IMPORTANT DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE FOR FLOOD MAPS

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PURPOSE OF THE MAPS

The maps contained within this bound volume were prepared under the following project:

- ***Project Name: Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAMS)***
- ***Project Period: 2008 - 2011***

The maps were prepared for the purpose of assessing the degree of flood hazard and risk to assist in the identification and development of measures for managing the flood risk. They may, however, also be of use to the public, Local Authorities and other parties as indicative maps of flood-prone areas for a range of purposes, including raising awareness of flood risk, preparedness and response planning for flood events, assisting in planning and development decisions, etc.

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GUIDANCE NOTES

This bound volume contains a number of different types of map. How these maps have been derived, and what they do and do not present, is described below.

Derivation of Maps

The maps included within this bound volume are 'predictive' flood maps, as they provide predicted flood extent and other information for a 'design' flood event that has an estimated probability of occurrence (e.g., the 1% AEP event – see below), rather than information for floods that have occurred in the past (which is presented on 'historic' flood maps).

The predicted extents are based on analysis and modelling. This includes:

- Hydrological analysis: Estimation of the flood flows (cubic metres of water per second: m^3/s) for the design flood events
- Hydraulic modelling: Estimation of the flood levels in a tidal area, at intervals along a river, or for locations on a floodplain, based on the design flood flows (river flooding) and local physical and hydraulic conditions
- Analysis of flooding: Estimation of how flooding would propagate from the river, estuary or tidal area over the land, and the associated flood extents, depths, velocities, etc.

The maps have been produced at a strategic, catchment level using an automated mapping process, and minor or local features may not have been included in their preparation. A Digital Terrain Model (DTM) is used to generate the maps. The DTM is a 'bare earth' model of the ground surface with manmade and natural landscape features such as vegetation, buildings, bridges and embankments digitally removed. The automated mapping process can show some of these manmade features, such as bridges and embankments, as flooded on the flood maps, when in reality they do not flood. In addition, 'cleansing' is undertaken during flood map production, which involves various processes such as the removal of very small areas of flooding that are remote and isolated, the removal of very small islands (areas modelled as not flooding) within the flooded area, etc. Therefore, the maps should not be used to assess the flood risk associated with individual properties or point locations, or to replace a detailed local flood risk assessment.

The maps were produced based on survey data captured prior to, and during the early part of the project. They do not account for changes in development, infrastructure or topography that occurred after the date of survey data capture.

The DTM is derived from airborne laser survey data. The majority of this data is Light Detection and Ranging (LiDAR) data.

Detailed explanations of the methods of derivation, survey data used, etc. are provided in the relevant reports produced for the project under which the maps were prepared. Users of the maps should familiarise themselves fully with the contents of these reports in advance of the use of the maps.

Flood Event Probabilities

The maps refer to flood event probabilities in terms of a percentage Annual Exceedance Probability, or 'AEP'. This represents the probability of an event of this, or greater, severity occurring in any given year. These probabilities may also be expressed as odds (e.g., 100 to 1) of the event occurring in any given year. They are also commonly referred to in terms of a return period (e.g., the 100-year flood), although it should be understood that this does not mean the length of time that will elapse between two such events occurring, as, although unlikely, two very severe events may occur within a very short space of time.

Table 1 below sets out a range of flood event probabilities expressed in terms of AEP, and identifies their parallels under other forms of expression.

Table 1: Flood Event Probabilities

Annual Exceedence Probability (%)	Odds of Occurrence in any Given Year	Return Period (yrs)
50	2 : 1	2
20	5 : 1	5
10	10 : 1	10
4	25 : 1	25
2	50 : 1	50
1	100 : 1	100
0.5	200 : 1	200
0.1	1000 : 1	1000

Uncertainty
Although great care and modern, widely-accepted methods have been used to prepare the maps, there is a range of inherent uncertainties within the process of preparing the predicted flood extents maps. These include:

– Uncertainty in Design Event Flows: This can arise due to a lack of recorded flood data at the specific location, short periods of recorded flood flows where they have been recorded, approximations in the hydrological analysis in representing physical reality, assumptions in the hydrological analysis, etc.

– Uncertainty in Flood Levels: This can arise due to uncertainties in design event flows, topographic and other survey data, meteorological data, assumptions and / or approximations in the hydraulic models in representing physical reality, assumptions in the hydraulic modelling, datum conversions, etc.

– Uncertainty in Flood Extents: This can arise due to uncertainties in design event flows, flood levels, topographic and other survey data, assumptions and / or approximations in the way that flooding spreads over a floodplain is modelled, etc.

The flood maps are therefore only indicative, and the potential for inaccuracy should be recognised if these maps are to be used for any purpose. Analysis of the uncertainty of flood extents has been undertaken and is represented on the flood extent maps (see below).

Types of Flood Map
There are various types of flood map available, as outlined below. Further details on each type of map, including the methods of derivation, assumptions made, data used, etc. are provided in the relevant project reports and in particular the Hydraulics Report.

Flood Extent Maps
Flood extent maps contained in this volume show the predicted extents of flooding for both existing conditions and projected future conditions (see section on Consideration of Climate and Other Future Changes). The flood extent maps for existing conditions show the predicted extent of flooding for flood events of three estimated probabilities of occurrence:

– 10% AEP flood event

– 1% AEP flood event (for fluvial / river flooding) or 0.5% AEP flood event (for tidal / coastal flooding)

– 0.1% AEP flood event

Fluvial flooding is shown in shades of blue. Tidal flooding is shown in shades of green.

It should be noted that the flood extent maps indicate the predicted maximum extent of flooding (subject to limitations referred to herein), and flooding in some areas, such as near the edge of the flooded area, might be very shallow. The predicted depth of flooding is indicated on the Flood Depth Maps.

Flood Extent Uncertainty

Due to the various uncertainties within the process of preparing the maps (see 'Uncertainty' above), it is not possible to state that the maps are absolutely accurate. An assessment of some of the principal sources of uncertainty has been undertaken to estimate the degree of confidence one may have in the mapped flood extent (refer to relevant project report for details and limitations of method used). The line type (solid, dashed, dotted) bounding the flood extent for each flood event probability on the extent maps provides an indication of the degree of confidence, whereby:

- A solid line represents a high degree of confidence, and it is estimated that, based on the uncertainty estimation method used, there is 95% confidence that the true flood extent lies within 20m either side of the location of the mapped flood extent line
- A dashed line represents a medium degree of confidence, and it is estimated that, based on the uncertainty estimation method used, there is 95% confidence that the true flood extent lies within 40m either side of the location of the mapped flood extent line
- A dotted line represents a low degree of confidence, and it is estimated that, based on the uncertainty estimation method used, there is less than 95% confidence that the true flood extent lies within 40m either side from the location of the mapped flood extent line, and may lie significantly more than 40m from this line

Due to the significant uncertainty in estimating extreme flood flows and / or levels, the extents for the 0.1% AEP and for all future scenario AEP flood events are automatically assigned a low degree of confidence.

In addition to the above fluvial uncertainty extent lines are blue for 10% AEP, red for 1% AEP and blue for 0.1% AEP. Similarly tidal uncertainty lines are green for 10% AEP, red for 0.5% AEP and green for 0.1% AEP.

Uncertainly also exists for the water level and flow results and this level of confidence is represented in the tables on the maps by colour coding (yellow – high confidence, orange – medium confidence and red – low confidence).

Water level confidence:
The uncertainty in water levels for fluvial scenarios is estimated from scores assigned to the hydrological accuracy, model complexity and peak flow. The uncertainty in water levels for tidal scenarios is taken from the Department of Agriculture, Fisheries and Food report entitled Irish Coastal Protection Strategy Study Phase III, Draft Final Technical Report, August 2008.The confidence in water levels has been classified as follows:

- High confidence is described as the water level having a vertical distance uncertainty measure of less than 0.40m.
- Medium confidence is described as the water level having a vertical distance uncertainty measure between 0.40 and 0.70m.
- Low confidence is described as the water level having a vertical distance uncertainty measure of greater than 0.70m.

Due to the significant uncertainty in estimating extreme events, the water levels for the 0.1% AEP and for all future scenario AEP flood events are automatically assigned a low degree of confidence.

Flow confidence:
The uncertainty in flows for fluvial scenarios is estimated from scores assigned to the hydrological accuracy. These factors are presented in Table 6-4 – Scores used to estimate uncertainty in water levels - Index Flood Method in the Hydraulics Report. The confidence in flows has been classified as follows:

- High confidence is described as the Index Flood Method score of equal to 1 (where the gauging station records are long, > 10 years).
- Medium confidence is described as the Index Flood Method score of equal to 2 (where the gauging station records are short, ≤10 years).
- Low confidence is described as the Index Flood Method score of equal to 3 or 4 (where there are no gauging station records and Catchment Descriptors from the Flood Studies Report have been used).

Due to the significant uncertainty in estimating extreme events, the flows for the 0.1% AEP and for all future scenario AEP flood events are automatically assigned a low degree of confidence.

Flows in tables:
Flow data has been provided in the table on the maps for some of the node locations. The criteria for selecting the nodes are as follows:

- The node at the upstream boundary of hydraulic models.
- The node at the centre of each APSR (Area of Potential Significant Risk), and the nodes immediately upstream and downstream of the APSR, (i.e. 3 node locations per APSR).

- The nodes at all the hydrometric gauging stations.
- The nodes upstream and downstream of the confluences of all tributaries that potentially contribute more than 10% of the flow of the main channel.
- Other nodes at suitable locations to ensure that there is at least one node every 5km along reaches of all modelled rivers.

Defended areas - Two hydraulic model scenarios were considered for this study, a 'with defences' and a 'without defences' scenario. The 'with defences' scenario is the current situation with various embankments or walls providing flood protection at various locations along the rivers. The 'without defences' scenario was used to identify the 'areas benefiting from defences' (ABDs) and to allow them to be shown on the flood hazard maps as 'defended areas'.

Areas Benefiting from Defences (ABDs)

For the tidal maps, the area benefiting from defences is the difference between the extents for the 0.5% AEP with defences model run and 0.5% AEP without defences model run.

For the fluvial maps, the area benefiting from defences is the difference between the extents for the 1% AEP with defences model run and 1% AEP without defences model run.

Flood Zone Maps
The flood zone maps are based on the flood extent maps and show three zones namely Zones A, B and C. The maps have been developed following the publication of the Guidelines on Planning and Flood Risk Management. The key features particular to the zone maps are:

- Zone A, the area within the 1/0.5% AEP is shaded red.
- Zone B, the area between the 1/0.5% and 0.1% AEP is shaded orange.
- Zone C, the area outside the 0.1% AEP is shaded yellow.

Flood Depth Maps
The flood depth maps indicate the estimated depth of flooding at a given location, for a flood event of a particular probability.

The flood depths are calculated by subtracting the DTM ground levels, from the predicted water level. The flood depths are mapped as constant depths over grid squares, whereas in reality depths may vary within a given square.

Flood Velocity Maps
The flood velocity maps indicate the estimated velocity (speed) of the flow of floodwater at a given location, for a flood event of a particular probability.

The flood velocities are either derived directly from the hydraulic models, or through an approximation method. Localised flow paths may not always be represented in the model or by the method, and higher velocities than those shown may occur.

It should be noted that, due to the nature of the tidal zone modelling, the flood velocities for tidal / coastal flooding has not been mapped.

Flood Hazard Maps
The flood hazard maps provide an indication of the risk to life, based on a function of both flood depth and velocity, as calculated by:

Hazard = Depth * (Velocity + 0.5)

The hazard is classified into four classes as set out below:

– Low: Caution
– Medium: Dangerous for some people
– High: Significant danger for most people
– Extreme: Extreme danger for all

For tidal / coastal flooding, a fixed velocity of 0.1m/s has been assumed for the purposes of flood hazard mapping. It should be noted that this velocity may be exceeded and the hazard may be higher than that indicated on the maps, particularly in the event of overtopping or failure of flood defences.

Although not represented in the above hazard indication method, it should be noted that there are many other hazards to health and life associated with flooding and floodwaters, such as floating wood and debris, hidden dangers under the water, pollution in the water (contamination), hypothermia, etc.

Consideration of Climate and Other Future Changes
Maps have been produced for both existing conditions and projected future scenarios, where the maps for future scenarios include allowances for projected future changes in both climate and land use. As there is significant uncertainty as to what may happen in the future, two possible future scenarios have been used:

– Mid-Range Future Scenario (MRFS): This reflects changes that are within the typical range of projected changes
– High-End Future Scenario (HEFS): This reflects more extreme, but not unrealistic, changes

The allowances used for each scenario are set out in Table 2 below and further details are provided in both the Hydrology Report and Hydraulics Report.

Table 2 Allowances for Future Changes

Driver	Scenario	
	Mid Range Future Scenario	**High End Future Scenario**
Climate change - rainfall	+ 20%	+30%
Climate change - net sea level rise	+35cm	+100cm
Land use change – urbanisation	100% increase in urban area	400% increase in urban area

This volume includes maps that show the predicted extents of flooding for the MRFS for flood events of three estimated probabilities of occurrence:

– 10% AEP flood event
– 1% AEP flood event (for fluvial / river flooding) or 0.5% AEP flood event (for tidal / coastal flooding)
– 0.1% AEP flood event

Un-Modelled River Reaches
River reaches that have been modelled and for which flood extents, depths, velocities and risk to life have been mapped, have been indicated with a thick blue line. Flooding from other reaches of river may occur but has not been mapped, and so areas that are not shown as being within a flood extent may therefore be at risk from flooding from un-modelled rivers as well as one of the other sources referred to below.

Sources of Flooding Not Mapped
The maps indicate only the extents, depths, velocities and risks to life associated with flooding from modelled river reaches (see above), estuaries and the coast. There are however many other possible sources of flooding, such as from surcharged urban drainage systems, ponding rainwater, groundwater, overtopping or breaching of water retaining structures (such as embankments and reservoirs), etc. Flooding from these other sources have not been mapped, and so areas that are not shown as being within a flood extent may therefore be at risk from flooding from one of these other sources.

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CONTACTS REGARDING MAP INFORMATION
Any user who has reason to believe that these maps contain an error, or who wishes to contribute additional information, is requested to contact the Office of Public Works Engineering Services Section at the following address:

Flood Mapping Queries
Engineering Services
Office of Public Works
17-19 Lower Hatch Street
Dublin 2