Ave West

re: Study of Waste
Georgetown P.E.I

rrison:

I am pleased to reply to your verbal qu
licit details of our report Dated Novem
on comments directed to you by Mr A.J

J. A DELANEY & ASSOCIATES

CONSULTING ENGINEERS INGENIEURS-CONSEILS

MONTREAL 9, QUEBEC

1200 ST. AMOUR STREET
ST. LAURENT, MONTREAL 384, QUE.

AREA 514-331-4400

4B

J. A. Delaney & Associates

CONSULTING ENGINEERS
MUNICIPAL & INDUSTRIAL PROJECTS

T.D
899
F585
D41

Montreal 384 Que.
March 2nd, 1971

Mr. R.P. Harrison
Director
Technical Service Branch
Implementation Services Division
161 Laurier Ave West
Ottawa 4
Ontario.

re: Study of Waste Treatment
Georgetown P.E.I.

Dear Mr. Harrison:

I am pleased to reply to your verbal questionaire for more explicit details of our report Dated November 30th, 1970, based on comments directed to you by Mr A.J. Hiscock Manager of the Prince Edward Island Water Authority. I think that it would be expedient to answer your questions in the order in which you posed them to the writer, and our reply to each, is as follows:

A) On what basis do we justify a flow rate of 1250 GPM from Georgetown Seafoods Ltd, as the flow rate for the existing plant production, and, as so stated in our SYSTEM TREATMENT CRITERIA on p 5-1.

In Chapter 4 page 4-1, we have tabulated the actual daily consumption of water as reported by Georgetown Seafoods Ltd, whose personnel keep a daily record. It will be noted that for JULY and AUGUST, the average daily water consumption was 514,000 and 427,000 gals/day respectively. During these two particular months, the plant experienced severe contamination problems and their production was voluntarily curtailed. However, during the month of September, operations returned to normal and the daily average flow was calculated to be 600,000 gallons/day

During one plant visit, we discovered that the normal working day started at 7:00 a.m. to 12:00 noon and re-commenced at 1:00 p.m. to 4:00 p.m. for the period of fish processing.

This amounts to eight hours per day (See Chapter 3, page 3-1) or 480 minutes. Hence, by calculation:

./...

$$\frac{600,000}{480} = 1250 \text{ GPM}$$

There is a short period of two hours, more or less, devoted to cleaning-up at the end of the day when relatively little water is used. Since the volume is in fact so small, we did not include these extra two hours in our calculations for the following reason:

During two days in September, the daily flow rate was in excess of 700,000 gallons.

It can be concluded, therefore, that on some days the flow rates have been in excess of 1250 GPM, in fact about 1500 GPM if calculated on an eight-hour day. By the same token, some days are considerably less but it must be remembered that our design is intended to accommodate one day's flow and since the aeration basin is based on a 24-hour retention. We are not actually concerned if the flow is a steady 800 GPM in 12 hours or 1500 GPM in 6 or 7 hours.

The foregoing flow determinations are factual unless the flow meter proves to be inaccurate. We have accepted the data presented by Georgetown Seafoods Ltd.

B) <u>What justification did we consider in the use of "Tube-Settlers" for the secondary clarifier</u>.

Tube-settlers are a recent development (five years) and the results have proven to be outstanding in their original application when used for aluminium hydroxide settling, in water clarification plants, according to published results. When applied to activated sludge settling in sewage treatment, the results were equally striking but under certain conditions of operations, the rise rate through the settlers was recommended to be lowered to 2 to 3 USGPM/sq.ft. instead of the 4 to 5 USGPM/sq.ft. which was considered safe design for water treatment. In our case, we used a rise rate of 1.0 IGPM/sq.ft. to be on the safe side and we were assured by the two suppliers of these tube-settlers that this was a conservative rate (See page 6.3).

We chose this method for the secondary settling basin because of its inexpensive feature; however, if the Prince Edward Island Water Authority prefers the standard circular or rectangular clarifier with bottom scraper, this would add an additional $40,000. to our original estimate. By previous theoretical discussion with Mr. Baker of your Department, we pointed out the relative merits of each type and the expected problems that could ensue. These problems are contingent on the degree of nitrification and fungii development which in turn is correctable by the degree of aeration in the aeration basin. This is part and parcel of the fundamental theory of the biological operation of a sewage plant. If the above conditions do arise, the standard clarifier will also be subject to the same settling difficulties. It is a well-known fact, over-aeration is determintal and promotes sludge bulking.

For this reason, we have designed the aeration basin in a rectangular shape so that two aerators will be used (as opposed to a square aeration basin where only one aerator would be used). We selected the aerators with two-speed motors, which can be manually or automatically switched, as conditions dictate the degree of aeration necessary. Therefore, we have built into the system a wide range of aeration capacity. If the plant is properly operated, then both the standard clarifier and the tube-settlers can be expected to function satisfactorily.

By the same token, it must be considered that if sludge bulking does occur in the aeration basin, the same detrimental settling characteristics will be experienced in either the standard clarifier or the tube-settler.

The recommended rise rate for a standard clarifier is stated as being about 800 USGPM per square foot of surface area per day. This amount to about 0.55 US gallons/sq. ft. per minute. In addition, the recommended retention time is a minimum of two hours for the standard clarifier. However, in our case, we deliberately chose one hour and 15 minutes in order to reduce the chances for de-nitrification since published research data has indicated that over-extended periods of retention in the secondary clarifier will induce the formation of nitrogen gas from the nitrates in the waste water due to very low levels of oxygen in the water going to the secondary clarifier. Under these conditions (low oxygen and long retention), anaerobic conditions are more likely to prevail thus depleting the nitrate molecule of its oxygen and releasing nitrogen gas which is extremely detrimental to successful secondary settling.

Fundamentally, at this stage, we are more concerned with the results which will be obtained and which will only be determined once the plant is in operation, because of the nature of the waste to be treated. We have carefully pointed out in our report that we recommend the installation of only one aeration basin at this time in order to determine operating results so that further decision can then be made to add a second aeration basin and secondary clarifier if required.

C) What alternative methods have been considered for fish solids removal with specific reference to screening and air floatation.

On the suggestion of the Prince Edward Island Water Authority, we considered air floatation as a method of removal for gross solids from the Georgetown Seafoods Ltd. plant and the following was determined:

./...

i) Because of the size of this unit, the only possible location to accommodate this apparatus is an area between West Street and the Shore line. This would require an additional pumping station to pump the industrial wastes into the air floatation unit.

ii) We have had considerable experience with air floatation units on some of our projects and in order to effectively remove particles of specific gravity close to 1.0 and to remove colloids, the addition of alum is mandatory. Because of the nature of the collected sludge, it would require dewatering before further treatment for protein recovery providing that the inclusion of aluminium hydroxide was not considered deleterious to the finished fish meal.

iii) In spite of the above, detailed simultaneous field studies would be necessary to determine whether oonventional screening as outlined in our report and/or air floatation would be most efficient.

iv) The difference in costs for air floatation vs screening would be in the order of $150,000. which would have to be added to our estimate. For this reason and the added operational problems, this suggested to us that air floatation per se was not recommended when compared to the low costs and simple operation of a standard rotary screen. Therefore, we did not include this option in our report.

v) We also considered air floatation without alum and the use of compressed air only and the only advantage would be a slight reduction in operating costs but a higher colloidal content would be expected in the effluent. Again, we could see no justification for the additional $150,000. expenditure in comparison to about $6,000. for the rotary screen.

vi) Since we are working in an area where there is practically no published data, we felt it expedient to keep the overall costs of the plant as low as possible. However, future events may dictate that air floatation with or without alum will become mandatory. Certainly, before we would recommend screening or air floatation as being superior, extensive field trials would be required with each system.

vii) Fish particle size escaping to the system and the rate of their metabolic destruction within the aeration basin and digester will be the deciding criteria as to the efficiency of the overall waste treatment plant and as

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to whether screening is inadequate.

viii) There is of course an additional option and that is the use of multiple screening with decreasing mesh size in each stage. It is our opinion that this option should be reserved to a later date when all the operating parameters become available.

D) <u>Had we considered the treatment of the domestic wastes only as an alternative method</u>.

Our mandate from your Department was made clear to us that we were to concern ourselves with the treatment of the fish plant wastes from Georgetown Seafoods Ltd. and that the treatment of the domestic wastes from the town of Georgetown was the responsibility of Prince Edward Island Water Authority. After investigating, many alternatives (which will be described later), the most economical system that evolved was the extended aeration (24-hour retention) system with secondary clarifiers and aerobic digesters as recommended in our report. In order to assure the viable operation of this system, we would require domestic sewage. For this reason, we recommended that both the seafood plant waste and the town wastes should be treated simultaneously.

The following alternatives were considered and studied but rejected and not included as part of our report:

i) The complete separation of the fish plant wastes from all domestic wastes and their disposal via the existing effluent line with treated and chlorinated domestic wastes from Georgetown. This alternative was presented to the Department of Fisheries and Forestry, Halifax, N.S. by our letter of November 12, 1970. Mr. Ruggles' letter of December 3, 1970 (Department of Fisheries and Forestry) indicated that this alternative was inacceptable.

ii) We considered barging the fish plant wastes far out to sea, but the capital and operating costs were extraordinarily high. Tug costs alone were in the order of $500. per day just for operating costs.

iii) We considered septic tanks (or anaerobic digestion) followed by both aerated lagoons, but this system proved to be far more expensive in construction costs than the method we recommended in our report.

iv) We considered high rate aeration combined with secondary settling and aerobic digestion and in this case the costs were also higher and the system would not take shock loads or operate under starvation conditions when the fish plant was inoperative.

./...

Some of the above are detailed in Section 2 of our report in addition to others not mentioned above.

E) What consideration did we give to the maximum recovery of fish proteins and fish oil from the Georgetown Seafoods Ltd. Plant.

In this case, it will be necessary to refer to the Water Technology Laboratory Inc.'s report dated October 23, 1970, for Sample Location No. 2 which represents the fish plant effluent. It must be pointed out that these were grab samples and indicate an order of magnitude instead of absolute values.

These results indicate that the wastes from the fish plant are relatively weak. The suspended solids are only 140 mg/l indicating relatively low amounts of fish solids. The C.O.D. at 740 mg/l indicates that if there were fish oil present, it was in extremely small quantities (compare to 2A where the value was 8,900 mg/l from the fish meal plant). We did not do an extraction for fish oil because we did not notice free fish oil and secondly the wastes are so diluted that it was felt the only economic treatment for such a waste would be a biological one. However, this does not mean that all of the fish protein and fish oil could not be recovered if desired.

In this respect, we have recently priced a system which utilizes a combination of ultra-filtration followed by reverse osmosis for 100% protein recovery. At a flow rate of 700 gallons/day, this plant would cost $750,000. and produce a liquid product having about 20% protein content.

The price alone would make this system uneconomic for such a diluted waste. If we were dealing with a waste which was stronger by a factor of at least 10, then some consideration in regard to the utilization of this process would be realistic.

F) What consideration have we given to the Sorensen Process when we considered our ultimate design.

We are not aware of this process or of any applications. We have contacted the Resources Development Branch of the Department of Fisheries and Forestry in both Ottawa and Halifax and no one was able to give us any data pertaining to this process.

All wastes directed to the waste treatment plant will go through two comminutors in series in order to assure good comminution. We do expect that some grease will emanate from the domestic wastes and a small amount from the fish plant wastes. We expect the great majority of this material will remain on the surface and through some biological degradation some of it will be dissipated. The

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remaining portion will remain but the turbulent action of the surface water in the aeration basin will promote the formation of grease balls which can be readily removed manually from the aeration basin at periodic intervals.

A surface baffle arrangement is intended to prevent their exit to the secondary clarifier. As further assurance that grease or oil does not find its way to the secondary clarifier, we propose installing a small open stilling chamber in the line between the aeration basin and the secondary clarifier as a grease and/or oil trap.

We hope that the above covers all of the points to your satisfaction and if further clarification is necessary, please let us know and we will be happy to elaborate or investigate new and different approaches as they are brought forward.

Yours truly,

J. A. DELANEY & ASSOCIATES

for J. A. Delaney, Eng.

JAD/al

P.O. BOX 550,
HALIFAX, N.S.

CANADA

OUR FILE NO.
NOTRE DOSSIER NO
702-9-3
YOUR FILE NO.
VOTRE DOSSIER NO

DEPARTMENT OF FISHERIES AND FORESTRY
MINISTÈRE DES PÊCHES ET DES FORÊTS
MARITIMES REGION – RÉGION DES MARITIMES

December 3, 1970.

J.F. Delaney & Associates,
1200 St. Amour Street,
St. Laurent, Montreal 384,
Quebec.

RECEIVED
DEC 10 1970
J. A. DELANEY & ASSOC.

Attention: Mr. J.F. Delaney

Re: Georgetown Seafood Ltd., Fish Plant Wastes

Dear Sir:

This will acknowledge your letter of November 12, 1970, in which you proposed a waste treatment disposal system for the effluent from the fish plant at Georgetown, P.E.I.

As you are probably aware, the Department of Fisheries and Forestry is in the process of formulating regulations under the amended Fisheries Act for various types of industrial wastes, one of which will be the effluent from fish plants. These new regulations are being drawn up with the philosophy that industries should give their wastes the best treatment economically feasible under current technology. Because of this, I feel sure that something more than the primary system which you are proposing, will be necessary when these new regulations come into being. The timing or staging of treatment facilities would of course be open to negotiations between industry and government.

The alternative method, which you have included in your letter, and have discussed with members of my staff by telephone, is much more preferable, but still gives me cause for concern because of the lack of primary solids removal. It is thus suggested that you forward me information demonstrating that failure to remove solids before biological treatment will not adversely affect the efficiency of your biological process, or cause aesthetic damage to the operation of your digester by an overloaded condition.

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My technical staff will be available to discuss your proposals, and my above remarks.

Yours very truly,

C.P. Ruggles, Chief
RESOURCE DEVELOPMENT BRANCH,
MARITIMES REGION.

DR/cr

GEORGETOWN SEAFOODS LTD.
GEORGETOWN, P.E.I.

STUDY OF WASTE TREATMENT

INGÉNIEUR - ENGINEER
J. ALLISON DELANEY
PROVINCE DE QUÉBEC

- 3 DEC 1[illegible]0

Delaney (J.A.) + Assoc.

1200 ST. AMOUR STREET
ST. LAURENT, MONTREAL 384, QUE.

AREA 514-331-4400

J. A. Delaney & Associates
CONSULTING ENGINEERS
MUNICIPAL & INDUSTRIAL PROJECTS

November 30th, 1970.

Study of Methods for Waste Disposal

at
Georgetown Seafoods Ltd.
Georgetown
Prince Edward Island
for

Canada
Department of Regional
Economic Expansion
Ottawa

INDEX

Section I

Letters Related to Study

Section II

1200 ST. AMOUR STREET
ST. LAURENT, MONTREAL 384, QUE.

AREA 514-331-4400

J. A. Delaney & Associates
CONSULTING ENGINEERS
MUNICIPAL & INDUSTRIAL PROJECTS

November 16th, 1970

Canada
Department of Regional
Economic Expansion
161 Laurier Avenue West
Ottawa 4, Ontario

Attention: Mr. Garnet T. Page
Director General
Implementation Services

Re: Study Waste Disposal,
Georgetown P.E.I.

Gentlemen:

In accordance with the directives outlined in your letter of July 24th, 1970, and the Agreement between the Minister of Regional Economic Expansion and our firm dated October 22nd, 1970, we have now completed all the desired aspects of this study and we are herewith submitting our report in full in relation to:

a) A detailed study of existing conditions with respect to waste generation and disposal at Georgetown P.E.I.

b) Identification of sources, volume and strength,

c) An appraisal of desirable modifications to the existing system and

d) Engineering recommendations for an economic solution to provide for Treatment before discharge to the sea.

We trust that you will find the results, conclusions and recommendations we have presented to be acceptable, We are

Yours truly,

J. A. Delaney & Associates

J. A. Delaney Eng.

J.A.D./ipf

1200 ST. AMOUR STREET
ST. LAURENT, MONTREAL 384, QUE.

AREA 514-331-4400

J. A. Delaney & Associates
CONSULTING ENGINEERS
MUNICIPAL & INDUSTRIAL PROJECTS

November 12, 1970

Canada,
Department of Fisheries & Forestry,
P.O. Box 550,
Halifax,
N.S.

ATTENTION: Mr. R.A. Row
Environmental engineer.

RE: Fish plant wastes Georgetown Seafood Ltd.

Dear Mr. Row:

Further to our recent conversation in regard to the disposal of the process wastes from the fish plant at Georgetown P.E.I., one of the methods of waste disposal that we had under consideration concerned the following:

> " Biological treatment of the sanitary wastes from the town of Georgetown followed by chlorination of the effluent and then combining this chlorination and treated effluent, with the screened but untreated fish plant wastes. This final mixed effluent would exit to the sea, via the existing effluent pipe line. The purpose for considering the above as an alternative method of disposal encompasses the thought that the untreated fish plant wastes would serve as a source of food for small fish and micro-organisms at the end of the outfall."

The attached table showing "Systems Treatment Criteria" for the Georgetown area, is presented for your review and consideration as to whether your department would consider such a scheme, as outlined above accepta-

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ble as an alternative method, for the ultimate waste disposal for the Georgetown area.

Yours early reply to the above would be most appreciated, I am

Yours truly,

J.A. Delaney & Associates

J.A.D./lf

J.A. Delaney Eng.

SYSTEM TREATMENT CRITERIA

Georgetown P.E.I.

		Existing	Future
1) Georgetown Seafood Ltd.			
Raw Fish Production	Millions lbs/yr.	15	50
Water Consumption	Imp.Gals/day	600,000	1,090,000
B.O.D.	lbs/day	3,078	6,510
Total Suspended Solids	lbs/day	2,880	5,450
Flow in	I.G.P.M.	1,250	1,070
Avg. B.O.D.	p.p.m.	540	600
Avg. S.S.	p.p.m.	480	500
2) Town Georgetown, P.E.I.			
Population (1)		1,000	1,600
Water Consumption	Gals/day/cap.	70	80
Infiltration	Gals/day/cap.	20	20
Total Flow	Gals/day/cap.	90	100
Daily Flow	Imp.Gals	90,000	160,000
B.O.D.	lbs/day/cap.	0.17	0.17
S.S.	lbs/day/cap.	0.20	0.22
B.O.D. to system	lbs/day	170	272
T.S.S. to system	lbs/day	200	320
3) Total, Combined Load To The System			
B.O.D.	lbs/day	3,248	6,782
T.S.S.	lbs/day	3,080	5,770
Total Flow	Imp.Gals/day	690,000	1,250,000
Avg. B.O.D.	p.p.m.	470	545
Avg. T.S.S.	p.p.m.	450	465

POPULATION (1): Includes town of Georgetown plus workers in the fish plant.

B.O.D. : Bichemical oxygen demand- 5 Day

T.S.S. : Total Suspended Solids

S.S. : Suspended Solids

I.G.P.M. : Imp. Gals. per minute

Cap. : Capita

1200 ST. AMOUR STREET
ST. LAURENT, MONTREAL 384, QUE.

TEL. 331-1079 (AREA 514)

WATER TECHNOLOGY LABORATORY INC.

INVESTIGATIONS – ANALYSES

October 23, 1970

J.A. Delaney & Associates,,
Consulting Engineers,
1200 St-Amour Street,
St-Laurent 384, P.Q.

RE: Treatment plant for Georgetown Seafoods Limited.

ATTENTION: Mr. J.A. Delaney, eng.

Gentlemen:

Included please find results of analyses of waste water issueing from the plant of Georgetown Seafoods Limited and drawn during our inspection of the site on October 1st, 1970. These figures are necessary parameters for the design of the above mentioned project.

The samples are described as follows:

1- Waste water discharged directly to the harbour at an estimated rate of 325 U.S. gallons per minute and used for lifting of red fish (sea perch) from the trawler and for the subsequent descaling operation.

2- Used water from manhole No 1A (re: plan # 66-68-F-4-6-A.D.B.) issueing from the screen separating the offal and other parts of fish for the fishmeal plant and also from the screens separating fish waste for mink food.

X 2A- Waste water from the fishmeal plant and containing a proportion of stickwater because of an undersized pump.

....../2

3- Clear water used for cooling the barometric condenser and also for deodorizing the atmosphere of the drying drum.

4- Sewage from the wet well of the lift station.

5- Sewage from manhole No 9, the last one at the end of the street and at the begining of the line to sea.

These were grab samples, therefore they indicate an order of magnitude but not average values.

Yours very truly,

Paul Charbonneau

PC/lf

Paul Charbonneau
President

WATER TECHNOLOGY LABORATORY INC. OCTOBER 23rd, 1970

GEORGETOWN SEAFOODS LIMITED

SAMPLE no.	1	2	2A	3	4	5
pH	7.0	6.8	6.8	8.4	6.6	6.7
Settleable Solids	5.0	2.1	8.5	0.0	2.0	5.0
Total Solids	800.0	590.0	3740.0	230.0	1330.0	1390.0
Total Volatile Solids	160.0	350.0	3140.0	190.0	800.0	890.0
Suspended Solids	300.0	140.0	1020.0	0.0	480.0	460.0
Volatile Suspended Solids	264.0	95.0	760.0	0.0	410.0	410.0
COD	1320.0	740.0	8900.0	380.0	2300.0	2420.0
BOD_5	390.0	140.0	3180.0	47.0	470.0	880.0
BOD_5 Settled	210.0	190.0	3120.0	47.0	540.0	520.0
Total Nitrogen	54.0	29.0	450.0	traces	116.0	129.0

Results mg/l. (except pH in absolute values, and settleable solids in milliliters per liter).

N.B. For sample location and identification, See Plan N° 1.

LAURIE A. COLES & ASSOCIATES LTD.

CONSULTING ENGINEERS

DESIGN
PLANS AND SPECIFICATIONS,
SUPERVISION OF CONSTRUCTION
REPORTS-SURVEYS

P. O. BOX 54,
CHARLOTTETOWN, P. E. I.
PHONE 894-5616

MUNICIPAL ENGINEERING
WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE DISPOSAL
DRAINAGE-FLOOD CONTROL
PLANNING

5-2.01

28 February 1967

P. E. I. Water Authority
PROVINCIAL ADMINISTRATION BLDG.
Charlottetown, P. E. I.

Attention: Mr. A. J. Hiscock, Chairman

Re: Georgetown Well Field

Dear Sir:

With reference to your letter of 23 February 1967, requesting information on the above project, we wish to advise as follows:

(a)

WELL #	U.S. (GPM)	H.P.	DRAW DOWN INFORMATION FROM WELL TESTS
1	200	18	± 75' @ ± 200 GPM
2	250	21	± 25' @ ± 200 GPM.
3	250	21	± 30' @ ± 200 GPM
4	200	21	*
5	200	18	± 75' @ ± 200 GPM
6	150	18	± 110' @ ± 200 GPM
7	150	15	± 105' @ ± 200 GPM
8	100	12	± 108' @ ± 140 GPM

* Well test data for Well #4 is temporarily unavailable and will be forwarded as soon as possible.

(700 GPM)

(b) Maximum daily yield from well field 1,000,000 GPD

(c) We have checked with the Contractor who advises all necessary repairs to the water system will be carried out by 10 March 1967.

Further to our telephone conversation with regard to the operation of all pumps at any one time, we assure you that the installation is such that all pumps will operate simultaneously to supply a peak demand of 1500 GPM.

Trusting this is the information you require, we remain.

Yours very truly,

JMS/mb

LAURIE A. COLES & ASSOCIATES LTD.
Per: J.M. Simpson, Vice-President

Appendix "E"

ANALYSIS OF WATER SAMPLES
(In parts per million)

LOCATION: GEORGETOWN, P. E. I.

Source of Water	Test Well A	Test Well B
Reference	M.L.Parsons, Geological Survey of Canada	
Laboratory Number	1397	1398
Date of Sampling	July 29/64	July 30/64
Storage Period (Days)	8:14	37:43
Temp. at Testing (^{o}C)	23.8	23.5
Appearance, Odour, Etc.	Slight Iron Oxide PPT	Considerable iron Oxide PPT
Carbon Dio. (CO_2) Calc. PH	4	2
Colour (Hazen Units)	10	10
Alkalinity as (Phenolphthalein)	0.0	0.0
$CaCo_3$ (Total	83.8	79.7
SP Conductance, Micromhos at 25^{o}C	216.8	176.6
Hardness as (Total)	95.3	89.3
$CaCo_3$ (Non Carbonate)	11.5	9.6
Calcium (Ca)	20.2	20.2
Magnesium (Mg)	10.9	9.4
Iron (Fe) Total	0.37	----
Manganese (Mn) Total	0.00	0.00
Sodium (na)	5.7	4.4
Potassium (K)	1.2	1.1
Ammonia (NH_3)	0.0	0.0
Carbonate (CO_3)	0.0	00.0
Becarbonate (HCO_3)	102.0	97.2
Sulphate (SO_4)	8.7	4.7

Appendix "E"

ANALYSIS OF WATER SAMPLES CONTINUED
(In parts per million)

LOCATION: GEORGETOWN, P. E. I.

Source of Water	Test Well A	Test Well B
Chloride (CL)	9.1	7.6
Fluoride (F)	0.04	0.06
Nitrate (NO_3)	2.0	1.9
Silica $SIO_2)$	4.8	4.9
Sum of Constituents	113	102
% Sodium	11	9.5
Saturation Index at Test Temperature	-0.6	-0.4
Stability Index at Test Temperature	8.8	8.6
Sodium Absorption Ratio (SAR)	0.25	0.20

SECTION 1

CHAPTER I

RECOMMENDATIONS:

A) Plant Exterior Modifications

1. Water from Vacuum Lift Pump to be intercepted and diverted to the Process Waste System.
2. Drain the Harbour Receiving Area directly to the Fish Plant Process Water. New screening facility (See Plan No. 3).
3. Add an 8 inch diameter raw sewage collector for diversion of Trawler Sanitary Wastes to the sewage system of the town of Georgetown.

B) In - Plant Modifications

1. Separate all sanitary sewers from process waste-line within the fish plant.
2. Addition of a larger and more efficient screen for all fish plant process waste.
3. Divert fish meal deodorizing and condenser waste water line to the sewer system.

C) Sewer System Modifications

1. Add a comminutor device to the influent line to the proposed treatment ficility.
2. Increase the pump horse power in the existing sewage lift station to provide direct access to the proposed treatment facility by forced flow.
3. Extend the existing force main from its present termination point to the proposed treatment facility (approximately 2000 ft.)
4. The east area of Georgetown from Victoria Street (now flowing by gravity to the outfall) to be lifted at a new pump station to the proposed treatment plant.

D) Waste Treatment Plant

1. Construct one (1) extended aeration basin, based on existing flow. Space provided for additional basins for future requirements.
2. Construct a secondary sludge settling basin with sludge pumps for diversion of sludge to influent and/or to aerobic digester.

3. Construct an aerobic digester as part of the complete treatment process.

4. Construct a chlorine contact basin with facilities for chlorination of all of the effluent from the proposed treatment plant.

5. After completion of the treatment plant, a program of monitoring and testing to determine the efficiency of treatment is highly recommended, because of the lack of published operation data for fish plant wastes, in order to determine the efficiency of treatment and also to determine if one aeration is sufficient or not.

CHAPTER 2

PURPOSE AND SCOPE OF THE REPORT

Objectives of this report are:

a) Undertake a detailed study of the existing waste treatment facilities;

b) Enumerate the facilities and provide an engineering appraisal of the problem involved;

c) Recommend solution to said problems.

CHAPTER 3

FIELD INVESTIGATIONS

We visited and observed the operations of the Georgetown Seafoods Ltd. filleting and fish meal plant in Georgetown, P.E.I.; in addition we studies the existing sewage collection and disposal system of the Town of Georgetown on selected occasions, from July 5, 1970 to November 16, 1970.

The following observations were made during these visits:

A) Fish Plant Operations

The normal working day at Georgetown Seafoods starts at 7:00 a.m. to 12:00 noon. Then, from 1:00 p.m. to 4:00 p.m., a total of eight working hours daily, during which time fish processing operations are in effect. However, it was found that each day differed from the next in the degree and amount of fish actually processed. Some days when boats were unloading at the dockside, the continuity of processing was more or less constant and at times exceeded eight working hours and were extended to eleven working hours. On days when there were no boats unloading, fish were arriving by truck in far lesser quantities. On September 30, 1970, a rather large vessel arrived with 330,000 lbs. of Red fish. It took two days to unload the vessel and during this two-day period, the maximum capacity of the plant was utilized at about 75,000 lbs. per day, the remainder of the Red fish were frozen for future filleting.

The frozen fish were intended for future processing when no ship was in port, in order to even out operations.

After each day's operation, a period of two to four hours is utilized for a thorough antiseptic cleaning of all fish filleting facilities and equipment.

From the foregoing, it will be noted that the degree of daily filleting operations at Georgetown Seafoods is greatly dependent on the arrival of fish by trawler as well as the size and capacity of each trawler. During the period of one investigation, the longest interval between trawler arrivals was four to five days. During this interim period, fish arrived at the plant in small quantities by truck or by small boats.

We were advised by the management of Georgetown Seafoods Ltd. that since commencement of their operations at Georgetown, that the average quantity of raw fish processed is about 50,000 lbs. per day and based on 300 working days per year, this would amount to a yearly capacity of 15,000,000 lbs.

It was noted that in spite of the fact that at times when there were no fish being processed, water was still being used at a fairly high rate. We were told that this was characteristic of the operations of a fish processing plant in order to keep the equipment and process areas as clean as possible pending the arrival of additional quantities of fish during working hours.

The largest quantity of water is used when a trawler is being unloaded by means of an "Air Vacuum Lift", when an additional 300 gallons per minute are used to flume the fish from the Vacuum Chamber to the "Culling and Weighing" tables in the "Receiving Area". These graded fish are then transferred to the cutting lines by means of vertical lift apparatus and then by fluming.

The fish are either machine or hand filleted depending on the species of fish. The remains of the fish, termed "Offal" is flumed to the fish meal plant or alternately retreived from the flume water for further processing as animal food. The fillets of some species of fish have the skin removed by a "Skinning Machine" and this material is retrieved for resale.

During the months of July and August 1970, this plant experienced a severe problem of contamination that resulted in a voluntary curtailment of production. During our survey, we made recommendations to limit or eradicate the sources of contamination and by the end of August, the contamination was almost 100% eradicated so that the plant did not experience any serious effect of contamination during the month of September. During the first part of October, there was a re-occurence of some contamination which again cleared up in a few days. We feel certain although we did not carry out bacteriological tests, that some of the contamination is likely due to the interconnection of the sanitary and process lines under the floor of the plant. We recommend that these lines be disconnected and run separately in order to eliminate this potential source of contamination. A separate section of this report will deal with this recommendation.

In order to determine the hydraulic volume that could be anticipated from Georgetown Seafoods Ltd. for treatment, we are limited to the values obtained for the month of September, when production conditions were more or less normal as discussed in the previous paragraph.

B) <u>Drainage System at the Fish Plant</u>

1. The process wastes and the sanitary wastes lines are presently interconnected throughout the existing drainage system in the plant.

2. The water used as a part of the vacuum unloading system and which is also used to transport the raw fish to the culling and weighing tables, drains directly into the harbour, having a high BOD (see sample No. 1) which causes a local pollution problem in the quiescent zone in the harbour area.

3. In addition to the above (2) the open area between the fish plant and the edge of thewharf is a receiving area for a large quantity of fish transported by trucks and this area drains by gravity through openings in the wharf siding. These wastes contain fish particles, whole fish, blood and other wastes, which also contribute to the local harbour pollution.

4. The water used for a barometric condenser and deodorizer is presently wasted directly to the sea from the fish meal plant (see sample No. 3). This waste is highly odorous and also contributes to pollution in the harbour area.

5. Due to occasional malfunction in the fish meal plant, some stickwater and fish oil together with fish meal is inadvertently allowed to drain into the main sewer. (see sample No. 2A). This waste has an extremely high BOD.

6. The existing screening facilities for dewatering of the offal does not remove all fish solids directed to it because of its inherent design, and, in addition, only a portion of the total fluming water for offal transport is directed to the above screen. Therefore, in order to provide for maximum solids removal and dewatering from all sources in the plant, it will be necessary to replace the existing solids screening mechanism by a modified rotating circular screen drum of larger capacity. (See Plans No. 3 and No. 5).

C) Existing Sewage Lift Station

The existing lift station is equipped with a dual pump system, each having a capacity of 1,500 GPM, 15 HP motor having a head of 30 feet of water. This lift station is equipped with a Chicago pump type Duplex "Flush-Kleen" system for solids accumulation and subsequent discharge through the force main. This system is intended to prevent the clogging of the pumps by gross solids. During our visits to the pump station, this mechanism appeared to be mal-functioning and a large portion of the solids appeared to accumulate in the lift station wet well.

D) Town Sewer System

The Town of Georgetown sewer system is divided into a portion which flowes by gravity to the sewage lift station. The waste from the fish plant that are sent to the town sewers also travels by gravity to the sewage lift-station.

The remaining portion of the town of Georgetown travels by gravity directly to the outfall, thus bypassing the sewage lift-station.

E) Water Supply

The major portion of raw water from eight (8) wells located near Burnt Point Road, Northeast of Georgetown, is used by Georgetown Seafoods Ltd. Only six or more private homes are connected to the system plus Bathurst Marine Ltd.

According to a letter from Laurie A. Coles & Associates Ltd., Consulting Engineers, dated February 28, 1967, the maximum capacity of the well field is 1,000,000 GPD (700 GPM) with a peak of 1,500 GPM when all pumps are operating. (See letters related to study).

Two flow metering devices are installed on the system. One is located on the main header from the discharge of all pumps. This meter is a BIF flowmeter having a circular chart showing the instantaneous amount of water used in GPM.

A second meter is located at the water supply line into the fish plant; this meter is a Neptune Trident positive displacement meter with totalizer. The readings on the totalizer are recorded each day by the staff of Georgetown Seafoods Ltd.

Since the Neptune meter is more accurate for measuring flows, we have used these volumes as the basis for water consumption by Georgetown Seafoods Ltd.

F) Georgetown Water Supply

Except for six or seven houses and Bathurst Marine Ltd., all other houses and commercial establishment have private wells as a source of supply.

G) Georgetown Waste Water

During the Summer of 1970, final construction was completed for the interception and collection by a separate sanitary sewer grid system for the Town of Georgetown.

To our knowledge, no storm drainage enters this system. We have made provision in our calculations for a limited amount of infiltration in accordance with the usual norms used.

H) Site of Future Waste Treatment Plant

The large area East of Bathurst Marine Ltd. and South of Richmond Street presented a large area of unoccupied farm land of about 75 acres, suited for the possible location of treatment facilities. Of this total area, the Government of Prince Edward Island owns about eight acres (See Plan No. 1), adjacent to Bathurst Marine Ltd., and in close proximity to the existing sewer line to the outfall.

I) Manhole No. 10

This manhole is the last access to the 18-inch diameter underwater effluent line to the sea. On inspection, we found that this manhole contained large quantities of solid waste materials due to the back-up of the sea caused by the minimum elevation of the invert of the 18-inch diameter effluent line.

J) Sanitary and General Wastes from Docked Vessels

By observation, we noted that the boats used by Georgetown Seafoods Ltd. and other vessels periodically pump their sanitary waste, bilge water and their solids wastes into the harbour even when tied-up to the wharf.

CHAPTER 4

FLOW STUDIES AND LABORATORY ANALYSIS

GEORGETOWN SEAFOODS LTD.

WATER CONSUMPTION
(Imperial Gallons per Day)

Readings taken from an integrated Neptune Meter at the Plant

MONTH OF JULY 1970

17	563,000
18	459,000
-	
20	572,000
21	319,000
22	526,000
23	560,000
24	566,000
25	545,000

July average:

514,000 imp.gallons per day

MONTH OF AUGUST 1970

11	456,000
12	390,000
13	396,000
-	
25	384,000
26	432,000
27	435,000
28	496,000

August average:

427,000 imp.gallons per day

MONTH OF SEPTEMBER 1970

14	563,000
15	725,000
16	764,000
17	644,000
18	667,000
-	
-	
21	629,000
22	521,000
23	476,000
24	517,000
25	496,000
-	
-	
28	603,000

September average:

600,000 imp.gallons per day

CHAPTER 5

SYSTEM TREATMENT CRITERIA

GEORGETOWN, P.E.I.

		Existing	Future
1. Georgetown Seafoods Ltd.			
Raw Fish Production	Millions lbs./yr.	15	50
Water Consumption	Imp.Gals./day	600,000	1,090,000
B.O.D.	lbs./day	3,078	6,510
Total Suspended Solids	lbs./day	2,880	5,450
Flow in	I.G.P.M.	1,250	1,070
Avg. B.O.D.	P.P.M.	540	600
Avg. S.S.	P.P.M.	480	500
2. Town of Georgetown, P.E.I.			
Population (1)		1,000	1,600
Water Consumption	Gals./day cap.	70	80
Infiltration	Gals./day cap.	20	20
Total Flow	Gals./day cap.	90	100
Daily Flow	Imp. Gals.	90,000	160,000
B.O.D.	Lbs./day cap.	0.17	0.17
S.S.	Lbs./day cap.	0.20	0.22
B.O.D. to System	Lbs./day	170	272
T.S.S. to System	Lbs./day	200	320
3. Total, Combined Load to the System			
B.O.D.	Lbs./day	3,248	6,782
T.S.S.	Lbs./day	3,080	5,770
Total Flow	Imp.Gals./day	690,000	1,250,000
Avg. B.O.D.	P.P.M.	470	545
Avg. T.S.S.	P.P.M.	450	465

POPULATION (1)	:	Includes town of Georgetown plus workers in the fish plant.
B.O.D.	:	Bichemical oxygen demand - 5 days
T.S.S.	:	Total suspended solids
S.S.	:	Suspended solids
I.G.P.M.	:	Imperial gallons per minute
Cap.	:	Capita

The data presented on the foregoing page, represented our evaluation of the existing hydraulic and biological load for the two principal contributors for the area studied and the summation of both systems.

The data supplied on the "Existing" column is the result of flow determinations for hydraulic loading in the case of Georgetown Seafoods Ltd. and estimates for hydraulic loading for the Town of Georgetown. The biological data is based on sampling of the wastes at 5 points as shown on Plan No. 1. The samples so taken were not composite samples over a period of time but are "Grab" samples taken when conditions at the fish plant were considered to be the heaviest for the daily average capacity of 50,000 lbs. per day or raw fish.

During the day when samples were taken, the fish plant was unloading "Red fish" and simultaneously filleting these fish. Because "Red fish" are technically de-scaled prior to filleting, and all other conditions of operations of the fish plant and fish meal plant were normal, for these reasons, we consider the conditions of hydraulic and biological wastes would be a maximum condition for a daily process capacity of 50,000 lbs. of raw fish, and therefore, these results would essentially represent the maximum loading to a proposed waste treatment plant. In fact, we waited for several days at the plant for just such conditions.

In regard to "Future" hydraulic and biological criteria, we extrapolated the data on a biological basis for the fish plant but not on a linear basis for the hydraulic loading since it was discerned that a great deal of water was flowing needlessly during periods of low production. This apparently was practiced to maintain cleanliness and to avoid contamination.

We can deduct, therefore, that with twice, or three times, the present raw fish production, we would not end up with two or three times the volume of water.

In terms of when the "Future" flow conditions will become a reality, we are unable to determine from the plant management, a definite date as to their schedule for increased production because of many factors which include: availability of raw fish, market demand, plant modifications, and other requirements. But it must be borne in mind that with the advent of favourable conditions, the fish plant production could increase in a very short period to the maximum anticipated capacity of the plant at 167,000 lbs. per day of raw fish, from the present capacity of 50,000 lbs. per day.

CHAPTER 6

DISCUSSION OF CALCULATIONS

It must be emphasized here, that our present design as shown on Plan No. 2 is based on the "Existing" hydraulic and biological loading which in turn were determined during a work period at the fish plant that represented maximum conditions. We would expect, therefore, that the average loadings to the proposed treatment plant will be something less than that predicted. We must also emphasize that it is imperative to combine the domestic sanitary sewage from the Town of Georgetown with the fish plant wastes for reasons of providing the required bacterium and flora as well as the requirement for nutrients such as nitrates and phosphates.

Without the Town sanitary wastes, it would be necessary to add fecal matter either as animal manure or human wastes plus the addition of nutrient. This could prove to be more expensive than the inclusion of the existing waste load from the small population of Georgetown.

By calculation, the Town of Georgetown represents only 5.5% of the biological load and 15% of the hydraulic on the basis of "Existing" conditions. On the basis of "Future" conditions, these values are only 4.2% and 14.6% respectively.

A) Aeration Basin

Because of the wide variation in flow and biological load within a 24-hour period, it was deemed expedient to provide a means to attempt to even out the load to the proposed treatment facility. There are a number of alternatives in this respect and obviously the cheapest method would consist of a 24-hour basin that would be completely mixed on a continuous basis. Following this line of reasoning, it was a simple aim to not only provide for complete mixing, but simultaneously to provide air (oxygen) for biological stabilization. This can be accomplished by several means, the most economical being "Surface Aeration".

The volume of the "Aeration Basin" may be calculated as follows:

Flow - 690,000 Imp. Gals./day
- 110,000 Cu.Ft./day

At a maximum water depth of 14 feet.

Then, the basin dimension would be:

$$\frac{110,000}{14} = 7,900 \text{ square feet}$$

= approximately 63 feet X 126 feet.

Because the sides have a slope of 2:1, the basin size would be approximately:

85 feet X 170 feet.

On the basis of the combined "Existing" B.O.D. load of 3,248 lbs./day, the average charge to the basin would be:

$$\frac{3,248}{110,000} \times 1,000 = 30 \text{ lbs. B.O.D./day/1,000 cubic feet}$$

The norm for a 24-hour extended aeration basin is in the range of 15 to 20 lbs. B.O.D./day/1,000 cubic feet.

We realize that according to the foregoing calculation, this single basin is theoretically 50% overloaded. We also realize that the field test conditions were supposedly the maximum expected. Since the plant operations vary so drastically, actual operating conditions will likely be somewhat less.

We have deliberately sized this basin, in the manner shown, in order to obtain data on its operation when:

1. underloaded;

2. average loaded;

3. overloaded.

Only by operating this basin with existing loads will it be possible to determine:

1. the loading;

2. the efficiency;

3. if a second basin is necessary.

Actual operating conditions will determine if it is going to be mandatory to add a second aeration basin of the same or different size, or if it will suffice.

Because of the lack of published data on fish plant waste treatment and the extent of biodegradation that can be expected, we recommend the construction of a single aeration basin, as the initial phase of this project, with the contingent possibility that one additional aeration basin may be required to provide the desired degree of treatment for the "Existing" loadings.

B) Secondary Clarifier

In order to achieve as good a quality of effluent as as possible and in addition to provide a viably active biomass within the "Aeration Basin", it is mandatory to include a "Secondary Settling Clarifier", to return active sludge to the influent and to waste active sludge solids to a digester for further degradation.

Furthermore, in order to keep the capital costs as low as possible, we have selected a "Tube-Settler" type of secondary clarifier which is substantially lower in capital costs than the standard mechanical clarifier.

There are available, today, two independent suppliers of "Tube-Settlers". We propose using one half of the basin with each type, in order to determine efficiency. The efficiency of settling will depend upon:

1. the type and nature of the biomass;
2. the amount of carbohydrates in the system;
3. the degree of nitrification;
4. the amount of fungii produced;
5. the degree of de-nitrification.

We have selected a rise rate through the tubes of 1.0 IGPM per square foot since this is considered conservative, hence:

Flow = 690,000 IGPD
= 490 IGPM

Surface area of Tubes = $\frac{490}{1.0}$ = 490 square feet

=appr.= 20 feet X 25 feet

The volume of the basin is approximately:

6,000 cubic feet = 37,000 imperial gallons

Retention time = $\frac{37,000}{490}$ = 75 minutes = 1 hour 15 minutes

We have selected a low retention time in order to reduce the order of magnitude of de-nitrification.

The bottom of the clarifier has 60° sloped sides for effective settling. There are no mechanical parts in this system, except for the sludge pumps.

C) Aerobic Digester

The aerobic digester is designed for approximately a 10-day retention period based on "Future" conditions. This consideration was deemed reasonable since it would:

1. provide about a 20-day retention time for the existing conditions thus providing some flexibility for process determinations;

2. when new aeration basins are added in the future, then it would be unnecessary to add a second digester;

3. since the digester would be equipped with a two-speed surface aerator, then at low loads, power can be conserved.

It is estimated that for the "Future" system, the secondary clarifier will produce 5,500 cubic feet per day of activated sludge at a concentration of 8,000 ppm of total suspended solids.

5,500 X 10 = 55,000 cubic feet

With a water depth of 14 feet and sloping sides at a ratio of 2:1, then the nominal dimensions of the digester at the top of the dyke would be:

100 feet X 100 feet

D) Chlorination

This facility would be located next to the secondary clarifier and would be built for 20-minute retention period at "Future" flow conditions. Since the flows are highly variable, we would utilize the "Cascade" type for better turbulence. The size of this basin would be as follows:

Flow - 1,250,000 IGPD
200,000 cubic feet per day
140 cubic feet per minute
2,800 cubic feet per 20 minutes

Average basin dimensions:

25 feet long X 10 feet wide X approximately 12 feet deep.

The basin would be equipped with a V-Notch recorder controller for chlorine addition.

E) Aeration

The aeration basin would have two (2) 25 HP surface aerators on fixed supports, each having two-speed afrators and a combined capacity of 155 lbs. O_2 per hour at a combined brake horse power of about 20 HP.

The digester would have one surface aerator on a fixed support having a 25 HP motor with characteristics similar to the above. All three aerators being of the same size and type would facilitate maintenance and replacement operations.

From a theoretical calculation, the total O_2 requirements for the aeration basin is calculated to be 120 lbs. O_2 per hour.

CHAPTER 7

DISCUSSION OF THEORY

The 24-hour extended aeration process is an extention or modification of the Activated Sludge Process which is the standard method of domestic sewage treatment in most large municipalities.

It is designed to accept shock hydraulic and biological loads as well as having the capacity to operate during periods of starvation, then to recover rapidly when re-fed.

This type of plant coupled with a sludge settler and aerobic digester, is indicated in applications where:

1. Sufficient low cost land is available;

2. A minimum of care and attendance is indicated;

3. The biological load is not excessive;

4. Facilities are available for trucking the liquid sludge wastes from the digester to suitable disposal areas.

Periodic daily visits will be required by a consciencious person to care for mechanical equipment. A high degree of knowledge of the biological process is not required, since the system is self-protective.

No provisions were made for grease removal, since only minimal amount of hydrogenated fatty acids are anticipated and the major portion will emenate from the small population of Georgetown. Should some grease accumulate in the aeration basin, it will be trapped there and the action of aeration will partially degrade this grease. If sufficient quantities exist, then, periodically, a man will be required to rake this material to the top of the dyke for physical disposal.

CHAPTER 8

EVALUATION OF PLANT OPERATIONS

We have searched the literature for design and operational data for treatment plant design to handle fish plant wastes. It is unfortunate that, unless there is some active research and development being done at the present time and as yet unpublished, there is only one plant we know of in Canada (Ontario) where fish wastes are being treated and this plant is so new that no results are available as yet. The only other source of significant data that we uncovered was an article in "Water and Sewage Works Supplement", "Industrial Wastes", September/October 1970, page IW/3 and the title of the article is "A Characterization of Tuna Packing Waste". Authors are M. J. Chun, R.H.F. Young and N.C. Burbank.

The concensus of this article is that a 24-hour extended aeration of a mixed domestic and fish plant wastes will produce an effluent with a 60% reduction in B.O.D. It appears that tuna fish wastes contain some constituents that are difficult to degrade biologically. The article indicates that the effluent from a 24-hour extended aeration basin could be effectively treated in a standard activated sludge system.

Without going into the specific bio-chemical details, we wish to determine the extent of the biodegradibility of the combined wastes at Georgetown. Although we are not dealing with tuna wastes, it is possible that the wastes in Georgetown may be simpler or more difficult to treat; only by trying will this fact be determined.

Should additional treatment be required beyond the 24-hour extended aeration system, we are suggesting then the test procedure which will indicate the next move.

Because of the discontinuity and variability of the wastes from Georgetown Seafoods Ltd., it may be possible to effectively treat these wastes to an acceptable level in a single aeration basin. For these and other reasons, we suggest starting out with one aeration basin and then study the results under varying conditions.

Page 8-3 following shows a flow diagram of the proposed facility. The mixed liquor suspended solids (M.L.S.S.) in the aeration basin will be carried over into the secondary settler where a large portion is expected to settle out. A sludge pump will transfer this sludge to either the influent of the aeration basin where this active sludge will assist in the biodegradation of the incoming wastes or if these are lean, then the recycled active sludge will degrade in its passage through the aeration basin. During periods of lean food supply, the organisms in the aeration basin will proceed through the "Endogenous Respiration Stage" which may be defined as follows:

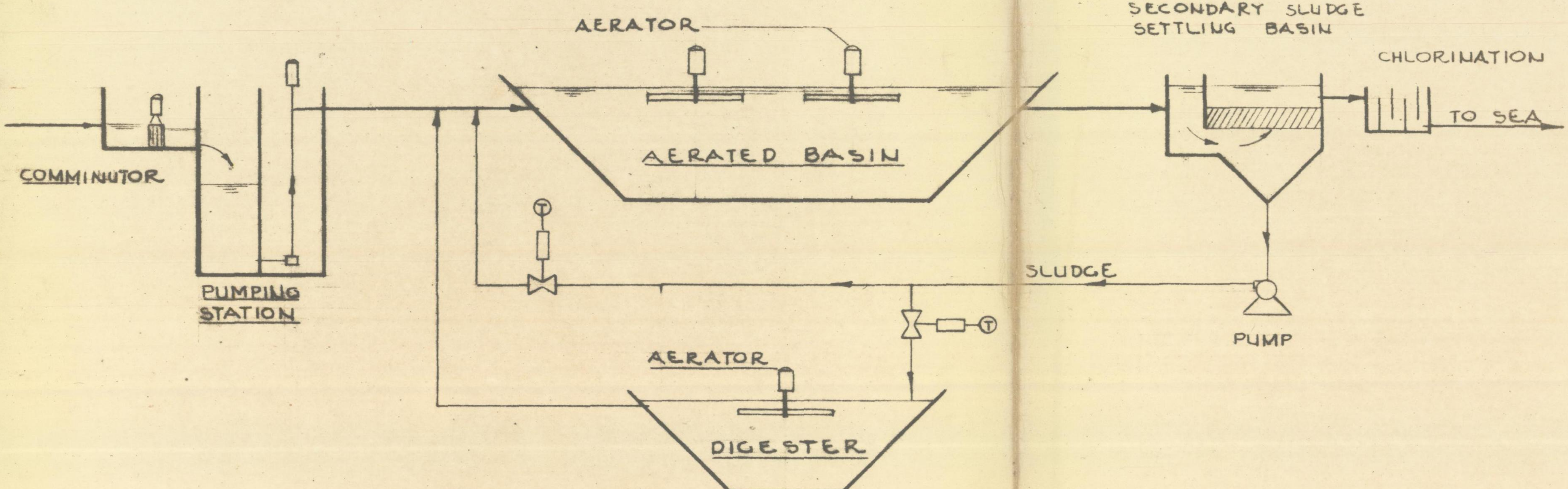
> "If the aeration period is allowed to continue, the bacterial population will continue to decrease and will be replaced by a higher form of organism such as the free swimming. Ciliates and stalked Ciliates which in turn will be destroyed by a still higher form of organism, the Rotifers. A very long period of aeration without food will result in the death of all biological forms due to starvation and only the inert fraction of the cellular structures will remain."

During periods of low feed rates, the recycled active sludge will be directed to the digester, so that a higher ratio of food will overflow from the digester to the influent of the aeration basin. With proper operation, the maximum biodegrability will be obtained and thus reduce the amount of solids wasted from the digester.

It is suggested that liquid disposal from the digester be sufficient and not too frequent. However, only experience will determine these parameters. If, in the future, the load to the system should be increased to a greatly increased amount, it may be necessary to dewater the sludge from the digester before haulage. This requirement would best be determined with time and experience of operation.

It is a well-known axiom in the waste treatment field that the more wastes sent to a waste treatment plant, the greater is the cost to remove and dispose of the resultant solids.

We are confident that the system,as designed, will likely produce a satisfactory effluent and at the lowest possible costs. Our aim in this project was to find a simple, inexpensive method of treating the wastes from Georgetown Seafoods Ltd., and there is sufficient flexibility built into this system to make some important determination in regard to biodegrability.



GEORGETOWN SEAFOODS
WASTE TREATMENT PLANT
J. A. DELANEY & ASSOCIATES
SKETCH - 1-

CHAPTER 9

REQUIRED MODIFICATIONS TO EXISTING FACILITIES

A) Modifications at Georgetown Seafoods Ltd.

The purpose of these modifications are twofold:

1. To direct all process wastes to a central screening device.

2. To reduce in-plant bacterial contamination.

i) Outside receiving area

New channel and pump pit to collect waste water from unloading operations and to divert these wastes to the modified screening operations (See Plan No. 3).

ii) Wharf sewer line

This is an eight-inch diameter line designed to accept the sanitary wastes from the boats tied up at the wharf. (See Plan No. 3).

iii) In-plant modifications

The modifications listed below are required for separation of sanitary sewage from process wastes in a manner to avoid bacterial contamination of finished products, and simultaneously to collect the maximum amount of fish solids from the plant operation for recovery in the fish meal plant.

a) Raw material receiving room:

A new pit with pumping station required to separate and collect process wastes in order to minimize bacterial contamination. (See Plan No. 3).

b) Offal flume:

Extend the existing offal flume to receive process wastes from No. a above, in order to direct all process wastes for maximum solids removal. (See Plan No. 3).

c) Filleting room:

Because of combined sanitary and process wastes in this area, a new pump pit is required to minimize bacterial contamination and in order to maximize solids removal. (See Plan No. 3).

d) New de-watering screen drum:

Change existing belt screen for a drum screen. This change is required for maximum solids removal.

This drum screen will have an increased capacity to take all process water.

The existing structure shall be modified in such manner to accommodate the new screen and have a trap to prevent bacterial infusion into the process waste lines.

e) Fish meal deodorizing process drain:

Divert existing six-inch diameter steel line to main sewers.

B) Town Sewer Modifications

These modifications are required to supply 20 feet more discharge head required for the waste treatment plant.

1. Pumps

Change the two 15 HP motors for 30 HP motors, change gasoline engine from 20 HP to 30 HP.

Change impeller, centric clutch from 6 X 2 to 7 X 2.5. Other miscellaneous requirements. The starters for the pumps shall also be changed.

2. Sewer Network

Add 14-inch forced sewer line from Kent Street to waste treatment plant, 2,000 feet X $10. a foot.

3. New pumping station at treatment plant

This pumping station is required for the collection of sanitary sewage from the gravity sewers of Georgetown in order to provide the required lift.

CHAPTER 10

CONSTRUCTION COSTS

ESTIMATED COST OF TREATMENT PLANT

1. Aerobic Digester

a) Excavation 7,900 cu.yd. X $1.00	$ 7,900.
b) Asphalt lining 2" - 1,245 sq.yd. X $2.00	2,490.
c) Steel walkway	1,500.
d) Platform for aerator	1,500.
e) Aerator (50 HP)	11,000.
Total Cost	$ 24,390.

2. Extended Aerated Lagoon

a) Excavation 27,800 cu.yd. X $1.00	$ 27,800.
b) Asphalt lining 2" - 2,500 sq.yd. X $2.00	5,000.
c) Two (2) steel walkways	3,000.
d) Two (2) aerators	13,000.
e) Two (2) platforms for aerators	3,000.
Total Cost	$ 51,800.

3. Secondary Sludge Settling Basin

a) Excavation and compaction 325 cu.yd.@$2.50	$ 800.
b) Concreting, 73 cu.yd. X $100.	7,300.
c) Tube settler, purchase and installation	9,000.
Total Cost	$ 17,100.

4.	Chlorination Building	
	a) Civil work, 300 sq.ft.	$ 4,000.
	b) Equipment and installation	12,000.
	Total Cost	$ 16,000.
5.	Yard Piping and MH in Treatment Plant	
	a) 18-inch diameter - 1,000 X $10.	$ 10,000.
	b) 4-inch diam. sludge pipe - 180 ft X $10.	1,800.
	c) MH - 7 units X 20' X $50. lin.ft.	7,000.
	Total Cost	$ 18,800.
6.	Sludge Transfer Pumps	
	Supply and installation	$ 10,000.
7.	Comminutor Assembly	11,400.
8.	Sluice Gates	2,300.
9.	Electricity	15,000.
10.	Fence	12,000.
Waste Treatment Plant Cost		$ 178,790.
	15% contingencies	26,800.
		$ 205,690.
	10% Engineering	20,569.
	TOTAL ESTIMATED PLANT COST	$ 226,259.

N.B.: Federal and provincial taxes are not included in price.

To be added to the above costs are modifications to the existing system as outlined in Chapter 1, Recommendations.

The sharing of costs for these works must be determined by others and we herewith submit the details and estimated costs for these works:

A) Fish Plant Exterior Modifications

(2) 1.	Wharf channel and pumping station	$ 13,000.
(3) 2.	Wharf sewer line	2,500.
	Total	$ 15,500.
	15% contingencies	2,325.
		$ 17,825.
	10% engineering	1,782.
	FISH PLANT EXTERIOR MODIFICATIONS TOTAL COST:	$ 19,607.

B) In-Plant Modifications (Georgetown Seafoods Ltd.)

1.	Raw material room	$ 10,000.
2.	Offal flume	2,000.
3.	Filleting room	8,000.
(1) 4.	Dewatering screen and MH	7,000.
5.	Deodorizing drain	200.
6.	Electricity	2,000.
	Total	$ 29,200.
	15% contingencies	4,500.
		$ 33,700.
	10% engineering	3,300.
	IN-PLANT MODIFICATIONS TOTAL COST:	$ 37,000.

Stickwater ?

Fish Plant 11/2/01 $100,000 -

C) <u>Sewer System Modifications</u>

1. Modifications for lift station	$ 6,830.
2. Forced main	20,000.
3. Pumping station for sanitary sewer	12,000.
Total	$ 38,830.
15% contingencies	5,820.
	$ 44,650.
10% engineering	4,465.
SEWER SYSTEM MODIFICATIONS TOTAL COST:	$ 49,115.

<u>RESUME</u>

A) FISH PLANT EXTERIOR MODIFICATIONS	$ 19,607.
B) IN-PLANT MODIFICATIONS	37,000.
C) SEWER SYSTEM MODIFICATIONS	49,115.
D) TREATMENT PLANT COSTS	226,259.
TOTAL PROJECT COST:	$ 331,981.

#105,722

CHAPTER 11

PLANT OPERATING COSTS

A) Aeration

Initially, we have recommended one aeration lagoon with two (2) 25 HP surface aerators. As previously described in chapter 6, we fell that this initial arrangement will probably reduce the wastes to a satisfactory level.

If, after a period of assessment, it is determined that the facility is functioning satisfactorily, no further addition will be necessary. If, however, it is found that the treatment results are unsatisfactory, it may be necessary to add an additional aeration basin. This requirement can only be determined by actual test results.

On the assumption that only one aeration basin will be required for the existing flow, we can now determine operating costs.

Installed H.P.	25 each aerator
Two speed	1,800/1,200 RPM
H.P. required	25/9 each aerator
Lbs. O_2/hour	85/29 each aerator

B) Digester

For this basin only, one aerator is required and since it is sized for future requirements, we have sized the aerator for maximum requirements for future demands. However, this unit is also a two-speed mechanism and the power requirements may be listed as follows:

Installed H.P.	50
Two speed	1,800/12,00 RPM
H.P. required	50/18 each speed
Lbs. O_2/hour	170/59 each speed

C) Comminutor

Required	1 H.P.

D) Lift Station

Changed to 2 X 30 HP and these motors will operate about 50% of the time during the period of operations of the fish plant.

E) Sludge Recycle Pumps

These are small pumps used to remove waste sludge from the secondary settling basin. The H.P. is determined at 3.5 H.P. These pumps operate intermittently for about 50% of the time.

F) New Lift Station (Georgetown East Area)

This station is required for the gravity drainage area of East Georgetown, requiring 6 H.P. operating about 50% of the time.

RESUME OF H.P. REQUIREMENTS

A)	Aeration	25 HP X 2	: 50 HP
B)	Digester	18 HP X 1	: 18 HP
C)	Comminutor	1 HP X 1/2 time	:0.5 HP
D)	Lift Station	60 HP X 1/2 time X 1/2 day	: 15 HP
E)	Sludge Pumps	3.5 HP X 1/2 time	: 2 HP
F)	Lift Station	6 HP X 1/2 time	: 3 HP

Total consumed HP for continuous operation :88.5HP

Approximate electrical power costs $ 500./Mth

G) Sludge Disposal

Haulage of sludge by local contractor

Estimated $4,000./yr. $ 330./Mth

H) Operation

A minimum of time will be required by the existing plant personnel to supervise the waste treatment plant.

Assume $ 200./Mth

I) Maintenance

The only maintenance we envision would be the care required for chlorine addition and over a long period about 10% of the mechanical equipment costs.

10% X $36,000. = $ 3,600./yr. $ 300./Mth

TOTAL OPERATING COSTS $ 1,330./Mth

$16,000./year

CHAPTER 12

FUTURE EXPANSION

As previously described, it is mandatory to obtain operational information on the system as suggested. It may prove to be necessary to add an additional aeration and a secondary settling basin for the existing flow to reach the required treatment efficiency. If this is necessary, the following expenditures would be required:

1 - 85 feet X 70 feet aeration basin	$ 51,800.
1 - 25 feet X 20 feet secondary settling	17,100.
Yard piping and electricity	8,000.
Total	$ 76,900.

For future expansion beyond the above requirements, the same costs would apply.

Unfortunately, at this stage, we are not able to predict whether the above requirement is necessary or not.

For budget purposes, it may be expedient to include the above costs with those shown in Chapter 10.

SECTION 2

CHAPTER 1

ALTERNATIVE TREATMENT METHODS AND COSTS

1. Aerobic Lagoon

Retention time: 30 days

Flow: 700,000 I.G.D.

Land area: 23,3 acres

B.H.P.: 70.2 HP

Cost of mechanical equipment	$ 110,000.
Installation - 30%	33,000.
Excavation - 90,000 cu.yd. X $1.00	90,000.
Menhole and gates and piping	9,000.
Comminutor assembly	11,400.
Electricity	13,000.
	$ 266,400.
15% contingencies	40,000.
	$ 306,400.
10% engineering	30,640.
TOTAL COST OF PLANT:	$ 337,040. +

\+ In-plant modifications

\+ Fish-plant exterior modifications

\+ Town sewer modifications

\+ Land (23.3 acres)

\+ Fence

2. Anaerobic and Aerobic Lagoons

a) Anaerobic lagoon (10 days retention time)

Flow: I MGD Imperial

Land area: 2 basins of 2 acres

ODOR problem

b) Aerobic lagoons

Retention time: 30 days

Flow: 1.0 MGD Imperial

Land area: 15.7 acres

B.H.P.: 46.8 HP

Equipment		$ 92,500.
30% installation		27,900.
Excavation		75,000.
Manhole and gates		8,500.
Comminutor assembly		11,400.
Electricity		12,500.
		$237,800.
	15% contingencies	35,400.
		$273,200.
	10% engineering	27,320.
	TOTAL COST OF PLANT:	$300,520. +

\+ In-plant modifications

\+ Fish-plant exterior modifications

\+ Town sewer modifications

\+ Land (19.8 acres)

\+ Fence

3. Septic Tank and "Bloc-Rapide"

a) Septic tank

Retention time: 1 day

Flow: 1.0 MGD Imperial

The septic tanks are calculated in concrete construction, dimensions 126' X 126' X 10' deep

Cost of Construction:	$ 150,000.

b) "Bloc-Rapide"

Hypothesis: 50% of B.O.D. is removed in septic tank

Flow: 1.0 MGD Imperial

Area dimensions: 120' X 57' X 12'

Aerobic digester 20-day retention

B.H.P.: 80 HP

Equipment and installation	$ 115,000.
Civil and concrete	92,000.
Manhole and gates	2,300.
(profit and engineering) COST TOTAL	$ 35~~4~~9,300.

TOTAL COST: $ 359,300.

+ In-fish plant modifications
+ Fish plant exterior modifications
+ Town sewer modifications
+ Land
+ Fence

4. <u>Septic Tank and Aerobic Lagoon</u>

a) <u>Septic Tank</u>

See 3 a)	$ 150,000.

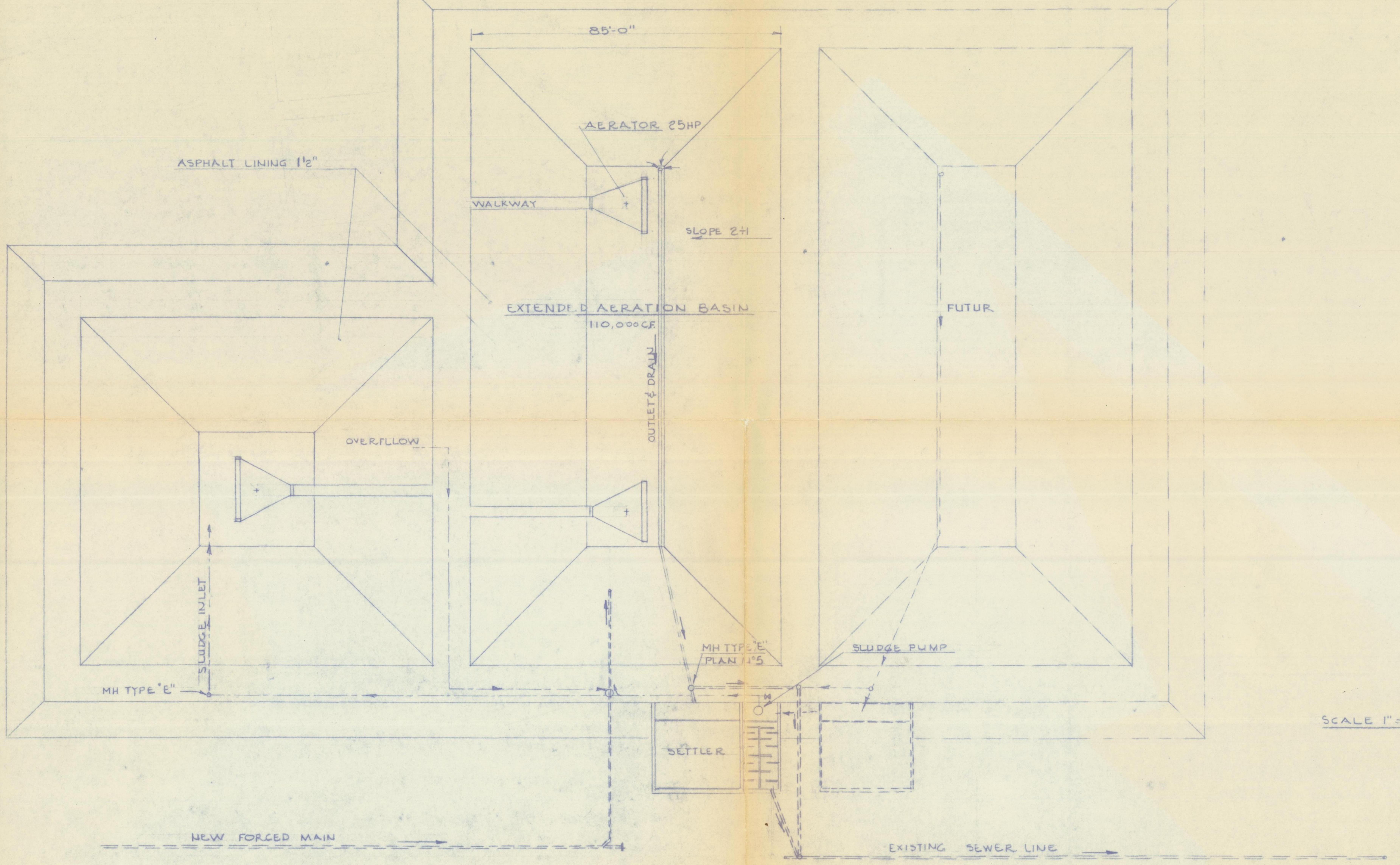
b) <u>Aerobic Lagoon</u>

See 2 b)

Equipment	$ 92,500.
30% installation	27,900.
Excavation	50,000.
Manhole and gates	8,500.
Electricity	13,000.
	$ 191,900.
15% contingencies	28,600.
	$ 220,500.
10% engineering	22,050.
	$ 242,550.
	150,000.
WASTE TREATMENT COST:	$ 392,550. +

+ In-fish plant modifications
+ Fish plant exterior modifications
+ Town sewer modifications
+ Land (16.5 acres)
+ Fence


GLENELG
DURHAM
CRAFTON
RICHMOND
WATER
WEST
FITZROY
KENT
VICTORIA
EAST
SAMPLING STATIONS
Pumping Station
27.10'
17.30'
26.5
16.20
end of forced sewer
CONTINUE FORCED SEWER TO TREATMENT PLANT
LIMITS OF PROVINCIAL PROPERTY
21.95'
12.00
WASTE TREAMENT PLANT
NEW PUMPING STATION
Bathurst Marine
12.28
4.40
Fish Meal
SEAFOODS PLANT
SEE DETAIL AT RIGHT
DIVERT THE DRAIN AS SHOWN
FISH MEAL PLANT
PROCESS PLANT
GEORGETOWN P.E.I.
SEWAGE COLLECTION SYSTEM
J.A. DELANEY & ASSOCIATES
PLAN No 1



SCALE 1" = 20'

PRELIMINARY

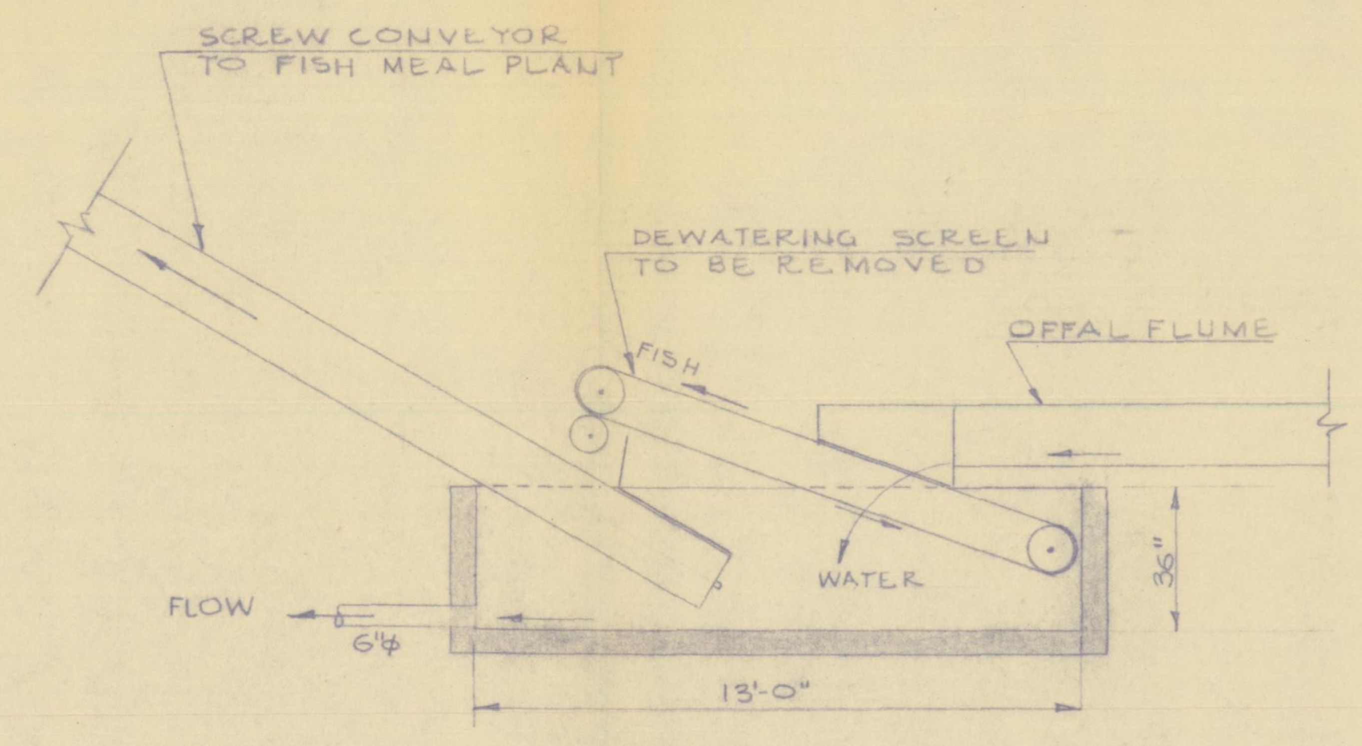
J. A. DELANEY & ASSOCIATES

WASTE TREATMENT PLANT
GEORGETOWN P.E.I.

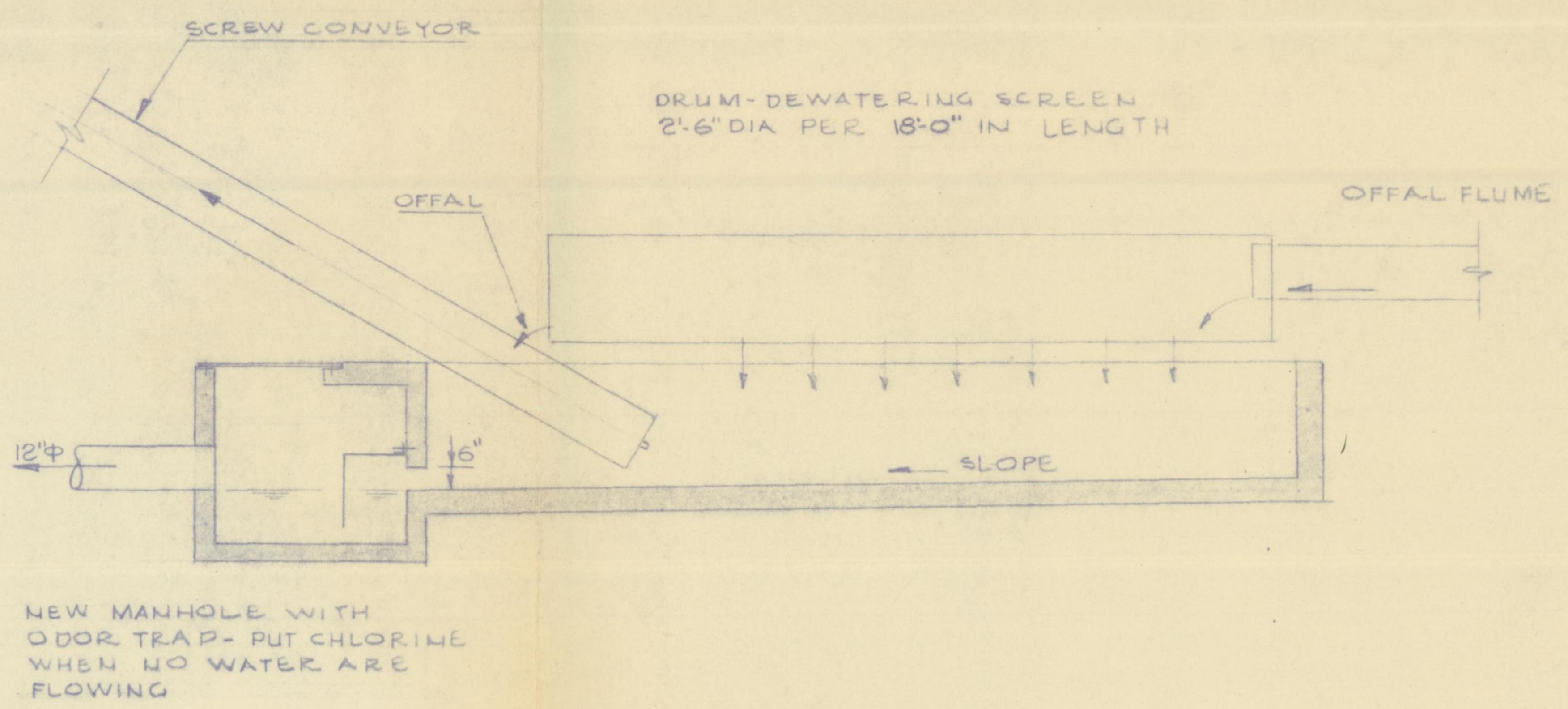
PLAN N° 2


FLUME IN ALUMINUM (SLOPE 1" FOR 10'-0)
3/8" PLATE SUPPORT AT 10'-0" c/c
1/2"Φ BOLT
DETAIL "A"
SEPTIC DISPOSAL FIELD
NEW 8"Φ SANITARY SEWER FROM BOATS
NEW PIT (SEE DETAIL B) (PLAN N° 5)
NEW OFFAL FLUME
OFFAL FLUME (SEE DETAIL "A")
NEW DEWATERING SCREEN (PLAN N° 5)
RAILWAYS
SANITARY SEWER
PROCESS DRAIN
LECTURE ROOM
INV. EL. 7'-0"
FLOOR EL. 11'-0"
INV. EL. 11'-10½"
RUNNING TRAP
INV. EL. 13'-4"
INV. EL. 10'-1"
R.W.L.
FLOOR EL. 16'-9"
SEE DETAIL "D" PLAN N° 5
RAW MATERIAL ROOM
FILLETING & PROCESSING ROOM
COLD STORAGE ROOM
ICE PLANT
BLAST FREEZER
SANITARY DRAIN
SANITARY SEWER
CONCRETE BASES
RAIN WATER?
OFFAL ROOM
FIRST
MEN
WOMEN
CONTROL LAB.
OFFICE
STORAGE
PLATE FREEZER
OFFICE
FLUME SEE DETAIL "C" (PLAN N° 5)
SEE DETAIL "B" PLAN N° 5
SEE DETAIL "D" (PLAN N° 5)
RUNNING TRAP
RAMP UP
FOR FUTURE EXTEN.
CLEANING ROOM
PROCESS DRAIN
CHLORINATOR
FOR FUTUR EXTENSION
OFFICE
OFFICE
RWL
Modification to the Existing Building
1/16" = 1'-0"
GEORGETOWN SEAFOODS LTD
J. A. DE LANEY & ASSOCIATES
PLAN N° 3

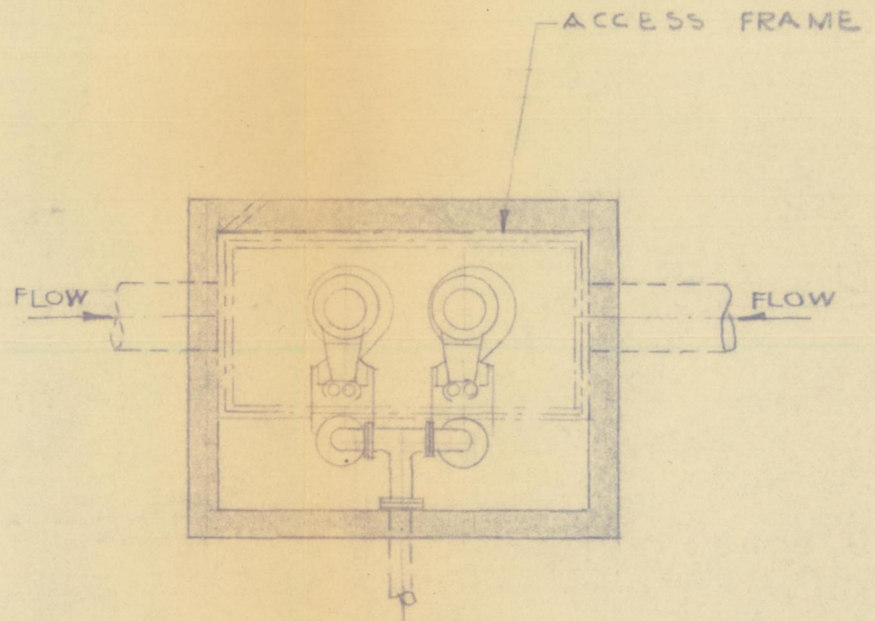
FLUME IN ALUMINUM (SLOPE 1" PER 10'-0")
3/8" PLATE SUPPORT AT 10'-0" c/c
1/2" Φ BOLT
DETAIL "A"
SEPTIC DISPOSAL FIELD
PIT
OFFAL FLUME (SEE DETAIL "A")
DEWATERING SCREEN
RAILWAYS
SANITARY SEWER
PROCESS DRAIN
LECTURE ROOM
INV. EL. 7'-0"
FLOOR EL. 11'-0"
INV. EL. 11'-10"
RUNNING TRAP
INV. EL. 13'-6"
INV. EL. 10'-1"
FLOOR EL. 18'-9"
RAW MATERIAL ROOM
FILLETING & PROCESSING ROOM
COLD STORAGE ROOM
ICE PLANT
OFFICE
PROCESS DRAIN
CONCRETE BASES
SANITARY DRAIN
OFFAL ROOM
FIRST AID
ELECT. RM.
MEN
WOMEN
CONTROL LAB
OFFICE
STORAGE
BLAST FREEZER
PLATE FREEZER
BLAST FREEZER
SANITARY SEWER
OFFICE
RUNNING TRAP
RAMP UP FOR FUTURE EXTEN.
CLEANING ROOM
PROCESS DRAIN
CHLORINATOR
FOR FUTURE EXTENSION
OFFICE
OFFICE
R.W.L.
EXISTING BUILDING
1/16" = 1'-0"
GEORGETOWN SEAFOODS LTD
J. A. DELANEY & ASSOCIATES
PLAN N° 4

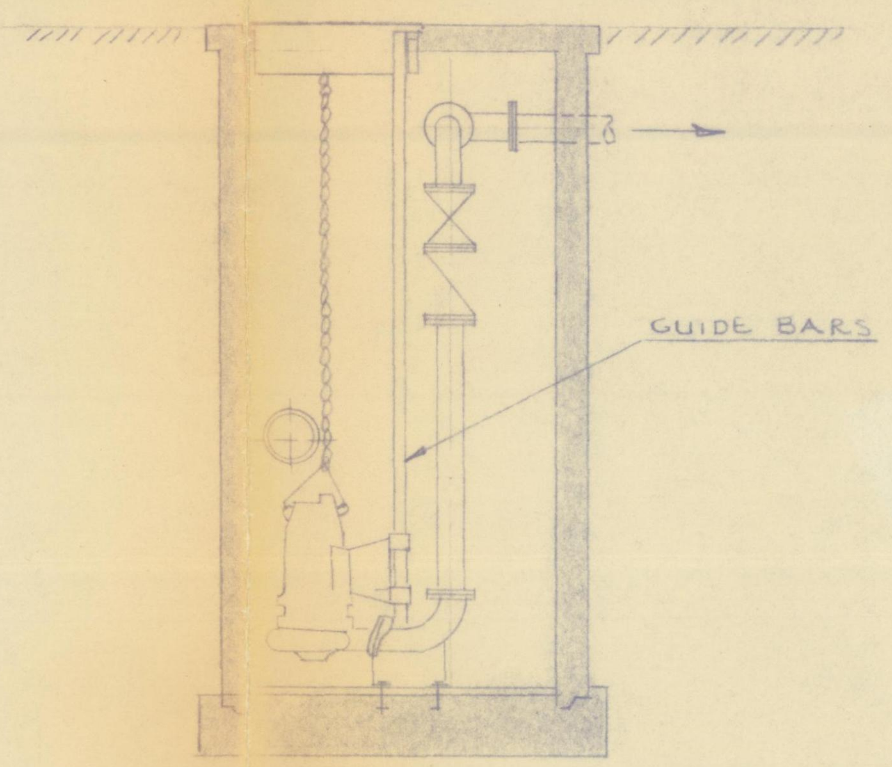


SKETCH OF EXISTING DEWATERING SCREEN

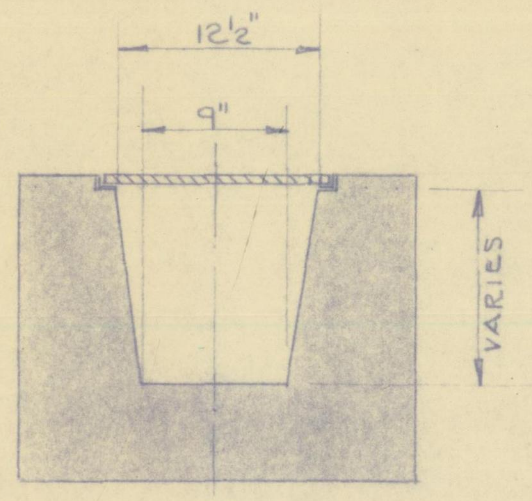


NEW ARRGT OF DEWATERING SCREEN

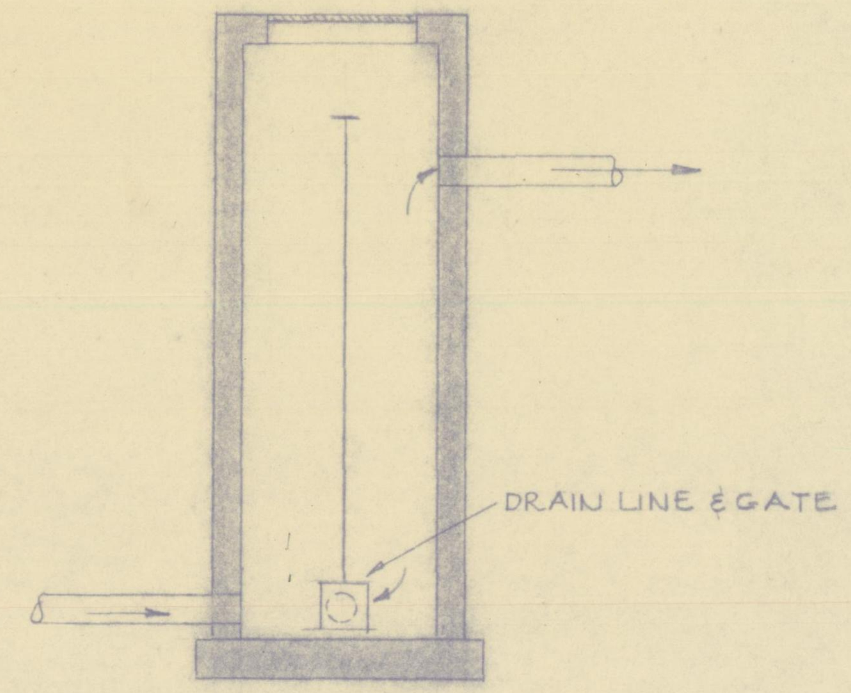




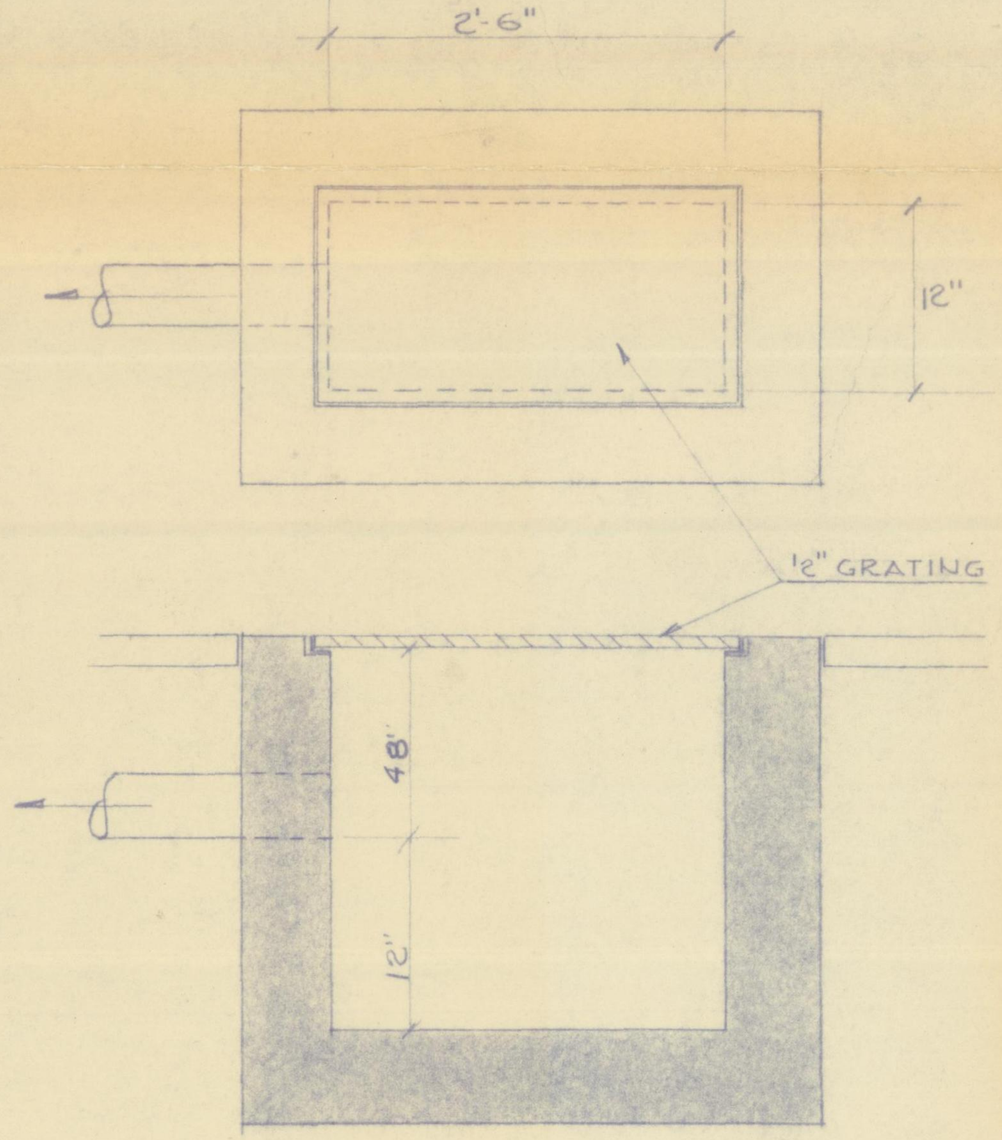
TYPICAL ARRGT FOR DUAL-PUMP
DETAIL "B"



DETAIL OF "C" TRENCH



MH TYPE "E"



DETAIL "D"

GEORGETOWN SEAFOODS
J.A. DELANEY & ASSOCIATES

PLAN No 5