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**GALWAY HARBOUR EXTENSION ORAL
HEARING: RESPONSE TO THE ORAL
EVIDENCE PRESENTED BY DR DAVID
TIERNEY, NPWS**

**Tom Gittings BSc, PhD, MIEEM
Ecological Consultant
3 Coastguard Cottages
Roches Point
Whitegate
CO. CORK
www.gittings.ie**

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1. INTRODUCTION

This is a response to the oral evidence presented by Dr David Tierney of the National Parks and Wildlife Service on 15 January 2015.

2. CONSERVATION OBJECTIVES

My assessment was carried out against the conservation objectives and all the specified attributes and targets have informed my assessment.

3. TURNSTONE

My assessment concluded that the potential displacement impact due to the Galway Harbour Extension (GHE) development will be very minor and will not have population-level consequences.

Therefore, the impact of the GHE development will be effectively zero. The impact of the Galway Harbour Enterprise Park (GHEP) development did not have population-level consequences. Therefore, there is no potential cumulative impact in combination with the historical impact of the Galway Harbour Enterprise Park (GHEP). It is for this reason that the assessment carried out herein reached the conclusion that there would not be cumulative impacts of the proposed development in conjunction with the previous development of the Galway Harbour Enterprise Park.

4. ATTRIBUTE 2

I note NPWS' position that attribute 2 can be interpreted as providing "spare capacity" against potential future environmental changes. However, there is no objective scientific criteria that can be used to specify the level of "spare capacity" that should be provided. Therefore, in the absence of specific guidance from NPWS, it is not possible to make an objective assessment against this interpretation of the attribute 2.

However, the intertidal habitat that will be removed as a result of the GHE development is small and fragmented and will not, therefore, provide any significant level of "spare capacity".

5. WETLAND CONSERVATION OBJECTIVE

The target for the Wetlands Qualifying Interest of the Inner Galway Bay SPA is:

The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 13,267 ha, other than that occurring from natural patterns of variation

I note that the target includes the qualifier *significantly*. Therefore, it is necessary to define what it is meant by significant in the context of this conservation objective.

The approach that we have taken in the interpretation of this conservation objective is that it necessarily refers to a property of the SPA that is more than just the sum of the habitat requirements of the SCI species. Otherwise, there would be no reason to list this as a separate conservation objective.

However, NPWS have not provided any guidance as to what this conservation objective is intended to achieve. Therefore, there is no objective way of interpreting the conservation objective to define what is meant by significant.

As we are not able to define what would be a significant reduction in wetland habitat in the context of this conservation objective, we have taken the precautionary approach that possibility of a significant impact on this conservation objective cannot be discounted. However, the actual magnitude of the habitat loss is very small (0.32% of the intertidal and subtidal habitat within the SPA, including the legacy wetland loss from the Galway Harbour Extension project). It is my

scientific opinion that this habitat loss will have no significant impact on any SCI species of the Inner Galway Bay SPA.

6. GREAT NORTHERN DIVER

6.1. DENSITIES

The areas covered by the I-WeBS subsites cover the full range of biotopes and depth zones that occur within the SPA. Great Northern Divers typically occur as widely dispersed individuals. Given these factors, and from all of my experience of surveying waterbirds in Britain and Ireland, it is my scientific opinion that an abrupt large change in Great Northern Diver densities, resulting in significantly higher densities of Great Northern Diver occur in the middle of the bay, is scientifically implausible.

My statement that densities of Great Northern Diver might be expected to be lower in the middle of the bay refers to the fact that during periods of rough weather (which are not an infrequent occurrence in Galway Bay), Great Northern Divers will typically move to more sheltered waters. Therefore, the average density across the winter will be expected to be lower in the middle of the bay.

I note also that my calculation of the increased densities that would occur as a result of displacement of Great Northern Divers were based on the habitat area within the I-WeBS subsites, not the overall habitat areas within the SPA. Therefore, these are conservative calculations of the potential increase in densities. Furthermore, the concern expressed by Dr Tierney that reduced densities in the middle of the bay would undermine my assessment of the impact on densities does not arise, as my assessment does not refer to these areas. On the basis of my density calculations, any birds displaced would be able to find adequate alternative habitat within the areas covered by the I-WeBS subsites.

6.2. SURVEY METHODS

The survey methods suggested by Dr Tierney are not considered to be appropriate survey methods for Great Northern Divers, and other diver species.

6.3. DISTURBANCE

For clarification, Dr Peppiatt's statement that Great Northern Divers "can certainly be flushed to flight by ships" refer to fast-moving small boats (e.g., 20-30 knots) and are based on his experience during survey work in Inner Galway Bay. As noted in the species profile report, from extensive observations in both Inner Galway Bay (by Dr Chris Peppiatt), and my own observations in Cork Harbour, it can be stated with certainty that Great Northern Divers are not routinely flushed by shipping traffic in Irish coastal waters. Therefore, no potential disturbance impact from shipping traffic arises.

As stated above, Great Northern Divers may be flushed by fast-moving small boats. However, based on experience in Inner Galway Bay (observations by Dr Chris Peppiatt, Mr Eugene McKeon and Dr Brendan O'Connor) and Cork Harbour (my observations), Great Northern Divers do not usually flush in response to fishing boats, and it can be assumed, similarly, that they will not flush from recreational boats travelling at slow-moderate speeds.

As stated in my brief of evidence, recreational boat activity is projected to increase from 2 to 4 boats per day in the winter period. As discussed in my report and brief of evidence, disturbance impacts have to be sustained over a long period (to cause displacement) and/or occur with sufficient frequency (to cause energetic impacts). Given that only a proportion of this boat activity will involve boats travelling at high speed, it is not plausible to suggest, my scientific assessment is that this activity will not cause significant disturbance impacts.

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**GALWAY HARBOUR EXTENSION ORAL
HEARING: RESPONSE TO BWI
SUBMISSION**

**Tom Gittings BSc, PhD, MCIEEM
Ecological Consultant
3 Coastguard Cottages
Roches Point
Whitegate
CO. CORK
www.gittings.ie**

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1. INTRODUCTION

This is a response to the oral evidence presented by Siobhán Egan of BirdWatch Ireland on 14 January 2015.

I have received a copy of her presentation. However, this only contains bullet point summaries of her oral evidence. Therefore, this response is largely based on my notes of her oral evidence.

A number of the issues raised by Ms Egan have already been dealt with in my cross-examination of her, and these issues are not discussed further here.

2. INTEGRITY

Ms Egan stated that the assessment should consider the possibility that the site may become more important in the future.

Clearly if there were major habitat changes (e.g., if 20% of the intertidal habitat in the SPA were removed), then the importance of all of the remaining habitat would increase. However, given the protection of the SPA, this is an extremely unlikely scenario.

The intertidal and shallow subtidal habitat within the GHE site is very small and fragmented and, given all the characteristics of the site, it is my scientific opinion that it would not be capable of supporting substantially larger numbers of the relevant SCI species than it does at present.

The subtidal habitat within the GHE site, supports SCI species that mainly feed on mobile fish prey. The occurrence of these species within the GHE site, relative to their overall numbers within the SPA, will depend upon the distribution of fish prey across the entire SPA. Any changes in the usage of the GHE site by these species would reflect larger-scale changes in the distribution of their prey (as the prey species are not confined within the GHE site). I am not aware of any projected environmental changes that are likely to cause such changes in the distribution of fish species.

3. CUMULATIVE IMPACTS

Ms Egan discussed the assessment of cumulative impacts and stated the need to consider all possible cumulative impacts, not just sectoral impacts.

The only specific example she gave was of the cumulative impact of disturbance in-combination with nutrient loads. This is not relevant to the GHE development, as the development will only have very minor disturbance impacts, while there are no predicted changes to nutrient loading in the vicinity of the development site.

My assessment fully considered the relevant potential cumulative impacts. It should be noted, in this context, that the assessment of disturbance impacts considered cumulative impacts of disturbance from the GHE development in-combination with the other disturbance pressures: e.g., the assessment of disturbance from ship and boat traffic considered all such traffic within the SPA, not just that generated by the development.

4. BLACK-HEADED GULL

Ms Egan referred to the possibility that much larger numbers of Black-headed Gulls may roost nocturnally within the SPA than are recorded during daytime counts.

I agree. The nocturnal roosting behaviour of Black-headed Gulls is discussed in the species profile for Black-headed Gull (Appendix 2.8 in the NIS Addendum/Errata), and in section 4.1.2 (sub-heading *Habitat/dietary flexibility*) in my species assessment report (Appendix 3.4 in the NIS Addendum/Errata).

I have surveyed nocturnal gull roosts at various sites in Britain and Ireland. These roosts typically occur on large bodies of sheltered open water, such as inland lakes and reservoirs, and

sheltered coastal bays, etc. In Cork Harbour, the main gull roost (which can hold in excess of 20,000 Black-headed Gulls) occurs in Lough Mahon, extending from the lower part of the River Lee channel, adjacent to Tivoli Docks, across Lough Mahon to the outer part of the Douglas Estuary and the Little Island and Rochestown shores. This roost occurs around the shipping channel into Tivoli Docks. I have observed the passage of large ships through the roost without any significant disturbance effects.

There is limited information available on the distribution of nocturnal gull roosts in Inner Galway Bay. However, observations during the monitoring counts carried out by Dr Chris Peppiatt indicates that there is not any significant roosting within the GHE site, and, from my knowledge of the habitat characteristics of gull roosts, I would consider that the GHE site is too exposed to be a significant gull roost.

Therefore, given the absence of a significant nocturnal gull roost in the GHE site, and the low sensitivity of nocturnal gull roosts to disturbance from shipping traffic, there is no scientific reason to suppose that the GHE development will have negative impacts on nocturnal Black-headed Gull roosts within Inner Galway Bay.

5. HABITAT USAGE

Ms Egan referred to the need to consider habitat usage across the SPA, at present and in the future.

Habitat usage across the SPA, at present, is analysed in Appendix 1 of Appendix 3.4 in the NIS Addendum/Errata.

Consideration of habitat usage across the SPA in the future would require specification of detailed scenarios of environmental changes that would result in significant changes in habitat availability, and/or scenarios of changes in bird populations.

6. SURVEY EFFORT

The issues raised by Ms Egan relating to survey effort were fully dealt with in my cross-examination. However, for the record, the publication that I cited is:

Gilbert, G., Gibbons, D.W. & Evans, J. (1998) *Bird Monitoring Methods: A Manual of Techniques for Key UK Species*. RSPB, Sandy.

7. EXTREME WEATHER EVENTS

Ms Egan criticised the assessment of extreme weather events contained in Section 7.4 of the Response to the RFI.

As noted in the *Response to Observations made by BirdWatch Ireland to An Bord Pleanála on 5th December 2014*, it is difficult in the absence of any specific complaint to know precisely the complaint being suggested here. However, the discussion presented in Section 7.4 of the Response to the RFI deals with the relevant issues and provides an accurate assessment of this issue.

8. DISTURBANCE

Ms Egan's presentation refers to "disturbance impacts (short term and longer term)".

It is not clear what specific issues this refers to. However, my assessment fully considered the potential disturbance impacts during the operational phase of the GHE development, which are the "longer term" disturbance impacts of the development.

My assessment found that the potential impacts of both habitat loss and disturbance will be very minor, so there is no potential for significant cumulative impacts arising from the impacts of habitat loss in-combination with disturbance.

9. MODELLING

Ms Egan referred to the potential use of modelling to examine longer-term changes.

I assume that she is referring to the use of individual-based models (IBMs).

IBMs are models that follow each individual of a population across the course of a specified time period (usually the non-breeding season for waterbird IBMs) and use fitness-maximising rules to model the behaviour of each individual (e.g., where and how long it feeds, how it responds to disturbance, etc.) on a daily basis. Population-level parameters, such as survival rates, can be predicted from the fate of all the modelled individuals. The basic site-specific parameters required to specify the model are the distribution and abundance of birds and prey resources at the beginning of the modelled period, while other parameters relating to bird energetics and foraging efficiency can usually be derived from literature sources. The model can be validated by comparing predictions with observations (e.g., bird distribution across the site, or bird diet, and how these change across the duration of the model). Once a basic model has been developed, the effects of specified scenarios of environmental impact can be examined. For example, for models examining disturbance impacts, the effects of varying the intensity and pattern of activity can be compared with baseline no disturbance scenarios. Usually any decrease in survival rates is taken as being a significant impact, as even small decreases in survival rates can have large cumulative impacts if continued over a period of years.

IBMs have been developed for a number of estuarine sites in Britain and Europe, and the results of most of these have been published in peer-reviewed scientific journals. The IBMs have generally been judged to be successful, as measured by the validation of the model outputs, while, in some cases at least, sensitivity analyses have shown that the models are robust to variations in the assumptions that need to be made.

The results of IBMs that have examined the effects of habitat loss of waterbird populations are discussed in Appendix 2 of my species assessment report (Appendix 3.4 in the NIS Addendum/Errata). These IBMs have examined large-scale habitat loss (10% or greater of the total habitat area). There is no precedent for developing an IBM to examine the very small-scale of habitat loss that will result from the GHE development. In fact, any such IBM would probably not be capable of detecting any impact. This is because the interference effects, which drive the density-dependent processes in an IBM, have a random variation component (in the IBM), which corresponds to the stochastic component of interference effects in real life.

I have tested the effect of a 1% displacement impact on an IBM that I have developed for the cockle-feeding Oystercatcher population in Dundalk Bay. At a population size of 6500 individuals (which is within the range where density-dependent effects start to become important in this model), increasing the population by 1% (i.e., simulating a 1% displacement impact) did not cause any change in mortality rates:

- At a population size of 6500 individuals, the mean mortality rate was 16.2% (95% C.I.: 15.9-16.5%, n = 10).
- At a population size of 6565 individuals, the mean mortality rate was 16.3% (95% C.I.: 15.9-16.7%, n = 10).

While clearly the exact effect of a specified displacement level will depend upon the details of the particular model, the Dundalk Bay example illustrates the low sensitivity of IBM outputs to very small displacement impacts. Therefore, while IBMs are a powerful tool for assessing the impacts of environmental changes on waterbird populations, they would not be appropriate for the particular circumstances of the GHE project. Instead, it is my scientific opinion that the assessment carried out for the GHE project used appropriate methodologies and can be considered as providing a robust prediction of the likely impacts.



14B

Galway Harbour Company



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Galway Harbour Extension

**RESPONSE TO QUESTIONS RAISED BY THE BOARD
ON NOISE & AIR QUALITY
And
POINTS RAISED BY THE DAHG
JANUARY 15th 2015**



UNDERWATER NOISE MODEL

The presentation of underwater noise results in the EIS is summarised as follows:

Tables 10.3.1 and 10.3.2 set out the underwater noise exposure criteria used in the EIS. Appropriate criteria are used for single pulse (blasting), multiple pulse (pile driving) and non-pulse (dredging and shipping) type noises. Species specific frequency sensitivity of the noise is catered for by applying the species M-weighting. [DAGH Guidance (2014), Southall et al (2007) and Finneran & Jenkins (2012)].

Dr. Ó Cadhla raised a question this morning regarding the hearing sensitivity and hearing frequency range of cetaceans. The sensitivity and range has been catered for in the underwater noise calculations by incorporating the M-weighting functions, the Finneran and Jenkins (2012) reference providing data for Mustelids (Otter).

The species specific M-weighting functions used in the EIS covered the range 0.016 to 256 kHz octave bands This includes the range appropriate for mid-frequency cetaceans (-160kHz) and the range for high-frequency cetaceans (180kHz) set out in the DAHG Guidance and 120-150kHz mentioned by Dr. Ó Cadhla in his submission to the board on 15th January.

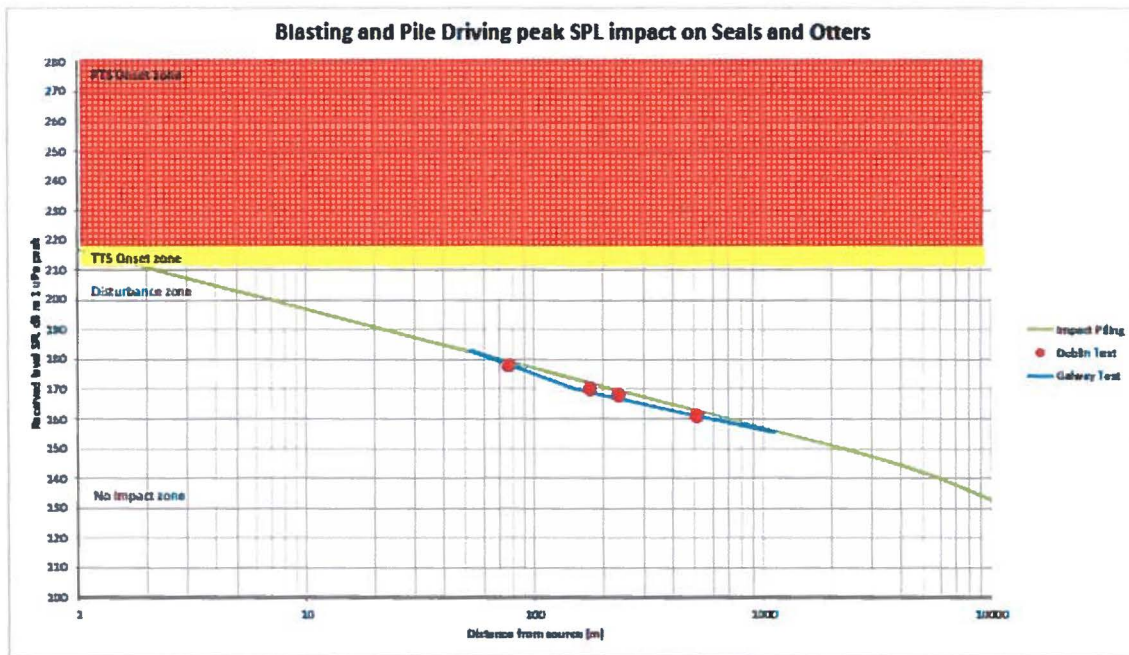
Model calculations are output as curves in Appendix 10.2. The impact ranges in Tables 10.5.3, 10.5.4 and 10.5.5 (Tables 10.5.3/4/5) are taken from the curves in Appendix 10.2. The plots in Appendix 10.3 are prepared using the impact zones in Tables 10.5.3/4/5. These plots are based on the most sensitive species and activities taking place during that phase of construction with the following impact zones:

Red	=	Permanent Threshold Injury
Yellow/Orange	=	Temporary Threshold Injury
Green	=	Medium Likelihood of Disturbance

Where 2 activities such as piling and dredging are happening in the same phase, the greater impact range is used in the plot.

Comparative measurements:

The model for pile driving peak SPL (the seventh plot in sequence in Appendix 10.2) is reproduced below. The red data points represent measurements taken during pile driving in June 2014 at Dublin Port. The piles being driven in Dublin Port had a cross sectional area of 333 cm². The measurements in Dublin Port were taken in Alexandra Basin which is an enclosed space and would have resulted in approximately 3 dB additional noise due to the measurement location. The piles modelled for Galway port were 1.5m diameter with a cross sectional area of 468 cm². This means that smaller piles would have resulted in approximately 3 dB of a lower prediction. The net effect is that these two factors in effect cancel each other out and the measurements would be expected to be close to the predicted line.



Galway Harbour Company commissioned 3 noise propagation tests on Galway Bay as part of the preparation for the EIS. All three tests indicate significant propagation losses due to the shallow waters and the 'lossy' seabed in the bay. One of these tests used a fixed point source and the result of the test is reported in Table 10.3.4 of the EIS. The rate of propagation over distance for this test is plotted as a blue line on the figure above and indicates good agreement with the Marsh & Schulkin Model.

Confidence in the model:

The standard deviation for underwater noise models is generally accepted as being 3 dB. The measurements for pile driving taken in Dublin and the rate of propagation based on a static source test carried out in Galway Bay are both within this margin of the EIS prediction model.

Mitigation Measures:

The proposed exclusion zone for blasting and pile driving has been set at 1000m in the mitigation measures proposed in the EIS. This is in compliance with the DAHG Guidance and provides an additional safety factor for Marine Mammals. Due to the nature of the inner bay, it is possible for an MMO to observe this area from the construction site, Hare Island or Mutton Island.

Erratum

In preparing this summary I noticed that Paragraph 4.78 of my witness statement contains incorrect impact zone data and should read as follows.

These figures indicate that for pile driving an exclusion zone of 500m is required, a zone of up to 350m for dredging and 500m for blasting activities in order to avoid any possibility of temporary injury to marine fauna. The limiting factor is the impact on seals in all cases.

As stated above a 1000m zone is being applied in the mitigation measures proposed.

H₂S ODOUR EMISSIONS AND TREATMENTS

We only expect H₂S in a small quantity of the sediment. Dr. Brendan O'Connor has indicated that his data indicates that organic carbon levels recorded in surface sediments are in the order of 2-5%, which in his experience are typical of inshore marine sediments.

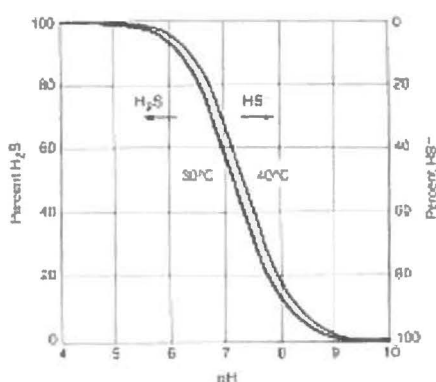
Galway Bay and the water from the Corrib is highly oxygenated which has a mitigating effect.

The Corrib is an alkaline river, this is confirmed by Mutton Island water quality monitoring results which indicate a pH of 8 in the area enclosed by Mutton and Hare Islands.

H₂S is soluble in water, the higher the pH the more H₂S remains in solution. This means that there will be a tendency for the H₂S to remain dissolved (80% according to Figure 10-1)¹.

Figure 10-1

Percent of hydrogen sulfide present as H₂S and HS⁻ as a function of pH



The towing of the suction head will cause an initial release of the gas from the sediment into the water column and this will not be transported into the vessel. The initial handling is a vacuuming process from the seabed into the TSHD where it is stored in the hold. TSHD operations comprise a double handling of the material. There is a second pumping operation from the hold when connected to the pipe/lagoon, (page 4-35 of the EIS).

In the event of a particularly high level of H₂S being encountered during dredging, the problem will arise on the TSHD in the first instance. At that point the material will be contained in the vessel and can be mitigated on a phased basis. Initial responses may include;

- Moving the vessel offshore until the H₂S levels stabilise
- Venting at the vessel
- Treating the material with odour suppressants on the barge.

At the lagoon end, the discharge is at a single end of pipe. A number of lagoons will be available and the most remote will be designed to take the worst case material. The sediment mix will be discharged under the water surface and the settlement takes place under water.

The end of the pipe is likely to be the main odour discharge location. It is feasible to construct an enclosure around this point (if required) and treat the odours with a suppressant or filter the air through activated carbon filters.

¹ Metcalf & Eddy (2004), Wastewater Engineering Treatment and Reuse, McGraw Hill, New York.

**Response to Department of Arts, Heritage and the Gaeltacht
Submissions at Oral Hearing for Galway Harbour Extension
15.01.2015**

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Dr. Chris Peppiatt

Response to Dr. Oliver O’Cadhla regarding Marine Mammals

Desktop Analysis

Desktop Analysis of ‘Observed impacts of similar developments and associated coastal/maritime activities on harbour seal populations’ or provide more detail on what review or other work was undertaken in this regard.

The desk study carried out by KELP Marine Research was reviewed available peer reviewed data as part of the Marine Mammal Risk Assessment that they undertook. A full list of the reference information reviewed by KELP Marine Research was provided with their further information (presented as Appendix 2.6 of the NIS Addendum/Errata Document I, October 2014). A further literature search was carried out following receipt of the submission from DAHG in ~~December~~ ^{JANUARY} 2015, using library database facilities at NUIG, which again, produced no detailed information for similar developments.

KELP’s statement:

‘Generally, our position is that the nature of the additional information asked for is not available, or not available as a scientific source or published report. We have performed a broad review of existing literature and widening that further to include much more grey literature may not yield results. It should be also be considered that in case of no effect, or no effect measured, data will often not be published so it is very difficult to ascertain.’

Wildlife Pass

Evidence to support the concept that the proposed Wildlife Pass will be a viable mitigation measure for seals, thereby alleviating a possible barrier effect from the proposed development.

The proposed wildlife pass will be two metres wide, with a baffle in place at either end (intended to prevent the passage of kayaks, etc) so that passage will be possible for animals of a maximum diameter of up to one metre (baffle size is 0.96m). Dr. Chris Peppiatt has personal observations of seals using narrow channels and entrances, which suggests that there is scope for seals to use this feature, at least at higher periods of the tidal cycle.

While the proposed harbour extension will take the form of a short promontory of new land jutting out into the bay, with a deeper water quay at the end, this does not constitute a complete barrier to movement for seals from any one part of the remaining marine habitat to another. The approximate distance from the river mouth to just offshore of Renmore Beach (i.e. for a seal) would be 2.5km, travelling all the way around the outside of the new harbour extension (and 1.5km where the proposed wildlife pass is used).

Target 5 for Harbour Seal – (Disturbance)

It is considered that the loss of any habitat involved in the construction of the harbour extension is unlikely to have a significant effect on attribute no. 5 with regard to harbour seal (i.e. Disturbance) in itself, given the type of habitat involved, the number of seals regularly using the area and the increasing trend of the Galway Bay population. However, since it is not possible to state beyond reasonable scientific doubt that habitat loss (or the effects of operating disturbance) will not affect harbour seal at the population level, those impacts has been treated as significant for the purposes of the assessment.

NPWS References re Construction Phase

It can be confirmed that agreement on monitoring or mitigation measures which had been outlined as those which would be agreed with the NPWS prior to the construction period, will be agreed with the relevant planning authority.

Visual Cetacean Surveys

With regard to Visual Cetacean Surveys, the concluding statement on Page 8 of Section 7 of my (Dr. Chris Peppiatt) Brief of Evidence, the NPWS are correct in assuming that the concluding statement of this section i.e. 'potential impacts due to habitat loss and construction/operating disturbance would not be expected to be of significance' has been made in view of proposed mitigation, monitoring and environmental management proposals presented by the Applicant.

Predicted Impacts and Proposed Mitigation

With regard to information presented in my (Dr. Chris Peppiatt) Brief of Evidence (Page 15) with regard to cetacecan ears and hearing sensitive frequency ranges, Mr. Eugene McKeown has prepared information to clarify these points. This has been presented already.

Dead or Injured Seals and Cetaceans

With regard to eventualities where dead or injured seals or cetaceans occur in Inner Galway Bay, during the period of the proposed construction, the following measures will be taken:

1. Dead animals will be subject to post mortem by a qualified veterinarian
2. Use of ADDs for deterrants of small cetaceans and seals from the site will be immediately considered
3. Use of RIBs to attempt to drive animals out of construction area will be considered
4. Works will be halted if it is indicated that construction works are likely to have caused the injury or death
5. The works will not restart until an appropriate action plan is in place

Response to Dr. Ferdia Marnell regarding Otter Questions

The information regarding available marine and terrestrial habitat for otter was obtained from the NPWS conservation objective for Galway Bay Complex cSAC. This provides a figure of 262ha of terrestrial habitat above high water and 2,040ha of marine habitat for otter.

Overall in terms of Marine Habitat, there will be an initial loss of 4.64ha (0.23%) with a gain of 16.08ha (0.79%) as a result of the proposed development (which will take 6 – 9 years to recolonise) which is an overall net gain of 11.44ha (0.56%).

With regard to Terrestrial Habitat, there will be an initial loss of 0.58ha (0.22%) with a gain of 2.1ha (0.8%) as a result of the proposed development (which will take 6 – 9 years to recolonise) which is an overall net gain of 1.52ha (0.58%).

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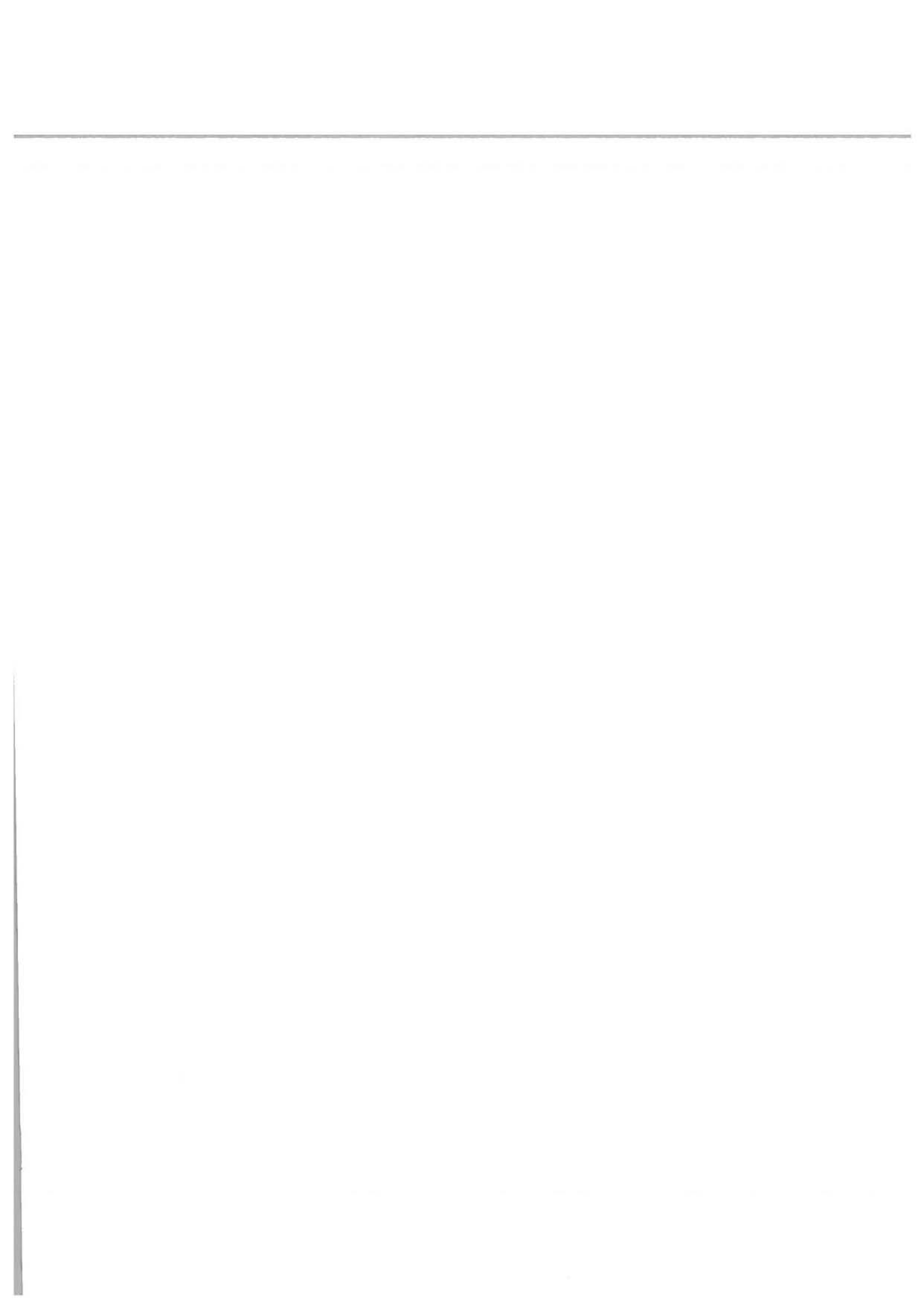
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**Response to An Taisce
In Respect of Climate Change Allowance
Submissions at Oral Hearing for Galway Harbour Extension
15.01.2015**

Mr. Anthony Cawley

Climate change allowance

The flood risk assessment for the Harbour development meets current best Irish practice for inclusion of sea level rise using a medium range climate change scenario. This represents a sea level rise of 500mm for the proposed project. This approach of using a medium range climate change scenario agrees with the OPW who are the national agency responsible for flood risk management in respect to the National cFRAM program. A High end climate change scenarios suggests potentially a 1m rise in mean sea level with the majority of the increase occurring towards the end of the century. In respect to the project it should be noted that the finish floor levels of all proposed structures are set at 5.5m OD malin which potentially provides an additional freeboard of 850mm on top of the 500mm sea level allowance. The quays which are maritime working areas and the internal roads are protected to 5m OD which potentially provides 850mm for possible climate change rise. The provision of freeboard in this development protects against uncertainty which includes uncertainty in respect to climate change and is in accordance with good flood risk management planning.



**Response to Department of Arts, Heritage and the Gaeltacht
Submissions at Oral Hearing for Galway Harbour Extension
15.01.2015**

Dr. Brendan O'Connor

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Habitat Maps

The attached habitat map shows the distribution of Annex 1 habitats and is based on the original habitat map presented in the NIS document.



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LEGEND








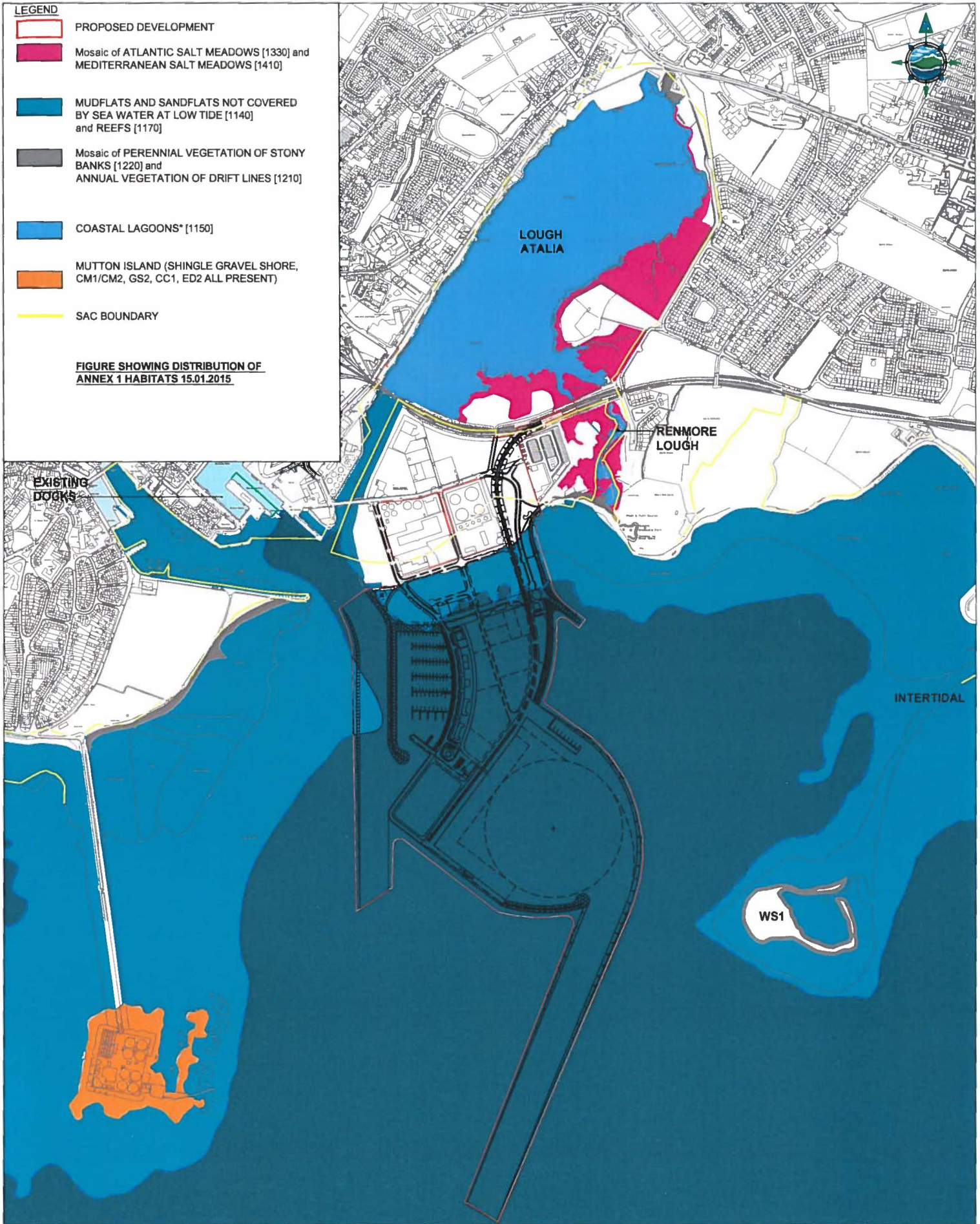
-  PROPOSED DEVELOPMENT
-  Mosaic of ATLANTIC SALT MEADOWS [1330] and MEDITERRANEAN SALT MEADOWS [1410]
-  MUDFLATS AND SANDFLATS NOT COVERED BY SEA WATER AT LOW TIDE [1140] and REEFS [1170]
-  Mosaic of PERENNIAL VEGETATION OF STONY BANKS [1220] and ANNUAL VEGETATION OF DRIFT LINES [1210]
-  COASTAL LAGOONS* [1150]
-  MUTTON ISLAND (SHINGLE GRAVEL SHORE, CM1/CM2, GS2, CC1, ED2 ALL PRESENT)
-  SAC BOUNDARY

FIGURE SHOWING DISTRIBUTION OF ANNEX 1 HABITATS 15.01.2015



Clarification on Shingle Shore (Renmore Beach)

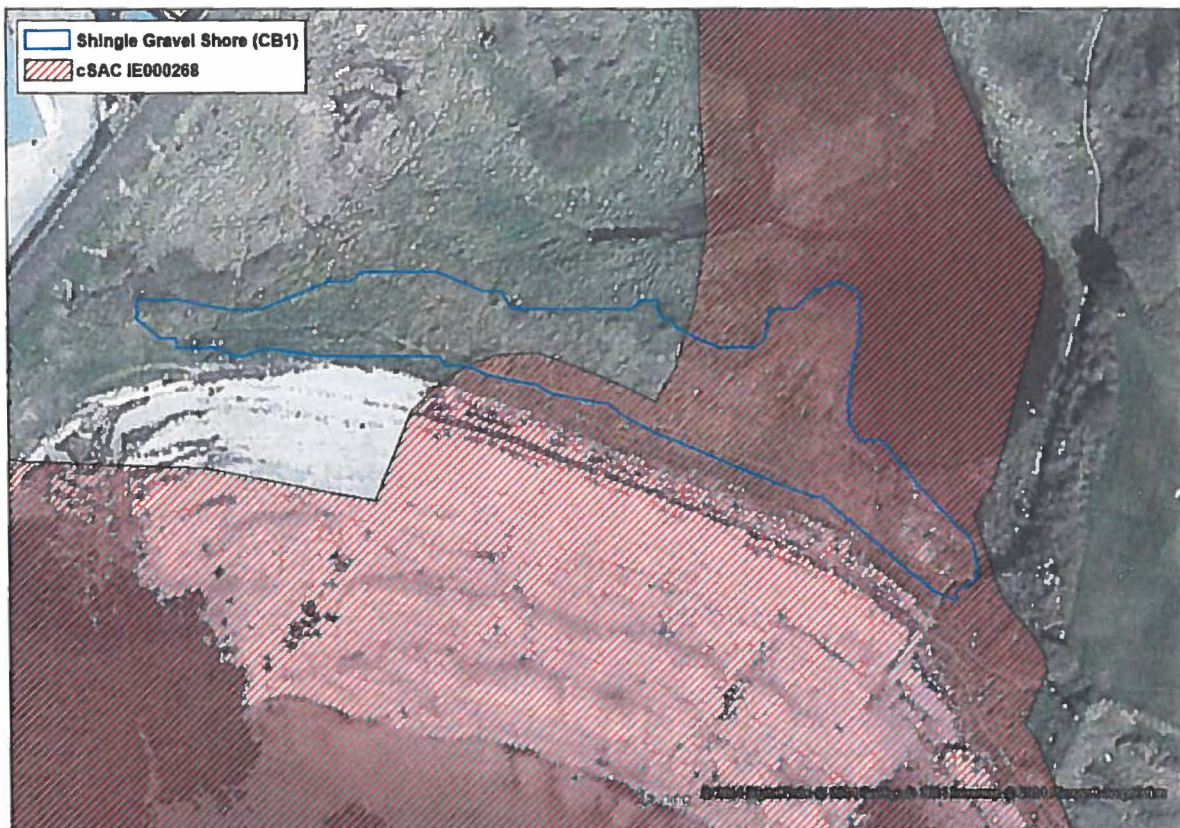


Figure NIS (A2) 1.3 from Michelline Sheehy Skeffington's Brief of Evidence

With regard to the shingle shore at Renmore Beach, the base aerial photograph used, is the Pre-Storm view i.e. taken pre January 2014. The area was surveyed following the storm in 2014 and the new additional area of shingle is shown within the blue line. The red hatched area shows the SAC boundary.

The existing shingle shore corresponds to Annex I Habitat 1220 Perennial Vegetation of Stony Banks, but also includes strandline vegetation (i.e. the habitat is a mosaic), 1210 Annual Vegetation of Drift Lines. Note that both are Annex I Habitats, but only Habitat 1220 is a Qualifying Interest of the Galway Bay Complex cSAC.

The discrepancy as identified by Dr. Julie Fossitt on Table 4.19 of the NIS addendum should read 0.46 ha with regard to total loss of stony bank habitat.

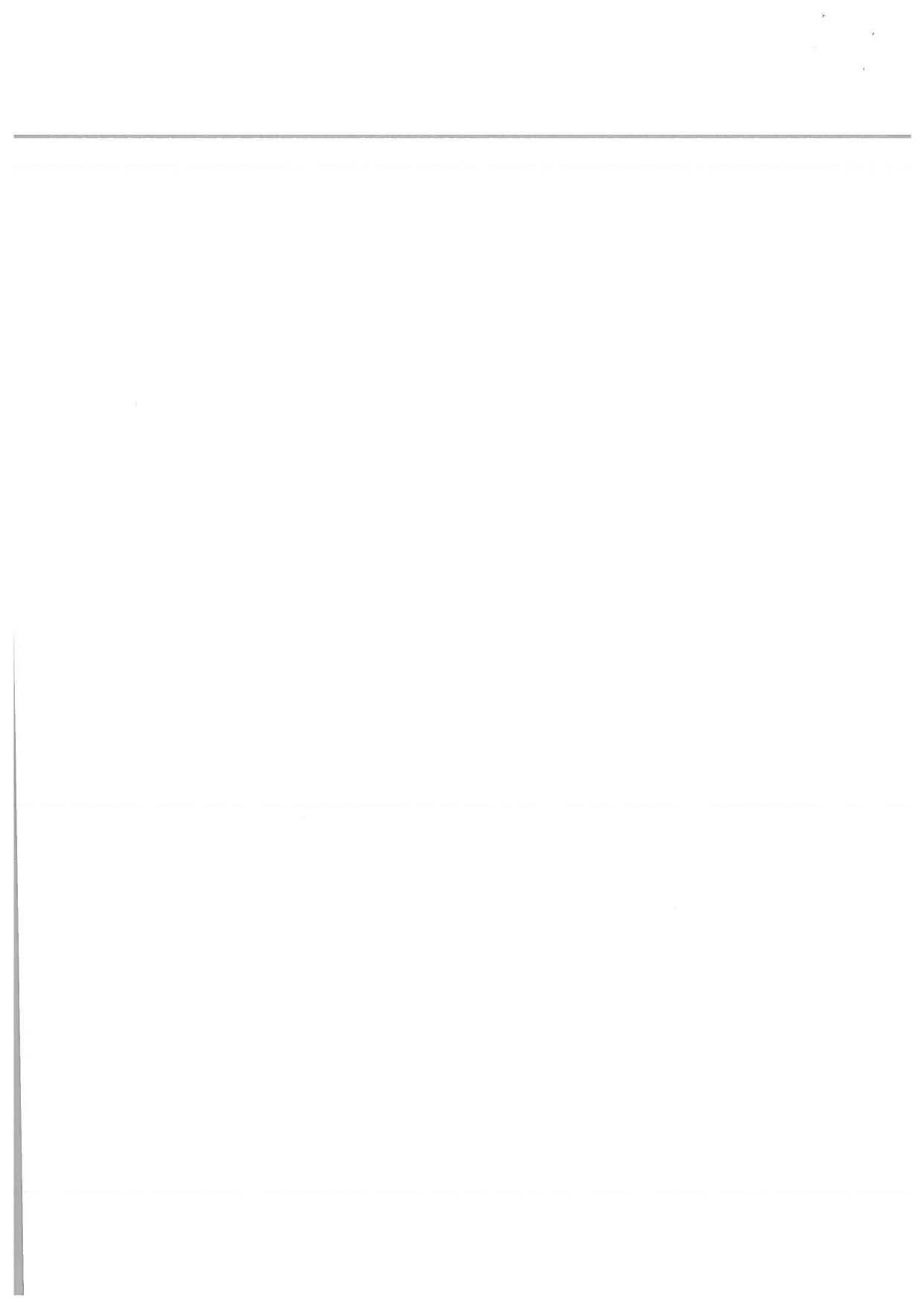
Habitat Maps

The attached habitat map shows the distribution of Annex 1 habitats and is based on the original habitat map presented in the NIS document.

The basis on which the figure of 0.18 ha of permanent habitat loss of perennial vegetation of stony banks was arrived was through the use of a mobile geographic positioning system (GPS) and a geographic information system (GIS). The stony bank habitat that has extended due to the storms of December 2013 and January 2014 was walked and the track was continuously recorded by the mobile GPS. These data were uploaded to MAPINFO which is standard GIS software and the track was mapped on to a satellite (BING) image of the area. This was shown by Dr. Sheehy Skeffington as an area delineated by a continuous blue line. The NPWS cSAC site boundary layer for Galway Bay was added to this figure. This was shown in Dr. Sheehy Skeffington's brief of evidence as an area shown by red hatched lines. An area determination routine within the GIS software allowed for the evaluation of the size of the entire area outlined in blue (0.31 ha) and that portion of it that falls within the cSAC (0.18 ha).

In relation to Dr. Lyons' final comment on page three of his presentation on Marine Annex I habitats, it is clearly stated in Dr. O'Connor's brief that 5.92 ha of Annex I habitat will be lost if the Galway Harbour Extension proceeds.

The proposed development will have no impact on Lough Atalia nor Renmore Lough both of which are listed as a priority habitat with the EU Habitats Directive.



In relation to assessing the zone of influence on coastal terrestrial environments in the vicinity of the proposed new structure, modelled output of changes in wave climate (see Figures 4.4.25 – 4.4.36 of the response to the request for further information) for all onshore directions from west through east were examined. These clearly show that the zone of influence extends from the eastern headland at Ballyloughane Beach, the southern and western sections of Hare Island west to the eastern section of Mutton Island including the area along South Park. There is no predicted change to wave conditions in Lough Atalia and these images show no reduction in wave climate conditions east of Ballyloughane headland and west of Mutton Island along the shoreline at Gratten Road. Figure 4.4.41 is a composite image of the changes and these represent a diminution in wave climate and therefore a sheltering effect.



Figure 4.4.25 Difference Plot between Existing and Proposed Significant Wave heights for Atlantic Storm and West Storm Winds



Figure 4.4.26 Difference Plot between Existing and Proposed Significant Wave heights for Atlantic Storm and WSW Storm Winds



Figure 4.4.27 Difference Plot between Existing and Proposed Significant Wave heights for Atlantic Storm and SW Storm Winds

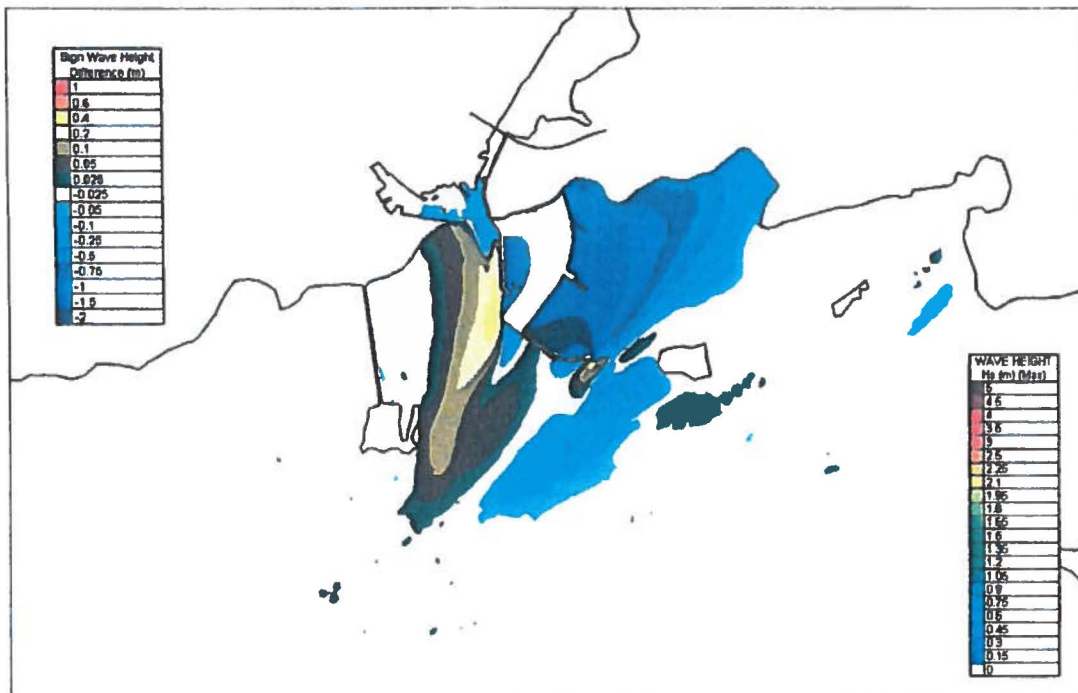


Figure 4.4.28 Difference Plot between Existing and Proposed Significant Wave heights for Atlantic Storm and SSW Storm Winds



Figure 4.4.29 Difference Plot between Existing and Proposed Significant Wave heights for Atlantic Storm and South Storm Winds



Figure 4.4.30 Difference Plot between Existing and Proposed Significant Wave heights for Local WSW Storm Winds



Figure 4.4.31 Difference Plot between Existing and Proposed Significant Wave heights for Local SW Storm Winds



Figure 4.4.32 Difference Plot between Existing and Proposed Significant Wave heights for Local SSW Storm Winds



Figure 4.4.33 Difference Plot between Existing and Proposed Significant Wave heights for Local South Storm Winds



Figure 4.4.34 Difference Plot between Existing and Proposed Significant Wave heights for Local SSE Storm Winds



Figure 4.4.35 Difference Plot between Existing and Proposed Significant Wave heights for Local SSE Storm Winds



Figure 4.4.36 Difference Plot between Existing and Proposed Significant Wave heights for Local ESE Storm Winds

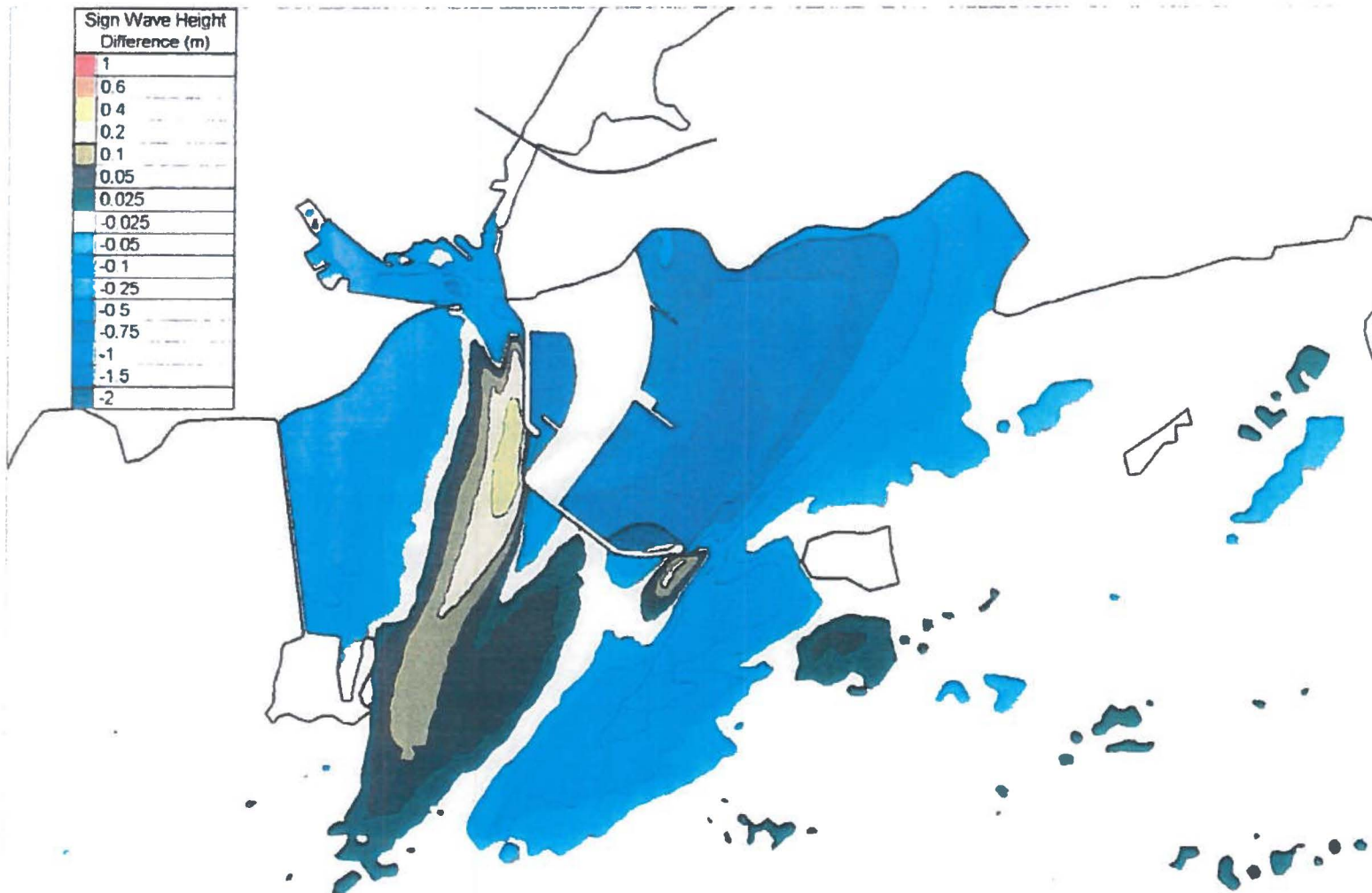


Figure 4.4.41 Difference plot of maximum predicted Wave heights existing and Proposed Wave climate for all onshore directions (West to ESE)

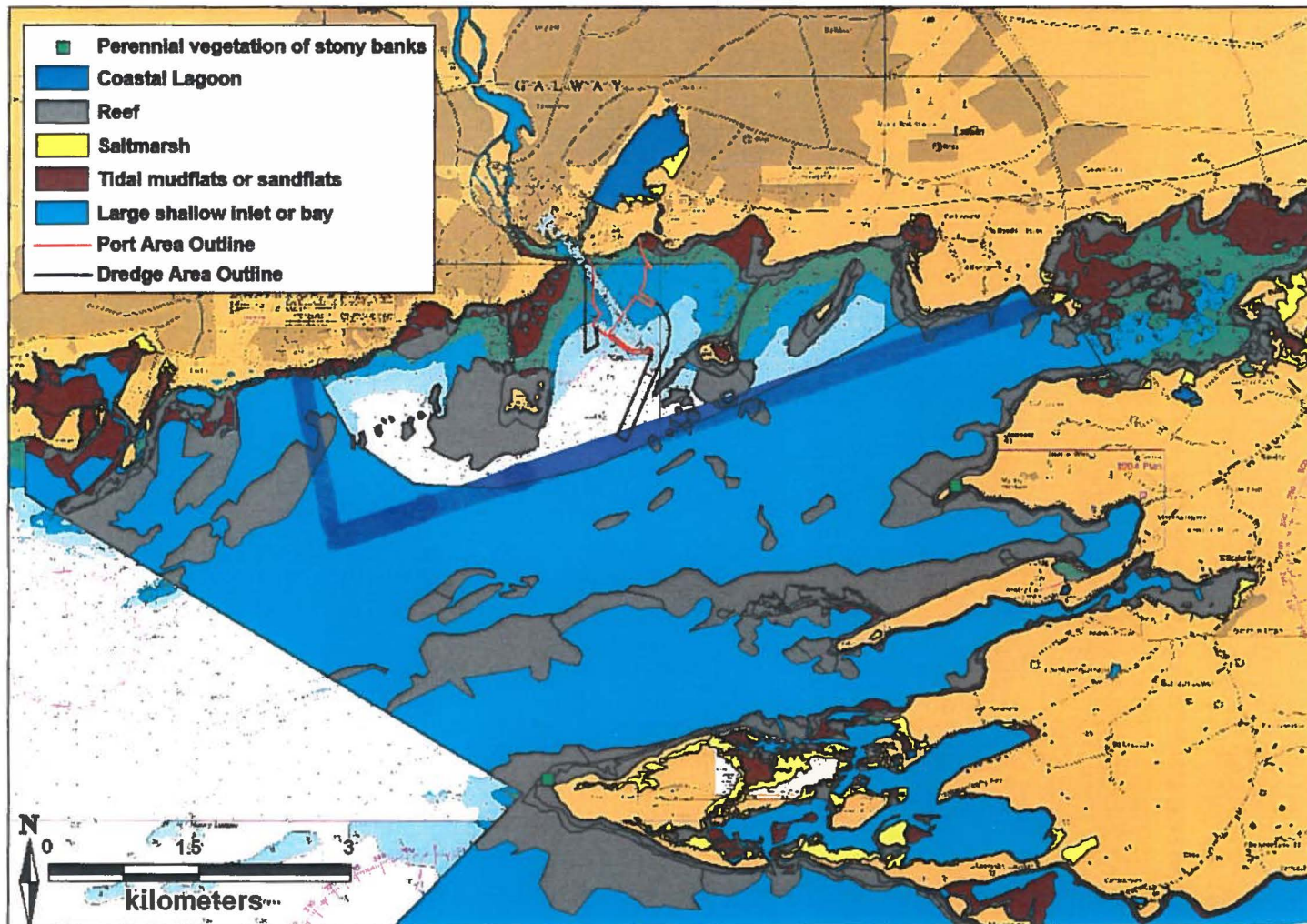


Figure showing area (outlined in blue) that will be affected by suspended sediments arising from the capital dredging operation.

This is based on the output of the hydrodynamic model data.
