Kieran Doherty

From: Daniel Bastreri <daniel@mpm-environment.london>
Sent: Wednesday 11 September 2019 17:54
To: Kieran Doherty
Subject: Galway Harbour - Compensatory Measures Report 2019
Attachments: P-APB-003 Galway Harbour CMR 2019.pdf

Hello Kieran

My apologies for the last minute delivery, but as promised, please find attached my review comments on the above.

I hope this meets the Board's requirements, but needless to say, please get back to me if you have any queries. I'd be glad to address any consultation or re-word parts of it for clarity if necesassary.

Best regards, and thank you for this consultation.

Daniel

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Galway Harbour extension (Strategic Infrastructure Case 61.PA0033): Compensatory Measures Report 2019

For An Bord Pleanála –Project P-ABP-003
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Contents

Executive Summary

Galway Harbour Company Limited (GHC) has applied to An Bord Pleanála (the Board) for an extension of Galway Harbour (Connaught, Ireland). This extension would be adjacent to the existing Galway Harbour Enterprise Park (GHEP), approximately 500m south-east of the commercial Inner Harbour. The proposed Galway Harbour Extension (GHE) would be constructed on reclaimed land to the south of the existing GHEP, which was also partially built on land reclaimed from the sea.

The Board concluded that approval of the proposed development could not be considered under article 6 (3) of the Habitats Directive, given that a significant adverse impact on the integrity of the Galway Bay SAC would occur. Additionally, and on a without prejudice basis to the final determination of the application, the Board sought to invoke the derogation provisions set out in Article 6 (4) of the Habitats Directive in regard to Imperative Reasons of Overriding Public Interest (IROPI). The Board issued a letter in which it sought compensatory measures from the applicant to address the impacts on the integrity of the Galway Bay SAC. GHC submitted a response on the 25th November 2015, setting out initial approaches for compensatory measures, and a report (Aquafact, 2015) addressing the requirements set for Phase 1.

After the review and discussion of this report, the Board invited GHC to proceed to Phase 2 of the preparation of the compensatory measures, whereby a detailed proposal was to be written and submitted for consideration. In response, the GHC prepared a report (Galway Harbour Extension – Compensatory Measures Report, An Bord Pleanála (Ref: 61.PA 0033), Galway Harbour Company, April 2019, which was submitted to the Board. With regard to the progress made on the discussion of compensatory measures, the Board had requested my advice on the approach being proposed by the applicant, which are iterated in the above report.

After reviewing the report and associated annexes and further information provided by the Board between July and August 2019, my opinion is that the proposed compensatory measures have the potential to improve the ecological status of the stony bank and intertidal habitats that have been selected for their implementation. By reducing disturbance, physical damage to habitats, discharges of effluents from

agriculture, and removing man-made debris (flotsam, jetsam), anthropogenic pressure in these habitats will decrease. The removal of aquaculture practice in intertidal areas will significantly reduce the input of organic matter due to the excretion of oysters and associated fauna and physical damage and disturbance to these habitats. The removal of the invasive sea squirt *Didemnum sp.* will also be a significant step in the recovery of the intertidal habitats.

In relation to the ongoing monitoring programme for intertidal habitats, this has so far provided a significant amount of data, which is appropriate for a characterisation of these habitats. However the monitoring programme it is not coupled with measurable outcomes, and the methodology employed for the benthic infaunal data is flawed. There is a risk is that in its current form, the monitoring programme imay not provide an effective method to measure the success of the compensatory measures, should this be required

1. Introduction

Galway Harbour Company Limited (GHC) has applied to An Bord Pleanála (the Board) for an extension of Galway Harbour (Connaught, Ireland). This extension would be adjacent to the existing Galway Harbour Enterprise Park (GHEP), approximately 500m south-east of the commercial Inner Harbour. The proposed Galway Harbour Extension (GHE) would be constructed on reclaimed land to the south of the existing GHEP, which was also partially built on land reclaimed from the sea.

After considering the Natura Impact Statement (NIS) and all other relevant submissions, including further information submitted by the applicant and further submissions made in the course of the oral hearing, the Board undertook an appropriate assessment of the implications of the proposed development for the European Sites potentially affected by the project in view of the sites' conservation objectives. The Board's Statement of Appropriate Assessment (SAA) (2015) concluded that the integrity of the Galway Bay Complex Special Area of Conservation (SAC) would be affected by the proposed development, due to the direct loss of fucoid-dominated reef habitat (Natura 2000 code 1170) and mud and sand flat habitat (Natura 2000 code 1140) within the footprint of the extension, and the potential loss of perennial vegetation on stony banks (Natura 2000 code 1220) due to the expected sheltering effect of the harbour extension.

The Board concluded that approval of the proposed development could not be considered under article 6 (3) of the Habitats Directive, given that a significant adverse impact on the integrity of the Galway Bay SAC would occur. Additionally, and on a without prejudice basis to the final determination of the application, the Board sought to invoke the derogation provisions set out in Article 6 (4) of the Habitats Directive in regard to Imperative Reasons of Overriding Public Interest (IROPI). The Board issued a letter in which it sought compensatory measures from the applicant to address the impacts on the integrity of the Galway Bay SAC.

Following the completion of the Appropriate Assessment, the Board wrote to the developer (GHC) on the 29th September 2015, to ask if they wished to have the project

considered for approval under Article 6 (4) of the Habitats Directive. The Board also advised that GHC should submit proposals for compensatory measures to address the impacts on the integrity of the Galway Bay SAC mentioned above. These compensatory measures would be addressed in two phases:

- Phase 1, in which the proposals for compensatory measures would be set out by GHC for initial consideration. GHC was advised to liaise with the National Parks and Wildlife Service (NPWS) in this regard.

- Phase 2: Pending the outcome of Phase 1, the applicant will be afforded further time to develop the compensatory measures in more detail leading to submission of a detailed proposal for consideration by the Board.

GHC submitted a response on the 25th November 2015, setting out initial approaches for compensatory measures, and a report (Aquafact, 2015) addressing the requirements set for Phase 1. The approach taken by the developers is based on the criteria and principles set out by the EU Commission's guidance on Article 6 (4) (EU, 2007/2012), as advised by the Board. The Board considered these initial measures and issued a Direction on the 29th January 2016, instructing that the applicant's submission be forwarded to the National Parks and Wildlife Service of Ireland (NPWS) for comments and to arrange a meeting between representatives of the Board and the NPWS to discuss the acceptability of the proposed measures. The NPWS responded by way of a submission dated 27th May 2016, which included comments on the applicant's proposal for compensatory measures. A meeting between representatives of NPWS and the Board (Director of Planning and Assistant Director of Planning) was held on the 28th June 2016. Following this meeting, further discussions on the approach to the proposed compensatory measures were held between the applicant and the NPWS. Legacy issues related to the previous loss of intertidal, stony bank and saltmarsh habitats due to the construction of the GHEP in the 1990s were also raised by NPWS, and these were addressed by the applicant in a further submission to the Board in October 2016. The combined extension of List I Habitats that would be lost to the development, and for which compensatory measures are required is:

- Intertidal fucoid-dominated reef (1170) – intertidal mud and sand flats (1140) complex: 14.51ha

- Stony banks (1220): 0.63ha

- Atlantic and Mediterranean saltmarsh (1410) complex: 7.39ha

A tripartite meeting between the Board, NPWS and the applicant was held on the 13th December 2016. Previous to this meeting, the applicant submitted a further package of information setting out their proposals for compensatory measures, which was also discussed during the tripartite meeting.

Following NPWS' comments on the initial set of compensatory measures, the applicants submitted a second report with a set of proposals for compensatory measures. This report (Aquafact, December 2016) which includes a package of measures with focus on three areas within Galway Bay SAC was also considered by the Board and NPWS. After further consultations and a meeting between the Board, the NPWS and GHC, a new set of potential compensatory measures was proposed by the applicant in August 2017. These proposals are described in version 2.3b of the report (Tobin/Aquafact, 2017b) which was intended by the applicant to be the final stage of Phase 1.

The Board requested my advice on the approach to compensatory measures being proposed by applicant, as detailed in their report (Tobin/Aquafact, 2017) and report to the Board on whether I consider the proposals to be appropriate and adequate.

After reviewing the information provided to me by the Board, I concluded (Report P-ABP-002, September 2017) that the proposed compensatory measures are in line with EU guidance on the application of Article 6 (4) of the Habitats Directive and relevant precedents within the EU.

In a letter dated the 13th October 2017, the Board invited GHC to proceed to Phase 2 of the preparation of the compensatory measures, whereby a detailed proposal was to be written and submitted for consideration.

In response, the GHC prepared a report (Galway Harbour Extension – Compensatory Measures Report, An Bord Pleanála (Ref: 61.PA 0033), Galway Harbour Company, April 2019, which was submitted to the Board.

2. The Brief

The Board has requested my comments on the following report:

- Galway Harbour Extension – Compensatory Measures Report, An Bord Pleanála (Ref: 61.PA 0033), Galway Harbour Company, April 2019 (CMR).

With regard to the progress made on the discussion of compensatory measures, the Board had requested my advice on the approach being proposed by the applicant, which are iterated in the above report.

In addition to the CMR, the Board has also forwarded the following reports for me to review and comment:

- Galway Harbour Extension – Compensatory Measures Report, An Bord Pleanála (Ref: 61.PA 0033), Galway Harbour Company, April 2019. Annexes 1 to 21.

- Galway Harbour Extension – Addendum to Natura Impact Statement to include Consideration of the Compensatory Measures (4) An Bord Pleanála (Ref: 61.PA 0033). Galway Harbour Company, April 2019.

- Galway Harbour Extension – Addendum to Natura Impact Statement to include Consideration of the Compensatory Measures (4) An Bord Pleanála - APPENDIX No. 1, Statement of Appropriate Assessment

(Article 6(3))

- Galway Harbour Extension – Addendum to Natura Impact Statement to Include Consideration of the Compensatory Measures (4) APPENDIX No. 2 Map of cSAC and SPA at the proposed Compensatory Measures Site at Mweeloon, Tawin, Co Galway

- Galway Harbour Extension – Addendum to Natura Impact Statement to Include Consideration of the Compensatory Measures (4) APPENDIX No. 3
  Map 1 of Intertidal Management Area
  Map 2 of Stony Bank Management Area and Reference Areas
  Map 3 of Salt Marsh Management Areas
  Map 4 of Photo Locations of Proposed Gate Positions and Wall Repairs

- Comments on the Galway Harbour Extension – Compensatory Measures Report (Ref: 61.PA 0033) April 2019 by the National Parks and Wildlife Service (in letter to the Board dated on 27th August 2019, Ref. SID-2014-GE-02/2019)

In addition to the above documents, the following reports were used for the preparation of this report:

EU (2007/2012) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC

EU (2018). Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.

European Commission (2001) Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.

CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.

NPWS (2013) The Status of Protected EU Habitats and Species in Ireland. Overview Volume 1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland. Editor: Deirdre Lynn.

NPWS (2012) Marine Natura Impact Statements in Irish Special Areas of Conservation.

3. Discussion

The CMR addresses the compensatory measures sought by the Board from the applicant, to compensate for the impacts on the integrity of the Galway Bay SAC arising from the proposed expansion of Galway Harbour.

The compensatory measures were described in detail in the applicant's previous report (V2.3b,Tobin/Aquafact, 2017b). I discussed these in my previous report to the Board (P-ABP-002, 2017), and during a tripartite meeting at the Board's office in Dublin the 27th July 2017. The proposed compensatory measures are based on the management of Perennial vegetation of stony banks (1220), Salt marsh (1310, 1330, 1410) and intertidal habitats (1170, 1140) in Mweeloon, Tawin Island, located in the inner Galway Bay. The implementation of a series of management plans would improve their ecological status, thus avoiding significant adverse impacts on the Galway Bay Complex SAC and Inner Galway Bay SPA and their qualifying conservation features and conservation objectives.

Additionally, the developers propose to include a coastal lagoon, also located in Tawin Island, within the Galway Bay Complex SAC in the proposed nature reserve. This habitat (1150) is a qualifying feature of the SAC, however, the lagoon has not yet been identified to be part of this qualifying interest by the NPWS. I note that while the expansion of Galway Port will not adversely affect this specific qualifying habitat, the NPWS acknowledge in their report that the inclusion of the lagoon in the nature reserve

would be beneficial. Furthermore, the NPWS has visited the site, and they consider that the lagoon appears to function as a coastal lagoon. They are planning to undertake a survey to confirm that the lagoon meets the criteria for classification as Annex I habitat Coastal Lagoons 1150 and that its quality is sufficient to be considered to be contributing to the qualifying interest for the Galway Bay SAC. We visited the site with Senior Inspector Paul Caprani on the 18th February 2017, and based on this visit and the information available, I also believe that it is a coastal lagoon. I expect that this will be confirmed by the results of NPWS's survey, which is scheduled for 2020.

As I stated in my 2017 report, it is my opinion that the proposed compensation, based on the ecological restoration of habitats in Tawin Island has the potential to bring ecological restoration and/or enhancement to the same type of habitats to that which will be lost to the development of Galway Harbour and have been lost to the Galway Enterprise Park in the past. I note that the implementation of compensatory measures has been advanced since the time of the previous report, by initiating the purchase of land in Mweeloon, where the habitats that will be subject to management are located.

The CMR provides details (Section 2.6.2 Phase 2) of the qualitative and quantitative surveys undertaken at Mweeloon. This area contains habitats that have been classed by NPWS as being in "unfavourable / inadequate" status on a National scale (NPWS 2013b), and it has been selected for the implementation of the compensatory measures, as detailed in successive reports from GHC between 2105 and 2017. This has met the requirements of the Board for the project to be considered for approval under Article 6 (4) of the Habitats Directive. It also follows the Board's advice that GHC should submit proposals for compensatory measures to address the impacts on the integrity of the Galway Bay SAC, and that these compensatory measures would be addressed in two phases. During the current phase (Phase 2) the applicant has been afforded further time to develop the compensatory measures in more detail leading to submission of a detailed proposal for consideration by the Board.

For clarity, I will focus my comments on the new information on the quantitative survey results included in the CMR, and on the review of the proposed compensatory measures undertaken by the NPWS in August 2019.

3.1 Monitoring programme results

The results of monitoring programme obtained so far provide a comprehensive coverage of a relatively large area of Mweeloon, in Tawin Island. A significant amount of high-quality data was collected using standard survey methods, and with a survey design that was agreed with the NPWS.

All the relevant designated habitats within the Galway Bay Complex SAC have been covered in this survey. These include Perennial vegetation of stony banks (1220), and intertidal fucoid-dominated reef (1170) – intertidal mud and sand flats (1140) complex.

Overall, the data being collected will be a significant contribution to the establishment of a baseline prior to the implementation of the compensatory measures, subject to adjustments and continuation over time. It is important that the baseline data are acquired within a short period of time before implementation, to ensure that they provide accurate scientific evidence of the ecological status of these habitats immediately before the management practices are in place. Seasonal variations should also be considered when planning the timing of the surveys: spring or early summer surveys are ideal for the acquisition of good quality data for intertidal and coastal habitats.

Agreement with NPWS in relation to the scope of the monitoring programme is essential. The EU Guidance document on Article 6(4) of the 'Habitats Directive (92/43/EEC, EU Commission 2007/212) establishes that "*The programme of compensatory measures needs to include detailed monitoring during implementation to ensure effectiveness in the long term. Being in the framework of the Natura 2000 network, such monitoring should be co-ordinated with, and eventually integrated into, that foreseen under Article 11 of the Habitats Directive*". The need for coordination and agreement is also highlighted in the EPA (Ireland, 2002) Guidelines on the information to be contained in Environmental Impact Assessments:

"Monitoring of the effectiveness of mitigation measures put forward in the EIS, both by the competent authorities and the developer, is an integral part of the process. Monitoring of environmental media and indicators arise either from undertakings or from conditions. In either case it is important for all parties to be aware of the administrative, technical, legal and financial burdens that can accompany inflexible or unresponsive monitoring regimes. It is important to ensure that, where monitoring is provided for, it is clearly related to thresholds, which if exceeded cause a clearly defined set of actions to be implemented"

In section 1.4 (p. 3) of the CMR it is stated that annual monitoring surveys have been devised to document the recovery of the stony bank and intertidal habitats within the proposed compensatory area. Some more detail is given in section 12.1 (p.65), where it is stated that long-term annual surveys of these habitats will be undertaken and the results will be reported to GHC recommending any revisions necessary to improve the management of the compensatory areas. This monitoring programme – which would be subject to independent expert review – is to "ensure that the Compensatory Measures being implemented bring about a measurable improvement in ecological conditions in the compensatory area."

"Measurable improvement' is key here. In the context of environmental impact assessment, monitoring is necessary to test impact hypotheses. In this specific case, it should be used to test the success of the compensatory measures, which would have a positive impact on the habitats subject to the proposed management plans (the compensation measures). However, there are no clear specific objectives for the monitoring programme in the report. In my opinion, and especially in the light of the guidance quoted above and good general practice, the objectives of the monitoring programme should be stated, and progress assessed in relation to these objectives. My review is based on the assumption that the monitoring programme being implemented has the objective of measuring the improvement of the managed habitats by comparing a set of **indicators and thresholds**.

I will discuss the findings of the monitoring report in relation to the above, the different habitats in consideration, together with the comments made by the NPWS.

3.1.1 Perennial vegetation of stony banks (1220)

A summary of the results of this survey are presented in the main report and in Annex 10. Overall, these include a good description of the habitat, its condition and included a list of plant species found during the survey. A comparison with the stony bank habitat in Renmore that would be adversely affected by the expansion of the harbour is made. I note that this comparison shows that the stony bank is Renmore is in unfavourable condition, according with the survey results. The CMR concludes (Appendix 5, Section 3) that in the absence of disturbance such as trampling, grazing and shingle extraction, it is likely that the action of tides and storms is the only form of disturbance taking place at present. Based on my own observations during three visits to the site, I would disagree with the lack of disturbance due to trampling. The area is urban, and it is used by local people for recreation, dog walking, etc., so trampling is likely to be a regular form of disturbance, and I referred to this in my previous report. However, if the assumption that disturbance – and thus unfavourable condition – is caused by high tides and storms is correct, then the more sheltered conditions created by the expansion of the harbour will in fact improve the condition of this habitat. In any case, there is no evidence in the report to support either hypotheses.

3.1.2 Intertidal habitats

3.1.2.1 Renmore

The results of the intertidal survey in Renmore are presented in Appendix 4. The objectives of this survey are not stated in the report, so for my review, I will assume that it is to provide a characterisation of the intertidal habitats that would be lost due to the expansion of the harbour, and enable a comparison with the intertidal habitats in Tawin Island that will be subject to management as part of the compensatory measures.

According to the report, the survey was undertaken between the 28th and 29th October 2015. This appears to be a mistake, as the previous version of this appendix, issued in February 2016 states that the surveys were carried out in January 2016. This should be amended, if applicable.

Biological samples were taken using 0.25m2 quadrats to determine habitat types and presumably record epifauna. Additionally, 10 duplicate infaunal samples and 10 particle size samples were taken at 10 locations, shown in fig. 2.1. Standard univariate indices were calculated, including taxon numbers, number of individuals, Margalef's species richness, Pielou's evenness, Shannon Weiner and Simpson's diversity.

Multivariate numerical power analyses were also used to analyse the biological data included multidimensional scaling ordination (MDS) and hierarchical cluster techniques using PRIMER (Plymouth Routines in Multivariate Ecological Research) and Principal Components Analysis (PCA) to explain the relationships between carbon content and particle size. These are standard techniques to analyse marine biological data. However, these analyses require the use of a significant amount of data to obtain meaningful results. I will discuss this point in relation to the reported results.

The results of the multivariate analyses show exactly what the univariate analyses presented in figure 3.5 in the report also show, as illustrated below in Fig 1. This is, that the biological communities present in stations 1 & 2 have a relatively high number of individuals and low diversity. Stations 3, 4, 6 & 7 have significantly lower number of individuals than stations 1 & 2 and higher diversity, and stations 5, 8, 9 & 10 have the lowest abundance (number of individuals) and also low diversity.

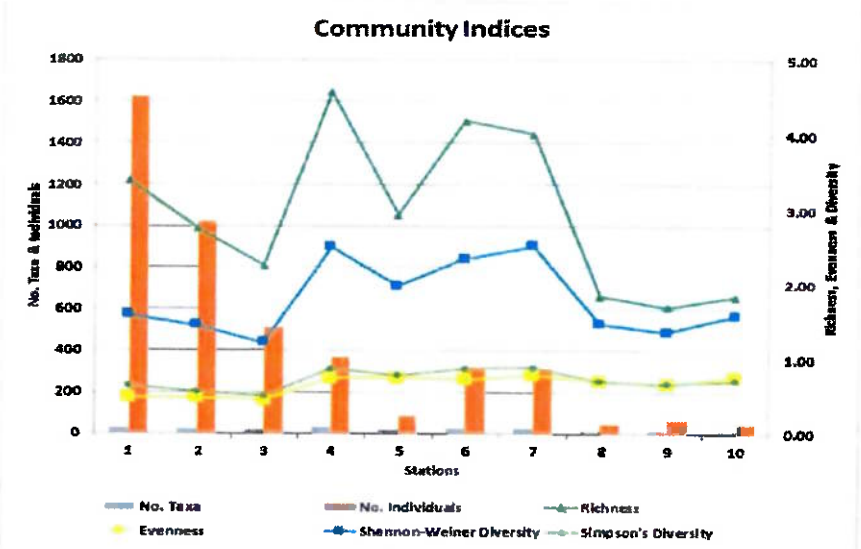

Fig 1: Univariate community results (from figure 3.5 in CMR)

This corresponds with groups A, B & C identified using cluster analyses, so these don't really provide any further useful information in addition to what it is clear from the univariate analyses results. This is to be expected, as multivariate analyses are normally used to process large data sets. In addition to the reduced number of stations, an absolute minimum of 4 replicate samples per station is required to perform these analyses with the level of robustness that is required to provide evidence to support management decisions of this nature (Noble-James *et al*, 2018). The discussion of the technical aspects of the use of power analysis in the context of monitoring studies exceeds in my opinion the scope of this review, so I would refer this discussion to the external expert review that is mentioned in the report. My recommendation to the Board is that this independent review should be undertaken by specialists in multivariate analyses for benthic data, and that careful thought and due consideration is given to the number of stations, samples and techniques used for these studies in the monitoring programme.

Regardless of the above considerations, the CMR conclude that the explanation for these groupings (A, B & C) is due to organic enrichment. They explain this conclusion on high organic loads in the sediments in samples 1 & 2, which are dominated, as they correctly point out, by benthic species that thrive in organic sediments, such as oligochaete worms. However, no data of sediment chemistry are provided.

They conclude that this would be due to the proximity of stations 1 & 2 with the mouth of the River Corrib, but this is not supported by the data. Station 5, according to the report, would have the highest content of organic carbon; however, according to figure 2.1 in the CMR, it is further away from the alleged source of organic pollution than stations 1 & 2. Unfortunately, the full results of the particle size analysis (PSA) are not presented in the report, so it is not possible to examine the data in relation to this. The results of the PCA analysis, which are not explained in Annex 4 show that the sample 5 does not belong in group C, as it is stated. It would appear that samples 8, 9 and 10 have similar PSA, and the rest of the samples (1,2, 3, 4, 6 & 7) also may have PSA different of sample 5 and samples 8, 9 & 10.

Due to the low number of samples and replicates, the differences in community parameters shown in multivariate analyses may well be explained by difference in particle size of the sediment, since the most important variables controlling the occurrence of benthic organisms in an estuary are salinity and sediment characteristics (Boesch, 1977; Rakoscinski *et al.* 1997; Attrill and Rundle, 2002), which are in turn determined by local hydrodynamic conditions.

Organic enrichment is likely to occur in Galway Bay, as it happens in most coastal waters in Northern Europe, especially where the density of the population is high and agriculture is practiced. Rivers carry a significant input of nutrients from sewage works outfalls and agricultural run-off, but these nutrients are quickly distributed spatially in estuaries and coastal waters by hydrodynamic processes, and end sinking and associating to the sediment matrix through a series of chemical and physical processes. However, the main factor regulating the rate of nutrient absorbed and adsorbed by the sediment matrix is particle size. Fine sediments – typically with particle size of < 63μ - retain the largest fraction of available nutrients, while coarse sediment like sand, coarse sand and gravel retain very little. Therefore, our current understanding of benthic assemblages and species distribution comes primarily from their associations with sediment composition in relation to particle size.

The report also claims that during many decades untreated raw sewage was discharged to the River Corrib and/or a pipe south of Nimmo's Pier, over the west part of the area, "giving raise to sediment with low levels of oxygen, high levels of sedimentary hydrogen sulphide and therefore reduced numbers of infaunal invertebrates." However, the survey results show exactly the opposite: the sites closer to the River Corrib have the highest numbers of infaunal invertebrates.

In any case, there is no evidence to support the hypothesis that the observed distribution of benthic communities in the study area responds to sediment chemistry. The survey is not designed to test this hypothesis, and the available data do not support it either.

AMBI analyses results show that all sites have disturbed benthic communities, ranging from heavily disturbed to moderately disturbed. AMBI is one of the many methods of

detecting anthropogenic stress, as for example, organic enrichment. However, estuaries are naturally stressed systems, due to the wide changes in temperature, salinity, etc., especially in intertidal areas. These methods detect both naturally as well as anthropogenic stress, so these results, especially considering the low number of observations (samples) should be taken with extreme caution.

3.1.2.2 Mweeloon, Tawin Island

Unlike in Renmore, five replicate core samples were taken at each of the 25 sampling stations, distributed in three different locations, as it can be seen in figure 2.

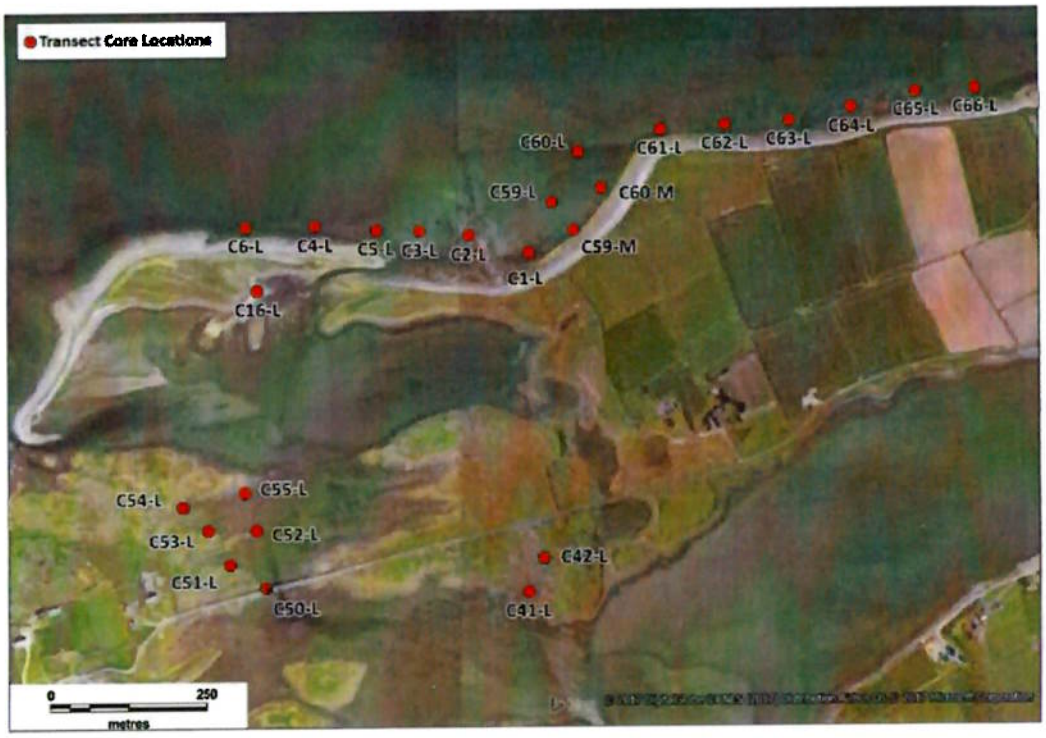

Fig 2: Core benthic infaunal samples (from Fig. 3.2 Annex 8)

Samples in stations C41 & C42 were taken in what appears to be part of the lagoon system at south of the site, and samples C50 to C55 also in this lagoon or system of lagoons, to the west. C16 is located also within the lagoon, to the north, and the rest 16 stations are on the north of Tawin Island, on the intertidal section of the coast. The rationale beyond the decision of this sampling grid is not explained in the report, and it must be noticed that these samples will represent different biotopes and habitats,

since the hydrodynamic conditions will be different in each area, and this will also determine different sediment types.

Quadrat samples were obtained at 66 transects, with the same methodology used in Renmore. The results of the quadrat survey provide a good qualitative description of the habitats and associated macrofauna within the study area.

Sediment samples for biological and PSA analyses were also taken at 25 locations, and the results of particle size distribution (type of sediment) unlike those corresponding to Renmore – are clearly shown in a table and a map of the area. The benthic and sediment particle size data will be extremely useful to contribute to the establishment of a baseline of the ecological condition of intertidal habitats which will be subject to management to deliver ecological improvement.

Univariate and multivariate analysis were also undertaken to analyse this larger dataset of benthic infauna, and the results are presented and discussed in Appendix 8; a comparison of Renmore and Mweeloon benthic data was also made. Particle size sediment data was compared with the benthic data using PCA, to establish whether there is a relationship between particle size and community structure. The AMBI benthic index was also calculated.

As it would be expected, the results of the particle size analyses show that different areas have different type of sediment, with more or less fine silt or/and mud depending on the local dynamic conditions. This is well illustrated in figure 3:

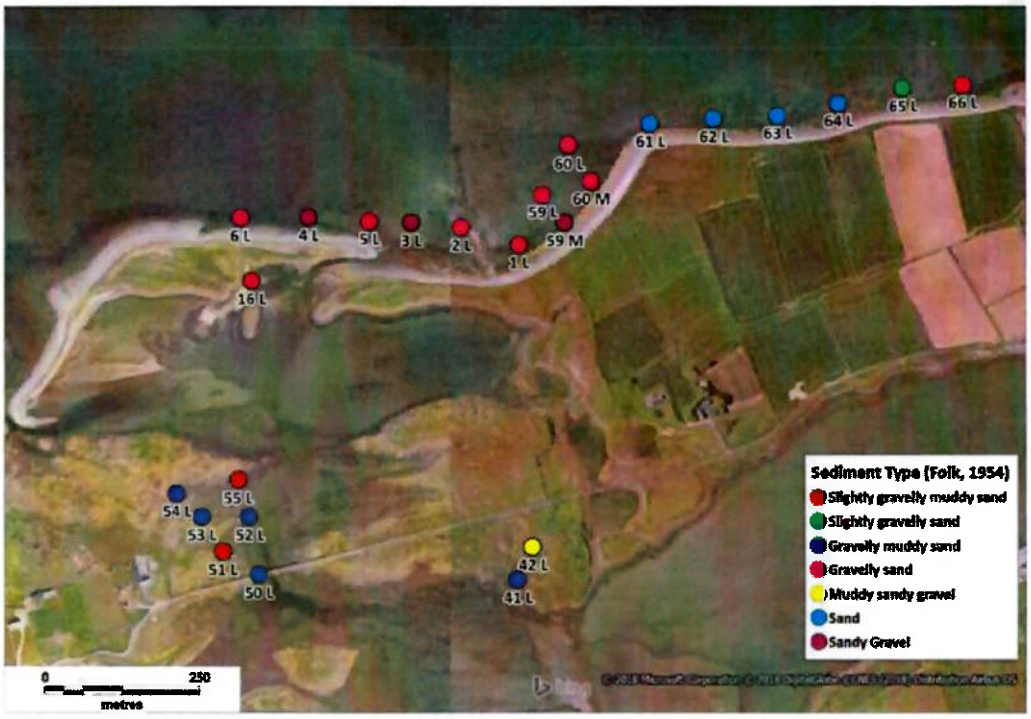

Fig 3: Sediment composition in Tawin Island PSA samples (Fig 3.3 in Annex 8)

The results of univariate and multivariate data analyses show that the differences in benthic community parameters respond to the difference in sediment type, though there is no interpretation in the report.

Not surprisingly, the results of the AMBI disturbance show – like in Renmore – that most of the sites range between heavily disturbed and disturbed, with only two locations (both on the north shore) being slightly disturbed. These results also should be taken with caution, as it is very possible that the levels of disturbance attributed to the benthic communities by this index (AMBI) correspond to natural disturbance, and not to anthropogenic disturbance, as discussed above. This could also explain the comparison made between the Renmore and Tawin samples, which shows that all of the Tawin samples except those of sites 2 and 16 are very similar to those of Renmore. Once again, the report attempts to explain differences and similarities on the basis of the alleged historical discharge of effluents in Renmore. This is not supported by these results. In the first place, there are some methodological issues regarding the comparison of samples taken in Tawin Island in summer and winter (August and

December) and samples taken in Renmore in late October. Furthermore, the number of replicates is different, two in Renmore and five in Tawin Island. For all these reasons, the results and especially the conclusions should be taken with extreme caution.

My other concern regarding the monitoring programme is the decision of not using reference stations to compare the ecological condition of the intertidal habitats before and after the implementation of the compensatory measures with similar (reference) habitats not subject to management, and in consequence, to be able to assess the success of the compensatory measures, if this is a requisite. While it is technically possible to do it without the use of reference sites, this would be more difficult, and the amount of data required to achieve the necessary level of statistical robustness will be high. I also referred to this in my previous report to the Board.

3.1.2.3 Summary:

The monitoring programme for intertidal habitats has so far provided a significant amount of data, which is appropriate for a characterisation, this is, the identification of principal habitats and benthic communities within the area of interest. For the purpose of characterisation it is usually sufficient to use single sample stations (e.g. no replication) at a suitable spatial distribution to define the main habitats and their extent, targeting the areas where there is least confidence or where the gaps in spatial coverage are greatest. A more specific sampling strategy, as outlined above, will be required for the establishment of a baseline, in order to compare the 'before' and 'after' scenarios.

In its current form, the monitoring programme it is not coupled with measurable outcomes. The risk is that it may not provide an effective method to measure the success of the compensatory measures, should this be required. As stated in the EU Guidance document on Article 6 (European Commission, 2018), specific monitoring and reporting schedules should be based on progress indicators according to the objectives of the compensation measures. This requirement is also highlighted in the NPWS' 2012 guidance document on Marine Natura Impact Statements in Irish Special Areas of Conservation (NPWS, 2012), which states that "Where monitoring and reporting for a proposed operation/activity is to be undertaken, a clear description of

the monitoring programme and reporting schedule and timeframe should be provided. (…) Such reporting should outline the success or otherwise of any relevant mitigation"

4. The compensatory measures

4.1 Perennial vegetation of stony banks

The habitat management plan for this habitat focuses on the prevention of vehicle traffic, shingle extraction, use of agrochemicals and supplementary cattle feeding in areas of shingle habitat. The NPWS consider that these measures meet the requirements of the Habitats Directive, in terms of management of the site to reach favourable conservation status. I also consider that these measures will contribute to improve the current status of this specific habitat, and will be conducive to favourable status. In their advice, the NPWS state that the removal of the coastal protections, if feasible, should be considered, as this could provide genuine compensation for habitat loss while also improving the structure and functions of the habitat. While all the implications and impacts of the removal of coastal protection should be carefully considered, I agree that this could also improve this habitat, which requires periodical flooding by tidal water. However, I would stress that this should be fully assessed, to ensure that no significant impact on this or other habitats or the coastal physical processes arises as a consequence of removing part of the coastal protection structures.

In relation to the other proposed management measures, I consider these to be appropriate to improve the ecological status of the stony bank habitat. Flotsam and jetsam are anthropogenic waste, either produced by the wreck of vessels (flotsam) or by waste thrown overboard from vessels (jetsam), so their removal will benefit both the natural environment and the visual aspects of the area. The sea-borne organic matter which NPWS correctly state is a food resource for biological populations is seston, this should be left in the coast, together with land-originated organic matter.

4.2 Saltmarsh

It is also stated in the CMR that some sensitive repairs to the sea wall may be required at the north west of Lurgan Island to protect intertidal and coastal lagoon areas. In their response to the CMR, the NPWS state that the maintenance of intertidal ('transitional') areas subject to natural processes is a conservation objective for this Annex I habitat, and in consequence, repairs to the sea walls is not compatible with coastal natural processes. Furthermore, NPWS consider that there is no evidence of the extent or the severity of potential impacts caused by the breach of the sea defences on coastal or terrestrial habitats in the CMR, and that these should be assessed before a decision on the maintenance of the sea defences is made. I fully agree with the NPWS on this point, and on the lack of evidence to support such a decision.

4.3 Intertidal Habitats

The proposed management measures, including elimination of the invasive alien sea squirt *Didemnum sp.*, cease of aquaculture, cease of construction of drainage channels and sea defences, cease of winter and supplementary cattle feeding, control of flotsam and jetsam and signage will in my opinion lead to an improvement on the ecological status of these habitats. Very especially, the removal of trestles and oysters will significantly reduce the input of organic matter as a result of excretion and faeces, and the physical habitat damage caused by the deployment, operation and harvesting of these trestles. The prevention of tractor movements will also eliminate physical damage of the habitats and associated biota.

The eradication of the invasive sea squirt *Didemnum sp.*, if achieved successfully, will be a significant improvement of these intertidal habitats, in the sense that they will be returned to their natural ecological condition. It would also prevent this invasive species – which has the potential to form extensive colonies, displacing the natural epibenthic populations – from further extending to intertidal and subtidal habitats across Galway Bay. This species, which has been most likely introduced to the Galway Bay SAC with imported Pacific oysters, is now present in many countries in Europe, and in some areas, it has completely smothered or displaced the native benthic communities.

5. Conclusions

The proposed compensatory measures have the potential to improve the ecological status of the stony bank and intertidal habitats that have been selected for their implementation. By reducing disturbance, physical damage to habitats, discharges of effluents from agriculture, and removing man-made debris (flotsam, jetsam), anthropogenic pressure in these habitats will decrease. The removal of aquaculture practice in intertidal areas will significantly reduce the input of organic matter due to the excretion of oysters and associated fauna and physical damage and disturbance to these habitats. The removal of the invasive sea squirt *Didemnum sp.* will also be a significant step in the recovery of the intertidal habitats

As explained in sections 3 and 4, it may be necessary to provide evidence of the success of the compensatory measures. The monitoring programme, whilst comprehensive and generally correct in field and laboratory methods, will not be able to provide this evidence in its current form. Due to the dynamic nature of coastal sediment in coastal and estuarine systems in general, and especially those in Galway Bay, the benthic communities are very likely to experience wide fluctuations in abundance, diversity and species dominance and assemblage. In consequence, the benthic ecology component should be reviewed and re-designed to ensure that a representative number of biotopes are included, and that sampling these biotopes may be more fit for purpose than sampling fixed locations. Sampling should take place during the late Spring or Summer months.

Equally important, the monitoring programme should be testing specific hypotheses, using indicators and thresholds. In this case, that the hypothesis should be that the compensatory measures will improve the ecological condition of the habitat, as stated in the report.

If there is a requirement to demonstrate the recovery or improvement of the habitats subject to compensatory management measures, the way in which this will be measured should be established.

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