(10)

MCOS
M.C.O'SULLIVAN
Consulting • Engineers

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24th November, 1999.

Mr. Jack Matson,
Divisional Engineer,
Cork County Council,
County Hall,
Cork.

COUNTY ENGINEERS DEPT.
SOUTHERN DIVISION
ROOM 611
25 NOV 1999
CORK COUNTY COUNCIL
COUNTY HALL, CORK

Re: Midleton Main Drainage.

Dear Sir,

The proposed treatment plant has the capacity to treat a flow of 3 DWF from 15,000 p.e. The treatment is divided into three streams each capable of providing treatment for 5,000 p.e. The contract presently under construction is for the construction of two streams, 10,000 p.e.

In the 1993 Preliminary Report the 1993 population was calculated at 8,341 p.e. Between 1993 and 1998 planning permission for 1300 housing units has been granted and of which 500 units have been constructed. Allowing for the same rate of construction for 1999 and 2000 and assuming an occupancy rate of 4 persons/unit results in an additional 2,800 p.e. requiring treatment. = + 700 houses from 1993 - 2000

Cork County Council has agreed to provide treatment to the effluent from Dawn Meats treatment plant. The E.P.A. discharge license for Dawn Meats plant allows a maximum hourly discharge of 50 m^3/hr with a BOD of 60 mg/l. To ensure that the retention time in the Garryduff Treatment Plant is maintained to ensure full denitrification is achieved the volume of the Dawn Meats plant is the critical factor. During the period May 1998 to April 1999, the daily volume of discharge was of the order of 550 m^3/day. If this volume was delivered to the Garryduff treatment plant over a 24 hour period the hourly volume entering the treatment plant would be 23 m^3/hr, which is equivalent to a population of 594.

the "splendid results" show full denitrification is occurring

As result of the increase in population and the discharge from Dawn Meats, delivered over a 24hr period, on commissioning the treatment plant will be required to provide treatment for: -

$\frac{594}{11,141} = 5\%$

1993 population equivalent	= 8,341	11,141
1994 to 2000 increase in population	= 2,800	
Population equivalent form discharge from Dawn Meats	= 594	= 150 houses (5%)
Total population equivalent	=11,735	

M C O'SULLIVAN
Consulting • Engineers

a "variation order" such as this is a rare event according to John Fleming – he has done 2 in his life – points to urgency.

Mr. Jack Matson, Cork County Council — 24th November, 1999.

Therefore, the third stream at the Garryduff Treatment Plant is required immediately. I would recommend that the construction of the third stream should be constructed as an extension to John Fleming Construction Ltd.'s contract for the following reasons: -

- The rates in the present contract for this work are extremely competitive and the construction costs of the extra stream would be IR£610,000 (incl. VAT) approximately. If the third stream was to be constructed as a separate contract, starting when the present contract is completed, the corresponding rates would in all probability be significantly higher.

- A second contractor could not enter the site until the present contract is completed. Therefore, the only way of providing adequate treatment capacity in 2000 is to construct the third stream as an extension to John Fleming Construction Ltd.'s contract.

- It must be borne in mind that if the plant was overloaded by 20% or more there would be danger of not complying with the Department of Fisheries discharge licence.

Assuming that from the year 2000 onwards the annual rate of house construction remains at that experienced from 1994 to 1998 the treatment plant at Garryduff, with the three streams constructed (15,000 p.e.), would have adequate capacity until 2007. It should be noted that in the last two years approximately the rate of planning applications for Midleton has increased substantially, as has the size of the proposed developments with one application for 700 houses alone. Therefor, the likely rate of house construction in Midleton will be significantly greater than that experienced to date. The review of the Development Plan for Midleton currently being carried by Cork County Council, in relation to the allowable densities on currently zoned land and the zoning of additional lands for housing, should also examine the impacts on the Garryduff treatment plant.

Exceeded by an order of magnitude

If you have any queries please contact me.

Yours sincerely

Liam Singleton

LIAM SINGLETON.

LS/DOD.

Our Ref:N:\Workdirs\033(Cork CoCo S)\037(Midleton SS)\LETTERS\LS 24-11-99.doc

(11)

airle Chontae Chorcaí
Cork County Council

County Hall,
Cork, Ireland.
Tel. No: (021) 276891
Fax No: (021) 276321
Web: http://www.corkcoco.com/

Engineer's Dept. (South)
Fax No. 021-342098

1899 ~ 1999
A Century of Service

Mr. D. Barrett
Asst. County Manager
Floor 15

CO. MANAGER'S OFFICE
RECEIVED
16 DEC 1999
COUNTY HALL, CORK

15 December, 1999

Re: **Midleton Main Drainage**

I attach report of 24/11/99 from M. C. O'Sullivan, Consulting Engineers.

Our contract, at present under construction, caters for a population equivalent of 10,000.

With the advent of Dawn Meats and the large number of houses under construction and proposed, M. C. O'Sullivan detail the 'new' population equivalent at 11,735, and recommend that a third stream of the Garryduff Treatment Plant be proceeded with.

They recommend that the work be proceeded with immediately as an addition to the present contract.

This would effect considerable savings to the Council as well as expediting the procedure.

I recommend that we proceed as suggested.

D.O.E. approval will be required.

J. F. MATSON
DIVISIONAL ENGINEER

Approved subject to D.O.E. Agreement

16/12/99

(12)

CORK COUNTY COUNCIL
(South Cork District)

Number: 146/2000

Subject: Midleton Main Drainage Scheme - Contract No. 2.

- Provision of third stream to proposed Treatment Plant (to cater for increase in population equivalent.

Order: On the recommendation of the Divisional Engineer the provision of a third stream to the Garryduff Treatment Plant (currently under construction) is hereby approved subject to agreement of the Department of the Environment and Local Government.

It is further ordered, also subject to Department of the Environment and Local Government approval that the work (estimated to cost approximately £610,000 (including VAT)) be proceeded with as an addition to the present contract.

Signed: ______________________ **Date:** 27/1/2000

Cork Assistant County Manager

(13)

DEPARTMENT OF THE
ENVIRONMENT

ARTMENT OF
ENVIRONMENT
ROINN COMHSHAOIL
ONNELL
OGE HOUSE
IUN 2
CH DROICHEAD
HONAILL
E ÁTHA CLIATH 2
01 679 3377
01 677 9278
17 1 08

3 April 2000

Secretary,
Cork County Council,
County Hall,
Cork.

SECRETARY'S OFFICE
RECEIVED
- 5 APR 2000
COUNTY HALL, CORK

Re: Midleton Main Drainage Scheme
Provision of third stream to proposed Treatment Plant

A Chara,

I wish to refer to your letter of 28th. January 2000 requesting Departmental approval for the provision of a third wastewater treatment stream to the Garryduff Treatment Plant in order to cater for an increase in the Population Equivalent of its catchment area.

This request has been examined by the Department's Engineering Inspector and I am to advise you that before the proposal can be given further consideration it will be necessary to submit a Review Report to take account of the following matters:

- the establishment of an accurate estimate of the load to be imposed on the treatment plant at commissioning, taking into account the 1996 census of population figures, updated estimates of abattoir wastewater load and current data relating to house construction rates in the town and its environs;
- it is felt that the design parameters for the secondary wastewater treatment plant are conservative and that the capacity of the existing Stage 1 works could be increased. The Consultant should be asked to address this issue and examine the costs associated with this approach if it is deemed feasible;
- the estimated cost of the third stream does not appear to include the cost of the mechanical, electrical, control and associated works for this process expansion. The cost should be reviewed and submitted in due course;
- the County Council should address the validity of including the Dawn Meats wastewater along with the main municipal load to the works. Since this process influent is already partially treated and arrives separately to the plant it may be possible to polish the influent separately prior to combining it with the plant's treated water upstream of the UV disinfection facility, thus retaining bioreactor capacity for municipal wastewater treatment only. (600 PE

In the preparation of this Review Report, the County Council may wish to consult with the Department's Engineering Inspector, Mr. Tadhg O'Connor.

If you have any queries relating to the above please contact the undersigned at (01) 888 2095.

Mise le meas,

(Nothing too unreasonable here?)

T. Gaynor
Tony Gaynor,
Water Services Section.

Copy
Mr. Lavelle SE
J Donnelly A/SE
for Attn

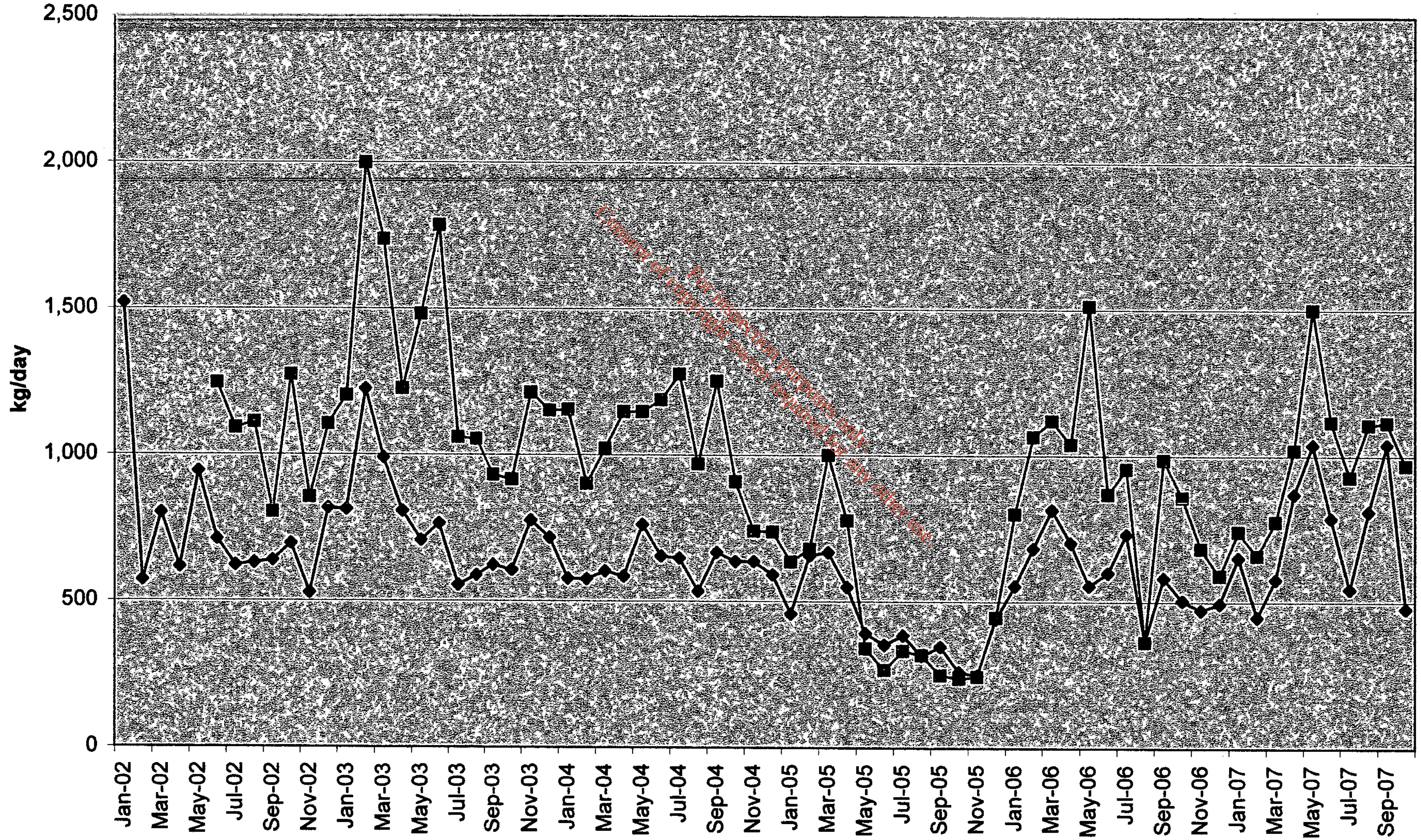
A.O. Smith
Senior Eng, South
for preparation + submission
review report.
J. O'Neill
6.4.2000

10/4/0

Printed on recycled paper

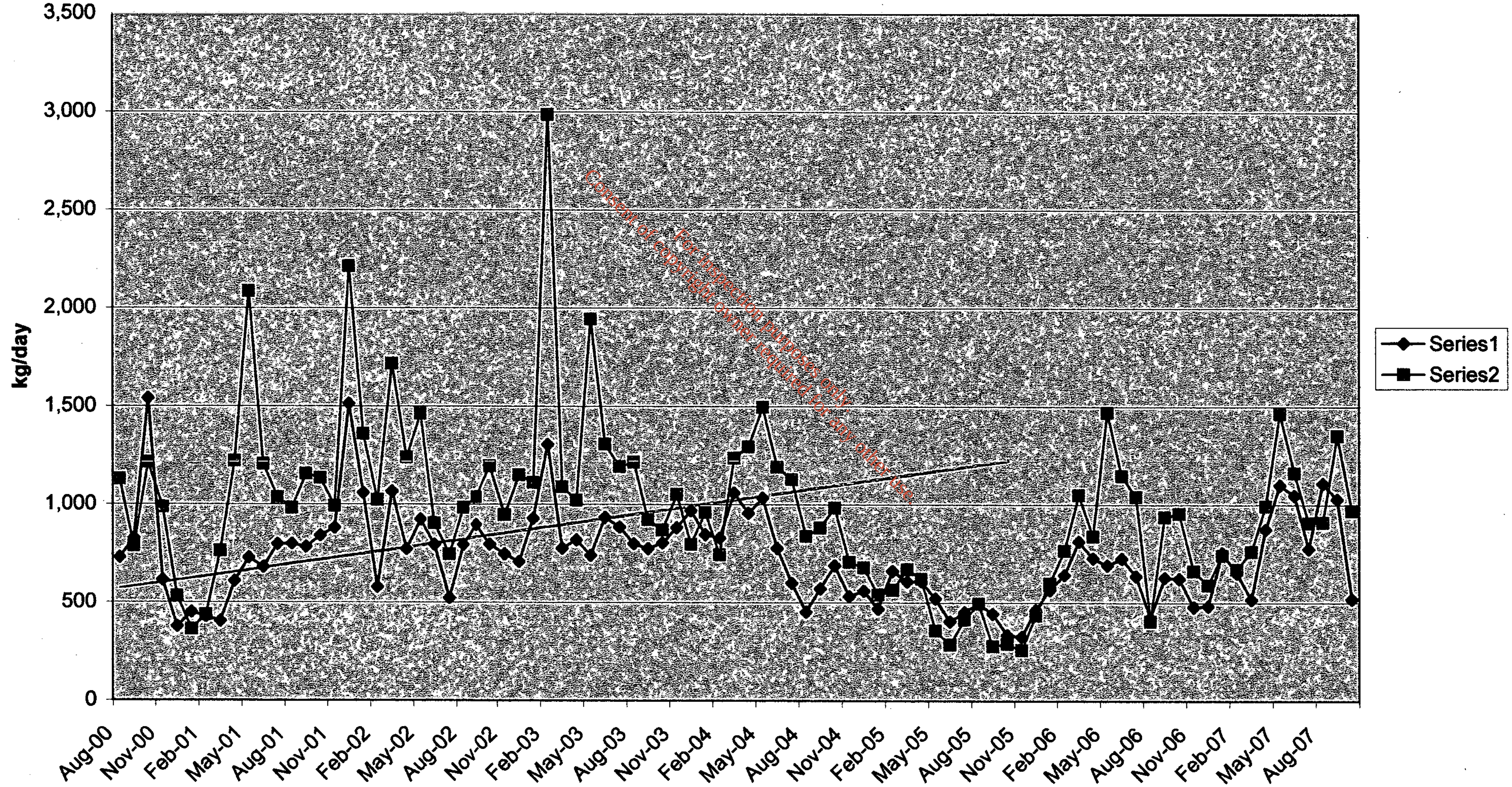
(14)

Influent load to Midleton WWTP : BOD (blue) and SS (red) in kg/day. (Taken from the EPS published monthly "Process Statistics")



(15)

Influent load to Midleton WWTP : BOD (blue) and SS (red) in kg/day. (Taken from the on-site and external lab. figures)



(16)

Maximum BOD load 900Kg/day, which is equivalent to 150% of the design BOD load or 15,000PE.

Minimum BOD load 237Kg/day, which is equivalent to 39.5% of the design BOD load or 3,950PE.

The Service Provider will be responsible for producing final effluent to the current consent detailed above up to these incoming flows and loads. Flows and loads in excess of these maximum limits will not be subject to the penalty mechanism however it will be expected that the Service Provider will undertake his best endeavours to still comply with the required treated quality standards if these maximum inlet flows and loads are exceeded. NB.

Option B: -
The following assets are to be include in Option B:-

Bailick No. 1 Pumping station consisting of: -

- 2 No. Industrial Pumps
- 3 No. Foul Pumps
- 1 No macerator screen
- 3 No. Storm Pumps and 3 No Storm holding tanks with 6 No. tipping bucket cleaning systems
- 2 No Storm Return Pumps
- 1 No. 300mm Foul Rising Main to Midleton WWTP
- 1 No. 300mm Industrial Rising Main to Ballinacurra No. 1 Treated Effluent PS
- 4 No. 525mm Storm Overflow Pipes with penstocks to Owenacurra River
- Flow meter, generator, fuel store, gas detection system, odour control Telemetry System
- Odour Control – 2 No extractor fans air flow meter and woodchip scrubber.
- Buildings – Foul/industrial/storm pumping station building, Storm Overflow pumping station building with Fire alarm and security alarm systems.

No drain pump now

Bailick No. 2 Pumping station consisting of: -

- 2 No. Foul Pumps
- 1 No. Screen
- 2 No. Storm Pumps and 1 No Storm holding tanks with 2 No. tipping bucket cleaning systems
- 1 No. 250mm Foul Rising Main to Midleton WWTP
- 1 No. 600mm Storm Overflow to the River.
- Flow meter and Telemetry System
- GRP Kiosk housing control panels and tranformer.

Ballinacurra No. 1 Treated Effluent Pumping station consisting of:-

- 3 No. Treated Effluent Pumps.
- 1 No. 600/750mm AC Rising Main to Rathcousey Tidal Holding Tank.
- Flow meter .
- Control Building which also contains the control panel and telemetry outstation for Ballinacurra No. 2 Foul Pumping Station. The Employer will require access to this equipment at all times

No storm overflow mentioned – but see sensor req'd for this on p 57. (3.12 4)

Rathcoursey Tidal Holding Tank consisting of:-

- 1 No. Concrete Holding Tank.
- 1 No Control House.
- 1 No Penstock.
- 1 No 750mm AC outfall pipeline including diffuser.

Provision is to be made within the Contract Document for the Service Provider to operate a new terminal pumping station, which is proposed to be constructed at Dwyres Road to pumps flows to Midleton WWTP (if constructed). Note it has been anticipated that this

C. O'SULLIVAN Consulting Engineers

Inishmore, Ballincollig, Co. Cork, Ireland
Telephone 021-80200 Telex 75342

Clara House, Glenageary,
Telephone: 01-853311

(17)

Mr. John Anderson,
Department of the Environment,
Room 203,
O'Connell Bridge House,
Dublin 2.

27th September, 1985.

RE: Midleton Sewerage Scheme

Dear Mr. Anderson,

I enclose, herewith, drawings 24 - 29 inclusive for the above scheme. Drawing 24 is an amended drawing, the rest are new drawings.

If you look at drawing 27 and also the plan on a 1:2500 scale it would appear from the plans that the diffuser goes beyond the centre line of the cross section of the channel. However, if you look at the cross section on drawing 27 on the top left hand corner there is a longitudinal section of the whole outfall pipe from the tidal tank forward. It is clear that the diffuser has been kept in the eastern half of the channel though we had to go out as far as we have shown in order to obtain a reasonable depth and the consequent diffusion of the effluent at the surface of the water.

It would appear from surface indications that at the beginning of the flooding tide the new water coming up from the harbour deflects to the east as one would expect and there is evidence that at that time (just after the tide has turned) water is still flowing south on the western side of the channel that is the Great Island side.

As you will see the diffuser is a 600 mm. steel pipe. The channel cross section here consists of rock (shale) and I do not think that a high density polythene pipe like we used off Little Island would give any length of service in the very arduous conditions obtaining at this point.

You will also notice that we have retained the distancing pieces and 90° bends because I think that the bends give us a more prolonged travel path for the jets from the diffuser with better mixing at the surface. If you disagree with those they can always be omitted from the contract but we have retained them for the present.

I am more than ever convinced that the tidal tank performs no more useful function than a soother would to a baby and this is of no practical use in the discharge of effluent at Rathcoursey Point. I ~~hope that~~ the advertisements will appear in the papers on Monday next, 30th September, '85.

Yours sincerely,

537

MCOS/BB
Encls.

(18)

CONCLUSION

33. As a generalisation and contrary to much lay belief, for the disposal of sewage from a coastal town, a well-sited marine treatment scheme will generally be environmentally superior to an inland works. Each situation is, however, different and must be considered on the merits of the particular case. Also, environmental features are only part of the overall picture which should be considered when the best solution to a particular problem is being sought."

21. While the brief for this Report specifically calls for a scheme incorporating secondary treatment on land, I would be failing in my duty as an engineering advisor if I did not point out that aside from monetary considerations the proposals to discharge comminuted sewage at Rathcoursey Point for marine treatment is the more reliable form of treatment. In addition, it is superior to land treatment in 9 out of the 10 environmental criteria listed on the table on the foregoing page.

Signed ....

Date 15/12/81

340

(19)

Roinn na Mara
Lána Chill Mochargón
Baile Átha Cliath 2
Teileafón 01-785444
Teiloacs 91798
Macasamhail 01-618214

Department of the Marine
Leeson Lane
Dublin 2
Telephone 01-785444
Telex 91798
Facsimile 01-618214

Tagairt

25 March 1992

Mr I Maclean
Chief Environmental Officer
Cork County Council
County Hall
Cork.

Re: Midleton Sewerage Scheme.

Dear Sir

I am directed by the Minister for the Marine to refer to the above scheme and in particular to Conditions nos 7 and 8 of the Foreshore Licence in respect of the Rathcoursey outlet.

The overall pattern of results emerging from monitoring by the ERU and by the Department itself confirms that there has been a significant deterioration in water quality in the area in question since the discharge outlet was moved to Rathcoursey.

The resultant adverse public health implications for the business of the shellfish operations in the area and the wider Irish oyster and shellfish industry are a matter of grave concern for this Department and for An Bord Iascaigh Mhara, which has primary responsibility for the promotion and marketing of the Irish shellfish industry in the UK and throughout Europe.

The Department considers that the continuing risks to human health and the threat to the Irish shellfish industry are such as to require immediate action.

In the first instance therefore, I am to notify the County Council that the Department is now formally invoking Condition No 8 of the Foreshore licence in question which provides that:

> "In the event that monitoring shows secondary treatment to be justified the provision of such treatment shall be planned and financed by the Licensee as a priority item."

I am to request you, therefore, to advise as a matter of urgency on the steps which the County Council propose to take to install a treatment plant for the sewage discharge at the earliest possible date and the timescale involved.

Secondly, and pending the installation of the treatment facility, the Department considers it essential that effective management measures are put in place to alleviate the present situation and to prevent further contamination of the shellfish resource. In this regard it was agreed at the meeting of the Monitoring Committee on 14th February last that the County Council would reexamine discharge management strategy in consultation with this Department.I understand that proposals for modifications to the discharge management have been advanced in subsequent consultations. I would be grateful for your comments on how these are being taken forward. In particular I would ask you to advise on the feasibility of moving the outfall back to Ballinacurra Estuary in the intervening period before secondary treatment works can be put in place.

The Department is available to meet with the County Co[illegible]l at any stage to discuss the situation. I look forward to hearing from you on how we can best move to a speedy resolution of this matter.

Yours sincerely

Sara White

ara White
Principal Officer
Aquaculture/Foreshore/Research Division.

(19b)

2.2 FLOWS AND LOADS

2.2.1 Dry Weather Flow and Load

Measured waste water flows and loads from the sewerage system are given in Table 2.4 below, and are based on monitoring data provided for the period January to June 2002.

Table 2.4
Measured Flows and Loads to & from the WWTP

Location	DWF* (m^3/d)	BOD (kg/d)	P (Kg/d)	NH_4 (Kg/d)	SS (Kg/d)	Peak Flow (m^3/d)	Confidence Grade
Inflow to WWTP	7,042	757	17	78	1,275	10,927	1
Discharge from WWTP to Rec. waters	7,075	21	10	20	96	10,960	1

* Dry weather flow data was not available, so average daily flows were used

The confidence grade is high because the influent and effluent quality is monitored daily by 24 hour composite sampling and flow measurement at the WWTP inlet and outlet, with comprehensive records kept on site. The figures quoted above are based on the average flow to the WWTP.

Although the town has some tourist attractions e.g the Heritage Centre at Midleton Distillery, it is not a traditional tourist town, and no allowance for a tourism contribution to the flow and load has been included. The waste water flow from the commercial sector is not known. The commercial contribution has been estimated at 16% of the domestic contribution (in accordance with the Standard Methodology Volume 2).

There are two major "wet" industries in town. The waste water from these industries is treated by private WWTP's, and the treated effluent from one (Dawn Meats) is discharged to the Owenacurra Estuary via a separate sewerage system. Treated effluent from the second private WWTP (Midleton Distillery) is discharged to the treated effluent sewer from the town's WWTP, and is subject to an IPC discharge licence. Although there is a considerable amount of land zoned for future industrial development, contributions from this land were not included in the 2022 estimates since the time frame and scale of such development is unknown.

There are three primary and four secondary schools in the town (including Midleton College which has approximately 100 boarders), with approximately 1,210 associated students/staff live outside the catchment. The Midleton hospital caters for approximately 30 patients with all staff assumed to live within the catchment.

Significant infiltration into the sewerage network has been reported, with recent local authority studies indicating infiltration levels of approximately 2,000 m^3/day.

At the time of this study approximately 100 m^3/week (over three days) of leachate with a BOD load of 400 kg/week was imported from Rossmore landfill. However, this practice is expected to cease. In the future only liquid sludge from Cloyne and Mogeely WWTPs will be imported to the WWTP for thickening and dewatering.

Table 2.5 gives the estimated breakdown of the current and future flows and loads on a sectoral basis. There is a considerable difference between the recorded flow data (Table 2.4) and the flow data derived from the standard methodology. Based on the high confidence grade of the local authority data, it is used in subsequent analysis of the waste water system. A Water Services Pricing Policy Report has not been prepared for the Midleton sewerage system.

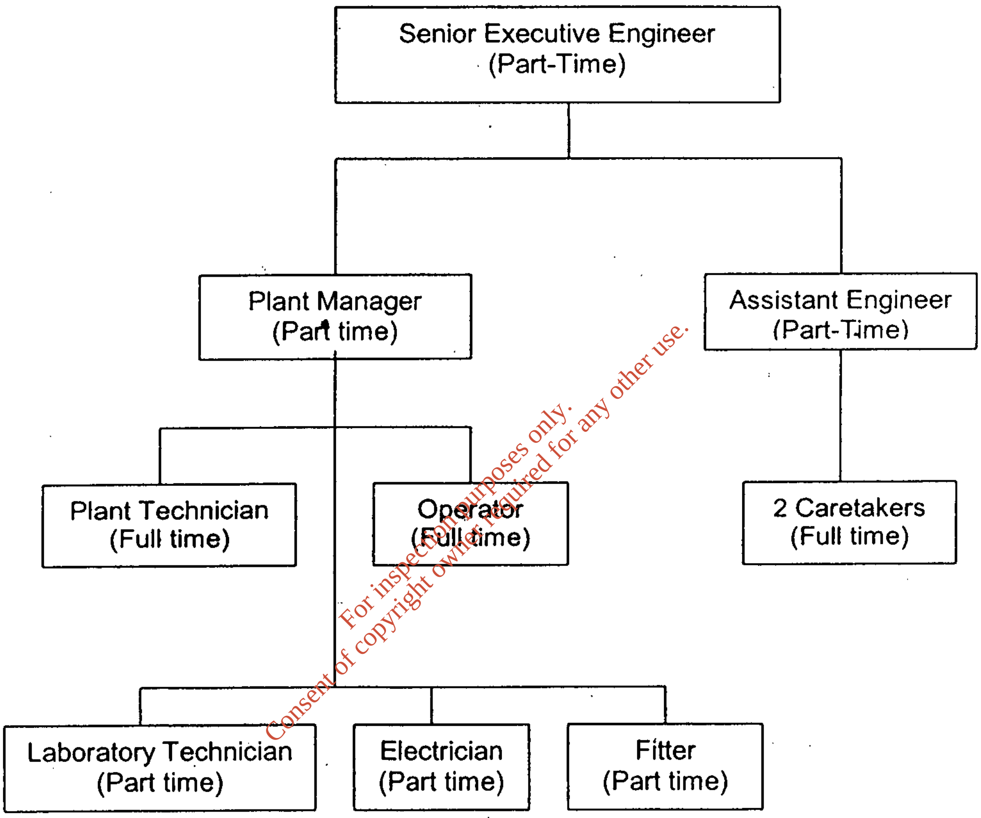
(19c)

3.3 OPERATIONAL CONTROL & STAFFING STRUCTURE

3.3.1 Management Structure

The management structure for operation and maintenance of both the sewerage network and the WWTP is represented in the organogram below. The WWTP is currently operated and maintained by a private contractor.

Organogram of Staffing Structure for Midleton Sewerage System



3.3.2 Operation and Maintenance Policy

The operation and maintenance policy for the sewerage network as described by the Local Authority is as follows:

NB

- Main pump stations are checked daily.
- Smaller pump stations are checked once per week.
- The SCADA system at the waste water treatment plant is not fully operational. It could not be confirmed if the SCADA system monitors the operation of the main pump stations.
- Pump stations are manually controlled.

3.3.3 Relative Manpower

The Local Authority has indicated that the amount of staff time expended on the sewerage network is as set out in Table 3.6 below:

Control Readings (SCADA) - October 2007 -

Date	Baillick1	Baillick2	Ballinacurra	Aeration Tanks		Settling Tanks Inlet		Sludge Return		Wasting pumps to PFT			
	Flow (m3)	Flow (m3)	Flow (m3)	Flow 1 (m3)	Flow 2 (m3)	Flow 1 (m3)	Flow 2 (m3)	Flow 1 (m3)	Flow 2 (m3)	Flow 1 (m3)	Flow 2 (m3)	Duty Hours 1	Duty Hours 2
01-Oct-06	61536.00	31.81	30.62	3851.87	2483.3	6309.95	5775.8	2516.69	3101.37	72.04	70.17	12.06	11.5
02-Oct-06	65535.00	119.01	197.50	3687.13	2353.30	6087.89	5651.91	2454.98	3086.30	71.70	70.47	12.02	11.54
03-Oct-06	65535.00	60.54	247.45	3685.10	2346.45	6071.34	5636.84	2450.86	3087.39	68.87	73.83	11.33	12.23
04-Oct-06	65535.00	3.82	295.79	3472.00	2191.58	5988.97	5530.30	2499.11	3112.75	54.20	88.39	9.06	14.50
05-Oct-06	65535.00	620.76	375.00	3110.94	1864.73	5775.23	5155.96	2590.41	3025.43	54.21	88.27	9.07	14.49
06-Oct-06	65535.00	168.53	74.71	3262.46	2037.38	5854.69	5318.09	2542.96	3046.95	54.20	88.28	9.06	14.50
07-Oct-06	65535.00	564.84	417.38	3524.28	2231.48	6005.67	5684.45	2489.18	3224.35	68.57	73.50	11.30	12.24
08-Oct-06	65535.00	148.30	380.10	3569.19	2253.98	6035.48	5714.66	2476.45	3206.98	60.33	49.39	10.08	8.20
09-Oct-06	65535.00	454.86	502.04	3656.95	2329.95	6252.80	5726.53	2617.57	3162.49	57.55	49.10	9.39	8.20
10-Oct-06	65535.00	43.79	145.74	3542.48	2484.61	6077.56	5866.19	2597.47	3197.14	72.04	70.28	12.07	11.49
11-Oct-06	4671.00	18.74	552.20	3408.43	2103.11	5894.86	5598.46	2559.24	3230.45	71.03	71.14	11.57	11.09
12-Oct-06	5151.00	0.01	411.91	3670.40	2335.54	6091.40	5806.98	2503.84	3238.20	70.43	71.87	11.50	12.06
13-Oct-06	9857.00	0.76	598.98	3556.41	2251.13	5980.26	5762.42	2468.39	3220.71	70.43	71.88	11.49	12.07
14-Oct-06	10330.00	0.01	397.91	3478.44	2176.54	6021.98	5725.91	2448.91	3220.54	12.27	10.92	2.02	1.51
15-Oct-06	15034.00	0.01	379.48	3547.32	2243.68	6045.80	5706.27	2528.25	3159.30	71.45	70.23	12.01	11.49
16-Oct-06	15469.00	0.01	325.93	3547.93	2234.59	6051.81	5614.75	2500.03	3079.32	72.03	70.16	12.06	11.50
17-Oct-06	0.00	0.00	269.00	3368.60	2100.03	5910.95	5477.17	2470.58	3091.94	61.59	80.57	10.21	13.33
18-Oct-06	0.00	0.00	128.10	3350.13	2076.80	5802.24	5445.01	2421.05	3083.17	52.96	89.05	8.54	15.02
19-Oct-06	0.00	0.26	144.44	3317.67	2097.34	5758.84	5447.53	2415.80	3116.39	58.42	84.10	9.50	14.06
20-Oct-06	3897.00	0.02	191.14	3126.28	1915.69	5711.20	5250.44	2527.52	3142.45	54.58	87.74	9.11	14.43
21-Oct-06	4619.00	187.24	236.59	3231.73	2030.35	5880.73	5329.65	2581.86	3076.91	70.42	71.57	12.05	12.05
22-Oct-06	4567.00	100.50	498.72	3094.64	1931.93	5857.74	5244.72	2554.83	3063.86	61.85	80.35	10.23	13.32
23-Oct-06	4567.00	66.04	600.84	3070.42	1895.93	5749.46	5166.10	250.75	3100.11	44.74	97.85	16.24	7.25
24-Oct-06	65379.00	146.93	294.59	3025.42	1819.22	5597.91	5144.65	2484.70	3136.96	59.58	82.86	10.00	13.56
25-Oct-06	0.00	48.33	293.62	3554.27	2239.93	6013.72	5476.38	2493.56	3087.69	61.49	80.79	10.20	13.36
26-Oct-06	0.00	438.22	161.94	3504.50	2174.28	6036.92	5466.63	2533.78	3092.31	60.08	82.44	10.05	13.51
27-Oct-06	0.00	107.32	581.40	3933.69	2544.80	6514.01	5927.49	2628.32	3196.86	72.92	75.24	12.14	12.42
28-Oct-06	0.00	130.12	257.99	3893.33	2537.52	6486.39	5836.41	2546.17	3093.04	2.53	2.84	0.25	0.29
29-Oct-06	0.00	0.01	235.86	3693.13	2344.62	6223.42	[illegible]	2563.44	3081.64	65.88	70.23	11.04	11.50
30-Oct-06	0.00	10.16	400.93	3310.05	2053.99	5823.08	5333.60	2540.48	3090.39	71.82	70.24	12.03	11.51
31-Oct-06	0.00	534.67	601.14	3637.41	2300.06	6094.02	5579.59	2512.61	3083.49	71.81	70.14	12.05	11.49
Average				3473.6	2193.0	6000.2	5548.8	2443.5	3127.0	60.4	71.4	10.3	11.5
Total										1872	2213.9	319.73	355.71

Legend: X = PLC Problem Weekend B.Holiday

(20)

(21)

Department of the Marine
Government Buildings
Sullivan's Quay
Cork

Telephone Cork

Roinn na Mara
Tithe an Rialtais
Cé Ó Súilleabháin
Corcaigh

Fax (021) 968617

Ref. No.

29 June, 1994

Re: Midleton Sewage

Dr. Farrell, GP 1 July 94
Mr. Williams,

The following are my preliminary comments on the proposed scheme of secondary treatment for Midleton.

Treatment Plant location

The proposed location of the treatment plant is a considerable distance upstream of Ballinacurra where almost all effluents flow or are pumped to at present. Considerable extra sewerage is envisaged as a result. It is not clear from the report why a suitable site is not available near Ballinacurra. My concern here is that this extra cost may delay works proceeding.

Outfall location

The report favours the existing outfall at Rathcoursey. As there will be adequate dilutions at Ballinacurra to achieve satisfactory physical and chemical quality, it is recommended that this option be chosen. The two miles distance from there to the oyster beds will give a further buffer against bacterial and viral infection.

There is considerable confusion as to the sources of faecal coliforms according to the report. This matter should be sorted out through a monitoring programme.

Disinfection

The report says UV disinfection will not be necessary. Undoubtedly secondary treatment coupled with a remoter outfall location will improve upon the existing unsatisfactory bacteriological water quality.

Changes carried out last year to the discharge regime at Rathcoursey have had reputedly beneficial results. However, as I have not got data on bacteriological conditions in the north channel I am not in a position yet to comment on the necessity for UV treatment. Sean O'Donoghue's section will be in a better position to comment on that aspect.

awaiting S O Donoghue obs

VC

Catherine Hickey
John O'Keeffe,
Divisional Engineer.

Mick O'Driscoll will try to get to this by Friday 12/07

706

2,

(22)

RE: Midleton Sewage Scheme.

I agree with John O'Keeffe's report of 29/6/1994 on the above. We would support Ballinacurra as an outfall location rather than Rathcoursey so as to remove the source of bacterial and viral infection further away from the oyster beds.

We have had problems with VIRAL contamination of oysters from the beds in the area resulting in outbreaks of illness and possible marketing problems. The Department may be involved in litigation as a result.

This Section insists that a U.V. system must be incorporated into the proposed treatment works, irrespective of the location of the new outfall. M O'Driscoll

DOM File No MS 51/8/580 A Vol 4 45

(23)

Extract from report of MLVC Meeting 6 March 1995

E1/2/62 **Midleton Sewerage Scheme**

Mr. Sean O' Donoghue, Sea Fisheries Control, joined the meeting for this discussion.

The MLVC consider Ballinacurra to be a more suitable outfall location than Rathcoursey as this would move the source of bacterial and viral infection further away from the Oyster beds.

- MLVC insist that UV treatment be introduced in conjunction with secondary treatment. Cork County Council's plans do not include UV treatment.

- Foreshore section to request an Environmental Impact Statement and copy to Mr. S O' Donoghue.

(24)

MIDLETON SEWERAGE SCHEME

TEMPORARY RELOCATION OF OUTFALL TO BALLYNACORRA

CORK COUNTY COUNCIL 1899

CIVIL STRUCTURAL & ENVIRONMENTAL ENGINEERS

Cork
County Council

County Engineer :-

C.B.Devlin
B.E., C.Eng., F.I.E.I.

M. C. O'SULLIVAN & CO. LTD.
CONSULTING ENGINEERS
INNISHMORE, BALLINCOLLIG, CO. CORK.
Telephone 021 870200 Fax 021 873742
ASHURST, MOUNT MERRION AVE., BLACKROCK, CO. DUBLIN.
Telephone 01 2884499 Fax 01 2835676

MAY 1997

MIDLETON SEWERAGE SCHEME

PROPOSED TEMPORARY OUTFALL

ADJACENT TO BALLINACURRA

Simulation of BOD concentrations in estuary waters

Prepared for:

M.C. O' Sullivan & Co.,
Consulting Engineers.

Prepared by:

Irish Hydrodata Limited.

1/5/97

Simulation Models

Two models were used to predict the values contained in this document:

1. Graphical plots and HW & LW tabular results are based on predictions from a 2d dispersion model utilising a 25m x 25m grid size. This model would produce an underestimate of the peaks due to averaging within a cell. River flows within the range 0.05-1.0 m^3/s have no major influence on the results.

2. A simple volume dilution model was used to predict the likely maximum BOD values in the river at low water. This assumes that only river and effluent waters are available to mix together at low water during spring tides and that some tidal water is present at low water neaps. This model would be considered to give an upper estimate of the likely concentrations.

Simulations are based on an effluent discharge of $0.06m^3/s$.

Tabular results have been prepared for effluent BOD loadings of 272 & 70 mg/litre (these are taken to correspond to 32000pe and 6000pe from results of Co. Co. Sampling).

Graphical output has been prepared for an effluent BOD loading of 272mg/litre.

Estimates of the likely river concentrations for different ranges of BOD and effluent flow can be scaled directly from the plots or the HW & LW values. The Max LW Conc. value can only be scaled if the effluent flow remains at $0.06m^3/s$

SUMMARY OF PREDICTED PEAK BOD_5 LEVELS IN ESTUARY ADJACENT TO OUTFALL POINT AT BALLINACURRA

Continuous Discharge from Site at Ballinacurra

Source Concentration 270 mg/litre @ 0.06m^3/s (32000pe)

River Flow	Neap Tide			Spring Tide		
m^3/s	High Water	Low Water	Max LW Conc	High Water	Low Water	Max LW Conc
0.05	7 mg/l	12 mg/l	60 mg/l	2 mg/l	20 mg/l	120 mg/l
0.15	7 mg/l	12 mg/l	38 mg/l	2 mg/l	20 mg/l	76 mg/l
1.00	6 mg/l	10 mg/l	8 mg/l	1 mg/l	16 mg/l	15 mg/l

Source Concentration 70 mg/litre @ 0.06m^3/s (6000pe)

River Flow	Neap Tide			Spring Tide		
m^3/s	High Water	Low Water	Max LW Conc	High Water	Low Water	Max LW Conc
0.05	1.8 mg/l	3 mg/l	15 mg/l	<1 mg/l	5 mg/l	32 mg/l
0.15	1.7 mg/l	3 mg/l	9 mg/l	<1 mg/l	5 mg/l	20 mg/l
1.00	1.5 mg/l	2.5 mg/l	2 mg/l	<1 mg/l	4 mg/l	4 mg/l

Intermittent Discharge from Site at Ballinacurra

Source Concentration 270 mg/litre @ 0.06m^3/s (32000pe)

River Flow	Neap Tide			Spring Tide		
m^3/s	High Water	Low Water	Max LW Conc	High Water	Low Water	Max LW Conc
0.05	4 mg/l	18 mg/l	60 mg/l	<1 mg/l	30 mg/l	120 mg/l
0.15	4 mg/l	18 mg/l	38 mg/l	<1 mg/l	30 mg/l	76 mg/l
1.00	3 mg/l	15 mg/l	8 mg/l	<1 mg/l	28 mg/l	15 mg/l

Source Concentration 70 mg/litre @ 0.06m^3/s (6000pe)

River Flow	Neap Tide			Spring Tide		
m^3/s	High Water	Low Water	Max LW Conc	High Water	Low Water	Max LW Conc
0.05	<1 mg/l	5 mg/l	15 mg/l	<1 mg/l	8 mg/l	32 mg/l
0.15	<1 mg/l	5 mg/l	9 mg/l	<1 mg/l	8 mg/l	20 mg/l
1.00	<1 mg/l	3 mg/l	2 mg/l	<1 mg/l	7 mg/l	4 mg/l

HW & LW values are based on the 2d dispersion model and values are averaged over 25m x 25m cells.

Max LW Conc represents the highest BOD likely to occur in the channel at low water and is based on the dilution of the effluent stream by the river flow and tidal waters.

CONTINUOUS DISCHARGE OF 0.06m^3/s with BOD of 270mg/l

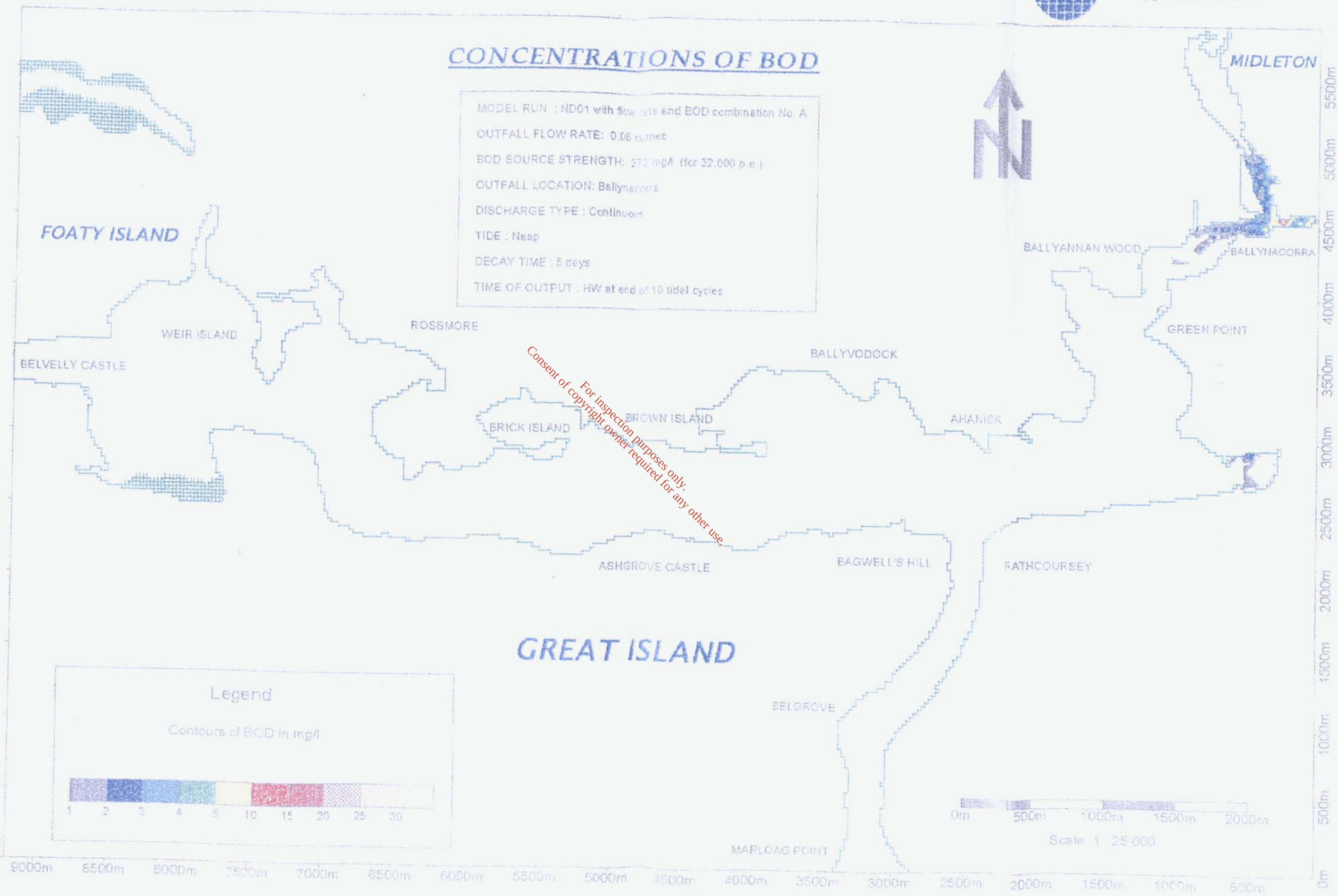
NEAP TIDE

Outputs at High Water & Low Water

MIDELTON SEWERAGE SCHEME - OUTFALL STUDY

Addendum April 1997

Prepared by Irish Hydrodata Ltd.
Ballygarvan, Co. Cork.

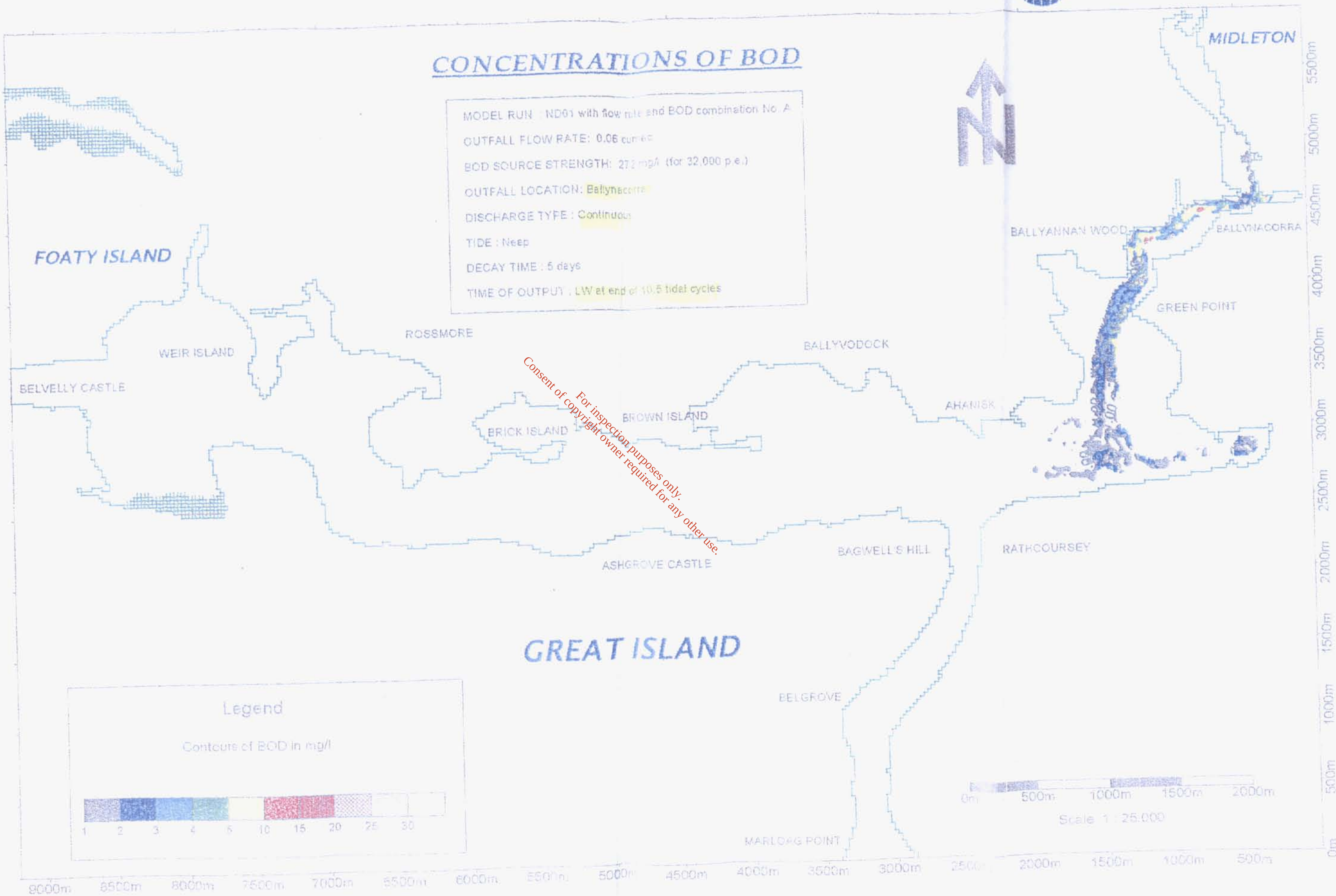


MIDELTON SEWERAGE SCHEME - OUTFALL STUDY

Prepared by Irish Hydrodata Ltd
Ballygarvan, Co. Cork

CONCENTRATIONS OF BOD

MODEL RUN : ND01 with flow rate and BOD combination No. A
OUTFALL FLOW RATE: 0.06 cumecs
BOD SOURCE STRENGTH: 272 mg/l (for 32,000 p.e.)
OUTFALL LOCATION: Ballynacorra
DISCHARGE TYPE : Continuous
TIDE : Neap
DECAY TIME : 5 days
TIME OF OUTPUT : LW at end of 10.5 tidal cycles



CONTINUOUS DISCHARGE OF 0.06m^3/s with BOD of 270mg/l

SPRING TIDE

Outputs at High Water & Low Water

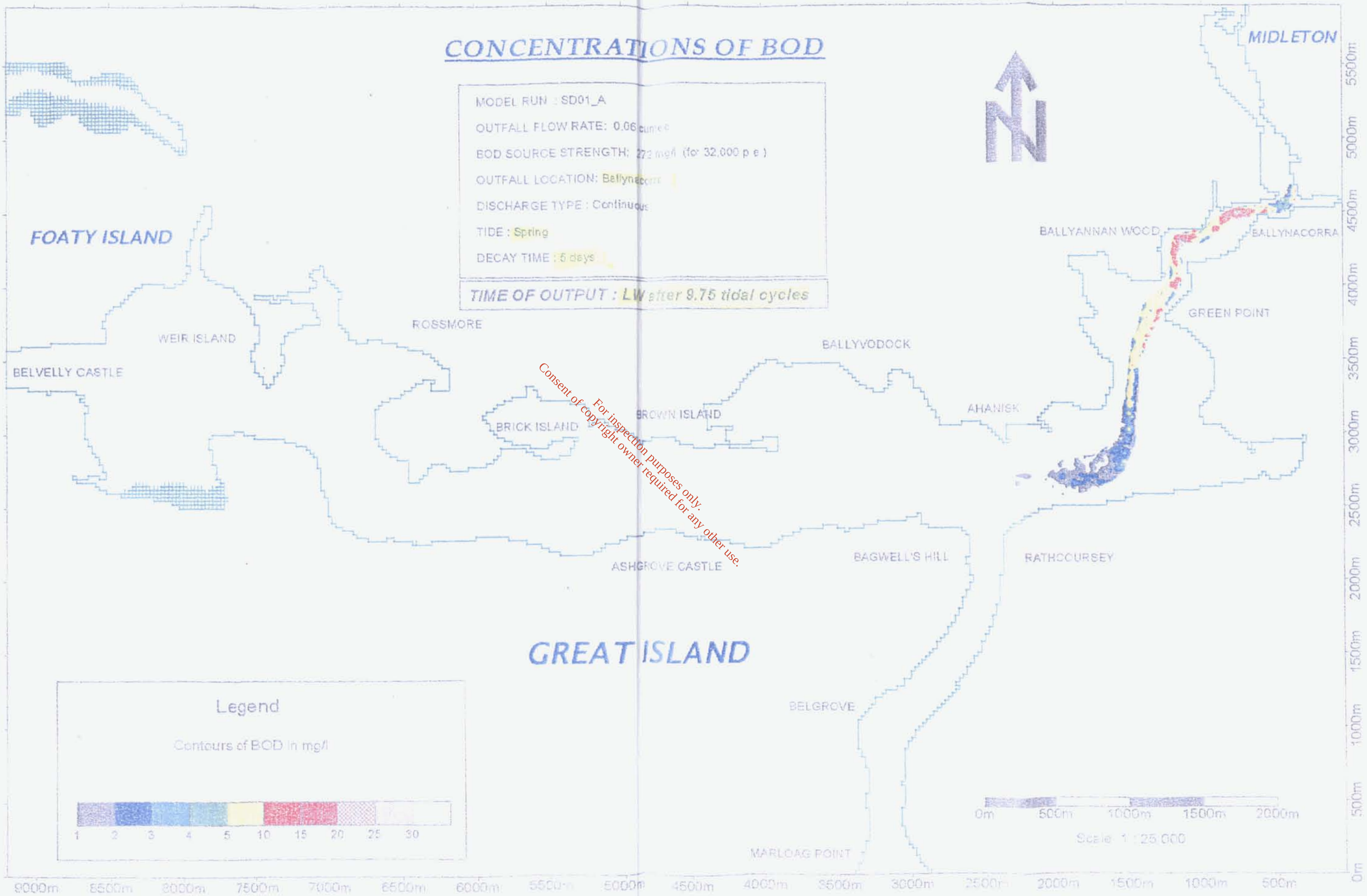
MIDELTON SEWERAGE SCHEME - OUTFALL STUDY

Addendum April 1997

Prepared by Irish Hydrodata Ltd.
Ballygarvan, Co. Cork.

MIDELTON SEWERAGE SCHEME - OUTFALL STUDY

Prepared by Irish Hydrodata Ltd
Ballygarvan, Co. Cork.



INTERMITTENT DISCHARGE OF 0.06m^3/s with BOD of 270mg/l

NEAP TIDE

Outputs at High Water & Low Water

MIDELTON SEWERAGE SCHEME - OUTFALL STUDY

Addendum April 1997

Prepared by Irish Hydrodata Ltd
Ballygarvan, Co. Cork

MIDELTON SEWERAGE SCHEME - OUTFALL STUDY

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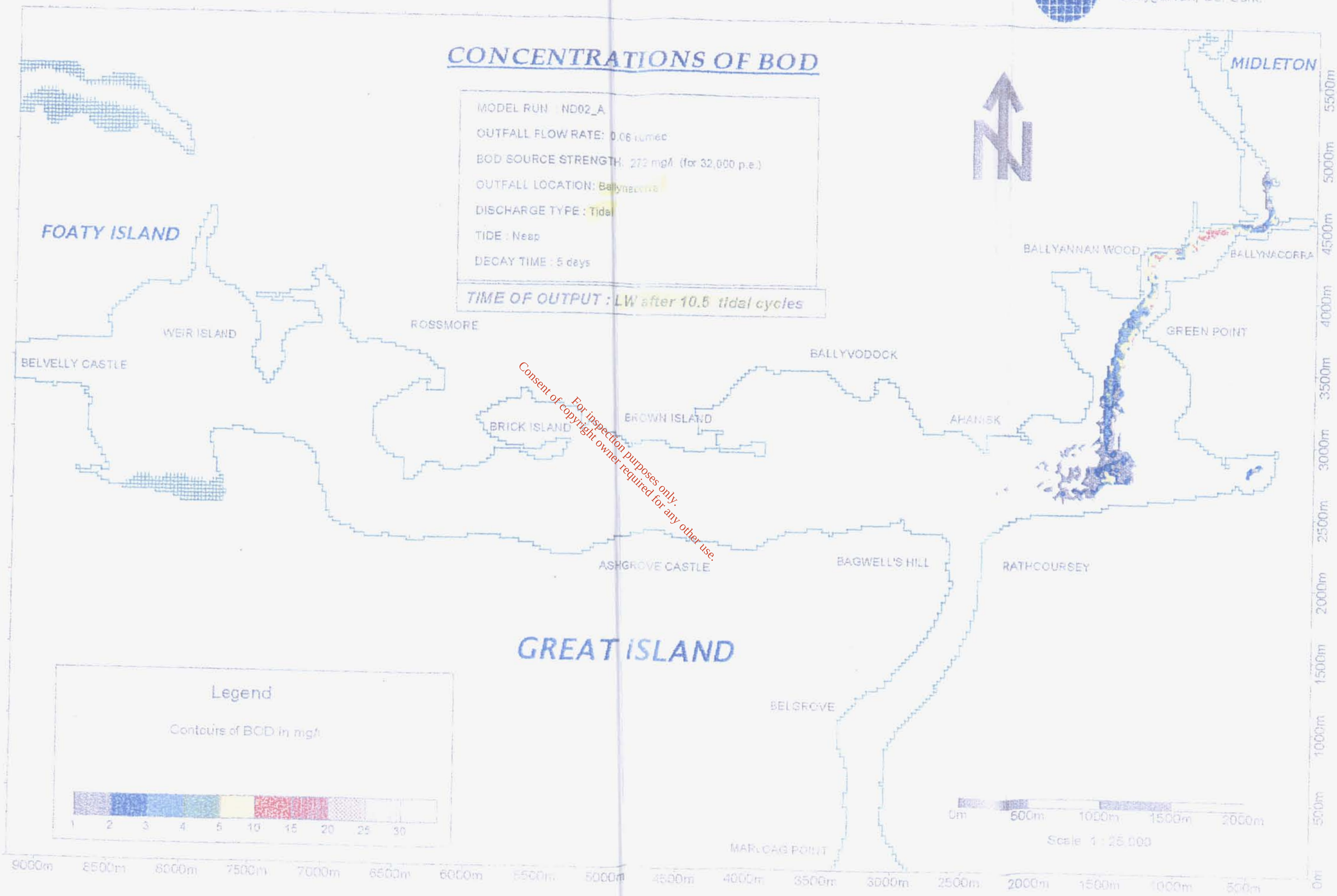
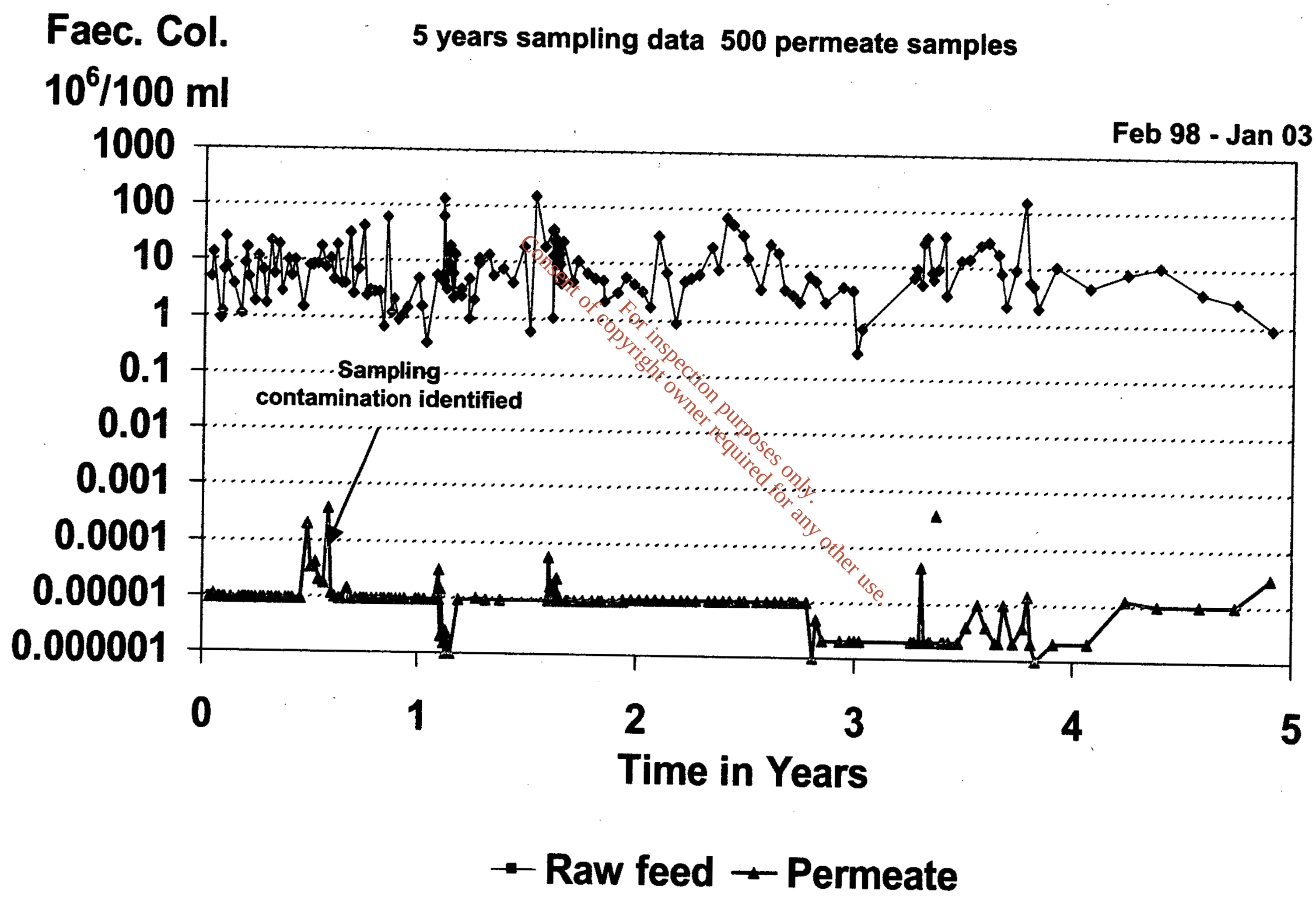
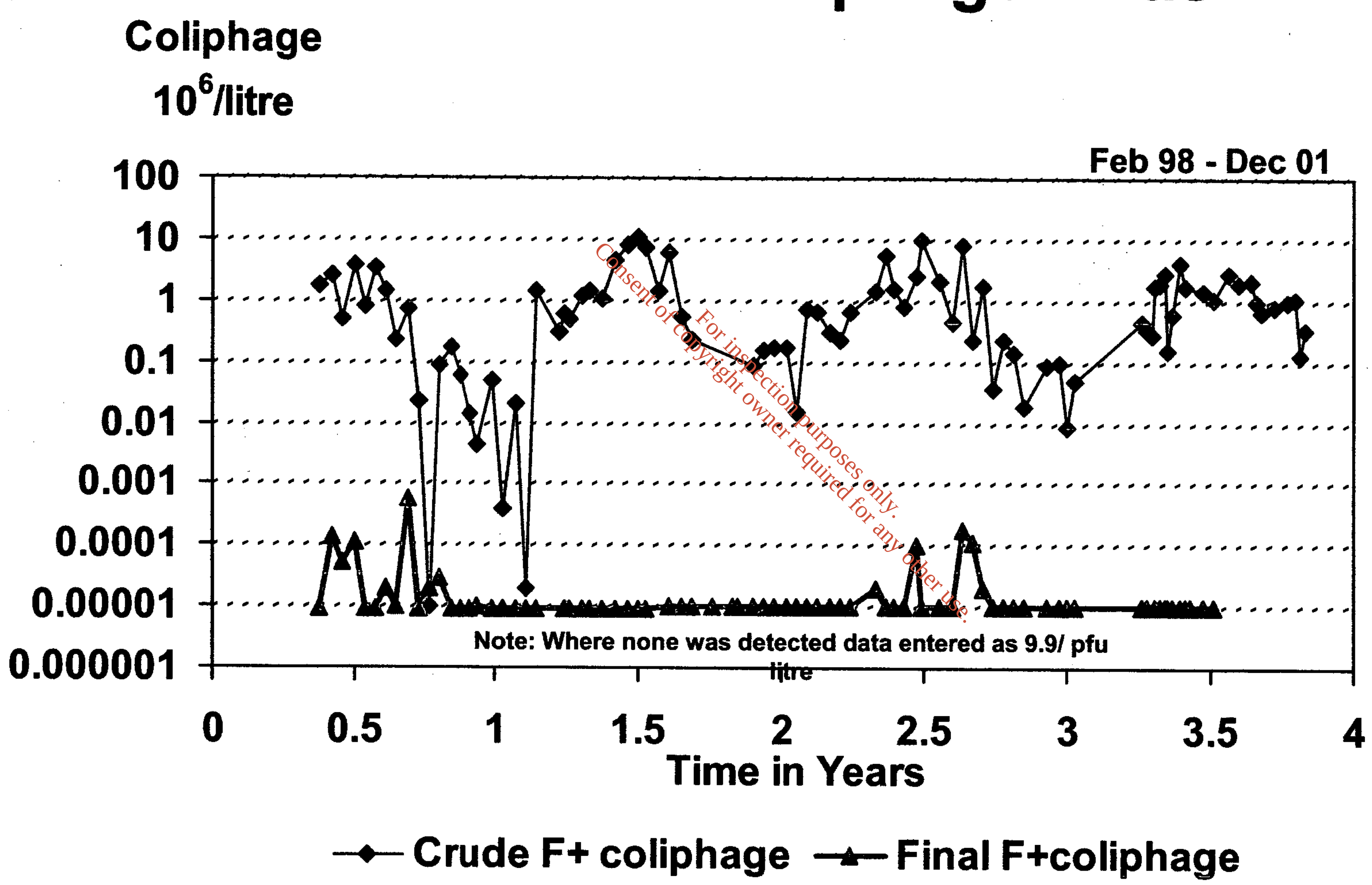


(24 b)

Porlock Faecal Coliforms



Porlock F+ Coliphage Virus



Porlock STW - Compliance Results

Kubota Submerged Membrane Process

Analyte	No of samples		Crude			Final		
	Crude/final		Min	Max	Average	Min	Max	Average#
Total coliforms /100 ml	97	99	2000000	>3000000000	113000000	<2	480	32
Faecal coliforms /100 ml	100	100	300000	160000000	14800000	0	378	7.3
Faecal streptococcus /100 ml	99	100	26000	9400000	1037000	0	20	2
Clostridium perfringens /100 ml	89	86	100	1800000	128000	0	90	8.6
Salmonella /10 litres	94	91	0	>1800	73	0	1	0.01
Enterovirus/virus /10 litres	85	86	<100	360000	9310	<1	18	0.53
F+ coliphage /1 litre	87	77	1 ?	11180000	1490000	0	600	19
Suspended solids mg/litre	127	121	20	1030	210	<1	7*	< 2*
Turbidity NTU (also on line)	-	32	-	-	-	<0.07	1.5	0.23
BOD_5 mgO_2/litre	127	117	22	640	208	<2	<10	< 4

* Excluding samples affected by salt crystals from seawater ingress (no rinsing)

For bacteria and virus = total no detected / total measured samples

June 1998 – January 2003

Typical UV Disinfection - Compliance Results

Weston-Super-Mare STW

UV dose rate 53 mWs/cm^2

Analyte	No of samples	Crude			Final		
		Min	Max	Average	Min	Max	Average
Total coliforms /100 ml	17	12000000	150000000	55900000	10	78000	9270
Faecal coliforms /100 ml	17	760000	34000000	9590000	10	30000	3580
Faecal streptococcus /100 ml	17	50000	4000000	1280000	10	11800	1260
Salmonella /10 litres	16	0	230	44	0	10	4
Enterovirus /10 litres	14	200	23400	8300	3	26000	2040
F+ coliphage /100 ml	14	380	556000	290000	20	71000	9090

3.3.9. Failure to Manage the Storm Water Handling Facilities

The Service Provider is required to manage the stormwater handling facilities in a manner that maximises the amount of available storage. Specifically, the Service Provider is obliged to empty the storm tanks in an expeditious manner (return flows to the foul pumps are to start within 2 hours of inlet flows being lower than the specified pump forward capacity of the foul pumps) to ensure that the tanks have as much capacity as possible for the next wet weather event.

Failure by the Service Provider to manage the stormwater handling facilities in a proper manner will result in the implementation of penalties equal to the value of all monies due to the Service Provider, for the fixed time based charges associated with that section of the Operation and Maintenance Phase, for each day on which overflow incidents occur. Charges measured on the basis of a monthly rate will be assessed in proportion to the number of days in the particular month.

The penalties, to be deducted from the monies due to the Service Provider, will be subject to a minimum value of **€1,500.00** for each day on which overflow incidents occur. This minimum value will be adjusted at the end of each calendar year in accordance with the procedure for adjusting the rates for the Operation and Maintenance Phase.

3.3.10. Failure to Achieve the Specified Treated Effluent Standard

The Service Provider is obliged to achieve a specified standard for a range of parameters in the final effluent discharged from the wastewater treatment plant. The Employer's Requirements also specify the extent of any permissible deviations from this discharge standard.

The deviation of any one of the parameters from the permitted standard will be considered to be a deviation of the effluent quality. The Employer's Requirements define two types of deviations:

<u>Deviations limited in their frequency</u> - an exceedance of the performance standards by not more than 100% for BOD, Total Phosphorus (TP) and Total Nitrogen (TN) and not more than 150% for SS and not more than 400% for UV disinfection and not less than 66% of the target for 15% Dry Solids for sludge leaving the Midleton Sludge Treatment Facility (i.e. not below 10% Dry Solids)

<u>Prohibited deviations</u> - an exceedance of the performance standards for BOD, TP and TN by more than 100% and for SS by more than 150% and for UV disinfection by more than 400%, and less than 66% pf the target of 15% Dry Solids for sludge leaving the Midleton Sludge Treatment Facility (i.e. below 10% Dry Solids)

Charges measured on the basis of volumes of wastewater handled will be assessed on the basis of the Current Treatment Capacity (CTC) as determined by the Employer's Representative having reference to the Monthly Status Reports and in consultation with the Liaison Monitoring Committee (LMC). Charges measured on the basis of kg of BOD removed will be assessed on the basis of the CTC and will assume a compliant final effluent.

(29)

Bailick 1 storm tank weir section hours and volume of the storm overflow pumped to the river.

Days when the storm pumps were not in use over the winter of 2006/07, and yet have a substantial inflow of effluent over the weir section into full storm cells, indicating that the outflow was by gravity (unrecorded by storm pump hours). On all the other days, not listed, use of the storm pumps masked the loss of water to the river through the 4 x 600 mm gravity pipes.

Date 2007		Storm pumps	Weir section (hours of flow)	
September	21	Not in use	12.98	overflow by gravity
	23	Not in use	3.37	filling cells?
	25	Not in use	0	
	26	Not in use	0	
	27	Not in use	0.45	filling cells?
	28	Not in use	20.64	overflow by gravity
	29	Not in use	0	
	30	Not in use	1.29	filling cells?
October	14	Not in use	13.24	overflow by gravity
	15	Not in use	18.36	overflow by gravity
November	10	Not in use	24.05	overflow by gravity
	13	Not in use	16.97	overflow by gravity
	14	Not in use	0	
December				
2007				
January	29	Not in use	21.72	overflow by gravity
	30	Not in use	24.13	overflow by gravity
	31	Not in use	23.95	overflow by gravity
February	1	Not in use	0.26	
	2	Not in use	0	
	11	Weir section meter disconnected		
March	30	Not in use	"	

The weir section meter remained disconnected for the rest of the year.

(27)

MIDLETON SEWAGE TREATMENT PLANT

ADDENDUM

TO

ENVIRONMENTAL IMPACT STATEMENT

TABLE OF CONTENTS

CHAPTER 2

PROPOSED OVERFLOW PIPES FROM THE BAILICK ROAD PUMPHOUSE

(POINT B)

CHAPTER 2

PROPOSED OVERFLOW PIPES FROM THE BAILICK ROAD PUMPHOUSES

INTRODUCTION

Combined sewage flows from the northern side of Midleton gravitates to the existing Bailick Road pumphouse. Ordinarily, this sewage flow will be pumped directly to the proposed treatment plant at Garryduff. In times of storm, any flow in excess of 3 DWF will be overflowed to a proposed storm water balancing tank adjacent to the pumphouse. The storm water tank is designed to have a minimum two hour retention time and all sewage entering the stormwater balancing tank will receive primary sedimentation as a minimum treatment.

After the storm event, sewage in the stormwater balancing tank gravitates back into the pumphouse, where it is then pumped to the proposed treatment site.

For storms of duration in excess of two hours, overflow from the stormwater balancing tank will occur to the river estuary. The quality of the discharge will be better than 20 mg per litre B.O.D and 30 mg per litre S.S. and therefore will exceed the treatment standards laid down by the "Urban Waste Water Treatment Directive (91/271/EEC)". The discharge will achieve this standard because of the high proportion of storm water which will contain dissolved oxygen and also the fact that the retention time in the balancing tank will allow settlement of suspended solids.

Fine screens and baffle plates provide a further safeguard and prevent floating solids being discharged through these overflow pipes.

Overflow to the river from the storm water balancing tank will only occur on average 5 - 6 occasions/annum and the volumes discharged will be no more than 1 - 1.5% of the total storm water collected in the catchment. Overflow to the river will be by means of 4 no. 525 mm. diameter pipelines. These will replace an existing 1,050 mm. overflow. The crown of these pipes can be maintained below the top water level of the river. Any overflow events would be recorded on the schemes telemetry system.

In the event of a breakdown of the scheme which would result in a significant discharge of untreated sewage to Rathcoursey, an alert system should be set up so that shellfish operators can take appropriate precautions.

These overflow pipes are to be constructed from the proposed storm water balancing tank to the river nearby. The location of the Bailick Road Pumphouse is identified on Map No. 2. Details of the modifications to pipework and new pipework are shown on Drg No. 040 together with details of the proposed storm water balancing tank.

THE EXISTING ENVIRONMENT

The location of these overflow pipes is just immediately downstream of the proposed 300mm diameter rising main from this pumphouse to Riversfield Estate and the associated 200mm diameter duct. As previously described, the Owenacurra River is quite wide at this location and an island occurs in the middle of the river at low flows and low tides.

WASTE PRODUCTION AND DISPOSAL

Overflow through these 4 No. 525mm diameter pipes will discharge effluent which achieves or exceeds the standards required by the Urban Waste Water Treatment Directive.

Overflows will only occur during storm periods and, hence, higher river flows. Dilution will further assist in ensuring that no unfavourable waste is produced which would require disposal at a later date.

The quantities of grit removed from combined sewerage systems usually amounts to 3.8 - 11.4m^3/1000 person/annum, the lower figure applying to densely built-up sewerage areas. Appendix 1 at the back of this report estimates the maximum volume of grit which could be discharged as 1.6m^3/ annum. This is an upper bound figure based on the larger value for grit production.

In Appendix 1 it has been estimated that the total volume of discharge to the estuary will be of the order of 2,973m^3/annum. Assuming the discharged effluent to have 30mg/l S.S., then 89kg of suspended solids is discharged through these overflow pipes per annum. Using a S.G. of 1.6 for suspended solids then the volume of suspended solids is discharged is 0.05m^3/annum. NB.

In any event, grit production will not present a problem at this location.

AIR EMISSIONS IMPACT

Effluent discharging through these overflow pipes will have had a maximum retention time of two hours in the stormwater balancing tanks. Because of this relatively short duration, dissolved oxygen levels in the effluent will not be reduced and anoxic conditions which could give rise to smells will not have developed.

River flows, during these overflow occasions, will be higher than normal and river velocities will ensure that further agitation of the effluent will occur immediately it enters the river system. The effluent will then begin to take up oxygen and again increase the dissolved oxygen level.

The operation of these pipes will not result in any significant air emissions.

The construction of these pipes will not result in any air emissions occurring.

EXISTING HABITAT

Existing fish and bird life at this location has been described in Chapter 1, dealing with the construction of the adjacent 300mm diameter rising main and service duct.

APPENDIX I

OVERFLOW GRIT VOLUMES AT BAILICK ROAD PUMPHOUSE

It has been estimated that overflow to the tide at this location will occur on 5 to 6 occasions/annum and the total discharge volumes will be 1-1.5% of the total storm water collected in the system.

Annual Average Rainfall		1,000mm/annum
Paved Area	=	3.88 + 4.07 + 11.87
(contributing to pump sump)	=	19.82 Ha
Total Rainfall collected	=	$\frac{19.82 \times 10{,}000 \times 1{,}000}{1{,}000}$
	=	198,200 m^3/annum

Maximum 1.5% discharged through the overflow pipe.

∴ Volume of discharge	=	198,200 x 0.015
	=	2,973m^3/annum

NB.

Quantity of grit from combined sewage systems based on the maximum value 11.4m^3 /1,000 persons/annum for low density housing development.

Total population served by pump sump = 9,334 persons.

With 1.5% maximum discharge

Volume of grit discharged	=	11.4 x 9,334 x 0.015/1,000
	=	1.6m^3/annum

The pump sump will act as a primary sedimentation tank and the major quantities of grit will be settled out. Therefore, it is extremely unlikely that this volume of grit will be discharged through the overflow pipes.

Fine screens and baffle plates along the weir will prevent floating matter entering the outfall pipe.

Tidal movements will ensure that grit, discharged through the overflow pipe, will not build up around the outfall pipe.

See esp. p18 statistics likelihood of failure. (28)

Water Quality Consenting Standard

Consenting Discharges to Achieve the Requirements of the Shellfish Waters Directive (Microbial Quality)

issue date

Number:	169_01	Status:	V.1	Issue Date:	25/09/01

Document Owner:	Richard Brook	Post:	Acting Discharge Control Process Manager
Document Author:	Catherine Wright	Post:	Principal Officer (Tidal Water Quality)

Approved by:	Martin Griffiths	Post:	Head of Water Quality

If any term or acronym used in this document is unfamiliar you might find the definition in the Glossary, on the Agency's Intranet site:
Information Resources > Glossary of Terms and Acronyms.

TABLE OF CONTENTS

1. Purpose

This document sets out the standards that we apply to the determination of consent applications for discharges that impact on Shellfish Waters so that we meet:

- our obligations in relation to the Shellfish Waters Directive, in particular the 'Guideline' standard for faecal coliforms in shellfish flesh and intervalvular fluid;
- the aspirations of Government in respect of improving the quality of all commercially harvested shellfish beds classified under the Shellfish Hygiene Directive (91/492 /EEC).Contents

are to be undertaken within AMP3 the changed obligations will be subject to DEFRA's procedure for change in companies' agreed environmental obligations affecting the sewerage service (Ref: letter from Stuart Hoggan to Martin Griffiths dated 13 March 2001). Otherwise the improvements will be required after AMP3.

4.2.6 The Agency will not permit any increase in consented load from intermittent discharges to Shellfish Waters, which are aggregated in terms of their combined impact on the Shellfish Water. N B

4.2.7 Where the need for improvements to intermittent discharges (including storm tanks at sewage treatment works) discharging into or affecting Shellfish Waters has been identified, the discharger will be required to demonstrate that:

- The frequency of significant independent spills (see section 6.2.7 of the AMP2 Guidelines, which states "in general... for design purposes a spill greater than $50m^3$ will be significant") should be limited to 10 per annum on average (over 10 years), (Appendix 2, paragraphs 14 to 18) NB.

<u>OR</u>

- The scheme, as a whole, is designed to achieve a water quality standard of ***1,500 faecal coliforms per 100ml*** for at least 97% of the time in the long term. The total duration of impact of 3% applies to at <u>any</u> location within the Shellfish Water and not just the monitoring point (See Appendix 2, paragraph 24).

These design standards are consistent with achieving the water quality standards for 19 years in 20. A similar degree of confidence applies to achieving Category B status for the Shellfish Hygiene Directive

4.2.8 For schemes where the spill frequency design standard is used, the frequency of significant independent spills may be limited to less than 10 per annum on average on a site-specific basis, if the duration of impact of the CSO is considered to be longer than 24 hours (Appendix 2, paragraph 17). NB

4.2.9 Where more than one CSO discharges to a Shellfish Water, then spills should be aggregated, by frequency and volume, so that the combined impact of the aggregated discharges is no more than: NB.

- 10 significant spills per annum on average

<u>OR</u>

- 3% of the time on average.

The details of which CSO spills should be aggregated in a particular Shellfish Waters will need to be made on a site-by-site basis, based on an assessment of the combined impact of the CSOs on the Shellfish Water (Appendix 2, paragraph 19).

4.2.10 Spills from storm tanks from sewage treatment works should also be aggregated with CSO spills as described in 4.2.9.

4.2.11 AMP2 guidelines on the location of CSOs, and screening requirements will apply to improvements to CSOs included in the AMP3 programme (see paragraphs 4.2.3 to 4.2.5 inclusive).

4.2.12 CSOs that are included in the AMP3 programme (see paragraphs 4.2.3 to 4.2.5 inclusive), which discharge directly into or which impact on Shellfish Waters must be fitted with event/duration monitors and recording equipment. This is required to enable water companies to provide annual summaries of the operation of storm discharges to the Agency, and Local Food Authorities, and details of individual spill events to be provided on request from the Agency.

4.2.13 Summary reports of the frequency and duration of spills will be required from the Water Company to coincide with the annual classification under the Shellfish Hygiene Directive (Appendix 3, paragraph 12).

4.2.14 All Emergency Overflows, which are being improved as part of the AMP3 programme, must be fitted with telemetry. This is required to enable the water company to notify both the Agency <u>and</u>

Date	B1 + B2 Overflow manual logs next a.m.	Secondary Treatment Plant Influent f.c./100ml	Pre UV f.c./100ml	Post UV f.c./100ml	Industrial sewer Baby's Walk f.c./100ml	Bailick 1 Ind. Tank f.c./100ml	Industrial + Treated Domestic Ballinacurra Sump f.c./100ml	Rathcoursey Tank f.c./100ml	Storm Tank at Bailick 1 f.c./100ml	Vol. Cu.m/day Ballinacurra (recorded 10.00 next day, same as for the EPS Reports)	Storm o'flow days vol.	Date
These are the results of the bacterial analysis around the Midleton sewerage system for the period that you took in your report as representative of winter storm overflow conditions :												
02.01.03	3,692	3,500,000	12,500	1		11,500	5,500		120,000	15,277	3,692	02.01.03
08.01.03	1,427	1,350,000	3,000	1		90,000	1,000	3,000		14,053	1,427	08.01.03
The Bailick 1 storm tank was not sampled much till this last winter when a good run of samples was taken :												
26.10.06	13,155	4,600,000	2,200	36	1,800	27,000	3,400	6,600	400,000	15,585	13,155	26.10.06
31.10.06	391	7,700,000	50,000	17	100	3,000	720	130	2,000,000	13,670	391	31.10.06
09.11.06	533	4,400,000	34,000	4	760	4,500	350		1,600,000	12,673	533	09.11.06
16.11.06	4,250	3,300,000	1,000	21	3,700	4,200	960	890	880,000	14,730	4,250	16.11.06
23.11.06	3,854	640,000	1,000	1	1,600	2,600	740		2,120,000	15,039	3,854	23.11.06
01.12.06	7,821	210,000	13,800	1	3,500	28,000	620	290	46,000	18,565	7,821	01.12.06
08.12.06	4,484	530,000	2,000	1	1,800	1,600	130		1,600,000	16,718	4,484	08.12.06
11.12.06	2,887	792,000	3,800	1	1,400	600	340	270	730,000	15,283	2,887	11.12.06
19.12.06	1,715	440,000	26,000	1	3,500	2,400	57		2,000,000	14,823	1,715	19.12.06
05.01.07	2,754	4,600,000	96,000	4	2,800	3,000	1,200		2,000,000	15,345	2,754	05.01.07
10.01.07	1,769	2,300,000	29,000	1	440	740	1,300	230	1,100,000	14,354	1,769	10.01.07
15.01.07	1,962	3,200,000	21,000	1	100	990	160		200,000	13,950	1,962	15.01.07
25.01.07	277	2,600,000	42,000	16	840	21,000	490	100	1,400,000	13,750	277	25.01.07
30.01.07	295	6,600,000	10,000	26	1,500	100	240		1,600,000	12,952	295	30.01.07
09.02.07	1,609	4,700,000	1,000	41	10,000	2,300	960	640	3,120,000	15,601	1,609	09.02.07
12.02.07	576	2,400,000	15,800	800	10,000	17,000	10	350	4,800,000	12,530	576	12.02.07
22.02.07	5,184	340,000	35,000	2	2,200	3,300	54,000	680	390,000	20,050	5,184	22.02.07
28.02.07	2,041	2,800,000	10,000	3	1,000	1,700	670		1,000,000	14,527	2,041	28.02.07
05.03.07	10,876	19,000,000	1,000	1	330	3,100	380		12,000,000	18,291	10,876	05.03.07
15.03.07	482	4,200,000	23,000	1	100	580	110		8,800,000	14,141	482	15.03.07
20.03.07	619	2,800,000	22,000	29	280	2,000	720		10,000	14,462	619	20.03.07
30.03.07	40	3,800,000	96,000	22	100	1,400	740		10,000	13,278	40	30.03.07
02.04.07	562	29,000,000	25,000	5	3,200	1,800	90		100	12,766	562	02.04.07
13.04.07	356	10,000	11,000	560	1,000	400	160		5,600,000	11,060	356	13.04.07
19.04.07	785	8,200,000	10,000	10	100,000	100,000	10,000			12,891	785	19.04.07
01.05.07	166	7,600,000	290,000	4	320	1,000	1,000			11,054	166	01.05.07
09.05.07	58	3,900,000	76,000	12	100	22,000	3,500	10		9,668	58	09.05.07
14.05.07	0	10,000	110,000	14	100	1,900	200,000			11,781	0	14.05.07
24.05.07	0	19,000,000	1,000	13	360	840		13,000		9,623	0	24.05.07

*

*

32% of samples at the storm tank are higher than the influent to WWTP

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Bailick 2 storm tank weir section hours and volume of the storm overflow pumped to the river.

Days when the storm pumps were not in use over the summer of 2007, and yet have a substantial inflow of effluent over the weir section, indicating that the outflow was by gravity (unrecorded by storm pump hours). On all the other days, not listed, use of the storm pumps masked the loss of water through gravity flow out of the tank.

Date 2007		Storm pumps	Weir section (hours of flow)	
April	1	Not in use	14.70	overflow by gravity
	7	Not in use	4.93	overflow by gravity
	8	Not in use	24.95	overflow by gravity
	9	Not in use	22.40	overflow by gravity
	10	Not in use	21.55	overflow by gravity
	14	Not in use	22.12	overflow by gravity
	22	Not in use	18.96	overflow by gravity
	27	Not in use	7.51	overflow by gravity
	28	Not in use	0.00	
	29	Not in use	4.09	overflow by gravity
	30	Not in use	16.59	overflow by gravity
May	1	Not in use	13.24	overflow by gravity
	9	Not in use	20.48	overflow by gravity
	11	Not in use	24.39	overflow by gravity
	13	Not in use	3.57	overflow by gravity
	15	Not in use	24.47	overflow by gravity
	23	Not in use	7.88	overflow by gravity
	24	Not in use	0.00	
	25	Not in use	0.00	
	26	Not in use	0.00	
	27	Not in use	0.00	
	28	Not in use	0.00	
June	4	Not in use	18.74	overflow by gravity
	5	Not in use	0.00	
	6	Not in use	0.00	
	7	Not in use	0.00	
	8	Not in use	0.00	
	9	Not in use	0.00	
	10	Not in use	0.00	
	11	Not in use	4.22	overflow by gravity
	17	Not in use	26.70	overflow by gravity
	24	Not in use	23.55	overflow by gravity
July	3	Not in use	17.03	overflow by gravity
	11	Not in use	24.11	overflow by gravity
	12	Not in use	18.29	overflow by gravity
	20	Not in use	22.09	overflow by gravity
	21	Not in use	0.02	
	22	Not in use	15.13	overflow by gravity

Date 2007		Storm pumps	Weir section (hours of flow)	
August	3	Not in use	9.82	overflow by gravity
	4	Not in use	0.00	
	7	Not in use	0.00	
	8	Not in use	0.00	
	9	Not in use	0.00	
	10	Not in use	0.00	
	11	Not in use	0.00	
	12	Not in use	17.04	overflow by gravity
	20	Not in use	0.00	
	21	Not in use	0.00	
	22	Not in use	0.00	
	23	Not in use	0.00	
	24	Not in use	12.55	overflow by gravity
	25	Not in use	16.21	overflow by gravity
	26	Not in use	0.00	
	27	Not in use	0.00	
	28	Not in use	0.00	
	29	Not in use	0.37	
	30	Not in use	0.00	
	31	Not in use	0.00	
September	1	Not in use	0.00	
	2	Not in use	5.46	overflow by gravity
	3	Not in use	9.13	overflow by gravity
	4	Not in use	0.00	
	5	Not in use	11.98	overflow by gravity
	6	Not in use	20.39	overflow by gravity
	7	Not in use	0.00	
	8	Not in use	0.00	
	9	Not in use	0.00	
	10	Not in use	0.00	
	12	Not in use	20.44	overflow by gravity
	13	Not in use	15.10	overflow by gravity
	16	Not in use	6.22	overflow by gravity
	17	Not in use	6.73	overflow by gravity
	18	Not in use	0.00	
	19	Not in use	0.00	
	20	Not in use	0.02	
	22	Not in use	13.81	overflow by gravity
	23	Not in use	0.00	
	24	Not in use	5.94	overflow by gravity
	25	Not in use	15.18	overflow by gravity
	26	Not in use	16.85	overflow by gravity
	28	Not in use	20.00	overflow by gravity
October	5	Not in use	24.65	overflow by gravity
	8	Not in use	0.00	
	9	Not in use	0.00	
	10	Not in use	0.00	
	11	Not in use	14.68	overflow by gravity
	20	Not in use	25.39	overflow by gravity

WWTP and the new proposed terminal at the Midleton Area Office to enable instantaneous and totalised flows to be recorded and download. During the tender period the Service Provider is to ascertain/satisfy themselves that there is suitable up and downstream straight pipes and the pipeline is constantly submerged in order that the proposed new flow meter can be installed and calibrated to the tolerance +-5%. In the event that there is insufficient space to provide the correct up and down stream diameters or the existing pipeline is not constantly submerged the Service Provider is to provide an alternative solution so that final effluent flow measurement can be obtained to the required tolerance. During the tender period the Service Provider is to ascertain/satisfy themselves that area velocity flow meters can be installed on the inlet to the pumping station. The Service Provider is to include all costs above associated with the installation of the flow meter including pipeline modifications and temporary overpumping during installation and connection to the telemetry and SCADA system including software modifications. The flow meters are to be installed within four months of Contract Commencement date.
The Service Provider is to install a helix water flow meter on the incoming water service to the PS within four months of the Contract Commencement date.

3.11. PROPOSED DWYERS ROAD PUMPING STATION – (OPTION B)

3.11.1. INTRODUCTION

The proposed Dwyers Road Pumping Station is required to receive part of the wastewater collected in the local sewerage network. The collected wastewater is then to be pumped forward to Midleton WTTP. All flows received from the Dwyers Road collection network will either be pumped forward to the Midleton WWTP or stored in the storm holding tank and then subsequently pumped forward to Midleton WWTP when the storm has ceased. No storm overflows or emergency overflow will be installed from the pumping station. Once the pumping station has been built and commissioned rates will be agreed between the Client and Service Provider (based on rates in this Contract for similar size pumping stations) prior to the Service Provider undertaking the Operation and Maintenance activities for the remainder of the 10 year operating period or less as determined by the Employer.

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3.12. BALLINACURRA No. 1 TREATED EFFLUENT PUMPING STATION – (OPTION B)

3.12.1. INTRODUCTION

The Ballinacurra No. 1 Treated Effluent Pumping Station is required to receive all treated effluent flows from Midleton WWTP and treated industrial effluent from Bailick No. 1 Industrial sump. During periods of heavy rainfall the pumping station will also receive storm water flows from Bailick No. 2 and Ballinacurra No. 2 foul pumping station. The treated effluent/storm water is pumped forward to the tidal holding tank at Rathcoursey and discharge into Cork Harbour via a gravity outfall pipeline during low tide.

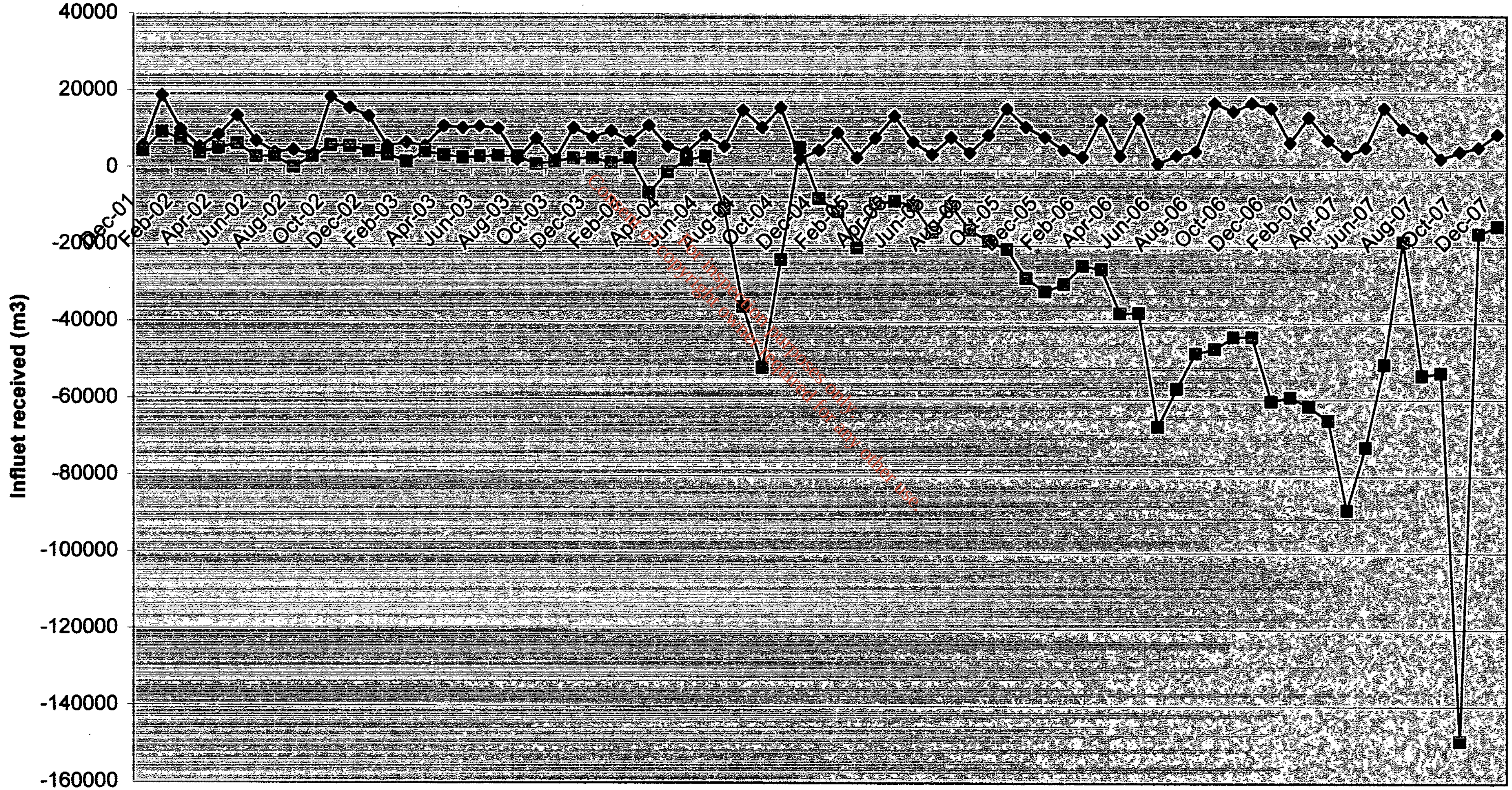
NB

3.12.2. BALLINACURRA No. 1 TREATED EFFLUENT PUMPING STATION – CONTRACT LIMITS

The limits of the Operation and Maintenance Works at this site are as follows:

- All items contained within the site boundary, extending vertically up into the air or down into the ground as appropriate;
- Storm water overflow pipe sewers, commencing at the boundary of Ballincurra No. 2 foul pumping station

Flow received into Bailick 2 in addition to the flow from Bailick 3 (shown red) with rainfall (blue) in mm exagerated x 100 from 2002-2007.



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Report Supporting Rejection of Midleton WWTP Consents to Discharge at Rathcoursey Point and at the Storm Overflows in Midleton.

by

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Report Supporting Rejection of Midleton WWTP Consents to Discharge at Rathcoursey Point and at Bailick 1 & 2.

1. Introduction

The following report contains my opinion, comments on the adequacy of design and the interpretation of the analytical results contained in the various monthly reports which indicate the efficiency of the process installed at Midleton Waste Water Treatment Plant.

I have taken the 1993 report produced by Cork CC as the basis of the design since this report is constantly referred to in correspondence from Cork CC and M C O'Sullivan, the design consultants commissioned by Cork CC.

As a Chartered Engineer & Scientist I was the "only expert" engaged by my client to analyse all engineering and scientific data and hence perform a dual role. Since I have had many years experience in the design, construction and operation of waste, water treatment works I feel completely confident in performing the dual role I was engaged to carry out.

My comments on the engineering design of the W.W.T.P are based on the analysis of the parameters detailed in the 1993 Report and their adequacy to achieve the desired results. It will be seen in the chapter on "works design" that I totally disagree with the design and consider it to be totally inadequate to fully treat the design load stated in the report. I also state that the basic concept of the works design i.e. an extended aeration process is impossible to achieve and hence from commissioning to the present date has never produced the desired result. Even with the obvious shortfall, comments by various engineers and operators insist that the plant is capable of achieving a standard 2-3 times the design figure.

The above opinion is also reflected in reports written by M.C. O'Sullivan 2002 and Pettit 2004 on the adequacy of the Midleton Plant. Both consultants base their conclusions entirely on the data produced by EPS agents of Cork County Council. Neither comment on the accuracy of this data and both accept its conclusions in spite of the fact that simple analysis shows both data and conclusions to be highly flawed.

I base this fact on the very detailed analysis of the monthly reports I have carried out over several years and in my opinion have shown the results presented in the reports are impossible to achieve.

There is great inconsistency over the years in the p/e arriving at the works which can vary from under 3000 to over 60000 and yet even at the high loads, compliance with the required standards is always claimed in the monthly reports. Other parameters such as BOD loading rates, sludge production from oxidation, retention times etc., which are often many times above the basic design figure, seem to have no ill effects on the performance of the Treatment Plant.

Suspended solids figures, a large proportion of which are mineral, and hence un-oxidisable, seem to be lost within the system, since the monthly sludge disposed of at the plant is much lower than that element arriving plus activated sludge produced, leaving large amounts unaccounted for.

By far the greatest flaw in the design of the plant is the lack of availability of oxygen. I calculate this figure every month in my report and show that the oxygen levels are too low to achieve the results claimed and which have been confirmed by the suppliers of the compressors in correspondence I have received.

All the above points confirm to me how very little thought went into the initial design and shows that the general approach by Cork C.C. and M.C.O'S was that even with little or no secondary treatment, there would be minimal environmental impact on the estuary.

This may be so when considering visual impact, but not when discharging to waters containing oyster farms, where the general public are the canaries of the contamination and which, as a consequence of this plant, are now closed, with all the resulting financial loss and reputation, both of which will take a long time, if ever, to re-establish.

2. Report

The reasoning behind the need to construct a full treatment plant at Midleton is well recorded.

Preliminary correspondence on the principles to be adopted in the design and the high standards of effluent required from the plant to fulfil EU and Irish directives are also well documented.

An initial report in 1981 advocated an extended aeration oxidation system, which would achieve any reasonable standard imposed at Midleton. This concept was later repeated in the 1991 Report brief, which stated, *"The principle of precautionary action, even where there is no definite scientific evidence to link emissions or discharges with environmental effects, is to be carried out."*

A brief to construct a full treatment works to include extended aeration and UV treatment was given to the firm of civil, structural & environmental engineers, M.C.O'Sullivan, Consulting Engineers.

A request was made by the water services section of the Dept of the Environment to Cork C.C to include primary settlement as part of the treatment process so as to comply with the requirement of the sludge strategy report, but was appealed by Cork C.C. on the basis that, 1) Midleton would only produce 144 tonnes of sludge per annum and 2) that the County Council was concerned that should the High Court case be heard in the near future, it could be given a dead line by the court to install new treatment plant at very short notice. It was therefore worried that the present request to carry out a review of the preliminary report proposals could have resulted in a critical and possibly very expensive delay in implementing the proposals.

The appeal was upheld and hence the design of the Midleton treatment plant was to be extended aeration with UV disinfection (added later) – but without primary sedimentation.

2.1 Design

Mr. Michael J. O'Sullivan in a letter to T. Coughlan, S.E.E., Cork C.C., dated 02/03/95 entitled *"Some Notes on Options as discussed"* made several comments on the proposals, which had a major bearing on the ultimate design of the treatment plant.

1) "The versatility to remove nitrogen in Midleton is extremely desirable, as it would allow for compliance with any changes in the status of the receiving waters."

2) Showing a table, which included nitrogen reduction of 10% as a result of primary sedimentation, he concluded, *"If nitrogen reduction is a parameter then primary sedimentation has no significant effect."*

3) On the oxidation stage clearly therefore, "if nitrification and de-nitrification are required then extended aeration with a sludge age in excess of 25 days is required."

4) His comments on the sludge produced from various types of treatment are quoted below. *"Conventional activated sludge plants produce twice as much sludge as an extended aeration plant and need further stabilisation. Extended aeration plants produce a stabilised sludge which is inert."* This in my opinion is the fundamental error that led to the "wrong" design being installed at Midleton – because the above statement although fundamentally correct is not so for the Midleton case.

5) In concluding his letter, M.J.O'Sullivan pointed out that there was **very little buffering available for shock loads**- the main cause of all the problems at the treatment plant.

2.2 <u>Design Parameters</u>

Quote from M J O'Sullivan & Co 12th December 1994 *"The per capita loading parameters used in the design of this scheme are based on many years of experience and on actual measurements in Midleton and not on theoretical figures."*

This being the case I examined the many pages of hydraulic calculations, which contributed to the final dry weather flow (D.W.F) figure of 2,350 cu m/day for stage 1 and 3,850 m³ day for stage 2 and concluded that these calculations, the 26pp attached as C.1 with the Application, had little bearing on the final design.

Nowhere in the sewerage design figures, or DWF calculations, did I find reference to **present** "total flow" measurements, which existed at the time, which, by 2000, far exceeded the proposed DWF. In the body of my main report you will find reference to accepted and long established practice in arriving at a meaningful final DWF.

It is quite evident when analysing the monthly reports produced since the treatment works commenced operating, that the DWF has never been achieved and the plant] mainly operates at between 2.5 to 3+ times the DWF design figures, again a major miscalculation.

Retention time in the AS plant design for 1 DWF is quoted at 29 hrs 34 mins, (low for a conventional EA plant, often quoted in literature at 36-48 hours aeration time) this may produce some element of stabilisation if the BOD loading rates are low.

However the hydraulic load is always too high to allow for any stabilisation and this reduces the retention time to less than 9 hrs average during the daily peak flow hours. This completely destroys the design concept of the plant and increases the upward flow velocity in the clarifiers which in turn effects the settlement times and the settling characteristics of the sludge produced in the E.A plant, as indicated by S.V.I.'s which are always well above the levels where good settlement and consolidation are achieved.

In the absence of primary sedimentation, the floc absorbs mineral matter from the suspended matter hence the sludge yield in this case increases to 1kg sludge/kgBOD from 0.4 kg sludge/kgBOD recorded in conventional extended aeration following settlement (I.W.E.M handbook)

Since the plant is continuously receiving 2-3 times design flow, the loading rate reduces from a range 0.05 – 0.15kg BOD/kg MLSS to 0.05 – 0.1kg BOD/kg MLSS (I.W.E.M, Boon & Thomas 1998) since the upward velocity in the settlement tanks approaches the critical figure.

Wide ranges in sludge production are the result of significant difference in the non-biodegradable solids which are present in waste waters. Even waste waters which have similar origins (such as domestic sewage) can produce different quantities of surplus activated sludge depending on such factors as hardness of the water, effectiveness of primary sedimentation in removing suspended solids, sludge loading rate and temperature of the waste water (Boon et al. CIWEM 1998). However, this will make no difference to the sludge balances between the incoming SS, SS in the effluent and the sludge produced on-site and disposed of. This is obviously not what is happening at Midleton , as I attempt to show in my calculations later.

2.3 <u>The absence of primary sedimentation and the problem of "shock" loads</u>.

The decision to exclude primary sedimentation at the treatment works is in my opinion a major design fault, as is the totally incomprehensible decision to pump raw settled sludge from the Bailick 1 storm tanks to the treatment works. Any engineer designing a treatment plant would examine the benefits of primary settlement and realise what these are and also recognise the heavy pollution load imposed on the A.S plant by the introduction of raw sludge at the inlet of an EA plant, a practice not recommended in any design manual.

I quote from Kempe (the engineer's standard reference). ***"In terms of overall efficiency it should be possible under most circumstances and within accepted design criteria to achieve 65-70% reduction in suspended solids, while at the same time reducing the BOD by 30-40%, by the use of primary sedimentation."***

To have excluded this stage of the treatment on the grounds of odour is to conclude, with the consequent assumptions made, that it is perfectly acceptable to pump volumes of liquid with high suspended solids directly into an aeration unit designed to operate on a finely balanced plug flow system with a built in sludge stabilisation element and depending on a designed α factor for aeration efficiency.

Maximum design effort appears to have been given in sizing the storm tanks at Bailick 1 with careful consideration to overflows etc., but no thought at all appears to have been given as to how to dispose of the huge loads of solids, which would be imposed at Midleton when the tanks were emptied.

If primary sedimentation were available, some "arrest" of the sludge would take place in these tanks, although soluble BOD would still impose extra "shock"load when pumping from Bailick 1 took place.

It can also be concluded that primary settlement, since reducing particulate matter, must also reduce viruses, but although microbiologists agree with this statement qualitatively they cannot agree quantitively. This would not matter with a works correctly designed, since no carry over of particulate matter occurs. For Midleton this is not the case.

These shock loads appear with regularity in the monthly reports with no explanation ever given as to their treatability.

Unless primary sedimentation and Bailick 1 & 2 storm tank sludge disposal arrangements are included immediately, Midleton plant can never achieve the desired standard and will always remain in constant violation of its consent conditions.

2.4 Extended aeration unit

The design concept of the unit appears to me to have been completely misunderstood. In the 1981 Report the design was clearly that of an oxidation ditch (drawings were shown) to nitrify, de-nitrify and aerobically stabilise any sludge produced.

Conceptually there is no flaw in the reasoning behind this design (I have designed and operated these plants and written papers on their design when they became the "vogue" in the late 70's).

They do in fact achieve the result they are designed to do very well and do reduce the volume of sludge produced but not as designed at Midleton. Because the flow rates are so high and hence retention times so low, the BOD loading rates have in turn to be low. Under these conditions no sludge stabilisation takes place and hence sludge production is higher than conventional plants. Since there is no primary settlement stage the mineral matter present as suspended solids (60%-70%) is incorporated into the sludge floc thus increasing production to that of a high rate A.S plant.

It seems to me that when M.C.O'Sullivan & Co were considering the design of Midleton in the1993 Report, they appear to have lifted a perfectly good design of an EA plant from the 1981 Report and failed to adjust the design parameters of hydraulic retention time, loading rates and sludge yield to meet the new design conditions.

There seems to be a complete misunderstanding of oxidation with and without primary settlement, the role of oxygen in the aeration process and the effects on sludge yields of the absence of primary settlement.

Yields of 0.4 kg sludge / kg BOD oxidised were used to calculate the TDS produced by the plant, this totally overlooked the impact of the inorganic matter which is carried over into the unit in the form of suspended solids present because of the omission of primary sedimentation

2.5 Loading rates

The plant was designed to operate on a "constant" loading rate of 600kg BOD day and on the assumption that, if the hydraulic load increased, the biological load remained the same, since any increase in flow was only infiltration and did not impose any additional organic load. Inspection of the Monthly Reports shows that this is not so and that greater flows very often simply result in greater organic loads.

No account was taken of the obvious diurnal variations and no reference is made to this figure in any of the reports or indeed correspondence in my possession. This figure can vary between 1.25 – 2.0 times the average daily flows. Hence during peak hours (10.00am – 5.00pm) the polluting load on the plant can increase considerably. Even at the design load (600kg) the rate can increase to between 750- 1200 kg/day and hence requires the appropriate rate of increase in oxygen production.

Rates as high as 3700kg/ BOD day with an average of 1286 kg/BOD were recorded in January 2002, the time when reasonable records began.

These levels continued into February with a high of 1678 kg (recalculated from 21st February figures), March 4151kg, April 1859kg, and so it continued every month July, 1780, January 2003 2593kg, December 2003 3305kg and still continues to the current date showing that most monthly BOD averages are much higher than the design figure – and especially when the on-site results are added in.

The installed air capacity, hence oxygen levels, is totally insufficient to oxidise even the average daily load of BOD and NH_3-N which arrives at the plant to the levels recorded in the monthly reports and each month my report shows this.

Oxygen levels are available to produce a 20:30 standard without nitrification from an average daily load of approximately 1000kg if sludge age is around 4-5 days and MLSS levels are carefully monitored. But since the Midleton Plant is designed to completely nitrify, it is in my opinion only capable of an approximate load of 500kg BOD/day if the diurnal variation is taken into account, and air volume at maximum.

Day-time peak loads are ignored, as are the grossly polluting "shock loads", which are not recorded as point loads hence their true concentration is not calculated. There are however occasions when I have been able to do this by using pumping rates at Bailick1.

Installed blower capacities are totally inadequate and if the recorded monthly running hours are examined for most months only sufficient oxygen is produced to treat a proportion of the incoming flow, some months this figure is less than 50% of the average daily flow.

α factors seem to be completely ignored in the design documents; no allowance has been made for this to show that oxygen output can be reduced by 50% due to oxygen/liquid transfer difficulties. These are, of course, exacerbated by the lack of primary sedimentation and the high levels of oils, fats and greases, which thus enter the aeration streams – all of which reduce the solubility of the oxygen supplied by the compressors.

The design engineers seem to have overlooked the fact that with extended aeration the initial α factor can be as low as 0.4 and often never increases beyond 0.6. Hence from the initial operation of the plant to date, the oxygen levels and its role have been completely misunderstood.

N.B. In my calculations I often give factors of 0.75 (giving the plant the maximum benefit of the doubt) but this still falls far short of the required quantity of oxygen.

2.6 <u>Suspended Solids Levels and sludge production.</u>

Typical sludge production rates in the UK are :

Feed	**Mode**	**Dry solids kg/kg BOD**	**Volume % DWF**	**SRT (d)**
Crude sewage	High rate	>1	3	1-2
Crude sewage e.g. Midleton	Extended aeration	1	3	>10
Settled sewage	High rate	1	3	2-3
Settled sewage	Conventional Nitrifying	0.8 – 1.0 0.6-0.8	2 1.5	4-6 8-15
Settled sewage	Extended	0.4 – 0.7	1.0	>15

Because there is no primary sedimentation in Midleton, some 30% of the unoxidisable and mineral element of the SS entering the plant (c. 70% of the SS in all), will be bound up in the floc of the AS. **This will raise the sludge yield in an extended aeration plant from the 0.4 -0.7 kg sludge produced/kg BOD to 1.0 kg sludge/kg BOD oxidised (IWEM Design Manual p.12).**

Suspended solids loads entering the Midleton WWTP are extremely high and indicate yet again a total lack of understanding of the implication of these loads on the E.A system. This figure plus the actual sludge yield at approx.1kg sludge/kg BOD, as opposed to the simplistic figure quoted in the design, make up the total value of sludge production per day.

Daily sludge yields are quoted in the monthly report, which equate to the sludge TDS disposed of each month. It can be seen that a massive shortfall exists each month between the TDS disposed of and the weight of suspended solids arriving at the plant, together with the weight of the activated sludge generated by the plant. The question must be asked, where does the shortfall go?

The suspended solids cannot be oxidised due to the insufficient air supply, and even if this was available, only 30% would be oxidised anyway i.e. the mineral element still remains.

In February 2002 the total sludge removed from the plant was recorded as 10.6 tonnes however days with suspended solids of 1354kg, 1113kg, and 1664kg, a total of 4131kg were recorded during the month. So for the rest of the month only a little over 6 tonnes of sludge were produced. Of course this is totally incorrect and indicates that for the most of the month the plant did not operate as recorded, or the records are also incorrect.

Again in March 2002, TDS removed is 10,500kg yet on the 28th March the monthly report shows a solids load of 8759kg, with a BOD load of 4151 kg, and on the previous day a solids load of 2294 kg with a BOD load of 2098 kg. Thus a total month's sludge figure is recorded in 2 days. There is no record of the effect on the receiving waters during March, but it must have been significant. Similar high figures appear throughout the remaining months, which do question the annual sludge production figure quoted by Cork C.C of 144 tonnes/annum. In my estimation and, although based on somewhat sparse figures, I would put the annual sludge figure between 500 – 600 tonnes. **This gives some approximation as to the weight unaccounted for during the year, which is discharged to the receiving waters in complete violation of the consent conditions.**

2.7 Oxygen requirements.

Mechanism of oxygen transfer

Aeration serves two purposes:

a) It satisfies the demands of the microbial population
b) It maintains the MLSS in suspension.

The above can be achieved by mechanical means or air diffusion. In the case of Midleton "fine bubble" aeration is the preferred option.

Transfer of oxygen to the liquid phase takes place as follows:

1. Transfer from bulk gas phase
2. Transfer across interface
3. Transfer to bulk liquid phase

The transfer mechanism can be affected by temperature, surface-active material, fatty acids.

Since such impurities affect the mass transfer efficiency this has to be taken into account when assessing the efficiency of aeration processes and can be expressed as the alpha factor,

$$\alpha = \frac{(K_{L}a)\text{ waste water}}{(K_{L}a)\text{ clean water}}$$

and has a range of 0.63 – 0.94 depending on degree of impurities which have been calculated by several workers and Kla is the mass transfer coefficient.

The alpha factor cannot be derived by theoretical means but it is reasonably easy to measure in full scale plant. The alpha factor is a function of the bubble size produced by the aeration process and the loading rate of various constituents of the sewage. FBDA systems (fine bubble diffused air) are more susceptible to adverse alpha-factor effects when installed in plug flow aeration tanks (Midleton).

At the region of a plug-flow aeration tank, which is designed to achieve nitrification, (tanks 2 & 6 Midleton beginning of carbonaceous and nitrifying process) the process oxygen transfer rate might only be 40% of the clean water rate. As the treatment proceeds, the alpha factor increases until rates approaching the clean water value are obtained near the tank outlet.

The major problems in the case of the AS Plant at Midleton are the extremely high suspended solids, which frequently arrive at the Plant, and the high rates of flow, both of which affect the rate of oxygen transfer.

Usually the α factor increases over the length of an aeration pass because the concentration of surface active agent decreases. The α factor is also lower for high rate processes than for low rate complete mix processes.

However in the case of Midleton since the level of suspended solids is high at all times and the flow is always 2-3 times the design, then oxygen transfer will be greatly effected.

Literature tends to suggest a figure as low as 0.4- 0.5 as the average for cases similar to Midleton.

One large UK Water Plc suggests α factors of :-

Tank	1	2	3	4
α factor	0.4	0.5	0.6	0.8

Average 0.58 for a well balanced and correctly loaded conventional AS Plant (IWEM Design Manual).

Using the above criteria it would be my opinion that Midleton must constantly be "struggling" around the α = 0.5 mark

2.7.1 Carbonaceous oxidation.

Air is provided by blower which is passed through porous diffusers placed in the bottom of the treatment unit.

Oxygenation efficiencies of 2 kgO_2/kWh measured at the aerator are quoted by manufacturers of this equipment and plants are designed around this figure. In conventional aeration oxygenation efficiencies of the fine bubble diffused – air system exhibit values in the range of 500 – 700 kWh/tonne of oxygen produced.

In the case of Midleton, 2 blowers duty and 1 standby are installed each of 30kW. Hence available oxygen/day = 2x 30 x 2 x 24x α = 2880kg x α

I have taken α as 0.6 in some circumstances, but given a higher value 0.85 or even 1 in others, giving maximum benefit of the doubt due to the high BOD's & SS compared to the design figures. I can often justify α = 0.5 due to associated grease and fats. I have seen no figures to suggest that three blowers are used, or if they can be used, since the flow meter maximum recording is for 2 blowers. In my experience meters reflect maximum capacity of associated pipework.

2.7.2 Ammoniacal-Nitrogen oxidation

The Midleton plant is designed for complete nitrification and de- nitrification. Sludge wastage rates and sludge recycled volume are calculated to this end.

Nitrification in AS reactors involves two types of autotrophic bacteria:

$NH_4+ + 1.5\ O_2 + (Nitrosomas) \longrightarrow NO_2- + H_2O + 2H+$

$NO_2- + 0.5\ O_2\ (Nitrobacter) \longrightarrow NO_3-$

The main factors affecting nitrification are:

i) Biomass growth rates
ii) Dissolve oxygen
iii) Inhibiting substances
iv) Temperature
v) PH

Under steady state conditions the specific wastage of sludge is equal to the reciprocal of the sludge age (SRT) and is determined by sludge loading rate, MLSS and period of aeration.

As the sludge loading rate is a major factor affecting the production rate of sludge, operating experience has shown that where DO levels >2mg/l nitrification will be achieved provided that the loading rate does not exceed 0.15kgBOD/kg sludge /day.

During the growth of autotrophic bacteria a small amount of oxygen is made available by the reduction of CO_2 so that the net weight of molecular oxygen required by nitrosomonas to oxidise 1gm of ammoniacal nitrogen is 3.22g and for nitrobacter to oxidise 1gm of nitrate N is 1.11g.

$5CO_2 + 55NH_4+ + 76O_2 \longrightarrow C_5H_7O_2N + 54NO_2- + 52H_2O + 109H+$

nitrosomonas cells.

$5CO_2 + 400NO_2- + 195O_2 + NH_3 + 2H_2O \longrightarrow C_5H_7O_2N + 400NO_3-$

nitrobacter cells.

Hence the overall requirement for nitrification is 4.3 times the concentration of ammoniacal-N oxidised to N and this is the figure I use in all calculations to establish oxygen demand.

The requirement for oxygen to nitrify/de-nitrify approximates to a third of the oxygen requirement for carbonaceous oxidation of sewage BOD. De-nitrification in the anoxic zone can return oxygen to the system, but only if the retention time

is sufficient. Because the hydraulic loading in Midleton is so extreme, this can rarely be the case and thus there is a shortfall of oxygen in Midleton, that was not allowed for in the 1993 Preliminary Report, whose figures were then used for the design of the plant in 2000. Thus, even under perfect conditions, I calculate that the Midleton plant can never treat more than 450-500kg BOD/day.

<u>2.7.3 Standard design criteria for the oxygen requirement for extended aeration plants</u>.

From the above two sections, the oxygen requirement for the carbonaceous BOD and for the nitrification/de-nitrification process are :

BOD x 2.0kg O_2 + NH_3 x 4.3 kg O_2

It is found that 20% more oxygen is require to "drive" the chemical reaction – i.e times a factor of 1.2
Standard design practice incorporates a further factor of 1.5 for "installed capacity" to cover the diurnal variations in load, which can be as high as x 2.

A further factor of 1.25 is then incorporated to cover breakdowns etc.

These figures are commonly used in the design of aeration unit by consulting and design engineers. It can be seen that to satisfy BOD oxidation i.e. carbonaceous oxidation, the weight of oxygen is fixed at 2 kg O_2/kg BOD to include excess and mixing and NH_3-N oxidation at 4.3 kg O_2/kg NH_3-N, based on the chemical relationships mentioned earlier for the oxidation of carbon & nitrogen.

2.8 <u>Sludge stabilisation unit</u>

The aerobic digester was to have been designed for three streams, or 15,000 p.e, with a retention time of 12 days to ensure oxidation and loading rate of 2.65 kg/m³ (capacity of digester 204m³). This would be well below the required capacity and incapable of stabilising the recorded volume.

To treat the weight of sludge TDS, both produced in the EA unit and arriving as S.S, would require a completely new plant of a much larger capacity than was originally suggested. Without sludge treatment the plant could not operate as intended.

2.9 <u>Final settlement Tanks</u>

With many of the daily volumes pumped to the treatment plant metered at 7,000 – 7,500m³ per day it will be a frequent occurrence that the maximum volume pumped 9,300m³/day rate will be exceeded for several hours a day when these levels are achieved. This produces a loading rate of 20m³/m² and an upward flow velocity 0.83 m/ hour very near to the maximum design of 0.9m/hr.

Obviously the maximum figure is designed to be achieved in times of heavy storm etc. and not at the current frequency, which occurs several times a month.

Since the SVI is averaging, from the time the plant was commissioned, levels well beyond the optimum settling value, it is difficult to see how any settlement can take place at these high velocities. Hence flow rates to the clarifiers will have to be greatly reduced if any settlement is to take place at all. Even at much reduced flow rates and hence much reduced upward flow velocities, I suspect there are many occasions of sludge carry over per month.

2.10 Comments on the monthly report

The most incorrect statement I used to read every month in the reports was, *"However, the plant achieved compliance with EU Directive and Irish Regulations".* The final effluent had an average BOD result less than 3mg/l and suspended solids average of approximately 8mg/l.

I am also amazed by the comments from the Dept. of the Marine & Cork C.C.

Mr J O'Keefe 28th Aug 2002 Makes reference to 23 days between 18th Oct 2001 and 27th June 2002. I have examined the EPS analytical results for those dates and adjoining days for suspended solids and faecal coliforms – these being clear indicators of a sludge problem in the effluent with one exception the suspended solids (average 12mg/l) were well within the accepted standard of 30mg/l.

Mr Sean O'Breasail, senior engineer Cork C.C, 13th August 2003 *"The result obtained from monitoring of the effluent demonstrates that the plant is of more than adequate size. The treatment process is very effective."*

During the first six months of this year the average results were BOD 2.6mg/l, S.S 4.2mg/l total nitrogen 5.4 mg/l.

Obviously neither of the above gentlemen examined the report in detail. The effluent result tells the trained engineer nothing, all the other parameters tell the true story. Any plant can produce the above results given the correct loadings and oxygen supply, but only, in the case of Midleton, while large volumes of sewage by-pass the aeration unit.

The point is that the Midleton plant could not possibly produce such sparkling results with the BOD loadings, suspended solids loading, oxygen supply and SVI values recorded in the reports. It is interesting to go through the monthly reports as I have, recalculating existing figures and including figures left out of the report – which are always high, to discover the true loading rates. In the following pages of calculations appended to this shortened report, I have analysed representative periods in the life of the WWTP:

1. Results of the first 6 months of records, which were summarised in the National Urban Waste Water Study carried out for the DOE in 2003.

2. A few particularly high loads received in 2002, 2003 and 2004.

3. The first 6 months of 2007, to show the current state of affairs.

Mass balance of BOD and solid loads indicate quite clearly that **large volumes of effluent are discharged from the plant untreated,** apart from passing through the screening and grit removal plants, if the analytical results and recorded flow rates in the monthly reports are to be believed.

Blower hours each month indicate the obvious shortfall in oxygen required, verified by the manufactures, to oxidise the total weight of BOD. In the following sample analyses, I have calculated – giving the plant, in most cases, the benefit of the doubt – two main ways of checking the real performance of the plant:

1. Looking at the oxygen availability, to see how much of the organic load can be treated, and

2. Performing a standard sludge balance to see what sludge should be produced from the BOD and SS loads received by the plant and comparing them to what was actually produced.

Any experienced and competent engineer would arrive at the same conclusion. I find it inexplicable how month after month, in face of obvious pointers to the total inadequacy of the plant, no comments are recorded and no explanation as to the poor settleability of the AS, as clearly indicated in the SVI values, is given.
Extremely high D.O. levels in the A.S units indicate that the plant is receiving very small BOD loads, with ensuing low volumes, whilst at the same time failing to alter the air flow rates.

It is clear to me that EPS, in producing the monthly reports, does so in the hope that no experienced engineer ever reads them – up to now they appear to have been successful in this.

2.11 <u>Comments on Monthly Report Analysis</u>

I have analysed the monthly report data in some detail. My comments are of a technical nature and designed to show in several ways that the plant is totally inadequate and that the resulting effluent analysis, quoted in the report, is generally impossible to achieve.

I note that, each month, complete failures of consent standard conditions are recorded as indicated by the quoted figures, but these are not recognised in the general text of the reports.

Hence my monthly analysis has to be read in conjunction with the monthly reports to compare my results with those in the reports. Several parameters from E.P.S reports are used to analyse the performance of the treatment plant.

Loading figures are often calculated by me in the appendix, to show that the results quoted in the report are incorrect and are usually within the optimum operating figures, as often quoted in the literature, but when recalculated, are shown to be well outside these figures. Hence the plant does not function as an E.A unit with no pre-settlement of SS.

Each parameter used to judge the efficiency comes up with the same result and that is to show, quite conclusively, that the plant cannot treat the volume of raw sewage it claims. Most days large volumes of untreated sewage must be discharged either at Bailick, or by-passed through the activated sludge plant to the outfall, if the data in the monthly report is correct.

These discharges are in my opinion on a planned basis and I have seen no reference to any remedial works which need to be carried out to rectify the situation.

In the early days of the plant's operation, salinity figures for influent and effluent were frequently recorded.

These figures would indicate quite clearly:

A) The infiltration of sea water into the sewerage system
B) The comparison between the in coming and outgoing flow.

Since chloride concentrations are unaffected by treatment processes they are commonly used to verify that the samples through the plant are clearly comparable. If the chloride concentrations are different then the samples do not compare.
It is interesting to note that the inlet salinity analysis was discontinued early in the plant's life and so comparisons could not be made. This seems extremely odd and not the usual way to operate a unit, since sample comparisons are a clear way of proving the integrity of the process.

EPS always base their conclusions on compliance each month **"based on the external chemical analysis"** and not the internal analysis carried out at the plant, which they seem to completely ignore.

However the National Urban Waste Water Study, published in April 2004, gave Midleton the highest confidence grade in the range 1 to 5 to reflect the confidence, which it was considered an external party could attach to **the data gathered on-site, without further checking**. The grades are directly related to the sources of available information. See, for instance Table 2.4 of the NUWW Study :

Table 2.4. Measured flows and loads to and from the WWTP

Location	DWF	BOD	P	NH_4	SS	Peak flow	**Confidence Grade**
Inflow to WWP	m^3/d 7042	Kg/d 757	Kg/d 17	Kg/d 78	Kg/d 1275	m^3/d 10927	**1**
Discharge to rec. waters	7075	21	10	20	96	10960	**1**

Grade 1- represents a high degree of confidence based on comprehensive current records, down to Grade 5 with a degree of confidence at a very low level.
"The confidence grade is high because the influent and effluent quality is monitored daily by 24 hour composite sampling and flow measurement at the WWTP inlet and

outlet with comprehensive records kept on site. The figures above are based on the average flow to the WWTP." Having thus gained their confidence grade at no 1 from this time, EPS then chose to completely ignore the daily chemical on-site analyses carried out, and began using only the eight external laboratory samples carried out - on the same days each week (Thursday & Friday) - to arrive at the conclusions in their monthly report.

If the on-site laboratory was awarded Grade 1, then I believe its results should be published in the Monthly Reports. The EPA, themselves, have also requested the County Council to do this in their UWW Audit Report dated 1st May 2007, Recommendation No.3, to which the County Council replied, "this on-site lab is obviously not an accredited lab and therefore these results will not be included." This is clearly unhelpful in assessing the performance of the plant and totally contradicts the NUWW Study.

3. <u>Summary & Conclusions</u>

On examining the monthly analysis carried out on the site, it can be seen that the extremely high loading rates detected on site are never used in calculating the process statistics recorded in the report. Since Midleton was awarded Grade 1 on the basis of on-site analysis, I have felt confident that the only way to assess the efficiency of the treatment plant is to use all the data available. This in my opinion presents a much clearer picture of what is taking place at the plant, rather than the results of external analysis taken on the same days each week (Thursday & Friday). True samples should be random, thus representing levels of compliance. Fixed "time" samples would be totally unaccepted elsewhere since a lot of "mistakes" can take place in the 5 unsampled days per week e.g. large volumes of raw sludge pumped from Bailick 1 through the plant and into the Estuary. The list of Sampling Procedures and flow measurements listed on page 41-43 of the WWDL Application, are in my opinion quite meaningless. Since whatever result is obtained from the analysis, the results are always the same i.e. total compliance with every standard.

I have been designing and operating treatment plants for many years, and I have never seen a plant which can produce such excellent results irrespective of biochemical loads, suspended solids and flow rate and with such small volumes of oxygen available.

It appears to me that this grading system and the award of grade 1 to Midleton could be the main reason for some of the misleading statements in recent outside reports on the performance of the plant. From the phrasing of the Grade 1, it allows any third party to accept data produced by Cork CC, without checking behind the figures, and hence to quote the accuracy of such data with impunity and sign reports as being totally accurate, even when the data is so obviously incorrect.

3.1 <u>Claims made in the application</u> on the design and efficiency of the plant cannot be substantiated, since an average of 2-3 times the design DWF arrives at the treatment plant – according to EPS monthly reports, with any excess flow held in storm tanks at Bailick 1.

The treatment plant is not designed to treat these large volumes on a daily basis, and since the BOD appears often to **increase** with volume, the flow in excess of the design DWF cannot be infiltration, otherwise the BOD would be approximately constant.

Evidence from the monthly pumping station records suggest that the storm tanks at Bailick 1 are in constant use, and when cleaned, discharge very high levels of BOD to Midleton treatment works and I show in the appendix examples of the effects of these loads and how they cannot possibly be treated.

The Application seems to avoid the fact that the Midleton plant was designed as an extended aeration plant based on 29 hours retention and complete oxidation of ammoniacal nitrogen, followed by de-nitrification in anoxic zones.

This fact, although impossible in the circumstances, is claimed each month in the EPS report, which shows the ammonia and oxidised nitrogen (NO_3) is absent from the final effluent discharge.

Claims that "flow balancing" at Bailick 1 reduces BOD in overflow discharges cannot be sustained. Since the claim is based on the sedimentation and dilution effect in the holding tanks, it must be pointed out that, with average daily suspended solids often over 1000kg/day, then between 3-6DWF, even if the increased flow was pure water, the S.S load would be over 500kg/day giving a discharge concentration of BOD and S.S much greater than a 20/30 standard.

The statement that *"Balancing the flow at pumping stations supersedes the need for flow balancing at the treatment plant"* would be correct if:

a) The incoming flow to the pumping station was truly a diluted flow to the value of 3-6 DWF
b) If all the settled BOD & S.S load at the pumping stations' storm tanks was not pumped to the treatment plant, imposing a huge load on the plant, which it is totally incapable of treating.

Finally the current agreed treatment capacities, which have been contractually accepted with the current operator are impossible to achieve and any claim that the proposed extension to 3 aeration lanes will solve the current problems, are completely misguided and a waste of public finance. Only a complete re-think and new design will achieve this objective.

The EPA should satisfy themselves that the maximum daily flow that is acceptable to the current operator is continuously exceeded by about 100% and that the 1200 kg/day of BOD, well over twice the capacity of the extended aeration plant, cannot possibly be achieved. This fact was acknowledged on p.155 of the 1981 Preliminary Report, where increasing amounts of available oxygen were matched to the varying loads of BOD that could be expected as the volume of effluent from Campbell Foods rose or declined. This is completely overlooked in the current design as the same volume of oxygen appears to oxidise BOD loads varying from 200kg to several thousand kg per day.

I have often seen the statement similar to that quoted in your audit report of 1st May 2007 (attachment B.11), that *" all effluent that enters the plant is treated at that plant"* (page 5). The question that Cork C.C should be asked is, *"does the plant treat all effluent that enters and leaves the reticulation system to the standard in their consent?"*

4. Calculations based on specific data

I append calculations on a spread of data, covering the first year when reports on performance on the plant were made, 2002. I have commented on :

1. The 6 months January – June 2002, chosen for analysis in the National Urban Waste Water Study carried out by E.G.Pettit's in 2003.

2. I have looked at examples of some of the worst "shock" loads that have been continually and regularly imposed on this plant, with examples from 2003 and 2004.

3. I have looked at each of the first 6 months of 2007, to show the current situation, which is that the plant cannot treat more than about half the load that it is receiving. Of course, as time has gone on, more and more of the load is being shed untreated to the estuary anyhow via the 2 storm overflow tanks and the connection we are advised of between the 2 southern pumping stations and the final pumphouse, Ballinacurra 1.

4.1 Calculations of data submitted by National Urban Waste Water Study for January to June 2002 – as in Table 2.4 on p.17 above.

Considering the 6 month average flows and loads into the WWTP.

The organic load treated in the plant (influent – effluent) is :

Inflow	BOD (Influent-Effluent)	NH_4 (Influent-Effluent)	S.S. (Influent-Effluent)
7,042m3/d	736kg	58kg	1179kg

O_2 Available Max

= 30kW x 2kg O_2/kWh x 24hrs x 2 blowers = 2880kg/day to plant.

Average α factor 0.6

Hence O_2 available at plant : 1728kg O_2 =72kg/O_2/hr maximum

O_2 required to oxidise 736kg BOD and 58kg NH_3

[(736 x 2) + (4.3 x 58)] 1.2 ("driving factor") =

(1472 + 249)1.2

= 2065.6kgO_2

Thus 84% is treated max.

Compressors have, however, never operated at max over 24 hour period, usually average 32hr/day.

Thus probably we can assume :

16 hours for peak 8 hours : i.e 2 compressors for 8 hrs = 16 hrs

16 off peak/compressor i.e. 1 compressor for 16 hrs = 16 hrs

Consider the BOD load recorded in NUWWS :

Assume peak flow = Qx1.25

α BOD = Av. x 1.5

Flow for 8 hours = $\frac{Q}{24}$ x 1.25 x 8

BOD for 8 hours = $\frac{BOD_{AV}}{24}$ x 1.5 x 8

Flow = 293.4 x 1.25 x 8 = 2934m³ for 8 hours

BOD = $\frac{736}{24}$ x 12 = 368kg

NH_3 = $\frac{58}{24}$ x 1.5 x 8 = 29kg

O_2 required over 8 hours = (368 x 2) + (4.3 x 29)1.2

= (736 + 125)1.2

= 1033kg O_2

Max available 72 x 8 = 576kg

Hence proportionally $\frac{576}{1033}$ = 56% treated

i.e. 44% untreated.

Consider SS recorded in NUWWS :

Incoming 1275kg/d

Discharged in effluent 96kg/d

Hence 1179kgday treated within plant.

Yield from Extended Aeration Plant working efficiently 1kg dry solid/kgBOD

Hence sludge produced from oxidation 736kg/day

30% of this will result from Suspended Solids oxidation – i.e. 220kg/d

Total solids (1179 – 220) + 736 = 1695kg/day

Or 50,850kg/month produced.

Thus I calculate that in this 6 month period taken for the NUWWS, Midleton WWTP should have been producing, on average, 50 tons dry solids/month. In fact :

4 months produced less than 11 tons
5 months produced less than 15 tons
3 months production was between 15 – 20 tons

I would draw the EPA's attention to the loads received by the plant in the following months :

Month	Total SS load	Total BOD load	Tons Dry Solids produced
January 2002	54.0 tons	43.5 tons	20.0 tons
March 2002	70.0 tons	24.9 tons	10.5 tons
May 2002	41.2 tons	29.3 tons	10.6 tons
February 2003	173.5 tons	34.3 tons	12.6 tons
March 2003	53.9 tons	30.7 tons	9.3 tons
May 2003	46.0 tons	21.9 tons	19.0 tons
June 2003	53.6 tons	23.0 tons	20.0 tons
May 2006	46.9 tons	17.2 tons	19.9 tons
May 2007	46.5 tons	32.2 tons	21.9 tons

In all these months, it is quite clear that there is a huge shortfall in the predicted production of sludge dry solids. We have been assured on many occasions by the County Council that these are not removed as sludge except, as recorded, to landfill and thus we can only assume that they have by-passed the plant in some other way.

4.2 An examination of larger loads.

<u>4.2.1 February 2003</u>

This month's data is some of the worst recorded and yet the report contains an ironic touch on the opening page, *"On the 20th February results showed a BOD value of 2mg/l, a COD of 99 mg/l and an SS value of 8mg/l.The BOD and SS results would not suggest a COD of 99 mg/l. Therefore we are of the opinion that this result is either due to laboratory error or high levels of recalcitrant material."*

This appears to be the first reference to odd results although there have been in previous months much more serious "oddities" which required specific explanation.

Sludge loading rates were again checked and found to be in "error" hence the F/M ratio had to be recalculated.

The monthly report records that a figure of 12.6 tonnes was disposed of during the month. This is a very questionable figure since on one day, 20th February, 4396 mg/l of SS were recorded which gave an SS load of 33.801 tonnes, which is an incredible amount and 2.68 times the monthly disposal figure. This was associated with 2153 kg BOD, a very high load (– figures from independent analysts).

On analysing the pumping data from Bailick 1 on the 20th Feb it shows that the drain pump pumped for 4.07 hours, a total of 716m³.

If the average flow to the works in 4.07 hours =

$$\frac{4.07}{24} \times (7689 \text{ (daily flow)} - 716) = 1182 \text{ m}^3$$

Then 1182 + 716 = 1898m³ is the volume containing the "sludge"

Hence concentration = $\frac{33801}{1898}$ = 17800 mg/l

(I have ignored the "average" SS levels since they are small in comparison)

i.e. 1.78% solution of sludge arriving at the treatment works for 4 hours.

If this event was allowed to happen and this amount of sludge entered the E.A system over 4hrs, then the system would be completely denuded of oxygen. Two options seem available, either the "plug" of sludge passed through the E.A system, or the plant was completely by-passed for 4 hours. In either case the result would have caused a major pollution incident at the discharge point, 1km from the oyster beds, yet no mention is made of this anywhere in the report.

From the February Process Statistics in the monthly report, the average BOD load is given as 1226 kg/day (also my calculation), with an average SS load of 6196 kg/d although the BOD load recorded in the Process Calculations is 813.9 kg/d. This figure seems to have just been left unchanged from the previous month's record. Perhaps EPS, who produce these figures, expect nobody to check and question them?

A sludge yield of 405 kg/d was recorded, whereas if all the BOD was oxidised the yield would be 1226 kg/d approximately.

F/M ratio reported as 0.1 should in fact be 0.084 but using the corrected figure quoted in the process calculations should equal 0.127, but using the treated figure of 405 k/d = 0.042. This figure is so low it would allow for total nitrification, de-nitrification and high DO levels.

Recorded compressor hours for the month totalled 918hrs/month or 32.8hrs/day

Maximum oxygen = 918 x 30kW x 2kg/kWh = 55080 kg /month
(Maximum benefit no α factor applied)
= 1967 kg/day average.

Using only NH_3-N figure, not total N figure.

NH_3 figure = 102 kg/d

Average demand for O_2 for BOD and N oxidation is

(1226 x 2 + 102 x 4.3) 1.2

= 3469 kg O_2

Taking the diurnal variation 3469 x 1.5

= 5204 kg O_2 /d (rate for say 8 hours).

Bearing in mind that no α factor is applied, which most of the time will have difficulty-reaching 0.5. Even using the basic figure for oxygen requirement quoted in the 1993 Report of 2.5 kg O_2/kg BOD, which equals 3065 kg, there is a massive shortfall and, in this case, without considering Nitrogen oxidation.

Again no comment is made in the monthly report only the cynical comment on full compliance.

Using the SS and sludge yield figures, 56,354 kg of solids are unaccounted for during February 2003, together with 23,128 kg BOD.

Calculated BOD loads which were omitted from the monthly report together with F/M ratios at these loads plus F/M ratios at diurnal flow rates are as follows :-

Date	BOD	Loading rate kg BOD/kg sludge	1.25Q	1.5Q
4th Feb	1190	0.123	0.154	0.185
5th Feb	1680	0.174	0.218	0.261
12th Feb	1751	0.182	0.227	0.273
13th Feb	1352	0.140	0.175	0.210
18th Feb	1751	0.182	0.227	0.273
19th Feb	1993	0.206	0.258	0.309
20th Feb	2153	0.223	0.279	0.334
21st Feb	1174	0.121	0.152	0.182
24th Feb	1740	0.180	0.225	0.27
26th Feb	2321	0.241	0.301	0.361

Biomass recorded is 9639kg with MLSS 2967.

Activated sludge plants are successfully operated in different modes i.e. at different loadings within the range of sludge loading rates recommended (for E.A CIWEM practice handbook 0.05 – 0.15 kg/kg MLSS at MLSS conc. of 2000 – 6000).

Hence the loading rates in the above table far exceed the recommended levels and indicate that the plant is too under designed to oxidise such high levels.

It is interesting to note the sludge mass balance during the 4 hours pumping of sludge from Bailick 1 i.e. given volume pumped (sludge) = 716m³ and average SS for the month (excluding 20th February) = 181 mg/l then :-

1898 x X + 1898 x 181 = 33801 (i.e volume containing sludge x Conc + (7698 x 181) = 33801
1,898X + = (33801 – 1046)10^3
X = 17256 mg/l

Total weight of sludge pumped = 33801 – 1048 = 32753
Since volume = 716m³
Concentration = 45744 mg/l
= 4.57% solution.

It is surprising that the enormous concentrations of OFG were not mentioned in the opening pages of the report.

Concentrations were 4453 mg/l in the influent OFG column and yet 601 mg/l were recorded in the effluent on 20th Feb. with a follow-on in the effluent on the 21st Feb of 336 mg/l which appear in the effluent salinity column.

I assume that the figure 4453 is OFG and if so the effect on the plant would be disastrous from two points of view.

1. The effect on aeration reducing the efficiency of absorption of oxygen into solution by such an amount that the culture could not survive.
2. The effect of the "chocolate mousse type foam", since when oils, fats and greases occur in waste water the organism causing this effect often adopts the foaming configuration because it has a requirement for long-chain fatty acids and in particular oleic acid (IWEM Aug 2004)

If however it did prove to be salinity and not OFG in the influent, then although organisms can adapt to increased levels of chloride concentration a sudden increase can be more than they can tolerate. Acceptable limits are no more than 50% of the average chloride concentrations of the previous 24 hours. Large salinity swings disperse the floc and cause poor treatability (Activated sludge bulking – Foot & Robinson, Handbook of Water & Wastewater Microbiology ISBN 0-12-470100-0).

However since chlorides remain unchanged through treatment processes the balance between influent and effluent should be the same. Thus 4453 mg/l on the 20th Feb should balance with 20th & 21st Feb (due to retention time in the aeration unit) effluent of 601 and 336 respectively.

Hence weight of "chloride" (on 20th February)
= 4453 x 7.689
= 34239 kg (influent)

And the effluent

20th Feb = 601 x 7.689
= 4621 kg

21st Feb = 336 x 7.574
= 2545 kg

Total = 7166 kg

The figures do not balance (even approximately)

Klein (Aspects of River Pollution (1957)) states, *"Sewage always contains chlorides, the amount present depending upon the strength of sewage, the presence of trade wastes containing chlorides and the chloride content of the water supply".*

"Chloride remains unaltered during the purification of sewage and consequently approximately the same value should be obtained at each stage of the purification process otherwise the samples are not truly comparable."

It seems to me that the whole of the February 2003 Report needs some serious explanation since it is impossible to make any sense from it.

4.2.2 October 2004

This month shows wide variation in both BOD, SS & TN loads.

BOD range 64 – 1236 kg/d
SS 153 – 1874 kg/d
T.N 56 – 189 kg/d

No plant can be operated in this way, grossly under loaded and grossly over loaded at each end of the scale.

The oxygen demand for the TN varies from 289 kg/d to 960 kg/d, taking a high proportion of the daily oxygen production.

However, this month, it is not possible to calculate the oxygen production, since blower 3 operated for 907 hours whilst blower 4 operated for 1036 hrs. Since there are only 744 hrs in a month, the dilemma is obvious. The pumps also worked over time, all seven pumping for over 1400 hrs during October.

I have been informed by EPA that an eminent consultant (their words) has produced a report which claims that the Midleton Treatment Plant can treat the flow from a population of 24,000, equivalent to the required standard i.e. 20 mg/l BOD, 30 mg/l SS and 15 mg/l T.N.

4.2.3 Consider an idealised theoretical WWTP, treating a load of c.20,000 PE, *such as is frequently encountered at Midleton*

On designing a plant to treat the above I will consider one of similar capacity as Midleton i.e. plant volume 3249 m^3 and a flow rate of 7000 m^3/d (or approximately 330 l/h/d).

From the monthly report I have selected a day 15th October 2004 which recorded a flow 6500 m^3/d and p.e. of 20602.

Analysis on this day was BOD 1236 kg, SS 1874 kg, T.N 189 kg.

Considering the design figures:-

Flow = 7000 m^3/d
BOD = 1200 kg/d
SS = 1000 kg/d
TN = 150 kg/d

Since the capacity of the aeration unit is 3249m^3 the retention time in the plant is

$$\frac{3249}{7000} \times 24 = 11 \text{ hrs}$$

Hence the plant is a conventional AS Plant with nitrification and an element of de-nitrification, with an idealised retention time and MLSS 2,500 mg/l.

Since the plant is a standard AS plant, due to its retention time, primary sedimentation has to be installed.

This will reduce the SS figure by 70% (approx). Hence SS to secondary treatment will be 300 kg/d. Overall reduction of BOD will be slight since any BOD removed as SS will be returned as decanted liquor from sludge treatment.

Hence load to AS Plant
1200 kg/d BOD
300 kg/d SS
150 kg/d TN

Loading rate on the plant is:

$$\frac{1200 \times 1000}{3249 \times 2500} = 0.148 \text{ kg/BOD/kg MLSS}$$

(An ideal loading rate for this type of plant with this level of retention).

Oxygen required achieving nitrification and an element of de-nitrification

(BOD x 2 + TN x 4.3) 1.2 =
(1200 x 2 + 150 x 4.3) 1.2 =
(2400 + 645) 1.2 =
Oxygen required = 3654 kg O_2/day

Oxygen available = 2kg/kWh x α x β

Since my theoretical plant is correctly loaded and contains few inhibiting factors (i.e. suspended solids, high grease & fats, since these have been greatly reduced in primary sedimentation) then:-
$\alpha = 0.7$
$\beta = 0.98$

Hence O_2 available / kWh

= 2 x 0.7 x 0.98
= 1.37 kg/kWh

Hence kWh required is $\frac{3654}{1.37}$ = 2667 kWh

I now have to consider the peak flows and breakdown factors.

For Q av kWh = 2667
For Q 1.25 kWh = 3334
For Q 1.5 kWh = 4000

For breakdown under worst case allow for maximum kWh x 1.25 = 5000 kWh.

Hence installed kWh required to ensure treatment of 1,200kg BOD during day-time peak production and allowing for breakdowns = 5000 kWh

= $\frac{5000}{24}$ = 208 kW capacity compressors **or 7 x 30kW units**.

By contrast, the Midleton WWTP is operating without the benefit of primary sedimentation; has received loads in excess of 20,000PE on 154 occasions and uses just 2 x 30kW compressors (with 1 stand-by).

<u>Consider sludge production</u>

The yield of sludge / kg BOD oxidised is given in design manuals as 0.6 – 0.8. The average of 0.7 is taken since we will assume the plant is not subjected to shock loads and runs under ideal conditions. BOD oxidised is (given BOD effluent is 10 mg/l) then 1200 – 70 = 1130 kg/BOD oxidised.

Hence sludge produced / day = 1130 x 0.7 = 791 kg excess activated sludge; this includes the 300 kg mineral element from the SS, which will be absorbed within the floc.

Total sludge production is 791 + 700 = 1491 kg day.

Total sludge production per month = 1491 x 30days = 45 tons per month.

This ideal plant would then require digestion of the sludge produced (although aerobic digestion has been omitted in Midleton). However, to complete this discussion :

If I assume 80% volatile matter =

$$1490 \times \frac{80}{100} = 1192 \text{ kg}$$

And a loading rate in the aerobic digester of 2.65 kg/m³ then the capacity of the digester is:-

$$\frac{1192}{2.65} = 449.8$$

$= 450m^3$

Since the current plant proposal was for twelve days and was to have a capacity of 204 then this would give a retention time of $\frac{204 \times 12}{450} = 5.4$ days.

Which may just oxidise 11% of the volatile solids.

This is briefly what a plant designed for 20,000 p.e., without the wide variation in flow and load which occur in the existing plant will achieve. Obviously for 24,000 p.e. it would need more kW capacity and greater sludge treatment capacity.

If the plant at Midleton is analysed to ascertain its capacity, then I will take actual data mentioned earlier in the report i.e.

15th October 2004 – figures from the external laboratory.

Flow = 6500m³/d
BOD = 1236 kg
= p.e 20,602
SS = 1874 kg
TN = 189 kg.

Retention time in the aeration unit = $\frac{3249}{6500} \times 24 = 12$ hours average

Hence this is not an extended aeration plant and falls within the design criteria of a conventional aeration plant with nitrifying capabilities (but only just).

Loading rate = $\frac{1236 \times 10^3}{3249 \times 3282}$ (3282 = MLSS average on the 15th Oct)

= 0.116 kg/kg MLSS

Suspended solids = 1874 kg.

Since no primary settlement is available, the total weight is discharged into the aeration unit. This is contrary to all practice and I have never encountered this or seen it recorded in any literature.

We now have the problem of large amounts of inert solids (70% mineral- 30% volatile) mixing with the active MLSS and a plant, which, during the course of October, has received BOD loads varying from 64 kg/d to 1236 kg/d BOD load at the influent of the plant and an effluent recorded on the same day as 3 mg/l BOD.

Oxygen requirement =

(1236 x 2 + 189 x 4.3) 1.2
(2472 + 813) 1.2
3285 x 1.2 = **3940 kg O_2 required for average load**

$$\left.\begin{array}{l}\text{For Q 1.25} = 4927\text{ kg}\\ \text{For Q 1.5} = 5913\text{ kg}\end{array}\right\}\quad \text{are required}$$

However the problem with this plant is that the **"shock"** loads often arrive over a few hours, which makes the BOD load for that short time much higher than an increase in Q reflected in the diurnal variation.

Since the AS plant solids content is now increased by 50% due to SS and all the fats and greases which would normally float on the surface of primary sedimentation tanks and be removed, it will be under very difficult conditions for the α factor to approach 0.5 – 0.6 (literature is full of examples of α factor values under various conditions).

However a factor of 0.6 will be applied and a β factor of 0.9 will also be applied, hence:-

O_2/kWh = 2 x 0.6 x 0.9
= 1.08 kg O_2/kWh.

Hence kWh required to accommodate peaks = $\frac{4927}{1.08}$ = 4562 kWh at Q1.25

= $\frac{5913}{1.08}$ = 5475 kWh at Q 1.5

Add to this the standard factor of 0.25 contingency breakdown maintenance etc,

= 5718 kWh Q1.25

= 6843 kWh Q 1.5

Installed kW required for this BOD load of 1236kg = $\frac{5718}{24}$ = **238 kW** (Q1.25)

= $\frac{6843}{24}$ = **285 kW** (Q 1.5)

Maximum installed kW at Midleton = 30 x 2 = 60 kW (plus 30 kW standby).

There is thus less than one quarter of the required capacity in Midleton to oxidise this load of approx. 20,000 PE using standard design criteria.

Note also that the maximum average compressor running hours have only exceeded 40hrs/month on a very few days in the lifetime of the plant. At the more normal 32 hrs running time per day, the 2 compressors will still be operating at about only 67% capacity.

Consider Sludge Production

Suspended solids entering the AS plant 1874 kg/day and sludge yield 0.72 kg/kg BOD.

Since BOD = 1236 kg/day
Then 1236 x 0.72 = **890 kg/day (sludge from oxidation)**

A proportion of this is mineral absorbed from the suspended solids (say 60%), then sludge from BOD oxidation =

$$890 - (890 \times \frac{60}{100}) =$$

890 – 534 = **356 kg /day**

Total solids now in suspension in the AS Plant is

MLSS + 1874 + 356 (i.e. MLSS + incoming SS + solids from BOD oxidation)

= MLSS + 2230

Since daily sludge wastage is recorded in the Process Statistics for the month as 459 kg, then remaining is MLSS + 1771 kg

This should produce a new MLSS figure, which includes the SS figure.

Total biomass (before SS entry) = 3249 x 3282 (av. of 8 tanks on 15th) = 10663 kg

New biomass = 10663 + 1771 kg = 12434 kg

$$= \frac{12434}{3249} = 3.827 \text{ kg/m}^3 \text{ (theoretical),}$$

= 3827 mg/l MLSS - this checks with what is recorded in tank 8 as 3836 mg/l on the 18^{th} Oct)

Thus, on this day (15th October), there is clearly an imbalance in the sludge production and SS figures, since1771 kg SS has been added and yet the average sludge wastage is just 458.9 kg (14.2 tons/month) – an imbalance of 1,312kg. We cannot be more precise, as we are only given monthly figures. On a well-operated plant, daily wastage figures are produced, which obviously relate to the SS and sludge produced from oxidation of the BOD on that particular day. With this amount of SS in the influent on this day, it would be expected that the SS in the effluent would be far greater than the reported level of 3mg/l and, as such, effect the efficiency of the UV plant.

What must also not be overlooked in this plant is the wide range of BOD loads which occur over a monthly period.

In the month of October the loading varied from 64 kg/day to 1236 kg/day. Since no plant has the capability to vary its MLSS by a factor of 20, then the F/M ratio variation is enormous and outside any convention.

The difference between the **"ideal"** plant and the Midleton plant of the same capacity of AS unit is that the "ideal" plant receives a constant load of 20,000 p.e. whilst the Midleton plant is subject to **"shock loads"** at frequent intervals.

In a handwritten letter to Mr Coughlan, SEE, Cork C.C., M J O'Sullivan, consultant to the Midleton scheme, says of the option "extended aeration", "the fact that the volumes in configuration C (extended aeration) are much smaller than the other two (primary sedimentation & AS) means that **there is very little buffering available for shock loads".**

What is also relevant is why the consultants (Pettits) claimed that the plant could treat up to 20,000 p.e. since up to April 2004 there had been 96 recorded flows and loads exceeding even this figure. Since each one of these discharges is very likely to produce a positive result of norovirus in the oysters, which requires 6 weeks to clear, then this represents 576 weeks of "shutdown", which is the equivalent of nearly five years.

Of course one must not lose sight of the fact that the Pettit Report and its conclusions are based on the data supplied by Cork C.C., which when analysed cannot be substantiated. If Pettit's were told the WWTP could produce an effluent of BOD < 2 mg/l and SS < 5mg/l with zero nitrogen, for BOD loads approaching 2000kg, then it is obvious they would conclude that loads of 1440 kg BOD/day (24,000 population) could be adequately treated.

It is interesting to note that in the 1993 Report (page 10/1 in book 2 of 2) the Plant to treat Campbell Irish Foods waste together with the domestic load is outlined, *"The problems associated with design of a treatment plant for this effluent are very great because of the wide variation in flow 0m³/day to 2258m³/d; BOD 50 mg/l to 1320 mg/l; pH 4.11 to 12.54".*

"The plant design must be capable of virtually continuous adjustment to cater for constantly varying effluent flows and concentrations" ..... "The type of effluent requires a biological treatment and a hybrid activated sludge plant is proposed." ...

"In general the plant will operate as either an Extended Aeration plant with all the reactors operating in parallel or as a High Rate roughing followed by Extended Aeration polishing with pairs of reactors operating in series" ... ... and on page 10/10, the air requirements to ensure that sufficient oxygen is available are given as 12,203m^3/hr of air (74 % to reactors, 11.7% to aerobic digesters and 14.3% to equalisation tank) by the installation of six no. blowers, with installed motor power of 55 kW each, i.e. a total of 330 kW. The BOD to be catered for is 1,425kg from Campbell Irish Foods and 500kg from extended aeration (p. 10/5), i.e 1,925kg (or 32,000 PE). But the present plant in Midleton has had to contend with loads of this size >30,000 PE on 37 occasions with only 2 x 30kW = 60 kW – less than a **fifth** of the aeration capacity calculated as being necessary for the "combined" plant in the 1993 Preliminary Report.

With 330 kW required for 1,925 kg BOD, proportionately 206 kW would have been calculated as necessary for 1,200 kg BOD (20,000 PE), for which there have been 154 days, when loads of >20,000 PE have been received at the plant. **On these days the plant had less than a third of the aeration capacity calculated as being necessary for the 1993 "combined" plant treating a load of the same size. If the plant that was designed to cater for the widely varying loads, caused by the cyclical use of the Campbell Irish Food's factory, built-in such varying aeration capacity up to 330 kW, then how can the present plant be expected to oxidise equally large loads with the fixed capacity of just 60 kW?**

It should be noted that the "hybrid activated sludge plant" described as being necessary (in the 1993 Preliminary Report), above, to handle the widely varying loads associated with Campbell's Irish Foods waste as well as the domestic sewage, is totally different to the plant, which we now have in Midleton to handle equally varying load sizes. A hybrid activated sludge plant will usually incorporate vigorous mechanical aeration, followed by diffused air, in series.

4.2.4 Consider the present situation with the Midleton WWTP – taking the first six months of 2007.

Results 2007 (from Monthly Reports)

	Daily flow m^3	Av BOD kg/d	Max BOD kg/d	Suspended Solids kg/d	Max SS kg	NH3-N calculated kg/d	t.d.s.(tonnes) Disposed
Jan	7984	652	998	742	1552	83	18.8
Feb	7040	449	696	660	1655	69	14.8
March	7556	579	999	776	1989	79.3	13.7
April	6434	870	1009	1021	1760	105	17.5
May	5518	1039	2058	1501	4852	108.4	21.9
June	5407	788	1487	1118	2253	115	25.1

Average Compressor Hours		**Oxygen Available α 0.6**	
		kg/day	kg/hour
Jan	32.0hrs/d average	1152	48
Feb	32.5hrs/d average	1170	48.8
March	24.7hrs/d average	889	37
April	34.8hrs/d average	1253	52
May	37.6hrs/d average	1296	54
June	43.3hrs/d average	1559	65

N.B All data taken from EPS Monthly Reports.

N.B α factor, β factor = 0.6 total

Consider January 2007

Flow 7984 m^3
BOD av 652 kg/d
NH_3 83 kg/d

02 available 1152 kg/d

For peak 8 hours, assuming 50% of BOD loading arrives in these peak hours

BOD total 326 kg

O_2 required $(326 \times 2 + \frac{83}{3} \times 4.3)1.2$

$= (652 + 119)1.2$

$= 925$ kg

$= \frac{925}{8}$ kg

$= 116$ kg O_2 /hr

For 16 hours off peak, BOD total 326 kg

O_2 required $(326 \times 2 + 83 \times \frac{2}{3} \times 4.3)1.2$

$= 1068$kg

$= \frac{1068}{16\text{hrs}}$

$= 67$ kg/hr

Theoretical BOD treated by the oxygen available from the compressors

$(\text{BOD} \times 2 + 83 \times 4.3)1.2 = 1152$ kg O_2

$(\text{BOD} \times 2 + 357)1.2 = 1152$ kg O_2

$\text{BOD} = \frac{1152 - (357 \times 1.2)}{2.4}$

$= \frac{742}{2.4} = 309$kg/day

Proportionally $\frac{309}{652}$ = **47% treated**

Hence 53% of the BOD remains untreated

Although the report shows total ammoniacal oxidation and de-nitrification – very little recovery of oxygen will have taken place in the anoxic zone, since total oxidation has obviously not taken place.

Consider the case of the maximum load (26th January – external analysis figure)

BOD treated peak daily load concentration kg/day 998kg.

Flow 8605m³

NH_3= 114kg

To calculate theoretical BOD treated :

(BOD x 2 + 114 x 4.3)1.2 = 1152kg O_2

$$\text{BOD} = \frac{1152 - 581}{2.4}$$

= 238kg

Hence treated = $\frac{238}{998}$ = **23.8%**

Untreated = 76.2% of BOD load entering the plant that day.

Sludge balance average day - January

SS = 742 kg/d

BOD 652 kg/day

EPS Report claims sludge wastage 606 kg/day

40% of the sludge comes from the SS

Hence total sludge = 652 – 240 (40%) + 742

= 412 + 742

= 1154 kg/day dry solids

=1154 x 31 kg

= 35,774 kg/month

Sludge disposed 18,800 kg (EPS Report)

Hence unaccounted = 16,974 kg/month of dry solids

<u>Consider the sludge balance where SS is max. (22nd January)</u>

SS = 1552 kg

Hence total SS of sludge = 412 (av. as above) + 1552

= 1964 kg/day

Sludge discharged = 1964 – 652

=1312 kg/d untreated on this particular day.

<u>February 2007</u>

Flow 7040m3

BOD av 449kg/d may reach full oxidation levels – but not at peak day-time loads. The max BOD of 696kg on 2nd February cannot be treated to full oxidation.

Consider this day, 2nd February:

NH_3 N 9.6 x 7.245 = 69 kg/day (EPS Report)

O_2 required

= (696 x 2 + 69 x 4.3)1.2

= 2026 kg/day rate

= 84.4 kg/hour

Compressor hours (total) for February (daily av)

= 32.5/hours

O_2 available $\frac{32.5 \times 60 \times 0.6}{24}$

$= \frac{1170}{24} = 48.7$ kg/hr

Hourly deficiency = 84.4 – 48.7 kg O_2

= 35.7 kg O_2

Hence untreated = 42.3%

This load size (11,600 PE), not greatly in excess of the design load, is received frequently at the WWTP, but, it can be seen that it will still have a large polluting effect on the oyster beds.

<u>Consider suspended solids at average 660kg/day</u>

=18480 kg month

Daily sludge wastage 529 kg/d (14.8 tons/28 days)

and say 30% from SS = 158.7 kg

Hence solids from solution:

= 529 – 159 = 370kg/day

Total solids = 18,480 + (370 x 28)

= 18,480 + 10,360kg

Total sludge SS in system = **28,840kg/month**

Sludge disposed from site in EPS Report = **14,800kg/month**

Therefore unaccounted weight of sludge = 14,040kg/month

This would indicate that approx 50% of the total flow went untreated.

<u>BOD and SS balances do not support EPS analysis.</u>

Very high levels of D.O in tank 4 i.e. 6 occasions when O_2 saturation was reached – **shows very little BOD load going through this aeration stream during the month.**

<u>Consider the day with 1655kg of SS arriving at the plant (19th February)</u>

Solids to be disposed are:

370 kg from solution (as above) + 1655kg

= 2025kg

Since on average day $\frac{14800}{28}$ = 529 kg/d disposed

$= \frac{529}{2025 - 529}$ = **35% treated**

If proportionality is applied, then 65% of flow untreated.

There is a reasonable correlation between BOD and SS balance, bearing in mind that the peaks occurred on different days. N.B. it should be noted that this is the only day in the month when no COD result, which is likely to have been very high (as the SS were 1655 kg), is given. This is by no means a lone example of the omission of results for high BOD loads.

March 2007

Flow 7556m3/d

Av BOD 578kg/day

Max. BOD 999kg/day (external analysis)

Max. O_2 available 37kg O_2/hr (see table of compressor hours above)

Or 889kg/day

Calculate max. BOD treated: on average day

(BOD x 2 + 4.3 x 79.3)1.2 = 889

2.4BOD = 889 – 409

Therefore maximum BOD it was possible to treat in a day was 200kg/day

O_2 production represents the capacity of one compressor (at process) and shows that 65% of the BOD load has received no oxidation, at max BOD of 999kg/day then 78% of the BOD load is discharged untreated.

Yet compliance is claimed in the EPS Report and daily BOD load stated as 578kg/d oxidised. This is an impossible figure as shown by the above calculation.

Consider the solids balance for March 2007

Average SS 776kg/d

Max. SS 1989kg/d

Total sludge produced (corrected – see BOD that could be treated above):

200kg/d from BOD

i.e. 140kg from oxidation

and 30% from SS (bound in floc) = 60kg

Total daily sludge

140 + (776 – 60)kg

= 856kg

= 26,536kg/month

Leaving 26,536 – 13700kg

= 12,836kg discharged untreated.

<u>Consider the daily maximum discharge (SS) for March of 1989kg (on 21st)</u>

Total daily sludge produced:

140 + (1989 – 60)

= 2069kg/day

Daily sludge wastage 443kg/day (EPS Report)

Hence on this one day 1626kg of sludge was discharged untreated.

<u>April 2007</u>

Flow 6434 m^3

BOD av 870 kg/d

Max BOD 1,009 kg/d

NH_3 N calculated from EPS Report 105 kg/d

Oxygen available 1253 kg/d

Oxygen required = (870 x 2 + 4.3 x 105)1.2

= (1740 + 451)1.2

= 2629 kg/day

At peak flow the rate could increase to 2629 x 1.3

= 3,418 kg (rate for 8 hours)

Average treated = 48%

And treated in the peak 8 hours = 37%

<u>Consider the max. daily BOD 1009 kg/d</u>

O_2 required 2962 (average)

Peak (8 hours) 3852 kg/day rate

Percentage treated = 42%

Peak treated = 32.5%

<u>Consider Solids Balance - average for April</u>

SS av = 1021 kg/d
Max. SS = 1760 kg/d

Using extended aeration parameters, sludge produced from av BOD

$$870 \times \frac{47.6}{100} = 414 \text{ kg}$$

with 124kg coming from the SS

Hence total sludge:

414 + (1021 – 124) = 1311 kg/day

Total 1311 x 30d = 39,330 kg/month

EPS Report states 17,500 kg/month disposed of.

Leaving 39,330 – 17,500 kg

= 21,830 kg discharged untreated.

On the day of max. SS in influent, daily total sludge is:

414 + (1760 – 124)

= 2,050 kg/day

Thus a large discharge of untreated effluent associated with the above must have taken place.

May 2007

Flow 5518m³

Av BOD 1039kg

Max BOD 2058kg

NH_3 N calculated from EPS Report 108.4 kg

Available O_2 1296 kg

O_2 required:

[1039 x 2.0 + 4.3 x (19.7 x 5.5)] 1.2

O_2 required = 3053 kg/day

O_2 available = 1296 kg/d (calculated from compressor hours)

Hence $\frac{1296}{3053}$ = **42.5% treated**

On the day of the max. load of 2058 kg BOD in the influent

O_2 required is 5484 kg O_2

On this particular day $\frac{1296}{5484}$ = 23.6% treated

thus 76.4% of the load was untreated.

Data from the aeration tank check list indicate that optimum loading rates were the norm for the month. **Hence only a small portion of flow entered the units.**

Consider the Sludge Balance for May

Av SS 1501 kg/day

Max 4852 kg

Since 42.5% of BOD load treated using EA data (calculated above)

Sludge produced = $\frac{42.5}{100}$ x 1039

= 441 kg/day (a third of which will be mineral SS in floc)

Hence total sludge = 441 + (1501 – $\frac{441}{3}$)

= 1,795 kg/day

55,645 kg/month

tds discharge for month (EPS Report) = 21,900 kg
Hence discharged untreated = 55,645 – 21,900 kg

= 33,745 kg/month discharged untreated

Consider the day of the max. SS loading on the plant - 24th May (external analysis figure).

Total sludge = 441 + (4852 – 147) kg

= 5,146 kg/day

This represents over 25% of the total monthly discharge in one day, showing quite clearly how wrong the monthly EPS Report really is.

June 2007

Flow 5407m³ day average

BOD av 788 kg/d

BOD max 1487 kg/d (8th June – external analysis figure)

Available O_2 1559 kg/day

O_2 required for oxidation is

(788 x 2 + 4.3 x 115)1.2 kg

= (2070)1.2 kg

= 2484 kg/day

Hence daily average treated

$= \frac{1559}{2484}$

Thus average amount BOD that can be treated is 63%

During daily peaks the rate increases by 30% to 3312 kg/d

So during peak flows

$\frac{1559}{3312}$ = **47% treated**

On peak load day (8th June)

(1487 x 2 + 4.3 x 115)1.2

4162 kg O_2 required

So only $\frac{1559}{4162}$ = **37% treated**

The untreated volume of 63% of flow is sufficient to contaminate the oyster farm for many days.

If on this day 50% of the BOD load arrived at the plant during 8 hours, thus 2,081 kg O_2 required for oxidation.

Available O_2 is 520 kg

Then $\frac{520}{2081}$ = **25% treated**

During this period 75% of flow discharged untreated.

N.B. If the on-site COD figures are converted in accordance with the payment system now agreed with the plant operators – there were 4 further days this month when the BOD load was even greater (7th, 12th, 14th and 27th)

<u>Consider the Sludge Balance for the month of June</u>

Average SS 1118 kg

Peak SS 2253 kg/day

Sludge produced 835 kg/day (EPS Report – 25.1 tons in 30d)

One third = 278 kg will be from the SS bound in the sludge floc

Daily sludge 835 + SS (1118 – 278)

= 1,675 kg

= 50,250 kg/month

Monthly TDS removed (from EPS Report) = **25,100 kg**

Hence untreated is 25,150 kg

I have not taken into account, the increase in biomass weight since it cancels out over the months.

If peak SS load is considered, then weight of sludge on this particular day (8th June) is:

835 + (2253 – 278)

= 2,810 kg

Comparing this to the monthly sludge produced by the plant (25,100 kg)

$= \frac{2,810}{25,100}$

= 11.2% of the monthly total to disposal occurred on this single day.

Summary of 2007 WWTP performance estimations.

Comparison of estimation of performance of Midleton WWTP by availability of oxygen and sludge balance calculations, from above, for these 6 months of 2007.

Month	BOD treated or O_2 available (kg)	BOD load or O_2 required (kg)	Untreated	Sludge produced (EPS Reports) (kg)	Sludge production calculated from loads (kg)	Untreated
Jan- BOD	309	652	**53%**	18,800	35,774	**47%**
Feb. - O_2	1170	2026	**42%**	14,800	28,840	**49%**
Mar BOD	200	578	**65%**	13,700	26,536	**52%**
April - O_2	1253	2629	**52%**	17,500	39,330	**56%**
May - O_2	1296	3053	**58%**	21,900	55,645	**61%**
June - O_2	1559	2484	**37%**	25,100	50,250	**50%**

Conclusion that can be drawn from the current situation at Midleton.

Using standard design criteria, accepted throughout the world, for the oxygen requirement for BOD in fully nitrifying/denitrifying extended aeration, I show that that, for the first 6 months of 2007, there is a monthly average shortfall of oxygen varying from 37-65%. This means that this percentage of the BOD, measured as entering the plant, cannot have been treated and must have been discharged untreated. On days of "shock" loads, it can be seen, in the calculations, that the situation was considerably worse.

I have checked these figures by carrying out standard mass sludge balances for the plant and get comparable estimates for the amount of sewage, measured as entering the plant, but not accounted for as sludge disposed of, and which must therefore have passed through the plant untreated.

C.J.Mulready.
18.3.08

5. Summary C.V. for C.J.Mulready

1. Manager Main Drainage – Southend-on-Sea B.C

2. Area Manager S.E Essex Anglian Water Authority

3. Controller Bristol & Avon Co, Wessex Water Authority

4. Divisional Engineer – Wessex Water Authority

5. Regional Engineer – Wessex Water Authority

6. Chairman of the Design Group of professional engineers responsible for the design of Water Treatment and Waster Water Treatment Plants for Wessex Water plc.

7. Director Resources Board – States of Jersey

8. Chief Executive Public Services – States of Jersey

9. Consultant Carl Bro Consultants – Denmark & UK

10. Independent Consultant – Self Employed

11. Additional information: Visiting Professor University of Leeds.

12. Received National Award, presented on live television, for leading the team which developed the use of UV as a disinfectant, and consequently the construction of the first large scale plant in the world at 1000 l/sec capacity i.e. 86,400m³/day