EAST AYRSHIRE COUNCIL

CABINET – 6 NOVEMBER 2019

Report By Depute Chief Executive: Safer Communities

IRVINE VALLEY FLOOD STUDY REPORT

PURPOSE OF REPORT

1 This report provides an update on the modelling work for the Irvine Valley Flood Study and provides recommendations for potential Irvine Valley Flood Schemes.

RECOMMENDATIONS

2 **It is recommended that Cabinet:**

(i) Confirms that the proposed scheme continues forward to the prioritisation stage;

(ii) Agrees that after the prioritisation process is confirmed, that the existing commission with RPS (Ireland) Ltd is varied to complete the outline and detailed design;

(iii) Agrees to consider how future developments behind new flood schemes can become more resilient and that the further studies recommended in paragraph 22 are commenced;

(iv) Remits the Head of Roads to ensure all this work is undertaken to allow a further report to be presented to a future Cabinet meeting detailing progress made;

(v) Notes there is ongoing cross service work between Planning & Economic Development; and the Ayrshire Roads Alliance to ensure sustainable development solutions are identified for the Irvine Valley;

(vi) Remits the Chief Executive to meet with SEPA to discuss this work and its relationship to the Local Development Plan;

(vii) Otherwise, notes the contents of the report.

MAIN ISSUES

3 Under the Flood Risk Management (Scotland) Act 2009, and the Local Flood Risk Management Plan for Local Plan District (LPD) 14 (Solway) and LPD 12 (Ayrshire), the Council is required to undertake flood protection works in area 14, and complete flood studies in area 12 before June 2022. The study work will identify solutions to manage the effects of flooding; and this will also inform the next Council Local Development Plan which is currently under preparation.

AYRSHIRE AND SOLWAY FLOOD RISK MANAGEMENT PLANS - PROGRESS

4 The report submitted to Cabinet on 11 May 2016 detailed the actions required to be completed by June 2022. The Flood Risk Management Strategy for East Ayrshire sets out the "short to long term" ambitions for flood risk management. They state the objectives for tackling floods in the areas identified as being at high risk of flooding, namely the Potentially Vulnerable Areas (PVAs).

5 As part of this work a number of studies are proposed to be undertaken. In addition to the Irvine Valley Flood Study, the Council will also complete flood studies in the Catrine, Dalmellington and Dalrymple areas by June 2022. At present tenders are being prepared for the River Ayr Catchment (Catrine) and the River Doon Catchment (Dalmellington and Dalrymple). Appendix one provides further detail on these specific locations.

6 New Cumnock is included in the Solway Flood Risk Management Plan as the River Nith flows south through Dumfries & Galloway towards the Solway Firth. In relation to the New Cumnock Flood Protection Scheme at the Leggate, the flood protection scheme is fully operational although there is still some site work to be completed. Design work is complete for the flood scheme adjacent to the Afton Water but tender issue has been delayed due to land access issues. Both these schemes attract the full 80% grant from the Scottish Government.

PROGRESS ON THE IRVINE VALLEY FLOOD STUDY

7 A severe flood event occurred around Kilmarnock on 22 December 2014. Following this event, a Report was submitted to Cabinet on 3 June 2015 providing detail of the event. Cabinet approved that a Flood Study be carried out to assess the current defences in the Kilmarnock and the Galston areas; and also to improve the understanding of flooding within the Upper Irvine Valley which would allow any issues to be identified and make recommendations on any actions required. This proposed approach was subsequently re-confirmed as an identified action in the Local Flood Risk Management Plan, when this Plan was approved by Cabinet on 11 May 2016.

8 RPS (Ireland) Ltd were appointed to undertake the flood study work. The initial stages of the study required them to build a flood model for the entire

Irvine Valley. This work was complex and the outcome was subjected to a series of sensitivity analyses and a substantial verification process against recorded events. Once the modelling work was completed satisfactorily, the hydrology section and the inundation maps were submitted to SEPA. Although substantial verification was undertaken prior to submission this model was again subjected to an extensive checking and verification process by SEPA. The model was eventually approved by SEPA on 18 January 2018.

9 From a hydrological perspective flood events are described as being based on a particular event over time, for example the “one in a hundred year flood”. It is recognised that this type of nomenclature can be confusing to the general public. Perhaps a better way of describing the “one in a hundred year flood” is that this event has a 1% probability of occurring in any given year. However, it should be recognised that a “one in a hundred year flood” does not necessarily have 100 year intervals. It can be more and it can be less. For river systems, floods are actually expressed as a flowrate and by definition a flow depth which when mapped will indicate the inundation levels in any specific area.

10 The flood protection design standard approach in Scotland was previously based on a 1 in 200 year event (this equates to a 0.5% probability of flooding occurring in any particular year) plus a climate change allowance of 25%. The inundation maps for such events for the Irvine Valley are provided in Appendix Two. The darker the shading, the greater the expected depth of flood water. As part of the Kilmarnock Flood Protection Schemes built between 1990 and 2007, it was necessary to allow flood alleviation areas where flood water could escape from the watercourses and thereby not flood houses and commercial properties. The specific flood alleviation areas in Kilmarnock are around Queens Drive and the Scott Ellis Playing Fields.

11 The existing Flood Protection Schemes in Kilmarnock were designed to a 1 in 100 year event, the standard at that time. The current work undertaken by RPS (Ireland) Ltd has verified that they will protect for the 1 in 100 year event.

12 The next stage of the study work is to design and test proposals to reduce the risk of property flooding in the Irvine Valley. This work includes option development and analysis, and will require further modelling and mapping of the preferred options chosen. This option evaluation work will require specific areas to be modelled to calculate the impact of the proposals so as to prevent inundation of those areas predicted to flood under the 1 in 200 year event but this will also ensure that other built up areas outwith the predicted flood zones are not affected. Additionally, if areas of shared benefit are identified from potential mitigation measures, and meet the needs of each adjacent Authority, then the Authorities would share costs as appropriate.

13 This feasibility optioneering has commenced after SEPA approved the model in January 2018. Thereafter, all potential flood protection options have undergone a cost benefit analysis and any cost beneficial options identified.

14 From a national perspective, there are 14 Local Flood Risk Management Plans and these were formally published by the Scottish Government in June 2016. At this stage it was expected that each national plan/funding cycle would have a period of six years within the Flood Risk Management Act. Cycle 1 June 2016 to June 2022; Cycle 2 June 2022 to June 2028, etc.

15 From the various local flood risk management plans cycle 1 was developed with 40 flood protection schemes being identified across the country. The Scottish Government committed £420 million to allow these schemes to be completed by June 2022. This commitment includes New Cumnock. In July 2016 the Scottish Government confirmed that all the flood schemes would continue to receive support until all these schemes are completed. Since 2016, the proposed costs for these 40 scheme estimates have increased but the available Government funding has remained constant with the effect that it is not expected that cycle 1 will conclude before 2028.

16 Accordingly, any new schemes generated by further flood study work may not be supported by the Scottish Government until at least 2028, thus any urgent flood protection works identified from the current study may well require to be funded by the Council until that time.

17 The conclusions from the flood study work will be an important material consideration in the determination of planning applications both within and outwith the flood inundation areas. In addition, this work will form a critical part of the background information and evidence for site allocations and proposals for the next Council Local Development Plan, and also relevant Place making Maps including that for Kilmarnock Town Centre. The flood study consultants will continue to work co-operatively and in parallel with officials and partners of the Council so that as work on a new town centre strategy develops, flooding matters are fully considered to allow them to be addressed as early as practicable as part of any plan evaluation process.

18 The Council's consultants RPS (Ireland) Ltd were commissioned to produce a Feasibility report to establish if schemes could be developed which offered a 1 in 200 year level of protection including an allowance for climate change. It should be noted that in order to secure the Scottish Government Grant funding as described above, it is a requirement that the benefits received from any scheme are greater than the costs of delivering the scheme. Effectively this will give a Benefit Cost ratio of at least 1. This detail is summarised in Appendix three which includes table 4.2 of the Feasibility Report. This identified schemes with significant cost, but no cost benefits being identified.

19 As a result of this work RPS (Ireland) Ltd were then tasked to produce a supplementary report to look at lower levels of protection to establish if schemes with a benefit cost ratio of at least 1 could be developed. This work established that schemes offering a 1 in 100 year level of protection excluding climate change could be developed with a benefit to cost ratio of 1.11. Appendix four contains this detail.

Scheme identified include
:

- Various burn locations including works in Darvel, Newmilns, Galston, East Holmes reservoir and on the Cessnock Water;
- Kilmarnock Water;
- Simons Burn;
- Queens Drive which includes works at Crookedholm.

The following areas which did not have a positive benefit cost ratio are included in the overall scheme because their inclusion still maintains an overall positive BCR. These schemes locations are at Crookedholm; Darvel; Cessnock Water and Galston. This detail is provided in Appendix five. The overall scheme benefit to cost ratio is summarised in Appendix six.

20 Therefore, in order to secure funding from the Scottish Government this detail was submitted to SEPA to seek their "Prioritisation approval". Only schemes which have been granted prioritisation approval by SEPA will attract funding from the Scottish Government.

21 SEPA have replied positively to our submission stating that they will put this forward to the Scottish Government for a future funding cycle of flooding protection schemes. However, SEPA expressed concerns that the schemes, as presented, did not fully demonstrate adequate "adaptability" for the future. They advised that in order to demonstrate an appropriate level of "adaptability", the Council would need to consider that any future development behind these new schemes is sufficiently resilient. The statement of being "sufficiently resilient" will be acceptable to SEPA.

22 Separately, the Council needs to understand the broader implications of meeting future resilience requirements for all flood affected communities. This will need to be identified and fully assessed. Thereafter, options appraisal should be undertaken to identify how to improve resilience within the context of this assessment. The Council should approve this additional work being carried out as soon as the Prioritisation is confirmed by the Scottish Government. This work has an estimated cost of £80,000. It is expected that this work can proceed in early 2020. These studies will inform future planning policy and proposals for all of the areas that are liable to flooding within the next Local Development Plan. These will be considered before any flood protection works commence on site.

23 Given the Scottish Government's confirmation at the Lead Local Authority Forum meeting on 5 June 2019, that due to the rising costs in Cycle 1, it is now expected that in order to deliver the prioritised schemes, the £42 million funding per year will now be required to be extended to 12 years. This results in the likelihood that there will be no new Scottish Government funding before 2028. Nevertheless, the Scottish Government continue to encourage all Councils to submit schemes as it was likely that if a need for additional funding from the Scottish Government were established, then it could be forthcoming ahead of this timescale.

24 In light of this potential delay to Scottish Government funding, RPS (Ireland) Ltd were commissioned to produce a viability report to establish the works that East Ayrshire Council could undertake in advance of 2028, without jeopardising the whole scheme's viability.

25 RPS (Ireland) Ltd produced the Viability Report and outlined the consequences on the overall proposed schemes and any individual action being carried out independently. These conclusions are summarised in Appendix 7. This identifies that the works on the Kilmarnock Water could be carried out without compromising the viability of the whole scheme. The works on the Kilmarnock Water could be carried out in advance, and still leave the rest of the scheme with a Benefit Cost ratio of 1.09.

26 It should be noted, that it is only once the whole scheme has been prioritised and confirmed by the Scottish Government and deemed planning consent secured, that advanced works in the Kilmarnock Water may be carried out, which would not affect the grant funding from the Government.

POLICY/COMMUNITY PLANNING IMPLICATIONS

27 This work will provide economic and physical benefits to the community, improving business continuity within the communities currently at risk from flooding which will contribute to various Council objectives.

LEGAL IMPLICATIONS

28 The Council is required to undertake its duties in accordance with the Flood Risk Management (Scotland) Act 2009.

HUMAN RESOURCE IMPLICATIONS

29 Consultants are carrying out the flood appraisal and development work. Additional Council resources will be required when projects are established and developed from this work.

EQUALITY IMPACT IMPLICATIONS (INCLUDING SOCIO-ECONOMIC DUTY)

30 An equality impact assessment is not needed because the proposal does not have a differential impact on any of the protected characteristics.

FINANCIAL IMPLICATIONS

31 The Scottish Government allocates £114,000 per annum of general grant to East Ayrshire Council to meet the Council's commitments within the Local Flood Risk Management Plan in order to undertake general flooding management and flood study work. It is anticipated that the Scottish Government will continue its current funding arrangements for successful Flood Protection Schemes. Cabinet agreed at their meeting on 3 June 2015

that this flood study would be funded from a balance drawdown from the severe weather budget.

32 The original Flood Study cost was slightly lower than the cost estimate of £40,000. This work required additional work to be undertaken. A feasibility study on delivering the 1 in 200 year level of protection was prepared but as this could not provide any schemes with a benefit cost ratio greater than 1, a further feasibility study was carried out to determine whether a lower level of protection could be provided. This work highlighted a potential scheme for a 1 in 100 year level of protection with a benefit to cost ratio in excess of 1.

33 The final report was required because the Scottish Government announced that the current cycle 1 of projects would be extended from 2022 to 2028. RPS (Ireland) Ltd were instructed to produce a viability report to identify any works that could be carried in advance of any Scottish Government funding being confirmed. This additional work has increased the cost to date to £140,000. This increase is funded from the Scottish Government annual allocation.

34 Should Cabinet agree to fund the detailed design work of the schemes, this is estimated to cost £250,000 which will be funded from the annual allocation from the Scottish Government. Corporate Procurement has confirmed that the current commission with RPS (Ireland) Ltd may be varied to allow negotiation of this element of the consultancy works in accordance with Standing Orders relating to Contracts clause 21 (2) – Authority to extend or negotiate award. The service has sought advice and guidance in regards to the extension from the Corporate Procurement as per Standing Orders.

35 The additional work recommended in paragraph 22 will be funded from existing budgets in Planning and Economic Development; and from the Ayrshire Roads Alliance, annual allocation of general grant funding from the Scottish Government for flood management.

RISK IMPLICATIONS

36 The risk will be managed by expediting the current flood appraisal and development work to establish potential flood protection options.

TRANSFORMATION STRATEGY

37 This Report aligns with the following design principle stated in the "Transformation Strategy 2017-2022".

- "Maximum value for our communities", by ensuring the various elements of the Transport (Scotland) Bill once enacted will improve Transport provision throughout East Ayrshire.

BACKGROUND PAPERS

1 Report to Cabinet - Flooding Event at Kilmarnock - Monday 22 December 2014" - 3 June 2015.
2 Report to Cabinet - Ayrshire and Solway Flood Risk Management Plans - 11 May 2016.
3 Draft Irvine Valley Flood Study Report - December 2017, is available on the Members Portal with a copy in the Members' Lounge.
4 Report to Cabinet - East Ayrshire Local Development Plan – Supplementary Guidance - 7 March 2018
5 Report to Cabinet - East Ayrshire Local Development Plan – Development Plan Scheme - 7 March 2018
6 Irvine Valley Feasibility Report Doc No. IBE 1093/Nov 18 is available on the Members Portal with a copy in the Members' Lounge
7 Irvine Valley Feasibility Addendum Report Doc No. IBE 1093/Apr 19 is available on the Members Portal with a copy in the Members' Lounge
8 Irvine Valley Flood Study Viability Report Doc No. IBE 1093/Sept 19 is available on the Members Portal with a copy in the Members' Lounge

Appendix One - Summary of Actions in each Potentially Vulnerable Area

Appendix Two - Extract from the Irvine Valley Feasibility Report - Flood Inundation Maps showing the 1 in 200 year events plus climate change.

Appendix Three - Table 4.2 of the Irvine Valley Feasibility Report

Appendix Four - Extract from the Irvine Valley Feasibility Addendum Report - Flood Inundation Maps showing the 1 in 100 year events

Appendix Five - Preferred Option Location Drawings

Appendix Six - Preferred Option Summary

Appendix Seven - Conclusions from the viability report

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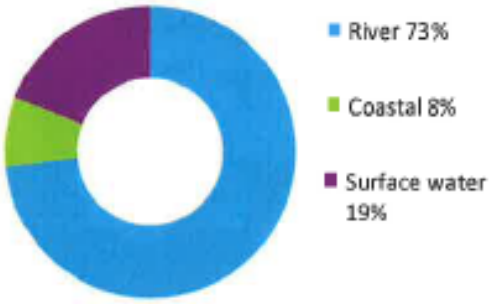
Appendix One Summary of Actions in each Potentially Vulnerable Area

Figure 1: The No 12 LPD catchment group

Flood Risk in Ayrshire

Table 1 shows the main areas, number of properties at risk and the Annual Average Damages caused by flooding. This includes damages to residential properties, non-residential properties, transport and agriculture. Please note that economic damages to airports and rail infrastructure were not assessed as strategic information on damages at this scale is not available.



Annual Average Damages by flood source

	Residential and non-residential properties at risk of flooding	Annual Average Damages
Irvine (including Dreghorn)	2,000	£4.7 million
Kilmarnock (including Hurlford)	1,300	£1.2 million
Prestwick/Ayr	1,100	£1.7 million
Troon	930	£430,000
Kilbirnie	850	£1.3 million
Saltcoats/Ardrossan	610	£450,000
Newmilns/Greenholm	420	£550,000
Galston	400	£620,000
Largs	290	£200,000
Stevenston	250	£490,000

Table 1: Main areas at risk of flooding

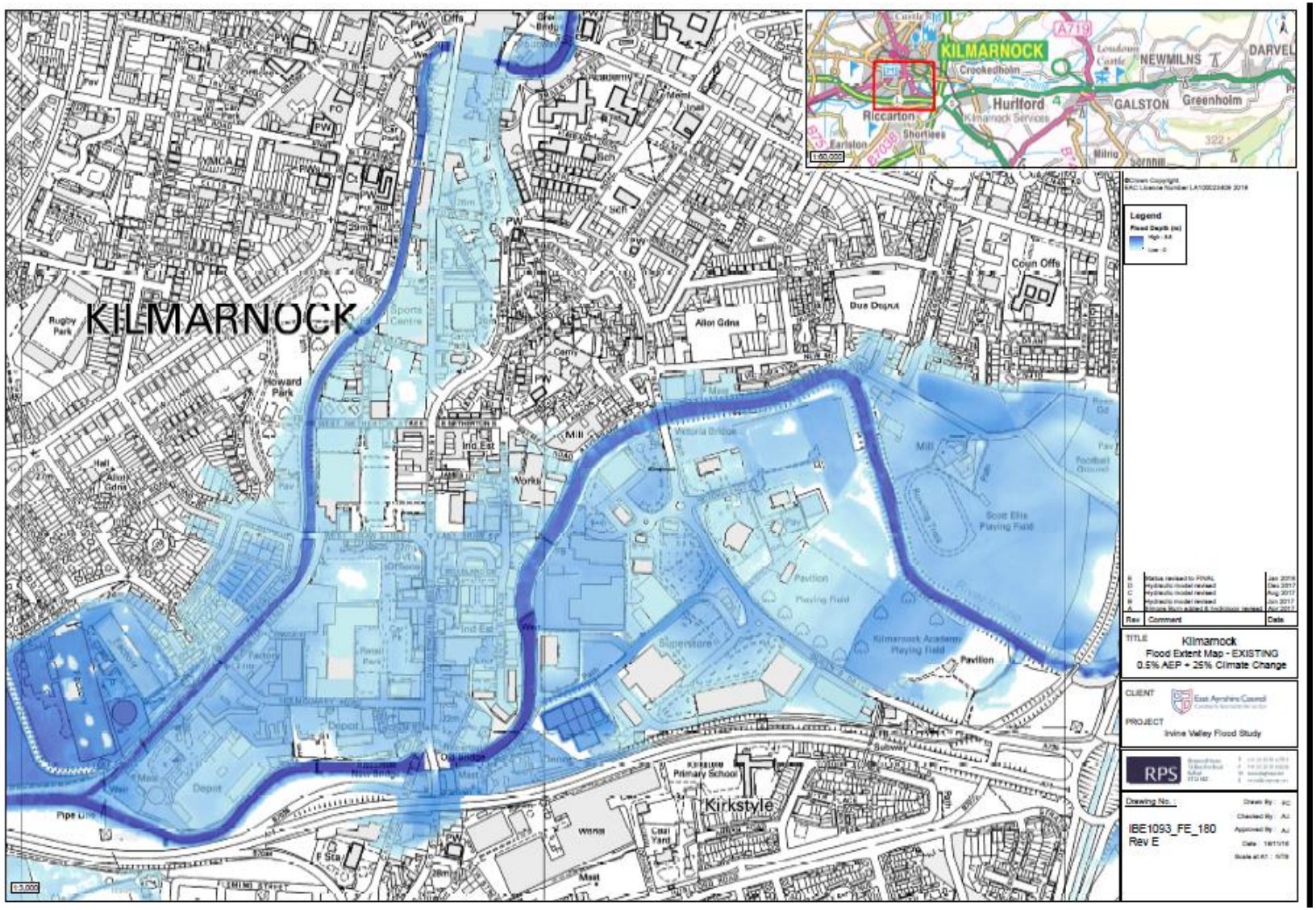
PVA \ Action to manage flood riks	Flood protection scheme/works	Natural flood Management works	Flood Protection Study	Natural flood Management study	Surface Water plan/study	Site protection plans	Property level protection scheme	Maintain Flood Protection Scheme	Community flood action groups	New flood warning	Maintain flood warning	Avareness raising	Emergency Plans and responses	Strategic mapping and modelling	Flood Forecasting	Self Help	Mailntenance	Planning policies
12/01 Noddsdale Water			✓					N/A			N/A	✓	✓	✓	✓	✓	✓	✓
12/02 Great Cumbrae Island	✓✓		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓
12/03 Largs to Stevenston			✓		✓			✓			✓	✓	✓	✓	✓	✓	✓	✓
12/04 Upper Garnock Catchment	✓			✓				N/A		✓	N/A	✓	✓	✓	✓	✓	✓	✓
12/05 Kilwinning			✓		✓			N/A		✓	N/A	✓	✓	✓	✓	✓	✓	✓
12/06 River Irvine and Annick Water			✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12/07 Irvine to Troon		✓	✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓
12/08 Isle of Arran			✓					✓			✓	✓	✓	✓	✓	✓	✓	✓
12/09 Prestwick to Ayr		✓	✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓
12/10 Pow Burn Catchment					✓			N/A		✓	N/A	✓	✓	✓	✓	✓	✓	✓
12/11 River Ayr					✓			N/A		✓	N/A	✓	✓	✓	✓	✓	✓	✓
12/12 Ayr east								N/A			N/A	✓	✓	✓	✓	✓	✓	✓
12/13 Ayr south								N/A			N/A	✓	✓	✓	✓	✓	✓	✓
12/14 Cumnock and Catrine			✓				✓	N/A			N/A	✓	✓	✓	✓	✓	✓	✓
12/15 Dalrymple and Patna			✓					✓			N/A	✓	✓	✓	✓	✓	✓	✓
12/16 Straiton								N/A			N/A	✓	✓	✓	✓	✓	✓	✓
12/17 Dailly								N/A			N/A	✓	✓	✓	✓	✓	✓	✓
12/18 Girvan			✓					✓			✓	✓	✓	✓	✓	✓	✓	✓
12/19c Dalmellington*			✓					N/A			N/A	✓	✓	✓	✓	✓	✓	✓

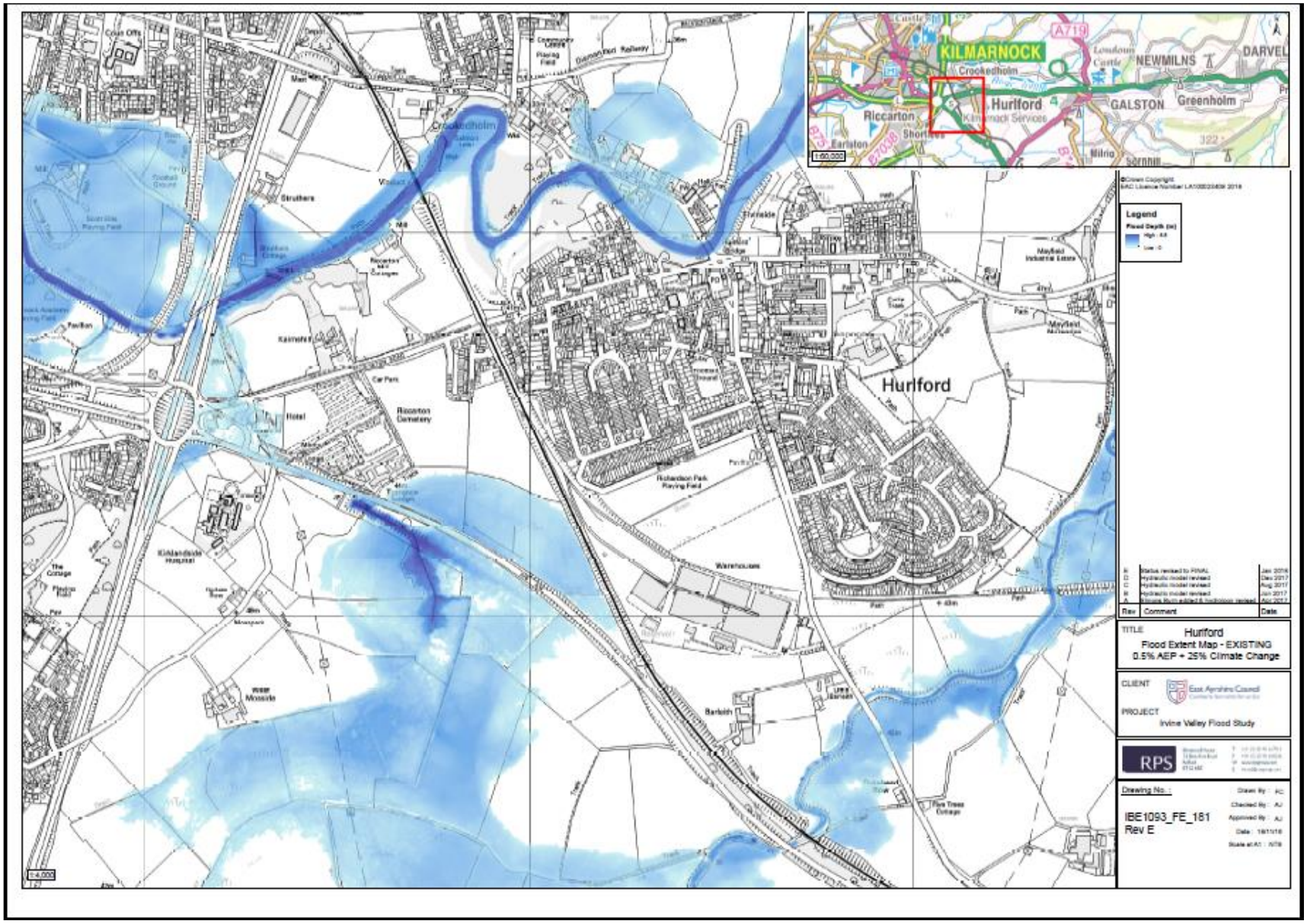
Notes: * Candidate PVA

N/A is used where there is no formal flood protection scheme or flood warning present

Table 4: Range of Objectives and Actions identified for each PVA.

Appendix Two - Extract from the Irvine Valley Feasibility Report - Flood Inundation Maps showing the 1 in 200 year events plus climate change.




KILMARNOCK
Crookedholm
Hurlford
Riccarton
Kilmarnock Services
Earlston
Shortlees
GALSTON
Greenholm
NEWMILNS
DARVEL
Sornhill
A719
1:60,000
Legend
Flood Depth (m)
Hurlford
Struthers
Kilmarnock Infirmary
Riccarton Cemetery
Richardson Park Playing Field
Warehouses
Barleith
Maybole Industrial Estate
Maybole
Rev
Comment
Date
TITLE
Hurlford
Flood Extent Map - EXISTING
0.5% AEP + 25% Climate Change
CLIENT
East Ayrshire Council
PROJECT
Irvine Valley Flood Study
RPS
Drawing No.:
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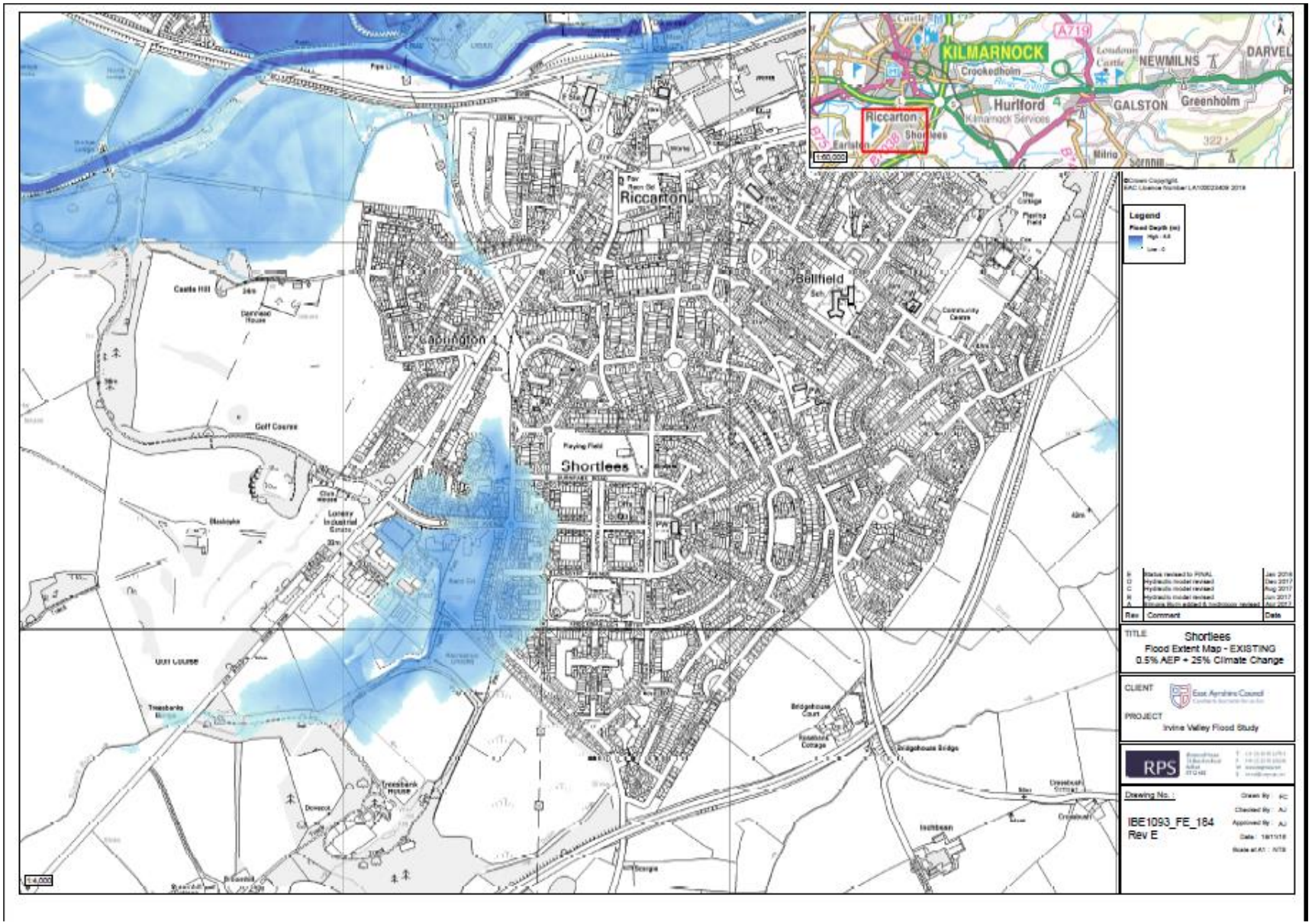
KILMARNOCK
Riccarton
Shortlees
Hurlford
NEWMILNS
GALSTON
Greenholm
DARVEL
Bellfield
Gatherton
Golf Course
Legend
Flood Depth (m)
Rev
Comment
Date
TITLE
Shortlees
Flood Extent Map - EXISTING
0.5% AEP + 25% Climate Change
CLIENT
East Ayrshire Council
PROJECT
Irvine Valley Flood Study
RPS
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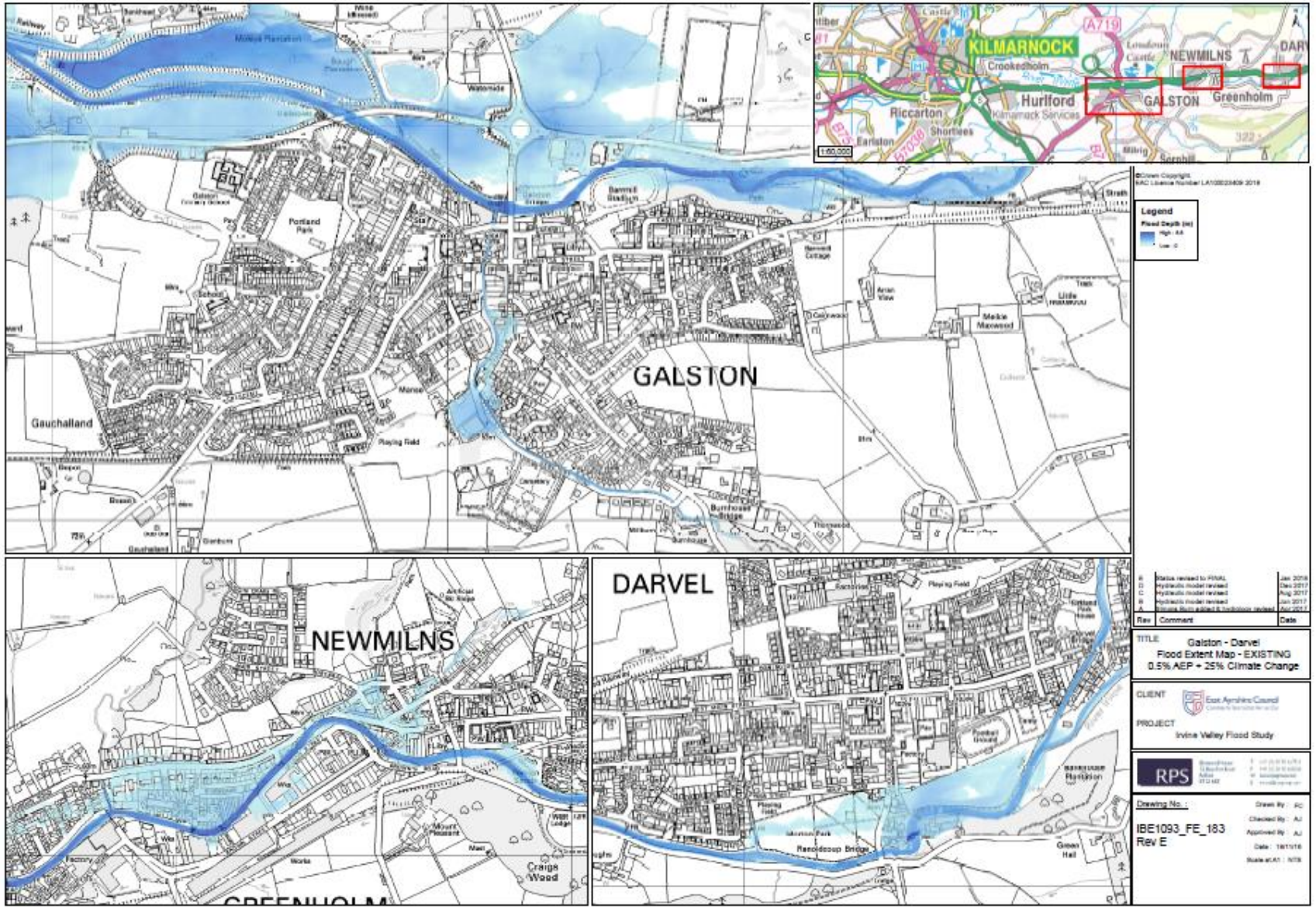
KILMARNOCK
Crookedholm
Hurlford
Kilmarnock Services
Riccarton
Shortlees
Earlston
NEWMILNS
GALSTON
Greenholm
GALSTON
Gauchalland
NEWMILNS
DARVEL
Legend
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Galston - Darvel
Flood Extent Map - EXISTING
0.5% AEP + 25% Climate Change
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PROJECT
Irvine Valley Flood Study
RPS
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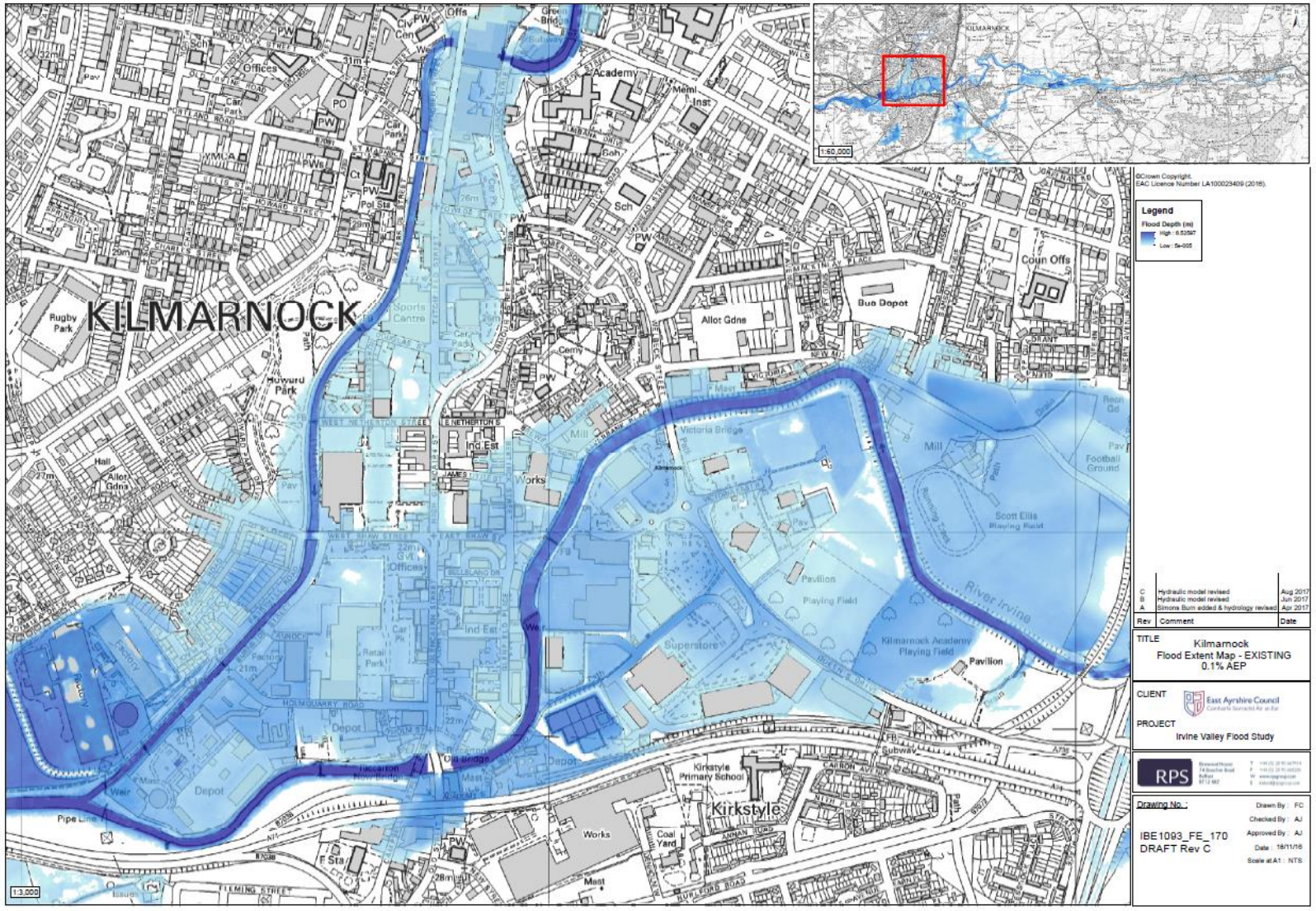
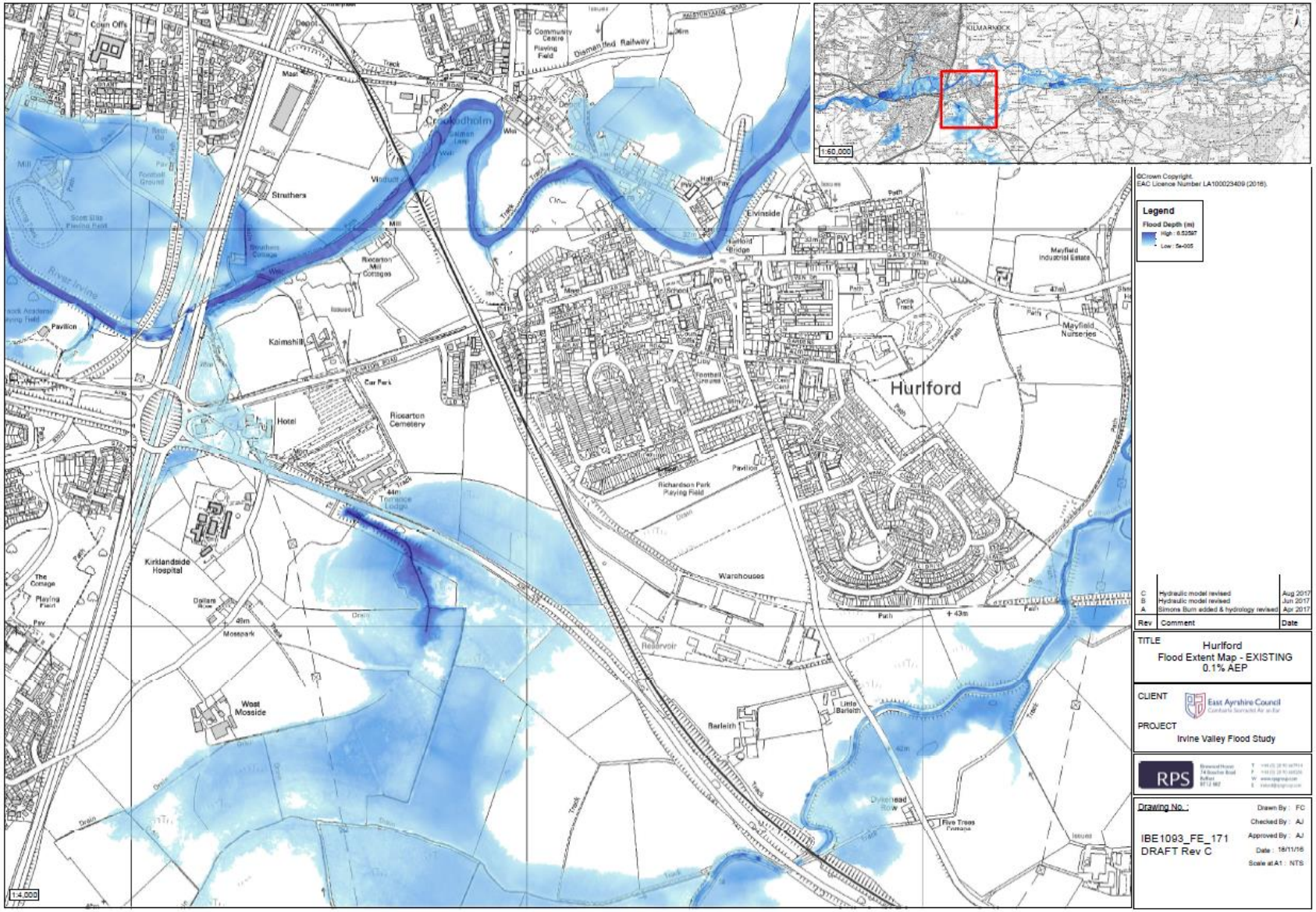
Appendix Three - Table 4.2 of the Irvine Valley Feasibility Report

Table 4.2 - Summary of Economic Appraisal

	Baseline	Non-Structural Option	Structural Option 0.1 (NFM)	Structural & Non-Structural Option 1.1	Structural Option 1.2	Structural Option 1.3	Structural Option 1.4	Structural Option 1.5	Structural& Non-Structural Option 2.1	Structural & Non-Structural Option 3.1	Structural Option 4.1	Structural Option 4.2	Structural Option 5.1	Structural Option 6.1
	Costs (£)													
Capital costs	-	-	-	12,851,000	24,036,000	24,404,000	16,431,000	16,780,000	1,804,000	1,311,000	12,618,000	7,948,000	1,439,000	523,000
Optimism Bias Adjustment	-	-	-	7,935,000	13,777,000	13,998,000	9,180,000	9,401,000	1,291,000	873,000	7,780,000	4,978,000	935,000	385,000
Maintenance Costs (NPV over 100 years)	187,044	-	-	373,000	778,000	735,000	721,000	677,000	348,000	144,000	348,000	765,000	119,000	87,000
Total Present Value Costs	187,044	30,359,000	12,960,000	21,160,000	38,591,000	39,138,000	26,332,000	26,878,000	3,443,000	2,329,000	20,746,000	13,691,000	2,492,000	1,027,000
	Benefits (£)													
Present Value Damage	45,064,000	45,064,000	45,064,000	5,795,000	27,626,000	27,626,000	27,626,000	27,626,000	645,000	1,440,000	8,524,000	8,524,000	904,000	131,000
Present Value Damage Avoided	0	17,816,000	1,320,000	1,518,000	23,496,000	23,496,000	14,948,000	14,948,000	495,000	896,600	7,753,000	7,753,000	860,000	122,000
Intangible Benefit	0	2,449,000	163,000	246,000	1,400,000	1,400,000	1,400,000	1,400,000	42,000	1,400	1,056,000	1,056,000	110,000	8,000
Total Present Value Benefit	0	20,265,000	1,483,000	1,764,000	24,896,000	24,896,000	16,348,000	16,348,000	537,000	898,000	8,809,000	8,809,000	970,000	130,000
	Benefit Cost Ratio													
Average benefit/cost ratio	-	0.67	0.11	0.08	0.65	0.64	0.62	0.61	0.16	0.39	0.42	0.64	0.39	0.13

Appendix Four - Extract from the Irvine Valley Feasibility Addendum Report - Flood Inundation Maps showing the 1 in 100 year events

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KILMARNOCK
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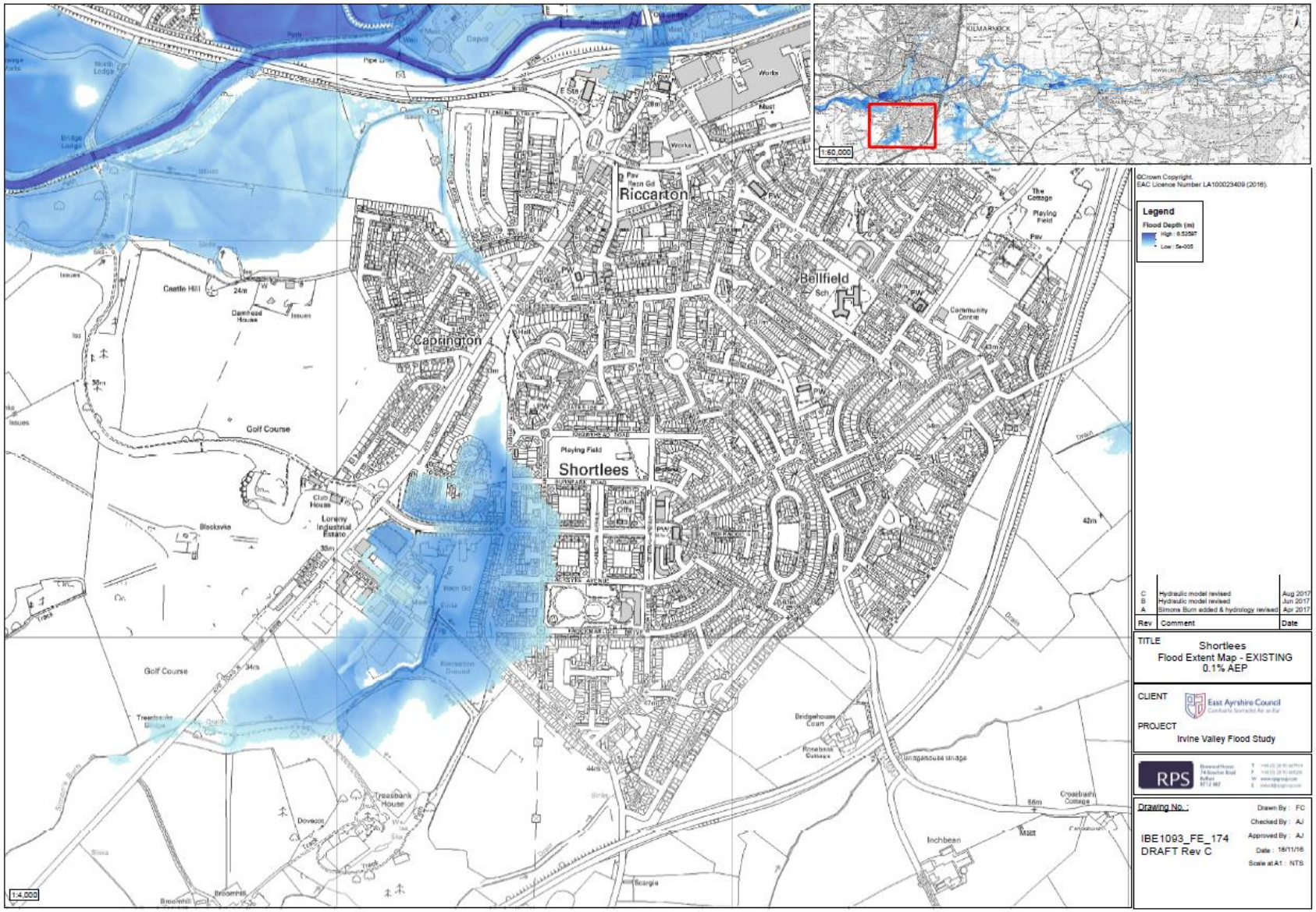
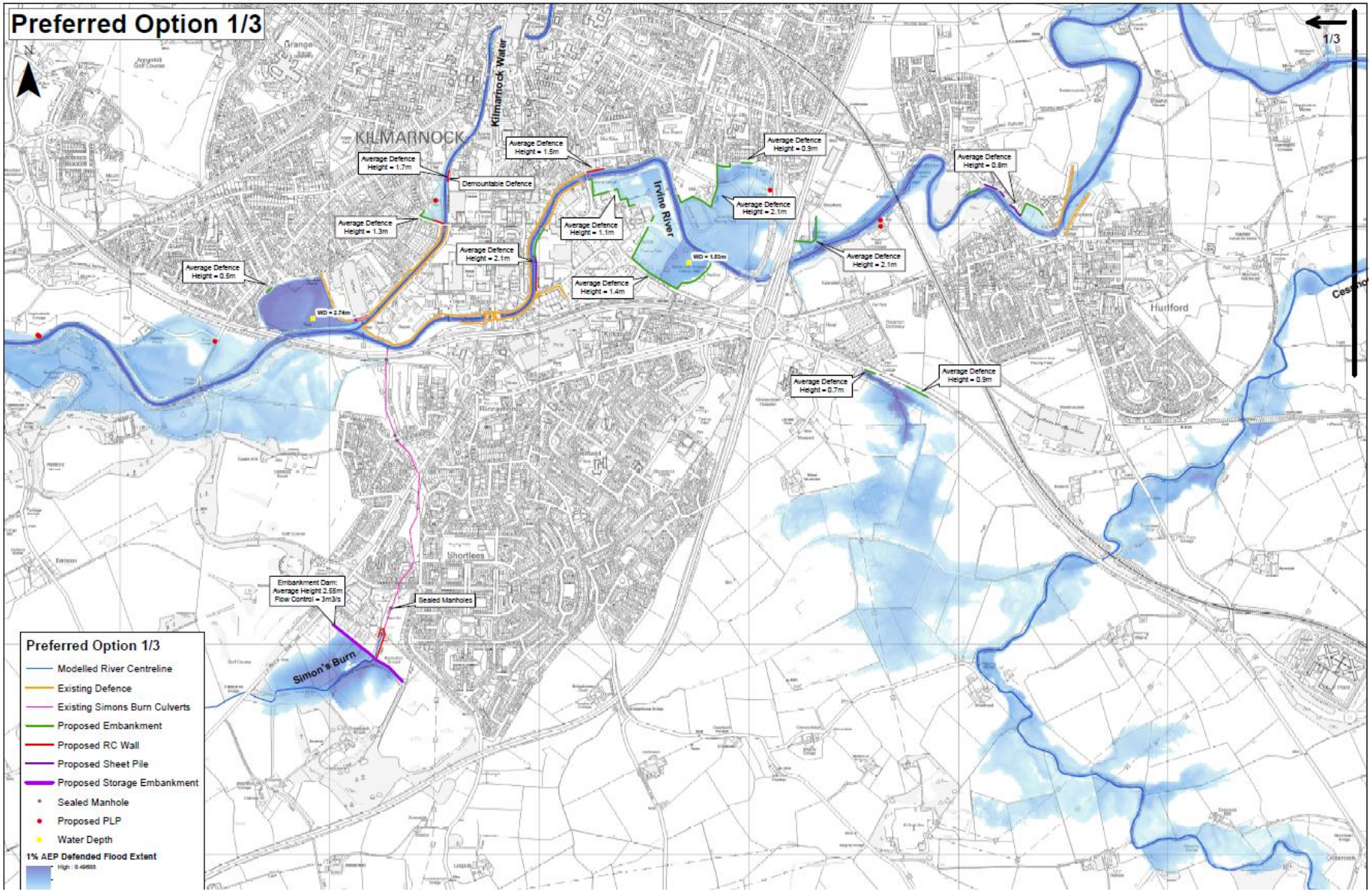
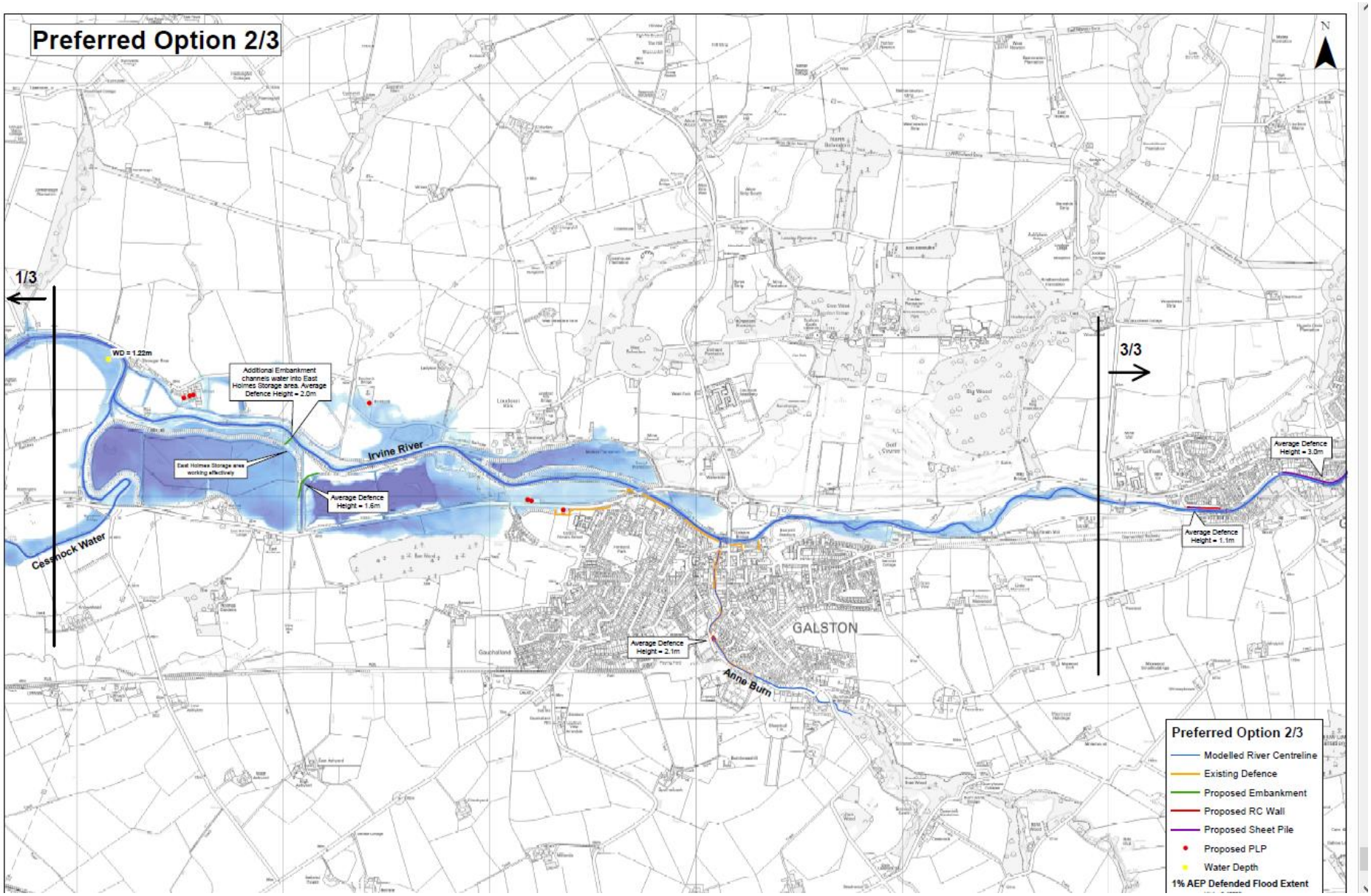
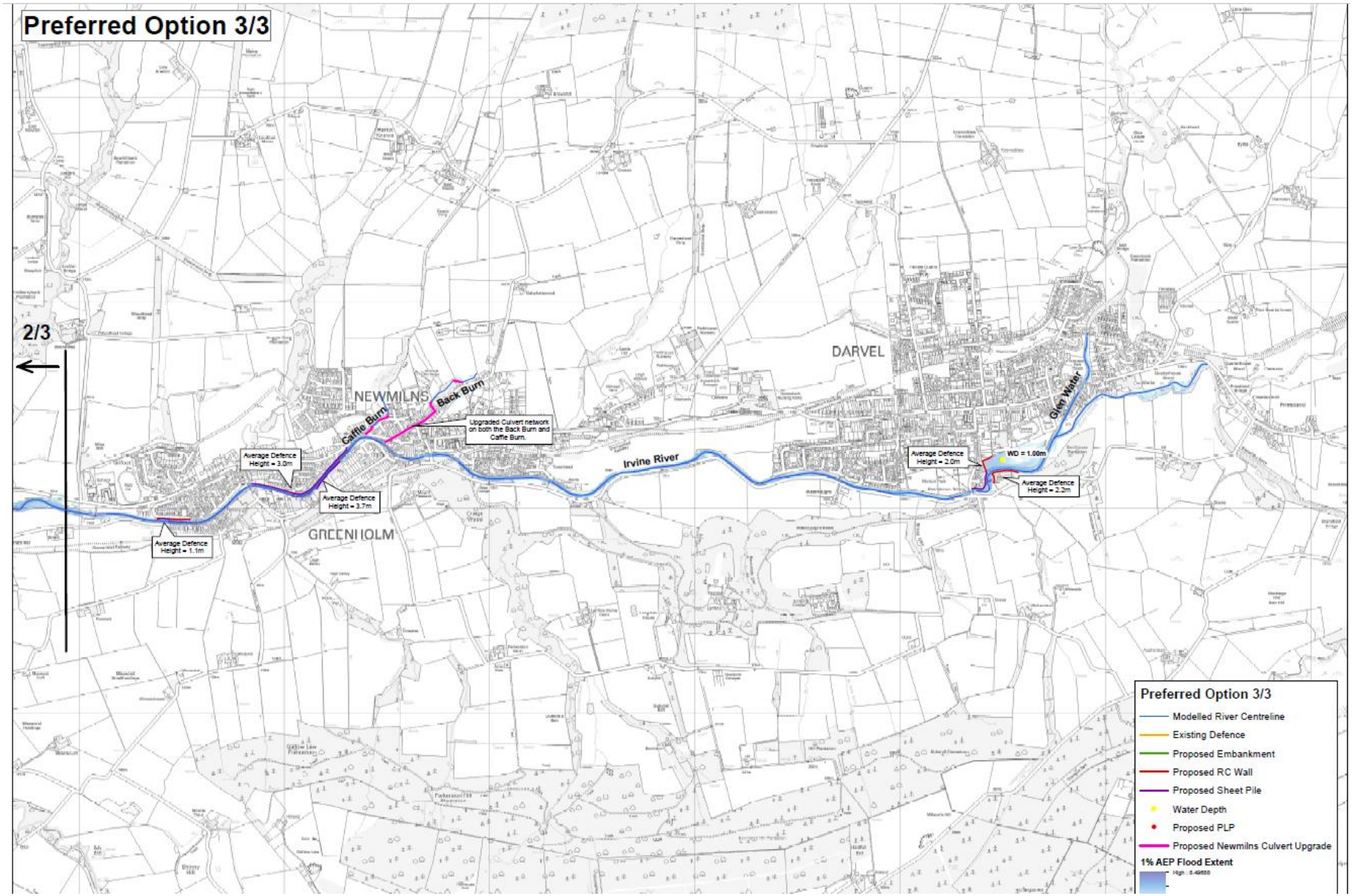
EAC Licence Number LA100023409 (2016).
Legend
Flood Depth (m)
High : 6.52597
Low : 5e-005
C Hydraulic model revised Aug 2017
B Hydraulic model revised Jun 2017
A Simons Burn added & hydrology revised Apr 2017
Rev Comment Date
TITLE
Hurlford
Flood Extent Map - EXISTING
0.1% AEP
CLIENT
East Ayrshire Council
PROJECT
Irvine Valley Flood Study
RPS
Drawing No. :
IBE1093_FE_171
DRAFT Rev C
Drawn By : FC
Checked By : AJ
Approved By : AJ
Date : 18/11/16
Scale at A1 : NTS


KILMARNOCK
1:50,000
©Crown Copyright.
EAC Licence Number LA100023409 (2016).
Legend
Flood Depth (m)
High : 6.52597
Low : 5e-005
Riccarton
Bellfield
Sch.
Community Centre
The Cottage
Playing Field
Pav
Pav Recn Gd
Castle Hill
24m
Dalmaud House
Issues
Caprington
Golf Course
Playing Field
Shortlees
Court Cots
Club House
Lonmy Industrial Estate
Blocksyke
33m
42m
Golf Course
34m
Treasbank House
Dovecot
Broomhill
Bridgehouse Court
Rosebank Cottages
Unspecified Bridge
44m
Crosebarn Cottage
66m
Mast
Inchbean
Scargie
1:4,000
C Hydraulic model revised Aug 2017
B Hydraulic model revised Jun 2017
A Simons Burn added & hydrology revised Apr 2017
Rev Comment Date
TITLE
Shortlees
Flood Extent Map - EXISTING
0.1% AEP
CLIENT
East Ayrshire Council
PROJECT
Irvine Valley Flood Study
RPS
Drawing No. :
IBE1093_FE_174
DRAFT Rev C
Drawn By : FC
Checked By : AJ
Approved By : AJ
Date : 16/11/16
Scale at A1 : NTS

Appendix Five - Preferred Option Location Drawings




Preferred Option 2/3
N
1/3
3/3
WD = 1.22m
Additional Embankment channels water into East Holmes Storage area. Average Defence Height = 2.0m
East Holmes Storage area working effectively
Irvine River
Average Defence Height = 1.6m
Cessnock Water
Average Defence Height = 3.0m
Average Defence Height = 1.1m
GALSTON
Average Defence Height = 2.1m
Anne Burn
Preferred Option 2/3
Modelled River Centreline
Existing Defence
Proposed Embankment
Proposed RC Wall
Proposed Sheet Pile
Proposed PLP
Water Depth
1% AEP Defended Flood Extent


Preferred Option 3/3
2/3
NEWMILNS
DARVEL
GREENHOLM
Back Burn
Caffie Burn
Irvine River
Glen Water
Upgraded Culvert network on both the Back Burn and Caffie Burn.
Average Defence Height = 3.0m
Average Defence Height = 3.7m
Average Defence Height = 1.1m
Average Defence Height = 2.0m
Average Defence Height = 2.2m
WD = 1.00m
Preferred Option 3/3
Modelled River Centreline
Existing Defence
Proposed Embankment
Proposed RC Wall
Proposed Sheet Pile
Water Depth
Proposed PLP
Proposed Newmilns Culvert Upgrade
1% AEP Flood Extent

Appendix Six - Preferred Option Summary

4.5.1 Summary of Preferred Option

As was discussed in the previous section, the preferred option to protecting the Irvine Valley area from flooding is a combination of Solution 2, 3 and 5. An overview of this can be seen in Figure 4.1 and in more detail in Appendix G.

As was set out at the beginning of this Addendum report, the aim of this Study was to find a cost beneficial solution to providing flood protection up to the 1% AEP flood event. Table 4.6 below provides a summary of the overall Cost Benefit Analysis of the combined Solutions 2, 3 and 5:

Table 4.6: Preferred Option Economic Summary

	Costs: (£)
Enabling Cost	3,595,364
Capital costs	11,848,739
Maintenance Costs (NPV over 100 years)	1,068,695
Optimism Bias Adjustment	9,900,688
Total Present Value Costs	26,496,128
	Benefits: (£)
Present Value Damage	£42,685,702.74
Present Value Damage Avoided	£26,621,665.20
Intangible Benefit	£2,686,597.43
Total Present Value Benefit	£29,308,262.63
	Benefit
Average Benefit/Cost Ratio	**1.11**

It can be seen from Table 4.6 that the preferred flood defence option for the Irvine Valley Study area is cost beneficial.

Appendix Seven - Conclusions from the viability report

6 CONCLUSION

The viability investigation shows that all four flood cells being considered, while being hydraulically connected to the rest of the study area, could be considered separately with negligible flood risk impact to the remaining study area.

While implementing these flood cells separately, as stand-alone schemes, would be technically feasible there would also be an economic impact to the overall scheme. This impact was investigated for each flood cell and is summarised in the table below.

Table 6: Economic impact of flood cell separation

Flood Cell		PV Costs	PV Benefits	BCR
Kilmarnock Water	Kilmarnock Water Stand-alone Scheme	£627,711	£1,265,582	2.02
	Whole Scheme minus Kilmarnock Water	£25,785,775	£28,042,682	1.09
Simon's Burn	Simon's Burn Stand-alone Scheme	£2,682,373	£11,656,273	4.35
	Whole Scheme minus Simon's Burn	£23,731,112	£17,651,991	0.74
Queen's Drive	Queen's Drive Stand-alone Scheme	£4,141,682	£7,148,067	1.73
	Whole Scheme minus Queen's Drive	£22,271,803	£22,160,197	0.99
Burns	Burns Stand-alone Scheme	£1,323,629	£5,633,770	4.26
	Whole Scheme minus Burns	£25,089,857	£23,674,494	0.94

The economic assessment shows that each of the stand-alone schemes considered would be cost beneficial. The Kilmarnock Water stand-alone scheme could be considered separately while maintaining the economic viability of the whole scheme minus Kilmarnock Water. The BCR of the whole scheme minus Kilmarnock Water would be reduced from 1.11 to 1.09. However, considering the other three stand-alone schemes would result in the remaining whole scheme's BCR dropping to below 1 making them economically unviable.

It should be noted that at this stage of the study the costing of schemes is high level with conservative assumptions made for preliminaries, enabling costs and optimism bias. As more detail is added to the study the costs would be updated and this could change a scheme's BCR. Options with a BCR close to 1 could therefore change from being economically unviable to being economically viable or vice versa. This would apply to the whole scheme minus Kilmarnock Water, minus Queen's Drive and minus Burns. More detailed costing is unlikely to change the economically viability of the whole scheme minus Simon's Burn.