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An Taisce
The National Trust for Ireland

AN BORD PLEANÁLA
TIME 12.00 BY An Taisce
14 JAN
LTR-DATED JM. FROM
PL R00033

An Taisce Component Submission

to the Oral Hearing of An Bord Pleanála

on 14th January 2015

on the Galway Harbour Extension Application

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1. INTRODUCTION

Mr Inspector, Ladies and Gentlemen, An Taisce welcomes this opportunity to make a further submission at this oral hearing on the Galway Harbour Extension application to An Bord Pleanála.

This submission concerns in particular:

A. The Appropriate Assessment obligation of the Board as the "Competent Authority" for the purposes of the Article 6 of:
   i. COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, "The Habitats Directive".

B. Certain other considerations related to the above given the concurrent obligation on the Board as the "Competent Authority" to perform an Environmental Impact Assessment under:
   DIRECTIVE 2011/92/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, the EIA Directive" or "EIAD"

The primary focus of this submission will be to highlight <u>certain</u> of the binding legal obligations on the Board in its role as Competent Authority for the purposes of the Galway Harbour Extension development proposal, "GHE".

This submission should be read and heard in the context of An Taisce's earlier submissions on this matter to the Board, and An Taisce wishes in particular to adopt the concerns and issues raised by BirdWatch Ireland's submission and in its submission which will be heard later today.

Additionally, given the sequencing of submissions at the oral hearing, An Taisce reserves the right to adopt such further valid concerns raised, regarding in particular but not limited to - the adequacy of information presented to inform both the Appropriate Assessment and Environmental Impact Assessment obligations which the Board - as the Competent Authority for these assessments is obliged to perform for the instant development application of concern in these proceedings.

CONSIDERATIONS

The considerations we wish to highlight here relevant for the Appropriate Assessment obligation include but obviously are not limited to the following:

An Taisce submits that the Board's obligation under the Habitat's Directive and Environmental Impact Assessment Directive necessarily requires the following:

a) **C-127/02, the Waddenzee case**: Fulfilment of obligations under Articles 6(3) and 6(4) of the Habitat's Directive, in strict accordance with the clarifications on same afforded by the Court of Justice of the European Union's, CJEU judgement in case C-127/02, referenced more generally as the Waddenzee case, and consideration for the associated Advocate General's opinion informing the Judgement.

   In particular this includes strict compliance with the process requirements and the different obligations clarified in this case in relation to the issue of both "scientific doubt" and "scientific certainty" and the "precautionary principle" in the Board's consideration of the project in accordance with Article 6(3) Habitats:

   - Firstly in the screening exercise, where the test is whether the Galway Harbour Expansion is *"likely to have a significant effect"* on Natura 2000 sites"; and then where that is the conclusion then
   - Secondly in the conduct of the second stage which is the actual Appropriate Assessment to determine the second test as to whether there are *"adverse impacts on the integrity of the site"* as required by Art 6(3) of the Habitats Directive.

   In summary full adherence to these process requirements and principles, and full compliance with the generic requirements of Art 6(3) and 6(4) as clarified by this judgement is required of the Board as the Competent Authority for the purposes of Article 6(3) and Article 6(4) of the Habitats Directive.

b) **Competence**: Consideration and fulfilment of the associated competence implications required for the Competent Authority in the conduct of the Appropriate Assessment and fulfilment of obligations under Articles 6(3) and 6(4) of the Habitat's Directive.

c) **Adequacy of Inputs:** Consequent on the high bar established in relation to scientific certainty, there is an obligation on the Board to ensure the adequacy of information from all inputs necessary to assist in the execution of the obligations under Article 6(3) and 6(4) and the studies purporting to informing the Appropriate Assessment which the Board is obliged to undertake. This includes in particular:

I. The adequacy or otherwise of studies purporting to inform:

- The current situation assessment; and

- The impact assessment, including those impacts during all phases and scenarios relevant to this development namely, construction, normal operational phase, and exceptional or accident scenarios in both the constriction and operation phases of the development;

II. The consequential obligation where the Board determines it arises, to require further information to address any deficit for the Appropriate Assessment exercise, should it be of the view the scheme for the Galway Harbour expansion should proceed.

III. The adequacy or otherwise of Conservation Objectives for the Natura 2000 sites at issue, which are a necessary input into the Appropriate Assessment exercise, and the evaluation of the proposed development's impacts on the ecological integrity of the site which is necessary for the maintenance or restoration of the site to favourable conservation status.

IV. The adequacy or otherwise of Management Objectives for the Natura 2000 sites at issue in terms of how they impact upon the Favourable Conservation status.

V. The adequacy or otherwise of the assessment of "Favourable Conservation Status" in the reports evaluating same produced by Ireland pursuant to obligations in Article 17 of the Habitats Directive. Given the importance of the evaluation of "favourable conservation status" for the determinations which the Board is required to undertake, the Board must satisfy itself that the information on the "favourable conservation status" of the habitats and species of concern here has been adequately and robustly determined, and no deficit arises in relation to the assessment of same. Where concerns on issues with the determination of "Favourable Conservation arises" it is submitted the Board must exercise a precautionary approach therefore to the assessment of impacts, and cannot conclude with the requisite scientific certainty on the impact on "favourable conservation status".

VI. Appropriate consideration regarding the reports produced by Ireland pursuant to Article 12 of the Birds Directive.

VII. Consideration for the Natura Impact Statement submitted in relation to the above, as but an input to the Appropriate Assessment obligation which the Board is required to undertake for itself.

d) **Wider Compliance and Compatability Considerations: Compliance with other** obligations arising from the Treaty of the Functioning of the EU, "TFEU", in particular Articles 191(1) and 191(2) in relation to Environmental Protection obligations and the Precautionary approach which underpin all the EU Directives relevant to this development, including, but not limited to those on: Water, Waste, the Marine Environment, Ports, Habitats, Birds, Land Use and Strategic Impact Assessment, and Assessment of individual projects.

e) **c-258/11, the Sweetman Case** : Consideration for the judgement in case c-258/11, the Sweetman Case (http://curia.europa.eu/juris/liste.jsf?language=en&num=C-258/11)

- where this case concerned the:

> "Assessment of the implications for a protected site of a plan or project - Criteria to be applied when assessing the likelihood that such a plan or project will adversely affect the integrity of the site concerned"

and the judgement which concluded that: (emphasis added)

> "Article 6(3) of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora must be interpreted as meaning that a plan or project not directly connected with or necessary to the management of a site will adversely affect the integrity of that site <u>if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of sites of Community importance, in accordance with the directive</u>. The precautionary principle should be applied for the purposes of that appraisal."

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Where such circumstances arises, the Board is therefore obliged to conclude there are adverse impacts on the integrity of the site, and proceed to Article 6(4) of the Habitats Directive accordingly and as appropriate , which we address later below.

It should be noted that this judgement as the Board will be aware, was further to a reference to the CJEU from the Irish Supreme Court, in relation to a particular circumstance. Therefore it provides a binding clarification in relation to the particular circumstances at issue in that case and where they arise more generically. Or to put it plainly, where this impact arises elsewhere - it clarifies that the conclusion must necessarily be that there are "adverse impacts on the integrity of the site".

However the judgement is not exhaustive in its determination of what constitutes adverse impacts on the integrity of the site, i.e. there are other situations and circumstances which would require a conclusion that there are adverse impacts on the integrity of the site not limited to *"the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of sites of Community importance, in accordance with the directive".*

The deliberations of the Court on arriving at this conclusion together with Advocate General Sharpston's opinion for this case is additionally drawn to the attention of the Board, the latter being available here: (http://curia.europa.eu/juris/document/document.jsf;jsessionid=9ea7d2dc30dd772dcde7dfe0486581abf5c933d7c522.e34KaxiLc3qMb40Rch0SaxuPahz0?text=&docid=130253&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=241223)

f) **Guidance:** Additionally in relation to the determination of the first test "likely significant effects" and the second test "adverse impacts on the integrity of the site" the Commission's guidance is highlighted for the Board's consideration, in particular the Guidance on Article 6(3) and Article 6(4) and on the Management of Natura Sites which is referenced in the Guidance on Art 6(3) and the Guidance on Conservation Objectives, including:

- Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC
- Assessment of plans and projects significantly affecting Natura 2000 sites ⊗
- Guidance document on Article 6(4) (updated on 7.12.2012)

of the Habitats Directive 92/42/EEC.

⊗ Methological guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/42/EEC

- COMMISSION NOTE ON SETTING CONSERVATION OBJECTIVES FOR NATURA 2000 SITES

g) **Further Information Requirements and their implications:** It is common ground that the requirements of the Habitats Directive are an integral part of the considerations and obligations required by the Board for this application. Article 6(3) of the Habitats Directive as a standalone provision requires this, and furthermore the obligations arising from Article 3 of the EIA Directive which prescribes the Environmental Impact Assessment as follows:

> "Article 3
> The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 12, the direct and indirect effects of a project on the following factors:
> (a) human beings, fauna and flora;
> (b) soil, water, air, climate and the landscape;
> (c) material assets and the cultural heritage;
> (d) the interaction between the factors referred to in points (a), (b) and (c)."

- Necessarily invokes the legislative framework of the Habitats and Birds Directives pertaining to the habitats and species which are required to be assessed under the above. The Appropriate Assessment and Environmental Impact Assessment are thus linked.
-

Article 8 of the EIA Directive is highlighted here given it sets out key elements of what is legally required of the Board as the competent authority for the purposes of the EIA Directive obligations for this application:

> "Article 8
> The results of consultations and the information gathered pursuant to Articles 5, 6 and 7 shall be taken into consideration in the development consent procedure."

Public Participation obligations arising from Article 6, therefore are critical and in particular the requirements of Article 6(3)c are highlighted which states: (emphasis added)

"3. Member States shall ensure that, within reasonable time- frames, the following is made available to the public concerned:
(a) any information gathered pursuant to Article 5;
(b) in accordance with national legislation, the main reports and advice issued to the competent authority or authorities at the time when the public concerned is informed in accordance with paragraph 2 of this Article;
(c) in accordance with the provisions of Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information (1), information other than that referred to in paragraph 2 of this Article which is relevant for the decision in accordance with Article 8 of this Directive <u>and which only becomes available after the time the public concerned was informed in accordance with paragraph 2 of this Article."</u>

Where paragraph 2 states:

"2. The public shall be informed, whether by public notices or by other appropriate means such as electronic media where available, of the following matters early in the environmental decision-making procedures referred to in Article 2(2) and, at the latest, as soon as information can reasonably be provided:
(a) the request for development consent;
(b) the fact that the project is subject to an environmental impact assessment procedure and, where relevant, the fact that Article 7 applies;
(c) details of the competent authorities responsible for taking the decision, those from which relevant information can be obtained, those to which comments or questions can be submitted, and details of the time schedule for transmitting comments or questions;
(d) the nature of possible decisions or, where there is one, the draft decision;
(e) an indication of the availability of the information gathered pursuant to Article 5;
(f) an indication of the times and places at which, and the means by which, the relevant information will be made available;
(g) details of the arrangements for public participation made pursuant to paragraph 5 of this article"

In summary, the implications we submit of Article 6(3)c and Art 8 are very significant in respect of any information which the Board considers "relevant for the decision" which is submitted by the applicant after the notification process, and must be made available for full public consultation. Therefore, given the interplay of the Appropriate Assessment Process and the Environmental Impact Assessment Process, and supplementary information for the AA or which changes the description or the impacts of the project must be considered in accordance with the public consultation obligations.

Additionally, the clarifications of the CJEU in case c-183/05 in relation to the requirement to consider assessments and necessary studies in advance of any decision to grant a Development Consent, as required by Art 2(1) of the EIA Directive is also highlighted to the Board, together with the fundamental obligations of Art 2(1) itself. In summary in that case the reliance on post-consent assessments was prohibited. Therefore the Board cannot rely on conditions to fulfil consideration, assessment and mitigation determinations which are actually necessary as part of the Environmental Impact Assessment Process prescribed by Article 3 of the Directive, which includes the Appropriate Assessment. Case c-183/05 also clarifies the requirements in respect of derogation licences required under Article 16 of the Habitats Directive for species listed under Annex IV of the Habitats Directive and the requirements for these to be considered in advance of consent.

h) Alternatives Case c-239/04: In the event that adverse impacts on the integrity of the site are concluded and the Board wishes to proceed to Article 6(4) it is critical to note the requirements in relation to the exhaustion of alternatives. In brief it is not sufficient to argue that IROPI considerations prevail. The requirement of Article 6(4) is explicit in requiring the exhaustion of alternatives by the use of the word "and" as highlighted below in the extract from Article 6(4):

> " .. If, in spite of a negative assessment of the implications for the site **and** in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature

The judgement of the court in c-239/04 and in particular the following from the associated Advocate General's opinion is highlighted to the Board: (the emphasis is the AG's)

"43. The absence of alternatives cannot be ascertained when only a few alternatives have been examined, but only after *all* the alternatives have been ruled out. The requirements applicable to the exclusion of alternatives increase the more suitable those alternatives are for achieving the aims of the project without giving rise – beyond reasonable doubt – to manifest and disproportionate adverse effects."

i) Compensatory Measures
In the event the Board arrives at a point where it is considering compensatory measures, the considerations in the Commission's guidance are highlighted for the Board's attention, particularly in relation for the ecological equivalence for the species impacted. In brief the compensation needs to be equivalent for example for the flocks of birds which use the site impacted, not just other instances of the same species. The specification of adequate compensatory measures, requires therefore a sound understanding of the site and the species and habitats involved.

IRPOPI we submit must also consider the public interest at large, not just in a localised context.

j) **Kelly Judgement, Irish High Court**. The requirements of the High Court in the judgement of Ms Justice Finlay-Geoghegan case in the matter of Kelly v An Bord Pleanala, 25th July 2014 are also drawn to the attention of the board.

We thank the Board for its consideration of our remarks on this element of the hearing.

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Environment Agency

Adapting to Climate Change:

Advice for Flood and Coastal Erosion Risk Management Authorities

We are the Environment Agency. We protect and improve the environment and make it **a better place** for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve.

Published by:

Environment Agency
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Bristol BS1 5AH
Tel: 0117 9334 4000
Email: enquiries@environment-agency.gov.uk
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Further copies of this report are available from our publications catalogue: http://publications.environment-agency.gov.uk or our National Customer Contact Centre: T: 08708 506506

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1 Introduction

This part describes Defra's policy statement and its relation to this advice

This advice replaces Defra's Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006. It is provided as supplementary information to Defra's policy statement on Appraisal of Flood and Coastal Erosion Risk Management (2009) and the Environment Agency's Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG), as well as supporting the FCERM National Strategy for England.

This advice is based on Government's policy for climate change adaptation, and is specifically intended for projects or strategies seeking Government Flood Defence Grant in Aid (FDGiA). However, Risk Management Authorities (RMA) in England may also find this information useful in developing plans and making FCERM investment decisions even if there is no intention of applying for central government funding. Guidance for Wales is still provided by the Defra 2006 supplementary note - Treatment of climate change impacts.

The purpose of this advice is to ensure that an economically credible appraisal, taking account of the uncertainties associated with climate change, can be made to support Government investment decisions. This is necessary to ensure that a fair comparison can be made between investment in projects in different locations that compete for central government grant, as well as ensuring that the most appropriate means of reducing risk is investigated in any one place.

Given the long lifetime and high cost of the built environment and many flood and coastal erosion management measures, it is imperative that plans and investment projects take into account in, an appropriate way, the changing risks over the coming century. This includes designing for adaptation to a changing climate where appropriate.

Defra's appraisal policy statement recommends a "managed adaptive approach" where possible and sets out some broad principles that should be considered. A managed adaptive approach is based on taking action when particular trigger points are observed. It is most likely to be appropriate in cases where ongoing responsibility can be assigned to tracking the change in risk, and managing that risk through pre-determined interventions. This provides flexibility to manage future uncertainties associated with climate change.

In some circumstances, a managed adaptive approach may not be technically feasible. For example, it may not be possible to manage multiple interventions or it may be economically more efficient to build in a precautionary element at the outset. In these cases, a precautionary approach, with a one-off intervention, may be the only feasible or best option. Considering only precautionary options would lead to greater levels of investment at fewer locations. A managed adaptive approach would ensure a fairer and more flexible spread of public investment and therefore should be preferred where possible.

2 Transitional arrangements

This part describes the transitional arrangements for this advice

This advice should be applied to all future appraisals that are started (new) from August 2011 or are to be submitted for approval after 1st January 2012. Work already in progress should, as a minimum, be assessed ensuring that this advice would not lead to different decisions.

However, even for substantially complete work, or that submitted for approval before 1 January 2012, if the new advice can be factored in, or the plan or investment decision tested against it without slowing completion or adding significantly to the cost, then this should be done.

For existing approved plans and strategies we would not normally expect this advice to be applied until the next review, unless specific investment projects within them are planned before this. In these cases, project appraisals should adopt the new advice (subject to the first paragraph above).

3. Change to relative mean sea levels

Projections of relative mean sea levels for any location around the whole UK coast are provided within UKCP09. They are summarised and explained within the [marine report](), and are available through the [user interface]().

UKCP09 relative sea level rise projections account for future land level movements. They also, for the first time, account for regional oceanographic effects. These regional effects arise from the difference in change in sea level for the region immediately surrounding the UK compared to the global mean.

UKCP09 relative sea level rise projections are available for three emission scenarios through the user interface as change relative to 1990 for any year up to 2100. They are presented as central estimates of change for each emission scenario with upper and lower confidence bands.

The projections are based on the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report. Since that was published the possible magnitude of sea level rise has attracted renewed attention, and a number of researchers have suggested that the IPCC numbers underestimate the potential sea level rise range during the 21st century. For this reason, it is recommended that RMAs do not use the central estimates of relative sea level rise from UKCP09 as the change factor for their investment decisions. Instead, it is recommended that the upper confidence band (95 percentile) medium emission projection is used, see Table 5. The scientific basis for this recommendation is provided in detail in Annex 3.

A low probability high end scenario is also presented within the UKCP09 (UKCP09 H++ scenario) marine report to provide users with estimates of sea level rise increase beyond the likely range but within physical plausibility. The UKCP09 H++ scenario is presented as a range for the whole of the UK, from 93cm up to 1.9m increase for 2100 compared to 1990. The UKCP09 H++ scenario range has been used to develop an upper end estimate and H++ scenario within this advice presented in Table 5 below. It is envisaged that only those circumstances involving events of extremely high probabilities or where the consequences of rare events could be extreme would be required to consider the H++ limits within assessments covering the period to 2115.

Because only the total sea level increase for 2100 is provided for UKCP09 H++ scenario rates of changes for different time-periods through the century are provided in Table 5.

The change factor and the lower end estimate can be taken directly from the UKCP09 user interface for the relevant location. The user interface provides a change estimate for any year through the century compared to 1990. When taking projections from UKCP09, change up to 2115 should be derived by extrapolating beyond 2100.

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Table 5 Change to relative mean sea level

	Sea level rise mm/yr up to 2025	Sea level rise mm/yr 2026 to 2050	Sea level rise mm/yr 2051 to 2080	Sea level rise mm/yr 2081 to 2115
H++ scenario	6	12.5	24	33
Upper end estimate	4	7	11	15
Change factor	Use UKCP09 relative sea level rise medium emission 95% projection for the project location available from the user interface.			
Lower end estimate	Use UKCP09 relative sea level rise low emission 50% projection for the project location available from the user interface.			

4. Change to storm surge

The latest research into future storm-surges presented in the UKCP09 marine report is based on the Met Office Hadley Centre/Proudman Oceanographic Laboratory (POL) models. The Hadley Centre/POL models suggests that change to storm surge (defined as skew surge in UKCP09) around the UK, with a 1 in 50 chance of occurring in any given year, is projected to increase by less than 0.9 mm/yr (not including relative mean sea level change) over the 21st century. In most locations this trend could not be clearly distinguished from natural variability. The largest changes were found in the Bristol Channel and Severn Estuary.

There is a long-period natural variability known to affect European storminess (longer than a few decades). Over the century-scale, change has been reported to be of the order of 50cm. Accounting for this long-period variability would also account for the projected change to storm surge from UKCP09 over the century. Where coastal extreme water levels are derived from very long tide gauge records, of the order of 100 years, the full range of natural variability will be accounted for.

It is anticipated that further advice will be provided in time to account for the full range of natural variability. It is recommended that a full and rigorous analysis of the current extreme coastal water levels is undertaken using the "national coastal flood boundary data for the coasts of England and Wales". Reports can be downloaded from http://publications.environment-agency.gov.uk/?lang=_e by searching on the title 'Coastal boundary'.

There is significant uncertainty in the projected change to the storm track over the UK, the primary driver of storm surge intensity and frequency. Other plausible international climate models were used in UKCP09 to evaluate alternative projections of storm surge over the century. This is presented in UKCP09 as a H++ scenario for storm surge. As with the H++ sea level rise scenario it is not possible to estimate how likely this is to occur, but the H++ storm surge scenario is considered more likely than the upper end of the H++ sea level rise range. In this advice the UKCP09 H++ storm surge scenario is presented as the upper end estimate.

Table 6 Change to storm surge

	Total potential change anticipated up to the 2020s	Total potential change anticipated up to the 2050s	Total potential change anticipated up to the 2080s
Upper end estimate	20cm	35cm	70cm
Change Factor	Ensure a rigorous assessment of the current coastal extreme water level has been undertaken	Ensure a rigorous assessment of the current coastal extreme water level has been undertaken	Ensure a rigorous assessment of the current coastal extreme water level has been undertaken
Lower end estimate	n/a	n/a	n/a

Surge and mean sea level changes can be taken to be additive and changes to extreme coastal water levels can be evaluated by adding the mean relative sea level change to the current extreme coastal water level. The base date of the Environment Agency national coastal flood boundary data estimates are for 2008, and any climate change projections into the future must use this as a start date for the calculations. The projections translate into assessments similar to the diagram for rivers with a fixed baseline date of 2008.

5. Change to wave climate

Change to wave climate is presented within UKCP09. There are large uncertainties especially with the projected extreme values. Changes in the annual maxima are projected to be between –1.5 m and +1 m. Projections of longer return period wave heights will reflect the same pattern but with larger error bars. Changes in wave period and direction are small and more difficult to interpret.

Given the significant uncertainty both to the future position of the storm track over the UK and the projections of wave climate within UKCP09, it is recommended that RMAs employ a sensitivity analysis to understand the impact on flood risk and coastal change, and the form of any feasible options. The sensitivity analysis can be used as part of the sensitivity analysis presented in Annex 2.

It is anticipated that over the next 12 months, wave climate projections will become available covering significant wave height, period and direction. When these are published this advice note will be updated to include that evidence.

that this approach underestimates the possible magnitude of sea level rise during the twentieth century[iii].

Observations, largely from satellites, show that both ice sheets are losing mass overall[iv]. There was an acceleration in the rate of ice loss especially since 2003, due to the increased flow of many outlet glaciers on Greenland and ice streams in the West Antarctic Ice Sheet. This recent acceleration may be due in part to natural variability, and might not continue[v]. Observations show that a number of the outlet glaciers that accelerated have since started to slow. Research on-going under the ICE2SEA program[vi] will improve projections of the contribution of ice to future sea-level rise. Some of these results may be available for the IPCC fifth assessment report in 2013.

It is also worth noting that the IPCC fourth assessment report models used for the sea level rise projections do not include uncertainties in climate-carbon cycle feedback and so do not cover the full range of projected global mean temperature change reducing the potential upper end estimate of sea level rise.

There have been a number of papers that have commented on the sea level rise projections from the IPCC fourth assessment report and some have tried to derive a better estimate of rise through the century[vii]. There have been a number of approaches to this. Some have used a semi-empirical method[viii], others consider the eventual contribution from different glacier flow velocities[ix], others proxy records from the last interglacial period[x], and others have used expert opinion[xi].

In the Netherlands, expert judgement was used to derive sea level rise scenarios for coastal management. This concluded that plausible global sea level rise scenarios were 0.55m to 1.1m in 2100. The UKCP09 marine report also presented alternative research published by Pfeffer et al, 2008[xii] to highlight the risk of much greater increases in sea levels compared with the IPCC report. Pfeffer concluded that an increase of up to 2m of sea level rise for the twenty-first century for the UK cannot be excluded, but a rise of 0.8m is more likely.

Given the research since the IPCC fourth assessment report it seems clear that considerable uncertainty in sea level rise projections remains. This suggests that there is a need for coastal managers to keep open a range of adaptation options and to be able to change approach as confidence in the predictions become more robust. It also leads to the recommendation in Annex 1 to use the upper end of the medium emissions scenario from UKCP09 as the change factor, especially where coastal managers are not able to pursue a managed adaptive approach.

Land levels are changing across the UK. This is a result of the earth's crust adjusting to the melting of the ice sheets at the end of the last ice age. These vertical land movements' trends are well understood and are expected to remain constant over the 21st century[xiii]. Allowances for changes in land level will need to be made in the design of schemes in addition to those for climate change. These are included in the information on relative sea level rise provided in Table 5, Annex 1. The high end estimate and H++ estimates do not include a land movement term as these are not provided within UKCP09.

Projections of storm surge and wave climate

Table 8 Summary of latest research findings on changes to storm surge and wave climate for the UK

Current trends	Future Projections
Natural variability in wave climate is large and the role of anthropogenic influence is unclear.	There is no consensus on the future storm and wave climate for north-western Europe, since projected future storm track behaviour varies among atmospheric models.
Increases in monthly mean and maximum wave height in the north-eastern Atlantic occurred between 1960 and 1990. However, this rise in wave height may be part of long-term natural variability. There has been no clear pattern since 1990.	Predictions of storm behaviour used by the UKCP09 wave model show storm tracks moving south, resulting in lower wave heights to the north of the UK and slightly larger wave heights in some southern regions, especially the south-west.
There is no significant evidence for any recent observed trend in storm surge frequency or magnitude.	Changes to storm surge driven extreme water levels appears to be less important than changes in global mean sea level over the next 100 years.

The main driver of future risk on the coast is predicted to be sea level rise, rather than changes to storm surge intensity, although there is no consensus on the future storm and wave climate for north-western Europe.

Projections of change to river flood flows

Significant positive trends were observed in all high-flows indicators over the 30–40 years prior to 2003, primarily in maritime-influenced, upland catchments in the north and west of the UK. But, there is little compelling evidence for high-flow trends in lowland river flows. Long run river flow records (>55 years) provide little compelling evidence for long-term trends but show evidence of pronounced multi-decadal fluctuations. Trends are thought to be linked to changes in winter precipitation arising from changes in atmospheric circulation patterns (North Atlantic Oscillation). It is not clear if this is natural variability or a consequence of a changing climate[xiv].

Defra and the Environment Agency have funded substantial research to consider future changes to river flood flows in England and Wales, reports available here.

The summary findings are:

- Results for the 2080s show that for the catchments modelled (155 in total) the Defra 2006 20% allowance no longer encompasses the majority of catchment changes in flood flows using the UKCP09 climate projections. Current guidance is likely to underestimate the changes to future river flows for a significant number of catchments tested with UKCP09 and other climate models.
- This challenges the degree to which the current guidance provides precautionary factors for river flows.
- Some 15% of catchments modelled showed changes in the central estimate of river flow greater than 30% for the 2080s using UKCP09 projections.

- There is strong evidence from our research that catchment response to climate change is dependent on catchment properties. This implies that a single national factor for climate change may be inappropriate and that more 'regionalised' allowances, based on catchment type, should be developed.
- By continuing with a single national factor we would be under-representing the future risk for particular types of catchments for certain locations in the country.
- We are now much better able to understand how different catchment properties influence river flow changes from climate change, potentially allowing regional projections of change by catchment types and location.
- We have developed a technique to determine catchment response to climate change for the whole of the river network in England and Wales.
- UKCP09 models do not provide indications of changes in localised, convective rainfall. So there is a high degree of uncertainty in outcomes and impacts where this mechanism is particularly important such as changes to river flows for small, rapidly responding catchments -– typically heavily urbanised catchments or short steep rural catchments.

This research formed the basis for the change factors provided in Annex 1 together with a methodology to determine catchment type.

Projections of change to extreme rainfall

There have been significantly increased levels of precipitation over northern Europe (an area which includes the UK) between 1900 and 2005. This is particularly noticeable since about 1979. These changes are likely to be the result of human activity[xv]. There have been more frequent spells of very wet weather and an increase in total precipitation, at least during the last 40 years. Over the past 100 years the intensity of UK precipitation has increased during winter and to a lesser extent also during spring and autumn. All regions of the UK have experienced an increase over the past 45 years in the contribution to winter rainfall from heavy precipitation events[xvi].

- UKCP09 does not provide a full understanding of changes to extreme, convective rainfall at the scales needed to manage surface water flooding.
- Met Office research[xvii] carried out for the Pitt Review in 2008 suggested that the 1 in 20 year rainfall event could increase by up to 40% at the local scale.
- This means the Defra 2006 guidance (+20% for the 2080s) could be under-representing changes to extreme rainfall for some regions of England and Wales.
- The UKCP09 toolkit does not enable flood risk assessments to be carried out for rainfall events rarer than 1 in 5 annual probability without additional guidance.
- The Met Office research for the Pitt review has been used as the basis for the numbers provided in Annex 1.

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References:

i. IPCC. Climate Change 2007: The Physical Science Basis (eds Solomon, S. et al.) 356–369, 408–420, 812–822 (Cambridge University Press, Cambridge, UK, and New York, 2007).http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml

ii. A sea of uncertainty, Nature Reports, Climate Change, vol4 April 2010, J Lowe and J Gregory

iii. Sea level rise and its possible impacts given a 'beyond 4 degree C world' in the twenty-first century, Nicholls et al, 2011

iv. Increasing rates of ice mass loss from the Greenland and Antarctic ice sheets revealed by GRACE, Isabella Velicogna. Geophysical Review Letters, Vol 36, 2009

v. Nature Reports, Climate Change, vol4 April 2010, J Lowe and J Gregory

vi. http://www.ice2sea.eu/

vii. Sea level rise and its possible impacts given a 'beyond 4 degree C world' in the twenty-first century, Nicholls et al, 2011

viii. Vermeer, M. & Rahmstorf, S. Proc. Natl Acad. Sci USA 106, 21527–21532 (2009)

iv. Pfeffer, W. T., Harper, J. T. & O'Neel, S. Science 321, 1340–1343, 2008.

x. Rohling, E. J. et al. Nature Geosci. 1 38–42 (2007).

xi. Vellinga, P. et al. 2008 Exploring high-end climate change scenarios for flood protection of The Netherlands. International Scientific Assessment carried out at request of the Delta Committee. Scientific report WR-2009-05. KNMI, Alterra, The Netherlands. See http://www.knmi.nl/bibliotheek/knmipubWR/WR2009-05.pdf.

xii. Pfeffer, W. T., Harper, J. T. & O'Neel, S. Science 321, 1340–1343, 2008

xiii. UKCP09 marine report, http://ukclimateprojections.defra.gov.uk/content/view/1969/500/

xiv. Hannaford, Jamie; Marsh, Terry J.. 2008 High-flow and flood trends in a network of undisturbed catchments in the UK. International Journal of Climatology, 28 (10). 1325-1338. 10.1002/joc.1643

xv. Zhang, X., F. W. Zwiers, G. C. Hegerl, F. G. Lambert, N. P. Gillett, S. Solomon, P. A. Stott, and T. Nozawa (2007), Detection of human influence on twentieth□century precipitation trends, Nature, 448, 461– 465, doi:10.1038/nature06025

xvi. Changing intensity of rainfall over Britain, Tim Osborn and Douglas Maraun, Climatic Research Unit Information Sheet no. 15

xvii. Met Office, The extreme rainfall of Summer 2007 and future extreme rainfall in a changing climate. S J Brown, M Beswick, E Buonomo, R Clark, D Fereday, D Hollis, R G Jones, E J Kennett, M Perry, J Prior and A A Scaife.

An Bord Pleanála

Agenda for Galway Harbour Oral Hearing – PA0033

Day 1 Tuesday 13th January

10.00 Brief introduction by Inspector

10.10 Submissions from Public Representatives

MODULE 1: ECOLOGY

10.30 Commencement of formal submission from the applicant

- Introduction (E. Waldron)
- Hydrology (T. Cawley)
- Underwater Noise (E. Mc Keown)
- Renmore Lough (M. Sheehy Skeffington)
- Bird Counts (C. Peppiatt)
- Species Analysis (T. Gittings)
- Ecology Water and Marine (B. O'Connor)

(Lunch to be taken at appropriate time between presentations)

Day 2 Wednesday 14th January

10.00 - Inland Fisheries Ireland

10.30 - An Taisce

12.00 - Cladonian Mariners Community Boat Club

12.30 - Birdwatch Ireland

1.00 - National Parks and Wildlife Service (if applicable)

Lunch

Commencement of questioning on Ecology Issues

Prescribed Bodies/observers questions to applicant's expert witnesses

Day 3 Thursday 15th January

10.00 Continuation of questions to the applicant

Lunch

Continuation of questioning to the prescribed bodies by applicant

Possible summations on Ecology Module (depending on time)

Day 4 Friday 16th January

10.00 Possible summations on Ecology Module (depending on time allocated to questions and cross-examination).

END OF MODULE 1 ON ECOLOGY

MODULE 2: OTHER ISSUES

Day 5/6 Tuesday 20th and Wednesday 21st (morning)

10.00 Submission by Public Representatives
- Cllr Connolly (and or other).

Commencement of formal submission by the applicant

- Background and Need	(E. Waldron/E. Bradshaw/B. Sheridan)
- Planning	(G. Mc Carthy)
- Cost Benefit Analysis	(J. Lawlor)
- Climate	(E. Mc Keown)
- Soils	(D. Duggan)
- Transport/Traffic/Rail	(T. Cannon)
- Landscape Visual	(M. Egan)
- Archaeology	(J O'Donoghue)
- Architectural	(S. O'Laoire)
- Cultural Heritage	(A. Carey)

Wednesday (afternoon)

Commencement of submissions of Local Authority, Prescribed Bodies

Day 7 Thursday 22nd (morning)

10.00 Submission from other observers:

Derek Hambleton
Atlantic Fuel Supply Company
Claddagh Residents Association
Coiste Tacaíochta Calaphort Ros a' Mhíl
Susan and Sarah Curran
Galway Bay Inshore Fisherman's Association
Galway Cycling Campaign
PA Mannion

Thursday (afternoon)

ENWest
Bruscar Bhearna Teoranta
Cold Chon
Galway City Sailing Club
Trad on the Prom
Mc Graths Limestone
Hygeia Chemicals
Galway Metal
IBEC
Heritage Harbour Holdings
Topaz Energy
Murray Timber Group
City of Galway Shipping
Galway Chamber of Commerce (representing various Business Associations)