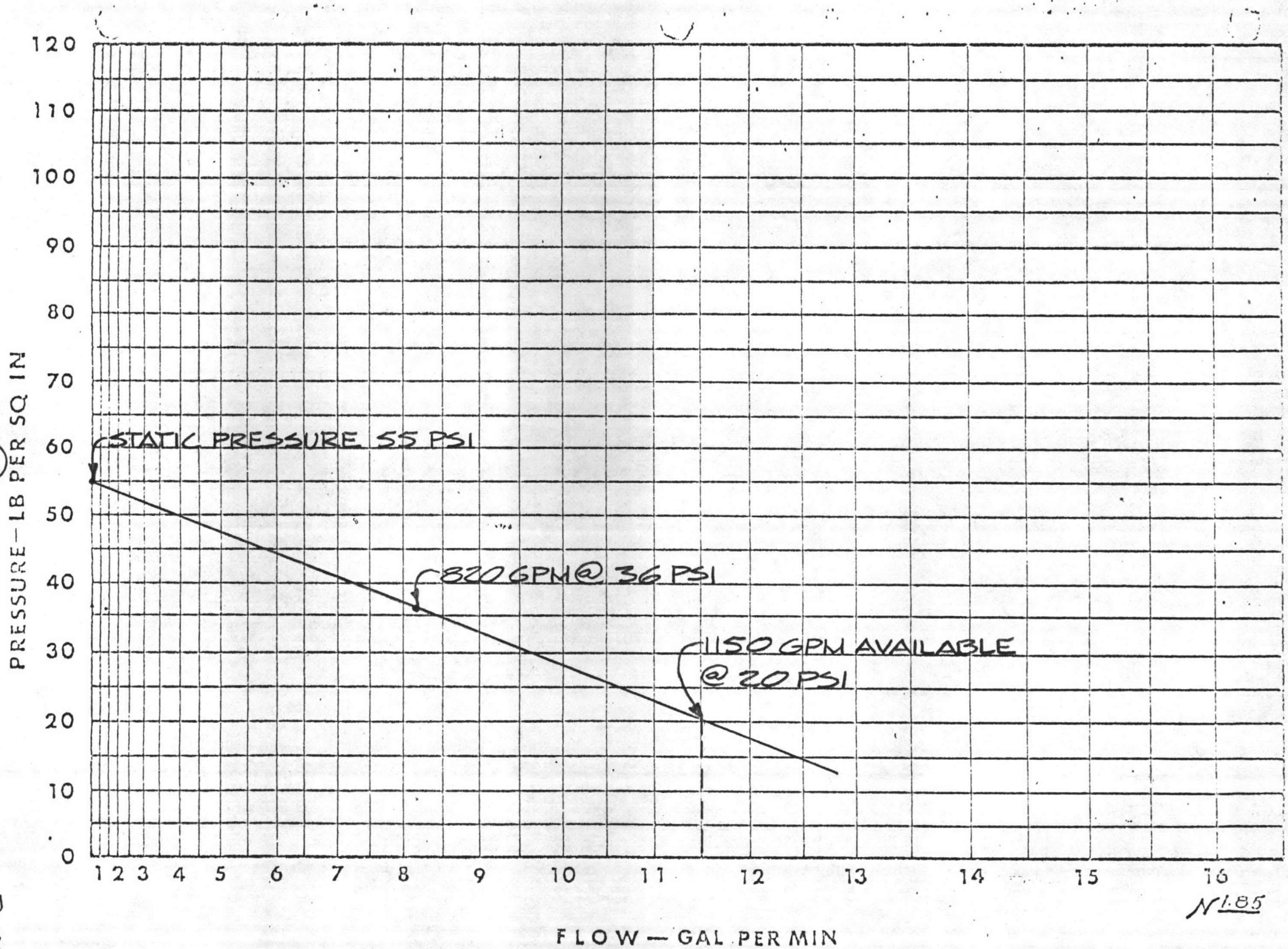
14. FIRE PROTECTION CHARTS



FIRE HYDRANT NUMBER (7·1·8)

(28)

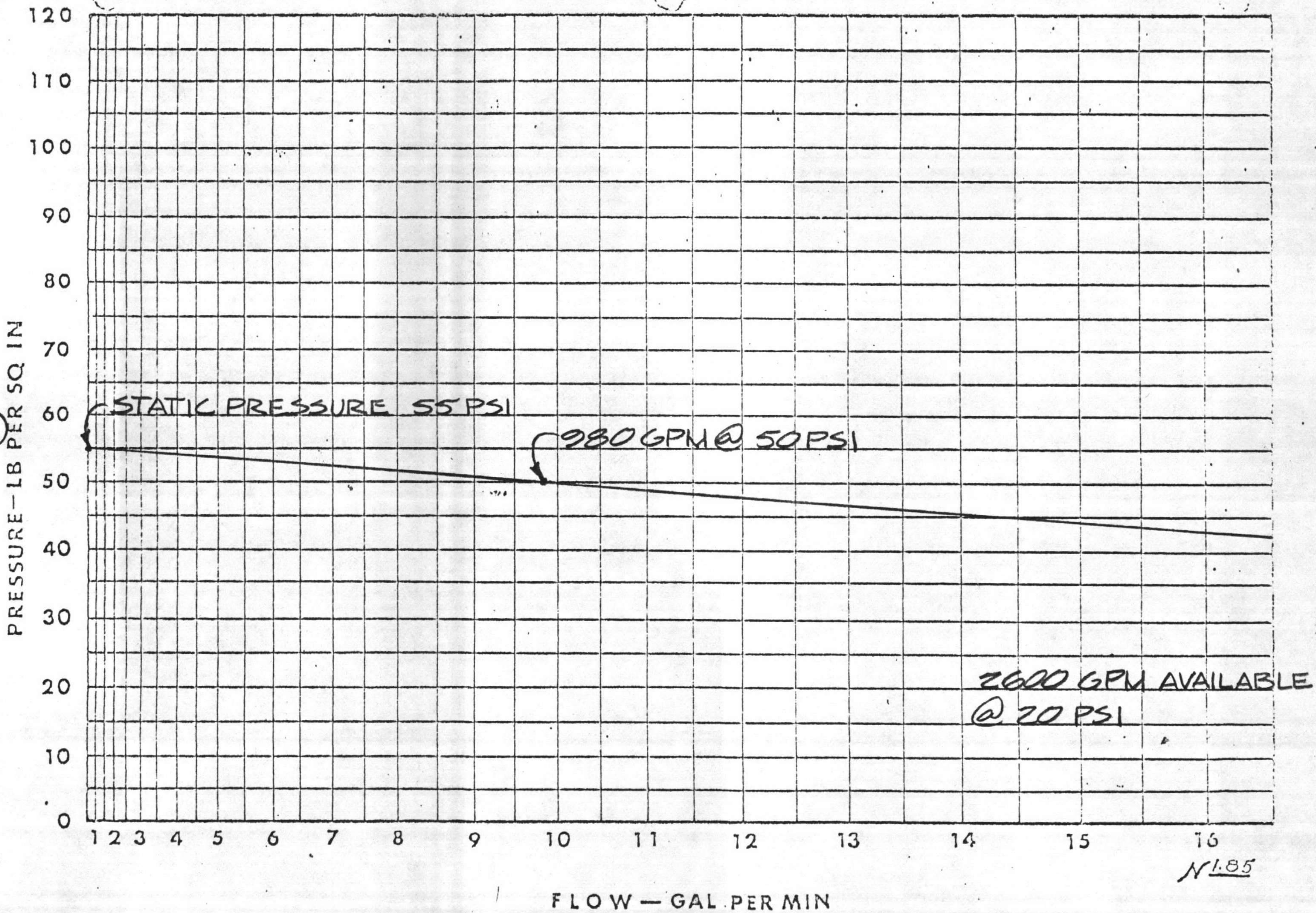
10F5



FIRE HYDRANT NUMBER (7·32·4)

(83)

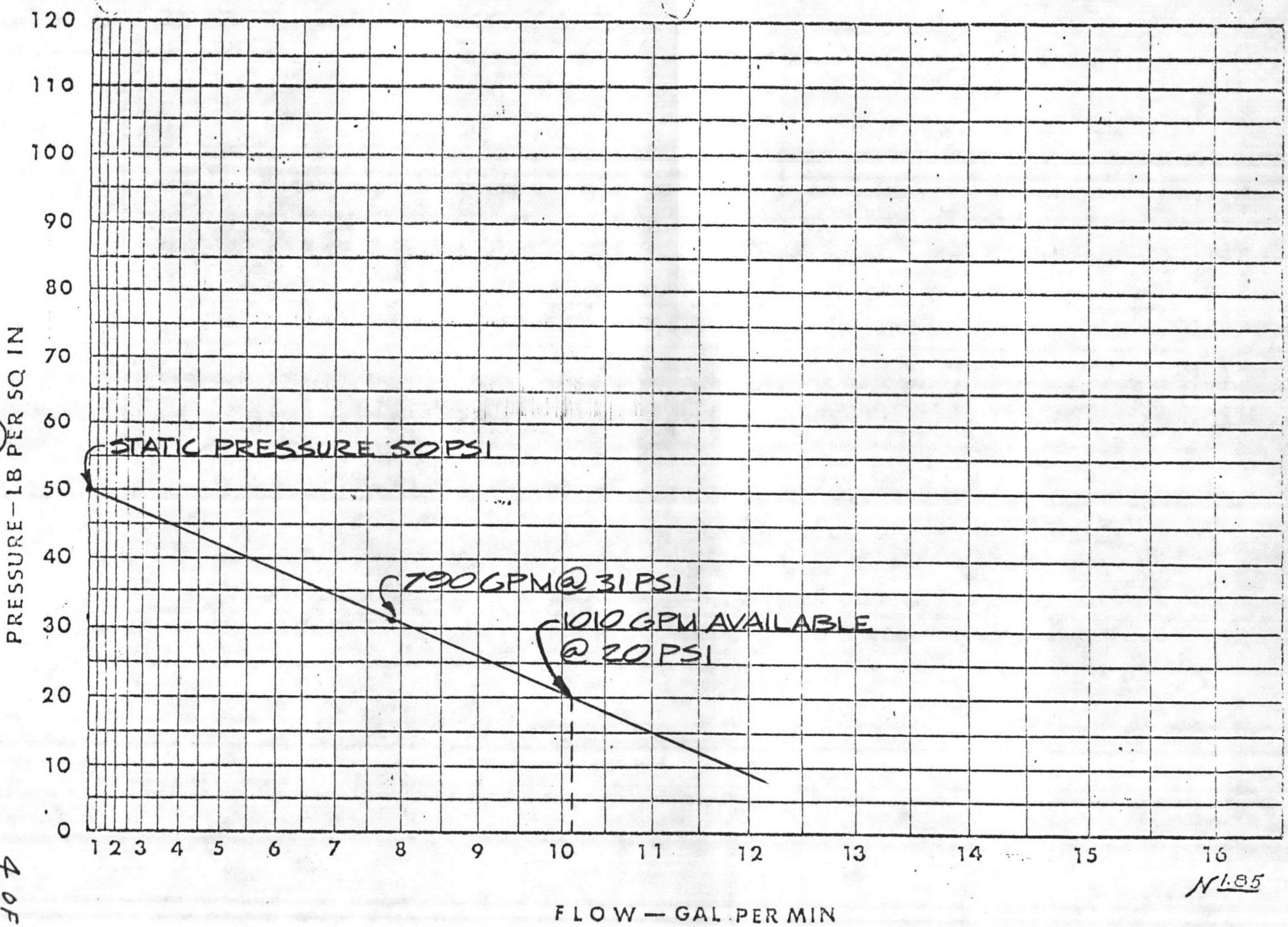
2 of 5



84

3 of 5

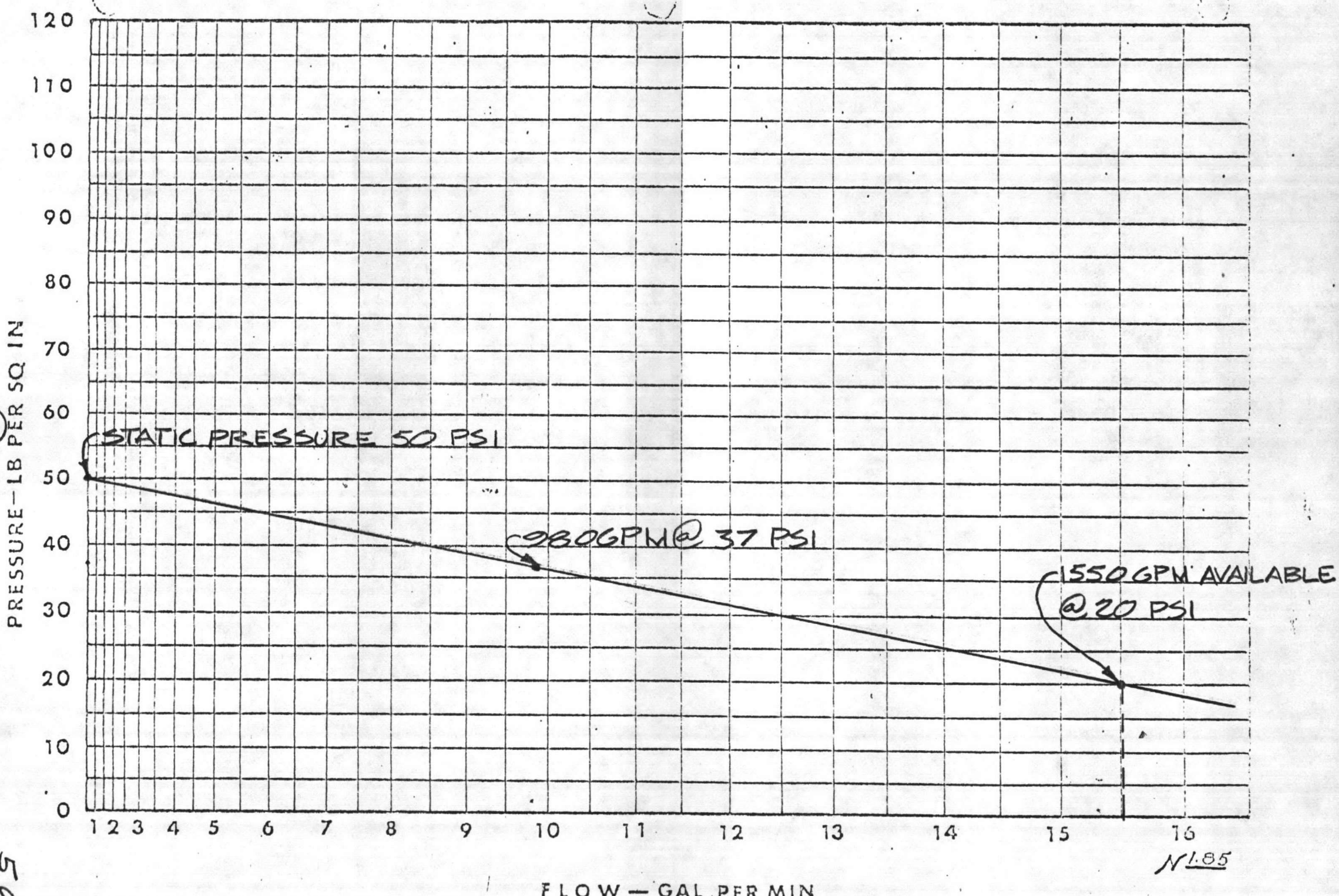
FIRE HYDRANT NUNBER (7·11·8)



FIRE HYDRANT NUMBER (7·22·6)

85

4 of 5



FIRE HYDRANT NUMBER (7·28·8)

98

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J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/12/78
COMPUTED BY TLO
WORKING STRESS

15. FIRE PROTECTION CALCULATIONS

— FIRE PROTECTION —
(EXISTING)

THE FOLLOWING EQUATION CAN BE USED BECAUSE THE RATE OF FLOW IS APPROXIMATELY PROPORTIONAL TO THE SQUARE ROOT OF THE PRESSURE DROP.

$$\frac{Q_1}{Q_2} = \frac{\sqrt{P_1}}{\sqrt{P_2}}$$

Q_1 = MAX. FLOW OUT OF THE HYDRANT AT 20 PSI
Q_2 = FLOW OUT OF THE HYDRANT WITH A CERTAIN RESIDUAL PRESSURE
P_1 = PRESSURE DROP BETWEEN STATIC PRESSURE THE REQUIRED 20 PSI
P_2 = PRESSURE DROP BETWEEN STATIC AND RESIDUAL.

HYDRANT 7·1·8

STATIC = 55 PSI
RESIDUAL = 32 PSI
FLOW = 820 gpm

$$\frac{Q_1}{820} = \frac{\sqrt{55-20}}{\sqrt{55-32}} \qquad Q_1 = 1012 \text{ gpm}$$

HYDRANT 7·32·4

STATIC = 55 PSI
RESIDUAL = 36 PSI
FLOW = 820 gpm

$$\frac{Q_1}{820} = \frac{\sqrt{55-20}}{\sqrt{55-36}} \qquad Q = 1113 \text{ gpm}$$

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/12/78
COMPUTED BY TCD
WORKING STRESS

HYDRANT 7·11·8

STATIC = 55 PSI
RESIDUAL = 50 PSI
FLOW = 980 gpm

$$\frac{Q_1}{980} = \frac{\sqrt{55-20}}{\sqrt{55-50}}$$

Q_1 = 2593 gpm

HYDRANT 7·22·6

STATIC = 50 PSI
RESIDUAL = 31 PSI
FLOW = 790 gpm

$$\frac{Q_1}{790} = \frac{\sqrt{50-20}}{\sqrt{50-31}}$$

Q_1 = 993 gpm

HYDRANT 7·28·8

STATIC = 50 PSI
RESIDUAL = 37 PSI
FLOW = 980 gpm

$$\frac{Q_1}{980} = \frac{\sqrt{50-20}}{\sqrt{50-37}}$$

Q_1 = 1489 gpm

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/12/78
COMPUTED BY TLD
WORKING STRESS

—— FIRE PROTECTION ——
(EXISTING)

COURTHOUSE BAY & AMTRAC AREA WILL FALL WITHIN THE FOLLOWING OCCUPANCY CLASSIFICATION

OCCUP. CLASS	GPM	DURATION
LIGHT HAZARD	750	60 MIN
ORDINARY HAZARD GROUP 1	1000	75 "
" " " 2	1250	90 "
" " " 3	1750	120 "

THE FIRE PROTECTION WILL BE UNDER FAVORABLE CONDITIONS DUE TO THE EARLY RESPONSE BY A WELL TRAINED FIRE DEPARTMENT.

THE PRESSURE REQUIRED IS 20 POUNDS PER SQUARE INCH. MINIMUM.

STORAGE REQUIREMENTS. THE REQUIREMENTS FOR FIRE PROTECTION WATER STORAGE ARE BASED ON THE ASSUMPTION THAT THERE WILL BE ONLY ONE FIRE AT A TIME.

TOTAL STORAGE CAPACITY: STORAGE REQUIRED TO SUPPLY THE PEAK FIRE FLOW DEMAND PLUS 50% OF THE PEAK DAILY DOMESTIC CONSUMPTION.

PEAK DAILY = 656,390 gal
FIRE MAX = 1750 gpm FOR 120 MIN = 210,000 gal

TOTAL STORAGE REQ'D. = 656,390/2 + 210,000 = 538,195 gal

STORAGE AVAILABLE = 450,000 gal

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/12/78
COMPUTED BY TCD
WORKING STRESS

FIRE PROTECTION
(EXISTING)

REPLENISHMENT OF STORAGE: IT SHALL REACH REQUIRED VOLUME DURING NORMAL CONSUMPTION WITHIN 48 HOURS AND WITHIN 24 HOURS BY CURTAILING NORMAL CONSUMPTION.

CAL: AVG. DAILY DEMAND = 385,230 gal/DAY
FIRE PROTECTION = 210,000 gal/DAY
595,230 gal/DAY

AT PRESENT THE DESIGN CAPACITY OF THE H_2O PLANT IS 550,000 gal/DAY

DURING A 48 HOUR PERIOD, THE SYSTEM APPEARS TO BE ABLE TO. REPLENISHING STORAGE

DISTRIBUTION RESERVOIRS: 50% OF AVERAGE DAILY CONSUMPTION PLUS FIRE PROTECTION

$$\frac{385,230}{2} + 210,000 = 402,615 \text{ gals.}$$

AT PRESENT, STORAGE CAPACITY = 450,000 gals.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY

STRUCTURE

LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/16/78

COMPUTED BY TCD

WORKING STRESS

— FIRE PROTECTION —
(F.Y. 1986)

COURTHOUSE BAY & AMTRAC AREA WILL FALL WITHIN THE FOLLOWING OCCUPANCY CLASSIFICATION

OCCUP. CLASS	GPM	DURATION
LIGHT HAZARD	750	60 MIN
ORDINARY HAZARD GROUP 1	1000	75 "
" " " 2	1250	90 "
" " " 3	1750	120 "

THE FIRE PROTECTION WILL BE UNDER FAVORABLE CONDITIONS DUE TO THE EARLY RESPONSE BY A WELL TRAINED FIRE DEPARTMENT.

THE PRESSURE REQUIRED IS 20 POUNDS PER SQUARE INCH. MINIMUM.

STORAGE REQUIREMENTS. THE REQUIREMENTS FOR FIRE PROTECTION WATER STORAGE ARE BASED ON THE ASSUMPTION THAT THERE WILL BE ONLY ONE FIRE AT A TIME.

TOTAL STORAGE CAPACITY: STORAGE REQUIRED TO SUPPLY THE PEAK FIRE FLOW DEMAND PLUS 50% OF THE PEAK DAILY DOMESTIC CONSUMPTION.

PEAK DAILY = 960,200 gal.
FIRE MAX = 1750 gpm FOR 120 MIN = 210,000 gal.

TOTAL STORAGE REQ'D. = $\frac{960{,}200}{2}$ + 210,000 = 690,100 gal.

STORAGE AVAILABLE = 91 450,000 gal.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/16/78
COMPUTED BY TCD
WORKING STRESS

— FIRE PROTECTION —
(F.Y. 1986)

REPLENISHMENT OF STORAGE: IT SHALL REACH REQUIRED VOLUME DURING NORMAL CONSUMPTION WITHIN 48 HOURS AND WITHIN 24 HOURS BY CURTAILING NORMAL CONSUMPTION.

CAL. AVG. DAILY DEMAND = 462,950 gal/DAY
FIRE PROTECTION = 210,000 gal/DAY
672,950 gal/DAY

THE H_2O PLANT WILL BE DESIGNED FOR A CAPACITY OF 960,200 gal/DAY

THEIR SHOULD BE NO PROBLEM IN REPLENISHING STORAGE.

DISTRIBUTION RESERVOIRS: 50% OF AVERAGE DAILY CONSUMPTION PLUS FIRE PROTECTION.

$$\frac{462,950}{2} + 210,000 = 441,475 \text{ gals}$$

AT PRESENT, STORAGE CAPACITY = 450,000 gals.

APPENDIX II

-APPENDIX II-

WATER TREATMENT PLANT

DESIGN CALCULATIONS

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

APPENDIX II

INDEX

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______
STRUCTURE ______ COMPUTED BY ______
LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

DESIGN Assumptions

Assume 960,200 GAL/DAY REQ'D - 667 gpm
use 670 gpm for design

THIS IS Treated water NOT INCL. BACKWASH & softener regeneration

HARDNESS OF wells #43 - 293 ppm AS $CaCO_3$

#43	293 ppm AS $CaCO_3$
#44	138
#220	152
#221	133

Assume total hardness of raw water to be 200 ppm. And Any new wells to be in same range of hardness. Abandon #43 due to low flow rate of 50 gpm.

DESIRE plant effluent to have 50 ppm total hardness which will be Achieved by bypassing filtered water around softener system.

$200(x) = 50$

$x = 50/200 = 25\%$ bypassed flow

DEsign criteria flow loading

softeners - 6 to 8 gpm/ft²

filters - max of 2 gpm/ft²

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______
STRUCTURE ______ COMPUTED BY ______
LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

Hydraulic Considerations, Softeners

Hydraulic Considerations for Softeners having treated effluent of 670 gpm · 75% = 503 gpm

$\frac{503 \text{ gpm}}{x \text{ sq. ft}} = 6 \text{ gpm/ft}^2$

sq ft req'd = 83.8 use 84 sq ft

presently have 2 5'ϕ vessels → 2 x 19.635 ft^2 = 39.3 ft^2

84 - 39.3 = 44.7 sq ft Additional softener area req'd.

44.7 ft^2 can be met by 2 6'ϕ vessels w/ 28.2744 ft^2 each (56.55 sq ft total)

This yields a system w/ 2 5'ϕ & 2 6'ϕ tanks

Total surface area = 39.3 + 56.5 = 95.8 ft^2

503 gpm / 95.8 ft^2 = 5.25 gpm / ft^2 with all units on line

with one 5'ϕ offline
503 gpm / 19.635 + 56.549 sqft = 6.6 gpm/ft^2
ok

with one 6'ϕ offline

503 gpm / 39.3 + 28.2744 sq ft = 7.44 gpm/ft^2
ok

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______

STRUCTURE ______ COMPUTED BY ______

LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

Hydraulic Considerations, FILTERS *

With one 5'ϕ & one 6'ϕ tank offline

$503 \text{ gpm} / 19.635 + 28.2744 \text{ ft}^2 = 10.5 \frac{\text{gpm}}{\text{ft}^2}$

too fast

system to consist of 2 5'ϕ and 2 6'ϕ vessels interlocked to prevent simultaneous regenerations.

* HYDRAULIC Considerations For FILTERS

effluent of 670 gpm

Require 2 gpm/ft² maximum flow loading

$670 \text{ gpm} / 2 \text{ gpm/ft}^2 = 335 \text{ sq ft}$

present system has 3 7½'ϕ vessels =

(3 × 44.1787 = 132.5 sq ft)

335 − 132.5 = 202.5 additional sq ft req'd.

Can be achieved with 3 − 10'ϕ = 3 × 78.54 = 235.6

3 − 9'ϕ = 3 × 63.6174 = 190.85

3 − 9'-6"ϕ = 3 × 70.88.23 = 212.6

Assume 9½'ϕ vessels

∴ system would consist of 3 7½'ϕ & 3 9½'ϕ filters'

with all units on line

$670 \text{ gpm} / 3 \times 44.1787 + 3 \times 70.8823 = 1.94 \frac{\text{gpm}}{\text{ft}^2}$ ok

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______

STRUCTURE ______ COMPUTED BY ______

LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

WITH one 7½'φ unit off for backwash

670 gpm / (2 × 44.1787) + (3 × 70.8823) = 2.23 gpm/ft²

88.36 + 212.6

With one 9½'φ vessel off for backwash

670 gpm / (132.5) + (2 × 70.8823) = 2.44 gpm/ft²

Consider 3 additional 10'φ units, ea. 78.54 sq ft

WITH all units on line

670 gpm / (3 × 44.1787) + (3 × 78.54) sq ft = 1.82 gpm/ft² ea

132.5 235.6

With one 7½'φ offline backwashing

670 gpm / (2 × 44.1787) + (3 × 78.54) sq ft 2.07 gpm/ft²

88.4 + 235.6

With one 10'φ offline backwashing

670 gpm / (3 × 44.1787) + (2 × 78.54) = 2.31 gpm/ft²

132.5 + 157.1

SEE ALTERNATE #2

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ____________ JOB NO ____________ DATE ____________
STRUCTURE ____________ COMPUTED BY ____________
LIVE LOAD PER SQUARE FOOT ____________ WORKING STRESS ____________

Water Consumption

Lost water due to backwash & Regeneration

2-5'ϕ softeners - 4480 gallons/regeneration/softener

3-7½ϕ filters - 4560 gallons/regeneration/filter

2-6'ϕ softeners - 9,000 gallons/Regen/softener
(13,000 gallons - 7'ϕ vessel w/3' bed)

3 10'ϕ filters - 17,000 gallons/Regen/filter

4 8'ϕ filters - 4600 gallons/backwash/filter - est

Assume filters will be backwashed daily
softeners regenerated on basis of hardness breakthrough.

Softener Resin Volumes

2 5'ϕ existing softeners - 49 ft^3 resin each @ 2'6" depth
19.635 sq ft

- 58.9 ft^3 resin each @ 3' depth

2 6'ϕ softeners - w/ 2½' depth - 70.7 ft^3
28.2744 sq ft
w/ 3' depth - 84.8 ft^3

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______
STRUCTURE ______ COMPUTED BY ______
LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

Softener Capacities

Determination of Capacity of Softeners

Existing softeners – 49 ft^3 CRA-Z resin
2½' deep bed
∴ O & M manual info

1275 Kgr hardness removed between regeneration
176,000 gallons treated / regen.

raw water – 7.25 gr/gallon hardness (124 ppm total hardness)

Cochrane capacity of resin – 26 Kgr/ft^3 resin

SIRRINE capacity of resin – 18 Kgr/ft^3 resin

Water to have 200 ppm total hardness as opposed to 124 ppm and 503 gpm as opposed to 256 gpm.

Flow proportioning (assuming same resin depth, same Δp, same flow load, gpm/ft^2)

TOTAL surface area = 2 × 19.635 + 2 × 28.2744
= 39.3 + 56.5
= 95.8 sq ft

Assume all 4 units on line

5' ϕ $\left\{ \dfrac{503\ \text{gpm}}{95.8\ \text{sq ft}} = \dfrac{x}{19.635} \right.$

x = 103.1 gpm
5.25 gpm/ft^2

6' ϕ $\left\{ \dfrac{503\ \text{gpm}}{95.8\ \text{sq ft}} = \dfrac{x}{28.2744} \right.$

x = 148.5 gpm
5.25 gpm/ft^2

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB

STRUCTURE

LIVE LOAD PER SQUARE FOOT

JOB NO DATE

COMPUTED BY

WORKING STRESS

When 1 5'ϕ vessel offline:

5'ϕ

$$\frac{503\text{ gpm}}{76.17\text{ sq ft}} = \frac{X}{19.635}$$

X = 129.7 gpm

6.6 gpm/ft²

6'ϕ

$$\frac{503\text{ gpm}}{76.17} = \frac{X}{28.2744}$$

X = 186.7 gpm

6.6 gpm/ft²

When 1 6'ϕ vessel offline:

5'ϕ

$$\frac{503\text{ gpm}}{67.5\text{ sq ft}} = \frac{X}{19.635}$$

X = 146.3 gpm

7.45 gpm/ft²

6'ϕ

$$\frac{503\text{ gpm}}{67.5\text{ sq ft}} = \frac{X}{28.2744}$$

X = 210.7 gpm

7.45 $\frac{\text{Gpm}}{\text{ft}^2}$

Softener Exchange Capacities

Cochrane - 26 kgr/ft³

SIRRINE - 18 kgr/ft³

w/ 2½' deep resin beds ; SIRRINE 18 kgr/ft³

5'ϕ tank

$$\frac{(200\text{ ppm})(103.1)(X)}{(17.1)(1000)(18)} = 49\text{ ft}^3$$

X = 731.4 min

12.2 hrs.

6'ϕ tank

$$\frac{(200\text{ ppm})(148.5)(X)}{(17.1)(1000)(18)} = 70.7\text{ ft}^3$$

X = 732.7 min

12.2 hrs

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ STRUCTURE ______ LIVE LOAD PER SQUARE FOOT ______
JOB NO ______ DATE ______ COMPUTED BY ______ WORKING STRESS ______

Calculate time of SERVICE RUN using Cochrane capacity of 26 Kgr/ft^3 & 2½' bed depth

5' ϕ

$$\frac{(200)(103.1)(x)}{(17.1)(1000)(26)} = 49\ ft^3$$

X = 1057 min
17.6 hrs

6' ϕ

$$\frac{(200)(148.5)(x)}{(17.1)(1000)(26)} = 70.7\ ft^3$$

X = 1058 min
17.6 hrs

Using 3' resin depth & SIRRINE 18 Kgr/ft^3

5' ϕ

$$\frac{(200)(103.1)(x)}{(17.1)(1000)(18)} = 58.9\ ft^3$$

X = 879.2 min
14.7 hrs

6' ϕ

$$\frac{(200)(148.5)(x)}{(17.1)(1000)(18)} = 84.8\ ft^3$$

X = 878.8 min
14.7 hrs

Using 3' resin depth & Cochrane 26 Kgr/ft^3

5' ϕ

$$\frac{(200)(103.1)(x)}{(17.1)(1000)(26)} = 58.9\ ft^3$$

X = 1270 min
21 hrs

6' ϕ

$$\frac{(200)(148.5)(x)}{(17.1)(1000)(26)} = 84.8\ ft^3$$

X = 1269 min
21 hours

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______
STRUCTURE ______ COMPUTED BY ______
LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

SERVICE TIMES

Summary of SERVICE Times

18 Kgr 2½' resin depth — 12.2 hours
26 Kgr 2½' resin depth — 17.6 hours

18 Kgr 3' resin depth — 14.7 hours
26 Kgr 3' resin depth — 21 hours

EACH UNIT WILL regenerate after 12.2 to 17.6 hours operation w/ 2½' resin based on 200 ppm total hardness assumption

Actual hardness w/o DB43 − $\frac{138+152+133}{3}$

= 141 ppm total hardness

$\frac{200}{141} = \frac{X}{14.7}$ $\frac{200}{141} = \frac{X}{21}$

X = 20.8 hours X = 29.8 hours

Actual run times w/ 3' resin beds

$\frac{200}{141} = \frac{X}{12.2}$ $\frac{200}{141} = \frac{X}{17.6}$

X = 17.3 hrs X = 24.9 hrs

Avg 21.1 hours

Actual run times w/ 2½' resin beds.
@ 141 ppm hardness

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______

STRUCTURE ______ COMPUTED BY ______

LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

Waste Water Flows From Water Treatment Plant

Frequency: Filter backwash - 1 backwash per day/filter

softener regen. - 21 hours - once/day/per unit

3	7½'ϕ	Filters	- 4560 × 3 =	13,680	gallons
4	8'ϕ	Filters	- 4600 × 3 =	18,400	"
2	5'ϕ	softeners	- 4480 × 2 =	8960	"
2	6'ϕ	softeners	- 10,000 × 2 =	20,000	"
				61,040 gpd	

Assume 65,000 gpd.

would require additional 45 gpm to make up loss.

∴ Assume losses to be made up at night during low flow demand.

65,000 gal / 670 gpm = 97 minutes ≈ 1½ hours.

Assume system to consist of:

7 filters - 3, 7½ϕ 4, 8'ϕ

4 softeners - 2, 5'ϕ. 2, 6'ϕ

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ______ JOB NO ______ DATE ______

STRUCTURE ______ COMPUTED BY ______

LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

Salt Usage

Salt Usage Calculations

5' ϕ vessals – 49 ft^3 ea

6' ϕ vessals – 70.7 ft^3 ea

11.7 lbs salt / cu. ft resin × 239.4 cu. ft resin total per day = 2800 lbs salt / day

2800 × 30 = 84,000 / 2000 = 42 ton for 30 day supply

present capacity – 23 ton / bin × 2 bins = 46 ton capacity

no enlargement of salt storage necessary

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB

STRUCTURE

LIVE LOAD PER SQUARE FOOT

JOB NO DATE

COMPUTED BY

WORKING STRESS

FILTER ALTERNATE #1

DESIGN FILTERS ON basis of 3-4 gpm/ft² not 2.0 $\frac{gpm}{ft^2}$ max

$$\frac{670 \text{ gpm}}{3 \text{ gpm/ft}^2} = 224 \text{ sqft req'd}$$

Present system 3 7½' ϕ's = 132.5 sqft

224 − 132.5 = 91.5 Additional sq ft req'd

Can be met by 2 additional 7½' ϕ tanks.

5 7½' ϕ vessels — 5 x 44.1787 = 220.9 sqft

670 gpm / 220.9 = 3.03 gpm/sq ft with all units on line.

With one unit backwashing

$$\frac{670 \text{ gpm}}{4 \times 44.1787 \text{ sqft}} = 3.8 \text{ gpm/ft}^2 \quad \text{ok}$$

ALTERNATE #1 — Add 2 more 7½' ϕ filters

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ____________ JOB NO ____________ DATE ____________

STRUCTURE ____________ COMPUTED BY ____________

LIVE LOAD PER SQUARE FOOT ____________ WORKING STRESS ____________

FILTER ALTERNATE # 2

Consider all additional filters to be 7½' ϕ units or close to it to hold down water consumption during backwash, less effect on on line units while backwashing one unit, and retain same backwash piping size and drain pipe size:

670 gpm / 2 gpm / ft^2 = 335 sq ft req'd

presently have 3 7½' ϕ units : 3 x 44.1787 ft^2
= 132.5 sq ft

335 − 132.5 = 202.5 additional sq ft req'd

if 7½' ϕ units

202.5 sq ft / 44.1787 sq ft = 4.58 7½' ϕ units needed

if 8' ϕ units

202.5 sq ft / 50.2656 = 4.03 8' ϕ units needed.

Assume 8' ϕ units (4) will be added

670 gpm / (3 x 44.1787) + (4 x 50.2656) = 2.008 gpm / ft^2
132.5 + 201.06

all units on line

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ________ JOB NO ________ DATE ________

STRUCTURE ________ COMPUTED BY ________

LIVE LOAD PER SQUARE FOOT ________ WORKING STRESS ________

With one 7½' φ offline

670 gpm / (2 × 44.1787) + (4 × 50.2656) = 2.31 gpm/ft²

88.36 + 201.06

With one 8'φ offline

670 gpm / (3 × 44.1787) + (3 × 50.2656)

= 2.36 gpm / ft²

Filters will be 3 - 7½'φ 3 - 8'φ units

Pipeline Velocities (pumped)

	6"	8"
400 gpm	4.55 fps	2.56 fps
670 gpm	(650 gpm) 7.38 fps	(650 gpm) 4.15 fps

no piping changes for size reasons.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ____________ JOB NO ____________ DATE ____________

STRUCTURE ____________ COMPUTED BY ____________

LIVE LOAD PER SQUARE FOOT ____________ WORKING STRESS ____________

Langelier Index Determination

Raw water TDS - 345
Total Alkalinity - 214 ppm as $CaCO_3$
Calcium - 223 ppm as $CaCO_3$

Calcium as Ca = 223 × .4 = 89.2 ppm as Ca

temp.	20°C 68°F	25°C 77°F	30°C 86°F
pHs	7.4	7.3	7.25
pHactual	7.2	7.2	7.2
Sat. Index	-0.2	- 0.1	-0.05 corrosive index
Chem. Engg sat. Index	- 0.2	-0.06	0 corrosive index
pH after lime add.	7.8	7.8	7.8
Sat. Index	+.4	+.5	+.55

-APPENDIX III-

WASTEWATER TREATMENT

PLANT

A UTILITY STUDY

FOR

THE COURTHOUSE BAY AREA

APPENDIX III

INDEX

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE SEWER
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10-4-78
COMPUTED BY TCD
WORKING STRESS

J.E. SIRRINE COMPANY SEWER STUDY RESULTS 1/4

SANITARY SEWER PLANT

		1MG/mo		1MG/mo	MGD/mo DIFF
JAN	1977 →	9.983	1978 →	12.010	2.027
FEB		7.927		11.174	3.247
MAR		9.545		13.031	3.486
APR.		9.182		12.596	3.414
MAY		9.328		13.662	4.334
JUNE		9.709		12.953	3.244
JULY		10.389		13.206	2.817
	AVG =	9.438	AVG =	12.662	AVG = 3.224

AVG. DAYS PER MO. = 30.29 DAYS

3,224,000 gpmo. / 30.29 DAYS = 106,438 gpd.

ASSUME AN AVERAGE OF 500 ENG. STUDENTS DURING THIS TIME.

106,438 gpd / 500 STUDENTS = 212.88 gpcd

TO ADD SOME SAFETY FACTOR, USE 225 gpcd / NEW USER

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY — JOB NO A-1086 — DATE 10/4/78
STRUCTURE — COMPUTED BY TCD
LIVE LOAD PER SQUARE FOOT — WORKING STRESS

J.E. SIRRINE COMPANY SEWER STUDY RESULTS 2/4

EXISTING FLOW BEFORE ENGINEERING BARRACKS WERE ADDED.

AMTRAC	664	X	150 gpd	=	99,600
ENGINEERING	500	X	50 gpd	=	25,000
OFFICERS	30	X	150 gpd	=	4,500
RESIDENT	25	X	100 gpd	=	2,500
OFF BASE	655	X	50 gpd	=	32,750
POWER PLANT				=	6,000
INFILTRATION				=	130,950
RESTAURANT	2 gpd/MEAL X 3 MEALS X 700			=	4,200
	2 gpd/MEAL X 1 MEAL X 800			=	1,600

AVG. DAILY FLOW = 307,100 gpd

1977

JAN	9.983 MG/MO.
FEB	7.927
MAR	9.545
APR	9.182
MAY	9.328
JUNE	9.709
JULY	10.389

AVG = 9.438

9,438,000 gp MO./30.29 DAY/MO = 311,590 gpd ACTURAL AVG. DAILY FLOW

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE SEWER
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/4/78
COMPUTED BY TLD
WORKING STRESS

3/4

EXISTING CONDITIONS WHEN AMTRAC PEOPLE ARE ON BASE

AMTRAC	664 × 150 gpd	=	99,600
ENGINEERING	500 × 225 gpd	=	112,500
OFFICERS	30 × 150 gpd	=	4,500
RESIDENTS	25 × 100 gpd	=	2,500
OFF BASE	655 × 50 gpd (1775-1320)	=	32,750
POWER PLANT		=	6,000
RESTAURANT	2 gal/MEAL × 3 MEALS × 1200	=	7,200
	2 gal/MEAL × 1 MEAL × 300	=	600
INFILTRATION		=	130950

AVG. DAILY FLOW = 396,600 gpd

1978

JAN	12.010	MG/MO
FEB	11.174	
MAR	13.031	
APR.	12.596	
MAY.	13.662	
JUNE	12.953	
JULY	13.206	

AVG = 12.662 OR 12,662,000 gpmo/30.29 DAY/MO = 418,025 gpd

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB COURTHOUSE BAY
STRUCTURE S. SEWER
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10/3/78
COMPUTED BY TLD
WORKING STRESS

4/4

CALCULATIONS BASED ON MAXIMUM POPULATION FOR YEAR 1986.

AMTRAC	882 × 225 gpd	=	198,450
ENGINEERING	654 × 225 gpd	=	147,150
OFFICERS	30 × 150 gpd	=	4,500
RESIDENT	25 × 100 gpd	=	2,500
OFF BASE	615 × 50 gpd	=	30,750
POWER PLANT		=	6,000
RESTAURANT	2 gal/meal × 3 meals × 1560	=	9,360
	2 gal/meal × 1 meal × 300	=	600
INFILTRATION		=	130950
AMTRAC WASH RACK		=	0

AVG. DAILY FLOW = 557,260 gpd

NOTE: FOR MAX DAILY FLOW I WOULD MULTIPLY THE INFILTRATION BY A FACTOR OF 1.25
= 590,000 gpd
≈ 600,000 gpd
AMTRAC WASHRACK 50,000 gpd
AVG. DAILY FLOW = 650,000 gpd

BOD CONTAMINATED WASTEWATER FLOW = 393,310 gpd
NON-CONTAMINATED WASTEWATER FLOW = 284,588 gpd

AVG. DAILY FLOW – (393,310) + (284,588) ≈ 678,000 gpd
MAX. 24 HR. FLOW – (393,310)(2.7) + (284,588) ≈ 1,346,500 gpd
PEAK FLOW – (393,310)(3.8) + (284,588) ≈ 1,779,200 gpd
MIN. FLOW – (393,310)(.23) + (284,588) ≈ 375,000 gpd

J. E. SIRRINE COMPANY

ARCHITECTS ENGINEERS PLANNERS

WASTE ANALYSIS

Job No. A-1086-03

CLIENT
U. S. Navy
Courthouse Bay - Camp Lejune, N. C.

Sample Received 9/22/78
Analysis Completed 9/28/78
Transmittal

Analysis No.	Sample Description
36574	Chlorine contact chamber, taken 9/20-21/78
36575	Trickling filter effluent, taken 9/20-21/78
36576	Imhoff effluent, taken 9/20-21/78
36577	Inlet stream, taken 9/20-21/78

Results in milligrams per liter (parts per million) unless noted. APHA or EPA Std. Methods unless noted.

Component	Reported as	36574	36575	36576	36577
Biochemical Oxygen Demand, 5-Day	O_2	30	23	36	61
Chemical Oxygen Demand	O_2	125	55	82	137
Immediate Oxygen Demand	O_2				
Dissolved Oxygen	O_2				
pH					
Alkalinity, Methyl Orange	$CaCO_3$				
Alkalinity, Phenolphthalein	"				
Carbon Dioxide	CO_2				
Mineral Acidity	$CaCO_3$				
Total Dissolved Solids by Evaporation					
Suspended Solids		9.4	13	16	27
Volatile Suspended Solids					
Specific Conductance at 23° C	MMHOS/CM				
Temperature	°C				
Color					
Turbidity					
Settleable Solids: 30 Min., 1, 6, 24 Hr.	ml/L				
Chlorides	Cl				
Chromium, Total	Cr				
Copper	Cu				
Phosphate	P				
Fluoride	F				
Nitrogen Kjeldahl	N				
Nitrogen (Ammonia)	N				
Nitrogen (Nitrate)	N				
Oil & Grease, Hexane Soluble					
Surfactants	ABS or LAS				
Lead	Pb				
Mercury	Hg				
Zinc	Zn				

Remarks: Holding Time for Samples was 22 hrs.

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By Babb
Analyst

COURTHOUSE BAY WASTEWATER TREATMENT PLANT MONITORING DATA

MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: CHB

MONTH: Jan 78

DATE	SEWAGE FLOW: MAXIMUM (X 1000 GPD)	SEWAGE FLOW: MINIMUM (X 1000 GPD)	SEWAGE FLOW: TOTAL DAILY (X 1000 GPD)	PH: RAW	PH: EFFLUENT	CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS: RAW (MG/1)	SETTLEABLE SOLIDS: EFFLUENT (MG/1)	5-DAY 20°C BOD: RAW (MG/1)	5-DAY 20°C BOD: EFFLUENT (MG/1)	5-DAY 20°C BOD: PERCENT REMOVAL	SUSPENDED SOLIDS: RAW (MG/1)	SUSPENDED SOLIDS: EFFLUENT (MG/1)	SUSPENDED SOLIDS: PERCENT REMOVAL	TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	CHLORINE FEED lbs/day
1	372	288	396	7.2	6.3	3.2	8.5	0.5	0.0											40
2	431	407	435	7.0	6.3	3.1	10.0	1.4	0.0	65	8	88	88	24	74	236			0	40
3	—	—	342	7.0	6.2	2.6	7.8	1.0	0.0											40
4	420	288	398	7.0	6.6	3.0	8.6	1.5	0.0											50
5	360	360	345	7.0	6.5	3.3	8.7	1.2	0.0											50
6	420	336	339	7.0	6.4	3.1	7.0	1.3	0.0											50
7	360	216	340	7.1	6.5	3.0	8.5	0.8	0.0											50
8	431	300	361	7.1	6.5	3.0	8.1	1.0	0.0											50
9	384	192	328	7.1	6.6	3.0	8.0	1.0	0.0	80	11	86	600	15	98	218			0	50
10	384	312	384	7.2	6.4	3.1	8.4	0.9	0.0											50
11	407	336	444	7.2	6.6	3.0	8.2	1.0	0.0											50
12	488	312	400	7.2	6.6	2.8	8.6	1.2	0.0											50
13	420	336	390	7.2	6.5	3.0	8.3	1.4	0.0											50
14	425	255	374	7.1	6.5	3.5	7.4	1.2	0.0											50
15	407	312	357	7.0	6.8	3.5	7.5	1.1	0.0											50
16	384	312	390	7.1	6.4	3.0	9.0	1.4	0.0	150	48	68	68	17	75	488			0	50
17	384	336	395	71	64	2.8	8.4	1.4	0.0											50
18	407	336	389	7.0	6.5	3.0	8.2	0.9	0.0											50
19	480	240	424	7.1	6.5	3.0	7.2	0.5	0.0											50
20	420	360	410	7.0	6.6	3.0	8.6	1.5	0.0											50
21	425	240	392	7.0	6.3	2.0	7.8	1.0	0.0											50
22	480	384	416	7.2	6.6	3.3	8.2	1.0	0.0											50
23	480	264	294	7.1	6.7	3.0	8.1	1.0	0.0	60	8	87	92	9	90	147			0	50
24	431	312	404	7.2	6.6	3.0	8.4	1.2	0.0											50
25	431	312	421	7.2	6.7	3.0	8.0	1.5	0.0											50
26	407	360	420	7.2	6.7	2.9	8.2	1.0	0.0											50
27	410	296	354	7.2	6.9	2.8	8.1	1.0	0.0											50
28	450	220	436	7.2	6.8	3.0	8.5	1.0	0.0											50
29	445	210	453	7.0	6.5	3.3	8.0	1.0	0.0											50
30	431	360	431	7.2	6.6	3.0	8.3	1.2	0.0	60	10	83	26	8	62	215			0	50
31	431	360	402	7.2	6.6	3.0	8.1	1.3	0.0											50
TOT.	13771	9411	12081	2225	2087	928	2576	352	0.0	415	85	412	874	73	399					1520
AVE.	411	303	389	7.3	6.7	2.9	8.3	1.1	0.0	83.0	17	82.4	174.8	14.6	79.8					49

79.5 Ave

91.6 Ave

MCBCL 11345/2 (REV 10-74)

MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: Courthouse Bay

MONTH: February 1978

MCBCL 11345/2 (REV 10-74)

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DATE	SEWAGE FLOW: MAXIMUM ~~M.G.D.~~ (X1000 GPD)	SEWAGE FLOW: MINIMUM ~~M.G.D.~~ (X1000 GPD)	SEWAGE FLOW: TOTAL DAILY (X 1000 GPD)	PH: RAW	PH: EFFLUENT	CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS: RAW (MG/1)	SETTLEABLE SOLIDS: EFFLUENT (MG/1)	5-DAY 20°C BOD: RAW (MG/1)	5-DAY 20°C BOD: EFFLUENT (MG/1)	5-DAY 20°C BOD: PERCENT REMOVAL	SUSPENDED SOLIDS: RAW (MG/1)	SUSPENDED SOLIDS: EFFLUENT (MG/1)	SUSPENDED SOLIDS: PERCENT REMOVAL	TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	Chlorine Feed lbs/day	
1	431	336	399	7.0	6.7	3.0+	8.6	0.9	0.0											50	1
2	407	288	411	7.1	6.6	3.0	8.4	1.0	0.0											50	2
3	408	336	393	7.0	6.6	3.0	8.0	1.3	0.0											50	3
4	420	300	391.1	7.0	6.4	2.5	8.2	1.0	0.0											50	4
5	460	345	410.2	7.2	6.4	2.8	9.2	2.0	0.0											50	5
6	432	269	420.8	7.2	6.6	2.0	9.8	1.3	0.0	30	2	93	38	2	94	105			0	50	6
7	509	338	422	7.2	6.8	3.0	9.6	1.8	0.0											50	7
8	407	338	394.8	7.1	6.7	2.5	10.0	1.0	0.0											50	8
9	372	242	473.7	7.2	6.7	3.5	9.4	2.0	0.0											50	9
10	meter	out	402.7	6.8	6.7	4.4	9.3	1.2	0.0											50	10
11	437	312	374	7.1	6.8	3.5	9.3	2.0	0.0											50	11
12	420	316	3.55	7.2	6.7	3.3	9.2	4.0	0.0											50	12
13	360	288	343.8	7.0	6.7	3.1	8.1	2.0	0.0	110	18	84	68	11	84	316			0	50	13
14	374	331	331.4	7.0	6.6	3.1	7.0	1.9	0.0											50	14
15	401	360	372.6	7.1	6.7	3.3	7.2	1.8	0.0											50	15
16	384	288	395	7.3	6.8	3.3	9.2	2.0	0.0											50	16
17	407	384	386.1	7.2	6.9	3.0+	9.0	4.0	0.0											50	17
18	432	336	370.8	7.0	6.6	3.0	9.0	1.0	0.0											50	18
19			173.5	7.1	6.4	2.6	9.5	1.0	0.0											50	19
20			387	7.0	6.8	3.5	9.6	1.5	0.0	40	8	80	108	4	96	179			0	50	20
21			396	7.0	6.6	3.5	8.8	1.9	0.0											50	21
22			424.7	7.1	6.8	3.5	9.0	1.8	0.0											50	22
23			453.2	7.4	6.7	4.0	10.0	1.0	0.0											50	23
24			422	7.2	6.8	3.3	9.6	1.1	0.0											50	24
25			418.1	7.1	6.8	4.1	9.1	1.8	0.0											50	25
26			434.5	7.0	6.6	5.5	8.5	1.2	0.0											50	26
27			402.9	7.0	6.6	5.2	6.7	1.8	0.3	50	7	86	40	7	83				0	50	27
28			415	7.0	6.6	4.7	6.9	2.1	0.1											50	28
29																					29
30																					30
31																					31
TOT.			11,173.9	198.6	186.7	97.6	246.2	47.4	0.4	230	35	343	254	24	357					1400	
AVE.			399.1	7.1	6.7	3.5	8.8	1.7	0.014	57.5	8.8	85.75	63.5	6.0	89.3					50	

MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: Crest Haven Bay

MONTH: March 1978

DATE	SEWAGE FLOW: MAXIMUM ~~M.G.D.~~	SEWAGE FLOW: MINIMUM ~~M.G.D.~~	SEWAGE FLOW: TOTAL DAILY (X 1000 GPD)	PH: RAW	PH: EFFLUENT	CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS: RAW (MG/1)	SETTLEABLE SOLIDS: EFFLUENT (MG/1)	5-DAY 20°C BOD: RAW (MG/1)	5-DAY 20°C BOD: EFFLUENT (MG/1)	5-DAY 20°C BOD: PERCENT REMOVAL	SUSPENDED SOLIDS: RAW (MG/1)	SUSPENDED SOLIDS: EFFLUENT (MG/1)	SUSPENDED SOLIDS: PERCENT REMOVAL	TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	Chlorine Feed lbs/day
1			416.1	7.1	6.8	5.6	6.7	4.0	0.0											2.5
2			416.8	7.2	6.9	5.5	7.5	3.0	0.0											40
3			433.1	7.4	6.9	5.8	7.4	3.1	0.0											40
4			427.3	7.1	6.9	4.6	7.9	2.0	0.0											40
5			447.7	7.0	6.8	4.1	7.6	1.0	0.0											40
6			405.5	7.2	6.6	5.0	7.6	2.3	0.0											40
7			395.2	7.3	6.8	4.7	6.2	3.1	0.0	55	9	84	61	2	97					40
8			426.1	7.7	7.0	4.9	6.0	3.8	0.0										0	40
9			445.5	7.6	7.1	4.5	7.2	3.5	0.0											40
10			422.0	7.3	7.0	6.2	6.2	4.0	0.0											40
11			428.0	7.3	7.0	4.6	8.0	2.5	0.0											40
12			412.1	7.2	6.8	4.1	7.9	2.0	0.0											35
13			399.1	7.2	6.8	3.8	8.6	2.1	0.0											40
14			402.9	7.4	6.6	4.2	6.0	4.1	0.0	50	6	88	70	8	89					40
15			426.2	7.3	6.9	5.5	5.2	5.0	0.0										0	35
16			409.2	7.3	6.8	5.1	5.9	2.0	0.0											35
17			415.0	7.4	7.0	5.0	6.6	3.5	0.0											35
18			374.6	7.3	6.9	4.8	5.6	2.5	0.0											35
19			418.4	7.2	6.[illegible]	4.5	7.6	2.0	0.0											35
20			398.7	7.1	6.8	5.1	6.2	3.4	0.0											35
21			420.4	7.1	6.8	3.8	6.6	3.1	0.0	55	10	82	36	3	92					35
22			416.1	7.2	6.8	4.8	6.2	3.0	0.0										0	35
23			399.4	7.2	6.8	4.7	5.8	4.8	0.0											30
24			406.8	7.2	6.8	4.5	8.3	4.3	0.0											30
25			384.3	7.2	6.8	4.0	8.1	1.7	0.0											30
26			444.6	7.1	6.9	3.8	8.0	2.4	0.0											30
27			437.1	7.1	6.8	4.8	8.1	3.3	0.0											20
28			426.2	7.0	6.8	4.6	8.2	3.2	0.0	125	8	94	74	3	96					30
29			422.7	7.2	7.0	3.8	8.1	2.0	0.0										0	20
30			439.1	7.5	7.1	4.9	8.5	2.5	0.0											30
31			410.9	7.3	7.0	4.0	8.2	3.5	0.0											30
TOT.			13021.1	224.6	202.9	145.3	230.0	91.7	0.0											1086
AVE.			420.4	7.3	6.6	4.7	7.4	3.0	0.0											35

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MCBCL 11345/2 (REV 10-74)

MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: Crystal Haze Bay

MONTH: [illegible] 1978

MCBCL 11345/2 (REV 10-74)

(9)

DATE	SEWAGE FLOW: MAXIMUM M.G.D.	SEWAGE FLOW: MINIMUM M.G.D.	SEWAGE FLOW: TOTAL DAILY (x 1000 GPD)	PH: RAW	PH: EFFLUENT	CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS: RAW (MG/1)	SETTLEABLE SOLIDS: EFFLUENT (MG/1)	5-DAY 20°C BOD: RAW (MG/1)	5-DAY 20°C BOD: EFFLUENT (MG/1)	5-DAY 20°C BOD: PERCENT REMOVAL	SUSPENDED SOLIDS: RAW (MG/1)	SUSPENDED SOLIDS: EFFLUENT (MG/1)	SUSPENDED SOLIDS: PERCENT REMOVAL	TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	CHLORINE FEED lbs/day
1			401.4	7.0	7.1	3.50	7.9	1.9	0.00											.27
2			438.3	7.1	6.9	3.30	8.5	1.0	0.00											.27
3			438.0	7.4	7.2	4.83	8.6	2.0	0.01	135	8	94	186	17	99				0	.27
4			414.3	7.5	7.2	5.85	8.2	3.0	0.00											.27
5			420.1	7.3	7.1	5.38	8.0	3.0	0.00											.27
6			432.0	7.3	7.1	4.35	8.0	3.0	0.00											.27
7			415.2	7.3	7.1	5.65	7.7	4.8	0.00											.27
8			416.0	7.2	6.8	4.28	7.7	3.2	0.00											.27
9			426.9	7.2	7.1	4.09	7.5	2.8	0.00											.27
10			421.0	7.1	6.8	4.68	7.7	2.0	0.10	570	17	97	2860	4	99	2001			0	.27
11			409.4	7.3	7.2	5.83	8.0	4.8	0.00											.27
12			400.4	7.2	6.9	5.17	7.5	2.8	0.05											.27
13			410.7	7.1	7.2	5.21	4.0	4.0	0.10											.27
14			397.2	7.4	7.2	5.36	5.0	5.0	0.00											.27
15			375.3	7.2	6.6	5.01	5.1	3.4	0.00											.27
16			392.5	7.1	6.8	5.45	5.5	2.9	0.00											.27
17			410.3	7.3	7.1	6.85	4.5	5.0	0.05	780	23	97	220	15	93	[illegible]			0	.27
18			428.7	7.1	6.9	6.32	4.5	4.7	0.05											.27
19			424.6	7.4	7.2	6.61	5.1	4.5	0.10											.27
20			443.1	7.6	7.1	6.92	5.2	2.5	0.10											.27
21			432.0	7.2	7.0	5.64	5.0	3.6	0.05											.27
22			419.8	7.2	6.8	5.51	5.2	4.1	0.05											.27
23			396.5	7.1	6.6	7.01	4.9	4.2	0.05											.27
24			415.1	7.3	7.1	6.08	5.0	5.7	0.02	340	19	94	650	13	98	1176			0	.27
25			456.1	7.3	7.2	4.94	5.6	4.6	0.02											.27
26			446.5	7.3	7.2	5.84	6.0	5.1	0.01											.27
27			444.2	7.1	7.0	6.01	6.0	4.6	0.03											.27
28			432.5	7.1	7.0	5.57	5.7	—	—											.27
29			398.3	7.0	7.0	7.71	4.4	2.9	0.00											.27
30			451.2	7.0	7.0	6.62	5.8	3.2	0.00											.27
31																				
TOT.			13590.5	216.7	210.5	165.67	188.6	100.3	0.73	1825	67	382	3916	49	389					8.10
AVE.			418.35	7.25	7.05	5.52	6.27	3.44	0.021	456	16.75	95.5	979	12.25	97.25					

453.01

MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: Court Haven Bay

MONTH: May 1978

DATE	SEWAGE FLOW: MAXIMUM ~~M.G.D.~~	SEWAGE FLOW: MINIMUM ~~M.G.D.~~	SEWAGE FLOW: TOTAL DAILY (x 1000 GPD)	PH: RAW	PH: EFFLUENT	CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS: RAW (MG/1)	SETTLEABLE SOLIDS: EFFLUENT (MG/1)	5-DAY 20°C BOD: RAW (MG/1)	5-DAY 20°C BOD: EFFLUENT (MG/1)	5-DAY 20°C BOD: PERCENT REMOVAL	SUSPENDED SOLIDS: RAW (MG/1)	SUSPENDED SOLIDS: EFFLUENT (MG/1)	SUSPENDED SOLIDS: PERCENT REMOVAL	TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	CHLORINE FEED lbs/day
1			435.7	7.4	7.2	5.48	5.2	9.1	0.0	280	14	95	550	22	96				0	.25
2			431.0	7.3	7.2	4.57	5.5	8.0	0.05											.25
3			421.6	7.2	7.2	5.27	6.5	7.0	0.10											.25
4			455.0	7.3	7.1	6.26	5.8	8.8	0.10											.25
5			438.4	7.4	7.2	6.48	6.0	6.0	0.00											.25
6			444.2	7.0	7.0	7.15	5.4	7.3	0.00											.25
7			415.7	7.4	7.2	5.85	6.3	6.3	0.00											.25
8			440.4	7.3	7.2	5.59	6.5	6.9	0.10	110	8	93	27	4	85				0	.25
9			470.2	7.1	6.9	4.21	6.4	4.1	0.10											.25
10			448.2	7.2	7.0	5.00	5.6	6.9	0.10											.25
11			444.3	7.3	7.1	4.84	5.8	5.7	0.05											.25
12			455.2	7.2	6.9	5.86	6.0	5.0	0.05											.25
13			438.9	7.2	6.9	5.93	6.9	6.9	0.00											.25
14			463.1	7.2	7.1	5.01	6.3	5.0	0.05											.25
15			434.7	7.1	6.8	5.19	5.9	2.8	0.10	225	18	92	412	8	98	816			0	.25
16			438.7	7.1	6.9	5.00	6.1	3.4	0.10											.25
17			446.0	6.8	6.8	3.77	5.5	2.5	0.00											.25
18			422.0	7.2	7.1	3.71	5.2	2.5	0.00											.25
19			406.2	7.1	7.0	3.80	6.0	2.6	0.00											.25
20			411.2	7.4	7.2	4.97	6.2	4.0	0.00											.25
21			445.5	7.3	7.1	4.84	6.0	1.8	0.00											.25
22			444.3	7.0	6.8	3.73	7.7	2.6	0.00	135	13	90	266	22	92				0	.25
23			438.3	7.0	6.8	4.30	7.2	3.0	0.00											.25
24			453.1	7.2	7.1	4.12	6.5	4.5	0.00											.25
25			445.2	7.3	7.1	4.85	6.8	5.0	0.00											.25
26			456.7	7.3	7.1	5.16	7.0	5.0	0.00											.25
27			415.3	7.4	7.1	4.81	7.0	5.0	0.00											.25
28			404.2	7.2	7.0	4.59	6.8	5.0	0.00											.25
29			434.2	7.0	6.8	5.08	7.1	3.4	0.00	115	9	92	318	7	98				120	.25
30			452.5	7.0	6.8	5.08	7.1	4.1	0.00											.25
31			418.3	7.1	7.0	4.94	6.4	6.1	0.00											.25
TOT.			13357.40	214.0	207.7	153.8	195.7	145.9	.90	865	62	462	1573	63	469					7.75
AVE.			440.7	6.9	6.7	5.04	6.3	4.7	.029	173	12.4	92.4	314.6	12.6	93.8					

MCBCL 11348/2 (REV 10-74)

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MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: Court House Bay

MONTH: June 197

DATE	SEWAGE FLOW: ~~MAXIMUM M.G.D.~~	SEWAGE FLOW: ~~MINIMUM M.G.D.~~	SEWAGE FLOW: TOTAL DAILY (X1000 GPD)	PH: RAW	PH: EFFLUENT	CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS: RAW (MG/1)	SETTLEABLE SOLIDS: EFFLUENT (MG/1)	5-DAY 20°C BOD: RAW (MG/1)	5-DAY 20°C BOD: EFFLUENT (MG/1)	5-DAY 20°C BOD: PERCENT REMOVAL	SUSPENDED SOLIDS: RAW (MG/1)	SUSPENDED SOLIDS: EFFLUENT (MG/1)	SUSPENDED SOLIDS: PERCENT REMOVAL	TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	chlorine lbs used per day
1			431.5	7.4	7.2	4.50	7.0	4.5	0.0											25
2			442.7	7.3	7.0	4.21	6.9	2.5	0.0											25
3			449.7	7.2	7.1	4.20	7.0	2.5	0.0											25
4			491.5	7.4	7.3	2.10	6.7	3.0	0.0											25
5			464.4	7.2	6.8	3.90	6.4	3.1	0.0	135	16	88	138	4	97				4	22
6			504.7	7.1	7.0	2.10	7.0	3.3	0.0											22
7			438.5	7.2	6.8	3.54	6.8	2.0	0.0											22
8			463.3	7.2	7.0	2.63	6.8	6.5	0.0											22
9			429.5	7.0	6.8	3.42	5.7	3.1	0.0											22
10			435.1	7.0	7.0	3.16	6.2	5.5	0.0											22
11			448.4	7.0	7.2	2.82	6.0	3.5	0.0											22
12			443.1	7.1	6.9	3.73	6.6	3.2	0.0	135	17	87	212	8	96				0	22
13			409.2	7.1	7.0	3.45	6.5	2.9	0.0											22
14			424.7	7.2	6.8	3.50	6.8	2.4	0.0											22
15			443.6	7.0	6.8	3.44	6.5	2.9	0.0											22
16			401.2	7.1	7.0	4.10	6.2	3.2	0.0											22
17			416.7	7.1	6.8	4.20	6.3	2.9	0.0											22
18			416.5	7.0	6.9	3.10	6.1	3.2	0.0											22
19			407.4	7.1	6.9	3.30	6.1	3.4	0.0	160	7	90	256	5	98				10	22
20			421.2	7.1	6.7	3.53	6.7	3.9	0.0											22
21			451.7	6.8	6.5	3.81	6.3	3.5	0.0											22
22			416.5	7.0	7.0	6.90	5.8	3.0	0.0											22
23			404.9	7.0	6.8	4.72	6.0	3.4	0.0											22
24			368.5	7.0	6.8	3.15	5.8	4.5	0.0											22
25			404.6	7.2	6.6	2.95	5.4	6.0	0.0											22
26			432.1	7.1	6.6	3.78	6.1	3.3	0.0	145	15	90	176	5	97				0	22
27			476.3	7.0	6.8	4.06	6.7	3.9	0.0											22
28			371.3	7.2	7.0	4.40	6.5	3.0	0.0											22
29			442.8	7.2	6.9	3.33	6.0	3.5	0.0											22
30			417.2	7.4	6.8	4.33	5.7	3.5	0.0											22
31																				
TOT.			12952.9	213.7	207.1	112.67	192.1	102.1	0.0	575	55	355	782	22	388					672
AVE.			431.8	7.1	6.9	3.76	6.4	3.4	0.0	144	13.8	88.8	196	5.5	97.0					22.4

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MCBCL 11345/2 (REV 10-74)

MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: Crest Haven Bay

July 1978

DATE	SEWAGE FLOW: MAXIMUM ~~M.G.D.~~	SEWAGE FLOW: MINIMUM ~~M.G.D.~~	SEWAGE FLOW: TOTAL DAILY (x 1000 GPD)	PH: RAW	PH: EFFLUENT	CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS: RAW (MG/1)	SETTLEABLE SOLIDS: EFFLUENT (MG/1)	5-DAY 20°C BOD: RAW (MG/1)	5-DAY 20°C BOD: EFFLUENT (MG/1)	5-DAY 20°C BOD: PERCENT REMOVAL	SUSPENDED SOLIDS: RAW (MG/1)	SUSPENDED SOLIDS: EFFLUENT (MG/1)	SUSPENDED SOLIDS: PERCENT REMOVAL	TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	chlorine lbs used per day
1			315.5	7.2	6.8	3.13	5.5	2.0	0.0											22
2			371.1	7.2	6.9	4.31	5.9	3.2	0.0											22
3			380.3	7.3	7.0	3.62	7.4	5.0	0.0	700	14	98	122	5	96				0	22
4			400.4	7.4	6.8	4.21	7.6	4.0	0.0											22
5			486.2	6.6	7.0	3.05	6.5	8.5	0.0											22
6			477.5	7.4	7.0	4.70	8.5	4.8	0.0											22
7			390.7	7.4	7.1	5.60	7.4	4.5	0.0											22
8			447.2	7.1	6.8	5.72	6.7	3.3	0.0											22
9			434.4	7.0	6.9	5.61	6.1	3.6	0.0											22
10			447.6	7.2	6.9	4.33	7.5	5.0	0.0	590	12	98	63	1	98				6	22
11			442.8	7.3	7.1	5.09	6.9	6.0	0.0											22
12			433.3	7.1	7.0	4.28	6.5	4.0	0.0											22
13			503.2	7.1	7.1	4.33	6.8	4.2	0.0											28
14			462.1	7.2	7.1	4.29	7.5	5.4	0.0											28
15			404.0	7.0	6.8	4.63	6.0	3.1	0.0											28
16			407.6	7.1	6.9	5.63	6.1	3.0	0.0											28
17			422.6	6.9	6.8	3.31	6.4	8.0	0.0	650	9	99	716	11	98				0	28
18			480.7	7.2	7.0	2.25	6.0	5.0	0.0											28
19			470.8	7.2	7.0	3.98	6.0	3.0	0.0											28
20			480.6	7.1	7.0	3.20	6.5	7.0	0.0											28
21			448.7	7.1	6.9	4.36	6.0	3.5	0.0											28
22			422.8	7.1	6.8	4.37	6.4	2.4	0.0											28
23			475.8	7.0	6.9	4.47	6.0	2.8	0.0											28
24			482.0	7.2	6.8	1.66	6.2	10.0	0.0	620	17	97	1332	4	99				0	28
25			424.8	7.2	6.9	3.12	5.5	5.0	0.0											28
26			463.1	7.1	6.8	4.26	6.0	5.2	0.0											28
27			314.8	7.2	6.9	4.82	6.5	6.0	0.0											20
28			438.8	7.2	7.1	4.58	4.0	6.0	0.01											28
29			368.0	7.0	6.9	5.68	5.4	3.2	0.0											28
30			329.0	7.1	6.9	5.31	6.1	3.0	0.0											28
31			347.7	7.3	7.0	3.70	5.8	5.0	0.0	310	12	96	600	4	99				0	28
TOT.			13205.5	221.6	214.9	137.70	198.2	145.0	0.01	2370	64	488	2833	25	490					
AVE.			426.0	7.2	6.9	4.44	6.4	4.6	0.0003	[illegible]	12.8	97.6	566	5.0	98					[illegible]

(12)

NJEPA 1134R/2 (REV 10-74)

MONTHLY REPORT OF WASTE TREATMENT PLANT OPERATION

NAME OF PLANT: Cent Hause Bay

MONTH: August 1978

MCBCL 11345/2 (REV 10-74)

DATE	SEWAGE FLOW			PH		CHLORINE RESIDUAL (MG/1)	EFFLUENT D.O. (MG/1)	SETTLEABLE SOLIDS		5-DAY 20°C BOD			SUSPENDED SOLIDS			TOTAL SOLIDS (MG/1)	C.O.D. (MG/1)	KJELDAHL NITROGEN (MG/1)	FECAL COLIFORM (M.P.N.)	CHLORINE FEED lbs/day
	MAXIMUM M.G.D.	MINIMUM M.G.D.	TOTAL DAILY (X 1000 GPD)	RAW	EFFLUENT			RAW (MG/1)	EFFLUENT (MG/1)	RAW (MG/1)	EFFLUENT (MG/1)	PERCENT REMOVAL	RAW (MG/1)	EFFLUENT (MG/1)	PERCENT REMOVAL					
1			412.1	7.3	6.9	3.86	6.0	5.4	0.0											31
2			424.1	7.3	7.0	3.92	6.4	4.8	0.0											31
3			390.9	7.2	7.0	2.86	6.0	3.5	0.0											31
4			389.2	7.2	6.9	3.31	6.4	3.5	0.0											31
5			689.7	7.1	6.9	4.81	6.1	3.4	0.0											31
6			370.5	7.6	7.1	6.95	7.1	4.0	0.0											31
7			403.5	7.3	7.1	4.12	5.9	3.6	0.0	275	14	95	400	6	99				8	31
8			383.8	7.4	7.0	3.54	6.5	3.2	0.0											31
9			394.2	7.3	6.8	5.63	5.9	3.1	0.0											23
10			380.0	7.2	7.1	5.74	4.2	5.8	0.0											35
11			360.5	7.2	6.9	7.54	6.0	5.0	0.0											30
12			375.3	7.1	7.0	3.97	5.9	4.8	0.0											38
13			360.1	7.8	7.2	5.88	6.5	2.5	0.0											38
14	[illegible]		473.1	7.1	7.0	4.45	6.2	3.2	0.0	235	16	93	206	1	99				0	38
15			383.8	7.0	6.9	4.55	6.0	3.3	0.0											38
16			420.9	7.2	6.8	3.08	6.1	3.2	0.0											38
17			383.8	7.2	6.6	5.54	6.4	5.4	0.0											38
18			388.6	7.1	6.6	5.31	6.0	4.0	0.0											37
19			388.6	7.2	6.7	4.47	6.0	3.8	0.0											37
20			95.0	7.3	6.7	8.38	8.8	2.5	0.0											37
21			142.5	7.1	6.7	5.51	7.8	3.4	0.0	125	11	91	245	8	97				0	37
22			237.5	7.1	6.8	4.63	7.1	3.1	0.0											37
23			304.0	7.0	7.2	4.79	6.5	3.0	0.0											37
24			362.7	7.3	6.6	5.40	6.8	4.5	0.0											37
25			362.0	7.2	6.6	6.92	7.0	3.0	0.0											37
26			322.12	7.2	6.6	6.89	7.0	4.0	0.0											37
27			363.9	7.5	6.8	6.27	6.5	3.8	0.0											37
28			371.5	7.0	6.8	5.38	8.0	3.5	0.0	105	14	87	182	9	95				0	37
29			339.2	7.0	6.9	5.85	7.4	3.2	0.0											37
30			357.2	7.5	6.9	4.40	3.0	4.0	0.0											35
31			356.3	7.5	7.7	6.15	6.0	5.7	0.0											30
TOT.			10012.3	221.5	213.8	166.17	188.4	128.2	0.0	740	55	366	1033	24	390					1043
AVE.				7.2	6.9	5.36	6.1	4.1	0.0	185	13.8	91.5	258	6	97.5					34

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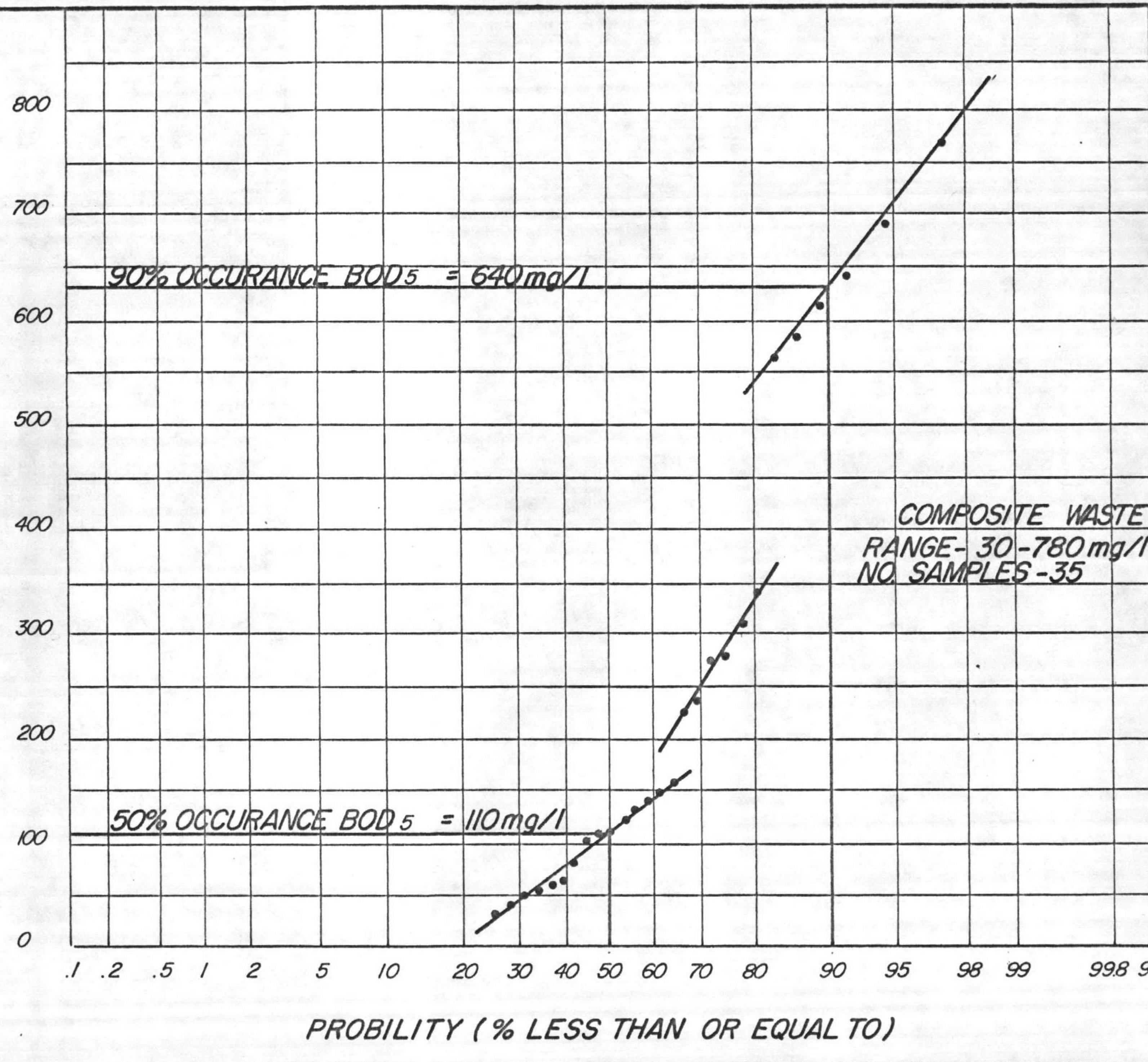
A-E CONTRACT NO.
N 62470-78-C-3675

J. E. SIRRINE COMPANY

PAGE 14 OF

PROBABILITY CURVE - WASTEWATER BOD5
CAMP LEJEUNE
JACKSONVILLE, N.C.

STATISTICAL ANALYSIS OF MONITORING DATA



A. (1) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (FINAL)

1. During this period beginning Modification Effective Date and lasting through Permit Expiration, the permittee is authorized to discharge from outfall serial number 004 - Courthouse Bay STP.

Such discharges shall be limited and monitored by the permittee as specified below:

PARAMETER	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS		
	kg/day(lbs/day) Monthly Average	kg/day(lbs/day) Weekly Average	Other Units (Specify) Monthly Average	Other Units (Specify) Weekly Average	Measurement Frequency	Sample Type	Sampling Point
Flow, M^3/day (MGD)	1987(0.525)				Daily	N/A	Influent or Effluent
Biochemical Oxygen Demand (5 day)	59.7(131.4)	89.5(1971.1)	30mg/1	45mg/1	1/week	Composite	Influent & Effluent
Suspended Solids	59.7(131.4)	89.5(1971.1)	30mg/1	45mg/1	1/week	Composite	Influent & Effluent
Fecal Coliform Bacteria, Geometric Mean			200/100 ml	400/100 ml	1/week	Grab	Effluent
Chlorine Residual (1)					Daily	Grab	Effluent

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NPDES PERMIT CONDITIONS

2. In addition to the specified limits, the monthly average effluent BOD_5 and suspended solids concentration shall not exceed 15 percent of the respective monthly average influent concentrations.

3. The pH of the effluent shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored by grab sample 1/week.

4. There shall be no discharge of floating solids or visible foam in other than trace amounts.

5. The effluent shall not cause a visible sheen on the receiving water.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB ________ JOB NO ________ DATE ________
STRUCTURE ________ COMPUTED BY ________
LIVE LOAD PER SQUARE FOOT ________ WORKING STRESS ________

Design Calculations

Calculations Based on Max. Population for 1986

I Waste water Characterization

1) Contaminated Wastewater Flows

AMTRAC -	198,450 gpd
Engineering -	147,150 gpd
Officers -	4,500 gpd
Residents -	2,500 gpd
OFF Base -	30,750 gpd
Restraunt -	9,960 gpd
	393,310 gpd (AVG Flow)

a) BOD_5

Assume 200 mg/l BOD_5 in Contaminated wastewater

$$\text{lbs. } BOD_5 = (200\ mg/l)(8.34)(0.393\ MGD)$$
$$= 656\ \text{lbs } BOD_5/\text{day}$$

2) Non-contaminated Wastewater Flows

Power Plant -	6,000 gpd
H_2O Plant -	65,000 gpd
(1.25) Infiltration -	163,688 gpd
AMTRAC Washrack -	50,000 gpd
	284,588 gpd (Avg. Flow)

a) BOD_5

Assume No BOD_5

3) Total Flows

Avg. Daily Flow = 393,310 gpd + 284,588 gpd = 678,000 gpd = 471 gp
Max 24 hr Flow = (")(2.7) + (") = 1,346,500 gpd = 935 gp
Peak Flow = (")(3.8) + (") = 1,779,200 gpd = 1,236 gp
Min. Flow = (")(0.23) + (") = 375,000 gpd = 260 gpm

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3) BOD_5 loadings & Conc.

lbs BOD_5/day = 656 (Based on DM-5 criteria for contaminated fraction of flow)

$$\text{mg/l } BOD_5 = \frac{656 \text{ lbs } BOD_5/d}{(0.678 \text{ MGD})(8.34)}$$

$$BOD_5 = 116 \text{ mg/l}$$

II. Unit Process Design Calculations

1) Primary Clarifiers

a) Design Criteria from DM-5

Two (2) Primary Clarifiers
Overflow rate @ 24 hr. Max Flow w/ one unit down = 3600 gpd/ft^2
Overflow rate @ Avg. Daily Flow w/ all units in operation = 1200 gpd/ft^2

b) Surface Area Required & Size

@ Max 24 hr flow w/ one unit down

$$\text{Area} = 1{,}346{,}500 \text{ gpd}/3600 \text{ gpd/ft}^2 = 374 \text{ ft}^2$$

@ Avg. Daily flow w/ all units in operation

$$\text{Area} = (678{,}000 \text{ gpd}/1200 \text{ gpd/ft}^2)/2 = 283 \text{ ft}^2$$

∴ Max flow condition controls

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Surface Area = 374 ft^2

$\pi r^2 = 374$
r = 11 ft
Diameter = 22 ft.

Overflow Rate @ Ave daily Flow
(678,000/2)/(374)
= 906 gpd/sqft

w/ 8ft Side Water Depth
Volume = 2992 cuft = 22,380 gal

Detention Time @ Avg. Daily Flow = 48 min.

c) Removal Eff. for Primary Clarifiers

From DM-5 60% S.S.
30% BOD_5

2) Trickling Filter

An additional T.F. is to be installed identical to the existing unit

a) loadings (at Avg. Daily Flow & Parallel Operation)
Diameter = 62 ft
Surface Area = 0.07 acre
Volume = 22,600 cuft
Media Depth = 7.4 ft.

30% removed during Primary Clarification
Two filters

BOD_5 Loading = (656 lbs/d)(0.7)(.5) / 22.6 x 10^3 cuft
= 10 lbs BOD_5/1000 cuft

Hydraulic Loading = (0.678 MGD)(.5)/0.07 acre
= 4.8 MGD/acre

b) loadings (@ Avg. Daily Flow w/ Series operation

0% recycle		1^{st} STAGE	2^{nd} STAGE
Hydraulic Loading	-	9.6 MGD/acre	9.6 MGD/acre
BOD_5 Loading	-	20 lbs/1000 cuft	0.4 lbs/1000

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LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

c) Existing Trickling Filter Avg Daily Loadings

Flow - 525,000 gpd

Hydralic Loading = (.525)/.07
= 7.5 MGD/acre

lbs BOD = 434 lbs - 130 lbs (removed in Primary Clarifier)
= 304 lbs

BOD Loading = (304 lbs)/22.6
= 13.5 lbs BOD/1000 cuft

d) NRC Equation

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

$$E_2 = \frac{1}{1+0.0085\left(\frac{W'}{VF}\right)^{1/2}} \times 100$$

$$F = (1+R)/(1+R/10)^2$$

50% Recycle F = 1.65
0% " F = 1
V = 0.52 acre
W = (656 lbs)(.7)(.5) = 230 lbs/day

1) Parallel operation of dual Filters

Recycle	% BOD Removed	Influent BOD	Effluent BO[D]
0%	85 %	116 mg/l	17.4 mg/l
50%	88 %	116 mg/l	14.0 mg/l

2) Sieries operation of dual Filters

Recycle	Overall % BOD Removed	Influent BOD	Effluent BO[D]
0%	98 %	116 mg/l	2.3 mg/l
50%	99 %	116 mg/l	1.2 mg/l

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3) Secondary Clarifier

a) Existing S.C.

26' diameter
Area = 530 sq. ft
Surface Loading @ Existing Design Flow (.525 MGD)
= 990 gpd/sq. ft.

b.) Design Criteria

From DM-5
Avg Daily Flow - 800 gpd/sq. ft
@ Max 24 hr Flow w/
one unit down - 2000 gpd/sq. ft.

c.) New S.C.

24 hr. Max Flow - 1,346,500 gpd

Area required = 1,346,500 gpd/2000 gpd/sq ft.
= 673 sq. ft.

$\pi r^2 = 673$ sq. ft
$r = 14.6$

diameter = 29 ft.

d) Overflow on New & Existing S.C. at Avg. Daily Flow

Overflow (New S.C.) = (.678 MGD)(.5)/673 sq. ft
= 503 gpd / sq. ft

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Overflow (Existing S.C.) = (.678)(.5)/530 sq. ft.
= 639 gpd/sq. ft.

e) Max flow Existing S.C. can accomidate

= (800 gpd/sq. ft)(530 sq. ft.)
= 424,000 gpd

Flow should be split between the S.C. up to 848,000 gpd at which point any additional Flow should be diverted to the New S.C.

4) Chlorine Contact Chamber

a) Design Criteria:
30 min. Detention Time @ Peak Flow

Peak Flow = 1,236 gpm

Volume = (1,236 gpm)(30 min.)
= 37,080 gal

Use dual contact chambers Volume = 18540 gal
= 2479 cu ft

Water Depth = 4 ft.
Area = 620 sq ft
Dimentions = 20' x 31' x 4' SWD

b) Dosage (Chemical Usage) DM-5 = 10 mg/l
@ Avg. Daily Flow 678,000 gpd = 2,566,510 liters/d
Cl_2 used/day = (2,566,510 l)(10 mg/l) = 25665 g/d
= 57 lbs/d

5.) Sludge Quantities

DM-5: 72% of total Suspended Solids are Volatile
50% of total Dissolved Solids are Volatile

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lbs solids (based on domestic flows)
= (0.393 MGD)(8.34)(200 mg/l)
= 656 lbs/day

DM-5 - 60% solids removed in primary clarifier

lbs solids removed in primary clarifier
= (656 lbs/d)(.6)
= 393.6 lbs/day removed

This leaves 262.4 lbs/day to be removed by the Secondary Clarifiers

DM-6 - 95% solids removed in S.C.

lbs solids removed in S.C.
= (262.4 lbs/d)(.95)
= 249.3 lbs/day removed

This leaves 13.12 lbs/day to pass through the plant in the effluent at a concentration of:

(13.12 lbs/day)/(.678)(8.34)

= 2.3 mg/l

Mass of solids removed = 643 lbs/d

Assume:
S.G. = 1.02
Sludge Solids = 3%

$$\text{Volume of Sludge} = \frac{643 \text{ lbs/day}}{(1.02)(62.4 \text{ lbs/cuft.})(.03)}$$
= 337 cuft/day
= 2,520 gpd

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JOB ______ JOB NO ______ DATE ______
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LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

6) Gravity Thickener

a) Design Criteria (DM-5)

Overflow Rate = 600-800 gpd/sq.ft Select 700 gpd/sq.ft

Max solids loading (dry solids) = 15 lb dry solids/ft^2/day
Min. SWD = 10 ft
Min. D.T. = 6 hrs.

b) Size - based on overflow Rate

Req. Area = (2520 gpd)/(700 gpd/sq.ft.)
= 3.6 sq. ft.

Req. Vol. = (2520 gpd/24 hr/day) (6 hrs.)
= 630 gal
= 84 cuft

Assume 20 gpm flow through Gravity Thickener (constant)

Area required = (20 gpm)(1440)/700 gpd/sq.ft
= 41 sq.ft.

πr^2 = 41 sq.ft
r = 3.6 ft

diameter = 7.5 ft.
SWD = 10 ft.
Vol. = 442 cuft (3,305 gal)
D.T. = 1.3 days

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LIVE LOAD PER SQUARE FOOT ______ WORKING STRESS ______

c) Size - based on solids loading (15 lbs dry solids/ft²/d)

643 lb solids / 15 lbs/ft²/d = 43 ft

$\pi r^2 = 43$ sq.ft
$r = 3.7$
diameter = 8 ft.

d.) Select 10 ft diameter Gravity Thickener

Solids content of Primary & Seconary Clarifiers = 3%
Solids content of Gravity Thickener Underflow = 9% by weight

7.) Aerobic Digester

a). Design Criteria (DM-5)

Allowable Max 24 hr. Solids loading = 0.1 lbs Volatile Solids/cuft/d
D.T. = 20 days
Solids conc. in digester 3-6% by weight
Sludge Age - 25 to 30 days
Max Tank Depth - 15 ft.
Air. req. = 1.5 lbs O_2 / lb BOD

b) Volume of sludge wasted per day from G.T.

Solids are concentrated in the thickener from 3% to 9%. This corresponds to a volume reduction of 2/3 (67%)

Volume = (2520 gal/d)(0.33)
= 832 gpd

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Check on volume $= \dfrac{643 \text{ lbs}}{(1.02)(62.4 \text{ lbs/cuft.})(0.09)}$

= 840 gal/d
= 112 cuft/d

c) Volume

Solids = (643 lbs/d)(0.72 volatile)
= 463 lbs volatile solids

Volume = (463 lbs / 0.1 lbs/cuft/d)
= 4630 cuft

SWD = 15 ft
Area = 309 sq.ft.

πr^2 = 309 sq.ft
r = 10 ft
diameter = 20 ft

d) O_2 required = (643 lbs)(0.72)(1.5 lbs O_2/lb BOD)
= 694 lb/day
= 29 lb/hr

e) Dosing Interval

Existing Sand Bed area (1 Bed) = 1050 sq.ft.
Dosing Depth = 1 ft.
Volume = 1050 cuft

40% of solids oxidized
Dosing Vol. = 112 cuft (.6) = 67 cuft
Dosing Interval = 1050 cuft / 67 cuft = 15.7 days

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8) Sludge Drying Beds

a) Design Criteria (DM-5)

Per capita allowance - 1.5 sq ft/cap
3 Beds

b) Existing Beds

3 Beds
Total Area = 3150 sq. ft.
EACH Bed = 1050 sq. ft.

c) Size Required

Total future billeting capacity = 1566 people
Off base personel = 615 (daytime)
adjusted to full time = 615/3 = 205 people

Total personel to be served
= 1566 + 205 = 1771 people

Required Bed area = (1771 cap.)(1.5 sq. ft. /cap.)
= 2,657 sq. ft.

∴ No additional sludge drying beds required.

9) Lift Pumps (sludge)

a) Primary Clarifier Sludge Pumps

Two (2) pumps per clarifier in a lead lag configuration w/ Timer

Flow = 2,520 gpd

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12 pump cycles/day (1 every 2 hrs.)

Volume to be pumped/cycle = 210 gal

@ 20 gpm pump for 10.5 min./cycle

b) Gravity Thickener Sludge Pumps

Two (2) pumps Lead Lag configuration w/ Timer

Flow - 840 gal/day

6 pump cycles/day (1 every 4 hrs.)

Volume to be pumped/cycle = 140 gal

@ 10 gpm pump for 14 min./cycle

10) Effluent Recirculation Pumps

Two (2) pumps Lead Lag configuration w/ Timer

Recirculate 50 gpm from Chlorine Contact Chamber to Gravity Thickener to prevent septic conditions

-APPENDIX IV-

STEAM GENERATION AND

DISTRIBUTION SYSTEM

A UTILITY STUDY

FOR

THE COURHOUSE BAY AREA

APPENDIX IV

INDEX

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9-78
COMPUTED BY MJC
WORKING STRESS

REFERENCES

A. DESIGN MANUAL - NAVFAC	DM-3
B. ASHRAE- FUNDAMENTALS	1972

J. E. SIRRINE COMPANY

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JOB Steam Study

STRUCTURE Courthouse Bay

LIVE LOAD PER SQUARE FOOT

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COMPUTED BY MK

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1. Boiler House Bldg-9

Information

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BOILERS

BLDG-9

BOILER No-53: 15,000 lbs/HR WATER TUBE – NEBRASKA 100 PSI
OPERATION: 3 MONTHS
STEAM ATOMIZATION
(14000 lbs/HR TITUSVILLE ROTARY) REPLACED

BOILER No. 54: 8,000 lbs/HR ORR-SEMBOWER – FIRE TUBE
OPERATIONAL: SINCE 1952
STEAM ATOMIZATION

BOILER No. 55: 12,000 lbs/HR ERIE CITY – WATER TUBE
OPERATIONAL: SINCE 1957
TODD ROTORARY
8,000/10,000 lbs/HR

FUEL STORAGE: 3-10,000 GAL UNDERGROUND STORAGE TANKS
#6 BUNKER -C-

NOTES FROM USING AGENCY:
- BOILER No. 54 USED ONLY IN EMERGENCYS
- BOILER No. 55 - RETUBED, EXPECTED LIFE 12-15 YRS

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BOILER HOUSE RECORDS - BLDG 9 *

DATE	OIL USED (GALS)	STEAM GENERATED	MAX HOURLY USAGE (LBS)
JAN. 77	85,576	9,413,360	19,350
FEB. 77	67,608	7,436,880	17,910
MAR. 77	56,865	6,254,050	14,190
APR. 77	34,366	3,780,260	9,555
MAY. 77	27,142	2,985,620	12,405
JUN 77	20,048	2,205,280	9,900
JUL 77	22,916	2,520,760	9,915
AUG 77	22,438	2,468,180	7,290
SEPT 77	22,632	2,489,520	8,040
OCT 77	39,007	4,290,770	11,205
NOV 77	55,889	6,447,790	12,780
DEC 77	73,720	8,109,200	17,385
JAN 76	83,551	9,190,610	17,610
FEB 76	64,629	7,109,190	13,750
MAR 76	63,943	7,033,730	15,400
APR 76	42,696	4,696,560	13,900
MAY 76	27,729	3,050,190	8,360
JUN 76	28,143	3,095,730	7,150
JUL 76	20,665	2,273,150	5,960
AUG 76	20,707	2,277,770	4,935
SEP 76	19,863	2,184,930	5,060
OCT 76	34,750	3,822,500	11,550
NOV 76	60,467	6,651,370	19,365
DEC 76	75,822	8,340,420	30,585

* INFORMATION SUPPLIED BY USING AGENCY (B. LANIER)

J. E. SIRRINE COMPANY

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JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT

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BOILER HOUSE RECORDS - BLDG 9 CONT'D

DATE	OIL USED (GALS)	STEAM GENERATED	MAX HOURLY USAGE (LBS)
JAN 75	59,703	6,567,330	14,780
FEB 75	53,713	5,908,870	21,475
MAR 75	55,086	6,059,460	13,305
APR 75	34,738	3,821,180	10,095
MAY 75	25,943	2,853,730	8,620
JUN 75	22,778	2,506,480	13,510
JUL 75	24,571	2,702,810	8,205
AUG 75	26,186	2,880,460	5,610
SEP 75	24,884	2,737,240	4,400
OCT 75	30,262	3,328,820	9,600
NOV 75	55,013	6,051,430	17,170
DEC 75	73,068	8,037,480	15,090

J. E. SIRRINE COMPANY

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JOB Steam Study
STRUCTURE Courthouse Bal
LIVE LOAD PER SQUARE FOOT

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2. BUILDING STEAM REQUIREMENTS

J. E. SIRRINE COMPANY

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JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT CAMP LEJEUNE

JOB NO A-1086 DATE 10-78
COMPUTED BY (T)
WORKING STRESS

BLDG. ~~BB~~-28 TRAINING SCHOOL (DWG. 248166)
RADIATION 903.2# ÷ 4 = 225.8 #/HR
HW. ASSUME 40 GPH 100°F RISE

$$\frac{40 \times 8.3 \times 100^\circ}{952\ BTU/\# \times .80} = 43.6\ \#/HR$$

SUB-TOTAL 269.4 #/HR
PIPING LOSSES 26.9
TOTAL 296 #/HR - 15 PSI

BLDG BB-30 (ON SITE CHECK)
HTG + HW 762 #/HR
PIPING LOSSES 76
TOTAL 838 #/HR. 15 PSI

BLDG BB-208 (ON SITE CHECK)
HTG 67 #/HR
PIPING LOSSES 7
TOTAL 74 #/HR 15 PSI

BLDG BB-27 ADMIN (DWG. 248173)
RADIATION 512# ÷ 4 = 128 #/HR
HW GEN ASSUME 40 GPH

$$\frac{40 \times 8.3 \times 100^\circ}{952\ BTU \times .8} = 43.6\ \#/HR$$

171.6 #/HR
PIPING LOSSES 17.2
189 #/HR 15 PSI

BLDG BB-31 (ON SITE CHECK) (DWG 248169)
UH. 760 #/HR
PIPING LOSSES 76
TOTAL 836 #/HR 15 PSI

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BLDG BB-54 PHOTO LAB (DWG. 387181)

UH - 424.4 #/HR
RAD 312.8#÷4 78.2
HW. GEN
$\frac{40\text{ GPH} \times 8.3 \times 100}{952\text{ BTU/\#} \times .8} =$ 43.6 #/HR

546.2
PIPING LOSSES 54.6
TOTAL 601 #/HR - 15 PSI

BLDG BB-51 (DWG. 647044)

UH 668.4 #/HR
RAD 473÷4 118.0

786.4
PIPING LOSSES 78.6

865 #/HR

BLDG BB-52 SHOP (DWG. 647045)

UH 385.3 #/HR
RAD 266#÷4 66.5 #/HR

451.8
PIPING LOSSES 45.2
TOTAL 497 #/HR 15 PSI.

DE-GREASING STATION
1½" PIPE 600 #/HR ESTIMATED.

BLDG BB-50 (DWG. 765456)

UH - 269.8 #/HR
RADS 104.7#÷4 26.2
TEMP COILS 356.3
HWGEN
$\frac{125\text{ GPH} \times 8.3 \times 100}{952 \times .80}$ 136.2

788.5
78.9
TOTAL 867 #/HR (15 PSI)

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JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT CAMP LEJEUNE

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WORKING STRESS

BEQ 250 (FROM

HTG. 798 #/HR
HW 730 #/HR
1528 #/HR.
PIPING LOSSES 153
TOTAL 1681 #/HR 25 PSI

BEQ 255
TOTAL 1681 #/HR - 25 PSI

BLDG - 16 LAUNDRY / CHAPEL (ON SITE CHECK)

UH 36 #/HR
RAD (6) 50
86
PIPING LOSSES 9
TOTAL 95 #/HR 15 PSI

BLDG 48
*BOILER: 836,800 BTUH ÷ 952 BTU/# = 879 #/HR
PIPING 88 #/HR
967 #/HR - 25 PSI

BLDG 49
*BOILER: 870,272 BTUH ÷ 952 BTU/# = 914 #/HR
PIPING LOSSES 92 #/HR
1006 #/HR - 25 PSI

* FURNISHED BY BEN LANIER 11/28/78 WITH TELEPHONE CONVERSATION WITH A/C

J. E. SIRRINE COMPANY

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JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT CAMP LEJEUNE

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BLDG. BB-45 BOQ (LESS GALLEY) (DWG. 304717)

RAD 3034 Ø ÷ 4 — 758 #/HR

$\frac{500\ GPH \times 8.3 \times 100°F}{910\ BTU/\# \times .80} =$ 570 #/HR

NO GALLEY

1328 #/HR

PIPING LOSSES 133

1461 #/HR

BLDG BB-5 BATALION HDQ (DWG. 162685)

RAD 975 Ø ÷ 4 = 244 #/HR

HW GEN. ASSUME 100 GPH

$\frac{100 \times 8.3 \times 100°}{920 \times .8} =$ 112.8

356.8
35.7
393 #/HR 50

BLDG BB-10 INFIRMARY (DWG 162603)

RAD 780.75 Ø ÷ 4 — 195.2 #/HR
STER — 150
HW GEN — 125 — 50 PSI

470.2 #/HR

PIPING LOSSES 470

517 #/HR

BB-11 - 1992 (TO BE REMOVED)
BB-12 - 1978 "
BB-13 - 1978 "
BB-14 - 1992 "

7940 TOTAL / 6352

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY.
LIVE LOAD PER SQUARE FOOT CAMP LEJEUNE

JOB NO A-1086 DATE 10-78
COMPUTED BY (T)
WORKING STRESS

BLDG BB-7 MESS HALL (DWG. 162565)

DIRECT RAD	111 #/HR
INDIRECT "	781
GALLEY	2953
HW-GEN	556
	4401 #/HR.
PIPING LOSSES	440
	4841

50 PSI

BLDG BB-2 THEATER (DWG. 162652)

RAD 579.6 ⁄4	144.9 #/HR
BLAST COIL	1687.0
	1831.9
PIPING LOSSES	183.2
	2015.1

15 PSI

BLDG BB-3 PX (ON SITE CHECK)

410 #/HR
41
451 #/HR. 50 PSI

BLDG BB-15 100 #/HR
10
110 #/HR 50 PSI.

BLDG BB-8 (DWG 387181)

UH -	205.5
INDIRECT	39.4
	244.9
	245
	269 #/HR.

30 PSI.

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB STEAM STUDY

STRUCTURE COURTHOUSE BAY

LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9-78

COMPUTED BY MK

WORKING STRESS

3. STEAM LINE DISTRIBUTION

PRESSURE LOSSES

J.E. SIRRINE COMPANY
Engineers - Architects

DESIGN SHEET

JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT CAMP LEJEUNE

JOB NO A-1086 DATE 10-78
COMPUTED BY (F)
WORKING STRESS

MAX. PPH
OPTIMUM
RECOMMENDED
MAX PD PSI

PSI.	PD/100'		PPH #/HR	FPM
23 TO 37	.4 PSI	1/2"	18	1400
DM-3 - FIG 11-1 (a)		3/4	40	1700
		1	75	2000
		1¼	150	2400
		1½	240	2700
		2	470	3200
		2½	700	3500
		3	1300	4000
		4	2800	4900
		5	5000	5600
		6	8000	6400
		8	17000	7600
40 TO 60	.5	1/2	27	1400
DM-3 FIG. 11-1 (b)		3/4	52	1650
		1	100	2000
		1¼	210	2400
		1½	300	2600
		2	580	3000
		2½	980	3400
		3	1700	4000
		4	3700	4600
		5	6400	5300
		6	10000	6000
		8	23000	7000
85 TO 125	1.0	1/2	50	1600
DM-3 FIG. 11-2 (a)		3/4	100	1850
		1	180	2200
		1¼	400	2600
		1½	600	2850
		2	1200	3400
		2½	2000	3800
		3	3500	4500
		4	7000	5100

J.F. SIRRINE COMPANY
Engineers - Architects

DESIGN SHEET

JOB Steam Study
STRUCTURE Courthouse Bay
LIVE LOAD PER SQUARE FOOT Camp Lejeune

JOB NO A-1086 DATE 10-78
COMPUTED BY T
WORKING STRESS

(CONT.)

			#/HP	FPM
85-125 DM-3 FIG 11-2(a)	1.0	4"	7000	5100
		5	13000	6000
		6	22000	6700
		8	4400	8000
		10	80,000	9200
127 TO 180 DM-3 FIG 11-2(b)	1.0	1/2	55	1200
		3/4	130	1600
		1	230	1800
		1 1/4	500	2200
		1 1/2	700	2400
		2	1400	2800
		2 1/2	2300	3200
		3	4000	3600
		4	8000	4000
		5	15000	5000
		6	26000	5500
		8	50,000	7000
		10	90000	8000

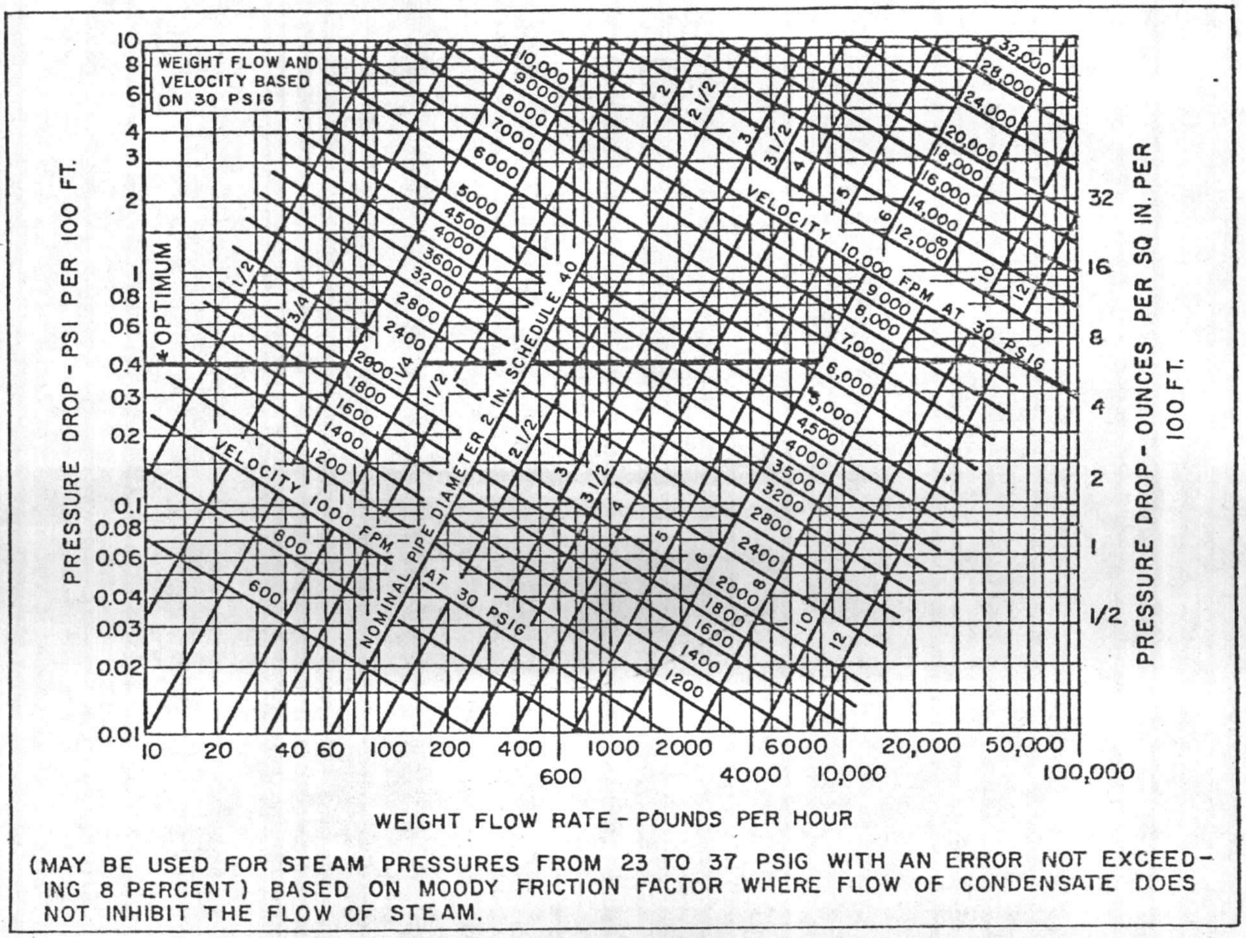
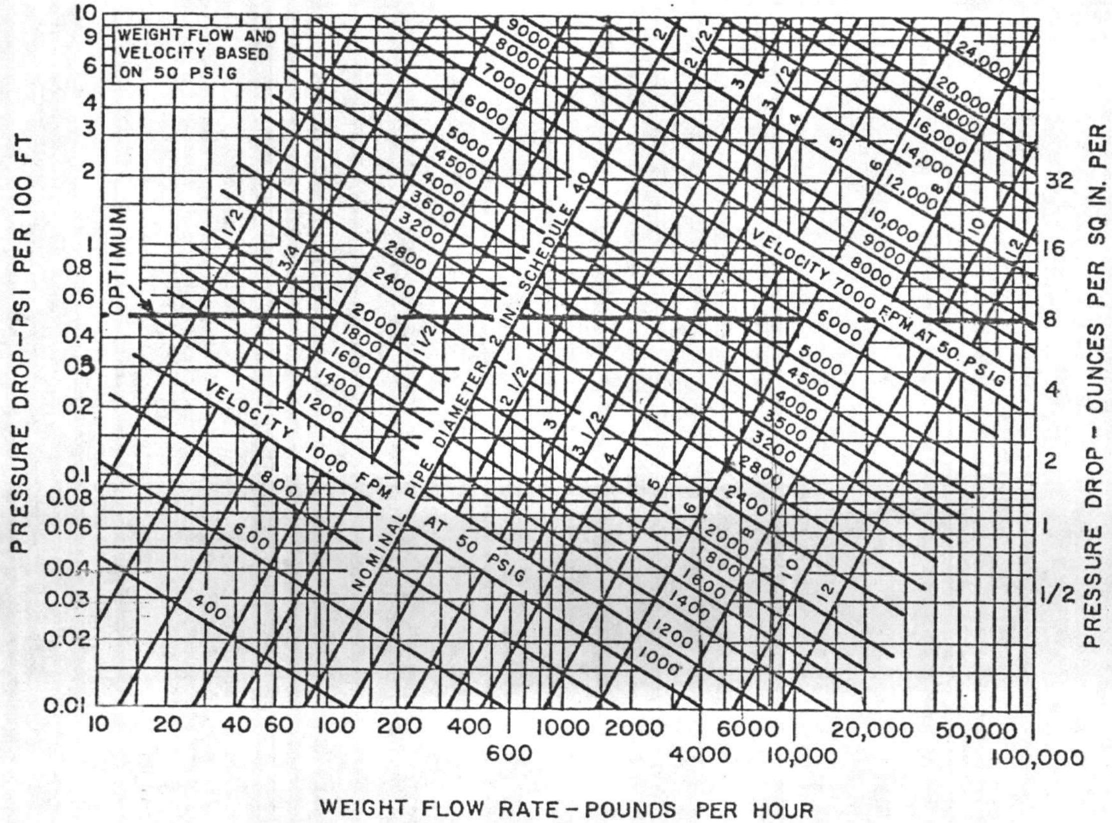
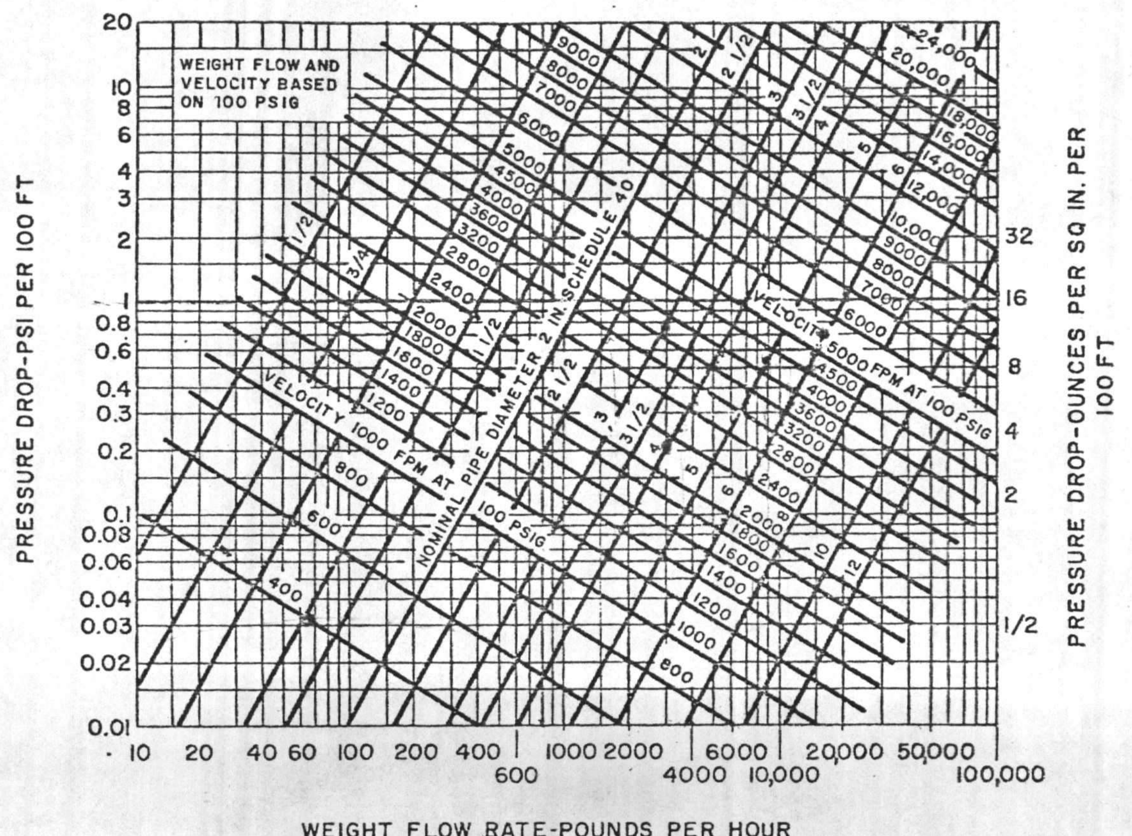


FIGURE 11-1(a)
Chart for Weight-Flow Rate



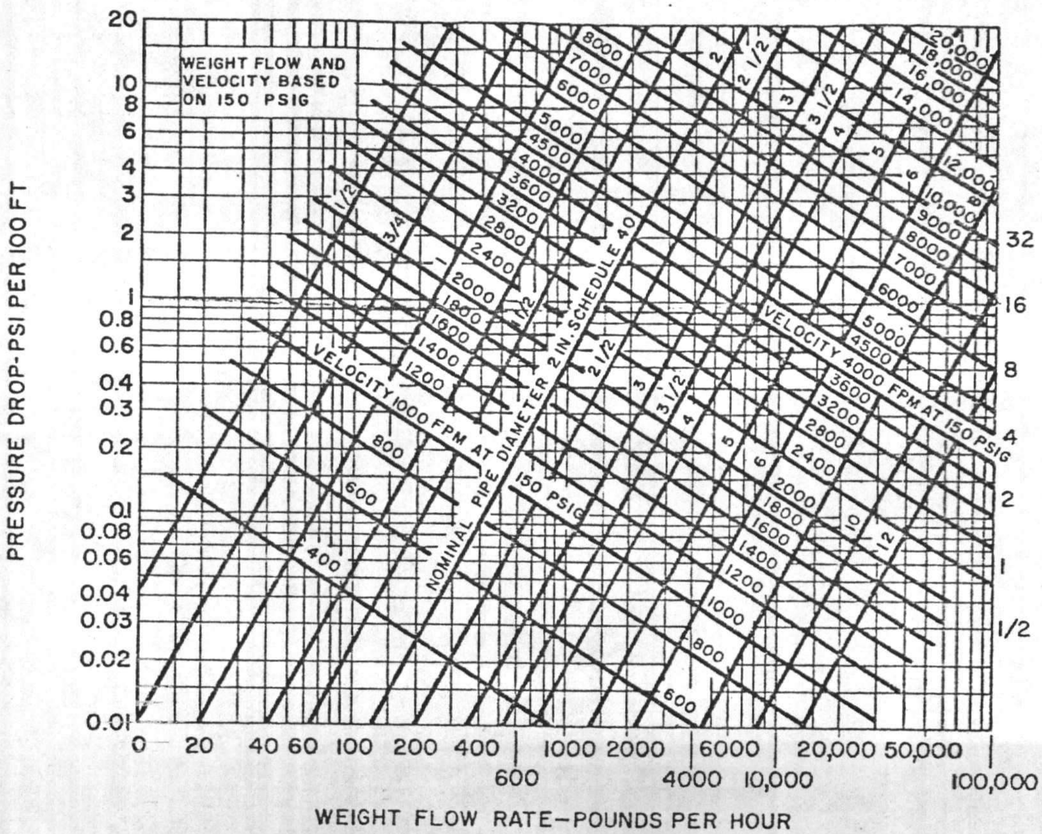
(MAY BE USED FOR STEAM PRESSURES FROM 40 TO 60 PSIG WITH AN ERROR NOT EXCEEDING 8 PERCENT) BASED ON MOODY FRICTION FACTOR WHERE FLOW OF CONDENSATE DOES NOT INHIBIT THE FLOW OF STEAM.

FIGURE 11-1(b)
Chart for Weight-Flow Rate



(MAY BE USED FOR STEAM PRESSURE FROM 85 TO 125 PSIG WITH AN ERROR NOT EXCEEDING 8 PERCENT) BASED ON MOODY FRICTION FACTOR WHERE FLOW OF CONDENSATE DOES NOT INHIBIT THE FLOW OF STEAM

FIGURE 11-2(a)
Chart for Weight-Flow and Velocity of Steam

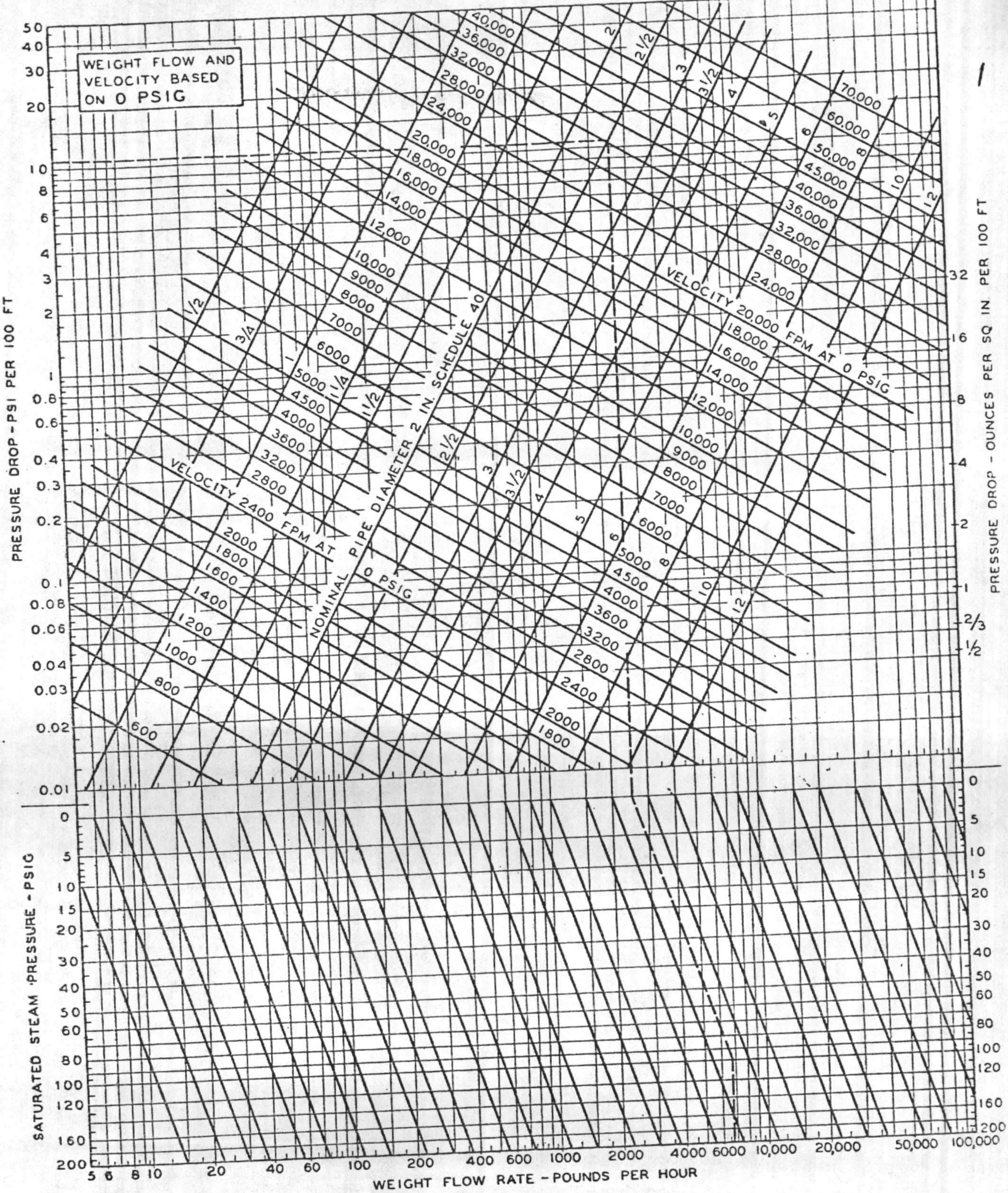


(MAY BE USED FOR STEAM PRESSURES FROM 127 TO 180 PSIG WITH AN ERROR NOT EXCEEDING 8 PERCENT) BASED ON MOODY FRICTION FACTOR WHERE FLOW OF CONDENSATE DOES NOT INHIBIT THE FLOW OF STEAM.

FIGURE 11-2(b)
Chart for Weight-Flow Rate and Velocity of Steam

1972
ASHRAE Handbook of Fundamentals
20 of 29

1



Based on Moody Friction Factor where flow of condensate does not inhibit the flow of steam.

Fig. 5 .... Basic Chart for Weight-Flow Rate and Velocity of Steam in Schedule 40 Pipe Based on Saturation Pressure of 0 Psig

(With Multiplier Charts for Obtaining Weight-Flow Rates and Velocities of All Saturation Pressures Between 0 and 200 Psig)

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 12-13-78
COMPUTED BY MJC
WORKING STRESS

PRESS. IN LINE (NEW B.E.Q)

	PPH	PD*		PSIG
BOILER				100
NON-RET. VA	15,000	5		95
10" HDR	24,442	0.1		94.9
6" MAIN	16,398	.6		94.3
6" MAIN TO FUT PX	16,322	.6	300 x .6 x 1.2 = 2.16	92.1
6" MAIN TO BARR. T.O.	15,522	.6	500 x .6 x 2.0 = 6.	86.1
5" MAIN TO BLDG 6	8,302	.5	1900 x .5 x 1.2 = 11.4	74.7
5" MAIN TO BLDG 5	7,660	.5	400 x .5 x 1.2 = 2.4	72.3
5" MAIN TO BLDG 48	7017	.4	150 x .4 x 1.2 = .72	71.6
5" TO TEE (BLDG 9 & 49)	6243	.5**	100 x .5 x 1.2 = .6	71.0
4" TO FUT BARR 1	3494	.5	200 x .5 x 1.4 = 1.4	69.6
4" TO FUT BARR 2	2687	.3	600 x .3 x 1.4 = 2.5	67.1
2½" TO BLDG 49	1006	.5	600 x .5 x 1.2 = 3.6	63.5
				71.0
4" TO MECH. BLDG.	2750	.3	150 x .3 x 1.2 = .5	70.5
2" TO BLDG 4	803	1.0	200 x 1.0 x 1.2 = 2.4	68.1
				86.1
6" TO BLDG 50	7220	.15	600 x .15 x 1.2 = 1.1	85.0
6" TO 6X4 TEE	6526	.15	200 x .15 x 1.2 = .4	84.6
4" TO BB 26	4957	.5	500 x .5 x 1.4 = 3.5	81.1
4" TO TEE	3362	.2	200 x .2 x 1.2 = .5	80.6
4" TO BLDG 250	1681	.1	400 x .1 x 1.4 = .6	80.0
4" TO BLDG 255	1681	.1	500 x .1 x 1.4 = .7	79.3
				84.6
4" TO BLDG 51	1570	.1	500 x .1 x 1.2 = .6	84.0
3" TO BLDG 52	1097	.1	200 x .1 x 1.2 = .3	83.7

* USE FIG 11-2(a) DM-3
** USE FIG 11-1(b) DM-3

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB: STEAM STUDY
STRUCTURE: COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT:

JOB NO: A-1086 DATE: 12-13-78
COMPUTED BY: MJC
WORKING STRESS:

ALTERNATE

PRESS. IN LINE

	PPH	PD*		PSIG
BOILER				100
NON-RET VA	15,000	5		95
10" HDR	24,442	.15		94.9
6" MAIN	16,398	.7	200 X 1.2 X .7 = 1.7	93.2
6" MAIN TO PX	16,322	.7	300 X 1.2 X .7 = 2.5	90.7
6" TO BLDG 5D	15,522	.6	900 X 1.2 X .6 = 6.5	84.2
6" To Tee	14,828	.6	200 X 1.2 X .6 = 1.5	82.7
6" To BB-26	13,258	.4	500 X 1.4 X .4 = 2.8	79.9
6" To 6X4 Tee	10,991	.3	180 X 1.6 X .3 = .87	79.0
6" To BB-25D	9,646	.3	100 X 1.4 X .3 = .4	78.6
6" To BB-48	8,302	.2	1300 X 1.2 X .2 = 3.1	75.5
6" To Tee	7,528	.2	200 X 1.2 X .2 = .5	75.0
6" To Tee 6X4	6,243	.1	200 X 1.6 X .1 = .5	74.5
4" To Fut Barr 1	3494	.3	200 X 1.4 X .3 = .8	73.7
4" To Fut Barr 2	2687	.3	600 X 1.4 X .3 = 2.5	71.2
2½" To BLDG 48	1006	.5	600 X .5 X 1.2 = 3.6	67.6
				75.0
3" To BLDG 5	1606	.3	50 X .3 X 1.2 = .2	74.8
2½" To BLDG 6	803	.2	500 X .2 X 1.2 = 1.2	73.6
				74.5
4" To Mec BLD	2750	.3	200 X .3 X 1.2 = .5	~~74~~.0
2" To BLDG	803	1.0	200 X 1.0 X 1.2 = 2.4	71.6

* USE FIG 11-2(a) DM-3

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10-78
COMPUTED BY CDT
WORKING STRESS

PRESS IN LINE

LP (15PSI) OVERHEAD SYSTEM

	PPH	PD*		PSIG
BB-26 (PRV STATION)				15.0
4" To BB27	1786	.1	150X1.4X.1=.2	14.8
3½" To TEE	1635	.15	150X1.2X.15=.3	14.5
2½" To BB31	836	.2	400X1.2X.2=1.0	13.5
2½" To BB-30	966	.35	300X1.3X.35=1.4	12.1
2½" To BB-28	296	.03	150X1.2X.03=.1	12.0
2" To BB-54	601	.28	100X1.4X.28=.4	14.6

*USE FIG. 5 PAGE 502 ASHRAE GUIDE 1972 FUNDAMENTALS

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 10-78
COMPUTED BY KDT
WORKING STRESS

PRESS. IN LINE
UNDERGROUND SYSTEM

	PPH	PD*		PSIG
BOILER				100
NON-RET. VA	15000	5.		95.
10" HDR	24442	.1		94.9
6" MAIN	8045	.2		94.7
6" TO BLDG 15	8045	.2	250 X .2 X 1.2 = .6	94.1
6" TO BLDG 7	5984	.1	200 X .1 X 1.4 = .3	93.8
4" TO BLDG 13	1897	.1	300 X .1 X 1.2 = .4	93.4
4" TO BLDG 10	1897	.1	800 X .1 X 1.2 = 1.0	92.4

USE FIG. 11-2(a) DM-3

J. E. SIRRINE COMPANY

DESIGN SHEET

JOB STEAM STUDY
STRUCTURE COURTHOUSE BAY
LIVE LOAD PER SQUARE FOOT

JOB NO A-1086 DATE 9-78
COMPUTED BY M/C
WORKING STRESS

4. ALTERNATIVES - COST ESTIMATE

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED 12/18/78

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE (X) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE ( )

HEADING: SCHEME A | ESTIMATOR: CROMER | CHECKED BY: LINER

MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
PIPE							
5" B.S. SCH. 40	1615	FT.	8.85	14293.	10.70	17281.	31574.
3" B.S. SCH. 80	1615	FT.	5.90	9529.	6.00	9690.	19219.
4" B.S. SCH 40	1030	FT.	7.10	7313.	5.25	5408.	12721.
2" B.S. SCH 80	1080	FT	3.14	3391.	4.01	4331.	7722.
3" B.S. SCH 40	50	FT	5.60	280.	3.50	175.	455.
2" B.S. SCH 40	950	FT	3.80	3610.	2.02	1919.	5529.
1½" B.S. SCH 80	950	FT	2.34	2223.	3.80	3610.	5833.
2½" B.S. SCH 40	550	FT	4.70	2585	2.78	1529.	4114.
PIPE INSULATION (STM)							
5" PIPE INSUL W/JACKET	1615	FT.	4.38	7074.	8.27	13356.	20430.
3" Thick							
4" PIPE INSUL. W/JACKET	1030	FT.	3.78	3893.	6.62	6819.	10712.
2½" Thick							
3" PIPE INSUL W/JACKET	50	FT	3.35	168.	5.48	274.	442.
2½" Thick							
2½" PIPE INSUL W/Jacket	550	FT	3.06	1683.	4.78	2629.	4312.
2" Thick							
2" PIPE INSUL W/JACKET	950	FT	2.77	2632.	4.08	3876.	6508.
2" Thick							
PIPE INSULATION COND.							
3" PIPE INSUL. W/JACKET	1615	FT	2.49	4021.	3.19	5152.	9173.
1½" Thick							
2" PIPE INSUL W/JACKET	1080	FT	2.16	2333.	2.65	2862.	5195.
1" Thick							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED 12/18/78

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE (X) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE ( )

HEADING: SCHEME A | ESTIMATOR: CROMER | CHECKED BY: LINER

MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
PIPE INUL. COND. CONT.							
1½" PIPE INSUL w/Jacket 1" Thick	950	FT	1.98	1881.	2.36	2242.	4123.
SUPPORTS	185	EA	121	22385.	242	44770	67155
BRIDGES	3	EA	1833	5499.	2366	7098	12597
PIPE GUIDES							
5"-3" INSUL.	81	EA	21.50	1742.	55.46	4492.	6234.
4"-2½" INSUL.	52	EA	16.54	860.	43.54	2264.	3124.
3"-2½" INSUL.	2	EA	14.51	29.	38.18	76.	105.
2½"-2" INSUL.	28	EA	13.40	375	35.26	987	1362.
2"-2" INSUL.	48	EA	10.00	480.	26.34	1264.	1744.
SUB-TOTAL				98279		142104	240383
CONTRACTOR MARKUP	49%					240383	117,788
SUB-TOTAL							358,171
CONTINGENCY	10%						35817
SUB-TOTAL							393,988
ESCALATION TO 1-1-80	11%						43,339
SUB-TOTAL							437,327
TOTAL ROUNDED							437,300
SIOH	5.5%						24,052
TOTAL							461,400

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED 12/18/78

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE (X) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE ( )

HEADING: SCHEME B | ESTIMATOR | CHECKED BY

MATERIAL DESCRIPTION	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
PIPE							
6" B.S. SCH. 40	750	FT	10.45	7838.	11.80	8850.	16688.
5" B.S. SCH. 40	1700	FT	8.85	15045.	10.70	18190.	33,235.
4" B.S. SCH 40	1030	FT	7.10	7313.	5.25	5408.	12,721.
3" B.S. SCH 40	75	FT	5.60	420.	3.50	263.	683.
2" B.S. SCH 40	950	FT	3.80	3610.	2.02	1919.	5529.
3" B.S. SCH. 80	2500	FT	5.90	14,750.	6.00	15,000.	29,750.
2" B.S. SCH. 80	1030	FT	3.14	32,342.	4.01	4130.	36472.
1½" B.S. SCH. 80	950	FT	2.34	2223.	3.80	3610.	5833.
PIPE INSULATION (STM.)							
6" PIPE INSUL W/JACKET	750	FT	4.92	3690	9.58	7185.	10875.
3" THICK							
5" PIPE INSUL W/JACKET	1700	FT	4.38	7446.	8.27	14059	21,505.
3" THICK							
4" PIPE INSUL W/JACKET	1030	FT	3.78	3893.	6.62	6819.	10712.
2½" THICK							
3" PIPE INSUL W/JACKET	75	FT	3.35	251.	5.48	411.	662.
2½" THICK							
2" PIPE INSUL W/JACKET	950	FT	2.77	2632.	4.03	3829.	6461.
2" THICK							
PIPE INSULATION (COND.)							
3" PIPE INSUL W/JACKET	2500	FT	2.49	6225.	3.19	7975.	14200.
1½" THICK							
2" PIPE INSUL W/JACKET	1030	FT	1.81	1864.	2.15	2215.	4079.
1" THICK							

ATLANTIC DIVISION - NAVAL FACILITIES ENGINEERING COMMAND

PROJECT TITLE: Utility Study - Courthouse Bay Area DATE PREPARED 12-18-78

ACTIVITY & LOCATION: MCB, Camp Lejeune, N. C.

A&E FIRM & ADDRESS: J. E. Sirrine Company
P. O. Box 5456
Greenville, S.C. 29606

CONST. CONTRACT NO.

A&E CONTRACT NO. N62470-78-C-3675

PRELIMINARY ESTIMATE (√) FINAL ESTIMATE ( ) REVISED FINAL ESTIMATE ( )

HEADING: SCHEME B — ESTIMATOR: CROMER — CHECKED BY: LINER

MATERIAL DESCRIPTION	QUANTITY NO. UNITS	UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
1½" PIPE INSUL W/JACK	950	FT	1.98	1881.	2.36	2242.	4123.
1" THICK							
SUPPORTS	200	EA.	121	24200	242	48400	72600.
BRIDGES	3	EA.	1833	5499	2366	7098.	12597.
PIPE GUIDES							
6" - 3" INSUL.	38	EA	21.50	817.	55.46	2108.	2925.
5" - 3" INSUL.	85	EA	21.50	1828.	55.46	4714.	6542.
4" - 2½" INSUL.	52	EA	16.54	860.	43.54	2264.	3124.
3" - 2½" INSUL.	3	EA	14.51	43.	38.18	115.	158.
2" - 2" INSUL.	48	EA	10.00	480.	26.34	1264.	1744.
DEMOLITION							
REMOVE EXIST 4" STM	750	LF	13.00	9750.	-	-	9750.
REMOVE EXIST. 2" COND	750	LF	9.00	6750.	-	-	6750.
SUB-TOTAL				161,650.		168,068	329,718.
CONTR. MARKUP	49%						161,562
SUB-TOTAL							491280
CONTINGENCY	10%						49,128
SUB-TOTAL							540,408
ESCALATION	11%						59,445
SUB-TOTAL							599,853
TOTAL ROUNDED							599,900
SIOH	5.5%						32,995
TOTAL							632,900

J. E. SIRRINE COMPANY

ARCHITECTS **ENGINEERS** **PLANNERS**

ARCHITECT - ENGINEER DIVISION

P. O. Box 5456 • GREENVILLE, SOUTH CAROLINA 29606 • TELEPHONE 803/298-6000
P. O. BOX 27194 • HOUSTON, TEXAS 77027 • TELEPHONE 713/627-2050
P. O. BOX 12748 • RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709 • TELEPHONE 919/541-2081
P. O. BOX 3790 • RIYADH, SAUDI ARABIA • TELEPHONE 60204