

Plean um Bainistiú Priacal Tuile

Flood Risk Management Plan

An Iarthuaiscirt
North Western

2018

Plean um Bainistiú Priacal Tuile

Flood Risk Management Plan

Amhantrach (01) An Iarthuaiscirt

River Basin (01) North Western

Limistéir um Measúnú Breise a chuimsítear sa phlean seo:
Areas for Further Assessment included in this Plan:

<i>Dún Fionnachaidh</i>	<i>Dunfanaghy</i>
<i>Ráth Mealtain</i>	<i>Rathmelton (Ramelton)</i>
<i>Baile Dhún na nGall</i>	<i>Donegal</i>
<i>Ráth Bhoth</i>	<i>Raphoe</i>
<i>Na Cealla Beaga</i>	<i>Killybegs</i>
<i>An Clochán Liath</i>	<i>Dungloe</i>
<i>Ard an Rátha</i>	<i>Ardara</i>
<i>An Bun Beag - Doirí Beaga</i>	<i>Bunbeg - Derrybeg</i>
<i>Bealach Féich / Srath an Urláir</i>	<i>Ballybofey / Stranorlar</i>
<i>Bun na hAbhann</i>	<i>Burnfoot</i>
<i>Ceann an Droichid</i>	<i>Bridge End</i>
<i>Bun Cranncha & Luddan</i>	<i>Buncrana & Luddan</i>
<i>Carn Domhnach</i>	<i>Carndonagh</i>
<i>An Cheathrú Chaol</i>	<i>Carrowkeel (Kerrykeel)</i>
<i>Caisleán na Finne</i>	<i>Castlefinn</i>
<i>Cluain Maine</i>	<i>Clonmany</i>
<i>Conmhaigh</i>	<i>Convoy</i>
<i>Leifear</i>	<i>Lifford</i>
<i>Cuil na gCuirridín</i>	<i>Killygordon</i>
<i>Leitir Ceanainn</i>	<i>Letterkenny</i>
<i>Málainn</i>	<i>Malin</i>
<i>Bun an Phobail</i>	<i>Moville</i>
<i>Na Dúnaibh</i>	<i>Downies (Downings)</i>
<i>Na Gleannta</i>	<i>Glenties</i>
<i>An Baile Nua</i>	<i>Newtown Cunningham</i>
<i>Ráth Maoláin</i>	<i>Rathmullan</i>

Ullmhaithe ag Oifig na nOibreacha Poiblí 2018
Prepared by the Office of Public Works 2018

De réir In accordance with

Rialacháin na gComhphobal Eorpach (Measúnú agus Bainistiú Priacal Tuile) 2010 agus 2015
European Communities (Assessment and Management of Flood Risks) Regulations 2010 and 2015

Séanadh Dlíthiúil

Tugadh na Pleananna um Bainistiú Priacal Tuile chun cinn mar bhonn eolais le céimeanna indéanta agus molta chun priacal tuile in Éirinn a fhreagairt agus le gníomhaíochtaí eile pleanála a bhaineann leis an rialtas. Ní ceart iad a úsáid ná brath orthu chun críche ar bith eile ná um próiseas cinnteoireachta ar bith eile.

Legal Disclaimer

The Flood Risk Management Plans have been developed for the purpose of informing feasible and proposed measures to address flood risk in Ireland and other government related planning activities. They should not be used or relied upon for any other purpose or decision-making process.

Acknowledgements

The Office of Public Works (OPW) gratefully acknowledges the assistance, input and provision of data by a large number of organisations towards the implementation of the National CFRAM Programme and the preparation of this Flood Risk Management Plan, including:

- RPS Consulting Engineers
- WFD Local Authorities Water and Communities Office LAWCO
- Cavan County Council
- Donegal County Council
- Leitrim County Council
- Louth County Council
- Monaghan County Council
- Department for Infrastructure (Rivers & Flooding) (formerly Rivers Agency of Northern Ireland)
- The Environmental Protection Agency
- Met Éireann
- All members of the National CFRAM Steering and Stakeholder Groups

Maps in the FRMP include Ordnance Survey of Ireland (OSI) data reproduced under licence.

Copyright

Copyright - Office of Public Works. All rights reserved. No part of this report may be copied or reproduced by any means without prior written permission from the Office of Public Works.

ACHOIMRE FHEIDHMEACH

RÉAMHRÁ

Is é seo an Plean um Bainistiú Priacal Tuile (an ‘Plean’) d’Abhantrach An Iarthuaiscirt. Tá cur síos ar an Abhantrach i Rannán 2 den Phlean.

Is cuspóir don Phlean straitéis, ar a n-áirítear sraith céimeanna molta, um bainistiú costéifeachtach inbhuanaithe fadtéarnmach an phriacail tuile ins an Abhantrach a leagan amach, ar a n-áirítear limistéir inar cinneadh go bhfuil an priacal tuile dóchúil suntasach.

Tá an Plean seo, don tréimhse 2018-2021, ar cheann de 29 bPlean atá dá bhfoilsiú; leagann gach ceann acu amach an réimse indéanta de chéimeanna um bainistiú priacal tuile atá molta dá nAbhantracha ar leith. Céim shuntasach chun tosaigh is ea ullmhú na bPleananna seo maidir le feidhmiú pholasaí an Rialtais um bainistiú priacal tuile, mar atá leagtha amach i dTuarascáil an Ghrúpa um Athbhreithniú ar Pholasaí Tuile (OPW, 2004¹), agus freagraíonn sé oibleagáidí na hÉireann faoi Threoir ‘Tuilte’ an AE 2007 (EU, 2007²).

Cuimsíonn an Plean céimeanna indéanta a tugadh chun cinn trí réimse clár agus tionscnamh polasaí ar a n-áirítear:

- Céimeanna neamhstruchtúrtha um chosc agus ullmhacht priacal tuile atá infheidhme ar bhonn náisiúnta, dírithe ar thionchair thuilte a laghdú, a tugadh agus atá á dtabhairt chun cinn chun polasaí Rialtais um bainistiú priacal tuile a fheidhmiú (OPW, 2004).
- Céimeanna struchtúrtha um chosaint tuile atá molta do phobail atá ar phriacal suntasach tuile, dírithe ar dhóchúlacht agus/nó céim thuilte a laghdú, a léiríodh tríd an Chlár Náisiúnta um Measúnú agus Bainistiú Priacal Tuile Abhantraí (MBPTA).

Scrúdaigh an Clár MBPTA an priacal tuile, agus céimeanna féideartha um an priacal a fhreagairt, in 300 pobal ar fud na tíre atá ar phriacal dóchúil suntasach tuile. Léiríodh na pobail seo ins an Réamh-Mheasúnú um Priacal Tuile (RPT); measúnú náisiúnta scagtha a bhí anseo. I dTábla ES-1 thíos tugtar liosta na bpobal atá léirithe tríd an phróiseas RPT mar phobail atá faoi phriacal dóchúil suntasach tuile in Abhantrach An Iarthuaiscirt chomh maith leis na foinsí tuile a cinneadh a bheith suntasach maidir le gach pobal. Tugadh chun cinn agus foilsíodh sraith mapaí tuile le haghaidh gach pobal díobh, ag léiriú na limistéir atá ar phriacal tuile.

Tógann an Plean ar an chlár náisiúnta oibreacha cosanta tuile a críochnaíodh roimhe seo, orthu san atá faoi dhearadh agus faoi thógáil um an dtaca seo nó atá leagtha amach trí thionscadail nó pleananna eile, agus ar chothabháil leanúnach ar scéimeanna dhraenála agus faoiseamh tuile.

Rinneadh Measúnú Straitéiseach Comhshaoil, agus Measúnú Cuí faoin Treoir um Ghnáthóga mar ba chúil, mar chuid den ullmhú, agus tá siad folisithe i dteannta leis an Phlean.

¹ Tuarascáil an Ghrúpa um Athbhreithniú ar Pholasaí Tuile, OPW, 2004 (www.floodinfo.ie)

² Treoir faoi mheasúnú agus bainistiú priacal tuile, 2007/60/EC

Táble ES-1 Pobail atá ar Phriacal Dóchúil Suntasach Tuile taobh istigh d'Abhantrach An Iarthuaiscirt

CONTAE	AINM an PHOBAIL	FOINSÍ PRIACAL TUILE
Dún na nGall	Ard an Rátha	Abhann
Dún na nGall	Bealach Féich / Srath an Urláir	Abhann
Dún na nGall	Ceann an Droichid	Abhann & Cósta
Dún na nGall	An Bun Beag - Doirí Beaga	Abhann & Cósta
Dún na nGall	Bun Cranncha & Luddan	Abhann & Cósta
Dún na nGall	Bun na hAbhann	Abhann & Cósta
Dún na nGall	Carn Domhnach	Abhann
Dún na nGall	An Cheathrú Chaol	Abhann
Dún na nGall	Caisleán na Finne	Abhann
Dún na nGall	Cluain Maine	Abhann
Dún na nGall	Conmhaigh	Abhann
Dún na nGall	Baile Dhún na nGall	Abhann & Cósta
Dún na nGall	Na Dúnaibh	Abhann & Cósta
Dún na nGall	Dún Fionnachaidh	Cósta
Dún na nGall	An Clochán Liath	Abhann & Cósta
Dún na nGall	Na Gleannta	Abhann
Dún na nGall	Na Cealla Beaga	Abhann & Cósta
Dún na nGall	Cuil na gCuirridín	Abhann
Dún na nGall	Leitir Ceanainn	Abhann & Cósta
Dún na nGall	Leifear	Abhann
Dún na nGall	Málainn	Abhann & Cósta
Dún na nGall	Bun an Phobail	Abhann & Cósta
Dún na nGall	An Baile Nua	Abhann & Cósta
Dún na nGall	Ráth Mealtáin	Abhann & Cósta
Dún na nGall	Ráth Bhoth	Báistiúil
Dún na nGall	Ráth Maoláin	Abhann & Cósta

CUSPÓIRÍ AN PHLEAN

Is é cuspóir foriomlán an Phlean ná tionchair tuilte a bhainistiú agus a laghdú, agus aird ar shochair agus éifeachtaí eile, ar fud réimse leathan earnála, ar a n-áirítear sláinte daoine, an comhshaol, an oidhreacht chultúrtha agus gníomhaíocht eacnamaíoch, trí scéimeanna inmharthana cosanta tuile agus céimeanna eile, bunaithe ar thuiscint chruinn ar phriacal tuile mar atá léirithe in ullmhú mapáí tuile.

Maidir le gach ceann ar leith de na hearnála seo tugadh chun cinn sraith cuspóirí a bhí comhsheasmhach ar bhonn náisiúnta. Tugtar liosta de na cuspóirí ar leith seo agus an tábhacht a bhaineann le gach ceann díobh i Rannán 1.4 den Phlean.

RAON AN PHLEAN

Leagtar amach raon an Phlean thíos:

- **Raon Spásúil:** Leagann an Plean amach céimeanna inmharthana, scéimeanna cosanta tuile go hiondúil, atá molta chun priacal tuile a bhainistiú agus a laghdú ins na pobail sin a léiríodh tríd an RPT a bheith faoi phriacal dóchúil suntasach tuile. Leagtar amach

freisin réimse polasaí agus céimeanna neamhstruchtúrtha, atá in áit nó faoi fhorbairt, a thacaíonn le laghdú agus bainistiú priacal tuile ar fud na hAbhantraí.

- **Foinsí Priacal Tuile:** Freagraíonn na céimeanna cosanta tuile atá leagtha amach sa Phlean priacal tuile ó na foinsí tuile mar a léiríodh i dTábla ES-1 i bpobal amháin nó níos mó, mar cinneadh tríd an RPT go raibh na foinsí seo dóchúil suntasach ins na pobail seo. Féadfaidh an réimse polasaí agus céimeanna neamhstruchtúrtha tacú le laghdú agus le bainistiú priacal tuile ó fhoinsí uile priacal tuile.
- **Leibhéal Sonraí:** Leagtar amach sa Phlean na céimeanna atá léirithe mar na céimeanna is cuí ag an phointe seo measúnaithe. Is dearadh imlíneach iad na céimeanna cosanta tuile a leagtar amach sa Phlean; níl siad réidh um thógáil ag an am seo. Beidh gá le dearadh breise mionsonraithe, ar a n-áirítear athbhreithniú ar chostais agus tairbhí, measúnú comhshaoil agus comhairliúchán roimh a bhfeidhmiú.

COMHAIRLIÚCHÁN AGUS PLÉ LE POBAL AGUS LE PÁIRTITHE LEASMHARA

Rinneadh comhairliúchán poiblí ar scála leathan le linn do na mapaí tuile agus na Pleananna a bheith dá n-ullmhú. Cuireadh suíomhanna gréasáin don Chlár MBPTA agus do na Tionscadail ar fáil chun eolas faoin phróiseas iomlán agus faoi na tionscadail bhainteacha a sholáthar agus chun torthaí na dtionscadal a fhoilsiú (tá an t-eolas a bhí ar fáil ar na suíomhanna gréasáin sin ar fáil anois ag www.floodinfo.ie).

Thionóil an OPW breis agus 200 Lá Comhairliúcháin Phoiblí maidir leis na mapaí tuile ins na pobail bhainteacha; bhí deis ag daoine tuithe staitiúla agus cruinneas na mapaí a phlé leis na hinnealtóirí ón OPW agus a gcuid comhairleoirí. Tharla comhairliúchán reachtúil poiblí faoi na mapaí tuile go déanach sa bhliain 2015. In ullmhú na mapaí críochnaithe tugadh aird ar na tráchtas, tuairimí agus agóidí ó na Laethanta Comhairliúcháin Phoiblí agus ón chomhairliúchán foirmiúil chun eolas áitiúil ar thuilte agus tuairimí an phobail a chuimsiú ins na mapaí.

Tionóladh dhá bhabhta de Laethanta breise Comhairliúcháin Phoiblí ins na pobail maidir leis na roghanna dóchúla agus ansin maidir leis na Dréacht-Phleananna um bainistiú an phriacail tuile. Tionóladh comhairliúchán reachtúil poiblí eile maidir leis na Dréacht-Phleananna. Breathnaíodh an réimse leathan tuairimí agus aighneachtaí a tháinig trí na comhairliúcháin seo agus tugadh san áireamh iad de réir mar ba chúil nuair a bhí na Pleananna dá gcríochnú.

Tiomsaíodh Grúpaí Náisiúnta agus Réigiúnacha Páirtithe Leasmhara chun deis a thabhairt do pháirtithe leasmhara páirt a ghlacadh in ullmhú na mapaí tuile agus na bPleananna. Bhí cruinnithe comhordaithe leis na húdaráis atá freagrach as an Creat-Treoir Uisce a fheidhmiú agus, maidir le habhantracha a roinntear i bpáirt le Tuisceart Éireann, leis na húdaráis chúil ansin.

Tá cur síos ar na gníomhaíochtaí maidir le comhairliúchán leis an bpobal agus le páirtithe leasmhara i Rannán 4 den Phlean.

MEASÚNÚ TEICNIÚIL

In ullmhú an Phlean bhí anailís agus measúnú forleathan teicniúil chun an priacal tuile a léiríodh tríd an PBT a chinneadh agus ansin chun céimeanna roghnaithe inmharthana um fhreagairt an phriacail a léiriú. Ar an measúnú teicniúil seo bhí:

- **Suirbhé ón Aer:** Suirbhé ón aer ar thopagrafaíocht na dtuilemhánna, chun anailís a dhéanamh ar chonas a scaipeann uiscí tuile trasna na dtuilemhánna.
- **Suirbhé Topagrafaíoch:** Suirbhé de thalamh ar leagan amach na n-aibhneacha agus na sruthán a ritheann trí na limistéir agus ansin anuas chun na farraige, ar a n-áirítear suirbhéanna ar chruth ghrinill abhann, na bruacha agus na struchtúir atá in aice leis na cainéil nó os a gcionn nó iontu.
- **Anailís Hidreolaíoch:** Anailís chun sruthanna tuile isteach agus trí na haibhneacha agus na sruthán a chinneadh, chomh maith leis na géirleibhéil farraige is cúis le tuilte. Bhí tuairiscí ar leibhéil agus srutha stairiúla abhann mar bhonn eolais leis seo, maraon le meastachán ar thionchair dhóchúla athrú aeráide ar shrutha tuile agus géirleibhéil farraige.
- **Samhaltú Hiodrálach:** Tugadh chun cinn samhaltuithe ríomhaire de na haibhneacha, srutháin agus tuilemhánna chun leibhéil tuile um shrutha tugtha tuile a mheas agus a fhiosrú conas a rithfeadh agus a leathnódh tuilte ar fud na dtuilemhánna, ag tabhairt aird ar chosanta tuile atá ann cheana. Bhí na samhaltuithe mar bhonn eolais um éifeacht céimeanna dóchúla chun an priacal tuile a bhainistiú agus a laghdú.
- **Mapáil Tuile:** Maidir leis na limistéir shamhaltaithe, ullmhaíodh mapáil tuile chun réimse, doimhneacht agus luas srutha na n-uiscí tuile a thaispeáint, chomh maith le réimse mapáil guaise (chun baol agus tionchair dhóchúla tuilte a thaispeáint) agus mapáil Creasa Tuile mar bhonn eolais ar phleanáil agus forbairt inbhuanaithe. Don chás reatha agus don chás amach anseo, ullmhaíodh mapáil ócáidí tuile le réimse dóchúlachtaí tarlaíthe (ó ócáidí le seans 1 as 2 in aon bhliain ar leith, chuig ócáidí le seans 1 as 1000 in aon bhliain ar leith), ag tabhairt aird ar thionchair dhóchúla ón athrú aeráide.
- **Measúnú Priacail:** Measúnú ar thionchair dhóchúla tuilte ins na pobail, ag tabhairt san áireamh an díobháil a fhéadfadh tuilte a dhéanamh maidir le tithe cónaithe, sócmhainní pobail agus sochaí, gnóthais, talmhaíocht, bonneagar, an comhshaol agus an oidhreacht chultúrtha áitiúil. Rinneadh measúnú priacail eacnamaíoch (díobháil) chun impleachtaí eacnamaíocha tuilte ins na pobail a chinneadh.
- **Measúnú agus Breithmheas ar Céimeanna Dóchúla um Bainistiú Priacal Tuile:** Rinneadh réimse leathan céimeanna dóchúla um bainistiú priacal tuile ins na pobail a bhí ar phriacal suntasach tuile a fhorbairt, a mheasúnú agus a bhreithmheas chun céim dóchuil roghnaithe a léiriú um a mholadh sa Phlean. Bhí roinnt céimeanna i gceist anseo:
 - o **Scagadh:** Measúnú ar mhodhanna dóchúla um bainistiú priacal tuile chun iad san a fhéadfadh bheith éifeachtach agus inmharthana a léiriú.
 - o **Céimeanna Dóchúla Inmharthana a Fhorbairt:** Cumadh modhanna dóchúla éifeachtacha i gcéimeanna dóchúla; rinneadh iad san a fhorbairt chuig dearadh imlíneach agus ríomhadh an costas dóchuil ar an chéim sin a fheidhmiú agus a chothabháil.
 - o **Breithmheas faoi ‘Anailís Ilchritéir’ (AI):** Rinneadh measúnú agus breithmheas ar na céimeanna indéanta trí AI chun a n-éifeacht um bainistiú priacal tuile agus na sochair agis tionchair dhóchúla faoi réimse aidhmeanna ar leith a chinneadh.
 - o **Breithmheas Eacnamaíoch:** Rinneadh anailís eacnamaíoch costais tairbhe ar na céimeanna indéanta chun inmharthanacht aon chéimeanna molta a chinntiú.
 - o **Plé le Pobail agus le Páirtithe Leasmhara:** Chuathas i gcomhairle leis na pobail áitiúla, ionadaithe tofa agus páirtithe leasmhara eile san áireamh, chun tuairimí ar aon chéim mholta a ghlacadh ar bord.
 - o **Céimeanna Roghnaithe a Léiriú:** Ceim roghnaithe do na pobail a chinneadh, ag tabhairt aird ar shochair agus ar thionchair eacnamaíocha, comhshaoil agus foriomlána, tuairimí an phobail áitiúil agus páirtithe leasmhara agus costais tuartha na céime.

Maidir le cuid de na pobail, chinn an anailís mionsonraithe teicniúil go bhfuil leibhéal íseal priacal tuile don phobal ó aibhneacha agus/nó an fharraige. Ins na cásanna sin, níorbh fhiú céimeanna um bainistiú priacal tuile (i.e. scéimeanna áitiúla um fhaoiseamh tuile) a fhorbairt

dírithe ar na pobail sin ar leith a chosaint. Le haghaidh pobail eile, fuarthas amach nach mbeadh sé indéanta scéimeanna um chosaint tuile a chur chun cinn. Ach féadfaidh polasaithe agus céimeanna neamhstruchtúrtha atá infheidhme ins na limistéir uile an priacal reatha agus dóchúil a bhainistiú agus a laghdú ins na pobail seo.

Tá cur síos ar na measúnaithe teicniúla i Rannáin 5 agus 7 den Phlean.

MEASÚNAITHE COMHSHAOIL

Rinneadh Measúnú Straitéiseach Comhshaoil (MSC) agus, nuair ba ghá, Measúnú Cuí (MC) ar Phleanleibhéal faoin Treoir um Ghnáthóga, chun sochair agus tionchair dhóchúla na bPleananna ar an chomhshaoil a chinneadh, agus chun céimeanna maolaithe agus monatóireachta a léiriú um thionchair dá leithéid a sheachaint nó a íoslaghdú.

Ba chóir a thabhairt faoi deara nach ionann faomhadh an Phlean agus cead a thabhairt um oibreacha fisiciúla ar bith a thógáil. Ní foláir Measúnú Tionchair Chomhshaoil agus Measúnú Cuí ar leibhéal tionscadail a dhéanamh, de réir na reachtaíochta bainteach mar is cuí, mar chuid de chur chun cinn céimeanna molta lena mbaineann oibreacha fisiciúla.

Tá cur síos ar na ceisteanna agus measúnaithe comhshaoil a ndearnadh i Rannán 6 den Phlean.

CÉIMEANNA MOLTA

Tá achoimre ar na céimeanna atá molta sa Phlean, agus na scéimeanna agus oibreacha um bainistiú priacal tuile atá curthe chun cinn nó á moladh trí thionscadail nó pleananna eile, leagtha amach anseo thíos.

Is ar dhearadh imlíneach, nach bhfuil réidh ag an bpointe seo um thógáil, atá na hoibreacha fisiciúla um fhaoiseamh tuile nó ‘Scéimeanna’ a tugadh chun cinn tríd an Chlár MBPTA. Roimh a bhfeidhmiú, is gá dearadh breise mionsonraithe trí mheasúnú ar leibhéal tionscadail le haghaidh oibreacha dóchúla dá leithéid, ar a n-áirítear suirbhéanna áitiúla, comhairliúcháin breise poiblí agus le páirtithe leasmhara agus measúnú comhshaoil.

CÉIMEANNA ATÁ MOLTA SA PHLEAN

Céimeanna is Infheidhmithe do gach Limistéar

Bainistiú Pleanála agus Forbartha Inbhuanaithe: Tá feidhmiú cóir na dTreoirínte ar an Chóras Pleanála agus Bainistiú Priacal Tuile (RTPRA/OPW, 2009) ag na húdaráis phleanála fíor-riachtanach chun forbairt mhí-oiriúnach i limistéir atá ar phriacal tuile a sheachaint, agus mar sin méadú nach gá ar phriacal tuile a sheachaint amach anseo. Soláthróidh an mhapáil tuile a tháinig tríd an Chlár MBPTA bonn fianaise níos mó um chinntí inbhuanaithe pleanála.

Córais Inbhuanaithe um Dhraenáil Uirbeach (CIDU): De réir na dTreoirínte ar an Chóras Pleanála agus Bainistiú Priacal Tuile (RTPRA/OPW, 2009), ba cheart do na húdaráis phleanála féachaint chuig cruadhromchlú agus cruaphábháil a laghdú agus teicnící inbhuanaithe draenála a fheidhmiú chun tionchar dóchúil forbartha ar phriacal tuile le sruth anuas a laghdú.

Pleanáil um Oiriúnú: Tar éis don Rialtas an Creat Náisiúnta um Oiriúnú d’Athrú Aeráide a fhaomhadh, is gá do phríomhearnálacha agus do na húdaráis Áitiúla pleananna earnála agus

áitiúla um oiriúnú a thabhairt chun cinn. Mar sin is gá don OPW plean athchóirithe earnála a ullmhú, a chlúdaíonn an earnáil um bainistiú priacal tuile. Caithfidh earnálacha eile a léiriú sa Chreat agus Údaráis Áitiúla aird a thabhairt ar phriacal tuile nuair atá a gcuid pleananna earnála agus áitiúla um oiriúnú á n-ullmhú acu.

Bainistiú Talamhúsáide agus Bainistiú Nádúrtha Priacal Tuile: Oibreoidh an OPW leis an Ghníomhaireacht um Chaomhnú Comhshaoil, leis na hÚdaráis Áitiúla agus le gníomhaireachtaí eile le linn measúnaithe ar leibhéal tionscadail ar oibreacha fisiciúla agus níos leithne ar leibhéal abhantraí, chun céimeanna ar bith mar chéimeanna nádúrtha um choinneáil uisce a léiriú, a thairbheoidh aidhmeanna faoin Treoir um Chreat Uisce, bainistiú priacal tuile agus bithéagsúlacht.

Scéimeanna um Dhraenáil Artaireach: Tá dualgas reachtúil ar an OPW faoin Acht um Dhraenáil Artaireach 1945, agus Leasú 1995 an Achta sin, cothabháil a dhéanamh ar na Scéimeanna um Dhraenáil Artaireach agus um Fhaoiseamh Tuile a thóg an OPW faoi na hAchtanna sin.

Ceantair Dhraenála: Is ar na hÚdaráis Áitiúla cuí a luíonn an dualgas reachtúil cothabhála maidir leis an 4,600 km de chainéil abhann a thairbhíonn ó na Scéimeanna Ceantair Dhraenála.

Cothabháil Cainéal nach cuid de Scéim iad: Taobh amuigh de na Scéimeanna um Dhraenáil Artaireach agus na Scéimeanna Ceantair Dhraenála, is ar úinéirí talún a bhfuil cúrsaí uisce ar a gcuid tailte a luíonn cúram a gcothabhála. Tá treoir faoi chearta agus dualgais úinéirí talún, maidir le cothabháil cúrsaí uisce ar a gcuid tailte nó ina gcóngar, ar fáil ag www.flooding.ie.

Réamhaisnéis agus Foláireamh Tuile: Ar 5 Eanáir 2016 chinn an Rialtas ar Sheirbhís Náisiúnta um Réamhaisnéis agus Foláireamh Tuile a bhunú. Pléifidh an seirbhís le réamhaisnéis tuile ó thuille abhann agus cósta; nuair a bheidh sé ag feidhmiú ina iomlán eiseofar réamhaisnéisí agus foláirimh ginearálta ar scálaí náisiúnta agus abhantraí araon. Tá clár cúig bliana aontaithe chun an seirbhís seo a bhunú.

Pleanáil um Fhreagairt Éigeandála: Tá doiciméad *Bainistiú Straitéiseach Éigeandála (BSE): Struchtúir agus Creat Náisiúnta* á dhréachtadh faoi láthair ag Tascfhórsa Rialtais um Pheanáil Éigeandála. Beidh Caibidil ann maidir le Téarnamh, a chuireoidh conas a phléifear le cistiú um éigeandálacha, agus um chostais téarnaimh ach go háirithe, amach anseo.

Díonacht Aonair agus Phobail a Chothú: Tá taighde ar bun ag an Roinn Tithíochta, Pleanála agus Rialtais Áitiúil (RTPRA) maidir le conas is féidir Díonacht Phobail a chur chun cinn mar chuid den athbheithniú foriomlán ar an Chreat um Bhainistiú Móréigeandála.

Cosaint Mhaoine Aonair: Tá dhá scéim phíolótach um Chosaint Mhaoine Aonair (CMA) ar bun faoi láthair agus beidh a dtorthaí seo mar bhonn eolais don Rialtas maidir le tacú indéanta ar bith a fhéadfaí a sholáthar do mhaojne atá ar phriacal.

Bailiú Sonraí maidir le Tuille: Tá bailiú sonraí ar thuille agus, nuair is cuí, a bhfoilsíú, ar siúl ar bhonn leanúnach; is céim í seo a chuideoidh um ullmhú agus um fhreagairt ar thuiliú.

Athlonnú Deonach Tí Cónaithe: Ins na cúinsí is géire, féadfaidh an priacal tuile do theach cónaithe a bheith chomh mór sin go gceapadh úinéir an tí nach bhfuil sé inbhuanaithe fanacht ann agus go gcinneadh sé ar athlonnú. Ar 11 Aibreán 2017 d'aontaigh an Rialtas na socruithe riaracháin do Scéim aonuaire um Athlonnú Deonach d'Úinéirí Tí Cónaithe, maidir leis na príomhthithe cónaithe sin a bhí faoi thuille le linn na tréimhse ó 4 Nollaig 2015 go 13 Eanáir 2016.

Céimeanna ar Leibhéal Abhantraí / Fo-Abhantraí

Ní bhfuarthas aon chéimeanna indéanta ar leibhéal abhantraí / fo-abhantraí don Abhantrach seo.

Céimeanna ar Leibhéal Pobail

Do na pobail seo a leanas, moltar sa Phlean go dtabharfar scéim um fhaoiseamh tuile chun cinn chuig forbairt agus measúnú ar leibhéal tionscadail, ar a n-áirítear measúnú comhshaoil mar is gá agus tuilleadh comhairliúcháin phoiblí, um mionchoigeartú agus ullmhú um a phleanáil agus a thaispeáint agus, más agus nuair is cuí, um fheidhmiú:

- Bealach Féich / Srath an Urláir
- Bun Cranncha & Luddan
- Carn Domhnach
- Caisleán na Finne
- Baile Dhún na nGall
- Na Dúnaibh
- Dún Fionnachaidh
- Na Gleannta
- An Cheathrú Chaol
- Na Cealla Beaga
- Leitir Ceanainn
- Leifear
- Ráth Mealtáin
- Ráth Maoláin

Do na pobail seo a leanas rinneadh scrúdú ar chéimeanna struchtúrtha dóchúla indéanta um fhaoiseamh tuile dar léiríodh scéim um fhaoiseamh tuile atá inmharthana ar bhonn teicniúil. Ach beidh gá le measúnú níos mionsonraithe ar chostais agus ar thairbhí a chríochnú um a chinneadh an bhfuil an Scéim atá molta indéanta:

- An Bun Beag - Doirí Beaga
- Bun na hAbhann
- Conmhaigh
- Bun an Phobail

Sul a dtabharfar an scéim um fhaoiseamh tuile atá molta do Bhealach Féich / Srath an Urláir chun cinn chuig forbairt agus measúnú ar leibhéal tionscadail, ba cheart measúnú iomlán mionsonraithe a dhéanamh ar stádas an chlaífoirt chosanta tuile atá ann, le moltaí maidir le hoibreacha um uasghrádú agus cothabháil.

Scéimeanna agus Oibreacha um Fhaoiseamh Tuile atá Tugtha Chun Cinn nó Molta trí Thionscadail nó trí Phleananna Eile

Tá Scéim um Fhaoiseamh Tuile faoi dhearadh nó faoi thógáil cheana féin do Ráth Bhoth agus leanfar leis seo a chur chun cinn.

FEIDHMIÚ, MONATÓIREACHT AGUS ATHBHREITHNIÚ AN PHLEAN

Is gá infheistíocht chaipitiúil suntasach chun na céimeanna uile, mar atá leagtha amach sa Phlean seo agus ins na Pleananna uile, a fheidhmiú. Mar sin is gá tosaíocht a thabhairt don infheistíocht is gá chun an sraith náisiúnta de chéimeanna molta a fheidhmiú.

I dteannta le foilsiú an Phlean seo agus na bPleananna eile, fógraíodh an chéad sraith d'oibreacha cosanta tuile dar tugadh tosaíocht dóibh atá leagtha amach sa Phlean seo agus san 28 bPlean eile. Oibreoidh an OPW agus na hÚdaráis Áitiúla go dlúth lena chéile chun feidhmiú éifeachtach na dtionscadail tosaigh seo a thabhairt chun críche agus ina dhiaidh sin ar na tionscadail eile.

Léirítear sa Phlean an dream/na dreamanna atá freagrach as feidhmiú na gcéimeanna molta um bainistiú priacal tuile ar bhonn tosaíochta mar atá leagtha amach thuas.

Is é an tAire Stáit le cúram speisialta um Oifig na nOibreacha Poiblí agus Faoiseamh Tuile atá ina Chathaoirleach ar an An Ghrúpa Idir-Rannach um Chomhordú Pholasaí Tuile. Is é an Grúpa seo a chomhordaíonn agus a dhéanann monatóireacht ar dhul chun cinn maidir le feidhmiú na moltaí atá leagtha amach in Athbhreithniú Pholasaí Tuile an Rialtais 2004, ar a n-áirítear na céimeanna atá leagtha amach ins na Pleananna.

Is don tréimhse 2018-2021 na Pleananna seo. Athbhreithneoidh an OPW agus páirtithe leasmhara eile iad, maidir leis an dul chun cinn atá déanta, agus déanfar iad a uasdhátú in 2021.

EXECUTIVE SUMMARY

INTRODUCTION

This is the Flood Risk Management Plan (the 'Plan') for the North Western River Basin. A description of the River Basin is provided in Section 2 of the Plan.

The purpose of the Plan is to set out the strategy, including a set of proposed measures, for the cost-effective and sustainable, long-term management of flood risk in the River Basin, including the areas where the flood risk has been determined as being potentially significant.

This Plan, which is for the period of 2018-2021, is one of 29 Plans being published; each setting out the feasible range of flood risk management measures proposed for their respective River Basins. The preparation of these Plans represents a significant milestone in the implementation of Government policy on flood risk management, as set out in the Report of the Flood Policy Review Group (OPW, 2004³), and addresses Ireland's obligations under the 2007 EU 'Floods' Directive (EU, 2007⁴).

The Plan includes feasible measures developed through a range of programmes and policy initiatives including:

- Non-structural flood risk prevention and preparedness measures that are applicable nationally, aimed at reducing the impacts of flooding, that have been and are being developed to implement Government policy on flood risk management (OPW, 2004).
- Structural flood protection measures proposed for communities at significant flood risk, aimed at reducing the likelihood and/or degree of flooding, identified through the National Catchment Flood Risk Assessment and Management (CFRAM) Programme.

The CFRAM Programme has examined the flood risk, and possible measures to address the risk, in 300 communities throughout the country at potentially significant flood risk. These communities were identified through the Preliminary Flood Risk Assessment (PFRA - See Section 3 of the Plan), which was a national screening assessment of flood risk. The communities identified through the PFRA process as being at potentially significant flood risk in the North Western River Basin are listed in Table ES-1 below, along with the sources of flood risk that were deemed to be significant for each community. A set of flood maps, indicating the areas prone to flooding, has been developed and published for each of the communities.

The Plan builds on and supplements the national programme of flood protection works completed previously, that are under design and construction at this time or that have been set out through other projects or plans, and the ongoing maintenance of existing drainage and flood relief schemes.

A Strategic Environmental Assessment, and an Appropriate Assessment under the Habitats Directive where appropriate, have been undertaken as part of the preparation of, and have been published with, the Plan.

³ Report of the Flood Policy Review Group, OPW, 2004 (www.floodinfo.ie)

⁴ Directive on the assessment and management of flood risks, 2007/60/EC

Table ES-1 **Communities at Potentially Significant Flood Risk within the North Western River Basin**

COUNTY	COMMUNITY NAME	SOURCE(S) OF FLOOD RISK
Donegal	Ardara	Fluvial
Donegal	Ballybofey / Stranorlar	Fluvial
Donegal	Bridge End	Fluvial & Coastal
Donegal	Bunbeg - Derrybeg	Fluvial & Coastal
Donegal	Buncrana & Luddan	Fluvial & Coastal
Donegal	Burnfoot	Fluvial & Coastal
Donegal	Carndonagh	Fluvial
Donegal	Carrowkeel (Kerrykeel)	Fluvial
Donegal	Castlefinn	Fluvial
Donegal	Clonmany	Fluvial
Donegal	Convoy	Fluvial
Donegal	Donegal	Fluvial & Coastal
Donegal	Downies (Downings)	Fluvial & Coastal
Donegal	Dunfanaghy	Coastal
Donegal	Dungloe	Fluvial & Coastal
Donegal	Glenties	Fluvial
Donegal	Killybegs	Fluvial & Coastal
Donegal	Killygordon	Fluvial
Donegal	Letterkenny	Fluvial & Coastal
Donegal	Lifford	Fluvial
Donegal	Malin	Fluvial & Coastal
Donegal	Moville	Fluvial & Coastal
Donegal	Newtown Cunningham	Fluvial & Coastal
Donegal	Rathmelton (Ramelton)	Fluvial & Coastal
Donegal	Raphoe	Fluvial
Donegal	Rathmullan	Fluvial & Coastal

OBJECTIVES OF THE PLAN

The overall objective of the Plan is to manage and reduce the potential consequences of flooding, recognising other benefits and effects across a broad range of sectors including human health, the environment, cultural heritage and economic activity, through viable flood protection schemes and other measures informed by a sound understanding of the flood risk established through the preparation of flood maps.

A nationally consistent set of specific objectives relating to each of these sectors was developed for the preparation of the Plans. These specific objectives and the importance given to each are listed in Section 1.4 of the Plan.

SCOPE OF THE PLAN

The scope of the Plan is set out below:

- **Spatial Scope:** The Plan sets out viable measures, typically flood protection schemes, proposed to manage and reduce flood risk in the communities that were identified through the PRFA as being at potentially significant flood risk. The Plan also sets out a range of non-structural policies and measures, which are in place or under development,

that contribute to the reduction and management of flood risk throughout the River Basin.

- **Sources of Flood Risk:** The flood protection measures that are set out in the Plan address flood risk from the sources of flooding as identified in Table ES-1 in one or more communities, as these sources were determined through the PFRA to be potentially significant in these communities. The range of non-structural policies and measures set out in the Plan can contribute to the reduction and management of flood risk from all sources of flood risk.
- **Level of Detail:** The Plan sets out the measures that have been identified as the most appropriate at this stage of assessment. The flood protection measures set out in the Plan are to an outline design, and are not at this point ready for construction. Further detailed design, including a review of costs and benefits, environmental assessment, and consultation will be required for such works before implementation.

PUBLIC AND STAKEHOLDER CONSULTATION AND ENGAGEMENT

Extensive public consultation has been undertaken throughout the preparation of the flood maps and the Plans. Websites for the CFRAM Programme and Projects were also maintained throughout the process to provide information on the overall process and the relevant projects and to provide access to project outputs (the information that was available from these websites is now available through www.floodinfo.ie).

Over 200 Public Consultation Days were held by the OPW in or near the relevant communities in relation to the flood maps, where residents and the engineers of the OPW and its consultants could discuss past floods and the accuracy of the maps. A statutory public consultation on the draft maps was also undertaken late in 2015. The preparation of the final maps have taken the comments, observations and objections from the Public Consultation Days and formal consultation on board to reflect the local knowledge of flooding and people's views of the maps.

Two rounds of further Public Consultation Days were held in or near the communities in relation to potential options and then the Draft Plans for managing the flood risk. A further statutory public consultation was held in relation to the Draft Plans. The extensive comments and submissions made through these consultations have all been considered and taken into account as appropriate in finalising the Plans.

National and Regional Stakeholder Groups were formed to provide an opportunity for input by stakeholders to participate in the preparation of the flood maps and the Plans. Coordination and engagement meetings were held with the authorities responsible for implementing the Water Framework Directive and, for river basins that are shared with Northern Ireland, with the relevant authorities in the North.

The public and stakeholder consultation and engagement activities are described in Section 4 of the Plan.

TECHNICAL ASSESSMENT

The preparation of the Plan has involved extensive technical analysis and assessment to determine the flood risk in the communities identified through the PFRA, and then to identify preferred, viable measures to address the risk. This technical assessment has included:

- **Aerial Survey:** Airborne survey of the physical topography of the floodplains to facilitate an analysis of how flood waters spread across the floodplains.

- **Topographical Survey:** Ground-based survey of the geometry of the rivers and streams running through the communities, between the communities and then down to the sea, including surveys of the shape of the river bed and banks and of structures in, over or alongside the channels.
- **Hydrological Analysis:** An analysis to determine flood flows into and through the rivers and streams, and extreme sea levels that can cause flooding. This analysis has been informed by records of past river levels and flows and an estimation of the potential impacts of climate change on flood flows and extreme sea levels.
- **Hydraulic Modelling:** The development of computer models of the rivers, streams and floodplains to determine the flood levels for given flood flows and how floods would flow and spread over the floodplains, taking into account existing flood defences. The models informed the assessment of the effectiveness of possible measures to manage and reduce the flood risk.
- **Flood Mapping:** The preparation of flood maps to indicate the extent, depth, flow velocity (speed) of flood-waters and a range of risk maps (showing the potential dangers and impacts of flooding) for the modelled areas, along with Flood Zone maps to inform sustainable planning and development. Maps of flood events with a range of likelihoods of occurrence (from events with a 1 in 2 chance of occurring in any year, to those with a 1 in a 1000 chance in any year) have been developed for the current scenario and for future scenarios taking into account the potential impacts of climate change.
- **Risk Assessment:** An assessment of the potential impacts of flooding in the communities, taking account of the homes, community and society assets, businesses, agriculture, infrastructure, the environment and the local cultural heritage that could be damaged by flooding. An economic risk (damage) assessment was undertaken to determine the economic implications of floods in the communities.
- **Assessment and Appraisal of Possible Flood Risk Management Measures:** The development, assessment and appraisal of a wide range of possible measures to manage flood risk in the communities at significant flood risk to identify a potentially preferred measure to be proposed in the Plan. This involved a number of steps:
 - o **Screening:** The assessment of possible methods to manage flood risk to identify those that might be effective and potentially viable.
 - o **Development of Potentially Viable Measures:** Potentially effective methods were formed into possible measures, which were then developed to outline design, and the likely cost of implementing and maintaining the measure calculated.
 - o **Appraisal by 'Multi-Criteria Analysis' (MCA):** The possible measures were assessed and appraised through a MCA to determine their effectiveness in reducing flood risk and their potential benefits and impacts across the range of specific objectives.
 - o **Economic Appraisal:** The possible measures were also subject to an economic cost-benefit analysis to ensure the viability of any proposed measures.
 - o **Public and Stakeholder Engagement:** The local communities, including elected representatives and other stakeholders, were consulted with to take on board views and opinions on any proposed measure for the community it would protect.
 - o **Identification of Preferred Measures:** Determination of a preferred measure for the communities, taking account of the economic, environmental and overall benefits and impacts, the observations of the local community and stakeholders and the foreseen costs of the measure.

For some communities, the detailed technical analysis has determined that there is currently a low level of flood risk to the community from rivers and/or the sea. In such cases, the development of flood risk management measures aimed specifically at protecting such communities (i.e. local flood relief schemes) was not merited. For some other communities, it was found that it would not be feasible to progress flood protection schemes. However, the

non-structural policies and measures applicable across all areas can reduce and manage the existing and potential future risk in these communities.

The technical assessments are described in Sections 5 and 7 of the Plan.

ENVIRONMENTAL ASSESSMENTS

The Plans have been subject to Strategic Environmental Assessment (SEA), and, where necessary, Plan-level Appropriate Assessment (AA) under the Habitats Directive, to determine the potential benefits and impacts of the Plans on the environment, and to identify mitigation and monitoring measures necessary to avoid or minimise such impacts.

It should be noted that approval of the Plan does not confer consent to the construction of any physical works. Environmental Impact Assessment and Project-level Appropriate Assessment must be undertaken in accordance with the relevant legislation where relevant as part of the progression of proposed measures that involve physical works.

The environmental issues and assessments undertaken are described in Section 6 of the Plan.

PROPOSED MEASURES

A summary of the measures proposed in the Plan and the flood relief schemes and works that have been progressed or proposed through other projects or plans are set out below.

The proposed physical flood relief works or 'Schemes' set out in the Plans that have been developed through the CFRAM Programme are to an outline design, and are not at this point ready for construction. Further detailed design through a project-level of assessment will be required for such potential works before implementation, including local surveys, further public and stakeholder consultation and environmental assessment.

MEASURES PROPOSED IN THE PLAN

Measures Applicable for all Areas

Sustainable Planning and Development Management: The proper application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009) by the planning authorities is essential to avoid inappropriate development in flood prone areas, and hence avoid unnecessary increases in flood risk into the future. The flood mapping produced through the CFRAM Programme will provide an even greater evidential basis for sustainable planning decisions.

Sustainable Urban Drainage Systems (SUDS): In accordance with the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009), planning authorities should seek to reduce the extent of hard surfacing and paving and require the use of sustainable drainage techniques to reduce the potential impact of development on flood risk downstream.

Adaptation Planning: Following approval by Government of the National Climate Change Adaptation Framework key sectors and Local Authorities are required to develop sectoral and local adaptation plans. This will require a revised sectoral plan to be prepared by the OPW, covering the flood risk management sector. Other sectors identified in the Framework and

Local Authorities will also be required to take account of flood risk when preparing their own sectoral and local adaptation plans.

Land Use Management and Natural Flood Risk Management: The OPW will work with the Environment Protection Agency, Local Authorities and other agencies during the project-level assessments of physical works and more broadly at a catchment-level to identify any measures, such as natural water retention measures, that can have benefits for Water Framework Directive, flood risk management and biodiversity objectives.

Arterial Drainage Schemes: The OPW has a statutory duty under the Arterial Drainage Act, 1945, and the Amendment of the Act, 1995, to maintain the Arterial Drainage and Flood Relief Schemes constructed by it under those Acts.

Drainage Districts: The statutory duty of maintenance for 4,600 km of river channel benefitting from Drainage District Schemes rests with the relevant Local Authorities.

Maintenance of Channels not part of a Scheme: Outside of the Arterial Drainage and Drainage District Schemes, landowners who have watercourses on their lands have a responsibility for their maintenance. Guidance to clarify the rights and responsibilities of landowners in relation to the maintenance of watercourses on or near their lands is available at www.flooding.ie.

Flood Forecasting and Warning: A Government decision was taken on 5 January 2016 to establish a National Flood Forecasting and Warning Service. The service will deal with flood forecasting from fluvial (river) and coastal sources and when fully operational will involve the issuing of flood forecasts and general alerts at both national and catchment scales. A 5-year programme has been agreed to oversee the establishment of this new service.

Emergency Response Planning: A Government Task Force on Emergency Planning is currently drafting a *Strategic Emergency Management (SEM): National Structures and Framework* document. This is to include a Chapter on Recovery to include how funding for emergencies, particularly recovery costs, may be handled in the future.

Promotion of Individual and Community Resilience: The Department of Housing, Planning & Local Government (DHPLG) is researching how Community Resilience may be advanced as part of the overall review of the Framework of Major Emergency Management.

Individual Property Protection: The outcomes of two Individual Property Protection (IPP) pilots currently underway will inform the Government on any feasible support it could provide to at risk properties.

Flood-Related Data Collection: The ongoing collection and, where appropriate, publication of flood-related data is a measure that will help to continually improve preparation for, and response to, flooding.

Voluntary Home Relocation: In extreme circumstances, the flood risk to a home may be such that the homeowner may consider that continuing to live in the property is not sustainable and would choose to relocate. On 11 April 2017, the Government agreed the administrative arrangements for a once-off Homeowners Voluntary Relocation Scheme for those primary residential properties that flooded during 4 December 2015 to 13 January 2016.

Catchment / Sub-Catchment-Level Measures

No catchment / sub-catchment-level measures were found to be feasible for this River Basin.

Community-Level Measures

For the following communities, it is proposed in the Plan that a flood relief scheme is progressed to project-level development and assessment, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation:

- Ballybofey / Stranorlar
- Buncrana & Luddan
- Carndonagh
- Castlefinn
- Donegal
- Downies (Downings)
- Dunfanaghy
- Glenties
- Carrowkeel (Kerrykeel)
- Killybegs
- Letterkenny
- Lifford
- Rathmelton (Ramelton)
- Rathmullan

Potentially viable structural flood relief measures have been investigated for the following communities for which a technically viable flood relief scheme has been identified. However, a more detailed assessment of the costs and benefits will need to be completed to determine if the proposed Scheme is feasible:

- Bunbeg - Derrybeg
- Burnfoot
- Convoy
- Moville

A full detailed condition assessment should be undertaken of the existing flood defence embankment, with recommendations for any upgrade or maintenance works, before the proposed flood relief scheme for Ballybofey / Stranorlar is progressed to project-level development and assessment.

Flood Relief Schemes and Works Progressed or Proposed through Other Projects or Plans

There is a Flood Relief Scheme already in design or construction for Raphoe, which will continue to be progressed.

IMPLEMENTATION, MONITORING AND REVIEW OF THE PLAN

Implementing all of the measures, set out in this and all Plans, requires a significant capital investment. It has therefore been necessary to prioritise the investment required to implement the national set of proposed measures.

A prioritised initial tranche of flood protection works set out within this and the 28 other Plans to be advanced to the more detailed project level of assessment has been announced in conjunction with the publication of this and the other Plans. The OPW and Local Authorities

will work closely to bring about the effective implementation of these initial projects and then subsequent projects.

The Plan identifies the body/bodies responsible for implementing the proposed flood risk management measures in a prioritised manner as above.

The Minister of State with special responsibility for the Office of Public Works and Flood Relief chairs the Interdepartmental Flood Policy Co-ordination Group. This Group co-ordinates and monitors progress in the implementation of the recommendations set out in the Government's 2004 Flood Policy Review, including the measures set out in the Plans.

These Plans are for the period 2018 - 2021. They will be reviewed in terms of progress made and be updated by the OPW and other stakeholders in 2021.

CONTENTS

1	INTRODUCTION AND BACKGROUND.....	4
1.1	OVERVIEW	4
1.2	FLOODING AND FLOOD RISK.....	4
1.2.1	Types and Causes of Flooding.....	5
1.2.2	Impacts of Flooding	5
1.2.3	Potential Impacts of Future Change	5
1.3	BACKGROUND	5
1.3.1	Flood Policy and Legislative Background.....	5
1.3.2	Competent and Responsible Authorities for the 'Floods' Directive	6
1.3.3	The 'CFRAM' Programme	6
1.3.4	Pilot CFRAM Projects.....	7
1.3.5	Other Relevant Flood Risk Management Projects	7
1.3.6	Other Relevant Policies and Plans	9
1.4	FLOOD RISK MANAGEMENT OBJECTIVES	12
1.4.1	Overview	12
1.4.2	Definition of the Flood Risk Management Objectives	12
1.5	SCOPE OF THE PLAN	15
1.5.1	Spatial Scope of the Plan	15
1.5.2	Sources of Flooding Addressed in the Plan	15
1.5.3	Level of Detail of the Plan.....	15
1.6	STRUCTURE OF THE PLAN	17
2	OVERVIEW OF THE RIVER BASIN.....	18
2.1	THE NORTH WESTERN RIVER BASIN	18
2.2	TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER.....	18
2.3	LAND USE AND LAND MANAGEMENT	20
2.4	HYDROLOGY	21
2.5	FLOOD HISTORY	22
2.6	EXISTING FLOOD RISK MANAGEMENT MEASURES.....	27
2.6.1	Raphoe Flood Relief Scheme	27
2.6.2	Arterial Drainage Schemes and Drainage Districts	27
2.6.3	Minor Works	28
3	PRELIMINARY FLOOD RISK ASSESSMENT.....	30
3.1	INTRODUCTION	30
3.2	OUTCOMES OF THE PFRA.....	30
3.3	FURTHER INFORMATION	30
4	PUBLIC AND STAKEHOLDER CONSULTATION AND ENGAGEMENT ..	33
4.1	OVERVIEW	33
4.2	AVAILABILITY OF PROJECT INFORMATION	33
4.3	STAKEHOLDER ENGAGEMENT	33

4.3.1	The CFRAM Steering and Progress Groups	33
4.3.2	Stakeholder Consultation Groups	35
4.3.3	Coordination with the Implementation of the Water Framework Directive	35
4.4	PUBLIC CONSULTATION AND ENGAGEMENT	35
4.4.1	Consultation on Preliminary Flood Risk Assessment	36
4.4.2	Launch of the NWNB CFRAM Project	36
4.4.3	Consultation on Flood Maps	36
4.4.4	Consultation on Flood Risk Management Objectives	37
4.4.5	Consultation on Options	37
4.4.6	Consultation on Draft Plans	37
4.5	CROSS-BORDER COORDINATION	38
5	FLOOD HAZARD AND RISK ASSESSMENT	39
5.1	HYDROLOGICAL ANALYSIS	39
5.2	HYDRAULIC MODELLING	40
5.3	FLOOD HAZARD MAPPING	43
5.4	FLOOD RISK ASSESSMENT AND MAPPING	45
5.5	CONSIDERATION OF FUTURE CHANGES	48
5.6	COMMUNITIES (AFAS) OF LOW RISK	49
6	ENVIRONMENTAL CONSIDERATIONS	50
6.1	OVERVIEW	50
6.2	ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES IN THE NORTH WESTERN RIVER BASIN	52
6.3	STRATEGIC ENVIRONMENTAL ASSESSMENT	53
6.4	APPROPRIATE ASSESSMENT	54
6.5	COORDINATION WITH WATER FRAMEWORK DIRECTIVE	55
6.5.1	Bi-Lateral Meetings	55
6.5.2	Cross-Representation on Management Groups	55
6.5.3	Exchange of Information	56
6.5.4	Coordination on Measures	56
6.6	PROGRESSION OF MEASURES AND ASSESSMENT OF FUTURE WORKS	57
6.6.1	Approval of the Plan	57
6.6.2	Implementation Routes for Physical Works	58
6.6.3	Mitigation Measures	59
7	MANAGING FLOOD RISK	61
7.1	OVERVIEW	61
7.2	METHODS OF FLOOD RISK MANAGEMENT	61
7.2.1	Flood Risk Prevention Methods	61
7.2.2	Flood Protection Methods	62
7.2.3	Flood Preparedness (Resilience) Methods	62
7.2.4	Continue Existing Regime / Do Nothing / Minor Measures	62
7.3	DEVELOPMENT AND APPRAISAL OF FLOOD RISK MANAGEMENT OPTIONS	63
7.3.1	Spatial Scales of Assessment	63
7.3.2	Step 1: Screening of Flood Risk Management Methods	65

7.3.3	Step 2: Development of Options for Flood Risk Management Measures	65
7.3.4	Step 3: Appraisal by Multi-Criteria Analysis	66
7.3.5	Step 4: Economic Appraisal	67
7.3.6	Step 5: Public And Stakeholder Engagement	67
7.3.7	Step 6: Identification of Preferred Measures	68
7.3.8	Measures Identified from Other Policies, Projects and Initiatives	68
7.4	OUTCOMES.....	69
7.4.1	Measures Applicable for All Areas	69
7.4.2	Finn - Deelee Sub-Catchment Measures	76
7.4.3	Ballybofey and Stranorlar AFA Measures	76
7.4.4	Bunbeg-Derrybeg AFA Measures	80
7.4.5	Buncrana and Luddan AFA Measures	81
7.4.6	Burnfoot AFA Measures	82
7.4.7	Carndonagh AFA Measures	82
7.4.8	Castlefinn AFA Measures.....	84
7.4.9	Convoy AFA Measures.....	86
7.4.10	Donegal AFA Measures	86
7.4.11	Downings AFA Measures.....	88
7.4.12	Dunfanaghy AFA Measures	90
7.4.13	Glenties AFA Measures.....	92
7.4.14	Kerrykeel AFA Measures.....	94
7.4.15	Killybegs AFA Measures	95
7.4.16	Letterkenny AFA Measures	97
7.4.17	Lifford AFA Measures.....	99
7.4.18	Moville AFA Measures.....	101
7.4.19	Ramelton AFA Measures	101
7.4.20	Raphoe AFA Measures	103
7.4.21	Rathmullan AFA Measures.....	104
7.4.22	Measures with a Benefit - Cost Ratio below Unity	106
7.5	PRIORITISATION OF PROPOSED PROTECTION MEASURES.....	113
7.6	FLOOD RISK MANAGEMENT IN OTHER AREAS	114
7.7	SUMMARY OF PROPOSED MEASURES	114
8	IMPLEMENTATION, MONITORING AND REVIEW OF THE PLAN	118
8.1	IMPLEMENTATION OF THE PLAN	118
8.1.1	River Basin Level Measures.....	118
8.1.2	Catchment and AFA-Level Physical Measures.....	118
8.1.3	Other Catchment and AFA-Level Measures	120
8.1.4	Public and Stakeholder Consultation and Engagement.....	120
8.2	MONITORING OF PROGRESS IN IMPLEMENTATION OF THE PLAN	121
8.3	ENVIRONMENTAL MONITORING.....	121
8.4	REVIEW OF THE PFRA, FLOOD MAPS AND THE PLANS.....	121
	GLOSSARY AND ACRONYMS	125
	REFERENCES	131
	APPENDICES.....	132

1 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

This is the Flood Risk Management Plan (the 'Plan') for the North Western (UoM01) River Basin.

The purpose of the Plan is to set out the strategy, including a set of measures, for the cost-effective and sustainable, long-term management of flood risk in the North Western River Basin, including the areas where the flood risk has been determined as being potentially significant. The Plan includes feasible measures developed through a range of programmes or policy initiatives including:

- Non-structural flood risk prevention and preparedness measures that are applicable nationally, aimed at reducing the impacts of flooding, to implement the recommendations of the Report of the Flood Policy Review Group, 2004¹
- Structural flood protection measures for communities at significant flood risk, aimed at reducing the likelihood and/or degree of flooding, identified through the National Catchment Flood Risk Assessment and Management (CFRAM) Programme

The Plan builds on and supplements the programme of flood protection works completed previously, that are under design and construction at this time or that have been set out through other projects or plans, and the ongoing maintenance of existing drainage and flood relief schemes.

The Objectives and scope of the Plan are set out in Sections 1.4 and 1.5 respectively.

This Plan is one of 29 Plans being published; each setting out the feasible range of flood risk management measures for their respective River Basins. The preparation of these Plans is a central part of the implementation of Government policy on flood risk management (OPW, 2004), and meets Ireland's obligations under the 2007 EU 'Floods' Directive (EU, 2007²). A Strategic Environmental Assessment, and an Appropriate Assessment under the Habitats Directive, have been undertaken as part of the preparation of the Plan.

The Government's National Development Plan 2018-2027 has provided the capital envelope for a prioritised programme of investment for the advancement and implementation of ongoing flood relief projects and the flood protection measures set out within this and the 28 other Plans.

1.2 FLOODING AND FLOOD RISK

Flooding is a natural event that can happen at any time in a wide variety of locations.

Flood **hazard** is the potential threat posed by flooding to people, property, the environment and our cultural heritage. Flooding only presents a **risk** however when people, property, businesses, farms, infrastructure, the environment or our cultural heritage can be potentially impacted or damaged by floods.

Flood risk is the combination of the probability of flood events of different magnitudes and the degree of the potential impact or damage arising from a flood.

¹ Report of the Flood Policy Review Group, OPW, 2004 (www.floodinfo.ie)

² Directive on the assessment and management of flood risks, 2007/60/EC

1.2.1 Types and Causes of Flooding

Flooding can occur from a range of sources, individually or in combination, including:

- Coastal flooding (from the sea or estuaries)
- Fluvial flooding (from rivers or streams)
- Pluvial flooding (from intense rainfall events and overland flow)
- Groundwater flooding (typically from turloughs in Ireland)
- Other sources, such as from water-bearing infrastructure

A description of each of these sources of flooding is provided in Appendix A.

1.2.2 Impacts of Flooding

Flooding can cause damage, loss or harm in a number of ways, including:

- Impacts of people and society, including physical injury, illness, stress and even loss of life
- Damage to property, such as homes and businesses
- Damage to, and loss of service from, Infrastructure (such as water supply or roads)
- Impacts on the environment, such as damage or pollution of habitats
- Damage to our cultural heritage, such as monuments and historic buildings

A description of each of these potential impacts of flooding is provided in Appendix A.

1.2.3 Potential Impacts of Future Change

Climate change is likely to have a considerable impact on flood risk in Ireland, such as through rising mean sea levels, increased wave action and the potential increases in winter rainfall and intense rainfall events. Land use change, for example through new housing and other developments, can also increase potential future flood risk.

1.3 BACKGROUND

1.3.1 Flood Policy and Legislative Background

Flood risk to urban areas in Ireland has been addressed, since the 1995 Amendment to the Arterial Drainage Act (1945), through the use of structural or engineered solutions (flood relief schemes). In line with internationally changing perspectives, the Government adopted a new policy in 2004 that shifted the emphasis in addressing flood risk towards:

- A catchment-based context for managing risk and the identification of solutions to manage existing and potential risks
- More pro-active flood hazard and risk assessment and management, with a view to avoiding or minimising future increases in risk, e.g., from development on floodplains,
- Increased use of non-structural and flood impact mitigation measures

Notwithstanding this shift, engineered solutions to manage existing and potential future risks will continue to form a key component of the overall national flood risk management programme and strategy.

Specific recommendations arising from the policy review included:

- The preparation of flood maps, and,
- The preparation of flood risk management plans.

A further influence on the management of flood risk in Ireland is the EU 'Floods' Directive [2007/60/EC]. The aim of this Directive is to reduce the adverse consequences of flooding on human health, the environment, cultural heritage and economic activity. The 'Floods' Directive was transposed into Irish law by Statutory Instrument SI No. 122 of 2010³ and amended by SI No. 495 of 2015⁴.

Under the 'Floods' Directive, Ireland, along with all other Member States, are required to undertake a Preliminary Flood Risk Assessment (PFRA) to identify areas of potentially significant flood risk (referred to in Ireland as Areas for Further Assessment, or 'AFAs'), and then for these areas to prepare flood maps in relation to the sources of flood risk deemed to be significant. Ireland is then required to prepare Plans for each River Basin, focussed on managing and reducing the risk within the AFAs. The PFRA, flood maps and the Plans need to be reviewed on a 6-yearly cycle.

1.3.2 Competent and Responsible Authorities for the 'Floods' Directive

The Office of Public Works (OPW) was designated following the Government approval of the Report of the Flood Policy Review Group (OPW, 2004) as the lead agency for flood risk management in Ireland. As lead agency, the OPW was designated as the Competent Authority under SI No. 122 of 2010 for the implementation of the Directive.

The following authorities may be designated by the OPW under SI Nos. 122 of 2010 and 495 of 2015 as being responsible for the implementation of key requirements of the EU 'Floods' Directive (Preliminary Flood Risk Assessment, preparation of flood maps, and identification of flood risk management measures) with respect to infrastructure for which they have responsibility:

- All local authorities
- Electricity Supply Board (ESB)
- Waterways Ireland
- Irish Water

1.3.3 The 'CFRAM' Programme

The purpose of the CFRAM Programme is to assess the existing fluvial and coastal flood risk, and the potential increase in risk due to climate change, ongoing development and other pressures that may arise in the future, and develop a Plan setting out a sustainable, long-term strategy to manage this risk. The OPW in conjunction with the CFRAM Study Consultants (the 'Consultants', being RPS for the North Western River Basin), are undertaking the National Catchment-based Flood Risk Assessment and Management (CFRAM) Programme.

The objectives of the CFRAM Programme are to:

- Identify and map the existing and potential future fluvial and coastal flood hazard and flood risk in the Areas for Further Assessment (AFAs),
- Identify viable structural and non-structural options and measures for the effective and sustainable management of flood risk in the AFAs,

³ SI No. 122 of 2010 (<http://www.irishstatutebook.ie/eli/2010/si/122/made/en/pdf>)

⁴ SI No. 495 of 2015 (<http://www.irishstatutebook.ie/eli/2015/si/495/made/en/pdf>)

- Prepare a set of Plans, and associated Strategic Environmental and Habitats Directive (Appropriate) Assessments, that sets out the proposed strategies, measures and actions that should be pursued by the relevant bodies, including the OPW, local authorities and other Stakeholders, to achieve the most cost-effective and sustainable management of existing and potential future flood risk, taking account of environmental plans, objectives and legislative requirements and other statutory plans and requirements.

The CFRAM Programme has been implemented for seven large areas called River Basin Districts (RBDs) that cover the whole country. Each RBD is then divided into a number of River Basins (Units of Management, or 'UoMs'), where one Plan has been prepared for each River Basin. A map of the RBDs and the UoMs is provided in Figure 1.1.

The CFRAM Programme is focused on a number of areas where the risk has been determined through the PFRA to be potentially significant, which are referred to as Areas for Further Assessment, or 'AFAs', and on the sources of flooding within these areas that were determined to be the cause of significant risk.

Further details on the CFRAM Programme can be found on the OPW website: www.floodinfo.ie.

1.3.4 Pilot CFRAM Projects

Following the adoption of the new policy by Government in 2004, the OPW commenced a series of pilot CFRAM Projects to test and develop the approach before rolling-out the Programme nationally. None of the pilot CFRAM projects were located within the North Western River Basin.

1.3.5 Other Relevant Flood Risk Management Projects

The National CFRAM Programme is delivering on the requirements of the Government Policy and the EU 'Floods' Directive for most of the AFAs. In some areas however, other parallel or preceding projects have delivered on these requirements. In relation to this Plan, these projects are:

- Raphoe Flood Relief Scheme

The process undertaken in preparing the flood maps and/or determining suitable flood risk management options under these projects would be generally similar to those undertaken for the CFRAM Programme, and are set out in the project reports available from the relevant project website.

This Plan includes the measures undertaken or proposed through the above Projects, including an update on their current status.

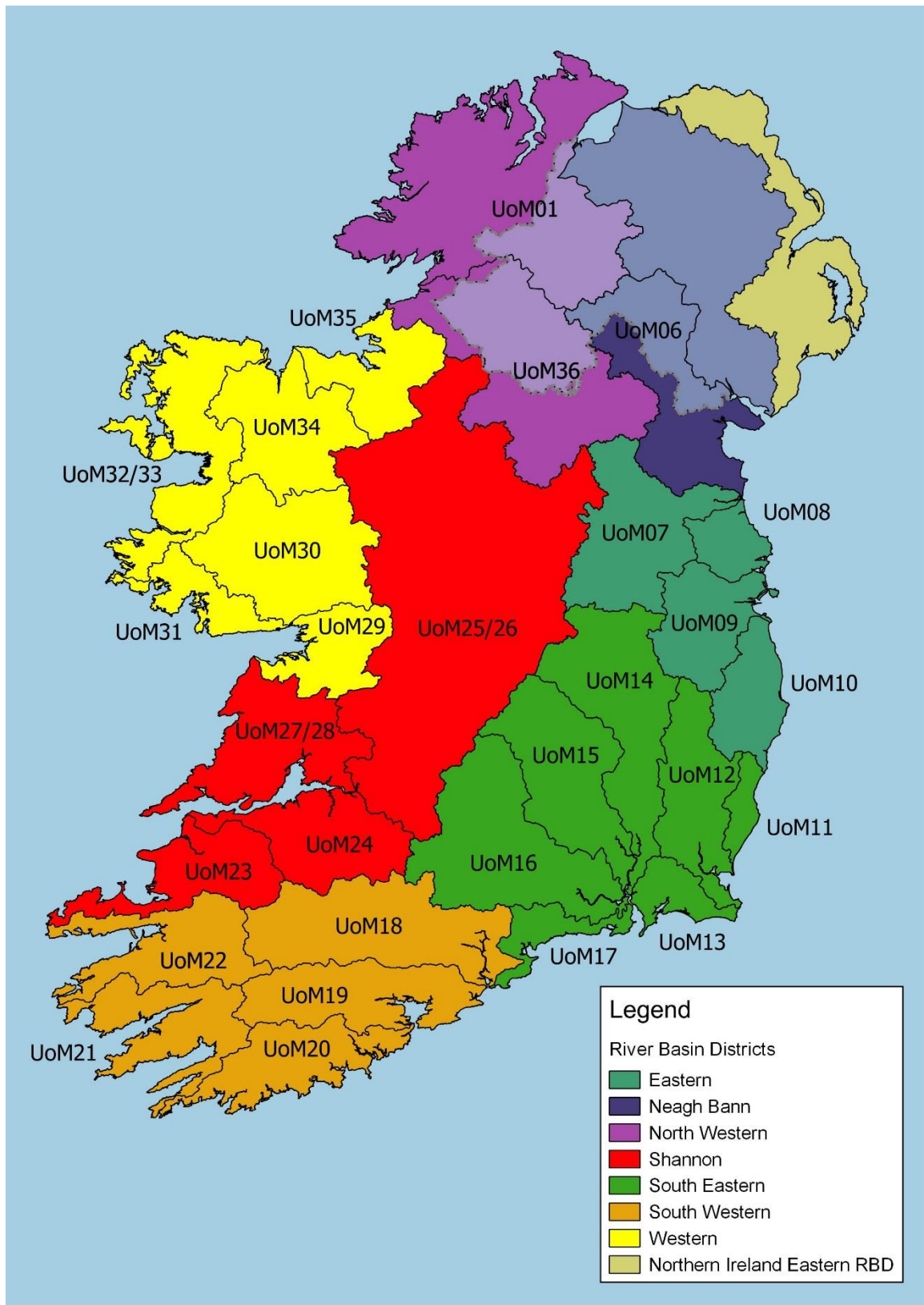


Figure 1.1: River Basin Districts (RBDs) and River Basins (UoMs) in Ireland

1.3.6 Other Relevant Policies and Plans

The 2004 Report of the Flood Policy Review Group and SI Nos. 122 and 495 of 2010 and 2015 respectively are the policy and legislation that directly relate to the preparation of this Plan. However, a wide range of legislation, policies and plans are relevant to, or may be impacted by, this Plan. The relevant legislation, policies and plans (as of June 2017) are listed in Table 1.1.

Table 1.1 **Legislation, Policies and Plans Relevant to the Plan**

Legislation / Policy / Plan	Description
Legislation	
Arterial Drainage Act, 1945, and Amendment Act, 1995	Acts empowering the Commissioners of Public Works to implement Arterial Drainage Schemes (1945) and Flood Relief Schemes (1995), which must then be maintained.
Commissioners of Public Works (Functions and Powers) Act, 1996	Act to make further provision in relation to the functions and powers of the Commissioners of Public Works including in relation to flooding. The Minor Works Programme (to fund local authorities to implement local flood relief schemes) is an administrative scheme operated by the OPW under its general powers and functions to make schemes to address flood risk.
Coast Protection Act, 1963	Act to provide for the making and execution of coast protection schemes and to provide for other matters connected with the matters aforesaid.
Local Government (Works) Act, 1949	Enables local authorities to execute works affording relief or protection from flooding
SI Nos. 122 and 495 of 2010 and 2015	Transposing Instruments for the EU 'Floods' Directive - European Communities (Assessment and Management of Flood Risks) Regulations 2010 & 2015
SI Nos. 722 and 350 of 2003 and 2014,	Transposing Instruments for the EU Water Framework Directive: - European Communities (Water Policy) Regulations, 2003 & 2014
SI Nos. 435 and 200 of 2004 and 2011	Transposing Instruments for the EU Strategic Environmental Assessment Directive: - European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2004 & 2011
SI No. 477 of 2011	Transposing Instruments for the EU Birds and Habitats Directives: - European Communities (Birds and Natural Habitats) Regulations 2011
Planning and Development Act, 2000 (No. 30 of 2000) and associated regulations	Principal Planning Act (and amendments) - Planning and Development Regulations 2001 to 2015 Provides for the adoption of Guidelines under Section 28 Sets out planning requirements for certain flood relief works by local authorities
Climate Action and Low Carbon Development Act, 2015	Provides for the making of a National Adaptation Framework to specify the national strategy for the application of adaptation measures in different sectors and by local authorities to reduce the vulnerability of the State to the negative effects of climate change, including potential increases in flood risk.

Policies	
Report of the Flood Policy Review Group, 2004	Report, approved by Government in September 2004, that sets out recommendations for flood risk management policy in Ireland, including roles and responsibilities.
Guidelines on the Planning System and Flood Risk Management, 2009	Guidelines published under Section 28 of the Planning and Development Acts that provide a transparent and robust framework for the consideration of flood risk in planning and development management.
Major Emergency Management Framework, 2006	Sets out common arrangements and structures for front line public sector emergency management in Ireland to facilitate the co-ordination of the individual response efforts of the Principal Response Agencies to major emergencies.
National Adaptation Framework, 2012 & 2018	Set out Government policy for addressing climate change adaptation in Ireland, focusing on key climate sensitive sectors and mandating certain Government Departments, other public sector bodies and Local Authorities to prepare sectoral and local climate change adaptation plans. A new statutory Framework was introduced in January 2018 under the Climate Action and Low Carbon Development Act, 2015.
Plans	
Climate Change Sectoral Adaptation Plan for Flood Risk Management, 2015	Sets out the policy on climate change adaptation of the OPW, the lead agency for flood risk management in Ireland, based on a current understanding of the potential consequences of climate change for flooding and flood risk in Ireland, and the adaptation actions to be implemented by the OPW and other responsible Departments and agencies in the flood risk management sector. A revised statutory Sectoral Adaptation Plan will be prepared under the 2018 National Adaptation Framework.
National Spatial Strategy, 2002 - 2020	A 20-year coherent national planning framework for Ireland that aims to achieve a better balance of social, economic and physical development across Ireland, supported by more effective and integrated planning.
National Landscape Strategy for Ireland (Draft) 2014 – 2024	Strategy for the provision of a framework for the protection of the many cultural, social, economic and environmental values embedded in the landscape.
River Basin Management Plan, 2010	Plans (RBMPs) prepared under the Water Framework Directive (2000/60/EC) that summarise the waterbodies that may not meet the environmental objectives of the WFD and identify which pressures are contributing to the environmental objectives not being achieved. The plans describe the classification results and identified measures that can be introduced in order to safeguard waters and meet the environmental objectives of the WFD. <ul style="list-style-type: none"> • North Western International River Basin District - River Basin Management Plan: 2009 – 2015 • SEA for the WFD River Basin Management Plans and Programmes of Measures - North Western iRBD (2009) <p>The second cycle (2018-2021) represents a new approach to river basin management planning. Ireland is now taking a single river basin district approach with a much improved evidence base to underpin decision making at both national and local level</p> <ul style="list-style-type: none"> • River Basin Management Plan for Ireland (2018-2021) (Draft) • SEA for the Draft River Basin Management Plan for Ireland (2018-2021)

Regional Planning Guidelines	<p>Planning strategies at the regional level to provide the link between the national and local planning frameworks, which work within the overall approach taken in the NSS, while providing more detail and establishing a development and spatial framework that can be used to strengthen local authority development plans and other planning strategies at county, city and local level.</p> <ul style="list-style-type: none"> Regional Planning Guidelines for the Northern and Western 2010-2022, (Regional Planning Guidelines Office, 2010)
Development Plans	<p>The development plan sets the agenda for the development of the local authority's area over its six year lifespan. Development, whether it be residential, industrial, commercial or amenity, must generally take place in accordance with the development plan. The plan is therefore a blueprint for the economic and social development of the city, town or county for which it has been made.</p> <ul style="list-style-type: none"> County Donegal Development Plan 2014-2018 (Donegal County Council, 2012) Newtowncunningham Development Plan Map 2007-2013 (Donegal County Council, 2008) Buncrana and Environs Development Plan 2008-2014 Bundoran and Environs Development Plan 2009- 2015 County Donegal Development Plan 2012-2018 Letterkenny and Environs Development Plan 2009-2015
Local Areas Plans	<p>Local Area Plans provide more detailed planning policies at a local level for either urban areas or wider urban and rural areas where significant development and change is anticipated.</p> <ul style="list-style-type: none"> Ballyshannon & Environs Local Area Plan 2009-2015 (Donegal County Council, 2009) Killybegs Local Area Plan 2008-2014 (Donegal County Council, 2008) Lifford Local Area Plan 2007-2013 (Donegal County Council, 2007)
Other Spatial / Development Plans for the North Western River Basin	<ul style="list-style-type: none"> Landscape Character Assessment Mapping Donegal (Donegal County Council, 2014) The Donegal Local Economic & Community Plan 2016 – 2022 (Donegal County Council, 2015) County Donegal Groundwater Protection Scheme (GIS, 2005) County Donegal Heritage Plan 2014-2019 (Donegal County Council, 2015) Housing Strategy Donegal (Appendix 1) 2014-2020 (Donegal County Council, 2013) Clady Freshwater Pearl Mussel Sub-Basin Management Plan (DEHLG, 2010) Eske Freshwater Pearl Mussel Sub-Basin Management Plan (DEHLG, 2010) Glaskeelan Freshwater Pearl Mussel Sub-Basin Management Plan (DEHLG, 2010) Leannan Freshwater Pearl Mussel Sub-Basin Management Plan (DEHLG, 2010) Owencarrow Freshwater Pearl Mussel Sub-Basin Management Plan (DEHLG, 2010) Ownea Freshwater Pearl Mussel Sub-Basin Management Plan (DEHLG, 2010)

1.4 FLOOD RISK MANAGEMENT OBJECTIVES

1.4.1 Overview

The Flood Risk Management Objectives set out the goals the Plan is aiming to achieve. They have a key role in the preparation of the Plan, and the identification of appropriate measures, as the options that are available to manage flood risk within a given area are appraised against these Objectives to determine how well each option contributes towards meeting the defined goals. Establishing such Objectives is also a requirement of the EU 'Floods' Directive [Art. 7(2)].

The Flood Risk Management Objectives are aimed at considering potential benefits and impacts across a broad range of sectors including human health, the environment, cultural heritage and economic activity. The Flood Risk Management Objectives are well aligned with the objectives defined for the Strategic Environmental Assessment (see Section 6.3), as both are aimed at defining sustainable measures providing benefits to a wide range of sectors.

1.4.2 Definition of the Flood Risk Management Objectives

A set of Flood Risk Management Objectives was developed and applied through the Pilot CFRAM Studies, with stakeholder consultation to ensure the Objectives set were appropriate. In commencing the National CFRAM Programme, the Objectives developed for the Pilot Studies were reviewed and refined. The OPW considered it appropriate to publicly consult on the proposed Objectives, and launched a public consultation in October 2014. Seventy one submissions were received which informed amendments then made to define the final Objectives. The final set of Objectives are set out in Table 1.2.

Sets of Objectives, similar to those adopted for the National CFRAM Programme, have also been adopted for other flood relief scheme projects undertaken in parallel to the CFRAM Programme. Details of these are set out in the relevant project reports (Section 1.3.5).

The purpose of the Global Weightings referred to in Table 1.2 is set out in Section 7.3.4.

Table 1.2 *Flood Risk Management Objectives and Global Weightings for the National CFRAM Programme*

CRITERIA		OBJECTIVE		SUB-OBJECTIVE		GLOBAL WEIGHTING
1	Social	a	Minimise risk to human health and life	i)	Minimise risk to human health and life of residents	27
				ii)	Minimise risk to high vulnerability properties	17
		b	Minimise risk to community	i)	Minimise risk to social infrastructure and amenity	9
				ii)	Minimise risk to local employment	7
2	Economic	a	Minimise economic risk	i)	Minimise economic risk	24
		b	Minimise risk to transport infrastructure	i)	Minimise risk to transport infrastructure	10
		c	Minimise risk to utility infrastructure	i)	Minimise risk to utility infrastructure	14
		d	Minimise risk to agriculture	i)	Minimise risk to agriculture	12
3	Environmental	a	Support the objectives of the WFD	i)	Provide no impediment to the achievement of water body objectives and, if possible, contribute to the achievement of water body objectives.	16
		b	Support the objectives of the Habitats Directive	i)	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping stones.	10
		c	Avoid damage to, and where possible enhance, the flora and fauna of the catchment	i)	Avoid damage to or loss of, and where possible enhance, nature conservation sites and protected species or other known species of conservation concern.	5
		d	Protect, and where possible enhance, fisheries resource within the catchment	i)	Maintain existing, and where possible create new, fisheries habitat including the maintenance or improvement of conditions that allow upstream migration for fish species.	13

CRITERIA		OBJECTIVE		SUB-OBJECTIVE		GLOBAL WEIGHTING
3	Environmental (Continued)	e	Protect, and where possible enhance, landscape character and visual amenity within the river corridor	i)	Protect, and where possible enhance, visual amenity, landscape protection zones and views into / from designated scenic areas within the river corridor.	8
		f	Avoid damage to or loss of features, institutions and collections of cultural heritage importance and their setting	i)	Avoid damage to or loss of features, institutions and collections of architectural value and their setting.	4
				ii)	Avoid damage to or loss of features, institutions and collections of archaeological value and their setting.	4
4	Technical	a	Ensure flood risk management options are operationally robust	i)	Ensure flood risk management options are operationally robust	20
		b	Minimise health and safety risks associated with the construction, operation and maintenance of flood risk management options	i)	Minimise health and safety risks associated with the construction, operation and maintenance of flood risk management options	20
		c	Ensure flood risk management options are adaptable to future flood risk, and the potential impacts of climate change	i)	Ensure flood risk management options are adaptable to future flood risk, and the potential impacts of climate change	20

1.5 SCOPE OF THE PLAN

This Plan sets out a sustainable, long-term strategy to manage the flood risk within the North Western River Basin, focused on the areas of potentially significant flood risk (AFAs), and the sources of flooding giving rise to that risk.

1.5.1 Spatial Scope of the Plan

The Plan is focussed on the areas, the 'AFAs', where the risk was determined through the PFRA as being potentially significant. There are 300 AFAs, which are typically communities (villages, towns and cities) where the flood risk is concentrated, throughout the country. The areas covered by this Plan are set out in Section 3.2 (Table 3.1).

Some flood risk mitigation measures developed for the AFAs will have benefits for other areas, and so areas outside of the AFAs may also benefit from the proposed specific measures set out in the Plan.

While the Plan does not include locally specific flood protection measures to address the flood risk in areas outside of the AFAs, it does set out the range of policies and measures, which are in place or under development, that can contribute to the reduction and management of flood risk throughout the River Basin, including areas outside of the AFAs, such as spatial planning, emergency response planning and maintenance of drainage schemes.

1.5.2 Sources of Flooding Addressed in the Plan

The Plan for the North Western River Basin addresses fluvial, coastal and pluvial flooding in one or more communities (AFAs), as these sources were determined through the PFRA to be potentially significant in one or more communities within the area covered by the North Western River Basin Plan. The sources of flooding addressed for each of the AFAs are indicated in Table 3.1.

Other sources of flood risk within these communities, which were not deemed to have been significant for those communities within the scope of the PFRA, have not been specifically addressed (i.e., through locally specific flood protection measures). The Plan does however set out a range of policies and measures that can contribute to the reduction and management of flood risk for all sources of flood risk throughout the River Basin, including areas outside of these communities, such as spatial planning, emergency response planning and maintenance of drainage schemes.

1.5.3 Level of Detail of the Plan

The Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment, which has involved detailed modelling and appraisal of possible options for managing and reducing flood risk, including environmental assessment to the degree of detail appropriate for the Plan.

The observations and views submitted as part of the consultation on the Draft Plan (See Section 4.4.6) have been reviewed and taken into account in the preparation of this Plan.

It should be noted that the flood relief works or 'Schemes' set out in the Plans that have been developed through the CFRAM Programme are to an outline design, and are not at this point ready for construction. Further detailed design through a project-level of assessment will be required for such works before implementation, along with project-level environmental assessment and appraisal (including the consideration of alternatives), further public and stakeholder consultation and engagement and a statutory planning process such as

planning permission or public exhibition and confirmation (Ministerial approval), where relevant. Local information that cannot be captured at the Plan-level of assessment, such as ground investigation results and project-level environmental assessments, may give rise at that stage to some amendment of the proposed works to ensure that they are fully adapted, developed and appropriate within the local context, and that they are compliant with environmental legislation.

The works set out in the Plan may therefore be subject to some amendment prior to implementation.

1.6 STRUCTURE OF THE PLAN

The structure of the Plan is set out below.

Flood Risk Management Plan

Section 1	Provides an introduction and background to the Plan, including the flood risk management Objectives the Plan is aiming to achieve, and sets out the scope of the Plan
Section 2	Provides an overview of the catchment and coastal areas covered by the Plan, including a summary of the flood history and existing flood risk management measures
Section 3	Describes the PFRA undertaken to identify the AFAs that are the focus of this Plan
Section 4	Outlines the public and stakeholder consultation and engagement undertaken throughout the National CFRAM Programme and other relevant projects.
Section 5	Details the existing and potential future flood hazard and risk in areas covered by the Plan
Section 6	Describes the environmental assessments undertaken to ensure that the Plan complies with relevant environmental legislation and inform the process of identifying the suitable strategies that will, where possible, enhance the environment
Section 7	Sets out the measures to manage the flood risk in the area covered by the Plan, and how these were developed and assessed, and provides a summary of the measures proposed in the Plan
Section 8	Outlines how the implementation of the Plan will be monitored and reported, and then reviewed and updated at regular intervals
APPENDIX A	Provides an overview of flooding and flood risk
APPENDIX B	Describes in more detail a physical overview of the River Basin
APPENDIX C	Summarises the process in undertaking the Preliminary Flood Risk Assessment
APPENDIX D	Provides details on certain aspects of the stakeholder and public engagement and consultation
APPENDIX E	Sets out the flood risk in each AFA
APPENDIX F	Provides a summary of the different methods of flood risk management
APPENDIX G	Describes the potential flood risk management works

Strategic Environmental Assessment Statement

Natura Impact Statement

The flood maps that have informed and form part of this Plan are available from the OPW website: www.floodinfo.ie.

2 OVERVIEW OF THE RIVER BASIN

2.1 THE NORTH WESTERN RIVER BASIN

The North Western River Basin District (RBD) is transboundary and is therefore classified as an International River Basin District (IRBD).

The North Western IRBD covers an area of 12,320 km² with approximately 7,400 km² of that area in Ireland. It includes two Units of Management; UoM01 (North Western) and UoM36 (Erne). The North Western River Basin includes hydrometric areas 01, 37, 38, 39 and 40. It covers an area of 4,610 km² within Ireland.

This plan covers only the portion of the North Western River Basin within Ireland which includes the majority of County Donegal.

The North Western River Basin is predominantly rural with the largest urban areas being Letterkenny and Donegal town. Smaller towns and villages include Buncrana and Lifford.

The lower lying fertile soils of the North Western River Basin are capable of supporting intensive agriculture. However, much of the North Western River Basin is mountainous with coniferous forest plantations and some sheep and cattle grazing. The spectacular coastline, the surfing beaches and the remote beauty spots attract many tourists.

2.2 TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER

The topography of the North Western River Basin shows an elevated plateau in central County Donegal with drainage radiating outward, towards the extensive coastline, where many of the settlements are located, or to Foyle system, via the River Finn.

The geology of the study area consists of banded semi-pelitic and psammitic schist that make up over 15% of the bedrock in the North Western River Basin. Other significant rocks in County Donegal include coarse biotite granite and granodiorite, and whitish quartzite with pebble beds stretching inland from the west coast at Malin bay and Loughros Beg bay. A large formation of schist and grit with thin marble units, and a smaller formation of marble, quartzite, psammite and graphitic sit between the south-east shoreline of Lough Swilly and the Northern Irish border.

Most of County Donegal has bedrock and aquifers that are generally unproductive.

Blanket peat covers significant parts of County Donegal. The most predominant soil types in the North Western River Basin are deep poorly drained minerals derived from mainly non-calcareous parent materials including surface water, and ground water gleys.

Further details on the topography, geology, soils and groundwater in the North Western River Basin is provided in Appendix B.

Table 2.1 **Zoned Lands within Key Urban Areas in the North Western River Basin**

NAME	AREA ZONED (km ²)	PLAN DATE
Ardara	0.46	07/05/12 – 07/04/18
Ballybofey & Stranorlar	13.46	07/05/12 – 07/04/18
Bridge End	0.75	07/05/12 – 07/04/18
Bunbeg-Derrybeg	1.64	07/05/12 – 07/04/18
Buncrana	10.66	24/06/13 – 27/04/14
Burnfoot	0.37	07/05/12 – 07/04/18
Cardonagh	1.61	07/05/12 – 07/04/18
Castlefinn	0.47	07/05/12 – 07/04/18
Clonmany	0.26	07/05/12 – 07/04/18
Convoy	0.93	07/05/12 – 07/04/18
Donegal Town	10.65	07/05/12 – 07/04/18
Downings	0.43	07/05/12 – 07/04/18
Dunfanaghy	0.58	07/05/12 – 07/04/18
Dungloe	1.17	07/05/12 – 07/04/18
Glenties	0.51	07/05/12 – 07/04/18
Kerrykeel	0.41	07/05/12 – 07/04/18
Killybegs	2.45	05/03/08 – 04/03/14
Killygordan	0.46	07/05/12 – 07/04/18
Letterkenny	24.7	24/06/13 – 25/10/15
Lifford	2.21	07/05/12 – 07/04/18
Malin	0.34	07/05/12 – 07/04/18
Moville	1.07	07/05/12 – 07/04/18
Newtown Cunningham	0.76	07/05/12 – 07/04/18
Rameltown	0.52	07/05/12 – 07/04/18
Raphoe	0.67	07/05/12 – 07/04/18
Rathmullan	0.78	07/05/12 – 07/04/18

2.3 LAND USE AND LAND MANAGEMENT

The 2011 census data held by the Central Statistics Office (CSO, 2011) show a total population of 253,675 in the North Western RBD. The North Western RBD has a low average population density. Less than 2% of the land is urbanised and many people live in small villages or single dwellings. Most of the main urban areas are located beside rivers – Ballybofey, Cavan, Donegal Town and Letterkenny. Population has increased in County Donegal by around 9% since the previous census in 2006.

The North Western River Basin is essentially rural, dominated by peat bogs, with pockets of forest in western upland areas and pasture to the east. There are also significant areas of moors and heathland. Land cover is dominated by agricultural pastureland, with urban areas making up a very small proportion of the North Western River Basin.

While it is unlikely that the general pattern of land use will be substantially changed in the future, increases in population can pose development pressures resulting in changes in land

use. The 2011 census shows a dramatic increase in urban population of over 10% from the 2006 census.

The areas of land zoned for further development, under extant development plans, in the key urban areas within the North Western River Basin are summarised in Table 2.1.

Further details on land use and land use management in the North Western River Basin is provided in Appendix B.

2.4 HYDROLOGY

The principal Irish river system in the North Western River Basin is the Foyle River (which flows northwards from the confluence of the rivers Finn and Mourne at Lifford and Strabane towns).

The Foyle forms the international border between Ireland and Northern Ireland, draining the Finn, Deelee and Skeoge tributaries, discharging into Lough Foyle.

In addition to the Foyle River system, there are numerous rivers and streams discharging to the estuaries and coastal waters all around the Donegal coastline including the Leannan, Owenea and Owencarrow rivers.

Within the North Western River Basin the OPW has implemented and maintains the following Arterial Drainage Schemes: Deelee, Swillyburn, Foyle Embankment, Abbey, Blanket Nook Embankment, Cloonburn, Swilly Embankment, also Thorn, Big Isle and Oldtown/ Newmills (Extensions to Swilly Embankment Drainage Scheme) and Skeoge & Burnfoot. These Schemes were undertaken by the OPW under the 1945 Arterial Drainage Act. The OPW continues to have statutory responsibility for inspection and maintenance of the Schemes, which includes a number of channels and designated tributaries. The primary focus of arterial drainage schemes is not for flood relief but for the improvement of agricultural land.

Drainage Districts represent areas where the Local Authorities have responsibilities to maintain watercourse channels and therefore contribute to maintaining the existing regime. In relation to the four Drainage Districts located within the North Western River Basin, none are located directly on the key watercourses where fluvial and coastal flood risk is being investigated.

Hydrometric data is available at 33 hydrometric gauge station locations within the North Western River Basin. Only six stations which are located on watercourses to be modelled have data available and three of these have sufficient confidence in their ratings at flood flows such that they could be used in the hydrological analysis at flood flows.

Meteorological data is available from a number of Met Éireann, NRA and UK Met Office daily, sub-daily and hourly rain gauges within the NWNB CFRAM study area and beyond. The only location at which hourly rain gauge data is available within the North Western River Basin is at Malin Head although gauge data was also made available for the Met Office hourly station just outside of the river basin at Castlederg.

Full details of the methodology, datasets used and outcomes of the hydrological analysis for the NWNB CFRAM study area can be found at www.floodinfo.ie.

Further details on the hydrology of the North Western River Basin is provided in Appendix B.

2.5 FLOOD HISTORY

Based on a review of the information outlined above, the historical flood events which occurred in the various AFAs in the North Western River Basin are summarised in Table 2.2.

The majority of the flood history data collection results yielded from searches on the OPW National Flood Hazard Mapping website related to floods which had occurred pre-2005. A desk study was carried out for information on the more recent flood events to supplement the records for each AFA in the North Western River Basin. During the Study information was brought forward by local authorities, particularly in relation to events which occurred in the intervening period between the flood event analysis and verification of the hydraulic modelling some of these events occurred outside the key urban areas and provide valuable information on local, flood related, issues. Information on flood events that occurred during the Study was also collected through Flood Event Response and there are further reports for Kilmacrenan, Trentagh, Corkey Manor, Bucht Road and the causeway at Roy Island, but there is limited information available on these localised events. Details of the more widely reported events are summarised below.

Flood Event of December 2015 – On the 5th to the 7th December 2015, three few weeks after flooding which occurred in November 2015 there was again severe flooding reported along the Finn valley affecting the Ballybofey & Stranorlar, Castlefinn and Lifford AFAs. At Stranorlar the River Finn backed up along a tributary causing flooding to two mobile classrooms and a boiler room at St. Mary's National School. At the option development public consultation day attendees also reported flooding to the rear of the Villa Rose and to the basement of the boxing club on Chestnut Road in Ballybofey. In Castlefinn the CPI centre was again flooded by the River Finn but this time to a depth of approximately 1.06m causing damage to the health centre, crèche and other business located within the CPI centre. McGlynn's restaurant and a mechanics garage on the main road as well as two residential properties were also reported to have flooded. In Lifford the area along the Roughan Road was flooded due to elevated water levels in the River Foyle overtopping the embankments adjacent to the Foyle and along the lower Deelee reaches. It is estimated that four residential properties, six commercial properties as well as an IT server room belonging to the council were affected by flooding.

Flood Event of November 2015 – Widespread flooding across Donegal was reported on the 15th and 16th of November 2015 following prolonged and persistent heavy rainfall. At Ballybofey a wall adjacent to the River Finn collapsed under the weight of floodwater leading to the flooding of Jackson's Hotel car park. At Castlefinn the ground floor of the CPI centre was flooded to a depth of 0.3m due to elevated water levels in the River Finn. In Burnfoot the river overtopped its banks upstream of the R238 road bridge affecting seven residential and two commercial properties. In Donegal Town the River Eske overtopped its banks leading to flooding of 11 residential properties. In Letterkenny the River Swilly overtopped its banks at Ballymacool. This led to flooding at the Aura Leisure centre as well as approximately 200m of the R250. At Rathmullan a combination of heavy rain and high coastal water levels led to some road flooding on the previous day (14th).

Table 2.2: Summary of Historical Flood Events for each AFA

Event	Ardara	Ballybofey/ Ballyvaughan	Bridge End	Bunbeg- Ballyvaughan	Buncrana	Burnfoot	Carndonagh	Kerrykeel	Castlefinn	Clonmany	Convoy	Donegal	Downings	Dunfanaghy	Dungloe	Glenties	Killybegs	Killygordon	Letterkenny	Lifford	Malin	Moville	Newtown Cunningham	Ramelton	Raphoe	Rathmullan
Dec-2015		■							■											■						
Nov-2015		■				■			■			■							■							■
Aug-2014																			■					■		
Jun-2014								■																		
Jul-2013								Recurring											■							
29 Jan-12											■		■						■							
4 Jan-12	■	■														■	■		■	■						
30 Dec-11												■				■			■	■				■		
14 Dec-11		■									■				■	■			■	■						
28 Nov-11												■	■						■				■			
3 Nov-11													■						■							
Oct-2011	■	■	■		■				■			■	■			■		■	■	■				■		
Nov-2009									■											■						
Aug-2009																										
Jun-2009				■																						
Jun-2007																									■	
Sep-2006																								■		
Oct-2005							■																			

Event	Ardara	Ballybofey/ Castlerea	Bridge End	Bunbeg- Ballyvaughan	Buncrana	Burnfoot	Carndonagh	Kerrykeel	Castlefinn	Clonmany	Convoy	Donegal	Downings	Dunfanaghy	Dungloe	Glenties	Killybegs	Killygordon	Letterkenny	Lifford	Malin	Moville	Newtown Cunningham	Ramelton	Raphoe	Rathmullan				
Jan-2005		■																												
Oct-2000																								■						
May-2000	■																													
Dec-1999																									■					
Jan-1999			■																											
Aug-1998																			■					■		■				
Feb-1990																			■											
Oct-1989		■		■	■				■						■	■		■	■	■										
Oct-1987									■									■												
Sep-1985		■	■		■				■		■	■			■				■	■										
Aug-1970		■																												
Oct-1965		■																												
Oct-1961																											■			
Oct-1954	■						■																							
1947	■																													
Oct-1886																			■					■						
Aug-1880				■																										
Oct-1870					■	■																								
1828																						■								

Flood Event of June 2014 – Flooding occurred in Kerrykeel on 10th June 2014. A flood event response report describes how a stretch of Kerrykeel River, which is culverted under a bridge constructed to access the local sports ground, overflowed after short-term heavy rainfall, supplemented by heavy rainfall earlier in the afternoon in the surrounding high grounds. 4 no. culverts run under the bridge in question which quickly became blocked with debris and flood wrack forcing the water to divert up and over the bridge, and subsequently directed through nearby housing estates. Highland Radio reported that a sports complex and several residential homes located within two estates suffered severe water damage, forcing residents to evacuate their homes. Approximately 4 residential homes, 3 holiday homes and a local sports ground was affected during the flood event.

Flood Event of August 2014 – Flooding occurred in Letterkenny on 5th August 2014. A flood event response report describes how the insufficient capacity of a 450mm pipe running East-West which led to a man-hole surcharge. White-water gushed over the bank onto the hospital's approach road to the building. Minor flooding of approx 25mm occurred at entrance to Emergency Department but temporary defences kept flood water from entering the building. The switch room and boiler room experienced minor flooding however no damages occurred. Drainage within the site was backed up. The Irish Independent also reported that flooding in surrounding area, including the Glenwood and Beechwood areas. This flood event occurred a year after more than €25 million of damage was caused in another flood.

Flooding also occurred in Ramelton on 5th August 2014. A flood event response describes how a property in Castleshanaghan that flooded was affected by the overtopping of a small stream in the vicinity which exceeded its capacity. In Glen Upper, Ramelton, the flood source was pluvial. The drain immediately outside the affected property was unable to dispose of surface waters from the road. At Pound Street it was described how the bridge became blocked with debris and backed up eventually overtopping its banks and walls. The community centre in Pound Street, Ramelton was flooded during children's band practice, the children were lifted to safety by the local people. Electrics within houses were affected however electricity supply was not affected.

Flood Event 7th September 2013 - It was reported by residents of Dunfanaghy that flooding occurred along Pound Street and within the vicinity of Portdale Cottages on the 7th September 2013. This area is drained by a pipe which discharges to the sea; however this pipe was unable to adequately drain the area during this flood event. This particular flooding incident has been attributed to pluvial flood mechanism, which is outside the scope of the CFRAMS remit.

Flood Event of July 2013 - A flood event response report and newspaper articles detail flooding which occurred at Letterkenny General Hospital on the 26th July 2013. It was reported that a tributary of the River Swilly (the Glencar River) overflowed following short-term (<1hour) and intense heavy rainfall. The major contributing factor of this flooding was the blocking of two trash screen grilles covering a culvert inlet just upstream of the Letterkenny General Hospital. These culvert blockages lead to the Glencar River to overflow through the hospital carpark, hospital grounds and into the hospital building, affecting the newly constructed Accident and Emergency ward. The maximum flood depth was recorded at 0.91m and typical depth at 0.5m. Circular Road, High Road and Glencar Road were also affected, as well as residential properties situated within Glenwood Park. The commercial property, Glencar Service Station was also affected by the occurrence of this flood event. During this event, the rural village of Ballindrait located to the north west of Lifford was also affected. The R264 leading to the village was flooded as well as 3 residential and 1 commercial property.

Flood Event 18th May 2013 - During May 2013, following an intense rainfall event, Dunfanaghy, particularly Chapel Street was flooded. The presence of several restrictive structures contributed to flooding. Also, during this flood event, 6 residential properties located within Burnfoot, Pairc an Grainan estate and a WWTP were affected.

Flood Event of October 2011 - Information was found during the historical review which indicated that flooding occurred in Ardara, Ballybofey/Stranorlar, Bridge End, Buncrana, Castlefinn, Donegal, Downings, Glenties, Killygordon, Letterkenny, Lifford, Moville and Ramelton in October 2011. It was reported on www.donegaldaily.com that more than 40mm of rain fell across the county on 23rd October. In Bridge End, it was reported (on www.donegaldaily.com) that house evacuations were necessary. An estate at Bonemaine in Bridge End was flooded after large quantities of water flowed into the estate following twelve hours of heavy rain (www.inishowennews.com). Anecdotal information from www.boards.ie reported that the road from Castlefinn to Ballybofey was badly flooded. It was reported on this website that, at some parts, the side of road adjacent to the River Finn looked like it had partly collapsed. Castlefinn, Killygordon and Ballybofey were flooded, and pubs and houses there were badly affected. In Downings, pictures were available from www.donegaldaily.com showing flooding of roads, streets, gardens and a caravan park. Atlantic Drive was closed due to floods. In Letterkenny, a website (www.donegalnow.com) reported that the heavy rain resulted in intense flooding around the Dry Arch and Ballyraine areas. Floodwaters were reported to be gushing over the Dry Arch roundabout. Anecdotal information from www.boards.ie indicated that flooding outside Mount Errigal Hotel in Letterkenny. The road was passable on the opposite side to the hotel, while on the hotel side, the water level was reported to be up to car lights. There were reports on www.donegaldaily.com of flooding and house evacuations in Lifford. No detailed information was available on the extents of the flooding in the other areas mentioned above, as it was only reported that general flooding of roads occurred in these areas.

Flood Event of 14th December 2011 - Information was found during the internet search detailing how flooding occurred in Ballybofey/Stranorlar, Convoy, Dungloe, Glenties, Letterkenny and Lifford on 14th December 2011 following heavy rain, which subsequently led to many roads becoming impassable. A website (www.donegalnow.com) described how stretches of the road between Ballybofey and Glenfin, Stranorlar and Lifford were seriously flooded, with additional reports of bad flooding between Glenties and Dungloe. Other areas reporting flooding problems were Kilross to Stranorlar. In Ballybofey/Stranorlar, it was reported (www.donegaldemocrat.ie) that the Finn overflowed at Navenny behind Finn Park and almost reached the top of the Dreenan Bridge. The same website reported that, in Convoy, the cellar of a pub, Mannie's Bar, was flooded with more than 300mm of water. According to the owner of the pub, flood water from local housing estates flowed past his pub and the system was unable to cope with the deluge during this event. In the Letterkenny area, there was serious flooding at Glenwood Park, Bonagee, Ballyraine, Conwal and Ballymacool. There were also reports of bad flooding between Lifford and Letterkenny. Council staff helped out with the sandbagging of some areas. There were serious traffic delays in the Dry Arch area of Letterkenny due to part of the dual carriageway being blocked due to flooding - and hundreds of people were late for work (www.donegalnow.com). Another website (www.donegaldemocrat.ie) told of how commuters faced long delays in and around Letterkenny as the Ballyraine Road by the Mount Errigal Hotel and the main Glenties Road out of Letterkenny were closed. In the Conwal area of Letterkenny, the River Swilly burst its banks leaving local families stuck in their homes. A number of houses on Lower Ard O'Donnell were flooded also. The Lifford area was also affected with floods. In addition to the reports of bad flooding between Lifford and Letterkenny and between Stranorlar and Lifford as mentioned previously, thousands of acres of land were submerged and livestock, mainly sheep, were washed away when river banks burst between Fintown and Lifford (www.donegaldemocrat.ie).

Pluvial Flood Events of 2006 and 2007 – Whilst Raphoe town has flooded repeatedly over the last 30 years most major events have occurred in the recent past:

- 24th September 2006
- 12th June 2007

It is understood that the source of these and other flood events in the town are due to intense convective rainfall. The topography of Raphoe and the surrounding hills means that surface water is quickly conveyed towards the town with little chance of infiltration or loss to the drainage network. The accumulation of overland flow within the town results in pluvial flooding. In addition, the watercourse that runs through the town may present a fluvial flood risk since it is culverted in several places and has associated conveyance capacity issues.

Minor flood relief works have been undertaken in 2006 and 2007 by Donegal County Council including roadside drains and debris clearance from culverted and open sections of the watercourse although flood risk remains which needs to be addressed.

Information on the above past floods, such as flood flows, levels, depths, extents and mechanisms, has been used as appropriate in the CFRAM Programme to inform the preparation of the flood maps and Plans, where such information has been available at the relevant stage of the Programme and has been considered adequately reliable.

2.6 EXISTING FLOOD RISK MANAGEMENT MEASURES

2.6.1 Raphoe Flood Relief Scheme

A Flood Risk Assessment and Management Study for Raphoe was commissioned by OPW in March 2013. Raphoe experienced flooding in the past from a combination of fluvial and pluvial flooding, most notably in September 2006 and June 2007. The Raphoe Scheme is expected to proceed to Outline Design with the appointment of Engineering and Environmental Consultants to take the Preferred Raphoe Flood Relief Scheme through to exhibition, and following Confirmation through the Department of Expenditure and Reform, on to project-level assessment and construction. Timelines will be set following appointment of the Consultants.

2.6.2 Arterial Drainage Schemes and Drainage Districts

The following Arterial Drainage Schemes and Drainage Districts have been completed, and are maintained by the OPW or local authority respectively, in the North Western River Basin.

- Deelee ADS: OPW
 - Years of Works (1957-1961)
 - Length of Channel (33 Km)
 - Length of Embankment (7km)
 - Benefitting Area (13.93 Km²)
- Swillyburn ADS: OPW
 - Years of Works (1957-1961)
 - Length of Channel (56Km)
 - Length of Embankment (19Km)
 - Benefitting Area (0) Included with Deelee Drainage Scheme
- Foyle Embankment ADS: OPW
 - Years of Works (1957-1961)
 - Length of Channel (7Km)
 - Length of Embankment (17km)
 - Benefitting Area (0) Included with Deelee Drainage Scheme
- Abbey ADS: OPW

- Years of Works (1964-1967)
 - Length of Channel (34 Km)
 - Length of Embankment (7Km)
 - Benefitting Area (3.66 Km²)
- Blanket Nook Embankment ADS: OPW
 - Years of Works (1965-1968)
 - Length of Channel (24Km)
 - Length of Embankment (13Km)
 - Benefitting Area (3.97 Km²)
- Cloonburn Drainage ADS: OPW
 - Years of Works (1967-1968)
 - Length of Channel (21Km)
 - Length of Embankment (0Km)
 - Benefitting Area (1.7 Km²)
- Swilly Embankment ADS: OPW
 - Years of Works (1961-1968)
 - Length of Channel (24 Km)
 - Length of Embankment (18Km)
 - Benefitting Area (3.92 Km²)
- Thorn (Extension to the Swilly Embankment ADS): OPW
 - Years of Works (1965)
 - Length of Channel (2 Km)
 - Length of Embankment (3Km)
 - Benefitting Area (1.01 Km²)
- Big Isle (Extension to the Swilly Embankment ADS): OPW
 - Years of Works (1964-1965)
 - Length of Channel (17 Km)
 - Length of Embankment (14Km)
 - Benefitting Area (2.77 Km²)
- Oldtown/Newmills (Extension to the Swilly Embankment ADS): OPW
 - Years of Works (1964-1966)
 - Length of Channel (19 Km)
 - Length of Embankment (13 Km)
 - Benefitting Area (1.5 Km²)
- Skeoge & Burnfoot ADS: OPW
 - Years of Works (1968-1970)
 - Length of Channel (10 Km)
 - Length of Embankment (5Km)
 - Benefitting Area (1.62 Km²)
- Carrigans DD: Donegal CoCo
- Carrowcannon (Rayriver) DD: Donegal CoCo
- Portsalon & Duntinny DD: Donegal CoCo
- Ballasallagh (Ray River) DD: Donegal CoCo

2.6.3 Minor Works

The Minor Flood Mitigation Works and Coastal Protection Scheme (the 'Minor Works Scheme') is an administrative scheme introduced in 2009 and operated by the OPW under its general powers and functions to provide funding to local authorities to enable the local authorities, to address qualifying local flood problems with local solutions.

Under the scheme, applications from local authorities are considered for projects that are estimated to cost up to €750,000 in each instance. Funding of up to 90% of the cost is available for approved projects, with the balance being funded by the local authority concerned. Local authorities submit funding applications in the prescribed format, which are

then assessed by the OPW having regard to the specific technical, economic, social and environmental criteria of the scheme, including a cost benefit assessment. With regard to the latter, proposals must meet a minimum benefit to cost ratio of 1.35 or 1.5 : 1 (depending on cost) in order to qualify. Full details are available on www.opw.ie

By the end of 2017, over 650 applications for flood relief works under the Minor Works Scheme have been approved since the inception of the Scheme in 2009. Details of the Scheme and works for which funding under the Scheme have been approved are available from the OPW Website:

- <http://www.opw.ie/en/floodriskmanagement/operations/minorfloodworkscoastalprotectionscheme/>

3 PRELIMINARY FLOOD RISK ASSESSMENT

3.1 INTRODUCTION

The Preliminary Flood Risk Assessment (PFRA) was a national screening exercise, based on available and readily-derivable information, to identify areas where there may be a significant risk associated with flooding.

The PFRA in Ireland was finalised in December 2011, following public consultation. A summary of how the PFRA was undertaken is provided in Appendix C.

3.2 OUTCOMES OF THE PFRA

The OPW designated 300 AFAs around Ireland, informed by the PFRA, the public consultation outcomes and the Flood Risk Reviews (further details available in Appendix C of this Plan and from the OPW website: www.floodinfo.ie). The AFAs were the focus of the CFRAM Studies and parallel detailed studies.

A list of all AFAs is provided in Appendix C of the Report on the Designation of the Areas for Further Assessment (OPW, 2012). Table 3.1 identifies the AFAs that are within the area covered by this Plan, and the sources of flood risk that were deemed to be significant for each AFA, which are also shown in Figure 3.1.

3.3 FURTHER INFORMATION

The Main Report on the PFRA, the Report on the Designation of the Areas for Further Assessment and a number of technical reports are available from the OPW website (www.floodinfo.ie). These reports describe the process followed in the first cycle of the PFRA, describe how the AFAs were designated and provide a full national list of the AFAs.

The PFRA will be reviewed as required under the relevant legislation. It is anticipated that the review of the PFRA will consider and support a range of issues in more detail than in the first cycle of the implementation of the 'Floods' Directive, and other issues that were not possible to consider in the first cycle given the information that was available or readily-derivable at the time. Such issues may include:

- Rural and dispersed flood risk: The CFRAM Programme has focused on communities at potentially significant flood risk (the AFAs) where the risk was understood to be concentrated and where it is more likely that viable measures could be identified. In the second cycle, it is foreseen that there will be a greater level of assessment of rural and dispersed risk.
- The potential impacts of climate change: The OPW has supported research commissioned by the EPA to investigate potential impacts of climate change on extreme rainfall patterns and hence on flood flows. This should support future assessments of potential future changes in flood risk.
- Critical Infrastructure: Assets that are critical to normal societal function and that may be at risk from flood events need to be identified. This will enable assessments of the potential 'knock-on' effects for other assets and services, such that appropriate risk management measures can be implemented to help ensure Ireland's resilience to severe flood events.

The outcomes of the PFRA undertaken in the second cycle of the 'Floods' Directive implementation, which will include environmental screening / assessments as appropriate,

will inform the need for further detailed assessment and flood mapping and the review of the Plans.

Table 3.1 **List of the AFAs within the North Western River Basin**

ID No.	COUNTY	NAME	SOURCE(S) OF FLOOD RISK
380592	Donegal	Ardara	Fluvial
10002	Donegal	Ballybofey / Stranorlar	Fluvial
390599	Donegal	Bridge End	Fluvial & Coastal
385321	Donegal	Bunbeg Derrybeg	Fluvial & Coastal
390600	Donegal	Buncrana & Luddan	Fluvial & Coastal
390601	Donegal	Burnfoot	Fluvial & Coastal
400616	Donegal	Carndonagh	Fluvial
380594	Donegal	Carrowkeel (<i>Kerrykeel</i>)	Fluvial
10003	Donegal	Castlefinn	Fluvial
400617	Donegal	Clonmany	Fluvial
10005	Donegal	Convoy	Fluvial
370580	Donegal	Donegal	Fluvial & Coastal
380595	Donegal	Downies (<i>Downings</i>)	Fluvial & Coastal
380596	Donegal	Dunfanaghy	Coastal
385339	Donegal	Dungloe	Fluvial & Coastal
380597	Donegal	Glenties	Fluvial
370585	Donegal	Killybegs	Fluvial & Coastal
10007	Donegal	Killygordon	Fluvial
390607	Donegal	Letterkenny	Fluvial & Coastal
10008	Donegal	Lifford	Fluvial
400620	Donegal	Malin	Fluvial & Coastal
400621	Donegal	Moville	Fluvial & Coastal
390610	Donegal	Newtown Cunningham	Fluvial & Coastal
390611	Donegal	Rathmelton (<i>Ramelton</i>)	Fluvial & Coastal
010648	Donegal	Raphoe	Pluvial
390613	Donegal	Rathmullan	Fluvial & Coastal

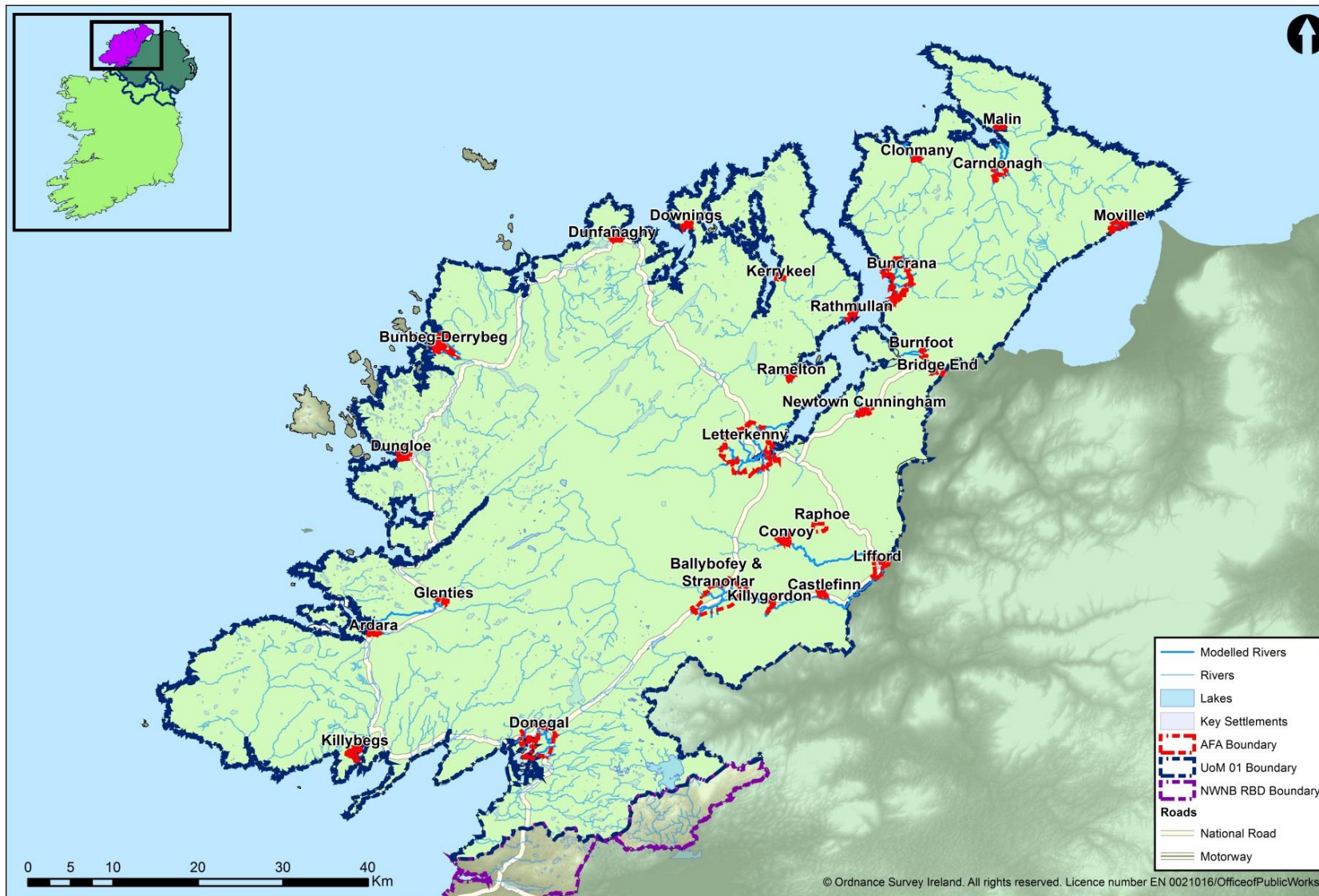


Figure 3.1 Map of the AFAs within the North Western River Basin

4 PUBLIC AND STAKEHOLDER CONSULTATION AND ENGAGEMENT

4.1 OVERVIEW

Public and stakeholder engagement is a critical component to the process of developing a sustainable, long-term strategy for flood risk management. This engagement is necessary to ensure that flood risk management measures are suitable and appropriate, as well as technically effective.

This section describes the public and stakeholder consultation and engagement that has been undertaken under the CFRAM Study for the North Western River Basin in the development of this Plan. An overview of the CFRAM consultation stages and structures is provided diagrammatically in Figure 4.1.

4.2 AVAILABILITY OF PROJECT INFORMATION

A website for the National CFRAM Programme and the PFRA was established in 2011, and a Project-specific website was developed upon inception of the NWNB CFRAM Project. Relevant information from these websites is now available from the OPW website (www.floodinfo.ie), which provides information on the 'Floods' Directive and SI Nos. 122 of 2010 and 495 of 2015, the PFRA and the CFRAM Programme, and provides access to view and download reports, the Plans and other project outputs.

Information on OPW flood relief schemes and other, parallel projects is provided through the OPW Website, www.opw.ie.

Flood maps prepared through the CFRAM Programme and through other projects are available through the OPW website (www.floodinfo.ie).

4.3 STAKEHOLDER ENGAGEMENT

4.3.1 The CFRAM Steering and Progress Groups

4.3.1.1 The National CFRAM Steering Group

The National CFRAM Steering Group was established in 2009, and met on nine occasions to the date of publication of this Plan. It was established to provide for the engagement of key Government Departments and other state stakeholders in guiding the direction and the process of the implementation of the 'Floods' Directive, including the National CFRAM Programme. The membership of this Group is provided in Appendix D.1.

The National CFRAM Steering Group reported, through the OPW, to the Interdepartmental Co-ordination Group (now the Interdepartmental Flood Policy Co-ordination Group).

4.3.1.2 NWNB CFRAM Project Steering Group

A Project Steering Group was established for the NWNB CFRAM Project, that includes the North Western River Basin, in 2011. This Group, which included senior representatives of the members, provided for the input of the members to guide the CFRAM Programme and act as a forum for communication between the CFRAM Programme and senior management of key stakeholders. The Project Steering Group typically met twice a year. The membership of this Group is provided in Appendix D2.



Figure 4.1: Overview of the CFRAM Consultation Stages and Structures

4.3.1.3 NWNB CFRAM Project Progress Group

A Project Progress Group was established for the NWNB CFRAM Project in 2012. This group was a working group that supported the Project Steering Group and met approximately every six weeks. The Group was established to ensure regular communication between key stakeholders and the CFRAM Project and to support the successful implementation of the Project.

The membership of this Group was the same as for the NWNB CFRAM Project Steering Group.

4.3.2 Stakeholder Consultation Groups

Stakeholder Groups were formed at national and regional level to provide an opportunity for input by non-governmental stakeholder groups to participate in the 'Floods' Directive and CFRAM processes.

4.3.2.1 National CFRAM Stakeholder Group

The National CFRAM Stakeholder Group was established in 2014, and met three times to the date of publication of this Plan. It was established to provide for the engagement of key national non-governmental stakeholder organisations at key stages in the process of the implementation of the National CFRAM Programme. Members of the organisations listed in Appendix D.3 were invited to meetings of this Group.

4.3.2.2 Project (Regional) CFRAM Stakeholder Group

The NWNB CFRAM Stakeholder Group was established in 2012, and met on four occasions to the date of publication of this Plan. It was established to provide for the engagement of local non-governmental stakeholder organisations at key stages in the process of the implementation of the NWNB CFRAM Project. The organisations listed in Appendix D.4 attended meetings of this Group, although many other organisations were also invited to attend.

4.3.3 Coordination with the Implementation of the Water Framework Directive

The Water Framework Directive (WFD) is concerned with the protection of the ecological quality of our waters. While the 'Floods' Directive is concerned with the protection of people and society from our waters, both Directives are concerned with water and river basin management, and hence coordination is required between the two processes to promote integrated river basin management, achieve joint benefits where possible and address potential conflicts.

There has been, and will continue to be, coordination with the authorities responsible for the implementation of the WFD through a range of mechanisms, including bi-lateral meetings and cross-representation on various management groups, as set out in Section 6.5.

4.4 PUBLIC CONSULTATION AND ENGAGEMENT

In addition to the structured engagement with relevant stakeholders through the Steering, Progress and Stakeholder Groups, the public have also been given the opportunity and encouraged to engage with the implementation of the 'Floods' Directive and the CFRAM process. These engagement and consultation steps are set out in Figure 4.1, and are described in the sub-sections below.

4.4.1 Consultation on Preliminary Flood Risk Assessment

The public and stakeholder consultation and engagement in the Preliminary Flood Risk Assessment (PFRA) is described in Section 3.

4.4.2 Launch of the NWNB CFRAM Project

The NWNB CFRAM Project commenced in 2012.

4.4.3 Consultation on Flood Maps

The preparation of the flood maps, which serve a range of functions (see Section 5.3) is the second key requirement of the 'Floods' Directive. The initial preparation of the flood maps involved extensive consultation with the NWNB Progress Group and planners within the various relevant local authorities. This led to the development of draft flood maps that were then consulted upon with the public through local Public Consultation Days and a national, statutory consultation.

4.4.3.1 Public Consultation Days

The OPW identified that effective consultation and public engagement would require local engagement at a community level, and hence determined that Public Consultation Days (PCDs) would be held in each AFA (where possible and appropriate) to engage with the communities at various stages of the Projects, including during the production of the flood maps.

The PCDs were advertised locally in advance, and were held at a local venue in the community during the afternoon and early evening. OPW, Local Authority and RPS staff were present to explain the maps that were displayed in the venue and answer any questions on the maps and the CFRAM process, and to collate local information to refine or confirm the maps. The PCDs in the North Western River Basin were held for consultation on the flood maps at the venues listed in Appendix D.5.



Figure 4.2: Public Consultations

4.4.3.2 National Flood Map Consultation

The Government considered it appropriate to stipulate in SI No. 122 of 2010 that a national consultation exercise should be undertaken⁵. The consultation on the flood maps for all areas was launched in November 2015. Observations and Objections submitted through the consultation process have been assessed and the flood maps amended accordingly, where appropriate.

4.4.4 Consultation on Flood Risk Management Objectives

The Flood Risk Management Objectives of the National CFRAM Programme define what the process is trying to achieve in terms of reduction of flood risk, and where possible provide wider benefits, to human health, the environment, cultural heritage and economic activity. The Objectives are described further in Section 1.4.

The OPW considered it appropriate to publicly consult on the proposed flood risk management Objectives, and launched a public consultation in October 2014. Submissions received were duly considered and amendments made to the Objectives where appropriate. The Objectives were finalised in March 2015.

A Multi-Criteria Assessment (MCA) is used as part of the process for assessing potential options for reducing or managing flood risk for each AFA. The MCA and this process are described in Section 7 herein. The MCA makes use of weightings to rank the importance of the Objectives. The OPW considered it appropriate to consult on the weightings that would be assigned to each Objective, and commissioned an independent poll of over 1000 members of the public on the weightings through a structured questionnaire. The results of this poll were analysed by UCD⁶, and the weightings for each of the Objectives then set.

4.4.5 Consultation on Options

Based on the flood hazard and risk identified in the flood maps, options for reducing or managing flood risk in each AFA were developed and assessed. This process is described in Section 7 herein.

PCDs, similar to those held for the consultation on the flood maps were held during the development and assessment of options. These were an opportunity to engage with the community and for the community to set out what local issues were particularly important and what measures they considered would be most suitable and comment on which identified options might be effective and appropriate, or otherwise. The PCDs in the North Western River Basin were held during the option development stage at the venues listed in Appendix D.6.

4.4.6 Consultation on Draft Plans

The Draft Plan for the North Western River Basin as published for the purposes of public consultation on 19/08/16. Observations from the public and from relevant Councils were to be submitted to the OPW by 28/10/16 and 21/11/16 respectively. Presentations were made to Councils during the public consultation period.

In parallel and complementary to the formal public consultation process, a series of PCDs, similar to those held for the consultation on the flood maps (Section 4.4.3 above), were held to engage locally and directly with the community and provide people with opportunity to discuss and fully understand the Draft Plans. A total of 223 elected representatives and

⁵ Sections 12, 13 and 14, SI No. 122 of 2010

⁶ (UCD, 2015): Weighting the Perceived Importance of Minimising Economic, Social and Environmental/ Cultural Risks in Flood Risk Management, University College Dublin, 2015

members of the public attended. The PCDs in the North Western River Basin were held in relation to the Draft Plans at the venues listed in Appendix D.7.

The observations submitted to the OPW through the public consultation processes were considered and the Plans amended accordingly where appropriate. A synopsis of the observations submitted and amendments made to the Plan arising from the observations is available from the OPW website (www.floodinfo.ie).

4.5 CROSS-BORDER COORDINATION

The OPW has an on-going relationship with the former Rivers Agency (Northern Ireland) (now part of the Dept. for Infrastructure), Northern Ireland, which is the Competent Authority for the implementation of the 'Floods' Directive in Northern Ireland.

In 2009, it was agreed between the two Authorities that a Cross-Border Coordination Group would be established to coordinate the implementation of the 'Floods' Directive across the border, and that this would be supported by a Cross-Border Technical Coordination Group. These groups first met in November 2009 and February 2010 respectively, and met on a number of occasions since to coordinate on the identification of AFAs and Significant Flood Risk Areas ('SFRAs' - the terminology in Northern Ireland used for an AFA), to share information and agree approaches to and the production of flood mapping in border areas and to coordinate on the identification of measures and the preparation of Plans.

The Rivers Agency (Northern Ireland) have developed, in coordination with the OPW as above, Plans for the areas within Northern Ireland for the North-Western and Neagh-Bann River Basin Districts (<https://www.infrastructure-ni.gov.uk/publications/flood-risk-management-plans>).

There are a number of watercourses that flow between the Republic of Ireland and Northern Ireland in the North Western River Basin. The downstream extents of the Finn and most of the Foyle form the border with Northern Ireland from upstream of Lifford to Lough Foyle and Moville is located on the shoreline of Lough Foyle which is a transboundary waterbody. There may be potential cross border impacts associated with the transboundary watercourses. The Rivers Agency (Northern Ireland) have been consulted directly on these impacts.

For the NWNB CFRAM Study, the Rivers Agency (Northern Ireland) have been represented throughout the CFRAM study on the steering, progress and stakeholders groups. The Rivers Agency (Northern Ireland) and the OPW have undertaken information exchange at all deliverable stages, including delivering joint presentations to stakeholders and also joint attendance at relevant consultation events.

5 FLOOD HAZARD AND RISK ASSESSMENT

A general description of flooding and flood risk has been provided in Section 1.2 of this Plan. This Section describes the assessment processes followed under the CFRAM Programme to determine the extent and nature of flooding in the AFAs within the North Western River Basin, and the resultant flood risk. A description of these processes and outcomes for other projects is provided in the relevant project reports (see Section 1.3.5).

To ensure consistency in approach where required, a National Technical Coordination Group was established under the National CFRAM Programme to bring together all of the Consultants with the OPW, and other organisations as necessary, to determine common standards and methodologies.

5.1 HYDROLOGICAL ANALYSIS

For AFAs where fluvial flooding is a potentially significant risk, the hydrological assessment under the CFRAM Programme has been limited to rivers and streams with a catchment area of more than 1km². Smaller streams may also give rise to some flood risk, and such risk would need to be considered where relevant at the project-level of assessment (see Section 8.1), when the interaction between urban storm water drainage systems, fluvial flooding and proposed measures would also need to be considered in detail.

Limited hydrometric data exists within the North Western River Basin which is of sufficient quality such as to be of use for design flow estimation and as such there is generally a high degree of uncertainty in design flow estimates, although there is no evidence to suggest that the FSU (Flood Studies Update) Qmed equation performs poorly within the unit of management. Meteorological data is also sparse within the catchment with the high temporal resolution data needed for driving rainfall run-off models being available in only a few locations. These locations are lacking any hydrometric data that would allow some calibration of rainfall run-off models and as such it has not been possible to apply this approach within the North Western River Basin. Design flow estimates have been compared to those for similar catchments where high quality gauge data is available to arrive at improved adjusted estimates of flood flow. The calibration of the hydraulic models to historic flood data and observed evidence will further help to screen out design flow estimates which are not reflective of the actual behaviour of these sub-catchments.

There are many potential future changes to the catchment, margins of error and uncertainties which must be considered within the study. However the cumulative application of worst case scenarios, one on top of the other could lead to erroneous flood extents which do not take into account the diminishing cumulative joint probability of these factors. For this reason, the hydrology report has separated future North Western River Basin changes that have a high degree of certainty in the projections from those changes which are less certain. Future changes which have a high degree of uncertainty, along with margins of error and other uncertainties have been risk assessed individually. This risk assessment was taken forward and built upon through the hydraulic modelling phase to provide a single error margin for the flood extent maps on an AFA by AFA basis.

The North Western River Basin catchment can be characterised hydrologically as follows:

- The catchment has a wide range of climatic and physiographic characteristics. The drier, lowland areas in the Foyle floodplain have SAAR values as low as 1000mm while catchments in the upland areas of the Bluestack and Derryveagh Mountains have SAAR values in excess of 2000mm.

- Hydrometric data is of poor quality and availability.
- Meteorological data is of low availability in the catchment.
- Flood behaviour when defined in terms of the growth curve, i.e. in orders of magnitude greater than the median event, is relatively more extreme in the upper catchment than would have been thought based on older Flood Studies Reports (FSRs). This is in line with other more recent, catchment specific studies.
- The 1% AEP flood event ranges from approximately 1.7 to 2.8 times larger than the median flood flow. This compares to approximately 2 under FSR.

Design flow estimation is the primary output of this study and has been developed from analysis based on previous observed data and estimation / modelling techniques further refined through calibration of hydraulic models. This is reflective of best practice in hydrology / hydraulic modelling for flood risk assessment.

The main potential source of uncertainty in the analysis is due to the lack of hydrometric gauge data. Through the use of best practice statistical methods the design flow estimation had as high a degree of certainty as was possible prior to calibration / validation, nevertheless the modelling necessitated the adjustment of some of the design flows and as such any adjustments made were recorded within the NWNB CFRAM reporting.

Following this cycle of the NWNB CFRAM Study the main potential adverse impacts on the hydrological performance of the catchment are the effects of future changes and urbanisation.

Full details of the methodology, datasets used and outcomes of the hydrological analysis for the NWNB CFRAM Study area can be found www.floodinfo.ie.

5.2 HYDRAULIC MODELLING

For AFAs where fluvial flooding is a potentially significant risk, the hydraulic assessment and modelling under the CFRAM Programme has been limited to rivers and streams with a catchment area of more than 1km². Smaller streams may also give rise to some flood risk, and such risk would need to be considered where relevant at the project-level of assessment (see Section 8.1), when the interaction between urban storm water drainage systems, fluvial flooding and proposed measures would also need to be considered in detail.

Hydraulic analysis was undertaken in order to identify the location and frequency of flooding within the extents of the North Western River Basin modelled watercourses. The analysis utilised computational modelling software informed by detailed topographical survey information (channel sections, in-channel/flood defence structures, bathymetric and floodplain), combined with hydrological inputs (riverine inflows and sea levels) and water-level control parameters (such as channel-roughness), to determine flood hazard. A series of flood extent, zone, depth, velocity and risk-to-people maps known collectively as flood hazard maps were generated based on the model results.

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

The second hydraulic modelling software package used is ISIS, which was developed by CH2M HILL. ISIS 2D has a fully hydrodynamic computational engine designed to work alone or with ISIS 1D, enabling dynamic interaction between 1D and 2D models. 1D and 2D

models are linked through shapefiles specifying the model cells in the 2D domain to be linked to 1D model nodes. Models can be linked by water level (levels computed by the 1D model are sent to the 2D model) or by flow (flows computed by the 1D model are sent to the 2D model). These linking methods allow ISIS 1D and ISIS 2D to represent lateral floodplains, a 1D channel running into a 2D estuary, spill over defences, and other representations of river, coastal or floodplain systems. Multiple 2D domains, with different cell sizes, time steps and simulation times can be coupled to a single 1D model to represent different areas of floodplain at different resolutions.

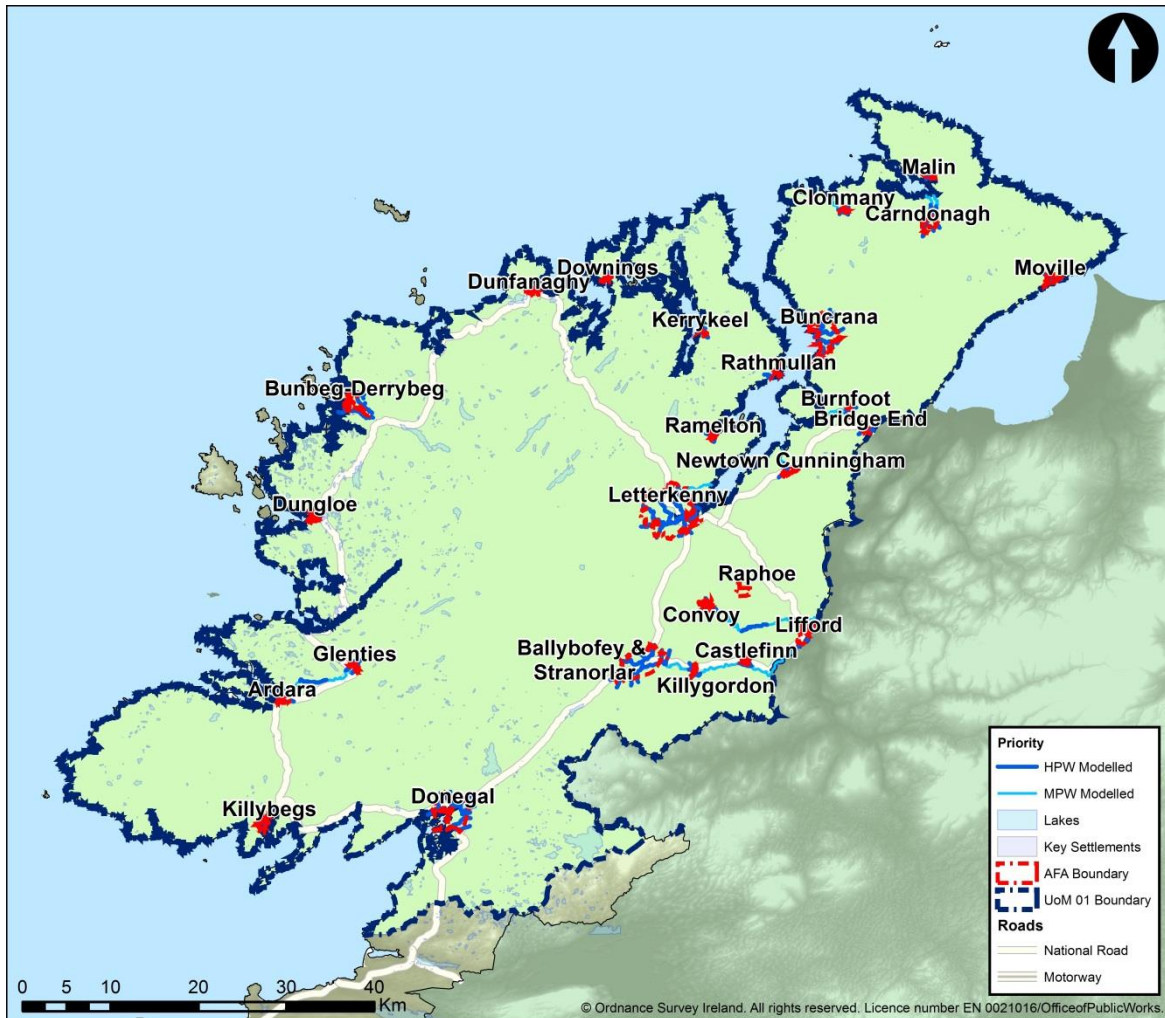


Figure 5.1 Map showing the modelled watercourses and AFAs within the North Western River Basin

There is one pluvial model (Raphoe) and one fluvial/tidally influenced model (Finn system - Ballybofey-Stranorlar, Killygordon, Castlefinn and Lifford) in the North Western River Basin, in which ICM (Integrated Catchment Modelling) was used. In Raphoe the modelling represented the rainfall runoff and the influence of the piped drainage system with a high degree of interaction with topographical surface features. For the Finn model ICM was used in order to represent culverted watercourses the software is a 1D/2D dynamically linked modelling package developed by Innovyze. Whilst integrated fluvial-drainage system hydraulic modelling was generally beyond the scope of the CFRAM, this integrated platform enables both above and below ground drainage systems to be modelled in one package. Infoworks ICM can also be used for modelling coastal flood risk within the same AFAs for which it was used to model fluvial flood risk, enabling seamless integration of both models for flood mapping.

The influence of coastal water levels has been modelled by applying an appropriate water level boundary profile to the downstream extent of the relevant models. Tidal data has been taken from the Irish Coastal Protection Strategy Study (ICPSS). The effects of the sea levels are propagated upstream by the modelling software allowing the interaction of river flows and coastal water levels to be modelled accurately. The subsequent combined water level profiles are then applied as the downstream boundaries for each of the rivers ensuring both coastal and fluvial flooding mechanisms are investigated. Model tests included variation in fluvial-tidal joint probability and temporal variations, along with parameters such as eddy viscosity and bed resistance. In some AFAs, relative timings between fluvial and coastal peaks were adjusted to establish the worst case flood outlines, for a particular combination of events.

RPS assessed the potential for wave overtopping leading to coastal flooding in selected AFAs using calculated overtopping rates for relevant coastal structures under a range of combined tidal levels and wave heights of known joint return period using the EurOtop application. This identified the critical structure/overtopping rate/event combination for the frontage. The temporal variation in overtopping rate is subsequently determined to analyse the performance of the critical structure, under the critical wave conditions and a range of tidal levels associated with a generic storm profile derived from a combination of the normal astronomical tidal profile and an appropriate sinusoidal surge profile with a duration of 48 hours. The instantaneous overtopping rates resulting from this analysis were combined to create boundary “hydrographs” that can be applied to the coastal flood models at the locations of the overtopping defences to facilitate simulation of the flood pathways and flood extents resulting from overtopping of the defences. The results of the coastal modelling were then combined with the output of the direct tidal inundation mapping to establish the coastal flood hazard maps.

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

- 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 accuracy of the models representing existing conditions in terms of flood level, depth, extent and flow velocity allows potential flood options to be meaningfully assessed, enabling the appropriate actions/decisions to be taken. The calibrated models were used to simulate present day and future flood hazard conditions and potential options to facilitate the appraisal of possible flood risk management actions and measures.

Sensitivity tests have been conducted for each model, and reported within the North Western River Basin Hydraulics Report. 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

Future potential changes which may affect the outputs of the CFRAM Study were also assessed:

- The climate change allowances are applied to all models. Urbanisation allowances are applied on a case by case basis as required, the factors themselves having been derived during the hydrology analysis by looking at historic urbanisation growth indicators and estimating appropriate growth factors for mid-range future scenario (MRFS) and high end future scenario (HEFS).
- The effect of arterial drainage within the North Western River Basin relates to the River Swilly in Letterkenny and the River Skeoge in Burnfoot/Bridgend. Both schemes involved river widening and deepening, accompanied by construction of flood embankments. The long term effect of the scheme is land improvement, with some secondary increases in channel conveyance for lower AEP event flows. None of the affected watercourses in the North Western River Basin have a record of hydrometric data predating these drainage works and it was therefore not possible to make a comparison of pre- and post- drainage Qmed values to enable accurate estimation of the effect of the drainage works. Consequently all of the catchment rainfall run-off models have been generated using the CORINE 2006 database and GSI datasets and have been calibrated against post scheme continuous flow data where available. As such the hydrological inputs derived so far for modelling are considered to accurately reflect the effect of arterial drainage and should represent the best estimates of the present day scenario.

There are inherent assumptions, limitations and uncertainty associated with hydraulic modelling, which are detailed for each hydraulic model within the North Western River Basin Hydraulic Report. The issues addressed include:

- Schematisation decisions regarding out-of-bank flow routes;
- Culvert/bridge schematisation (including skew angle considerations);
- Sweetening flow assumptions;
- Comments and notes throughout to reflect data sources; changes to parameters from default;
- Explanation of parameters used that are outside of the expected ranges; and
- Any other atypical assumptions made.

The North Western River Basin hydraulic report describes the overall conceptualised models (see Figure 5.1) and details the key aspects of each modelling software package used, including model inputs, how channel structures are represented and model parameters selected. The integration of hydraulic analysis with previously undertaken hydrological analysis is also outlined, with AFA/HPW specifics provided. Full details of the methodology, datasets used and outcomes of the hydraulic analysis for the North West CFRAM Study area can be found at www.floodinfo.ie.

5.3 FLOOD HAZARD MAPPING

The flood maps serve a range of functions:

Public Awareness:

Flood maps, and in particular flood extent maps and flood depth maps, inform the public, home owners, business owners, landowners and farmers, landlords and tenants about the likely risk of flooding in their areas, including the likely frequency of occurrence and depth. This knowledge can help people make decisions and prepare for flood events to reduce the potential impacts of flooding.

Planning & Development Management:

The flood maps should inform the Spatial Planning processes and support Planning Development decisions to avoid unnecessary development in flood-prone areas, in line with the 2009 Guidelines on The Planning System and Flood Risk Management⁷.

Emergency Response Management:

The flood maps should aid in the preparation and implementation of flood event emergency response plans, by providing information on areas prone to flooding, the potential depths of flooding and what might be at risk in the event of a flood.

Flood Risk Management Decision Support:

Flood maps, and in particular various flood risk maps, are intended to be used as a decision support tool in the identification, planning, development, costing, assessment and prioritisation of flood risk management options, such as flood defence schemes, flood warning systems, public awareness campaigns etc.

Based on extensive survey and analysis of river flows and the development of computer models to determine how flooding occurs, a range of flood hazard maps has been produced for each AFA within the North Western River Basin.

Flood hazard maps include maps of the projected extent of flooding for a range of flood events of different severity or probability, and the depth of flooding that would be expected for these events. The range of flood event probabilities include frequent events that may have recently been observed, up to very extreme events that may not have been previously seen, but which could occur at some point in the future.

The mapping also provides tabulated information on water level and flow for key points along the watercourses during the mapped flood event probabilities. These key locations include AFA boundaries / centres, river confluences, gauging stations along the watercourses and other locations approximately every 5km along a modelled watercourse. Model flows were validated against the estimated flows at hydrological estimation check points to determine if the model is well anchored to the hydrological estimates. The comparisons indicated that the model were generally well anchored to the hydrological estimates with very good correlation during the high frequency events were little flow is lost to overland flow. Any differences there may be between model flows and hydrological estimates during the medium to low frequency events can be attributed to the loss of flow from the watercourse to the floodplain. There is a change in the shape of the hydrograph due to attenuation, the higher return period hydrographs become longer as the attenuated flow makes its way through the system.

Extensive consultation on the draft hazard mapping was undertaken during 2015 as described in Section 4.4.3 via local authority workshops, stakeholder workshops, public consultation days, elected members' briefings, project level website correspondence and formal SI consultation.

In excess of 300 members of the public attended the series of Public Consultation Days in their local AFAs across the NWNB CFRAM study area. Many property and land owners expressed concern in relation to the impact of the flood maps on local authority planning decisions and zoning.

Many property owners expressed concern that their properties may be devalued by being identified as being within an area of flood risk. The information obtained was used to verify the hydrological and hydraulic modelling outputs based on the degree to which participants

⁷

DHPLG/OPW 2009: Guidelines on The Planning System and Flood Risk Management

presented with local knowledge in agreement or disagreement with the draft mapping. As a result many of the models were updated in order to better represent the flood hazard and risk.

The formal SI consultation resulted in sixteen additional observations/comments pertaining to the NWNB CFRAM study area, twelve of which were relevant to the North Western River Basin, mainly providing information, maps and photographs with regard to flooding in the Finn Catchment during the consultation period (in Castlefinn, Ballybofey and Stranorlar) but also in relation to Donegal town and Ramelton. No objections were received relating to the North Western River Basin.

The flood maps will be reviewed on an ongoing basis as new information becomes available (e.g. in relation to future or recent floods), with a formal review to be completed by the end of 2019 (see Section 8.4).

The final core flood hazard mapping for the NWNB CFRAM Study area can be found at www.floodinfo.ie.

5.4 FLOOD RISK ASSESSMENT AND MAPPING

The Flood Risk Analysis is undertaken to assess and map the existing and potential future flood risk within the Study Area.

The analysis focuses on the receptors at risk from flooding and are categorised as social (including risk to people), environmental, cultural heritage or economic receptors. The risk to a receptor can be affected by its location within the flood extent or the proportion of the receptor within the flood extent, the depth to which it floods, the velocity of the water adjacent to the receptor and the receptors' vulnerability to flooding.

The clearest way to present the flood risk within an area being studied is through flood risk maps. The flood risk maps show the potential consequences of flooding. These maps detail the source of the risk and the receptors at risk. The flood risk maps include:

- Social Risk map
- Environmental Risk map
- Cultural Heritage Risk map
- Economic Risk map
- Economic Activity map
- Number of Inhabitants map
- Economic Risk Density map

Receptors were determined to be at risk from flooding if they were located within the flood extent, or with any part of their footprint intersecting with the flood extent. The degree of flood risk within buildings depends on the internal floor levels in comparison to simulated flood levels; internal floor levels were established by adjusting topographical ground levels outside the building, by allowance for threshold level change (based on the number of external steps visible externally).

The core risk mapping presents risk to number of inhabitants, environment and types of economic activity and these were also consulted on alongside the draft hazard mapping for each AFA. The final flood risk mapping for the NWNB CFRAM Study Area can be found at www.floodinfo.ie.

As set out in Section 1.2.2 there are flooding impacts where receptors are located within the floodplain. During a flood event, there is a heightened risk to people in both rural and urban

environments. However such risks are considered to be more severe particularly at locations where high velocities have been predicted (which is in all of the AFAs within the North Western River Basin) or known vulnerable properties have been identified within the floodplain (which is in Bunbeg-Derrybeg, Buncrana, Kerrykeel and Lifford AFAs commencing at the 10% AEP present day event. Ballybofey & Stranorlar, Castlefinn AFAs commencing at the 1% AEP present day event and similarly Ardara AFA at the 0.1% AEP event).

Table 5.1 presents a summary of the current risk within the North Western River Basin, including the number of residential and non-residential properties at risk in each AFA and in the floodplains of other river reaches modelled outside of the AFA. The numbers of properties presented are determined independently for each source of flooding. For AFAs which are affected by more than one source of flooding, some properties may be at risk by more than one source, and as such properties may have been included in the numbers for both sources.

Further details of properties and assets (receptors) at risk in each AFA are given in Appendix E.

The numbers of properties at risk and the damage values set out in Table 5.1 are as determined at this stage of assessment under current conditions. The numbers and values may change when the risk is assessed in more detail at the project-level of development of measures and/or due to the potential impacts climate change, future development and price inflation.

Table 5.1: Summary of Flood Risk in the North Western River Basin

AFA / Area	No. of Residential Properties at Risk		No. of Non-Residential Properties at Risk		NPVd ² (€ millions)
	1% / 0.5% AEP ¹	0.1% AEP	1% / 0.5% AEP ¹	0.1% AEP	
Ardara	15	35	1	12	0.37
Ballybofey & Stranorlar	53	132	6	83	10.02
Bridge End	0	6	1	15	0.49
Bunbeg-Derrybeg	1 Fluvial 1 Coastal 1	1 Fluvial 1 Coastal 1	2 Fluvial 0 Coastal 1	2 Fluvial 0 Coastal 1	1.98
Buncrana	21 Fluvial 6 Coastal 1	43 Fluvial 6 Coastal 1	2 Fluvial 3 Coastal 1	3 Fluvial 3 Coastal 1	65.41
Burnfoot	20	28	2	4	1.34
Carndonagh	32	43	10	14	19.31
Castlefinn	18	30	17	19	4.42
Clonmany	7	26	2	2	0.22
Convoy	5	14	4	4	3.37
Donegal	35 Fluvial 3 Coastal 1	82 Fluvial 12 Coastal 1	26 Fluvial 10 Coastal 1	50 Fluvial 23 Coastal 1	30.95
Downings	2 Fluvial 1 Coastal 1	2 Fluvial 1 Coastal 1	1 Fluvial 0 Coastal 1	2 Fluvial 1 Coastal 1	2.45
Dunfanaghy	13 Coastal 1 10 Coastal 2	15 Coastal 1 10 Coastal 2	24 Coastal 1 7 Coastal 2	25 Coastal 1 7 Coastal 2	2.91
Dungloe	0 Fluvial 1 Coastal 1	0 Fluvial 1 Coastal 1	1 Fluvial 0 Coastal 1	2 Fluvial 0 Coastal 1	0.50
Glenties	4	13	4	16	11.93

AFA / Area	No. of Residential Properties at Risk		No. of Non-Residential Properties at Risk		NPVd ² (€ millions)
	1% / 0.5% AEP ¹	0.1% AEP	1% / 0.5% AEP ¹	0.1% AEP	
Kerrykeel	12	17	1	3	0.19
Killybegs	13 Fluvial 16 Coastal 1 0 Coastal 2	13 Fluvial 16 Coastal 1 0 Coastal 2	11 Fluvial 24 Coastal 1 5 Coastal 2	12 Fluvial 28 Coastal 1 10 Coastal 2	38.78
Killygordon	0	0	0	0	0
Letterkenny	11 Fluvial 4 Coastal 1	49 Fluvial 8 Coastal 1	21 Fluvial 15 Coastal 1	45 Fluvial 31 Coastal 1	35.07
Lifford	41	61	37	53	21.73
Malin	0 Fluvial 1 Coastal 1	1 Fluvial 2 Coastal 1	0 Fluvial 4 Coastal 1	1 Fluvial 5 Coastal 1	0.24
Moville	1 Fluvial 17 Coastal 1 8 Coastal 2	15 Fluvial 17 Coastal 1 8 Coastal 2	0 Fluvial 0 Coastal 1 1 Coastal 2	0 Fluvial 1 Coastal 1 2 Coastal 2	0.86
Newtown Cunningham	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0
Ramelton ³	6 Fluvial 11 Coastal 1	7 Fluvial 13 Coastal 1	1 Fluvial 4 Coastal 1	2 Fluvial 4 Coastal 1	13.77
Raphoe	212 Pluvial	237 Pluvial	64 Pluvial	83 Pluvial	100.72
Rathmullan	8 Fluvial 7 Coastal 1 13 Coastal 2	8 Fluvial 8 Coastal 1 13 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	14.72
D/S of Cardonagh AFA - Coast	5	6	3	4	N.A.
D/S of Clonmany AFA - Coast	0	1	0	0	N.A.
D/S of Burnfoot AFA - U/S of Bridge End AFA	0	3	0	0	N.A.
D/S of Newtown Cunningham AFA - Coast	0	0	0	0	N.A.
D/S of Convoy AFA - River Foyle confluence	8	15	1	5	N.A.
D/S of Ballybofey AFA - U/S of Killygordon AFA	0	0	3	3	N.A.
D/S of Killygordon /Castlefinn AFA - U/S of Lifford AFA	6	8	6	8	N.A.
D/S of Glenties AFA - Coast	1	2	2	3	N.A.

Notes: 1: AEP Flood Event Probabilities: 1% (or 100-year flood) for Fluvial/Pluvial Flooding, 0.5% (or 200-year flood) for Coastal / Tidal Flooding = Coastal 1 & Overtopping Flooding = Coastal 2
2: NPVd = Net Present Value Damages (accumulated, discounted damages over 50 years)
3. It should be noted that the risk presented in Ramelton AFA was evaluated on the basis of free-flow conditions (as is the case in all other AFAs) however there is a known high risk of culvert blockage further assessed in Section 8.4.

5.5 CONSIDERATION OF FUTURE CHANGES

It is likely that climate change will have a considerable impact on flood risk in Ireland.

- Sea level rise is already being observed and is projected to continue to rise into the future, increasing risk to our coastal communities and assets, and threatening damage to, or elimination of, inter-tidal habitats where hard defences exist (referred to as 'coastal squeeze').
- It is projected that the number of heavy rainfall days per year may increase, which could lead to an increase in both fluvial and pluvial (urban storm water) flood risk, although there is considerable uncertainty associated with projections of short-duration, intense rainfall changes due to climate model scale and temporal and spatial down-scaling issues.
- The projected wetter winters could give rise to increased fluvial flood risk and groundwater flood risk associated with turloughs.

These potential impacts could be significant for Ireland, where most of the main cities are on the coast and many of the main towns are on large rivers.

While there is considerable uncertainty associated with most aspects of the potential impacts of climate change on flood risk, it is prudent to take the potential for change into account in the development of Flood Risk Management policies and strategies and the design of Flood Risk Management measures.

Other changes, such as in land use, farming practices and future development could also have an impact on future flood risk through increased runoff and a greater number of people and number and value of assets within flood prone areas.

The National CFRAM Programme and parallel projects include the assessment of risk for two potential future scenarios; the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). These scenarios include for changes as set out in Table 5.2.

Table 5.2: Allowances in Flood Parameters for the Mid-Range and High-End Future Scenarios

Parameter	MRFS	HEFS
Extreme Rainfall Depths	+ 20%	+ 30%
Peak Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year ¹	- 0.5 mm / year ¹
Urbanisation	<i>No General Allowance – Review on Case-by-Case Basis</i>	<i>No General Allowance – Review on Case-by-Case Basis</i>
Forestation	- 1/6 Tp ²	- 1/3 Tp ² + 10% SPR ³

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)

Note 2: Reduction in the time to peak (Tp) to allow for potential accelerated runoff that may arise as a result of drainage of afforested land

Note 3: Add 10% to the Standard Percentage Runoff (SPR) rate: This allows for temporary increased runoff rates that may arise following felling of forestry.

The impacts on flooding and flood risk under the MRFS and HEFS for the AFAs within the North Western River Basin are outlined in Appendix E.

Section 7.3.3 briefly describes how climate change was taken into account in the assessment of flood risk management options, which is detailed further in the relevant project reports.

5.6 COMMUNITIES (AFAs) OF LOW RISK

The AFAs were determined through the PFRA, as described in Section 3. The flood hazard and risk analysis undertaken through the North Western River Basin CFRAM Project has been significantly more detailed than the analysis undertaken for the PFRA.

For certain AFAs, this more detailed analysis has determined that there is in fact currently a low level of flood risk to the community from rivers and/or the sea. In such cases, the development of flood risk management measures aimed specifically at reducing the risk in such AFAs (i.e., local flood protection schemes) has not been pursued. Some of the River Basin-level measures will however still be relevant and applicable as some infrastructure, such as roads, may nonetheless be prone to flooding, and land around the AFA may be prone to flooding.

In the North Western River Basin, the level of risk has been determined as being low in the following AFAs:

- Ardara
- Bridge End
- Clonmany
- Dungloe
- Killygordon
- Malin
- Newtown Cunningham

The level of risk in the AFAs where the CFRAM process has determined that there is currently a low level of flood risk will be reviewed, along with all areas, as part of the review of the PFRA (see Section 3.3). This includes AFAs where the current level of risk may be low, but where the level of risk may increase in the future due to the potential impacts of climate change and so action in the future may be required to manage such impacts.

It is important to note that a low level of existing risk does not infer that undeveloped lands around the community are not prone to flooding, only that a limited number of existing properties are prone to flooding. When considering planning and development management, the potential for flooding in undeveloped areas needs to be fully considered for the AFAs where the risk to the existing community is low, as well as for all other communities, in accordance with the Guidelines on the Planning System and Flood Risk Management (see Section 7.4.1.1).

6 ENVIRONMENTAL CONSIDERATIONS

6.1 OVERVIEW

The Plan for the North Western River Basin has been the subject of a Strategic Environmental Assessment (SEA) and an Appropriate Assessment (AA) to meet the requirements of the Irish Regulations transposing the EU SEA and Habitats Directive respectively⁸. This Section provides a description of the process used to ensure that the environmental considerations within the North Western River Basin were addressed appropriately in the preparation of this Plan. The considerations with respect to each AFA, and the overall Plan, are summarised below and are detailed in the accompanying environmental documents.

The Draft Plan issued for consultation was accompanied by an SEA Environmental Report, which documented the SEA process. The Environmental Report identified, evaluated and described the likely significant effects on the environment of implementing the potential measures set out in the Draft Plan, with a view to avoiding adverse effects, and also, where appropriate, to set out recommendations as to how any identified adverse effects can be mitigated, communicated and monitored.

A Natura Impact Statement also accompanied the Draft Plan, to set out the potential impacts of possible measures on Natura 2000 sites (core breeding and resting sites for rare and threatened species, or sites for some rare natural habitat types)⁹.

Following consideration of observations made in response to the public consultation on the Draft Plan, including comments received on the SEA Environmental Report and the Natura Impact Statement, the final Plan has been prepared. The Plan has been published with a SEA Conclusion Statement, which documents changes made to the Plan and its overall effects, and an Appropriate Assessment Conclusion Statement.

It is emphasised that the Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment.

It should be noted that potential flood relief works or 'Schemes' set out herein will need to be further developed at a local, project-level before public exhibition or submission for planning approval. Local information that cannot be captured at the Plan-level of assessment, such as ground investigation results and project-level environmental assessments, may give rise at that stage to some amendment of the proposed works to ensure that it is viable and fully adapted, developed and appropriate within the local context, and that it is compliant with environmental legislation.

While the degree of detail of the assessment undertaken to date would give confidence that any amendments should generally not be significant, the potential works set out in the Plan may be subject to amendment prior to implementation.

In this context, it should be noted that the SEA and AA undertaken in relation to the Plan are plan-level assessments. The Plan will inform the progression of the proposed measures, but project-level assessments will need to be undertaken as appropriate under the relevant legislation for consenting to a Scheme or works that involves physical works and that may progress in the future. The approval / adoption of the Plan has not and does not confer approval or permission for the installation or construction of any physical works. EIA and/or

⁸ SI No. 435 of 2004 (SEA Directive) and SI No. 477 of 2011 (Habitats Directive)

⁹ http://ec.europa.eu/environment/nature/natura2000/index_en.htm

AA Screening, and, where so concluded from the screening, Environmental Impact Assessment and / or Appropriate Assessment, must be undertaken in accordance with the relevant legislation where relevant as part of the progression of measures that involve physical works. The body responsible for implementation of such measures (see Section 7) is required to ensure that these requirements will be complied with.

The environmental assessments set out herein relate to the Plan, and measures set out and proposed under the Plan (see Table 7.21). Flood relief schemes and works proposed or progressed through other projects and plans are not the focus of the environmental assessments of the Plan, but are considered in terms of their in-combination or cumulative effects with the measures set out within the Plan.

Figure 6.1 shows the Interaction and stages of the optioneering, SEA and AA Processes.

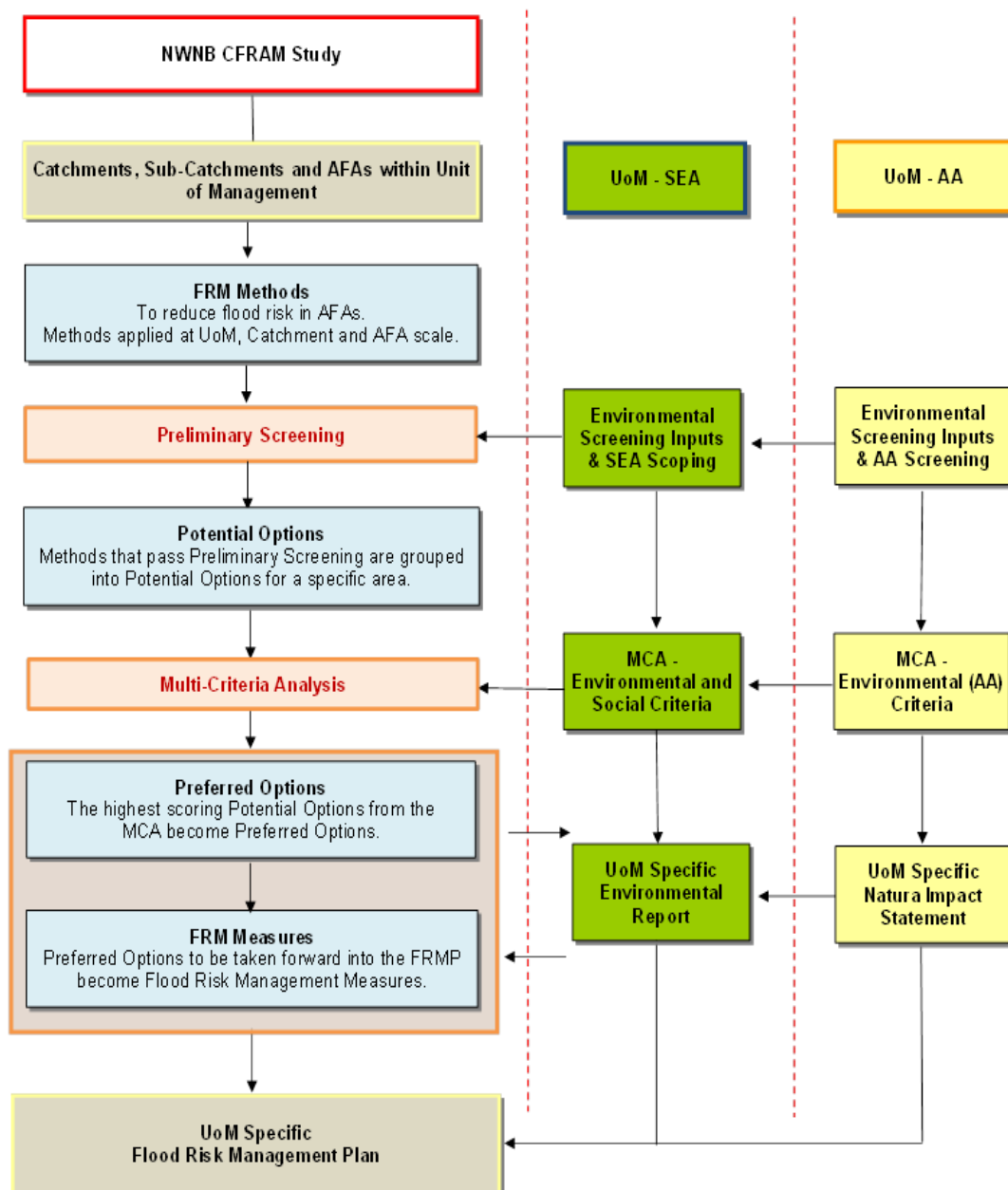


Figure 6.1 Interaction and stages of the optioneering, SEA and AA Processes

Particular issues such as knowledge gaps or mitigation measures that are expected to be necessary are set out in Section 6.6.3 and Appendix G for each preferred measure.

6.2 ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES IN THE NORTH WESTERN RIVER BASIN

The North Western River Basin is of high environmental value, particularly in terms of its protected areas, WFD Annex IV sites, heritage features and its sensitive landscapes. The maintenance and protection of these areas need to be taken into consideration when considering potential FRM options.

There are 23 SACs and 16 SPAs located within the North Western River Basin (Figure 6.2). These sites contain a large variety of habitats, along with their associated flora and fauna. For example, bog, wetland, heath, reef, sea cliff and dune habitats are all found within the North Western River Basin. In addition, Glenveagh National Park, one of six National Parks in Ireland is located within the North Western River Basin 01. This is the second largest National Park in Ireland, encompassing 16,000 hectares in the Derryveagh Mountains. It contains the largest herd of red deer in Ireland and the formerly extinct golden eagle.

The WFD, similar to the Floods Directive, supports the management of water resources on a catchment wide basis, however focuses on water status rather than flood risk management. All waterbodies are classified under the WFD according to their chemical, biological and hydromorphological status. In the North Western River Basin, 59% of rivers, 89% of lakes, and 36% of coastal and transitional water bodies were classified as being of satisfactory condition in the WFD first cycle North West River Basin Management Plan.

Twenty-four lakes and 5km of rivers in the North Western River Basin are designated as Drinking Water Lakes/Rivers (Figure 6.2).

There are 18 designated bathing waters in the study area. In the 2015 bathing season, 13 beaches in the North Western River Basin achieved “Blue Flag” status.

There are two Industrial Emission Directive (IED) sites within the area, flooding of which has the potential to generate new pathways for pollutants to reach rivers and other waterbodies and result in failure to achieve WFD objectives.

In addition, 135 km of seven rivers in the North Western River Basin are designated as Salmonid Rivers.

All waterbodies within the North Western River Basin need to either remain at Good/High Status or improve to at least Good Status under the WFD.

Furthermore, it is vital that designated drinking waters and salmonid water bodies are not negatively impacted upon by the development of FRM Options.

Although there are no sensitive landscapes within the North Western River Basin, tourism to the area is important due to the landscape, seascape and heritage. This is especially seen around the coast; the ‘Wild Atlantic Way’ which follows the route of the N56 south along the coast from Donegal Town to Murvagh passes through the North Western River Basin. This 2,500 km tourist trail is the world’s longest defined coastal touring route, and many tourists from both Ireland and abroad visit each year for the landscape and culture found here.

Environmental considerations must be taken into account while assessing FRM options, in order to ensure that the key sites, features and landscapes located in the North Western River Basin remain protected.

Throughout the development and assessment of FRM Methods and Options environmental criteria were taken into consideration through the inputs from environmental professionals; initially at the methods screening stage, then via the weighting and scoring of relevant objectives in the MCA options phase and ultimately by the SEA and AA of the draft plan in order that mitigation measures could be developed for inclusion in further detailed studies identified in this plan. Examples of the strong and ongoing environmental influence are; development of alternatives, positional improvements of methods and incorporation of methods into options to enhance sustainability.

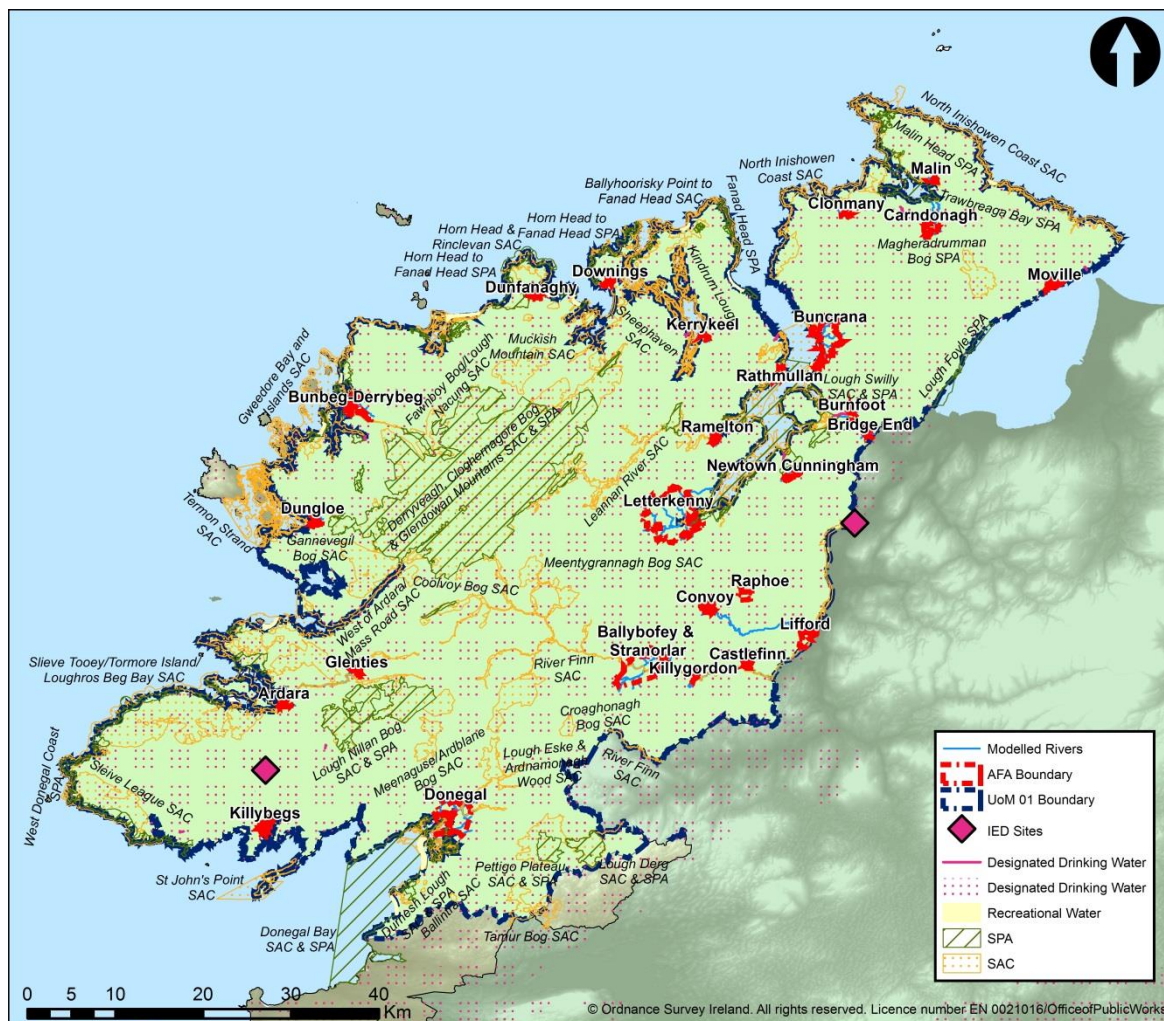


Figure 6.2 Environmental sites / features

6.3 STRATEGIC ENVIRONMENTAL ASSESSMENT

A Strategic Environmental Assessment (SEA) Environmental Report for this Plan has been prepared in accordance with the European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011 [S.I. 200/2011] and the Planning and Development (Strategic Environmental Assessment) (Amendment) Regulations 2011 [S.I. 201/2011]. The purpose of this Environmental Report is to provide a formal and transparent assessment of the likely significant impacts on the environment as a

result of implementing the Plan measures for the North Western River Basin under the North West – Neagh Bann CFRAM Study.

The OPW carried out a SEA Screening in 2011 for all the CFRAM Studies in Ireland and determined that SEA of the Plans would be required. A SEA Scoping Report, a SEA Scoping Summary Report, an Environmental Constraints Report and a table of High Level Impacts of FRM Methods were produced as part of the scoping phase of the SEA for the North West – Neagh Bann CFRAM Study in 2015. The purpose of the Scoping Report and associated documents was to provide sufficient information on the North West – Neagh Bann CFRAM Study to enable the consultees to form an opinion on the appropriateness of the scope, format, level of detail, methodology for assessment and the consultation period proposed for the Environmental Report. All SEA Scoping documentation was made available to the public and formal consultations were undertaken with statutory bodies, local authorities and project stakeholders.

The MCA framework adopted to assist the decision making in the Plan (presented in Section 6 and 8.3), has environmental and social objectives on an equal weighting and importance as the technical and economic objectives. The wider environment has therefore been considered in the development of the Plan. As the Plan objectives cover a range of topics these were matched to the SEA Directive requirements. Many of the Plan objectives could therefore be used directly within the SEA as they are directly compatible. Much of the data used in the SEA process had to be nationally consistent and at a strategic level, to reflect the strategic nature and national scale of the CFRAM studies. Site visits and walkovers were however also undertaken throughout the CFRAM Studies by various technical, environmental and surveying staff, to gain an appreciation of local issues.

The SEA further informed the development of the Plan through the recommendation of mitigation measures to minimise or eliminate any potential negative environmental impacts of the options and the recommendation of environmental monitoring, to measure any wider environmental impacts of the Plan. All SEA documents published in support of the Plan for the North Western River Basin can be found at: www.floodinfo.ie.

6.4 APPROPRIATE ASSESSMENT

The Habitats Directive (Council Directive 92/43/EEC) on the conservation of natural habitats and of wild fauna and flora obliges member states to designate, protect and conserve habitats and species of importance in a European Union context. Article 6(3) of the Habitats Directive requires that “Any plan or project not directly connected with or necessary to the conservation of a site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives.” This Directive was initially transposed into Irish Law through several pieces of legislation; however these have now been consolidated into the European Communities (Birds and Natural Habitats) Regulations 2011. Any proposed plan or project in Ireland that has potential to result in a significant effect on a designated European Site will require an Appropriate Assessment (AA). A key outcome of the Habitats Directive is the establishment of Natura 2000, an ecological infrastructure developed throughout Europe for the protection of sites that are of particular importance for rare, endangered or vulnerable habitats and species. In Ireland, Special Areas of Conservation (SACs), together with Special Protection Areas (SPAs) designated under the ‘Birds Directive’ (Council Directive 2009/147/EC - codified version of Directive 79/409/EEC on the Conservation of Wild Birds, as amended), are included in the Natura 2000 network, and are the ‘European sites’.

An AA Screening was undertaken for the North West – Neagh Bann CFRAM Study in late 2015 / early 2016, which demonstrated that there were 27 European sites (19 SACs and

nine SPAs) assessed as having the potential to experience an impact from the implementation of FRM methods in the catchments of 24 of the AFAs in the North Western River Basin. The findings of the AA Screening were used to guide the development of the alternatives to be considered as part of the SEA. A Stage 2 AA was also undertaken in parallel with the SEA process. The outputs of the Stage 2 AA were integrated into the SEA Environmental Report and subsequently into this Plan. A source – pathway – receptor model approach was taken in the assessment of potential impacts on European sites, taking into account their qualifying interests, conservation objectives and condition. The AA further impacted upon the development of the Plan again through the abandonment of particular methods, development of alternatives, positional improvements of methods and incorporation of methods into options to enhance sustainability having regard for the objectives of the particular protected areas.

Relevant mitigation measures are discussed in Section 6.6.3.

All AA documents published in support of the Plan for the North Western River Basin can be found at: www.floodinfo.ie.

6.5 COORDINATION WITH WATER FRAMEWORK DIRECTIVE

The Water Framework Directive (WFD) is concerned with the protection of the ecological quality of our waters. While the 'Floods' Directive is concerned with the protection of people and society from our waters, both Directives are concerned with water and river basin management, and hence coordination is required between the two processes to promote integrated river basin management, achieve joint benefits where possible and address potential conflicts.

6.5.1 Bi-Lateral Meetings

The Department of Housing, Planning and Local Government (DHPLG) is the lead Government Department for the WFD, and the nominated Competent Authority for establishing the environmental objectives and preparing a programme of measures and the River Basin Management Plans. The OPW has held bi-lateral meetings with senior representatives in DHPLG to establish the appropriate methods and approaches to coordination, which were agreed to be primarily through cross-representation on management / governance groups.

For the second cycle of implementation of the WFD, the Environmental Protection Agency (EPA) has been defined as the Competent Authority for undertaking the characterisation and reporting of same to the Commission, and is also required to assist the DHPLG in its assigned duties. The OPW has held bi-lateral meetings with the EPA since 2013 to determine the suitable approaches to the practical aspects of implementation, which were agreed to be through cross-representation on management / governance groups, and ongoing bi-lateral meetings. These meetings have included workshops to share relevant data.

6.5.2 Cross-Representation on Management Groups

The governance structure for the WFD in Ireland was restructured for the second cycle under SI No. 350 of 2014, with a number of groups subsequently set up in 2014 and 2015.

6.5.2.1 WFD: Water Policy Advisory Committee

The Water Policy Advisory Committee (WPAC) was formally established in 2014 as the 'Tier 1' management committee. Its role is to provide strategic direction and advise the Minister for Housing, Planning and Local Government on the implementation of the WFD.

The OPW is represented on the WPAC to help ensure coordination in the implementation of the WFD and the 'Floods' Directive at a strategic level.

6.5.2.2 WFD: The National Implementation Group

The 'Tier 2' management committee is the National Implementation Group (NIG), which was established in March 2015. The purpose of the NIG is to assist the EPA and DHPLG with the technical and scientific implementation aspects of the WFD to ensure effectiveness, consistency and efficiency. The Group has also been established to provide a mechanism for coordination with the implementation of the 'Floods' Directive.

Working Groups have been established by the NIG to assist with the implementation of certain aspects of the WFD, including characterisation and hydromorphology. A working group on the programme of measures has also been established under the WPAC.

The OPW is represented on the NIG, and also on the characterisation and hydromorphology working groups, to promote coordination on the technical and scientific aspects of mutual relevance in implementation.

6.5.2.3 WFD: Catchment Management Network

The Catchment Management Network was convened to provide a forum for the organisations involved in implementation of the WFD, and other key stakeholders, at the regional and local level, including the local authorities. The Network first met at a launch event and workshop in November 2014, which the OPW attended. The OPW has since continued to engage with the Network to consider the coordination issues in implementation at a local level.

Local Authorities Water and Communities Office

The Local Authority Water and Communities Office (LAWCO) was established in 2015 and is led jointly by Kilkenny and Tipperary County Councils on behalf of the local authority sector. LAWCO's functions include supporting communities to take action to improve their local water environment and provision of coordination at a regional level across public bodies involved in water management. The OPW has been kept aware of the development of the LAWCO through the WPAC and NIG. This local level of activity may provide a suitable point of coordination for local flood risk management activities such as flood protection works being implemented under the Minor Works Scheme or the promotion of natural water retention measures.

6.5.2.4 'Floods' Directive: Steering and Progress Groups

The EPA are represented on the National CFRAM Steering Group, as described in Section 4.3.1.1 above, and have advised on coordination matters, such as defining Objectives relevant to the WFD (see Section 1.4). EPA representatives and the WFD Project Coordinators (appointed in the first cycle of WFD implementation, and to be replaced by LAWCO officers) are also represented on the Project Steering and Progress Groups as described.

6.5.3 Exchange of Information

Relevant information was exchanged between the Competent Authorities relating the 'Floods' Directive and the WFD as necessary.

6.5.4 Coordination on Measures

One of the Flood Risk Management Objectives (Objective 3.a, Table 1.2) is to support the objectives of the WFD. This required an assessment of potential flood risk management measures against the objectives and requirements of the WFD to determine which measures

might have a benefit or cause an impact in terms of the objectives of the WFD, varying in scale and duration. In this way, the potential contribution of flood risk management measures towards, or potential impacts on, the objectives of the WFD are embedded into the process for the identification of proposed measures.

Following approval of the Plans, the next stage to progress the proposed flood risk management measures will be to undertake more detailed assessment and design at a project-level, before submitting the proposals for public exhibition (under the Arterial Drainage Acts) or planning permission. This assessment will normally include an Environmental Impact Assessment (EIA) and, where necessary, a project-level Appropriate Assessment (AA) in line with the Birds and Habitats Directives.

The assessment at the project-level will also enable a detailed appraisal of the potential impacts of the final measure on the water body hydromorphology, hydrological regime and status to be undertaken including, where necessary (if impacts cannot be avoided or mitigated), a detailed appraisal under Article 4(7) of the WFD (derogation related to deterioration caused by new modifications). This will build on the initial work done during the preparation of the Plans.

The work planned by EPA to improve assessment methods for river morphology has the potential to assist in:

- Assessing the potential impact of flood management measures on WFD objectives,
- Identifying the most appropriate mitigation measures, and,
- Supporting decisions on the application of Article 4(7) derogations.

The EPA and OPW will work together to develop technical methods to assist in the assessment of impacts from flood protection schemes.

The OPW is also liaising with the EPA on the potential impact of WFD measures on flood risk, which are typically neutral (no impact), or may have some benefit in reducing runoff rates and volumes (e.g., through agricultural measures such as minimising soil compaction, contour farming or planting, or the installation of field drain interception ponds).

The OPW will continue to work with the EPA and other agencies implementing the WFD to identify, where possible, measures that will have benefits for both WFD and flood risk management objectives, such as natural water retention measures. It is anticipated that this is most likely to be achieved in areas where phosphorous loading is a pressure on ecological status in a sub-catchment where there is also an identified potentially significant flood risk (i.e., an AFA). This coordination will also address measures that may otherwise cause potential conflict between the objectives of the two Directives.

6.6 PROGRESSION OF MEASURES AND ASSESSMENT OF FUTURE WORKS

6.6.1 Approval of the Plan

As set out in Section 6.1 above, the approval / adoption of the Plan has not and does not confer approval or permission for the installation or construction of any physical works.

The progression of any measure towards the implementation of flood relief works or a 'Scheme' must, where applicable, include EIA and/or AA Screening, and, where so concluded from the screening, Environmental Impact Assessment and / or Appropriate Assessment, in accordance with the relevant legislation, and taking into account new

information available at that time (e.g., as available from the Environmental Monitoring Framework and from the www.catchments.ie website).

As part of the EIA, alternatives to the potential works set out in the Plan must be considered. It is emphasised that the Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment. Potential flood relief works or 'Schemes' set out herein will need to be further developed at a local, project level before exhibition under the Arterial Drainage Acts 1945 and 1995 (OPW managed schemes) or submission for planning approval under the Planning and Development legislation/regulations (Local Authority managed schemes). The project-level assessment will include the consideration of alternatives, taking into account local information that cannot be captured at the Plan-level of assessment, such as ground investigation results and project-level environmental assessments. The project-level assessment may give rise at that stage to amendment of the proposed works to ensure that the works:

- Are viable and fully adapted, developed and appropriate within the local context,
- Comply with environmental legislation,
- Consider at a project-level of detail the potential impacts and benefits related to the objectives of the Water Framework Directive (see Section 6.5.4)
- Provide benefits with regards to other objectives (e.g., water quality, biodiversity) where reasonably possible and viable, such as through the use of natural water retention measures, removing barriers to fish migration or the creation of habitat features.

No measure in the Plan has been considered for, or been subject to an assessment under, the 'Imperative Reasons of Over-riding Public Interest (IROPI)' procedure under the Birds and Habitats Directive (Article 6[4]).

In addition to planning or confirmation, licences may be required by the implementing body to progress certain physical works, such as those that may cause damage or disturbance to protected species or their habitats, and the granting of such licences during or following the project-level assessment would be required before such works could proceed.

The body responsible for the implementation of such measures (typically the OPW or a local authority - see Section 8) is required to ensure that the requirements above, and the requirements of all relevant environmental legislation (such as the Environmental Liability and Water Framework Directives), are complied with.

6.6.2 Implementation Routes for Physical Works

6.6.2.1 Works Requiring Planning Consent or Confirmation

As set out above, the body responsible for the implementation of measures that will involve physical works, such as a flood relief scheme, will typically be either the OPW or the relevant local authority. There are three primary legislative routes by which such works may progress to construction stage, as set out in Figure 8.1, are:

- Project led by OPW (or by a Local Authority on behalf of the OPW), under the Arterial Drainage Acts.
- Project led by the relevant Local Authority under the Planning and Development Regulations.
- Project led by the relevant Local Authority under the Strategic Infrastructure Act.

As noted above, while the Plans have conducted a Strategic Environmental Assessment and Appropriate Assessment, the progression of any measure by either the OPW or a local authority will include all applicable 'project-level' assessments, such as:

- Environmental Impact Assessment: For a project above the thresholds specified under Article 24 of the European Communities (Environmental Impact Assessment) Regulations, 1989 as amended or a project likely to have significant effects on the environment, having regard to the criteria specified for under Article 27 of the same EIA Regulations 1989 as amended.
- Appropriate Assessment: All projects will be screened for Appropriate Assessment and, where there is a potential for a significant effect on a European (Natura 2000) site, an Appropriate Assessment will be undertaken in accordance the European Communities (Birds and Natural Habitats) Regulations 2011.

6.6.2.2 Exempted Development

For some measures, the physical works involved are of limited scale and scope. These will typically be works that would be progressed by the local authority, with funding provided by the OPW through the Minor Flood Mitigation Works and Coastal Protection Scheme (the 'Minor Works Scheme' - see Section 2.6.5), that are deemed as exempted development in accordance with the Planning and Development Act 2000 (as amended).

As public bodies, the local authorities are required to comply with all relevant legislation, and hence must undertake EIA and/or AA screening for physical works where relevant (i.e., where the works are not exempt or below relevant thresholds) and as required by legislation. As a condition of the provision of funding for such works, the OPW requires written confirmation from the local authority of compliance with all relevant environmental legislation.

6.6.3 Mitigation Measures

Projects stemming from the Flood Risk Management Plans (FRMP) will apply a range of standard processes and measures that will mitigate potential environmental impacts. While the applicability of processes and particular measures will be dependent on the nature and scale of each project, examples of typical processes and measures that will be implemented where applicable at the different stages of project implementation are set out below.

6.6.3.1 Project Mitigation: Consenting Process

As set out in Section 6.6.2 above, the consenting process for the progression of measures involving physical works will require the applicable environmental assessments. Also, the consenting authorities may set out specific environmental conditions as part of the project approval.

6.6.3.2 Project Mitigation: Pre-Construction / Project-Level Assessment

For the project-level assessment of projects, where options are available, the design uses a hierarchy to mitigation measures along the following principles:

- Avoidance: avoid creating the potential impact where feasible.
- Mitigation: minimise the potential impact through mitigating measures
- Enhancement: Enhance the environment to better than pre-project conditions, where reasonably possible

The progression of a flood management project through the project-level assessment phase can entail a series of surveys to inform the design, where the scale of surveys would be proportionate to the complexity and potential impacts of the project. These can include:

- Engineering structure surveys,
- Topographical surveys,
- Habitat & species surveys¹⁰
- Ornithological surveys,
- Bat surveys,
- Fish surveys,
- Water quality surveys,
- Archaeological surveys,
- Landscape and visual assessments,
- Land valuation surveys and
- Other surveys as deemed necessary to prepare a project.

Where necessary, Wildlife Derogation Licences and archaeological licences will be sought from Dept. of Culture, Heritage and the Gaeltacht.

The scope of the EIS will include a hydro-morphological assessment to more clearly consider and support the Water Framework Directive (WFD) objectives (see Section 6.5.4).

The potential role for non-structural measures for each flood risk area, including natural type flood management measures will be examined in more detail and incorporated into the scheme design if deemed appropriate.

6.6.3.3 Project Mitigation: Construction Stage

For large and complex projects and sites, where environmental management may entail multiple aspects, a project specific Construction Environmental Management Plan (CEMP) may be developed. This will form a framework for all environmental management processes, mitigation measures and monitoring and will include other environmental requirements such as invasive species management measures, if applicable.¹¹

A designated environmental officer, project ecologist and project archaeologist will be appointed, as appropriate for the project.

6.6.3.4 Project Monitoring

The Plan, with its associated SEA and plan-level AA, sets out a series of monitoring requirements, in connection with the SEA objectives and the predicted effects of the Plan. For measures involving physical works, the project-level EIA and AA, where conducted, will set out the specific monitoring required for each measure.

¹⁰ In the context of ecological mitigation, the habitat and species surveys are conducted as required to assess the various aspects for the project, such as ecological surveys for:

- protected or notable habitats and species, including Annex 1 habitats, Annex II and Annex IV species,
- species protected under the Wildlife Acts,
- species protected under the Flora Protection Order,
- the resting and breeding places of relevant species and,
- invasive species, both plant and animal.

¹¹ There are a range standard type mitigation measures consisting of good construction practices and good planning of works, that are used within flood management projects such as for example: Refuelling of plant and vehicles away from watercourses, Installation of wheel-wash and plant washing facilities, working only within environmental windows e.g. in-stream works in salmonid channels from May to September, Integrate fisheries in-stream enhancement through the Environmental River Enhancement Programme

7 MANAGING FLOOD RISK

7.1 OVERVIEW

The purpose of the Plan is to set out the strategy for the sustainable, long-term management of flood risk in the North Western River Basin, focussed on the AFAs. The strategy comprises a set of potential measures, that may be actions, physical works or 'Schemes', further assessments or data collection. For each area or location, a number of options would typically have been available as to what measures could be brought forward and proposed as part of the Plan.

This Section describes the process pursued under the National CFRAM Programme and other policies, projects or initiatives for identifying what flood risk management measures might be suitable for a given area or location, and then how the options for such measures were appraised to determine which options would be most effective and appropriate for each area or location. This process makes use of the flood mapping (Section 5), information provided through public consultation events and processes, and a range of other data and information, as appropriate. Similar processes were followed for the Pilot CFRAM Projects and other projects undertaken in parallel with the CFRAM Programme. The Section concludes with a summary of the measures proposed under this Plan.

Further information on the process set out within this Section on the identification and appraisal of options for managing flood risk within the North Western River Basin is set out in the Preliminary Options Report for the NWNB CFRAM Project, and in similar reports for parallel studies. These reports are available from the OPW website; www.floodinfo.ie.

7.2 METHODS OF FLOOD RISK MANAGEMENT

There are a wide range of different approaches, or methods, that can be taken to reduce or manage flood risk. These can range from non-structural methods, that do not involve any physical works to prevent flooding but rather comprise actions typically aimed at reducing the impacts of flooding, to structural works that reduce flood flows or levels in the area at risk or that protect the area against flooding. The range of methods for managing flood risk that are considered include those outlined below.

7.2.1 Flood Risk Prevention Methods

Flood risk prevention measures are aimed at avoiding or eliminating a flood risk. This can be done by not creating new assets that could be vulnerable to flood damage in areas prone to flooding, or removing such assets that already exist. Alternatively, prevention can be achieved by completely removing the potential for flooding in a given area, although in practice this is rarely possible (the frequency or magnitude of flooding can be reduced by flood protection measures, but it is generally not possible to remove the risk of flooding entirely).

Flood prevention is hence generally focussed on sustainable planning and / or the re-location of existing assets, such as properties or infrastructure, and includes:

- Sustainable Planning and Development Management
- Sustainable Urban Drainage Systems (SUDS)
- Voluntary Home Relocation
- Preparation of Local Adaptation Planning
- Land Use Management and Natural Flood Risk Management Measures

7.2.2 Flood Protection Methods

Flood protection measures are aimed at reducing the likelihood and/or the severity of flood events. These measures, typically requiring physical works, can reduce risk in a range of ways, such as by reducing or diverting the peak flood flows, reducing flood levels or holding back flood waters.

Protection measures typically considered include:

- Enhance Existing Protection Works
- Flood Defences
- Increasing Channel Conveyance
- Diverting Flood Flows
- Storing Flood Waters
- Implementing Channel Maintenance Programmes
- Maintenance of Drainage Schemes
- Land Commission Embankments

The preferred Standard of Protection offered by flood protection measures in Ireland is the current scenario 1% Annual Exceedance Probability (AEP) flood for fluvial flooding and 0.5 % AEP flood for tidal flooding (also referred to as the 100-year and 200-year floods respectively), although these standards can increase or decrease depending on local circumstances.

7.2.3 Flood Preparedness (Resilience) Methods

In some instances, it may not be possible to reduce the likelihood or severity of flooding to an area at risk. However, actions and measures can be taken to reduce the consequences of flooding, i.e., reduce the risk to people and of damage to properties and other assets, and make sure that people and communities are resilient to flood events. This can be achieved by being aware of and preparing for the risk of flooding, knowing when floods are going to occur, taking actions immediately before, during and after a flood. The actions and measures of this type include:

- Flood Forecasting and Warning
- Emergency Response Planning
- Promotion of Individual and Community Resilience
- Individual Property Protection
- Flood-Related Data Collection

7.2.4 Continue Existing Regime / Do Nothing / Minor Measures

In some circumstances the existing programme of works may be sufficient to effectively manage the existing flood risk. For instance, the OPW Arterial Drainage Maintenance Programme ensures that some towns and villages around the country have already been afforded a significantly reduced level of flood risk, and in some communities, the 1% AEP flood is contained within the river channel and so there is very little flood risk. In such circumstances, there may be no need to implement additional measures, and so continuing the existing regime of works may be sufficient to adequately meet the flood risk management Objectives.

In other areas, the level of risk may be relatively low and the cost of implementing any substantial additional measures may be significant. Where the costs of implementing new measures are higher than the benefits of such measures, in terms of risk reduction, then it will not be possible to justify such works. In this case, it may not be possible to undertake any new measures, or only implement low-cost actions such as local maintenance of a channel or minor repairs / alterations to existing structures to reduce the risk and/or avoid a future increase in risk.

7.2.4.1 Maintain Existing Flood Risk Management Works

Flood protection works require maintenance to keep them in good order and able to offer the Standard of Protection they were designed to provide (subject to further works that may be necessary arising from the impacts of climate change). If the level of maintenance is inadequate, the condition can deteriorate and the likelihood of failure of the measure during flood events, including those below the standard of protection, can increase. Maintenance of existing flood risk management works, such as flood relief schemes, should therefore be undertaken by the owner of the works to ensure their performance as designed.

7.3 DEVELOPMENT AND APPRAISAL OF FLOOD RISK MANAGEMENT OPTIONS

This Section describes the process, or steps, pursued under the National CFRAM Programme for identifying the measures that would be most effective and appropriate for each area and location. Section 7.3.8 describes how other measures were identified through other policies, projects and initiatives.

7.3.1 Spatial Scales of Assessment

Measures to manage flood risk can be applied at a range of spatial scales, namely the whole River Basin, at a catchment- or sub-catchment level, or at an AFA or local level. The assessment of possible flood risk management measures has been undertaken at each of these spatial scales of assessment under the CFRAM Programme, to ensure that a catchment-based approach is taken. This is to ensure that a measure that may benefit multiple areas or AFAs is fully considered, and that potential impacts of measures elsewhere in the catchment (e.g., up- and down-stream) are assessed and understood.

Identifying the appropriate spatial scale of assessment (SSA) informs the optioneering process by assuring that only flood risk management methods appropriate to the spatial scale are considered, to identify measures that may benefit multiple areas, and to ensure measures proposed for smaller SSAs are not redundant or do not conflict with other areas within a catchment. When considering which methods to assess it is accepted that certain methods will be more appropriate at larger spatial scales and others at smaller spatial scales. It is important therefore to define what spatial scale is being assessed at the beginning of the method screening process. This is to avoid a situation where the full impact of a FRM method is missed due to the spatial scale of assessment (SSA) being too small, or the FRM method being considered is ineffective as the SSA is too large.

The following SSAs are defined within the NWNB CFRAM Study Area:

- Unit of Management SSA - refers to the whole Unit of Management. There are three Units of Management within the NWNB CFRAM study area one of which is the North Western River Basin;
- Sub-Catchment SSA - refers to the catchment of the principle river on which multiple AFAs sit, in this case the Finn-Deele Sub Catchment was identified;
- AFA SSA - refers to the individual AFA being considered only;

- IRR SSA - refers to Individual Risk Receptor (IRR). There are no such IRRs identified in the NWNB CFRAM Study area.

Table 7.1 and Figure 7.1 detail the SSAs for the North Western River Basin.

Table 7.1 – List of SSAs in the North Western River Basin

SSA	Name	AFAs within SSA		
UoM	North Western (UoM01)	All		
Sub Catchment	Finn - Deelee	Ballybofey and Stranorlar	Killygordon	Castlefinn
		Lifford	Convoy	
AFA		Ballybofey and Stranorlar	Bunbeg-Derrybeg	Buncrana and Luddan
		Burnfoot	Carndonagh	Castlefinn
		Convoy	Donegal	Downings
		Dunfanaghy	Glenties	Kerrykeel
		Killybegs	Letterkenny	Lifford
		Moville	Ramelton	Raphoe
		Rathmullan		

Ardara, Bridge End, Clonmany, Dungloe, Killygordon, Malin and Newtown Cunningham AFAs are low risk.

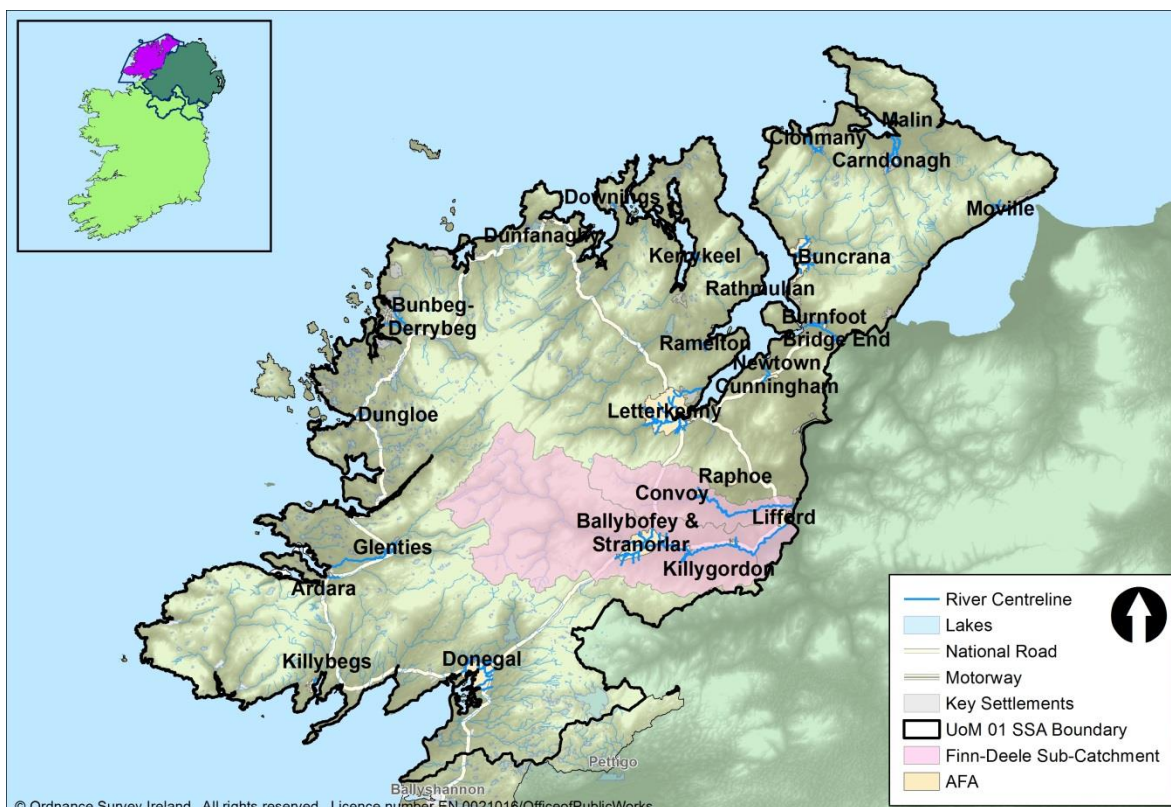


Figure 7.1 The North Western River Basin Spatial Scales of Assessment

The process for developing and appraising potential flood risk management options as described herein was hence undertaken at the catchment- or sub-catchment level, as well as the AFA or local level.

Flood risk management measures applicable at the River Basin level are generally non-structural measures already in-place or mandated under existing legislation or policy (as set out in Table 1.1 or determined through Government Decisions). These measures are set out in the Plan for clarity, and are being kept under review.

7.3.2 Step 1: Screening of Flood Risk Management Methods

Not all of the available methods for flood risk management will be applicable in all areas or locations. Some may, for example, not be socially or environmentally acceptable, be excessively expensive or may not be effective in managing or reducing flood risk in a particular community.

Screening is a process that is undertaken for the catchment and AFA spatial scale to filter out flood risk management methods that are not going to provide applicable, acceptable or viable measures for managing flood risk, either alone or in combination with other methods, for a given area or location. The methods were screened, based on an initial assessment, against the following criteria:

- **Applicability:** Effectiveness in managing or reducing flood risk
- **Economic:** Indicative costs relative to economic benefits
- **Environmental:** Potential impacts for the environment
- **Social:** Potential impacts for people, the community and society
- **Cultural:** Potential impacts for assets and collections of cultural importance

The outcome of the screening process was a set of flood risk management methods that might form, alone or in combination, potentially viable options for flood risk management measures.

For some communities (AFAs), typically those where the risk is relatively low, no local flood risk protection methods were found to be applicable, acceptable and viable, based on the screening process. In such cases, the process does not move to the next steps described below. However, the River Basin-level prevention and preparedness measures will generally be applicable or available to manage the flood risk that does exist in the community. These cases are described along with other AFAs under Section 7.4.

7.3.3 Step 2: Development of Options for Flood Risk Management Measures

The set of flood risk management methods identified through the screening process as being potentially effective or appropriate for each area or location were considered as to how they might be used to form potential measures aimed at achieving the flood risk management Objectives. This process involved professional experience and judgement, informed and guided by local knowledge and suggestions, to develop potentially viable options that incorporate one, or more often a combination of, the screened methods.

The options for possible measures were then developed to outline design, typically to the target Standards of Protection (see Section 7.2.2), based on the information available at the time of development. This permitted an estimation of the cost of the option, and also an appraisal of the option to determine how well it would achieve the flood risk management Objectives, the potential negative impacts arising, and whether it would be economically viable.

The development of options under the CFRAM Programme, while focused primarily on existing risk, included consideration of potential future flood extents, depths and risks based

on the flood mapping undertaken for the Mid-Range and High-End Future Scenarios (see Section 5.5). This was completed to identify what flood protection or other measures might be required in the future, and how adaptable measures aimed at addressing existing risks would be to meet future needs.

The development of options typically included the modelling of the measures where these include physical works. This was to determine the effectiveness of the option in reducing risk, and also to assess any impacts up- or down-stream with the objective of ensuring that any proposed measure does not increase risk up- or down-stream. Where a possible increase in risk elsewhere has been identified as being significant then the option would have been rejected or amended. Where a minor increase in risk was identified, then this will be addressed and mitigated at the project-level of assessment (see Section 8.1) to ensure that the measure would not increase risk elsewhere.

The options considered include 'No Change', which means continuing only the current flood risk management activities.

7.3.4 Step 3: Appraisal by Multi-Criteria Analysis

A range of possible options for measures are typically available to manage and reduce flood risk in a given area or location, and so a method of analysis was needed to determine which of the options might be the most effective and appropriate. This analysis needed to take account of the goals of the Plan, i.e., the flood risk management Objectives (see Section 1.4), and also the general importance of each Objective (the 'Global Weighting' - see below) and the local importance or relevance of each Objective (the 'Local Weighting' - see below).

The method of analysis used to appraise the options is called a 'Multi-Criteria Analysis', or 'MCA'. This is a method for appraising an option against a weighted range of diverse Objectives, to produce a mark or score of performance, referred to as the 'MCA-Benefit Score'. To produce the overall MCA-Benefit Score, a number of steps were followed, as below:

1. Each option was scored on how it performed against each Objective in turn (i.e., its benefits in reducing risk or contributing to other objectives, or its negative impact in terms of increasing risk or causing harm or detrimental impacts)
2. This score was then multiplied by both the Global and Local Weightings (see below)
3. The weighted scores for each Objective were then added up to give the overall MCA-Benefit Score for the option.

The MCA-Benefit Score permitted the comparison of one option against another to identify which option would perform best on balance across all of the Objectives, whereby the higher the score, the better the option would perform. The MCA-Benefit Score reflects the balance of benefits and impacts across all sectors and Objectives.

A critical consideration in selecting a preferred, or best-performing, option is cost. One option may perform marginally better than another, but cost considerably more, and it would be in the best interest of the tax-payer to achieve the best performance per Euro invested. The preferred measure, based on the MCA Appraisal, was hence initially determined as that which had the highest MCA-Benefit Score relative to cost.

A detailed description of the MCA Appraisal process is set out in the CFRAM Technical Methodology Note on Option Appraisal and the Multi-Criteria Analysis (MCA) Framework, which is available from the OPW website (www.floodinfo.ie).

7.3.4.1 Assigning Global Weightings for Each Objective

The MCA makes use of 'Global Weightings' to rank the general importance, or level of 'societal value', for each of the Objectives. The more important the Objective, the higher the Global Weighting, and hence the more influence the Objective has in determining the overall MCA-Benefit Score and the choice of preferred flood risk management measure.

Given the key role the Objectives and their Global Weightings have in selecting preferred measures for managing flood risk, the OPW considered it appropriate to consult on the Global Weightings that would be assigned to each Objective (see Section 4.4.4).

The final Global Weightings adopted for each Objective, which are consistent nationally (i.e., do not vary between River Basins or AFAs), are included in Table 1.2.

7.3.4.2 Assigning Local Weightings for Each Objective

Local Weightings are intended to reflect the relevance of each Objective within the context of each catchment or AFA for which flood risk management measures are being considered. For example, in a given AFA there may be no Utility Infrastructural assets, or no Environmentally Protected Areas, and hence the Local Weighting for the relevant Objectives should be reduced as they are not relevant for that AFA. A Local Weighting value from 0 up to 5 was assigned for each Objective for each catchment and AFA, depending on the relevance of the Objective in the given area.

The Local Weightings were determined by the Project Consultants in consultation with the OPW and the Project Steering and Progress Groups, and informed by:

- Public and stakeholder consultation through questionnaires that were available from the Project Website and issued at the PCDs and through the Project Stakeholder Group, and,
- Guidance issued by the OPW to ensure a consistent approach nationally (see www.floodinfo.ie, CFRAM Technical Methodology Note - Option Appraisal and the Multi-Criteria Analysis (MCA) Framework).

The Local Weightings for the AFAs for the North Western River Basin are set out in the Preliminary Options Report available from the OPW website (www.floodinfo.ie).

7.3.5 Step 4: Economic Appraisal

As well as an MCA, flood risk management investments must be economically viable, i.e., the economic benefits of a measure (reduction in flood damages) must outweigh the cost of the measure, to ensure value for money. This equation is called the Benefit - Cost Ratio (or 'BCR'), where the BCR should be equal to or greater than one.

The appraisal to determine whether options meet this requirement, is called a cost-benefit analysis. This analysis was undertaken to determine the economic viability of each option for each area or location. A more detailed description of the cost-benefit analysis is set out in the CFRAM Technical Methodology Note on Cost-Benefit Analysis (CBA), which is available from the OPW website, www.floodinfo.ie.

7.3.6 Step 5: Public And Stakeholder Engagement

Public and stakeholder engagement and participation in the process to develop effective and appropriate flood risk management measures is critical. The local community typically have a wealth of knowledge about flooding in their area that can help identify possible solutions and ensure that any proposed measures are effective. Community participation is also essential to make sure that any proposed measure is locally-acceptable, addressing

key areas of concern and ensuring that the measure, if structural, will fit into the community environment in a way that local people will welcome.

The engagement process with the public and stakeholders to identify potentially suitable measures began at the Public Consultation Days (PCDs) held for the flood mapping (see Section 4.4.3), where people were asked to identify what they saw as potential solutions for the flood problems in their area, and also what was locally important to guide the identification of the Local Weightings for the MCA Appraisal (see Section 7.3.4).

As options were being considered and appraised, following the processes set out above, a further set of PCDs were held in relevant communities. Members of the local community and other stakeholders attending were presented at these events with the possible options and the findings of the appraisal processes to that time, and were asked for their opinions and input to help guide the process of identifying a preferred measure. The list of PCDs that were held at this stage of the Project is provided in Appendix D.6.

7.3.7 Step 6: Identification of Preferred Measures

The measures set out in this Plan have been determined based on a range of considerations, namely:

- The MCA Benefit - Cost Ratio (BCR)
- The economic viability (the economic BCR)
- The environmental considerations and assessments
- The adaptability to possible future changes, such as the potential impacts of climate change
- Professional experience and judgement of the OPW, local authorities and RPS
- Public and stakeholder input and opinion

A further series of PCDs were held to engage locally and directly with the community and provide people with opportunity to discuss and fully understand the Draft Plans (see Section 4.4.6). The PCDs in the North Western River Basin were held during the option development stage at the venues listed in Appendix D.7.

The measures to be taken forward to project-level development through the implementation of this Plan are described in Section 7.4 below, and are summarised in Section 7.7.

7.3.8 Measures Identified from Other Policies, Projects and Initiatives

In addition to the measures identified through the CFRAM Programme, a number of other measures and actions are required or have been deemed to be of benefit in managing flood risk through other policies, projects and initiatives. A range of policy and legal requirements, as identified in Table 1.1, mandate that certain measures be implemented, such as the ongoing maintenance of Flood Relief Schemes and Arterial Drainage and Drainage District Schemes, or the consideration of flood risk in planning and development management. Other measures and actions have been identified through past or ongoing projects, such as certain flood relief schemes in AFAs not addressed by the CFRAM Programme, or through other initiatives, such as policy recommendations from the Interdepartmental Flood Policy Co-ordination Group. These measures are identified within the draft Plan along with those developed through the CFRAM Programme.

7.4 OUTCOMES

The application of the process and the resultant outcomes for the North Western River Basin, and for the catchments, sub-catchments and AFAs within the River Basin are set out in the sub-sections below.

7.4.1 Measures Applicable for All Areas

There are certain prevention and preparedness measures related to flood risk management, as described in Section 7.2 above and in Appendix F, that form part of wider Government policy. These measures, set out below under the themes of prevention, protection and preparedness, should be applied as appropriate and as applicable across all areas of the River Basin, including properties and areas outside of the AFAs, as well as within.

7.4.1.1 Prevention: Sustainable Planning and Development Management

The application of the Guidelines on the Planning System and Flood Risk Management by the planning authorities is essential to avoid inappropriate development in flood prone areas, and hence avoid unnecessary increases in flood risk into the future. The flood mapping produced through the CFRAM Programme and parallel projects will facilitate the continued application of the Guidelines.

Measure Name:	Application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009)
Code:	GBNIIENW-01-UoM-9011-M21
Measure:	The Planning Authorities will ensure proper application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009) in all planning and development management processes and decisions, including where appropriate a review of existing land use zoning and the potential for blue/green infrastructure, in order to support sustainable development, taking account of the flood maps produced through the CFRAM Programme and parallel projects.
Implementation:	Planning Authorities
Funding:	Existing duties (Planning Authorities)

7.4.1.2 Prevention: Sustainable Urban Drainage Systems

Sustainable Urban Drainage Systems (SUDS) can play a role in reducing and managing run-off from new developments to surface water drainage systems, reducing the impact of such developments on flood risk downstream, as well as improving water quality and contributing to local amenity.

Measure Name:	Implementation of Sustainable Urban Drainage Systems (SUDS)
Code:	GBNIIENW-01-UoM-9012-M34
Measure:	In accordance with the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009), planning authorities should seek to reduce the extent of hard surfacing and paving and require, subject to the outcomes of environmental assessment, the use of sustainable drainage techniques.
Implementation:	Planning Authorities
Funding:	Existing duties (Planning Authorities)

7.4.1.3 Prevention: Voluntary Home Relocation

In extreme circumstances, the flood risk to a home may be such that the homeowner may consider that continuing to live in the property is not sustainable and would choose to relocate.

In response to the floods of Winter 2015/2016, the Government has agreed to the administrative arrangements for a voluntary homeowner relocation scheme, to provide humanitarian assistance for those primary residences worst affected by these floods. At present, there is no Scheme to provide financial assistance to other home-owners choosing to relocate due to their flood risk.

The Interdepartmental Flood Policy Co-ordination Group is considering the future policy options for voluntary home relocation for consideration by Government.

Measure Name:	Voluntary Home Relocation Scheme
Code:	GBNIIENW-01-UoM-9052-M22
Measure:	Implementation of the once-off Voluntary Homeowner Relocation Scheme that has been put in place by Government in 2017. The Interdepartmental Flood Policy Co-ordination Group is considering the policy options around voluntary home relocation for consideration by Government.
Implementation:	Home-Owners with humanitarian assistance to those qualifying under the Voluntary Homeowners Relocation Scheme, 2017
Funding:	Homeowners and the OPW, under the 2017 Scheme

7.4.1.4 Prevention: Local Adaptation Planning

The National Climate Change Adaptation Framework recognises that local authorities also have an important role to play in Ireland's response to climate adaptation. Given the potential impacts of climate change on flooding and flood risk, the local authorities should take fully into account these potential impacts in the performance of their functions, in particular in the consideration of spatial planning and the planning and design of infrastructure, in line with the Local Authority Adaptation Strategy Development Guidelines (EPA, 2016).

Measure Name:	Consideration of Flood Risk in local adaptation planning
Code:	GBNIIENW-01-UoM-9013-M21
Measure:	Local authorities should take into account the potential impacts of climate change on flooding and flood risk in their planning for local adaptation, in particular in the areas of spatial planning and the planning and design of infrastructure.
Implementation:	Local Authorities
Funding:	Existing duties (Local Authorities)

7.4.1.5 Prevention: Land Use Management and Natural Flood Risk Management Measures

The OPW has been liaising with the EPA on the potential impact of WFD measures on flood risk, which are typically neutral (no impact), or may have some benefit in reducing runoff rates and volumes (e.g., through agricultural measures).

The OPW will work with the EPA, local authorities and other agencies to identify, where possible, measures that will have benefits for both WFD and flood risk management objectives, such as natural water retention measures, and also for biodiversity and potentially other objectives. This will form part of the project-level assessment required to progress physical works and flood relief schemes towards planning or exhibition and confirmation (see Section 8.1), where potential works may be amended or enhanced by the introduction of natural water retention and similar measures. The work will include seeking, and where possible implementing, pilot studies in coordination with the Local Authority WFD Offices and other relevant agencies. It is anticipated that this is most likely to be achieved in areas where there are pressures on the ecological status of a water body in a sub-catchment where there is also an identified potentially significant flood risk (i.e., an AFA). This coordination will also facilitate the resolution of issues for measures that may otherwise cause potential conflict between the objectives of the two Directives in certain water bodies.

Measure Name:	Assessment of Land Use and Natural Flood Risk Management Measures
Code:	GBNIIENW-01-UoM-9021-M31
Measure:	The OPW will work with the EPA, local authorities and other agencies during the project-level assessments of physical works and more broadly at a catchment-level to identify, where possible, measures that will have benefits for both WFD and flood risk management objectives, such as natural water retention measures, and also for biodiversity and potentially other objectives, including the use of pilot studies and applications, where possible.
Implementation:	Local Authority WFD Offices, OPW, EPA, Others
Funding:	Existing Duties (OPW, Others)

7.4.1.6 Protection: Minor Works Scheme

The Minor Flood Mitigation Works and Coastal Protection Scheme (the 'Minor Works Scheme') is an administrative scheme operated by the OPW under its general powers and functions to support the local authorities through funding of up to €750k to address qualifying local flood problems with local solutions.

Measure Name:	Minor Works Scheme
Code:	GBNIIENW-01-UoM-9051-M61
Measure:	The OPW will continue the Minor Works Scheme subject to the availability of funding and will keep its operation under review to assess its continued effectiveness and relevance.
Implementation:	OPW, Local Authorities
Funding:	OPW, Local Authorities

7.4.1.7 Protection: Maintenance of Arterial Drainage Schemes and Existing Flood Relief Schemes

There are eleven Arterial Drainage Schemes and an existing flood relief scheme within the North Western River Basin, namely

- Deelee Drainage Scheme
- Swillyburn Drainage Scheme
- Foyle Embankment Drainage Scheme
- Abbey Drainage Scheme
- Blanket Nook Embankment Drainage Scheme
- Cloonburn Drainage Scheme
- Swilly Embankment Drainage Scheme
- Thorn (Extension to Swilly Embankment Drainage Scheme)
- Big Isle (Extension to Swilly Embankment Drainage Scheme)
- Oldtown/ Newmills (Extension to Swilly Embankment Drainage Scheme)
- Skeoge & Burnfoot Drainage Scheme

The existing flood relief scheme is set out in Section 2.6. The OPW has a statutory duty under the Arterial Drainage Act, 1945, and the Amendment of the Act, 1995, to maintain the Arterial Drainage and the flood relief Schemes. The local authorities should also maintain those flood relief schemes for which they have maintenance responsibility. This Plan does not amend these responsibilities to provide additional flood relief. The Plan therefore does not set out additional measures in this regard.

The Arterial Drainage Maintenance service has developed and adheres to a suite of Environmental Management Protocols and Standard Operating Procedures which minimise the potential environmental impact of operations. A Strategic Environmental Assessment (SEA) was conducted for the national Arterial Drainage Maintenance activities for the period 2011-2015 and a further SEA process was again carried out for the national Arterial Drainage Maintenance activities for the period 2016-2021. Appropriate Assessments are also carried out on an ongoing basis for Arterial Drainage Maintenance operations.

Operations outside the scope of the SEA or AA processes are subject to Ecological Assessment to consider environmental sensitivities around Arterial Drainage Maintenance.

7.4.1.8 Protection: Maintenance of Drainage Districts

There are four Drainage Districts within the North Western River Basin, namely the Ballasallagh (Ray River) Drainage District, Carrigans Drainage District, Carrowcannon (Ray River) Drainage District and Portsalon & Duntinny Drainage District. The local authorities have a statutory duty to maintain the Drainage Districts, and this Plan does not amend these responsibilities to provide additional flood relief. The Plan therefore does not set out additional measures in relation to the maintenance of Drainage Districts.

7.4.1.9 Maintenance of Channels Not Part of a Scheme

Outside of the Arterial Drainage and Drainage District Schemes, landowners who have watercourses on their lands have a responsibility for their maintenance. Guidance to clarify the rights and responsibilities of landowners in relation to the maintenance of watercourses on or near their lands is available at www.flooding.ie.

7.4.1.10 Preparedness: Flood Forecasting

The Government decided in January 2016 to establish a National Flood Forecasting and Warning Service. When fully operational, this will be of significant benefit to communities and individuals to prepare for and lessen the impact of flooding. The Government decision has provided the opportunity to proceed with a first stage implementation of the service and will involve the following elements:

- establishment of a National Flood Forecasting Service as a new operational unit within Met Éireann, and
- establishment of an independent Oversight Unit within the Office of Public Works (OPW).

The service will deal with flood forecasting from fluvial (river) and coastal sources and when established it will involve the issuing of flood forecasts and general alerts at both national and catchment scales.

A Steering Group, including representatives from the OPW, the Department of Housing, Planning and Local Government (DHPLG), Met Éireann and the Local Authorities has been established to steer, support and oversee the establishment of the new service. A number of meetings have taken place to progress this complex project.

Given the complexities involved in establishing, designing, developing and testing this new service, it is anticipated that the first stage of the service will take at least 5 years before it is fully operational. In the interim period, existing flood forecasting and warning systems and arrangements will continue to be maintained.

Measure Name:	Establishment of a National Flood Forecasting and Warning Service
Code:	GBNIIENW-01-UoM-9031-M41
Measure:	The establishment of a new operational unit in Met Éireann to provide, in the medium term, a national flood forecasting service and the establishment of an independent Oversight Unit in the OPW.
Implementation:	OPW, DHPLG, Met Éireann and Local Authorities
Funding:	OPW, DHPLG

7.4.1.11 *Preparedness: Review of Emergency Response Plans for Severe Weather*

Section 4.7 of the Major Emergency Management (MEM) Framework introduces the concept of self-appraisal as part of the systems approach to emergency management. The purpose of the appraisal process is to assist agencies and regions to review, monitor and assess their activities and to identify issues which may need to be addressed and consider what measures they could adopt to improve preparedness, as part of the major emergency development programmes.

The regional appraisal, which is undertaken annually, is based on a self-assessment questionnaire, for which the answers are evidence-based and supported with references to documentary support (e.g. document dates, exercise reports, etc.). The process is supported by meetings of the National Steering Group project team with Regional Steering Group Chairs (2 per annum) to shape future MEM developments and identify challenging issues and areas for improvement. It is the task of the National Steering Group to review and validate these appraisals and provide appropriate feedback.

Flood planning and inter-agency co-ordination are included in appraisals and remains a key objective for National Steering Group and Regional Steering Groups.

The local authorities should, in particular, review their flood event emergency response plans, making use of the information on flood hazards and risks provided through the CFRAM Programme and this Plan.

Measure Name:	Ongoing Appraisal of Flood Event Emergency Response Plans and Management Activities
Code:	GBNIIENW-01-UoM-9032-M42
Measure:	Ongoing, regular appraisal of emergency management activities to improve preparedness and inter-agency coordination and to shape future MEM developments as part of the major emergency development programmes, taking into account in particular the information developed through the CFRAM Programme and this Plan.
Implementation:	Principal Response Agencies, Regional Steering Groups, National Steering Group
Funding:	Existing duties (Implementation Bodies)

7.4.1.12 *Preparedness: Individual and Community Resilience*

While the State, through the OPW, local authorities and other public bodies can take certain actions (subject to environmental assessment, where relevant) to reduce and manage the risk of flooding, individual home-owners, businesses and farmers also have a responsibility to manage the flood risk to themselves and their property and other assets to reduce damages and the risk to personal health in the event of a flood.

Research by the DHPLG is informing a review of the national emergency framework and the supports that can be provided to communities to help them respond to all emergencies, including flooding emergencies. This will build on past initiatives and existing support, such as that provided through the 'Plan, Prepare, Protect' programme (<http://www.flooding.ie/>) and the 'Be Winter Ready' Campaigns (<http://winterready.ie/>).

Measure Name:	Individual and Community Action to Build Resilience
Code:	GBNIIENW-01-UoM-9033-M43
Measure:	All people at flood risk should make themselves aware of the potential for flooding in their area, and take long-term and short-term preparatory actions (subject to environmental assessment, where relevant) to manage and reduce the risk to themselves and their properties and other assets.
Implementation:	Public, business owners, farmers and other stakeholders
Funding:	N/A

7.4.1.13 *Preparedness: Individual Property Protection*

Individual Property Protection can be effective in reducing the damage to the contents, furniture and fittings in a house or business, but are not applicable in all situations (for example, they may not be suitable in areas of deep or prolonged flooding, or for some types of property with pervious foundations and flooring). Property owners considering the use of such methods should seek the advice of an appropriately qualified expert on the suitability of the measures for their property, and consider the possible requirements for environmental assessment.

While there may be some existing tax relief for some homeowners works on their homes which are aimed at preventing the risk of flooding, the Interdepartmental Flood Policy Co-ordination Group is considering the administrative arrangements, for consideration by Government, of any appropriate assistance to home owners, where it is suitable, to install Individual Property Protection measures for their property.

Measure Name:	Individual Property Protection
Code:	GBNIIENW-01-UoM-9053-M43
Measure:	Property owners may consider the installation of Individual Property Protection measures. The Interdepartmental Flood Policy Co-ordination Group is considering the policy options around installation of Individual Property Protection measures for consideration by Government.
Implementation:	Home owners, Interdepartmental Flood Policy Co-ordination Group
Funding:	Home owners, N/A

7.4.1.14 *Preparedness: Flood-Related Data Collection*

Ongoing collection and, where appropriate, publication of hydrometric and meteorological data, and data on flood events as they occur, will help us to continually improve our preparation for, and response, to flooding.

Measure Name:	Flood-Related Data Collection
Code:	GBNIIENW-01-UoM-9041-M61
Measure:	The OPW, Local Authorities / EPA and other organisations collecting and, where appropriate, publishing hydro-meteorological data and post-event event flood data should continue to do so to improve future flood risk management.
Implementation:	OPW, Local Authorities / EPA and other hydro-meteorological agencies
Funding:	Existing duties (Implementation Bodies)

The majority of AFAs are located on watercourses which are ungauged however there is scope to improve the rating and record length of data at the existing gauge stations located on / upstream / downstream of AFAs where benefits can be achieved earlier and more cost effectively than would be the case through installing new gauging stations. This is particularly the case at Bunbeg-Derrybeg, Buncrana, Clonmany and Donegal Town where existing stations could potentially be upgraded to flood flow rated stations and the existing records utilised for the analysis of extreme floods. It is important also that the existing flood flow gauging stations are maintained such that their ratings are developed further and record lengths increased.

AFAs 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:

- Ballybofey & Stranorlar (Burn Durnett, Sessiagh and Magherapaste watercourses)
- Cardonagh (Donagh and Glengannon Rivers)
- Clonmany (Ballynahallan River)
- Donegal Town (River Eske)
- Downings (Magherabeg watercourse)
- Glenties (Stracashel River)
- Kerrykeel (Burnside River)
- Killybegs (Drumbeagh watercourse)
- Letterkenny (Glencar, Ballymacool / Sallaghagrane watercourses)
- Ramelton (Rathmelton River)
- Rathmullan (Ballyboe watercourse)

7.4.2 Finn - Deelee Sub-Catchment Measures

No methods were found to be feasible from the Finn sub-catchment screening. Storage was found to be technically unfeasible while Improvement of Channel Conveyance methods were found to be technically feasible however not economically viable. As no methods have been deemed potentially viable, the next steps in the process, such as development of options or MCA appraisal have not been implemented.

7.4.3 Ballybofey and Stranorlar AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Ballybofey and Stranorlar AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of hard defences and improvement of channel conveyance. At risk properties affected by the River Finn and on

the tributaries where it has been found to be the lowest cost option would be protected by a series of flood embankments and walls. These Hard Defences would protect to the 1% AEP flood event with an average height of 1.66m and a total length of 687m. At risk properties on the tributaries where Improvement of Channel Conveyance was found to be the lowest cost method will be protected by widening and lowering of the watercourse where restrictions are causing out of bank flooding. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

There was much interest in the prioritisation process for the proposed physical flood protection measures. Many submissions wished to see the measures for Ballybofey/Stranorlar to reflect the degree of risk to people present in this AFA were there to be a breach of the existing embankment in the AFA.

It is to be noted that the existing embankment does not form part of the proposed measure and so will not have any impact on the prioritisation of the proposed measure in the AFA.

However an assessment was carried out to assess the risk to people based on two defence failure scenarios that were conducted for Ballybofey. These are documented in the North Western River Basin hydraulics report. The simulations show significant inundation in Ballybofey with a number of receptors shown to be at risk. The locations for the defence failure scenarios were selected to reflect the most critical locations in terms of the damage which would occur and also based on anecdotal knowledge provided by members of the public during PCDs.

On the basis of both this defence failure assessment and also the submissions a new measure has been added to the plan calling for a full detailed condition assessment of the existing embankment with recommendations for any upgrade or maintenance works identified.

Public Consultation Outcomes

Many submissions requested that more information was needed for a full assessment of the proposed measures. The measures within the Plans will involve further public consultation. For example, the project development stage for identified schemes will involve a significant level of further public consultation on the proposed measures in the Plan at key points in the progress of the design work required to bring those measures to a state of readiness to submit for planning approval (in the case of projects being implemented by local authorities under the Planning and Development Acts) or for Public exhibition (in the case of projects being implemented by the OPW under the Arterial Drainage Acts ADA). Public Information Days will be organised to inform the communities affected of the progress with the design of the proposed scheme (see Section 8).

The OPW is using this feedback to enhance public and stakeholder engagement and involvement for the next stage of development and implementation of the proposed measures.

Many submissions questioned the level of and effectiveness of the Consultation carried out during the Study to date. Consultation Synthesis Reports were prepared for each stage of consultation on the CFRAM Programme and all comments were considered at each stage of consultation, a Consultation Synopsis Report will be published when the final Plan is complete. Public and stakeholder engagement was a critical component to the process of developing a sustainable, long-term strategy for flood risk management, as set out in the Plan. Such engagement was prioritised by the OPW to ensure that flood risk management measures are suitable and appropriate, as well as technically effective. The OPW has

sought to ensure, and has invested significant resources, in consultation activities. Three rounds of local consultation in the communities that have been the focus of the CFRAM Programme has been a particular focus, with nearly 500 public consultation days (PCDs) within the communities held at key stages throughout the Programme. Details of the consultation undertaken is set out in Section 4 of the Plans. In addition there have been two rounds of statutory public consultation on both the draft flood maps and the draft Flood Risk Management Plans. The PCDs, while not required by statutory requirements, have been very informative to both generate awareness of the Programme and to provide essential material and local knowledge. These local consultation events provided for face-to-face discussion, facilitating the explanation and understanding of the detailed and technical issues involved in the CFRAM Programme.

Some submissions questioned the role of OPW with regard to the provision of insurance and the recalculation of the BCR in Ballybofey based on new information.

The OPW and Dept. Finance are engaging with the Insurance Industry in relation to the availability of insurance for properties at risk from flooding - these discussions are ongoing.

In order to assist insurance companies assess the risk and take into account the protection provided by completed OPW flood defence schemes the OPW has a Memorandum of Understanding with Insurance Ireland, the representative body of the insurance industry. This Memorandum sets out principles of how the two organisations work together and meet quarterly to ensure that appropriate and relevant information on these completed schemes is provided to insurers to facilitate, to the greatest extent possible, the availability to the public of insurance against the risk of flooding. Insurance Ireland members have committed to take into account all information provided by OPW when assessing exposure to flood risk within these protected areas. To date OPW has provided details to Insurance Ireland on 18 completed schemes nationally and Insurance Ireland has advised that flood insurance cover is included in 83% of policies in these defended areas. The Insurance Industry has highlighted that it relies on its own flood models and the OPW Flood Maps do not inform its flood models.

The CFRAM assessment addresses economic damages using a consistent method and dataset across all Areas of Further Assessment for fluvial and coastal flood mechanisms. Detailed damage information (which was provided in this case) is noted for further consideration at the project-level assessment stage.

Table 7.2 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Ballybofey and Stranorlar AFA	900	224	150	-826	-452	1.92	-235.64	1.59

Measure Appraisal

Table 7.2 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed

measure. The proposed measure has the highest benefit cost ratio compared to other potential measures which were investigated.

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is potential for minor medium to long term impacts on water quality and fisheries from recurrent dredging. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term. Ballybofey & Stranorlar is within the Finn Freshwater Pearl Mussel sensitive area, and non-SAC designated populations may be present within, upstream and downstream of the proposed measures. There is potential for sedimentation and water quality impacts on this species during the construction phase.

As the proposed works will be located immediately adjacent to the River Finn SAC, and upstream of the River Foyle and Tributaries SAC (UK), with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

In relation to the proposed measure for Ballybofey and Stranorlar AFA, it can be seen from Table 7.2 that the measure may cause detrimental impacts in relation to the environment / cultural heritage, resulting in an overall multi-criteria assessment (MCA) score of below zero. At the project-level development and assessment of the measure for Ballybofey and Stranorlar the potential detrimental impacts of the measure will need to be carefully considered to determine whether, and how, the potential impacts can be mitigated, such that the measure can be progressed without detrimental impacts to the community and its surrounding environment.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Ballybofey & Stranorlar AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the lengths and height of the hard defences and further localised widening and dredging of tributary channels, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Ballybofey and Stranorlar AFA
Code:	GBNIIENW-01-IE-AFA-010002-0101-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Ballybofey and Stranorlar AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Measure Name:	Full detailed condition assessment of existing embankment with recommendations for any upgrade or maintenance works identified for Ballybofey and Stranorlar AFA
Code:	GBNIIENW-01-IE-AFA-010002-0201-M33
Measure:	Carry out a full detailed condition assessment of the existing embankment with recommendations for any upgrade or maintenance works identified for Ballybofey and Stranorlar AFA
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

There may be potential cross border impacts associated with the transboundary watercourses, Rivers Agency (Northern Ireland) have been consulted on the proposed measure.

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.4 Bunbeg-Derrybeg AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Bunbeg-Derrybeg that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. However the proposed measure has 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. It is therefore recommended that the proposed measure for Bunbeg-Derrybeg progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment. Further information on Measures with a Benefit – Cost Ratio below Unity is presented in Section 7.4.22, with Bunbeg-Derrybeg AFA detailed in Section 7.4.22.1.

7.4.5 Buncrana and Luddan AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Buncrana and Luddan AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of sea walls, flood embankments and flood walls. The hard defences will provide an SoP of 0.5% AEP for coastal flood events, and an SoP of 1% AEP for fluvial flood events with an average height of 1m and a total length of 1.6km. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.3 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure scored better technically, environmentally and had the highest benefit cost ratio compared to other potential measures which were investigated.

Table 7.3 **Appraisal of the Flood Risk Management Measure/Potential Works**

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Buncrana and Luddan AFA	700	804	643	-398	1050	3.32	316.15	4.76

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, agricultural land and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located immediately adjacent to and upstream of Lough Swilly SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of otter and bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Buncrana and Luddan AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Buncrana and Luddan AFA
Code:	GBNIIENW-01-IE-AFA-390600-0301-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Buncrana and Luddan AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.6 Burnfoot AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Burnfoot AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. However the proposed measure has 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. It is therefore recommended that the proposed measure for Burnfoot progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment. Further information on Measures with a Benefit – Cost Ratio below Unity is presented in Section 7.4.22, with Burnfoot AFA detailed in Section 7.4.22.2.

7.4.7 Carndonagh AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Carndonagh AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of using storage areas providing a combined volume of 66,310m³ on the Ballywilly Brook along with a series of embankments and walls along the Donagh River. Improvement of channel conveyance would protect properties impacted by flooding from the Carndonagh watercourse and hard defences would protect properties impacted by flooding from the Glennagannon River. These combined measures provide

protection to a 1% AEP fluvial event. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.4 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure scored better technically and had a higher benefit cost ratio compared to the other potential measure that was investigated.

Table 7.4 *Appraisal of the Flood Risk Management Measure/Potential Works*

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Carndonagh AFA	800	894	753	-368	1279	5.06	252.86	2.21

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located upstream of the North Inishowen Coast SAC and the Trawbreaga Bay SPA, with the potential for indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Carndonagh AFA is considered to be at moderate vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the hard defences and extending their length, carrying out excavation works to increase the storage volume available and further

dredging and excavation, with some bank raising to increase the channel conveyance, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Carndonagh AFA
Code:	GBNIIENW-01-IE-AFA-400616-0501-M61
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Carndonagh AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.8 Castlefinn AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Castlefinn AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments and walls. These hard defences would protect to the 1% AEP fluvial event with an average height of 1.85m and a total length of 797m. The hard defences option would also require a number of culverts through flood defences to be constructed including non-return valves. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

People who attended the Public Consultation were informed of the options, those who commented were in favour of the proposed measure many of whom had experienced flooding over winter 2015/16 and were keen to see a solution implemented urgently. Residents were also concerned about any development resulting in added flood risk. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.5 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Castlefinn AFA, consequently this is the proposed measure.

Table 7.5 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Castlefinn AFA	800	283	741	135	1159	1.75	664.29	1.52

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, a utility, agricultural land, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences. Castlefinn is within the Finn Freshwater Pearl Mussel sensitive area, and non-SAC designated populations may be present within, upstream and downstream of the proposed measures. There is potential for sedimentation and water quality impacts on this Annex II species during the construction phase.

As the proposed works will be located immediately adjacent to the River Finn SAC, and upstream of the River Foyle and Tributaries SAC (UK), with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected habitats and species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Castlefinn AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the height of the hard defences to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Castlefinn AFA
Code:	GBNIIENW-01-IE-AFA-10003-0601-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Castlefinn AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

There may be potential cross border impacts associated with the transboundary watercourses, Rivers Agency (Northern Ireland) have been consulted on the proposed measure.

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.9 Convoy AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Convoy AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. However the proposed measure has 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. It is therefore recommended that the proposed measure for Convoy progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment. Further information on Measures with a Benefit – Cost Ratio below Unity is presented in Section 7.4.22, with Convoy AFA detailed in Section 7.4.22.3.

7.4.10 Donegal AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Donegal AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of storage and a series of flood embankments and walls. These hard defences would protect to the 1% AEP flood event with an average height of 0.9m and a total length of 2.4km. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

There is concern for the time it will take for the proposed measure to be put in place and also regarding scheme costings, drainage issues and ensuring local fishing access with proposed hard defences. It was suggested raising the car park at the mouth of the Eske could be an alternative to hard defences. It was noted that works are currently underway to solve the issue of surface water in Drumlonagher. The consultation process provided further

information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Table 7.6 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Donegal AFA	700	820	551	-983	388	8.50	45.76	1.22

Measure Appraisal

Table 7.6 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Donegal AFA, consequently this is the proposed measure.

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located adjacent to Donegal Bay SAC and SPA, and Lough Eske and Ardnamona Wood SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. The River Eske is a Freshwater Pearl Mussel river, with extant populations recorded directly upstream of Donegal town. There is potential for direct impacts on this species and indirect sedimentation impacts during construction. It is imperative that effective sediment control is in place to protect this species. Following the avoidance and mitigation measures proposed by the Appropriate Assessment, the potential for residual impacts on Lough Eske and Ardnamona Wood SAC remains. Significance of the potential impacts would need to be investigated further at the project-level assessment phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Donegal AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the height of the Hard Defences and extending their length and carrying out excavation works to increase the storage volume available, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Donegal AFA
Code:	GBNIIENW-01-IE-AFA-370580-0801-M61
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Donegal AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.11 Downings AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Downings AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments and flood walls. The hard defences will provide an SoP of 0.5% AEP for coastal flood events and an SoP of 1% AEP for fluvial flood events. The hard defences have an average height of 1m and a total length of 0.3km. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.7 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure scored better environmentally compared to other potential measures which were investigated.

Table 7.7 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Downings AFA	800	226	85	-209	102	0.87	116.60	1.58

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measure, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, minor visual impacts in the medium to long term, and a slight increase in the extent of flooded agricultural land.

As the proposed works will be located immediately adjacent to and upstream of Sheephaven SAC and Tranarossan and Melmore Lough SAC, and within the potential zone of influence of Horn Head to Fanad Head SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Downings AFA is considered to be at moderate vulnerability from the mid-range future scenario and moderate vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Downings AFA
Code:	GBNIIENW-01-IE-AFA-380595-0901-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Downings AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.12 Dunfanaghy AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Dunfanaghy AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood walls, raising of the deck level of Dunfanaghy pier and ‘tanking’ of three properties. These measures will provide a 0.5% AEP SoP for coastal flood events. The flood walls are required to be an average height of 1.0m and a total length of 200m. The Dunfanaghy pier would require approximately 850m² of raising by an average of 900mm. Additionally, a structural survey of the existing wall would be required to ensure it is fit for purpose as a flood defence. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.8 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Dunfanaghy AFA, consequently this is the proposed measure.

Table 7.8 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Dunfanaghy AFA	800	389	345	-495	239	1.93	124.36	1.30

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, minor visual impacts, and minor impacts to the setting of a castle in the medium to long term.

As the proposed works will be located adjacent to and upstream of Horn Head and Rinclevan SAC, and in close proximity to Horn Head to Fanad Head SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Dunfanaghy AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the hard defences, raising of the pier and raising of the waterproof membrane on tanked properties, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Dunfanaghy AFA
Code:	GBNIIENW-01-IE-AFA-380596-1001-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Dunfanaghy AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.13 Glenties AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Glenties AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments and walls and land use management. These measures will provide a 1% AEP SoP. One location would consist of 67m of flood walls between 1m and 1.8m high and tanking of two existing building walls. The second location would consist of 139m of flood embankment 0.8m high (average). Land use management would be applied to the catchments in order to mitigate any adverse effects from constructing the hard defences on a protected species. The freshwater pearl mussels' habitat is located downstream in the Owenea River. Land use management would be assessed to identify land use features that would reduce surface water runoff. Consequently, there would be flood risk reduction juxtaposed with a reduced sediment and pollutant load entering the protected watercourses. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.9 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Glenties AFA, consequently this is the proposed measure.

Table 7.9 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Glenties AFA	600	658	489	-731	416	0.55	756.20	5.05

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, a transport link and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located immediately adjacent to the West of Ardara / Maas Road SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. The Owenea River is a designated Freshwater Pearl Mussel River. There is potential for direct impacts on this species, as well as salmon and otter, and indirect sedimentation impacts during construction. It is imperative that effective sediment control is in place to protect these species. Following the avoidance and mitigation measures proposed by the Appropriate Assessment, the potential for residual impacts on the West of Ardara / Maas Road SAC remains. Significance of the potential impacts would need to be investigated further at the project-level assessment phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Glenties AFA is considered to be at moderate vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Glenties AFA
Code:	GBNIIENW-01-IE-AFA-380597-1101-M61
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Glenties AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	Typically the local authority under the OPW Minor Works Scheme
Funding:	Typically OPW Minor Works Scheme

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.14 Kerrykeel AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Kerrykeel AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of removing a restrictive bridge structure. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Table 7.10 ***Appraisal of the Flood Risk Management Measure/Potential Works***

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Kerrykeel AFA	900	125	130	-224	32	0.03	1017.48	2.84

Measure Appraisal

Table 7.10 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Kerrykeel AFA, consequently this is the proposed measure.

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, transport links and a social infrastructure/amenity site in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located adjacent to and upstream of Mulroy Bay SAC, and upstream of Greer's Isle SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Kerrykeel AFA is considered to be at low vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Kerrykeel AFA
Code:	GBNIIENW-01-IE-AFA-380594-1201-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Kerrykeel AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	Typically the local authority under the OPW Minor Works Scheme
Funding:	Typically OPW Minor Works Scheme

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.15 Killybegs AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Killybegs AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood walls and road raising. These hard defences will provide an SoP of 1% AEP for fluvial flood events and 0.5% for coastal flood events, at a total length of 1.3km and an average height of 1m. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in

Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.11 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Killybegs AFA, consequently this is the proposed measure.

Table 7.11 *Appraisal of the Flood Risk Management Measure/Potential Works*

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Killybegs AFA	800	1065	824	-342	1547	8.41	183.85	1.58

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

There are no European sites with any identifiable potential impact pathway arising from the proposed measures; therefore Appropriate Assessment was not required. Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Killybegs AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the hard defences (with heights up to 3m) and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Killybegs AFA
Code:	GBNIIENW-01-IE-AFA-370585-1301-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Killybegs AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.16 Letterkenny AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Letterkenny AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood walls and embankments, along with the replacement of a footbridge on the Cullion watercourse. The hard defences will provide an SoP of 0.5% AEP for coastal flood events and an SoP of 1% AEP for fluvial flood events. The hard defences have an average height of 1.4m and a total length of 3.8km. The replacement of the footbridge will have a minimum soffit level of 6.5mOD Malin. The proposed measure would also involve extending and raising existing flood defences where they are found to have insufficient height/length to prevent flooding. It is assumed that existing flood defences can be extended, the required extension height and associated base width was determined.

The proposed measure relies on flood protection being provided by some existing embankments that were constructed to provide protection to agricultural land, and that were not constructed to the modern engineering standards that would be applied now when providing urban flood protection. A detailed geotechnical structural and stability assessment of the existing embankments was not undertaken as part of the CFRAM study, but should be undertaken as part of the project-level assessment in progressing this measure.

The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Table 7.12 **Appraisal of the Flood Risk Management Measure/Potential Works**

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Letterkenny AFA	600	414	526	-632	307	4.23	72.70	4.89

Measure Appraisal

Table 7.12 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure has the highest benefit cost ratio compared to other potential measures that were investigated.

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, agricultural land, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located adjacent to and upstream of Lough Swilly SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Letterkenny AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing culvert and channel capacity, increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Letterkenny AFA
Code:	GBNIIENW-01-IE-AFA-390607-1401-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Letterkenny AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.17 Lifford AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Lifford AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments and walls. These Hard Defences would protect to the 1% AEP fluvial event with an average height of 2.1m and a total length of 2.6km. The proposed measure would also require raising two local roads in the northern part of the AFA.

The proposed measure relies on flood protection being provided by some existing embankments that were constructed to provide protection to agricultural land, and that were not constructed to the modern engineering standards that would be applied now when providing urban flood protection. A detailed geotechnical structural and stability assessment of the existing embankments was not undertaken as part of the CFRAM study, but should be undertaken as part of the project-level assessment in progressing this measure.

The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

Many attendees have experienced flooding during winter 2015/16 and pointed to the fact that a lot of the flooding emanates from drainage but is driven by high water levels in the Finn/Foyle/Deele. Any solution must allow for drainage works to ensure that this does not result in a residual flood risk. Geomorphological changes along the Finn/Foyle were reported to have been exacerbated by the recent flooding event. In general those who attended were in agreement with the hazard and proposed solutions with their main concern centring round the need for a solution to be put in place as soon as possible. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.13 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Lifford AFA, consequently this is the proposed measure.

Table 7.13 *Appraisal of the Flood Risk Management Measure/Potential Works*

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Lifford AFA	600	1250	1032	-577	1705	5.94	286.89	1.91

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, agricultural land, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located immediately adjacent to the River Finn SAC and River Foyle and Tributaries SAC (UK), with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Lifford AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the hard defences, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Lifford AFA
Code:	GBNIIENW-01-IE-AFA-010008-1501-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Lifford AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

There may be potential cross border impacts associated with the transboundary watercourses, Rivers Agency (Northern Ireland) have been consulted on the proposed measure.

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.18 Moville AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Moville AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. However the proposed measure has 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. It is therefore recommended that the proposed measure for Moville progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment. Further information on Measures with a Benefit – Cost Ratio below Unity is presented in Section 7.4.22, with Moville AFA detailed in Section 7.4.22.4.

7.4.19 Ramelton AFA Measures

It should be noted that the risk in Ramelton AFA was evaluated on the basis of known high risk of culvert blockage.

The summary of flood risk information presented in Table 5.1 is for the unblocked scenario in Ramelton. There is a culvert which blocks and this was assessed as part of the assessment of this AFA. It was found that the flood risk, under blockage conditions changes to:

- Fluvial 1%AEP - 10 residential and 2 non residential properties,
- Coastal 0.5%AEP - 14 residential and 11 non-residential properties, and
- A NPVd value of €13.77M

These are the figures pertaining to the optioneering process for Ramelton AFA, which is summarised in the following sections.

Description of the Proposed measure

Potentially viable flood relief works for Ramelton AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works.

The proposed measure consists of a series of flood embankments with revetment protection, walls, demountable barriers along the quays and a flood gate located on Shore Road. These hard defences would protect to the 0.5% AEP coastal event and 1% AEP fluvial flood event with an average height of 1.4m and a total length of 797m. At risk properties would also be protected by installing a trash screen upstream of a bridge which is susceptible to blockage. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

It was suggested the built heritage of Ramelton AFA was important and should be a reason to prioritise the works. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.14 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure scored better socially, environmentally and has a higher benefit cost ratio than the other potential measure which was investigated.

Table 7.14 *Appraisal of the Flood Risk Management Measure/Potential Works*

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Ramelton	500	900	699	-776	823	6.79	121.25	1.02

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and visual impacts on the historic setting of the town in the medium to long term.

As the proposed works will be located adjacent to and upstream of Lough Swilly SAC and SPA, and adjacent to and downstream of Leannan River SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Ramelton AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the size of the trash screen and increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Ramelton AFA
Code:	GBNIIENW-01-IE-AFA-390611-1701-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Ramelton AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.20 Raphoe AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Raphoe AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of diverting surface water flow originating from the hills to the north and west of Raphoe by the creation of an open channel to collect and divert flows away from the town. Earth embankments from the excavated channel will be created on the lower side of the channels to provide freeboard and prevent overtopping. Diverted flow will be directed to existing river channels to the south-west and south-east of the town respectively. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

Public consultation for Raphoe AFA mapping took place in September 2013, elected members and members of the public that attended were shown the mapping and outline, high level, options were discussed. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.15 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure scored better technically, economically, environmentally and had a significantly higher benefit cost ratio compared to other potential measures investigated.

However it was reported that a significant residual risk would remain in Raphoe with the proposed measure in place due to rain falling downstream of the defences. A further study was therefore carried out to consider secondary measures that would provide the preferred SoP (1% AEP). The secondary measures consisted of hard defences, upstream storage, diversion of flow and overland floodway and associated drainage network improvements, such measures are not included as part of this option as there are the subject of ongoing discussion and development at study level.

Table 7.15 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Raphoe AFA	800	150	210	60	420	0.89	472	13.71

Climate Change Adaptability

Adaptation of the proposed measure would require the open channels to be modified to convey increased flow in the future and the size of the bridges to convey future flow should be considered in the project-level assessment stage, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Raphoe AFA
Code:	GBNIIENW-01-IE-AFA-010648-1801-M31
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Raphoe AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.21 Rathmullan AFA Measures

Description of the Proposed measure

Potentially viable flood relief works for Rathmullan AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood embankments, walls and improvement of channel conveyance. This combination would protect to the 1% AEP fluvial

flood event and 0.5% AEP coastal flood events. An average height of 2m and a total length of 281m will be required. The Improvement of Channel Conveyance consists of 71m of upgraded culvert. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

People who commented were in favour of the proposed measure provided the works were sympathetic with the town and views towards Lough Swilly. It was noted that Donegal County Council have applied for "severe weather funding" to upgrade/replace an individual culvert in a particular location. The status of this application should be taken into consideration during project-level assessment. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.16 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. The proposed measure has a higher benefit cost ratio than the other potential measure which was investigated.

Table 7.16 *Appraisal of the Flood Risk Management Measure/Potential Works*

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Progress the development of a Flood Relief Scheme for Rathmullan AFA	600	671	760	-888	543	4.39	123.74	1.70

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties, a monument and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is potential for recurring impacts on water quality and fisheries from dredging. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the long term.

As the proposed works will be located immediately adjacent to and upstream of Lough Swilly SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Rathmullan AFA is considered to be at low vulnerability from the mid-range future scenario and moderate vulnerability from the high end future scenario. Adaptation of the proposed measure would require upgrading a culvert capacity and increasing the height of the hard defences and extending their length. However this would require a wall being raised to over 3m high and is deemed unacceptable due to the residual risk and social impact, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Progress the development of a Flood Relief Scheme for Rathmullan AFA
Code:	GBNIIENW-01-IE-AFA-390613-1901-M33
Measure:	Progress the project-level development and assessment of a Flood Relief Scheme for Rathmullan AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.22 Measures with a Benefit - Cost Ratio below Unity

For some AFAs, no economically viable measure (i.e., a measure with a benefit - cost ratio of greater than 1.0) has been found through the analysis undertaken to date, but a technically viable measure has been identified with a benefit - cost ratio of between 0.5 and 1.0. A more detailed assessment of the costs of such measures may indicate that the measure could be implemented at a cost below that determined through the analysis undertaken to date.

While it would not be prudent to progress such measures to full project-level assessment towards planning / public exhibition based on the information available at present, a more detailed assessment of the costs can be progressed to determine if an economically viable measure may in fact exist that could justify the progression to full project-level assessment.

7.4.22.1 Bunbeg-Derrybeg

Description of the Proposed measure

Potentially viable flood relief works for Bunbeg-Derrybeg AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of walls and embankments. These hard defences would protect to the 1% AEP fluvial flood event and 0.5% AEP coastal event with 197m of wall height between 0.6m and 1.2m, and 160m of wall height between 1.2 and 2m.

The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.17 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Bunbeg-Derrybeg AFA, consequently this is the proposed measure.

Table 7.17 *Appraisal of the Flood Risk Management Measure/Potential Works*

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Undertake a Detailed Assessment of the Costs of the Potential Measure for Bunbeg-Derrybeg AFA	800	407	147	-600	-46	1.36	-34.03	0.87

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor medium term impacts on fisheries from habitat alteration.

As the proposed works will be located upstream of Gweedore Bay and Islands SAC and the West Donegal Coast SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected otter and bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase, in particular to nearby saltmarsh habitat.

In relation to the proposed measure for Bunbeg-Derrybeg AFA, it can be seen from Table 7.17 that the measure may cause detrimental impacts in relation to the environment / cultural heritage, resulting in an overall multi-criteria assessment (MCA) score of below zero. At the project-level development and assessment of the measure for Bunbeg-Derrybeg the potential detrimental impacts of the measure will need to be carefully considered to determine whether, and how, the potential impacts can be mitigated, such that the measure

can be progressed without detrimental impacts to the community and its surrounding environment.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Bunbeg-Derrybeg AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the height of the hard defence and extending its length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Undertake a Detailed Assessment of the Costs of the Potential Measure for Bunbeg-Derrybeg AFA
Code:	GBNIIENW-01-IE-AFA-385321-0201-M25
Measure:	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.22.2 Burnfoot

Description of the Proposed measure

Potentially viable flood relief works for Burnfoot AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of flood embankments and urban walls. The hard defences would protect to the 1% AEP flood event with an average height of 2.1m and a total length of 0.6km.

The proposed measure relies on flood protection being provided by some existing embankments that were constructed to provide protection to agricultural land, and that were not constructed to the modern engineering standards that would be applied now when providing urban flood protection. A detailed geotechnical structural and stability assessment of the existing embankments was not undertaken as part of the CFRAM study, but should be undertaken as part of the project-level assessment in progressing this measure.

The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.18 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Burnfoot AFA, consequently this is the proposed measure.

Table 7.18 *Appraisal of the Flood Risk Management Measure/Potential Works*

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Undertake a Detailed Assessment of the Costs of the Potential Measure for Burnfoot AFA	500	252	285	-521	16	1.23	12.96	0.88

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties, a commercial property, and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located immediately adjacent to and upstream of Lough Swilly SPA, and upstream of Lough Swilly SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Burnfoot AFA is considered to be at low vulnerability from the mid-range and high end future scenarios. Adaptation of the proposed measure would require increasing the height of the Hard Defences and extending their length. However this would require a wall being raised to over 3m high and is deemed unacceptable due to the residual risk and social impact, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Undertake a Detailed Assessment of the Costs of the Potential Measure for Burnfoot AFA
Code:	GBNIIENW-01-IE-AFA-390601-0401-M25
Measure:	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.22.3 Convoy

Description of the Proposed measure

Potentially viable flood relief works for Convoy AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of a series of flood walls to protect to the standard of a 1% AEP fluvial flood event. These walls consist of a total of 416m of wall height ranging between 0.6m and 3m. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Table 7.19 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Undertake a Detailed Assessment of the Costs of the Potential Measure for Convoy AFA	700	124	68	-258	-65	1.94	-33.59	0.84

Measure Appraisal

Table 7.19 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Convoy AFA, consequently this is the proposed measure.

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measure, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located upstream of the River Foyle and Tributaries SAC (UK), with the potential for indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

In relation to the proposed measure for Convoy AFA, it can be seen from Table 7.19 that the measure may cause detrimental impacts in relation to the environment / cultural heritage, resulting in an overall multi-criteria assessment (MCA) score of below zero. At the project-level development and assessment of the measure for Convoy the potential detrimental impacts of the measure will need to be carefully considered to determine whether, and how, the potential impacts can be mitigated, such that the measure can be progressed without detrimental impacts to the community and its surrounding environment.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Convoy AFA is considered to be at moderate vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the Hard Defences and extending their length. However this would require walls being raised to over 3m high and deemed unacceptable due to the residual risk and social impact, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Undertake a Detailed Assessment of the Costs of the Potential Measure for Convoy AFA
Code:	GBNIIENW-01-IE-AFA-010005-0701-M25
Measure:	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.
Implementation:	OPW and/or Donegal CoCo - To be confirmed
Funding:	OPW

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.4.22.4 Merville

Description of the Proposed measure

Potentially viable flood relief works for Merville AFA that may be implemented after project-level assessment and planning or exhibition and confirmation might include physical works. The proposed measure consists of embankments and walls which would protect properties to both the 0.5% AEP coastal events and 1% fluvial events. The potentially viable flood relief works which, at this stage of assessment, are deemed to be preferred are set out in Appendix G (noting that these will be subject to further assessment and possible amendment).

Public Consultation Outcomes

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the proposed measure at this stage.

Measure Appraisal

Table 7.20 outlines the MCA appraisal scores for the technical, social, economic and environmental/cultural aspects of the evaluation along with MCA outcomes for the proposed measure. One measure was identified for Merville AFA, consequently this is the proposed measure.

Table 7.20 Appraisal of the Flood Risk Management Measure/Potential Works

Option	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Undertake a Detailed Assessment of the Costs of the Potential Measure for Merville	900	253	160	-193	220	0.72	305.39	0.98

The proposed measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the proposed measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located in the potential zone of influence of Lough Foyle SPA, with the potential for direct impacts on the qualifying species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species during the construction phase.

Specific mitigation measures will be identified at the project-level assessment stage. A list of potential mitigation measures are outlined in Section 6.6.3 and Appendix G.

Climate Change Adaptability

Moville AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the proposed measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme.

Conclusion

Measure Name:	Undertake a Detailed Assessment of the Costs of the Potential Measure for Moville AFA
Code:	GBNIIENW-01-IE-AFA-400621-1601-M25
Measure:	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.
Implementation:	Typically the local authority under the OPW Minor Works Scheme
Funding:	Typically OPW Minor Works Scheme

There may be potential cross border impacts associated with the transboundary waterbody, Rivers Agency (Northern Ireland) have been consulted on the proposed measure.

Section 8.1 sets out the routes for the progression of measures and future assessments, including environmental assessments, of any potential future physical works.

7.5 PRIORITISATION OF PROPOSED PROTECTION MEASURES

Implementing all of the proposed measures as set out in this, and all, Plans would require a significant capital investment as well as substantial resources to manage the implementation process. The Government's National Development Plan 2018 to 2027 has committed up to €1 billion over the lifetime of the Plan for flood relief measures. This will enable the OPW to continue with the implementation of its existing flood relief capital works programme and will also facilitate the phased implementation of the proposed measures within the Plans. Within this period, it is necessary to prioritise the investment of resources in the delivery of the flood relief capital investment programme.

The basis on which measures in the Plans have been prioritised for implementation is a key consideration in planning the investment of the significant public resources made available for flood relief over the next 10 years. The prioritisation primarily relates to the protection measures to be implemented by the OPW or funded by the OPW but implemented by a local authority.

For the purposes of prioritisation, the measures have been divided into three streams as follows:

1. Large Schemes: Measures costing in excess of €15m
2. Medium and Small Schemes: Measures costing in between €750k/€1m and €15m
3. Minor Schemes: Measures costing less than €750k/€1m

There are only a small number of Large Schemes, all of which will be advanced at an early stage due to their scale and their long lead in period.

It is anticipated that the Minor Schemes will be brought forward by the local authorities, with OPW funding, and so may be advanced at an early stage.

The measures in the remaining stream (Medium and Small Schemes) will be prioritised on a regional basis, by reference to the six CFRAM study areas. The management objective for this €1billion ten year programme of flood relief works is to efficiently utilise available capacity to plan progression and completion of schemes that deliver greatest protection and maximise return.

7.6 FLOOD RISK MANAGEMENT IN OTHER AREAS

This Plan identifies a series of flood risk management measures for the entire River Basin and also viable, locally-specific flood protection measures for the AFAs identified through the PFRA.

While it is considered that the PFRA identified the areas of significant flood risk throughout Ireland, the PFRA will be reviewed in line with legislation, and other areas can be considered for detailed assessment at that stage.

In the interim, local authorities may avail of the OPW Minor Flood Mitigation Works and Coastal Protection Scheme (Section 2.6.5 and 7.4.1.6), where the relevant criteria are met, to implement local solutions to local flood problems, including in areas outside of the AFAs.

7.7 SUMMARY OF PROPOSED MEASURES

Table 7.21 provides a summary of the measures that are to be progressed through the implementation of the Plan for the North Western River Basin.

Table 7.21: Summary of Flood Risk Management Measures

Measure	Implementation	Funding
Measures Applicable for All Areas		
Application of the Guidelines on the Planning System and Flood Risk Management (DHPLG/OPW, 2009)	Planning Authorities	Planning Authorities
Implementation of Sustainable Urban Drainage Systems (SUDS)	Planning Authorities	Planning Authorities
Voluntary Home Relocation	Interdepartmental Flood Policy Co-ordination Group	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, DHPLG, Met Éireann and local authorities	OPW, DHPLG
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, Interdepartmental Flood Policy Co-ordination Group	Homeowners
Flood-Related Data Collection	OPW, Local Authorities / EPA, and other hydro-meteorological agencies	Implementation Bodies
Catchment / Sub-Catchment Measures		
No Sub-Catchment methods were found to be feasible		

Community-Level (AFA) Measures		
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.		
Ballybofey and Stranorlar AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Buncrana and Luddan AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Carndonagh AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Castlefinn AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Donegal AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Downings AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Dunfanaghy AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Glenties AFA	Typically the local authority under the OPW Minor Works Scheme	Typically OPW Minor Works Scheme
Kerrykeel AFA	Typically the local authority under the OPW Minor Works Scheme	Typically OPW Minor Works Scheme
Killybegs AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Letterkenny AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Lifford AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Ramelton AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Raphoe AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Rathmullan AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Progress further Data Collection and/or further Analysis for the Communities set out below.		
None		

Undertake a Detailed Assessment of the Costs of the Potential Measure for the Communities set out below.		
Bunbeg-Derrybeg AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Burnfoot AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Convoy AFA	OPW and/or Donegal CoCo - To be confirmed	OPW
Moville AFA	Typically the local authority under the OPW Minor Works Scheme	Typically OPW Minor Works Scheme

Table 7.22: Summary of Flood Relief Schemes and Works Progressed or Proposed through Other Projects or Plans

Flood Relief Schemes and Works Progressed or Proposed through Other Projects or Plans		
Community (AFA)	Scheme or Works	Status
Raphoe AFA	Raphoe (Pluvial) Flood Relief Scheme	Design / Planning Stage

8 IMPLEMENTATION, MONITORING AND REVIEW OF THE PLAN

8.1 IMPLEMENTATION OF THE PLAN

The Plan sets out the strategy, actions and measures that are considered to be the most appropriate at this stage of assessment, including a programme of structural and non-structural measures to be implemented and has identified the responsible body/bodies for implementing those measures.

8.1.1 River Basin Level Measures

The River Basin level measures, i.e., those applicable in all areas (Section 7.4.1), typically do not involve physical works, and represent the implementation of existing policy and/or the development of new policies or Schemes.

Many prevention and preparedness measures are already in-hand with the relevant implementing bodies or are being proactively progressed by the Inter-Departmental Flood Policy Co-ordination Group. Other such measures requiring new action should be proactively and urgently progressed and implemented by the relevant implementing bodies, subject to any licences and/or environmental assessments required, through normal business practices.

8.1.2 Catchment and AFA-Level Physical Measures

Most of the measures at the catchment and/or AFA-level involve physical works. The body responsible for the implementation of measures that will involve physical works, such as a flood relief scheme, will typically be either the OPW or the relevant local authority (see Table 7.21).

The potential physical flood relief works or 'Schemes' set out in the Plans that have been developed through the CFRAM Programme are to an outline design, and are not at this point ready for construction. Further detailed design through a project-level of assessment will be required for such works before implementation, including more detailed adaptation planning for the potential impacts of climate change along with:

- Project-level environmental assessment and appraisal (e.g., EIA and Appropriate Assessment where relevant)
- Further public and stakeholder consultation and engagement (see Section 8.1.4)
- Statutory planning processes, such as planning permission or public exhibition and confirmation (Ministerial approval), where relevant.

Local information that cannot be captured at the Plan-level of assessment, such as ground investigation results, project-level environmental assessments and interactions with local urban storm water drainage systems, may give rise at that stage to some amendment of the proposed works to ensure that they are viable, fully adapted, developed and appropriate within the local context, and that they are compliant with environmental legislation. The works set out in the Plan may therefore be subject to some amendment.

There are three routes by which such works may progress to construction stage, as set out in Figure 8.1.

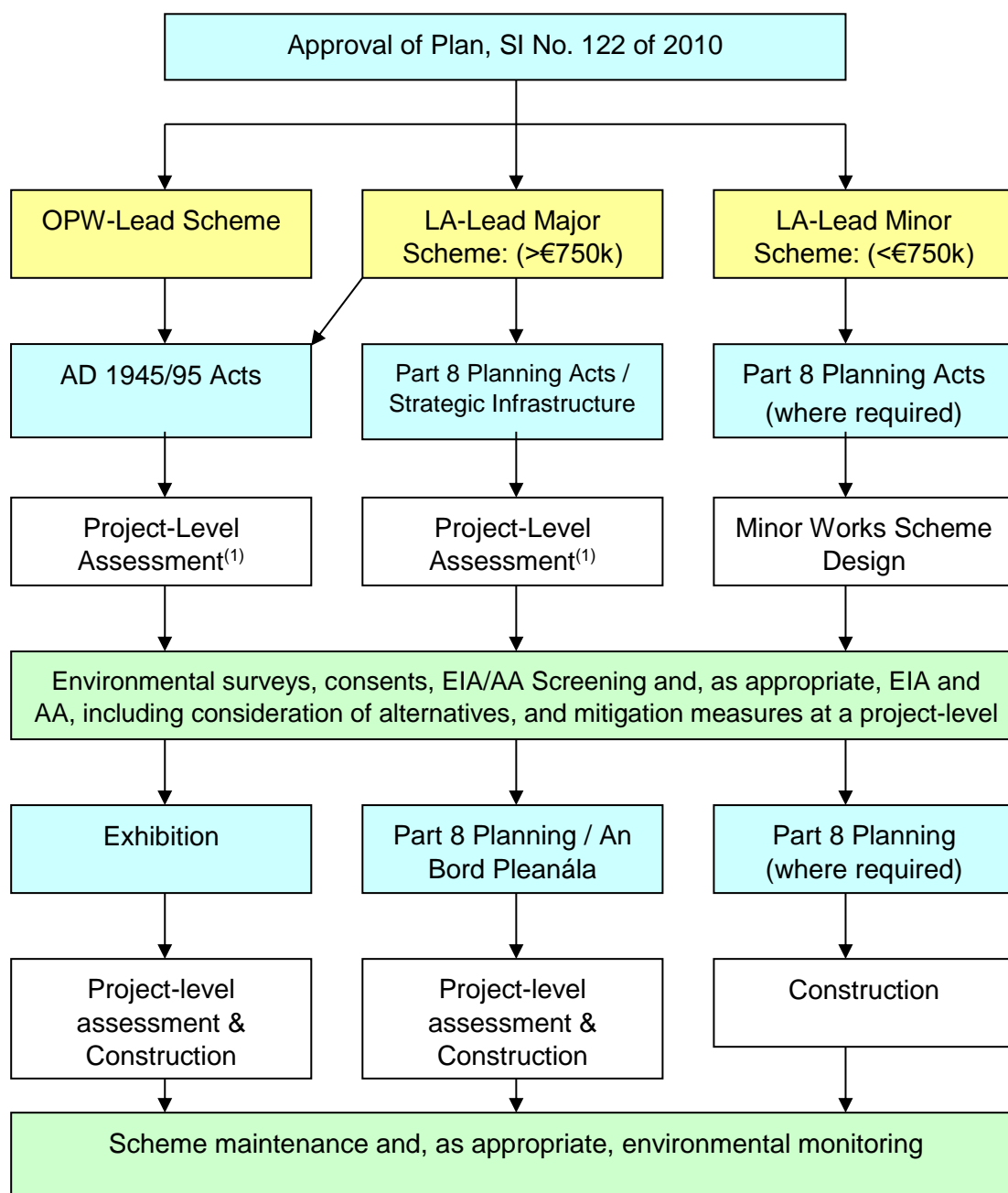


Figure 8.1: Options for the Progression of Measures Involving Physical Flood Relief Works

Note (1): Project-level assessment will take account of the potentially viable measures identified in the Plan, but will involve the consideration of alternatives at the project-level and, as appropriate, EIA and AA, including the definition of necessary mitigation measures at the project-level. Only schemes/measures confirmed to be viable following project-level assessment will be brought forward for exhibition/planning and project-level assessment.

Where measures require further assessment or hydrometric monitoring before progression to further development at a local, project-level, such assessments or monitoring will be implemented and progressed as soon as possible.

8.1.3 Other Catchment and AFA-Level Measures

Measures may have been identified at the catchment or AFA-level in the North Western River Basin that do not involve physical works. Such measures might include:

- The need for further hydrometric monitoring / data gathering
- Further study or analysis (for example, in areas of high technical uncertainty)
- The operation of existing structures to manage water levels or flows

Measures relating to the operation of existing structures would typically be the responsibility of the ESB or Waterways Ireland, and represent ongoing practice or the enhancement of same.

For the remaining measures under this category, the OPW will advance these, subject to any licences and/or environmental assessments that may be required, as a matter of priority within available resources.

8.1.4 Public and Stakeholder Consultation and Engagement

The project development stage will involve a significant level of further public consultation on the proposed measures in the Plan at key points in the progress of the design work required to bring those measures to a state of readiness to submit for planning approval (in the case of projects being implemented by local authorities under the Planning and Development Acts) or for public exhibition (in the case of projects being implemented by the OPW under the Arterial Drainage Acts ADA). Public Information Days will be organised to inform the communities affected of the progress with the design of the proposed scheme.

In the case of schemes being implemented by the OPW under the ADA, the main public consultation event is the formal public exhibition stage. This involves the preparation of the scheme documentation (schedules setting out details and benefits of the scheme, including names of the proprietors, owners and occupiers of the lands with which the proposed scheme will interfere; maps, drawings, plans, sections setting out the technical detail; Environmental Impact Statement, if required; and Interference Notices sent to each affected person detailing the extent of works proposed on their respective lands or property and any proposed compulsory interference with, or acquisition of, these lands and property). All of the Scheme Documents are forwarded to the relevant Local Authority and they are also placed on formal public exhibition in a public building(s) in the area typically over a period of 4 weeks when interested parties and the public have the opportunity to study the proposals and make comments, observations, objections, etc. OPW staff and/or consultancy staff are available at public exhibition to answer queries and offer clarification. Interference Notices are also forwarded to affected parties in advance of the exhibition period. All observations received are responded to and, if necessary, the scheme may be revised as a result of them. Following public exhibition, the scheme is submitted to the Minister for Finance and Public Expenditure and Reform for Confirmation (approval) of the Scheme.

The OPW is also considering suitable mechanisms at a national level to provide for consultation and engagement for the national flood risk management programme with stakeholders that have a national remit.

8.2 MONITORING OF PROGRESS IN IMPLEMENTATION OF THE PLAN

The OPW will monitor progress in the implementation of measures for which the OPW has responsibility on an ongoing basis as part of its normal business management processes.

The OPW will coordinate and monitor progress in the implementation of the Plans through an Interdepartmental Co-ordination Group.

On a six-yearly cycle, the OPW will undertake a full review of the progress in the implementation of the Plan and the level of flood risk, and will report this progress publicly and to the European Commission as part of obligations of Ireland under the 'Floods' Directive.

In addition to monitoring of implementation of the measures set out in the Plan, monitoring will also be undertaken in relation to:

- Continued collection and analysis of hydro-meteorological data for improved flood flow and sea level frequency analysis and for observation of the potential impacts of climate change
- Ongoing recording of flood events through established systems, with photographs, peak water levels, duration, etc., for recording and publication on the National Flood Event Data Archive (www.floodinfo.ie)
- Monitoring of compliance with the Guidelines on the Planning System and Flood Risk Management through ongoing review of development plans, local area plans and other forward planning documents
- Changes that may affect the areas prone to flooding as shown on the flood maps, with the flood maps updated on an ongoing basis as necessary

8.3 ENVIRONMENTAL MONITORING

The SEA Directive requires that the significant environmental effects of the implementation of a Plan are monitored in order to identify at an early stage unforeseen adverse effects and in order to undertake appropriate remedial action. The proposed monitoring programme in Table 8.1 is based on the Targets and Indicators established in the SEA Objectives and will be undertaken during development of the 2nd cycle of the Plan.

8.4 REVIEW OF THE PFRA, FLOOD MAPS AND THE PLANS

In accordance with the requirements of the EU 'Floods' Directive, the PFRA, flood maps and Plans will be reviewed on a six-yearly cycle, with the first reviews of the PFRA, maps and final Plans due by the end of 2018, 2019 and 2021 respectively.

The review of the PFRA is described in Section 3.3.

The review of the flood maps, on an ongoing basis and formally by the end of 2019, will take account of additional information received and/or physical amendments such as the construction of new infrastructure, and, where appropriate, the amendment of the flood maps.

It is anticipated that this review of the Plans will include any changes or updates since the publication of the Plans, including:

- A summary of the review of the PFRA and the flood maps, taking into account the potential impacts of climate change, including where appropriate the addition or removal of AFAs
- An assessment of the progress made towards the achievement of the flood risk management Objectives
- A description of, and an explanation for, any measures foreseen in the final version of the Plan which were planned to be undertaken and have not been taken forward
- A description of any additional measures developed and/or progressed since the publication of the Plan

The Review of the Plan, which will include assessments under SEA and Habitats Directives as appropriate, taking into account new information available at that time (e.g., as available from the Environmental Monitoring Framework and from the www.catchments.ie website), will be published in line with relevant legislation, following public and stakeholder engagement and consultation.

Table 8.1 Environmental Monitoring of the Plan

SEA Topic	Objective	Sub-Objective		Indicator	Possible Data and Responsible Authority
Biodiversity, Flora and Fauna	Support the objectives of the Habitats Directive	i)	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping stones	Area, condition and trend of European sites and species in the river basin. (European sites to review are those identified by AA Screening.)	NPWS – Conservation Action Plans NPWS reporting on Irelands Habitats and Species – Article 17 Reports. NPWS reporting on the status of Irelands Birds – Article 12 Reports.
	Avoid damage to, and where possible enhance, the flora and fauna of the catchment	i)	Avoid damage to or loss of, and where possible enhance, nature conservation sites and protected species or other know species of conservation concern	Area, condition and trend of national, regional or local conservation sites in the river basin (National sites to review are those identified in SEA Environmental Report.)	Local Authority – Local Area Plans and County Development Plans. NPWS - Status of Protected Sites and Species in Ireland Reporting
Population and Human Health	Minimise risk to human health and life	i)	Minimise risk to human health and life of residents	Residential property flooding in the river basin	OPW, Local Authority and Emergency Services Reporting.
		ii)	Minimise risk to high vulnerability properties	High vulnerability sites impacted by flooding in the river basin	OPW, Local Authority and Emergency Services Reporting.
Geology, Soils and Landuse	Minimise risk to agriculture	i)	Minimise risk to agriculture	Area of soil resource lost due to flooding and flood risk management in the river basin.	EPA - CORINE landcover mapping. Local Area Plans and County Development Plans – myplan.ie
Water	Support the objectives of the WFD	i)	Provide no impediment to the achievement of water body objectives and, if possible, contribute to the achievement of water body objectives	Status and status trend of waterbodies, where FRM activities are within and upstream of a waterbody.	EPA / ERBD – WFD status reporting and RBMPs.
Climate	Ensure flood risk management options are adaptable to future flood risk	i)	Ensure flood risk management options are adaptable to future flood risk	Requirement for adaptation of FRM management activities for climate change in the river basin.	OPW and Local Authority reporting.
Material Assets	Minimise risk to transport & utility infrastructure	i)	Minimise risk to transport infrastructure	Number and type of transport routes that have flooded in the river basin.	OPW, Local Authority and NRA reporting.
		ii)	Minimise risk to utility infrastructure	Number and type of utilities that have flooded in the river basin.	OPW, Local Authority, ESB, Eirgrid, Eircom, BGE, Irish Water and EPA reporting.
Cultural Heritage	Avoid damage to or loss of features, institutions and	i)	Avoid damage to or loss of features, institutions and collections of architectural value and their setting.	Number of designated architectural heritage features, institutions and collections that have flooded in the river basin.	OPW, Local Authority and DAHRRGA reporting. Archaeological Survey of Ireland Sites and Monuments Records

	collections of cultural heritage importance and their setting	ii)	Avoid damage to or loss of features, institutions and collections of archaeological value and their setting.	Number of designated archaeological heritage features, institutions and collections that have flooded in the river basin.	OPW, Local Authority and DAHRRGA reporting. Archaeological Survey of Ireland Sites and Monuments Records
Landscape and Visual	Protect, and where possible enhance, landscape character and visual amenity within the river corridor	i)	Protect, and where possible enhance, visual amenity, landscape protection zones and views into / from designated scenic areas within the river corridor.	Length of waterway corridor qualifying as a landscape protection zone within urban areas of the river basin. Change of quality in existing scenic areas and routes in the river basin. Loss of public landscape amenities in the river basin.	Local Authority – Landscape Character Assessments, County Development Plans and Local Area Plans. EPA - CORINE Landcover.
Fisheries, Aquaculture & Angling	Protect, and where possible enhance, fisheries resource within the catchment	i)	Maintain existing, and where possible create new, fisheries habitat including the maintenance or improvement of conditions that allow upstream migration for fish species.	Improvement or decline in fish stocks and habitat quality in the river basin. Barriers to fish movement within the river basin.	IFI and WFD fish surveys and reports. Local fisheries reporting.
Amenity, Community & Socio-Economics	Minimise risk to community	i)	Minimise risk to social infrastructure and amenity	Social infrastructure and amenity assets impacted by flooding in the river basin.	OPW and Local Authority reporting.
		ii)	Minimise risk to local employment	Non-residential properties impacted by flooding in the river basin.	OPW and Local Authority reporting.

GLOSSARY AND ACRONYMS

Annual Exceedance Probability Or AEP	The probability, typically expressed as a percentage, of a flood event of a given magnitude being equalled or exceeded in any given year. For example, a 1% AEP flood event has a 1%, or 1 in a 100, chance of occurring or being exceeded in any given year.
Appropriate Assessment	An assessment of the potential impacts of a plan or project on the integrity of a site designated as a Natura 2000 Site, as required under the Habitats Directive.
Area for Further Assessment Or AFA	Areas where, based on the Preliminary Flood Risk Assessment, the risks associated with flooding are considered to be potentially significant. For these areas further, more detailed assessment was required to determine the degree of flood risk, and develop measures to manage and reduce the flood risk. The AFAs were the focus of the CFRAM Studies.
Arterial Drainage Scheme	Works undertaken under the Arterial Drainage Act (1945) to improve the drainage of land. Such works were undertaken, and are maintained on an ongoing basis, by the OPW.
Benefiting Lands Catchment	Lands benefiting from an Arterial Drainage Scheme. The area of land draining to a particular point on a river or drainage system, such as an Area for Further Assessment (AFA) or the outfall of a river to the sea.
Catchment Flood Risk Assessment and Management Study Or CFRAM Study Communities	A study to assess and map the existing and potential future flood hazard and risk from fluvial and coastal waters, and to define objectives for the management of the identified risks and prepare a Plan setting out a prioritised set of measures aimed at meeting the defined objectives. Cities, towns, villages or townlands where there are a collection of homes, businesses and other properties.
Consequences	The impacts of flooding, which may be direct (e.g., physical injury or damage to a property or monument), a disruption (e.g., loss of electricity supply or blockage of a road) or indirect (e.g., stress for affected people or loss of business for affected commerce)
Drainage	Works to remove or facilitate the removal of surface or sub-surface water, e.g., from roads and urban areas through urban storm-water drainage systems, or from land through drainage channels or watercourses that have been deepened or increased in capacity.
Drainage District	Works across a specified area undertaken under the Drainage Acts to facilitate land drainage.
Flood	The temporary covering by water of land that is not normally covered by water.
'Floods' Directive	The EU 'Floods' Directive [2007/60/EC] is the Directive that came into force in November 2007 requiring Member States to undertake a PFRA to identify Areas for Further Assessment (AFAs), and then to prepare flood maps and Plans for these areas.
Flood Extent	The extent of land that has been, or might be, flooded. Flood extent is often represented on a flood map.
Flood Hazard Map	A map indicating areas of land that may be prone to flooding, referred to as a flood extent map, or a map indicating the depth, velocity or other aspect of flooding or flood waters for a given flood event. Flood hazard maps are typically prepared for either a past event or for (a) potential future flood event(s) of a given probability.

Flood Risk Map	A map showing the potential risks associated with flooding. These maps may indicate a particular aspect of risk, taking into account the probability of flooding (e.g., annual average economic damages), but can also show the various receptors that could be affected by floods of different probabilities.
Flood Risk Management Plan (Plan)	A Plan setting out a prioritised set of measures within a long-term sustainable strategy aimed at achieving defined flood risk management objectives. The Plan is developed at a River Basin (Unit of Management) scale, but is focused on managing risk within the AFAs.
Floodplain	The area of land adjacent to a river or coastal reach that is prone to periodic flooding from that river or the sea.
Fluvial	Riverine, often used in the context of fluvial flooding, i.e., flooding from rivers, streams, etc.
Habitats Directive	The Habitats Directive [92/43/EEC] aims at securing biodiversity through the provision of protection for animal and plant species and habitat types of European importance.
Hazard	Something that can cause harm or detrimental consequences. In this context, the hazard referred to is flooding.
Hydraulics	The science of the behaviour of fluids, often used in this context in relation to estimating the conveyance of flood water in river channels or structures (such as culverts) or overland to determine flood levels or extents.
Hydrology	The science of the natural water cycle, often used in this context in relation to estimating the rate and volume of rainfall flowing off the land and of flood flows in rivers.
Hydrometric Area	Hydrological divisions of land, generally large catchments or a conglomeration of small catchments, and associated coastal areas. There are 40 Hydrometric Areas in the island of Ireland.
Indicative	This term is typically used to refer to the flood maps developed under the PFRA. The maps developed are approximate, rather than highly detailed, with some local anomalies.
Individual Risk Receptor Or IRR	A single receptor (see below) that has been determined to represent a potentially significant flood risk (as opposed to a community or other area at potentially significant flood risk, known as an Area for Further Assessment, or 'AFA').
Inundation	Another word for flooding or a flood (see 'Flood')
Measure	A measure (when used in the context of a flood risk management measure) is a set of works, structural and / or non-structural, aimed at reducing or managing flood risk.
National CFRAM Programme	The programme developed by the OPW to implement key aspects of the EU 'Floods' Directive in Ireland, which included the CFRAM Studies, and built on the findings of the PFRA.
Pluvial	Refers to rainfall, often used in the context of pluvial flooding, i.e., flooding caused directly from heavy rainfall events (rather than over-flowing rivers).
Point Receptor	Something that might suffer harm or damage as a result of a flood, that is at a particular location that does not cover a large area, such as a house, office, monument, hospital, etc.
Preliminary Flood Risk Assessment Or PFRA	An initial, high-level screening of flood risk at the national level to determine where the risks associated with flooding are potentially significant, to identify the AFAs. The PFRA is the first step required under the EU 'Floods' Directive.

Public Consultation Day Or PCD	A public and stakeholder consultation and engagement event advertised in advance, where the project team displayed and presented material (e.g., flood maps, flood risk management options) at a venue within a community, with staff available to explain and discuss the material, and where members of the community and other interested parties could provide local information and put forward their views.
Receptor	Something that might suffer harm or damage as a result of a flood, such as a house, office, monument, hospital, agricultural land or environmentally designated sites.
Return Period	A term that was used to describe the probability of a flood event, expressed as the interval in the number of years that, on average over a long period of time, a certain magnitude of flood would be expected to occur. This term has been replaced by 'Annual Exceedance Probability, as Return Period can be misleading.
Riparian	River bank. Often used to describe the area on or near a river bank that supports certain vegetation suited to that environment (Riparian Zone).
Risk	The combination of the probability of flooding, and the consequences of a flood.
River Basin	An area of land (catchment) draining to a particular estuary or reach of coastline.
River Basin District Or RBD	A regional division of land defined for the purposes of the Water Framework Directive. There are eight RBDs in the island of Ireland; each comprising a group of River Basins.
Riverine	Related to a river
Runoff	The flow of water over or through the land to a waterbody (e.g., stream, river or lake) resulting from rainfall events. This may be overland, or through the soil where water infiltrates into the ground.
Sedimentation	The accumulation of particles (of soil, sand, clay, peat, etc.) in the river channel
Significant Risk	Flood risk that is of particular concern nationally. The PFRA Main Report (see www.floodinfo.ie) sets out how significant risk is determined for the PFRA, and hence how Areas for Further Assessment have been identified.
Strategic Environmental Assessment Or SEA	An SEA is an environmental assessment of plans and programmes to ensure a high level consideration of environmental issues in the plan preparation and adoption, and is a requirement provided for under the SEA directive [2001/42/EC]
Standard of Protection Or SoP	The magnitude of flood, often defined by the annual probability of that flood occurring being exceeded (the Annual Exceedance Probability, or 'AEP'), that a measure / works is designed to protect the area at risk against.
Surface Water	Water on the surface of the land. Often used to refer to ponding of rainfall unable to drain away or infiltrate into the soil.
Surge	The phenomenon of high sea levels due to meteorological conditions, such as low pressure or high winds, as opposed to the normal tidal cycles
Survey Management Project	A project commissioned by the OPW in advance of the CFRAM Studies to specify and manage a large proportion of the survey work.
Sustainability	The capacity to endure. Often used in an environmental context or in relation to climate change, but with reference to actions people and society may take.
Tidal	Related to the tides of the sea / oceans, often used in the context of tidal flooding, i.e., flooding caused from high sea or estuarine levels.

Topography	The shape of the land, e.g., where land rises or is flat.
Transitional Water	The estuarine or inter-tidal reach of a river, where the water is influenced by both freshwater river flow and saltwater from the sea.
Unit of Management Or UoM	A hydrological division of land defined for the purposes of the Floods Directive. One Plan has been prepared for each Unit of Management, which is referred to within the Plan as a River Basin.
Vulnerability	The potential degree of damage to a receptor (see above), and/or the degree of consequences that could arise in the event of a flood.
Waterbody	A term used in the Water Framework Directive (see below) to describe discrete section of rivers, lakes, estuaries, the sea, groundwater and other bodies of water.
Water Framework Directive Or WFD	The Water Framework Directive [2000/60/EC] aims to protect surface, transitional, coastal and ground waters to protect and enhance the aquatic environment and ecosystems and promote sustainable use of water resources

LIST OF ACRONYMS

AA	Appropriate Assessment
AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
AR5	5th Assessment Report (IPCC)
BCR	Benefit - Cost Ratio
CFRAM	Catchment-Based Flood Risk Assessment and Management
DHPLG	Department of Housing, Planning and Local Government
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
EU	European Union
FRMP	Flood Risk Management Plan
FRR	Flood Risk Review
HEFS	High-End Future Scenario
HPW	High Priority Watercourse
INFF	Irish National Flood Forum
IPCC	Intergovernmental Panel on Climate Change
IROPI	Imperative Reasons of Over-riding Public Interest
MCA	Multi-Criteria Analysis
MPW	Medium Priority Watercourse
MRFS	Mid-Range Future Scenario
NCCAF	National Climate Change Adaptation Framework
OPW	Office of Public Works
PCD	Public Consultation day
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SI	Statutory Instrument

SPA	Special Protection Area
SUDS	Sustainable Urban Drainage Systems
UoM	Unit of Management
WFD	Water Framework Directive

REFERENCES

Dwyer, N., and Devoy, R., 2012. 'Sea Level' In: Dwyer, N. ed. The Status of Irelands Climate, 2012.

EPA, 2016. Local Authority Adaptation Strategy Development Guidelines

EU, 2007. Directive 2007/60/EC on the Assessment and Management of Flood Risk. Official Journal of the European Communities L288 of 6th November 2007, p.27.

EU, 2014. EU policy document on Natural Water Retention Measures, CIS Technical Report - 2014 - 082, 2014

IPCC, 2014. Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jevrejeva, S., Grinsted, A., and Moore, J.C., 2014. Upper limit for sea level projections by 2100, Environmental Research Letters, 9 104008

OPW, 2004. Report of the National Flood Policy Review Group (www.floodinfo.ie).

OPW, 2011. Main Overview Report - Preliminary Flood Risk Assessment.

OPW, 2012. Designation of the Areas for Further Assessment

UCD, 2015. Weighting the Perceived Importance of Minimising Economic, Social and Environmental/ Cultural Risks in Flood Risk Management, O'Sullivan, J. and Bedri, Z., University College Dublin, 2015 (www.floodinfo.ie)

APPENDICES

APPENDIX A

FLOODING AND FLOOD RISK

A.1 INTRODUCTION

A flood is defined in the 'Floods' Directive as a "temporary covering by water of land not normally covered by water", i.e., the temporary inundation of land that is normally dry. Flooding is a natural process that can happen at any time in a wide variety of locations.

Flood **hazard** is the potential threat posed by flooding to people, property, the environment and our cultural heritage. The degree of hazard is dependent on a variety of factors that can vary from location to location and from one flood event to another. These factors include the extent and depth of flooding, the speed of the flow over the floodplains, the rate of onset and the duration of the flood.

Flooding only presents a **risk** however when people, property, businesses, farms, infrastructure, the environment or our cultural heritage can be potentially impacted or damaged by floods. Flood risk is the combination of the probability of flood events of different magnitudes and the degree of the potential impact or damage that can be caused by a flood. The actual damage that can be caused depends on the vulnerability of society, infrastructure and our environment to damage or loss in the event of a flood, i.e., how sensitive something is to being damaged by a flood.

A.2 Types and Causes of Flooding

Flooding can occur from a range of sources, individually or in combination, as described below.

A.2.1 Coastal Flooding

Coastal flooding occurs when sea levels along the coast or in estuaries exceed neighbouring land levels, or overcome coastal defences where these exist, or when waves overtop the coastline or coastal defences. Mean sea levels around Ireland are rising (Dwyer and Devoy, 2012), and are expected to continue to rise due to climate change in the range of 0.52 to 0.98m (IPCC, 2014) by 2100, with an associated increase in flood risk from the sea over the coming decades.

Coastal flooding can also occur in the form of tsunamis, and Ireland has suffered from tsunami flooding in the past¹. It was determined during the Preliminary Flood Risk Assessment (PFRA, see Section 3) however that this cause of flooding is not, on the basis of our current understanding, a significant cause of flood risk in Ireland, although further investigation is required on this matter. As a result, tsunami risk is not addressed in this Plan.

A.2.2 Fluvial Flooding

Fluvial flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains). This can arise where the runoff from heavy rain exceeds the natural capacity of the river channel, and can be exacerbated where a channel is blocked or constrained or, in estuarine areas, where high tide levels impede the flow of the river out into the sea. While there is a lot of uncertainty on the impacts of climate change on rainfall patterns, there is a clear potential that fluvial flood risk could increase into the future.

¹ The tsunami that devastated Lisbon, Portugal in 1755 also hit the south coast of Ireland according to records of that time, and there are reports of tsunami-like flood events around the South coast from 1761 and 1854 (Pers comm., GSI)

A.2.3 Pluvial Flooding

Pluvial flooding occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural or man-made hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall before the flood waters eventually enter a piped or natural drainage system. This type of flooding is driven in particular by short, intense rain storms.

A.2.4 Groundwater Flooding

Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall, to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding results from the interaction of site-specific factors such as local geology, rainfall infiltration routes and tidal variations. While the water level may rise slowly, it may cause flooding for extended periods of time. Hence, such flooding may often result in significant damage to property or disruption to transport. In Ireland, groundwater flooding is most commonly related to turloughs in the karstic limestone areas prevalent in particular in the west of Ireland.

A.2.5 Other Causes of Flooding

The above causes of flooding are all natural; caused by either extreme sea levels or heavy or intense rainfall. Floods can also be caused by the failure or exceedance of capacity of built or man-made infrastructure, such as bridge collapses, from blocked piped sewerage networks, or the failure or over-topping of reservoirs or other water-retaining embankments (such as raised canals). While it is recognised that some of these other sources may cause local problems, it was determined during the PFRA (see Section 3) however that these causes of flooding are not, in the context of the national flood risk and on the basis of our current understanding, causes of significant flood risk, or can not always be foreseen, and hence are not addressed in the Plan.

A.3 IMPACTS OF FLOODING

A.3.1 Impacts on people and society

Flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous. For example, even shallow water flowing at 2 metres per second (m/sec) can knock children and many adults off their feet, and vehicles can be moved by flowing water of only 300mm depth. The risks increase if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) can also cause illnesses, either directly as a result of contact with the polluted floodwater or indirectly, as a result of sediments left behind. Those most likely to be at risk are people living in a single-storey bungalow or below ground in a basement, those outdoors on foot or in a vehicle, or people staying in a tent or caravan.

As well as the immediate dangers, the impact on people and communities as a result of the stress and trauma of being flooded or having access to their property cut-off by floodwaters, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process.

The ability of people to respond and recover from a flood can vary. Vulnerable people, such as the elderly, people with mobility difficulties or those who have a long-term illness, are potentially less able to respond to a flood emergency. Some people may have difficulty in

replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood.

Floods can also cause impacts on communities as well as individuals through the temporary, but sometimes prolonged, loss of community services or infrastructure, such as schools, health services, community centres or amenity assets.

A.3.2 Impacts on property

Flooding can cause severe damage to properties. Floodwater is likely to damage internal finishes, contents and electrical and other services and possibly cause structural damage. The physical effects can have severe long-term impacts, with re-occupation sometimes not being possible for over a year. The costs of flooding are increasing, partly due to increasing amounts of electrical and other equipment within developments. The degree of damage generally increases with the depth of flooding, and sea-water flooding may cause additional damage due to corrosion.

Flooding can also cause significant impacts to agriculture. A certain level of flooding is intrinsic in certain areas, and agricultural management takes this into account, however extreme or summer flooding can have detrimental impacts through loss of production, as well as damage to land and equipment.

A.3.3 Impacts on Infrastructure

The damage flooding can cause to businesses and infrastructure, such as transport or utilities like electricity, gas and water supply, can have significant detrimental impacts on individuals and businesses and also local and regional economies. Flooding of primary roads or railways can deny access to large areas beyond those directly affected by the flooding for the duration of the flood event, as well as causing damage to the road or railway itself. Flooding of water distribution infrastructure such as pumping stations or of electricity sub-stations can result in loss of water or power supply over large areas. This can magnify the impact of flooding well beyond the immediate community. The long-term closure of businesses, for example, can lead to job losses and other economic impacts.

A.3.4 Impacts on the Environment

Detrimental environmental effects of flooding can include soil and bank erosion, bed erosion or siltation, land slides and damage to vegetation and species that are not resilient against flooding, as well as the impacts on water quality, habitats and flora and fauna caused by pollutants carried by flood water. Flooding can however be a necessary element of natural and semi-natural habitats. Many wetland habitats are dependent on continual or periodic flooding for their sustainability and can contribute to the storage of flood waters to reduce flood risk elsewhere.

A.3.5 Impacts on our Cultural Heritage

In the same way as flooding can damage properties, flood events can damage or destroy assets or sites of cultural heritage value. Particularly vulnerable are monuments, structures or assets (including building contents) made of wood or other soft materials, such as works of art and old paper-based items such as archive records, manuscripts or books. Soil erosion during flood events could also destroy buried heritage and archaeological sites.

A.4 Potential Impacts of Future Change

It is likely that climate change will have a considerable impact on flood risk in Ireland, such as through rising mean sea levels, increased wave action and the potential increases in winter rainfall and intense rainfall events. Land use change, for example through new housing and other developments, can also increase potential future flood risk.

APPENDIX B

PHYSICAL OVERVIEW OF THE RIVER BASIN

B.1 TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER

Section 2.1, Figure 2.1 demonstrates the topography of the North Western River Basin, showing an elevated plateau in central County Donegal with drainage radiating outward, towards the extensive coastline, where many of the settlements are located, or to Foyle system, via the River Finn.

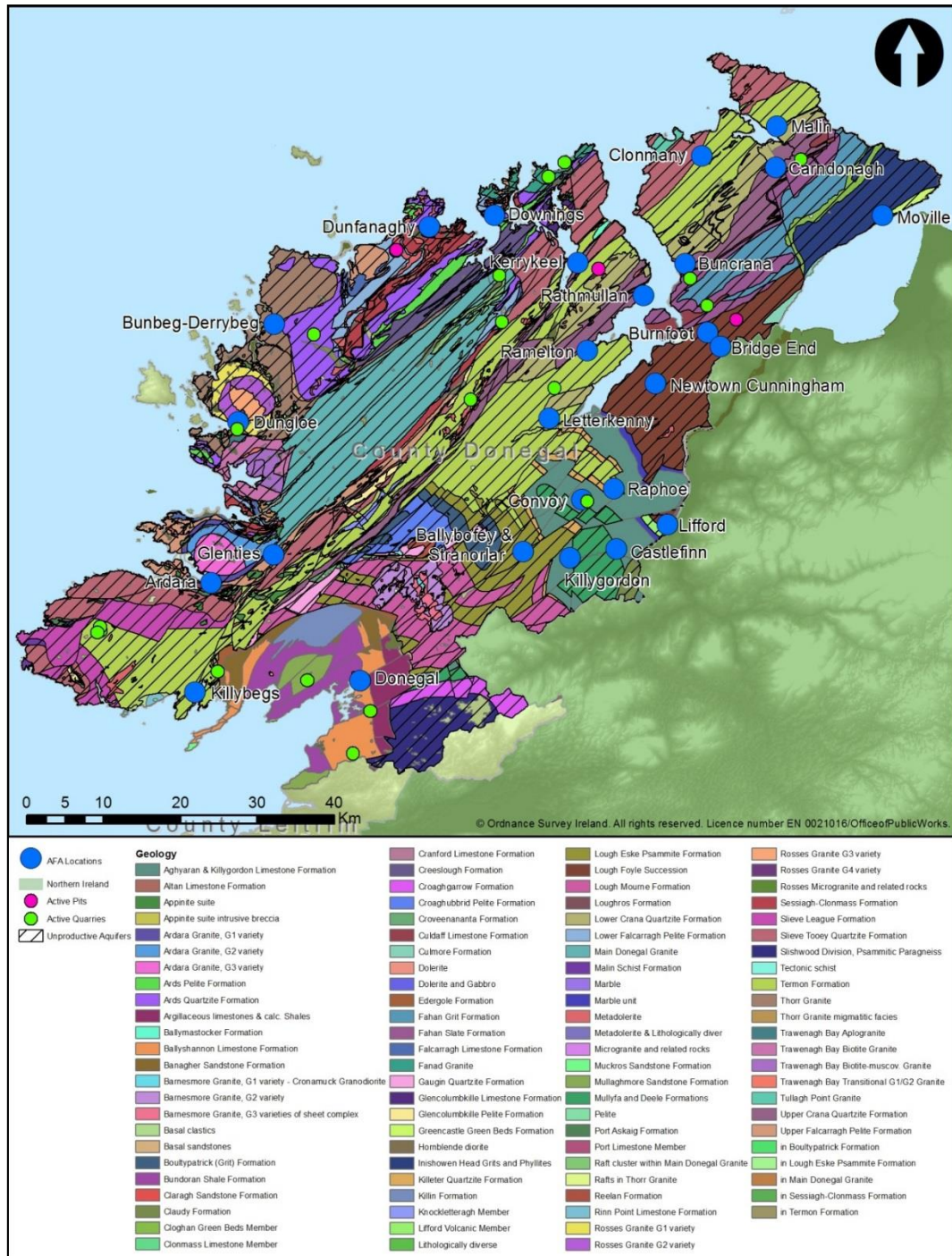


Figure B.1 *Geology & Quarries, Mines and Unproductive Aquifers*

The area is bounded to the south by the Erne River Basin of the North Western district, and to the east within Northern Ireland by the Neagh-Bann River Basin District.

The geology of the North Western River Basin, as shown in Figure B.1, consists of banded semi-pelitic and psammitic schist makes up over 15% of the bedrock in the North Western River Basin, running in a north easterly direction throughout County Donegal. Other significant rocks in County Donegal include coarse biotite granite and granodiorite, and whitish quartzite with pebble beds stretching from the west coast at Malin bay and Loughros Beg bay, inland and north eastwards to Mulroy Bay, Lough Swilly and Trawbreaga Bay. A large formation of schist and grit with thin marble units, and a smaller formation of marble, quartzite, psammite and graphitic sit between the south-east shoreline of Lough Swilly and the Northern Irish border. Smaller formations of psammitic schist with pebbly grit beds, and psammitic schist with some marble beds run in a north easterly direction, with pockets of pale grey grit with psammitic schist and psammitic and pelitic schist with grit in the north east of the river basin.

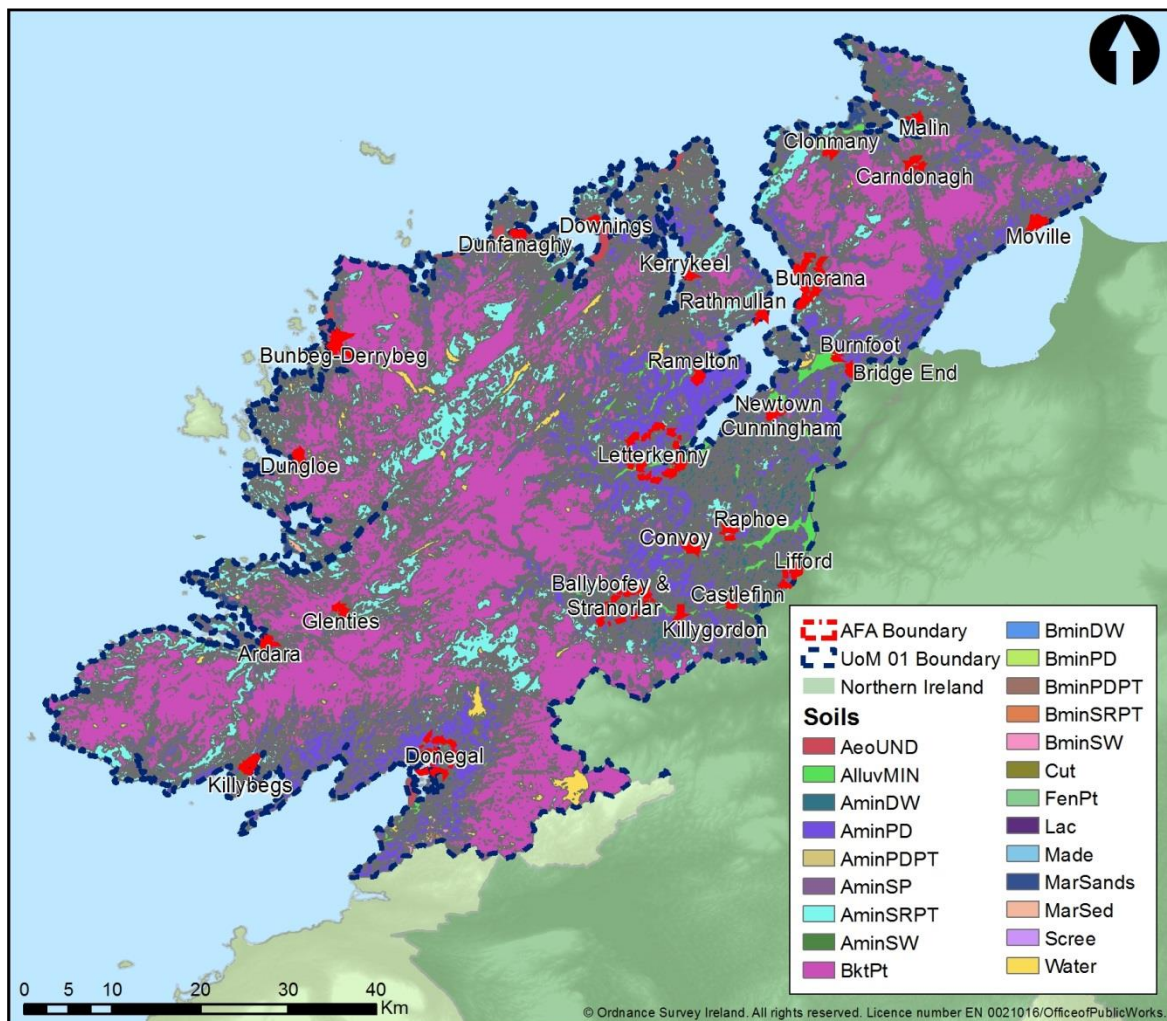


Figure B.2 Soil Types

Figure B.2 demonstrates the distribution of the Irish Geological Heritage sites, the mines and the areas of unproductive aquifers in the North Western River Basin. Most of County Donegal has bedrock that is generally unproductive.

Blanket peat covers significant parts of County Donegal. The most predominant soil types in the North Western River Basin are deep poorly drained minerals derived from mainly non-calcareous parent materials including surface water and ground water gleys are also present in large areas in the North Western River Basin. There is wide distribution of shallow,

lithosolic or podzolic type soils potentially with peaty topsoil and predominantly shallow soils derived from non calcareous rock or gravels with/without peaty surface horizon including podzols (peaty), lithosols, peats, and some outcropping rock throughout the County Donegal. Deep well drained minerals derived from mainly non-calcareous parent materials including acid brown earths and brown podzolics are also present in small pockets along the west coastline of Donegal, large areas along the coastline of northern Donegal and along the shoreline of Lough Swilly, as well as a significant area stretching from the centre of County Donegal to the Northern Irish border and northwards to Lough Foyle.

B.2 LAND USE AND LAND MANAGEMENT

The 2011 census data held by the Central Statistics Office (CSO, 2011) show a total population for the NWNB study area of approximately 401,343, of which 253,675 are in the North Western RBD. The North Western RBD has a low average population density. Less than 2% of the land is urbanised and many people live in small villages or single dwellings. Most of the main urban areas are located beside rivers – Ballybofey, Cavan, Donegal Town and Letterkenny. Population has increased in County Donegal by around 9% since the previous census in 2006.

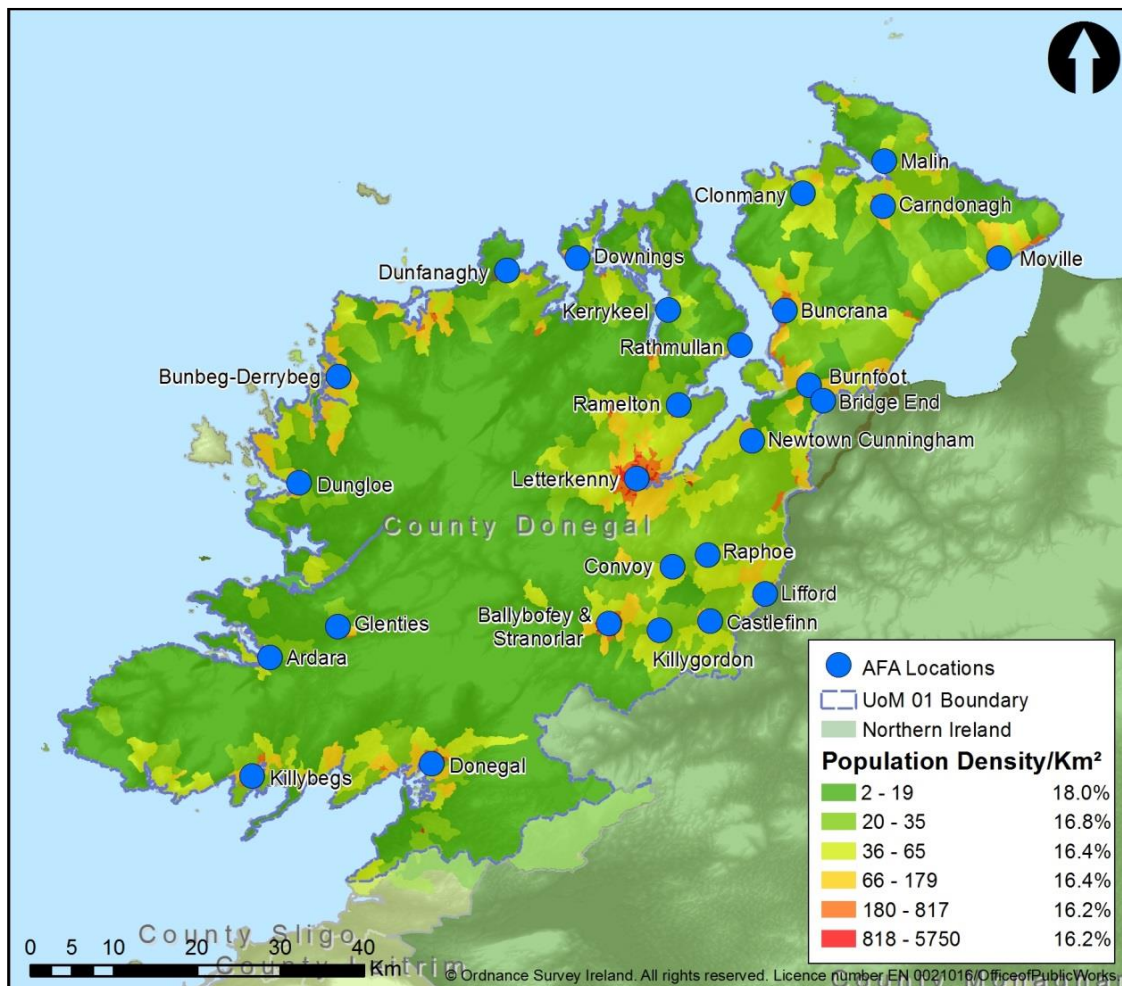


Figure B.3 Population Density (population/km²) by Small Area - 2011 Census

The 2011 census also revealed the high rates of emigration which have occurred during the economic downturn following the previous census, with a decrease of 12% since 2006 in the population of 19-24 year olds. The CSO confirmed that emigration plays a significant role in the diminishing young population, with around 30,000 young people aged between

15 and 24 leaving the country each year to seek work elsewhere. This has left behind a population with a higher proportion of aging (>65) people and particularly young people (<15) than elsewhere in Europe.

The population trend within the NWNB study area is generally one of increasing growth, broadly matching the national average growth through the last census period of around 8%. There will be ongoing population pressure on infrastructure and resources and the provision of adequate health care resources for the expanding population, particularly in terms of the expansion of the elderly and young populations that are not economically active. The population density by electoral division for the North Western River Basin is shown in Figure B.3 (CSO, 2011).

Increases in population pose land use and land management pressures which can influence catchment response. For example, demand to increase agricultural productivity, which coincides with the Irish agricultural industry also aiming to provide more goods to the global market. Associated land drainage to improve soil quality may have effects on flood risk by increasing the speed at which water reaches the main arterial river networks.

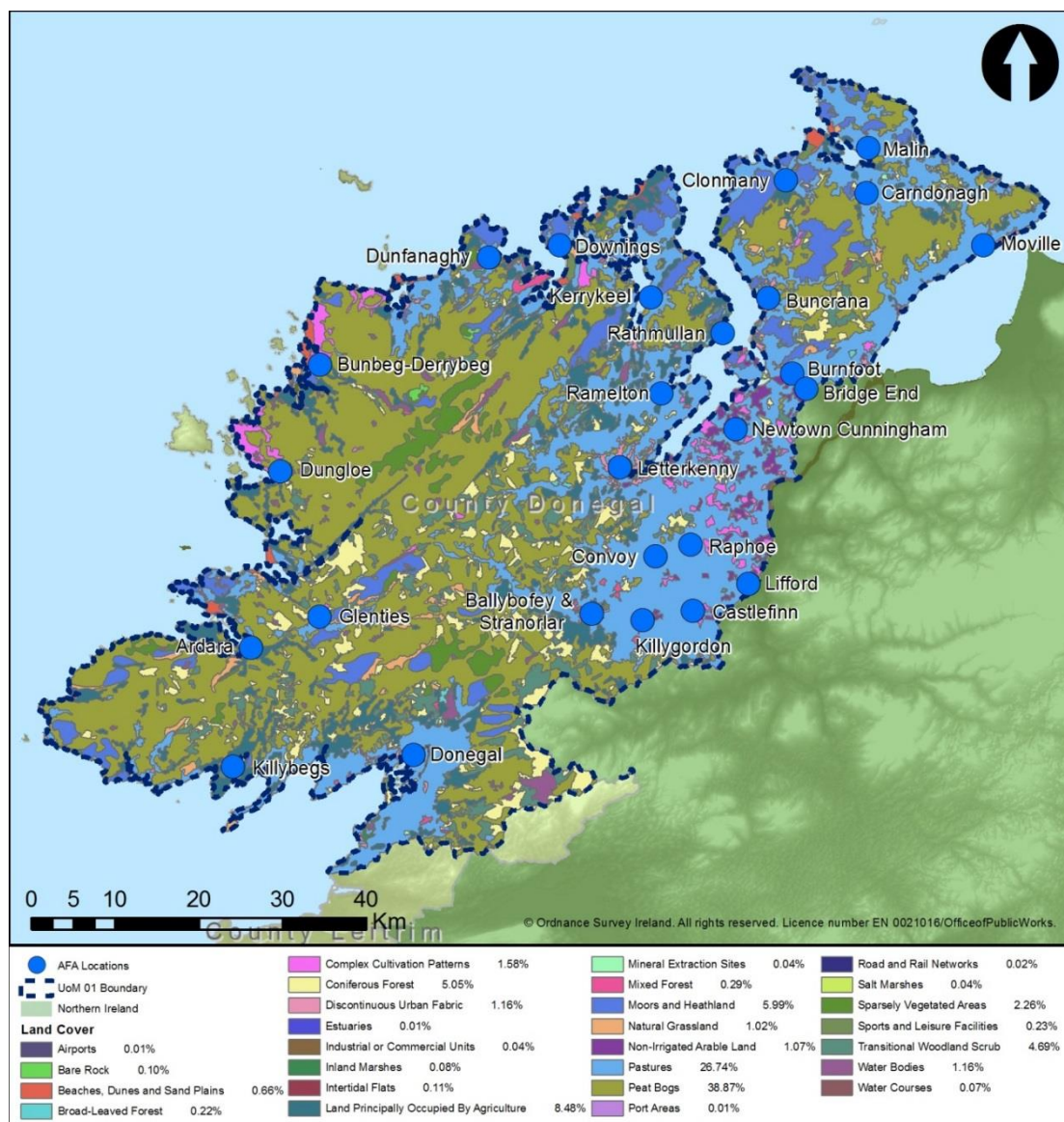


Figure B.4 Land cover in the North Western River Basin determined from the CORINE Land Cover Database

Land use directly affects the surface and groundwater environments through processes such as run off, infiltration and abstraction. The broad pattern of land cover in the NWNB study area has been determined from the CORINE Land Cover Database (2012) from which it can be seen that the main land use types in the study area are peat bogs and agricultural lands (pastures, arable, etc.), however there are also significant areas of moors and heathland.

The North Western River Basin is essentially rural, dominated by peat bogs, with pockets of forest in western upland areas and pasture to the east. Agricultural and natural areas represent the main land-use within the North Western River Basin. The fertile Foyle basin and valley supports intensive and arable farming. There are pockets of peat bogs in the uplands to the north west and areas of forest, again mainly in the north west. The upland regions of the study area support coniferous forest plantations, as well as sheep and cattle grazing.

Land cover is dominated by agricultural pastureland, with urban areas making up a very small proportion of the North Western River Basin. While it is unlikely that the general pattern of land use will be substantially changed in the future, the increasing population will continue to drive a requirement for new housing and expansion of developed areas.

Increases in population also can pose development pressures resulting in changes in land use, for example increases in paved areas, which can directly affect the surface and groundwater environments through processes such as run off, infiltration and also changes in abstraction.

The 2011 census shows a dramatic increase in urban population of over 10% from the 2006 census. The average population growth within the urbanised AFAs in the North Western River Basin, can be shown to be 10.3% for the period (1.6% annualised).

In terms of growth of the urban areas within the North Western River Basin the average annualised growth in the AFAs for which there is data is 5% based on a comparison of urban areas within each AFA between the Corine 2000 and 2006 land use datasets. Bunbeg & Derrybeg represents the highest observed growth of 174% between the two data sets (18% increases annually)

CSO population projections for the Border region predict annual population growth rates of 0.4 to 1.5%. Considering a mid-range future scenario (MRFS) growth rate in the urban extents within the Unit of Management of 1% is estimated to result in a 10% increase in the index flood flow (Qmed) for the Swilly catchment at Letterkenny and a 5% increase in the Finn catchment at Lifford over a 100 year time horizon. When a 2.5% growth rate is considered for the high end future scenario (HEFS) it is estimated that the index flood flow would increase by 71% in the Swilly and 24% in the Finn over a 100 year time horizon.

B.3 HYDROLOGY

The principal catchment characteristics for the North Western River Basin are summarised in Table B.1. Hydrometric data is available at 33 hydrometric gauge station locations within the North Western River Basin as shown in Figure B.5.

Only six stations which are located on watercourses to be modelled have data available and three of these have sufficient confidence in their ratings at flood flows such that they could be used in the hydrological analysis at flood flows. The North Western River Basin can be considered a poorly gauged catchment given that most of the AFAs do not benefit from flood flow gauge stations located either on, upstream or downstream of modelled watercourses.

Meteorological data is available from a number of Met Éireann, NRA and UK Met Office daily, sub-daily and hourly rain gauges within the NWNB CFRAM study area and beyond as shown in Figure B.6. The only location at which hourly rain gauge data is available within the North Western River Basin is at Malin Head although gauge data was also made available for the Met Office hourly station just outside of the river basin at Castlederg.

Following a review of the available radar coverage from the rainfall radars at Dublin Airport, Shannon and at Castor Bay (UK Met Office) it was found that beam blockage from the hilly terrain of the Sperrin Mountains and the hilly interior of County Donegal would significantly affect the accuracy of the radar images. It was therefore considered that processing of the radar data covering the river basin would not provide sufficient benefit to be of use in hydrological rainfall run-off modelling. No opportunities were identified for the development of hydrological rainfall run-off models within the North Western River Basin given the availability of high temporal resolution rainfall data and hydrometric calibration data.

The Flood Studies Update methodologies have been used as the core methodologies upon which the hydrological analysis has been undertaken. In the case of the North Western River Basin these methods have been complemented with the use of FSR based techniques, primarily to aid the derivation of hydrographs for small catchments.

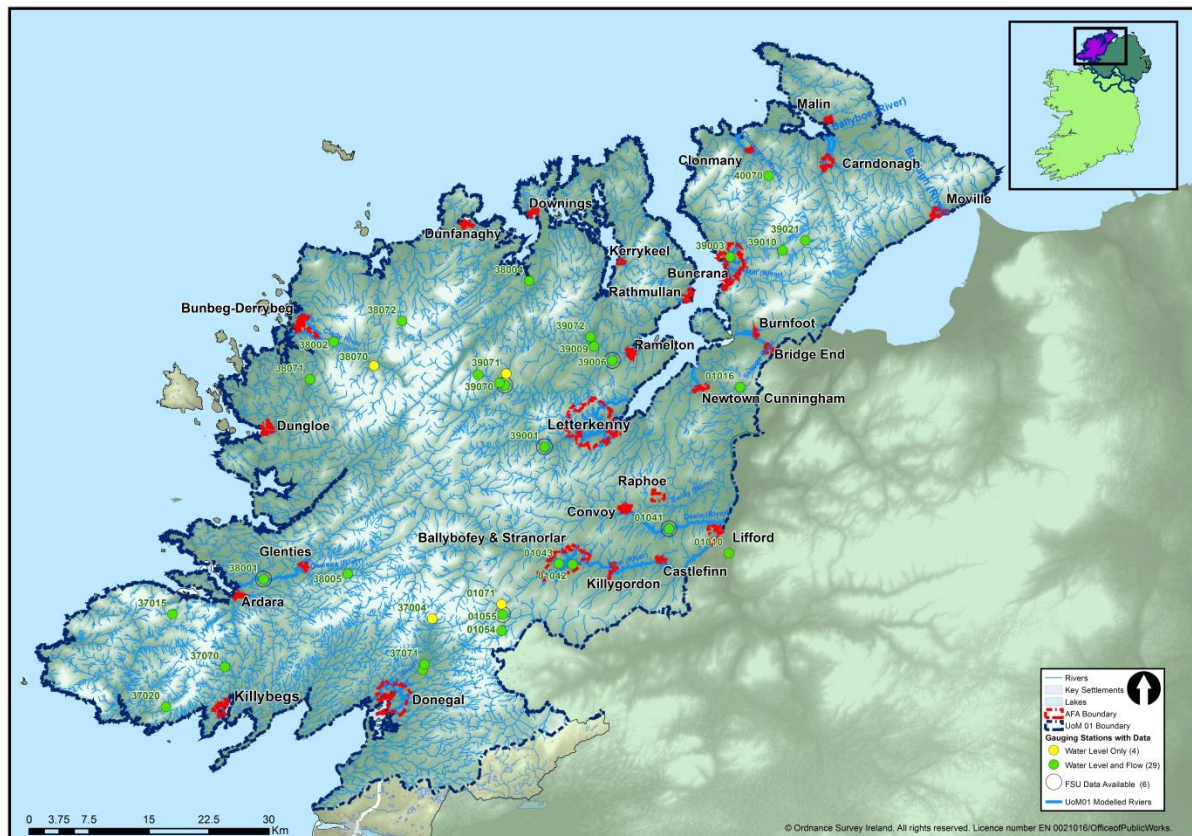


Figure B.5 Hydrometric Data Availability

Table B.1 Hydrological Catchment Characteristics in the North Western River Basin.

Model	River	Tributaries / Minor Watercourses	Area (Km ²)	Slope (m/Km)	Qmed
Malin	Ballyboe River / Trawbreaga Bay	Drumcarbit River	9.63	16.99	3.99
Carndonagh	Donagh River	-	34.31	9.68	25.37
	Glennagannon River				
Clonmany	Clonmany River	Ballyhallen River	55.51	13.01	32.08
Moville	Breadagh River	-	18.50	21.31	12.03
Downings	Magherabeg Stream	-	1.56	40.00	0.99
Kerrykeel	Burnside River	-	12.27	34.60	8.82
Buncrana	Crana River	-	98.71	6.98	75.12
	Mill River				
Rathmullan	Millbrook / Ballyboe watercourse	-	3.27	24.88	1.78
Burnfoot	Skeoge River	Burnfoot River	65.85	10.88	40.26
Bridge End	Skeoge River	-	27.20	22.13	25.32
Rameltown	River Leannan	-	262.52	3.68	66.65
Newtown Cunningham	Blanket Nook	Moyle River	31.75	7.20	8.28
		Monfad Stream			
Letterkenny	Swilly River	Glencar	120.83	8.29	88.58
		Coravaddy Burn			
		Ballymacool			
		Lismonaghan			
		Knockamonna			
Bunbeg-Derrybeg	Clady River	Catheen River	88.96	12.60	32.31
Dungloe	Dungloe River	-	39.60	4.42	6.32
Glenties	Owenea River	Gortnamucklagh Watercourse	126.05	5.68	74.30
		Stracashel River			
Ardara	Owentocker River	-	43.08	13.26	37.92
Ballybofey & Stranorlar	River Finn	Daurnett Burn	383.52	4.94	273.88
		Magherapaste			
		Treanamullin			
		Cooldawson			
Killygordon	River Finn	Killygordon	436.80	4.25	273.88
		Cross Roads			
		Garrisonhill			
Castlefinn	River Finn	Corcullion watercourse	493.75	3.18	273.88
Lifford	Foyle River	River Finn	1861.05	3.18	603.72
		Mourne River			
		Deele River			
Convoy	Deele River	-	134.00	5.40	88.72
Donegal Town	River Eske	Drummeny River	115.62	10.76	40.04
		Drumroosk			
		Drumlaght			
		Drumgun			
Killybegs	Cashelcummin River	-	1.98	22.37	2.88

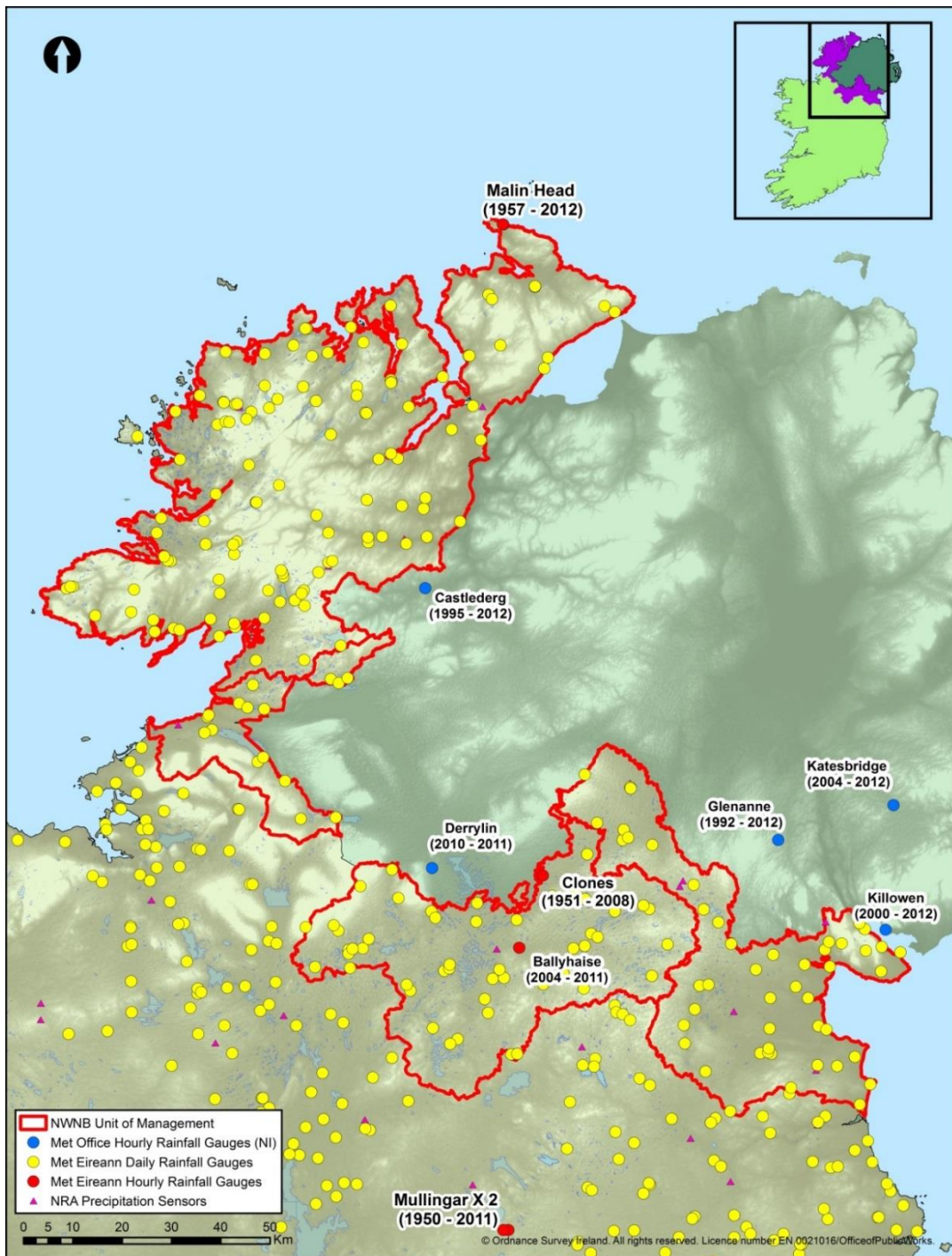


Figure B.6 Meteorological Data Availability

APPENDIX C

SUMMARY OF THE PRELIMINARY FLOOD RISK ASSESSMENT

C.1 INTRODUCTION

The Preliminary Flood Risk Assessment (PFRA) is a national screening exercise, based on available and readily-derivable information, to identify areas where there may be a significant risk associated with flooding.

The PFRA in Ireland was finalised in December 2011, following public consultation.

C.2 OVERVIEW OF THE PFRA

The objective of the PFRA is to identify areas where the risks associated with flooding might be significant. These areas (referred to as Areas for Further Assessment, or 'AFAs') are where more detailed assessment will then be undertaken to more accurately assess the extent and degree of flood risk, and, where the risk is significant, to develop where possible measures to manage and reduce the risk. The more detailed assessment, that focussed on the AFAs, was undertaken through the National CFRAM Programme or parallel studies.

It is important to note that the PFRA is not a detailed assessment of flood risk. It is rather a broad-scale assessment, based on available or readily-derivable information, to identify where there is a genuine cause for concern that may require national intervention and assessment, rather than locally developed and implemented solutions.

Three key approaches have been used in undertaking the PFRA to identify the AFAs. These are:

- Historic Analysis: The use of information and records on floods that have happened in the past
- Predictive Analysis: Undertaking analysis to determine which areas might flood in the future, as determined by predictive techniques such as modelling, analysis or other calculations, and of the potential damage that could be caused by such flooding
- Consultation: The use of local and expert knowledge of the local authorities and other Government departments and agencies to identify areas prone to flooding and the potential consequences that could arise

The assessment considered all types of flooding, including natural sources, such as that which can occur from rivers, the sea and estuaries, heavy rain and groundwater, and the failure of built infrastructure. It has also considered the impacts flooding can have on people, property, businesses, the environment and cultural heritage.

Other EU Member States have used similar approaches to undertaking the PFRA as that undertaken in Ireland.

The 'Floods' Directive does not provide a definition for 'significant' flood risk. A highly prescriptive definition is not suitable given the preliminary nature of the PFRA, and so a set of guiding principles were defined. It should however be remembered that, while flooding of one home will be traumatic to the owner or residents of that home, the PFRA needs to consider what is nationally or regionally significant flood risk.

The provisional identification of the AFAs has involved interpretation of information from all three of the above approaches. The final designation of the AFAs also took into account information and views provided through the public consultation and arising from on-site inspections that were undertaken in parallel with the consultation.

C.3 PUBLIC CONSULTATION ON THE PFRA

The 'Floods' Directive requires Member States to publish the PFRA once completed. However, the OPW has also publicly consulted on a draft of the PFRA before it was finalised, published and reported to the European Commission.

Consultation with various bodies has been undertaken during the preparation of the draft PFRA, which has included two rounds of workshops (Summer 2010 and Winter 2010-2011) involving all local authorities. During these workshops, the local authorities provided information on areas known or suspected to be at risk from flooding, and reviewed provisional Areas for Further Assessment (AFAs) identified by the OPW in relation to fluvial and coastal flood risk.

Consultation was also held with the following organisations to inform the process and draft outcomes of the PFRA:

- Dept. Agriculture, Food and the Marine
- Dept. of Culture, Heritage and the Gaeltacht
 - *National Monuments*
 - *National Parks and Wildlife Service*
- Environmental Protection Agency
- ESB
- Geological Survey of Ireland
- Health Service Executive
- Transport Infrastructure Ireland (formerly National Roads Authority)
- Waterways Ireland

Discussions were also held with utility operators in relation to the location and potential vulnerability of utility infrastructure.

The OPW published the Draft PFRA for consultation on the National CFRAM Programme website (now closed) in August 2011, and placed it on public exhibition in the principal offices of all city and county councils on the same date. While not a requirement of the Directive, SI No. 122 of 2010 set out a requirement for public consultation on the PFRA. The public consultation period began upon publication of the PFRA and extended to 1st November 2011. Submissions were invited in writing, by email, or via the website.

A total of 52 submissions were received under the public consultation process. A breakdown of the source of submissions is set out below:

County and City Councils	18
Councillors	4
Members of the Public	15
Community Groups / Associations	5
Other	10

The principal issues raised in the submissions include the following:

- Recommendations for the inclusion of locations for designation as AFAs, and / or expressions of concern related to past flooding, or the potential for flooding, of a particular location
- Comments that certain bodies, and / or their past or ongoing actions, were responsible for causing or aggravating flooding or flood problems
- Requests for inclusion in the consultation / engagement process for the CFRAM Studies
- Comments relating to past planning decisions and / or recommendations for changes to planning law
- Queries on the accuracy of, or suggested correction to, the PFRA maps
- Recommendations as to how flood risk in a location / region could be managed, or concerns as to how future flood risk management could have detrimental impacts

Only a very small number of submissions (7) included comments (positive or negative) on the PFRA process and / or the PFRA consultation process. These were carefully considered by the OPW and it was concluded that there was no basis to amend the PFRA process given nature of the exercise.

All submissions were also considered, in parallel with the findings of the Flood Risk Review (see below), in the final designation of the AFAs.

C.4 FLOOD RISK REVIEWS

To assist in the final designation of AFAs, it was deemed appropriate that the probable and possible AFAs be inspected on-site, informed by the PFRA data and findings, by suitably qualified professionals.

The on-site inspections, referred to as Flood Risk Reviews (FRRs), were undertaken by the Consultants. The inspections included a prior review of available relevant information (such as the PFRA data and findings), interviews with local residents and / or local authority staff (where possible), and an on-site inspection of the AFA to confirm, through duly informed professional opinion, the likely flood extents and potential receptors.

Following the FRR, the consultants submitted to the OPW FRR reports that set out the FRR process, described their findings and made recommendations as to whether or not a location should be designated as an AFA. The final FRR reports are available from the OPW website (www.floodinfo.ie).

The CFRAM Steering and Progress Groups (comprising representatives of the local authorities, regional authorities and the EPA as well as of the OPW ²) considered the FRR reports and their recommendations, and expressed their opinions on the designation of AFAs to the OPW. The OPW has taken these opinions into consideration in the final designation of AFAs.

² Representatives of the Rivers Agency of Northern Ireland are also members of the Steering and Progress Groups for CFRAM Studies that cover cross-border catchments.

C.5 OUTCOMES OF THE PFRA

The communities designated as AFAs are set out in Section 3 herein.

Full information on the PFRA, including the outcomes nationally, are set out in the Main Report of the PFRA and the Report on the Designation of the Areas for Further Assessment, which are both available from the OPW website (www.floodinfo.ie).

APPENDIX D

STAKEHOLDER AND PUBLIC ENGAGEMENT AND CONSULTATION

APPENDIX D.1 Membership of the National CFRAM Steering Group

- Office of Public Works
- County and City Managers Association
- Dept. Housing, Planning and Local Government
- Dept. Agriculture, Food and the Marine
- Dept. of Culture, Heritage and the Gaeltacht
- Environmental Protection Agency
- Electricity Supply Board
- Geological Survey of Ireland (Dept. of Communications, Climate Action and Environment)
- Irish Water
- Met Eireann
- Office of Emergency Planning
- Rivers Agency (Northern Ireland)
- Waterways Ireland

APPENDIX D.2 Membership of the NWNB CFRAM Steering Group

- Office of Public Works
- RPS
- Environmental Protection Agency
- WFD Local Authorities Water and Communities Office LAWCO
- Cavan County Council
- Donegal County Council
- Leitrim County Council
- Louth County Council
- Monaghan County Council
- Rivers Agency (Northern Ireland)

APPENDIX D.3 Organisations Invited to Meetings of the National Stakeholder Group

Table D.3 Organisations Invited to Meetings of the National Stakeholder Group

An Bord Pleanála	Iarnród Éireann	Irish Small and Medium Enterprises Association
An Taisce	Industrial Development Agency	Irish Water
Association of Consulting Engineers of Ireland (ACEI)	Inland Fisheries Ireland	Irish Water and Fish Preservation Society
Badgerwatch	Inland Waterways Association of Ireland	Irish Wildlife Trust
Bat Conservation Ireland	Institute of Professional Auctioneers and Valuers	IRLOGI
BirdWatch Ireland	Insurance Ireland	Landscape Alliance Ireland
Bord Gáis Networks	Irish Academy of Engineering	Macra na Feirme
Bord na Mona	Irish Angling Development Alliance	Marine Institute
Canoeing Ireland	Irish Business and Employers Confederation (IBEC)	National Anglers Representative Association
Chambers Ireland	Irish Co-Operative Organisation Society	Transport Infrastructure Ireland (formerly National Roads Authority)
CIWEM Ireland	Irish Countrywomen's Association	Native Woodland Trust
Coarse Angling Federation of Ireland	Irish Creamery Milk Suppliers Association (ICMSA)	Recreational Angling Ireland
Coastal and Marine Resources Centre	Irish Farmers Association (IFA)	Rivers Agency (Northern Ireland)
Coastwatch Ireland	Irish Federation of Pike Angling Clubs	Rowing Ireland
Coillte	Irish Federation of Sea Anglers	Royal Town and Planning Institute (RTPI)
Construction Industry Federation (CIF)	Irish Marine Federation / Irish Boat Rental Association	Society of Chartered Surveyors of Ireland (SCSI)
Council of Cultural Institutes	Irish National Committee of Blue Shield	St. Vincent de Paul
Dublin City Council / Dublin Flood Forum	Irish National Flood Forum	Sustainable Water Network (SWAN)
Eircom	Irish Natural Forestry Foundation	Teagasc
EirGrid	Irish Peatland Conservation Council	The Heritage Council
Engineers Ireland	Irish Planning Institute (IPI)	Trout Anglers Federation of Ireland
Health Services Executive (HSE)	Irish Red Cross	

APPENDIX D.4 Organisations Represented at Meetings of the NWNB CFRAM Stakeholder Group

Table D.4 *Organisations Represented at Meetings of the NWNB CFRAM Stakeholder Group*

Scoping Phase	08.11.2012	Rivers Agency (Northern Ireland)
Scoping Phase	08.11.2012	Cavan County Council
Scoping Phase	08.11.2012	Louth County Council
Scoping Phase	08.11.2012	Donegal County Council
Scoping Phase	08.11.2012	OPW
Scoping Phase	08.11.2012	Bord Iascaigh Mhara
Scoping Phase	08.11.2012	Irish Wildlife Trust
Scoping Phase	08.11.2012	Inland Fisheries Ireland
Scoping Phase	08.11.2012	Monaghan County Council
Scoping Phase	08.11.2012	FPM Project
Scoping Phase	08.11.2012	Birdwatch Ireland
Scoping Phase	08.11.2012	Irish Creamery Milk Suppliers Association
Scoping Phase	08.11.2012	Dept. of Culture, Heritage and the Gaeltacht
Scoping Phase	08.11.2012	Irish Farmers Association
Mapping Phase	09.09.2015	Rivers Agency (Northern Ireland)
Mapping Phase	09.09.2015	Loughs Agency
Mapping Phase	09.09.2015	ICA. Donegal
Mapping Phase	09.09.2015	Irish Creamery Milk Suppliers Association
Mapping Phase	09.09.2015	OPW
Mapping Phase	09.09.2015	Inland Fisheries Ireland
Mapping Phase	09.09.2015	Environment
Mapping Phase	09.09.2015	RBCT
Mapping Phase	09.09.2015	Dept. of Culture, Heritage and the Gaeltacht
Mapping Phase	09.09.2015	Irish Central Border Area Network
Mapping Phase	09.09.2015	Donegal County Council
Mapping Phase	09.09.2015	Birdwatch Monaghan
Mapping Phase	09.09.2015	Monaghan Irish Farmers Association
Mapping Phase	09.09.2015	Cavan Irish Farmers Association
Mapping Phase	09.09.2015	Louth County Council
Mapping Phase	09.09.2015	Louth Irish Farmers Association
Mapping Phase	09.09.2015	Monaghan County Council
Mapping Phase	09.09.2015	Donegal County Council
Options Phase	08.03.2016	Dept. of Agriculture
Options Phase	08.03.2016	Inland Fisheries Ireland
Options Phase	08.03.2016	Irish Central Border Area Network
Options Phase	08.03.2016	Leitrim County Council
Options Phase	08.03.2016	Cavan County Council
Options Phase	08.03.2016	Monaghan County Council
Options Phase	08.03.2016	Rivers Agency (Northern Ireland)

APPENDIX D.5 Public Consultation Days Held at the Flood Mapping Stage in the North Western River Basin

Table D.5 *Flood Mapping PCDs Held in the North Western River Basin*

AFA	Date	Venue	No. Attendees
Ballybofey and Stranorlar	25.03.2015	Villa Rose Hotel	17
Bunbeg-Derrybeg	04.03.2015	Leabharlann Phobail Ghaoth Dobhair	15
Buncrana, Bridge End and Burnfoot	05.02.2015	Inishowen Gateway Hotel	8
Carndonagh, Malin, Moville, Clonmany	05.02.2015	Carndonagh Public Services Centre	14
Donegal, Ardara, Killybegs, Bundoran and Tullaghan	25.03.2015	Donegal Public Services Centre	24
Dungloe and Glenties	04.03.2015	Dungloe Public Services Centre	2
Letterkenny and Newton Cunningham	26.03.2015	Letterkenny Public Services Centre	11
Lifford, Castlefinn, Killygordon, Convoy	26.03.2015	The Old Courthouse	9
Ramelton, Rathmullan, Kerrykeel, Downings, Dunfanaghy	03.03.2015	Milford Public Services Centre	8
Raphoe	26.09.2013	Raphoe Cathedral Hall, McBride Street, Raphoe	34

APPENDIX D.6 Public Consultation Days Held at the Flood Risk Management Optioneering Stage in the North Western River Basin

Table D.6 *Flood Risk Management Optioneering PCDs Held in the North Western River Basin*

AFA	Date	Venue	No. Attendees
Ballybofey and Stranorlar	15.03.2016	Villa Rose Hotel	28
Bunbeg-Derrybeg	01.03.2016	Leabharlann Phobail Ghaoth Dobhair	7
Buncrana, Bridge End and Burnfoot	03.03.2016	Inishowen Gateway Hotel	6
Carndonagh, Malin, Moville, Clonmany	03.03.2016	Carndonagh Public Services Centre	15
Donegal, Ardara, Killybegs, Bundoran and Tullaghan	14.03.2016	Donegal Public Services Centre	19
Dungloe and Glenties	01.03.2016	Dungloe Public Services Centre	1
Letterkenny and Newton Cunningham	15.03.2016	Letterkenny Public Services Centre	3
Lifford, Castlefinn, Killygordon, Convoy	15.03.2016	The Old Courthouse	32

Ramelton, Rathmullan, Kerrykeel, Downings, Dunfanaghy	02.03.2016	Milford Public Services Centre	9
---	------------	--------------------------------	---

APPENDIX D.7 Public Consultation Days Held at the Draft Flood Risk Management Plan Stage in the North Western River Basin

Table D.7 *Draft Flood Risk Management Plan PCDs Held in the North Western River Basin*

AFA	Date	Venue	No. Attendees
Lifford, Castlefinn, Killygordon, Convoy, Ballybofey/Stranorlar, Raphoe	13.10.2016	The Old Courthouse The Diamond Lifford	17
Letterkenny, Netowncunningham, Kerrykeel/Carrowkeel, Downings, Dunfanaghy, Ramelton, Rathmullan, Bridge End, Burnfoot	18.10.2016	Letterkenny Public Services Centre Neil T Blaney Road Letterkenny	16
Carndonagh, Malin, Clonmany, Moville, Buncrana, Bridge End, Burnfoot	18.10.2016	Carndonagh Public Services Centre Malin Road Carndonagh	11
Dungloe, Glenties, Ardara, Dunfanaghy. Bunbeg- Derrybeg	19.10.2016	Dungloe Public Services Centre Gweedore Road Dungloe	7
Donegal Town, Ardara, Killybegs, Bundoran & Tullaghan, Glenties, Ballybofey/Stranorlar	19.10.2016	Donegal Public Services Centre Drumlonagher Donegal Town	25

APPENDIX E

DESCRIPTION OF THE FLOOD RISK IN EACH AFA

The numbers of properties at risk and the damage values set out herein are as understood under current conditions and at this stage of assessment. The numbers and values may change when the risk is assessed in more detail at the project-level of development of measures and/or due to the potential impacts climate change, future development and inflation. The numbers presented are determined independently for each source of flooding. For AFAs which are affected by more than one source of flooding, some properties may be at risk by more than one source, and as such properties may have been included in the numbers for both sources.

E.1 Flood Risk Analysis and Mapping – Ardara AFA

Fluvial flooding occurs at Ardara during a 1% AEP event. There are two main areas which are affected which are in close proximity and have potential to interact. Out of bank flooding occurs on the Owentocker River due to insufficient channel capacity inundating the floodplain. Downstream of this, towards Ardara town, insufficient channel capacity is noted again, putting a few receptors at risk of flooding.

There are a reasonably small number of residential properties and a business property at risk of flooding during a 1% AEP fluvial event.

It was possible to compare certain areas that were identified to have flooded in the past and ascertain that the model is producing similar results. Overall there is moderate confidence in the both the hydrology and hydraulics of the Ardara AFA due to the lack of gauge data for verification.

Ardara has been agreed as a low/no risk AFA and the existing maintenance regime should continue in order to maintain the current SoP.

Ardara AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0	385,395.04	4,591,257.62
No. Residential Properties at Risk	0	15	35
No. Business Properties at Risk	0	1	12
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	0	3	6
No. Highly Vulnerable Properties at Risk	0	0	1
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

Mid-Range Future Scenario			
Event Damage (€)	60,201.59	2,401,190.75	20,346,898.08
No. Residential Properties at Risk	2	22	68
No. Business Properties at Risk	3	5	25
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	2	6	9
No. Highly Vulnerable Properties at Risk	0	0	1
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	706,379.68	14,121,618.28	24,249,443.45
No. Residential Properties at Risk	17	34	75
No. Business Properties at Risk	4	19	28
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	2	6	9
No. Highly Vulnerable Properties at Risk	0	1	1
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.2 Flood Risk Analysis and Mapping – Ballybofey & Stranorlar AFA

Ballybofey & Stranorlar AFA is at risk of flooding during a 1% AEP fluvial event. The main flood risk is to receptors located along the River Finn. There are a number of locations along this watercourse where out of bank flooding occurs and as they have the potential to influence one another. There are five further discrete areas of flooding within Ballybofey & Stranorlar AFA. These are mainly caused due to a single flood mechanism on tributaries of the main river. Receptors in these locations are also at risk during more frequent flood events.

There are a reasonable number of residential properties and a business property at risk of flooding during a 1% AEP event. Several transport infrastructure assets including local roads and a regional road are also located within the floodplains. A school which is a highly vulnerable property is included within the risk during a 1% AEP event.

Flood event flow and level information is available for two gauging stations within the modelled extents and covers the period from 1972 – 2013. Flood extent data for validation of the model and verification of the mapped flood extents is fairly poor with most of the events having very little data apart from that there was flooding within the AFA or in agricultural land adjacent to the Finn. Overall there is good confidence in both the hydrology and hydraulics of the Ballybofey & Stranorlar AFA, particularly along the River Finn.

Due to the frequency of flooding at Ballybofey & Stranorlar there are significant event damages and risks in present day and future scenarios.

Ballybofey AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	17,334.64	5,767,931	83,936,333.92
No. Residential Properties at Risk	2	53	132
No. Business Properties at Risk	0	6	83
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	5	17	42
No. Highly Vulnerable Properties at Risk	0	2	5
No. of Social Infrastructure Assets at Risk	9	13	13
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	1
Mid-Range Future Scenario			
Event Damage (€)	1,886,588	43,194,694	109,678,920
No. Residential Properties at Risk	12	88	144
No. Business Properties at Risk	4	51	94
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	8	32	43
No. Highly Vulnerable Properties at Risk	1	3	6
No. of Social Infrastructure Assets at Risk	11	13	13
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	74,020,444	81,362,869	124,903,974
No. Residential Properties at Risk	58	127	179
No. Business Properties at Risk	10	77	100
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	21	39	45
No. Highly Vulnerable Properties at Risk	3	6	6
No. of Social Infrastructure Assets at Risk	11	13	13
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.3 Flood Risk Analysis and Mapping – Bunbeg-Derrybeg AFA

Bunbeg-Derrybeg is at risk of flooding during a 1% AEP fluvial event and a 0.5% AEP coastal event. Out of bank flooding occurs on the Cathleen River due to insufficient channel capacity inundating the floodplain. Immediately downstream of this, the channel capacity of the Cathleen River is again exceeded putting a receptor at risk. This receptor is also at risk during a 0.5% AEP coastal event due to the topography of the area. Further flooding is observed in a discrete location during the 1% AEP fluvial event on the Derrybeg River due to insufficient culvert capacity causing inundation of the floodplain.

A few properties, both residential and non-residential, are at risk of flooding within Bunbeg-Derrybeg AFA. A social infrastructure asset, Derrybeg Chapel, and a couple of transport infrastructure assets, a local and regional road, are also located within the floodplains.

It was possible to compare certain areas that were identified to have flooded in the past and ascertain that the model is producing similar results. There are no gauging stations available within the modelled extents of the Clady or Catheen Rivers however there is some flow information available at the dam control upstream of the modelled extents on the Clady River. Overall there is good confidence in both the hydrology and hydraulics of the Bunbeg-Derrybeg model.

There are reasonable event damages and risks associated with Bunbeg-Derrybeg AFA in present day and future scenarios. The flood risk associated with the two CFRAM flooding mechanisms applicable to Bunbeg-Derrybeg; fluvial and coastal (tidal inundation), is summarized in the following table.

Bunbeg-Derrybeg AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	145,231 Fluvial 0 Coastal	1,235,561 Fluvial 147,893.29 Coastal	2,028,220.03 Fluvial 157,414.45 Coastal
No. Residential Properties at Risk	1 Fluvial 0 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. Business Properties at Risk	0 Fluvial 0 Coastal	2 Fluvial 0 Coastal	2 Fluvial 0 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	3 Fluvial 3 Coastal	4 Fluvial 3 Coastal	4 Fluvial 3 Coastal
No. Highly Vulnerable Properties at Risk	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	2 Fluvial 0 Coastal	2 Fluvial 0 Coastal	2 Fluvial 0 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

Mid-Range Future Scenario			
Event Damage (€)	1,202,159 Fluvial 170,101 Coastal	1,804,476 Fluvial 264,256 Coastal	1,987,487 Fluvial 326,802 Coastal
No. Residential Properties at Risk	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. Business Properties at Risk	2 Fluvial 0 Coastal	2 Fluvial 1 Coastal	2 Fluvial 1 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	4 Fluvial 3 Coastal	4 Fluvial 3 Coastal	4 Fluvial 3 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 0 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	1,703,957 Fluvial 301,208 Coastal	2,153,717 Fluvial 838,308 Coastal	2,381,567 Fluvial 1,146,937 Coastal
No. Residential Properties at Risk	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal	2 Fluvial 1 Coastal
No. Business Properties at Risk	3 Fluvial 1 Coastal	3 Fluvial 2 Coastal	3 Fluvial 2 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	4 Fluvial 3 Coastal	4 Fluvial 3 Coastal	4 Fluvial 3 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.4 Flood Risk Analysis and Mapping – Buncrana AFA

Buncrana AFA is subject to flooding during a 1% AEP fluvial event and a 0.5% AEP coastal event. The main flood risk is to receptors located along the Buncrana River where three discrete areas of fluvial flooding occurs due to insufficient channel capacity which results in overland flow and inundation of the floodplain. On the Crana River, out of bank flooding occurs due to insufficient channel capacity.

There are a reasonable number of residential and business properties at risk of flooding within Buncrana AFA. Social infrastructure assets including a leisure centre, social amenity sites and transport infrastructure assets including regional and urban local roads are situated within the floodplains. Crana River Water Treatment Plant is also at risk of flooding.

Despite the lack of calibration and verification data for the Buncrana AFA, the model is considered to be performing satisfactorily for design event simulation.

There are substantial event damages and risks associated with Buncrana AFA in present day and future scenarios. The flood risk associated with the two CFRAM flooding mechanisms applicable to Buncrana; fluvial and coastal (tidal inundation), is summarized in the following table.

Buncrana AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	6,995,472.36 Fluvial 392,057.77 Coastal	23,727,431.09 Fluvial 832,957.73 Coastal	36,470,185.89 Fluvial 1,150,420.86 Coastal
No. Residential Properties at Risk	2 Fluvial 4 Coastal	21 Fluvial 6 Coastal	43 Fluvial 6 Coastal
No. Business Properties at Risk	1 Fluvial 2 Coastal	2 Fluvial 3 Coastal	3 Fluvial 3 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	2 Fluvial 2 Coastal	12 Fluvial 2 Coastal	14 Fluvial 2 Coastal
No. Highly Vulnerable Properties at Risk	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. of Social Infrastructure Assets at Risk	28 Fluvial 28 Coastal	29 Fluvial 28 Coastal	29 Fluvial 28 Coastal
No. Environmental Assets at Risk	3 Fluvial 3 Coastal	3 Fluvial 3 Coastal	3 Fluvial 3 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

Mid-Range Future Scenario			
Event Damage (€)	30,225,622 Fluvial 1,325,839 Coastal	41,877,633 Fluvial 1,916,662 Coastal	51,742,250 Fluvial 2,332,545 Coastal
No. Residential Properties at Risk	6 Fluvial 6 Coastal	34 Fluvial 8 Coastal	90 Fluvial 8 Coastal
No. Business Properties at Risk	4 Fluvial 3 Coastal	6 Fluvial 3 Coastal	9 Fluvial 3 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	12 Fluvial 6 Coastal	18 Fluvial 6 Coastal	23 Fluvial 6 Coastal
No. Highly Vulnerable Properties at Risk	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	28 Fluvial 28 Coastal	29 Fluvial 28 Coastal	30 Fluvial 28 Coastal
No. Environmental Assets at Risk	3 Fluvial 3 Coastal	3 Fluvial 3 Coastal	3 Fluvial 3 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	40,930,549 Fluvial 2,232,981 Coastal	50,575,966 Fluvial 4,843,100 Coastal	69,943,900 Fluvial 8,753,376 Coastal
No. Residential Properties at Risk	32 Fluvial 8 Coastal	112 Fluvial 23 Coastal	206 Fluvial 30 Coastal
No. Business Properties at Risk	6 Fluvial 3 Coastal	9 Fluvial 5 Coastal	23 Fluvial 15 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	17 Fluvial 13 Coastal	22 Fluvial 13 Coastal	40 Fluvial 19 Coastal
No. Highly Vulnerable Properties at Risk	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	29 Fluvial 28 Coastal	30 Fluvial 29 Coastal	32 Fluvial 29 Coastal
No. Environmental Assets at Risk	3 Fluvial 3 Coastal	3 Fluvial 3 Coastal	3 Fluvial 3 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.5 Flood Risk Analysis and Mapping – Burnfoot AFA

Burnfoot is subject to fluvial flooding during a 1% AEP event. All of the properties which are identified as at risk are within an area located on the left bank of the Burnfoot River in the northern extent of the AFA.

There are a number of residential properties at risk along with a couple of business properties.

One historical flooding incident was identified for Burnfoot. This event dated back to October 1870 when it was reported that the railway communication was blocked by flood waters. The only available rainfall records for this period were recorded at Armagh Observatory. Overall there is poor confidence in both the hydrology and hydraulics of the Burnfoot AFA.

Due to the frequency of flooding Burnfoot AFA has reasonable damages and risks in present day and future scenarios.

Burnfoot AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	39,320	1,211,135	2,491,805
No. Residential Properties at Risk	3	20	28
No. Business Properties at Risk	1	2	4
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	1	3	5
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	805,113	1,915,534	3,458,388
No. Residential Properties at Risk	14	26	30
No. Business Properties at Risk	3	4	6
No. Utilities at Risk	0	0	1
No. Major Transport Assets at Risk	3	5	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	3
No. Potential Pollution Sources at Risk	0	0	0

High-End Future Scenario			
Event Damage (€)	1,398,241	3,044,627	4,706,697
No. Residential Properties at Risk	21	29	36
No. Business Properties at Risk	4	6	7
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	4	5	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.6 Flood Risk Analysis and Mapping – Bridge End AFA

Fluvial flooding occurs in Bridge End AFA during a 1% AEP event within one discrete area. It is located at the northern extent of the AFA and occurs when water spills from the low left river embankment of the Bridge End River, inundating the adjacent commercial area.

A business property is affected during a 1% AEP fluvial event, but also floods during more frequent flood events.

Several reported historical flooding incidents were compared to the modelled flooding extents to produce a reasonable spatial comparison. It is recognised that localised flood relief work constructed after the 1999 fluvial flooding event may have rendered any flooding reports prior to this period as invalid for modelled flooding extent comparison purposes. Overall there is poor confidence in both the hydrology and hydraulics of the Bridge End.

Bridge End has been agreed as a low/no risk AFA and so the existing maintenance regime should continue in order to maintain the current SoP.

Bridge End AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0	345,210	2,955,518
No. Residential Properties at Risk	0	0	6
No. Business Properties at Risk	0	1	15
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	5	5	5
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0

Mid-Range Future Scenario			
Event Damage (€)	190,912	1,925,242	5,107,810
No. Residential Properties at Risk	1	4	17
No. Business Properties at Risk	1	14	23
No. Utilities at Risk	0	0	1
No. Major Transport Assets at Risk	6	6	7
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	1,674,098	5,217,865	12,178,480
No. Residential Properties at Risk	2	8	28
No. Business Properties at Risk	11	22	28
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	6	7	13
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0

E.7 Flood Risk Analysis and Mapping – Carndonagh AFA

Carndonagh suffers from fluvial flooding during a 1% AEP event in multiple locations. The majority of the flooding originates from the Donagh River and its tributaries. There are a couple of regions with two locations of flooding which have potential for interaction.

In one area, the Donagh River and the Ballywilly Brook contribute due to a combination of insufficient channel and culvert capacity. These watercourses combine resulting in back water effects up the Ballywilly Brook. Immediately downstream of this a receptor is at risk due to low banks resulting in out of bank flooding. On the Carndonagh watercourse, flooding occurs due to an extremely low left bank. Flooding is accentuated here due to the topography of the area and affects many properties. Downstream of this flooding occurs again due to a low bank level. In a discrete area of flooding, overland flow originating from the Glennagannon River occurs due to insufficient channel capacity.

A reasonably large number of residential and business properties are at risk of flooding along with several transport infrastructure assets including regional and local roads. A community centre, which is a highly vulnerable property, is also situated within the floodplain.

There is good confidence in both the hydrology and hydraulics of the Carndonagh AFA due to the presence of a gauging station and flood extent verification events.

Due to the number of receptors affected there are reasonable event damages and risks associated with Carndonagh in present day and future scenarios.

Carndonagh AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	1,989,167.77	6,386,854.34	10,119,471.54
No. Residential Properties at Risk	29	32	43
No. Business Properties at Risk	4	10	14
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	4	5	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	1	1	1
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	3,886,653	7,051,286	14,026,788
No. Residential Properties at Risk	31	35	56
No. Business Properties at Risk	6	12	16
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	4	5	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	3	3	4
No. Environmental Assets at Risk	8	8	8
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	6,134,235	9,719,230	17,232,884
No. Residential Properties at Risk	32	44	65
No. Business Properties at Risk	10	14	17
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	4	5	8
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	3	3	5
No. Environmental Assets at Risk	8	8	8
No. Potential Pollution Sources at Risk	0	0	0

E.8 Flood Risk Analysis and Mapping – Castlefinn AFA

Castlefinn is subject to fluvial flooding during a 1% AEP event with the main flood risk originating from the River Finn and the Corcullion Tributary. Out of bank flooding occurs from both watercourses although flooding on the tributary is largely due to elevated water levels in the River Finn flooding out along the tributary's lower reaches. The elevated water levels on the Finn are caused by a combination of flood flows emanating in the Finn catchment upstream of Castlefinn and a back water effect coming from the Foyle/Mourne River system.

A number of residential and non-residential properties are at risk during a 1% AEP event. Many transport infrastructure assets including a regional and a national road are also located within the floodplain. Castelfinn Waste Water Treatment Plant and a community centre which is classified as a highly vulnerable property are also at risk of fluvial flooding. These receptors are also affected during more frequent flooding events than the 1% AEP.

There is good confidence in both the hydrology and hydraulics of the Castelfinn AFA, particularly along the River Finn where there are long term gauging station records and good flood extent verification events.

Due to the frequency of flooding there are substantial damages within Castelfinn AFA in present day and future scenarios.

Castelfinn AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	113,849.05	5,798,929.19	10,904,878.37
No. Residential Properties at Risk	2	18	30
No. Business Properties at Risk	3	17	19
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	3	10	12
No. Highly Vulnerable Properties at Risk	0	1	1
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	3,014,368.03	9,197,729.03	15,573,477.46
No. Residential Properties at Risk	9	23	41
No. Business Properties at Risk	19	25	27
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	7	11	13
No. Highly Vulnerable Properties at Risk	1	1	1
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

High-End Future Scenario			
Event Damage (€)	3,611,703.48	12,843,342.22	20,414,463.77
No. Residential Properties at Risk	15	32	76
No. Business Properties at Risk	22	26	28
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	10	13	17
No. Highly Vulnerable Properties at Risk	1	1	1
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.9 Flood Risk Analysis and Mapping – Clonmany AFA

Clonmany is affected by fluvial flooding during a 1% AEP event in three discrete locations throughout the AFA. Flooding from the Ballynahallan River, Clonmany River and Cleghagh Stream occurs due to insufficient channel capacity.

A small number of residential properties and a couple of business properties are affected by flooding during a 1% AEP event in Clonmany. A community centre which is classified as a highly vulnerable property is at risk along with Clonmany Waste Water Treatment Works. Some of these receptors are also at risk during more frequent flood events.

Generally, historical evidence has provided an indication that this location is susceptible to flooding following heavy rainfall and subsequent overland flow. Overall there is moderate confidence in both the hydrology and hydraulics of the Clonmany AFA as no hydrometric gauges are located within the model extents to support calibration.

Due to the small number of receptors affected within Clonmany it has been agreed as a low/no risk AFA and therefore the existing maintenance regime should continue in order to maintain the current SoP.

Clonmany AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	255.83	442,172.52	1,556,266.15
No. Residential Properties at Risk	0	7	26
No. Business Properties at Risk	1	2	2
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	0	1	1
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0

Mid-Range Future Scenario			
Event Damage (€)	38,952.84	1,056,355.65	2,384,839.53
No. Residential Properties at Risk	0	21	33
No. Business Properties at Risk	3	3	4
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	0	1	4
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	253,071	1,766,891.4	2,959,453.54
No. Residential Properties at Risk	3	26	39
No. Business Properties at Risk	3	4	4
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	1	4	4
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0

E.10 Flood Risk Analysis and Mapping – Convoy AFA

Fluvial flooding occurs in Convoy during a 1% AEP event. On the Cloghroe River flooding is due to a combination of insufficient capacity of a bridge and insufficient channel capacity upstream of this structure. Immediately downstream of this out of bank flooding occurs as a consequence of insufficient channel capacity. In a separate location flooding occurs primarily because of insufficient channel capacity. However, water levels are high at this location during less frequent flood events due to the surcharging of a bridge, which also acts to reduce backwatering effects originating from downstream from the Cloghroe River.

A few residential and non-residential properties are affected in each location along with a few local roads. These receptors are also at risk of flooding during the less frequent events.

With the limited information available it has been not possible is to compare specific areas that have been identified to have been affected in the past.

Due to the frequency of flooding to receptors within Convoy there are reasonable damages in present day and future scenarios.

Convoy AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0	9,898,818.06	14,060,838.53
No. Residential Properties at Risk	0	5	14
No. Business Properties at Risk	0	4	4
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	1	4	5
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	2	2	2
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	31,469.7	13,334,332.14	15,949,885.56
No. Residential Properties at Risk	0	8	32
No. Business Properties at Risk	1	4	7
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	3	5	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	2	2	2
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	11,951,168.31	15,632,102.61	17,883,035.69
No. Residential Properties at Risk	7	21	36
No. Business Properties at Risk	4	7	7
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	4	5	7
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	2	2	2
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0

E.11 Flood Risk Analysis and Mapping – Donegal AFA

Donegal is at risk from both 1% AEP fluvial events and 0.5% coastal events. Along the River Eske, the Drumrooske watercourse, the Drumlaght watercourse and the Drummenny River out of bank flooding occurs due to high volumes of water inundating the floodplain. This area is considered complex due to the number of watercourses involved. Another area of flooding occurs due to the low lying land immediately downstream of Tyrconnell Bridge during a 0.5% tidal inundation event. A property in this region is also affected by fluvial flooding during a

1% AEP event. Three further discrete areas of flooding occur along the Drumgun watercourse, the Tully watercourse and the Tawnalary watercourse. These are a consequence of structures such as culverts which restrict flow during a flood event.

There are a number of residential and business properties at risk of flooding within Donegal including social infrastructure assets such as a church and community centre, and cultural heritage assets. Environmental assets and transport infrastructure assets including national regional and local roads are also located within the floodplains.

There is moderate confidence in both the hydrology and hydraulics of the Donegal model as there was limited flood extent verification events and poor data recorded at the gauge stations in the area.

There are significant event damages and risks within Donegal AFA in present day and future scenarios. The flood risk associated with the two CFRAM flooding mechanisms applicable to Donegal; fluvial and coastal (tidal inundation), is summarized in the following table.

Donegal AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	4,888,700 Fluvial 30,595 Coastal	11,129,699 Fluvial 2,545,103 Coastal	35,134,170 Fluvial 7,774,104 Coastal
No. Residential Properties at Risk	8 Fluvial 0 Coastal	35 Fluvial 3 Coastal	82 Fluvial 12 Coastal
No. Business Properties at Risk	15 Fluvial 2 Coastal	26 Fluvial 10 Coastal	50 Fluvial 23 Coastal
No. Utilities at Risk	0 Fluvial 1 Coastal	0 Fluvial 1 Coastal	0 Fluvial 1 Coastal
No. Major Transport Assets at Risk	17 Fluvial 2 Coastal	25 Fluvial 6 Coastal	43 Fluvial 13 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	5 Fluvial 3 Coastal	5 Fluvial 4 Coastal	5 Fluvial 4 Coastal
No. Environmental Assets at Risk	6 Fluvial 6 Coastal	6 Fluvial 6 Coastal	6 Fluvial 6 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

Mid-Range Future Scenario			
Event Damage (€)	7,460,684 Fluvial 6,745,236 Coastal	22,261,356 Fluvial 15,306,896 Coastal	50,929,782 Fluvial 22,771,815 Coastal
No. Residential Properties at Risk	13 Fluvial 5 Coastal	58 Fluvial 30 Coastal	115 Fluvial 35 Coastal
No. Business Properties at Risk	23 Fluvial 20 Coastal	44 Fluvial 34 Coastal	63 Fluvial 43 Coastal
No. Utilities at Risk	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. Major Transport Assets at Risk	24 Fluvial 22 Coastal	42 Fluvial 25 Coastal	43 Fluvial 25 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	7 Fluvial 6 Coastal	8 Fluvial 6 Coastal	9 Fluvial 6 Coastal
No. Environmental Assets at Risk	6 Fluvial 6 Coastal	6 Fluvial 6 Coastal	6 Fluvial 6 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	18,122,981 Fluvial 16,265,620 Coastal	45,430,152 Fluvial 30,042,175 Coastal	67,408,793 Fluvial 37,729,221 Coastal
No. Residential Properties at Risk	53 Fluvial 31 Coastal	95 Fluvial 38 Coastal	141 Fluvial 39 Coastal
No. Business Properties at Risk	45 Fluvial 36 Coastal	70 Fluvial 48 Coastal	85 Fluvial 53 Coastal
No. Utilities at Risk	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. Major Transport Assets at Risk	47 Fluvial 26 Coastal	47 Fluvial 27 Coastal	47 Fluvial 28 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	9 Fluvial 8 Coastal	10 Fluvial 9 Coastal	10 Fluvial 9 Coastal
No. Environmental Assets at Risk	6 Fluvial 6 Coastal	6 Fluvial 6 Coastal	6 Fluvial 6 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.12 Flood Risk Analysis and Mapping – Downings AFA

Downings is at risk of flooding in two discrete areas during a 1% AEP fluvial and during a 0.5% AEP coastal event. Along the Magherbeg watercourse, out of bank flooding occurs due to insufficient culvert capacity during a fluvial event. In a second area, a property is predicted to flood during a 0.5% AEP coastal event due to tidal inundation.

There are a couple of residential and business properties at risk within Downings AFA including a sports and leisure centre, which is classified as a social infrastructure asset. A couple of local urban roads are also located within the floodplains. These receptors are also at risk during more frequent flooding events.

Rainfall and tide gauge data was used where possible to quantify historic flood events in the Downings AFA, however these deductions should be treated with caution due to local coastal processes in Downings Bay and localised intense rainfall which may not be accounted for. Due to the nature of the data available; limited model verification has been achieved and the model is considered to be performing satisfactorily for design event simulation.

Due to the frequency of flooding within Downings AFA there are reasonable event damages and risks in present day and future scenarios. The flood risk associated with the two CFRAM flooding mechanisms applicable to Downings; fluvial and coastal (tidal inundation), is summarized in the following table.

Downings AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	282,251 Fluvial 0 Coastal	332,654 Fluvial 11,383 Coastal	379,234 Fluvial 103,961 Coastal
No. Residential Properties at Risk	2 Fluvial 0 Coastal	2 Fluvial 1 Coastal	2 Fluvial 1 Coastal
No. Business Properties at Risk	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal	2 Fluvial 1 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	4 Fluvial 3 Coastal	5 Fluvial 3 Coastal	5 Fluvial 4 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

Mid-Range Future Scenario			
Event Damage (€)	357,240 Fluvial 65,623 Coastal	579,595 Fluvial 394,193 Coastal	840,161 Fluvial 1,848,349 Coastal
No. Residential Properties at Risk	3 Fluvial 1 Coastal	19 Fluvial 2 Coastal	20 Fluvial 13 Coastal
No. Business Properties at Risk	2 Fluvial 1 Coastal	2 Fluvial 2 Coastal	4 Fluvial 8 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	5 Fluvial 8 Coastal	10 Fluvial 8 Coastal	10 Fluvial 8 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	661,902 Fluvial 1,295,595 Coastal	1,159,068 Fluvial 5,939,185 Coastal	2,793,799 Fluvial 9,060,509 Coastal
No. Residential Properties at Risk	17 Fluvial 9 Coastal	21 Fluvial 22 Coastal	28 Fluvial 29 Coastal
No. Business Properties at Risk	2 Fluvial 7 Coastal	7 Fluvial 11 Coastal	9 Fluvial 13 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	8 Fluvial 8 Coastal	10 Fluvial 8 Coastal	10 Fluvial 8 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 1 Coastal	0 Fluvial 1 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.13 Flood Risk Analysis and Mapping – Dunfanaghy AFA

Dunfanaghy AFA is subject to flooding during a 0.5% AEP coastal event and during a 0.5% wave overtopping event. The area at risk has multiple flood mechanisms affecting it and a large number of receptors at risk.

There are a reasonably large number of residential and business properties at risk within Dunfanaghy AFA including a community centre which is a social infrastructure asset. A few local roads and a national road are also at risk of flooding. Horn Head and Rinclevan SAC which is an environmental asset is also subject to flooding within this location.

There is moderate confidence in both the tidal boundary and hydraulics of the Dunfanaghy AFA. There are no active tidal gauges within the Dunfanaghy model extents. In addition there are no historical reports of specific coastal flooding events at Dunfanaghy. Detailed model calibration was therefore not possible; however a report of recurring flooding from the OPW Area Engineer for Glenties was used to provide limited qualitative support for the model results.

Due to the number of receptors at risk, there are significant event damages and risks within Dunfanaghy AFA. The flood risk associated with the two CFRAM flooding mechanisms applicable to Dunfanaghy; coastal 1 (tidal inundation) and coastal 2 (wave overtopping), is summarized in the following table.

Dunfanaghy AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	17,356 Coastal 1 0 Coastal 2	4,516,097 Coastal 1 1,131,552 Coastal 2	8,125,499 Coastal 1 1,128,583 Coastal 2
No. Residential Properties at Risk	2 Coastal 1 1 Coastal 2	13 Coastal 1 10 Coastal 2	15 Coastal 1 10 Coastal 2
No. Business Properties at Risk	0 Coastal 1 0 Coastal 2	24 Coastal 1 7 Coastal 2	25 Coastal 1 7 Coastal 2
No. Utilities at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	3 Coastal 1 0 Coastal 2	5 Coastal 1 0 Coastal 2	5 Coastal 1 2 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	1 Coastal 1 1 Coastal 2	1 Coastal 1 1 Coastal 2	1 Coastal 1 1 Coastal 2
No. Environmental Assets at Risk	2 Coastal 1 2 Coastal 2	2 Coastal 1 2 Coastal 2	2 Coastal 1 2 Coastal 2
No. Potential Pollution Sources at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2

Mid-Range Future Scenario			
Event Damage (€)	4783284 Coastal 1 3,305,291 Coastal 2	10,333,507 Coastal 1 9,642,182 Coastal 2	12,976,242 Coastal 1 9,642,182 Coastal 2
No. Residential Properties at Risk	13 Coastal 1 12 Coastal 2	15 Coastal 1 15 Coastal 2	16 Coastal 1 15 Coastal 2
No. Business Properties at Risk	24 Coastal 1 22 Coastal 2	25 Coastal 1 25 Coastal 2	27 Coastal 1 25 Coastal 2
No. Utilities at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	4 Coastal 3 Coastal 2	7 Coastal 4 Coastal 2	8 Coastal 4 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	1 Coastal 1 1 Coastal 2	1 Coastal 1 Coastal 2	1 Coastal 1 1 Coastal 2
No. Environmental Assets at Risk	2 Coastal 1 2 Coastal 2	2 Coastal 2 Coastal 2	2 Coastal 1 2 Coastal 2
No. Potential Pollution Sources at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
High-End Future Scenario			
Event Damage (€)	14,113,252 Coastal 1 11,039,816 Coastal 2	18,987,561 Coastal 1 15,206,843 Coastal 2	20,789,018 Coastal 1 15,206,843 Coastal 2
No. Residential Properties at Risk	16 Coastal 1 15 Coastal 2	24 Coastal 1 15 Coastal 2	26 Coastal 1 15 Coastal 2
No. Business Properties at Risk	30 Coastal 1 25 Coastal 2	35 Coastal 1 26 Coastal 2	35 Coastal 1 26 Coastal 2
No. Utilities at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	7 Coastal 1 4 Coastal 2	9 Coastal 1 4 Coastal 2	9 Coastal 1 4 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	1 Coastal 1 1 Coastal 2	3 Coastal 1 1 Coastal 2	3 Coastal 1 1 Coastal 2
No. Environmental Assets at Risk	2 Coastal 1 2 Coastal 2	2 Coastal 1 2 Coastal 2	2 Coastal 1 2 Coastal 2
No. Potential Pollution Sources at Risk	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2

E.14 Flood Risk Analysis and Mapping – Dungloe AFA

Fluvial 1% AEP events and coastal 0.5% AEP events cause flooding at two discrete areas within Dungloe AFA. Tidal inundation occurs in the low lying area immediately east of Dungloe Pier during a 0.5% AEP event. Fluvial flooding occurs on the Dungloe River due to raised water levels caused by a bridge on Main Street. Further flooding occurs at the Atlantic Bar where the gable wall forms part of the river channel on the left hand bank.

A residential and a non-residential property are affected within Dungloe during these flood events.

General information from the Glenties Area Engineer was used in conjunction with historical data, but overall the model is poorly calibrated due to the lack of useable information. However 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.

Dungloe has been agreed as a low/no risk AFA and therefore the existing maintenance regime should continue in order to maintain the current SoP.

The flood risk associated with the two CFRAM flooding mechanisms applicable to Dungloe; fluvial and coastal (tidal inundation), is summarized in the following table.

Dungloe AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	52,592 Fluvial 0 Coastal	80,644 Fluvial 42,164 Coastal	136,523 Fluvial 132,416 Coastal
No. Residential Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 1 Coastal	0 Fluvial 1 Coastal
No. Business Properties at Risk	1 Fluvial 0 Coastal	1 Fluvial 0 Coastal	2 Fluvial 0 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	1 Fluvial 2 Coastal	1 Fluvial 3 Coastal	1 Fluvial 3 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

Mid-Range Future Scenario			
Event Damage (€)	56,111 Fluvial 98,024 Coastal	174,824 Fluvial 170,319 Coastal	297,738 Fluvial 255,619 Coastal
No. Residential Properties at Risk	1 Fluvial 1 Coastal	2 Fluvial 2 Coastal	1 Fluvial 2 Coastal
No. Business Properties at Risk	1 Fluvial 0 Coastal	2 Fluvial 0 Coastal	2 Fluvial 0 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	3 Fluvial 5 Coastal	3 Fluvial 5 Coastal	3 Fluvial 5 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	98,198 Fluvial 184,154 Coastal	258,677 Fluvial 342,687 Coastal	2,291,266 Fluvial 471,940 Coastal
No. Residential Properties at Risk	1 Fluvial 3 Coastal	1 Fluvial 4 Coastal	1 Fluvial 5 Coastal
No. Business Properties at Risk	2 Fluvial 0 Coastal	2 Fluvial 0 Coastal	7 Fluvial 0 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	3 Fluvial 5 Coastal	3 Fluvial 8 Coastal	4 Fluvial 8 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal	1 Fluvial 1 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.15 Flood Risk Analysis and Mapping – Glenties AFA

Fluvial flooding occurs during a 1% AEP event in a couple of areas within Glenties AFA. One of these areas is located in the east of the AFA along Stracashel River whilst the other is located along the Gortnamucklagh River. Flooding along the Gortnamucklagh is due to the effect of a road bridge. Although this bridge may contribute to the attenuation of downstream river flow, its presence also reduces the backing up effect that the Owenass River has upon this reach.

A few residential and business properties are at risk during a 1% AEP event. A social amenity site and environmental assets are also located within the floodplains. A number of these receptors are also at risk of flooding during more frequent flood events.

There is good confidence in both the hydrology and hydraulics of the Glenties AFA due to the presence of a gauging station and flood extent verification events.

Due to the frequency of flooding Glenties AFA has reasonable event damages and risks in present day and future scenarios.

Glenties AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	861,710	3,767,202	7,881,303
No. Residential Properties at Risk	2	4	13
No. Business Properties at Risk	1	4	16
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	1	1	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	1	1	1
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	3,377,030	5,388,019	10,524,265
No. Residential Properties at Risk	5	12	17
No. Business Properties at Risk	4	11	20
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	1	1	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	1	1	1
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

High-End Future Scenario			
Event Damage (€)	3,927,229	8,344,453	19,131,826
No. Residential Properties at Risk	8	14	61
No. Business Properties at Risk	5	18	32
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	1	2	5
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	1	1	1
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.16 Flood Risk Analysis and Mapping – Kerrykeel AFA

Fluvial flooding occurs within Kerrykeel during a 1% AEP event. Out of bank flooding occurs from the Burnside River due to insufficient culvert capacity. This reduced capacity would cause water to back up and spill out of bank in two distinctive flow paths. The first of these is from the right bank which continues overland before re-joining the river. This is exacerbated by a high water level upstream of a road bridge. The second flow path is from the left bank where flow gathers around a low area at the northern end of the sports pitch.

A number of residential properties and a business property are at risk of flooding during a 1% AEP event. A regional road and a sports pitch, which is a social amenity, are also located within the floodplain in Kerrykeel.

There is good confidence in both the hydrology and hydraulics of the Kerrykeel AFA due to the presence of gauging stations with flow data available within a neighbouring hydrometric area approximately 8km to the south of Kerrykeel.

Due to the number of properties affected there are significant event damages and risks in present day and future scenarios.

Kerrykeel AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0	491,470	1,043,263
No. Residential Properties at Risk	0	12	17
No. Business Properties at Risk	0	1	3
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	3	4
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

Mid-Range Future Scenario			
Event Damage (€)	0	710,393	1,556,917
No. Residential Properties at Risk	0	14	17
No. Business Properties at Risk	0	1	4
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	6	6	6
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	467,059	1,063,935	1,898,086
No. Residential Properties at Risk	12	17	17
No. Business Properties at Risk	2	4	5
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	7	7	7
No. Highly Vulnerable Properties at Risk	1	1	1
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	2	2	2
No. Potential Pollution Sources at Risk	0	0	0

E.17 Flood Risk Analysis and Mapping – Killybegs AFA

Killybegs is at risk during 1% AEP fluvial events, 0.5% AEP coastal events and 0.5% AEP wave overtopping events. The majority of Killybegs AFA's flood risk is in one area along the Drumbeagh watercourse. Here properties are affected during both 1% AEP fluvial and 0.5% AEP coastal events. There are five further discrete areas of flooding which are all affected by coastal flooding mechanisms. Receptors in these areas are affected due to the low lying topography of the land, making them susceptible to tidal inundation.

There are a number of residential and non-residential properties at risk within Killybegs including a health centre which is a social infrastructure asset. A couple of local roads and social amenity sites are also located within the floodplains. A number of these receptors are also at risk during less frequent flooding events.

Due to the lack of quantitative data on previous fluvial and coastal flood events it has not been possible to calibrate the model with historical events. There are no suitable level or flow gauge records available for the Cashelcummin River. Overall the results imply both model results are robust and there is moderate confidence in both the hydrology and hydraulics.

Due to the frequency and number of properties which are at risk within Killybegs, there are significant event damages and risks in present day and future scenarios. The flood risk associated with the three CFRAM flooding mechanisms applicable to Killybegs; fluvial, coastal 1 (tidal inundation) and coastal 2 (wave overtopping), is summarized in the following table.

Killybegs AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	1,672,937 Fluvial 1,883,020 Coastal 1 0 Coastal 2	2,006,000 Fluvial 5,052,210 Coastal 1 4,535,768 Coastal 2	2,319,537 Fluvial 7,554,000 Coastal 1 9,487,936 Coastal 2
No. Residential Properties at Risk	11 Fluvial 11 Coastal 1 0 Coastal 2	13 Fluvial 16 Coastal 1 0 Coastal 2	13 Fluvial 16 Coastal 1 0 Coastal 2
No. Business Properties at Risk	8 Fluvial 10 Coastal 1 0 Coastal 2	11 Fluvial 24 Coastal 1 5 Coastal 2	12 Fluvial 28 Coastal 1 10 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	1 Fluvial 3 Coastal 0 Coastal 2	1 Fluvial 3 Coastal 0 Coastal 2	1 Fluvial 3 Coastal 0 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	2 Fluvial 3 Coastal 1 0 Coastal 2	3 Fluvial 3 Coastal 1 1 Coastal 2	3 Fluvial 6 Coastal 1 1 Coastal 2
No. Environmental Assets at Risk	1 Fluvial 3 Coastal 0 Coastal	1 Fluvial 3 Coastal 1 1 Coastal 2	1 Fluvial 3 Coastal 1 1 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
Mid-Range Future Scenario			
Event Damage (€)	1,929,301 Fluvial 6,812,219 Coastal 1 23,179,695 Coastal 2	2,289,779 Fluvial 12,808,383 Coastal 1 33,459,391 Coastal 2	2,704,098 Fluvial 18,035,908 Coastal 1 35,629,272 Coastal 2
No. Residential Properties at Risk	12 Fluvial 17 Coastal 1 7 Coastal 2	13 Fluvial 21 Coastal 1 10 Coastal 2	14 Fluvial 21 Coastal 1 10 Coastal 2
No. Business Properties at Risk	12 Fluvial 28 Coastal 1 26 Coastal 2	13 Fluvial 34 Coastal 1 35 Coastal 2	14 Fluvial 41 Coastal 1 37 Coastal 2
No. Utilities at Risk	0 Fluvial	0 Fluvial	0 Fluvial

	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	1 Fluvial 3 Coastal 1 4 Coastal 2	1 Fluvial 5 Coastal 1 6 Coastal 2	1 Fluvial 6 Coastal 1 6 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	2 Fluvial 5 Coastal 1 4 Coastal 2	3 Fluvial 8 Coastal 1 7 Coastal 2	4 Fluvial 9 Coastal 1 7 Coastal 2
No. Environmental Assets at Risk	1 Fluvial 3 Coastal 1 1 Coastal 2	1 Fluvial 3 Coastal 1 1 Coastal 2	1 Fluvial 3 Coastal 1 1 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
High-End Future Scenario			
Event Damage (€)	2,465,666 Fluvial 14,100,067 Coastal 1 38,181,333 Coastal 2	2,710,696 Fluvial 21,512,078 Coastal 1 41,879,221 Coastal 2	3,005,535 Fluvial 27,466,620 Coastal 1 61,503,986 Coastal 2
No. Residential Properties at Risk	12 Fluvial 19 Coastal 1 10 Coastal 2	14 Fluvial 19 Coastal 1 11 Coastal 2	14 Fluvial 22 Coastal 1 45 Coastal 2
No. Business Properties at Risk	15 Fluvial 36 Coastal 1 39 Coastal 2	16 Fluvial 46 Coastal 1 40 Coastal 2	16 Fluvial 47 Coastal 1 69 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	1 Fluvial 5 Coastal 1 8 Coastal 2	1 Fluvial 7 Coastal 1 8 Coastal 2	2 Fluvial 8 Coastal 1 12 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	4 Fluvial 9 Coastal 1 8 Coastal 2	5 Fluvial 9 Coastal 1 8 Coastal 2	5 Fluvial 11 Coastal 1 11 Coastal 2
No. Environmental Assets at Risk	1 Fluvial 3 Coastal 1 2 Coastal 2	1 Fluvial 3 Coastal 1 2 Coastal 2	1 Fluvial 3 Coastal 1 2 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2

E.18 Flood Risk Analysis and Mapping – Killygordon AFA

Fluvial flooding occurs in Killygordon during a 1% AEP event, although no properties within the AFA are at risk of flooding. However, a national primary road is located within the floodplain along with an environmental asset, River Finn SAC.

Flood event data in relation to Killygordon is very sparse and as such is not useable for the purposes of hydraulic model calibration. In that sense the model cannot be described as well calibrated to flood event data. The historic event data indicates a highly active Finn floodplain but no definite evidence of fluvial flooding of properties and in this sense the flood event data can be considered to be consistent with model outputs. Overall, there is good data in relation the River Finn flows and in relation to the flood extents on the River Finn however no significant verification information in relation to the smaller watercourses exists for the Killygordon AFA with which to verify the model hydrology and hydraulics.

Killygordon has been agreed as a low/no risk AFA and therefore the existing maintenance regime should continue in order to maintain the current SoP.

Killygordon AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0	0	0
No. Residential Properties at Risk	0	0	0
No. Business Properties at Risk	0	0	0
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	0	0
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	0	38,478	112,417
No. Residential Properties at Risk	0	0	2
No. Business Properties at Risk	0	1	1
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	0	0
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0

High-End Future Scenario			
Event Damage (€)	10,688	68,468	359,378
No. Residential Properties at Risk	0	1	3
No. Business Properties at Risk	1	1	2
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	0	0	0
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	0	0
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0

E.19 Flood Risk Analysis and Mapping – Letterkenny AFA

Letterkenny is subject to flooding during a 1% AEP fluvial event and a 0.5% AEP coastal event. There are a number of areas which have multiple flood mechanisms and so are considered complex. A few areas in close proximity flood due to high water levels in the River Swilly. These areas are also affected by tidal mechanisms although fluvial flooding is dominant. Another few areas which are in close proximity flood mainly due to high water levels in the River Swilly backing up into the tributaries. These areas are both fluvially and tidally influenced although tidal mechanisms are dominant.

There are four further discrete areas of flooding within Letterkenny AFA, all fluvially influenced. Flooding in these areas is due to a combination of restricted flow in culverts and in bridges.

There are a number of both residential and business properties at risk of flooding within Letterkenny AFA. Several social amenity sites and transport infrastructure assets including national, regional and local roads are also located within the floodplains.

There is good confidence in both the hydrology and hydraulics of the Letterkenny AFA. There are numerous reports available of historical flood events in the Letterkenny AFA. Hydrometric, rainfall and tide gauge data was used where possible to quantify these historic flood events. Model calibration was not possible; however limited model verification has been achieved.

Due to the number of properties at risk there are significant event damages and risks associated with Letterkenny AFA in present day and future scenarios. The flood risk associated with the two CFRAM flooding mechanisms applicable to Letterkenny; fluvial and coastal (tidal inundation), is summarized in the following table.

Letterkenny AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	7,091 Fluvial 4,597 Coastal	60,579,244 Fluvial 14,057,330 Coastal	100,769,796 Fluvial 22,886,627 Coastal
No. Residential Properties at Risk	1 Fluvial 1 Coastal	11 Fluvial 4 Coastal	49 Fluvial 8 Coastal
No. Business Properties at Risk	0 Fluvial 0 Coastal	21 Fluvial 15 Coastal	45 Fluvial 31 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	2 Fluvial 1 Coastal	16 Fluvial 8 Coastal	33 Fluvial 10 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	18 Fluvial 16 Coastal	28 Fluvial 21 Coastal	43 Fluvial 22 Coastal
No. Environmental Assets at Risk	7 Fluvial 7 Coastal	7 Fluvial 7 Coastal	7 Fluvial 7 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
Mid-Range Future Scenario			
Event Damage (€)	35,022,704 Fluvial 27,228,583 Coastal	96,837,264 Fluvial 51,428,071 Coastal	310,628,862 Fluvial 85,556,634 Coastal
No. Residential Properties at Risk	41 Fluvial 10 Coastal	62 Fluvial 17 Coastal	146 Fluvial 21 Coastal
No. Business Properties at Risk	33 Fluvial 33 Coastal	54 Fluvial 59 Coastal	158 Fluvial 90 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	18 Fluvial 15 Coastal	32 Fluvial 19 Coastal	61 Fluvial 31 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	18 Fluvial 16 Coastal	42 Fluvial 31 Coastal	46 Fluvial 31 Coastal
No. Environmental Assets at Risk	7 Fluvial 7 Coastal	7 Fluvial 7 Coastal	7 Fluvial 7 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

High-End Future Scenario			
Event Damage (€)	115,862,932 Fluvial 75,662,093 Coastal	293,327,684 Fluvial 208,862,263 Coastal	413,590,933 Fluvial 242,710,082 Coastal
No. Residential Properties at Risk	55 Fluvial 20 Coastal	121 Fluvial 67 Coastal	175 Fluvial 81 Coastal
No. Business Properties at Risk	85 Fluvial 82 Coastal	157 Fluvial 131 Coastal	173 Fluvial 143 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	35 Fluvial 25 Coastal	59 Fluvial 46 Coastal	66 Fluvial 48 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	18 Fluvial 16 Coastal	43 Fluvial 31 Coastal	49 Fluvial 31 Coastal
No. Environmental Assets at Risk	7 Fluvial 7 Coastal	7 Fluvial 7 Coastal	7 Fluvial 7 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.20 Flood Risk Analysis and Mapping – Lifford AFA

Lifford AFA is subject to flooding during a 1% AEP fluvial event. The main flood risk is due to out of bank flooding from along the left bank of the Finn and Foyle Rivers and from the right bank of the Dee River. All three rivers in the vicinity of the AFA are tidally influenced but fluvial flooding is the dominant mechanism in relation to all receptors.

A significant number of residential and non-residential properties are at risk in Lifford AFA including social infrastructure assets such as a local authority office and a post office. Lifford Waste Water Treatment Plant and a number of transport infrastructure assets including a national road are also located in the floodplain.

There is good confidence in both the hydrology and hydraulics of the Lifford AFA given that all of the rivers have gauging stations upstream of Lifford and good flood extent verification events.

Due to the number of receptors at risk, there are substantial event damages and risks associated with Lifford AFA in present day and future scenarios.

Lifford AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	1,969,207	17,293,243	29,686,780
No. Residential Properties at Risk	3	41	61
No. Business Properties at Risk	4	37	53
No. Utilities at Risk	0	0	1
No. Major Transport Assets at Risk	2	7	9
No. Highly Vulnerable Properties at Risk	1	1	1
No. of Social Infrastructure Assets at Risk	4	7	8
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	11,484,367	27,810,006	34,931,750
No. Residential Properties at Risk	28	59	67
No. Business Properties at Risk	24	50	56
No. Utilities at Risk	0	1	1
No. Major Transport Assets at Risk	5	8	9
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	5	8	8
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	24,491,397	32,840,356	40,604,539
No. Residential Properties at Risk	57	66	80
No. Business Properties at Risk	45	54	58
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	9	9	9
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	7	8	8
No. Environmental Assets at Risk	3	3	3
No. Potential Pollution Sources at Risk	0	0	0

E.21 Flood Risk Analysis and Mapping – Malin AFA

Malin suffers from coastal flooding during a 0.5% AEP event in one local area. Tidal inundation would occur in Malin on both sides of Malin Bridge during a 0.5% AEP event putting a small number of properties at risk.

A few business properties along with a residential property are at risk of flooding in Malin AFA. A regional road and environmental assets including the North Inishowen Coast SAC and Trawbreaga Bay SPA are also at risk during the 0.5% AEP coastal event.

As historical flood data for specific events is not available for the Malin AFA, and there are no active gauging stations within the model extent, model calibration was not possible. Limited qualitative support for the model results has been achieved based on the data available, however due to the lack of data the accuracy of this model is somewhat unknown. Despite the lack of calibration and verification data, the model is considered to be performing satisfactorily for design event simulation.

As there are only a few receptors at risk, Malin has been agreed as a low/no risk AFA and therefore the existing maintenance regime should continue in order to maintain the current SoP. The flood risk associated with the two CFRAM flooding mechanisms applicable to Malin; fluvial and coastal (tidal inundation), is summarized in the following table.

Malin AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0 Fluvial 7,009 Coastal	0 Fluvial 492,505 Coastal	20,227 Fluvial 828,831 Coastal
No. Residential Properties at Risk	0 Fluvial 1 Coastal	0 Fluvial 1 Coastal	1 Fluvial 2 Coastal
No. Business Properties at Risk	0 Fluvial 2 Coastal	0 Fluvial 4 Coastal	1 Fluvial 5 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	0 Fluvial 0 Coastal	1 Fluvial 2 Coastal	1 Fluvial 3 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	0 Fluvial 3 Coastal	0 Fluvial 3 Coastal	0 Fluvial 3 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

Mid-Range Future Scenario			
Event Damage (€)	0 Fluvial 599,512 Coastal	6,628 Fluvial 1,433,247 Coastal	74,896 Fluvial 2,512,515 Coastal
No. Residential Properties at Risk	0 Fluvial 1 Coastal	1 Fluvial 4 Coastal	1 Fluvial 10 Coastal
No. Business Properties at Risk	0 Fluvial 4 Coastal	0 Fluvial 8 Coastal	1 Fluvial 10 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	1 Fluvial 1 Coastal	2 Fluvial 7 Coastal	3 Fluvial 9 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	0 Fluvial 3 Coastal	0 Fluvial 3 Coastal	0 Fluvial 3 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	0 Fluvial 1,646,941 Coastal	23,042 Fluvial 3,560,923 Coastal	216,694 Fluvial 4,705,149 Coastal
No. Residential Properties at Risk	0 Fluvial 6 Coastal	1 Fluvial 17 Coastal	1 Fluvial 27 Coastal
No. Business Properties at Risk	0 Fluvial 8 Coastal	1 Fluvial 11 Coastal	3 Fluvial 13 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	4 Fluvial 8 Coastal	7 Fluvial 9 Coastal	8 Fluvial 10 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Environmental Assets at Risk	0 Fluvial 3 Coastal	0 Fluvial 3 Coastal	0 Fluvial 3 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.22 Flood Risk Analysis and Mapping – Moville AFA

Receptors in Moville are affected by flooding during a 1% AEP fluvial event, a 0.5% AEP coastal event and also during a 0.5% AEP wave overtopping event. One area is affected by both coastal mechanisms due to the low lying topography of the land. Properties along River Row and along the coast between Bredagh Glen watercourse and the pier at the end of Quay Street are at risk of flooding. On the eastern extent of the AFA, out of bank flooding occurs due to restricted culvert capacity which causes flooding on Main Street.

There are a number of residential properties and a business property affected by flooding within Moville AFA. A few local roads and a social amenity site are also at risk.

With the limited information available it was possible to compare certain areas that were identified to have flooded in the past and ascertain that the model is producing similar results.

Due to the number of properties affected by flooding within Moville AFA there are significant events damages and risks in present day and future scenarios. The flood risk associated with the three CFRAM flooding mechanisms applicable to Moville; fluvial, coastal 1 (tidal inundation) and coastal 2 (wave overtopping), is summarized in the following table.

Moville AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0 Fluvial 0 Coastal 1 8,864 Coastal 2	146,296 Fluvial 771,418 Coastal 1 568,439 Coastal 2	654,165 Fluvial 1,075,455 Coastal 1 1,456,324 Coastal 2
No. Residential Properties at Risk	0 Fluvial 0 Coastal 1 1 Coastal 2	1 Fluvial 17 Coastal 1 8 Coastal 2	15 Fluvial 17 Coastal 1 8 Coastal 2
No. Business Properties at Risk	0 Fluvial 0 Coastal 1 1 Coastal 2	0 Fluvial 0 Coastal 1 1 Coastal 2	0 Fluvial 1 Coastal 1 2 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	2 Fluvial 0 Coastal 1 0 Coastal 2	2 Fluvial 1 Coastal 1 0 Coastal 2	4 Fluvial 3 Coastal 1 0 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	0 Fluvial 4 Coastal 1 0 Coastal 2	5 Fluvial 4 Coastal 1 0 Coastal 2	5 Fluvial 4 Coastal 1 0 Coastal 2
No. Environmental Assets at Risk	1 Fluvial 1 Coastal 1	1 Fluvial 1 Coastal 1	1 Fluvial 1 Coastal 1

No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
Mid-Range Future Scenario			
Event Damage (€)	318,375 Fluvial 939,805 Coastal 1 1,297,950 Coastal 2	718,818 Fluvial 1,935,362 Coastal 1 2,542,565 Coastal 2	1,565,482 Fluvial 2,348,931 Coastal 1 2,596,628 Coastal 2
No. Residential Properties at Risk	12 Fluvial 17 Coastal 1 14 Coastal 2	15 Fluvial 17 Coastal 1 18 Coastal 2	18 Fluvial 18 Coastal 1 18 Coastal 2
No. Business Properties at Risk	0 Fluvial 1 Coastal1 1 Coastal 2	0 Fluvial 3 Coastal1 3 Coastal 2	0 Fluvial 4 Coastal1 3 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	3 Fluvial 3 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	4 Fluvial 4 Coastal 1 2 Coastal 2	5 Fluvial 4 Coastal 1 2 Coastal 2	5 Fluvial 4 Coastal 1 2 Coastal 2
No. Environmental Assets at Risk	2 Fluvial 2 Coastal 1 1 Coastal 2	2 Fluvial 2 Coastal 1 1 Coastal 2	2 Fluvial 2 Coastal 1 1 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
High-End Future Scenario			
Event Damage (€)	1,778,791 Fluvial 2,399,891 Coastal1 2,637,570 Coastal 2	1,900,284 Fluvial 3,716,778 Coastal1 3,167,201 Coastal 2	2,414,884 Fluvial 4,562,340 Coastal1 3,303,290 Coastal 2
No. Residential Properties at Risk	16 Fluvial 19 Coastal 1 18 Coastal 2	17 Fluvial 21 Coastal 1 21 Coastal 2	20 Fluvial 24 Coastal 1 21 Coastal 2
No. Business Properties at Risk	0 Fluvial 4 Coastal 1 3 Coastal 2	0 Fluvial 5 Coastal 1 4 Coastal 2	1 Fluvial 5 Coastal 1 4 Coastal 2
No. Utilities at Risk	0 Fluvial	0 Fluvial	0 Fluvial

	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2	0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	3 Fluvial 4 Coastal 1 4 Coastal 2	3 Fluvial 4 Coastal 1 4 Coastal 2	3 Fluvial 5 Coastal 1 6 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	4 Fluvial 4 Coastal 1 2 Coastal 2	5 Fluvial 4 Coastal 1 2 Coastal 2	5 Fluvial 4 Coastal 1 2 Coastal 2
No. Environmental Assets at Risk	2 Fluvial 2 Coastal 1 1 Coastal 2	2 Fluvial 2 Coastal 1 1 Coastal 2	2 Fluvial 2 Coastal 1 1 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2

E.23 Flood Risk Analysis and Mapping – Newton Cunningham AFA

Newton Cunningham AFA is affected by both 1% AEP fluvial events and 0.5% coastal inundation events. However, there are no properties or other receptors at risk of flooding within the AFA.

Overall there is poor confidence in both the hydrology and hydraulics of Newtown Cunningham AFA due to the lack of gauging stations and flood extent verification events.

As there are no receptors at risk of flooding within Newton Cunningham, this has been agreed as a no risk AFA and therefore the current maintenance regime should continue in order to maintain the current SoP. The flood risk associated with the two CFRAM flooding mechanisms applicable to Newton Cunningham; fluvial and coastal (tidal inundation), is summarized in the following table.

Newtown Cunningham AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Residential Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Business Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Utilities at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1

No. of Social Infrastructure Assets at Risk	1 Fluvial 0 Coastal 1	1 Fluvial 0 Coastal 1	1 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	2 Fluvial 2 Coastal 1	2 Fluvial 2 Coastal 1	2 Fluvial 2 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
Mid-Range Future Scenario			
Event Damage (€)	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Residential Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Business Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Utilities at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. Major Transport Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
No. of Social Infrastructure Assets at Risk	1 Fluvial 0 Coastal 1	1 Fluvial 0 Coastal 1	2 Fluvial 0 Coastal 1
No. Environmental Assets at Risk	2 Fluvial 2 Coastal 1	2 Fluvial 2 Coastal 1	2 Fluvial 2 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1
High-End Future Scenario			
Event Damage (€)	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	1,465,621.02 Fluvial
No. Residential Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	1 Fluvial 0 Coastal
No. Business Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	2 Fluvial 0 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	2 Fluvial 0 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 0 Coastal 1	1 Fluvial 0 Coastal 1	2 Fluvial 0 coastal 1
No. Environmental Assets at Risk	2 Fluvial 2 Coastal 1	2 Fluvial 2 Coastal 1	2 Fluvial 2 Coastal 1
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1	0 Fluvial 0 Coastal 1

E.24 Flood Risk Analysis and Mapping – Ramelton AFA

It should be noted that, for the purposes of the optioneering process, the risk in Ramelton AFA was evaluated due to a known high risk of culvert blockage. Ramelton suffers from flooding during a 1% AEP fluvial event and during a 0.5% AEP coastal event; however the main risk originates from tidal inundation. Coastal flooding occurs on the left bank of the Leannan River upstream of Ramelton Bridge. Out of bank flooding also occurs in this area during a 1% AEP fluvial event from the left bank of the Leannan River, adjacent to the weir. Downstream of this tidal inundation occurs on the right bank of Leannan River as water levels rise above the level of the current quay walls. Due to the close proximity of these areas they have potential to interact and so are considered complex.

There is also a discrete area of flooding affected during a 1% AEP fluvial event, which can be caused due to a 66% blockage of total flow through a bridge. If this occurs flow would be restricted upstream of this resulting in water levels rising beyond the top of the right bank.

There are a number of both residential and non-residential properties at risk of flooding within Ramelton, including social infrastructure assets such as a health centre and a community centre. Several local roads are also located within the floodplains. Many of these receptors are also at risk of flooding during more frequent events.

A limited verification exercise has been undertaken based on the data available, however due to the lack of data the accuracy of this model is somewhat unknown. Despite the lack of calibration and verification data, the model is considered to be performing satisfactorily for design event simulation.

Due to the frequency of flooding of properties, there are significant event damages and risk associated with Ramelton AFA in present day and future scenarios. The flood risk associated with the two CFRAM flooding mechanisms applicable to Ramelton; fluvial and coastal (tidal inundation), is summarized in the following table.

Ramelton AFA Flood Risk Table – CULVERT BLOCKED

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	653,608 Fluvial 628,228 Coastal	1,225,111 Fluvial 1,922,790 Coastal	1,572,775 Fluvial 3,188,361 Coastal
No. Residential Properties at Risk	6 Fluvial 5 Coastal	10 Fluvial 14 Coastal	11 Fluvial 16 Coastal
No. Business Properties at Risk	1 Fluvial 2 Coastal	2 Fluvial 11 Coastal	2 Fluvial 11 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	0 Fluvial 0 Coastal	1 Fluvial 0 Coastal	3 Fluvial 4 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 1 Coastal	1 Fluvial 3 Coastal	1 Fluvial 3 Coastal

No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
Mid-Range Future Scenario			
Event Damage (€)	2,431,907 Fluvial 2,742,823 Coastal	2,712,205 Fluvial 5,119,593 Coastal	3,155,779 Fluvial 6,646,828 Coastal
No. Residential Properties at Risk	16 Fluvial 15 Coastal	17 Fluvial 16 Coastal	17 Fluvial 16 Coastal
No. Business Properties at Risk	9 Fluvial 12 Coastal	9 Fluvial 16 Coastal	10 Fluvial 17 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	5 Fluvial 5 Coastal	5 Fluvial 5 Coastal	5 Fluvial 6 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 3 Coastal	1 Fluvial 3 Coastal	1 Fluvial 3 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	5,355,969 Fluvial 7,148,221 Coastal	5,769,657 Fluvial 10,512,958 Coastal	6,310,183 Fluvial 12,718,326 Coastal
No. Residential Properties at Risk	20 Fluvial 18 Coastal	19 Fluvial 27 Coastal	23 Fluvial 33 Coastal
No. Business Properties at Risk	16 Fluvial 18 Coastal	15 Fluvial 23 Coastal	16 Fluvial 26 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	5 Fluvial 6 Coastal	7 Fluvial 7 Coastal	7 Fluvial 8 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 3 Coastal	3 Fluvial 3 Coastal	1 Fluvial 3 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

The information in the table below relates to the free-flow conditions and has been presented for the purposes of comparison across AFAs on a like for like basis.

Ramelton AFA Flood Risk Table – CULVERT FREE-FLOW

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	804,613 Fluvial 626,972 Coastal	821,426 Fluvial 1,296,579 Coastal	2,318,941 Fluvial 1,817,555 Coastal
No. Residential Properties at Risk	6 Fluvial 4 Coastal	6 Fluvial 11 Coastal	7 Fluvial 13 Coastal
No. Business Properties at Risk	1 Fluvial 0 Coastal	1 Fluvial 4 Coastal	2 Fluvial 4 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	5 Fluvial 5 Coastal	5 Fluvial 5 Coastal	5 Fluvial 5 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 1 Coastal	1 Fluvial 3 Coastal	1 Fluvial 3 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
Mid-Range Future Scenario			
Event Damage (€)	1,941,830 Fluvial 2,873,913 Coastal	2,072,335 Fluvial 4,816,659 Coastal	2,842,882 Fluvial 5,985,747 Coastal
No. Residential Properties at Risk	13 Fluvial 11 Coastal	14 Fluvial 12 Coastal	19 Fluvial 12 Coastal
No. Business Properties at Risk	7 Fluvial 11 Coastal	7 Fluvial 15 Coastal	8 Fluvial 16 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	5 Fluvial 5 Coastal	5 Fluvial 5 Coastal	5 Fluvial 6 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 3 Coastal	1 Fluvial 3 Coastal	1 Fluvial 3 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal

No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
High-End Future Scenario			
Event Damage (€)	5,018,325 Fluvial 5,573,510 Coastal	5,431,043 Fluvial 8,738,063 Coastal	5,963,927 Fluvial 10,248,924 Coastal
No. Residential Properties at Risk	18 Fluvial 12 Coastal	19 Fluvial 22 Coastal	20 Fluvial 27 Coastal
No. Business Properties at Risk	15 Fluvial 16 Coastal	15 Fluvial 21 Coastal	15 Fluvial 23 Coastal
No. Utilities at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. Major Transport Assets at Risk	5 Fluvial 6 Coastal	7 Fluvial 7 Coastal	7 Fluvial 8 Coastal
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal
No. of Social Infrastructure Assets at Risk	1 Fluvial 3 Coastal	3 Fluvial 3 Coastal	1 Fluvial 3 Coastal
No. Environmental Assets at Risk	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal	4 Fluvial 4 Coastal
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal	0 Fluvial 0 Coastal

E.25 Flood Risk Analysis and Mapping – Raphoe AFA

Raphoe AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	20,881,451	27,661,941	32,272,045
No. Residential Properties at Risk	126	212	237
No. Business Properties at Risk	35	64	83

E.26 Flood Risk Analysis and Mapping – Rathmullan AFA

Rathmullan is affected in a few areas throughout the AFA during a 1% AEP fluvial event, a 0.5% AEP coastal event and during a 0.5% AEP wave overtopping event. At the south east of the AFA, a number of properties are affected by both coastal flooding mechanisms. There are a further two discrete areas of flooding where receptors are at risk from fluvial flooding. An overland flow path originating from the Ballyboe River is caused due to a long culvert with restricted capacity, whilst flooding also occurs from the right bank of Millbrook Stream.

Overall there are a reasonable number of residential properties at risk of flooding within Rathmullan AFA. Several local roads and a regional road are also at risk along with an environmental asset, Lough Swilly SAC & SPA. Many of these receptors are also at risk of flooding during more frequent events.

There is moderate confidence in both the hydrology and hydraulics as there is limited historical flood data for specific events and as there are no active gauging stations within the model extent, consequently model calibration was not possible.

Due to the frequency of flooding of receptors, there are significant event damages and risks associated with Rathmullan AFA in present day and future scenarios.

The flood risk associated with the three CFRAM flooding mechanisms applicable to Rathmullan; fluvial, coastal 1 (tidal inundation) and coastal 2 (wave overtopping), is summarized in the following table.

Rathmullan AFA Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% AEP 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	771,022 Fluvial 5,835 Coastal 1 695,153 Coastal 2	847,451 Fluvial 126,378 Coastal 1 695,153 Coastal 2	893,828 Fluvial 326,230 Coastal 1 695,153 Coastal 2
No. Residential Properties at Risk	8 Fluvial 1 Coastal 1 13 Coastal 2	8 Fluvial 7 Coastal 1 13 Coastal 2	8 Fluvial 8 Coastal 1 13 Coastal 2
No. Business Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	2 Fluvial 1 Coastal 1 3 Coastal 2	3 Fluvial 1 Coastal 1 3 Coastal 2	3 Fluvial 1 Coastal 1 3 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	0 Fluvial 0 Coastal 1	0 Fluvial 1 Coastal 1	0 Fluvial 1 Coastal 1

	0 Coastal 2	0 Coastal 2	0 Coastal 2
No. Environmental Assets at Risk	3 Fluvial 4 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
Mid-Range Future Scenario			
Event Damage (€)	830,982 Fluvial 236,270 Coastal 1 695,153 Coastal 2	855,017 Fluvial 894,226 Coastal 1 695,153 Coastal 2	967,422 Fluvial 1,541,916 Coastal 1 695,153 Coastal 2
No. Residential Properties at Risk	7 Fluvial 8 Coastal 1 13 Coastal 2	7 Fluvial 17 Coastal 1 13 Coastal 2	10 Fluvial 21 Coastal 1 13 Coastal 2
No. Business Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 2 Coastal 1 0 Coastal 2	0 Fluvial 4 Coastal 1 0 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	2 Fluvial 2 Coastal 3 Coastal 2	3 Fluvial 7 Coastal 3 Coastal 2	3 Fluvial 8 Coastal 3 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	0 Fluvial 1 Coastal 1 0 Coastal 2	0 Fluvial 2 Coastal 1 0 Coastal 2	0 Fluvial 2 Coastal 1 0 Coastal 2
No. Environmental Assets at Risk	3 Fluvial 4 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
High-End Future Scenario			
Event Damage (€)	851,846 Fluvial 1,608,682 Coastal 1 697,022 Coastal 2	907,624 Fluvial 3,805,477 Coastal 1 697,022 Coastal 2	964,086 Fluvial 4,784,724 Coastal 1 697,022 Coastal 2
No. Residential Properties at Risk	8 Fluvial 28 Coastal 1 13 Coastal 2	8 Fluvial 42 Coastal 1 13 Coastal 2	8 Fluvial 48 Coastal 1 13 Coastal 2
No. Business Properties at Risk	0 Fluvial	0 Fluvial	0 Fluvial

	4 Coastal 1 0 Coastal 2	5 Coastal 1 0 Coastal 2	6 Coastal 1 0 Coastal 2
No. Utilities at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. Major Transport Assets at Risk	6 Fluvial 7 Coastal 1 3 Coastal 2	6 Fluvial 8 Coastal 1 3 Coastal 2	6 Fluvial 9 Coastal 1 3 Coastal 2
No. Highly Vulnerable Properties at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2
No. of Social Infrastructure Assets at Risk	0 Fluvial 2 Coastal 1 0 Coastal 2	0 Fluvial 2 Coastal 1 0 Coastal 2	0 Fluvial 2 Coastal 1 0 Coastal 2
No. Environmental Assets at Risk	3 Fluvial 4 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2	3 Fluvial 4 Coastal 1 3 Coastal 2
No. Potential Pollution Sources at Risk	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2	0 Fluvial 0 Coastal 1 0 Coastal 2

APPENDIX F

METHODS OF FLOOD RISK MANAGEMENT

There are a wide range of different approaches, or methods, that can be taken to reduce or manage flood risk. These can range from non-structural methods, that do not involve any physical works to prevent flooding but rather comprise actions typically aimed at reducing the impacts of flooding, to structural works that reduce flood flows or levels in the area at risk or that protect the area against flooding.

The range of methods for managing flood risk that are considered include those outlined below.

F.1 FLOOD RISK PREVENTION METHODS

Flood risk prevention measures are aimed at avoiding or eliminating a flood risk. This can be done by not creating new assets that could be vulnerable to flood damage in areas prone to flooding, or removing such assets that already exist. Alternatively, prevention can be achieved by completely removing the potential for flooding in a given area, although in practice this is rarely possible (the frequency or magnitude of flooding can be reduced by flood protection measures, but it is generally not possible to remove the risk of flooding entirely).

Flood prevention is hence generally focussed on sustainable planning and / or the re-location of existing assets, such as properties or infrastructure.

F.1.1 Sustainable Planning and Development Management

In November 2009, the Guidelines on the Planning System and Flood Risk Management, jointly developed by DHPLG and the OPW, were published under Section 28 of the Planning Acts. These Guidelines provide a systematic and transparent framework for the consideration of flood risk in the planning and development management processes, whereby:

- A sequential approach should be adopted to planning and development based on avoidance, reduction and mitigation of flood risk.
- A flood risk assessment should be undertaken that should inform the process of decision-making within the planning and development management processes at an early stage.
- Development should be avoided in floodplains unless there are demonstrable, wider sustainability and proper planning objectives that justify appropriate development and where the flood risk to such development can be reduced and managed to an acceptable level without increasing flood risk elsewhere (as set out through the Justification test).

The proper application of the Guidelines by the planning authorities is essential to avoid inappropriate development in flood prone areas, and hence avoid unnecessary increases in flood risk into the future, and to take a precautionary approach in regards to the potential impacts of climate change on flood risk that should be addressed in spatial plans, planning decisions and through Local Adaptation Plans. The flood mapping produced through the CFRAM Programme and parallel projects provided as part of the Plan will facilitate the application of the Guidelines.

In flood-prone areas where development can be justified (i.e., re-development, infill development or new development that has passed the Justification Test), the planning authorities can manage the risk by setting suitable objectives or conditions, such as minimum floor levels or flood resistant or resilient building methods.

F.1.2 Sustainable Urban Drainage Systems (SUDS)

Development of previously 'green', or permeable, land within an urban area increases the impermeable area, reducing infiltration and increasing runoff rates and volumes. Traditional urban storm water drainage systems are effective at transferring surface water quickly, but they provide only limited attenuation causing the volume of water in the receiving watercourse to increase more rapidly and increasing flood risk. Sustainable Drainage Systems (SUDS) can play a role in reducing and managing run-off to surface water drainage systems as well as improving water quality and contributing to local amenity. SUDS comprise a wide range of techniques, including swales, basins, ponds and infiltration systems.

In accordance with the Guidelines (see Section 7.2.1.1), planning authorities should seek to reduce the extent of hard surfacing and paving and require the use of sustainable drainage techniques to reduce the potential impact of development on flood risk downstream.

F.1.3 Voluntary Home Relocation

In extreme circumstances, the flood risk to a home may be such that the home owner may consider that continuing to live in the property is not sustainable and would choose to relocate.

F.1.4 Preparation of Local Adaptation Planning

It is likely that climate change will have a considerable impact on flood risk in Ireland, such as through rising mean sea levels and the potential increases in winter rainfall and intense rainfall events. For example, it is known that sea levels are rising at a rate of more than 3mm/yr at present, and the Fifth Assessment Report (AR5) of the Inter-Governmental Panel on Climate Change (IPCC) projects that mean sea level is likely to rise between 0.52m and 0.98m by the end of the century. The flood risk assessment for the future scenarios, described in Section 5 herein, highlight the potential impacts of such changes. More recent research (Jevrejeva et al. 2014) indicates that it is plausible that mean sea level may rise by up to approximately 2m by the end of the century.

The Climate Action and Low Carbon Development Act, 2015, required that the Minister for Communications, Climate Action and Environment prepare a National Climate Change Adaptation Framework (NCCAF) that shall specify the national strategy for the application of adaptation measures in different sectors and by a local authority in its administrative area in order to reduce the vulnerability of the State to the negative effects of climate change. The consultation document on the NCCAF (DCCAE, March 2016) noted that as the impacts of climate change vary by region, adaptation requires locally specific, place-based responses, and that Building resilience to the impacts of the climate change at local level for communities and businesses can be achieved in an effective manner if it is integrated into existing planning frameworks and policies under the remit of the local government sector. The NCCAF was published in January 2018 and sets out that local level adaptation measures will be identified in Local Adaptation Strategies prepared by the relevant local authority and implemented through inclusion in relevant plans and policies under the local authority's remit. To this end, local authorities should take into account the potential impacts of climate change on flooding and flood risk in their planning for local adaptation, in particular in the areas of spatial planning and the planning and design of infrastructure.

F.1.5 Land Use Management and Natural Flood Risk Management Measures

Flood flows depend on how much rain falls in the catchment and the pattern of rainfall, and also on how much and how rapidly the rain runs off the land into the river. The volume and rate of runoff can be reduced by changing land use practices, such as by reducing stocking rates, changing the way ploughing is undertaken (e.g., along contours rather than perpendicular to contours), the retention, protection and/or rewetting of peatlands and bogs and by planting hedgerows across hillsides.

Similarly, excess runoff can be stored in wetlands, micro-detention basins, or be attenuated in small streams and channels through the use of obstructions to flow, such as large woody-debris dams. While such measures have been shown to reduce flood peaks in small catchments and frequent, less severe flood events, they may be less effective for more severe floods and in larger catchments and often require very significant land owner engagement for implementation (EU, 2014).

These types of measures will often not be able to solve severe flood problems on their own, but they have the potential to form part of the solution and can also help to achieve the goals in a range of areas, including water quality, nature conservation / biodiversity, agriculture and forestry, green growth and climate change mitigation and adaptation (EU, 2014), and as such would be best addressed on a multi-sectoral level in partnership with all relevant agencies, to promote integrated catchment management.

F.2 FLOOD PROTECTION METHODS

Flood protection measures are aimed at reducing the likelihood and/or the severity of flood events. These measures, typically requiring physical works, can reduce risk in a range of ways, such as by reducing or diverting the peak flood flows, reducing flood levels or holding back flood waters. The preferred Standard of Protection offered by such measures in Ireland is the current scenario 1% Annual Exceedance Probability (AEP) flood for fluvial flooding and 0.5 % AEP flood for tidal flooding (also referred to as the 100-year and 200-year floods respectively), although these standards can increase or decrease depending on local circumstances.

A description of the protection measures typically considered is provided below.

F.2.1 Enhance Existing Protection Works

Flood protection works will provide flood protection up to a certain 'Standard of Protection' and, depending on the type of protection measure, may reduce the severity of flooding above this Standard. The Standard of Protection is the magnitude of flood, often defined by the annual probability of that flood occurring being exceeded (the Annual Exceedance Probability, or 'AEP'), that the measure is designed to protect the area at risk against.

In some locations where existing flood protection works exist, measures can be taken, in addition to the necessary ongoing maintenance, to improve the condition of the works to reduce the likelihood of failure, and/or increase the Standard of Protection to further reduce the risk in, and extend, the protected area. This can apply to both structures that were deliberately built as flood protection works, and also other structures (e.g., quay walls, road embankments) that provide some flood protection as a secondary function.

Some natural features can provide defences against floods, or form part of a defence in depth. For example sand dunes and flood marshes often form effective barriers against flooding in coastal areas. These features may be vulnerable to rapid erosion and some enhancement may be useful to retain the feature and their effectiveness in providing a defence function.

F.2.2. Flood Defences

Solid structures built between the source of flood waters (rivers, estuaries or the sea) and an area vulnerable to flooding (people, properties, land and other assets) can prevent flooding up to the Standard of Protection of the structure, hence reducing the flood risk in the area being protected by the structure. Such structures typically include walls (generally in urban areas with limited space) or embankments (generally in rural areas and in urban areas where space is available, such as parks), but can also include other built or natural structures, such as sand dunes. However, the residual risk of flooding which remains after a defence is constructed, which arises as a flood in excess of the design standard of the defence may occur, also needs to be carefully considered during design.



Figure F.1: Flood Defence Wall



Figure F.2: Flood Defence Embankment (During Construction / Maintenance)

F.2.3 Increasing Channel Conveyance

The water level of a river is determined by the flow and the hydraulic characteristics of the river, any structures (e.g., bridges, weirs, walls) in, alongside and over the river and, when in flood, of the floodplain. The hydraulic characteristics determine the conveyance of the river, and changing these characteristics can reduce the water level for a given flow. This can be achieved by works such as dredging to deepen and/or widen the river, reducing the roughness of the rivers, its banks and floodplain to allow more flow to pass, or removing or altering structures to reduce the build up of water upstream of the structure.



Figure F.3: River Widening (During Construction)



Figure F.4: River Widening (After Construction)

By increasing channel (and floodplain) conveyance, river levels during a flood can be lowered, hence reducing the likelihood and severity of flooding. This can be to the point that flooding during events up to the design Standard of Protection is avoided, but this type of measure has the advantage that it also reduces the risk for floods greater than the design Standard of Protection.

This type of measure is typically only applicable for river flooding,

F.2.4 Diverting Flood Flows

Flooding of an area from a river occurs because the quantity of flow flowing through an area exceeds the conveyance capacity of the channel and so the river spills out on to its floodplain. Reducing the flow through an area in the event of a flood can reduce the likelihood of flooding for that area, and this can be achieved by diverting some of the flows around the area of risk through a flood diversion channel or across a designated area of land.

F.2.5 Storing Flood Waters

Instead of diverting excess flood waters to reduce the flow through an area at risk, the flow can also be reduced by storing flood waters upstream of the area.

This can be in large, single flood attenuation structures, in wash-lands on the floodplain or in multiple, smaller storage areas dispersed around the catchment. Storage using soft measures, such as wetlands or micro-detention basins, or through attenuation in small channels, is generally considered to be part of land use management, or natural flood risk management (see Section 7.2.2.7).

Floods can also be attenuated (i.e., the flood slowed down, the peak flow reduced and the flood volume spread over a longer period of time) by measures along the river and floodplain, e.g., increasing channel and floodplain roughness (introducing impediments to flow in the river, or on floodplains, such as by increasing riparian vegetation or planting hedgerows) or by restoring meanders.

Such measures are often referred to as natural water retention measures or natural flood management. While these have been shown to reduce flood flows in smaller, more common floods, it is understood that their impact in larger, more extreme or rare floods, is reduced. Further research is required on this matter. However, such measures can have significant benefits for environmental enhancement, such as contributing to the objectives of the Water Framework Directive or increasing biodiversity.

F.2.6 Implementing Channel Maintenance Programmes

Excess silt and gravels deposited in watercourses and vegetation in and on the banks of river channels, or the blockage of channels by discarded rubbish or bulky objects in urban areas, can reduce the conveyance of a channel, increasing flood levels in the event of a flood and hence increasing the flood risk in the surrounding area. The blockage of culvert screens by debris and rubbish can also increase flood risk.

A regular maintenance programme to remove excess inorganic material, vegetation and/or remove debris and rubbish from river channels, and ensure that culvert screens are kept clear, can help reduce flood levels during flood events.

F.2.7 Maintenance of Drainage Schemes

Following the passing of the Arterial Drainage Act, 1945, the OPW began investigations to determine where Arterial Drainage Schemes would be suitable and economically viable. The implementation of the Schemes began in the late-1940s and continued into the early-1990s, and a total of 11,500kms of river channel now form part of the Arterial Drainage Schemes, that also include 800km of embankments.

The purpose of the Arterial Drainage Schemes was primarily to improve the drainage of agricultural lands to enhance production. This typically involved lowering or widening river beds and removal of weirs to facilitate the drainage and discharge of neighbouring lands and drainage channels. While not the primary focus of the Schemes, they did also provide enhanced conveyance capacity where they passed through towns, villages and dispersed rural communities that in turn has reduced the flood risk to properties in these areas.

While new Arterial Drainage Schemes are no longer being undertaken, the OPW has a statutory duty to maintain the completed schemes in proper repair and in an effective condition. The annual maintenance programme is published by the OPW on the OPW website, and typically involves some clearance of vegetation and removal of silt build-up on a five-yearly cycle.

Drainage Districts are areas where drainage schemes to improve land for agricultural purposes were constructed under a number of Acts of Parliament and Acts of the Oireachtas prior to 1945. 170 Drainage District Schemes were established, covering 4,600km of channel. The statutory duty of maintenance for these schemes lies with the local authorities concerned. The standard of this maintenance varies widely from county to county.

F.2.8 Land Commission Embankments

The Land Commission was created in 1881 as a rent fixing commission by the Land Law (Ireland) Act 1881, and was reconstituted in the Irish Free State by section 2 of the Land Law (Commission) Act, 1923, backdated to the state's creation. With very few exceptions, lands acquired through the Land Commission are now in private ownership. Trusts were established in some cases for the maintenance of flood defences on acquired lands. The Commission was dissolved on 31 March 1999 by the Irish Land Commission (Dissolution) Act, 1992 and the trusts held by the Land Commission were transferred to the Dept. Agriculture, Food and the Marine (DAFM), with retained funds entrusted to the Public Trustee, who is an officer of the DAFM.

While the Public Trustee administers these funds that may be used for repairs of the embankments, this is applied only in very exceptional circumstances, as the amount of such funds is generally small and wholly inadequate to maintain the various embankments. The DAFM does not however have a general responsibility for the maintenance, repair or restoration of the embankments, which rests with the land owner in most cases (Section 10 of the Land Act, 1965).

F.3 FLOOD PREPAREDNESS (RESILIENCE) METHODS

In some instances, it may not be possible to reduce the likelihood or severity of flooding to an area at risk. However, actions and measures can be taken to reduce the consequences of flooding, i.e., reduce the risk to people and of damage to properties and other assets, and make sure that people and communities are resilient to flood events. This can be achieved by being aware of and preparing for the risk of flooding, knowing when floods are going to occur, taking actions immediately before, during and after a flood. The actions and measures of this type are described below.

F.3.1 Flood Forecasting and Warning

Knowing that a flood event is imminent allows people, communities and local authorities to prepare for the flood by, for example, erecting temporary defences or moving people and assets out of harm's way.

It is possible to forecast floods under certain conditions using weather predictions, observed rainfall and river levels and flows, and with the aid of computer models. Flood forecasts based on predicted weather are generally less certain than those based on observed rainfall or river levels or flows. The forecast period achievable generally depends on the catchment size and characteristics, and, while in larger catchments it may be possible to provide a number of hours or even days of advance warning of a flood event, in small, flashy catchments this period can be extremely short and therefore of less or potentially no real benefit. Flood forecasting also involves significant uncertainty, as it entails trying to simulate very complex systems in real time with limited data.

The OPW, on behalf of Ireland, signed a partner agreement in 2010 with the European Flood Awareness System (EFAS), which was developed by the EU Joint Research Centre for use by partner organisations. EFAS was developed to help improve and increase preparedness for fluvial floods and is intended to provide early warning or notification of potential flood events under specified criteria. These EFAS flood notifications are disseminated by the OPW to local authorities and other relevant stakeholders. During the floods of winter 2015/16, EFAS provided a number of valuable flood notifications and forecasts which informed and supported the management of these floods. The OPW also provides national tidal and storm surge forecasts for local authorities and other relevant stakeholders and disseminates high tide advisory notices to local authorities when tide, weather and atmospheric conditions are such that coastal flooding may arise.

A number of other project-specific flood forecasting systems are in place as part of OPW funded flood relief schemes that include demountable flood defence systems.

Appendix F6 of the Major Emergency Management (MEM) Framework (2006) sets out the arrangements put in place by Met Éireann to issue public service weather warnings to the local authorities. Met Éireann operates a weather warning system that aligns with the EU Meteoalarm system (www.meteoalarm.eu). Met Éireann also issues weather warnings to the public. Warnings for very heavy rainfall may indicate a threat of widespread flooding or flooding for a specific area.

Local warnings are also issued by the local authority. Warnings may be circulated to national and/or local broadcast media, as appropriate, which can be supplemented, in the case of specific local areas identified as being at risk, with emergency vehicles and personnel to deliver the warnings in very exceptional cases.

A Government decision was taken on the 5th January 2016 to establish a National Flood Forecasting and Warning Service (refer Section 7.4.1.10 for further details).

F.3.2 Emergency Response Planning

Well prepared and executed emergency response plans can significantly reduce the impact of flood events, particularly for human health and welfare. The MEM Framework designates the local authority as the lead agency for co-ordinating a response to a flooding emergency. "A Guide to Flood Emergencies (2013)" sets out the sequence of steps required to prepare for and respond to flood emergencies. The Department of Housing, Planning and Local Government is designated as the Lead Government Department for co-ordinating a national response to large scale flood emergencies.

Local authorities develop and review flood plans. Flood plans detail how local authorities receive, assess and respond to weather and flood warnings that can be received from the OPW, Met Éireann, EFAS or other sources, taking into account other relevant information available to them, such as real-time gauge information (e.g., www.waterlevel.ie) and local knowledge of river systems, roads, infrastructure and vulnerable communities.

Local authorities, as part of their planning for flood emergencies, appoint a Severe Weather Assessment Team. This team monitors weather alerts and provides an analysis of the flood risk before and during an event, as well as providing specialist advice to the operational services deployed to a flood event.

It is the responsibility of the Severe Weather Assessment Team to determine the scale of response that is required, i.e. further action required, the activation of an internal operational response, or the requirement for increased levels of inter-agency co-ordination, up to the declaration of a major emergency and activation of the Major Emergency Plan.

During a flood emergency, where a national response is required to support the local response, the Lead Government Department activate and chair the National Co-ordination Group. Once the National Co-ordination Group is activated, the Lead Government Department establishes links with all Regional / Local Co-ordination Groups. The National Co-ordination Group sets key response objectives, prioritising life safety and protection of property/ critical infrastructure. The National Co-ordination Group works with the Principal Response Agencies to ensure that resources are allocated where needed and can provide optimum benefits. The National Co-ordination Group also develops key public safety messages and provides a single point for information to media and public sector organisations.

F.3.3 Promotion of Individual and Community Resilience

Individuals and communities that are aware of any prevalent flood risk are able to prepare for flood events such that if and when such events occur, people are able to take appropriate actions in advance of, during and after a flood to reduce the harm and damages a flood can cause. This could include short-term preparation and action such as elevating valuables to above likely flood levels, helping neighbours who may have mobility difficulties to prepare and if necessary evacuate, moving vehicles to high ground and evacuating themselves if necessary. Longer-term preparations can involve making homes and properties flood resilient or flood resistant, such as through new floor and wall coverings chosen to be durable in a flood or moving electrical sockets above likely flood levels.

In 2005, the OPW launched the Plan, Prepare, Protect campaign that provides general, practical advice to homeowners, businesses and farmers on what they can do to prepare for flood events and make themselves resilient. This advice has recently been updated and is available to view and download from: www.flooding.ie.

While the Plan, Prepare, Protect campaign provides useful information, as a national campaign it is generic. Resilience also has a strong local dimension involving consultation with the local community, the dissemination of site-specific advice, and the provision of assistance with preparedness at a local level for individuals and businesses known to be at risk. The Report of the Flood Policy Review Group (OPW, 2004) recommends that local authorities should assume responsibility for the local dimension of the flood risk education programme, including raising awareness of individuals and business interests considered to be at risk, and to assist individuals and business interests considered to be at risk with preparations for minimising damages in the event of a flood event

While the State, through the OPW, local authorities and other public bodies can take certain actions to reduce and manage the risk of flooding, individual home-owners, businesses and

farmers also have a responsibility to manage the flood risk to themselves, their property and other assets to reduce damages and the risk to personal health in the event of a flood.

All people at flood risk within the North Western River Basin should:

- Make themselves aware of the potential for flooding in their area, including the likely extents, depths and risk-to-people
- Consider what long-term preparatory actions they might take to reduce the potential damage, such as implementing property resilience or resistance measures
- Prepare a flood event plan to set out the actions they should take before, during and after a flood event
- Discuss the issue of flooding and flood risk with other people in their communities, and consider forming a local Flood Action Group

Advice on what steps can be taken is provided in the Plan, Prepare, Protect booklet available through www.flooding.ie.

F.3.4 Individual Property Protection

Individual Property Protection includes generally low-cost and small-scale measures that can be applied to individual properties to help make them more resistant to flood waters. Examples might include flood-gates to go across doorways, water-proof doors, air-vent covers, non-return valves for pipe-work and sewerage, etc. These measures can be effective in reducing the damage to the contents, furniture and fittings in a house or business, but are not applicable in all situations (for example, they may not be suitable in areas of deep or prolonged flooding, or for some types of property with pervious foundations and flooring).

F.3.5 Flood-Related Data Collection

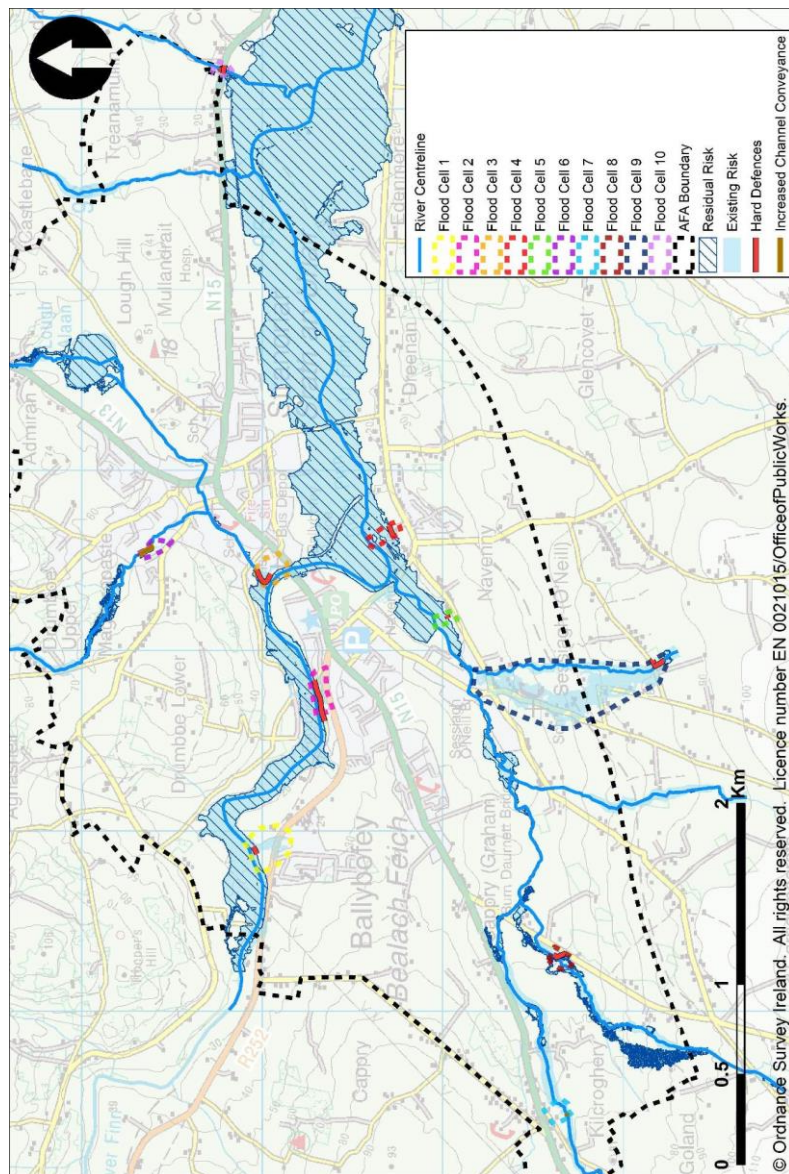
Data on flood flows and levels, as collected through the hydrometric networks of the OPW, EPA / local authorities, the Marine Institute and other organisations, are essential to understand what extreme river flows and levels and sea levels might occur, and hence to enable the appropriate design of structural and non-structural flood risk management measures. Similarly, recording details on flood events that happen are extremely useful to build up our knowledge of flood risk throughout the country and also to understand how the flooding occurs in the affected area to calibrate the computer models used to predict potential future flooding. The ongoing collection and, where appropriate, publication of such data is a measure that will help us to continually improve our preparation for, and response, to flooding.

APPENDIX G

DESCRIPTION OF POTENTIALLY VIABLE FLOOD RELIEF WORKS

G.1 Ballybofey and Stranorlar AFA

River Basin	North Western	AFA	Ballybofey & Stranorlar AFA
Measure	Progress the development of a Flood Relief Scheme for Ballybofey and Stranorlar AFA		
Code	GBNIIENW-01-IE-AFA-010002-0101-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Ballybofey and Stranorlar AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes			
Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	3.38	2.8	<i>There are 53 ground floor properties and there are no additional upper floor properties benefiting with this option in place.</i>
1.a.ii	3.19	2.4	<i>There are 2 highly vulnerable properties benefiting with this option in place.</i>
1.b.i	-3.89	5.0	<i>There are 2 social infrastructure/amenity sites benefiting with this option in place.</i>
1.b.ii	1.53	1.8	<i>There are 6 commercial properties benefiting with this option in place.</i>
2.a	1.46	4.1	<i>With this option in place the annual average damages have been reduced from €305,036.58 to €216,157.47.</i>
2.b	0.15	5.0	<i>There are 6 transport links benefiting with this option in place.</i>
2.c	0.00	1.0	<i>There are no additional utilities benefiting with this option in place.</i>
2.d	0.00	3.0	<i>Option has a negligible impact on the area of agricultural land affected by flooding.</i>
3.a	-4.00	5.0	<i>Construction of walls and embankments set back from sensitive waterbody and increasing channel conveyance in non-sensitive waterbodies. Rehabilitation of existing defences. Potential for in-stream and on-bank works. Potential for indirect downstream sedimentation impacts during construction. Potential for recurring impacts from future dredging. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Reduced flood risk for the 1% AEP event.</i>
3.b	-3.00	5.0	<i>Potential for direct disturbance impacts to River Finn SAC from construction of and rehabilitation of walls and embankments set back from the River Finn and tributaries. Potential for short term, indirect, downstream impacts from sedimentation during construction and conveyance works adjacent to and upstream of the River Finn SAC. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-4.00	4.0	<i>Direct loss of local, undesignated flora and fauna that may re-establish following works. Many areas for defences already modified. Potential for indirect sedimentation impacts to the Finn Freshwater Pearl Mussel sensitive area, and FPM beds downstream of the AFA, during construction and conveyance works. No impacts on national, regional or local designated sites. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>

3.d	-4.00	5.0	Potential for direct disturbance impacts from construction and augmentation of walls and embankments adjacent to / set back from the sensitive River Finn salmonid waterbody. Potential for short term and recurring, indirect, downstream impacts to fisheries and fish passage from sedimentation during construction and conveyance works. Reduced conveyance works over Option 2. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.	
3.e	-1.00	2.0	Construction of and rehabilitation of walls and embankments, and increasing channel conveyance, in low sensitivity / already impacted landscapes, prior to establishment of screening. Impacts mainly on those to be protected.	
3.f.i	0.00	3.0	No impacts on architectural heritage features from FRM measures.	
3.f.ii	0.00	2.0	No impacts on archaeological heritage features from FRM measures.	
4.a	4.00	5.0	Mix of embankments, walls, widened / dredged channels and culverts but maintenance of existing and proposed embankments will be needed into the future.	
4.b	4.00	5.0	The following hazard has been identified: Working near water	
4.c	1.00	5.0	Option is adaptable only at significant cost	
Total MCA-Benefit Score			Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
-452.17			1.92	-235.64
No Properties Benefitting		10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential		2	53	N/A
Commercial		0	6	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions				
Area NPVd (uncapped)		Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
10.02		1.92	3.04	1.59

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is potential for minor medium to long term impacts on water quality and fisheries from recurrent dredging. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term. Ballybofey & Stranorlar is within the Finn Freshwater Pearl Mussel sensitive area, and non-SAC designated populations may be present within, upstream and downstream of the preferred measures. There is potential for sedimentation and water quality impacts on this species during the construction phase.

As the proposed works will be located immediately adjacent to the River Finn SAC, and upstream of the River Foyle and Tributaries SAC (UK), with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the setting back of hard defences from the watercourse, and avoidance of in-stream works,
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- and appropriate surveys of habitats and species.

(see Section 6.6.3: timing to avoid disturbance of salmon spawning seasons, specific sediment control measures for sensitive areas, surveys incl. salmon, otter, freshwater pearl mussel).

Adaptability to Potential Future Changes

Ballybofey & Stranorlar AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the lengths and height of the hard defences and further localised widening and dredging of tributary channels, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6 year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

Public consultation for the Ballybofey & Stranorlar AFA Options was held on 14/03/2016, 26 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

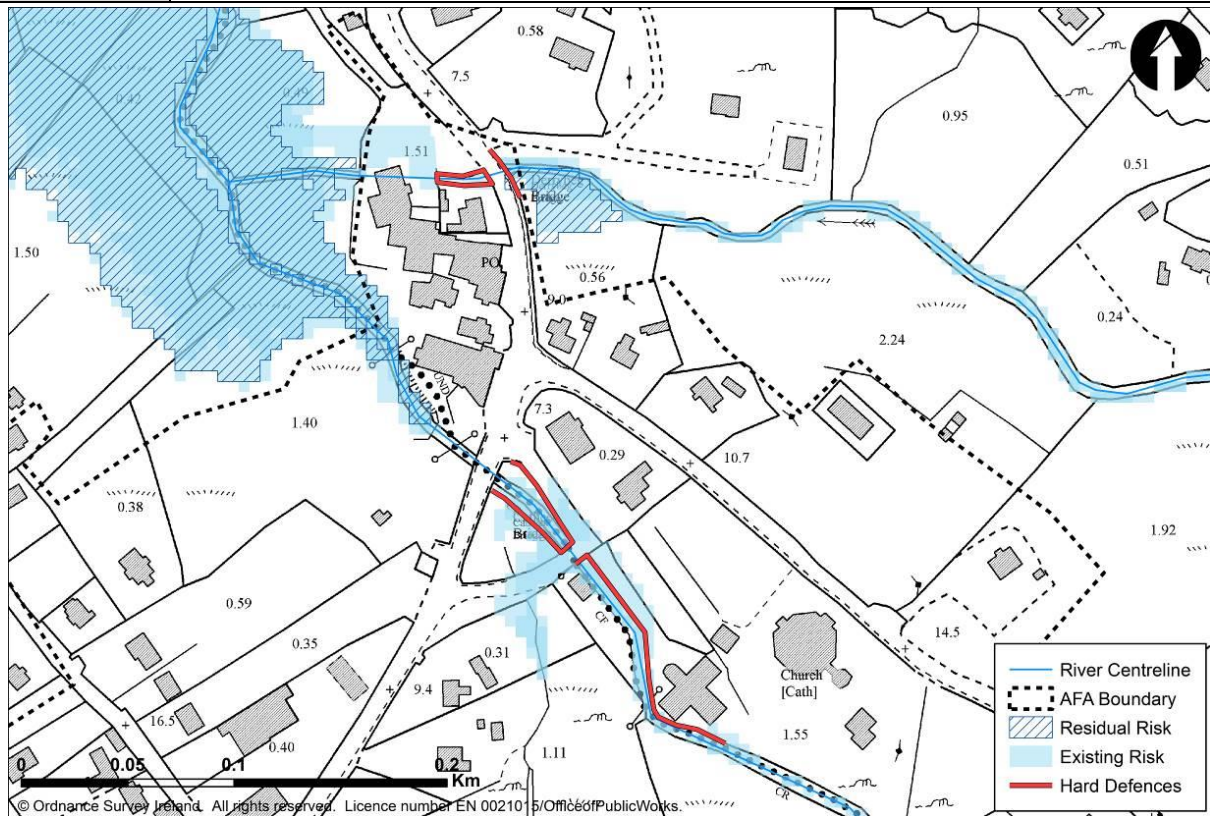
Of the three potentially viable measures presented in the Preliminary Options Report the preferred measure as described above had the highest benefit cost ratio compared to other potential measures.

Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.

Consultations and submissions provided additional information which has been noted for project-level assessment. This includes concerns regarding storm water drainage, condition of existing embankments, risk to people and mitigation of any cross border impacts associated with the transboundary watercourses. Information regarding both urban drainage and also groundwater issues in this area has been noted for project-level assessment, noting that the local authorities have responsibility for urban storm water drainage, and for addressing any localised problems associated with the urban storm water drainage network. Volunteered community resilience and willingness is also noted for any potential benefits available at the project-level assessment stage. On the basis of both the defence failure assessment and also the submissions a new measure has been added to the plan calling for a full detailed condition assessment of the existing embankment with recommendations for any upgrade or maintenance works identified.

G.2 Bunbeg-Derrybeg AFA

River Basin	North Western	AFA	Bunbeg – Derrybeg AFA
Measure	Undertake a Detailed Assessment of the Costs of the Potential Measure for Bunbeg-Derrybeg AFA		
Code	GBNIIENW-01-IE-AFA-385321-0201-M25		
Description	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.93	2.4	There is a combined number of 2 ground floor properties and there are 6 upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	4.50	1.3	There is a combined number of 1 social infrastructure/amenity site benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.ii	4.44	1.0	There is a combined number of 3 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.
2.a	3.97	1.0	With this option in place the annual average damages have been reduced from €44750.08 to €9215.

2.b	1.22	5.0	<i>There is a combined number of 4 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>	
2.c	0.00	1.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>	
2.d	0.00	2.0	<i>Agriculture was not affected by the option applied.</i>	
3.a	-2.00	5.0	<i>Catheen River & tributary not assigned a WFD status, but treated as sensitive due to proximity to Gweedore Bay & Islands SAC. FC2 is <160m to the SAC boundary and FC3 is <100m to the SAC boundary. Walls works considered under category of "medium term - recurring impediment to achievement of objective - excavation and restoration of banks" as will require rebuilding of existing in-bank measures. score offset by +2 as will result in reduction in flooding in area with no significant pollution sources in 1% AEP</i>	
3.b	-5.00	5.0	<i>Gweedore Bay & Islands SAC includes qualifying species "Otter" and habitat "atlantic salt meadows" [1410]. known area of potential salt marsh habitat ~600m downstream of FC3 and ~700m downstream of FC2 . construction of walls could have potential to impact these qualifying features, an AA would be required to evaluate effectiveness of mitigation & ensure no significant impacts</i>	
3.c	-3.00	4.0	<i>Close to Ballyness Bay lwebs site and <100m from Gweedore Bay and Islands pNHA. Potential localised loss of habitat.</i>	
3.d	-2.00	5.0	<i>No specific evidence of Catheen River/tributary's importance as an inland fishery however was treated as sensitive as <500m upstream of shellfish production area. Assessed as "medium term alteration of habitat - excavation and restoration of banks" as will require rebuilding of existing in-bank measures. score offset by +2 as will result in reduction in flooding in area with no significant pollution sources in 1% AEP</i>	
3.e	0.00	2.0	<i>Area where walls are proposed is in development zone M1 (town centre) and not designated as being sensitive or with any specific special features. Proposal involves upgrading existing walls in urban/suburban area, therefore no material changes to landscape</i>	
3.f.i	0.00	1.0	<i>No recorded architectural heritage features with preservation orders or in state care within the AFA, or in the vicinity of the AFA.</i>	
3.f.ii	0.00	1.0	<i>No recorded archaeological heritage features with preservation orders or in state care within the AFA, or in the vicinity of the AFA. Archaeological heritage features in the area are mainly ringforts, with low vulnerability to flooding.</i>	
4.a	4.00	5.0	<i>Negligible operational risk</i>	
4.b	2.00	5.0	<i>The following hazards have been identified: Working near water, Working near water, Heavy Plant Machinery</i>	
4.c	2.00	5.0	<i>Option is adaptable at moderate to significant cost</i>	
Total MCA-Benefit Score			Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
-46.16			1.36	-34.03

No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	1 (Fluvial) 0 (Coastal 1)	1 (Fluvial) 1 (Coastal 1)	N/A
Commercial	0 (Fluvial) 0 (Coastal 1)	2 Fluvial 0 Coastal 1	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
1.98	1.36	1.18	0.87
Environmental Assessments			
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor medium term impacts on fisheries from habitat alteration.</p> <p>As the proposed works will be located upstream of Gweedore Bay and Islands SAC and the West Donegal Coast SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected otter and bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase, in particular to nearby saltmarsh habitat.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the setting back of hard defences from the watercourse, and avoidance of in-stream works, • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, • and appropriate surveys of habitats and species. <p>(see Section 6.6.3: timing to avoid disturbance of protected bird species, specific sediment control measures for sensitive areas, surveys incl. otter, saltmarsh, birds).</p>			
Adaptability to Potential Future Changes			
<p>Bunbeg-Derrybeg AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the height of the hard defence and extending its length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>			

Public Consultation Outcomes

A public consultation for Bunbeg-Derrybeg AFA Options was held on 01/03/2016, 7 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions. These consultations and submissions provided valuable information which has been noted for project-level assessment however none resulted in a change of the preferred measure.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

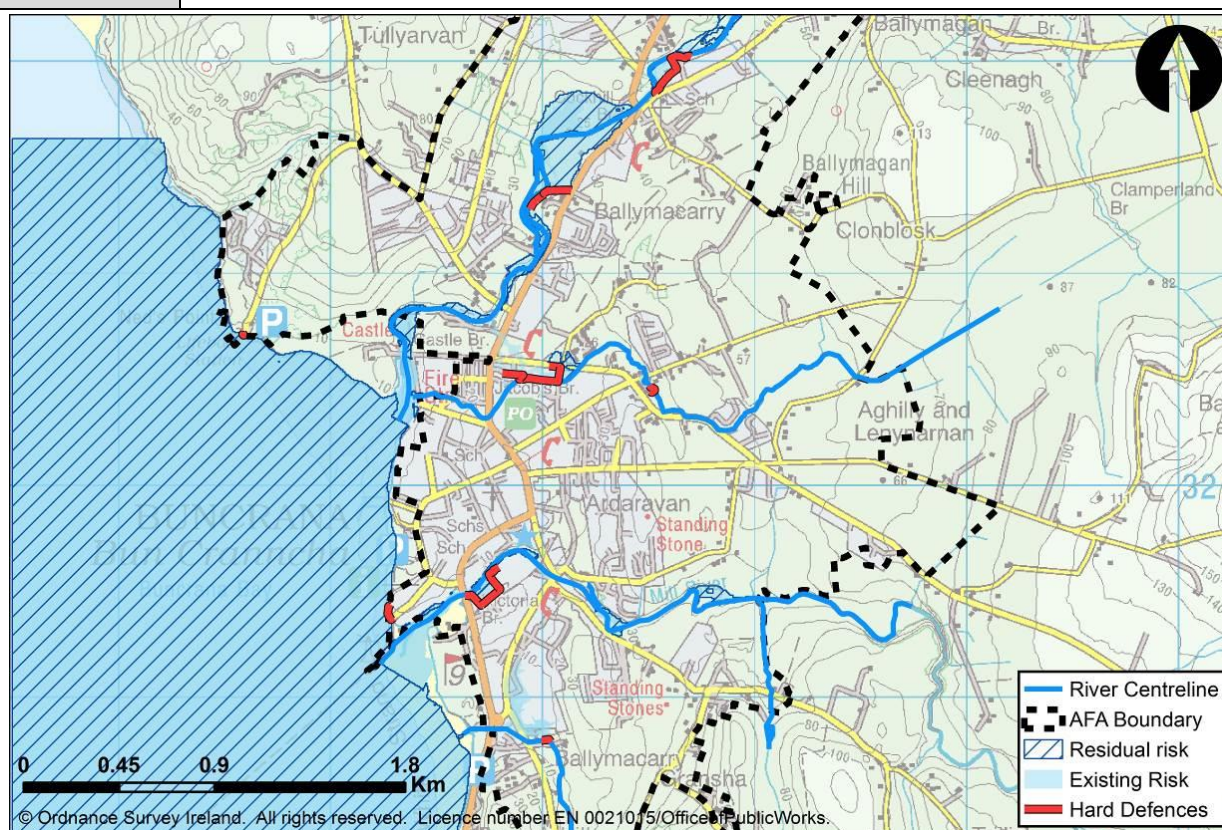
One measure was identified for Bunbeg-Derrybeg AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score and the benefit – cost ratio is below unity. It is therefore recommended that the preferred measure for Bunbeg-Derrybeg progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.

Consultations and submissions provided additional information which has been noted for project-level assessment. This includes the architectural and historical heritage of the AFA. None of the submissions resulted in a change of the preferred measure.

G.3 Buncrana and Luddan AFA

River Basin	North Western	AFA	Buncrana and Luddan AFA
Measure	Progress the development of a Flood Relief Scheme for Buncrana and Luddan AFA		
Code	GBNIIENW-01-IE-AFA-390600-0301-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Buncrana and Luddan AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.69	5.0	There is a combined number of 27 ground floor properties and no additional upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	0.00	5.0	There are no additional social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.ii	4.90	5.0	There is a combined number of 5 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.

2.a	4.67	5.0	<i>With this option in place the annual average damages have been reduced from €2481045.43 to €162691.14.</i>
2.b	1.18	5.0	<i>There is a combined number of 17 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.00	5.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	1.00	2.0	<i>Flooding decreased slightly</i>
3.a	-2.00	5.0	<i>Construction phase impacts with potential for excavation and restoration of banks adjacent to and set back from sensitive and non-sensitive waterbodies. Most works well set back from waterbodies.</i>
3.b	-1.00	4.0	<i>Potential for short term, indirect, downstream impacts from sedimentation during works. Construction of embankments and walls upstream of and adjacent to Lough Swilly SAC. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-1.00	4.0	<i>Potential for short term, indirect, downstream impacts from sedimentation during works. Construction of embankments and walls upstream of and adjacent to Lough Swilly pNHA. Potential for direct temporary local loss of habitat and displacement of species from works area. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.d	-2.00	5.0	<i>Potential for direct short term impacts from construction of walls and embankments adjacent to waterbodies known for sensitive species. Potential for short term, indirect, downstream impacts to sensitive waterbodies, fisheries and aquaculture sites from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-2.00	3.0	<i>Construction phase impacts and slight permanent impacts on local landscape from walls and embankments at Lough Swilly and within Buncrana. Localised impacts mainly on views from those being protected.</i>
3.f.i	0.00	4.0	<i>No effects on architectural heritage features.</i>
3.f.ii	0.00	3.0	<i>No effects on archaeological heritage features.</i>
4.a	4.00	5.0	<i>Regular monitoring and intermittent maintenance required.</i>
4.b	2.00	5.0	<i>The following hazards have been identified: Working Near Water, Working Near Water, Heavy Plant Machinery</i>
4.c	1.00	5.0	<i>Option is adaptable only at significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
1049.88		3.32	316.15
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	2 (Fluvial) 4 (Coastal 1)	21 (Fluvial) 6 (Coastal 1)	N/A
Commercial	1 (Fluvial) 2 (Coastal 1)	2 (Fluvial) 3 (Coastal 1)	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
65.41	3.32	15.8	4.76
Environmental Assessments			
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, agricultural land and transport links in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.</p> <p>As the proposed works will be located immediately adjacent to and upstream of Lough Swilly SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of otter and bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the setting back of hard defences from the watercourse, and avoidance of in-stream works, • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, • and appropriate surveys of habitats and species. <p>(see Section 6.6.3: timing to avoid disturbance of protected bird species, specific sediment control measures for sensitive areas, surveys incl. otter, birds).</p>			
Adaptability to Potential Future Changes			
<p>Buncrana and Luddan AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>			
Public Consultation Outcomes			
<p>A public consultation for the Buncrana and Luddan AFA Options was held on 03/03/2016 (combined with Bridge End and Burnfoot), 6 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>			
Other Issues / Conclusions			

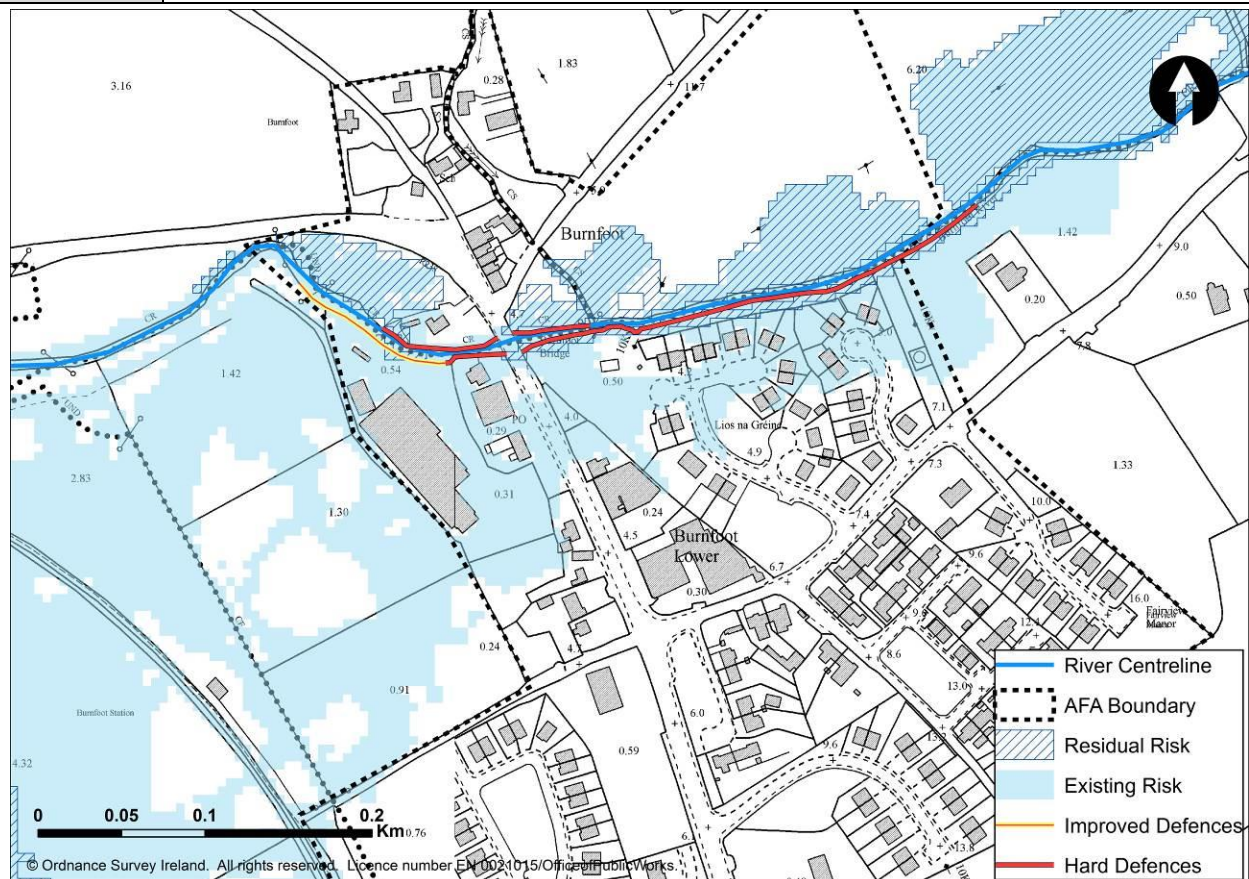
Of the three potentially viable measures presented in the Preliminary Options Report the preferred measure as described above scored better technically, environmentally and had the highest benefit cost ratio compared to other potential measures.

Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.

Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.

G.4 Burnfoot AFA

River Basin	North Western	AFA	Burnfoot AFA
Measure	Undertake a Detailed Assessment of the Costs of the Potential Measure for Burnfoot AFA		
Code	GBNIIENW-01-IE-AFA-390601-0401-M25		
Description	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.40	1.9	There are 20 ground floor properties and there are no additional upper floor properties benefiting with this option in place.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting with this option in place.
1.b.i	0.00	1.0	There are no additional social infrastructure/amenity sites benefiting with this option in place.
1.b.ii	4.02	1.0	There is 1 commercial property benefiting with this option in place.
2.a	2.79	1.0	With this option in place the annual average damages have been reduced from €57596.22 to €25436.27.
2.b	4.35	5.0	There are 2 transport links benefiting with this option in place.

2.c	0.00	1.0	<i>There are no additional utilities benefiting with this option in place.</i>
2.d	0.00	2.0	<i>No change</i>
3.a	-2.00	5.0	<i>waterbody has been treated as sensitive. (2km upstream of the Lough Swilly TWB (shellfish & SAC). River moderate WFD status but designated as a salmon river upstream in NI.) short term intermittent benefits potential as will reduce flooding in 1% AEP (no pollution point source present).</i>
3.b	-5.00	4.0	<i>Lough Swilly SPA is <300m downstream of the Burnfoot flood option. Lough Swilly SAC is 2km downstream. Construction works has potential to result in detrimental impact on SAC /SPA but should not impact conservation objectives if mitigation is employed.</i>
3.c	-1.00	3.0	<i>Localised loss or disturbance of habitat and displacement of species in the footprint of the defences. However this is mitigated by the already modified nature of the banks. Lough Swilly pNHA <200m downstream. iWebs keysite in surrounding fields</i>
3.d	-2.00	5.0	<i>Treated as sensitive waterbody - Skeoge river is designated upstream in NI for salmon. Lough Swilly important fishery. Potential for medium term impacts from excavation and restoration of banks to build flood walls & intermittent operational impacts during fluvial flooding (-4). offset by +2 for reduction in pollution risk</i>
3.e	-1.00	2.0	<i>Localised visual impacts from construction of permanent flood embankments / walls prior to establishment of screening.</i>
3.f.i	0.00	1.0	<i>No recorded architectural heritage features with preservation orders or in state care within the AFA, or in the vicinity of the AFA.</i>
3.f.ii	0.00	1.0	<i>No effects on archaeological features. No archaeological heritage features in proximity to proposed flood embankments / walls.</i>
4.a	4.00	5.0	<i>Negligible operational risk</i>
4.b	1.00	5.0	<i>The following hazards have been identified: Risk of burial from earthfall, working near water (construction), work with heavy plant and components, working near water (O&M)</i>
4.c	0.00	5.0	<i>Option is not adaptable</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
16		1.23	12.96
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	3	20	N/A
Commercial	1	2	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
1.34	1.23	1.08	0.88

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties, a commercial property, and transport links in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located immediately adjacent to and upstream of Lough Swilly SPA, and upstream of Lough Swilly SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the setting back of hard defences from the watercourse, and avoidance of in-stream works,
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- and appropriate surveys of habitats and species.

(see Section 6.6.3: timing to avoid disturbance of protected bird species, specific sediment control measures for sensitive areas, surveys incl. otter, birds).

Adaptability to Potential Future Changes

Burnfoot AFA is considered to be at low vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the height of the Hard Defences and extending their length. However this would require a wall being raised to over 3m high and is deemed unacceptable due to the residual risk and social impact, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

A public consultation for Burnfoot AFA Options was held on 03/03/2016 (combined with Buncrana and Bridge End), 6 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

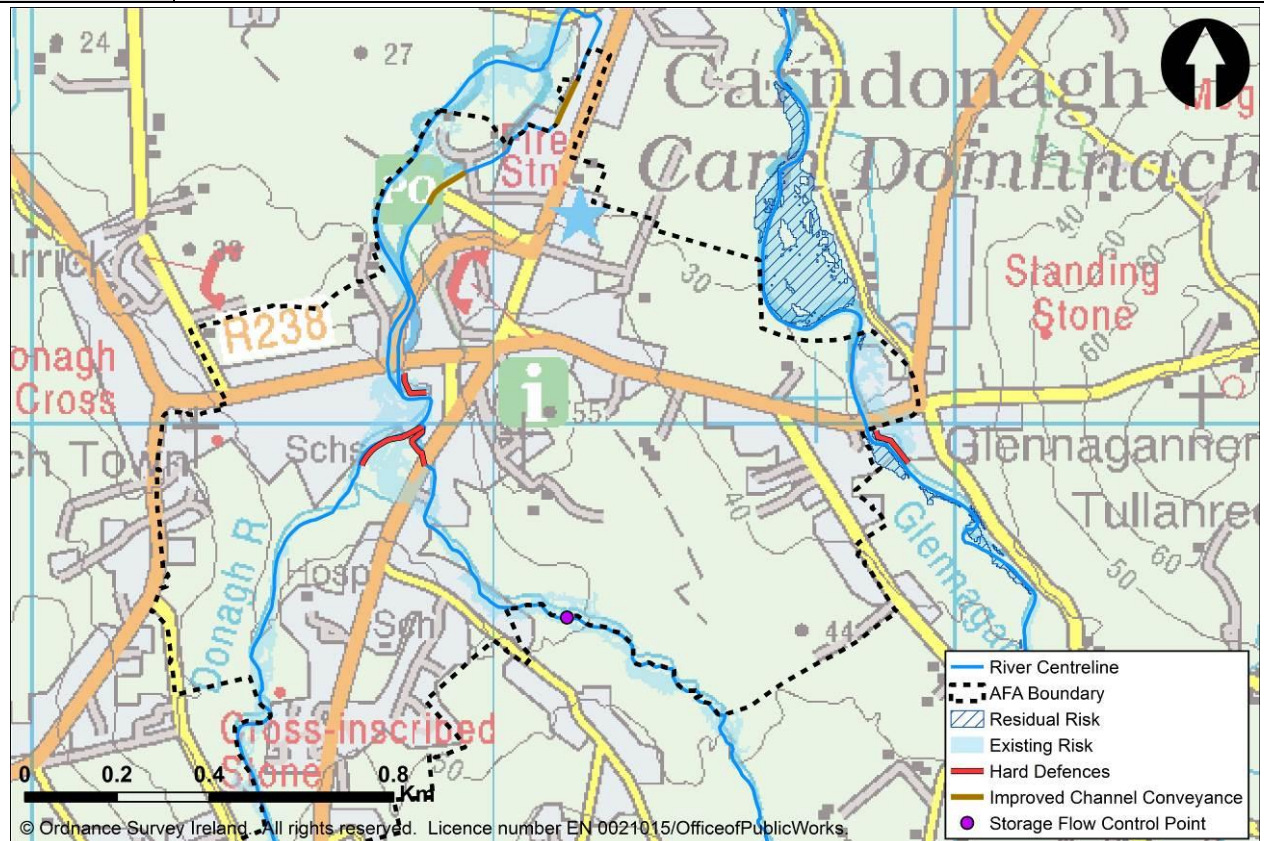
One measure was identified for Burnfoot AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score and the benefit – cost ratio is below unity. It is therefore recommended that the preferred measure for Burnfoot progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.

Consultations and submissions provided additional information which has been noted for project-level assessment. This includes the architectural and historical heritage of the AFA. In addition there is an Irish Water site that will require more exploration at project-level assessment in order to define the exact extent of the site that may benefit from OPW works. None of the submissions resulted in a change of the preferred measure.

G.5 Carndonagh AFA

River Basin	North Western	AFA	Carndonagh AFA
Measure	Progress the development of a Flood Relief Scheme for Carndonagh AFA		
Code	GBNIIENW-01-IE-AFA-400616-0501-M61		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Carndonagh AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.93	5.0	There are 32 ground floor properties and there are 2 upper floor properties benefiting with this option in place.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting with this option in place.
1.b.i	1.61	5.0	There is 1 social infrastructure/amenity site benefiting with this option in place.
1.b.ii	4.74	4.7	There are 9 commercial properties benefiting with this option in place.
2.a	4.71	5.0	With this option in place the annual average damages have been reduced from €468000.73 to €27508.33.
2.b	4.72	5.0	There are 3 transport links benefiting with this option in place.

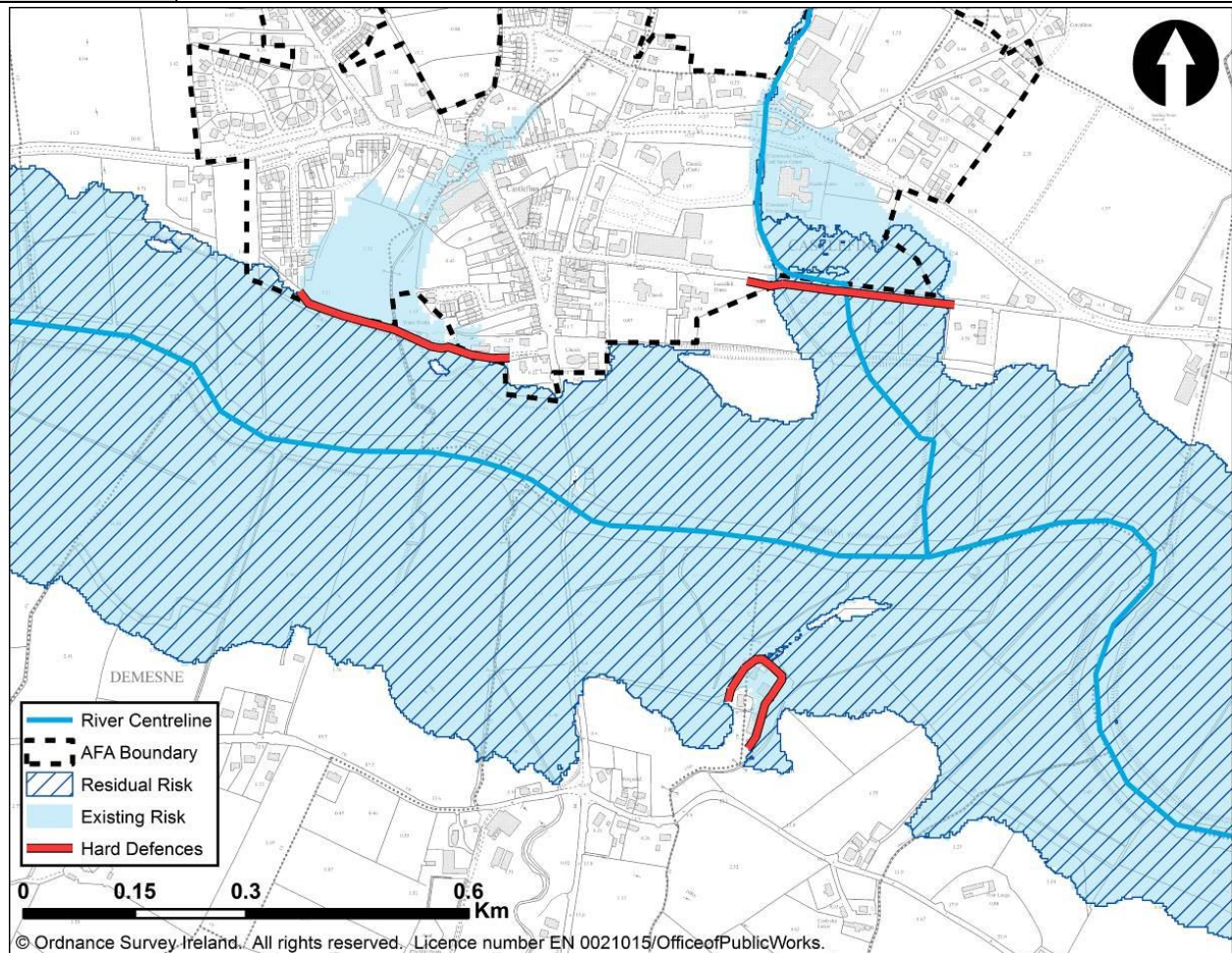
2.c	0.00	1.0	<i>There are no additional utilities benefiting with this option in place.</i>
2.d	-2.00	2.0	<i>Storage area on the Ballywilly Brook proposed is situated in agricultural land, therefore this FRM method has the potential to cause local disturbance to local agricultural practice should the land be arable and/or pasturable.</i>
3.a	-3.00	5.0	<i>Construction impacts from hard defences set back from, conveyance within and storage upstream on non-sensitive waterbodies. Permanent and recurring impacts from storage and dredging. Potential for indirect downstream sedimentation impacts during construction to sensitive waterbody. Construction impacts could be mitigated for with good site practice, effective planning and timing of works. Reduced flood risk for the 1% AEP fluvial event.</i>
3.b	-1.00	3.0	<i>Slight potential for short term, indirect, downstream impacts from sedimentation during works to the North Inishowen Coast SAC and the Trawbreaga Bay SPA and Ramsar site. Impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-1.00	3.0	<i>Direct loss of local, undesignated flora and fauna that may re-establish following works. Slight potential for indirect sedimentation impacts to the North Inishowen Coast pNHA during construction. No impacts on national, regional or local designated sites. Construction impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.d	-1.00	3.0	<i>Slight potential for short term, indirect, downstream impacts from sedimentation during works to the Trawbreaga Bay shellfish areas. Potential for short term impacts on local fishing activity. Construction impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-2.00	2.0	<i>Construction of walls and embankments, and increasing channel conveyance in low sensitivity landscapes, prior to establishment of screening. Construction of storage area in semi-natural landscape prior to establishment of screening. Impacts mainly on those to be protected.</i>
3.f.i	-1.00	3.0	<i>Potential for physical impacts to and on the setting of Glennagannon Bridge NIAH structure from tie in of embankments.</i>
3.f.ii	0.00	3.0	<i>No impacts on archaeological heritage features from FRM measures.</i>
4.a	4.00	5.0	<i>Negligible operational risk, i.e., no reliance on systems or intervention, with more regular monitoring and intermittent, but potentially substantial, maintenance requirements</i>
4.b	2.00	5.0	<i>The following hazards have been identified: Working near water (Construction), Working near water (O&M), Use of heavy machinery (O&M)</i>
4.c	2.00	5.0	<i>Option is adaptable at moderate to significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
1278.76		5.06	252.86

No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	29	32	N/A
Commercial	4	10	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
19.31	5.06	11.18	2.21
Environmental Assessments			
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.</p> <p>As the proposed works will be located upstream of the North Inishowen Coast SAC and the Trawbreaga Bay SPA, with the potential for indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the setting back of hard defences from the watercourse, and avoidance of in-stream works, • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, and • appropriate surveys of habitats and species. <p>(see Section 6.6.3: specific sediment control measures for sensitive areas, surveys).</p>			
Adaptability to Potential Future Changes			
<p>Carndonagh AFA is considered to be at moderate vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the hard defences and extending their length, carrying out excavation works to increase the storage volume available and further dredging and excavation, with some bank raising to increase the channel conveyance, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>			

Public Consultation Outcomes
<p>Public consultation for the Carndonagh AFA Options was held on 03/03/2016 (combined with Malin, Clonmany and Moville), 15 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>
Other Issues / Conclusions
<p>Of the two potentially viable measures presented in the Preliminary Options Report the preferred measure as described above scored better technically and had a higher benefit cost ratio compared to the other potential measure.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided information which has been noted for project-level assessment.</p> <ul style="list-style-type: none"> • The preferred measure includes potential storage and will require landowner liaison at design stage. • In Carndonagh there is a culvert downstream of node 0149M00038J under a filling station and some commercial units with a grating cover at the upstream face which is prone to blockage. <p>None resulted in a change of the preferred measure.</p>

G.6 Castlefinn AFA

River Basin	North Western	AFA	Castlefinn AFA
Measure	Progress the development of a Flood Relief Scheme for Castlefinn AFA		
Code	GBNIIENW-01-IE-AFA-10003-0601-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Castlefinn AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.05	1.2	<i>There are 18 ground floor properties and there are no additional upper floor properties benefiting with this option in place.</i>
1.a.ii	0.0	1.0	<i>There are no additional highly vulnerable properties benefiting with this option in place.</i>
1.b.i	4.50	2.5	<i>There are 2 social infrastructure/amenity sites benefiting with this option in place.</i>

1.b.ii	4.23	1.9	<i>There are 11 commercial properties benefiting with this option in place.</i>
2.a	3.84	1.8	<i>With this option in place the annual average damages have been reduced from €131782.64 to €30651.46.</i>
2.b	3.79	5.0	<i>There are 7 transport links benefiting with this option in place.</i>
2.c	4.88	5.0	<i>There is 1 utility benefiting with this option in place.</i>
2.d	1.00	4.0	<i>Very modest reduction in agricultural land flooded when option is in place.</i>
3.a	3.00	5.0	<i>Construction of walls and embankments set well back from sensitive waterbody. Slight potential for indirect downstream sedimentation impacts during construction. Impacts could be mitigated for with good site practice, effective planning and timing of works. Reduced flood risk for the 1% AEP event and protecting Castlefinn WWTW.</i>
3.b	-1.00	4.0	<i>Slight potential for short term, indirect, downstream impacts from sedimentation during works to the River Finn SAC. Impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-1.00	4.0	<i>Direct loss of local, undesignated flora and fauna that may re-establish following works. Slight potential for indirect sedimentation impacts to the Finn Freshwater Pearl Mussel sensitive area, and FPM beds downstream of the AFA, during construction. No impacts on national, regional or local designated sites. Impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.d	-1.00	5.0	<i>Slight potential for short term, indirect, downstream impacts from sedimentation during works to the sensitive River Finn salmonid waterbody. Impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-1.00	2.0	<i>Construction of walls and embankments in low sensitivity / already impacted landscapes, prior to establishment of screening. Impacts mainly on those to be protected.</i>
3.f.i	3.00	3.0	<i>Protection to several NIAH buildings from the 1% AEP fluvial event, including the Castlefinn Railway Station.</i>
3.f.ii	0.00	2.0	<i>No impacts on archaeological heritage features from FRM measures.</i>
4.a	4.00	5.0	<i>Nearly all flood defence embankments. Negligible operational risk</i>
4.b	2.00	5.0	<i>The following hazards have been identified: Working near water, Maintenance near water, Heavy plant and machinery</i>
4.c	2.00	5.0	<i>Option is adaptable at moderate to significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
1159.04		1.75	664.29
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	2	18	N/A
Commercial	3	17	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
4.42	1.75	2.65	1.52
Environmental Assessments			
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, a utility, agricultural land, transport links and social infrastructure/amenity sites in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences. Castlefinn is within the Finn Freshwater Pearl Mussel sensitive area, and non-SAC designated populations may be present within, upstream and downstream of the proposed measures. There is potential for sedimentation and water quality impacts on this Annex II species during the construction phase.</p> <p>As the proposed works will be located immediately adjacent to the River Finn SAC, and upstream of the River Foyle and Tributaries SAC (UK), with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected habitats and species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the setting back of hard defences from the designated site boundaries, and avoidance of in-stream works, • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, • and appropriate surveys of habitats and species. <p>(see Section 6.6.3: timing to avoid disturbance of salmon spawning seasons, specific sediment control measures for sensitive areas, surveys incl. salmon, otter, freshwater pearl mussel).</p>			
Adaptability to Potential Future Changes			
<p>Castlefinn AFA is considered to be at moderate vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the height of the hard defences to provide the required SoP, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>			

Public Consultation Outcomes

A public consultation for Castlefinn AFA Options was held on 15/03/2016 (combined with Lifford, Killygordon and Convoy), 32 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

People who attended the Public Consultation were informed of the options, those who commented were in favor of the preferred measure many of whom had experienced flooding over winter 2015/16 and were keen to see a solution implemented urgently. Residents were also concerned about any development resulting in added flood risk. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

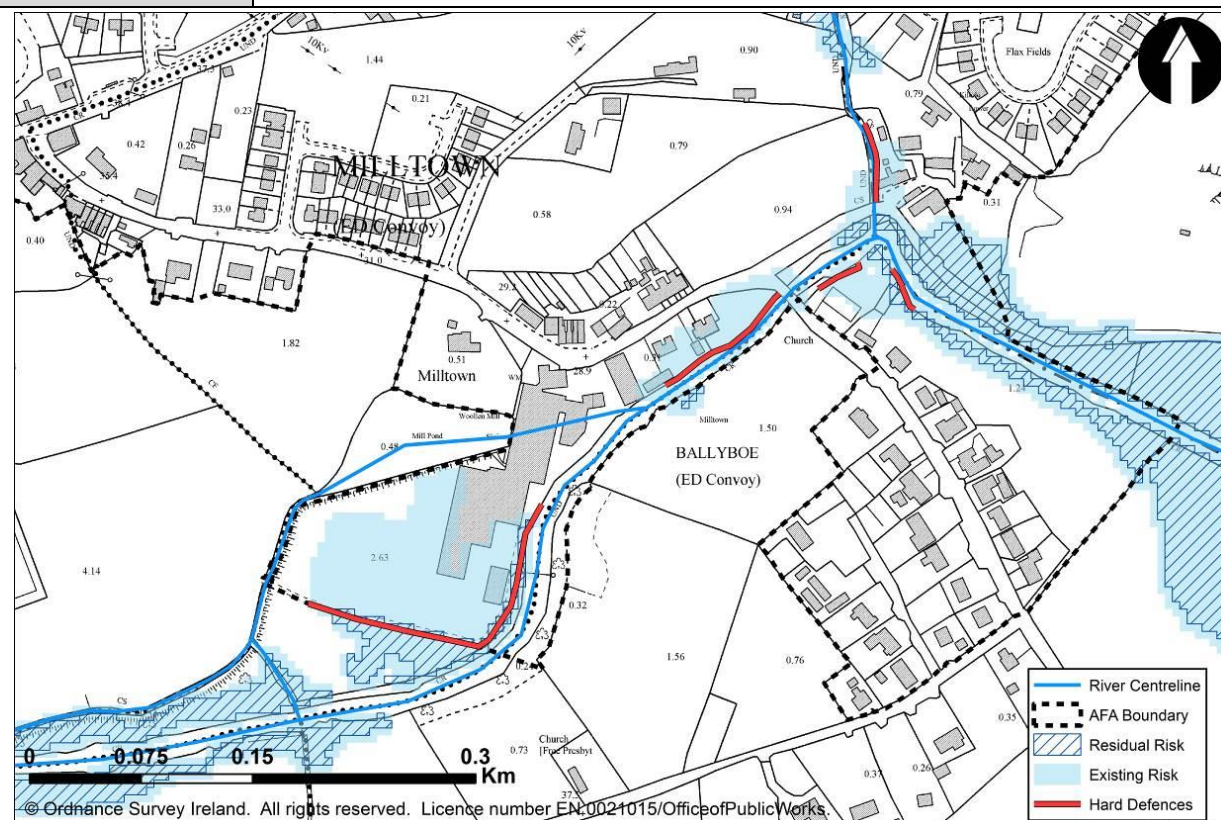
One measure was identified for Castlefinn AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

Overall the preferred measure has a positive technical, social, economic, environmental/cultural score and the benefit – cost ratio is above unity.

Consultations and submissions provided additional information which has been noted for project-level assessment. For any further development of preferred measures to project-level assessment stage the OPW should liaise with the Rivers Agency (Northern Ireland) regional office and DFI Rivers staff who have a direct interest in the management of flood risk in the North-Western and Neagh-Bann River Basins. None of the submissions resulted in a change of the preferred measure.

G.7 Convoy AFA

River Basin	North Western	AFA	Convoy AFA
Measure	Undertake a Detailed Assessment of the Costs of the Potential Measure for Convoy AFA		
Code	GBNIIENW-01-IE-AFA-010005-0701-M25		
Description	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	3.10	1.0	There are 5 ground floor properties and there are no additional upper floor properties benefiting with this option in place.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting with this option in place.
1.b.i	0.05	5.0	There is 1 social infrastructure/amenity site benefiting with this option in place.
1.b.ii	4.53	1.2	There are 4 commercial properties benefiting with this option in place.
2.a	0.65	3.8	With this option in place the annual average damages have been reduced from €283010.25 to €245952.83.
2.b	0.18	5.0	There are 2 transport links benefiting with this option in place.

2.c	0.00	1.0	<i>There are no additional utilities benefiting with this option in place.</i>
2.d	0.00	4.0	<i>No Change.</i>
3.a	-3.00	5.0	<i>Mainly construction phase impacts from excavation and restoration of banks, in-stream and on bank impacts in non-sensitive waterbody.</i>
3.b	0.00	1.0	<i>No impact on existing SAC, SPA or Ramsar sites as a result of flood risk management measures.</i>
3.c	0.00	1.0	<i>No impact on existing national, regional and local sites as a result of flood risk management measures.</i>
3.d	-1.00	2.0	<i>Temporary construction phase impacts on non-sensitive waterbody. Potential for short term, localised sedimentation impacts on fishing habitat during construction</i>
3.e	-1.00	2.0	<i>Mainly construction phase impacts in well screened areas. Impacts to be mainly on those to be defended. No wider impacts on the landscape following completion of walls.</i>
3.f.i	2.00	3.0	<i>Potential for slight negative impacts on the setting of several NIAH buildings, however also increased protection from extreme flood events to these buildings so they are substantially less vulnerable to flooding.</i>
3.f.ii	0.00	1.0	<i>No effects on archaeological heritage features.</i>
4.a	5.00	5.0	<i>No reliance on systems or intervention, with limited monitoring / maintenance required, i.e. no operational risk</i>
4.b	2.00	5.0	<i>The following hazards have been identified: Working near water (construction), Working near water (O&M), Use of heavy machinery (construction)</i>
4.c	0.00	5.0	<i>Option is not adaptable</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
-65.27		1.94	-33.59
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	0	5	N/A
Commercial	0	4	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
3.37	1.94	1.62	0.84

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measure, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located upstream of the River Foyle and Tributaries SAC (UK), with the potential for indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the setting back of hard defences from the designated site boundaries, and avoidance of in-stream works,
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- and appropriate surveys of habitats and species.

(see Section 6.6.3: timing to avoid disturbance of salmon spawning seasons, specific sediment control measures for sensitive areas, surveys incl. salmon, otter).

Adaptability to Potential Future Changes

Convoy AFA is considered to be at moderate vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the Hard Defences and extending their length. However this would require walls being raised to over 3m high and deemed unacceptable due to the residual risk and social impact, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

A public consultation for Convoy AFA Options was held on 15/03/2016 (combined with Lifford, Castlefinn and Killygordon), 32 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

One measure was identified for Convoy AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

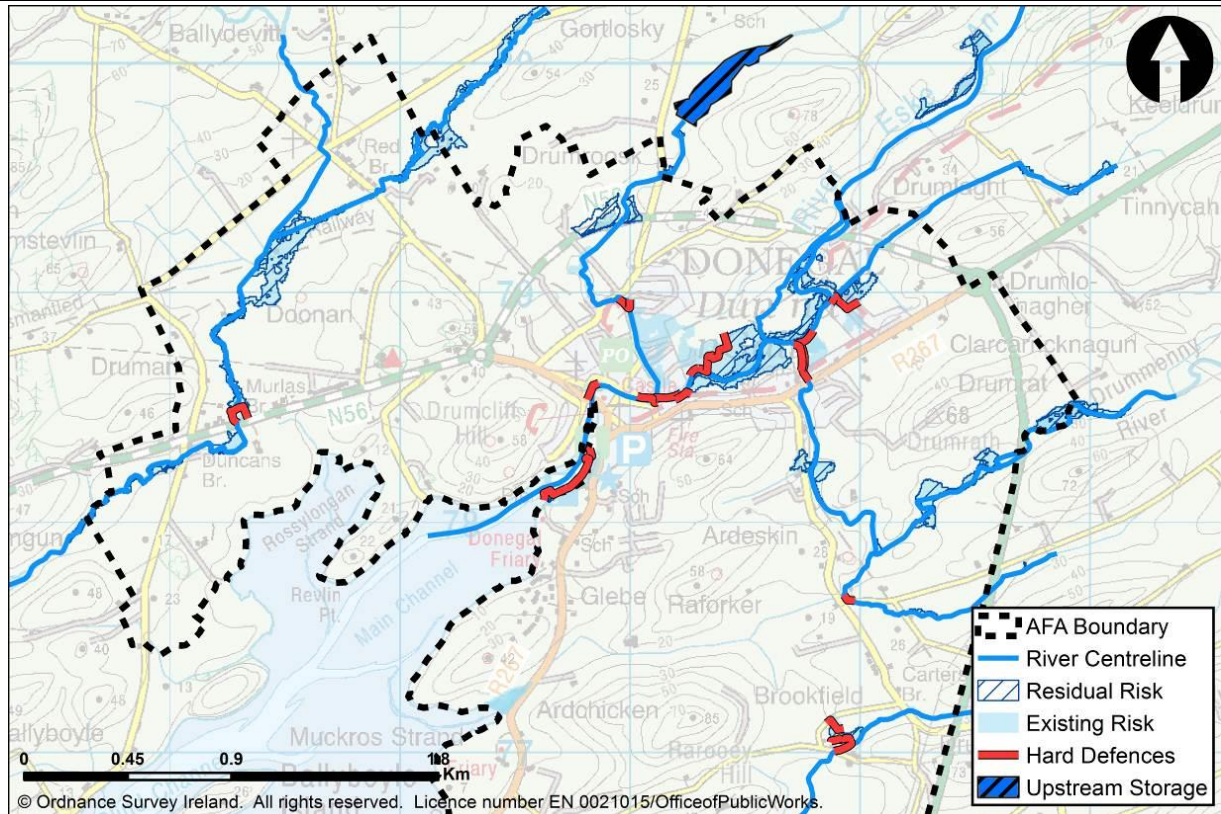
Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score and the benefit – cost ratio is below unity. It is therefore recommended that the preferred measure for Convoy progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.

Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.

It should be noted that there are current plans to expand the existing waste water treatment plant in Convoy AFA. The progression of this expansion should be reviewed at the project-level assessment stage.

G.8 Donegal AFA

River Basin	North Western	AFA	Donegal AFA
Measure	Progress the development of a Flood Relief Scheme for Donegal AFA		
Code	GBNIIENW-01-IE-AFA-370580-0801-M61		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Donegal AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.32	4.5	There is a combined number of 41 ground floor properties and 2 additional upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	3.09	5.0	There is a combined number of 4 social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.ii	4.64	5.0	There is a combined number of 34 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.

2.a	4.49	5.0	<i>With this option in place the annual average damages have been reduced from €1077786.18 to €109720.11.</i>
2.b	1.69	5.0	<i>There is a combined number of 19 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.00	1.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	-2.00	3.0	<i>Storage area on the Drumroosk watercourse proposed is situated in agricultural land, therefore this FRM method has the potential to cause local disturbance to local agricultural practice should the land be arable and/or pasturable.</i>
3.a	-4.00	5.0	<i>Construction and augmentation of walls and embankments adjacent to sensitive waterbodies. Construction of hard defences and storage adjacent to and on non-sensitive waterbodies, upstream of sensitive waterbodies. Potential for in stream and on bank works, and excavation and restoration of banks. Potential for indirect downstream sedimentation impacts during construction. Construction impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Reduced flood risk for the 1% AEP event.</i>
3.b	-5.00	5.0	<i>Potential for direct disturbance impacts to the Donegal Bay SAC and SPA and the Lough Eske and Ardnamona Wood SAC from construction and augmentation of walls and embankments adjacent to and upstream of the River Eske, Drummenny River and Inner Donegal Bay. Potential for small areas of direct footprint impacts from construction and augmentation works. Potential for short term, indirect, downstream impacts from sedimentation during works to the Donegal Bay SAC and SPA and the Lough Eske and Ardnamona Wood SAC. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. All defences to be set back from designations as far as possible.</i>
3.c	-5.00	5.0	<i>Potential for direct disturbance impacts to the Donegal Bay pNHA and River Eske FPM River from construction and augmentation of walls and embankments adjacent to and upstream of the River Eske, Drummenny River and Inner Donegal Bay. Potential for small areas of direct footprint impacts from construction and augmentation works. Direct loss of local, undesignated flora and fauna that may re-establish following works in other construction areas. Potential for short term, indirect, downstream impacts from sedimentation during works to the Donegal Bay pNHA and the River Eske FPM River and FPM catchment. Many of the potential impacts could be mitigated for with good site practice, effective planning and timing of works. All defences to be set back from designations as far as possible.</i>

3.d	-4.00	4.0	Potential for direct disturbance impacts to fish and fisheries from construction and augmentation of walls and embankments adjacent to / set back from, and upstream of, the River Eske and Inner Donegal Bay sensitive waterbodies. Potential for short term, indirect, downstream impacts to fisheries and fish passage from sedimentation during works. Storage on waterbody with low fishery potential. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.
3.e	-4.00	4.0	Construction of and rehabilitation of walls and embankments in moderate and high sensitivity landscapes, prior to establishment of screening. Storage area constructed within semi-natural landscape prior to mitigation establishment. Impacts mainly on those to be protected, however potential for permanent negative impacts on views within the town and of the River Eske and the Inner Donegal Bay.
3.f.i	3.00	4.0	Potential for impacts on the setting of 3 NIAH buildings from hard defences, however increased protection to 1 NIAH building (Donegal Town Methodist Church) from the 0.5% AEP coastal event and 6 NIAH buildings from the 1% AEP fluvial event (3 houses on Water Street and 3 records at Drumlonagher Mill).
3.f.ii	0.00	4.0	No effects on archaeological features.
4.a	4.00	5.0	Negligible operational risk, i.e., no reliance on systems or intervention, with more regular monitoring and intermittent, but potentially substantial, maintenance requirements
4.b	2.00	5.0	The following hazards have been identified: Working near water (Construction), Working near water (O&M), Use of heavy machinery (O&M)
4.c	1.00	5.0	Option is adaptable only at significant cost
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
388.91		8.50	45.76
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	8 (Fluvial) 0 (Coastal 1)	35 (Fluvial) 3 (Coastal 1)	N/A
Commercial	15 (Fluvial) 2 (Coastal 1)	26 (Fluvial) 10 (Coastal 1)	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
30.95	8.50	10.34	1.22

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located adjacent to Donegal Bay SAC and SPA, and Lough Eske and Ardnamona Wood SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. The River Eske is a Freshwater Pearl Mussel river, with extant populations recorded directly upstream of Donegal town. There is potential for direct impacts on this species and indirect sedimentation impacts during construction. It is imperative that effective sediment control is in place to protect this species. Following the avoidance and mitigation measures proposed by the Appropriate Assessment, the potential for residual impacts on Lough Eske and Ardnamona Wood SAC remains. Significance of the potential impacts would need to be investigated further at the project-level assessment phase.

The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the setting back of hard defences from the designated site boundaries, and avoidance of in-stream works,
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- appropriate surveys of habitats and species,
- and adherence to the recommendations of the Eske FPM Management Plan.

(see Section 6.6.3: timing to avoid disturbance of overwintering birds and salmon spawning season, specific sediment control measures for sensitive areas, surveys incl. salmon, freshwater pearl mussel, birds).

Adaptability to Potential Future Changes

Donegal AFA is considered to be at high vulnerability from the mid-range and high end future scenarios. Adaptation of the preferred measure would require increasing the height of the Hard Defences and extending their length and carrying out excavation works to increase the storage volume available, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

A public consultation for Donegal AFA Options was held on 14/03/2016 (combined with Ardara, Killybegs, Bundoran and Tullaghan), 19 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

There is an overall concern for the time it will take for the preferred measure to be put in place. Other concerns expressed included schemes costing, drainage issues and ensuring local fishing access with proposed hard defences. It was suggested raising the car park at the mouth of the Eske could be an alternative to hard defences. It was noted that works are currently underway to solve the issue of surface water in Drumlonagher. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

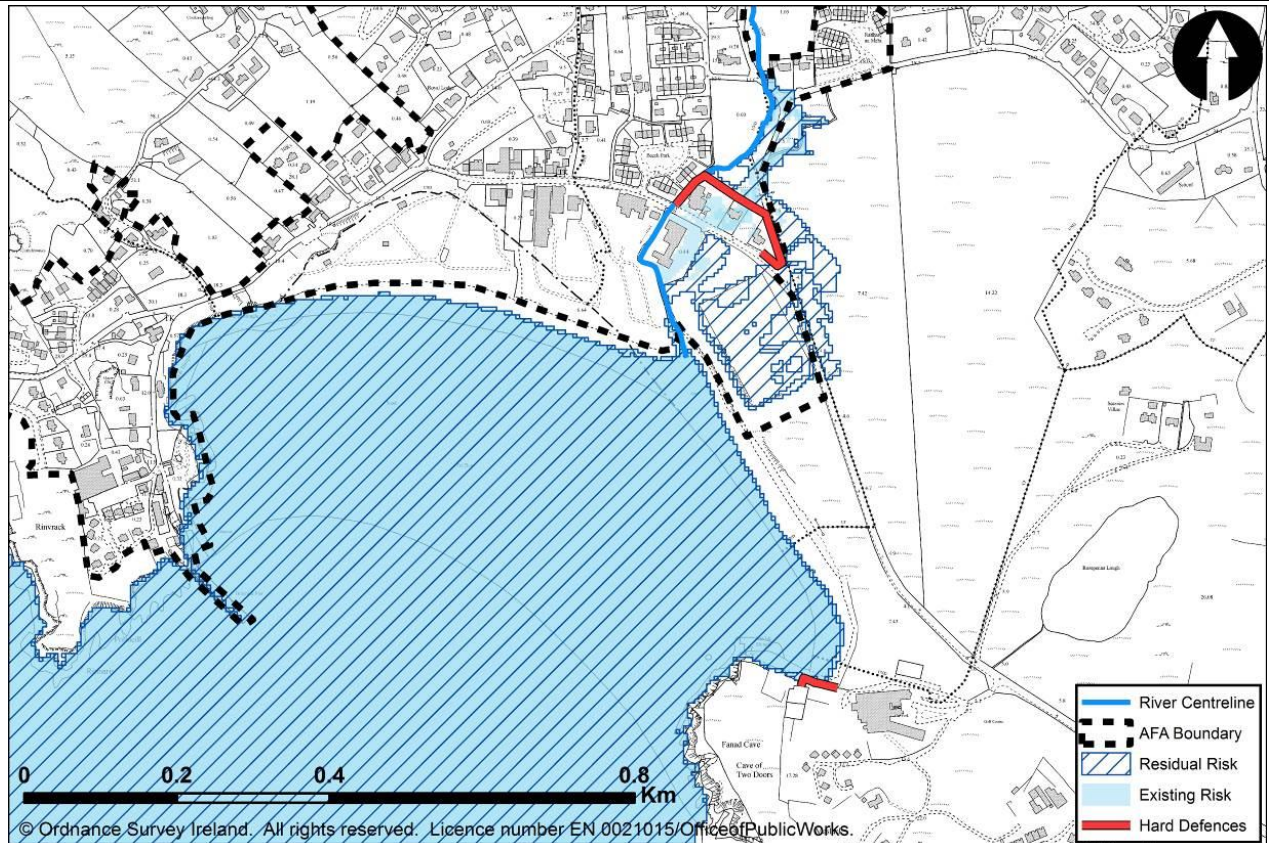
One measure was identified for Donegal AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.

Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.

G.9 Downings AFA

River Basin	North Western	AFA	Downings AFA
Measure	Progress the development of a Flood Relief Scheme for Downings AFA		
Code	GBNIIENW-01-IE-AFA-380595-0901-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Downings AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.92	1.4	<i>There is a combined number of 4 ground floor properties and no additional upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.</i>
1.a.ii	0.0	1.0	<i>There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.</i>
1.b.i	0.00	1.0	<i>There are no additional social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.</i>
1.b.ii	4.83	1.0	<i>There is 1 commercial property benefiting from the option's SoP from fluvial and coastal flood sources.</i>

2.a	4.89	1.0	<i>With this option in place the annual average damages have been reduced from €53994.41 to €1207.68.</i>
2.b	0.32	5.0	<i>There is a combined number of 3 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.00	1.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	-2.00	2.0	<i>Flood Extents larger</i>
3.a	-1.00	5.0	<i>Slight potential for construction phase impacts from construction of walls and embankments set back from non-sensitive waterbody, upstream of sensitive waterbody.</i>
3.b	-1.00	4.0	<i>Slight potential for short term, indirect, downstream impacts to Sheephaven SAC from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. No footprint of works in SAC.</i>
3.c	-1.00	3.0	<i>Slight potential for short term, indirect, downstream impacts to Sheephaven pNHA from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. No footprint of works in pNHA. Potential for direct, localised loss of local flora and displacement of fauna in footprint of works.</i>
3.d	-1.00	2.0	<i>Slight potential for short term, indirect, localised, downstream impacts to fishing activity in Sheephaven Bay from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-2.00	3.0	<i>Potential for temporary and slight permanent impacts on local views from construction of walls and embankments. Impacts mainly on those to be protected.</i>
3.f.i	0.00	1.0	<i>No effects on architectural features. No architectural heritage features in proximity to proposed FRM Methods.</i>
3.f.ii	0.00	1.0	<i>No effects on archaeological features. No archaeological heritage features in proximity to proposed FRM Methods.</i>
4.a	4.00	5.0	<i>Regular monitoring and intermittent maintenance required.</i>
4.b	3.00	5.0	<i>The following hazards have been identified: Working near Water, Working near Water</i>
4.c	1.00	5.0	<i>Option is adaptable only at significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
101.75		0.87	116.60
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	2 (Fluvial) 0 (Coastal 1)	2 (Fluvial) 1 (Coastal 1)	N/A
Commercial	1 (Fluvial) 0 (Coastal 1)	1 (Fluvial) 0 (Coastal 1)	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			

Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
2.45	0.87	1.38	1.58

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measure, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, minor visual impacts in the medium to long term, and a slight increase in the extent of flooded agricultural land.

As the proposed works will be located immediately adjacent to and upstream of Sheephaven SAC and Tranarossan and Melmore Lough SAC, and within the potential zone of influence of Horn Head to Fanad Head SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the setting back of hard defences from the designated site boundaries, and avoidance of in-stream works,
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- and appropriate surveys of habitats and species.

(see Section 6.6.3: timing to avoid disturbance of overwintering birds, specific sediment control measures for sensitive areas, surveys incl. habitats, birds).

Adaptability to Potential Future Changes

Downings AFA is considered to be at moderate vulnerability from the mid-range future scenario and moderate vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

A public consultation for Downings AFA Options was held on 02/03/2016 (combined with Ramelton, Rathmullan, Kerrykeel and Dunfanaghy), 9 members of the public attended.

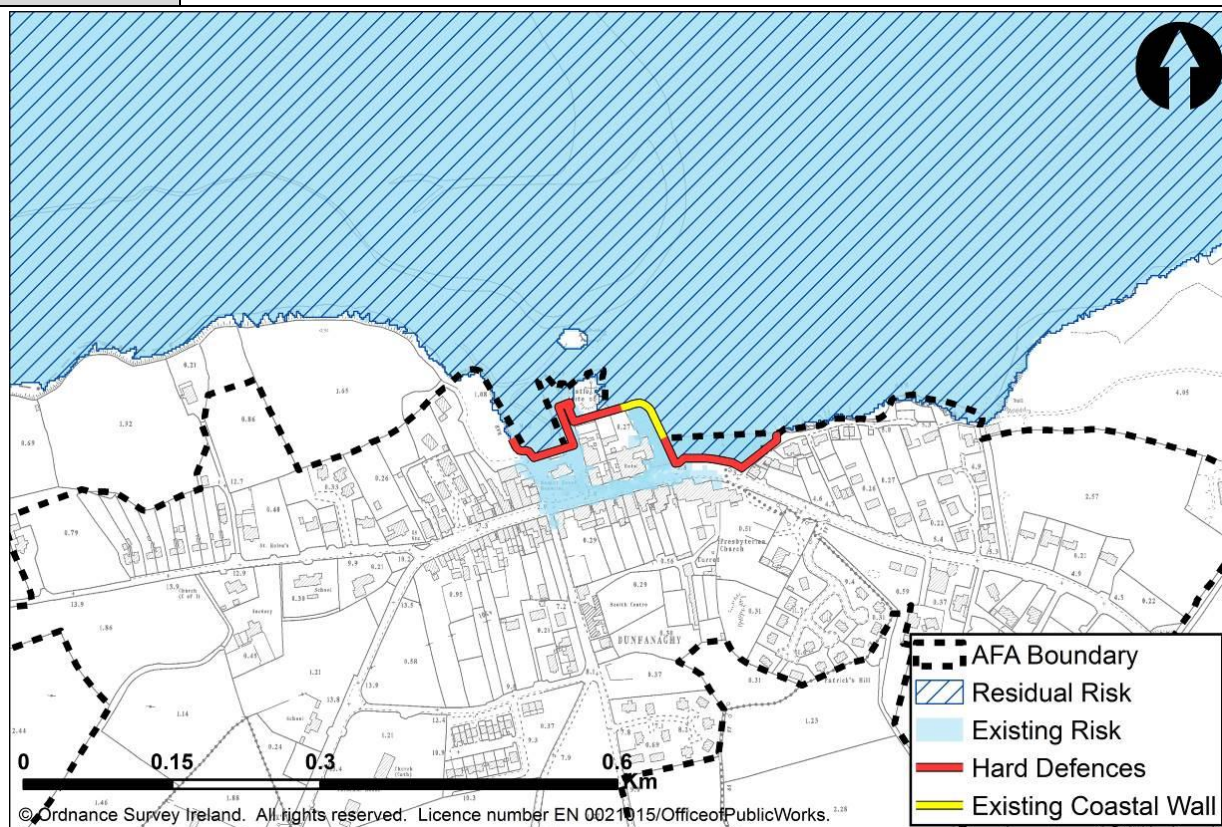
A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions
<p>Of the three potentially viable measures presented in the Preliminary Options Report the preferred measure as described above scored better environmentally than the other potential measures.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.</p>

G.10 Dunfanaghy AFA

River Basin	North Western	AFA	Dunfanaghy AFA
Measure	Progress the development of a Flood Relief Scheme for Dunfanaghy AFA		
Code	GBNIIENW-01-IE-AFA-380596-1001-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Dunfanaghy AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.76	2.1	There are 23 ground floor properties and there are 48 upper floor properties benefiting with this option in place.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting with this option in place.
1.b.i	0.33	5.0	There is 1 social infrastructure/amenity site benefiting with this option in place.
1.b.ii	4.77	3.3	There are 29 commercial properties benefiting with this option in place.
2.a	4.31	1.0	With this option in place the annual average damages have been reduced from €73,104 to €10,098.
2.b	4.83	5.0	There are 6 transport links benefiting with this option in place.

2.c	0.00	1.0	<i>There are no additional utilities benefiting with this option in place.</i>
2.d	0.00	2.0	<i>FRM option has no impact on agricultural land.</i>
3.a	-3.00	5.0	<i>Potential for construction phase impacts of augmenting existing walls and constructing new walls beside non-sensitive waterbody from sedimentation. Potential for excavation and restoration of walls / banks. Mitigation to set walls back from waterbody.</i>
3.b	-2.00	5.0	<i>Potential for construction phase impacts of augmenting existing walls and constructing new walls adjacent to designated area, from sedimentation and disturbance. Mitigation to set walls back from designation and seasonality of works.</i>
3.c	-2.00	4.0	<i>Potential for construction phase impacts of augmenting existing walls and constructing new walls adjacent to designated area, from sedimentation and disturbance. Mitigation to set walls back from designation and seasonality of works.</i>
3.d	-1.00	3.0	<i>Potential for construction phase impacts of augmenting existing walls and constructing new walls beside non-sensitive waterbody from sedimentation. Potential for excavation and restoration of walls / banks. Mitigation to set walls back from waterbody and timing of works.</i>
3.e	-3.00	3.0	<i>Potential for construction phase impacts and long term impacts of augmenting existing walls and constructing new walls, affecting the seascape from the town and the N56 - Wild Atlantic Way. Very localised impacts however.</i>
3.f.i	0.00	1.0	<i>No effects on architectural features. No architectural heritage features in proximity to proposed flood walls.</i>
3.f.ii	-1.00	1.0	<i>Potential negative impacts to the setting of recorded monument of castle remains due to the proximity of flood walls.</i>
4.a	5.00	5.0	<i>No operational risk</i>
4.b	2.00	5.0	<i>The following hazards have been identified: Working near water (construction), Working near water (O&M), Heavy plant & machinery (construction)</i>
4.c	1.00	5.0	<i>Option is adaptable only at significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
239.48		1.93	124.36
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	2 (Coastal 1) 1 (Coastal 2)	13 (Coastal 1) 10 (Coastal 2)	N/A
Commercial	0 (Coastal 1) 0 (Coastal 2)	24 (Coastal 1) 7 (Coastal 2)	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
2.91	1.93	2.49	1.30

Environmental Assessments
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, minor visual impacts, and minor impacts to the setting of a castle in the medium to long term.</p> <p>As the proposed works will be located adjacent to and upstream of Horn Head and Rinclevan SAC, and in close proximity to Horn Head to Fanad Head SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the setting back of hard defences from the watercourse, and avoidance of in-stream works, • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, • and appropriate surveys of habitats and species. <p>(see Section 6.6.3: timing to avoid disturbance of overwintering birds, specific sediment control measures for sensitive areas, surveys incl. habitats, birds).</p>
Adaptability to Potential Future Changes
<p>Dunfanaghy AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the hard defences, raising of the pier and raising of the waterproof membrane on tanked properties, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>
Public Consultation Outcomes
<p>A public consultation for Dunfanaghy AFA Options was held on 02/03/2016 (combined with Ramelton, Rathmullan, Kerrykeel and Downings), 9 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>

Other Issues / Conclusions

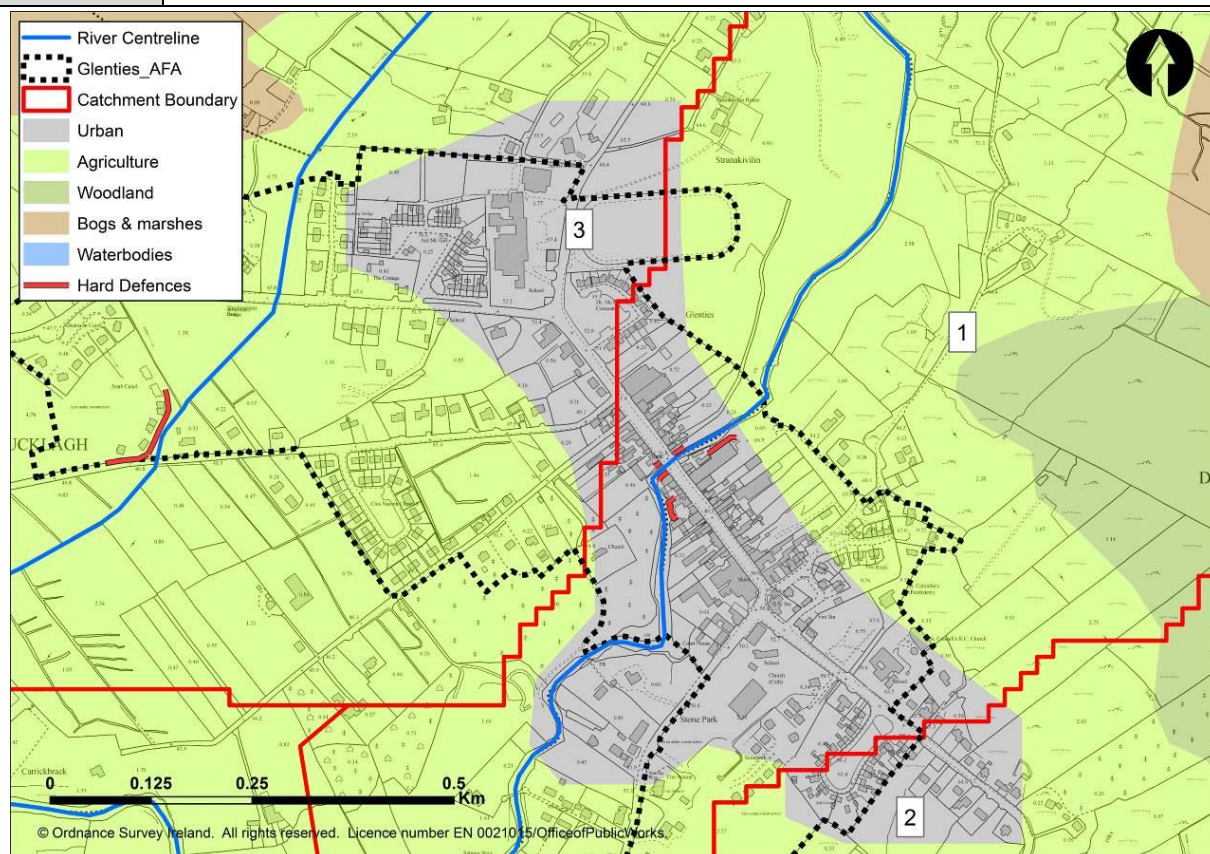
One measure was identified for Dunfanaghy AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.

Consultations and submissions provided additional information which has been noted for project-level assessment. Additional information was received regarding the Old Cottage Road area of Dunfanaghy. The risk here was deemed to be local, not 'nationally significant'. The local authorities have responsibility for urban storm water drainage, and for addressing any localised problems associated with the urban storm water drainage network. None of the submissions resulted in a change of the preferred measure.

G.11 Glenties AFA

River Basin	North Western	AFA	Glenties AFA
Measure	Progress the development of a Flood Relief Scheme for Glenties AFA		
Code	GBNIIENW-01-IE-AFA-380597-1101-M61		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Glenties AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.75	2.1	<i>There are 4 ground floor properties and there are no additional upper floor properties benefiting with this option in place.</i>
1.a.ii	0.0	1.0	<i>There are no additional highly vulnerable properties benefiting with this option in place.</i>
1.b.i	4.95	5.0	<i>There is 1 social infrastructure/amenity site benefiting with this option in place.</i>
1.b.ii	4.72	5.0	<i>There are 6 commercial properties benefiting with this option in place.</i>
2.a	4.76	5.0	<i>With this option in place the annual average damages have been reduced from €555496.64 to €26781.17.</i>
2.b	2.50	1.0	<i>There is 1 road benefiting with this option in place.</i>

2.c	0.00	1.0	<i>There are no additional utilities benefiting with this option in place.</i>
2.d	0.00	2.0	<i>No Change</i>
3.a	-2.00	5.0	<i>sensitive water body (FPM catchment - FPM river <700m downstream). Construction phase impacts and short term/intermittent effects during fluvial flooding</i>
3.b	-5.00	5.0	<i>Proposed flood walls for Flood Cell 1 are inside the boundary of the West of Ardara/Maas Road SAC on Stracashel River. Possibility of have detrimental impact on conservation objectives (otters) Mitigation/avoidance may be possible but would need specialist study</i>
3.c	-3.00	3.0	<i>Direct, permanent localised loss of habitat and displacement of species in the footprint of the defences.</i>
3.d	-4.00	5.0	<i>sensitive water body, SAC in FC1 designated for salmon. Owenea (downstream) important salmon river. Works appear to require excavation and restoration of banks or instream works in some areas in FC1 as no space to set back from bank. (downgrade to -2 if this is not the case)</i>
3.e	-1.00	2.0	<i>area not designated as high scenic value in CDP but local tourism value and character noted. Localised visual impacts anticipated from construction of permanent flood embankments / walls prior to establishment of screening.</i>
3.f.i	0.00	1.0	<i>No effects on architectural features. No architectural heritage features in proximity to proposed flood embankments / walls.</i>
3.f.ii	0.00	1.0	<i>No effects on archaeological features. No archaeological heritage features in proximity to proposed flood embankments / walls.</i>
4.a	4.00	5.0	<i>Negligible operational risk</i>
4.b	1.00	5.0	<i>The following hazards have been identified: Risk of burial from earthfall, working near water (construction), work with heavy plant and components, working near water (O&M)</i>
4.c	1.00	5.0	<i>Option is adaptable only at significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
416		0.55	756.20
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	2	4	N/A
Commercial	1	4	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
11.93	0.55	2.78	5.05

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, a transport link and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.

As the proposed works will be located immediately adjacent to the West of Ardara / Maas Road SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase. The Owenea River is a designated Freshwater Pearl Mussel River. There is potential for direct impacts on this species, as well as salmon and otter, and indirect sedimentation impacts during construction. It is imperative that effective sediment control is in place to protect these species. Following the avoidance and mitigation measures proposed by the Appropriate Assessment, the potential for residual impacts on the West of Ardara / Maas Road SAC remains. Significance of the potential impacts would need to be investigated further at the project-level assessment phase.

The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the setting back of hard defences from the designated site boundaries (however in one location there is insufficient space to set them back from the site boundary), and avoidance of in-stream works,
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- appropriate surveys of habitats and species,
- and adherence to the recommendations of the Owenea FPM Management Plan.

(see Section 6.6.3: timing to avoid disturbance of salmon spawning season, specific sediment control measures for sensitive areas, surveys incl. salmon, freshwater pearl mussel, otter).

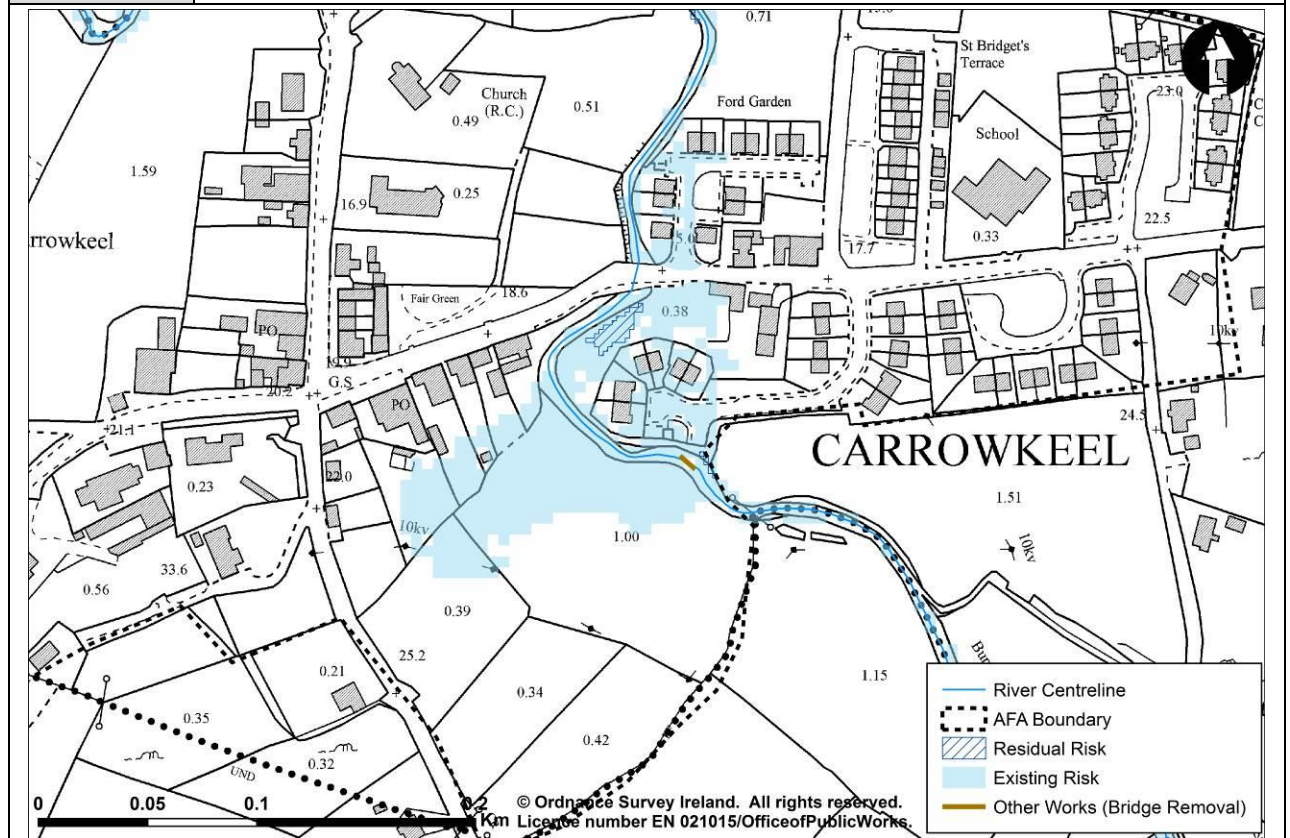
Adaptability to Potential Future Changes

Glenties AFA is considered to be at moderate vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes
<p>A public consultation for Glenties AFA Options was held on 01/03/2016 (combined with Dungloe), 1 member of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>
Other Issues / Conclusions
<p>One measure was identified for Glenties AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided additional information which has been noted for project-level assessment. In Glenties there is reported to be an Irish Water site that could not be found and so will require more exploration at project-level assessment in order to define the exact extent of the site that may benefit from OPW works. None of the submissions resulted in a change of the preferred measure.</p>

G.12 Kerrykeel AFA

River Basin	North Western	AFA	Kerrykeel AFA
Measure	Progress the development of a Flood Relief Scheme for Kerrykeel AFA		
Code	GBNIIENW-01-IE-AFA-380594-1201-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Kerrykeel AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	2.89	1.0	There are 12 ground floor properties and there are no additional upper floor properties benefiting with this option in place.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting with this option in place.
1.b.i	3.75	1.0	There is 1 social infrastructure/amenity site benefiting with this option in place.
1.b.ii	1.92	1.0	There is 1 commercial property benefiting with this option in place.
2.a	2.30	1.0	With this option in place the annual average damages have been reduced from €4,472.1 to €2,410.72.
2.b	2.07	3.6	There are 8 transport links benefiting with this option in place.

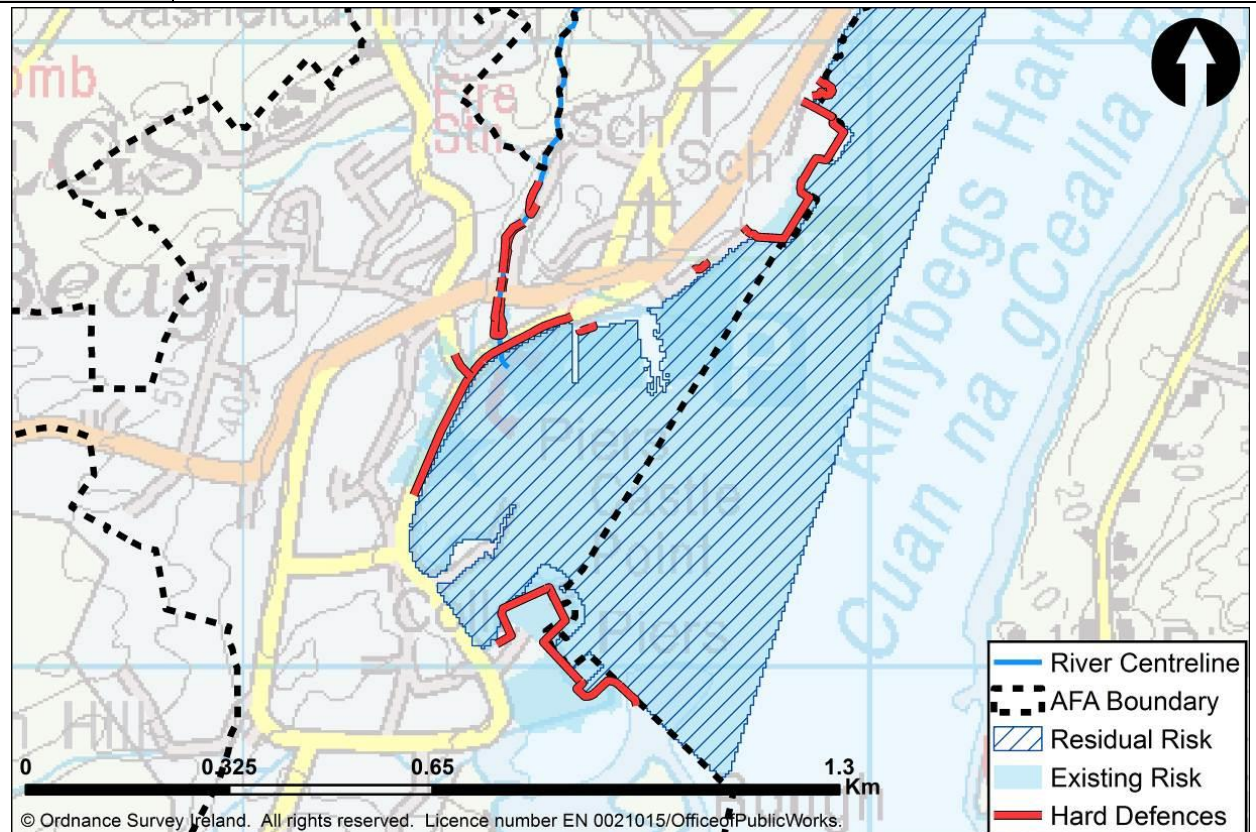
2.c	0.00	1.0	<i>There are no additional utilities benefiting with this option in place.</i>
2.d	0.00	2.0	<i>No significant difference between flood extents with option in place.</i>
3.a	-1.00	5.0	<i>Potential for short term construction impacts from bridge removal and intermittent operational impacts from increased flows during fluvial flooding. Waterbody treated as sensitive as high status 500m upstream and RPA site approx. 1.2km downstream. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Reduced flood risk for the 1% AEP event. Removal of artificial feature from channel.</i>
3.b	-1.00	4.0	<i>Potential for short term, indirect, downstream impacts from sedimentation during works of bridge removal and intermittent operational impacts from increased flows during fluvial flooding, to Mulroy Bay SAC 1.2km downstream. Impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-1.00	3.0	<i>Potential for short term construction impacts from bridge removal and intermittent operational impacts from increased flows during fluvial flooding, 1.2km upstream of the Carlan Isles (Mulroy Bay) pNHA and the Mulroy Bay Marine Protected Area. Direct loss of local, undesigned flora and fauna that may re-establish following works. Removal of artificial feature from channel. No direct impacts on national, regional or local designated sites. Impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.d	-1.00	5.0	<i>Waterbody treated as non-sensitive to fisheries, however upstream of sensitive Mulroy Bay. Angling activity appears limited on Burnside River. Mulroy Bay aquaculture 1.2km downstream. Short term minor impact to fisheries from sedimentation during construction. Impacts could be mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-1.00	3.0	<i>No specific landscape protection, local importance only. Construction phase impacts from removal of structure from the river. No impacts to overall landscape character.</i>
3.f.i	0.00	1.0	<i>No effects on architectural heritage features.</i>
3.f.ii	0.00	1.0	<i>No effects on archaeological heritage features.</i>
4.a	5.00	5.0	<i>Option consists of structure removal, therefore no operational risk.</i>
4.b	3.00	5.0	<i>The following hazards have been identified: Working near water, Heavy plant and machinery</i>
4.c	1.00	5.0	<i>Option is adaptable only at significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
31.56		0.03	1017.48
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	0	12	N/A
Commercial	0	1	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
0.19	0.03	0.09	2.84
Environmental Assessments			
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and a commercial property, transport links and a social infrastructure/amenity site in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.</p> <p>As the proposed works will be located adjacent to and upstream of Mulroy Bay SAC, and upstream of Greer's Isle SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the setting back of hard defences from the watercourse, and avoidance of in-stream works, • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, • and appropriate surveys of habitats and species. <p>(see Section 6.6.3: timing to avoid disturbance of overwintering birds, specific sediment control measures for sensitive areas, surveys incl. habitats, otter, birds).</p>			
Adaptability to Potential Future Changes			
<p>Kerrykeel AFA is considered to be at low vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>			
Public Consultation Outcomes			
<p>A public consultation for Kerrykeel AFA Options was held on 02/03/2016 (combined with Ramelton, Rathmullan, Downings and Dunfanaghy) 9 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>			

Other Issues / Conclusions
<p>One measure was identified for Kerrykeel AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.</p>

G.13 Killybegs AFA

River Basin	North Western	AFA	Killybegs AFA
Measure	Progress the development of a Flood Relief Scheme for Killybegs AFA		
Code	GBNIIENW-01-IE-AFA-370585-1301-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Killybegs AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.96	5.0	There is a combined number of 45 ground floor properties and there are 12 upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	4.93	5.0	There is a combined number of 2 social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.ii	4.95	5.0	There is a combined number of 61 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.

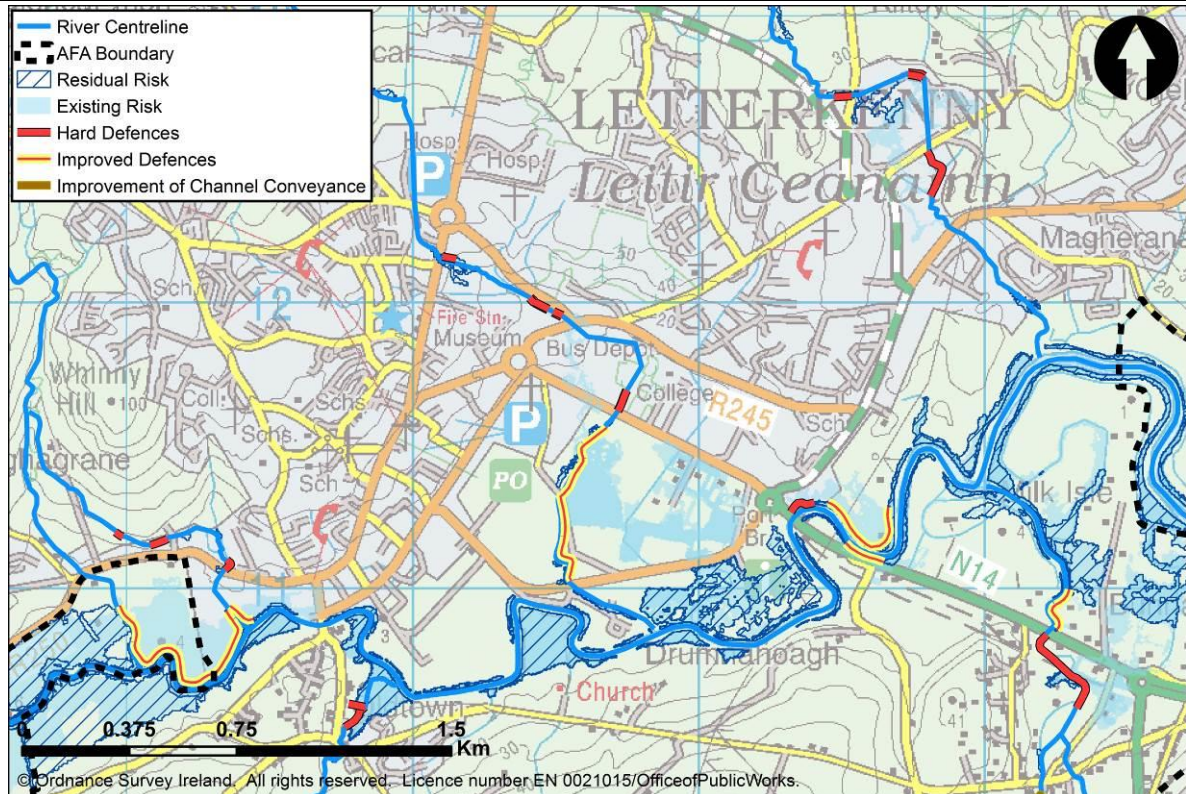
2.a	4.87	5.0	<i>With this option in place the annual average damages have been reduced from €1,134,993.35 to €28,982.46.</i>
2.b	4.78	5.0	<i>There is a combined number of 2 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.00	1.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	0.00	2.0	<i>No effect on agricultural land.</i>
3.a	-2.00	5.0	<i>Short term construction phase impacts adjacent to sensitive waterbody of Killybegs Harbour. Mainly on bank and on land works from road raising and creation of defences. Reduced risk of flooding.</i>
3.b	0.00	3.0	<i>Unlikely to be any impacts on existing SAC, SPA or Ramsar sites as a result of on bank and on land works from road raising and creation of defences.</i>
3.c	-1.00	4.0	<i>Direct loss of local, undesignated flora and fauna that may re-establish following works. Much of the area already modified. Slight potential for indirect sedimentation impacts in the harbour waterbody during construction that could impact fish passage. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.d	-2.00	5.0	<i>Potential for indirect sedimentation impacts in the sensitive waterbody during construction that could impact fisheries. Much of the area for development already modified. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-2.00	2.0	<i>Mainly short term construction phase impacts on area that is already heavily modified. Potential for impacts on the seascape with road raising and addition of defences along the harbour front. Local permanent impacts on views in non-sensitive area.</i>
3.f.i	0.00	2.0	<i>No effects on architectural features.</i>
3.f.ii	0.00	3.0	<i>No effects on archaeological features.</i>
4.a	5.00	5.0	<i>1. Option is adaptable only at significant cost</i>
4.b	2.00	5.0	<i>The following hazards have been identified: Working near water (construction), Working near water (O&M), Use of heavy machinery (construction)</i>
4.c	1.00	5.0	<i>Option is adaptable only at significant cost</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
1546.56		8.41	183.85
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	11 Fluvial 11 Coastal 1 0 Coastal 2	13 Fluvial 16 Coastal 1 0 Coastal 2	N/A
Commercial	8 Fluvial 10 Coastal 1 0 Coastal 2	11 Fluvial 24 Coastal 1 5 Coastal 2	N/A

Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
38.78	8.41	13.28	1.58
Environmental Assessments			
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.</p> <p>There are no European sites with any identifiable potential impact pathway arising from the proposed measures; therefore Appropriate Assessment was not required.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the setting back of hard defences from the watercourse, and avoidance of in-stream works, • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, • and appropriate surveys of habitats and species. <p>(see Section 6.6.3).</p>			
Adaptability to Potential Future Changes			
<p>Killybegs AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the hard defences (with heights up to 3m) and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>			
Public Consultation Outcomes			
<p>A public consultation for Killybegs AFA Options was held on 14/03/2016 (combined with Donegal, Ardara, Bundoran and Tullaghan), 19 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>			

Other Issues / Conclusions
<p>One measure was identified for Killybegs AFA as presented in the Preliminary Options Report; consequently this is the preferred measure.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.</p>

G.14 Letterkenny AFA

River Basin	North Western	AFA	Letterkenny AFA
Measure	Progress the development of a Flood Relief Scheme for Letterkenny AFA		
Code	GBNIIENW-01-IE-AFA-390607-1401-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Letterkenny AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	3.98	2.6	There is a combined number of 18 ground floor properties and there are 12 upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.00	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	2.80	1.9	There is a combined number of 7 social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.ii	3.48	3.8	There is a combined number of 49 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.

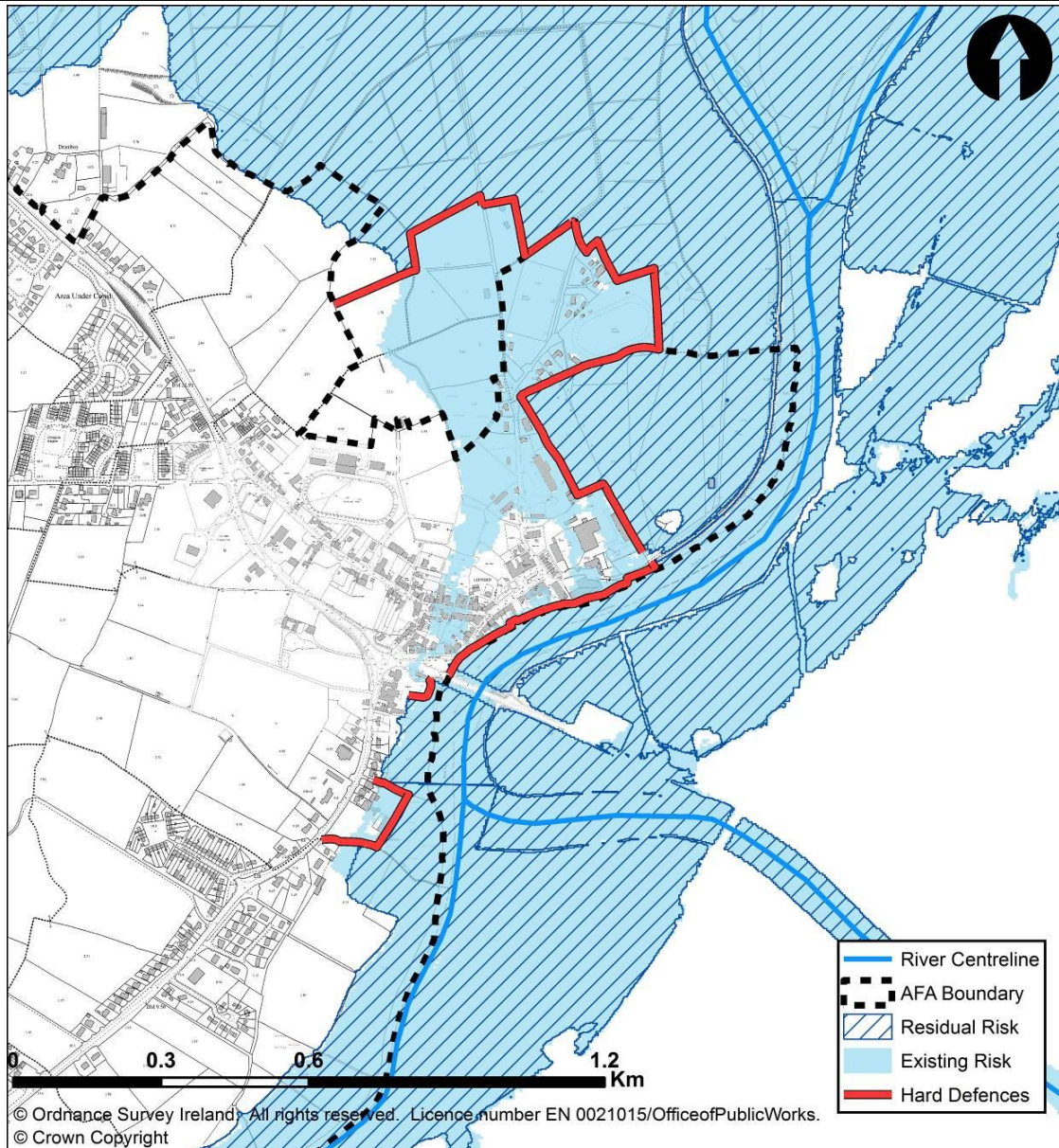
2.a	3.17	5.0	<i>With this option in place the annual average damages have been reduced from €1,343,300 to €492,210.</i>
2.b	2.43	5.0	<i>There is a combined number of 15 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.00	1.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	1.00	2.0	<i>This FRM option leads to a slight reduction in the total area of agricultural land subject to flooding.</i>
3.a	-2.00	5.0	<i>Augmentation / rehabilitation of existing defences adjacent to sensitive waterbodies. Construction of new hard defences adjacent to, and replacement of footbridge on, non-sensitive waterbodies, upstream of sensitive waterbodies. Potential for in stream and on bank works. Potential for indirect downstream sedimentation impacts during construction. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Reduced flood risk for the 1% AEP event.</i>
3.b	-3.00	4.0	<i>Potential for direct disturbance impacts to Lough Swilly SAC from construction of and rehabilitation of walls and embankments adjacent to and upstream of the River Swilly and Lough Swilly. Potential for small area of direct footprint impacts from augmentation works. Potential for short term, indirect, downstream impacts from sedimentation during works to the Lough Swilly SAC and SPA. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-3.00	4.0	<i>Potential for small area of direct footprint impacts in Lough Swilly pNHA from augmentation works. Direct loss of local, undesignated flora and fauna that may re-establish following works in other construction areas. Some areas for defences already modified. Footbridge to be replaced in already modified area. Potential for indirect sedimentation impacts during construction to the Lough Swilly pNHA . Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.d	-4.00	5.0	<i>Potential for direct disturbance impacts from construction and augmentation of walls and embankments adjacent to / set back from, and upstream of, the sensitive River Swilly salmonid waterbody. Potential for short term, indirect, downstream impacts to fisheries and fish passage from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-2.00	3.0	<i>Construction of and rehabilitation of walls and embankments in moderate sensitivity landscapes, prior to establishment of screening. Impacts mainly on those to be protected.</i>
3.f.i	1.00	4.0	<i>Protection to 2 NIAH designated bridges at Drumnaoagh from the 0.5% AEP coastal event.</i>
3.f.ii	0.00	3.0	<i>Protection to 1 monument record (enclosure) from the 1% AEP fluvial event, however appears to be developed upon already.</i>
4.a	4.00	5.0	<i>Regular monitoring and intermittent maintenance required</i>

4.b	2.00	5.0	The following hazards have been identified: Working near water (construction), Working near water (O&M), Heavy plant & machinery (construction)	
4.c	0.00	5.0	Option is not adaptable	
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio	
307.37		4.23	72.70	
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event	
Residential	1 (Fluvial) 1(Coastal 1)	11 (Fluvial) 4 (Coastal 1)	N/A	
Commercial	0 (Fluvial) 0 (Coastal 1)	21 (Fluvial) 15 (Coastal 1)	N/A	
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions				
Area NPVd (uncapped)		Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
35.07		4.23	20.69	4.89
Environmental Assessments				
The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, agricultural land, transport links and social infrastructure/amenity sites in the medium and long term.				
The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.				
As the proposed works will be located adjacent to and upstream of Lough Swilly SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.				
The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:				
<ul style="list-style-type: none">the setting back of hard defences from the watercourse, and avoidance of in-stream works,the appropriate timing of construction work to minimise disturbance of species,effective sediment control measures to protect water quality,and appropriate surveys of habitats and species.				
(see Section 6.6.3: timing to avoid disturbance of overwintering birds, specific sediment control measures for sensitive areas, surveys incl. habitats, otter, birds).				

Adaptability to Potential Future Changes
<p>Letterkenny AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing culvert and channel capacity, increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>
Public Consultation Outcomes
<p>A public consultation for Letterkenny AFA Options was held on 15/03/2016 (combined with Newton Cunningham), 3 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>There is an overall concern for the height and aesthetics of the hard defences in particular locations. Consequently Improvement of Channel Conveyance would be preferred to minimize visual impacts.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>
Other Issues / Conclusions
<p>Of the four potentially viable measures presented in the Preliminary Options Report the preferred measure had the highest benefit cost ratio compared to other potential measures.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided additional information which has been noted for project-level assessment.</p> <ul style="list-style-type: none"> • Additional Information was received regarding the catchment of the Glencar requesting that urban drainage works in this area be included in the final preferred measure. The catchment of the Glencar is 0.73km² and is therefore outside the remit of the CFRAM analysis. The Plans addresses the sources of flooding identified as being potentially significant in one or more communities (AFAs), as determined through the Preliminary Flood Risk Assessment. The sources of flooding addressed for each of the AFAs is indicated in Table 3.1 of the Plans. The Plan does not address sources of flood risk within the AFAs that were not deemed under the PFRA to have been significant for those AFAs. The area in question was not identified as being at risk during the PFRA. The local authorities have responsibility for urban storm water drainage, and for addressing any localised problems associated with the urban storm water drainage network. • In Ballymacool, Letterkenny there is reported to be an Irish Water site that could not be found and so will require more exploration at project-level assessment in order to define the exact extent of the site that may benefit from OPW works. <p>None of the submissions resulted in a change of the preferred measure.</p>

G.15 Lifford AFA

River Basin	North Western	AFA	Lifford AFA
Measure	Progress the development of a Flood Relief Scheme for Lifford AFA		
Code	GBNIIENW-01-IE-AFA-010008-1501-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Lifford, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes			
Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.35	4.7	<i>There are 41 ground floor properties and there are 2 upper floor properties benefiting with this option in place.</i>
1.a.ii	4.50	5.0	<i>There is 1 highly vulnerable property benefiting with this option in place.</i>
1.b.i	3.68	5.0	<i>There are 4 social infrastructure/amenity sites benefiting with this option in place.</i>
1.b.ii	4.14	5.0	<i>There are 31 commercial properties benefiting with this option in place.</i>
2.a	4.18	5.0	<i>With this option in place the annual average damages have been reduced from €712498 to €116891.</i>
2.b	4.41	5.0	<i>There are 6 transport links benefiting with this option in place.</i>
2.c	3.75	5.0	<i>There is 1 utility benefiting with this option in place.</i>
2.d	1.00	4.0	<i>Small amount of agricultural land protected to the west of the Roughan Road.</i>
3.a	-2.00	5.0	<i>Construction of walls and embankments mostly well set back from sensitive River Finn / Foyle waterbody. Rehabilitation of existing defences and infrastructure beside River Finn /Foyle. Potential for in-stream and on-bank works. Potential for indirect downstream sedimentation impacts during construction. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Reduced flood risk for the 1% AEP event.</i>
3.b	-3.00	4.0	<i>Potential for direct disturbance impacts to River Finn SAC / River Foyle and Tribs SAC from construction of and rehabilitation of walls and embankments set back from the River Finn / Foyle. Potential for direct footprint impacts if defences not set back from SAC. Potential for short term, indirect, downstream impacts from sedimentation during works to the River Finn SAC / River Foyle and Tribs SAC. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-3.00	3.0	<i>Direct loss of local, undesignated flora and fauna that may re-establish following works. Some areas for defences already modified. No direct impacts on national, regional or local designated sites. Potential for indirect sedimentation impacts during construction to the River Foyle and Tributaries ASSI. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.d	-4.00	5.0	<i>Potential for direct disturbance impacts from construction and augmentation of walls and embankments adjacent to / set back from the sensitive River Finn / Foyle salmonid waterbody. Potential for short term, indirect, downstream impacts to fisheries and fish passage from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-1.00	3.0	<i>Construction of and rehabilitation of walls and embankments in low sensitivity / already impacted landscapes, prior to establishment of screening. Impacts mainly on those to be protected.</i>

3.f.i	2.00	4.0	Protection to 4 NIAH buildings at The Diamond and Station Road, including the Lifford Halt railway station and the old courthouse, from the 1% AEP fluvial event.
3.f.ii	0.00	3.0	Potential for physical impacts on the site of the old town defences from construction of flood walls, although no longer existing, however archaeological material may be discovered in excavation work in this area. Increased protection to one monument, Bullaun Stone, from the 1% AEP fluvial event.
4.a	4.00	5.0	No reliance on intervention but some monitoring and maintenance needed of embankments
4.b	2.00	5.0	The following hazards have been identified: Working near water, Maintenance near water, Heavy plant and machinery
4.c	0.00	5.0	Option is not adaptable
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
1704.94		5.94	286.89
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	3	41	N/A
Commercial	4	37	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
21.73	5.94	11.32	1.91

Environmental Assessments

The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, agricultural land, transport links and social infrastructure/amenity sites in the medium and long term.

The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences.

As the proposed works will be located immediately adjacent to the River Finn SAC and River Foyle and Tributaries SAC (UK), with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.

The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:

- the setting back of hard defences from designated site boundaries, and avoidance of in-stream works,
- the appropriate timing of construction work to minimise disturbance of species,
- effective sediment control measures to protect water quality,
- and appropriate surveys of habitats and species.

(see Section 6.6.3: timing to avoid disturbance of salmon spawning seasons, specific sediment control measures for sensitive areas, surveys incl. habitat, salmon, otter).

Adaptability to Potential Future Changes

Lifford AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the hard defences, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.

Public Consultation Outcomes

A public consultation for Lifford AFA Options was held on 15/03/2016 (combined with Castlefinn, Killygordon and Convoy), 32 members of the public attended.

A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.

Many attendees have experienced flooding during winter 2015/16 and pointed to the fact that a lot of the flooding emanates from drainage but is driven by high water levels in the Finn/Foyle/Deele. Any solution must allow for drainage works to ensure that this does not result in a residual flood risk. Geomorphological changes along the Finn/Foyle were reported to have been exacerbated by the recent flooding event. In general those who attended were in agreement with the hazard and proposed solutions with their main concern centring round the need for a solution to be put in place as soon as possible. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.

Other Issues / Conclusions

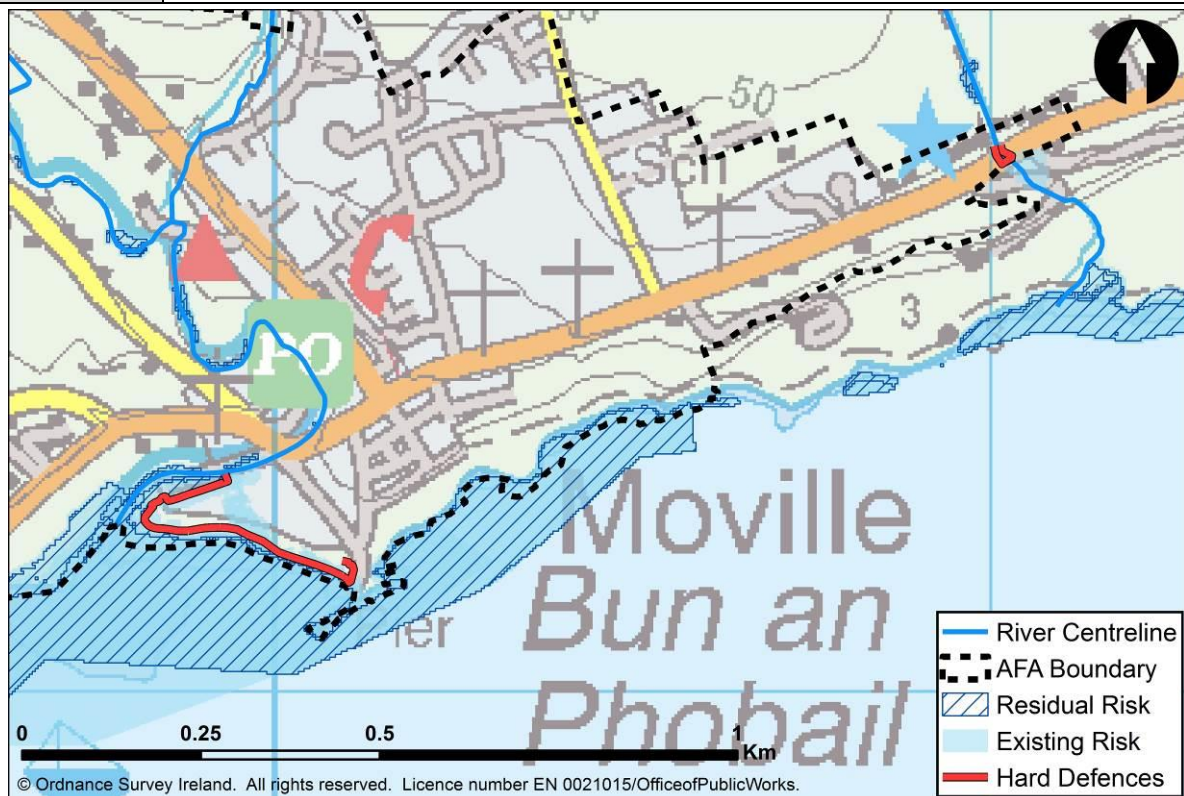
One measure was identified for Lifford AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

Overall the preferred measure has a positive technical, social, economic score and the benefit – cost ratio is above unity.

Consultations and submissions provided additional information which has been noted for project-level assessment. For any further development of preferred measures to the project-level assessment stage the OPW should liaise with the Rivers Agency (Northern Ireland) regional office and DFI Rivers staff who have a direct interest in the management of flood risk in the North-Western and Neagh-Bann River Basins. None of the submissions resulted in a change of the preferred measure.

G.16 Movice AFA

River Basin	North Western	AFA	Movice AFA
Measure	Undertake a Detailed Assessment of the Costs of the Potential Measure for Movice AFA		
Code	GBNIIENW-01-IE-AFA-400621-1601-M25		
Description	Undertake a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.63	1.8	There is a combined number of 48 ground floor properties and no additional upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	0.00	1.0	There are no additional social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.ii	4.75	1.0	There is a combined number of 2 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.
2.a	4.12	1.0	With this option in place the annual average damages have been reduced from €20,527 to €3,631.

2.b	4.80	1.3	There is a combined number of 2 transport links benefiting from the option's SoP from fluvial and coastal flood sources.
2.c	0.00	1.0	There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.
2.d	0.00	2.0	No change
3.a	-1.00	5.0	Slight potential for construction phase impacts from construction of walls and embankments set back from non-sensitive waterbodies.
3.b	0.00	2.0	No impacts on existing SAC, SPA or Ramsar sites as a result of FRM method.
3.c	-1.00	2.0	Potential for direct, localised loss of flora and displacement of fauna in footprint of works. No impact on national, regional or local designations.
3.d	-1.00	3.0	Slight potential for short term, indirect, localised, downstream impacts to fishing activity in Lough Foyle from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.
3.e	-3.00	4.0	Potential for temporary and permanent impacts on local views from construction of walls and embankments. Impacts mainly on those to be protected, however is sensitive landscape / seascape.
3.f.i	2.00	4.0	Potential for impacts on the setting of the Ark (House) NIAH building, however increased protection for it and 2 other NIAH buildings from severe flooding.
3.f.ii	0.00	2.0	No effects on archaeological features. No archaeological heritage features in proximity to proposed FRM Methods.
4.a	5.00	5.0	No operational risk, i.e., no reliance on systems or intervention, with limited monitoring / maintenance requirements
4.b	2.00	5.0	The following hazards have been identified: Working near water (Construction), Working near water (O&M), Use of heavy machinery (O&M)
4.c	2.00	5.0	Option is adaptable only at moderate to significant cost
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
220.32		0.72	305.39
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	0 (Fluvial) 0 (Coastal 1) 1 (Coastal 2)	1 (Fluvial) 17 (Coastal 1) 8 (Coastal 2)	N/A
Commercial	0 (Fluvial) 0 (Coastal 1) 1 (Coastal 2)	0 (Fluvial) 0 (Coastal 1) 1 (Coastal 2)	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
0.86	0.72	0.71	0.98

Environmental Assessments
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, NIAH buildings, and transport links in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the medium to long term.</p> <p>As the proposed works will be located in the potential zone of influence of Lough Foyle SPA, with the potential for direct impacts on the qualifying species, Appropriate Assessment was required. The direct impacts relate to the disturbance of protected bird species during the construction phase.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none"> • the appropriate timing of construction work to minimise disturbance of species, • effective sediment control measures to protect water quality, • and appropriate surveys of habitats and species. <p>(see Section 6.6.3: timing to avoid disturbance of overwintering birds, bird surveys).</p>
Adaptability to Potential Future Changes
<p>Moville AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>
Public Consultation Outcomes
<p>A public consultation for Moville AFA Options was held on 03/03/2016 (combined with Carndonagh, Malin and Clonmany), 15 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>

Other Issues / Conclusions

One measure was identified for Movable AFA as presented in the Preliminary Options Report, consequently this is the preferred measure.

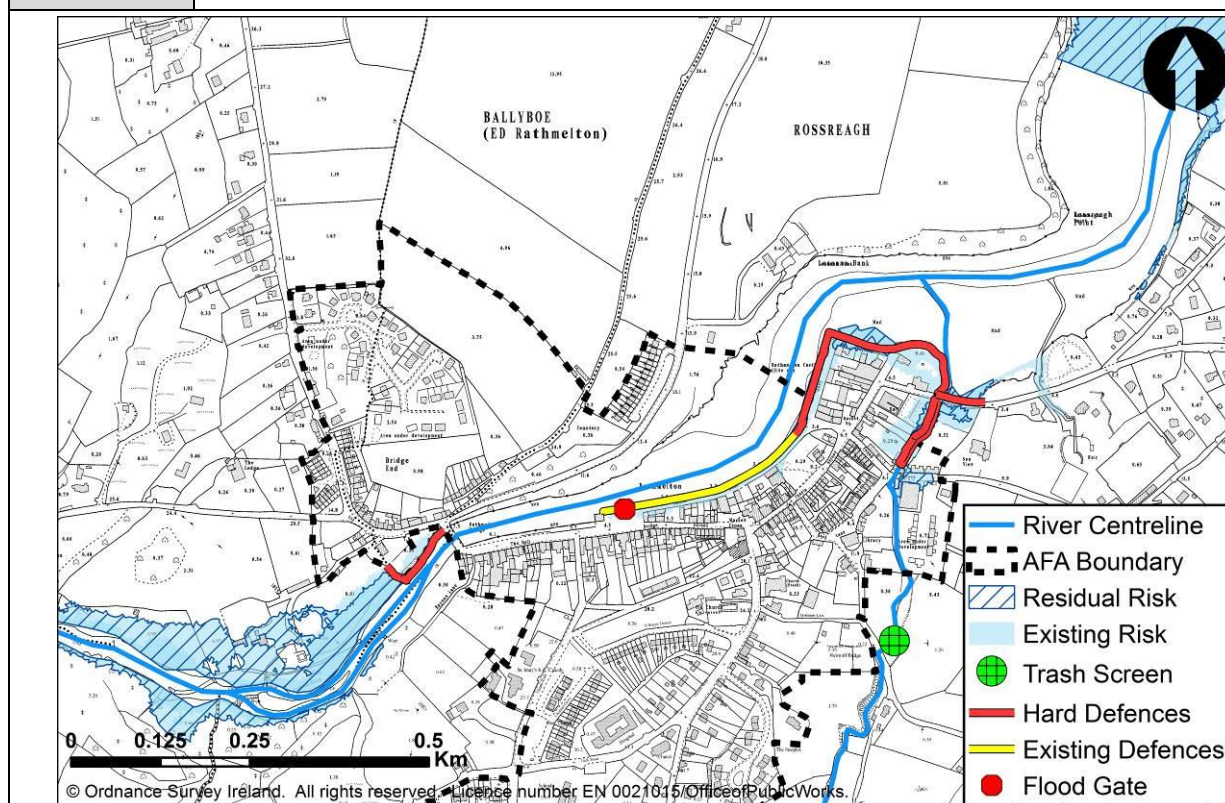
Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score and the benefit – cost ratio is below unity. It is therefore recommended that the preferred measure for Movable progress to include a detailed assessment of the costs to determine if an economically viable measure may exist that could justify the progression to full project-level assessment.

Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.

G.17 Ramelton AFA

It should be noted that the risk in Ramelton AFA was evaluated due to a known high risk of culvert blockage

River Basin	North Western	AFA	Ramelton AFA
Measure	Progress the development of a Flood Relief Scheme for Ramelton AFA		
Code	GBNIIENW-01-IE-AFA-390611-1701-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Ramelton AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.94	5.0	There is a combined number of 37 ground floor properties and there are 2 upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	4.53	1.9	There is a combined number of 4 social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.

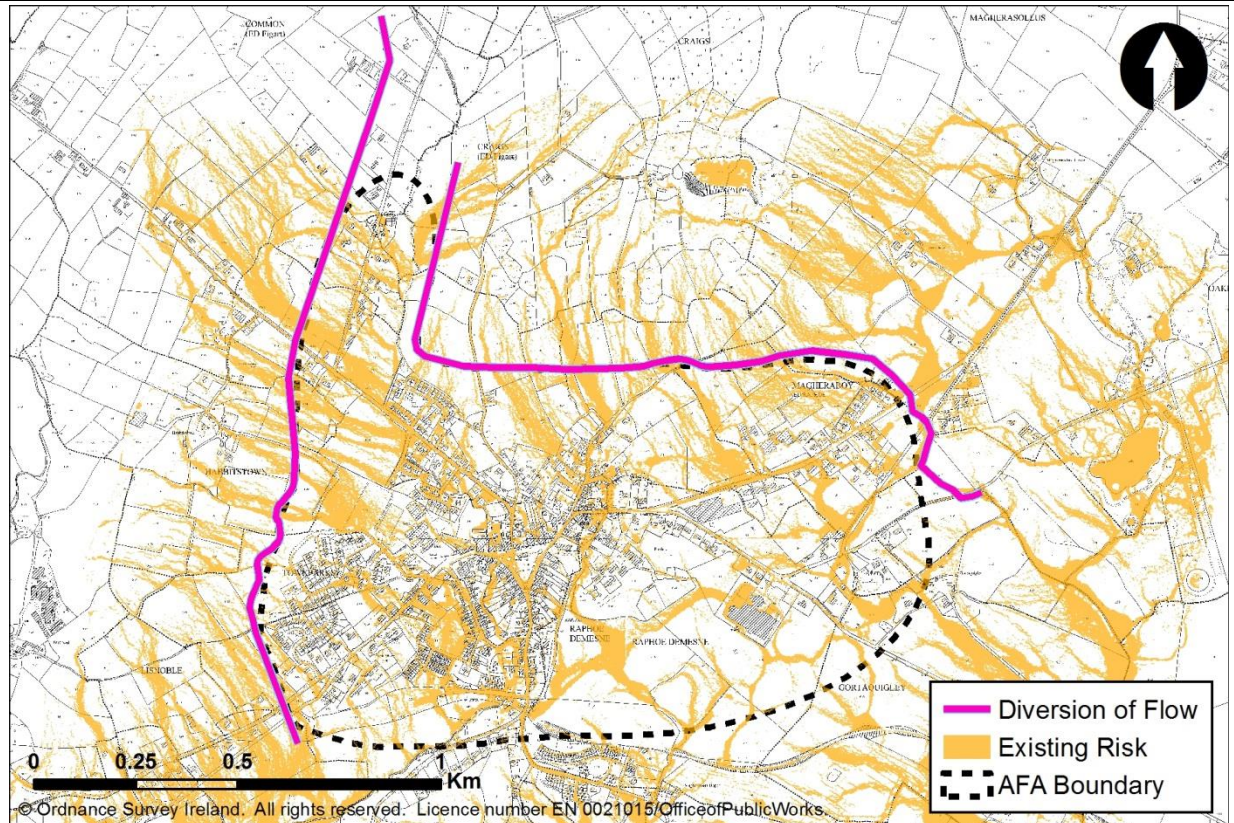
1.b.ii	4.94	4.6	<i>There is a combined number of 20 commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.a	4.88	4.1	<i>With this option in place the annual average damages have been reduced from €310,940 to €7,586.</i>
2.b	5.00	5.0	<i>There is a combined number of 10 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.00	1.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	-1.00	1.0	<i>Minimal increase rural land flooding</i>
3.a	-2.00	5.0	<i>Construction phase impacts adjacent to and within sensitive waterbodies of Swilly Estuary and Leannan River. Construction and augmentation of walls and embankments adjacent to Swilly Estuary and Leannan River. Trash screen in undesignated non-sensitive Ramelton River.</i>
3.b	-4.00	5.0	<i>Potential for direct construction phase impacts to the Lough Swilly SAC and SPA, and the Leannan River SAC from the construction of walls and embankments, set back from the waterbodies where possible. Potential for direct temporary loss of habitat and displacement of species from works area. Potential for short term, indirect, downstream impacts from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.c	-3.00	4.0	<i>Potential for direct construction phase impacts to the Lough Swilly pNHA and the Lough Fern pNHA from the construction of walls and embankments, set back from the waterbodies where possible. Potential for direct temporary loss of habitat and displacement of species from works area. Potential for short term, indirect, downstream impacts from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works. Slightly reduced works footprint with this option.</i>
3.d	-4.00	5.0	<i>Potential for direct construction phase impacts from construction and augmentation of walls and embankments adjacent to and within the sensitive Lough Swilly and Leannan River salmonid waterbodies. Potential for short term, indirect, downstream impacts to fisheries and aquaculture from sedimentation during works. Impacts could be mostly mitigated for with good site practice, effective planning and timing of works.</i>
3.e	-3.00	4.0	<i>Construction phase impacts and permanent impacts on local landscape from walls and embankments along Swilly Estuary and Leannan River at Ramelton. Potential to impact on the historic setting of the town with increased and new walls and embankments. Slightly reduced lengths of walls with this option, so slightly reduced, local visual impacts.</i>
3.f.i	0.00	3.0	<i>Potential for impacts on the setting of this historic town from walls and embankments, however also increased protection to the town from flooding.</i>
3.f.ii	0.00	3.0	<i>No effects on archaeological heritage features.</i>
4.a	2.00	5.0	<i>Low risk</i>

4.b	2.00	5.0	The following hazards have been identified: Working near water (construction), Working near water (O&M), Working with heavy plant and machinery	
4.c	1.00	5.0	Option is adaptable only at significant cost.	
Total MCA-Benefit Score		Option Cost (€millions)		MCA-Benefit Score / Cost Ratio
823.46		6.79		121.25
No Properties Benefitting		10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential		6 (Fluvial) 5 (Coastal 1)	10 (Fluvial) 14 (Coastal 1)	N/A
Commercial		1 (Fluvial) 2 (Coastal 1)	2 (Fluvial) 11 (Coastal 1)	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions				
Area NPVd (uncapped)		Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
13.77		6.79	6.94	1.02
Environmental Assessments				
<p>The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties and commercial properties, transport links and social infrastructure/amenity sites in the medium and long term.</p> <p>The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and visual impacts on the historic setting of the town in the medium to long term.</p> <p>As the proposed works will be located adjacent to and upstream of Lough Swilly SAC and SPA, and adjacent to and downstream of Leannan River SAC, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.</p> <p>The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:</p> <ul style="list-style-type: none">the setting back of hard defences from designated site boundaries, and avoidance of in-stream works,the appropriate timing of construction work to minimise disturbance of species,effective sediment control measures to protect water quality,and appropriate surveys of habitats and species. <p>(see Section 6.6.3: timing to avoid disturbance of overwintering birds, specific sediment control measures for sensitive areas, surveys incl. habitat, otter, birds).</p>				

Adaptability to Potential Future Changes
<p>Ramelton AFA is considered to be at high vulnerability from the mid-range future scenario and high vulnerability from the high end future scenario. Adaptation of the preferred measure would require increasing the size of the trash screen and increasing the height of the hard defences and extending their length, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>
Public Consultation Outcomes
<p>A public consultation for Ramelton AFA Options was held on 02/03/2016 (combined with Rathmullan, Kerrykeel, Downings and Dunfanaghy), 9 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>It was suggested the built heritage of Ramelton AFA was important and should be a reason to prioritise the works. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>
Other Issues / Conclusions
<p>Of the two potentially viable measures presented in the Preliminary Options Report the preferred measure as described above scored better socially, environmentally and has a higher benefit cost ratio than the other potential measure.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.</p> <p>The trash screen which is included in the preferred measure would need to have a regular maintenance regime in operation for it to be an effective FRM measure with the ownership of its operation clearly established.</p>

G.18 Raphoe AFA

River Basin	North Western	AFA	Raphoe AFA
Measure	Progress the development of a Flood Relief Scheme for Raphoe AFA		
Code	GBNIIENW-01-IE-AFA-400616-1801-M31		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Raphoe, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	3.0	1.0	<i>There is a combined number of 167 residential properties and there benefiting from the option's SoP from fluvial and pluvial sources.</i>
1.a.ii	0	1.0	<i>There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.</i>
1.b.i	0	1.0	<i>There are no infrastructure/amenity sites at risk from fluvial and pluvial flood sources.</i>
1.b.ii	2.0	3.0	<i>There is a combined number of 49 commercial properties benefiting from the option's SoP from fluvial and pluvial flood sources.</i>
1.c	0	2.0	<i>There are no social amenity sites (Sport fields) at risk</i>

2.a	1.0	5.0	<i>With this option in place the annual average damages have been reduced from €9.59m to €7.42m.</i>
2.b	1.0	2.0	<i>There is a combined number of 15 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.0	0.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	2.0	2.0	<i>There is a sizeable area at risk of local importance. Flow to be conveyed through channel on agricultural land, with total depth and storage of flood water on agricultural land reduced</i>
3.a	1.0	5.0	<i>Reduction in flooding will reduce input of contaminants from the urbanised town catchment which could have benefits for water status</i>
3.b	0.0	1.0	<i>No additional receptors are put at risk</i>
3.c	0.0	1.0	<i>No additional receptors are put at risk</i>
3.d.i	0.0	1.0	<i>No additional receptors are put at risk.</i>
3.d.ii	0.0	3.0	<i>No additional receptors are put at risk</i>
3.e.i	0.0	1.0	<i>No additional receptors are put at risk</i>
3.e.ii	0.0	1.0	<i>No additional receptors are put at risk</i>
3.f	-1.0	1.0	<i>Embankments will possibly have a negative impact on the landscape, although hard concrete defences have been avoided.</i>
3.g.i	0.0	2.0	<i>No additional receptors are put at risk.</i>
3.g.ii	0.0	2.0	<i>No additional receptors are put at risk.</i>
3.h	1.0	3.0	<i>There will be a reduction of sheet like runoff conveyed through agricultural land</i>
3.i	0.0	1.0	<i>No flood sensitive environmental receptors at risk</i>
4.a	4.00	5.0	<i>To perform successfully, this will rely on proper maintenance if embankment, involving grass cutting, removal of any blockages and maintaining hedges. Low level of operational risk</i>
4.b	4.00	5.0	<i>The following hazards have been identified: Working near water (construction), Working near water (O&M), Working with heavy plant and machinery, deep excavations, electrical work, restricted access</i>
4.c	0.00	5.0	<i>Option is adaptable at MRFS and HRFS with difficulty</i>
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio
420		0.895	472
No Properties Benefitting	10% AEP Event	1%/0.5% AEP Event	0.1% AEP Event
Residential	126	212	N/A
Commercial	35	64	N/A

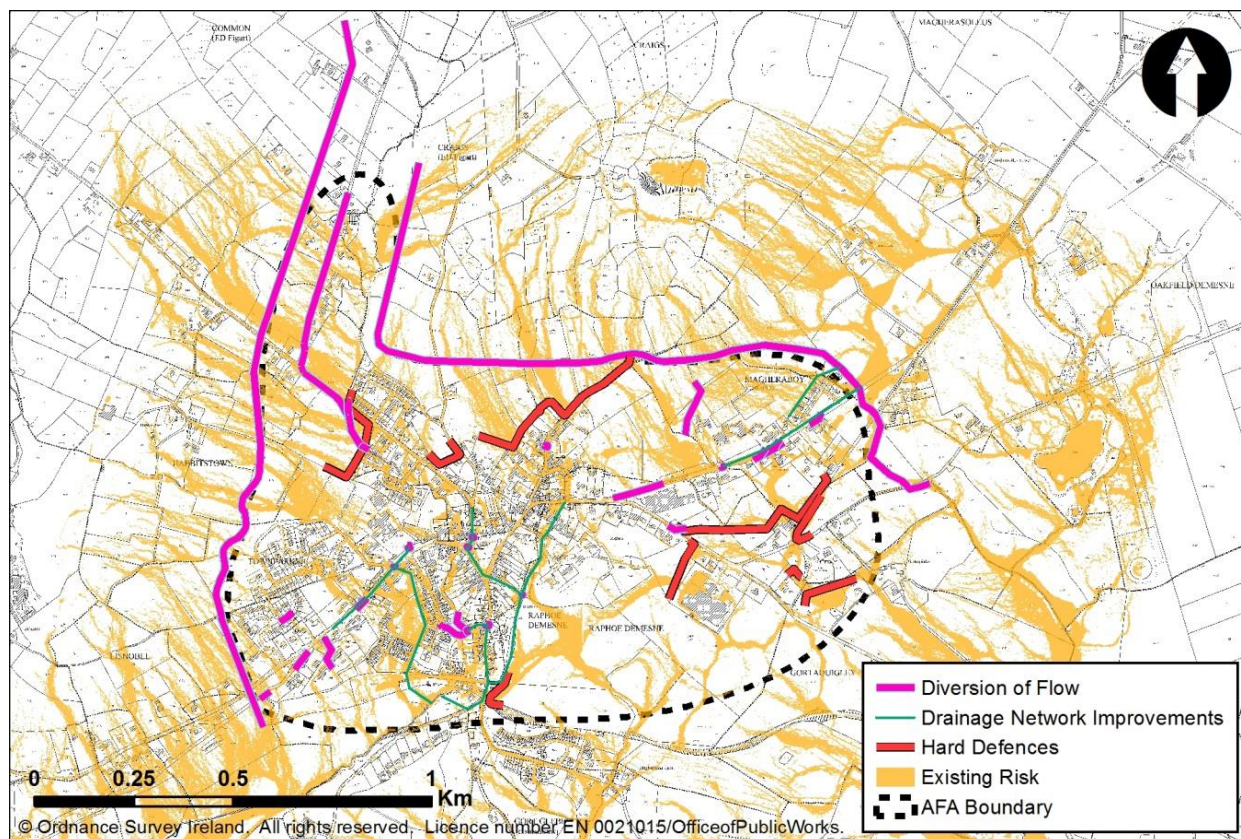
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions			
Area NPVd (uncapped)	Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
22.45	0.895	12.27	13.71
Environmental Assessments			
The potential for environmental impacts are mostly in the short term construction phase. There is the potential for negative impacts to visual amenity.			
Adaptability to Potential Future Changes			
Adaptation of the preferred measure would require the open channels to be modified to convey increased flow in the future and the size of the bridges to convey future flow should be considered in the project-level assessment stage, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.			
Public Consultation Outcomes			
Public consultation for Raphoe mapping took place in September 2013, elected members and members of the public that attended were shown the mapping and outline, high level, options were discussed.			
A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.			
The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.			

Other Issues / Conclusions

Of the three potentially viable measures available the preferred measure as described above scored better technically, economically, environmentally and had a higher benefit cost ratio compared to other potential measures.

Overall the preferred measure has a positive technical, social, economic and environmental/cultural score and the benefit – cost ratio is above unity.

It was reported that a significant residual risk would remain in Raphoe with the preferred measure in place due to rain falling behind the defences. A further study was therefore carried out to consider secondary measures that would provide the preferred SoP (1% AEP). The secondary measures consisted of hard defences, upstream storage, diversion of flow and overland floodway and associated drainage network improvements.



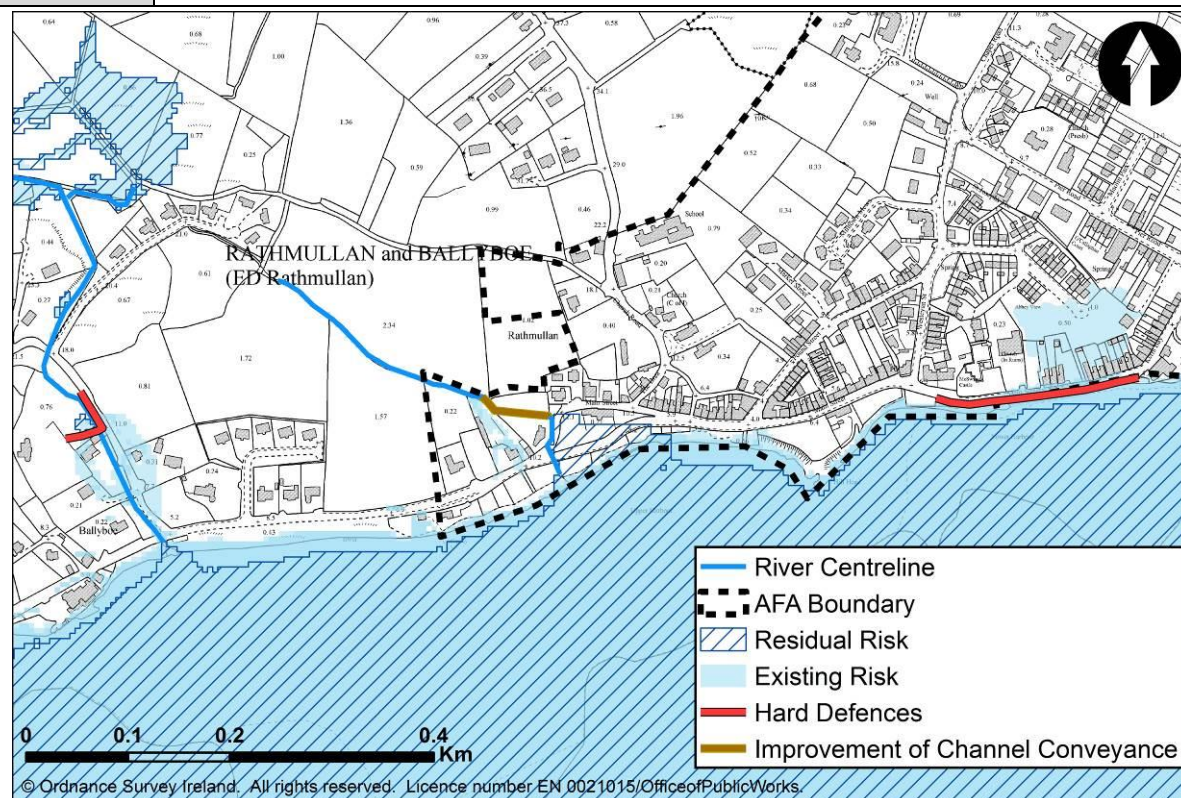
The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

The preferred measure will require refinement to incorporate the potential associated drainage network improvements. These are not included in this analysis as they are undergoing discussion and development at study level.

Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.

G.19 Rathmullan AFA

River Basin	North Western	AFA	Rathmullan AFA
Measure	Progress the development of a Flood Relief Scheme for Rathmullan AFA		
Code	GBNIIENW-01-IE-AFA-390613-1901-M33		
Description	Progress the project-level development and assessment of a Flood Relief Scheme for Rathmullan AFA, including environmental assessment as necessary and further public consultation, for refinement and preparation for planning / exhibition and, if and as appropriate, implementation.		



The works presented herein are not the final and definitive works. Potential flood relief works set out herein will need to be further developed at a local, project-level before exhibition or submission for planning approval (see Section 6.1 and 8.1).

MCA Appraisal Outcomes

Objective	Un-Weighted Score	Local Weighting	Comment
1.a.i	4.97	5.0	There is a combined number of 45 ground floor properties and no additional upper floor properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.a.ii	0.0	1.0	There are no additional highly vulnerable properties benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.i	0.00	1.0	There are no additional social infrastructure/amenity sites benefiting from the option's SoP from fluvial and coastal flood sources.
1.b.ii	0.0	1.0	There are no additional commercial properties benefiting from the option's SoP from fluvial and coastal flood sources.

2.a	4.94	4.3	<i>With this option in place the annual average damages have been reduced from €324,829.81 to €3,642.73.</i>
2.b	4.93	5.0	<i>There is a combined number of 7 transport links benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.c	0.00	1.0	<i>There are no additional utilities benefiting from the option's SoP from fluvial and coastal flood sources.</i>
2.d	0.00	2.0	<i>Minimal change in flood extents with option in place.</i>
3.a	-5.00	5.0	<i>Construction phase impacts of excavation and restoration of flood wall in and adjacent to Lough Swilly sensitive waterbody. Wall currently exists by Lough Swilly, however would likely need reconstructed. Potential for downstream sedimentation impacts during construction on Lough Swilly and Ballyboe, and from increasing conveyance / culvert replacement on the Millbrook. River defences to be set back from waterbody.</i>
3.b	-2.00	5.0	<i>Construction phase impacts of excavation and restoration of flood wall in and adjacent to Lough Swilly SAC and SPA. Wall currently exists by Lough Swilly, however would likely need reconstructed. Potential for downstream sedimentation impacts into the SAC and SPA during construction of walls, replacement of culvert and dredging. Impacts could be mitigated for with good working practices and good timing of works.</i>
3.c	-2.00	4.0	<i>Construction phase impacts of excavation and restoration of flood wall in and adjacent to Lough Swilly pNHA. Wall currently exists by Lough Swilly, however would likely need reconstructed. Potential for downstream sedimentation impacts into the pNHA during construction. Local, temporary and recurring loss of undesignated flora and fauna in footprint and vicinity of construction works / dredging and replacement of culvert. Impacts could be mitigated for with good working practices and good timing of works.</i>
3.d	-4.00	5.0	<i>Construction phase impacts of excavation and restoration of flood wall in and adjacent to Lough Swilly sensitive waterbody. Wall currently exists by Lough Swilly, however would likely need reconstructed. Potential for downstream sedimentation impacts during construction on Lough Swilly and Ballyboe, and from increasing conveyance / culvert replacement on the Millbrook. River defences to be set back from waterbody.</i>
3.e	-3.00	4.0	<i>Increase in height of permanent hard defences by Lough Swilly which will affect local views and seascape. Unlikely to impact the overall landscape as walls currently exist. Localised impacts on properties to be protected on the Ballyboe.</i>
3.f.i	0.00	3.0	<i>No effects on architectural heritage features.</i>
3.f.ii	1.00	2.0	<i>Flood protection provided to one monument from coastal flood wall.</i>
4.a	4.00	5.0	<i>Option includes fixed flood defence embankments and increased conveyance measures, Negligible operational risk, i.e., no reliance on systems or intervention, with more regular monitoring and intermittent, but potentially substantial, maintenance requirements</i>

4.b	2.00	5.0	The following hazards have been identified: Working near water, Maintenance near water, Heavy plant and machinery	
4.c	0.00	5.0	Option is not adaptable	
Total MCA-Benefit Score		Option Cost (€millions)	MCA-Benefit Score / Cost Ratio	
543.04		4.39	123.74	
No Properties Benefitting	10% AEP Event		1%/0.5% AEP Event	0.1% AEP Event
Residential	8 (Fluvial) 1 (Coastal 1) 13 (Coastal 2)		8 (Fluvial) 7 (Coastal 1) 13 (Coastal 2)	N/A
Commercial	0 (Fluvial) 0 (Coastal 1) 0 (Coastal 2)		0 (Fluvial) 0 (Coastal 1) 0 (Coastal 2)	N/A
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions				
Area NPVd (uncapped)		Option Cost	Option NPVb (capped)	Benefit - Cost Ratio
14.72		4.39	7.44	1.7
Environmental Assessments				
The preferred measure will deliver several key flood protection benefits; reducing risk to numerous local properties, a monument and transport links in the medium and long term.				
The Strategic Environmental Assessment identified a number of potential negative impacts associated with the preferred measures, but these are predominantly short term in nature. They include the potential for disturbance of the local community during construction of the hard defences, and short term sedimentation and water quality impacts. There is potential for recurring impacts on water quality and fisheries from dredging. There is also potential for disturbance or loss of habitats and/or species in the direct footprint of the hard defences, and minor visual impacts in the long term.				
As the proposed works will be located immediately adjacent to and upstream of Lough Swilly SAC and SPA, with the potential for direct and indirect impacts on the qualifying habitats and/or species, Appropriate Assessment was required. The direct impacts relate to the footprint of hard defences and disturbance of protected species, while the indirect impacts relate to the risk of increased sediment loads and associated nutrients to the water during the construction phase.				
The specific mitigation measures will be identified in detail at the project-level development stage of the proposed measure (i.e. the stage at which the final measure to be progressed will be determined), through the project-level EIA/AA, as necessary. However, at this stage of assessment, it is foreseen that the mitigation measures that are likely to be required will include the following:				
<ul style="list-style-type: none">the setting back of hard defences from designated site boundaries, and avoidance of in-stream works,the appropriate timing of construction work to minimise disturbance of species,effective sediment control measures to protect water quality,and appropriate surveys of habitats and species.				
(see Section 6.6.3: timing to avoid disturbance of overwintering birds, specific sediment control measures for sensitive areas, surveys incl. habitat, otter, birds).				

Adaptability to Potential Future Changes
<p>Rathmullan AFA is considered to be at low vulnerability from the mid-range future scenario and moderate vulnerability from the high end future scenario. Adaptation of the preferred measure would require upgrading a culvert capacity and increasing the height of the hard defences and extending their length. However this would require a wall being raised to over 3m high and is deemed unacceptable due to the residual risk and social impact, other measures including Natural Flood Risk Management Measures may be adopted to monitor and/or adapt the scheme. It should be noted that the cyclical Floods Directive (FD) process will mean that the need for action will be reviewed on a 6-year cycle, which would be the trigger to activate any potential future works based on ongoing assessment of the hazard/risk.</p>
Public Consultation Outcomes
<p>A public consultation for Rathmullan AFA Options was held on 02/03/2016 (combined with Ramelton, Kerrykeel, Downings and Dunfanaghy), 9 members of the public attended.</p> <p>A series of public consultation days for the North Western-Neagh Bann Draft Flood Risk Management Plans were held between 27/09/16 and 25/10/16 which a total of 223 elected representatives and members of the public attended. A formal SI consultation on the draft Plans was also held between 19/08/16 and 28/10/16, which received 40 formal submissions.</p> <p>People who commented were in favour of the preferred measure provided the works were sympathetic with the town and views towards Lough Swilly. It was noted that Donegal County Council have applied for "severe weather funding" to upgrade/replace an individual culvert in a particular location. The status of this application should be taken into consideration during project-level assessment. The consultation process provided further information, which has been noted for consideration during the project-level assessment stage; however, none resulted in further changes to the preferred measure at this stage.</p>
Other Issues / Conclusions
<p>Of the two potentially viable measures presented in the Preliminary Options Report the preferred measure as described above has a higher benefit cost ratio than the other potential measure which was investigated.</p> <p>Overall the preferred measure has a positive technical, social and economic score with a negative environmental/cultural score but the benefit – cost ratio is above unity.</p> <p>Consultations and submissions provided information which has been noted for project-level assessment however none resulted in a change of the preferred measure.</p>



Oifig na nOibreacha Poiblí, Ceannoifig, Sráid Jonathan Swift,
Baile Átha Troim, Co. na Mí, C15 NX36

The Office of Public Works, Head Office, Jonathan Swift Street,
Trim, Co. Meath, C15 NX36

Teileafón / Telephone: (0761) 106000, (046) 942 6000
Ríomhphost / Email: floodinfo@opw.ie
Suíomh Gréasáin / Website: www.floodinfo.ie