ANNUAL REPORT

1961

CITY OF PORT ARTHUR

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ON

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SEWAGE TREATMENT PLANT

OWRC PROJECT - 58-S-13

PORT ARTHUR SEWAGE TREATMENT 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 of Plant Operations
Mr. B. C. Palmer	-	Assistant Director, Division of Plant Operations
Mr. P. J. Osmond	-	Project Engineer, Division of Plant Operations
Mr. J.C.F. Macdonald		Assistant Director of Construction and Construction Engineer

CITY OF PORT ARTHUR

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.

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 a capacity of 16,000,000 gallons per day and serving 80,000 people.

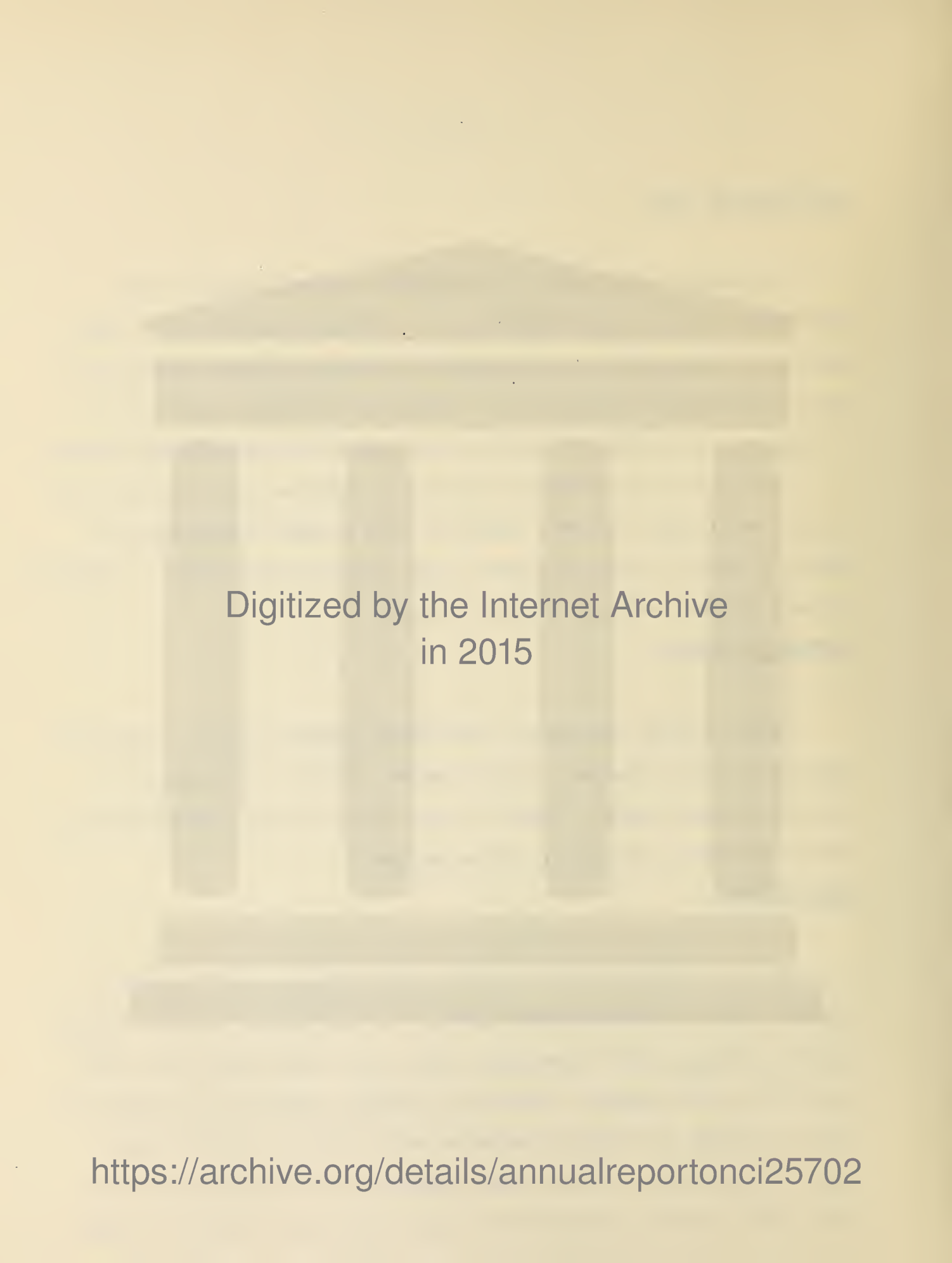
The facilities presently include a combined lift station and control building, two grit channels, two primary sedimentation tanks, a heated sludge digester, four sludge drying beds, a chlorine contact chamber and one chlorine feeder.

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.

OPERATING DATA

The Port Arthur sewage plant operated very efficiently during the past year. Most of the problems encountered were, fortunately, of a minor nature and the operation of the plant was not interrupted seriously.

During January one of the small transformers on the control panel blew out thus rendering the water seal pump inactive but only for a few hours. Remedial action was taken to prevent a recurrence. The barminutor was taken out of service for three days in January for necessary repair of worn parts. Also, during January the floating roof on the digester froze to the side wall. The roof was freed by increasing the temperature inside the digester and by placing rock salt around the periphery of the roof. This freezing is bound to occur again and the only action that can be taken is to watch the roof closely.

During April, the water seal pump tripped out during the night, possibly due to a power fluctuation, thus causing scorching of pump packing and sleeves. The badly scorched packing was replaced.

During August, the bearing housings on the south primary tank collector mechanism cracked. The tank was immediately taken out of service. Repairs were effected locally and the tank returned to service after a three day period.

During September, the barminutor was again reported in need of repair due to the heavy loading of solids which necessitates continuous operation. Repair parts were ordered.

A unique accident occurred during October. The standby sludge pump exploded doing irreparable damage to the lower casing and miscellaneous piping and valves. The explosion was probably caused by a gas build up from the confined sludge in the pump. The repairs, which were immediately made, were covered by insurance.

During November, the drain valve on the south primary tank stuck in the open position while the plant staff was servicing it. A temporary plug was installed and the valve repaired later. Ground settlement caused another pyrotenax cable to snap. No certain way of preventing these breaks has been developed as yet. The angle supports for the primary tank cross collectors had to be replaced, during November, due to wear.

The first freezing of the digester floating roof occurred during December and was easily handled by the addition of extra heat and salt.

The other five months not mentioned above were by no means trouble-free, but the problems were too minor to be mentioned in this report.

The following 6 pages are a tabulation of the operating results for the period from January 1st, 1961 to December 31st, 1961. They include flow results, performance data or efficiency, sludge removal and disposal, grit removal, chlorine usage, power and natural gas consumption.

FLOW RESULTS

MONTH	TOTAL FLOW (MG)	AVG. DAILY PEAK FLOW RATE (MG)	MAXIMUM RECORDED PEAK FLOW (MG)	AVG. DAILY MINIMUM FLOW RATE (MG)	MINIMUM RECORDED FLOW RATE (MG)	AVG. DAILY FLOW (MG)
JAN.	52.87	3.07	6.38	0.55	0.04	1.71
FEB.	51.51	2.79	4.42	0.48	0.01	1.84
MAR.	63.91	3.29	6.25	0.52	0.13	2.06
APR.	73.02	3.47	5.85	1.25	0.27	2.63
MAY	83.50	3.99	7.45	1.40	1.17	2.69
JUNE	66.27	3.22	6.05	1.18	1.06	2.21
JULY	69.55	3.99	8.25	1.24	0.93	2.24
AUG.	61.74	3.32	7.24	1.18	1.05	1.99
SEPT.	96.33	4.39	8.38	1.66	1.10	3.21
OCT.	79.80	3.56	5.22	1.24	1.13	2.57
NOV.	65.89	3.54	5.96	1.45	0.85	2.20
DEC.	76.02	3.04	4.05	1.18	0.92	2.77

Total flow for the year was 840.41 million gallons

Average daily flow for the year - 2.34 million gallons

PLANT PERFORMANCE DATA

DATE		INFLUENT BOD	INFLUENT S.S.	EFFLUENT BOD	EFFLUENT S.S.	% REMOVAL BOD	% REMOVAL S.S.
JANUARY	9	295	258	135	106	54.3	56.7
	23	250	322	155	88	38.0	72.6
FEBRUARY	6	205	258	110	76	46.4	70.6
	20	285	208	65	86	77.1	58.7
MARCH	6	245	220	185	114	24.5	48.2
	20	265	266	170	140	35.8	47.4
APRIL	3	310	202	140	86	54.9	57.5
	17	225	196	125	98	44.5	50.0
MAY	1	180	198	85	86	52.8	56.5
	15	150	188	92	112	38.6	40.4
	29	185	258	165	102	10.8	60.5
JUNE	12	325	192	115	88	64.6	54.2
	26	160	198	95	82	40.6	58.6
JULY	10	165	184	94	82	43.0	55.5
	24	170	198	114	98	32.9	50.5
AUGUST	7	150	222	48	74	68.0	66.0
	21	250	180	130	60	48.0	66.7
SEPTEMBER	4	255	300	92	66	64.0	78.0
	18	155	182	65	90	58.0	51.1
OCTOBER	2	230	218	96	80	58.2	63.4
	16	150	174	68	102	54.7	41.4
	30	155	174	80	94	48.4	46.0
NOVEMBER	13	155	170	75	98	51.5	42.4
	27	185	202	105	94	43.2	53.0
DECEMBER	11	185	206	140	88	24.3	57.0
	25	190	172	120	72	36.9	58.0
AVERAGE		210.6	213.3	110.2	90.8	47.6	57.5

RAW SLUDGE REMOVAL AND DIGESTED SLUDGE DISPOSAL

MONTH	GALLONS REMOVED	GALLONS PER MG SEWAGE	GALLONS TO DRYING BEDS	GALLONS TO LIQUID HAULAGE
JANUARY	162,720	3,080		
FEBRUARY	136,960	2,650		
MARCH	153,600	2,400		
APRIL	153,600	2,100	18,360	
MAY	164,000	1,960	102,440	11,790
JUNE	158,400	2,390	78,010	
JULY	165,600	2,380	75,820	
AUGUST	156,800	2,540	37,910	
SEPTEMBER	156,800	1,630	73,290	17,690
OCTOBER	160,800	2,020	50,540	7,580
NOVEMBER	156,800	2,380		
DECEMBER	156,900	2,060		
TOTALS	1,882,980	2,240	436,370	37,060
			473,430	

- Total weight of organics removed at 4% solids in the sludge was 377 tons. This represents 0.45 tons per million gallons of sewage.
- 39 beds of sludge were dried in a 204 day season (April 10 to October 31). This represented 2,590 cubic yards of sludge.
- Total digested sludge disposed of in 1961 was 2,810 cubic yards.

GRIT REMOVAL

MONTH	CUBIC FEET	CUBIC FEET/MG SEWAGE
JANUARY	314	5.9
FEBRUARY	177	3.4
MARCH	232	3.6
APRIL	209	2.9
MAY	196	2.4
JUNE	230	3.5
JULY	225	3.2
AUGUST	222	3.6
SEPTEMBER	273	2.8
OCTOBER	355	4.5
NOVEMBER	232	3.5
DECEMBER	175	2.3
TOTAL	2840	AVERAGE 3.4

It must be remembered that approximately 1/3 of all the grit collected is washed out of the grit channels when they are dewatered. However, with the addition of the proposed collecting mechanism this 1/3 will also be collected; thus raising the amount collected per million gallons to approximately 5.1 cubic feet. This figure is relatively high when compared with grit collected at other similar installations throughout 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 cubic feet. (This figure was compiled from data found in the FSIWA Manual of Practice #8 pages 62 and 63).

POWER CONSUMPTION

MONTH	K.W.H.		K.W.H./M.G. SEWAGE
JANUARY	33,500		635
FEBRUARY	27,000		525
MARCH	32,000		500
APRIL	31,500		430
MAY	34,500		415
JUNE	29,500		445
JULY	32,000		460
AUGUST	29,500		480
SEPTEMBER	37,500		390
OCTOBER	34,000		425
NOVEMBER	35,000		530
DECEMBER	34,000		450
TOTAL	390,000	AVERAGE	465

The increase in flows over 1960 and the installation of capacitors late in the year have improved the power factor such that the KWH/MG has been reduced from 658 in 1960 to 465 in 1961.

CHLORINE USAGE

MONTH	CHLORINE LBS	LBS. PER MG SEWAGE	DOSAGE P.P.M.
JUNE	282	45.7	4.6
JULY	2679	38.6	3.9
AUGUST	2905	47.1	4.7
SEPTEMBER	2836	29.4	2.9
OCTOBER	886	33.0	3.3
TOTAL	9588		

The recommended dosage for a primary sewage plant is from 5 to 10 ppm. The low dosage figures above were due to an error in the flow recorder and therefore an erronical feed rate setting on the chlorinator was calculated.

NATURAL GAS CONSUMPTION

MONTH	BUILDING HEAT CUBIC FEET	DIGESTER CU. FT.
JANUARY	1,238,000	
FEBRUARY	1,043,000	
MARCH	1,045,000	61,000 (32 hrs)
APRIL	771,000	
MAY	690,000	
JUNE	204,000	
JULY	169,000	
AUGUST	85,000	
SEPTEMBER	123,000	
OCTOBER	355,000	
NOVEMBER	503,000	
DECEMBER	743,000	
TOTAL	6,969,000 CU. FT.	61,000 CU. FT.
	7,030,000	

COST DATA

The Port Arthur Sewage Treatment Plant has operated economically during the past year, in spite of the fact that equipment costs were high and repairs were fairly numerous.

The following information is a summary of the capital and operating cost data for 1961. Following this will be found a statement of the actual expenditures during 1961 as well as forecast of 1962 expenditures.

The total actual construction cost for this project, OWRC 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, interest OMB charges, etc.)	34,630.32
TOTAL	$2,168,791.00

1. Per Capita Cost - 20,000 persons

a) Capital Cost

- sewer systems	68.22
- treatment facilities	40.22
	$108.44

b) Annual Cost (1961)

- operating cost	1.49
- debt retirement, interest	8.40
	$ 9.89

2. Per Household Cost (3.4 persons per household)

a) Capital Cost

- sewer system	231.95
- treatment facilities	136.75
	$368.70

b) Annual Cost (1961)

- operating	5.07
- debt retirement, interest	28.56
	$33.63

3. Treatment Costs

- cost per thousand gallons	₦ 0.0356
- cost per million gallons	₦ 35.60
- cost per day (2.34 MGD)	₦ 83.30

FORECAST OF 1962 EXPENDITURES

	1962	1961 Forecast
Payroll	₦ 16,820.00	₦ 15,250.00
Fuel	700.00	800.00
Power	4,400.00	6,000.00
Water	400.00	
Chemicals	1,000.00	5,500.00
General Supplies	1,100.00	2,000.00
Equipment	2,000.00	1,000.00
Maintenance and Repairs	800.00	1,800.00
Sludge Haulage		
Sundry	1,200.00	550.00
	$28,420.00	$32,900.00
Contingencies 10%	2,840.00	1,600.00
	$31,260.00	$34,500.00

PERSONNEL

On February 1, the supervised coverage of the treatment plant was reduced from 24 to 16 hours and consequently the nightwatchman, who was hired in December of 1959, was laid off at this time. The plant now had a complement of four men, three permanent and one casual.

On June 16, Messrs. Caverly, Uren and Osmond of the OWRC, Alderman Laakso, and Mr. Fell, City Engineer, interviewed 15 applicants for the job of plant operator. It was the intention to have a staff of four permanent operators instead of three permanent and one casual. Mr. E. Hughes was the successful applicant and commenced work on July 24. The casual Mr. J. Kolomeychuck was laid off at this time.

Later on during the summer, it became necessary to hire a casual labourer in order to keep on top of the job of grass cutting. This casual worked two weeks and was laid off on the arrival at the plant of the tractor mounted mower.

In November, Mr. S. Hrymnak was granted a leave of absence from December 7, 1961 to January 2, 1962 so that he could accompany the Port Arthur Bearcats Hockey Club on a good will tour of Europe. Mr. J. Kolomeychuck was hired as a replacement for the above period.

Mr. Antonik attended a chief operators conference in February and the first basic sewage works operators course in April. Both were held at the OWRC Laboratory in Toronto. Mr. R. Romanick attended the second basic sewage works operators course during October. Both men scored grade "A" marks in their respective courses.

The personnel of the Port Arthur Sewage Treatment Plant, under the capable guidance of Mr. S. Antonik, the Chief Operator, deserve a great deal of credit for the most efficient manner in which the plant was maintained and operated during 1961.

SUMMARY AND RECOMMENDATIONS

In summary, the writer would like to record a few items which have contributed greatly to decreased costs and increased efficiencies over the past year.

The quality and quantity of the digester gas produced was so high that natural gas was used for only 32 hours in 1961 for heating the digester. This efficient operation of the digester resulted in a considerable fuel economy.

The purchase of the tractor mounted front end loader and mower during late August has already produced an appreciable saving in man hours which were previously expended in sludge removal and lawn mowing. The removal of all the dried sludge from one bed had previously consumed 24 man hours; this job is presently done in approximately 6 hours resulting in a saving of 18 man hours per bed. Lawn mowing had previously consumed 40 man hours per week, this job is now done in 8 man hours, a saving of 32 man hours per week. Considerable economies also resulted. However, no definite figures are available as the equipment operated for only a small portion of the overall season.

The installation of capacitors late in the year, as well as a flow increase have resulted in an improved power factor and, consequently, an improved efficiency in the use of electric power. The KWH/MG treated decreased from 658 in 1960 to 465 in 1961.

Digested sludge in the amount of 2810 cubic yards was disposed of in 1961 at no cost for the actual disposal. This was due mainly to the fine promotional work done by the chief operator and his staff and represents a saving of from $2,000 to $3,000.

In addition to the above-mentioned, the installation in the near future of proposed new equipment, a list of which is found below, should result in a further decrease in the cost of operation per million gallons of sewage treated. As well as doubling the plant capacity from 2.0 MGD to 4.0 MGD, the proposed addition will provide more efficient grit collection, additional pumping capacity and the elimination of icing conditions on the primary tank mechanism.

Proposed additions and New Equipment

1. Extension to the trunk interceptor sewer.
2. Addition of two new primary settling tanks.
3. Construction of permanent enclosures over the primary tank 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.

RECOMMENDATIONS

1. The provision of a standby water seal pump unit or alarm, to prevent a sustained loss of lubrication on all pumps in the plant, is desirable. The cost of

the standby unit or alarm would not exceed $100.00.

2. An investigation is now being conducted to determine whether or not digester gas can be used as the main source of fuel for the building heat. If the investigation proves to be feasible and economical, equipment should be purchased for this purpose.

3. Alteration to the sludge drying beds should be carried out to facilitate removal from the beds of dried sludge. These alterations would adapt the beds to the use of the front end loader.

PORT ARTHUR 1961 EXPENDITURES

MONTH	EXPENDI-TURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIR AND MAINTENANCE	WATER	SUNDRY
JAN.	1913.11	1051.72	328.32	102.01	305.98		68.33		6.75		50.00
FEB.	2050.96	916.64	456.70	84.75	443.57		112.52				36.78
MAR.	1336.84	916.64	218.88	78.75		8.97	69.42				44.18
APR.	2490.10	916.64	218.88	86.25	619.49		91.37	165.00	25.30		367.17
MAY	1633.30	916.64	218.88	55.50	393.40		34.60				14.28
JUNE	2093.22	944.32	251.72	53.25	312.59		32.06	440.00			59.28
JULY	1747.47	932.21	218.88	42.00	262.64		237.46				54.28
AUG.	4643.52	1839.86	276.79	48.66	329.54	1702.50	126.86	84.00	29.20	146.16	59.95
SEPT.	2326.47	1227.86		42.00	292.48	574.03	79.10		52.00		59.00
OCT.	3042.49	1227.86		42.00	332.16	567.50	141.75		360.80		370.42
NOV.	1265.52	1227.86		42.00	343.85	CREDIT 1875.97	83.88	998.55	37.20	352.53	55.62
DEC.	5318.94	1750.05			306.85	CREDIT 4.00	90.19	3441.69	CREDIT 305.80		39.96
TOTALS	29861.94	13868.30	2189.03	677.17	3942.55	973.03	1167.54	5129.24	205.45	498.69	1210.92
		16057.35