

Plean um Bainistiú Priacal Tuile

Flood Risk Management Plan

An Laoi, Cuan Chorcaí & Cuan Eochaille
Lee, Cork Harbour & Youghal Bay

2018

Plean um Bainistiú Priacal Tuile

Flood Risk Management Plan

Amhantrach (19) An Laoi, Cuan Chorcaí & Cuan Eochaille

River Basin (19) Lee, Cork Harbour & Youghal Bay

Limistéir um Measúnú Breise a chuimsítear sa phlean seo:

Areas for Further Assessment included in this Plan:

<i>Gleann Maghair</i>	<i>Glanmire</i>
<i>Baile Mhic Íre / Baile Bhuirne</i>	<i>Ballymakeery / Ballyvourney</i>
<i>Inse Geimhleach</i>	<i>Inchigeelagh</i>
<i>Béal Átha an Ghaorthaidh</i>	<i>Ballingeary</i>
<i>Baile na Martra</i>	<i>Castlemartyr</i>
<i>Carraig Uí Leighin</i>	<i>Carrigaline</i>
<i>Cathair Chorcaí</i>	<i>Cork City</i>
<i>Dúglas</i>	<i>Douglas</i>
<i>An Geata Bán</i>	<i>Whitegate</i>
<i>Mainistir na Corann & Baile na Cora</i>	<i>Midleton & Ballynacorra</i>
<i>An tOileán Beag</i>	<i>Little Island</i>
<i>Cill Ia</i>	<i>Killeagh</i>
<i>Maigh Chromtha</i>	<i>Macroom</i>
<i>An Pasáiste</i>	<i>Passage West</i>
<i>An Tóchar</i>	<i>Togher</i>
<i>Teamhair</i>	<i>Tower</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.

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ACHOIMRE FHEIDHMEACH

RÉAMHRÁ

Is é seo an Plean um Bainistiú Priacal Tuile (an ‘Plean’) d’Abhantrach An Laoi, Cuan Chorcaí & Cuan Eochaille. 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 Pholasáí 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 Laoi, Cuan Chorcaí & Cuan Eochaille 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, agus cuireann sé leis, an chlár náisiúnta d’oibreacha cosanta tuile a críochnaíodh roimhe seo, atá faoi dheardh agus faoi thógáil ag an am seo nó atá leagtha amach trí thionscadail nó pleananna eile, ar a n-áirítear Plean um Bainistiú Priacal Tuile na Laoi, agus cothabháil leanúnach ar scéimeanna draenála agus faoisimh tuile atá ar bun cheana féin.

Rinneadh Measúnú Straitéiseach Comhshaoil mar chuid den ullmhúchán don Phlean seo, agus foilsíodh é ina theannta. Rinneadh scagadh ar an Phlean maidir le Measúnú Cuí (MC) faoin Treoir um Ghnáthóga, agus cinneadh nach raibh gá le MC maidir leis an Phlean seo.

¹ Tuarascáil an Ghrúpa um Athbhreithniú ar Pholasáí 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 Laoi, Cuan Chorcaí & Cuan Eochaille

CONTAE	AINM an PHOBAIL	FOINSÍ PRIACAL TUILE
Corcaigh	Inse Geimhleach	Abhann
Corcaigh	Maigh Chromtha	Abhann
Corcaigh	Cill la	Abhann
Corcaigh	Baile na Martra	Abhann
Corcaigh	Mainistir na Corann / Baile na Cora	Abhann
Corcaigh	An Bhlarna / Teamhair	Abhann
Corcaigh	An Geata Bán	Cósta
Corcaigh	An Pasáiste	Cósta
Corcaigh	An tOileán Beag	Cósta
Corcaigh	Cathair Chorcaí	Abhann / Cósta
Corcaigh	An Tóchar	Abhann
Corcaigh	Carraig Uí Leighin	Cósta
Corcaigh	Gleann Maghair	Abhann / Cósta
Corcaigh	Dúglas	Abhann / Cósta
Corcaigh	Baile Mhic Íre / Baile Bhuirne	Abhann
Corcaigh	An Cóbh	Cósta
Corcaigh	An Baile Gallda	Abhann
Corcaigh	Béal Átha an Ghaorthaidh	Abhann

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).

Thionól 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 chuí 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 Tuaisceart Éireann, leis na húdaráis chuí 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 léiriú 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 mapaí tuile chun réimse, doimhneacht agus luas srutha na n-uisce tuile a thaispeáint, chomh maith le réimse mapaí guaise (chun baol agus tionchair dhóchúla tuilte a thaispeáint) agus mapaí Creasa Tuile mar bhonn eolais ar phleanáil agus forbairt inbhuanaithe. Don chás reatha agus don chás amach anseo, ullmhaíodh mapaí ócáidí tuile le réimse dóchúlachtaí tarlaithe (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 comhshaoil agus an oidhreacht chultúrtha áitiúil. Rinneadh measúnú priacail eacnamaíoch (díobháil) chun impleachtaí eacnamaíocha tuilte ins na pobail a chinneadh.
- **Measúnú agus Breithmheas ar Chéimeanna 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 dóchuil 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 mar chuid den ullmhúchán don Phlean seo, agus foilsíodh é ina theannta, 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. Rinneadh scagadh ar an Phlean maidir le Measúnú Cuí (MC) faoin Treoir um Ghnáthóga, agus cinneadh nach raibh gá le MC maidir leis an Phlean seo.

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 Gníomhaireacht 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 chuimseoidh 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 athbhreithniú 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 gceapfadh 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:

- Béal Átha an Ghaorthaidh
- Baile na Martra
- Inse Geimhleach

Don Chóbh, 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.

Is gá tuilleadh bailiú sonraí hidraméadracha a dhéanamh, chun muinín a fháil as na leibhéil agus/nó sruthanna tuile mar chuid de fhorbairt agus measúnú ar leibhéal tionscadail a chur cinn maidir le scéim um fhaoiseamh tuile do Bhéal Átha an Ghaorthaidh.

Moltar mar chuid den fhorbairt ar Sheirbhís Náisiúnta um Réamhaisnéis Tuile, gur cóir córas réamhaisnéise tuile a fhorbairt don Phasáiste agus don Gheata Bán.

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

Tá Scéim um Fhaoiseamh Tuile ann cheana féin a dhéanann cosaint ar mhaoine ins na pobail seo a leanas. Déanfar cothabháil leanúnach ar na scéimeanna seo.

- Teamhair

Tá Scéim um Fhaoiseamh Tuile faoi dhearadh nó faoi thógail cheana féin do na pobail seo a leanas, agus leanfar leis seo a chur chun cinn:

- Baile Mhic Íre / Baile Bhuirne
- Carraig Uí Leighin
- Cathair Chorcaí (Scéim um Fhaoiseamh Tuile: An Laoi Íochtarach)
- Cathair Chorcaí (Scéim um Fhaoiseamh Tuile: An Linn Dubh)
- An Baile Gallda
- Dúglas / An Tóchar
- Gleann Maghair
- An tOileán Beag
- Maigh Chromtha
- Mainistir na Corann & Baile na Cora

FEIDHMIÚ, MONATÓIREACT AGUS ATHBHREITHNIÚ AN PHEAN

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 Lee, Cork Harbour & Youghal Bay 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 Lee, Cork Harbour & Youghal Bay 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, including the Lee Flood Risk Management Plan, and the ongoing maintenance of existing drainage and flood relief schemes.

A Strategic Environmental Assessment has been undertaken as part of the preparation of, and has been published with, the Plan. The Plan was also subject to screening for Appropriate Assessment (AA) under the Habitats Directive, which determined that AA was not required for this 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 Lee, Cork Harbour & Youghal Bay River Basin*

COUNTY	COMMUNITY NAME	SOURCE(S) OF FLOOD RISK
Cork	Inchigeelagh	Fluvial
Cork	Macroom	Fluvial
Cork	Killeagh	Fluvial
Cork	Castlemartyr	Fluvial
Cork	Middleton & Ballynacorra	Fluvial
Cork	Blarney / Tower	Fluvial
Cork	Whitegate	Coastal
Cork	Passage West	Coastal
Cork	Little Island	Coastal
Cork	Cork City	Fluvial / Coastal
Cork	Togher	Fluvial
Cork	Carrigaline	Coastal
Cork	Glanmire	Fluvial / Coastal
Cork	Douglas	Fluvial / Coastal
Cork	Ballymakeery / Ballyvourney	Fluvial
Cork	Cobh	Coastal
Cork	Crookstown	Fluvial
Cork	Ballingeary	Fluvial

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

A Strategic Environmental Assessment has been undertaken as part of the preparation of, and has been published with, the Plan, 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. The Plan was also subject to screening for Appropriate Assessment (AA) under the Habitats Directive, which determined that AA was not required for this Plan.

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:

- Ballingeary
- Castlemartyr
- Inchigeelagh

Potentially viable structural flood relief measures have been investigated for Cobh 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.

It is necessary to carry out further hydrometric data collection to increase the confidence in the flood levels and/or flows as part of the progression of the project-level development and assessment of a flood relief scheme for Ballingeary.

It is proposed that, as part of the development of the National Flood Forecasting Service, a flood forecasting system should be developed for Passage West and Whitegate.

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

There is an existing Flood Relief Scheme providing protection to properties in the following communities. Ongoing maintenance will be undertaken of these schemes.

- Tower

There is a Flood Relief Scheme proposed or already in design or construction for the following communities, which will continue to be progressed:

- Ballymakeery / Ballyvourney
- Carrigaline
- Cork City (Lower Lee Flood Relief Scheme)
- Cork City (Blackpool Flood Relief Scheme)
- Crookstown
- Douglas / Togher
- Glanmire
- Little Island
- Macroom
- Middleton & Ballynacorra
- Little Island

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.....	5
1.1	OVERVIEW	5
1.2	FLOODING AND FLOOD RISK	5
1.2.1	Types and Causes of Flooding.....	6
1.2.2	Impacts of Flooding	6
1.2.3	Potential Impacts of Future Change	6
1.3	BACKGROUND	6
1.3.1	Flood Policy and Legislative Background.....	6
1.3.2	Competent and Responsible Authorities for the 'Floods' Directive	7
1.3.3	The 'CFRAM' Programme	7
1.3.4	Pilot CFRAM Projects.....	8
1.3.5	Other Relevant Flood Risk Management Projects	8
1.3.6	Other Relevant Policies and Plans	11
1.4	FLOOD RISK MANAGEMENT OBJECTIVES	14
1.4.1	Overview	14
1.4.2	Definition of the Flood Risk Management Objectives	14
1.5	SCOPE OF THE PLAN	17
1.5.1	Spatial Scope of the Plan	17
1.5.2	Sources of Flooding Addressed in the Plan	17
1.5.3	Level of Detail of the Plan.....	17
1.6	STRUCTURE OF THE PLAN	19
2	OVERVIEW OF THE RIVER BASIN.....	20
2.1	THE LEE, CORK HARBOUR & YOUGHAL BAY RIVER BASIN.....	20
2.2	TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER.....	24
2.3	LAND USE AND LAND MANAGEMENT	24
2.4	HYDROLOGY	25
2.4.1	Sub-Catchments & Coastlines.....	25
2.4.2	Rainfall Distribution.....	25
2.4.3	Hydrometric Data Availability.....	26
2.5	FLOOD HISTORY	26
2.5.1	Historic Flood Events.....	26
2.6	EXISTING FLOOD RISK MANAGEMENT MEASURES.....	29
2.6.1	Midleton Flood Relief Scheme	29
2.6.2	Lower Lee (Including Ballyvolane) Flood Relief Scheme	29
2.6.3	Blackpool Flood Relief Scheme	29
2.6.4	Douglas Flood Relief Scheme (including Togher Culvert)	29
2.6.5	Ballinhassig Prefeasibility Study.....	29
2.6.6	Glashaboy (Glanmire/Sallybrook) Flood Relief Scheme	29
2.6.7	Baile Mhic Ire/Baile Bhúirne Flood Relief Scheme.....	30
2.6.8	Crookstown Flood Relief Scheme	30
2.6.9	Tower Flood Defences	30
2.6.10	Carrigaline Flood Relief Scheme.....	30
2.6.11	Cobh Measures	30
2.6.12	Little Island Measure	30
2.6.13	Macroon Hydrology and Hydraulics Review.....	30
2.6.14	Passage West Measure	30

2.6.15	Whitegate Measure	30
2.6.16	Arterial Drainage Schemes and Drainage Districts	31
2.6.17	Minor Works	31
3	PRELIMINARY FLOOD RISK ASSESSMENT.....	32
3.1	INTRODUCTION	32
3.2	OUTCOMES OF THE PFRA.....	32
3.3	FURTHER INFORMATION.....	33
4	PUBLIC AND STAKEHOLDER CONSULTATION AND ENGAGEMENT ..	35
4.1	OVERVIEW	35
4.1.1	Lee CFRAM Pilot Study Consultations.....	35
4.2	AVAILABILITY OF PROJECT INFORMATION	35
4.3	STAKEHOLDER ENGAGEMENT	36
4.3.1	The CFRAM Steering and Progress Groups	36
4.3.2	Stakeholder Consultation Groups	38
4.3.3	Coordination with the Implementation of the Water Framework Directive	38
4.4	PUBLIC CONSULTATION AND ENGAGEMENT.....	39
4.4.1	Consultation on Preliminary Flood Risk Assessment.....	39
4.4.2	Consultation on Flood Maps.....	39
4.4.3	Consultation on Flood Risk Management Objectives	40
4.4.4	Consultation on Options	40
4.4.5	Consultation on Draft Plans.....	40
5	FLOOD HAZARD AND RISK ASSESSMENT	41
5.1	HYDROLOGICAL ANALYSIS	41
5.2	HYDRAULIC MODELLING.....	41
5.3	FLOOD HAZARD MAPPING.....	43
5.4	FLOOD RISK ASSESSMENT AND MAPPING.....	45
5.5	CONSIDERATION OF FUTURE CHANGES.....	47
5.6	COMMUNITIES (AFAS) OF LOW RISK.....	48
6	ENVIRONMENTAL CONSIDERATIONS	50
6.1	OVERVIEW	50
6.2	ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES IN THE LEE, CORK HARBOUR & YOUGHAL BAY RIVER BASIN.....	53
6.2.1	Castlemartyr	53
6.2.2	Ballingeary	55
6.2.3	Inchigeelagh	57
6.3	STRATEGIC ENVIRONMENTAL ASSESSMENT	59
6.4	APPROPRIATE ASSESSMENT.....	60
6.5	COORDINATION WITH WATER FRAMEWORK DIRECTIVE	61
6.5.1	Bi-Lateral Meetings.....	61
6.5.2	Cross-Representation on Management Groups.....	62
6.5.3	Exchange of Information.....	63
6.5.4	Coordination on Measures	63

6.6	PROGRESSION OF MEASURES AND ASSESSMENT OF FUTURE WORKS.....	64
6.6.1	Approval of the Plan	64
6.6.2	Implementation Routes for Physical Works.....	65
6.6.3	Mitigation Measures	65
7	MANAGING FLOOD RISK.....	68
7.1	OVERVIEW	68
7.2	METHODS OF FLOOD RISK MANAGEMENT	68
7.2.1	Flood Risk Prevention Methods	68
7.2.2	Flood Protection Methods.....	69
7.2.3	Flood Preparedness (Resilience) Methods	69
7.2.4	Continue Existing Regime / Do Nothing / Minor Measures	69
7.3	DEVELOPMENT AND APPRAISAL OF FLOOD RISK MANAGEMENT OPTIONS	70
7.3.1	Spatial Scales of Assessment	70
7.3.2	Step 1: Screening of Flood Risk Management Methods	71
7.3.3	Step 2: Development of Options for Flood Risk Management Measures	71
7.3.4	Step 3: Appraisal by Multi-Criteria Analysis	72
7.3.5	Step 4: Economic Appraisal	73
7.3.6	Step 5: Public And Stakeholder Engagement	74
7.3.7	Step 6: Identification of Preferred Options	74
7.3.8	Measures Identified from Other Policies, Projects and Initiatives	74
7.4	OUTCOMES.....	75
7.4.1	Measures Applicable for All Areas	75
7.4.2	Ballingeary AFA Measures	83
7.4.3	Inchigeelagh AFA Measures	85
7.4.4	Castlemartyr AFA Measures	87
7.4.5	Baile Bhúirne and Baile Mhic Íre	89
7.4.6	Tower.....	89
7.4.7	Cork City	89
7.4.8	Douglas / Togher	89
7.4.9	Glanmire	89
7.4.10	Little Island	89
7.4.11	Macroon.....	89
7.4.12	Midleton & Ballynacorra.....	89
7.4.13	Passage West	89
7.4.14	Whitegate.....	89
7.5	PRIORITISATION OF PROPOSED PROTECTION MEASURES.....	90
7.6	FLOOD RISK MANAGEMENT IN OTHER AREAS	90
7.7	SUMMARY OF PROPOSED MEASURES	91
8	IMPLEMENTATION, MONITORING AND REVIEW OF THE PLAN	95
8.1	IMPLEMENTATION OF THE PLAN	95
8.1.1	River Basin Level Measures.....	95
8.1.2	Catchment and AFA-Level Physical Measures.....	95
8.1.3	Other Catchment and AFA-Level Measures	97
8.1.4	Public and Stakeholder Consultation and Engagement.....	97
8.2	MONITORING OF PROGRESS IN IMPLEMENTATION OF THE PLAN	98
8.3	ENVIRONMENTAL MONITORING.....	98
8.3.1	Monitoring of the Plan.....	98
8.4	REVIEW OF THE PFRA, FLOOD MAPS AND THE PLANS.....	99

GLOSSARY AND ACRONYMS	100
REFERENCES	108
APPENDICES.....	109

1 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

This is the Flood Risk Management Plan (the 'Plan') for the Lee, Cork Harbour & Youghal Bay 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 Lee, Cork Harbour & Youghal Bay 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 has been undertaken as part of the preparation of, and has been published with, the Plan. The Plan was also subject to screening for Appropriate Assessment (AA) under the Habitats Directive, which determined that AA was not required for this 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 Mott MacDonald Ireland for the Lee, Cork Harbour & Youghal Bay 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. Part of the area within the Lee, Cork Harbour & Youghal Bay River Basin was included as part of the Lee Pilot CFRAM Project, which covered the catchment of the River Lee in Cork city and county. Details of the Lee Project can be found on the OPW website; www.floodinfo.ie. This Plan notes the measures set out through the Lee Pilot CFRAM Project, including an update on their current status.

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:

- Baile Mhic Ire / Baile Bhúirne Flood Relief Scheme
- Ballinhassig Prefeasibility Study
- Blackpool Flood Relief Scheme
- Carrigaline Flood Relief Scheme
- Crookstown Flood Relief Scheme
- Douglas Flood Relief Scheme (including Togher Culvert)
- Glashaboy (Glanmire/Sallybrook) Flood Relief Scheme
- Lower Lee Flood Relief Scheme
- Macroom Hydrology and Hydraulics Review
- Middleton 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 or on the OPW website⁵:

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

⁵ <http://www.opw.ie/en/flood-risk-management/operations/flooddefenceschemes/#d.en.23394>

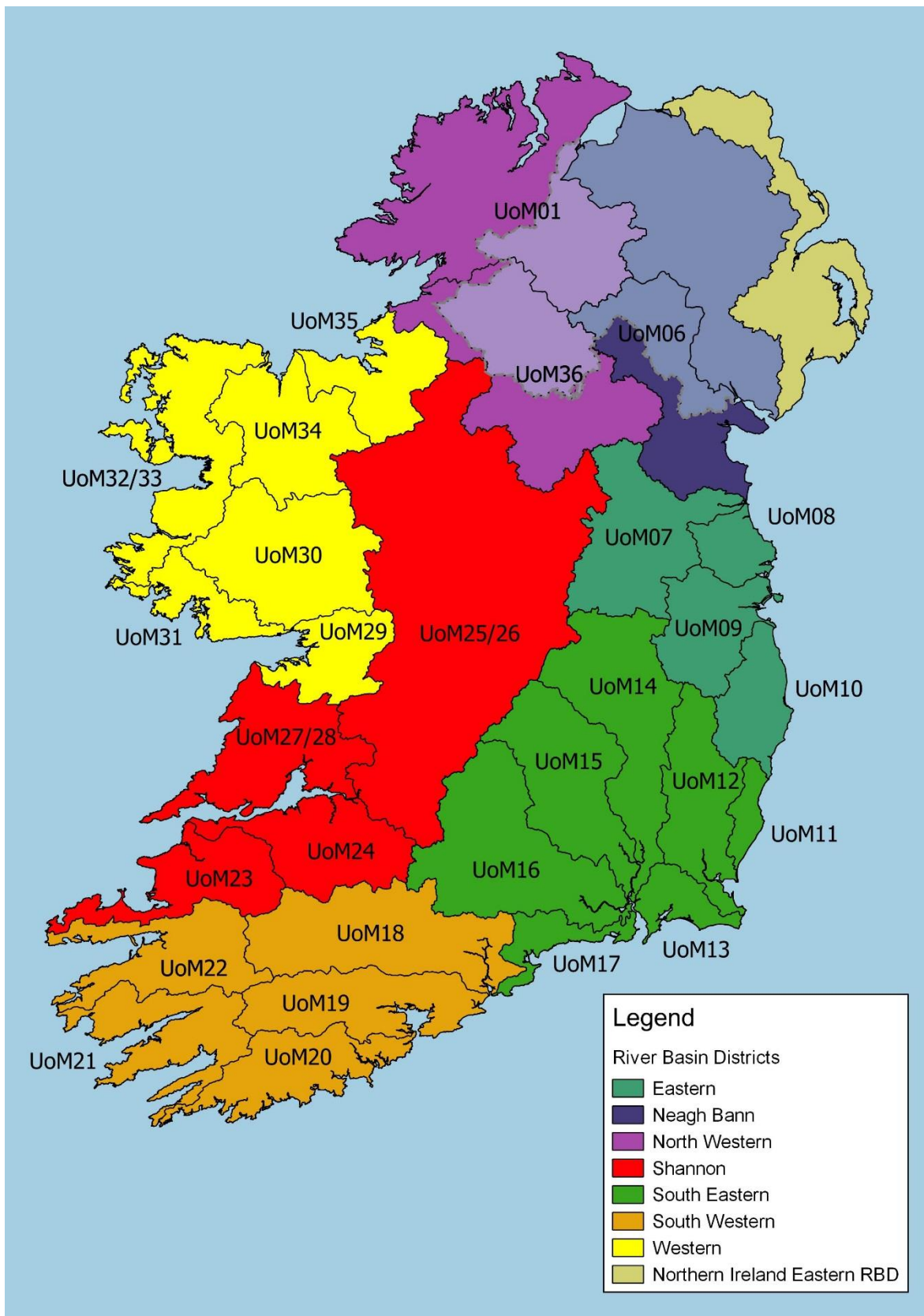


Figure 1.1: River Basin Districts (RBDs) and Units of Management (UoMs) in Ireland

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.
South Western 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. New RBMPs are to be adopted by the end of 2017.
Second Cycle of River Basin Management Plans: 2018 - 2021	River Basin Management Planning takes an integrated approach to the protection, improvement and sustainable management of the water environment. The South-West Regional Planning Guidelines 2010-2022 were adopted by the South-West Regional Authority in 2010 to cover counties Cork and Kerry. The South-West Regional Authority was subsequently dissolved in 2014 and its functions and responsibilities have been transferred to the Southern Regional Assembly. The South-West Regional Planning Guidelines 2010-2022 shall continue to have effect until a Regional Spatial and Economic Strategy is prepared and adopted by the Southern Regional Assembly.
Regional Planning Guidelines	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.
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"> • Cork County Development Plan 2014 • Cork City Development Plan 2015 - 2021
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"> • Midleton Electoral Area Plan • Macroom Electoral Area Plan • South Docks Local Area Plan 2008 • Farranferris Local Area Plan 2009 • North Blackpool Local Area Plan 2011 • Mahon Local Area Plan 2014
Ireland's Offshore Oil and Gas Exploration Plan (IOSEA5)	in the context of marine baseline information, and potential relationship with offshore and foreshore related infrastructure
National Peatlands Strategy	This Strategy guides the Government's approach to peatlands management and conservation in the future, taking into account current and potential uses of this key resource.
Food Wise 2025, Agri-Food Strategy	Outlines the key actions required to ensure that the agri-food sector (primary agriculture, the food and beverage industry, fisheries and fish processing, forestry and forestry processing) maximises its contribution to overall economic growth, job creation and environmental sustainability over the coming decade
Southern Region Waste Management Plan 2015-2021	The Waste Management Plan for the Southern Region is the framework for the prevention and management (including generation, collection and treatment) of wastes in a safe and sustainable manner.
Ireland's forest policy – a renewed vision	The strategic goal is to develop an internationally competitive and sustainable forest sector that provides a full range of economic, environmental and social benefits to society and which accords with the Forest Europe definition of sustainable forest management.
The National Climate Change Adaptation Framework (2012)	The National Climate Change Adaptation Framework provides the policy context for a strategic national adaptation response to climate change in Ireland.
The Wild Atlantic Way	A tourism trail on the west coast, and on parts of the north and south coasts, of the Republic of Ireland.
Draft National Landscape Strategy 2014 – 2024	This draft National Landscape Strategy is the means by which the State, working in co-operation with public authorities, stakeholders, communities and individuals, will provide a framework for the protection of the many cultural, social, economic and environmental values embedded in the landscape.

Planning Policy Statement 2015	<p>This statement sets out:</p> <ul style="list-style-type: none"> • Key principles that it expects planning authorities, other public bodies and those that engage with the planning process will observe; and • High level priorities for the continued enhancement of the planning system in Ireland.
Irish Water Strategic Services Plan, when published	Ireland's first integrated national plan for the delivery of water services.
Local Economic and Community Plans 2016 - 2021, when published	These plans set out the objectives and actions which will guide the economic and community development of local areas over the 2016 – 2021 period.

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 Lee, Cork Harbour & Youghal Bay 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 Lee, Cork Harbour & Youghal Bay River Basin addresses *fluvial and coastal 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 Lee, Cork Harbour & Youghal Bay 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 can not 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 LEE, CORK HARBOUR & YOUGHAL BAY RIVER BASIN

The Lee, Cork Harbour and Youghal Bay River Basin covers an area of approximately 2,145 km². The entire area of the River Basin is within County Cork. The extent of the Lee catchment is shown in Figure 2.1. Land height in River Basin varies from 649m AOD at Mullaghanish in the Shehy Mountains to 50m AOD at Inniscarra reservoir and about 5m AOD around Cork Harbour. From its source in the Shehy Mountains, the River Lee flows in a generally easterly direction to where it discharges to Cork Harbour at Cork City. In Cork City the river is used for navigation, its channel is dredged and the river banks include extensive quay walls. The River Lee is joined by a number of large tributaries including the Sullane, Laney, Dripsey, Bride and Shournagh. A number of smaller tributaries join the River Lee in Cork City including the Curraheen, Glasheen and Kiln Rivers. The flows in the river are influenced and partly controlled by the Carrigadrohid and Inniscarra hydroelectric dams. The catchment also includes a number of smaller rivers and their estuaries that drain directly into Cork Harbour. These include the Glashaboy, Owennacurra, Tramore and Owenboy Rivers. Cork Harbour is the second largest natural harbour in the world and covers an area of approximately 350 square kilometres. Other rivers in the River Basin that do not flow into the Lee include the Womanagh and its tributary which flows into Ballymacoda Bay.

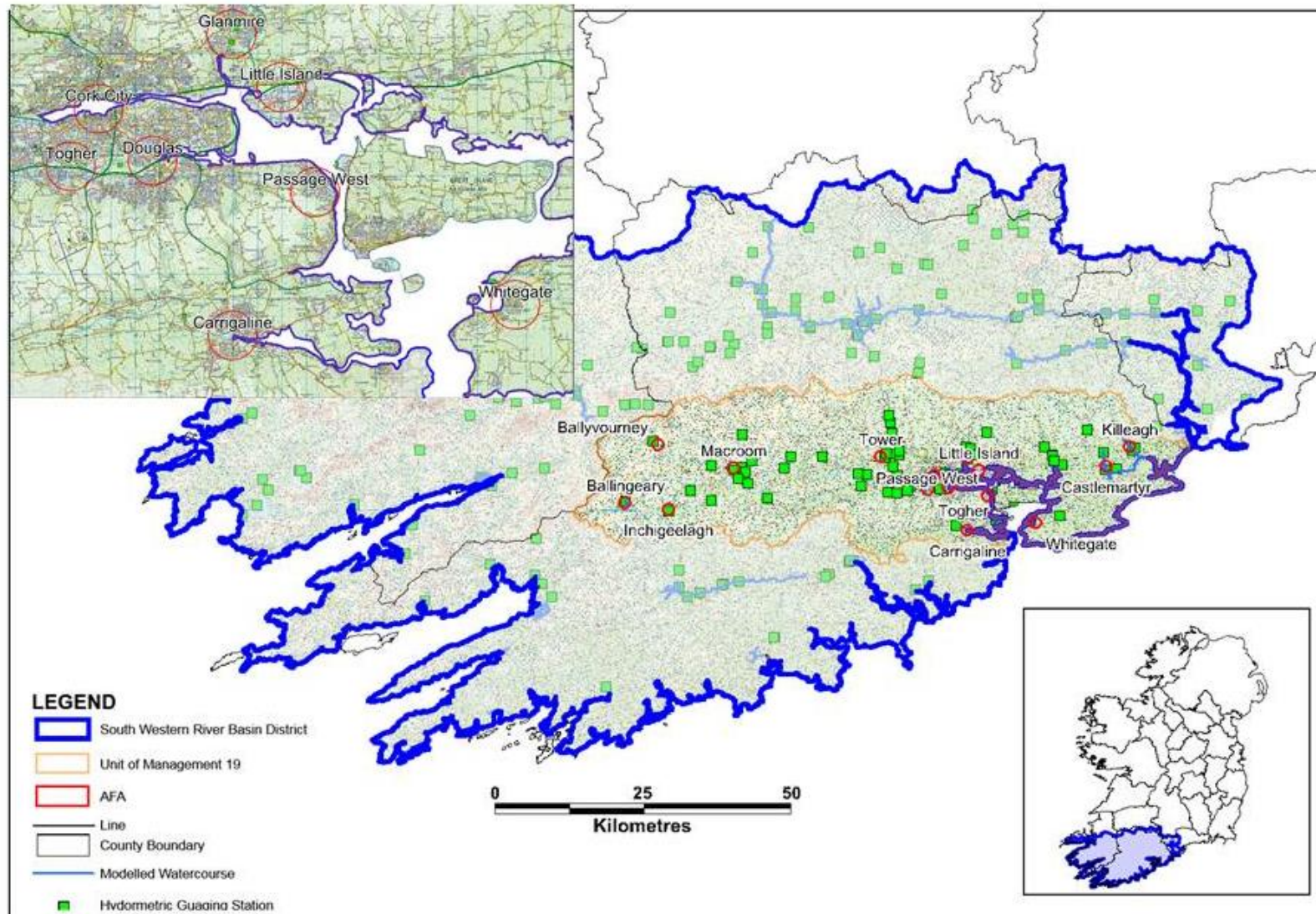
The OPW have undertaken a separate Catchment Flood Risk Assessment and Management (CFRAM) Study within the River Basin for the Lee Catchment. However, the towns of Ballingeary and Inchigeelagh in the upper reach of the Lee, which have been identified as AFAs were not included in the Lee CFRAM. This study includes the Womanagh and its tributaries the Kiltha and the Dissour which are outside of the Lee Catchment.

As part of this study, there are four Areas for Further Assessment (AFAs) within the Lee, Cork Harbour and Youghal Bay River Basin. The Lee CFRAM study included a further twelve AFAs. These are listed in Table 2.1 below. Associated with the AFA's is over 29km of high and medium priority watercourse. High priority watercourses are any modelled watercourse within an AFA. Medium priority watercourses are all other modelled watercourses.

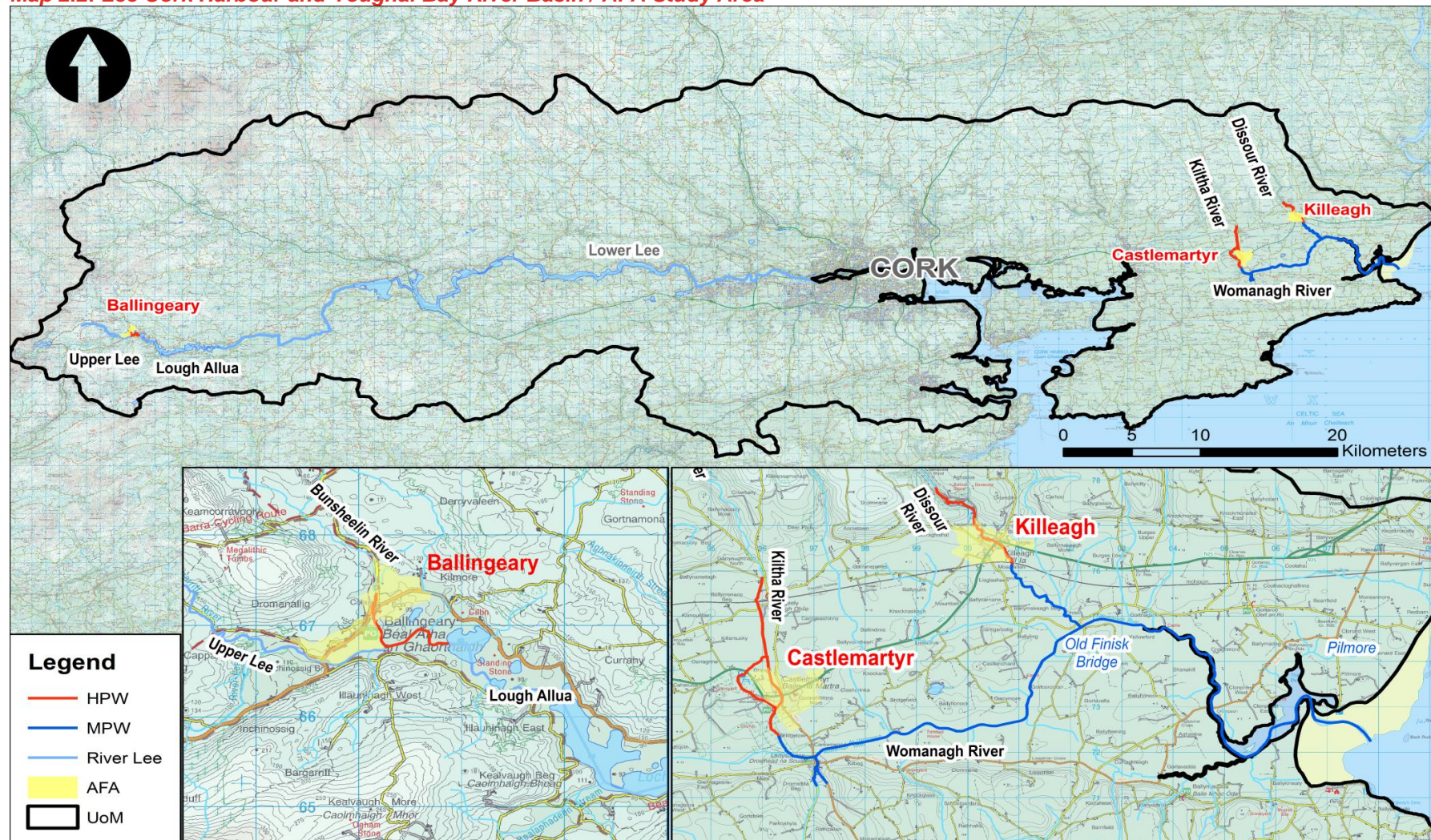
Table 2.1: AFAs within the Lee, Cork Harbour & Youghal Bay River Basin

UoM	Name	Unique ID	Fluvial	Coastal	County	Easting	Northing
South Western CFRAM Study							
19	Ballingeary	195499	Yes	No	Cork	115090	67135
19	Castlemartyr	190277	Yes	No	Cork	196250	73250
19	Killeagh	190274	Yes	No	Cork	200750	75750
19	Inchigeelagh	190268	Yes	No	Cork	122589	66287
Lee CFRAM Study							
19	Ballymakeery / Ballyvourney	190292	Yes	No	Cork	120250	77000
19	Blarney / Tower	190280	Yes	No	Cork	158250	73750
19	Carrigaline	190289	No	Yes	Cork	173000	62500
19	Cobh	192407	No	Yes	Cork	179420	66626
19	Cork City	190286	Yes	Yes	Cork	167750	71250
19	Crookstown	192414	Yes	No	Cork	142597	66085
19	Douglas	190291	Yes	Yes	Cork	170750	69500
19	Glanmire	190290	Yes	Yes	Cork	172500	73750
19	Little Island	190284	No	Yes	Cork	175250	72500
19	Macroom	190270	Yes	No	Cork	132250	73750
19	Middleton / Ballinacurra	190279	Yes	No	Cork	188250	73000
19	Passage West	190283	No	Yes	Cork	177000	68750
19	Togher	190288	Yes	No	Cork	166500	69000
19	Whitegate	190282	No	Yes	Cork	184000	63500

Map 2.1: South Western Study Area (Cork Harbour inset)



Map 2.2: Lee Cork Harbour and Youghal Bay River Basin / AFA Study Area



2.2 TOPOGRAPHY, GEOLOGY, SOILS AND GROUNDWATER

Elevations in the Lee catchment range from 649m AOD at Mullaghanish in the Shehy Mountains to 50m AOD at Inniscarra reservoir and about 5m AOD around Cork Harbour. The Lee catchment is predominantly underlain by Old Devonian Sandstones which are relatively impermeable and create steep relief in the mountainous areas around Ballingeary. Peaty topsoil and blanket bogs are present in some of the upland areas. The River Womanagh catchment ranges from less than 1mAOD near Gortnagark Castle, up to 238mAOD in the upper reaches of the Kiltha and Dissour River. The Womanagh valley and lower reaches of its tributaries are underlain by permeable Dinatian Limestone forming part of a regionally important aquifer. The Bunsheelin catchment ranges from 85mAOD at Lough Allua to over 530mAOD in its headwaters. The upper reaches are constrained by the mountainous topography which results in a fast-responding catchment. The floodplain widens to 400m as the Bunsheelin flattens out to join the Upper Lee and Lough Allua.

Further details on the topography, geology, soils and groundwater in the Lee, Cork Harbour & Youghal Bay River Basin is provided in Appendix B.

2.3 LAND USE AND LAND MANAGEMENT

Agriculture, predominantly pasture with some mixed farmland, is the dominant land use within the catchment covering approximately 77% of the land area. Areas of natural and semi-natural habitat cover approximately 11% of the catchment and include wetlands, grasslands, woodland and coastal habitats. Approximately 7% of the catchment is covered by forestry, mainly in the mountainous uplands of the headwaters of the Rivers Lee and Sullane.

Two dams in the Upper Lee catchment, at Carrigadrohid and Inniscarra, manage the flow of water from the Upper Lee catchment to the Lower Lee catchment. The dams play an important role in the management of flood risk in the Lee valley through the provision of storage and controlled discharge of flood waters.

Urban development and associated infrastructure covers approximately 5% of the catchment, principally concentrated around Cork Harbour. This includes major low-density residential areas, commercial centres and significant industrial areas. In future years pasture is likely to remain the dominant land use; although the pattern of use may change following recent changes in the EU's Common Agricultural Policy. The pattern of increasing reforestation is expected to continue at the expense of pasture, mixed farmland and wetlands in order to meet Government targets for forestry cover. Urban land cover will continue to grow with population growth.

The way in which the land is used can significantly impact the flow routes across the catchment, how much rainfall is stored, how much infiltrates into the ground, and how much evaporates.

The majority of the Ballingeary and Womanagh catchments are currently rural and dedicated to agricultural or pastoral use. Changes to agriculture can lead to intensification of activities and associated increased land drainage and runoff. Increased irrigation and drainage for the commercial forests can route more water to the rivers thus reducing the time to peak.

Future urban development within the river basin is also likely to cause more water to reach the river channels quicker and affect more people, property and environments.

Further details on land use and land use management in the Lee, Cork Harbour & Youghal Bay River Basin is provided in Appendix B.

2.4 HYDROLOGY

2.4.1 Sub-Catchments & Coastlines

The Lee, Cork Harbour and Youghal Bay River Basin can be split into sub-catchments covering the AFAs.

2.4.1.1 Lee Sub-catchment

The Upper Lee flows from its source near Rosslougha in an easterly direction to the south of Ballingeary at Inchinossig Bridge and continues towards Cork. The Bunsheelin River flows through Ballingeary from the North to join the upper River Lee downstream of Inchinossig Bridge. The River Lee then flows in an easterly direction into Lough Allua and downstream to Inchgeelagh. Further downstream flows increase more slowly due to the topography and geology of the area. It may take up to 24 hours from the start of a rainfall event for peak flows to be reached on the River Lee at downstream locations such as Cork City. Flows in urban watercourses such as the Glasheen, Tramore and Kiln reach peak levels in less than 2 hours due to the rapid runoff from urban surfaces. Flooding in the Glashaboy, Owenboy and Owennacurra is generally caused by long duration rainfall events as the flows build up.

2.4.1.2 Womanagh Sub-catchment

The Womanagh River stretches from its source at Carrigour to its tidal outfall at Pilmore into Youghal Bay. The Kiltha River flows from Springfields/Mogeely southwards through Castlemartyr to join the Womanagh near Ladysbridge. The Dower River is heavily dominated by karst and flows through swallow holes, creating a dry valley in its upper reaches. The Dower River and Ladysbridge Stream join the Womanagh before the Dissour River. The Dissour River flows from Kilcronatmountain southwards through Glenane Beg Ravine before flowing through Killeagh town and joining the River Womanagh at Finisk Old Bridge.

2.4.1.3 Coastal Features

In Cork Harbour the astronomical spring tidal range is approximately 3.7m and the neap range is approximately 1.9m. Storm surges can also propagate into Cork Harbour causing water levels to be further elevated. Storm surges of 0.5m and above occur frequently in the Harbour. However, these generally only give rise to concern when they coincide with periods of high spring tides. One such event occurred on 27 October 2004 when the combined tide and surge level at Tivoli reached +2.74m OD Malin and gave rise to extensive flooding in Cork City.

Downstream of Crompaun Bridge, the Womanagh River widens to a more estuarine feature over 300m wide with several low-flow loop channels until its tidal outfall at Pilmore. There are large intertidal flats in the estuarine area which are inundated on most tides. The spit features at the tidal outfall protect inland areas from extreme wave action.

2.4.2 Rainfall Distribution

Ballingeary has high annual rainfall, over 2000mm, because the regular westerly storms deposit much of their rainfall over the higher relief of the Shehy Mountains which drains to Ballingeary and Lough Allua. Conversely, the Womanagh catchment has relatively low rainfall, less than 1200mm, as it has much lower topography and is located within a rain shadow of the western mountains. Furthermore, the permeable karstic geology reduces the amount of rainfall reaching the rivers in this catchment. Rainfall tends to be greater in the

west and decreases towards the east. This corresponds with the dominant wind direction in the South West where storms tend to track west to east.

2.4.3 Hydrometric Data Availability

A range of different data sources have been used to undertake the hydrological data analysis for the Lee, Cork Harbour and Youghal Bay River Basin. The use of local hydrometric data can greatly improve and validate flood flows for historic events and design flood events. The following sources of data have been reviewed in the Lee, Cork Harbour and Youghal Bay River Basin (Table 2.2).

Table 2.2 Summary of Available Data

Type	Details	Owner	Date
River Flows	15 minute interval data series at 3 gauges with flow converted from water level	OPW EPA	Various up to 2012
River Levels	15 minute interval data series at 3 gauges	OPW EPA	Various up to 2012
Rainfall Gauges	Daily rainfall values at 7 gauges	Met Eireann	Various up to 2012
	Hourly rainfall series at Cork Airport and Roches Point	Met Eireann	1962-2012
	15 minute rainfall series Dunmanway	OPW	2011-2012
Extreme sea level	Irish Coastal Protection Strategy Study Total tide +surge design levels	OPW	Calculated in 2012
Sea Level	Sea level at 10 minute intervals at Ballycotton Gauge	OPW	2007 - 2012

Further details on the hydrology of the Lee, Cork Harbour & Youghal Bay River Basin is provided in Appendix B.

2.5 FLOOD HISTORY

2.5.1 Historic Flood Events

Historic flood events in the Womagh catchment, Inchigeelagh and Ballingeary were identified from the floods database (www.floodinfo.ie), previous reports, and interviews with Local Authority personnel and residents during the Flood Risk Review. There were limited details available for historic flood events as detailed records of impacts for events more than 20 years ago were scarce. Events in the wider Lee catchment have been assessed as part of the separate Pilot CFRAM Study and therefore have not been included here. The source, extent and impact of flooding from historic events are summarised below.

Flood Event of 2nd November 2011 affecting Upper Lee Catchment

Flooding downstream of Inchingossig Bridge due to a period of prolonged rainfall, particularly over an 18 hour period in the Upper Lee Catchment. Substantial areas of land were flooded, almost flooding local roads. No property was damaged, but grazing land was inundated.

Flood Event of 15th January 2011 affecting Inchigeelagh and Ballingeary

Flooding affected the areas of Inchigeelagh and Ballingeary on this date and was due to overtopping on the River Lee. OPW flood reports and local engineers anecdotal reports indicate that Ballingeary suffered damage to two commercial and one residential building. Within one of the commercial buildings (Butchers), flood waters rose to a depth of 0.125m and the main road was temporarily closed.

Inchigeelagh was flooded to the north of the River Lee by up to 0.15m in both the residential and commercial buildings that were flooded. The road from the bridge to the town centre was closed for several hours.

Flood Event of 19th November 2009

The flooding of November 2009 was attributed to the heavy rainfall that fell in the preceding days and particularly due to torrential rainfall that fell overnight in the Upper Lee Catchment. Therefore, the catchment was saturated and levels in Lough Allua were already elevated before the 19th November 2009.

Ballingeary experienced flash flooding with depths of up to 1.2 metres. Flooding occurred at 17:30 due to overtopping on the Bunsheelin River at the eastern end of the village. Overall, 19 residential properties were affected, plus the local school and six commercial properties. A 340m length of the R584 was also known to be flooded. Residential and commercial losses were estimated at €300,000 and €750,000 respectively (*Meitheal Forbartha na Gaeltachta, 2009*).

At Castlemartyr, flood levels rose to a depth of 0.25m as flood waters rose out-of-bank on the River Kiltha, the R632 road was flooded and 3 residential properties were affected. Killeagh also saw flooding with a maximum depth of 0.5m observed.

Details of flood events that occurred in the catchment during the study are detailed below:

Flood Event of 11th September 2015 affecting Ballingeary

A blockage of the main bridge on the Bunsheelin River caused water to back up and flood a residential garden and the local GAA playing field. The blockage was caused by a tree which became dislodged upstream during the high rainfall period.

Flood Events of 3rd & 4th February 2014 affecting Midleton

Extreme winds and storm surges coupled with high tides resulted in flooding of the Balick Road between Midleton and Ballinacurra on both the morning of 3rd February and the evening 4th February. The full extent of the road between Father Murphy Place to the North of the N25 and the crossroads of Bailick Road and the R630 in Ballinacurra was flooded by the high tidal waters. Approximately 11 Nr. residential properties were affected by the high tidal waters. The South Quay in Ballinacurra also flooded resulting in the tidal waters breaching defences in the public house and two dwellings in the village. A level of 2.65m OD Malin was recorded.

Flood Events between 3rd & 4th February 2014 affecting Cork City

Flooding occurred in Cork City Centre on the morning of 3rd February 2014 and the evening of 4th February 2014. The flooding was as a result of morning and evening high tides combined with extreme winds and storm surges. Significant flooding was recorded throughout the city centre from the Quays through to Patrick's Street with flood depths of 0.6m reported. A flood level of 2.69m OD Malin was recorded at a high water mark outside a premises on Patrick's Street. Approximately 23 Nr. residential and 200+ Nr. non-residential properties were affected.

Flood Events between 2nd & 6th January 2014 affecting Cork City

Flooding occurred periodically in Cork City Centre from the evening of 2nd January 2014 until the morning of 6th January 2014. The flooding was as a result of morning and evening high tides combined with surge events. There is a staff gauge located on Lapps Quay just downstream of Parnell Bridge. Cork County Council recorded a level of 2.65m OD for the morning high tide and 2.70m OD for the Thursday evening high tide. Other tide levels were less severe. Flooding occurred along the Quays extending to the South Mall and a number of side streets and over to Oliver Plunket Street. Approximately 6 Nr. residential and 6 Nr. non-residential properties were flooded.

Flood Events of 2nd & 6th January 2014 affecting Carrigaline

The flood events were similar to previous tidal events with the flooding of 1Nr. property. Refer to events on the 14th December and 17th October 2012.

Flood Event of 25th January 2013 affecting Monkstown

The open channel watercourse running along Castle Road enters a culvert under Strand Road before discharging to the sea. During periods of high tide and intense rainfall the culvert is surcharged causing flooding to the surrounding area. During this event the flooding was limited to gardens and roads and no properties were flooded.

Flood Event of 14th December 2012 affecting Carrigaline

1 Nr. property (Rosie's Pub) flooded in the village centre. The flood mechanism and extent was as per the event of the 17th October 2012.

Flood Event of 17th October 2012 affecting Cork City

Flooding occurred twice in Cork City Centre on 17th October 2012. The flooding was as a result of morning and evening high tides which combined with surge events. A staff gauge at Lapps Quay recorded a level of 2.65m OD Malin for the morning high tide and 2.75m OD Malin for the evening high tide. Flooding occurred along Fr. Mathew Quay, Georges Quay, Union Quay and Morrison's Quay. Flooding extended to the South Mall. Approximately 13 Nr. non-residential properties flooded.

Flood Event of 17th October 2012 affecting Carrigaline

1 Nr. property (Rosie's Pub) flooded in the village centre. The property is prone to flooding and the owner reported that the property has flooded 4-5 times this year. The flooding mechanism is always the same. The property is located on the main street adjacent to a bridge where the river is tidal. The property is situated within a depression on the road and the threshold of the front door is at pavement level. The inside of the property is at a lower level. During periods of very high tides the water comes up through a gully outside the front door and flows into the property due to the slope of the pavement and the lower internal level of the property. During this particular event there was a very high tide causing the river to overtop its banks and flood a significant section of road.

Flood Event of 27th June 2012 affecting numerous areas throughout the River Basin

Significant flood occurred throughout the catchment due to intense and prolonged rainfall events. Flood was reported in Ballyvolane, Blackpool, Crookstown, Curraheen, Douglas, Glanmire and Turners Cross.

Flood Event of 5th June 2012 affecting Midleton

Flooding was due to a very significant rainfall event which may have been exacerbated by the combined storm water system being blocked or at capacity. Spring high tides may also have affected capacity of the storm water system. A number of properties on Main Street were flooded. However, from discussions with locals, wave action caused by vehicles continuing to drive through flood may have increased severity of flooding in properties. The event was due to pluvial flooding.

Flood Event of November / December 2015

Flooding occurred in the River Basin after the completion of the hydraulic modelling for the study. This flooding occurred following prolonged rainfall during November and December 2015. One of the worst affected areas in the River Basin was Midleton. Groundwater flooding caused the N25 to be closed for a prolonged period between Castlemartyr and Killeagh in East Cork.

2.6 EXISTING FLOOD RISK MANAGEMENT MEASURES

2.6.1 Midleton Flood Relief Scheme

The Midleton Flood Relief Scheme was initiated in 2016 following major flooding in December 2015. It is currently at Outline Design stage, with consultants having been appointed by Cork County Council in 2016. It is expected to go to construction in 2019/2020 and to be completed in the following two years. The Scheme, which comprises permanent tidal and fluvial Flood Defence walls and/or embankments in the town should the preferred solution from the River Lee Catchment Flood Risk Management Plan be eventually identified as the preferred option. It is expected to provide protection against a 200-Year tidal flood (0.5% Annual Exceedance Probability) and a 100-Year fluvial flood (1% Annual Exceedance Probability) for 246 properties against flooding from the Dungourney and Owenacurra Rivers.

2.6.2 Lower Lee (Including Ballyvolane) Flood Relief Scheme

The Lower Lee Flood Relief Scheme was initiated in 2013 following major flooding in 2009 and 2012. It is currently at the Outline Design and Exhibition stage, and is expected to go to construction in 2018. The Scheme comprises of Flood Defences along the River Lee downstream of Inniscarra dam and through Cork city, changes to the operating procedures for the Carrigadrohid and Inniscarra reservoirs for the purposes of flood risk management (as may be facilitated by the proposed Flood Defences) and a flood forecasting system to help guide decision-making on dam discharges and, if necessary, the erection of temporary / demountable defences downstream and in Cork City. The Scheme is expected to provide protection against the 100-year fluvial flood (1.0% Annual Exceedance Probability) from the River Lee, and against the 200-year tide (0.5% Annual Exceedance Probability) for about 2,100 properties.

2.6.3 Blackpool Flood Relief Scheme

The Blackpool Flood Relief Scheme was initiated in 2013 following major flooding in 2012. It is currently at the Detailed Design stage, and is expected to go to construction in 2018. The Scheme, which comprises conveyance improvement, Flood Defence embankments and walls, and pumping stations is expected to provide protection against the 100-Year flood (1% Annual Exceedance Probability) for about 285 properties from the River Bride.

2.6.4 Douglas Flood Relief Scheme (including Togher Culvert)

The Douglas (Togher) Flood Relief Scheme was initiated in 2014 following major flooding in 2012. It is currently at the Outline Design and Planning stage, and is expected to go to construction in 2018. The Scheme, that comprises conveyance improvement, culvert removal and replacement, Flood Defence walls and a trash screen, is expected to provide protection against the 100-Year flood (1% Annual Exceedance Probability) for about 130 properties from the Ballybrack Stream in Douglas, as well as about 100 properties from the Tramore River in Togher.

2.6.5 Ballinhassig Prefeasibility Study

A prefeasibility study is currently underway for Ballinhassig. This will outline a preferred flood relief option along with a BCR, to determine whether flood protection may be potentially viable for Ballinhassig, up to against a 100-Year flood (1% Annual Exceedance Probability). The report is expected to be completed early in 2018.

2.6.6 Glashaboy (Glanmire/Sallybrook) Flood Relief Scheme

The Glashaboy Flood Relief Scheme was initiated in 2014 following major flooding in 2012. It is currently at Confirmation stage under the Arterial Drainage Acts, and is expected to go to construction in 2018. The Scheme, that comprises Flood Defence embankments and

walls, culverts and bridge works, vegetation clearing, individual property protection, and a pumping station is expected to provide protection against the 100-Year flood (1% Annual Exceedance Probability) for about 98 properties from the Glashaboy River, as well as protection for a further 19 properties against the 200-Year (0.5% Annual Exceedance Probability) tide.

2.6.7 Baile Mhic Ire/Baile Bhúirne Flood Relief Scheme

The Baile Mhic Ire / Baile Bhúirne Flood Relief Scheme is currently at pre-Exhibition Stage, and is expected to go to Exhibition in 2018. The Scheme comprises of a combination of embankments, walls, channel straightening, bridge underpinning and localised dredging and is expected to provide protection against a 100-Year flood (1% Annual Exceedance Probability) for 80 properties against fluvial flooding.

2.6.8 Crookstown Flood Relief Scheme

The Crookstown Flood Relief Scheme was initiated in 2014, following major flooding in 2012 and 2009. The Scheme is currently at feasibility study stage.

2.6.9 Tower Flood Defences

Flood defences were previously built to protect properties in the community of Tower / Blarney.

2.6.10 Carrigaline Flood Relief Scheme

The Carrigaline Flood Relief Scheme has been under review to confirm the technical aspects and viability, and, subject to outcomes, will then progress to Outline Design and Planning.

2.6.11 Cobh Measures

A flood relief scheme for Cobh was developed under the Lee CFRAM Study. The proposed measure consisting of Flood Defence walls to protect 8 properties against the 200-Year tide (0.5% Annual Exceedance Probability) has a Benefit-Cost Ratio of 0.9. The Lee CFRAM Study proposed carrying out a review of the technical and economic aspects of the proposed scheme to establish viability.

2.6.12 Little Island Measure

A flood relief scheme for Little Island was developed under the Lee CFRAM Study, and proposed for progression to implementation in the Lee CFRAM Study. The proposed measure consists of the installation of a sluice gate under the N25 to prevent the natural propagation of tidal water into low lying lands to the north of the N25 and is expected to provide protection against a 200-Year flood (0.5% Annual Exceedance Probability).

2.6.13 Macroom Hydrology and Hydraulics Review

A study is currently underway to review the hydrology and hydraulic analysis completed under the Lee Pilot CFRAM Study to determine whether a flood protection scheme may be potentially viable for Macroom. This study is expected to be completed in 2018.

2.6.14 Passage West Measure

The development of a tidal flood forecasting system was proposed for Passage West under the Lee CFRAM Study.

2.6.15 Whitegate Measure

The development of a tidal flood forecasting system was proposed for Whitegate under the Lee CFRAM Study.

2.6.16 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 Lee, Cork Harbour & Youghal Bay River Basin.

- Ballinhassig DD – Cork County Council
- Bride Kilcrea DD – Cork County Council
- Carrigrohane – Maglin DD – Cork City and Cork County Council
- Castlemartyr DD – Cork County Council
- Cork Slob DD – Cork City Council
- Glasheen DD – Cork City Council
- Killard DD – Cork County Council
- Tramore DD – Cork City and County Council
- Womanagh DD – Cork County Council
- Youghal DD – Cork County Council

2.6.17 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/minorfloodworkscoastalprotection/scheme/>

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.

Table 3.1 *List of the AFAs within the Lee, Cork Harbour & Youghal Bay River Basin*

ID No.	COUNTY	NAME	SOURCE(S) OF FLOOD RISK
190268	Cork	Inchigeelagh	Fluvial
190270	Cork	Macroom	Fluvial
190274	Cork	Killeagh	Fluvial
190277	Cork	Castlemartyr	Fluvial
190279	Cork	Middleton / Ballinacurra	Fluvial
190280	Cork	Blarney / Tower	Fluvial
190282	Cork	Whitegate	Coastal
190283	Cork	Passage West	Coastal
190284	Cork	Little Island	Coastal
190286	Cork	Cork City	Fluvial / Coastal
190288	Cork	Togher	Fluvial
190289	Cork	Carrigaline	Coastal
190290	Cork	Glanmire	Fluvial / Coastal
190291	Cork	Douglas	Fluvial / Coastal
190292	Cork	Ballymakeery / Ballyvourney	Fluvial
192407	Cork	Cobh	Coastal
192414	Cork	Crookstown	Fluvial
195499	Cork	Ballingeary	Fluvial

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.

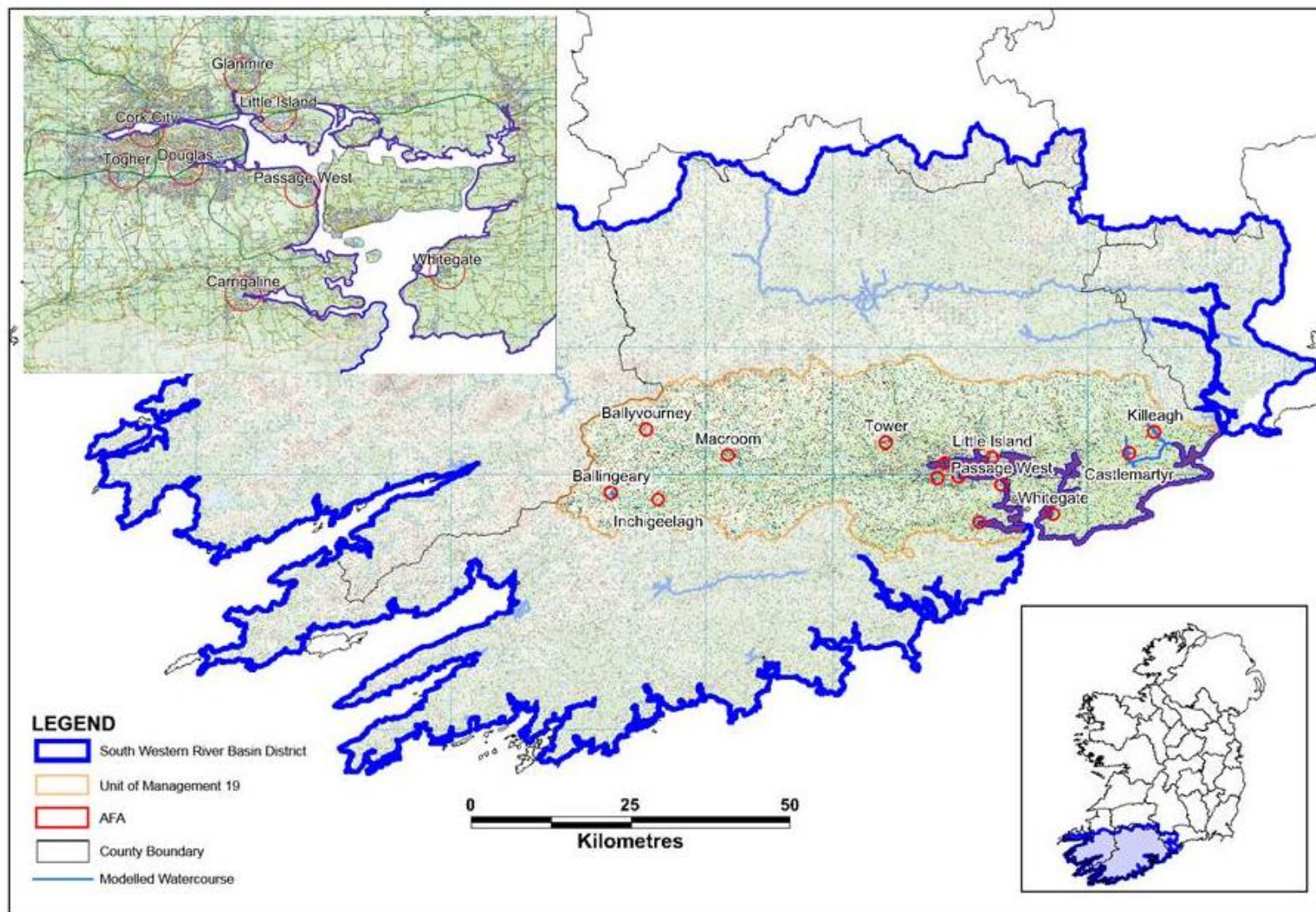


Figure 3.1 Map of the AFAs within the Lee, Cork Harbour and Youghal Bay River Basin

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 Lee, Cork Harbour & Youghal Bay River Basin in the development of this Plan. An overview of the CFRAM consultation stages and structures is provided diagrammatically in Figure 4.1.

4.1.1 Lee CFRAM Pilot Study Consultations

During the Lee CFRAM Pilot Study a series of public information and consultation days were held at key locations around the catchment at the start of the study in December 2006 and more recently in May 2009 when the draft flood maps and preliminary flood risk management options were presented. A total of 11 events were held (seven in 2006 and four in 2009), which were well-publicised in the national and local media and advertised locally. To follow up the events in May 2009, the draft flood maps were also made available for comment on the project website. The information obtained from these events has informed the finalisation of the flood maps for the catchment and the development of the Plan and its SEA.

The final stage of the consultation process was the publication of and consultation on the draft FRMP and accompanying SEA ER. The draft FRMP and SEA ER were made available on the project website www.leecframs.ie and in hard copy at the following Cork City Council and Cork County Council Offices throughout the catchment (Cork City Hall Foyer, Cork County Hall, Middleton Town Council Offices, Macroom Town Council Offices and Carrigaline Area Engineer's Offices). Comments on the draft FRMP were invited between 1 February 2010 and 30 April 2010. Following a review of comments received, and detailed analysis of the November 2009 flood event, the draft FRMP has been amended, finalised and published, together with a post-adoption SEA Statement, documenting how the comments received have been addressed.

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 South Western 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

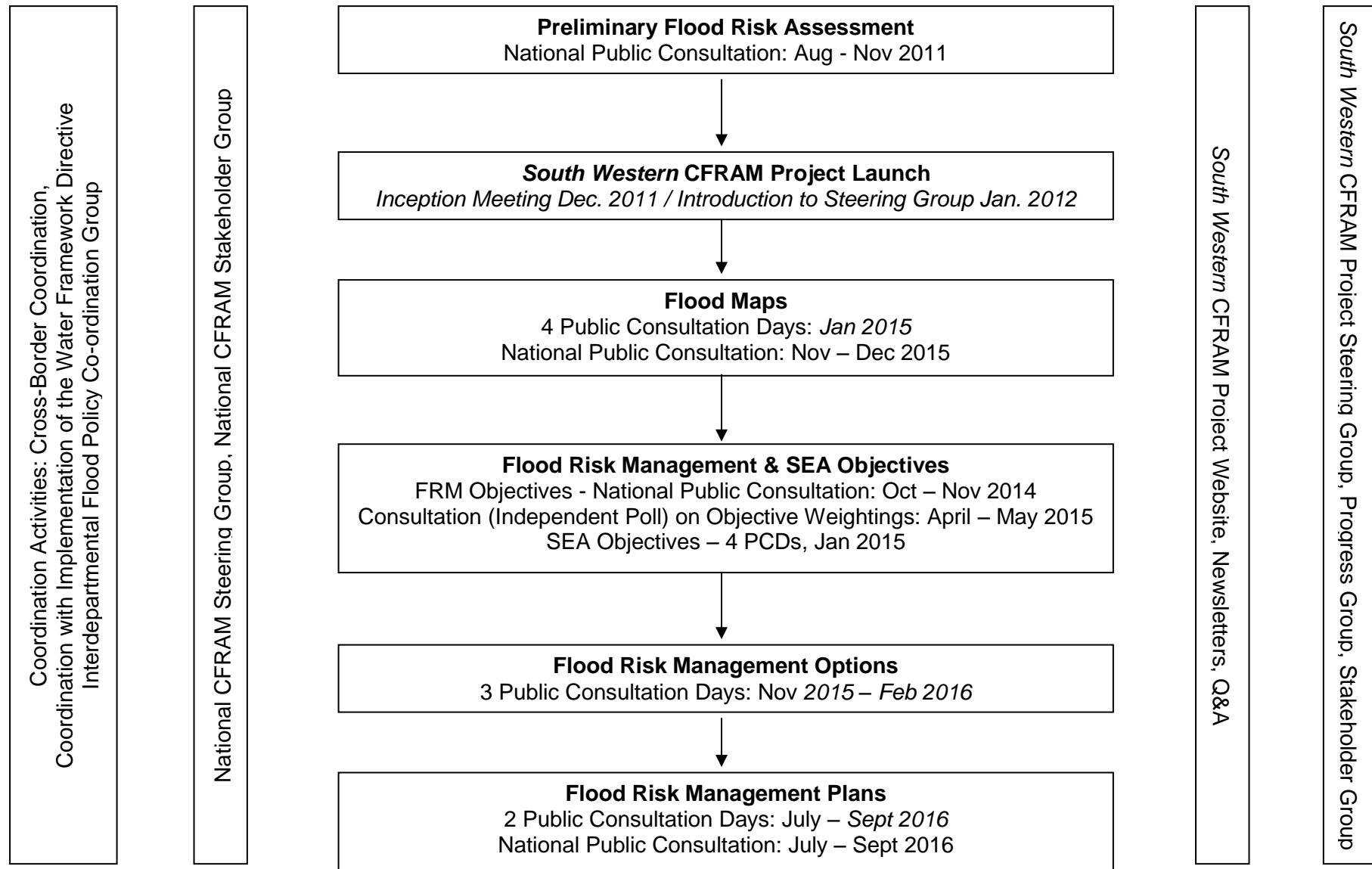
4.3.1 The CFRAM Steering and Progress Groups

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).

Figure 4.1: Overview of the CFRAM Consultation Stages and Structures



4.3.1.2 South Western CFRAM Project Steering Group

A Project Steering Group was established for the South Western CFRAM Project, that includes the Lee, Cork Harbour and Youghal Bay River Basin, in 2012. This Group, which includes senior representatives of the members, provides for the input of the members to guide the CFRAM Programme and acts 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 D.2.

4.3.1.3 South Western CFRAM Project Progress Group

A Project Progress Group was established for the South Western CFRAM Project in 2012. This group is a working group that supports the Project Steering Group and meets 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 South Western 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 South Western CFRAM Stakeholder Group was established in 2012, and met on three occasions up 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 South Western CFRAM Project. The organisations listed in Appendix D.4 have 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 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 South Western 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.

4.4.2.1 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 Mott MacDonald Ireland 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 Lee, Cork Harbour and Youghal Bay River Basin were held for consultation on the flood maps at the venues listed in Appendix D.5.

4.4.2.2 National Flood Map Consultation

The Government considered it appropriate to stipulate in SI No. 122 of 2010 that a national consultation exercise should be undertaken⁶. The consultation on the flood maps for all areas (*including those developed through the Pilot CFRAM Projects and other Projects*) was launched in November 2015. Observations and Objections submitted through the consultation process have been assessed and the flood maps amended accordingly, where appropriate.

⁶

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

4.4.3 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 UCD⁷, and the weightings for each of the Objectives then set.

4.4.4 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 Lee, Cork Harbour & Youghal Bay River Basin were held during the option development stage at the venues listed in Appendix D.6.

4.4.5 Consultation on Draft Plans

The Draft Plan for the Lee, Cork Harbour & Youghal Bay River Basin as published for the purposes of public consultation on 15 July 2016. Observations from the public and from relevant Councils were to be submitted to the OPW by 23 September and 17 October 2016 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. The PCDs in the Lee, Cork Harbour & Youghal Bay 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).

⁷ (UCD, 2015): Weighting the Perceived Importance of Minimising Economic, Social and Environmental/ Cultural Risks in Flood Risk Management, University College Dublin, 2015

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 Lee, Cork Harbour & Youghal Bay 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.

A review and analysis of historical flood events, hydrometric data and hydrogeomorphological processes highlighted flooding issues to urban areas and nationally important infrastructure from the River Womanagh, Upper Lee, Bunsheelin River and a number of smaller tributaries. The Flood Studies Update methodologies were used to determine the current design peak flows for eight specified flood probabilities. Rainfall-runoff modelling was used to derive the critical hydrograph at Ballingeary that results in flooding to the town. The FSU UPO-ERR Gamma curve was applied to derive the characteristic flood hydrographs across the Womanagh catchments. Corresponding coastal conditions were developed for the design fluvial events. Calibration events were identified in Castlemartyr, Killeagh, and Ballingeary where there was sufficient historical flood data.

Potential future catchment changes relevant to the Upper Lee and Womanagh catchment were assessed including changes in urban development, land use and hydrology related to global climate change. Two future scenarios were developed from this analysis, a Mid Range Future Scenario and High End Future Scenario, which were used to develop potential future flows and extreme sea levels.

The resultant design flood hydrographs and coastal conditions were used as input to the hydraulic models used to map flood hazard and to develop flood risk management options.

Full details of the hydrological analysis are provided in the South Western CFRAM Hydrology Report, UoM 19, which can be accessed through the OPW website (www.floodinfo.ie).

Details of the hydrological analysis carried out as part of the Lee CFRAM Pilot study are included in the Lee CFRAMS Hydrology Report and can be found at 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.

Four hydraulic models were developed for the Lee, Cork Harbour and Youghal Bay River Basin as follows:

- I18BY Covering Ballingeary and Inchigeelagh Areas for Further Assessment (AFAs);
- I19CR Covering Castlemartyr and downstream to the Womanagh;
- I20KL Covering Killeagh and downstream to Womanagh; and,
- I21WH Covering the River Womanagh Medium Priority Watercourse from Ladysbridge to the Sea

The hydraulic assessment and flood mapping for the remainder of the River Basin was completed as part of the Lee Pilot CFRAM Study in 2013.

The river channels were modelled using 1D software to calculate water levels, flows and head loss at hydraulic structures. 2D software was used to simulate the multi-directional flows across the urban floodplains of Castlemartyr and Killeagh. The 1D and 2D components of the models were hydrodynamically linked such that water can flow between the river and floodplain during the event to simulate the observed flood mechanisms. A 1D approach was taken in Ballingeary and Inchigeelagh because the floodplain flow was deemed to be parallel to and fully connected with the channel flow.

The Ballingeary, Inchigeelagh and Castlemartyr models were calibrated to the flood events of 19th November 2009 at Ballingeary, Inchigeelagh and Castlemartyr AFAs. The Killeagh and Womanagh models were not calibrated due to a lack of flood report, extents, levels and gauge information. However, sensitivity tests were undertaken on flow, downstream level and Manning's 'n' for all models.

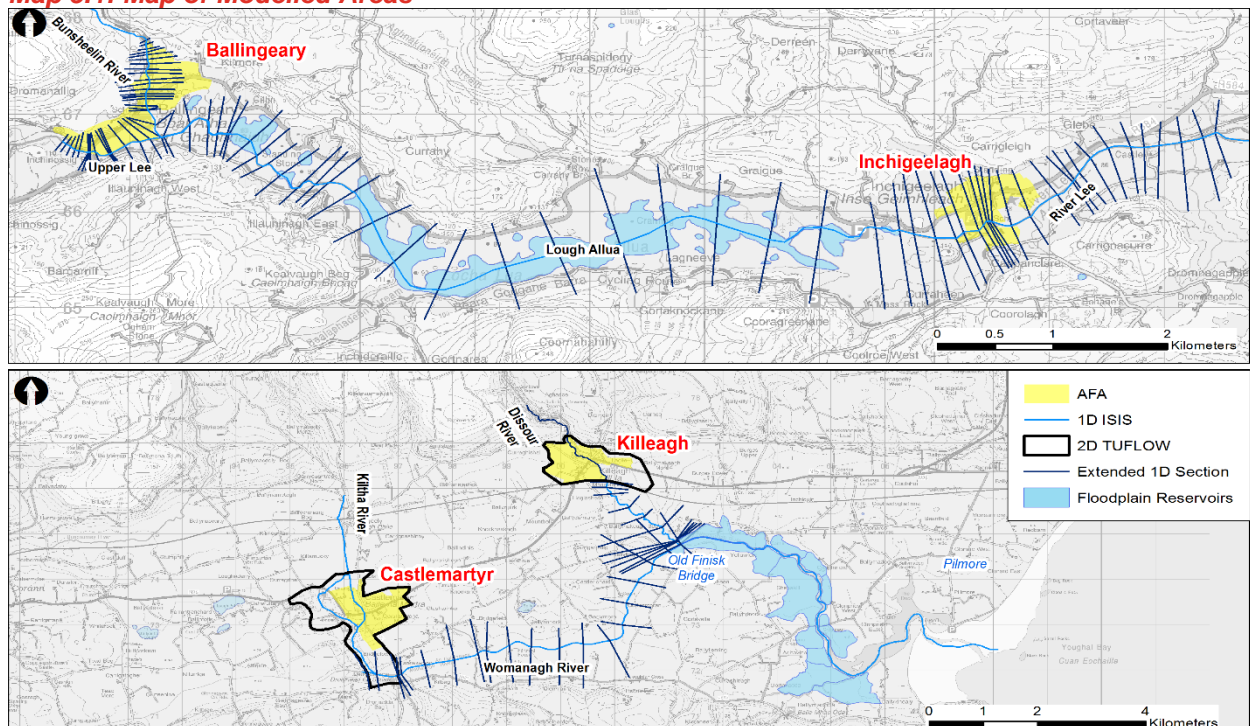
The calibrated and tested models were then run for eight flood probabilities under the current design scenario, eight flood probabilities under the mid-range future scenario, and three flood probabilities under the high end future scenario from both fluvial and coastal sources. Each scenario considers the joint probability between fluvial sources of both the main river and tributaries in Ballingeary, Inchigeelagh, and Womanagh; and between fluvial and coastal sources on the Womanagh. Joint probability between different fluvial sources was not considered for Castlemartyr and Killeagh because there are no tributaries within the Areas for Further Assessment.

The flood extent, flood zone, flood depth, flood velocity and flood hazard were mapped for the specified scenarios.

The findings from the modelling results and flood maps were used as inputs to the flood risk review. The knowledge of the flood mechanisms, critical structures and impact of flooding established supported the development of sustainable and appropriate flood risk management options in the flood risk areas.

The flood frequency analysis for extreme sea levels was taken from the Irish Coastal Protection Strategy Study (ICPSS), 2012.

Map 5.1: Map of Modelled Areas



Full details of the hydraulic analysis are provided in the South Western CFRAM Hydraulics Report, UoM 19, which can be accessed through the OPW website (www.floodinfo.ie).

To assess existing and future flood hazard in the Lee CFRAM Pilot Study the catchment was split into nine separate models: Upper Lee, Lower Lee, Glashaboy, Owenboy, Owennacurra, Carrigtohill, Kiln, Tramore / Douglas, and Cork Harbour.

A total length of 250km of rivers was modelled, with 86km of river located within the urban areas and 164km in the rural areas. A total area of 354 square kilometres was modelled for Cork Harbour.

Details of the hydraulic analysis carried out as part of the Lee CFRAM Pilot study are included in the Lee CFRAMS Hydraulics Report which 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 Management⁸.

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.

The results of the 1D/2D hydraulic models were used to produce the following mapped outputs:

- Maps of maximum flood extent maps for each AFA and MPW reach
- Maps of maximum flood depth, in ranges / classifications for each AFA and MPW reach
- Maps of maximum velocities of floodplain flow, in ranges / classifications for each AFA
- Maps of maximum flood hazard (risk to people) which is a function of depth and velocity for each AFA
- Maps of Flood Zones which show three flood extents as zones A, B and C, to facilitate implementation of the Guidelines on the Planning System and Flood Risk Management for each AFA and MPW reach

Flood mapping carried out as part of the Lee CFRAM Pilot study are included in the Lee CFRAMS Hydraulics Report which can be found at: www.floodinfo.ie

As highlighted in Section 4.4.3, the flood maps were presented to the public at consultation events held in each of the AFAs. The feedback received on the flood maps for the Lee, Cork Harbour and Youghal Bay River Basin was positive and no observations were received during the public consultation days.

The flood maps can be accessed through the OPW website (www.floodinfo.ie).

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).

⁸ DHPLG/OPW 2009: Guidelines on The Planning System and Flood Risk Management

5.4 FLOOD RISK ASSESSMENT AND MAPPING

Using the flood hazard mapping described in Section 5.3, the potential adverse consequences (risk) associated with flooding to the following four risk receptor groups were assessed and mapped (General Flood Risk Maps) for each AFA:

- Society
- The Environment
- Cultural Heritage
- The Economy

The number of properties within a flood extent was calculated by counting the number of receptors that had any part of their footprint located within a location that had a positive depth of flooding (flood extent).

In addition, specific flood risk maps were prepared to assess the following:

- Number of Inhabitants: maps which present the indicative number of inhabitants at risk of flooding
- Types of Economic Activity: maps which present the types of property use and type of economic activity at risk of flooding
- Specific Risk Density: maps which present the annual average damage.

An assessment of each AFA's vulnerability to climate change was also carried out. An AFA is deemed as being significantly vulnerable to climate change if the increase in damages in the Mid-Range Future Scenario is significantly different to the current scenario. According to this definition none of the AFA's within the Lee, Cork Harbour and Youghal Bay River Basin were identified as being significantly vulnerable to climate change.

The flood maps can be accessed through the OPW website (www.floodinfo.ie).

Table 5.1 presents a summary of the Current risk within the Lee, Cork Harbour & Youghal Bay 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.

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

Table 5.1: Summary of Flood Risk in the Lee, Cork Harbour & Youghal Bay River Basin

AFA / Area / MPW	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	
Ballingeary Fluvial	21	28	25	30	23.7
Castlemartyr Fluvial	13	17	9	16	3.3
Killeagh Fluvial	0	0	0	1	0
Inchigeelagh Fluvial	14	22	14	22	7.3
LEE CFRAM AFAs					
Ballymakeery / Ballyvourney Fluvial	61	N/A	19	N/A	23.2
Blarney / Tower Fluvial	11	N/A	0	N/A	0.3
Carrigaline Fluvial	42	N/A	5	N/A	1.6
Tidal	75	N/A	54	N/A	25.2
Cobh Tidal	3	N/A	5	N/A	2.2
Cork City Fluvial	994	N/A	992	N/A	176.5
Tidal	891	N/A	998	N/A	39.9
Crookstown Fluvial	5	N/A	4	N/A	0.6
Douglas / Togher Fluvial	72	N/A	13	N/A	7.4
Tidal	10	N/A	0	N/A	0.0
Glanmire / Sallybrook Fluvial	30	N/A	3	N/A	0.8
Tidal	20	N/A	5	N/A	0.8
Little Island Tidal	16	N/A	9	N/A	14.4
Macroom Fluvial	5	N/A	7	N/A	2.2
Midleton / Ballinacurra Fluvial	145	N/A	68	N/A	33.6
Tidal	80	N/A	62	N/A	23.8
Passage West Tidal	33	N/A	22	N/A	1.0
Whitegate Tidal	36	N/A	5	N/A	0.8
Kiltha	0	0	0	0	N/A

Womanagh					
Fluvial	1	3	3	10	N/A
Tidal	0	1	1	1	N/A

Notes: 1: AEP Flood Event Probabilities: 1% (or 100-year flood) for Fluvial Flooding, 0.5% (or 200-year flood) for Coastal / Tidal Flooding
2: NPVd = Net Present Value Damages (accumulated, discounted damages over 50 years)
3: N/A = data was not extracted for the Lee CFRAM Study

The numbers of properties at risk in Table 5.1 above are determined independently for each source (fluvial and coastal). For AFA's / MPW's where both sources of flooding occur, some properties may be at risk from both sources, and such properties have been included in the numbers for both sources.

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.

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 Lee, Cork Harbour & Youghal Bay 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 Lee, Cork Harbour & Youghal Bay River Basin 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 Lee, Cork Harbour & Youghal Bay River Basin, the level of risk has been determined as being low in the Killeagh AFA. This is because there are no properties at risk in Killeagh from the 1% AEP fluvial flood event.

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 Lee, Cork Harbour & Youghal Bay 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 respectively⁹. This Section provides a description of the process used to ensure that the environmental considerations within the Lee, Cork Harbour & Youghal Bay 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 (Vol. III), 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 (Vol. III) 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)¹⁰.

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 can not 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

⁹ SI No. 435 of 2004 (SEA Directive) and SI No. 477 of 2011 (Habitats Directive)

¹⁰ 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 7.1). Flood relief schemes and works proposed or progressed through other projects and plans (see Table 7.2) 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.

Particular issues such as knowledge gaps or mitigation measures that are expected to be necessary, are set out in Section 6.6.3 and Sections 7.4 for each preferred measure

Error! Reference source not found. shows the interaction and stages of the optioneering, SEA and AA processes.

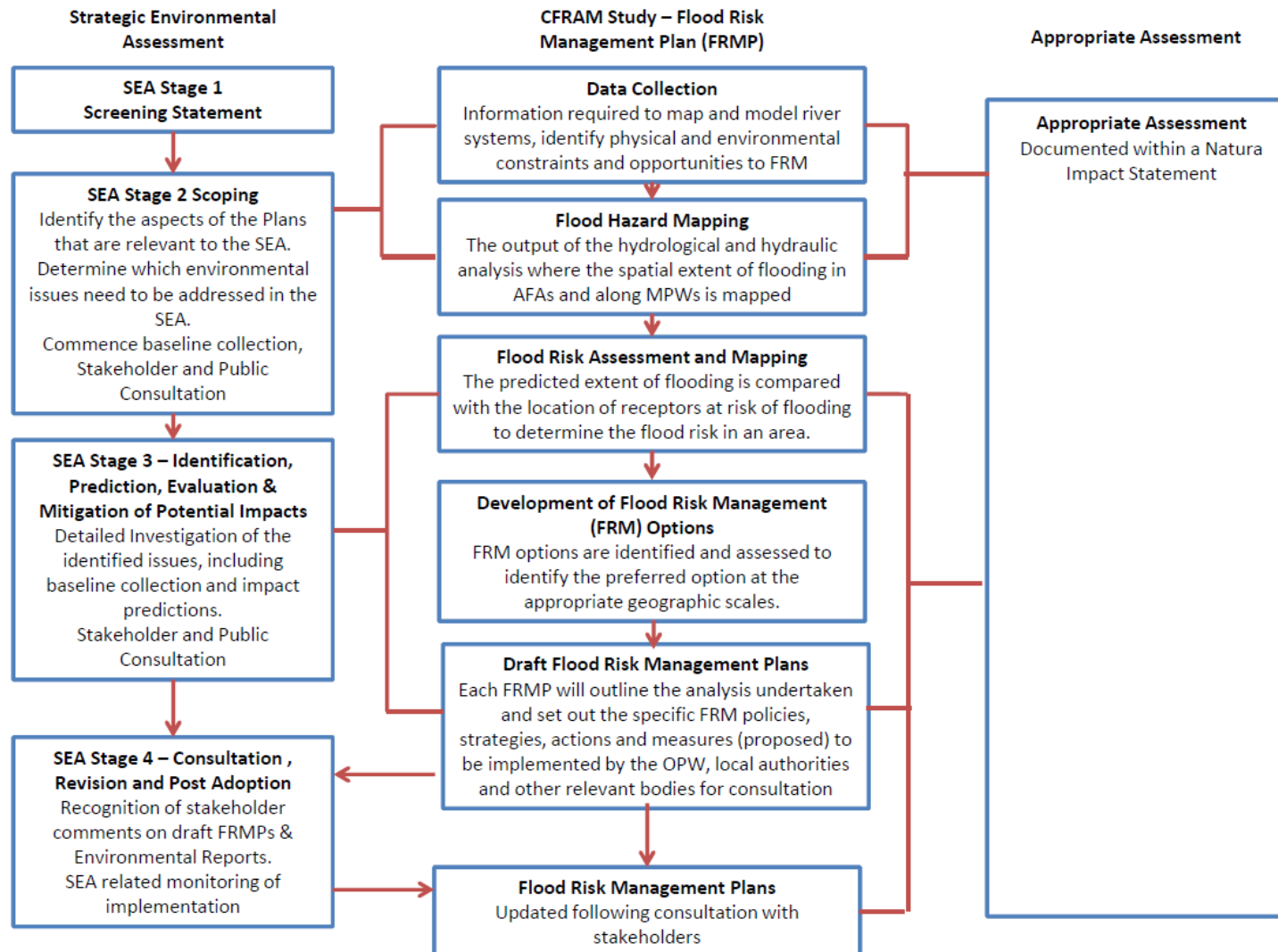


Figure 6.1: Interaction and Stages of Optioneering, SEA and AA Process

6.2 ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES IN THE LEE, CORK HARBOUR & YOUGHAL BAY RIVER BASIN

6.2.1 Castlemartyr

The key environmental sensitivities of the Castlemartyr AFA are summarised below:

- The Womanagh River stretches from its source at Carrigour to its tidal outfall at Pilmore.
- The Kiltha River flows from Springfields/Mogeely southwards through Castlemartyr to join the Womanagh near Ladysbridge. Upstream of Castlemartyr, the Kiltha splits with a historic flow diversion through the Castle grounds and through a lake before re-joining downstream of the town.
- The River Womanagh is classified as having a moderate to good water status under the Water Framework Directive (WFD) and is a considered sensitive body. Kilath is unclassified under the WFD.
- The rivers discharge into Youghal Bay a shellfish sensitive area designated under the European Communities (Quality of Shellfish Waters) Regulations 2006 as amended.
- The Castlemartyr AFA boundary does not overlap with any Natura 2000 site boundary. The Ballymacoda Bay Special Area of Protection (SPA) and Ballymacoda (Clonpriest and Pillmore) Special Area of Conservation (SAC) are located approximately 10km east of Castlemartyr. The Kiltha River (which flows through Castlemartyr) is hydrologically connected to Ballymacoda Bay via the Womanagh River.
- There are no significant polluting sources within the 1% Annual Exceedance Probability (AEP) flood extent.
- Womanagh River is not known as a river for high salmon/lamprey potential. There may be local fishing amenity value along the river.
- The village and surrounding area has a wealth of natural and built heritage. According to the Cork County Development Plan (2014), there are five buildings or other structures located within the village, which are entered in the Record of Protected Structures. These includes St. Anne's Church of Ireland and Castlemartyr Castle, which, along with its grounds and part of the village main street, are included as part of an Architectural Conservation Area. According to the Plan there is an objective to protect and enhance the special character of the area. These sites are not within the 1% AEP fluvial flood extent.
- According to the Cork Development Plan (2014), Castlemartyr is located within an area characterised as "Broad Fertile Lowland Valley" landscape character type. This landscape character type is classified as having local value and medium sensitivity in its ability to accommodate change without adverse impact on its character and value. There are no scenic routes within the town.
- Receptors at risk from the 1% AEP flood extent within the AFA include
 - 13 No. Residential properties
 - 9 No. Non-Residential properties
 - 1 No. Society Amenity Site
 - 3 No. Roads at risk

- There are no high vulnerability properties at risk from fluvial flooding within the AFA. There are no recorded or protected archaeological monuments or sites at risk from fluvial flooding within the AFA.

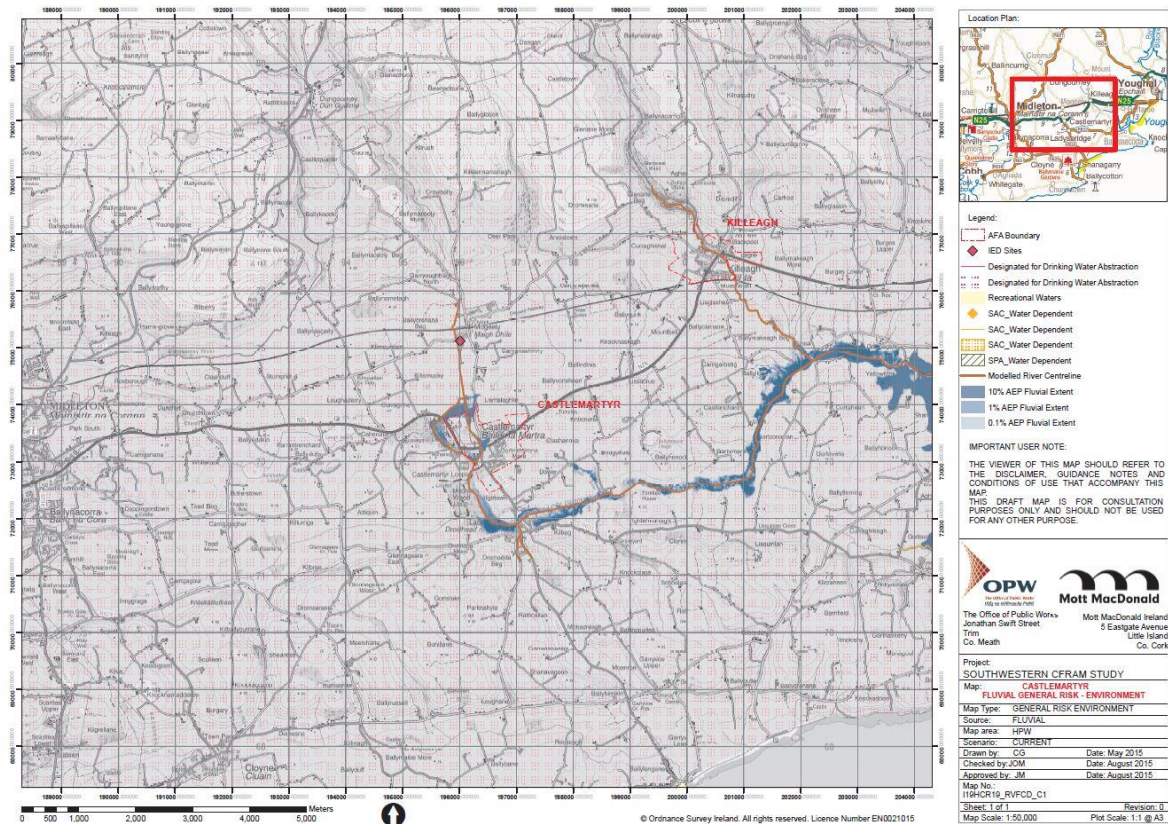


Figure 6.2: Castlemartyr Environmental Sites / Features (Fluvial Risk)

6.2.2 Ballingeary

The key environmental sensitivities of the Ballingeary AFA are summarised below:

- The Bunsheelin stream and River Lee flows through Ballingeary. These watercourses are classified as good status under the WFD.
- The River Lee supports an important population of salmonid fish and is considered sensitive to potential impacts from the flood risk management measures. Spawning grounds for salmonid are likely upstream along the River Lee. There is local fishing amenity value along the River Lee.
- There is one significant polluting source at risk from flooding in the 1% AEP flood extent.
- The AFA boundary does not overlap with any Natura 2000 site boundary. The Gearagh SPA and The Gearagh SAC are located approximately 15km southeast of Ballingeary. The sites are hydrologically connected via the River Lee.
- According to the Cork County Development Plan (2014), the village occurs in a landscape character zone "Ridged and Peaked upland". The landscape value is considered to be high value and has a sensitivity of local importance.
- According to the Cork County Development (2014), the approach roads into the town are protected scenic routes.
- Receptors at risk from the 1% AEP flood extent within the AFA include:
 - 21 No. Residential properties
 - 25 No. Non-Residential properties
 - 2 No. Society Amenity Site
 - 3 No. Roads at risk
 - 1 No. High Vulnerability Properties

6.2.3 Inchigeelagh

The key environmental sensitivities of the Inchigeelagh AFA are summarised below:

- The River Lee flows through Inchigeelagh AFA. This watercourse is classified as good status under the WFD.
- The River Lee supports an important population of salmonid fish and is considered sensitive to potential impacts from the flood risk management measures. Spawning grounds for salmonid are likely upstream along the River Lee. River Lee is noted for its importance of fishery amenity value.
- There is one significant polluting source at risk from flooding in the 1% AEP.
- The Inchigeelagh AFA boundary does not overlap with any Natura 2000 site boundary. The Gearagh SPA and Gearagh SAC are located approximately 7km east of the village.
- According to the Cork County Development Plan (2014), the village occurs in a landscape character zone assigned as "Ridged and Peaked upland". The landscape value is considered to be high value and sensitivity of local importance.
- According to the Cork County Development Plan (2014), there are scenic routes on the approach road from Ballingeary.
- Receptors at risk from the 1% AEP flood extent within the AFA include:
 - 14 No. Residential properties
 - 14 No. Non-Residential properties
 - 1 No. Society Amenity Site
 - 2 No. Roads at risk
- There are no high vulnerability properties at risk from fluvial flooding within the AFA.
- There are no NIAH monuments at risk within the 1% AEP extent. There is one monument (Record of Monuments and Places) within the 1% AEP extent

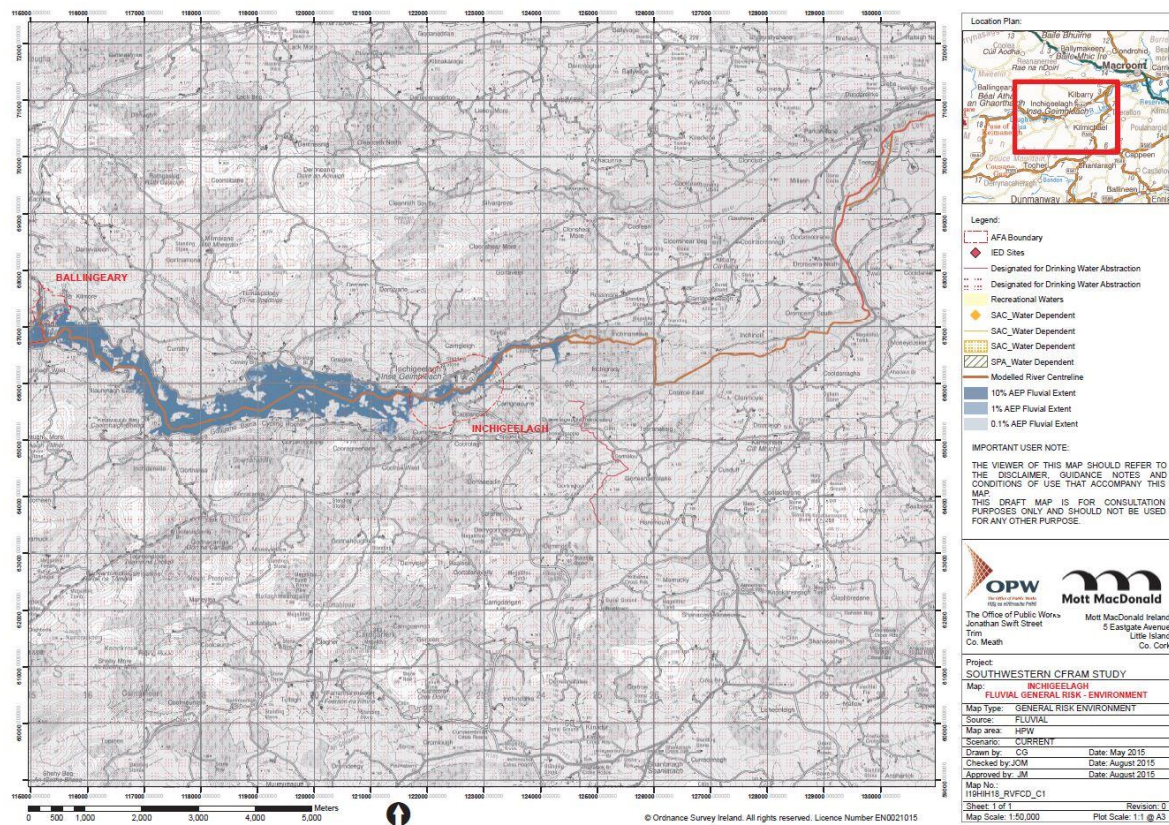


Figure 6.4: Inchegeelagh – Environmental Sites / Features (Fluvial Risk)

The SEA Environmental Report for the Lee, Cork Harbour & Youghal Bay River Basin can be found at: www.floodinfo.ie

The Appropriate Assessment for the Lee, Cork Harbour & Youghal Bay River Basin can be found at: www.floodinfo.ie

6.3 STRATEGIC ENVIRONMENTAL ASSESSMENT

The SEA process involves six key stages as follows:

- Screening - the process of deciding whether the flood risk management plans would be likely to have significant environmental effects and as such would warrant a full SEA. The OPW conducted a screening assessment for the CFRAM studies in September 2011 which concluded that a full SEA is required.
- Scoping – Scoping determines the key environmental issues which are to be addressed in the Strategic Environmental Assessment. The scoping process set out a framework for the assessment of environmental effects resulting from a plan or programme and the generation of alternatives to ensure minimal environmental impact. The SEA scoping process was completed in April 2015 following a consultation process with stakeholders.
- Environmental Assessment and Environmental Report – this is a key document in the SEA process as it outlines the likely significant effects on the environment of the Flood Risk Management Plan and recommends mitigation to address the significant adverse effects. The determination of the likely significant effects on the environment is based on a qualitative assessment under a series of Environmental Objectives. These environmental objectives are based on Environmental headings in Annex 2(f) of the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations, 2004 (S.I. 435 of 2004) as amended, and include the following aspects;
 - Biodiversity;
 - Population;
 - Human health;
 - Fauna;
 - Flora;
 - Soil;
 - Water;
 - Air;
 - Climatic factors;
 - Material assets;
 - Cultural heritage including architectural and archaeological heritage;
 - Landscape; and
 - The inter-relationship of the above factors.

The Report also contains a history of the SEA process and how it was conducted with particular emphasis on stakeholder and public involvement;

- Consultation on the Plan and SEA Environmental Report – Consultations were conducted with the relevant Environmental Authorities and also with the public. Both groups were invited to make submissions in relation to the Plan and Environmental Report. Submissions were considered and the Environmental Report amended appropriately if deemed necessary;
- SEA Statement – From a legal and process perspective the production of the SEA Statement was the most important phase in the process. The function of the SEA Statement was to identify how the SEA process influenced the plan. This required careful scripting, particularly in the context of how differing opinions from consultees were managed throughout the process. Another requirement of the SEA Statement was the inclusion of reasons for choosing the plan as adopted in light of the other reasonable alternatives considered.

- **Monitoring** - Monitoring requirements refer to the need to monitor the significant effects on the environment as a result of the implementation of the Plans. Monitoring begins with the adoption of the plan and continues for the duration of the plan.

The SEA Environmental Report and Statement carried out as part of the Lee CFRAM Pilot study can be found at www.floodinfo.ie

6.4 APPROPRIATE ASSESSMENT

The European Commission in 2002 published guidance on the assessment of plans and projects significantly affecting Natura 2000 sites. This guidance provides details of the general approach to Appropriate Assessment. The guidance sets out a tiered/staged approach as summarised below:

Stage 1 - Screening for a likely significant effect: An initial assessment of the project or plan's effect on a European site(s). A description of the plan/project and the elements that have the potential to impact on Natura 2000 sites must be provided. The potential impacts and their significance must be assessed. If it cannot be concluded that there will be no significant effect upon a European site, an Appropriate Assessment is required;

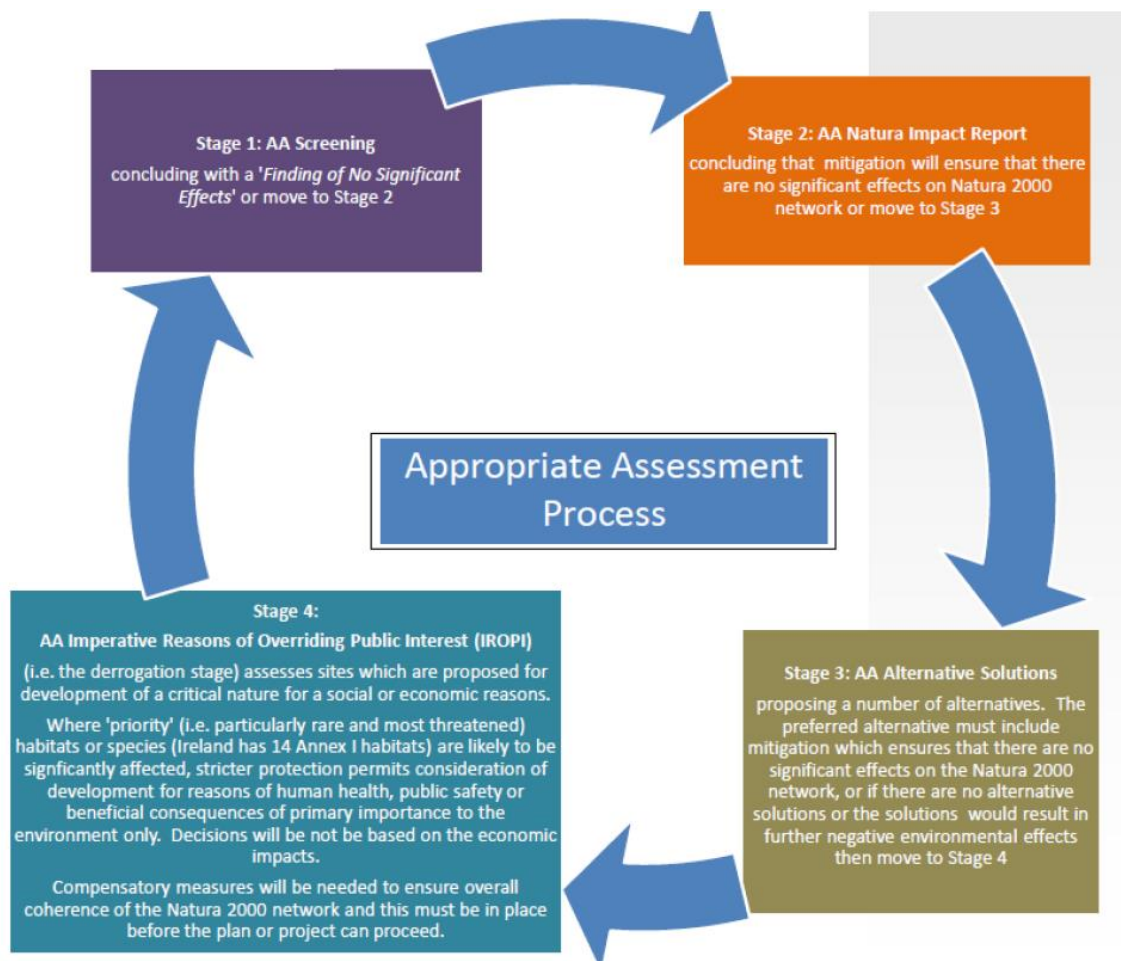
Stage 2 - Appropriate Assessment: The consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts. The output of this stage of Appropriate Assessment is a Natura Impact Statement (NIS) report;

Stage 3 – Assessment of alternative solutions: The process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site (where mitigation cannot be achieved); and

Stage 4 – Assessment where no alternative solutions exist and where adverse impacts remain: Development of compensatory measures where, in the light of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed.

Each stage in the process determines whether a further stage is required. If, for example, the conclusions at the end of Stage 1 are that there will be no significant impacts on the Natura 2000 site, there is no requirement to carry out an Appropriate Assessment (Stage 2). The approach to Appropriate Assessment screening must however apply the precautionary principle i.e. where it cannot be definitively determined that a plan/project will not adversely impact the integrity of the Natura 2000 site then it must be assumed that there is potential for impact and a full Appropriate Assessment must be carried out.

The objective of the process is to provide adequate information, based on the best available scientific information, to inform the Competent Authority to enable them to conduct an assessment of whether the plan or project is likely to have a significant effect on the conservation objectives of the relevant Natura 2000 sites within the zone of influence. Where adverse impacts are identified mitigation measures necessary to avoid, reduce or offset such impacts must be prescribed.



Source: West Regional Authority (WRA) in association with the Environmental Protection Agency (EPA) (2013) Draft 'SEA Resource Manual for Local and Regional Authorities'

Figure 6.5: Appropriate Assessment Process

The AA and NIS carried out as part of the Lee CFRAM Pilot study can be found at www.floodinfo.ie

The assessment of impacts of flood risk management options in Ballingeary, Castlemartyr and Inchigeelagh has determined that no likely significant effects on Natura 2000 sites are reasonably foreseeable as a result of the implementation of flood risk management measures.

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 can not 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 can not 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 / Detailed Design

For the detailed design 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 detailed design 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 surveys¹¹
- 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).

¹¹ 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.

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.¹²

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.

¹² 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 Lee, Cork Harbour & Youghal Bay 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 Lee, Cork Harbour & Youghal Bay River Basin is set out in the Preliminary Options Report for the South Western 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.

Within the Lee, Cork Harbour & Youghal Bay River Basin, the River Lee from Ballingeary to Inchigeelagh forms a Sub-Catchment SSA where measures and options have potential to benefit both AFAs.

No IRRs have been identified within the South Western RBD and as such are not considered.

Based on the above, the Lee, Cork Harbour & Youghal Bay River Basin is split into 3 Spatial Scales of Assessment (SSAs).

These are:

- The River Basin
- Sub-Catchment
 - Ballingeary / Inchigeelagh
- Areas for Further Assessment (AFAs)
 - Ballingeary

- Inchigeelagh
- Castlemartyr
- Killeagh

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 option, 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 Lee, Cork Harbour & Youghal Bay 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 Options

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 Mott MacDonald Ireland
- 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 Lee, Cork Harbour & Youghal Bay 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 Plan along with those developed through the CFRAM Programme.

7.4 OUTCOMES

The application of the process and the resultant outcomes for the Lee, Cork Harbour & Youghal Bay 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:	IE19-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:	IE19-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:	IE19-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:	IE19-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:	IE19-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:	IE19-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

There are 7 Arterial Drainage Schemes and existing flood relief schemes within the Lee, Cork Harbour & Youghal Bay River Basin as 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 10 Drainage Districts within the Lee, Cork Harbour & Youghal Bay River Basin, namely the Ballinhassig DD, Bride Kilcrea DD, Carrigrohane – Maglin DD, Castlemartyr DD, Cork Slob DD, Glasheen DD, Killard DD, Tramore DD, Womanagh DD, and the Youghal DD. 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:	IE19-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:	IE19-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:	IE19-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:	IE19-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:	EUUOMCode-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)

AFAs which are presently ungauged but are considered to have significant flood risk and would significantly benefit from the installation of new gauge stations are as follows:

- Ballingeary
- Inchigeelagh
- Castlemartyr

7.4.2 Ballingeary AFA Measures

Potentially Viable Flood Relief Works

Potentially viable flood relief works for Ballingeary that may be implemented after project-level assessment and planning or Exhibition and confirmation might include Fluvial Flood Defences.

The potentially viable flood relief works consist of flood walls and embankments to protect vulnerable properties in Ballingeary. These wall range in height from 0.7 – 1.1m while the embankments have a maximum height of 2.3m.

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

Public Consultation Outcomes

The feedback at the Public Consultation Day at Optioneering stage was in support of Fluvial Flood Defences. Feedback provided during the statutory consultation on the Plan indicated that some residents had a preference for natural flood management measures. Some residents also indicated that recent floods exceeded the level and extent of the predicted 1% AEP. The details of when the PCD's occurred are provided in Appendix D.

Appraisal of the Flood Risk Management Measure

Table 7.2 summarises the appraisal of the Flood Risk Management Measure for Ballingeary.

Table 7.1 Appraisal of the Flood Risk Management Measure

Measure	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Fluvial Flood Defences	1100	809	795	88	1692	3.07	551	4.85

Under the technical criteria it was found that the proposed measure was operationally robust and that there were few potential health and safety risks involved in the construction of the works. It was determined that the measure could be easily adapted to address future flood risk as the heights of flood walls could be increased to cater for future flows. Details of the climate change adaptability assessment are included in Appendix G.

Under the Social criteria it was found that the proposed measure significantly reduced the number of people and workplaces at risk from flooding. However no high vulnerability properties or social infrastructure are protected by the proposed measure in Ballingeary.

Under the Economic criteria it was found that the proposed measure significantly reduced the potential flood damages and risk to transport infrastructure in Ballingeary. However, as no utility infrastructure or agricultural activities were protected from flooding by the measure no score was achieved under the economic heading for these receptors.

Under the Environmental / Cultural criteria it was found that the River Lee supports an important population of salmonid fish and is considered sensitive to potential impacts from the flood risk management measures. There is one significant polluting source at risk from flooding in the 1% AEP. There is potential for long term retainment of good water status due to the implementation of the flood measures. The construction of this option could result in

temporary negative impacts on the water body status without appropriate mitigation. There is also a number of protected bridges (Record of Monuments and Places) at risk from flooding. The proposed measures include the construction of walls along the banks of the river which may directly impact on the setting of the bridge. The wall heights range from 0.7-1.1m and are in keeping with the existing built environment and provide protection from flooding.

Conclusions and Other Issues

Hydrometric monitoring is proposed due to concerns raised by some members of the public during the statutory consultation on the Plans who reported that recent floods exceeded the level and extent of the predicted 1% AEP.

Measure Name:	Ballingeary Hydrometric Monitoring Regime
Code:	IE19-IE-AFA-195499-BY01-M61
Measure:	Installation of hydrometric gauges on the Bunsheelin River and River Lee. Estimation of appropriate extreme flows to be carried out as part of the Ballingeary Flood Relief Scheme.
Implementation:	OPW
Funding:	OPW

These potentially viable flood relief works are expected to provide protection against a 100-Year flood (1% Annual Exceedance Probability).

Measure Name:	Progress the development of the Ballingeary Flood Relief Scheme
Code:	IE19-IE-AFA-195499-BY01-M33
Measure:	Progress the Ballingeary Flood Relief Scheme to project-level development and assessment for refinement and preparation for planning / Exhibition and, as appropriate, implementation.
Implementation:	OPW and/or local authority - To be confirmed
Funding:	OPW

Further details of the potentially viable flood relief works, their appraisal, and the public consultation outcomes are set out in Appendix G.

7.4.3 Inchigeelagh AFA Measures

Potentially Viable Flood Relief Works

Potentially viable flood relief works for Inchigeelagh that may be implemented after project-level assessment and planning or Exhibition and confirmation might include Fluvial Flood Defences.

The potentially viable flood relief works consist of flood walls and embankments to protect vulnerable properties in Inchigeelagh. These defences range from 0.6 – 1.9m in height.

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

Public Consultation Outcomes

The feedback at the Public Consultation Day at Optioneering stage was in support of Fluvial Flood Defences. During the statutory consultation on the Plans it was suggested that a project level AA and EIA was required before the works could commence. The details of when the PCD's occurred are provided in Appendix D.

Appraisal of the Flood Risk Management Measure

Table 7.3 summarises the appraisal of the Flood Risk Management Measure for Inchigeelagh.

Table 7.2 Appraisal of the Flood Risk Management Measure

Measure	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Fluvial Flood Defences	1100	567	784	74	1425	2.56	556	1.40

Under the technical criteria it was found that the Fluvial Flood Defences measure was operationally robust and that there were few potential health and safety risks involved in the construction of the works. It was determined that the measure could be easily adapted to address future flood risk as the heights of flood walls could be increased to cater for future flows. Details of the climate change adaptability assessment are included in Appendix G.

Under the Social criteria it was found that the Fluvial Flood Defences significantly reduced the number of people and workplaces at risk from flooding. However no high vulnerability properties or social infrastructure are protected by the proposed measure in Inchigeelagh.

Under the Economic criteria it was found that the Fluvial Flood Defences significantly reduced the potential flood damages and risk to transport infrastructure in Inchigeelagh. However, as no utility infrastructure or agricultural activities were protected from flooding by the measure no score was achieved under the economic heading for these receptors.

Under the Environmental / Cultural criteria it was found that the River Lee supports an important population of salmonid fish and is considered sensitive to potential impacts from the flood risk management measures. There is potential for a short term negative impact during the construction of the flood walls and embankments. This would result in emissions of sediment to the waterbody downstream. The defences will also change the views across

the river from the bridge however the wall and embankments are relatively low lying so the impact will not be significant.

Conclusions and Other Issues

The potentially viable flood relief works are expected to provide protection against a 100-Year flood (1% Annual Exceedance Probability).

Measure Name:	Progress the development of the Inchigeelagh Flood Relief Scheme
Code:	IE19-IE-AFA-190268-IH01-M33
Measure:	Progress the Inchigeelagh Flood Relief Scheme to project-level development and assessment for refinement and preparation for planning / Exhibition and, as appropriate, implementation.
Implementation:	OPW and/or local authority - To be confirmed
Funding:	OPW

Further details of the potentially viable flood relief works, their appraisal, and the public consultation outcomes are set out in Appendix G.

7.4.4 Castlemartyr AFA Measures

Potentially Viable Flood Relief Works

Potentially viable flood relief works for Castlemartyr that may be implemented after project-level assessment and planning or Exhibition and confirmation might include Flow Diversion & Flood Defences.

The potentially viable flood relief works consist of the diversion of the Kiltha River around the town via an existing bypass channel through the grounds of the hotel and the construction of flood walls to protect vulnerable properties at the confluence of the Kiltha and the bypass channel.

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

Public Consultation Outcomes

The feedback at the Public Consultation Day at Optioneering stage was in support of Flow Diversion & Flood Defences. During the statutory consultation on the Draft Plans it was observed that the spread of invasive species should be prevented during the construction of the works. The details of when the PCD's occurred are provided in Appendix D.

Appraisal of the Flood Risk Management Measure

Table 7.3 summarises the appraisal of the Flood Risk Management Measure for Castlemartyr.

Table 7.3 *Appraisal of the Flood Risk Management Measure*

Measure	MCA Appraisal Scores				TOTAL - MCA Benefit Score	Cost (€millions)	MCA Score / Cost	BCR
	Technical	Social	Economic	Environ / Cultural				
Flow Diversion & Flood Defences	600	338	589	-222	705	1.44	488	1.66

Under the technical criteria it was found that the proposed measure was operationally robust and that there were few potential health and safety risks involved in the construction of the works. However, it was determined that the measure could not be easily adapted to address future flood risk as the dimensions of the flow control structure and diversion channel could not be readily changed. Details of the climate change adaptability assessment are included in Appendix G.

Under the Social criteria it was found that the proposed measure significantly reduced the number of people and workplaces at risk from flooding. It also reduces the number of social infrastructure receptors at risk of flooding. However no high vulnerability properties are protected by the proposed measure in Castlemartyr.

Under the Economic criteria it was found that the proposed measure significantly reduced the potential flood damages and risk to transport infrastructure in Castlemartyr. However, as no utility infrastructure or agricultural activities were protected from flooding by the measure no score was achieved under the economic heading for these receptors.

The landscape of Castlemartyr is classified as having medium sensitivity and value. There are a number of sites/features listed on the record of structures and NIAH within the town and potentially affected with a high to moderate vulnerability. However, these sites are not within the 1%AEP fluvial flood extent. The proposed measures will however provide protection to the AFA. There are short term negative impacts associated with the construction of these measure.

Conclusions and Other Issues

The potentially viable flood relief works are expected to provide protection against a 100-Year flood (1% Annual Exceedance Probability).

Measure Name:	Progress the development of the Castlemartyr Flood Relief Scheme
Code:	IE19-IE-AFA-190277-CR01-M33
Measure:	Progress the Castlemartyr Flood Relief Scheme to project-level development and assessment for refinement and preparation for planning / Exhibition and, as appropriate, implementation.
Implementation:	OPW and/or local authority - To be confirmed
Funding:	OPW

Further details of the potentially viable flood relief works, their appraisal, and the public consultation outcomes are set out in Appendix G.

7.4.5 Baile Bhúirne and Baile Mhic Íre

The development of a flood relief scheme is currently underway for Baile Mhic Íre / Baile Bhúirne as described in Section 2.6.7. No additional measures specific to Baile Mhic Íre / Baile Bhúirne are proposed.

7.4.6 Tower

A flood relief scheme for Tower was developed under the Lee CFRAM Study, and proposed for progression to implementation in the Lee CFRAM Study, as described in Section 2.6.9. No additional measures specific to Tower are proposed.

7.4.7 Cork City

The development of flood relief schemes (Blackpool FRS and Lower Lee FRS) are currently underway for Cork City as described in Section 2.6.2 and 2.6.3. No additional measures specific to Cork City are proposed.

7.4.8 Douglas / Togher

The development of a flood relief scheme is currently underway for Douglas / Togher as described in Section 2.6.4. No additional measures specific to Douglas / Togher are proposed.

7.4.9 Glanmire

The development of a flood relief scheme is currently underway for Glanmire / Sallybrook as described in Section 2.6.6. No additional measures specific to Glanmire / Sallybrook are proposed.

7.4.10 Little Island

A flood relief scheme for Little Island was developed under the Lee CFRAM Study, and proposed for progression to implementation in the Lee CFRAM Study, as described in Section 2.6.12. No additional measures specific to Little Island are proposed.

7.4.11 Macroom

A study is currently underway to review the hydrology and hydraulic analysis completed under the Lee Pilot CFRAM Study to determine whether a flood protection scheme may be potentially viable for Macroom. No additional measures specific to Macroom are proposed.

7.4.12 Midleton & Ballynacorra

The development of a flood relief scheme is currently underway for Midleton as described in Section 2.6.1. No additional measures specific to Midleton are proposed.

7.4.13 Passage West

A flood relief scheme for Passage West was developed under the Lee CFRAM Study, and proposed for progression to implementation in the Lee CFRAM Study, as described in Section 2.6.14. No additional measures specific to Passage West are proposed.

7.4.14 Whitegate

A flood relief scheme for Whitegate was developed under the Lee CFRAM Study, and proposed for progression to implementation in the Lee CFRAM Study, as described in Section 2.6.15. No additional measures specific to Whitegate are proposed.

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 €1 billion 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 7.4 provides a summary of the measures that are to be progressed through the implementation of the Plan for the Lee, Cork Harbour & Youghal Bay River Basin, while Table 7.5 sets out the flood relief schemes and works that have been progressed or proposed through other projects or plans.

Table 7.4: Summary of Flood Risk Management Measures

Measure	Implementation	Funding
River Basin 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
<i>Other River Basin-Level Measures applicable at River Basin-Level</i>		

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.		
Progress further Data Collection and/or further Analysis for the Communities set out below.		
<i>Ballingeary</i>	<i>OPW and/or Cork County Council</i>	<i>OPW</i>
<i>Inchigeelagh</i>	<i>OPW and/or Cork County Council</i>	<i>OPW</i>
<i>Castlemartyr</i>	<i>OPW and/or Cork County Council</i>	<i>OPW</i>
<i>Progress further Data Collection and/or further Analysis for the Communities set out below.</i>		
<i>Ballingeary</i>	<i>OPW and/or Cork County Council</i>	<i>OPW</i>

Table 7.5: 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

<i>Baile Mhic Íre</i>	<i>Baile Mhic Ire Flood Relief Scheme [River Sullane (Baile Mhic Ire) Drainage Scheme]</i>	<i>Planning / Design Stage</i>
<i>Tower</i>	<i>Tower flood defences</i>	<i>Completed</i>
<i>Cork City</i>	<i>Cork City flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Blackpool</i>	<i>Blackpool flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Crookstown</i>	<i>Crookstown flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Carrigaline</i>	<i>Carrigaline flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Douglas / Togher</i>	<i>Douglas / Togher flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Glanmire / Sallybrook</i>	<i>Glanmire / Sallybrook flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Little Island</i>	<i>Little Island flood relief scheme</i>	<i>Proposed (Lee Catchment Flood Risk Management Plan 2014)</i>
<i>Macroom</i>	<i>Macroom flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Midleton</i>	<i>Midleton flood relief scheme</i>	<i>Planning / Design Stage</i>
<i>Passage West</i>	<i>Passage West flood forecasting system</i>	<i>Proposed (Lee Catchment Flood Risk Management Plan 2014)</i>
<i>Whitegate</i>	<i>Whitegate flood forecasting system</i>	<i>Proposed (Lee Catchment Flood Risk Management Plan 2014)</i>

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 Interdepartmental Flood Policy Co-ordination Group. Other such measures requiring new action should be pro-actively 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 7.1).

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 can not 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.

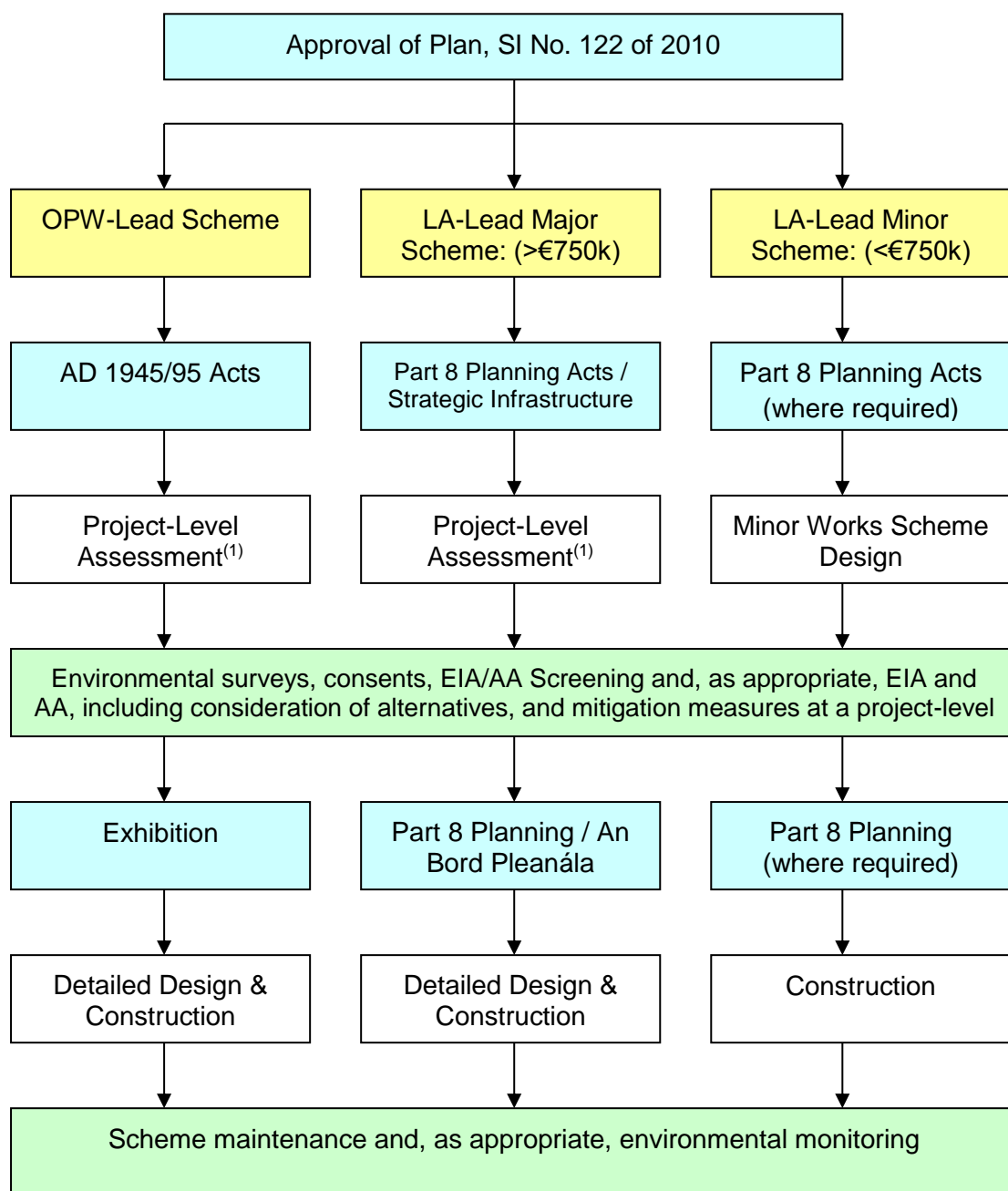


Figure 8.1: Options for the Progression of Measures Involving Physical Flood Relief Works

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 detailed design

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 Lee, Cork Harbour and Youghal Bay 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

8.3.1 Monitoring of the Plan

A mitigation and monitoring programme has been formulated for the each AFA within the Plan based on the SEA objectives, sub objectives and the associated indicators. The monitoring programme is required for the following reasons:

- To monitor the predicted significant negative effects of the Plan; and to
- Monitor the baseline environmental conditions for all SEA objectives.

The monitoring programme will also help to identify any unforeseen negative effects of the Plan and ensure that action can be taken to mitigate them. This monitoring will be carried out at various stages of scheme implementation e.g. before, during and after scheme development, such that the success of measures to protect or enhance environmental, social and cultural receptors can be assessed.

As part of the monitoring programme, relevant and appropriate thresholds will be agreed in consultation with the competent authorities to determine when remedial action is required for the particular aspect of the environment being monitored. Existing environmental monitoring is currently undertaken throughout Ireland by the OPW and other organisations like the EPA, IFI, and NPWS, for a number of environmental elements in accordance with environmental legislation, these sources will be used as baseline data or reference.

The proposed monitoring programme is specified in the SEA Environmental Report for the Lee, Cork Harbour & Youghal Bay River Basin.

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.

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	Lands benefiting from an Arterial Drainage Scheme.
Catchment	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	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.
Communities	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.

Probable Area for Further Assessment	The Probable AFAs are those identified through the draft PFRA where significant flood risk has been identified and which, subject to the outcomes of public consultation and the Flood Risk Review, are anticipated to be designated as AFAs.
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.
Standard Annual Average Rainfall Or	The average rainfall in an area per annum

SAAR

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	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	A hydrological division of land defined for the purposes of the Floods Directive. One Plan has been prepared for

UoM	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	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
NIAH	National Inventory of Architectural Heritage
OPW	Office of Public Works
PCD	Public Consultation day
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
RBMP	River Basin Management Plan
RMP	Record of Monument and Places
SAAR	Standard Annual Average Rainfall
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

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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 tsunami, 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

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)

impacts of climate change on rainfall patterns, there is a clear potential that fluvial flood risk could increase into the future.

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

Land height in the Lee catchment varies from 649m AOD at Mullaghanish in the Shehy Mountains to 50m AOD at Inniscarra reservoir and about 5m AOD around Cork Harbour. The topography and geology of the Upper Lee catchment give a higher runoff potential than the remainder of the Lee catchment.

The River Womanagh catchment ranges from less than 1mAOD near Gortnagark Castle, up to 238mAOD in the upper reaches of the Kiltla and Dissour River. The areas of highest relief are associated with the more resistant underlying geology to the north and south of the Womanagh Valley. The low-lying tidal floodplain downstream of Finisk is typically 600m wide, constrained by the resistant geology either side. The floodplain narrows to 350m at Crompaun Bridge as the valley side spurs limit the volume available on the floodplain. Downstream, the floodplain widens as the Gortavadden Channel joins from the west and Ballymadog Channel from the north. There is a low pass at Ballykinealy which may be vulnerable to extreme storm surges with predicted climatic change.

The relief in Ballingeary is much higher. The Bunsheelin catchment ranges from 85mAOD at Lough Allua to over 530mAOD in its headwaters. The upper reaches are steep (1 in 35) and the valley is constrained by the relatively mountainous topography. The steep-sided valley results in a fast-responding catchment, leaving some properties at the bottom of these slopes vulnerable to surface water run-off as well as flash flooding from the river. The floodplain widens to 400m as the Bunsheelin flattens out to join the Upper Lee and Lough Allua. The flatter topography and presence of Lough Allua downstream can prolong flooding in the lower reaches depending on the Lough level prior to the event.

The Lee catchment is predominantly underlain by Old Devonian Sandstones which are relatively impermeable and create steep relief in the mountainous areas around Ballingeary. The uplands extend around the north and west perimeter of the Upper Lee catchment and consist primarily of exposed rock and sandstone till subsoils with areas of peaty topsoil and blanket bogs in the uplands. The land is characterised by glaciated steep sided river valleys intercepted with ridges of upland. The remainder of the catchment is generally undulating with steeper sloping valleys located to the north of the catchment on the slopes of the Boggeragh Mountains. To the south of the catchment, the River Lee, Bride and Owenboy Rivers have wide flat floodplains which offer flood plain storage potential in a flood event. The geology of the catchment is predominantly sandstone till overlain by a cover of relatively fertile well drained acid brown earths. The geology and topography of this part of the catchment results in a lower runoff potential than the Upper Lee catchment.

The lower reaches of the river Bride are underlain by karst limestone, which may impact on the flow regime. There is potential for some river flow to be lost to the karst system although further investigation is required to determine if this is the case and, if so, to what extent this may be happening.

The Womanagh valley and lower reaches of its tributaries are underlain by permeable Dinian Limestone forming part of a regionally important aquifer. The high permeability of underlying soils in this area may reduce flows when the ground is unsaturated. However, flooding could be exacerbated when the underlying aquifer is saturated prior to a flood event.

B.2 LAND USE AND LAND MANAGEMENT

Agriculture, predominantly pasture with some mixed farmland, is the dominant land use within the catchment covering approximately 77% of the land area. 13% of this agricultural land is arable. Areas of natural and semi-natural habitat cover approximately 11% of the catchment and include wetlands, grasslands, woodland and coastal habitats. Approximately 7% of the catchment is covered by forestry, mainly in the mountainous uplands of the headwaters of the Rivers Lee and Sullane. These forests are predominantly coniferous, harvested on a 40 to 50 year cycle. All forest operations in Ireland are carried out in compliance with the principles of sustainable forest management (SFM) to meet high environmental, social and economic standards and are implemented through national standards, guidelines and a Code of Best Forest Practice (Forest Service, 2000).

The Bunsheelin is predominately rural in its upper reaches, with land assigned to peat bog, pastoral practices or forestry. The forest tends to be coniferous but this makes up less than 6% of the area around Ballingeary. The lack of dense vegetation across the majority of the catchment tends to exacerbate runoff over the steep sided slopes, creating a flashy response to rainfall downstream.

Two dams in the Upper Lee catchment, at Carrigadrohid and Inniscarra, manage the flow of water from the Upper Lee catchment to the Lower Lee catchment. The dams play an important role in the management of flood risk in the Lee valley through the provision of storage and controlled discharge of flood waters.

The River Lee hydro-electric scheme was built during the period 1952 to 1957. Inniscarra Dam is located approximately 13km west of Cork City with Carrigadrohid Dam a further 14km upstream. The construction of the dams created two lakes which stretch from Inniscarra upstream to the Gearagh near Macroom. The lakes cover an area of approximately 14km² and have a normal storage capacity of up to 35 million m³. The dams are owned and operated by the ESB. In normal day to day operations, the dams are run to optimise electricity generation utilising the available head of water in the reservoirs and flow rate, but with variability to meet daily demand. Control of water levels in the reservoirs also varies seasonally, with water levels upstream of Carrigadrohid Dam being kept high in summer to cover tree stumps at the Gearagh and water levels upstream of the Inniscarra Dam being maintained to facilitate water supply. Water level management in the Gearagh SAC and SPA is important to preserve this wetland habitat and its associated species.

During flood events, the hydro power stations prioritise the management of water levels behind the reservoirs to ensure dam safety, and to facilitate mitigation of potential flooding downstream. This is achieved both by the throughput of flood water through the turbines and spilling through the sluice gates. The ESB "Regulations & Guidelines for the Control of the River Lee" are specific regarding discharges from the dams during a flood event, and the top priorities are the proper management of the flood to avoid any risk to dam safety and to help mitigate flooding downstream. Also of critical importance is that the peak outflow from Inniscarra does not exceed the peak inflow during a storm. In practice, the operation of the reservoirs is responsive to flood risk in line with the existing Regulations & Guidelines, with beneficial effects downstream. When a particularly high tide is predicted in Cork Harbour then releases from Inniscarra Dam are controlled to prevent a fluvial peak coinciding with the high tide. In the event of predicted heavy rainfall in the upper catchment, however, water levels in the dams are lowered to create storage capacity to attenuate the flood.

Urban development and associated infrastructure covers approximately 5% of the catchment, principally concentrated around Cork Harbour. This includes major low-density residential areas, commercial centres and significant industrial areas. In future years pasture is likely to remain the dominant land use; although the pattern of use may change following recent changes in the EU's Common Agricultural Policy. The pattern of increasing reforestation is expected to continue at the expense of pasture, mixed farmland and wetlands in order to meet Government targets for forestry cover. Urban land cover will continue to grow with population growth.

The way in which the land is used can significantly impact the flow routes across the catchment, how much rainfall is stored, how much infiltrates into the ground, and how much evaporates.

The majority of the Ballingearry and Womanagh catchments are currently rural and dedicated to agricultural or pastoral use. Changes to agriculture can lead to intensification of activities and associated increased land drainage and runoff. Increased irrigation and drainage for the commercial forests can route more water to the rivers thus reducing the time to peak.

Future urban development within the river basin is also likely to cause more water to reach the river channels quicker and affect more people, property and environments.

B.3 HYDROLOGY

B 3.1 Sub-Catchments & Coastlines

The Lee, Cork Harbour and Youghal Bay River Basin can be split into sub-catchments covering the AFAs as shown in Maps 2.1 and 2.2.

B 3.1.1 Lee Sub-catchment

The Upper Lee flows from its source near Rosslougha in an easterly direction to the south of Ballingearry at Inchinossig Bridge and continues towards Cork. The Bunsheelin River flows through Ballingearry from the North to join the upper River Lee downstream of Inchinossig Bridge. The River Lee then flows in an easterly direction into Lough Allua and downstream to Inchgeelagh. The Bunsheelin River has a steep gradient of 1 in 35, reducing to 1 in 130 before entering the flat water body of Lough Allua. Generally fluvial flooding in the Lee catchment is as a result of prolonged heavy rainfall in the Shehy, Boggeragh and Derrynasaggart Mountains to the west and northwest of the catchment causing large volumes of water to pass down through the Sullane and Lee Rivers. This water gradually slows down as it passes through Lough Allua and the Lee reservoirs further downstream. However, the flow in the River Lee also gradually increases further downstream as more tributaries join and contribute flows. Flows at locations along the smaller and steeper tributaries, particularly in the upper parts of the Lee catchment can increase fairly rapidly, reaching peak flows within 5 hours of the rainfall starting, for example along the Laney and Dripsey Rivers. Flows at locations along the River Lee further downstream increase more slowly, as the catchment topography and geology result in slower catchment runoff rates. It may take up to 24 hours from the start of a rainfall event for peak flows to be reached on the River Lee at downstream locations such as Cork City. This is heavily influenced by the operation of the Carrigadrohid and Inniscarra dams. Flooding in small urban watercourses such as the Glasheen, Tramore and Kiln is greatly influenced by the rapid runoff from urban surfaces with peak flows being reached in less than 2 hours from the start of a rainfall event for some of these watercourses.

Flooding in the Glashaboy, Owenboy and Owennacurra is generally caused by long duration rainfall events. These rainfall events cause a build up of flows in these rivers over

a number of hours reaching peak flows at the mouth of these rivers within 7 to 10 hours from the start of a rainfall event.

B 3.1.2 Womanagh Sub-catchment

The Womanagh River stretches from its source at Carrigour to its tidal outfall at Pilmore into Youghal Bay. The Womanagh is relatively flat with a typical gradient of 1 in 900 in the upper reaches, reducing to over 1 in 20,000 in the tidal reaches. The Kiltha River flows from Springfields/Mogeely southwards through Castlemartyr to join the Womanagh near Ladysbridge. Upstream of Castlemartyr, the Kiltha splits with a historic flow diversion through the Castle grounds and through a lake before re-joining downstream of the town. Immediately upstream of Little Island a land drain crosses under the Kiltha which drains lands to the west. This land drain runs parallel to the river for a short distance before entering a swallow hole in an adjacent field. From discussions on site with Local Authority staff it is believed that this swallow hole is connected to the Dower River through a cave system. The Dower River is heavily dominated by karst and flows through swallow holes, creating a dry valley in its upper reaches. The Dower River and Ladysbridge Stream join the Womanagh before the Dissour River. The Dissour River flows from Kilcronatmountain southwards through Glenane Beg Ravine before flowing through Killeagh town and joining the River Womanagh at Finisk Old Bridge.

B 3.1.3 Coastal Features

In Cork Harbour the astronomical spring tidal range is approximately 3.7m and the neap range is approximately 1.9m. The astronomical tide levels for Cobh based on the Admiralty predictions for this Primary Port are as follows:

- Highest Astronomical Tide: + 1.94 m OD Malin
- Mean High Water Springs: + 1.54 m OD Malin
- Mean High Water Neap: + 0.64 m OD Malin
- Mean Low Water Neap: - 1.26 m OD Malin
- Mean Low Water Springs: - 2.16 m OD Malin
- Lowest Astronomical Tide: - 2.66 m OD Malin

In addition to the above astronomical tide levels, storm surges can propagate into Cork Harbour causing these levels to be further elevated. Storm surges of 0.5m and above occur frequently in the Harbour. However, these generally only give rise to concern when they coincide with periods of high spring tides. One such event occurred on 27 October 2004 when the combined tide and surge level at Tivoli reached +2.74m OD Malin and gave rise to extensive flooding in Cork City.

The ESB and Port of Cork operate a number of tide gauges in Cork Harbour. These tide gauges record sea surface levels and provide the best method of predicting tide levels and frequency through analysis of historical records.

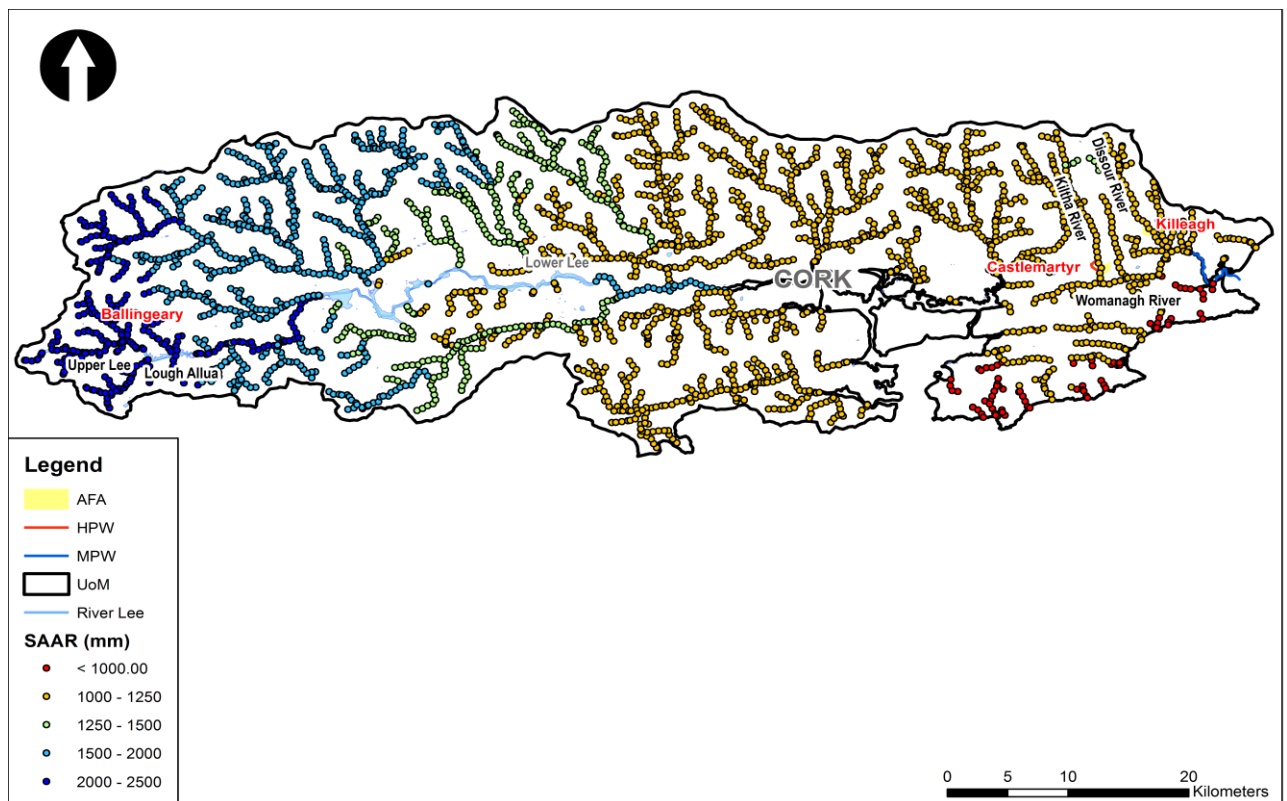
The Womanagh River can be considered tidal downstream of Finisk Old Bridge, some 10km inland. The tidal channel is embanked above the low-lying tidal floodplain downstream of Finisk Old Bridge limiting the width of the channel to 30m. Once these embankments are overtopped, it would be difficult for flood waters to return to the channel as the floodplain is typically lower than the river. Downstream of Crompaun Bridge, the tidal channel widens to a more estuarine feature over 300m wide with several low-flow loop channels until its tidal outfall at Pilmore. There are large intertidal flats in the estuarine area which are inundated on most tides. The spit features at the tidal outfall protect inland areas from extreme wave action. The Ireland Coastal Water level and Wave Study 2013 (ICWWS) did not identify any areas vulnerable to wave overtopping in this River Basin. Therefore, flooding arising from wave overtopping has not been considered further.

B 3.2 Rainfall Distribution

Ballingeary has high annual rainfall, over 2000mm, because the regular westerly storms deposit much of their rainfall over the higher relief of the Shehy Mountains which drains to Ballingeary and Lough Allua. Conversely, the Womanagh catchment has relatively low rainfall, less than 1200mm, as it has much lower topography and is located within a rain shadow of the western mountains. Furthermore, the permeable karstic geology reduces the amount of rainfall reaching the rivers in this catchment.

The variation in Standard Average Annual Rainfall across the Lee, Cork Harbour and Youghal Bay River Basin is shown in the map below. Rainfall tends to be greater in the west and decreases towards the east. This corresponds with the dominant wind direction in the South West where storms tend to track west to east.

Map B.1: Standard Annual Average Rainfall



B 3.3 Hydrometric Data Availability

A range of different data sources have been used to undertake the hydrological data analysis for the Lee, Cork Harbour and Youghal Bay River Basin. The use of local hydrometric data can greatly improve and validate flood flows for historic events and design flood events. The following sources of data have been reviewed in the Lee, Cork Harbour and Youghal Bay River Basin.

Table B.1 Summary of Available Data

Type	Details	Owner	Date
River Flows	15 minute interval data series at 3 gauges with flow converted from water level	OPW EPA	Various up to 2012
River Levels	15 minute interval data series at 3 gauges	OPW EPA	Various up to 2012
Rainfall Gauges	Daily rainfall values at 7 gauges	Met Eireann	Various up to 2012
	Hourly rainfall series at Cork Airport and Roches Point	Met Eireann	1962-2012
	15 minute rainfall series Dunmanway	OPW	2011-2012
Extreme sea level	Irish Coastal Protection Strategy Study Total tide +surge design levels	OPW	Calculated in 2012
Sea Level	Sea level at 10 minute intervals at Ballycotton Gauge	OPW	2007 - 2012

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

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 ¹) 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.

¹ 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 South Western CFRAM Steering Group

- Office of Public Works
- Mott MacDonald Ireland
- Environmental Protection Agency
- Cork City Council
- Cork County Council
 - WFD Co-ordinator
- Kerry County Council
- Limerick City and County Council
- Tipperary County Council
- Waterford City & County Council
- Southern Regional Assembly

APPENDIX D.3

Organisations Invited to Meetings of the National Stakeholder Group

Table D.3.1 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 (NI)
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 South Western CFRAM Stakeholder Group

Table D.4.1 Organisations Represented at Meetings of the South Western CFRAM Stakeholder Group

Office of Public Works	Teagasc
Mott MacDonald Ireland	Inland Fisheries Ireland
Cork City Council	Southern Assembly
Cork County Council	Irish Farmers Association
Environmental Protection Agency	
Kerry County Council	
Limerick County Council	
Tipperary County Council	
Waterford City and County Council	

APPENDIX D.5

Public Consultation Days Held at the Flood Mapping Stage in the Lee, Cork Harbour & Youghal Bay River Basin

Table D.5.1 Flood Mapping PCDs Held in the Lee, Cork Harbour & Youghal Bay River Basin

AFA	Date	Venue	No. Attendees
Ballingeary	27/01/2015	Ballingeary GAA Club	25
Inchigeelagh	27/01/2015	Iveleary GAA Club	23
Castlemartyr	23/01/2015	St Joseph's national School	6
Killeagh	23/01/2015	Killeagh Community Hall	18

APPENDIX D.6

Public Consultation Days Held at the Flood Risk Management Optioneering Stage in the Lee, Cork Harbour & Youghal Bay River Basin

Table D.6.1 Flood Risk Management Optioneering PCDs Held in the Lee, Cork Harbour & Youghal Bay River Basin

AFA	Date	Venue	No. Attendees
Ballingeary	17/02/2016	Ballingeary GAA Club	31
Inchigeelagh	18/02/2016	Iveleary GAA Club	21
Castlemartyr	26/11/2015	St Joseph's national School	4

APPENDIX D.7

Public Consultation Days Held at the Draft Flood Risk Management Plan Stage in the Lee, Cork Harbour & Youghal River Basin

Table D.7.1 Draft Flood Risk Management Plan PCDs Held in the Lee, Cork Harbour & Youghal Bay River Basin

AFA	Date	Venue	No. Attendees
UoM 19	29/8/2016	The Hibernian Hotel, Mallow	22
UoM 19	31/8/2016	Cork County Hall	24

APPENDIX E

DESCRIPTION OF THE FLOOD RISK IN EACH AFA

The numbers of properties at risk are determined independently for each source (fluvial and coastal). For AFA's where both sources of flooding occur, some properties may be at risk from both sources, and such properties have been included in the numbers for both sources.

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 greatest risk to residential properties is in Ballingeary. The greatest risk to non-residential properties is also in Ballingeary.

Note: N/A = Data not extracted for the Lee CFRAM Study

Ballingeary AFA

Within the Ballingeary AFA, 21 residential and 25 non-residential / business properties are affected for the 1% AEP fluvial event. The flooding also impacts on a range of assets including utilities, transport, social and environmental, along with a highly vulnerable property. The greatest risk to life is associated with deep flooding at the back of the Post Office and high velocities by Ballingeary Bridge which is classified as Significant to Extreme. The rapid response of the Bunsheelin catchment when ground conditions are saturated could mean a rapid rise in water levels with little warning.

The Ballingeary model has been shown to be sensitive to flow estimates and the duration of the flood hydrograph (or succession of flood events) which determine the volume available to fill Lough Allua. The design flood hydrograph takes a conservative assumption of 43 hour storm duration to represent similar mechanisms and volumes to the recorded flood events. The areas flooded are consistent with the recurring flood reports and the flooding experienced in November 2009. The model has been calibrated to the flood levels and flood extent recorded in November 2009. Therefore, there is reasonable confidence in the flood mapping in Ballingeary based on the information available at the time of this study.

The key flow routes and flooding mechanisms are as follows:

- Lough Allua fills after prolonged rainfall as only a limited discharge can exit at Inchigeelagh Bridge downstream.
- This causes the water levels to rise and backup towards Ballingeary. This leads to flooding in Ballingeary when this backwater combines with excess flows on the Lee and Bunsheelin to flood properties.
- There are also reports of pluvial flooding from overland sheet flow down the valley sides and from the urban drainage system. However pluvial flooding was not deemed a significant source of risk for this AFA.

The key thresholds and areas affected by flooding in Ballingeary are:

- 50% AEP event floods the school sports pitch, Casadh Na Spride Park, and floods up to the back of properties by the Post Office. This is caused by backwater in Lough Allua due to prolonged rainfall and limited capacity at Inchigeelagh Bridge.
- 20% AEP event floods Main Street and properties by the Post Office to Saint Finbarr's and Saint Ronan's Church. This is caused by a combination of high flows along the Bunsheelin River and backwater in Lough Allua due to prolonged rainfall/successive events.
- 20%-10% AEP floods over the R584 upstream of Ballingeary Bridge from the Upper Lee in accordance with the recurring flood reports and flood events in 2004 and 2005.

The critical structures in determining flood risk include:

- Inchigeelagh Bridge downstream of Lough Allua which limits the outflow and therefore the backwater along Lough Allua to Ballingeary.
- Level / channel capacity of the Bunsheelin and Lee Rivers downstream of the R584 to Lough Allua

E1. Ballingearry Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	2,580,905	4,585,527	7,343,831
No. Residential Properties at Risk	16	21	28
No. Business Properties at Risk	21	25	30
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	2	3	3
No. Highly Vulnerable Properties at Risk	0	1	2
No. of Social Infrastructure Assets at Risk	2	2	3
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	3,492,436	4,761,140	7,586,659
No. Residential Properties at Risk	19	22	28
No. Business Properties at Risk	22	26	30
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	3	3	3
No. Highly Vulnerable Properties at Risk	0	1	2
No. of Social Infrastructure Assets at Risk	2	2	3
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	3,896,352	6,243,118	7,976,214
No. Residential Properties at Risk	19	26	29
No. Business Properties at Risk	24	27	30
No. Utilities at Risk	1	1	1
No. Major Transport Assets at Risk	3	3	3
No. Highly Vulnerable Properties at Risk	1	2	2
No. of Social Infrastructure Assets at Risk	2	2	3
No. Environmental Assets at Risk	1	1	1
No. Potential Pollution Sources at Risk	0	0	0

Inchigeelagh AFA

Within the Inchigeelagh AFA, 14 residential and 14 non-residential / business properties are affected for the 1% AEP fluvial event. The flooding also impacts on transport and social assets. The greatest risk to life is associated with deep flooding and high velocities upstream of Inchigeelagh Bridge and between the islands downstream of the bridge which are classified as Significant to Extreme.

The Ballingeary model, which includes Inchigeelagh AFA, has been shown to be sensitive to flow estimates and the duration of the flood hydrograph (or succession of flood events) which determine the volume available to fill Lough Allua. The design flood hydrograph takes a conservative assumption of a 43 hour storm duration to represent similar mechanisms and volumes as the recorded flood events. The areas flooded are consistent with the recurring flood reports along the road and the flooding experienced in November 2009. The model has been calibrated to the flood levels and flood extent recorded in November 2009. Therefore, there is reasonable confidence in the flood mapping in Inchigeelagh based on the information available at the time of this study.

The key flow routes and flooding mechanisms are:

- Lough Allua fills after prolonged rainfall as only a limited discharge can exit at Inchigeelagh Bridge downstream.
- This causes the water level to rise upstream of the bridge and eventually overtop the road to flood properties in Inchigeelagh.

The key thresholds and areas affected by flooding in Inchigeelagh are:

- 10% AEP event floods low lying areas at the back of Rose Cottage and flooding of the road by Inchigeelagh Bridge.
- 2% to 5% AEP event begins to cause flooding to properties at Rose Cottage on the right bank and Cuan Mhuire along the L3404 on the left bank as the bridge is bypassed.

The critical structures that determine flood risk in Inchigeelagh are:

- Inchigeelagh Bridge.

E.2 Inchigeelagh Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	920,007	2,280,497	4,385,145
No. Residential Properties at Risk	9	14	22
No. Business Properties at Risk	2	14	22
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	1	2	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	1,465,038	2,342,764	4,472,516
No. Residential Properties at Risk	13	14	22
No. Business Properties at Risk	8	14	22
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	2	2	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	1,729,754	3,606,098	4,984,350
No. Residential Properties at Risk	13	18	22
No. Business Properties at Risk	12	17	23
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	2	2	2
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0

Castlemartyr AFA

Within the Castlemartyr AFA, 13 residential and 9 non-residential / business properties are affected for the 1% AEP fluvial event. The flooding also impacts on transport and social assets. The greatest risk to life is associated with deep flooding upstream of Castlemartyr Bridge which is classified as Moderate to Significant. Flooding over the N25 at Castlemartyr Bridge may present a hazard to road users.

The areas flooded are consistent with the recurring flood reports from the local area engineer and the 2009 flood report. Modelled flooding is more extensive than reported to the east of Mogeely Road because it has been assumed that no water exits the catchment through the sink hole there as a conservative estimate of flood risk in Castlemartyr. The model has been calibrated to the flood levels and flood extent recorded in November 2009. Therefore, there is reasonable confidence in the flood mapping in Castlemartyr based on the information available at the time of this study.

The key flow routes and flooding mechanisms are:

- The River Kiltha overtops the left bank upstream of the town to join with the Killamucky tributary and flow towards the sink hole near the Enterprise Centre.
- Backwater from Castlemartyr and the access bridge spills over the left bank to flood properties along Mogeely Road.

The key thresholds and areas affected by flooding in Castlemartyr are:

- 20% AEP event causes extensive flooding of fields towards the Enterprise Centre although properties are not affected.
- 20% AEP event floods properties upstream of Castlemartyr Bridge due to backwater from both the main bridge and access bridge upstream.
- 10% AEP event floods over the N25 at Castlemartyr Bridge assuming the sink hole is saturated.
- 0.5% AEP event floods properties opposite Ladysbrook House.

The critical structures that determine flood risk in Castlemartyr are:

- Bank levels at the Killamucky confluence
- Castlemartyr Bridge
- Access Bridge

E.3 Castlemartyr Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	642,600	1,092,209	1,873,409
No. Residential Properties at Risk	10	13	17
No. Business Properties at Risk	5	9	16
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	2	3	3
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0
Mid-Range Future Scenario			
Event Damage (€)	930,628	1,326,334	4,783,284
No. Residential Properties at Risk	13	15	18
No. Business Properties at Risk	6	13	18
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	3	3	3
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0
High-End Future Scenario			
Event Damage (€)	1,009,003	1,387,175	7,437,485
No. Residential Properties at Risk	13	16	19
No. Business Properties at Risk	7	15	19
No. Utilities at Risk	0	0	0
No. Major Transport Assets at Risk	3	3	3
No. Highly Vulnerable Properties at Risk	0	0	0
No. of Social Infrastructure Assets at Risk	0	1	1
No. Environmental Assets at Risk	0	0	0
No. Potential Pollution Sources at Risk	0	0	0

E.4 Baile Bhúirne and Baile Mhic Íre Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	23,204,000	N/A
No. Residential Properties at Risk	N/A	61	N/A
No. Business Properties at Risk	N/A	19	N/A
No. Utilities at Risk	N/A	1	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.5 Blarney and Tower Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	343,000	N/A
No. Residential Properties at Risk	N/A	11	N/A
No. Business Properties at Risk	N/A	0	N/A
No. Utilities at Risk	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.5 Carrigaline Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)			
Fluvial	N/A	1,580,000	N/A
Tidal	N/A	25,202,000	N/A
No. Residential Properties at Risk			
Fluvial	N/A	42	N/A
Tidal	N/A	75	N/A
No. Business Properties at Risk			
Fluvial	N/A	5	N/A
Tidal	N/A	54	N/A
No. Utilities at Risk			
Fluvial	N/A	0	N/A
Tidal	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.6 Cobh Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	2,149,000	N/A
No. Residential Properties at Risk	N/A	3	N/A
No. Business Properties at Risk	N/A	5	N/A
No. Utilities at Risk	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.7 Crookstown Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	549,000	N/A
No. Residential Properties at Risk	N/A	5	N/A
No. Business Properties at Risk	N/A	4	N/A
No. Utilities at Risk	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.7 Douglas / Togher Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	7,440,000	N/A
No. Residential Properties at Risk	N/A	72	N/A
No. Business Properties at Risk	N/A	13	N/A
No. Utilities at Risk	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.8 Glanmire / Sallybrook Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)			
Fluvial	N/A	832,000	N/A
Tidal	N/A	789,000	N/A
No. Residential Properties at Risk			
Fluvial	N/A	30	N/A
Tidal	N/A	20	N/A
No. Business Properties at Risk			
Fluvial	N/A	3	N/A
Tidal	N/A	5	N/A
No. Utilities at Risk			
Fluvial	N/A	0	N/A
Tidal	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.9 Little Island Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	14,401,000	N/A
No. Residential Properties at Risk	N/A	16	N/A
No. Business Properties at Risk	N/A	9	N/A
No. Utilities at Risk	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.10 Macroom Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	2,213,000	N/A
No. Residential Properties at Risk	N/A	5	N/A
No. Business Properties at Risk	N/A	7	N/A
No. Utilities at Risk	N/A	2	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.11 Middleton Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)			
Fluvial	N/A	33,575,000	N/A
Tidal	N/A	23,844,000	N/A
No. Residential Properties at Risk			
Fluvial	N/A	145	N/A
Tidal	N/A	80	N/A
No. Business Properties at Risk			
Fluvial	N/A	68	N/A
Tidal	N/A	62	N/A
No. Utilities at Risk			
Fluvial	N/A	0	N/A
Tidal	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.12 Passage West Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	1,020,000	N/A
No. Residential Properties at Risk	N/A	33	N/A
No. Business Properties at Risk	N/A	22	N/A
No. Utilities at Risk	N/A	0	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

E.13 Whitegate Flood Risk Table

Type of Risk	Flood Risk for Design AEP (%) Event		
	10% AEP	1% / 0.5% AEP	0.1% AEP
Current Scenario (Present Day)			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
Mid-Range Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A
High-End Future Scenario			
Event Damage (€)	N/A	N/A	N/A
No. Residential Properties at Risk	N/A	N/A	N/A
No. Business Properties at Risk	N/A	N/A	N/A
No. Utilities at Risk	N/A	N/A	N/A
No. Major Transport Assets at Risk	N/A	N/A	N/A
No. Highly Vulnerable Properties at Risk	N/A	N/A	N/A
No. of Social Infrastructure Assets at Risk	N/A	N/A	N/A
No. Environmental Assets at Risk	N/A	N/A	N/A
No. Potential Pollution Sources at Risk	N/A	N/A	N/A

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 Lee, Cork Harbour and Youghal Bay 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

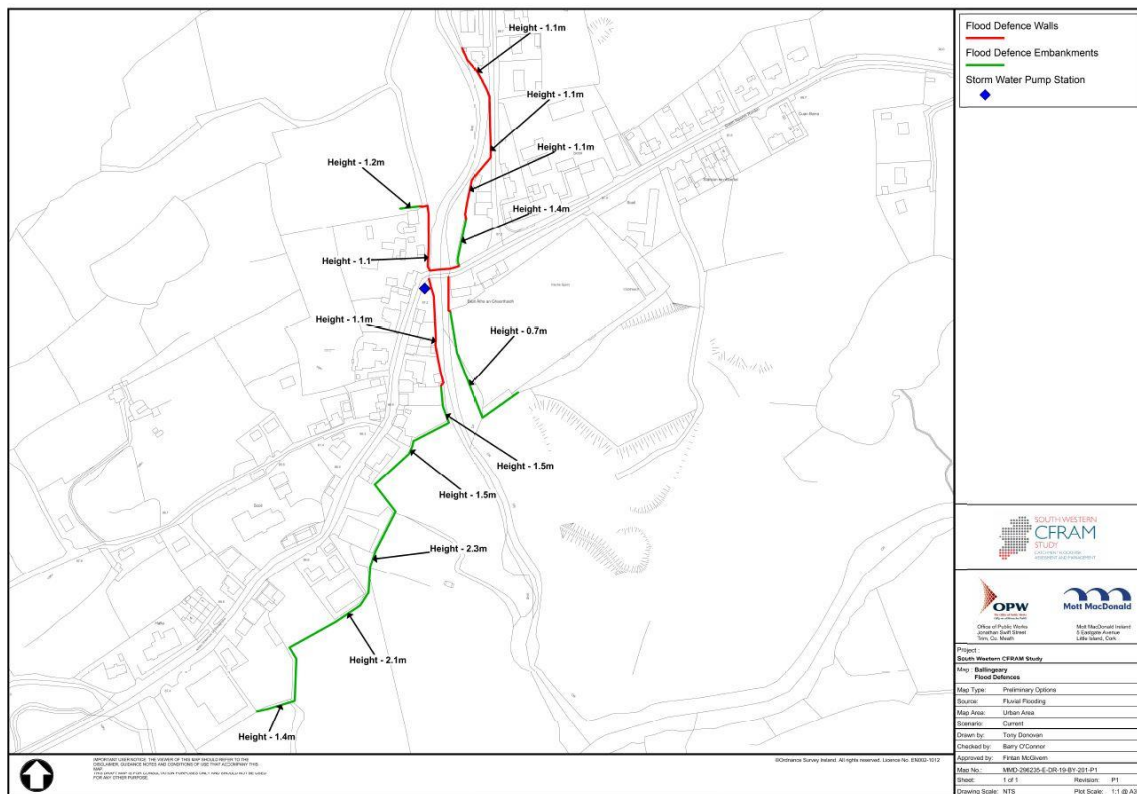
Data on flood flows and levels, as collected through the hydrometric networks of the OPW, EPA / local authorities, the Marine Institute and other organisations, are essential to understand what extreme river flows and levels and sea levels might occur, and hence to enable the appropriate design of structural 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 Ballingeary AFA

River Basin	Lee, Cork Harbour & Youghal Bay River Basin
AFA	Ballingeary AFA
Measure	Fluvial Flood Defences
Code	IE19-IE-AFA-195499-BY01-M33
Description	Fluvial Flood Defences comprising of walls and embankments.



IMPORTANT NOTE: The works presented herein are not the final and definitive works. Potentially viable flood relief works set out herein will need to be further developed at a local, project level before Exhibition or submission for planning approval.

MCA Appraisal Outcomes			
Objective	Un-weighted Score	Local Weighting	Comment
1.a.i)	4.77	5	Calculation based on the number of residential properties protected
1.a.ii)	0	1.05	Calculation based on the number of high vulnerability properties protected
1.b.i)	0	5	Calculation based on the number of social amenity properties protected
1.b.ii)	4.33	5	Calculation based on the number of non-residential properties protected
2.a	4.77	5	Calculation based on reduction in AAD
2.b	4.73	5	Calculation based on transport infrastructure protected
2.c	0	5	Calculation based on utility infrastructure protected
2.d	0	3.75	Calculation based on agriculture protected
3.a	2	5	The Bunsheelin stream and River Lee flows through Ballingearry These are classified as good status under the WFD. The River Lee supports an important population of salmonid fish and is considered sensitive to potential impacts from the flood risk management measures. Spawning grounds for salmonid are likely upstream along the River Lee. There is one significant polluting source at risk from flooding in the 1% AEP. There is potential for short term impacts on sensitive waterbodies (-2) There is potential for long term retainment of good water status due to the implementation of the flood measures (+4).
3.b	0	0	AFA dos not occur within the boundary of any Natura 2000 sites. The Gearagh SPA and SAC are located approximately 15km east of Ballingearry. The sites are hydrological connected via the River Lee. The proposed measures will not have significant effects on the conservation objectives of the designated sites.
3.c	-2	2	Otters have not been recorded within 10km of the village. It is extremely unlikely that Otter use the habitat in proximity to the village (0). The River Lee supports an important population of salmonid fish. Construction of flood walls and embankments can cause temporary release of sediment and pollutants to the watercourse which can negatively impact fishery habitat (-1) The proposed measures will result in temporary short negative impacts resulting from construction phase i.e. noise and disturbance on wintering birds. (-2)
3.d	-1	4	There is potential for a short term negative impact during the construction flood walls and embankments. This would result in emissions of sediment to the waterbody downstream. (-1).
3.e	0	3	The proposed measures will have no impact on the landscape value or sensitivity
3.f.i)	0	0	There are no RPS at risk from flooding.

3.f.ii)	0	3	There are a number of protected bridges RMP's at risk from flooding. The proposed measure includes the construction of walls along the banks of the river potential directly impacting on the setting of the bridge (-2). The wall height range from 0.7-1.1m and are in keeping with the existing built environment and provide protection from flooding (+2)	
4.a	5	5	Flood walls and embankments. No moving parts therefore minimal risk of operational failure	
4.b	2	5	Risk of electrocution, falling from a height and drowning	
4.c	4	5	Relatively easy to adapt for climate change, as height can be increased	
Total MCA-Benefit Score		Option Cost (€millions)		MCA-Benefit Score / Cost Ratio
1692.3		€3.07M		551.39
No Properties Benefitting		10% AEP Event	1%/05% AEP Event	0.1% AEP Event
Residential		16	21	0
Commercial		22	25	0
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions				
Area NPVd (uncapped)	Option Cost		Option NPVb (capped)	Benefit - Cost Ratio
€23.7M	€3.07		€14.88M	4.85
Environmental Assessments				
Key Conclusions:				
<ul style="list-style-type: none">The construction of this option could result in temporary negative impacts on the water body status without appropriate mitigation.The prevention of flooding will reduce the level of pollutants in the river Lee.				
Adaptability to Potential Future Changes				
Adaptive Approach: Increase height of existing Flood Defences (by 0.4m on Bunsheelin or 0.2m on Lee).				
Option is adaptable to climate change – Score 4				
An assessment of each AFA's vulnerability to climate change was also carried out. An AFA is deemed as being significantly vulnerable to climate change if the increase in damages in the Mid-Range Future Scenario is significantly different to the current scenario. According to this definition Ballingeary is not significantly vulnerable to climate change.				

Public Consultation Outcomes

The feedback received at the Public Consultation Day on option development indicated that this was the preferred option. During the statutory consultation on the FRMP, feedback received on the plan indicated that some people would like to see natural flood management measures and / or formal upstream flood storage progressed instead of Flood Defences. Some residents also indicated that recent floods exceeded the level and extent of the predicted 1% AEP.

Other feedback received at the Draft Flood Risk Management Plan stage includes:

- Some residents are opposed to the proposed Flood Defences.
- Access through the defences needs to be considered.
- Proposed defences are not high enough.
- Emergency power for pumping station needs to be considered.
- The GAA pitch should be allowed to flood.
- Flood storage should be considered as it would benefit Ballingeary and Inchigeelagh.
- The site of the proposed sewerage treatment plant should be protected.
- Maintenance of the river channel and flood plains is required.
- Planning control and SUDS should be implemented.
- Further hydrological assessment is required.
- The visual impact of the defences need to be considered.

A project level AA and EIA is required for the proposed works at Ballingeary and Inchigeelagh due to its proximity (15km) to the Gearagh SAC.

Other Issues / Conclusions

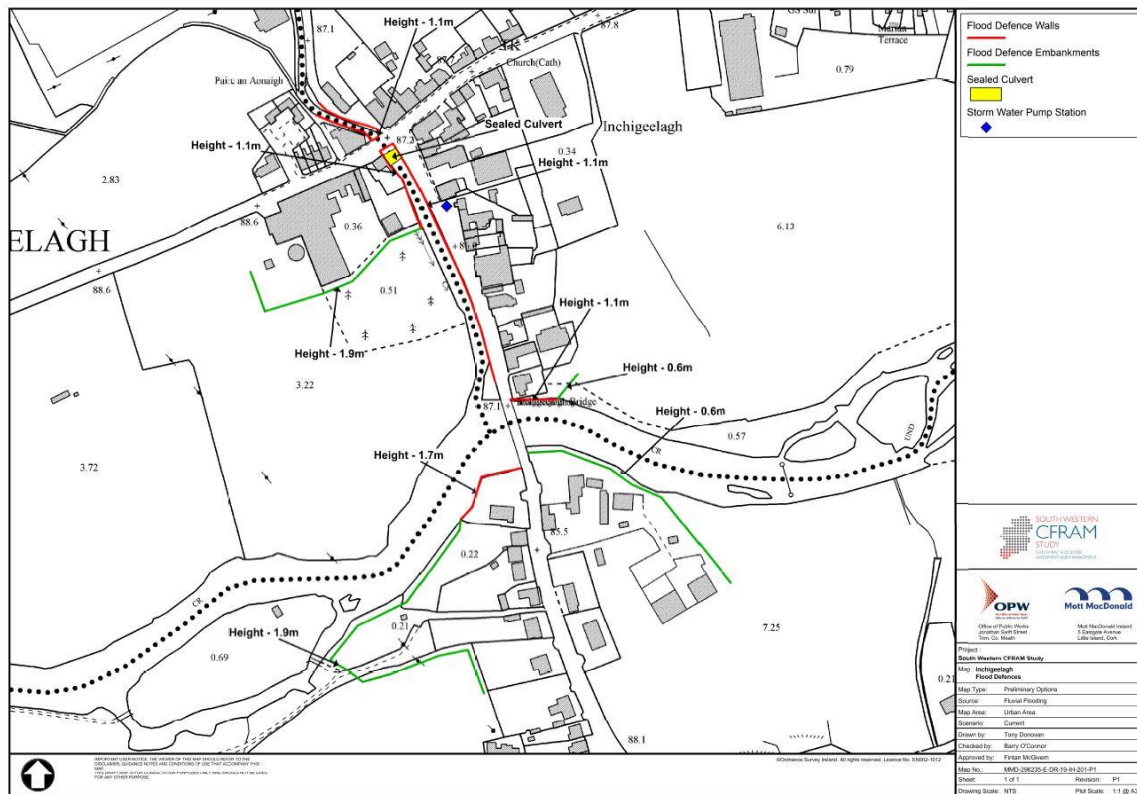
The MCA has identified Fluvial Flood Defences as the preferred Flood Risk Management Option.

As part of developing a flood relief scheme, a further review of flood levels in Ballingeary and Inchigeelagh should be carried out using a 2D hydraulic model.

Note: Information provided at Draft FRMP stage will be addressed at scheme development stage.

G.2 Inchigeelagh AFA

River Basin	Lee, Cork Harbour & Youghal Bay River Basin
AFA	Inchigeelagh AFA
Measure	Fluvial Flood Defences
Code	IE19-IE-AFA-190268-IH01-M33
Description	Fluvial Flood Defences comprising of flood walls and embankments



IMPORTANT NOTE: The works presented herein are not the final and definitive works. Potentially viable flood relief works set out herein will need to be further developed at a local, project level before Exhibition or submission for planning approval.

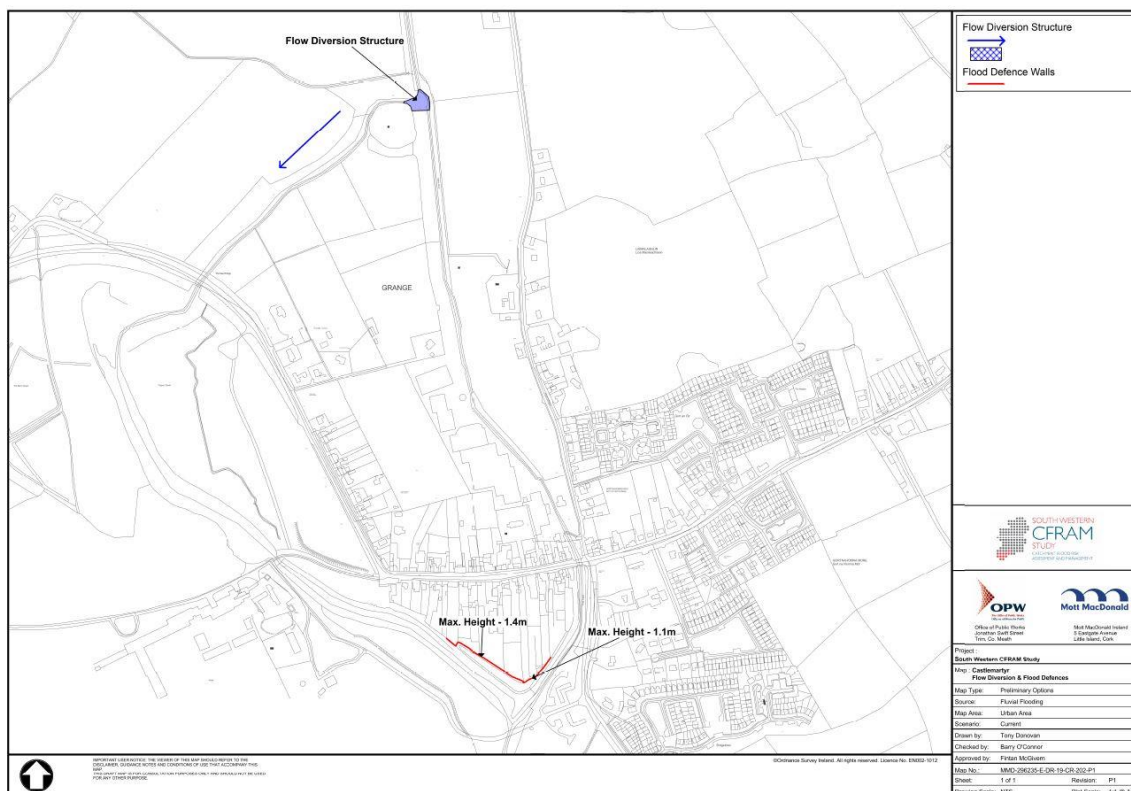
MCA Appraisal Outcomes			
Objective	Un-weighted Score	Local Weighting	Comment
1.a.i)	4.83	4.78	Calculation based on the number of residential properties protected
1.a.ii)	0.00	0	Calculation based on the number of high vulnerability properties protected
1.b.i)	0.00	0.25	Calculation based on the number of social amenity properties protected
1.b.ii)	4.59	5	Calculation based on the number of non-residential properties protected
2.a	4.60	2.97	Calculation based on reduction in AAD
2.b	4.78	5	Calculation based on transport infrastructure protected
2.c	0.00	0	Calculation based on utility infrastructure protected
2.d	0.00	4	Calculation based on agriculture protected
3.a	2.00	5	The River Lee supports an important population of salmonid fish and is considered sensitive to potential impacts from the flood risk management measures. Spawning grounds for salmonid are likely upstream along the River Lee. There is one significant polluting source at risk from flooding in the 1% AEP. Spawning grounds for salmonid are likely upstream along the River Lee. There is one significant polluting source at risk from flooding in the 1% AEP. There is potential for short term impacts on sensitive waterbodies (-2) There is potential for long term retainment of good water status due to the implementation of the flood measures (+4).
3.b	0.00	0	The Inchigeelagh AFA boundary does not overlap with any Natura 2000 site boundary. The Gearagh SPA and SAC are located approximately 7km east of the village. There will be no requirement for land take within a Natura 2000 site for the construction of flood protection works. Therefore there is no potential for direct damage to Annex I habitat.
3.c	-1.00	2	There are no current records for Otter within 10km of the village. It is extremely unlikely that Otter use the habitat for foraging as they would have to pass through the village in order to commute upstream. The urban setting is a likely deterrent to the species. There is temporary short term disruption (noise and physical presence) on local fauna. The proposed measures will be along the existing river bank and will require clearance.
3.d	-1.00	4	There is potential for a short term negative impact during the construction flood walls and embankments. This would result in emissions of sediment to the waterbody downstream. (-1). Short term impacts during construction prior to mitigation.
3.e	-1.00	3	The proposed measures will change the views across the river from the bridge however the wall and embankments relatively low lying.
3.f.i)	0.00	0	There are a number of NIAH within the town. However these are not at risk from flooding and are not impacted by flood measures.

3.f.ii)	0.00	3	There proposed measures will have potential impacts on the setting of the RMP's (-2). However the measures will provide protection to these monuments. (+2).	
4.a	5.00	5	Flood walls and embankments. No moving parts therefore minimal risk of operational failure	
4.b	2.00	5	Risk of electrocution, falling from a height and drowning	
4.c	4.00	5	Option is readily adaptable to climate change, as height can be increased by 0.4m for HEFS.	
Total MCA-Benefit Score		Option Cost (€millions)		MCA-Benefit Score / Cost Ratio
1424.97		€2.56M		555.91
No Properties Benefitting		10% AEP Event	1%/05% AEP Event	0.1% AEP Event
Residential		9	14	0
Commercial		3	14	0
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions				
Area NPVd (uncapped)	Option Cost		Option NPVb (capped)	Benefit - Cost Ratio
€7.23M	€2.56M		€4.68M	1.40
Environmental Assessments				
Key Conclusions:				
<ul style="list-style-type: none">The construction of this option could result in temporary negative impacts on the water body status without appropriate mitigation.This option will prevent pollution of the Lee from pollution sources at risk of flooding.				
Adaptability to Potential Future Changes				
Adaptive Approach: Increase height of existing Flood Defences by 0.4m.				
Option has easily adaptability to climate change – Score 4.0				
An assessment of each AFA's vulnerability to climate change was also carried out. An AFA is deemed as being significantly vulnerable to climate change if the increase in damages in the Mid-Range Future Scenario is significantly different to the current scenario. According to this definition Inchigeelagh is not significantly vulnerable to climate change.				
Public Consultation Outcomes				
The feedback provided at the Public Consultation Day on option development was in support of Fluvial Flood Defences. During the statutory consultation on the FRMP feedback received suggested that a project specific AA and EIA was required in advance of the construction of the scheme.				

Other Issues / Conclusions
<p>The MCA has identified Fluvial Flood Defences as the preferred Flood Risk Management Option.</p> <p>As part of developing a flood relief scheme, a further review of flood levels in Ballingeary and Inchigeelagh should be carried out using a 2D hydraulic model.</p> <p>Note: Information provided at Draft FRMP stage will be addressed at scheme development stage.</p>

G.3 Castlemartyr AFA

River Basin	Lee, Cork Harbour & Youghal Bay River Basin
AFA	Castlemartyr AFA
Measure	Flow Diversion and Flood Defences
Code	IE19-IE-AFA-190277-CR01-M33
Description	Diversion of the Kiltha away from the village of Castlemartyr and construction of Flood Defence walls to protect properties to the south of the village.



IMPORTANT NOTE: The works presented herein are not the final and definitive works. Potentially viable flood relief works set out herein will need to be further developed at a local, project level before Exhibition or submission for planning approval.

MCA Appraisal Outcomes			
Objective	Un-weighted Score	Local Weighting	Comment
1.a.i)	4.77	3.2	Calculation based on the number of residential properties protected
1.a.ii)	0.00	0	Calculation based on the number of high vulnerability properties protected
1.b.i)	3.75	0.5	Calculation based on the number of social amenity properties protected
1.b.ii)	4.67	4.9	Calculation based on the number of non-residential properties protected
2.a	4.33	1.29	Calculation based on reduction in AAD
2.b	4.08	5	Calculation based on transport infrastructure protected
2.c	0.00	0	Calculation based on utility infrastructure protected
2.d	0.00	0	Calculation based on agriculture protected
3.a	-2.00	5	The River Womanagh and Kiltha are classified as having a moderate to good water status under the WFD. The waterbodies are considered to be sensitive bodies. The river discharges into Youghal Bay a shellfish sensitive area. Ballymacoda Bay is a SAC. There are no significant polluting sources at risk from flooding. (-2) There are short term negative impacts associated with the construction. There is a permanent concrete structure being placed in the river which will have a permanent impact on the local flow and morphology. However it is not considered that this structure will significantly alter the attainment of good water status in the long term.
3.b	0.00	1	The Castlemartyr AFA boundary does not overlap with any Natura 2000 site boundary. The Ballymacoda Bay SPA and Ballymacoda (Clonpriest and Pillmore) SAC are located approximately 10km east of Castlemartyr. There will be no requirement for land take within a Natura 2000 site for the construction of flood protection works. Therefore there is no potential for direct damage to Annex I habitat. Potential removal of riparian habitat to accommodate the works will not impact the qualifying features of the SAC or SPA. The Kiltha River (which flows through Castlemartyr) is hydrologically connected to Ballymacoda Bay via the Womanagh River. Sediment release / accidental pollution of the Kiltha River could potentially enter the Bay. The release of sediment into the bay is extremely unlikely to impact the qualifying features of the SAC. These habitats are habitually inundated with sediment during tidal exchanges and are adapted to such conditions. Pollutants e.g. concrete / oil leaks will be diluted by flows in the Kiltha River, the Womanagh River and also by estuarine water in the bay. It is highly unlikely that pollutants would reach the Bay at such concentrations what would cause habitat damage.
3.c	-1.00	4	Potential removal of riparian habitat to accommodate the works will impact on the local flora and fauna of the catchment (-1).

3.d	-3.00	2	Castlemartyr Womanagh is not known as a river for high salmon/lamprey potential. The Kiltha however is known as a river where salmonids spawn. There may be local fishing value along the river. (-1). The measures will result in increase risk of flooding downstream of Castlemartyr and potential limiting access to fishing activity in the area during flooding. (-1) The construction of the measures on the river may require excavation of the bank of stream and diversion of the river during the construction stage this would result in significant short term emissions of sediment to the waterbody and downstream without treatment. The Flood Defence structure will result in a permanent loss of fisheries habitat. (-3) The diversion of the flow during high flow constitutes an intermittent negative impact to the hydrological regime of the river.				
3.e	-1.00	3	Castlemartyr is classified within the Development plan as being within a Broad Fertile Lowland valley. This landscape character type is classified as having local value and medium sensitivity and value. There are no scenic routes within the town. Existing vegetation will be removed to facilitate the construction of the structure. There are wide expansive views from the road. There will be short term impacts during construction and where is opportunity to design natural riparian around the structure.				
3.f.i)	3.00	3	Castlemartyr is classified in the Cork Development Plan as an area of architectural importance. There are a number of sites/features listed on the record of structures and NIAH within the town and potentially affected with a high to moderate vulnerability. However these sites are not within 1%AEP risk. The proposed measures will however provide protection to the AFA.				
3.f.ii)	3.00	2	The proposed measures will have no impact on the risk of flooding on archaeological heritage.				
4.a	4.00	5	Flood walls and embankments, no moving parts				
4.b	2.00	5	Risk of falling from a height, drowning and electrocution				
4.c	0.00	5	Adaptable but new Flood Defence works required to defend against climate change scenario				
Total MCA-Benefit Score		Option Cost (€millions)		MCA-Benefit Score / Cost Ratio			
704.98		€1.44M		488.28			
No Properties Benefitting		10% AEP Event		1%/05% AEP Event		0.1% AEP Event	
Residential		10		13		0	
Commercial		5		9		0	
Economic Appraisal (Cost-Benefit Analysis) Outcomes - All figures €millions							
Area NPVd (uncapped)		Option Cost		Option NPVb (capped)		Benefit - Cost Ratio	
€3.27M		€1.44M		€2.39M		1.66	

Environmental Assessments
<p>Key Conclusions:</p> <ul style="list-style-type: none"> • The construction of this option could result in temporary negative impacts on the water body status without appropriate mitigation. • This option will impose a permanent barrier to the transit of mammals along the river corridor.
Adaptability to Potential Future Changes
<p>No Physical Provision: Construct new Flood Defences</p> <p>Option is adaptable to climate change – Score 0.0</p> <p>An assessment of each AFA's vulnerability to climate change was also carried out. An AFA is deemed as being significantly vulnerable to climate change if the increase in damages in the Mid-Range Future Scenario is significantly different to the current scenario. According to this definition Castlemartyr is not significantly vulnerable to climate change.</p>
Public Consultation Outcomes
<p>This option was preferred option of people who gave feedback at the public consultation day on option development. During the statutory consultation on the FRMP feedback received indicated that the Kiltha was an important salmonid spawning and nursery river, that the spread of invasive plant species should be prevented during the works and that ecological surveys should be carried out in advance of the works.</p> <p>Other feedback received at the Draft Flood Risk Management Plan stage includes:</p> <ul style="list-style-type: none"> • The Kiltha is an important salmonid spawning and nursery of the Womanagh. • The spread of Invasive species has to be prevented. • Otter, bat and bird surveys are required to inform the environmental assessment for Castlemartyr.
Other Issues / Conclusions
<p>This option is the preferred option in the MCA and according to public feedback.</p> <p>At the public consultation a number of local residents advised of issues relating to the existing storm and foul sewer networks. From the low point on the east side of the bridge, surface water cannot discharge to the river. Locals have advised that the surface water gully is connected to the foul sewer which surcharges as a result during periods of heavy rainfall. As part of any flood relief scheme the existing storm and foul sewer networks should be investigated.</p> <p>Note: Information provided at Draft FRMP stage will be addressed at scheme development stage.</p>



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