

APPENDIX 2-1

CFRAM Consultation Documents

Section 1

Camac and Poddle Consultation Synthesis Report

**Eastern CFRAM Study, Accelerated Works Consultation, Synthesis Report
Camac and Poddle HPWs
IBE0600Rp0024**

6.1.3 Public consultation

Most of the consultees expressed their relief that detailed assessment has taken place within the Poddle and Camac catchments. They would prefer the works to take place as quickly as possible in order to reduce flood risk.

Insurance is a key issue with consultees in both catchments. Many property owners have been unable to obtain insurance since the flood event of October 2011. They are extremely anxious that flood alleviation work takes place before another large flood event occurs. Many were also concerned that their properties have been devalued by the flooding. They were also concerned about the risk to life associated with the flood risk, particularly in the Poddle catchment.

Maintenance and cleaning is another key concern amongst all consultees in both catchments. Debris in the rivers leading to blockages during high flows has greatly exacerbated flooding according to many consultees.

Many expressed their concern that some of the culverts within the catchments are too small or prone to blockage to deal with high flows. They feel that none of the options adequately address this issue.

Many consultees expressed the view that continued development in these highly urbanised catchments has put pressure on the drainage network which has exacerbated flooding.

Several consultees felt that dumping of rubbish in the Poddle River is a significant problem and contributes to blockages and flooding during high flows.

Several consultees expressed the belief that overflows from the canal exacerbate flooding in both the Poddle and Camac catchments. This has been raised with Waterways Ireland but as yet no conclusive answer has been reached on this matter.

6.1.3.1 Camac and Poddle Flood Risk Maps

There were several comments in relation to the flood extents illustrated on the flood risk maps. Discrepancies were highlighted by consultees between the maps and observed reality on the ground at a number of locations.

6.1.3.2 Poddle Flood Risk Management Options

None of the consultees identified option 1 as their preferred option. Several did not like the idea of intermittent walls and embankments as they fear it could cause a 'funnelling' effect that could lead to erosion. Concerns with the aesthetics of this option were also raised.

Options 2 and 3 were equally acceptable amongst consultees. The idea of storing water, or taking it out of the system entirely, at the top end of the catchment, thus reducing flows downstream, was very well received. However, many objected to the potential increased flood risk to Dodder residents associated with option 3. Many of the consultees expressed their hope that the aesthetics of the preferred option would be carefully considered before any works take place. This will be considered at the appropriate time i.e. during detailed design. Consultees would prefer that any option taken forward is designed so as to rely as little as possible on maintenance or human intervention in the event of flooding. This will be considered at the appropriate time i.e. during detailed design.

One consultee expressed concern that the weir at the bottom of the lakes in Tymon Park might not be a sufficient mechanism to hold the flow back during periods of high flow. They feared it might be drowned out during high flows. It was explained that the proposed flood defences at Tymon will include a culvert and overflow weir structure. Details of this structure will be looked at during the next phase of the process.

Some expressed interest in ensuring as little physical change as possible to the channels and riparian zones and therefore preferred the increased storage and diversion options generally. A small number of consultees strongly objected to the removal of trees to make way for walls and embankments. This will be considered at the appropriate time i.e. during detailed design. Eastern CFRAM Study Camac Poddle Accelerated Works Synthesis Report IBE0600Rp0024 20 F02.

Some were concerned in relation to the design and construction of flood walls and embankments due to the potentially severe consequences associated with failure of these structures. This will be considered at the appropriate time i.e. during detailed design. A couple of consultees suggested that the inclusion of railings at certain locations as part of the preferred option could significantly reduce illegal dumping within the channel and subsequent blockages. This will be considered at the appropriate time i.e. during detailed design.

6.1.3.3 Camac Flood Risk Management Options

Many consultees expressed their disappointment that no cost-effective option was identified as part of this first phase of the project. However, most understood that a holistic approach was required at this stage of the process, and that any option must provide protection to all flood risk properties in the catchment while providing a cost effective solution before it can be progressed. Most were therefore anxious to know when the next phase of the process could begin to identify more localised solutions to the flooding issues.

One person asked whether removal of the bridge at Kearns Place, Kilmainham was considered as a measure. The bridge was described as acting like a dam during high flows, holding water back and causing flooding in the area. The removal of this bridge was also suggested by Dublin City Council representatives.

6.2 INFLUENCE OF CONSULTATION ACTIVITIES

The principle aims of the consultation activities were to verify the flood maps and to refine the options and scenarios proposed.

The observation and submissions summarised above were carefully considered by the project team. The influence that they had on the mapping and preferred options is summarised below and described in more detail in the following reports:

- Poddle hydraulics report (IBE0600Rp0027_HA09 Hydraulics Report_Poddle_F02) Appendix A4;
- Camac hydraulics report (IBE0600RP0027_HA09 Hydraulics Report_Camac_F02) Appendix A2;
- Poddle options report (IBE0600Rp0030_Poddle Options Report_F02) Chapter 8;
- Camac options report (IBE0600RP0031_Camac Options Report_F02) Chapter 8;
- Culvert Blockage Analysis - Poddle Pilot Report

6.2.2 Choice of Preferred Options

For the Poddle catchment, option 2 (increased storage at Tymon Park) was revealed to be the

preferred option amongst consultees on balance. Option 3 (diversion to the Dodder catchment) was also popular but many consultees raised concerns that this options could result in increased flood risk within the Dodder catchment. Option1 did not progress to the preferred stage. The following elements were assessed and added to the options, or require further consideration, following stakeholder and public consultation:

Poddle Options 2 & 3

- Culvert upgrades;
- Flap valves on storm drainage network;
- Maintenance plan elements including new or upgraded screens, extensions to head and wing walls, erection of railings to prevent dumping, increased maintenance works, sediment removal and re-profiling and monitoring;
- Review of emergency response plan.

Camac Options 1 & 2

- Maintenance plan elements including cutting back vegetation, routine vegetation control, debris removal and monitoring;
- Review of emergency response plan; Culvert upgrades and further analysis;
- Further consideration of removal of Kearns Place Bridge;
- Further consideration of alternative standards of protection.

The comments made and issues raised by consultees in relation to specific aspects of the options, for example the aesthetics of the options or other design elements of the options, will all be considered during the detailed design phase once preferred options have been identified by Dublin City Council and South Dublin County Council.

Table 3.1 Public Consultation Day format

Event	Public Consultation Days		
Catchment	Poddle	Camac	Camac and Poddle
Venue	Perrystown Manor Community Centre	Clondalkin Library	Dolphin's Barn Library
Local authority	South Dublin County Council	South Dublin County Council	Dublin City Council
Date and time	24 June 2013, 1.00pm to 7.30pm	25 June 2013, 1.00pm to 7.30pm	26 June 2013, 1.00pm to 7.30pm 27 June 2013, 10.00am to 4.30pm
Attendance	31	21	51
Event format	<input type="checkbox"/> Information stand set-up, drop-in format		
Study personnel	<u>RPS</u> Grace Glasgow, Andrew Jackson, Mark Wilson, Katie Smart, Miriam Grant <u>OPW</u> Gavin Poole, Clare Butler <u>South Dublin Co Co</u> Dermot Finch, John Hand	<u>RPS</u> Grace Glasgow, Mark Wilson, Katie Smart <u>OPW</u> Gavin Poole, Clare Butler, Siobhan Mulford, Mary Lynch <u>South Dublin Co Co</u> Dermot Finch, John Hand	<u>RPS</u> Grace Glasgow, Brendan Quigley, Andrew Sloan, Katie Smart, Miriam Grant <u>OPW</u> Gavin Poole, Clare Butler, Siobhan Mulford <u>Dublin City Council</u> Gerard O'Connell, Victor Coe, Paul
Supporting materials	<input type="checkbox"/> Hard copies of the flood extent maps and options maps and disclaimers <input type="checkbox"/> Options summary sheets <input type="checkbox"/> Example images of flood risk management measures <input type="checkbox"/> Study newsletters and leaflets		

Event	Public Consultation Days
Promotion	<u>Direct contact</u> <input type="checkbox"/> Elected Members were encouraged to promote awareness of the PCDs <input type="checkbox"/> Elected Members at the briefings were invited to attend the PCDs <input type="checkbox"/> The Eastern CFRAM Study Stakeholders Group were invited to attend and encouraged to promote awareness of the PCDs <input type="checkbox"/> Many of the local stakeholders were contacted directly and invited to the PCDs
	<u>CFRAM Websites</u> Information in relation to the PCDs was uploaded to the study website
	<u>OPW and LA mechanisms</u> OPW and LA press officers were contacted to identify opportunities to tie-in with established dissemination mechanisms within the catchment areas. These included: <input type="checkbox"/> upload of information to websites; <input type="checkbox"/> announcements on facebook and twitter announcements; <input type="checkbox"/> upload of information to relevant community forum websites; <input type="checkbox"/> Inclusion of information in relevant and timely circulars/newsletter/leaflets etc (OPW/SDCC/DCC/RPS)
	<u>Poster campaign</u> Posters were erected at the PCD venues and in local authority offices
	<u>Letters and leafleting</u> Leaflets and letters announcing the events were circulated to relevant households between one week and 10 days in advance of the events. DCC – approx. 300 letters posted SDCC – approx. 1,500 leaflets delivered

Event	Public Consultation Days
	<u>Media campaign</u> Advertisements were placed in the following newspapers: <input type="checkbox"/> Southside People; <input type="checkbox"/> Tallaght Echo; <input type="checkbox"/> Clondalkin Echo; <input type="checkbox"/> Dun Laoghaire Gazette; <input type="checkbox"/> Clondalkin Gazette; <input type="checkbox"/> Tallaght Gazette. Press releases were also sent to these publications.

Table 6.1 Summary of number of responses and submissions

Type	Number	Summary
Elected member briefing comments	NA	Issues summarised in Section 6.1 Meeting note on file
Stakeholder workshop	NA	Issues summarised in Section 6.2 Meeting note on file
Public consultation days	Perrystown Community Centre = 27 comment sheets Clondalkin Library = 11 comment sheets Dolphin's Barn Library = 30 comments sheets	Summarised in Section 6.3 Electronic copies of comment sheets kept on file
Submissions	1	Issues summarised in Section 6.3 Recorded in Communications Register
Website	2	Issues summarised in Section 6.3 Recorded in Communications Register
Email	17	Issues summarised in Section 6.3 Recorded in Communications Register
Phonecalls	3	Issues summarised in Section 6.3 Recorded in Communications Register
Letter	1 (to Dublin City Council)	Issues summarised in Section 6.3 Recorded in Communications Register

Section 2

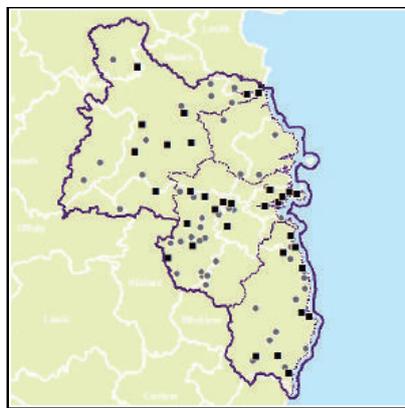
Eastern CFRAM Study - Poddle Options Report (Section 8)



Eastern CFRAM Study

Poddle Options Report

IBE0600Rp0030





Eastern CFRAM Study Poddle Options Report

DOCUMENT CONTROL SHEET

Client	Office of Public Works					
Project Title	Eastern CFRAM Study					
Document Title	IBE0600Rp0030_Poddle Options Report_F02					
Document No.	IBE0600Rp0030					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	1	58	1	1	5

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
D01	Draft	M Wilson	A Sloan	G. Glasgow	Belfast	10/09/2013
D02	Draft Final	M Wilson	A Sloan	G Glasgow	Belfast	23/10/2013
D03	Draft Final	M Wilson	A Sloan	G Glasgow	Belfast	11/12/2013
D04	Draft Final	M Wilson	A Sloan	G Glasgow	Belfast	05/01/2014
D05	Draft Final	M Wilson	A Sloan	G Glasgow	Belfast	17/02/2014
F01	Draft Final	M Wilson	A Sloan	G Glasgow	Belfast	18/02/2014
F02	Draft Final	M Wilson	A Sloan	G Glasgow	Belfast	08/07/2014

8 CONSULTATION AND UPDATING PREFERRED FRM OPTIONS

An important element of the Eastern CFRAM Study is consultation with all interested parties including the public. This is carried out at strategic points in the study, including the identification of preferred FRM options. This gives the interested parties an opportunity to communicate local knowledge and how they are currently affected, and to give their views on the preferred FRM options, thereby influencing the decision-making process.

The consultation includes a wide range of interested parties with general or specific interests such as impact on society, the environment, cultural heritage or the economy. All comments are considered and, where relevant, further updates to the options can be carried out before the final FRM measure are presented in the FRM Plans.

8.1 CONSULTATION RECOMMENDATIONS FOR THE RIVER PODDLE

Consultation was carried out through elected members briefings, a stakeholders workshop, public consultation days and correspondence with the Local Authorities and the OPW. Web-based consultation was also undertaken. Details of the consultation can be found in the Camac and Poddle HPWs Consultation Synthesis Report (Ref). The following summarises the main findings from the consultation activities regarding the options proposed.

- Most people who attended events had experienced flooding and consequently would be happy to see any kind of flood defence along the River Poddle and are keen to get something in place as soon as possible.
- Options 2 and 3 (options with the Tymon Park storage and the flow diversion respectively) are generally preferable to option 1 with just hard defences. There was no clear preference between options 2 and 3 but the concerns expressed during the public consultation over the potential flood impact along the River Dodder, with the strong objections from some elected members, indicates that option 3 is less socially preferable, despite option 3 being economically preferable
- It was stated that a main cause of flooding during the October 2011 flood was due to blocked culverts. Maintenance and keeping culverts clear are a major concern to the River Poddle residents. For many people, any option which does not address the problem of culvert blockages is unacceptable and options which remove the need to rely on maintenance should be sought.
- There was concern that any of the FRM options proposed would have an adverse impact on the pluvial flood risk.
- OPW recommended that LAs use the Flood mapping, various reports and proposed flood risk management measure to review and update their Emergency Response Plans

The comments from the consultation process were reviewed and the following was carried out:

- OPW commissioned RPS to carry out an additional culvert blockage analysis study. This study aims to identify the culverts at risk of blocking and would cause a significant flood risk and propose FRM measures to mitigate this risk.
- A maintenance review of the River Poddle was carried out to identify any maintenance measures required.
- A study on the impact to the River Dodder was carried out assuming option 3 (flow diversion) were to be implemented and any mitigation measures required were proposed.
- An analysis of the impact of FRM option to the pluvial flood risk was carried out

8.2 CULVERT BLOCKAGE ANALYSIS

The Poddle culvert blockage study was used as a pilot to develop a method to assess culvert blockages. Option 2 (Tymon Park storage) and option 3 (flow diversion to the River Dodder) were identified as the most preferable during the consultation. Of these two options, option 2 produces the

largest flows in the River Poddle and was therefore used in this analysis as it would create the most onerous scenarios. The following section details the results of this analysis.

The culvert blockage analysis identified five culverts as being likely to block and could cause significant flood risk and damage. Each culvert was assessed individually and the effect it would have on the surrounding area considered. The damage caused by culvert blockages if option 2 were in place was assessed to the same standard as described in section 2.3.2 and the increased damage is detailed in the table below.

Table 8.1 - Increased present value damage caused by culvert blockage

Culvert	pv Damage within area of influence - Clear Screen	pv Damage within area of influence - Blocked Screen	Increased Direct Damage
Kimmage Manor Culvert	€0	€0	€0
Poddle Park Culvert	€262,317	€1,110,210	€847,893
Sundrive Road Culvert	€9,889,045	€10,854,013	€964,968
Mount Argus Park Culvert	€232,852	€13,077,845	€12,844,994
Harolds Cross Culvert	€0	€7,011,465	€7,011,465
			€21,669,320

It can be seen in the table above that substantial damage can be caused if the culverts listed above were to block to the extent assumed. The culvert at Kimmage Manor produces no damage during the design event whether the culvert blocks to the assumed degree or not. From the assessment it was found that although the culvert blockage caused extensive flooding in that area, the FFLs were sufficiently high to avoid any damage to the properties. There will therefore be no benefit in mitigating against this risk.

An assessment on how to mitigate culvert blockages was carried out. In most cases a flood wall is proposed on both banks of the River Poddle approaching the culvert inlet as well as providing a head wall at the culvert. This tells us that even when the culverts are running clear the channel is at capacity and walls would be required to prevent out of bank flooding. While upgrading or installing new trash screens are also recommended they cannot be considered to mitigate the flood risk caused by blockages completely. This is due to all trash screens having the potential to collect a build up of debris during a flood event which will cause raised water levels upstream. While the impact would not be as severe as the current situation at each culvert it would still rely on human intervention to clear the screens and if the channel is at full capacity could not provide a complete solution by itself.

It was assumed that the method to manage this increased risk was to increase the height and length of the proposed upstream flood walls and provide suitable trash screens. The table below summarises the changes required to achieve this.

Table 8.2 - Changes required to mitigate blockage flood risk and BCR

Culvert	Measure	Increased Cost
Harolds Cross Culvert	Additional walls required at Mount Jerome Cemetery and Gandon Place approximately 310m in length and up to 2.1m high and also at Mount Argus Road adjacent to the church approximately 90m in length and up to 2.1m high. A screen upgrade is required at the Harolds Cross culvert to reduce the likelihood of blockage.	€2,324,280
Mount Argus Park Culvert	Walls and embankments required at Mount Argus Estate 335m in length and up to 2m high. A trash screen is required at the Mount Argus Park culvert to reduce the likelihood of blockage.	€1,376,930
Sundrive Road	Additional walls required at back of gardens at Blarney Park and	€1,722,688

Culvert	Measure	Increased Cost
Culvert	St Martins Park approximately 278m in length and up to 3.1m high. A screen upgrade is required at the Sundrive Road culvert to reduce the likelihood of blockage.	
Poddle Park Culvert	Additional walls required at Poddle Park and Fort Field Road approximately 665m in length and up to 3.6m high. A screen upgrade is required at the Poddle Park culvert to reduce the likelihood of blockage	€2,618,505.7

The increased benefit (table 8.1) and the increased cost (table 8.2) from mitigating the flood risk caused by culvert blockages was combined with the original figures to assess if a cost beneficial is achievable. This is summarised in table 8.3 below.

Table 8.3 - Comparison of costs and benefits

Option		Cost	Benefit	BCR
Option 2	Hard defences, sealing manholes and upstream storage at Tymon Park	€11,412,092	€17,838,862	1.56
Option 2 with culvert blockages	Hard defences, sealing manholes, upstream storage at Tymon Park and screen upgrades	€19,148,216	€39,428,786	2.06

It can be seen that a cost beneficial solution is available by combining the culvert blockage mitigation methods to the original option 2. It is assumed that a similar scenario is available for option 3 also.

Further details of culvert blockage analysis can be found in the Poddle Culvert Blockage Analysis Report (ref no IBE0600Rp0023).

8.3 MAINTENANCE REVIEW

It was highlighted during the consultation process that many members of the public have a perception that there is an ongoing maintenance issue along the River Poddle corridor. Problems with rubbish tipping and debris blocking stretches of the open channel and culverts is indeed a recurring problem. While the impact of rubbish tipping is difficult to quantify, it was appreciated that it is a real risk that had not been managed within the preferred FRM options. It was therefore recommended that maintenance be included to the preferred FRM options.

A review of the watercourse was carried out based on the channel survey and correspondence with the relevant Local Authorities. The review has been based on four maintenance criteria which contribute to the flood risk. These four criteria are:

- sedimentation,
- debris,
- vegetation, and
- blockage prone culverts or bridges.

Due to the urbanised nature of the watercourse, high concentration of flood receptors, and that fact that the river is relatively small, it is particularly sensitive to any restriction in flow. It has been noted that some areas are prone to rubbish tipping which can contribute significantly to the flood risk.

Dublin City Council and South Dublin County Council both proactively maintain the River Poddle and have provided additional maintenance and monitoring measures since the October 2011 flood. These measures consist of upgrading culvert screens or fitting new screens at Poddle Park, Sundrive Road and Gandon Hall/Mount Jermoe Cemetry and the installation of CCTV cameras to allow remote monitoring of problem areas.

Nine areas have been identified as areas requiring screen upgrades, increased maintenance and monitoring and are detailed in the figure and table below. For most of the areas identified where

screens and head & wing walls are recommended they are also identified as part of the blockage analysis recommendations as detailed in section 8.2. The cost benefit analysis for these measures was carried out during the blockage analysis and is not required for this section. The remaining recommendations mainly consist of measures already installed by the Local Authorities or is a recommendation for use of already existing resources. It is therefore assumed that there will be no additional costs to consider.

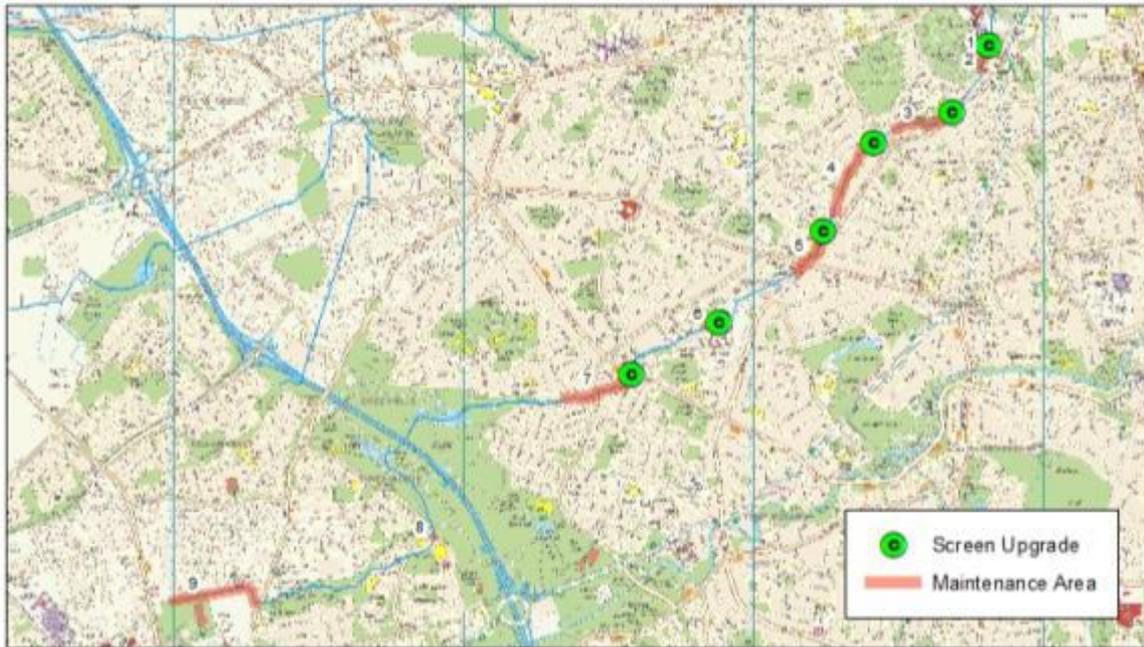


Figure 8.1 - Maintenance areas on the River Poddle

Table 8.3 - Recommended maintenance on the River Poddle

Maintenance Issue	Comment	Recommended Action
<p>Area 1</p> 	<p>The culvert at Harold's Cross has been identified as at risk of blocking and causing a significant increased flood risk. DCC currently monitor this culvert remotely using CCTV.</p>	<p>Upgrade screen. Extend head and wing walls to contain the water.</p>

Maintenance Issue	Comment	Recommended Action
<p>Area 2</p> 	<p>Sedimentation and debris appear to accumulate upstream of the Mount Argos Road bridge. However due to the high walls there is a large capacity along this stretch of the watercourse. The flood risk would therefore be considered low.</p>	<p>Monitor this stretch of watercourse.</p>
<p>Area 3</p> 	<p>The culvert leaving Mount Argos Park at Kimmage Road Lower has been identified as at risk of blocking and causing a significant increased flood risk. Debris has been found in the watercourse upstream of Mount Argos Park at Mount Argos Way which may potentially contribute to the culvert blockage risk/</p>	<ul style="list-style-type: none"> • Construct screen. • Extend head and wing walls to contain the water. • Secondary Screen at Mount Argos Way • Increased debris removal from Mount Argos Square to Kimmage Road Lower
<p>Area 4</p> 	<p>The culvert at Sundrive Road has been identified as at risk of blocking and causing a significant increased flood risk. The approach to the culvert consists of open space along St Martin's Drive followed by gardens backing on to the river. There is evidence of debris at the culvert and reports of rubbish tipping in the area. A small screen is located in the open space described upstream of a footbridge.</p>	<ul style="list-style-type: none"> • Upgrade screen has already occurred. • Extend head and wing walls to contain the water. • Upgrade Secondary Screen at open space adjacent to St Martin's Drive. • Increased debris removal from St Martin's Drive to SunDrive Shopping Centre. • Railings along Poddle Park Road to discourage tipping.

Maintenance Issue	Comment	Recommended Action
<p>Area 5</p> 	<p>The culvert at Poddle Park has been identified as at risk of blocking and causing a significant increased flood risk. There have been reports of rubbish tipping at the park and DCC carry out regular rubbish removal.</p>	<ul style="list-style-type: none"> • Construct screen. • Extend head and wing walls to contain the water. • Secondary Screen in Poddle Park has already been constructed. • Increased debris removal in Poddle Park. • Railings along Poddle Park to discourage tipping.
<p>Area 6</p> 	<p>The culvert at Kimmage Manor has been identified as at risk of blocking and causing a significant increased flood risk. The culvert is located between two recently upgraded culvert bypass screens. There is evidence of sedimentation upstream of the culvert</p>	<ul style="list-style-type: none"> • Construct screen. • Extend head and wing walls to contain the water. • Remove sediment and re-profile to ensure self cleansing channel
<p>Area 7</p> 	<p>The reach of watercourse between Wellington Drive (leaving Tymon Park) and Templeville Road was found to have a significant amount of debris. While the flood risk is not significant along this reach it is situated upstream of Whitehall Road and Wainsfort Manor which does. A course screen is located at the Templeville Road culvert but is in disrepair.</p>	<p>Replace course screen and increase debris removal.</p>

Maintenance Issue	Comment	Recommended Action
<p>Area 8</p> 	<p>There is evidence debris blocking the twin culverts at the school and sports complex in Tymon North. The flood risk here however is not significant.</p>	<p>Monitor the culvert inlet.</p>
<p>Area 9</p> 	<p>The reach of watercourse behind the commercial units at Airton Road is heavily vegetated and could restrict flow and raise water levels accordingly. Properties are at risk in this area and the flood risk could increase as a result of heavy vegetation.</p>	<p>Monitor Vegetation</p>

8.4 IMPACT ON THE RIVER DODDER AND SURROUNDING AREA

Introducing additional flow to any catchment can have consequences in relation to increasing the flood risk in that catchment. The River Dodder has a history of flooding and was subject to a pilot CFRAM study. The study found that no cost beneficial solution providing the preferred standard of protection (1% AEP flood event) could be found for the whole of the area being studied. Smaller areas, referred to as flood cells in the Dodder CFRAM Study, were assessed and cost beneficial FRM options identified. The Dodder study has progressed leaving a current scenario where some areas are currently protected due to defences being implemented, some areas not yet protected but defences proposed and some areas at risk during the 1%AEP flood event but no defences proposed.

Adding additional flow from the River Poddle could cause additional receptors to be at risk and increase the level of risk to existing receptors located within the Dodder floodplain. To ascertain if this is the case an assessment was carried out to quantify the change in flood depth to receptors.

At the point where the River Poddle flow diversion discharges to the River Dodder, the Dodder Q100 flow is estimated to be 150 cumecs. An estimated additional 3 cumecs coming from the diversion would increase the flow by 2%. To assess this impact a hydrological and hydraulic analysis was carried out and the resulting present day flood extents assessed. It was found that a maximum water level rise of 30mm was estimated during the 1%AEP event.

A review on the potential impact to the properties in the Dodder area was carried out by establishing the current level of flood risk to the properties within the River Dodder area and comparing it to the increased flood risk resulting from the increased flow from the Flood Diversion. The table below summarises the findings.

Table 8.4 - Impact of Flow Diversion on the Dodder area being studied

Description	No. of Properties	
Number of properties currently at risk within existing flood extent with no change in flood depth due to the increased flow from the River Poddle during the 1%AEP flood event	291	700
Number of properties currently at risk within existing flood extent with an increased flood depth due to the increased flow from the River Poddle during the 1%AEP flood event	409	
Number of additional properties at risk due to the increased flow from the River Poddle during the 1%AEP flood event	109	
	809	

From the table it can be seen that 700 properties are currently at risk from a 1%AEP flood event from the River Dodder. The increased flow from the Flood Diversion would result in an additional 109 properties being put at risk along with 409 properties from the current 700 being placed at increased flood risk, due to increased flood depth.

The properties affected by the River Dodder can be placed into 3 categories:

- Properties at flood risk in areas where defences are currently constructed
- Properties at flood risk in areas where defences are proposed
- Properties at flood risk in areas where no defences are present or proposed

The following paragraphs discuss the recommended action required if the Flow Diversion were to be constructed.

Areas where defences are currently constructed - The hydraulic models run for this assessment included the existing defences along the River Dodder. These defences protect areas from a 1%AEP fluvial flood event and consist of flood walls. These walls have been afforded a 1m freeboard, well over the recommended 300mm freeboard. This conservative freeboard will be able to accommodate a further increase in water level of 30mm and therefore the potential flood risk to properties located in areas protected by defences has already been mitigated and requires no further action.

Areas where defences are proposed - The FRM options proposed for flood cells along the River Dodder consist of flood walls and embankments. To ensure the original proposed level of protection is afforded to all properties an additional 50mm is recommended to be added to design crest height of all defences.

Areas where no defences are present or proposed - There are however some properties located in areas which are not offered any protection existing or proposed which will be subjected to an increased flood risk due to the increased flow from the River Poddle. The increase in flood depth to these properties range from 10 - 20mm. Further mitigation measures will be required to ensure no increase in flood risk as a result of FRM measures from the River Poddle. This may focus on the individual property protection for each building or as a group depending on flood mechanisms and location of properties relative to each other; or flow attenuation along the Flow Diversion or River Dodder such as the Dodder Valley Park or Bushey Park.

The table below summarises these scenarios and the recommendations associated with each.

Table 8.5 - Recommendations to mitigate increased flood risk to Dodder area

Area type	Number of properties at increased flood risk due to diversion from River Poddle	Recommendation
Areas currently protected	0	None; freeboard suitable
Areas proposed for protection	461	Additional 50mm to design crest height
Areas not proposed for protection	57	Further study to ascertain the full extent of flood risk and FRM methods

This study recognises that there are both perception and technical issue relating to increased levels of risk on the River Dodder that this study cannot fully address, but given the apparent economic merits of the Flow Diversion, the subsequent study should allocate a sufficient body of work to examining and if possible addressing these issues.

8.5 IMPACT ON PLUVIAL FLOOD RISK

Fluvial and coastal flooding can influence the pluvial flood risk in one of two ways. Flood water from the river or coast can enter and surcharge the storm drainage network that it discharges to or the raised water levels in the river or sea prevent the free discharge of surface water and causes the storm water to back up through the drainage system resulting in surcharging and flooding.

Given the perceived pluvial flood risk within the River Poddle area being studied it is important to prevent an increase in pluvial flood risk. As such an analysis was carried out on the two preferred FRM options (option 2 and option 3) to identify areas where this may be the case. A comparison of water levels in the river channel was carried out between each option and the present day scenario. This identified areas where the pluvial flood risk could potentially be increased. This would be due to the increased head that the water in the storm drainage network discharging to the Poddle would have to push against ultimately causing raised water levels within the drainage network. Where no flap valve is present at a discharge point the possibility of fluvial flood water entering the storm drainage network also exists. A review of the storm drainage network discharge point was carried out and while flap valves are present preventing water entering the system there are many without.

The analysis found that an increase in water levels in the River Poddle as a result of both FRM options would occur along the lower reaches up to Mount Argus. It would therefore be recommended that the condition of all storm drainage discharge points in this area be assessed and flap valves fitted if required. In addition to this it may be required that the storm drainage network be upgraded to provide adequate capacity. This analysis would be carried out as part of the detailed design and the MCA and CBA re-scored. However, to give an indication of how this would impact the overall cost benefit ratio the table below shows the result of adding an extra €1 million to the cost of each option.

Table 8.4 - Economic impact of upgrading storm drainage networks

Option	Description	Benefit	Project whole life cost ⁺	BCR
1	Hard defences and sealing manholes	€17,838,862	€13,672,152	1.30
2	Hard defences, sealing manholes and upstream storage	€17,838,862	€12,412,093	1.44
3	Hard defences, sealing manholes and flow diversion	€17,838,862	€10,457,249	1.71

8.6 UPDATING PREFERRED OPTIONS

The recommendations carried out as a result of the consultation process are to be applied to the preferred FRM options. However as there was no preference given for option 1 (hard defences) during the consultation process and as it scored the worst overall, option 1 was removed from further consideration. The recommendations were therefore applied to options 2 and 3 only and consist of mitigation measures to protect against flooding from culvert blockages at Harolds Cross, Mount Argus Park, Sundrive Road & Poddle Park, installing or upgrading culvert inlet screens, installing flap valves and revising the maintenance plan. Options 2 and 3 are summarised in the following sections.

8.6.1 Option 2 - Hard defences, sealing manholes and upstream storage.

Tymon Park has been identified as a potential storage area using the existing ponds and raising the banks around them to create further storage. The full range of baseline condition flood events were reviewed and it was found that significant flooding starts somewhere between the 50%AEP and 20%AEP flood events. In order for this option to be effective the flow therefore needs to be reduced to the equivalent of the 50%AEP flood event. This measure would be considered effective in significantly reducing the flood risk downstream and within the vicinity of the storage area with a small number of properties at risk upstream of Tymon Park to be addressed separately. However flooding to receptors from the more downstream urban catchment remains to be addressed and therefore this measure will need to be used along with hard defences which would consist of flood walls and earth embankments located where the river banks are low relative to water level. Approximately 2.0km of downstream flood defence would be required with an upstream storage measure. Ancillary works will be required with hard defences such as pumping stations and/or storage tanks to account for pluvial drainage routes being cut off from the river. To account for the associated pluvial risk flap valves at storm drainage network outlets to the River Poddle are required. A revision to the maintenance plan and fitting culvert inlet screens are required. At the downstream end of the Poddle where the river is fully culverted a food risk is present from manholes surcharging. Up to 20 manholes have been identified as surcharging, sealing these manholes would prevent the flood risk from this source. To account for the potential flood risk resulting from blocked culverts at Harolds Cross, Mount Argus, Sundrive Road and Poddle Park additional and heightened flood walls are required totalling over 1.5km.

Option 2 would consist of:

- Upstream Storage - 280m of sheet piled core earth embankment averaging 2m in height and overflow weir around Tymon Park ponds.
- Hard defences - 3420m of retaining wall and 180m of earth embankment.
- Sealing manholes - manholes to be sealed along main Poddle culvert line at Dolphins Barn area and Poddle Park area.
- Culvert inlet screens
- Flap Valves
- Maintenance plan
- Review of emergency response plan

8.6.2 Option 3 - Hard defences, sealing manholes and flow diversion.

A suitable diversion route has been identified from the Poddle to the Dodder along Tymon Park running south of the M50. In order to be effective the flow needs to be reduced to the equivalent of the 50%AEP flood event. The diversion route is approximately 1km and falls 10m discharging downstream of the weir at Mount Carmel Park. A 1.5 diameter pipe would be required to convey flood water. Flow diversion will reduce the flood risk significantly but not entirely during the design event and therefore this measure will need to be used along with hard defences which would consist of flood walls and earth embankments located where the river banks are low relative to water level. Approximately 1.2km of downstream flood defence would be required with a flow diversion measure. Ancillary works will be required with hard defences such as pumping stations and/or storage tanks to account for pluvial drainage routes being cut off from the river. To account for the associated pluvial risk flap valves at storm drainage network outlets to the River Poddle are required. A revision to the maintenance plan and fitting culvert inlet screens are required. At the downstream end of the Poddle where the river is fully culverted a food risk is present from manholes surcharging. Up to 20 manholes have been identified as surcharging, sealing these manholes would prevent the flood risk from this source. To account for the potential flood risk resulting from blocked culverts at Harolds Cross, Mount Argus, Sundrive Road and Poddle Park additional and heightened flood walls are required totalling over 1.5km.

As this option transfers flow to another catchment (Dodder River), an estimate of €1M construction cost has been included to allow for works in the receiving watercourse. The costing is high level as until a detailed study is carried out it is not clear how the properties would be protected (as a group or individually) also as the increase in water level is small it may be that some properties identified will have suitably raised FFL so as to not require protection and others may have lower FFL than the assumed 300mm above ground level and so will require a higher level of flood defence. The assumption of a €1M construction cost would require reassessment during further scheme refinement, by modelling any impacts on Dodder River flood risks and identifying mitigation measures and associated costs, which is currently being considered.

Option 3 would consist of:

- Flow diversion - 1.5m dia culvert 1070m in length. The culvert route will follow adjacent to the M50 in Tymon Park, past the national basketball arena and discharge to the Dodder immediately downstream of the weir near Mount Carmel Park.
- Hard defences - 2800m of retaining wall and 145m of earth embankment.
- Sealing manholes - manholes to be sealed along main Poddle culvert line at Dolphins Barn area and Poddle Park area.
- Culvert inlet screens
- Flap Valves
- Maintenance plan
- Review of emergency response plan

8.6.3 Future Flood Risk

Part of the objective of the CFRAM studies is to consider the management of potential future flood risk. This was carried out in part through the MCA of potential FRM options which assesses the options adaptability or provision of protection up to the mid range future scenario (MRFS) and the high end future scenario (HEFS).

The MRFS represents the likely future scenario based on the wide range of predictions available and with allowances for increased flow, sea level rise, etc within the bounds of widely accepted projections. The HEFS represents a more extreme potential future scenario, but one that is nonetheless not significantly outside the range of accepted predictions available, and with allowances for increased flow, sea level rise, etc at the upper bounds of widely accepted projections.

Additional hydraulic model runs were carried out to represent the MRFS and HEFS in order to assess the potential impact to the proposed FRM options. The impact is summarised in tables 8.5 & 8.6 below.

Table 8.5 - Impact of future scenarios to Option 2

Option 2 - Hard defences and Upstream Storage					
	Original Water Elevation (m OD)	MRFS Water Elevation (m OD)	MRFS increased water level (m)	HEFS water elevation (m)	HEFS increased water level (m)
Area of minimum increase in water level (Wellington Lane)	55.03	55.04	0.01	55.04	0.01
Area of maximum increase in water level (Poddle Park)	43.5	43.94	0.44	44.18	0.68

Table 8.6 - Impact of future scenarios to Option 3

Option 3 - Hard defences and Flow Diversion					
	Original Water Elevation (m OD)	MRFS Water Elevation (m OD)	MRFS increased water level (m)	HEFS water elevation (m)	HEFS increased water level (m)
Area of minimum increase in water level (Wellington Lane)	55.03	55.04	0.01	55.04	0.01
Area of maximum increase in water level (Poddle Park)	41.99	43.1	1.11	43.21	1.22

The results from the hydraulic analysis showed that the increase in water level resulting from the MRFS and HEFS ranges from 0.01m - 0.68m with option 2 in place and 0.01m - 1.22m with option 3 in place. With the exception of Poddle Park which as a potential water level increase of up to 1.22m the potential increase in water levels along the remainder of the Poddle is up to 0.5m. While the proposed wall and embankment heights are suitable for the present day 1%AEP flood event it is anticipated that upgrading and modification will be required in the future to accommodate the MRFS and possibly the HEFS. The design of the walls and embankments should therefore allow for expansion in length and height. The ability of each option to accommodate this is reflected in the MCA scoring as shown in appendix B.