Submission	
Submitter:	Mr David Hugh-Jones
Organisation Name:	Atlantic Shellfish Ltd.
Submission Title:	Second Objection to Dairygold/TINE discharge to Rathcoursey Point, Cork Harbour
Submission Reference No.:	S005625
Submission Received:	25 July 2019
Application	
Applicant:	Dairygold Co-Operative Society Ltd and TINE Ireland Ltd
Reg. No.:	P1103-01
See below for Submission details. Attachments are displayed on the following page(s).	

SECOND

Submission to the EPA by Atlantic Shellfish Ltd.

(David Hugh-Jones, MA, Dip. Agric. (Cantab.), MMBA, FRGS)

with reference to the

Application for an Industrial Emissions Licence

by

Dairygold Co-Operative Society Ltd. and TINE Ireland Ltd.

of Mogeely, Co. Cork P25Y996

Relevant Inspector: Orla Harrington

Environmental Licensing Programme
Office of Environmental Sustainability

EPA Licence Application Reference No: P1103-01

Continuing objection to the discharge of the treated wastewater from the enlarged cheese-making facility of Dairygold Co-Op and TINE Ireland Ltd. at Mogeely, Co. Cork, which is proposed to be made to the North Channel of Cork Harbour through the Midleton WWTP Primary Discharge at Rathcoursey Point in the North Channel of Cork Harbour.

with the,

Response of Atlantic Shellfish Ltd to the further Dairygold/TINE letter of 6 June 2019 in Response to the Regulation 10(2)(b)(ii) Request from the EPA for Further Information and the requested updated Coastal Modelling Assessment of 11th July 2019.

Contents

1. Dairygold/TINE Response to the Regulation 10(2)(b)(ii) Request from the EPA for Further Information.

This letter can be found on: http://www.epa.ie/licences/lic_eDMS/090151b2806f4418.pdf

1.1 Appendix 1 "Connection Offer"

The connection offer from Irish Water dated 08 April 2019 would appear to be missing pages 3 & 4, after listing an order of precedence with only,

"i. Special Conditions", as clearly the start of a list. I would think we need to see these also.

Nor am I sure if the General and Special Conditions referred to in the second paragraph of the IW letter are attached as Appendices 2 "General conditions" & 3 "Special Conditions", as Appendix 2 which follows is titled as, "*IW Consent for acceptance of the sanitary effluent"* (s. 1.2) and Appendix 3 is the "*EPS Report*".

1.4 Bypass of the Tidal Holding Tank

"*As a result of provisions set out in **the sewer connection agreement from Irish Water** (IW), the treated wastewater discharges from the Dairygold Food Ingredients (DFI) Wastewater Treatment Plant at Mogeely **will now not bypass the tidal holding tank at Rathcoursey".***

I think it is important that we should see the new sewer connection agreement from Irish Water?

We learn for the first time that the discharges **will now not bypass the tidal holding tank at Rathcoursey** and we are told that this is because (p.2):

"*On review it was established that this location however would not facilitate undertaking representative sampling of the combined effluent from the outfall, in this case that of Midleton Municipal WWTP, Irish Distillers Ltd. and Dairygold".*

This is indeed what the EPA Regulation 10(2)(b)(ii) letter of 13 March 2019 required, when the discharge was going to bypass the tidal holding tank.

But giving this some more thought, if the Dairygold discharge is going to be joined to the Midleton town and sewage discharge at Bawnard and all pass through the tidal holding tank, with the monitoring point positioned at the entrance to the tank (Drawing 9), there will be FOUR effluents contributing to the new "combined discharge":

(1) Untreated from the town industrial sewer pumped from Bailick 1 (measured at Bailick 1 sump) – which also contains the IDL discharge
(2) IDL – treated (measured as it leaves their premises, SE1 Final figs. given in EPA Returns) but later mixed with the town sewer,
(3) Discharge from the Midleton WWTP (measured both at the outlet to the WWTP and at Ballinacurra 1 sump – the Accepted Primary Discharge Monitoring Point)
(4) Dairygold

The quality of the water from Midleton can be judged to some extent by its f.c. content. It is likely to be poor when the f.c. content exceeds the maximum ELV, which is only allowed to happen on less than 5% of occasions. In the last 2 years of records (01.07.16 – 30.06.18) in 103 total no. of samples, these maximum exceedances from the above sources were:

(1) Town at Bailick 1: 16 times/ 2years (7.8% of samples p.a.)
(2) IDL: 0 times
(3) Town WWTP 17 times/2 years (8.3% of samples p.a.)

If sampling is carried out as in Drg. No. 9 at the entrance to the foreshore holding tank, all 4 streams will be mixed and, if there are elevated effluent results, it will be impossible to know which of the streams has failed. Indeed the quality of the effluent from the Midleton WWTP declared to the EPA between 2011-2016, at average values of COD 17.9 mg/l (14% of ELV); BOD 2.1 mg/l (8% of ELV); SS 5.5 mg/l (16% of ELV); TN 5.4 mg/l (36% of ELV), appears to have been so good, that failures of discharges from Dairygold could even be largely concealed.

This same point was actually made when M. O'Sullivan argued in his "Wastewater Assessment for New and Existing Cheese Production Facilities at Dairygold Mogeely, Co. Cork" (Nov. 2016) in s 2.2.1 "Whey Permeate":

http://www.epa.ie/licences/lic_eDMS/090151b2806d6d87.pdf (p.71 on web et seq.)

In which he declared that,

"Based on those figures (of "expected" characteristics) *this permeate could be used to dilute the treated effluent* ***thereby reducing the treatment standard required".***

Although this is then followed immediately by the caveat:

"*However, if, for any reason, the permeate does not meet the above standard, Dairygold wishes to make provision to pass the permeate through the secondary Treatment Plant".*

In s 2.3.3 "Treatment Standards" the first claim is then continued, despite the potentially increased volumetric throughput to the new WWTP from 1,700m3/day to 2,700m3/day and dilution of the load:

"*Based on the above standards secondary wastewater treatment is adequate to meet the projected standards* (25: 125: 35: 15: 2)*".*

This would seem to be at risk of repeating the same acknowledged difficulty as at Midleton WWTP, caused in that case by the excessive infiltration of groundwater, to dilute the influent BOD load from a normal 250 mg/l to 120 mg/l (figs. for the current 3-stream plant) – should the Dairygold WWTP, not be designed in the first place for the eventuality of the permeate not meeting the only 6 mg/l COD "*expected*" and for it having therefore to be treated?

In the EPA letter to Dairygold of 21 January 2019, Dr. Brian Donlon told them that

"*I am to advise; the High Court and Court of Appeal have both held that a person/company cannot carry on licensable activities under a licence issued to another".*

This position must surely have been taken so that each discharge could be held accountable, otherwise any redress sought by an injured party would become unachievable?

The EPA's letter to Dairygold of 13 March 2019 rightly requires that the combined discharge must demonstrate compliance with the ELVs set, "*by applying a worst case scenario*".

The most important factor here must be the ability to get the combined discharge away on the ebb tide. Mott MacDonald decided in their Concept Design Report for Irish Water (IW) of April 2016 (Ref. 14 with our original Submission) that,

"*While the WWDL allows for discharge over the full ebb tide, **it would be unwise to alter the current regime of discharging over three hours** without completing the necessary studies and hydrodynamic modelling to demonstrate that an increase in the discharge duration will not result in an unacceptable deterioration in receiving water quality".*

Mott MacDonald (MM) thus advise that their initial tank sizing is based on discharges continuing over a three hour duration on each ebb tide. However, already their calculations in sec. 2.3.3 for the section of pipe from Bawnard to the Rathcoursey Tank give peak flow as 0.767m3/s (2,762 m3/hr) and thus flows over 2,762 x (2 x 3) hrs = 16,572m3/day will not be possible, if a greater flow than this is generated, for the accepted 2 x 3-hour/ebb tide discharge regime.

Analysis of the flows being discharged to the sea, measured at the final pumping station of Ballinacurra 1, show that on about 4 days a month flows will exceed the flows projected by MM and of these higher flows, by as much as 70%. By just how much they can, on occasion, rise to, is shown in the final column. What happens on these occasions?

Present exceedances of the flow projections provided by Mott MacDonald. April 2016

Table 3.1 Mott MacDonald April 2016 Concept Design Report for Irish Water

Estimated and Projected Flow Profile						Actual flow profile			
Flow Profile 2016-2025 (with figs. added for 2014 & 2015)						No. flows > MM Total Projected Flow given	Av. size of these flows	% larger than MM allowance	Max. flow in year
Year	WWTP	Infiltration	IDL	Dairygold	Total				
2014	10,368	2,100	2,396		14,864	67	19,269	30%	33,398
2015	10,368	2,100	2,396		14,864	38	25,213	70%	63,140
2016	10,368	2,100	2,396		14,864	58	21,362	44%	51,047
2017	10,368	2,100	2,396		14,864	16	18,592	25%	24,981
2018	10,368	2,100	2,396	unaltered	14,864	34 (till 30.06.18)	17,189	16%	27,616
2019	10,368	2,100	2,396	2,500	17,364				
2020	10,368	2,100	5,000	2,500	19,968				
2021	10,368	2,100	5,000	4,000	21,468				
2022	10,368	2,100	5,000	4,000	21,468				
2023	10,368	2,100	5,000	4,000	21,468				
2024	10,368	2,100	5,000	4,000	21,468				
2025	20,736	2,100	5,000	4,000	31836				

The above MM Table still makes no allowance for the annual increase in population - and hence annual increase in sewage volume, being shown as a single jump from 10,368m3/day to 20,736 in 2025, when it suddenly doubles? Is this a tacit acknowledgement that all these increases are going to be accounted for by rising overflows from the pumping stations, until an expanded WWTP is built – as the WWTP is already acknowledged as overloaded by An Bord Pleanála?

The suggestion that the combined flow, measured by a new flow meter at Rathcoursey village, will be used, also means that excessive volumes from any one of the four streams will not be distinguishable.

1.5 The Primary Discharge shall discharge to the ebb tide only.

a) How will Dairygold know what volumes may be coming from the other 3 streams on any given day? Are the current licence holders happy for their present arrangement to be put at risk of non-compliance by the additional Dairygold flow?

The Dairygold discharge is hoped to accurately arrive in the 3hr window for the discharge having reached the high point of the pipeline, 1.6km from the connection point and a further 1.69km from there to the tidal holding tank. Dairygold state in their letter that, what then becomes a gravity sewer, will flow at 1.54 m/s to take their discharge in the allotted ebb-tide window, but this does not accord with the Mott MacDonald calculation that the peak flow for the last 1.69km section of the pipe is only half that figure at 0.767m3/s, as already stated above (see sec. 2.3.3 of the MM Concept Design Report. Earlier Ref. 14)

Dairygold are, however, clearly already banking on using the full ebb tide – less 30 minutes, which is NOT the current discharge regime required by the Department of the Marine in 1992 and adhered to, to this day. Dairygold state that this 30 min. stoppage is, *"so that none of the capacity of the Rathcoursey tank would be taken up by the Mogeely discharge".*

Should we believe Mott MacDonald, or is it possibly M. O'Sullivan behind this new Dairygold calculation, having been the author of the Dairygold Submissions on the design of their existing and new WWTPs? In which case these two Consultants have already held very different views over the design of the closely involved Midleton WWTP, for which M. O'Sullivan designed and oversaw the construction, having also been Consulting Engineer for the previous Midleton Sewerage Scheme in 1988.

O'Sullivan claimed all along that his design of the plant would lead to no more than 5/6 overflows totalling 2,793m3 spills per annum, making this clear in both the 1993 EIS and then restating it to the Minister of the Marine in the 1996 Cork CC Application for the foreshore licence. As it has turned out, he got his calculations wrong by a factor of over 100 (10,000%) – the average annual overflows between 2002 and June 30th 2018 being more than 312,000m3 per annum, with overflows occurring on average every second day (av. 192 spills p.a.).

When Mott MacDonald came to assess the adequacy of the construction for Cork CC as a requirement of the EPA's WWDL, they found the situation so bad with the design, that if the WWTP was to comply with M. O'Sullivan's assurances, a much greater storm water holding facility would be required (Mott MacDonald "Assessment of Pump Station Overflows" – see Ref. 9 p.16 of our earlier Submission) and that:

"This storage capacity would require the construction of storage tanks with a capacity of 130 to 140 times the capacity of the existing storage tanks. Based on an average tank height of 5m, the area of the storage tanks would be up to 52,500m2, or 5.25 hectares. The provision of this level of storage capacity is not practical or feasible."

It is our unfortunate experience, that, even with errors of the magnitude such as this one made with the Midleton WWTP, once the construction has been made, there is very little chance of getting it put right. We do not want to take any risks with the calculations again.

b) The outfall holding tank at Mogeely has, based on a 6.25hr storage requirement, been designed to hold 1194m3. This is just 152m3 over the 1,042m3, which is stated to be the *minimum* requirement – allowing only 12% spare storage. Is that really enough based on the usual margins built in for the construction of WWTPs to allow for weather, surges in demand and equipment and human failures?

And what of the current restriction to observe a 3hr discharge period each ebb? Can that DOM requirement be arbitrarily abandoned?

There is also a new passage in the updated Rathcoursey Outfall Investigation of 11.07.19, in s. 3.3 on p.11 (p.15 of the pdf, the link is given on p.22 below):

"*The treated DG process water will be pumped to Rathcoursey from where it will join the existing rising main from Midleton to discharge on the ebb tide. Tidal holding will be maintained in the pipeline from Mogeely".*

This sounds as though there are now to be no holding tanks at Mogeely, as we have been told before, and we would need to know what spare capacity is proposed to be built in to cater for those natural and man-made events, errors, plant break-downs and the like, for which plant and capacity usually make very ample provision in, say, standard sewage treatment works?

c) If the lunar valve closed and Dairygold needed to continue pumping to prevent overflows at Mogeely, I am sure it would be in Irish Water's best interest to open the valve at Rathcoursey, rather than running the risk of the flow backing up to their final pumping station and overflowing at the high-level overflow there to the strand, or, worse still, backing up first to the UV unit at the Midleton WWTP, which would put that unit out of action and lose its 99% reduction in reducing sewage pathogens.

1.6 Mogeely WWTP Upgrade Process Description. EPS 04.09.18.

We are referred to Appendix 3 (p.28 of the Response pdf)

2. Influent loading.

We see immediately that the Dairygold WWTP is needed for 3,500kg BOD/day. The plant is thus **four times** the size of the other main potential source of nutrients, the Midleton WWTP at 900kg BOD/day. It also has a 45% greater load of TN (Midleton c. 115kg/day), and FOG at 340kg/day

A belt and braces approach to a water body, which is already potentially eutrophic, would suggest a high dilution for accidental release of poorly treated effluent, which will have such a high BOD content. Such dilution is simply not available at this location where there is instead the highest residence time of any waterbody in the Harbour (50-70 days) and where, in fact, the discharge moves inland into the North Channel rather than out to the open sea.

Fats, oils and greases on boats kept on moorings in the East Ferry and its Marina will not be welcome. The East Ferry and Rostellan waters were selected in the recent Irish Water videos as the environmental high-spots of the Harbour and they are very much enjoyed by the public. Should there be any sort of hitch, there will be ⅓ tonne of insoluble oils, fats and greases per day rising to cover boats, moorings and rocks and deposit on the mudflats.

2. Coastal Modelling

We understood that a report under this heading was required by the EPA. This appears to now be an updated copy of the "Rathcoursey Outfall Investigation" (ROI) of May 2017, now dated 11th July 2019, thus it would be better to discuss the new passages provided at the end of the next section 3, re "Appropriate Assessment", Appendix 4 re the NIS at the end of the discussion on 6.2.1.2 on the Operational Phase, which deals with the hydrodynamics of the eastern harbour, on p.17 below.

However, I submit here, that it would be very easy for Irish Hydrodata to run their model using the full 12 days of the Brown Island current meter data that we know that they have, to determine the existence and magnitude of any residual flow to the west down the North Channel, as I have described very fully in sec. 5 of my earlier Submission and again here in the next section below.

Although we get a good idea of the considerably greater current speeds on the flood tides than the ebbs by studying the graphs, the model will give us our most accurate estimate and give us a figure for any residual current and therefore over a tidal cycle of 12hrs 25mins, the distance travelled by the general water body.

If it is found that the receiving water is, in fact, moving to the west from Rathcoursey on each succeeding flood, carrying its nutrients with it, I should hope that the EPA would agree with their own earlier recommendations of 2001 and 2002, that Rathcoursey is not the place to make this, or any, discharge. See my earlier Submission s. 6.2.3, e.g.

"*Measurement and Modelling of Nutrient Dynamics of Two Estuaries in Ireland – Wexford and Cork Harbours*" by Costello et al (12 others) published in 2001, Executive Summary, p.4:

"Within estuaries, eutrophication is better characterised by apparent problems than simple chlorophyll levels. ***On this basis, the deoxygenation in Cork Harbour estuary and toxicity from dinoflagellates, indicate that the estuary is eutrophic."***

"The study found that point sources (outfalls) of nutrients are contributing to phytoplankton blooms in both estuaries. ***Measures to reduce waste inputs into the inner brackish-water part of the estuaries are thus required to reduce the occurrence of harmful algal blooms, especially in Cork Harbour where toxic blooms have occurred and are likely to continue to occur".***

The addition of extra nutrients to a waterbody already described as potentially eutrophic (and alternating with being eutrophic since records began) and described in 2018 (Mockler and Bruen, EPA Research Report No. 249) as one of the 4 estuaries with the highest DIN levels in the country, is simply fanning the flames of a hazardous situation, which is, at present, on the cusp of becoming potentially really dangerous to human health (see secs. 6.1 and 6.2 of my earlier Submission, and s. 9.2 re Appendix E re Designated Shellfish Waters on p.42, below, re this summer's PSP closure).

3. Appropriate Assessment – Update to NIS needed

The first item of the EPA Regulation 10 Request was:

3.1 "*Update the NIS to address mitigation measures*". We are directed to:

Appendix 4 (p.53 of the Response pdf)

The introduction to this Appendix tells us that the updated NIS in respect of the EPA's Further Information Request of 13 March 2019 ("Updated April 2019") does not alter the findings or outcomes of the original NIS (of Nov. 2016), but it covers a new discharge plan.

The new discharge will join the Midleton town/IDL/WWTP discharge at Bawnard and then travel with it to outfall at Rathcoursey.

Nothing much else is altered in the NIS until we get to:

6.2.1.2 Operational Phase.

Much has now been deleted from the original version, including the tables showing the minimal rise in BOD calculated by the Tidal Prism method in Table 6 and other parameters in Table 7. The useful Fig. 8, showing the position of the diffuser in relation to the Natura Sites of pNHA, SAC and SPA is now dropped. Also dropped are all the claims that,

"*Over the 6+ hour period between ebb tides, water will undergo an ~ 80% exchange so that the subsequent discharge even will occur on new water coming in rather than the column which has gone out on the preceding ebb tide.*"

As we pointed out in our earlier Submission, no evidence has been put forward for such a statement (repeated 3 times in the original NIS of 2016 on pp. 37, 38 & 50), whereas all the evidence, which we have got, including from the 1977 Cork Harbour Pollution Report (CHPR) of MC O'Sullivan and the 1993 Irish Hydrodata dye studies, current meter records and modelling, all point to the fact that the water, not only does not flush away to the Lower Harbour and open sea directly, but actually circulates inland in an anti-clockwise direction around Great Island, residing in the North Channel for 50-60 days and exiting via Belvelly (residence time now 70 days) to Lough Mahon and thence down Passage West and the Main Cork Channel to the sea.

The new NIS thus waters down this extravagant claim on p.35 (p.90 of the pdf) to:

"It is proposed that discharges will be on an ebb tide only which will allow the effluent to be flushed out of the receiving environment."

No new evidence is put forward to support or quantify this statement.

The evidence, quoted on p.36 of the 2019 NIS, is still the unchanged Irish Hydrodata Report 1207/3/17 of the 19 May 2017, which I have discussed in detail in our Main Submission secs. 3, 5.2, 5.5 and 5.6.

Re-analysis of all the data in this report in the light of the NUIG hydrodynamic work, makes me question whether MC O'Sullivan's and Irish Hydrodata could have been truly unaware from the Brown Island current meter data, in particular, what the true flow pattern from Rathcoursey really was.

The data that was obtained in 1993 actually covered the full spring and neap tidal cycles of 12 days (as only shown 14 years later to us in the 2007 O'Kane Norovirus Report: Ref. 5 of my earlier Submission), though they only put 2 days of spring tides and 2 days of neap tides into the 1993 EIS by M.C. O'Sullivan's (see sec. 5.5 of our main Submission) and the huge significance of the substantially greater flood tide currents over the neaps was thus regrettably missed by myself and the Department of the Marine and the Fisheries Research Centre at that time – entirely due to not being given the full dataset of 12 days, which makes it so very much more obvious.

If this had actually been pointed out by those experts, who had been charged with determining the local hydrography, at that time, I feel quite sure that the Midleton discharge could never have been sanctioned to be have been made at Rathcoursey, which was thus shown to indeed be at the head of the main flow-channel to the Lower Harbour, BUT a channel via Belvelly, with only the very small receiving volume of the North Channel, with its low water depth being as little as 0.5m nearly all the way, and only a relatively small spillage at the top of each tide over the high-level weed sill at the far west end – leading to the huge residence times of the water in the North Channel, estimated by NUIG as 50-60 days and 70 days west of Weir Island.

It as well to consider again what was put up originally and repeated with the updated NIS by Dairygold, without change from the original version, this time on p.220 of the pdf of the Response to Regulation 10 Request for Further Information, Request No. 9 "Update Application Documents", given as Appendix A in:

http://www.epa.ie/licences/lic_eDMS/090151b2806d6d87.pdf

EPA Application Form, Appendix A: "Rathcoursey Outfall Investigation (ROI) **of the Impact of Treated Wastewater Discharges arising from the DairyGold Mogeely Plant to Cork Harbour", 1207/3/17 of 19 May 2017, by Irish Hydrodata.** (p.220 of this pdf)

(We will then add our comments, below this section, on the updated version of 11th July 2019, which has only recently been put up on the web)

We are advised in s. 2.5 *Coastal Oceanography*

"Tidal Current Data.

"Current profiling was conducted at Rathcoursey Point on several occasions."

But we are NOT given any current meter data, AT ALL, for the North Channel (i.e. from what is called the "Brown Island" current meter, but now shown even more central in the

North Channel and rather closer to Brick Island in Appendix A to the updated ROI of 11.07.19. Note that it is also many hundreds of metres west from the minor gyre off Brown Island and thus ideally placed in the main east-west flow of the channel to assess flows).

Instead, we are given the current meter flow data for just one single ebb tide and one single flood tide (and, even then, an incomplete record) BUT this is taken at the top of the "*East Channel off Rathcoursey*" (Figs. 2.5, 2.6 & 4.8). The fact that we can see that the ebb tide is flowing due south (180°) and the flood due north (360°/0°), shows that we are dealing with the East Ferry Channel and NOT the flows up and down the North Channel which are due east (90°) and due west (270°).

We are given the peak speeds of this single ebb tide and a single flood. The flood tide at c.1.35m/s is 20% greater than the ebb at c.1.12m/s. The volume of the tide flowing, the product of speed and time, can be estimated by eye from the area beneath the two curves and judged very obviously to be larger under the flood than the ebb curve.

No date is given for this data. It must have been cut off in the copying at the top of the page, where items 1/ and 2/ are not shown, but the reference for this fig. is then given as:

"*17. M.C. O Sullivan Ltd, Cork Harbour Pollution Report 1988"*

(Nor is this correct, this report was actually published 11 years earlier, in December 1977, making the two records being published here, seemingly as a pair, and clearly so in the 2-fig. "*Comparison of modelled and measured currents*" (Fig. 4.8), coming from two days 16 years and 8 years apart. Surely there was not such a paucity of data? This is not good science.)

It is agreed in the text of s. 2.5, considering Figs. 2.5 & 2.6, that,

"The speeds on the flooding tide are stronger than on the ebb,

But we then have the strange addition of:

"*….with the flood lasting for about 6 hours and the ebb for the remaining 6.42 hours. The high water slack lasts for less than 30 minutes".*

This appears to give this particular tidal cycle as taking (6.0 + 6.42 + 0.30) hours = 13 hours:12 minutes, in usual hrs.mins terminology for tides. This is odd when a normal tidal cycle is taken as 12hrs 25mins.

What is more, low water on the 25th August 1993 was at 04.59 a.m. GMT = 05.59 BST, for Cobh tides, thus we can add this to the portion cut off on Fig. 2.5 to give the total length of the flood tide that day, as shown, being from 05.59 to 12.00 = 6hrs. NO slack water at all is shown at high tide in this Figure (which is also my experience of the tide) and the ebb would appear to be from 12.00 (Tide Tables give it as 11.55) to about 18.30, so about 6hrs:30mins as I would expect – the ebb lasting slightly longer than the flood and 30 minutes would be about it.

In my earlier submission, looking at the 24 cycles over 12 days of the Irish Hydrodata data, I estimate the flood current speed as 60% greater than the ebb, with the ebb lasting 10% longer than the flood – see my Table "*Differential current speed and duration of flood and ebb tides in the North Channel"* in sec. 5.6 of my earlier Submission.

Why so many errors in giving and reading these two figs.?

1) Two graphs put together, with data from records taken 16 & 8 years apart?
2) Showing just one single ebb and one single flood tide?
3) Neither showing even both the tides as complete cycles – which could make a close comparison possible?
4) One record not even dated.
5) No HW slack showing in Fig. 2.5 and LW=HW slack in Fig. 2.6?
6) For some reason another pair of measured and modelled current speed graphs at the top of East Ferry are then put together, this time one on top of the other and joined together as the single Fig. 4.8. One is the same as Fig. 2.5 (of 25/Aug/1993) and the other a new one of 30/Sep/1985. The point is to show the accuracy of the model, but in Fig. 2.5 the peak speeds of the model are c. 0.63m/s and the actual current speeds were c. 0.88m/s, which is a 40% difference and not really such a particularly impressive fit?

Fig. 2.5, which is given twice, would appear to show an exaggerated length of ebb tide. This could seemingly balance the impact of the greater volume of water coming in on the faster flood tide than going out on the slower ebb (in Fig. 2.6) – and hence it would counter the idea of a flow inland and to the west across the oyster beds.

Whether this was intentional or not (it was given twice), it appears that this was the result that was achieved with An Bord Pleanála's Inspector, who states on p.70 of her report, re the "Residual Flow in North Channel":

"*Section 2.5 of the Irish Hydrodata Report states that the speeds on the flooding tide are stronger than on the ebb, with the flood lasting for about 6 hours and the ebb for the remaining 6.42 hours. The high water slack lasts for less than 30 minutes*. ***The difference in the length of Flood and Ebb tides would account for the difference in velocities."***

She thus dismisses the evidence that I had put forward.

Four points must be made here:

1) The 12-day record given to us by Prof. O'Kane in 2007 in his "*Modelling the Norovirus Contamination of an Oyster Farm in Cork Harbour*", of the Irish Hydrodata Brown Island current meter, does NOT show greatly extended ebb tides. I go into this in detail in s. 5.6 of my earlier Submission where my table of close analysis of the daily record shows that the ebb may last as much as 10% more, but the differential between flood and ebb current speeds is more like 60%, which vastly outweighs it and points to a substantial residual westerly movement of the North Channel waterbody.

2) In fact the Irish Hydrodata's own 1993 Figs 3a and 3b of the mid-flood and mid-ebb current speeds for the North Channel, that I reproduced in s. 5.5 of my earlier submission, give ebb tide values of between 0.00-0.25 (av. 0.125m/s) and flood tide values of 0.25-0.50 (av. 0.375m/s), which is a difference in current speed of 300%..... clearly these are not very

accurate, as the wide divisions of the current speeds are not sufficient for accuracy, but nonetheless a very telling differential between flood and ebb current speeds.

3) All our manual work on trestles at Rostellan – and we have 13km of trestles down there – has to be carried out at low water and we know from 30 years of experience at LW there, like every other oyster farmer in the world, that the ebb tide can be very variable in length depending on atmospheric pressure and wind speed and direction. These differences can add up to over 1m in low water depth, thus lowering or extending the apparent length of the ebb tide very considerably. If one wanted to pick a particular type of tide, one would pick it, if it had arisen and been recorded, and quote just that one day.

4) If we look at the modelled speeds (in green) on the 12-day Brown Island current meter record, not only is the model giving consistently lower speeds on the ebb than the flood (see the directions of flow on the lower Fig. 3.20), but it can be seen that the actual current speeds are even lower than the model on the ebb, but higher than the model on the flood.

I reproduce the intermediate 4 days of the 12-day set, as example of this, taken from O'Kane (2007), below, and trust that this makes this important observation quite clear. The full set of 12 days, in slightly better definition as pdfs, are on my Ref. 5 of our earlier Submission.

Brown Island Current Meter Data from Irish Hydrodata Ltd., 1993

Second 4 days (19.09.93 – 22.09.93) Transition to neaps. Irish Hydrodata 1993.

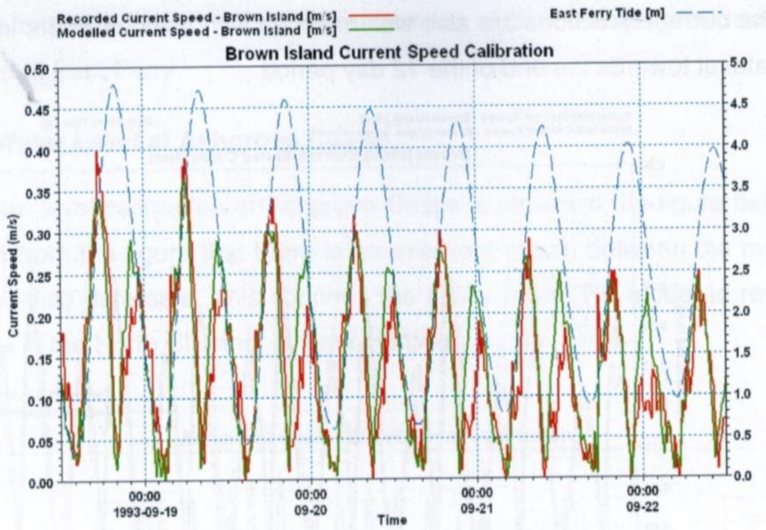


Fig. 3.19 Brown Island Current Speed Calibration – second 4 day period

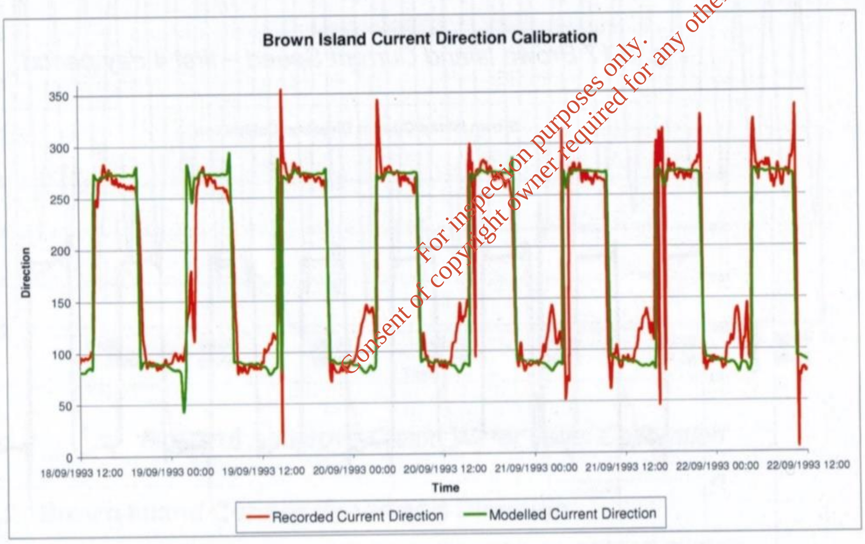


Fig. 3.20 Brown Island Current Speed Calibration – second 4 day period

We are referred in the last paragraph on p.36 of the NIS to "*A further assessment to evaluate the risk of adverse impact on Cork Harbour SPA and Great Island SAC in relation to the water quality changes from the proposed discharge from the Dairygold WWTP at Mogeely to the North Channel Great Island waterbody was undertaken (MWP, May 2017 – see Appendix 2)*".

The cover page for this Appendix 2 can be found on p.113 of the pdf version, but nothing further has been given – Appendix 2 is missing.

The continuation of 6.2.1.2 Operational Phase tells us on p.37 that, "*The scientific assessments undertaken by Irish Hydrodata ltd and Malachy Walsh and Partners (MWP) show that discharges from the project site either alone or in combination with other existing or planned discharges from the outfall at Rathcoursey will not result in significant effects to the water quality of Cork Harbour and subsequently would not have significant adverse affects on the designated Great Island Channel SAC (001058) and Cork Harbour SPA (004030) sites".*

This mantra, used twice in s. 6.2.1.2, is repeated in s. 6.3.1.2 and s. 6.7, but we have not been given any new scientific assessments since Table 6 was dropped from the 2016 NIS to support this.

Clearly everything depends on whether the water exchanges with "*~80% new water*" on each tide, or even the 0.35 calculated exchange factor, mentioned in the Rathcoursey Outfall Investigation of May 2017 s. 2.5, referring to the "tidal prism" work in the MCOS' CHPR of 1977 – or, if the receiving water is, in fact, actually slowly circulating westwards up the North Channel to empty out of Belvelly, and is therefore actually accumulating the nutrient discharges in the North Channel over the 50-60 days in the main body of water and up to 70 days towards Weir Island, as shown in the NUIG modelling work:

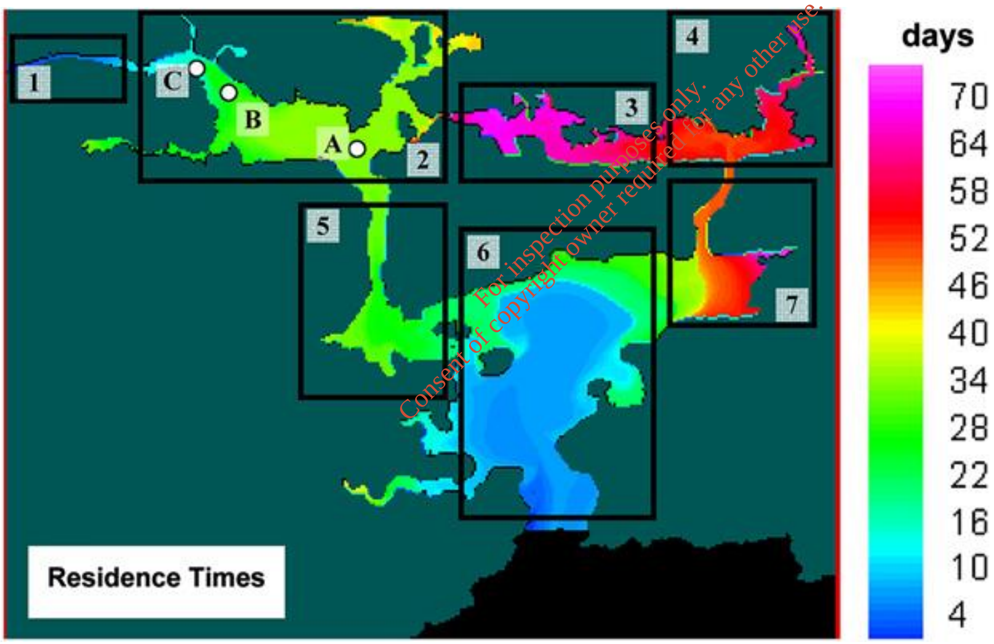


Fig. 9. Spatial plot of residence times (Dabrowski, 2005) showing boundaries of subregions and monitoring locations (white dots) (From Hartnett et al 2012: My Ref. 4)

I cannot understand how expert hydrographers could have failed to inform all of us in 1993 of this very obvious residual flow, which is what the current meter work was set up to find out in the first place, and which was essentially of make-or-break importance at that time to establishing Rathcoursey as the outfall point for Midleton's waste discharge.

If the water movements are as we now know them to be, then the use of Rathcoursey as the discharge point should never have gone ahead in 1988, or have been retained in 2000, and it should not be added to now, with any further discharge of nutrients.

The EPA has called for updated "Coastal Modelling", which has, at last, been put up on the EPA website (on 11.07.19) **and this residual flow question could still be very simply answered by using the 12 days of complete tidal cycle data which Irish Hydrodata collected in 1993, and putting it into their model, to find out exactly the model's calculations of the residual difference in current speeds between the flood and ebb tides, and if so, by how much the water body, as a whole, moves to the west down the North Channel on each tide. But this has not been done by them.**

To be quite clear, the Irish Hydrodata 1993 model must be more than adequate to give this figure for any residual flow.

Whilst on these pages, it is worth noting that the only evidence we have of dye or hydrodynamic studies of more than 1 whole day – i**.e. with any idea of the quantity of the discharge <u>returning</u> from the Lower Harbour**, is given in ONLY two studies:

1. The dye studies carried out by Irish Hydrodata in 1993 for just 3 days.

The Figs. 2.7, 2.8 and 2.11, (see s. 5.2 in my earlier Submission and Ref. 21) which represent the concentrations of a "continuous" release of dye (from LW-2hrs to HW+2.5hrs = 10.5hrs on Day 1) at HW on Days 1, 2 and 3 after the initial, single 10.5hr release, where we find the highest concentrations at HW on Days 2 & 3 to still be at the <u>far west end</u> of the North Channel.

2. The dye studies carried out by MC O'Sullivan for the CHPR of 1977 of both continuous and intermittent (ebb tide) release which are given in s. 5.5 of my earlier Submission (and, in part, on p.28 below). Again the highest concentrations of dye released <u>both</u> continuously, or intermittently at the top part of the ebb tide, and then followed for 5 days, are to be found at the <u>far west end</u> of the North Channel.

Of all the other modelling work which Irish Hydrodata carried, with a series of modelled discharges for the 1993 EIS, which were for:

1. A continuous discharge from Rathcoursey on a neap tide
2. A continuous discharge from Rathcoursey on a spring tide
3. A tidal discharge from Rathcoursey on a neap tide
4. A tidal discharge from Rathcoursey on a spring tide
5. A continuous discharge from Green Point on a neap tide
6. A continuous discharge from Green Point on a spring tide
7. A tidal discharge from Green Point on a neap tide
8. A tidal discharge from Green Point on a spring tide
9. A continuous discharge from Midleton on a neap tide
10. A continuous discharge from Midleton on a spring tide
11. A tidal discharge from Midleton on a neap tide
12. A tidal discharge from Midleton on a spring tide
13. A continuous discharge from Rathcoursey on a neap tide with a 6hr bact. decay time
14. A continuous discharge from Rathcoursey on a spring tide with a 6hr bact. decay time
15. A tidal discharge from Rathcoursey on a neap tide with a 6hr bact. decay time
16. A tidal discharge from Rathcoursey on a spring tide with a 6hr bact. decay time

<u>All</u> of these model runs are given for just HW-3; HW; HW+3; LW.

Quoting form the IH Report in the 1993 EIS, sec. 3.3.1 re the Hydrodynamic Model:

"Typical coastal water model coefficients (i.e. eddy viscosity, bed friction etc.) were employed and the model run for the required length of time; normally three tidal cycles. Output was generated for every hour of the tidal cycle and the first 6 hours of each simulation was disregarded due to possible initial transient start-up effects."

From this we see that the model run started at HW+3 (i.e. on the second half of the ebb), thus most of the initial discharge will hardly have reached the Lower Harbour 2,000m away at an av. speed of c. 0.25m/s on the second half of the falling tide (see Rathcoursey current data), which would take about 2.2hrs, with the earliest discharge arriving more or less at slack water in the first part of the East Channel and the rest still in the East Ferry – ready for the full 100% to return on the flood tide.

Thus not a single run of these modelled flows gives us any idea of what the model says will be returning from "mixing" in the Lower Harbour proper on the next flood tide and all we get instead is generalised thoughts about mixing due to tidal volumes, shallow waters expansive areas and predominant SW winds.

3. I have only just heard, mentioned in Gordon Reid's Submission to the EPA, of the Midleton College work, which also found increasing levels of TN further up the Great Island SAC, i.e. showing the same as the above two dye studies that lasted for 3-5 days – increasing concentrations of TN/dye to the west.

What, in fact, do the new Irish Hydrodata nutrient concentration simulations show?

Sec. 4.1 covers the Analysis Methods of the ROI, which we are told used "*various calculations and hydraulic modelling methods*" – 3 are specified. But by sec. 4.6 we are told:

"The model is a general-purpose modelling package for simulating flow and transport in surface water systems. It was used previously for the 1993 and 1997 outfall studies of the Rathcoursey outfall location" (thus 22 and 26 years ago).

In 4.7 we are told:

"Model runs were conducted for spring neap cycle under calm conditions", later clarified as:

"The required percentile plots were generated by simulating the full spring-neap tidal cycle and computing percentile occurrences at each model cell. These were computed for the calm weather scenario which would produce the most concentrated plume in the vicinity of the outfall".

However, the new version no longer gives us simulations for LW or HW, which would seem to be important, and we are not told which they refer to.

However, of far greater importance, as I say below in my fuller discussion of this paragraph 4.7 on p. 27, below, a simple comparison of the new Fig. 4.14 (and Fig. 4.15), which shows the effects of the discharges from Rathcoursey alone (i.e. WWTP, IDL and Dairygold) with the results of both sets of dye studies (IH 1993 and CHPR 1977) carried out over 3 & 5 days, the simulations, which we are now given, are the complete opposite of what was shown to actually happen in the dye studies.

We find that the concentration of the DIN released is now ten times (1,000%) **LESS** at the far west end of the North Channel than at Rathcoursey, whereas the physical dye releases from Rathcoursey Point, made by Irish Hydrodata in 1993, show concentrations above Weir Island to be 3 times (300%) **GREATER** after 2 days and still twice as great (200%) after 3 days (see Ref. 21 of my earlier Submission for these HW dye results).

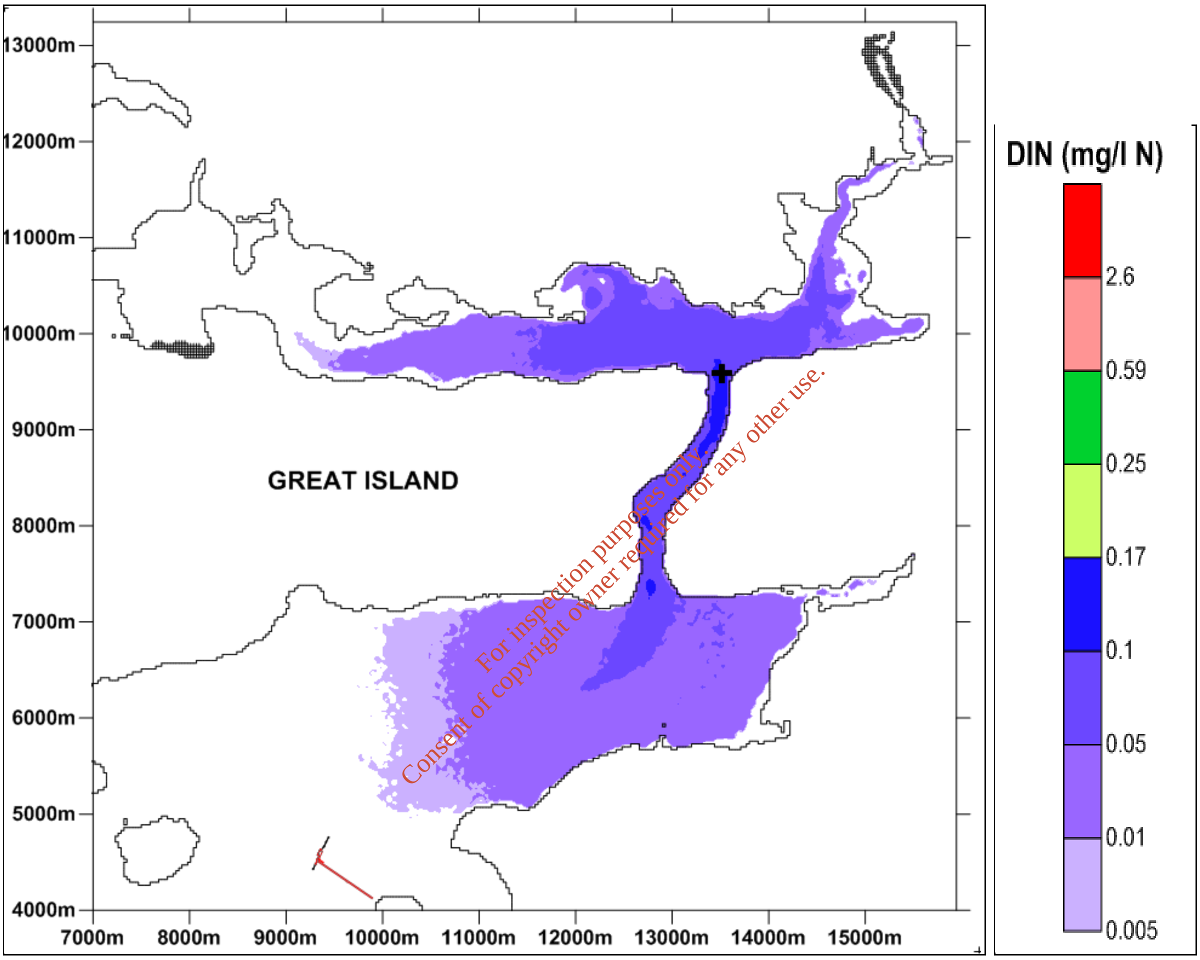


Fig 4.14 from the Rathcoursey Outfall Investigation of 11th July 2019

With the MCOS CHPR 1977 dye studies over 5 days shown on p. 28, below, the dye at the west end is shown to be **150% greater** than at Rathcoursey for the same intermittent release, at the end of the 5 days.

Now that the required Dairygold Coastal Modelling Report has been supplied as an updated version of the Rathcoursey Outfall Investigation of 19 May 2017, I will comment on the various other new details in it here.

<u>Updated</u> "Rathcoursey Outfall Investigation (ROI) **of the Impact of Treated Wastewater Discharges arising from the DairyGold Mogeely Plant to Cork Harbour". <u>11 July 2019</u> Prepared for Irish Water by Irish Hydrodata Ltd.**

We see immediately on the Contents page that there has been no modification of the contents, except for the addition of two Appendices.

Appendix A. Model Calibration Plots.

Firstly, the Current Meter Locations in Fig. 2.1 show the positions of the meter in:

a) the "Gyre" close to the top of East Ferry, which is of little interest and no use in calculating the passage of water along the North Channel.

b) what has been called the "*Brown Island*" meter in the Report, which is actually rather closer to Brick Island and thus close to the very middle of the oyster beds, excellently positioned to provide the data that is needed on water movements up and down the North Channel.

We are given the following figures:

Fig. 3.4a dated 25.08.1993 from the 1993 Midleton WWTP EIS (already in the 2017 report)

Fig. 3.4b 01.10.1985 from the original 1993 EIS from a MCOS 1985 (EIS s.3.3.4)

Fig. 3.4c 30.09.1985 " " (already in the 2017 report)

Fig 3.5a undated, "*Off Brown Island*" data from 1993 EIS for 2 days – see text below.

It is significant that this figure was NOT given to us in the original Rathcoursey Outfall Investigation (ROI) of 19th May 2017 and it may be significant that <u>only these 2 days were given in the original 1993 EIS</u>, rather than the fuller 12 day spring tide/neap tide cycles, collected at that time, but only put into the public domain by Prof. O'Kane in 2007, which made it so much clearer that the flooding current speeds to the west in the North Channel were consistently far greater than the ebb current speeds to the east (see my Ref. 5 of the earlier Submission for the best definition of the 12-day data.)

Fig. 3.5b undated, "*In gyre off NW Corner of East passage*" – this again is of no interest.

Fig. 3.6 Drogue tracks. These show the penetration of flows right up to Bailick 2 PS in the Owenacurra Estuary and to the west of Weir Island in the far west of the N. Channel, showing also that there is no inflow from the Cork side.

The accompanying text of the Brown Island current meter data for Fig. 3.5a, above, from the 1993 EIS reads:

"*s. 3.3.5. Predicted time series at the current meter sites compared reasonably well to measured values, figures 3.4a,b though not as closely as those in the East Passage. This is to* *be expected given that there is more scope for spatial variation in the open waters. Off Brown Island comparisons were very close during spring tides while the model did not fully reproduce the ebb pattern in this specific cell."*

Indeed, the modelled ebb tide currents on neaps show very much greater current speeds than actually recorded by the meter on both springs and neaps, but especially neaps, where neap model maxima appear to be flowing at c. 0.14m/sec and the actual speed was recorded at about 0.08m/sec – this is a difference in the ebb current speed of about 60% less, in reality, than modelled.

This is a big difference and cannot be overlooked or wished away.

Appendix B. Model details

This has clearly been added in answer to the EPA's Regulation 10 Request for Further Information in their Coastal Modelling question 2.3,

"2.3 Provide the model methods in the annex of the revised modelling report. This will enable the Agency to carry out a more detailed assessment of the model itself",

This was to enable the EPA to "*carry out a more detailed assessment of the model itself*", which was used for the 1993 Irish Hydrodata Report for the Midleton EIS, in comparison to the later work with the Falconer model used by NUIG from 2005-2012, and hopefully to form a view on the latter's flushing module, with its literally scores of fine-tuning variables, and the spatial distribution of residence times in the Harbour, which so accurately accounts today for the position of the Harbour's historic oyster beds.

What has been supplied in this Appendix 2 is close to the same order of magnitude difference in modern computer hydrodynamic modelling, as today's smart-phone having the computing power of the NASA lunar landing mission made 50 years ago in 1969. Indeed the documents produced in response to the EPA's request, even look very much as though they were produced on a typewriter.

The Appendix gives a list of the papers and background mathematics for:

The "Two Dimensional Flow Model – M2D"; with 1. "Overview"; 2. "Computational Aspects of Model"; 3. "Supporting Programs". No credits are given

Then the, "Particle Tracking Model – LPTM"; 2. "Computational Aspects". No credits are given.

Then the, "3D Flow and Dispersion Model – M3D"; 2. "Model Theory"; 3. "Computational Aspects" and 12 references cited from 1928 – 1990.

Then the "3D Spreading – Patch Model"; 1. "Theory" with 1 reference cited from 1985.

Then, "The Box Model Concept"; 1. "Theory". No reference is given.

Then, "The Near-Field : Integral Jet/Plume Model", with Introduction and Theory. 4 references date from 1960 to 1979.

The references quoted as background for the Irish Hydrodata model are thus drawn from:

1920's	1 paper
1960's	3 papers
1970's	3 papers
1980's	9 papers
1990	1 paper

Thus the most up-to-date of the 17 references cited is 1990 – i.e. 29 years ago, with many of the papers 10 to 20 years earlier still.

This approach to today's requirement to get to the truth about the water movements in this inner part of Cork Harbour, has to be contrasted with the advances made by the hydrodynamic team in NUIG, which has progressed to a further order of sophistication, as outlined, for instance, in the paper, "*Modelling phytoplankton dynamics in a complex estuarine system"*, by Nash, Hartnett and Dabrowski, published by the Institution of Civil Engineers, 2011 (Ref. 3 with my earlier Submission). On p.40, they explain in section,

"2.3 Flushing study

"Hydrodynamic circulation patterns within estuaries are often quite complex and difficult to understand when limited to analysis of traditional field data measurements or model outputs such as current velocity/direction time-series or vector snapshots. In order to assist in better understanding water circulation and nutrient dynamics within an estuarine system, flushing modules can be developed using numerical models to compute flushing characteristics such as residence time".

And they give as Table 1, the long list of further parameters that need to be built in to their nutrient model formulations and associated values:

Parameter	**Value**	**Range**	**Source***
Decay rate for BOD via de-oxygenation: per day	0.210	(0.02–3.4)	BB
Temperature correction for de-oxygenation	1.047	1.047	BB
Decay rate for BOD via settling loss: per day	0.130	(-0.36–0.36)	BB
Temperature correction for BOD via settling loss	1.024	1.024	BB
Decay rate for hydrolysis of organic N to NH_3: per day	0.400	(0.02–0.4)	BB
Temperature correction for organic N hydrolysis	1.047	1.047	BB
Decay rate for organic N via settling: per day	0.100	(0.001– 0.1)	BB
Temperature correction for organic N via settling	1.024	1.024	BB
Decay rate for NH_3 via oxidation: per day	1.000	(0.1–1.0)	BB
Temperature correction for NH_3 via oxidation	1.083	1.083	BB
Temperature correction for re-aeration	1.024	1.024	BB
Sediment oxygen demand (SOD) rate: mg/m_2 per day	5.000	(1.5–9.8)	F
Temperature correction for SOD rate	1.060	1.060	BB
Rate of oxygen uptake per unit of NH_3: mg DO/mg N	3.500	(3.0–4.0)	BB
DO exchange coefficient for stagnant water: mm/h	5.000	5.32	C
Half-saturation DO limiting constant: mg/l	2.000	2	F
DO production per unit of chlorophyll-a: mg DO/mg Chl-a	0.133	(1.4–1.8)	BB, B
DO uptake per unit of chlorophyll-a: mg DO/mg Chl-a	0.100	(1.6–2.3)	BB, B
Max. algae growth rate at reference temperature (20C)/ d	2.000	(1–3)	BB
Temperature correction for max. algae growth rate	1.047	(1.01–1.2)	B
Half-saturation constant for light limitation: Ly/day	6.000	(7.8–39)	BB
Rate of respiration plus excretion: per day	0.060	(0.05–0.15)	B, C

Temperature correction for respiration + excretion	1.047	(1.01–1.2)	B
Algae settling velocity: m/day	0.050	(0.04–0.6)	B
Phytoplankton death rate constant: per day			
non-predatory mortality rate	0.010	(0.01–0.1)	B
rate of losses due to grazing	0.020	—	
Half-saturation constant for N: mg N/l	0.060	(0.01–0.3)	BB
N fraction of algal chlorophyll: mg N/mg Chl-a	7.200	(7.2)	B, C
Fraction of dead and respired phytoplankton recycled to organic N pool:			
mg N/m^2 per day	0.100	—	F
Fraction of dead and respired phytoplankton recycled to organic P pool:			
mg P/m^2 per day	0.100	—	F
Half-saturation constant for P: mg P/l	0.010	(0.001–0.05)	BB
P fraction of algal chlorophyll: mg P/mg Chl-a	1.000	(1.0)	B, C
Hydrolysis rate for organic P to inorganic P: per day	0.085	(0.01–0.7)	BB
Temperature correction for organic P hydrolysis	1.047	1.047	BB
Settling rate constant for organic P: per day	0.010	(0.001–0.1)	BB
Temperature correction for inorganic P settling rate	1.024	1.024	BB
Settling rate constant for inorganic P: per day	0.010	—	F
Temperature correction for inorganic P settling rate	1.047	—	F

*BB, Brown and Barnwell (1987); B, Bowie et al. (1985); C, Chapra (1997); F, Falconer et al. (2001)

As I have said before, this model has been so highly developed that it apparently takes almost as long to run, as what is happening in real-time, but in my earlier submission, I note that the results of the flushing model and residence times, very accurately mirror all that we know of the historical position of the Cork Harbour oyster beds, which depended on, "*an almost perfect oscillation of the water*", for the larvae to still be present in sufficient numbers to maintain the oyster beds after 20+ tidal cycles – as well as also being ground-truthed by the chlorophyll-a concentrations predicted and then observed from the air.

The problem with the hydrodynamics offered by Dairygold all along, has been that there was nothing updated from the 1993 work put forward by Irish Hydrodata in their May 2017 Rathcoursey Outfall Report (ROI), nor again when the same work was appended to the Updated NIS.

However, the body of the ROI has now been updated to a small extent in this 11th July 2019 version, in response to the EPA's request for updating the data used in their Coastal Modelling and I will comment on it now, section by section.

Discussion of the Updated "Rathcoursey Outfall Investigations" of 11th July 2019 (cont.)

This update can be found on the pdf put up on the website on that date:

http://www.epa.ie/licences/lic_eDMS/090151b2806fe2d4.pdf

The first new passage comes in s. 3.3 on p.11 (p.15 of the pdf):

"*The treated DG process water will be pumped to Rathcoursey from where it will join the existing rising main from Midleton to discharge on the ebb tide. Tidal holding will be maintained in the pipeline from Mogeely*".

This sounds as though there are to be no holding tanks at Mogeely, as we had been told before, and we would need to know what spare capacity is proposed to be built in to cater for those natural and man-made events, errors, plant break-downs and the like, for which plant and capacity usually make very ample provision in, say, sewage treatment works?

4.2 Background Coastal Water Quality

On (p.14 and p.18 of the pdf). The following has been added:

"There is a general downward trend. This is in line with the findings of the 'EPA Water Quality in 2016 Report' (ref:19) which notes that there has been significant improvement in dissolved inorganic nitrogen in Lough Mahon and Outer Cork Harbour since 2007. The ongoing Cork Lower Harbour Main Drainage project is expected to lead to further significant improvements once complete in 2021.

This has no relevance at all to adding nutrients to the North Channel, which the more modern hydrodynamic studies have shown will only accumulate in that enclosed area, over a 50-70 day period of residence and obviously add very materially to the risk of raising the levels of the toxic algal blooms, which persist there, to a higher order of toxicity.

The latest report on the trophic status of the relevant water is, in fact, the November 2018 EPA's "*Water Quality in 2017: An Indicators Report"* Trodd W. and O'Boyle S.,

https://www.epa.ie/pubs/reports/water/waterqua/Water%20Quality%20in%202017%20-%20an%20indicators%20report.pdf

This is a countywide overview, but the Owenacurra Estuary features prominently and on p.46 the Owenacurra Estuary is singled out as being one of the four water bodies in the country which have the highest dissolved inorganic nitrogen concentrations:

- Glashaboy Estuary (Co. Cork),
- **Owencurra Estuary (Co. Cork),**
- Upper Barrow Estuary (Co. Kilkenny), and
- Lower and Upper Slaney Estuary (Co. Wexford).

Map 11 on p.48, shows these winter dissolved inorganic nitrogen (DIN) levels in estuarine and coastal waters for 2015–2017, and shows that the percentage exceedances of the Owenacurra Estuary and the Glashaboy Estuary are not only the highest in the country, but the only two in in the country with a record of greater than 50% exceedances.

I have argued that the figures for "riverine DIN", being taken from the freshwater reaches above the town pumping station overflows, do not account for a further significantly large input of untreated nutrients from the town's storm overflow tanks (see my earlier Submission s. 7.6.1 for more detail and including a consideration of phosphate in sec. 7.5)

Table 4.1 now splits summer and winter EPA trophic records, showing that the winter DIN level for eutrophication, quoted as 0.4mg/l, is exceeded at all the stations in the Owenacurra and East Ferry, but with none of the stations of the body of the North Channel being included. It is these North Channel stations, which will be affected by increasing nutrient status and the shellfish on the beds and foreshore there, which will be put at risk. These must be considered.

There are not so many winter DIN and Phosphate records in the latest batch of 2015-2017 records, but we have a winter snapshot for 2016 and 2017 for the North Channel stations off the N. of E. Ferry (LE450), Brick Island (LE430) and Weir Island (LE420):

Table of EPA sampling in the North Channel 2015-2017.

Station No	Sample Label	Survey Date	TON mg/l N	Av. TON	PO4 µg/l P	Av. PO4 mg/l	DIN mg/l	Av. DIN mg/l
LE420	Weir Island	21.01.15			n/a		n/a	
LE420		"			n/a		n/a	
LE430	Brick Is.	"			n/a		n/a	
LE430		"			n/a		n/a	
LE450	N of E. Ferry	"			n/a		n/a	
LE450		"			n/a		n/a	
LE420	Weir Is. S	03.03.16	0.93		36		1.05	
LE420	Weir Is. B	"	1.3	1.115	34	35	1.4	1.225
LE430	Brick Is. S	"	1.4		31		1.49	
LE430	Brick Is. B	"	0.91	1.155	30	30.5	1.001	1.246
LE450	N. of E. Ferry B	"	1.4		30		1.483	
LE450	N. of E. Ferry S	"	0.55	0.975	29	29.5	0.625	1.054
LE420	Weir Is. S	17.01.17	0.74		30		0.87	
LE420	Weir Is. B	"	0.55	0.645	24	27	0.635	0.753
LE430	Brick Is. S	"	0.46		18		0.531	
LE430	Brick Is. B	"	0.46	0.46	18	18	0.531	0.531
LE450	N. of E. Ferry B	"	0.41		24		0.472	
LE450	N. of E. Ferry S	"	0.41	0.41	24	24	0.472	0.472

These winter DIN results are all over the 0.4 mg/l quoted as the target value in the 2017 ROI but not all at the level of the 0.59 mg/l now given in the 2019 ROI for a water salinity of 29.52ppt (s. 4.5 p.17 and p. 21 of the pdf) – both, however, are advised as set as the target value for the "*edge of the mixing zone*". The figures above are for the waterbody many kilometres from the mixing zone at Rathcoursey, in fact, it must be noted that the levels are again highest for both DIN and P at the far west end of the North Channel, with Brick Island intermediate.

4.3 Background River.

We are pleased that after our earlier submissions, the 2019 ROI now admits that;

"*The Owenacurra estuary was reported (EPA, ref 17) to be one of the top five estuaries countrywide for highest absolute winter DIN concentrations for the period 2014-2016".*

(Note, however, that the wrong Ref. No. has been given. This should be Ref. 19).

4.4 Combined Nutrient Inputs

We should stress that we are not interested in the "*wider Cork Harbour context*" of the second paragraph, but the way in which the input from the Owenacurra Estuary and any further inputs of nutrients at Rathcoursey, actually get to the wider Cork Harbour, which the Brown Island current meter record, never given to us for the full spring and neap cycles, until published in the Prof. O'Kane Report of 2007 "*Modelling of the Norovirus contamination of an Oyster Farm in Cork Harbour*", produced as the Objective Study demanded under condition 7 of the 1999 foreshore licence issued by the DOMNR, has now made it so much more obvious. (See sec. 3 and p.13, above and secs. 5.5 and 5.6 of my earlier Submission).

4.5 Initial dilutions.

The new ROI tinkers here with the salinities to produce slightly higher target levels for DIN and PO4, but, apart from the rather telling sentence that,

"It is not possible to plot a winter DIN mixing zone as envisaged in SI 272/2009 as the background values are <u>already above the EQS</u>",

and,

"*Figures 4.3 to 4.6 show that the PO4 concentration is <u>mostly</u> well below the target EQS <u>except for a very short period around slack waters",</u>*

All further calculations of these nutrient inputs are not of much use, if there is, in fact, <u>no dilution</u> due to new water coming in, <u>but an accumulation</u> of the nutrients in the North Channel, reaching their highest levels eventually at the far west end of it, before exiting to Passage West and the Lower Harbour via Belvelly.

Figure 4.2 gives us summer and winter records for the following stations:

LE 810 Roches Point (8km away!)
LE 610 Adjacent to Aghada (4km away!)
LE 550 East Ferry Quay, Rathcoursey West (half-way down East Ferry)
LE 540 Ballynacurra Est. Rathcoursey (S. end of Ballinacurra Estuary in the N. Channel)
LE 450 North Channel, Bagwells Hill (the gyre opposite Rathcoursey Point)
LE 530 Top end of Owenacurra Estuary, below Ballinacurra.

All the last 4 are, in winter, above the DIN "EQS", but, of greater importance, conspicuous by their absence, are the stations of the North Channel proper, which are not considered:

LE 430 North Channel, Brick Island (middle of the North Channel and the Designated Shellfish Waters)
LE 420 Weir Island (west end of the North Channel)

My Table of EPA sampling in the winter at these stations in sec. 3, above, shows that both DIN and PO4 are highest at Weir Island as they accumulate to the west towards Belvelly. In the summer they are rapidly depleted by the excellent phytoplankton growth of the North Channel, but which, at the same time, puts it also in danger of these algal blooms – including harmful ones.

Figs. 4.3 to 4.8 give calculated dilutions of the surfacing plume on the outgoing ebb tide, but these are of no material interest to us whatsoever, if virtually the very same water is coming back again on the following flood tide.

4.7 Contaminant Dispersion Simulations.

Dropped is the claim that the, "*Model runs were conducted for a recurring average tide lasting 25 days under calm conditions".*

In its place, we are advised that,

"Model runs were conducted for spring neap cycle under calm conditions", which we discussed earlier and that:

"The specific requirements of the various regulations listed in Table 3.3 frame compliance in terms of occurrences at either the 95%ile or 50%ile level".

I can find no reference to a 50%ile value being allowed in Table 9 of the Schedules in S.I. No. 272 of 2009 :

http://www.irishstatutebook.ie/eli/2009/si/272/made/en/pdf

In fact to correctly extract the allowable EQS to Table 3.3, PO4 should read 0.04mg/l at 35psu – not 34 psu and DIN for Coastal Waters has no mention of it being the "median" level, though I see this is what was taken by the EPA 20 years ago (Water Quality in Ireland 1998-2000 p. 60).

In the simulation of 50% DIN concentrations, the existing outputs to the river have also now been reduced from 806kg/d to 750 kg/d (6.9% reduction) and, combined with the Dairygold output, 976 kg/d to 911kg/d (6.7% reduction), as well as now using 50%ile values.

Meanwhile the EQS has been raised to 0.59mg/l from 0.4mg/l – a 48% increase by assuming 29.5 psu at the top end of East Ferry and 34.5psu at the bottom.

I disagree with the new presentation of DIN and PO4 concentrations being made at a 50%ile level rather than the actual levels, **but, of far greater significance is that the projections do not bear any relationship to the real-life results of the 2 dye studies carried out for a number of days in 1977 (MCOS CHPR) and 1993 (IH Midleton WWTP EIS) – in fact, they are diametrically different** (as already pointed out on p.19 above).

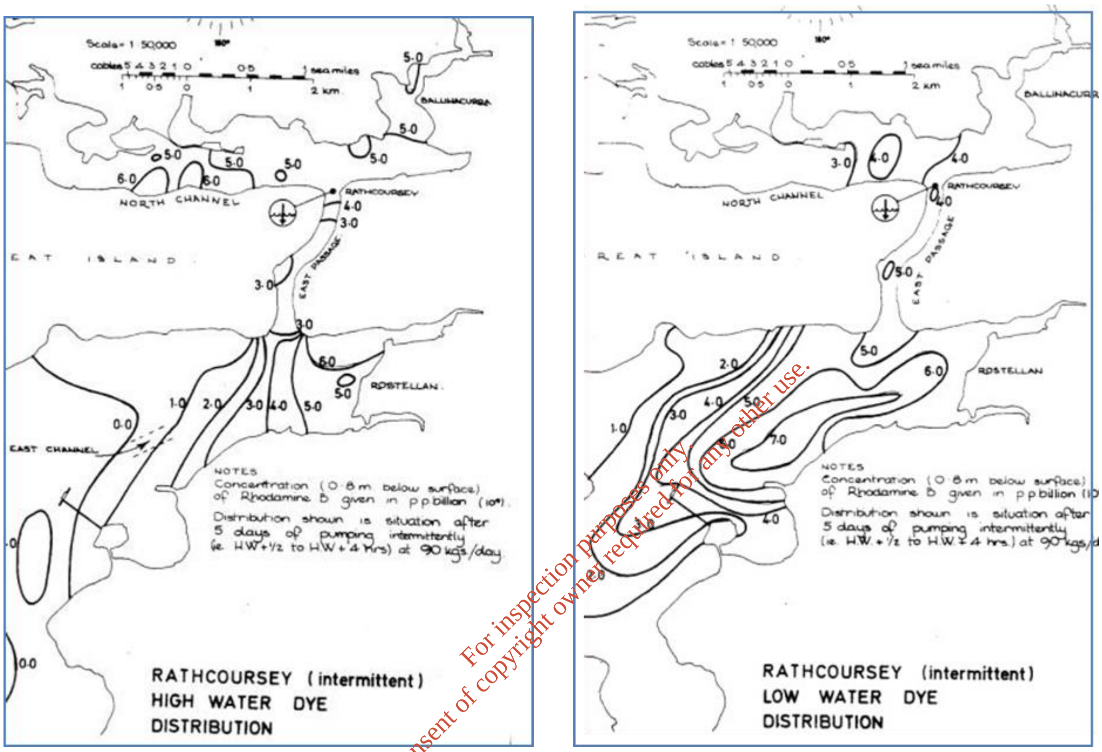
If we look at Fig. 4.14 (reproduced on p.19, above) - the simulation of 50%ile DIN concentrations arising from the Rathcoursey discharges on their own (WWTP, IDL and Dairygold), which we can therefore compare directly to the dye releases from the Rathcoursey outfall, we find that the concentration of the DIN release is modelled to be ten times (1,000%) **LESS** at the far west end of the North Channel than at Rathcoursey, whereas the physical dye releases from Rathcoursey Point, made by Irish Hydrodata in 1993, show concentrations above Weir Island to be 3 times (300%) **GREATER** after 2 days and still **twice as great after 3 days** (see my Ref 21 of the earlier Submission for these HW dye results).

The same is found for the PO4 concentrations, using Fig. 4.18 of the modelled Rathcoursey discharge. They are ten times less at the west end of the North Channel instead of being greater.

Exactly the same state of affairs is also found in the physical dye releases of MC O'Sullivan in the Cork Harbour Pollution Report of 1977, after 5 days of an intermittent release, as required at present in the EPA's WWDL and for the proposed Dairygold discharge, as shown on the page below.

The concentration here is **150% greater** at the west end than at Rathcoursey at HW.

Figs. Concentrations of dye at HW and LW after 5 days of intermittent release
at Rathcoursey Point at the top of each ebb tide (HW+ ½hr to HW+ 4hrs)



If the modelling put forward by Irish Hydrodata for Dairygold is diametrically different to the reality of two physically measured dye studies, it has surely to be dismissed as being totally inappropriate and unacceptable.

In contrast, the modelling of NUIG appears to fit with the dye studies and all the practical observations of the drift of boats and bodies coming from East Ferry (see the Submission also of Charles Hayes, who has lived on East Ferry for over 70 years) and supports the biological observations of the more retentive areas of the Harbour, which have proven ideal for the growth of phytoplankton and the maintenance of the historical oyster beds.

4.8 Dispersion Simulation Summary Results

We are again given just those stations at the east end of the North Channel, stretching to Aghada Power Station in the Lower Harbour – but we have shown that the direction of flow of this water body is inland and anti-clockwise around Great Island - thus this section of predicted increases in nutrient concentrations has no relevance to reality.

4.9 Estuary Tidal Flushing (p.41 and 45 of the pdf)

This section remains completely unchanged. It still says:

"*A fundamental part of flushing calculations is establishing what portion of waters that exit an area on the ebb tide will subsequently return on the following flood. The ebb tide from the Great Island channel travels past Marloag Point and on to the south-west for about 4-6* km".

We would agree entirely with the first part of this statement, but we are not given anything in this study to quantify this and not one of the models run by Irish Hydrodata in 1993 gives estimates for water returning from the Lower Harbour – all deal with HW-3hrs to the following LW only, on neaps and springs, for continuous and "tidal" releases at Rathcoursey, Green Point and Midleton.

Nor is there any support offered for the second part of the statement.

On the contrary, Ni Rathaille and Raine needed to know the precise tidal excursion of North Channel water to set the eastern boundary of their algal bloom model and examined this in their sec. 6.4.1.2 "Tidal Excursion" of the Ph.D Thesis, after numerous boat trips. They reported (see sec. 3.1 on p.17 of my earlier Submission):

"Having defined the western boundary of the model domain, the eastern boundary then needed to be defined. The extent of tidal excursion in the North Channel was used as a proxy to calculate the length of the model domain. Tidal excursion was found to be approximately 1.5 km at a tidal range of 2.1 m and 2.5 km at a tidal range of 3.3 m. Assuming tidal excursion is linearly proportional to tidal range, and that the two points found were representative points rather than exceptions to the rule, it can then safely be assumed that tidal excursion in the North Channel can vary between 1 km and 3.5 km depending on the tidal range."

3.5km, even taken from Marloag Point, at the very bottom of East Ferry, does not take the water to the Whitegate Jetty and the Main Cork Channel to the open sea.

The Conclusion to the Tidal Flushing Section of the NIS still says:

"A simple tidal prism model when applied to the harbour as a whole gives a first estimate of the flushing time: T= (P+V)/P where T is tidal cycles, V is the low water volume and P is the tidal prism. Using the values presented in Table 2.4 an average flushing time for the harbour as a whole based on neap tide volumes is T = (90.6+247)/90.6 = 3.7 tides or 2 days. The Cork Harbour Study (ref: 17 i.e of 1977*) report suggested exchange factors with the open sea waters of about 0.2 - 0.4 representing the amount of 'new' water that enters on the flooding tide. Using the average exchange factor of 0.3 the flushing time would increase to about 6 days".*

"The same calculation when applied to the waters upstream of Rathcoursey Point suggest a T = (10.49 + 8.4)/8.4 = 2.2 tides = approx 1 day. Applying an exchange factor of about 0.35 (ref:17) indicates a flushing time of about 3 days during neap tides. The 'new' flushing waters in this case are from the lower harbour and not from the open sea as above. However as the water sample data in Table 4.1 shows the median background values of DIN and PO4 at the Aghada and Roches Point sampling stations are not dissimilar.

"Tides vary with the spring-neap cycle over a period of about 14 days and no two tides have the same range. This leads to a seven day period when more water is leaving the harbour area on the ebb than is returning on the flood. The process is reversed over the following seven days. This tidal pumping is also an effective flushing mechanism.

The succeeding HW-LW volume differences have been calculated for 1 year of Cobh tidal data and are presented in Figure 4.28 for the Great Island Channel. They range from $0.2x10^6$ m3 to $2x10^6$ m3 with an average of about $0.45x10^6$m3. Applying the tidal prism method to the average mid-tide volume would indicate a flushing time of about 8 days for the Great Island channel.

All of these prism calculations assume good mixing which is believed to be a reasonable assumption given the tidal volumes, shallow depths and expansive areas discussed previously."

I have copied this vitally important section from the new 11th July 2019 updated ROI, without further comment, in the hope that the EPA will agree with me, that almost each succeeding statement is less worthy of our comment than the last, and that it is clear that Irish Hydrodata and M. O'Sullivan have not dared to properly revisit the illusion that they have built up together, that Rathcoursey was the suitable place to make the discharge from Midleton in 1988, 2000 and now still, in 2019, from Mogeely.

5. Conclusions

Now added to the end of the first paragraph is the admission that:

"The existing winter DIN background level is above the EQS target for Good Status"

and this, despite increasing the EQS from 0.4mg/l to 0.59mg/l. The level of 0.67mg/l being 14% over this new EQS for Good Status, without any additional discharge from Dairygold.

The penultimate paragraph states,

"*Discharges from the outfall are carried by the ebb tide to the south and into the lower harbour. A high proportion returns on the subsequent flood. Based on dye tests (ref:17) this fraction is about 65%".*

Thus they are still using the science of the 1977 CHPR of 42 years ago to get an exchange factor of 0.35.

They then go on to say,

"Estimates of flushing rates vary and are dependent on the method used and stage of the spring neap cycle. The tidal prism volumes are large relative to the low water volumes. Estimates range from 3-8 days for the waters upstream of Rathcoursey Point".

But they give no idea of how these "*estimates*" are arrived at.

If we assume the above exchange factor of 0.35/tide, i.e. with 65% water returning, from the first statement, then it is easy to calculate that, in 3 days, or 6 tides, there will be 100 x 0.65 x 0.65 x 0.65 x 0.65 x 0.65 x 0.65% = 7.5% remaining and in the same way, after 8 days, or 16 tides, there will be = 0.1%

The two statements are clearly totally incompatible. One is based on inexact technology of 40 years' ago, the other some sort of unknown guesstimate to meet the results of the NUIG work to some extent.

In my earlier Submission in s. 3.2.3, I give a Table on p.24 of the important differences for retaining at least 30% of the oyster larvae for the minimum of 10 days' development (20 tides) required for settlement and the biologically very significant success rates, that would be likely to be found from water with an exchange rate of 3.7% per tide (probable success) to 5% (marginal) to 6% (needing help from high water temperatures to speed growth). All that in such a fine difference of just 2.3% in the tidal exchange.

Thus the premise of this updated Rathcoursey Outfall Investigation continues to be that the discharge from Rathcoursey leaves to the south, where there is mixing, dilution and flushing to the open sea – but without any facts or figures.

This is incompatible with all we now know from the actual measurements of the tidal current speeds down the centre of the North Channel, which show that there is an anti-clockwise flow of water around Great Island, with a residual movement of the waterbody each tide to the west. There is probably very little initial mixing/dilution in the Lower Harbour, as demonstrated by the high residence times of 40-50 days in the NE corner of the Harbour, and with nearly all the water reaching there on the ebb, then returning up the East Ferry on the next flood tide, with approx. 75% turning to the west into the main body of the North Channel (MCOS CHPR 1977), penetrating further west on each flood tide over the last, until that slug of water passes out of the Belvelly Channel to Lough Mahon and to Passage West and down the west of Cork Harbour to the open sea.

Irish Hydrodata's model should be perfectly adequate to calculate this residual tidal movement to the west from the 12 days' current meter record, which they hold from the data collected for the Midleton WWTP EIS in 1993 and shown graphically in my Ref. 5, accompanying my earlier Submission.

The final paragraph, comparing the input of DIN by Dairygold to the much larger input by Cork City from Carrigrennan WWTP has no real relevance to the nutrient status and augmentation of algal blooms in the North Channel, which is what we are concerned with. However, it does alert us to the very pertinent fact that the Owenacurra and Dungourney Rivers, flowing through Midleton (population 13,000), contribute half as much DIN to the harbour as does Carrigrennan WWTP catering for the population of Cork City which is ten times larger. It also does this with a flow one tenth the volume and flushing effect of the River Lee, vide p. 176 of the MCOS CHPR 1977, which observed:

"(iii) The freshwater flushing of the Ballinacurra Estuary ***is well-nigh totally absent*** *in summer and in winter is very small in comparison with the Lough Mahon situation."*

One can well understand the continual eutrophic/potentially eutrophic status of this water into which this Dairygold discharge is planned to be made.

Continuing with the EPA's Regulation 10 Request for Further Information and the updated Natura Impact Statement:

http://www.epa.ie/licences/lic_eDMS/090151b2806f4418.pdf

6.7 Assessment of Potentially Significant Cumulative Effects (p.53 and p.108 of the pdf)

Dropped from the 2016 NIS are:

"Trade effluent will be discharged via diffuser pipe on 6+ hour ebbing tide in a 24 hour ebbing tide in a 24 hour period with water undergoing an ~80% exchange so that the subsequent discharge event will occur on new water coming in. Thus, considering the water exchange within Cork harbour it is unlikely that significant cumulative water quality will arise."

Added is reference to the assessment undertaken by Irish Hydrodata Ltd (2017), which,

"*considered the cumulative impact of discharges from the site together with licenced emissions from the Midleton UWWTP (EPA licence Ref: D0056-01) and Irish Distillers Ltd (EPA licence Ref: P0442-01)"* and concluded, "*that the additional increases will not materially impact the water quality".*

We would hold that the 300,000m3 p.a. of overflows from the Midleton pumping station storm tanks, already impact the water quality of the Owenacurra Estuary and North Channel and are not taken into account in the Dairygold calculations, which use freshwater riverine DIN levels from <u>above the town</u>, which do not take into account the overflows made into the <u>tidal waters</u> and are doubtless responsible for the Owenacurra Estuary being one of the 4 estuaries with the highest DIN levels in the country and listed as potentially eutrophic.

We also hold that not only are the proposed Dairygold discharges adding cumulatively to the town and overflow discharges, but are all accumulating in the North Channel as the residual water flow is coming inland and gradually, over 50-70 days, progressing westwards towards Belvelly, before exiting to the Lower Harbour and the open sea.

7. Mitigation (p.54 and p. 109 of the pdf.)

7.2 Operational phase.

- *"It is proposed that discharges will be on an ebb tide only which will allow the effluent to be flushed out of the receiving environment."*

Our comment is that "*flushing out of the receiving environment*" only occurs over a period of 50-70 days mainly via the North Channel and through Belvelly, with probably less than <u>4% per tide in total</u> being lost (i.e. really just the freshwater inflow down the Owenacurra Estuary), leaving very little not finding its way back to the North Channel after the first ebb tide from Rathcoursey down to the East Channel in the Lower Harbour - otherwise the oyster beds of the North Channel would never have been able to have retained sufficient larval numbers for settlement over the necessary minimum of 20 tidal cycles to maintain an oyster bed (see sec. 3.2.3 of my earlier Submission re the requirements for oyster bed formation and the *"almost perfect oscillation of the water",* required).

- *It is proposed that the necessary storage and controls will be provided at the DFI WWTP Mogeely, to meet the ebb tide discharge requirements. It is proposed that that discharges from the holding tank at the DFI WWTP at Mogeely will be pumped and the pumps will be synchronised, by lunar clock, with the opening of the penstock at Rathcoursey Tidal Tank".*

We believe that this is far too difficult to organise from a distance of 14km. There is no lunar clock at the Rathcoursey tank. In theory the water caretaker switches the timer from a week of neaps to a week of springs (the EPA has a picture of this in Brendan Wall's Report of a visit to the tank dated 27.04.12), but there is no precision and no records have ever been kept of the timing of discharges made and the daily times of the HW+½hr – HW +3½hrs, as required by the EPA for the control and monitoring of the discharge, after this visit:

"b. A record should be kept of the daily discharge times from the holding tank at Rathcoursey along with details of the tidal state during these times."

Can I remind you of our comments in s. 1.4, above, that analysis of the flows already being discharged to the sea and measured at the final pumping station of Ballinacurra 1, show that on about 4 days a month flows will exceed the flows projected by Mott MacDonald for Irish Water, and of these high flows, by as much as 70%. By just how much they can, on occasion, rise to, is shown in the final column:

Table of Exceedances of Mott MacDonald flow projections from Rathcoursey

Table 3.1 Mott MacDonald April 2016 Concept Design Report for Irish Water

Estimated and Projected Flow Profile						Actual flow profile			
Flow Profile 2016-2025 (with figs. added for 2014 & 2015)						No. flows > MM Total	Av. size of	% larger than	Max. flow
Year	WWTP	Infiltration	IDL	Dairygold	Total	Projected Flow given	these flows	MM allowance	in year
2014	10,368	2,100	2,396		14,864	67	19,269	30%	33,398
2015	10,368	2,100	2,396		14,864	38	25,213	70%	63,140
2016	10,368	2,100	2,396		14,864	58	21,362	44%	51,047
2017	10,368	2,100	2,396		14,864	16	18,592	25%	24,981
2018	10,368	2,100	2,396	unaltered	14,864	34 (till 30.06.18)	17,189	16%	27,616
2019	10,368	2,100	2,396	2,500	17,364				
2020	10,368	2,100	5,000	2,500	19,968				
2021	10,368	2,100	5,000	4,000	21,468				
2022	10,368	2,100	5,000	4,000	21,468				
2023	10,368	2,100	5,000	4,000	21,468				
2024	10,368	2,100	5,000	4,000	21,468				
2025	20,736	2,100	5,000	4,000	31836				

The above MM Table still makes no allowance for the annual increase in population in Midleton - and hence the annual increase in sewage volume, being shown as a single jump from 10,368m3/day to 20,736 in 2025, when it suddenly doubles?

In the case of plant failure or power cuts of any length, we are given no idea of the capacity of any "divert system" and I feel sure that the flow of even one day's downtime could not be sent elsewhere except to Rathcoursey, which is, of course, designated as a "sensitive water" to prevent just this sort of event occurring.

The Regulation 10 letter of 13.03.19 from the EPA asks of the updated NIS,

"*should mitigation failure be identified, how will that failure will be rectified".*

This does not appear to be answered and must include plans for diverting flow elsewhere, when there are periods of plant downtime or poor quality effluent. This should clearly not be into the Kiltha River, which is already overloaded by the Castlemartyr WWTP (see the WYG Report into Upgrading Wastewater Treatment Facilities at Midleton, Castlemartyr, Cloyne, Saleen & Ballycotton. Design Report. WYG Engineering (Ireland) Ltd., November 2008. NB on p.15 et seq. of EPA Export 26-07-2013:13:23:14

http://www.epa.ie/licences/lic_eDMS/090151b2802a665a.pdf

The plan to "*divert out of spec wastewater back to the inlet Balancing Tank for further treatment"* would clearly not be able to be done on any scale, or sustained poor treatment quality, or the treatment plant would be overloaded. I noted in sec. 1.5 (b) on p.8 above that the final holding tank had only 152m3 over the 1,042m3, stated to be the *minimum* requirement – allowing only 12% spare storage.

I also note on the same page that there may be some newer plan to hold the tidal slug of effluent in the pipeline itself, c.f. Rathcoursey Outfall Investigation of 11.07.19, in s. 3.3 on p.11:

"*The treated DG process water will be pumped to Rathcoursey from where it will join the existing rising main from Midleton to discharge on the ebb tide. Tidal holding will be maintained in the pipeline from Mogeely".*

This does not sound like a serious suggestion if real mitigation is to be provided.

It might be pointed out that EPA's requirement for an ebb tide release at Rathcoursey has been treated very lightly by Cork CC for very many years, not only by not repairing the apparently "leaking" lunar-clock controlled valve, but, in fact, their e-mails to John Feehan of 16.02.11, then copied to Brendan Wall of the EPA of 17.02.11, even went as far as to say that there was "*no power at the site*". Nor were Mott MacDonald ever able to visit the site on behalf of Irish Water. Nor was Brendan Wall's request in his Waste Water Inspection Report of 27.04.12, for a register of discharge times and tide times to be kept daily, given any regard by those in charge of the discharge.

No one can tell when the pipe to the seabed is discharging and this history of disregard for the EPA and the environment, does not bode well for trustworthy mitigation, should the Dairygold discharge be permitted.

9. EPA Requirement to Update Application Documents

Appendix 9

The Dairygold reply to the EPA's request is provided on Appendix 9 which starts on p.216 of

http://www.epa.ie/licences/lic_eDMS/090151b2806f4418.pdf

9.1 Updated Non-Technical Summary of April 2019. (pp. 1-25) (p.217 of the pdf)

This only advises us of the new plan to discharge to the Irish Water pipeline at Bawnard.

I understand that the plan has been changed in order to get over the problem of the six landowners on the last stretch of road from Bawnard to the Rathcoursey tank not being prepared to give their permission for the new pipeline to be installed on their property. Otherwise there is nothing new.

9.2 EPA Application Form. (pp. 1-7) (p.245 of the pdf)

9.2.1 Equivalent Level of Protection", Attachment 7-3-2 and 7-3-2-1

p.6 of the EPA Application Form advises that to find the "Equivalent Level of Protection", Attachment 7-3-2 Equivalent Level of Protection (Sewer) has been filed. This leads us to Attachment 7-3-2-1 Supporting Documents on p.7 of the pdf (filed by the EPA on 15.02.19)

http://www.epa.ie/licences/lic_eDMS/090151b2806d6d87.pdf

This advises us that,

"*The following documents are provided to demonstrate that the environmental quality standards for the receiving water will not be breached as a result of the installation's discharges.*"

Five Appendices are given:

Appendix A EIS Volume 2 Chapter 6 (p.9 of the pdf) – this has not been updated

Appendix B "Wastewater Assessment for New and Existing Cheese Production Facilities at Dairygold Mogeely, Co. Cork"

(Document Ref 17617_ 6007) by Malachy Walsh and Partners, 2016 (p.49 of the pdf).

This was initially prepared by M. O'Sullivan in August, October and November 2016.

I have already drawn attention to my concerns over this document, which appears to be full of uncertainties in section 2, "Upgrade of WWTP" (p. 70 of this pdf). Examples are:

2.2 *"If the peak effluent increased pro-rata then the effluent discharge should increase to 3,020m3 /day. Efficiencies will be introduced which will reduce this volume and Dairygold state that the process wastewater volumes are expected to be 1,700 m3 /day. Added to this would be 1,000 m 3 /d of permeate from an RO process which is being introduced to reduce the volume of liquid whey to be transported for further treatment in Mitchelstown.*

"We were originally instructed to design for an initial daily waste stream of 2,700m3 /day with provision to expand to 4,000m3 /day at some future date. Of the 2,700m3 /day we were informed that approximately 1,000m3 /day would be permeate from a Reverse Osmosis (RO) process on the whey so that the WWTP has to cater for 1,700m3 /day.

2.2.1 "The whey permeate is to be discharged with the remainder of the treated effluent. This permeate is expected to have the following characteristics.

Based on those figures this permeate could be used to dilute the treated effluent thereby reducing the treatment standard required. The permeate will be produced at a rate of 42.23m 3 /day over a 20 hour day. This would suggest 850 m3 /d of permeate but provision is made for 1,000 m 3 /d.

However, if, for any reason, the permeate does not meet the above standard, Dairygold wishes to make provision to pass the permeate through the secondary Treatment Plant. Since the permeate will be balanced at the Whey RO facility there is no need to balance it in the WWTP and it will be introduced, if necessary, into the secondary treatment process at the anoxic tanks.

2.3.3 "Based on the permeate characteristics provided by the RO provider it would appear that there will be zero Nitrogen (True Protein = -%; NPN=-%) and only 6 mg/l COD. That suggests that this liquor can be used to dilute the treated process wastewater.

"Based on the above standards secondary wastewater treatment is adequate to meet the projected standards.

2.4 "The above averages are quite consistent and show that the facility is becoming more water efficient. It is considered that the relation of BOD/TP/TN can be applied to the future loads for design purposes while keeping in mind the need to build in flexibility to allow the treatment process survive on lower loading on occasion e.g. the winter period.

No information is available on the pH or FOG characteristics of the wastewater. We are informed that the build-up of FOG in the Balance tank is cleaned once a year.

This is NOT what M O'Sullivan advised us a little earlier on pp. 8 & 9 (60 & 61 of the pdf), which was:

"The result of this is that there is a significant built up of grease in the Balancing Tank which is difficult to clear.

"As mentioned earlier grease accumulation is a major problem in the Balance tank which has no mechanism to clean it.

In 2.5 he gives us the normal and low (but not the high) strengths of the waste arriving at the plant. It could be noted that the "normal" strength of BOD at 2,188mg/l is 1,900% greater than the influent strength of the load reaching the Midleton WWTP (115mg/l in the present enlarged WWTP), for which he so spectacularly underestimated the degree of infiltration, although he had himself designed all the necessary metering of all the sewage flows in the town in the earlier 1988 Midleton Sewerage Scheme – and the UDC Caretaker had recorded daily.

2.5.1.1 "*The normal WWTP throughput will be 1,700 m 3 /d. The WWTP, post Balancing tank and high-rate treatment, will be designed to pass this flow in 20 hours (120% of average), plus permeate at a rate of 50 m 3 /hr to allow room to catch up in the event of an interruption.*

I understand that a 20% surplus capacity would not be considered adequate to cover variations in flow and mechanical failures etc. and I wonder how seriously the absolute quality of treatment required is being taken into account for a discharge directly into a sensitive receiving water.

No diurnal flow (flow pattern through a typical and peak day) information is available at present. In the absence of that information we will assume a peak flow of 6 times average flow.

Despite the above unknowns and assumptions made, we trust that M. O'Sullivan's design for a two-stage secondary treatment plant will give the required nitrification and denitrification to lose TN, and Dissolved Air Flotation with polyelectrolyte and coagulant to give the BOD, N, P and FOG reductions that are necessary. His poor record in designing and over-seeing the construction of the Midleton WWTP, with his gross under-designing of the WWTP capacity, leading to overflows from the sewerage system of 100 times (10,000%) what he said the plant was capable of, leaves us extremely anxious, when the outfall is again proposed to be made at Rathcoursey, right in the middle of our four designated oyster-growing areas and into the middle of a designated sensitive water, which is also on the cusp of suffering from highly toxic algal blooms.

The seriousness of getting the treatment process to be 100% effective all the time, can be gauged by the Dairygold waste being so much more highly concentrated than the sewage effluent reaching Midleton WWTP, as shown:

Comparison of influent loads to Dairygold WWTP compared to Midleton WWTP.

Parameter	Dairygold WWTP "Normal"	Midleton WWTP 3-stream plant	% greater of Dairygold waste
BOD mg/l	2,188	115	1900%
TP mg/l	49.7	6.7	740%
TN mg/l	133.4	20	670%

Midleton figs. from Oct. 2012 to Dec 2016 from monthly FOI requests.

Appendix C "Assessment of Proposed Wastewater Discharges on the Receiving Waters at Rathcoursey Point"

Prepared by M. O'Sullivan for Malachy Walsh and Partners. Oct. 2016 (p. 204 of the pdf)

1. Background. This explains the commissioning of the foreshore tank in 1988,

"*The Foreshore Licence issued at the time by the Department of the Marine included a condition that discharge be halted for 1 hour at the bottom of the tide. A Tidal tank sized for that requirement was constructed on the foreshore some 340 metres from Rathcoursey Point".*

Many of us would find this requirement, designed solely to help protect the oyster fishery from the Midleton discharge, after 18 months of dispute between the Department of Fisheries and Forestry and the DOE, with eventual arbitration by An Foras Forbartha, quite baffling. However, this explains why a tank, which was designed to hold the flow for just 1 hour, has proven to be totally inadequate, over all these years (from May 1992 when its usage was again insisted upon by the Department of the Marine) to hold the flow for 9 hours, so that the discharge could be confined to just the top 3 hours of the ebb.

M. O'Sullivan's paper goes on to say,

"The Foreshore Licence was varied in September 1999 to reflect this advance and the requirement for halting the discharge at any time was removed".

This is not true. His own Application for the Second Foreshore Licence on behalf of Cork CC lodged in October 1997, "*Application to the Minister for the Marine and Natural Resources for a Foreshore Licence"*, states quite categorically on p.7, that,

"Existing Licence (i.e. of 5th March 1986)

At present, Cork County Council holds an existing foreshore licence covering the following (inter alia) :-

- *A tidal holding tank at Rathcoursey*
- *A 750mm diameter outfall pipe and diffuser at Rathcoursey West.*

It is not proposed to extinguish any of these items but modifications are proposed at Bailick Road Pumphouse, the tidal holding tank and the 750mm outfall pipe."

These changes are then defined for the Proposed Foreshore Licence, being applied for, as:

"7) The modification of Rathcoursey Tidal Holding Tank to allow for continuous discharge.

8) A change in quality of effluent to be discharged at Rathcoursey Point."

The foreshore licence granted on 22 September 1999 did not permit any modification to allow a continuous discharge from the holding tank and Cork County Council have observed the DOM's requirement for a 3-hour ebb-tide discharge to be maintained to this day – and the continuing importance attached to a 3-hour ebb discharge by the EPA, was still evidenced by Brendan Wall's further requirement for Cork CC on 27.04.12:

"b. A record should be kept of the daily discharge times from the holding tank at Rathcoursey along with details of the tidal state during these times."

Mott Mac Donald, too, agreed in their Preliminary Options Report for Irish Water of 15 March 2016 (Ref.12 of my earlier Submission) s. 4.3:

"*It would be unwise to alter the current regime of discharging over three hours*….. (without studies and hydrodynamic modelling)….. *It is therefore recommended that the initial tank sizing is based on discharges continuing over a three hour duration".*

To make it quite clear, the 3-hour top of the ebb-tide discharge was a further burden placed on the foreshore licence by the licensors (DOM) in May 1992, in an additional attempt to protect the oyster beds of the North Channel. They have not rescinded this and it is understood by all directly concerned (Cork County Council and the EPA Local Inspector), that it is to be complied with to this day.

The Tables then supplied are all based on the same "Tidal Prism" theory (see the heading of the fourth column in every case), which provides the answer based on the discharge being made into ~80% new water on each tide – a statement now dropped from all the Dairygold updated material.

There is an awful difference between that assumption and an actual <u>accumulation</u> of nutrients in the North Channel over a 50-70 day residence time, for which I hope I have also provided convincing everyday pragmatic examples, as well as salinity/temperature tows, dye studies and up-to-date hydrodynamic modelling, rectifying the misinterpretations made from the studies of 1977 and 1993, which can now be seen to have been confirming, all along, the picture we now have.

This is something like a 4% tidal loss (enough to account for the new freshwater coming down the Owenacurra Estuary), with the harbour water circulating anti-clockwise around Great Island, exiting finally (after oscillating up and down into the Lower Harbour as far as Whitegate) but <u>not</u> via the direct route past Marloag and Whitegate and to the main Cork Channel and the sea, but working inland each tide and concentrating to the west (Fota/Belvelly) end of the North Channel, before exiting to Lough Mahon, Passage West and the Cork Main Channel down the west side of the Harbour, and thence to the sea.

Appendix D "Rathcoursey Outfall Investigation of the Impact of Treated Wastewater Discharges arising from the Dairygold Mogeely Plant to Cork Harbour,"

Prepared for Irish water by Irish Hydrodata. 19th May 2017. (p.219 of the pdf)

I have covered the new points raised in this piece over the original M. O'Sullivan "Appendix 6E Assessment of Proposed Wastewater Discharges on the Receiving Waters at Rathcoursey Point" for the Original EIS, in my earlier Submission in sections 3, 5.5, 6.2.1, 8.1, 13.9 etc. and also in section 3 re Appendix 4 on p.7, above, and extensively on pp. 11-28, above.

Appendix E "Evaluation of the Risk of Adverse Impact on Cork Harbour SPA (004030) and Great Island SAC (001058)". May 2017. Malachy Walsh and Partners (p.269 of the pdf)

We are told that,

"*This report has been prepared by Malachy Walsh and Partners on behalf of Dairygold Food Ingredient Ltd in response to a further information request by Cork County Council dated 9th February 2017 relating to Planning Application P16/07031".*

This request was either a copy of, or was related directly to the Report of the Senior Planner in Cork County Council of the same date, 9th February 2017.

In the Senior Planner's report, he advises on p.10 of 16, re. Chapter 6 of the EIS Hydrology and Hydrogeology:

"The process waste piped to Rathcoursey will discharge into the harbour (North Channel Great Island) which is an SAC, SPA and NHA. In terms of the Water Framework Directive, this water body is at risk of not achieving good status and the objective is to restore its good status by 2021. Part of the water body is designated under the EU Shellfish Waters Directive. There is potential for significant impacts on water quality in the harbour. This issue is also addressed in the Natura Impact Statement submitted with the application. …….. Further details are required to include a detailed impact assessment of water quality arising from the development. A justification for the proposed discharge option is also required, as recommended by the Senior Engineer in Water Services. Details are also required of the odour, pathogen and septicity impacts of the discharge upon arrival at the point of discharge."

We thus see that what was requested of Dairygold was considerably wider than just consideration of the two Natura sites in the Appendix heading, i.e.:

"Evaluation of the Risk of Adverse Impact on Cork Harbour SPA (004030) and Great Island SAC (001058)",

but covering the impact on:

1. The above Natura Sites.

2. The water body as a whole under the WFD, and we are advised by the Senior Engineer that its present status is, "*at risk of not achieving good status"* (p.10 of 16), i.e. it is "moderate" and therefore deemed "unsatisfactory" (see sec.10.3 in my earlier Submission)

3. Those areas covered by the Designations under the EU Shellfish Waters Directive (both the North Channel and the 3 further Designations at Rostellan, immediately below East Ferry, for which there is, "*potential for significant impacts on water quality in the harbour*".

4. Details, *"are also required of the odour, pathogen and septicity impacts of the discharge upon arrival at the point of discharge"*.

The introduction advises us straight away that this evaluation is based on the piece of work in the section above - i.e. Appendix D, the "Rathcoursey Outfall Investigation",

"The evaluation is made with regard to the detailed assessment undertaken by Irish Hydrodata Ltd on behalf of Irish Water of the proposed discharges using 2D estuarine hydraulic process modelling to simulate the resultant plume dispersal and pollutant exposure time".

We believe we have shown this bit of work to be a highly flawed hydrodynamic assessment, but we will look at each of the four points above.

1. The Natura Sites.

Although the native oyster has been listed in the UK as an endangered species for the past 20 years, with a Native Oyster Species Action Plan (NOSAP), which would automatically put it into the list of priority species, which would then be covered by the Habitats Directive, this is not at present the case in Ireland.

However, the native oyster (*Ostrea edulis*) and "oyster beds", themselves, are listed as "threatened" under the OSPAR Convention (in sec.11.3 of my earlier Submission) to which Ireland has been a Contracting Party for 16 years, which gives the North Channel oyster beds, which now can provide up to a third of the national French production of native oysters and has the largest semi-artificial breeding complex for them in the world, a claim to be considered under OSPAR:

Annex 5 "ON THE PROTECTION AND CONSERVATION OF THE ECOSYSTEMS AND BIOLOGICAL DIVERSITY OF THE MARITIME AREA"

"Article 2. *In fulfilling their obligation under the Convention to take, individually and jointly, the necessary measures to protect the maritime area against the adverse effects of human activities* ***so as to safeguard human health****……*".

2. The WFD

The Cork CC Senior Planner's Report of 09.02.17 gives the present status as, "*at risk of not achieving good status"* (p.10 of 16), i.e. it is "moderate" and therefore deemed "unsatisfactory" (see sec. 10.3 in my earlier Submission).

The EPA's last Trophic Status Report for 2015-2017 confirms this. The North Channel is shown as "intermediate" and the Owenacurra Estuary as "Potentially eutrophic" (Map 10 Water Quality in Ireland in 2017 An Indicators Report. Nov. 2018)

The Malachy Walsh Conclusion on pdf p.299 states that the

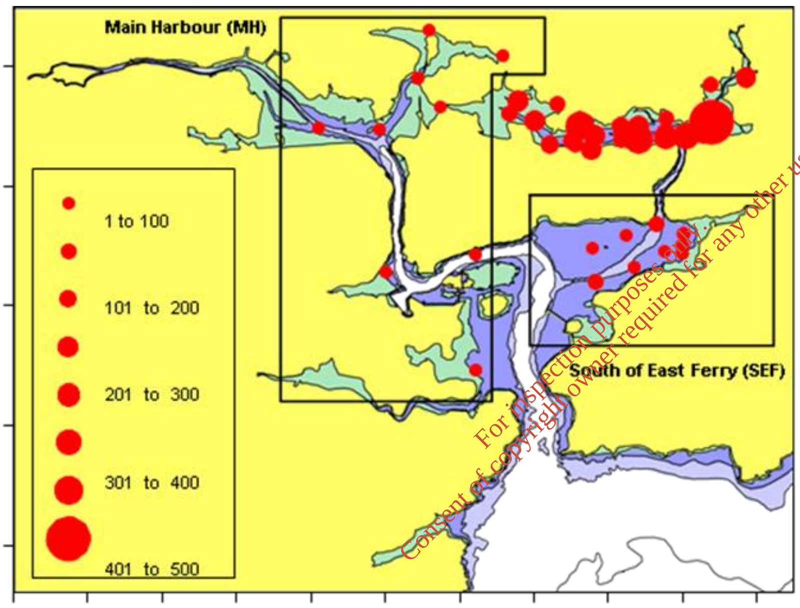
"*The latest water quality information on the North Channel Great Island waterbody from the EPA indicates that it has 'good' ecological status".*

This is not the same as the Trophic Status, or chemical status, which is what concerns us here with a further input of nutrients.

I deal with the trophic status of the Owenacurra Estuary in sec. 7.5 of my earlier Submission and in 7.5.2 and advise that on p.46 of the above EPA Report, the Owenacurra Estuary is singled out as being one of the four water bodies in the country which had the highest dissolved inorganic nitrogen concentrations, and one of the only two in in the country with a record of greater than 50% exceedances.

It is the lower end of this estuary which has the largest seed bed of *Alexandrium* cysts in the North Channel and one of the densest reported in the world (see 6.2.1 of my earlier Submission).

Figure of A. minutum cyst densities (cysts·g^{-1} dry sediment) in surface sediments of the whole of Cork Harbour (from Ni Rathaille Ph.D. Thesis 2007)



3. Designated Shellfish Waters

The introduction to Appendix E, above, advises us that EU Shellfish Water Designations must be taken into consideration by Dairygold in this Appendix:

"Part of the water body is designated under the EU Shellfish Waters Directive. There is potential for significant impacts on water quality in the harbour".

However, they are not taken into consideration at all. No less than four designated Shellfish Waters are involved. The production of oysters has been up in the hundreds of tonnes p.a. level and production in the North Channel and Lower Harbour has been continuous for ourselves and Fota Oysters Ltd. for about 50 years.

The effect of a further addition of nutrients on an already potentially eutrophic water, with one of the 4 highest DIN levels in the country, on taking the annual PSP bloom to a higher toxicity level, is dealt with very fully in sec.10 of my earlier Submission on pp.102-115.

However, I can now report the closure of the beds again this year, but, unlike last year's closure for mussels, oysters were joined to the mussel closure this year as a precautionary measure:

Extract of email sent from the SFPA 1510hrs on Friday 21st June 2019

Dear all,

Please note urgent correspondence from the MI's biotoxin unit warning of PSP (Paralytic Shellfish Poisoning) levels exceeding regulatory limits in Shellfish from Cork Harbour.

The regulatory limit for PSP toxicity is 800µg/kg. Mussels have resulted in 1080 µg/kg for PSP with Oysters at 194 µg/kg.

Due to serious nature of PSP toxicity, the high levels in Mussels and the rapid intoxicification detected in Oysters, Cork Harbour has been placed on an immediate closed pending biotoxin status for Oysters.

All harvesting activities of Oysters in Cork Harbour must immediately cease until further notice.

No harvesting of mussels from Cork harbour is permitted.

Weekly shellfish samples from Cork Harbour should continue in addition to the required weekly phytoplankton samples.

The biotoxin status for Oysters from Cork Harbour will be reviewed when next week's samples are to hand.

Please inform all affected harvesters in the area as a matter of urgency.

Regards,

Brian Nolan
Sea Fisheries Protection Authority HQ
Park Road,
Clogheen,
Clonakilty,
Co Cork
Tel 023 8859326
Mob: 087 9247343
E Brian.nolan@sfpa.ie

AN t-ÚDARÁS UM CHOSAINT IASCAIGH MHARA | SEA-FISHERIES PROTECTION AUTHORITY

Last year (2018) the North Channel was closed for the harvesting of mussels from 12th June up to 15th October – i.e. for four months. It was, however, allowed to be open for the sale of oysters all summer.

This is the great danger of any addition of further nutrients to this enclosed and protected waterbody. It is already creating hazardous conditions for people wishing to collect mussels from the foreshore, but it might just increase the size of the PSP bloom and close the bed for sales of oysters as well – as it has done this summer.

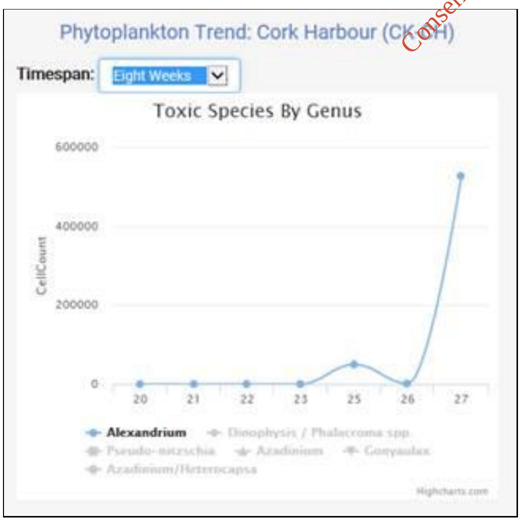
It is the danger that was perceived by the 22 authors involved in the two studies of 2001 and 2002, made for the EPA, which I dealt with in sec. 6.2.3 of my earlier Submission:

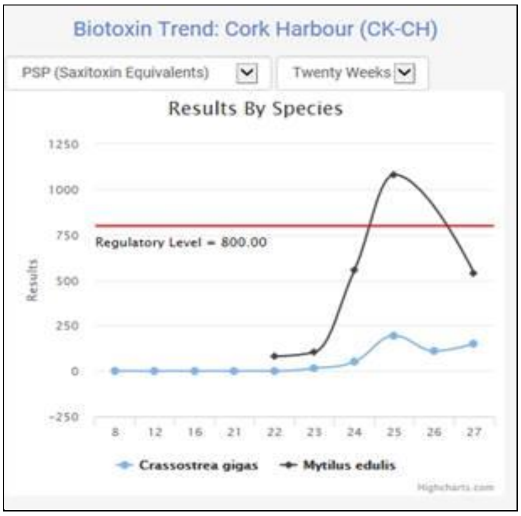
"*Measurement and Modelling of Nutrient Dynamics of Two Estuaries in Ireland – Wexford and Cork Harbours*" by Costello et al 2001 (Ref. 1 in the Submission)

"Water Quality in Ireland 1998-2000", McGarrigle et al, 128pp. plus c.100 pp. of Appendices (2002) (Ref. 6 in the Submission)

The 2019 PSP closure was not of long duration and has now been lifted (18.07.19) following the significant reduction in PSP levels.

However, the two graphs sent to us by the SFPA on that date, show the difficulty faced by both the regulating authority and us as producers, with the even greater threat of doing damage to the image of the safety of Irish shellfish ever present. This knife-edge situation cannot fail to be exacerbated by the addition of yet more nutrients to this confined waterbody, than are already being discharged by an acknowledged, overloaded WWTP and sewer network in Midleton.





Rise in Alexandrium counts in 2019 and exceedance of danger threshold in mussels.

Designated Shellfish Waters benefit very fully, under the protection of the EPA, from the Pollution Reduction Programmes (PRPs), which had to be established following designation. Key Pressures on the fishery identified under the PRPs are then given top A1 enforcement priority by the EPA, under its DREAM programme.

Normally, the Key Pressures relate to the far more common pollution of Shellfish Waters by the human pathogens that derive from untreated or poorly treated sewage, more or less entirely the viral pollution of the "winter vomiting bug", norovirus, for which the EPA has taken its own steps to introduce the requirement into PRPs that the levels of norovirus must be taken into account, both through its technical Amendment(s) A of 2014 of various Cork Harbour WWDLs (see sec. 10.1 of my Submission) and in the PRPs (sec. 10.2), which the EPA regulates, e.g.

"PRP 5.0 Action Programme. 5.1 Key Pressures:

"*The requirements of the European Communities (Quality of Shellfish Waters) Regulations, 2006 (as amended) have been fully integrated into the EPA licensing process. In addition this process takes into account the effect of viruses on the quality of shellfish waters. The licence will require detailed actions including infrastructural works, if required, by the licensee within specified time-frames if the discharge does not comply with the above Regulations. Each licence granted will be subject to enforcement by the EPA. Full details of each application and licence decision can be viewed online at www.epa.ie."*

In the case of the Dairygold discharge, we are not concerned with human pathogens, but share the concern of the above EPA Reports on the water quality in Cork Harbour, that the introduction of yet more nutrients into the totally unsuitable discharge area of inner Cork Harbour, must not occur.

A particular danger to the public is that they do not see warning notices in the papers and gather mussels, especially, which accumulate the toxin more readily than oysters, and which can be gathered freely on the shore. It should be noted that the gathering of shellfish has become much more usual in Cork Harbour, with the growth of Far Eastern and East European families moving in for work.

The Saxitoxin produced by blooms of *Alexandrium spp*. causing PSP is the only biotoxin specifically included in the Shellfish Water quality parameters of the 1979 EU Shellfish Water Directive (SWD) (79/923/EEC) and it was retained in the current codified version (2006/113/EC), which set out to rationalize and improve the original Directive, but with no addition of any of the later biotoxins identified. Thus the parameters covered by the SWD contain just this one biotoxin:

Table 1 - Parameters listed in Annex I:

Saxitoxin (produced by dinoflagellates)	No limit given	No limit given

In my sec. 10.3.2 of my earlier Submission, I note that in the EPA's *"Guidance on Conducting an Assessment of the Impact of Discharges from a Waste Water Works on the Microbiological Quality of Shellfish in Adjacent Designated Shellfish Waters"* (Ref. 18 of my Submission docs.) refers to the SWD being now subsumed into the WFD:

"*The EPA notes that while the Shellfish Directive is repealed the wider obligation to protect and improve Protected Areas under the Water Framework Directive applies.* ***In this regard the EPA considers that the standards specified in the shellfish regulations are the most appropriate for use at present and advise that impacts of waste water discharges are assessed against these".***

After setting out the process to assess any impact of a Waste Water Work on a Shellfish Water, important new wording has been added to Sec. 4 on "Assessment Reporting":

"*A report on the assessment and findings should be compiled including details of consultation with the consultees. Any comments and recommendations received from the consultees should be addressed in the final report,"*

and continues that even if an assessment does not satisfactorily conclude whether discharges are impacting on the shellfish water, the EPA have adopted the precautionary approach to the protection of these waters:

"***It is noted that the EPA have adopted a precautionary approach to the protection of shellfish waters*** *and may require that appropriate disinfection or other suitable measures are implemented in the event that an assessment does not satisfactorily conclude whether discharges are impacting on the shellfish water. The EPA will decide on such cases on an individual basis and following assessment of the report and where necessary consultation with the consultees".*

4. Odour, pathogen and septicity impacts of the discharge upon arrival at the point of discharge.

Details of these were required, quite naturally, as the East Ferry is one of the scenic waters with a pub and where a Marina with restaurant is situated and canoeists are based, as seen in the Irish Water videos of cleaning up sewage inputs to Cork Harbour.

They have not been supplied.

5.3 of this Appendix: Sensitivity to Nutrient Inputs

Dissolved Inorganic Nitrogen (DIN)

We are told that the Irish Hydrodata assessment,

"*calculated concentrations in these waters when all present day sources of DIN including riverine inputs are included.* ***The vast majority of the DIN input (circa 84%) arises from the freshwater input*** *(Refer to Table 4.3 of the Irish Hydrodata report for the existing load)".*

The IH assessment uses the freshwater input of DIN and that is NOT the same as the input of DIN into the tidal waters below the town overflows, where there is a release of, on average, 300,000 m3/tonnes p.a. of untreated waste water to the tidal Owenacurra Estuary, on average on 200 days p.a. – that is, on average, about 1,000 tonnes/day – and can be over ten times that figure. (Figs. from data in AERs and supplied under FOI from 2002 to mid-2018)

In sec. 7.6.1 of my earlier Submission I use the EPA's requirement that the f.c. load in the river be monitored by Cork CC and, comparing the f.c. levels at Cork Bridge (freshwater) and below Bailick 2 pumping station (tidal), where the f.c. level is approximately 2.5 times as large, I argue that if we use f.c. as the common indicator of faecal pollution and therefore faecal nutrients, the likelihood is that the nutrient load below the tide and entering the estuary is 2.5 times that used by Irish Hydrodata in their freshwater riverine load – and, at least, very substantially greater than the load used in their calculations.

Even then Irish Hydrodata has to report:

"The model shows that concentrations of DIN in the Great Island channel are generally below 0.4mg/l N. Higher values (up to a maximum of 2.6mg/l) are shown to occur for the Owenacurra estuary. The model shows that DIN concentrations gradually increase from Loughatalia to the upper sections of the estuary at Ballynacorra".

These modelled DIN levels in Figs. 3 & 4 are shown below the 0.44mg/l DIN target level for the lower half of the estuary, but 590% above this target level in the upper half, which will, of course, be the same water that passes over the main *Alexandrium* cyst bed for the second half of each ebb tide when there is virtually no water left in 90% of the estuary.

All these simulations are, of course, using only the freshwater DIN concentration.

If the town overflows are doubling what IH have given as 84% of the total DIN load, we have a hugely higher nitrogen load, on top of what is already an unacceptably high load, coming down the estuary and there is no further leeway for yet more. If the overflows were completely eliminated, the situation would be marginal, but the Midleton WWTP has been found to be so overloaded now that An Bord Pleanála have stopped further development in the town (ABP-302780-18 appeal refused February 2019) and an enlargement of the WWTP, or pumping the sewage to Carrigtwohill WWTP, which had also been put forward to ABP, will not come soon enough for this Dairygold discharge.

We understand that the pipeline is already being dug in the direction of Midleton, but we trust that they will understand that it simply cannot be discharged at Rathcoursey and has to be continued to the open sea at Ballycroneen – which was Option 3 put forward by Mott MacDonald in their Preliminary Options Report of March 2016 for Irish Water (Ref. 12 on pp. 26-28, with my earlier Submission).