ANNUAL REPORT

1962

CITY OF PORT ARTHUR

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ON THE

CITY OF PORT ARTHUR

WATER POLLUTION CONTROL PLANT

OWRC PROJECT - 58-S-13

PORT ARTHUR WATER POLLUTION CONTROL PLANT

OPERATED FOR

THE CITY OF PORT ARTHUR

BY

THE ONTARIO WATER RESOURCES COMMISSION

MR. A.M. SNIDER	CHAIRMAN
DR. A.E. BERRY	GENERAL MANAGER
MR. D.S. CAVERLY	ASSISTANT GENERAL MANAGER AND DIRECTOR, DIVISION OF PLANT OPERATIONS.
MR. B.C. PALMER	ASSISTANT DIRECTOR, DIVISION OF PLANT OPERATIONS
MR. B.G. PORTER	PROJECT ENGINEER, DIVISION OF PLANT OPERATIONS
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PREPARED BY

THE DIVISION OF PLANT OPERATIONS

I N D E X

CITY OF PORT ARTHUR

I HISTORY

In 1956, the City Council of Port Arthur in conjunction with the consultant, R.V. Anderson, initiated plans for a new primary sewage disposal plant and extension to existing sewers. Ontario Municipal Board approval was received for the above project in April of 1958 and the final agreement between the City of Port Arthur and the OWRC was signed during the same month.

In May, 1958, a contract for the construction of storm relief and sanitary trunk sewers was awarded to Hacquoil's Construction. The cost of the 0.76 miles of storm relief sewers was estimated at $152,909.20 and the cost of the 2.22 miles of sanitary trunk sewers was estimated at $1,078,652.32 for a total of $1,265,057.17.

The Foundation Company was awarded the contract for the construction of the primary treatment plant in June of 1958 at an estimated cost of $699,544.00.

Construction which was supervised by Mr. J.C.F. Macdonald of the Commission Construction Division officially began in August of 1958 after the sod turning ceremonies at which Mayor Eunice M. Wishart and Mr. A.M. Snider, Commission Chairman, officiated. Construction was substantially completed and the systems put into operation early in 1960.

The sewage treatment plant was officially opened on June 15, 1961, almost three years after the sod turning ceremony, by Mayor N.R. Wilson and the Honourable G.C. Wardrope.

II PLANT DESIGN DATA

At present, the plant is designed to give primary treatment with heated sludge digestion to 2,000,000 gallons of sewage per day. The plant is now capable of serving 20,000 persons and can be ultimately enlarged to a secondary treatment plant with a capacity of 16,000,000 gallons per day and serving 80,000 people.

The facilities presently include a combined lift station and control building, two grit channels, two primary sedimentation tanks, a heated sludge digester, four sludge drying beds, a chlorine contact chamber and one chlorine feeder.

CONTROL BUILDING

This building houses the raw sewage pumps, motors, electrical controls, heat exchanger, sludge pumps, office, laboratory and limited storage space. There is also room for the installation of future equipment necessary for expansion.

LIFT STATION

The raw sewage enters the wet well through a 60" diameter gravity sewer at sub-basement level. It is coarse screened before passing through a 36" barminutor which cuts and shreds any solid material in the sewage. Before the sewage enters the wet well it passes through an influent manhole which houses a control gate and a by-pass line. Due to the hydraulics of the sewer and wet well, this control gate has to be kept partially closed to avoid flooding the wet well. It is also impossible to use the by-pass without

flooding basements upstream in Port Arthur.

Sewage is lifted by two 4,000 gallons per minute pumps approximately 40' to the grit channels. Each pump is equipped with a 75 H.P. electric motor, and one is also equipped with a 90 H.P. diesel motor which acts as a standby power source in case of electrical power failures.

GRIT CHANNELS

Sand and grit is allowed to settle in two parallel grit channels, each 35' x 3' x 5' deep and having a detention time of 4.7 minutes at design flow.

PRIMARY SEDIMENTATION

From the grit channels the sewage flows into two rectangular primary settling tanks. These tanks each measure 100' x 18' x 8' deep and have travelling combination scum skimmers and sludge collectors. The retention time is 2.14 hours at design flow, however, their combined maximum hydraulic capacity is 4 MGD, but at a reduced efficiency.

The sludge and scum collected in the primary tanks flows by gravity to an 11' x 11' x 10' deep raw sludge hopper, from which it is pumped by a 150 GPM, raw sludge pump to the digester.

In the event of a failure of the regular sludge and recirculation pumps, a 150 GPM standby pump powered by a 6 H.P. motor is provided.

CHLORINATION

The primary tank effluent flows into the chlorine contact chamber where its bacterial content is reduced by the

addition of chlorine. The chlorine contact chamber measures 45' x 20' x 10' deep and has a retention time of 40 minutes at design flow. The gas chlorinator has a capacity of 400 pounds per day.

The chlorine tank effluent is discharged to the McIntyre River through an effluent sewer equipped with a flap gate to prevent back-flow from the river.

DIGESTION

The sludge collected in the two primary tanks is pumped from the raw sludge hopper to the digester. The sludge is heated to an average temperature of 93°F. and is broken down by bacterial action into:

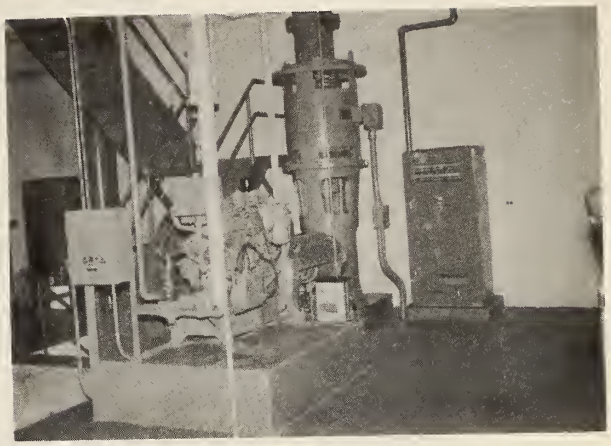
1. A thick, black, odourless sludge.
2. A relatively clear supernatant liquor which is returned to the wet well.
3. A digester gas of low quality which is utilized to heat the digester.

Natural gas is used as a standby fuel. The digested sludge is drained out onto the sand drying beds periodically throughout the warm season. The sludge is allowed to dry on the beds into a manageable sludge cake, and is then disposed of as a soil conditioner. Facilities are also available for disposal of this digested sludge in liquid form by tank trucks.

The digester measures 50' in diameter by 20' side wall depth. It has a capacity of 50,000 cubic feet or 312,000 gallons. This capacity allows for 2.5 cubic feet per capita at design flow.

The four drying beds have a total area of 10,000 square feet which represents 0.5 square feet per capita per year at design flow.

CONTROL BUILDING



PUMPING EQUIPMENT

SLUDGE DRYING BEDS

PRIMARY SEDIMENTATION

DIGESTER

III PLANT OPERATION

(A) HYDRAULIC LOADING

A total of 885.49 million gallons of raw sewage was treated at the plant during the year which was an average daily flow of 2.46 million gallons per day which is a slight increase over the 2.34 for 1961. The maximum daily flow recorded during the year was 5.15 million gallons and the minimum was 1.48 million gallons. The design plant flow is 2.00 million gallons per day and during the year 84.5% of the time the flow was equal to or greater than the design plant flow.

The maximum flow rate recorded during the year was 8.20 million gallons per day and the average daily maximum flow rate was 3.53 million gallons per day. The minimum flow rate recorded during the year was 0.30 million gallons per day and the average daily minimum flow rate was 1.32 million gallons per day.

A more detailed description of the flow is given in the table and graphs on the following pages.

The plant was by-passed for a total of 134 hours and it was all during the month of December while work was being carried out on a broken sludge line between the control building and primary tanks.

The plant is now being expanded to handle a design flow of 4 million gallons per day.

PORT ARTHUR

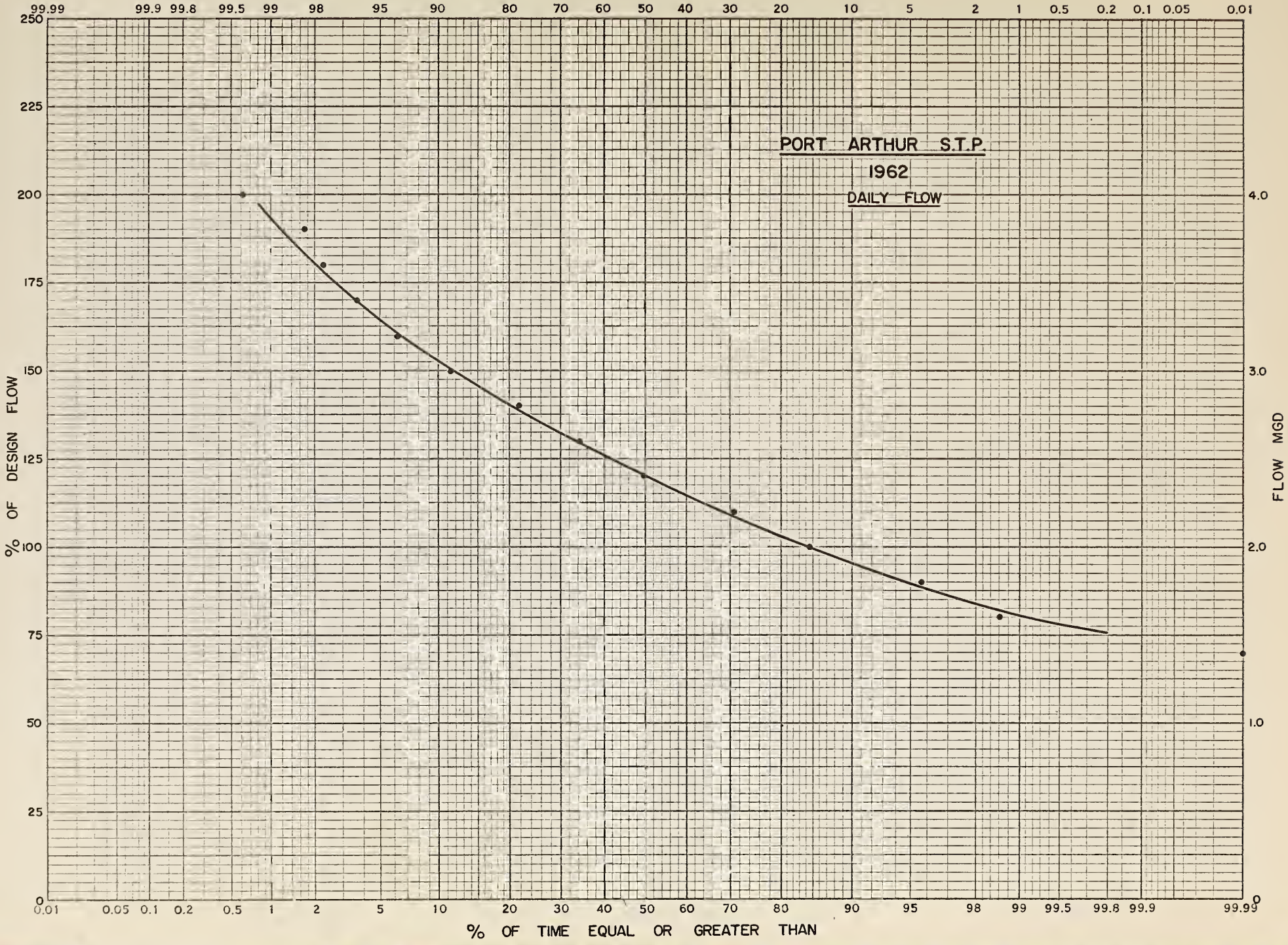
MONTH	FLOW				FLOW RATE			
	Total Flow MG	Avg. Daily Flow MGD	Max. Daily Flow MGD	Min. Daily Flow MGD	Max. Record Flow Rate MGD	Av. Daily Max. Recorded Flow Rate MGD	Min. Record Flow Rate MGD	Av. Daily Min. Recorde Flow Rate MGD
January	61.68	1.99	2.73	1.56	3.550	2.89	.300	1.11
February	52.72	1.88	2.22	1.48	3.650	2.83	.800	1.09
March	68.67	2.22	3.26	1.72	5.580	3.44	.250	1.10
April	79.57	2.65	3.81	2.23	5.500	3.68	1.150	1.44
May	91.95	2.97	3.30	2.66	8.000	3.89	1.150	1.58
June	75.45	2.52	3.11	2.24	7.600	3.67	1.280	1.34
July	84.34	2.72	5.15	2.11	8.200	3.95	1.180	1.53
August	82.39	2.66	3.76	2.29	4.600	3.77	1.200	1.37
September	85.70	2.86	3.96	2.20	4.100	3.84	1.220	1.69
October	68.90	2.22	2.54	2.00	3.660	3.21	0.980	1.12
November	66.93	2.23	2.59	1.97	4.000	3.26	1.080	1.22
*December	67.19	2.58	3.16	1.85	5.400	3.91	1.050	1.25
Year	885.49	2.46	5.15	1.48	8.200	3.53	0.300	1.32

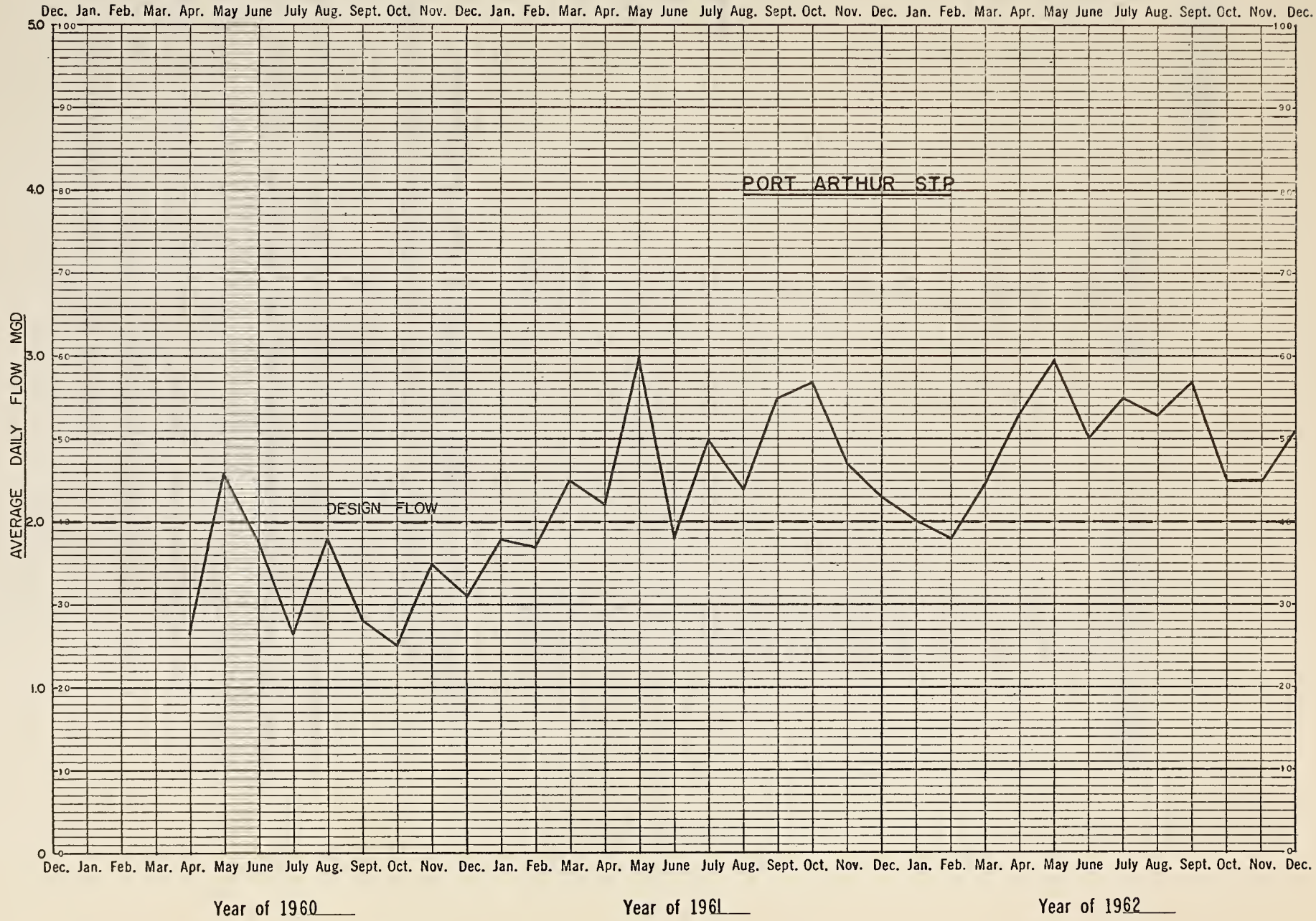
Note:

* Plant by-passed 134 hrs.

MG - million gallons

MGD - million gallons per day.


PORT ARTHUR S.T.P.
1962
DAILY FLOW
% OF DESIGN FLOW
FLOW MGD
% OF TIME EQUAL OR GREATER THAN
99.99 99.9 99.8 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.5 99.8 99.9 99.99
250 225 200 175 150 125 100 75 50 25 0
4.0 3.0 2.0 1.0 0


PORT ARTHUR STP
DESIGN FLOW
AVERAGE DAILY FLOW MGD
5.0
4.0
3.0
2.0
1.0
0
Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Year of 1960
Year of 1961
Year of 1962

(B) GRIT REMOVAL

MONTH	CUBIC FEET	CU. FT./M.G. SEWAGE
January	250	4.06
February	215	4.08
March	203	2.96
April	170	2.04
May	265	2.88
June	192	2.54
July	256	3.04
August	300	3.64
September	273	3.19
October	251	3.64
November	278	4.15
December	437	6.50
Year	3090	3.49

During the year a total of 3090 cu. ft. of grit was removed which averaged to 3.49 cu. ft. per million gallons of raw sewage. Approximately 1/3 of all the grit collected is washed away when the grit channels are dewatered. However, with the addition of the proposed collecting mechanism this 1/3 will also be collected. Therefore the amount of grit collected per million gallons of sewage was approximately 5.25 cu. ft. which is relatively high when compared to other similar installations in North America.

For instance, in 22 municipalities with 50% or more of their sewer system combined, the average grit collected per million gallons of sewage was 2.85 cu. ft. (This figure was compiled from data found in the FSIWA Manual of Practice #8 pages 62 and 63.)

(C) PLANT PERFORMANCE

During the year samples for sewage analysis were taken twenty-six times. The average five day B.O.D. of the raw sewage was 205 ppm and of the final effluent was 107 ppm. The total B.O.D. entering the plant was approximately 1,755,000 lbs. and the total B.O.D. removed was 842,000 lbs. which resulted in a 47.9% reduction in B.O.D.

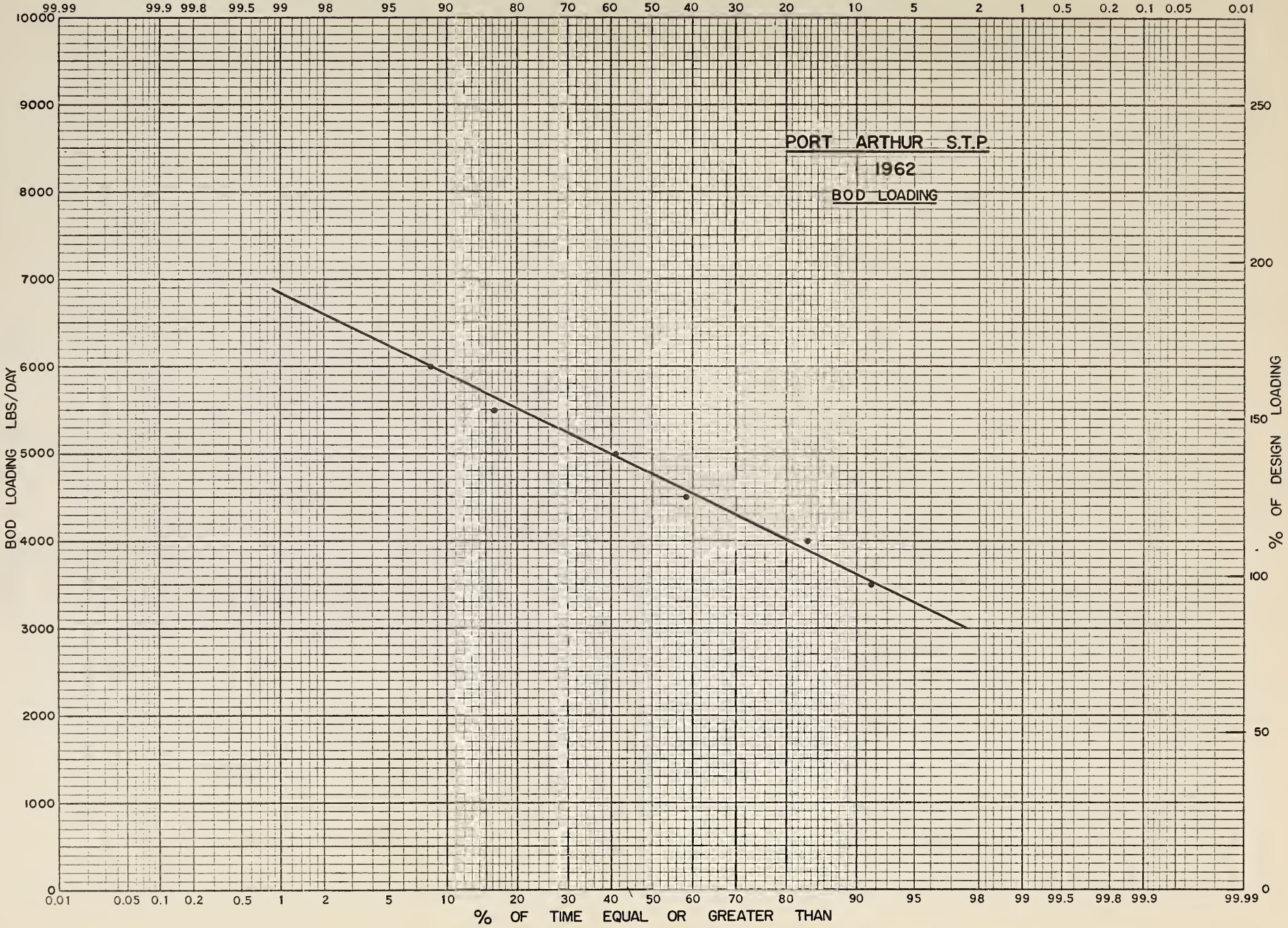
The average suspended solids of the raw sewage was 219 ppm and of the final effluent was 93 ppm. The total pounds of suspended solids entering the plant was approximately 1,876,000 lbs. and the total suspended solids removed was 1,064,000 lbs. which resulted in a 56.9% reduction in suspended solids.

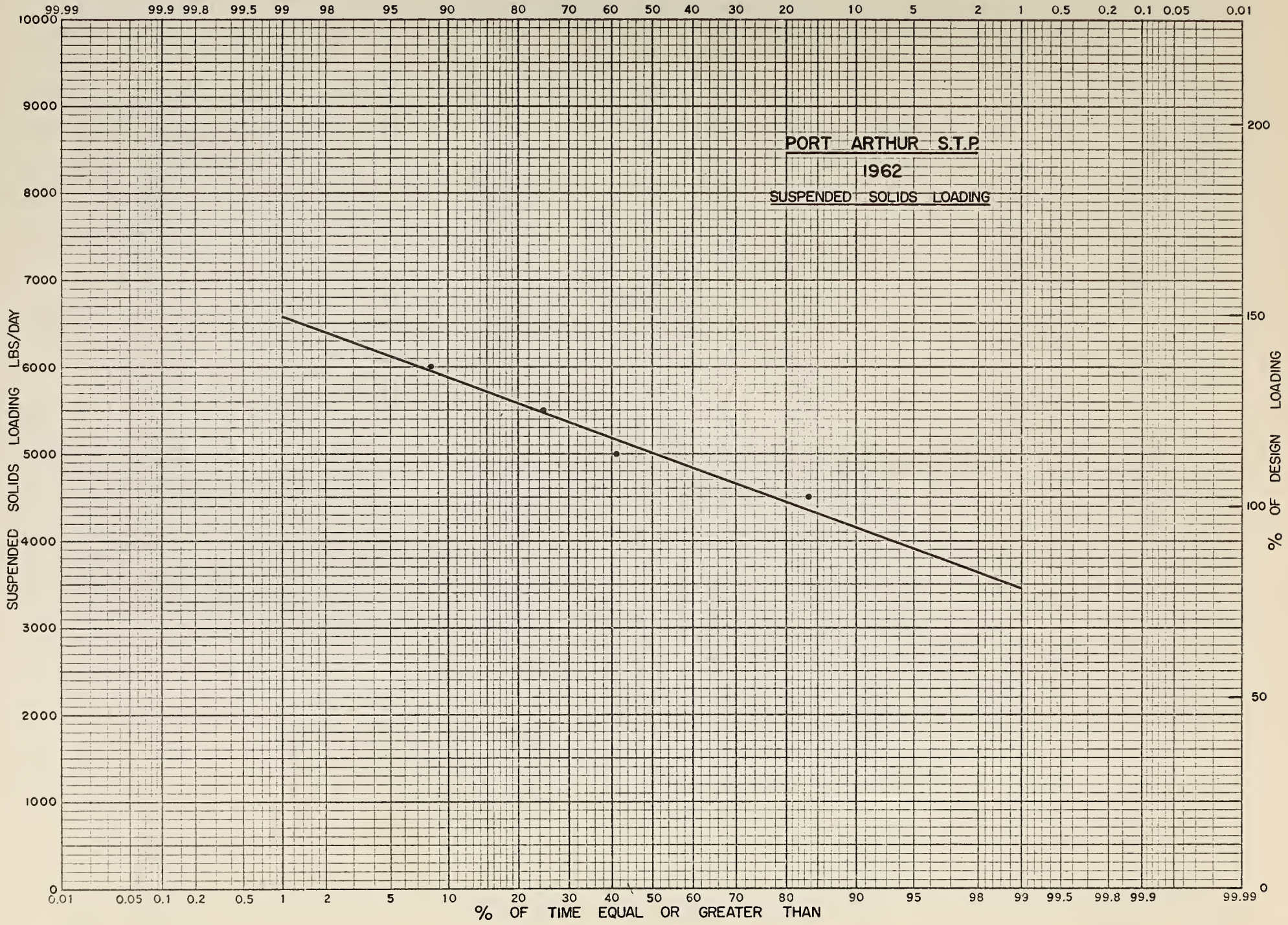
The plant was designed to remove 1260 lbs. of B.O.D. per day and the removal averaged 2340 lbs. per day. The design suspended solids removal is 2640 lbs. per day and the removal averaged 2960 lbs. per day.

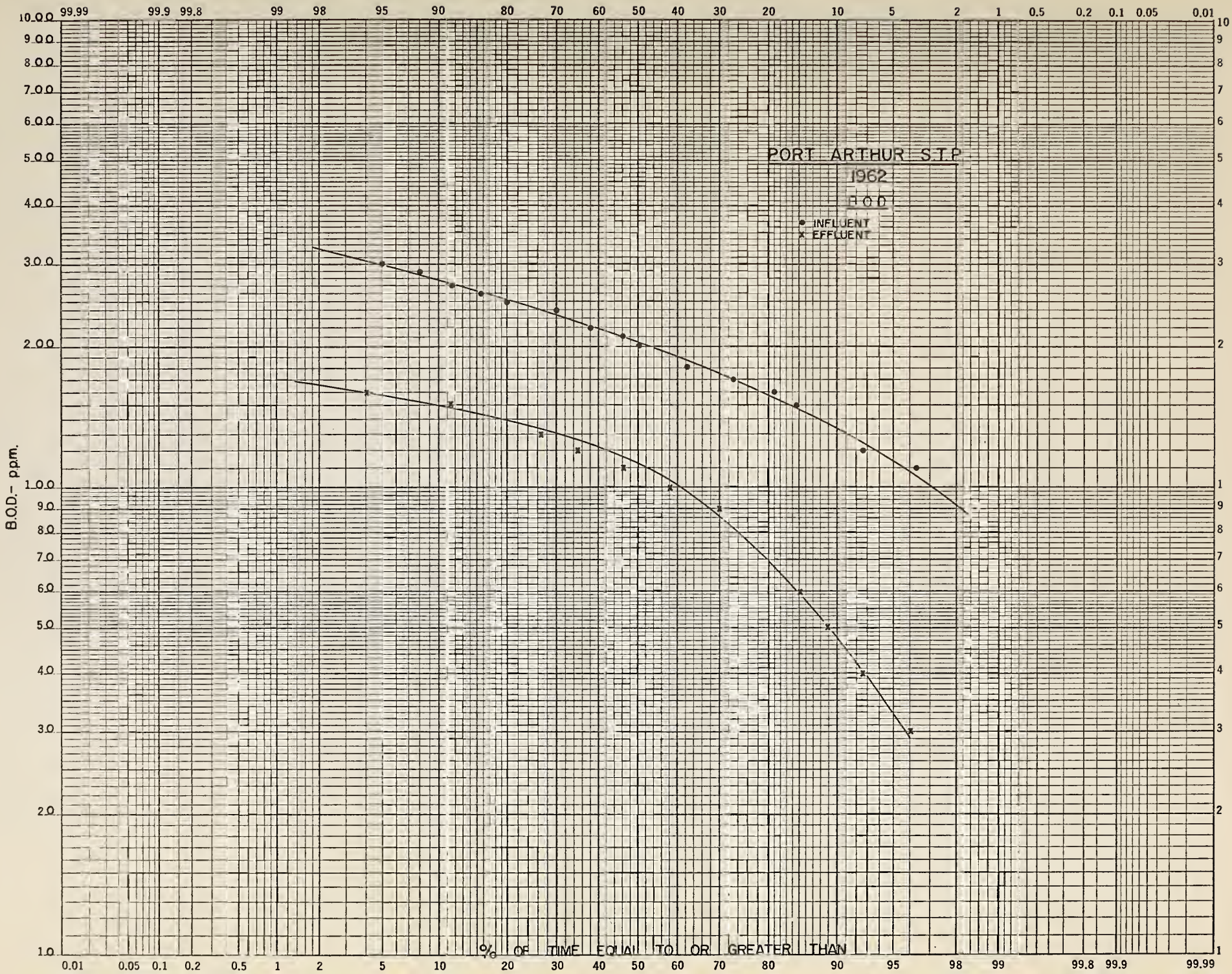
With the average daily flow for the year of 2.46 M.G.D. the retention period in the primary tanks was approximately 1.74 hours. The surface settling rate was approximately 690 gal./sq. ft. of tank/day and the weir overflow rate was approximately 6600 gal./lin. ft. of weir/day.

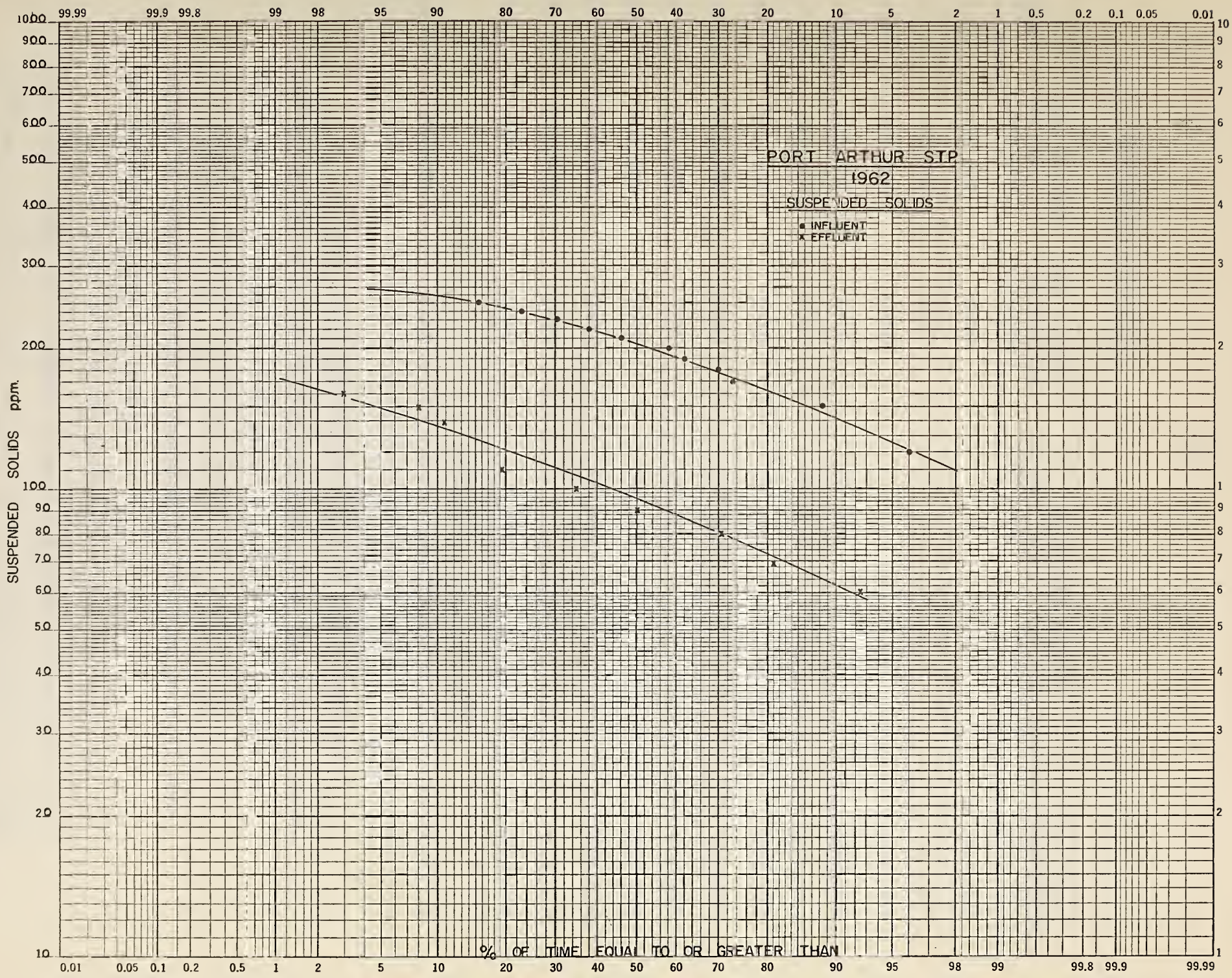
PLANT PERFORMANCE - 1962

DATE	INFLUENT		EFFLUENT		% REMOVAL		INFLUENT		REMOVAL	
	BOD PPM	S.S. PPM	BOD PPM	S.S. PPM	BOD PPM	S.S.	BOD LBS.	S.S. LBS.	BOD LBS.	S.S. LBS.
Jan. 8	215	220	110	102	49.0	53.5				
22	290	376	130	100	55.0	73.5	156,500	184,000	82,600	121,500
Feb. 5	245	506	128	156	47.5	69.0				
19	230	238	155	90	32.5	62.0	125,500	196,000	51,100	131,100
Mar. 5	190	182	130	74	31.5	57.0				
19	280	242	125	110	55.5	54.5	161,200	145,500	74,100	82,500
Apr. 2	180	202	115	92	30.5	54.5				
16	235	256	82	100	65.0	61.0				
30	120	142	80	96	33.5	32.5	141,500	159,000	68,500	82,800
May 14	125	160	90	144	28.0	10.0				
28	170	170	85	66	50.0	61.0	136,000	151,500	56,100	55,200
June 11	165	183	130	107	21.0	41.5				
25	180	141	100	72	44.5	49.0	130,500	122,000	43,700	55,100
July 9	54	114	38	57	29.5	50.0				
	170	208	80	54	53.0	74.0	94,400	135,700	44,600	89,400
Aug. 6	110	234	29	94	73.5	59.5				
20	155	164	46	82	70.5	50.0	109,500	163,800	79,000	91,300
Sept. 3	160	166	64	76	60.0	54.0				
17	200	162	90	68	55.0	58.0	154,000	140,500	88,400	78,900
Oct. 1	260	194	98	65	62.0	66.5				
15	240	248	105	71	56.0	71.5				
29	250	222	110	83	56.0	62.5	172,100	152,100	100,500	102,000
Nov. 12	170	202	105	78	38.0	61.5				
26	245	218	130	85	47.0	61.0	139,000	140,500	60,900	86,400
Dec. 10	210	216	155	119	26.2	44.9				
24	490	336	270	172	44.9	36.3	235,000	185,500	92,600	88,100
YEAR	205	219	107	93	47.9	56.9	1,755,200	1,876,100	842,100	1,064,300


PORT ARTHUR S.T.P.
1962
BOD LOADING
BOD LOADING LBS/DAY
% OF DESIGN LOADING
% OF TIME EQUAL OR GREATER THAN
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
250
200
150
100
50
0
99.99 99.9 99.8 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.5 99.8 99.9 99.99


PORT ARTHUR S.T.P.
1962
SUSPENDED SOLIDS LOADING
SUSPENDED SOLIDS LOADING LBS/DAY
% OF DESIGN LOADING
% OF TIME EQUAL OR GREATER THAN
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
200
150
100
50
0
99.99 99.9 99.8 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.5 99.8 99.9 99.99


PORT ARTHUR S.T.P.
1962
B.O.D.
INFLUENT
EFFLUENT
B.O.D. - ppm.
% OF TIME EQUAL TO OR GREATER THAN
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
99.99
99.9
99.8
99
98
95
90
80
70
60
50
40
30
20
10
5
2
1
0.5
0.2
0.1
0.05
0.01


PORT ARTHUR STP
1962
SUSPENDED SOLIDS
• INFLUENT
x EFFLUENT
SUSPENDED SOLIDS ppm.
% OF TIME EQUAL TO OR GREATER THAN
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
1000 900 800 700 600 500 400 300 200 100 90 80 70 60 50 40 30 20 10
10 9 8 7 6 5 4 3 2 1
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

(D) DIGESTER OPERATION

MONTH	RAW SLUDGE TO DIG. (GALLONS)	RAW SLUDGE PER MG SEW. (GALLONS)	DIGESTED SLUDGE TO DRY. BEDS (GALLONS)	DIGESTED SLUDGE TO LIQ. HAUL. (GALLONS)	DIG. GAS PRODUCTION (CU. FT.)
Jan.	153,600	2490			443,000
Feb.	138,400	2630			463,000
March	164,000	2390			476,599
April	155,200	1950	50,300		440,636
May	161,600	1760	83,950	22,725	371,911
June	161,600	2140	32,850	7,575	401,442
July	176,400	2090	23,290		409,076
Aug.	162,400	1980	9,270		461,182
Sept.	164,000	1920	38,410		447,043
Oct.	165,600	2410	40,290		536,320
Nov.	161,600	2420			475,539
Dec.	133,600	1990	7,575		513,798
			285,935	30,300	
Year	1,898,000	2140	316,235		5,439,546

A total of 1,898,000 gallons of raw sludge was pumped to the digester during the year from the primary tanks. This was an average of 2140 gallons per million gallons of raw sewage treated. At 4% solids in the sludge, the total weight of organics removed amounted to 380 tons or 0.43 tons per million gallons of sewage.

A total of 316,235 gallons or 1880 cu. yds. of digested sludge was removed from the digester of which 285,935 gallons or 1700 cu. yds. was put on the drying beds and 30,000

gallons or 180 cu. yds. was hauled away by truck. During the year, 24 beds of digested sludge were dried.

The digester gas production amounted to 5,439,546 cu. ft. and the boiler operated on digester gas throughout the year.

(E) CHLORINATION

MONTH	CHLORINE LBS.	LBS. PER MG SEWAGE	DOSAGE PPM	RESIDUAL PPM	CHLORINE DEMAND PPM
June	192	38.2	3.82	.38	3.44
July	2626	34.6	3.46	.55	2.91
Aug.	3083	37.5	3.75	.58	3.17
Sept.	2767	35.4	3.54	.54	3.00
Year	8668				

A total of 8668 lbs. of chlorine was applied to the final effluent from June 29th to September 27th. This was an approximate dosage of 3.6 ppm resulting in a chlorine residual of approximately 0.5 ppm in the final effluent.

(F) POWER CONSUMPTION

MONTH	K.W.H.	KWH/MG SEWAGE	KW DEMAND	COST
January	34,012	551	119.92	$269.93
February	30,914	596	101.72	262.97
March	34,512	502	104.76	271.06
April	30,479	383	132.08	263.66
May	41,542	451	150.00	318.22
June	32,479	431	152.32	297.83
July	32,527	386	177.86	391.28
August	36,542	443	170.60	395.65
Sept.	35,008	409	111.84	328.46
October	34,012	494	91.64	325.50
November	34,508	516	127.00	326.98
December	37,542	559	127.00	335.99
Total	414,077	Avg. 468		$3,787.53

The total power consumed during the year amounted to 414,077 K.W.H. which cost $3,787.53. The average power used during the year was 468 K.W.H. per million gallons of raw sewage treated which compares with the figure of 465 in 1961.

(G) PLANT SUPERVISION

The plant was under a 16 hour supervision by a staff consisting of a chief operator and three operators. At the close of the year 1962 the staff consisted of the following:

S. Antonik	Chief Operator
E.J. Hughes	Operator
S. Hyrmnak	Operator
R. Romanick	Operator

It was also necessary to hire part-time help in order that the staff could take their vacations and statuatory holidays.

The duties of the plant staff were such as to maintain a high quality effluent. In order to do so, tests were carried out daily by the staff at the plant. Samples were also taken every two weeks and sent to the OWRC Laboratory for analysis. The operators were also responsible for maintaining all the equipment, grounds and buildings.

The operation of the project is under the supervision of the Division of Plant Operations. During the year three visits were made by the head office project engineer and two visits by the Head Office Electronics Section. Approximately 50 invoices were handled by the Head Office staff during the year. The head office expenses were not charged to the project.

During the year both Mr. S. Antonik and Mr. R. Romanick successfully completed the Intermediate Sewage Operator's Course held in Toronto, also the staff should be congratulated for their efficient operation of the plant during the year 1962.

IV COST DATA

(A) CAPITAL COST

The tentative total construction cost for this OWRC project 58-S-13 was $2,168,791.00 which was divided as follows:

Sewer System	$1,265,057.17
Treatment Facilities	745,877.05
Engineering	123,226.46
Miscellaneous (property, OMB charges interest etc.)	35,630.32
	$2,168,791.00

The latest figure for the total construction cost is $2,156,057.22. Assuming a population of 20,000 persons this would amount to $107.80 per capita.

(B) RESERVE FOR CONTINGENCIES

As of December 31, 1962 there was a total of $46,023.69 in the reserve fund. The money in this fund is to be used in cases of emergency or major repairs. The money in this fund is earning interest.

(C) OPERATING COSTS

The following is the operating budget for the year 1962 and the actual operating expenditures for 1962. A more detailed breakdown of the 1962 operating expenditures of $31,781.54 will be found in the table on a following page.

	Budget 1962	Expenditure 1962
Payroll	16,820.00	17,671.42
Fuel	700.00	590.48
Power	4,400.00	3,714.59
Water	400.00	1,061.71
Chemicals	1,000.00	1,344.18
General Supplies	1,100.00	1,729.72
Equipment	2,000.00	3,888.70
Maintenance & Repairs	800.00	519.45
Sludge Hauling		
Sundry	1,200.00	1,260.91
	28,420.00	
Contingency 10%	2,840.00	
Total	$31,260.00	$31,781.54

Operating Cost - per lb. B.O.D. removed - $0.0377

- per lb. S.S. removed - $0.0298
- per M.G. sewage treated - $35.85
- per capita $1.59 (20,000 persons)

EXPENDITURES 1962

MONTH	EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIR & MAINTENANCE	SUNDRY	WATER
JAN.	1,735.42	1,244.82	53.60	42.00	263.05		88.00	9.24		34.71	
FEB.	1,572.68	1,267.06		71.25			20.58			46.66	167.13
MARCH	2,199.19	1,246.20		55.50	532.90		193.32	90.56		80.71	
APRIL	1,904.53	1,288.92					256.07	+10.07	189.92	179.69	
MAY	2,923.33	1,302.68		68.14	271.06		250.59	485.90	114.99	137.56	292.41
JUNE	2,395.27	1,246.20		85.50	263.66	574.03	166.83			59.05	
JULY	3,327.51	1,246.20	233.82		616.05	574.03	173.62			343.97	139.82
AUG.	3,087.64	1,869.30	400.96	42.00		574.03	197.00			4.35	
SEPT.	3,554.15	1,246.20	200.80	84.00	786.93	672.09	128.56	195.69	112.51	127.37	
OCT.	2,743.09	1,246.20	160.80	16.09			23.62	900.89	71.65		323.84
NOV.	1,229.47	1,246.20	41.44	42.00	653.96	+1,050.00	65.96	103.00		126.91	
DEC.	5,109.26	2,130.40		84.00	326.98		165.57	2,113.49	30.38	119.93	138.51
TOTAL	31,781.54	16,580.38	1,091.42	590.48	3,714.59	1,344.18	1,729.72	3,888.70	519.45	1,260.91	1,061.71

NOTE: + CREDIT

V EXPANSION

During the year 1962 construction work was carried out to increase the plant capacity from 2.0 MGD to 4.0 MGD and would be completed during 1963. The new equipment and additions are as follows:

1. Extension to the trunk interceptor sewer.
2. Addition of two new settling tanks.
3. Construction of permanent enclosures over the primary trunk collecting mechanisms.
4. Addition of a new 20,000 gpm storm pump.
5. Addition of a new 48" barminutor.
6. Addition of grit collecting mechanisms.
7. Grading and shaping of the chlorine contact chamber floor.
8. Miscellaneous equipment such as permanent ladders, fence gates, etc.