



# South Eastern CFRAM Study

## Final Report

### Unit of Management 17

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**APPENDIX A KEY INFORMATION UoM17**

## ABBREVIATIONS

AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
BCR	Benefit Cost Ratio
CFRAM	Catchment Flood Risk Assessment and Management
FHRC	Flood Hazard and Research Centre
FRA	Flood Risk Assessment
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
HEFS	High end future scenario
ICM	Integrated Catchment Management
KMM	Kirk McClure Morton
MCM	Multi Coloured Manual
MPW	Medium Priority Watercourse
MRFS	Mid range future scenario
OPW	Office of Public Works
OSi	Ordnance Survey ireland
PFRA	Preliminary Flood Risk Assessment
POR	Preliminary Options Report
PVb	Present Value benefit
PVd	Present Value damage
RBD	River Basin District
SEA	Strategic Environmental Assessment
SI	Statutory Instrument
SoP	Standard of Protection
SSA	Spatial Scale of Assessment
SUDS	Sustainable Urban Drainage Systems
UoM	Unit of Management

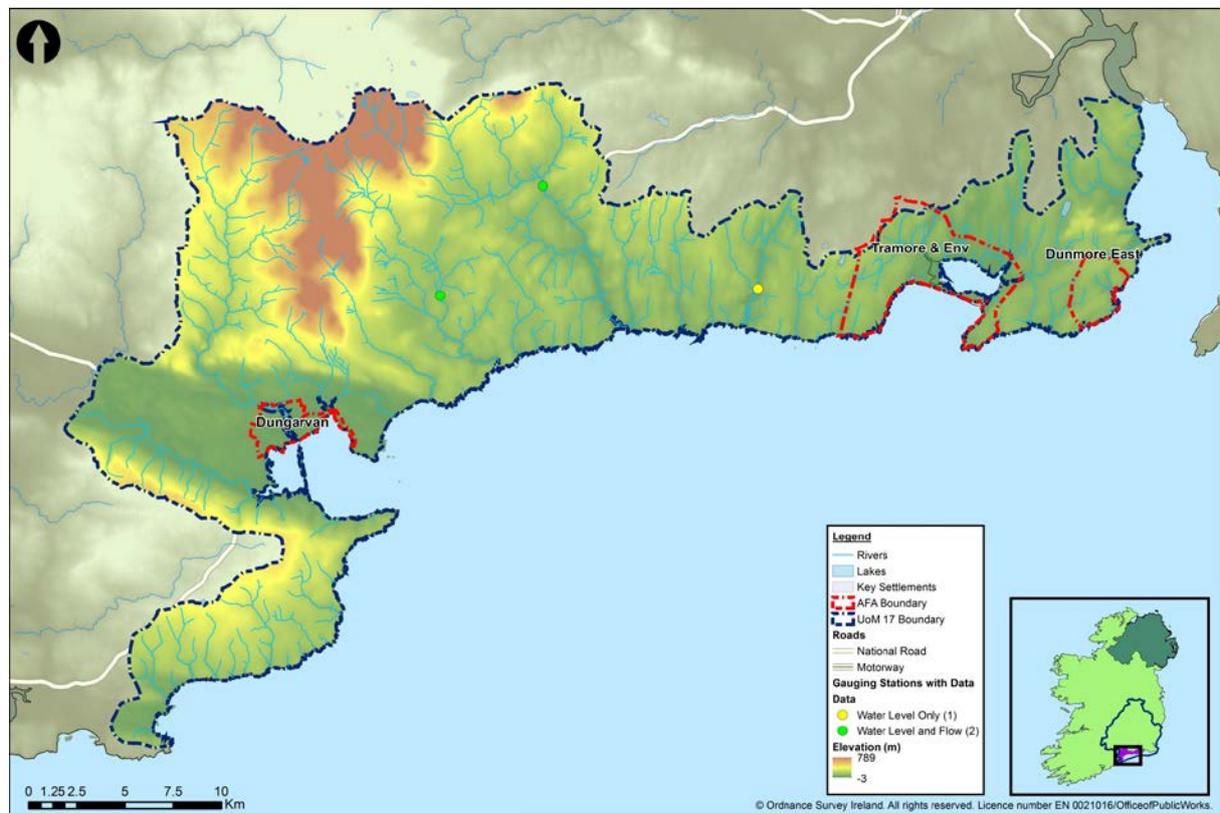
# 1 INTRODUCTION

## 1.1 THE 17 UNIT OF MANAGEMENT – UoM17

The South Eastern CFRAM Study covers an area of 12,857 km<sup>2</sup> and includes six River Basins organised into Units of Management (UoM) each comprised of a single Hydrometric Area (HA). They are UoM11 (Owenavorrhagh & Blackwater RB), UoM12 (Slaney RB), UoM13 (Ballyteigue-Bannow RB), UoM14 (Barrow RB), UoM15 (Nore RB) and UoM17 (Waterford South Coast RB). UoM16 (Suir RB) is covered by the Suir pilot CFRAM Study and covers an area of approximately 3,542 km<sup>2</sup>.

There is a high level of flood risk within UoM17, with significant coastal and fluvial flooding events having occurred in the past. UoM17 covers an area of approximately 655km<sup>2</sup> and lies entirely within county Waterford. UoM17 is a predominantly rural catchment with the major urbanised areas being Dungarvan and Tramore.

There are no particularly large rivers within UoM17 rather a number of smaller coastal rivers including the Brickey, Colligan, Dalligan, Mahon and Tay. These rise in the Comeragh Mountains in the north of the area and flow generally southwards to the coast.



**Figure 1.1: UoM17 Location Map**

There is one Arterial Drainage Scheme within UoM17, the Brickey Scheme where OPW has a statutory responsibility for inspection and maintenance under the 1945 Arterial Drainage Act.

UoM17 contains one drainage district, the Shandon Drainage District where the Local Authority has responsibility to maintain watercourse channels and therefore maintain the existing regime.

However none of modelled watercourses are included within either the Brickey Arterial Drainage Scheme or the Shandon Drainage District in UoM17 and as such maintenance activities associated with these schemes are not considered to significantly contribute to the maintenance of the existing regime affecting the AFAs however they do contribute to the maintenance of the existing regime in other parts of UoM17.

## **1.2 OBJECTIVE OF THIS REPORT**

The principal objective of this report, in accordance with Section 12.2 of the CFRAM Studies Stage 1 Project Brief, is to; provide a summary of the relevant reports prepared for UoM17 as part of the South Eastern CFRAM Study, and; detail the development of the draft UoM17 Flood Risk Management Plan (FRMP) consulted on during the second half of 2016 and the finalisation of the UoM17 FRMP in preparation for its adoption in 2017.

This report also aims to identify any issues that may influence the proposed methodologies or programme going forward into the second cycle of Floods Directive implementation.

## **1.3 ACCOMPANYING AND SUPPORTING REPORTS**

This report accompanies the draft UoM17 Flood Risk Management Plan containing the following volumes:

- VOLUME I Draft Flood Risk Management Plan
- VOLUME II SEA Environmental Report and Natura Impact Statement.

This report is also supported by a suite of project deliverables, including flood maps and key UoM17 technical reports on inception, hydrology, hydraulics and preliminary options, which are summarised in Sections 2 to 5 of this report respectively.

The development of the draft and final Flood Risk Management Plan (FRMP) is summarised in Section 6 of this report.

The full list of project reports to date, which also include a series of relevant consultation and environmental reports and specific assessments of flood risk, survey data and rainfall within the South Eastern CFRAM Study area, are listed in Table 1.1.

**Table 1.1: Reports – South Eastern CFRAM Study Overall & UoM17 Specific Reports**

Ref.	Document Title
Rp0001	IBE0601Rp0001_Communications Plan, Implementation Programmes & Event Plans <ul style="list-style-type: none"> <li>• Initial Scoping Phase</li> <li>• Mapping Phase</li> <li>• Options Phase</li> <li>• Draft Plan Phase</li> </ul>
Rp0002	IBE0601Rp0002_Flood Risk Review
Rp0003	IBE0601Rp0003_Initial Scoping Phase Synthesis Report Stakeholders Workshop
Rp0004	IBE0601Rp0004_Initial Scoping Phase Public Open Evening Synthesis Report
Rp0006	IBE0601Rp0006_HA17 Inception Report
Rp0009	IBE0601Rp0009_Radar Rainfall Stage 3
Rp0013	IBE0601Rp0013_HA17 Hydrology Report
Rp0016	IBE0601Rp0016_RPS_CFRAM_SouthEasternCFRAMS_SurveyContractReport_D01
Rp0018	IBE0601Rp0018_HA17 Hydraulics Report
Rp0019	IBE0601Rp0019_Mapping Phase Summary Report
Rp0020	IBE0601Rp0020_SE_SEA Scoping Constraints Report
Rp0021	IBE0601Rp0021_SE_SEA Scoping Report
Rp0022	IBE0601Rp0022_SE_AA_Screening_Report
Rp0026	IBE0601RP0026_HA17 POR
Rp0027	IBE0601Rp0027_SE_SEA_Environmental_Report_D01 UoM17
Rp0034	IBE0601RP0034_UoM17_NIS
Rp0040	O17_FRMP_PART01
Rp0044	IBE0601Rp0044_HA17 draft final report
Rp0045	IBE0601Rp0045_Option Phase Synthesis Report
Rp0049	IBE0601Rp0049 UoM17 Strategic SUDS Report
Rp0053	IBE0601Rp0053_UoM17 Strategic Planning Report
Rp0058	IBE0601Rp0058_UoM17_SEA_Environmental_Statement_Report
Rp0062	IBE0601Rp0062_UoM17 Defence Asset Database Report
Rp0067	IBE0601Rp0067_UoM17 Health & Safety Report
Rp0073	IBE0601Rp0073_O17_FRMP_PART01 Flood Risk Management Plan
Rp0077	IBE0601Rp0077_UoM17 final report (this report)
Rp0078	IBE0601Rp0078_Draft Plan Phase Synthesis Report
OPW	<i>Synthesis report – in preparation</i>

## 1.4 ACCOMPANYING AND SUPPORTING GIS DELIVERABLES

**Table 1.2: GIS Deliverables – CFRAM Study Overall & UoM17 Specific**

Survey Data	Type	Scale	
Survey Water Channel	Polyline	UoM	
Surveys Cross Sections	Polyline	UoM	
Surveyed Structures	Polyline	UoM	
Floodplain Photo Location	Point	UoM	
Flood Model Datasets	Type	Scale	Scenario (Probability %AEP)
Extent	Polygon	AFA	Current (All)
			Mid-Range Future Scenario (All)
			High End Future Scenario (10, 1, 0.1)
Flood Zones	Polygon	AFA	Current (1, 0.1)
			Mid-Range Future Scenario (1, 0.1)
Depth	Raster	AFA	Current (All)
			Mid-Range Future Scenario (All)
			High End Future Scenario (10,1,0.1)
Velocity	Raster	AFA	Current (All)
Risk to Life	Raster	AFA	Current (10,1 0.1)
Defence Failure Scenario- Extent	Polygon	AFA	Current (2 Scenarios)
Defence Failure Scenario- Depth	Raster	AFA	Current (2 Scenarios)
Defence Failure Scenario-	Raster	AFA	Current (2 Scenarios)
Defence Failure Scenario-Risk to	Raster	AFA	Current (2 Scenarios)
Specific Risk (No. of Inhabitants)	Raster	AFA	Current (10, 1, 0.1)
			Mid-Range Future Scenario (10, 1, 0.1)
Specific Risk (Type of Economic Activity)	Point	UoM	Current (0.1)
			Mid-Range Future Scenario (0.1)
Specific Risk (Risk Density)	Raster	AFA	Current (0.1)
			Mid-Range Future Scenario (0.1)
Other Datasets			
Modelled River Centreline	Polyline	AFA	
Flows and Water Level Nodes	Point	AFA	Current, Mid-Range & High End
Defended Area	Polygon	AFA	Current (If Applicable)
			Mid-Range (If Applicable)
Def. Failure – Breach Time Steps	Polygon	AFA	
Def. Failure – Defence Removal	Polyline	AFA	
Def. Failure – Defence Removal End point	Point	AFA	
Defence Asset Database	Type	Scale	
UoM Asset Menu	Polyline	UoM	
UoM Asset Menu_Point	Point	UoM	
UoM Structure Menu	Polyline	UoM	
UoM Defence Asset Database	Geodatabase	UoM	
Geometry Infill (if Applicable)	CAD Dwg	AFA	
Risk Management	Type	Scale	
Damage Assessment (Baseline)	Point	AFA	
Damage Assessment Benefit	Point	AFA	
Damage Assessment Defended	Point	AFA	

## 1.5 HEALTH & SAFETY ROLE

RPS have a role to advise the OPW on CFRAM Study related matters of Health and Safety; RPS undertook duties in the management of the Survey Contractor (ensuring compliance with best practice and Health, Safety and Welfare at Work legislation); and RPS was appointed as Project Supervisor Design Process (PSDP) under the Safety, Health and Welfare and Work (Construction Regulations) 2006 - updated 2013.

Within the remit of PSDP, RPS have undertaken a preliminary hazard management/risk assessment as part of the multi-criteria analysis of options. This has quantitatively assessed the potential hazards and risks associated with the construction and maintenance of options (for example, working near water (construction), working near water (maintenance), heavy plant and machinery, working at heights (construction), working at heights (maintenance), etc.). These have been collated into a South-Eastern CFRAM Study Safety File, which has been reviewed by the PSDP and will be provided with the final project deliverables in 2017.

## 2 THE UoM17 INCEPTION REPORT

In 2012, an Inception Report was prepared for UoM17. Its principal objective was to provide detail on the relevant datasets identified for use in the Colligan-Mahon Area as part of the South Eastern CFRAM Study, and also to provide an update on the collection and interpretation process to date for that data.

The Inception Report identified any issues that had been encountered in sourcing data and flagged any that were considered to potentially affect the proposed methodologies or programme going forward. The data requested, received or outstanding was detailed in the document, together with progress with data analysis.

At the time of preparing the report RPS had not identified any significant data gaps that would impact on the completion of the South Eastern CFRAM Study however this statement was made without having received any survey information or having full data returns for the information requested from the Local Authorities.

***Key findings:***

***RPS had to adopt an ongoing data collection and quality assurance exercise, to incorporate additional or updated data, as the South Eastern CFRAM Study evolved through its subsequent phases.***

***For example, in South Eastern CFRAM areas for further assessment (i.e. AFAs) outside UoM17, when the LiDAR and cross sectional survey data were received and quality checked in comparison with the National Digital Height Model, it became evident that manual data interpolation and correction was required during the hydraulic analysis stage. This ensured linkage between topographical survey and floodplain levels obtained from National Digital Terrain Models or LiDAR survey.***

***Similarly, population of the defence database remained “live” throughout the study, as, in some cases it was difficult to establish which structures were acting as formal or informal defences, and in others, the effectiveness of the defences required update of their condition due to damage by events or due to recent construction activities.***

***Thus, the flood risk management process must be considered as “live” and it is not possible at any given point in time to categorically conclude that there are no data gaps which will impact in some way on the future stages of the South Eastern CFRAM Study.***

Throughout the South Eastern CFRAM Study a register of datasets received was maintained, this is available with the project's progress reporting for reference. Metadata provided with final project GIS deliverables is also available to confirm the versions of datasets utilised in the CFRAM Study analysis.

### 3 THE UoM17 HYDROLOGY REPORT

In 2013, RPS commenced the preparation of the Hydrology Report for UoM 17. Its principal objectives were to build on the inception report methodology and to provide detail on the outputs from the processes of hydrological analysis and design flow estimation. The hydrology report did not include details of the data collection process, flood history within the Areas for Further Assessment (AFAs) or methodology and results from the historic flood analysis (except where this was used to inform the design flow estimation) as this was already contained within the Inception Report for UoM17.

The Hydrology Report provided a review and summary of the methodologies used as well as details of any amendments to the methodologies since completion of the Inception Report. The report detailed the results of the hydrological analysis and design flow estimation and summarised the outputs from the analysis which were taken forward as inputs to subsequent hydraulic modelling. Discussion was provided on the outputs in terms of the degree of confidence which could be attached to the outputs and the opportunities for providing greater certainty for future studies, including opportunities for improving the observed data used to inform the study.

The Hydrology Report was finalised in 2016 after completion of the hydraulic modelling. Hydrological analysis and hydraulic modelling activities were interactive and required input from the mapping consultation programme in order that they could be concluded.

The UoM17 catchment can be characterised hydrologically as follows:

- The catchment has a wide range of climatic and physiographic characteristics. The drier, lowland areas to the centre moving towards the coast have SAAR values as low as 875mm while the upper catchment to the north west has SAAR values in excess of 1500mm.
- There is no hydrometric data available for any of the modelled watercourses within UoM17 for use in model verification. Similarly, meteorological data is limited to rain gauge data across the catchment. The processing of rainfall data from the Dublin and Shannon Airport radar was not of benefit since it did not cover any of the AFAs in UoM17.
- Flood behaviour when defined in terms of the growth curve, i.e. in orders of magnitude greater than the median event, is on average higher than would have been thought based on older methodologies (Flood Studies Report (FSR)) particularly in smaller catchments.
- The 1% AEP flood event ranges from approximately 2.0 (lower reaches of the River Colligan) to 3.4 times larger than the median flood flow depending on catchment size. This compares to approximately 2 under FSR.

**Key Findings:**

*The primary output of the hydrological analysis was design flow estimation which was based on previous observed data and estimation/modelling techniques. Hydrological analysis required further validation through the calibration of the hydraulic models which is reflective of best practice in hydrology/hydraulic modelling for flood risk assessment. RPS believe that through complementing statistical analysis techniques with rainfall run-off modelling that the design flow estimation has as high a degree of certainty as is possible prior to calibration/validation and that this yielded efficiency and increased accuracy in the hydraulic modelling phase of the CFRAM Study process. However, it should be noted that the interaction between the hydrology and hydraulic analysis and mapping meant that hydrology could not be finalised until mapping consultation was concluded.*

*Risks - The main potential source of uncertainty in the analysis is due to the complete lack of useable hydrometric gauge data in UoM17. This has been mitigated as much as possible by the use of a comprehensive range of analysis and estimation techniques from statistical, catchment descriptor based estimates in line with the most recent CFRAM guidance to the use of rainfall run-off modelling.*

*After this cycle of the South Eastern CFRAM Study the main potential adverse impact on the hydrological performance of the catchment is the effect of future changes including climate change and urbanisation.*

*Opportunities - the following potential opportunities to improve the hydrological analysis further in the next cycle of the South Eastern CFRAM Study were identified:*

- 1. No hydrometric gauging stations were identified for rating review in UoM17 – there are two stations within UoM 17 where it is advised by EPA Hydrometrics that ratings are poor and unreliable (17001 at Kilmacthomas and 17002 at Fox's Castle, records since 1976). It is worth pursuing the improvement of these gauges by considering rating review of existing data, additional spot gaugings, or infrastructure improvements where needed. These stations are not located on any of the watercourses to be modelled in this Study but could serve as preferred pivotal sites in index flow adjustment if their reliability was improved.*
- 2. Recommending that new gauging stations are installed on all of the ungauged models (or branches of models) is a long term goal but probably unrealistic within the timeframe of this or even the next CFRAM Study cycle. Multiplied up nationally this would lead to a long list of gauging stations which would likely remain unrealised at a time when many organisations are rationalising their existing networks and may even obscure the case for those gauging stations which are more acutely needed. However, a more focussed exercise to identify the most acutely needed gauging stations more effectively was*

***undertaken following hydraulic modelling and consultation such that the AFAs which are at greatest risk, are most affected by uncertainty in the design flow estimates and which would significantly benefit from additional calibration data were identified as priorities. This exercise was undertaken following the hydraulic modelling and flood risk assessment stages. AFAs and watercourses within UoM17 which are presently ungauged but are considered to have significant flood risk, and as such would significantly benefit from the installation of new gauge stations are identified as follows:***

- ***Dungarvan (Colligan River Tributary)***
- ***Dunmore East (Dunmore River)***

***Interim improvements to the existing hydrometric gauge network should focus on improving the ratings through the collection of additional spot flow gaugings during flood flows at existing stations.***

## 4 THE UoM17 HYDRAULICS REPORT

Following delivery of UoM17 survey data in 2012-2013, RPS undertook the development of hydraulic models and hazard mapping throughout 2013. Drafting of the Hydraulics Report in 2014, led to consultation on the draft final deliverables, including core hazard and risk mapping, during 2015. The final hydraulics deliverables were completed during 2016, with reporting finalised in 2017.

UoM17 includes four AFAs which has resulted in the development of three separate models for flood risk analysis. A single model was developed for the Dungarvan and Environs and Ringphuca AFAs, due to their proximity and hydraulic interaction.

The hydraulic analysis utilised computational modelling software informed by detailed topographical survey information (channel cross-sections, in-channel/flood defence structures, bathymetric and floodplain data), combined with hydrological inputs (riverine inflows and sea levels) and water-level control parameters (such as channel-roughness), to determine flood hazard.

The principal modelling software package used was the MIKE FLOOD software shell which was developed by the Danish Hydraulics Institute (DHI). This provided the integrated and detailed modelling required at a river basin scale and provides a 1-dimensional /2-dimensional interface for all detailed hydraulic model development thus enabling seamless integration of fluvial and coastal models in the AFAs for which this was required.

Key flood events, where available, were used in the calibration of each model whereby the model was reviewed in order to make sure historic flooding was accurately represented. The principal model parameters that were reviewed and amended during the model calibration process were:

- Bed and floodplain roughness coefficients;
- Structure roughness and head loss coefficients;
- Timing of hydrographs;
- Magnitude of hydrographs;
- Incorporation of additional survey information (e.g. additional cross-sections or missed structures).

The calibrated models (incorporating relevant updates following the consultation process) were used to simulate present day and future flood hazard conditions for events with a range of AEPs. There are inherent assumptions, limitations and uncertainty associated with hydraulic modelling, which are detailed for each hydraulic model within the Hydraulics Report. Defence failure scenarios (where relevant) and sensitivity tests have been conducted for each model. The parameters selected for the sensitivity analysis were dependent on the specific model but generally included:

- Roughness coefficients;
- 2D domain grid cell size;
- Critical structure coefficients;
- Flow inputs;

- Operation of dynamic structures.

**Key Findings:**

***A series of flood extent, depth, velocity, zone and risk-to-life maps known collectively as flood hazard maps were generated based on the model results.***

***The outputs from the hydraulic analysis informed the subsequent stages of the CFRAM Study - the models were used to simulate potential options, facilitating the appraisal of possible flood risk management actions and measures and model outputs also helped to determine and map the degree of flood risk.***

***The specific findings in relation to the hydraulic modelling of each of the AFAs within UoM17 are summarised as follows:***

***Dungarvan & Environs AFA & Ringphuca AFA- There is good confidence in both the hydrology and hydraulics of the model. While there are no flow or water level gauges within model reaches for the purposes of flow calibration the flood model does generally agree with flood extent verification events. There are a significant number of residential and non-residential properties which are at flood risk in these AFAs. Many local roads are also located within the floodplain along with a utility asset and many social amenity sites. Dungarvan & Environs AFA & Ringphuca AFA are affected by 0.5% AEP coastal and 1% AEP fluvial flood events respectively. There are three areas around Dungarvan Harbour where low lying ground is subject to tidal inundation and wave overtopping. As these areas are close together and subject to the same flood mechanisms, they are considered complex. There is also a discrete area affected by fluvial flooding on the Colligan River (within Ringphuca AFA) due to both insufficient channel and culvert capacity which inundates the floodplain. Due to frequent flooding of properties in both the Dungarvan & Environs AFA & Ringphuca AFA there are significant damages and risks in both present day and future scenarios.***

***Dunmore East AFA - Historical flood data for specific events was very limited and insufficient, with no specific flood extent or frequency information available. There are also no active gauging stations within the model extent. Due to the lack of data available, it was possible to conduct only a limited verification exercise on this model. Despite this, the model is shown to be a reasonable representation of the flood mechanisms described from the available flood event records and considered to be performing satisfactorily for design event simulation. Fluvial flooding occurs within Dunmore East AFA at a discrete location during the 1% AEP event, due to both insufficient channel and culvert capacity on the Dunmore River, which inundates the floodplain. There are several properties at risk during the less frequent events***

*within this floodplain along with a local and a regional road.*

*Tramore & Environs AFA - Very little historical data relating to flooding is available and quantifying historical flood events is difficult as there are no hydrometric gauges within the model extents. There are also no tidal gauges within close proximity to the AFA, and data only goes back as far as 2000 at the nearest gauge at Cobh. Despite the lack of calibration and verification data, the model is considered to be performing satisfactorily for design event simulation. Fluvial flooding occurs during the 1% AEP event at two discrete locations in Tramore & Environs AFA. Both areas are due to insufficient culvert capacities causing out of bank flooding. A few properties, both residential and non-residential, are affected along with a small number of local roads, and a regional road, also located within the floodplain.*

*It should be noted that Tramore AFA experienced flooding due to wave overtopping during the South Eastern CFRAM Study, however this mechanism was not investigated further and it is recommended that analysis be undertaken during subsequent studies possibly in conjunction with progressing local measures within Tramore AFA.*

## 5 THE UoM17 PRELIMINARY OPTIONS REPORT

After completion of project level consultation on draft core flood hazard and risk mapping deliverables in early 2015, RPS commenced detailed risk assessment and optioneering. In April 2015, the OPW FRAM project managers attended a two-day workshop in RPS offices in order to review the outcome of the mapping public consultation, discuss the detail of the next stages of analysis, confirm the scope of optioneering (in certain areas with previous schemes) and resolve any associated queries.

Risk assessment (including economic analysis) and preliminary optioneering was completed in draft for all AFAs within UoM17 by December 2015, and a series of Progress Group workshops were held (in November and December 2015 and March 2016) to review the outputs and get Local Authority feedback. A further OPW/RPS workshop was held in December 2015 dealing with reporting feedback and final technical inputs (for example climate change analysis). The initial feedback from the workshops was addressed and a series of project level public consultation days on the preliminary options were held in early 2016 and the Preliminary Options Report (POR) was completed in mid-2016, in parallel with the draft Flood Risk Management Plan which drew heavily on the POR's findings.

The Preliminary Options Report (POR) was accompanied by AFA specific appendices containing supporting technical details on all potential options (whole life costing, multi-criteria analysis and option drawings) and also supporting information such as method screening calculations and GIS layers supporting the risk and options analysis and health and safety information. Some elements of analysis were de-coupled and reported separately, in 2016/2017, namely a strategic Sustainable Urban Drainage Systems (SUDS) analysis and a review of Spatial Planning and Impacts of Development.

All AFAs within UoM17 were included at POR stage. Identification of a very low risk in the Dunmore East and Tramore AFAs resulted in recommendations within the draft Flood Risk Management Plan (FRMP) to maintain the existing regime/progress options via alternative programmes.

Whilst the project level consultation on the mapping was undertaken in the first quarter of 2015, the formal SI consultation was delayed by an update of the relevant legislation and was not completed until the fourth quarter of 2015. This meant that the optioneering had to be progressed without having closed out the observations and objections on the mapping, introducing the possibility that model updates may have been required after optioneering had been undertaken. This risk was constrained by the relatively low number of AFAs for which valid formal consultation input was received.

The OPW awarded a specialist contract to develop an analysis tool to support the whole-life costing of the CFRAM Study options, so that these were consistently applied at national level, in order that the resulting options would be comparable for use to develop a nationally prioritised programme of implementation. Local Authority and the OPW regional team feedback raised concerns regarding the outcome costs of some options developed under this tool, particularly with regard to smaller schemes, and a wider perception that coastal works costing may be generally conservative, whilst culverting works may be less so. Although the database was informed by costs for completed projects, it was

considered prudent to respond to these concerns by lowering the benefit cost ratio threshold for potential schemes. A cut-off ratio of 0.5 (rather than 1.0) was used so that more potentially viable schemes were retained in the optioneering process. The following explanatory note was included in the draft FRMP *“option(s) identified has(have) a BCR below unity. It is considered that the costs for certain works, or smaller schemes, is likely to be conservative in the Unit Cost Database. More detailed assessment of costs, taking local factors into consideration, may improve the BCR”*.

The risk assessment, and particularly the economics aspects, drew together and analysed a range of datasets in relation to receptors and damages. For consistency, standard base year and versions of data (including Middlesex Flood Hazard Research Centre damage statistics) were utilised across the CFRAM studies. During the analysis it was noted that there were gaps and inconsistencies between the An Post geodatabase and the OSi buildings layers which required significant truthing and update.

Recognising the benefit of the draft mapping Progress Group workshops, RPS again found the addition of workshops with the OPW, on methodology/process, and the progress group, to gain local knowledge, to be useful, and a subsequent workshop on the draft FRMP was held. This engagement process, at least in part, meant that there was less change between the potential options presented in the POR and those in the draft FRMP than might have been expected. The consultation on the options mainly informed stakeholders and the wider public and there was little feedback received in terms of alternatives or modifications that resulted in alteration of the options in the draft FRMP.

**Key Findings:**

***The main deliverables for this report were the AFA specific risk analysis and the assessment of a series of potential flood risk management measures relevant at differing spatial scales of assessment (UoM, Sub-Catchment and AFA). These are presented in the following Tables 5.1 and 5.2 for the risk assessment and potential options for UoM17 respectively.***

**Table 5.1 Flood Risk Analysis UoM17**

Type of Risk	Flood Risk for Design AEP (%) Event		
	Dungarvan AFA * & Ringphuca AFA	Dunmore East AFA	Tramore AFA
<b>Current Scenario (Present Day)</b>			
Event Damage (€)	2,635,991 Fluvial 5,907,991 Coastal 1 2,692,174 Coastal 2	753,027 Fluvial 0 Coastal 1	432,273 Fluvial 0 Coastal 1
No. Residential Properties at Risk	24 Fluvial 39 Coastal 1 38 Coastal 2	8 Fluvial 0 Coastal 1	4 Fluvial 0 Coastal 1
No. Business Properties at Risk	1 Fluvial 20 Coastal 1 5 Coastal 2	0 Fluvial 0 Coastal 1	2 Fluvial 0 Coastal 1
No. Utilities at Risk	0 Fluvial 1 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	4 Fluvial 1 Coastal 1 8 Coastal 2	5 Fluvial 5 Coastal 1	6 Fluvial 0 Coastal 1
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. of Social Infrastructure Assets at Risk	23 Fluvial 39 Coastal 1 47 Coastal 2	3 Fluvial 0 Coastal 1	15 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	4 Fluvial 4 Coastal 1 5 Coastal 2	2 Fluvial 0 Coastal 1	9 Fluvial 0 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
<b>Mid-Range Future Scenario</b>			
Event Damage (€)	3,213,278 Fluvial 74,145,879 Coastal 1 32,565,353 Coastal 2	2,136,847 Fluvial 0 Coastal 1	559,048 Fluvial 0 Coastal 1
No. Residential Properties at Risk	31 Fluvial 388 Coastal 1 298 Coastal 2	16 Fluvial 0 Coastal 1	5 Fluvial 0 Coastal 1
No. Business Properties at Risk	1 Fluvial 60 Coastal 1 25 Coastal 2	3 Fluvial 0 Coastal 1	2 Fluvial 0 Coastal 1
No. Utilities at Risk	0 Fluvial 3 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	9 Fluvial 6 Coastal 1	6 Fluvial 5 Coastal 1	7 Fluvial 0 Coastal 1

Type of Risk	Flood Risk for Design AEP (%) Event		
	Dungarvan AFA * & Ringphuca AFA	Dunmore East AFA	Tramore AFA
	51 Coastal 2		
No. Highly Vulnerable Properties at Risk	0 Fluvial 1 Coastal 1 1 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. of Social Infrastructure Assets at Risk	36 Fluvial 84 Coastal 1 75 Coastal 2	3 Fluvial 0 Coastal 1	17 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	6 Fluvial 5 Coastal 1 8 Coastal 2	2 Fluvial 0 Coastal 1	9 Fluvial 0 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
High-End Future Scenario			
Event Damage (€)	3,499,625 Fluvial 164,012,933 Coastal 1 85,605,346 Coastal 2	2,228,077 Fluvial 0 Coastal 1	812,570 Fluvial 1,021,861 Coastal 1
No. Residential Properties at Risk	38 Fluvial 613 Coastal 1 465 Coastal 2	22 Fluvial 0 Coastal 1	6 Fluvial 25 Coastal 1
No. Business Properties at Risk	1 Fluvial 100 Coastal 1 40 Coastal 2	3 Fluvial 0 Coastal 1	2 Fluvial 3 Coastal 1
No. Utilities at Risk	0 Fluvial 4 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	10 Fluvial 11 Coastal 1 61 Coastal 2	6 Fluvial 5 Coastal 1	11 Fluvial 1 Coastal 1
No. Highly Vulnerable Properties at Risk	1 Fluvial 1 Coastal 1 1 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. of Social Infrastructure Assets at Risk	96 Fluvial 130 Coastal 1 100 Coastal 2	3 Fluvial 0 Coastal 1	19 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	7 Fluvial 7 Coastal 1 8 Coastal 2	2 Fluvial 0 Coastal 1	9 Fluvial 0 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1

**Table 5.2 Potential Options UoM17**

SSA	Design flood event (AEP)	Number of properties at risk in design flood event	Options	Area NPVd	Option NPVb (capped)	Option Cost (€m)	Benefit – Cost Ratio	Total MCA-Benefit Score	MCA-Benefit Score / Cost Ratio	Sensitivity to MRFS	Sensitivity to HEFS
UoM17	-	-	Sustainable Planning and Development Management	-	-	-	-	-	-	-	-
			Public Awareness Campaign								
Dungarvan & Ringphuca	1% Fluvial 0.5% Coastal	110	Hard Defences	€27,891,785	€17,369,422	€8,923,163	1.95	1055	118.24	High	High
Dunmore East	1% Fluvial	8	Hard Defences	€512,948	€255,180	€387,922	0.66	45	114.99	Moderate	Moderate
Tramore	1% Fluvial	6	Hard Defences	€172,199	€96,457	€143,619	0.67	-361	-2517.05	Moderate	Moderate

## **6 THE DEVELOPMENT OF THE UoM17 DRAFT FLOOD RISK MANAGEMENT PLAN**

### **6.1 DRAFT FLOOD RISK MANAGEMENT PLAN**

The development of the draft Flood Risk Management Plans (FRMP), which is the statutory output of the CFRAM studies, was led by the OPW. The OPW produced a template and undertook a series of consultations within the OPW, with other relevant government departments, national groups and the CFRAM Study Consultants.

The first draft of the template was produced for comment in July 2015. It was intended to indicate the overall format of the draft FRMP, and in particular, to identify the sections to be completed by the Consultants, and the structure of some template tables and forms that the OPW required to be used in order to facilitate reporting to the European Union, Common Implementation Strategy Working Group. A workshop with relevant FRAM Project Managers and RPS personnel was held in early May 2016 to discuss an initial version of the UoM07 draft FRMP (within the Eastern CFRAM Study area) and agree the level of detail required.

Revision C of the draft FRMP was produced by the OPW in May 2016, this version, incorporating later additions and policy updates, formed the basis of the draft plans that were consulted on during the second half of 2016.

The UoM specific material (text, maps and datasets) were populated by the CFRAM Study consultants drawing largely on the supporting technical studies on hydrology, hydraulics and the preliminary options assessments. The OPW reviewed the draft plans at project level and also with regard to consistency at national level. The progress group members also reviewed the draft FRMPs providing information about relevant plans and programmes, previous projects and influenced the selection of the preferred measures identified within the draft plans.

Within the draft plans areas of further assessment (AFAs) considered to be at very low risk were identified and the measures for such areas were not presented within the plans. The relevant measures remain available within the Preliminary Options Report and may be more readily implemented via a minor works programme. Within UoM17 there were two very low risk AFAs, namely Dunmore East AFA and Tramore AFA.

The draft plans are supported by the final core hazard and risk mapping (Volume II) and also the plan's statutory environmental assessments under the Strategic Environmental Assessment (SEA) Directive and the Habitats Directive (Volume III). The environmental assessment process, which resulted in an SEA Environmental Report and Natura Impact Statement, influenced:

- the development and assessment of measures,
- the selection of preferred measures,

- the identification of mitigation measures and
- an environmental monitoring programme during the Plan's implementation.

**Key Findings:**

***The draft FRMP is a consultation document, its main deliverable being the list of preferred measures.***

***The draft plan incorporates a suite of certain prevention and preparedness measures related to flood risk management that form part of wider Government policy. These measures, set out below, should be applied across the whole of UoM17, including all AFAs:***

- ***Sustainable Planning and Development Management***
- ***Sustainable Urban Drainage Systems***
- ***Voluntary Home Relocation***
- ***Local Adaptation Planning***
- ***Land Use Management and Natural Flood Risk Management Measures***
- ***Maintenance of Arterial Drainage Schemes***
- ***Maintenance of Drainage Districts***
- ***Flood Forecasting and Warning***
- ***Review of Emergency Response Plans for Severe Weather***
- ***Promotion of Individual and Community Resilience***
- ***Individual Property Protection***
- ***Flood-Related Data Collection***
- ***Minor Works Scheme.***

***No measures were identified at Sub-Catchment scale however the following AFA specific measures were identified under the South Eastern CFRAM Study:***

- ***Dungarvan & Ringphuca Flood Relief Scheme: Hard Defences and Improvement of Channel Conveyance.***

It should be noted that there were some policy changes for measures between the preliminary option reporting and draft plan finalisation, such as mechanisms to support relocation and individual property protection.

Furthermore, whilst public consultation was undertaken on the preliminary options there was little opinion that necessitated revision of the options, RPS considers that this is, in part, due to the good level of engagement with the South Eastern CFRAM Study Progress Group, Stakeholder Group and the OPW representatives who reviewed the options ahead of public consultation.

A common theme throughout the CFRAM Study consultation process was the need for a programme of when the measures would be implemented. The draft plans did not have such an overall programme as this was dependent on the outcome of the consultation process, however, it was intended, and there was a strong expectation, that the final plan would contain a finalised and prioritised implementation programme of measures. The key information fields to be prepared, in order to facilitate the prioritisation process, are presented in Appendix A.

## **6.2 DRAFT FRMP CONSULTATION & DEVELOPMENT OF THE FINAL FRMP**

*Project-level* consultation activities took place during 2016 in relation to the draft Flood Risk Management Plans produced by the South-Eastern Catchment-based Flood Risk Assessment and Management (CFRAM) Study. These comprised workshops with the South Eastern CFRAM Progress Group, a stakeholder workshop and a Public Consultation Day within Dungarvan.

A Public Consultation Day took place during February 2016, for the Dungarvan & Environs and Ringhuca AFAs, with seven members of the public attending. Local details of drainage issues were provided however no preference for or objection to the option was stated nor were any alternative options suggested. No objections were received through the formal SI consultation on the draft Plan, and no comments were received that changed the preferred measure although a number are relevant to the detailed design stage.

*Formal*, national-level consultation in support of the draft plans and supporting environmental assessments was undertaken in parallel during late 2016 by the OPW, comprising briefings to elected members, a website based portal for access to the draft plans and supporting materials and to make on-line submissions and also statutory consultation in relation to the supporting environmental assessments.

The OPW, with technical support from RPS, collated responses and reported statutory consultation on the draft FRMPs for UoMs 11, 12, 13, 14, 15 and 17, within a series of Public Consultation Synthesis Reports relating to each Unit of Management.

The OPW hosted an environmental workshop at national technical co-ordination level, on 13<sup>th</sup> February 2017, to consider the environmental issues raised during the consultation responses on the draft plans and supporting environmental reports with a view to developing standard environmental mitigations.

A workshop at project-level was held with relevant FRAM Section Engineers and RPS personnel in late February 2017 to discuss the South Eastern CFRAM consultation submissions in relation to the UoM17 draft FRMP and agree the actions required to reflect these in the final FRMP.

The development of the final FRMPs was again led by the OPW through the production of a template. The OPW undertook a series of consultations within the OPW, with other relevant government

departments, national groups and the CFRAM Study Consultants and considered the submissions made on the national suite of draft FRMPs.

The template was provided for information on the 10/04/17 (revision A-3) with guidance on the key changes and updates required within the final plans, and as near final on the 18/05/17 (revision C-0) noting further updates and insets to be supplied (executive summary and mapping).

The UoM specific material (text, maps and datasets) were again populated by the CFRAM Study consultants where appropriate updating the material from the draft FRMP. The Progress Group again reviewed the final plans, with the OPW examining with regard to both project-level detail and also national consistency, while the Local Authority Progress Group members provided local knowledge, and updated information about relevant plans, programmes and previous projects.

The OPW undertook consultation and prioritisation of the preferred measures identified within the final plans and published these separately in a National Flood Relief Capital Investment Programme which complements Ireland's final FRMPs.

The final plans are also supported by statutory environmental assessments (Volume II), under the Strategic Environmental Assessment (SEA) Directive and the Habitats Directive and drafts of the final statements for these assessments which remain subject to amendment until formal adoption of the plans.

**Key Findings:**

***The final FRMP responded to consultation submissions which related to inter alia, development in national policy, environmental requirements and National Flood Relief Capital Investment Programme. Modifications were also incorporated to make the final plans more nationally consistent.***

***The final plan generally contained a preferred measure for each AFA (unless there were requirements for further study to determine a preferred option). Whilst the consultations and submissions on the draft FRMP provided valuable information, which has been noted for detailed design, none resulted in a change of the preferred measures for the AFAs within UoM17.***

***The final FRMP measures for UoM17 are presented in Table 6.1.***

**Table 6.1 Summary of Flood Risk Management Measures**

Measure	Implementation	Funding
<b>Measures Applicable for All Areas</b>		
Application of the Guidelines on the Planning System and Flood Risk Management (DECLG/OPW, 2009)	Planning Authorities	Planning Authorities
Implementation of Sustainable Urban Drainage Systems (SUDS)	Planning Authorities	Planning Authorities
Voluntary Home Relocation	Inter-Dept. Flood Policy Review Group	Homeowners, OPW (2017 Scheme)
Consideration of Flood Risk in Local Adaptation Planning	Local Authorities	Local Authorities
Assessment of Land Use and Natural Flood Risk Management Measures	EPA, OPW, Others	OPW, Others
Minor Works Scheme	OPW, Local Authorities	OPW, Local Authorities
Establishment of a National Flood Forecasting and Warning Service	OPW, D/HPCLG, Met Éireann and local authorities	OPW, D/HPCLG
Ongoing Appraisal of Flood Event Emergency Response Plans and Management Activities	Principal Response Agencies, Regional Steering Groups, National Steering Group	Implementation Bodies
Individual and Community Action to Build Resilience	Public, business owners, farmers and other stakeholders	N/A
Individual Property Protection	Home Owners, Inter-Dept. Flood Policy Review Group	Homeowners
Flood-Related Data Collection	OPW, Local Authorities / EPA, and other hydro-meteorological agencies	Implementation Bodies
<b>Catchment / Sub-Catchment Measures</b>		
No Sub-Catchment methods were found to be feasible		
<b>Community-Level (AFA) Measures</b>		
Progress the project-level development and assessment of a Flood Relief Scheme, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / Exhibition and, if and as appropriate, implementation, for the Communities set out below.		
Dungarvan & Environs AFA & Ringphuca AFA	OPW and/or Waterford County Council	OPW

## 7 CONCLUSIONS AND RECOMMENDATIONS

### 7.1 TECHNICAL

The South Eastern CFRAM Study was a significant and challenging project in terms of the detailed analysis it required, simultaneously across its six Units of Management, and in the context of a suite of similar studies nationwide, including the adjoining Suir CFRAM for UoM16.

The level of ambition to undertake catchment scale studies of this nature created a significant resource demand on many of the parties involved, including the organisations represented on project progress, steering and stakeholder groups. In particular, a shortfall in third party survey resource introduced a programme delay, of over one year, which meant that the final consultation deliverables (draft FRMP and accompanying documentation) were prepared in 2016, rather than 2015 as originally programmed. The pre-contract survey programme was a valid endeavour to try to spread the survey workload, but was not sufficiently progressed ahead of the CFRAM studies, and also allowed there to be a disconnect between the survey specification and the modeller requirements (this meant that a supplementary survey arrangement needed to remain in place until model validation was complete). RPS was able to review pre-contract specifications and tailor these to reduce survey programme and costs and ultimately progress all of the South Eastern survey under a single tender action. With the benefit of hindsight, RPS would suggest that the main CFRAM studies should have started earlier (in the period when the pre-contract survey arrangements were being progressed) with more programme allowance for the surveys to be distributed, thus allowing staged delivery of Units of Management on all survey and subsequent deliverables. In addition, RPS would recommend that the Survey Framework is renewed so that support for post-CFRAM Study activities, such as responding to comments and queries regarding mapping and updates, remains in place.

Due to the survey related programme delay, it was decided to prioritise the development of the mapping specifically required for submission to the EU Commission from the rest of the mapping deliverables, so that statutory consultation and reporting obligations in relation to these “core deliverables” could be discharged as soon as possible within the revised programme. This focus had the additional benefit of avoiding re-working of huge numbers of associated maps with each iteration of core extent and depth mapping. It is recommended that this de-coupling of mapping deliverables would be incorporated into future planning cycles, to permit the earliest consultation on the mapping that the public and stakeholders are most readily engaged regarding, as well as avoiding nugatory re-working.

In some AFAs or watercourses there was insufficient information to provide high confidence in the analysis of flood risk and this can only be redressed by collecting data as and when events occur. However, the best use of available data was made so that in most cases recommendations could be made to progress flood risk management measures without recourse to further study. In other areas where data was sufficient, and especially where Flood Event Response was undertaken during the

study, there was more confidence in the findings and these could readily be displayed to the wider public audience. Communities subject to recent events are understandably sensitive, and must be dealt with sympathetically, however in every location where this had occurred RPS were especially well received once it was known that there had been recording of the event to inform the CFRAM Study process. The Flood Event Response enabled complex mechanisms to be better understood and replicated (for example in the Duiske in Graiguenamanagh) and this task is a valuable activity for those undertaking the modelling to be involved with.

The “live” nature of some of the tasks was challenging and led to reworking of deliverables and delayed closure of certain tasks. Whilst tasks were initially envisaged as sequential under the specification, for example finalised hydrology available in advance of final hydraulics and mapping consultation, this was not a realistic expectation and RPS advocated this from the study's outset which led to the establishment of an infill survey contract to allow further data collection if any problems were encountered during hydrological and hydraulic analysis.

In addition, there were competing demands on the time of the Progress Group members which meant that they could not always provide the information needed or respond to requests to meet the Eastern CFRAM Study timescales. To try to facilitate engagement with the progress group, in an efficient manner for all parties, RPS held a series of workshops with Local Authority engineering and planning personnel at key study stages. RPS found this addition to be a useful mechanism to ensure the quality of the modelling outputs and the optioneering and would recommend this approach for future stages.

In particular, there was ongoing uncertainty with regard to the defence asset database, which was populated during the study, but is “live” and therefore needs continual review and update, RPS would suggest that this particular task should have preceded the main study (with an update element and surveys included under the South Eastern CFRAM Study). Having populated the database during this cycle to the degree possible, it is important that the database is maintained centrally for future use.

Also in relation to the status of defences, a significant issue arose in determining whether defences were effective or ineffective. In many cases the design or as-built information required to establish effectiveness was not available, and there is a liability issue with assuming effectiveness for a structure where no such information is available, and the scope of the CFRAM Study did not extend to the level of detail required to determine effectiveness, in terms of site investigation or structural assessment. Hence, such structures were omitted from the models. While this is a failsafe approach from the OPW/RPS perspective by avoiding the indication of areas as “protected” when, in fact, the structural performance cannot be confirmed, it poses difficulties for property owners and other stakeholders within these areas which are now indicated to have no protection, thus leading to difficulties in obtaining insurance and other permissions. In order to address this further assessment of the defence performance and a policy review regarding the mapping of such areas would need to be carried out, possibly accompanied by provision of relevant information to the insurance industry.

## 7.2 COMMUNICATIONS

Communications are often a challenge on projects of this complex nature and duration. This is applicable at a number of levels:

- The South Eastern CFRAM Study benefitted from the regular and ongoing communication between the OPW FRAM project management team and that of RPS with key personnel remaining engaged throughout the study's duration, providing regular updates and participating in focussed workshops.
- The South Eastern CFRAM Study's integrated Progress/Steering Group generally engaged well throughout the study, perhaps benefiting from personnel who were involved together in previous catchment scale flood risk management studies. The resource demands that a study of this nature put on Local Authority partners is acknowledged and there was change of some Local Authority representation during the process.
- Early collaboration via a National Technical Co-ordination group was of some benefit, despite the group's large membership, these two day meetings evolved into targeted workshops on specific topics. RPS would suggest that further such workshops would have been of benefit in the latter stages of the projects and whilst the OPW's production of the draft plan template and covers, and their review of the draft Plans, ensured a reasonable degree of consistency, this may have been facilitated by the continuation of the co-ordination group or workshops engendering more of an ethos of partnership and providing more direct communication and access to policy level decision. For example, specific topics could have been; the use of the unit cost database and inputs to the draft FRMP.
- Engagement with stakeholders and the wider public was harder to achieve given the longevity of the studies, initial technical content and the early programme delays, which may have partially disengaged some participants. RPS would endorse our early views that the quality, rather than quantity, of consultation events remains the focus of future consultation phases, that the publicising the events is given a high priority going forward with engagement of national groups under an overall communications strategy, opportunities to tap into similar local engagement programmes are utilised (for example WFD engagement), and, that information be made available using flexible electronic visualisation applications as well as hard copy deliverables.
- It is noted that the OPW are already engaged with a number of relevant groups, for example national stakeholders and cross border fora, which are beyond the remit of the CFRAM studies to review. However, it is considered important that all engagement is maintained.

Within the realm of communications RPS found the use of key messages during every formal presentation to be helpful with managing expectations. This was complemented by using less

technical language and both addressing, and clearly communicating, the confidences and uncertainties in the process and its outcomes.

### 7.3 GENERAL

Throughout the process there was a degree of conflict between maintaining a strategic and plan level of detail, to develop a catchment-scale plan, and the need to address the often localised issues and nuances to particular flooding problems. In all relevant cases, it should be recognised that the subsequent analysis for progressing detailed design will involve some degree of remodelling to account for site investigations, service details, land owner requirements, and consequently this type of study provides “line and level” solutions with variations and refinements to be realistically expected in subsequent stages.

There are many peripheral, but nevertheless valuable, activities which could have been further explored within the Floods Directive’s first cycle assessment; however, due to the number of AFAs which were being assessed and brought together for catchment-scale analysis, focus had to be maintained on the project’s core activities. Whilst other analysis was piloted within various studies (for example culvert blockage, Natural Flood Risk Management and detailed climate change adaptation) these were not able to be implemented across the country due to programme constraints. RPS would recommend that such additions and innovations are taken forward during the Flood Directive’s second cycle alongside the implementation of the first cycle’s plans. In particular, RPS would recommend trialling/piloting measures, such as Natural Flood Risk Management and wetland/bog restoration, which may be of mutual benefit to the implementation of the Water Framework and Habitats Directives, as these integrated catchment measures are untested in the Irish context but may be relevant tools to help offset the impacts of future changes assessed under the first cycle of CFRAM studies and provide benefit where structural schemes are not financially viable.

The project has enabled the collation and development of a very detailed and valuable dataset of flood risk management information. It has provided a strong evidence base to enable strategic decisions to be taken on how best to manage flood risk within UoM17 and across the South Eastern CFRAM Study area. It has also provided sufficient clarity to allow, for the first time, a national prioritisation process to be undertaken for presentation in the final plans. The prioritised programme for the advancement and implementation of ongoing flood relief projects and also the flood protection measures set out with the FRMPs provides the basis for the short and long term planning for flood risk management expenditure in Ireland.

Importantly the project also identified weaknesses, such as where additional flooding mechanisms are still not fully understood or the risk could not be quantified sufficiently. Part of the next step will be to study these areas in more detail to further inform the planning of flood risk management into the next cycle of the Floods Directive and beyond.

The CFRAM studies in this first cycle were ambitious and whilst they had been informed by pilot studies there were areas where the methodology was untested at a CFRAM Study scale which led to some delays and iteration throughout the process. The methodology and scope for the second cycle should be developed as soon as possible to enable pilot studies and trials to be undertaken and a realistic programme to be developed. This should enable more efficient working in the next cycle.

## 8 REFERENCES & BIBLIOGRAPHY

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## **APPENDIX A**

### **KEY INFORMATION UOM17**

## FIELD NAME DESCRIPTION

**1 RBD** Name of the RBD / IRBD

**2 UoM No.** The number of the UoM, as per Appendix A of the Note on the Format of Measure Codes (18/05/16)

**3 AFA Code** If at AFA level, the number of the AFA, as per Appendix C of the Note on the Format of Measure Codes (18/05/16) - If measure is at UoM / Catchment level, insert '-999'

**4 AFA Name** If at AFA level, the name of the AFA, else leave blank

**5 Measure Name** The name of the measure

**6 Code** The Measure Code

**7 Measure Description** The short description of the measure

**8 Implementation** The name(s) of the nominated body or bodies responsible for implementation of the measure

**9 Funding** The name(s) of the nominated body or bodies responsible for funding of the measure

**10 Type of Measure** The Type of Measure Code, as per Appendix B of the Note on the Format of Measure Codes (18/05/16)

**11 1.a.i Unweighted** MCA score for the Objective (1.a.i) – Social - Human Health

**12 1.a.ii Unweighted** MCA score for the Objective (1.a.ii) – Social - High Vulnerability Properties

**13 1.b.i Unweighted** MCA score for the Objective (1.b.i) – Social - Social Infrastructure

**14 1.b.ii Unweighted** MCA score for the Objective (1.b.ii) – Social - Local Employment

**15 2.a Unweighted** MCA score for the Objective (2.a) - Economic - Economic Risk

**16 2.b Unweighted** MCA score for the Objective (2.b) - Economic - Transport

**17 2.c Unweighted** MCA score for the Objective (2.c) - Economic - Utilities

**18 2.d Unweighted** MCA score for the Objective (2.d) - Economic - Agriculture

**19 3.a Unweighted** MCA score for the Objective (3.a) - Environmental - WFD

**20 3.b Unweighted** MCA score for the Objective (3.b) - Environmental - Natura Sites

- 21 3.c Unweighted** MCA score for the Objective (3.c) - Environmental - Flora and Fauna
- 22 3.d Unweighted** MCA score for the Objective (3.d) - Environmental - Fisheries
- 23 3.e Unweighted** MCA score for the Objective (3.e) - Environmental - Visual Amenity
- 24 3.f.i Unweighted** MCA score for the Objective (3.f.i) - Environmental - Cultural (architectural)
- 25 3.f.ii Unweighted** MCA score for the Objective (3.f.ii) - Environmental - Cultural (archaeological)
- 26 4.a Unweighted** MCA score for the Objective (4.a) - Technical - Operationally Robust
- 27 4.b Unweighted** MCA score for the Objective (4.b) - Technical - Health and Safety
- 28 4.c Unweighted** MCA score for the Objective (4.c) - Technical - Adaptability to Climate Change
- 29 MCA Benefit Score Weighted** total MCA Score (i.e., sum of weighted scores for each objective)
- 30 Cost (€m)** Cost of the proposed measures in €m
- 31 Uncapped NPVd (€m) Uncapped** value of Net Present Value Damages in €m
- 32 NPVb (€m)** Capped Net Present Value of Benefits of measure in €m
- 33 MCA BCR (score/€m)** MCA Benefit - Cost Ratio - **NOTE:** As per GN28, the MCA Score for the purposes of calculating the MCA Benefits **excludes** the scores for Technical Objectives
- 34 Economic BCR** Economic Benefit - Cost Ratio
- 35 No. Residential Properties Protected** No. of Residential Properties that would be protected by the proposed measure
- 36 No. Non-Residential Properties Protected** No. of Non-Residential Properties that would be protected by the proposed measure
- 37 Technical Uncertainty** A ranking of the technical uncertainty as 'High', 'Medium' or 'Low' - This should reflect the uncertainty in technical parameters such as hydrological flows, flood levels, flood extents, etc. A description of each ranking category is provided below.
- High - There is significant uncertainty - Further data capture (e.g., hydrometric monitoring) is strongly required before the measure is advanced
- Medium - There is moderate level of uncertainty - Further should be collected if possible in advance of or during the progression of the development stage of the measure, but this data is not deemed critical before the measure may advance

Low - There is a low level of uncertainty, and, providing a reasonable freeboard / safety factor is allowed, the measure may progress without further data collection

**38 Technical Uncertainty Comment** A brief (2-3 lines) explanation as to why the Technical Uncertainty ranking assigned was selected

**39 Project Risk** A ranking of the risks in implementing the measure as 'High', 'Medium' or 'Low' - This should reflect the complexity and nature of the proposed measure, and what level of risk there may be to completing this measure within a defined timeline and the cost indicated. A description of each ranking category is provided below.

High - There are significant risks in progressing the measure, for example, the measure might involve complex construction, and/or, major works in confined urban areas, and/or significant environmental issues in advancing the measure (such as channel / river bank works in a protected Freshwater Pearl Mussel site)

Medium - There are moderate risks in progressing the measure, for example, a major construction project involving some construction in urban areas, or a smaller, but complex construction project, and/or moderate environmental issues in advancing the measure

Low - There are low risks in progressing the measure, for example, a construction project in a green-field site, with no particular environmental issues or risks

**40 Project Risk Comment** A brief (2-3 lines) explanation as to why the Project Risk ranking assigned was selected

**41 Environmental Sensitivity/Impact** A ranking of the likely environmental impact in implementing the measure as 'High', 'Medium' or 'Low' - This should reflect the derived from the outcome of the Strategic Environmental Assessment and/or the Appropriate Assessment.

**42 Environmental Impact Comment** A brief (2-3 lines) explanation as to why the Environmental Sensitivity/Impact ranking assigned was selected

**43 AA Screening Required?** Whether Appropriate Assessment Screening will be required at Project Level for that Measure / Location.

**EXTRACT FROM KEY INFORMATION SPREADSHEET**

FIELD NUMBER																		
3	4	5	6	7	8	9	29	30	31	32	33	34	35	36	38	40	42	43
LOCATION		MEASURE					Total MCA		Uncapped		MCA BCR	Economic	No. Residential	No. Non-Residential	Technical	Project	Environmental Impact	AA Screening Required?
AFA Code	AFA Name	Name	Code	Measure Description	Implementation	Funding	Benefit Score	Cost (€m)	NPVd (€m)	NPVb (€m)	(score/€m)	BCR	Properties Protected	Properties Protected	Uncertainty	Risk	Sensitivity /Impact	
170244 & 170246	Dungarvan	Progress the development of the Dungarvan & Ringphuca Flood Relief Scheme	IE17-170244-0117-M33	Progress the development of the Dungarvan & Ringphuca Flood Relief Scheme, to project-level development and assessment for refinement and preparation for planning / exhibition and, as appropriate, implementation.	OPW and/or Waterford County Council.	OPW	1055	8.92	27.89	17.39	118.24	1.95	24 Fluvial, 39 Coastal 1, 38 Coastal 2	1 Fluvial, 20 Coastal 1, 5 Coastal 2	Low There is good confidence in both the hydrology and hydraulics of the Dungarvan AFA . While there are no flow or water level gauges within model reaches for the purposes of flow calibration the Dungarvan flood model does agree with flood extent verification events.	Medium Extensive works located in an environmentally sensitive area. Includes works in a tidal environment and installation of a demountable barrier.	High Dungarvan Harbour SPA is within Dungarvan town in the Colligan River and downstream of the AFA in Dungarvan Harbour. Anticipated to be short term, highly significant negative impacts on biodiversity, water quality, fisheries and angling with the construction of hard defences on the shoreline, and adjacent to protected areas. These are mainly construction phase impacts that could be mitigated for provided defences are set back from designated areas, with good working practice and good timing of works, although dredging is likely to result in recurring negative impacts. The proposed hard defences to be constructed in sensitive areas will likely result in significant visual negative impacts during the construction phase.	Yes. Potentially 13 European sites to be screened at the project level.