

Perth & Kinross Council – Communities Service

Craigie Burn Flood Protection Study



Public Consultation Report: Summary of Questions & Answers

Drafted: 23/11/2023	Approved: 13/02/2024	Version FINAL
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1. Introduction

Perth & Kinross Council recently carried out a flood protection study for the Craigie Burn, primarily covering the Broxden, Cherrybank and Craigie areas of Perth. In June 2023, the Council engaged with the local community on:

- the risk of flooding in the Craigie Burn area;
- the findings from the Craigie Burn Flood Protection Study;
- other actions to raise awareness and improve community flood resilience.

Two community drop-in sessions were held at the Dewars Centre, Perth on Tuesday 20 June and Wednesday 28 June from 2pm until 8pm – see Figure 1 below. This supplemented the information already made available on the Council's website and offered residents the opportunity to speak directly with Council officers and Amey Consulting (design consultants), as well as SEPA, Scottish Water and the Scottish Flood Forum (who attended on Tuesday 20 June).

The community events were supplemented by an online consultation, with the display materials also made available on the Council's consultation hub (at <https://consult.pkc.gov.uk/communities/craigieburn>) from 16 June – 16 July 2023. This allowed residents to view the draft outputs from the flood study. Residents were encouraged to complete the online form provided to record their comments and views.

The Council would like to thank those that took the time to provide comments and attend the drop-in session.

This report collates the comments received and provides the Council's response to those questions.



Figure 1: Images from drop-in events

1.1. Community Response

The community drop in events were well-attended, with at least 60 people registering their attendance across the two events. A large volume of feedback was received with 50 comment forms submitted during the consultation period, comprising a total of 187 separate comments/questions. As well as focussing on the flood protection study, feedback also covered wider issues within the catchment. Feedback was received on the flood study methodology, options appraisal and recommendations, as well as on topics

including the Perth Flood Protection Scheme, existing maintenance arrangements and concerns about new development.

Appendix A (below) provides a list of all the questions along with the Council's response. Those submitting forms have not been named for confidentiality reasons, and the wording of some questions have been amended for the same reason (and to cover multiple questions on the same topic). This report will be published on the Council's Consultation Hub (at the web address detailed above) and distributed to local Councillors, the Community Council and members of the community that registered attendance at the drop-in session or provided a consultation response.

1.2. The Next Steps

The Council will now update and finalise the Craigie Burn Flood Protection Study and report the conclusions to the next available Climate Change and Sustainability Committee. Thereafter, the Council will implement the recommendations of the report.

The next steps are set out below, in the Council's response section Appendix A labelled "Next Steps". The Council will carry out further consultation with the community as the proposals are developed.

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Appendix A: Questions and Answers, Craigie Burn Flood Study

Funding

Q1. How much has the Craigie Burn Flood Study Cost, and where in the PKC budget is this funded from?

The Craigie Burn flood study is an identified action contained within the Tay Local Flood Risk Management (FRM) Plan. The document sets out funding arrangements for the actions contained within it. This details that the Craigie Burn flood study is funded from the Council's revenue budget.

The Craigie Burn flood study is expected to have a final cost of £104,184.00.

Q2. Why did the Council not speak to residents to find out the real number of properties flooded during the 2020 and 2022 flood events and an accurate results/information for the study to be based on (such as detailed financial losses suffered by residents and businesses)?

As part of the data gathering exercise for the study the Council issued a community questionnaire to approximately 600 addresses in December 2021. This was also made available on the Council's Consultation Hub from 01 December 2021 to 07 January 2022 (at <https://consult.pkc.gov.uk/communities/craigie-burn-flood-study>). 56 completed questionnaires were returned and this information was fed into the study.

The Council had officers out in Perth both during and after the significant flood events in August 2020 and September 2022. Online community events were also held following the August 2020 flood event. These were online due to the Covid restrictions in place at the time. This also provided valuable information to the study.

To inform our records of flooding, we often have to rely on residents reporting the impact of flooding they have experienced to us. Naturally, not everyone affected is open to sharing this information. This supplements the information we gather both during and after a flood event. The Council does not have complete records of all flooding events and recognises this fact.

It is important to note that the flood damages calculated by any flood study are economic damages, which differ from the actual financial losses experienced by individual residents.

Methodology

Design Flows

Q3. There is concern that the flows presented in the study have been underestimated and define recent flood events (2002,2020 and 2022) as much rarer than they are in reality. How have the flows used in the study been derived?

Flood flow estimation is an inherently uncertain process, and a range of methods are available for use, and are selected depending on the characteristics of the area of interest. The most up-to-date methods were used in this study, in line with industry standards.

A hydrological analysis was undertaken to understand the flows associated with the Craigie Burn. This included identifying the upstream (rural) catchment that drains into the Craigie Burn (and its tributaries), as well as the urban areas that drain into it. This also considers previous study work carried out in the catchment, as well as local information (from residents etc). There are no flow gauges situated within the Craigie Burn catchment, but the Council has a number of water level gauges at various locations throughout the catchment that provided useful information.

The hydrological analysis from the rural and urban sub-catchments were then input to the hydraulic model that was developed through the study. The performance of the model was tested (calibrated) against observed flooding (using water-level information and other information). Once the model provided an acceptable level of performance against these events, it was then validated against the last 3 significant flood events (6 August 2002, 11/12 August 2020 and 8 September 2022). The model outputs were then compared against the wide range of information available for these events (water level's, post-flood surveys, photos, videos and anecdotal information).

Following the drop-in sessions, we undertook a further review of the hydrology. It was established that the flows reported were lower than the model was predicting. The reason for this was down to some additional detail added to the model during the options appraisal process (notably around Croft Park).

The modelled flow for the August 2002 calibration event was also reviewed. We were able to produce results similar to the previous estimation of this event presented by SEPA in 2004 paper. This was achieved through changes to the antecedent conditions in the catchment (i.e. the conditions prior to the critical rainfall event, including how saturated the catchment was). There was a storm event one week prior to the flood event on 6 August 2002, and this gave justification to significantly increase how 'wet' the catchment was, resulting in more runoff reaching the watercourses quicker. This has highlighted how sensitive the catchment is to the existing conditions in terms of flood generation. The last 3 notable events have all occurred off the back of wetter than average years, reducing the catchment's ability to absorb rainfall and increasing the speed at which run-off is generated. The modelled flows are detailed in the table below.

Event Scenario	Modelled Flow (post-review)	Modelled flows (drop-in info)
6 August 2002*	9.9-12.1 m ³ /s	7 m ³ /s
11/12 August 2020	15 m ³ /s	15 m ³ /s
8 September 2022	12.8 m ³ /s	11.1 m ³ /s
0.5% AEP (200 year)	9.85 m ³ /s	8.7 m ³ /s

*model parameters changed to better represent existing conditions – only suitable to do this for recreating observed flooding and not 'design' flood events.

Whilst the flows are higher than what was presented at the drop-in events, the outputs remain the same, so there is no impact on the conclusions of the study.

Q4. Has the study considered the significant volume of water that flows down Glenlochay Rd? This results in significant damage to road surfaces, vehicles and properties at the lower end of the road. This occurred in August 2020 and September 2022. Were options considered to address this?

The flows originating from this part of the Craigie Burn catchment have been included in the estimation of flood flows. However the small channel at the top of Glenlochay Road was not explicitly modelled, and therefore is not shown on flood maps. As this is a surface water driven issue, we will consider this as part of the Perth Surface Water Management Plan, which is ongoing.

Q5. Why was it only the 0.5% AEP flood maps that were made available at the community drop-in sessions, when recent flooding in 2020 and 2022 were estimated to be of greater magnitude?

Flood maps for a number of different modelled scenarios were available at the community drop in sessions. This included the 0.5% AEP (or '200 year') design flood map, the 0.5% AEP plus 39% climate change flood map, as well as the model representation of the last 3 notable floods (August 2002, August 2020 and September 2022). Each set of maps was printed out over three A3 plans to provide the necessary detail and were left on tables for residents to view or use as a point of reference when discussing the study with the representatives available.

The 0.5% AEP (or 200 year) flood map are typically used as the point of reference as this aligns with the required standard of protection for new development, although this recently increased to the 0.5% AEP (plus climate change) flood following adoption of National Planning Framework 4.

Q6. The study highlights that 57 properties are at risk of flooding during the 0.5% AEP flood event. How was this figure established? Insurance companies define a property as anywhere within your boundary, and this is how flood studies should define it also.

The figure was established by modelling the 0.5% AEP flood scenario and reporting the outputs. The number of properties highlighted are those at risk of suffering from internal flooding (i.e. flood levels are above the lowest threshold into the finished floor level of the property). This was informed by a topographic survey which was carried out in April 2022, which included surveying the threshold levels of properties. It is recognised that flooding impacts more than just those who have suffered internal flooding, such as damage to garden buildings/areas, damage to vehicles and access issues.

The approach taken is in line with the requirements of the multi-coloured manual, which sets out the standardised approach to be used in flood protection studies.

The number of properties at risk of internal flooding are not the only properties that contribute to the assessment of potential flood damages. See Q11 for further details on how the economic appraisal is undertaken.

Q7. The description of flood history says that flooding has come from various sources including rainfall, water courses, surface water flooding (overland and from sewers), but the study seems to be disregarding most of these sources in favour of only fluvial flooding of the burns. The description of flood mechanisms makes no mention of the fact that the combined sewers through the catchment have a history of overflowing and releasing raw sewage, into houses, onto our streets and into watercourses. Does the study consider all sources of flood risk?

Yes, the flood study considers all relevant sources of flood risk within the catchment, both fluvial (watercourse) and pluvial (surface water). By surface water flooding, we are referring to overland flows as well as issues associated with the sewer networks.

Flooding from sewer networks is recognised as a significant source of flood risk within the Craigie Burn catchment. The study has identified that sewer/surface water flooding is the significant contributor during short duration, intense rainfall events (typically associated with summer storms) due to the rapid response from the urbanised parts of the catchment.

Q8. The 0.5% AEP flood risk map has some surprising omissions – the Cherrybank Garage, Perth Leisure Pool, Inchview Primary and the AK Bell library are not shown as at risk, despite having been affected by recent flood events? How would increasing the flows used impact the overall picture?

It is important to recognise that the 0.5% AEP flood map reflects a 'design' flood event. It is not a recreation of past events, which may have been of greater magnitude. The flood maps also provide a community level understanding of flood risk and may not consider every specific detail of individual properties that may influence flood flows in reality. This may include features such as low garden walls, raised areas (driveways, kerbs etc).

The 0.5% AEP flood map shows Inchview Primary School is shown to be potentially at risk of flooding during this event. More widespread flooding may have occurred during previous events, which may have been of greater magnitude than the 0.5% AEP flood. It is recognised that Cherrybank garage has previously been affected by flooding, but again this was likely during greater magnitude events than the 0.5% AEP design flood event.

Perth leisure Pool and the AK Bell library are not part of the Craigie Burn catchment, and so flood risk in these areas has not been included on the flood maps.

The integrated flood model was developed by calibrating and validating its performance against observed flood events, including telemetry data, videos/photographs and information provided by the community. The model reproduced the flooding experienced in these events with a high degree of confidence.

Increasing the flood flows will naturally increase the numbers of properties at risk. However, as noted in our response to Q3, we have carried out a robust review of the model inputs and performance against available information to come up with the flood flows.

Q9. Does the Craigie Burn study make any allowance for climate change, and the likelihood and severity of flooding increasing as a result?

The study has run model simulations to represent future scenarios, in line with the latest climate change guidance. This means that a 39% uplift was added to the peak rainfall to assess the potential future risk.

The study identified that the number of properties potentially at risk of internal flooding increased to 106 residential and 8 non-residential in the 0.5% AEP plus climate change flood event.

Options Appraisal

Q10. How was the short-list of options developed?

The process for developing the short-list is an iterative one and was covered on information board 4 displayed the drop-in events and online. This is set out again below:

- The flooding issues were defined by the initial flood modelling work, which served as a baseline to consider potential options to manage flood risk in the catchment.
- A long list of potential actions was considered that could manage or reduce the risk of watercourse flooding. This list was screened to remove actions that were clearly not feasible, leaving an initial short list of potential actions.
- A scoring exercise was carried out to evaluate the potential options and produce a final short-list of those that are most feasible. This helped us eliminate measures that were not practical or viable.
- We conducted a detailed appraisal of the final short-listed options using the hydraulic model. This involved evaluating their performance under different flooding scenarios, considering their implementation requirements, compatibility with other policies and plans, and their potential to achieve the objectives of the flood study.

Q11. Explain how the benefit-cost ratios are worked out? How are the estimated flood damages calculated? What do these include?

In managing flood risk, the Council is required to have regard to the economic impacts of its actions. In simple terms, this means that the cost of doing something must not exceed the benefits gained for something to be considered economically viable. This is expressed as a benefit:cost ratio, which must be greater than 1.0.

The economic appraisal of flood risk options involves several steps. Firstly, a flood damage assessment is carried out to establish a baseline to compare options against. The potential benefit of each option is calculated, in terms of flood damage avoided, by comparing against the baseline damages. The estimated costs of an option are then estimated, including upfront capital costs and longer-term operation/maintenance costs, and compared against the potential benefits.

The potential flood damages are calculated by running a range of flood events across a 100 year appraisal period. Properties at higher risk of flooding typically generate the most damages, due to more frequent flooding across the appraisal period. Damages start to be generated when flood levels are within 300mm of the lowest internal threshold of a property, so it is not only those at potential risk of internal flooding that accrue damages that are included in the economic appraisal. Flood damages are considered for a range of factors, including damage/replacement of damaged items, damage to building and damage to vehicles. Costs to emergency services are also considered, including emergency response and impacts on the road network. Intangible impacts are also considered as well.

It must be stressed that the value of the damages are not based on what individual residents have suffered. It is based on economic damages that provide a standardised way of assessing the cost of flooding, which isn't skewed by individual circumstances. Damages are also capped, so they cannot exceed the (approximate) value of the property.

Options are then built into the hydraulic model and tested for their potential impact on managing/reducing flood risk. The remaining damages following the inclusion of an option are compared against the baseline flood damages to give the benefit of an option.

A cost estimate for each option is built up. This sets out the estimated capital outlay, as well as the long-term operating and maintenance costs of an option. This is typically high level at the feasibility stage due to the amount of uncertainty at this point in the process. A factor is built into the estimates, known as optimism bias, to help account for this, but experience shows that costs will typically increase from the feasibility estimates as the costs/risks become better defined. As such an option that is only marginally above 1.0 is not typically considered truly feasible at this stage.

Further information on this can be found on the following website: <https://www.mcm-online.co.uk/public/>.

Q12. Not enough detail was provided on the display boards – full details of all the short-list options considered should have been made available and open to scrutiny. On what basis were options considered not feasible, and by whom?

Options were developed and considered through the process set out in Q10 (long/short list). The options appraisal was carried out in line with current guidance, including the Scottish Governments 'Options appraisal for flood risk management: Guidance to support SEPA and the responsible authorities' document.

Whilst we understand the desire to see further information on all short-listed options, public scrutiny of the discounted options will not alter the outcome of the appraisal process.

A summary of each option is included below:

Benefit-cost ratio assessment

Scenario	Properties at risk 0.5% AEP	Total Costs	PV	Total Damages	PV	Total Benefits	PV	Average BCR
'Do-Nothing'	67	£0.00		£1,179,112		-		-
'Do-Minimum'	57	£406,131		£632,173		£546,939		1.35
Option 1 - Upstream Storage and NFM South of M90	53	£633,331		£544,978		£634,134		1.00*
Option 3 – Improved Storage at A93 Glasgow Road ('Wet' Ponds)	49	£878,235		£601,935		£577,177		0.66
Option 4 – Improved Storage at Perth FPS Storage area (Dry Ponds)	53	-		-		-£3282		0#
Option 5 – Improved Storage at Necessity Brae Culvert	54	-		-		£40		0#
Option 7 – From Buckie Brae to South Inch Channel Dredging	49	£617,330		£561,204		£617,908		1.00**
Option 8 – Attenuation at Low Road to Woodside Crescent	59	£961,069		£603,625		£575,486		0.60
Option 9 – Orchard Place Raised Embankments and flood walls	47	-		-		-£54		0#

Option 10 – Queen’s Avenue Culvert	51	£675,624	£242,035	£937,077	1.39
Option 11 – Balmoral Place and Queen’s Avenue Channel Modification	39	£720,209	£158,444	£1,020,667	1.42
Option 12 – Croft Park Area Overtopping and Sewers	55	£824,404	£471,671	£707,440	0.86
Option 16 – South Inch Spill Mechanism	57	£1,063,059	£552,357	£626,754	0.59
Option 16 – South Inch Spill Mechanism (no footpath/floodgate modification)	57	£713,618	£552,357	£626,754	0.88
Combined Option 11 + 16	42	£1,377,139	£153,615	£1,025,496	0.74
Combined Option 11 + 16 (no footpath/floodgate modification)	42	£1,027,697	£153,615	£1,025,496	1.00
Combined Option 9 + 11	30	£1,054,829	£223,395	£955,716	0.91
Property Level Protection	57	£1,245,857	£632,173	£632,173	0.51

* For Option 1 an assessment is made to estimate the total PV costs required to make the BCR equal to 1. This way the maximum cost of the potential solution can be estimated so the option generates a net economic gain. The obtained results indicate that the total PV costs to obtain a BCR value of 1 or greater should remain below £646,961. Considering only the capital expenditure and the land acquisition (without considering the 60% optimism bias) results in a maximum cost of approximately £150,000.

** For Option 7 this does not consider the costs associated with bank protection work (under pinning of wall, erosion protection etc) which may be necessary due to the impact of dredging. These costs would take this below a BCR of 1.

#The average annual benefit are negative or very small, so a benefit cost ratio will be negative or very small, so a cost is not estimated.

Q13. Were options considered individually, or were they considered cumulatively?

Options are considered individually, and where potentially feasible, they have been considered cumulatively. The number of identified feasible individual options limited the potential number of options that could be cumulatively considered.

Q14. Option 11 has a BCR of 1.42, and option 13 is 0.88. If they were combined into a single option, would that be a viable option?

This option has been considered and it has resulted in a benefit cost ratio of 1.0. At the feasibility stage, this BCR is too low to be considered a viable option. Experience has shown us that the estimates of options identified at feasibility stage typically rise as we gather more detail through outline design, even though we include significant factors to account for unknown risk at such an early stage. This means the options do not remain viable as we progress them.

The Council has undertaken a number of flood studies where options with a BCR below 1.1 have not been recommended for this reason.

Q15. The recommended option only focusses on Queen's Avenue/Queen Street. Why is no consideration given to options for other areas also affected by flooding, such as Broxden, Glasgow Road, Low Road, and Murray Crescent?

See the response to Q12. Option's 3 to 9 were considered as a way to reduce the flood risk at these locations. However, the appraisal process did not identify any feasible options.

Q16. Why was upsizing the culvert beneath Craigieknowes Road not considered as well?

The hydraulic model indicates that this culvert has a much higher flow capacity than the vastly undersized culvert at the access to Queens Court. Increasing the Queen's Court culvert is not predicted to increase flood risk further downstream, as this culvert still provides the control on flows being conveyed downstream.

Upsizing the Craigieknowes Road culvert, would have required further downstream mitigations, such as upsizing of downstream culverts, and potentially new/raised flood defences at Windsor Terrace and Croft Park. This was not considered in detail due to the high anticipated costs exceeding any benefits.

It is noted that there is a propensity for debris to trap on the existing trash screen on the culvert inlet. Whilst trash-screens are designed to trap debris in a way that minimises the risk of flows being significantly blocked, a lot of debris around this screen is typical after high flow events. As such further consideration to reduce the risk of debris accumulating at this location is required which may include further debris traps upstream.

Q17. Why are flood storage options that hold the flood water back not being considered/recommended?

See the response to Q12. Option's 3, 4, 5, 8 & 9 considers this.

Q18. Board 5 contained a section titled 'Removing all flood risk' – what do the figures presented mean and why weren't all areas of flood risk addressed?

The purpose of this section was to highlight two things. The first was that the study carried out an exercise that looked at what would be required to remove the risk of flooding from the watercourses (up to the 0.5% AEP flood event), despite the lack of economic justification to do so. The second was that in removing all flood risk associated with the watercourse, there would still be a significant risk of flooding in the catchment from surface water (overland flows and sewer) flooding.

We considered two approaches to reducing the fluvial risk for all watercourses.

1. Flood storage/NFM measures in the upper catchment plus the recommended study option (upsizing Queens Court culvert plus channel modifications). This requires at least 72000m³ of flood storage in the upper catchment. High level costing gives a BCR of 0.28.
2. Increasing channel capacity (through reducing bed level by 450mm) and combining this with culvert/structure upgrades. This is not considered a sustainable approach due to high ongoing maintenance costs to maintain the required bed level, and high uncertainty on additional costs relating to underpinning riverbanks/bankside structures is also not fully considered. The assessment gave a BCR of 0.25.

Q19. Was natural flood management (NFM) considered, and would measures such as tree planting help to reduce flood risk?

Yes, it is a requirement that NFM measures are considered in a flood study, and an initial NFM appraisal was carried out, and identified the potential opportunity for NFM upstream that should be explored through the options appraisal.

Option 1 considered the benefit of NFM in the upper (rural) catchment. This would be measures including upland tree planting, blocking upland drainage and in-stream barriers to flow (such as leaky barriers/large woody debris). This was represented as a 10% reduction in flows from the upper catchment, which ties in with the current understanding of the effectiveness of NFM measures.

NFM was not recommended due to the limited benefits, excessive land take required to achieve the benefits and resultant high costs.

It is known that there are multiple benefits associated with more natural approaches, including increased biodiversity, carbon sequestration and improved resilience to climate change impacts. Therefore, the Council would be supportive of land managers who may wish to adopt this approach on their land.

Q20. Were low-cost solutions looked at that may not provide a high standard of protection, but still provide some betterment for residents? These could include low walls and landscaping, pump and demountable flood barriers.

The possibility of low walls placed at strategic locations (such as at Darnhall tennis Courts, Balmoral Place, Queens Avenue and Croft Park) are considered of limited value unless they were extensively placed along the riverbank. This would inevitably push water forward to downstream areas, and so an overall benefit would not be seen.

Landscaping to route water away from properties (e.g. at Low Road or Orchard Place) would again push water downstream leading to no benefits overall, so this is not recommended.

As shown in Q12, property level protection was considered as an option but was not found to be a viable option for the Council to promote. However property level protection measures are considered an effective way for homeowners to improve their own resilience to flooding.

The use of demountable flood barriers that residents could deploy themselves requires a coordinated approach (typically through a local resilience group), and needs to be implemented with caution as these measures can lead to some residents getting flooded in a worse manner if incorrectly positioned.

High-capacity pumps, specifically at Croft Park, is another resilience measure that is recommended for the residents due to the flooding that occurs from drainage systems. It is worth noting that 1 m³/s of water is the equivalent of 1000 litres per second, and so pumps are not considered to be effective in all areas, as most pumps will not be able to match this rate.

Recommendations

Q21. The recommended option to increase the Queen's Court culvert capacity will increase the volume of flows downstream, and therefore also increase flood risk?

A fundamental consideration for any flood management action is whether or not this will affect flood risk in other areas. The option was tested in the hydraulic model and did not result in any increased flood risk downstream. This is because the culvert downstream (under Craigieknowes Road) still remains the control on flows reaching downstream.

The recommended option is still subject to further design, investigation and funding. The impact on adjacent flood risk will be reviewed as the design is refined.

Q22. The recommended option will only increase the channel capacity up to the 1% AEP flood. This has been exceeded twice in the last three years. Does the option therefore provide good value with the likelihood of these event becoming more frequent and severe as a result of climate change?

The flood study identified that the only feasible option was with a 1% AEP standard of protection. The impacts of climate change are expected to bring more frequent storm events, with increased severity as well. Whilst the option does not completely remove the risk of flooding from extreme events, it does help reduce flood risk from smaller magnitude events, which will also become more frequent in our changing climate.

It is also noted that blockage of the trash screen on the culvert inlet is a factor in the overtopping, and it is recommended that further consideration of managing this blockage risk is given.

Q23. What recommendations are the study likely to suggest for potential future developments within the catchment?

The study does not make any specific recommendations about future development within the catchment. It does however provide the most detailed assessment of baseline flood risk available in the catchment. As noted in Q27, this will be used to inform future strategic level development planning, such as the next Local Development Plan, as well as being used to assess individual planning applications.

Q24. The findings of the study are very limited and leaves a clear impression that it lacks any ambition for Perth and the recommendations are the cheapest possible options.

The study has considered a number of options that could reduce flood risk within the catchment. However, the recommendations can only be based on those that are considered feasible/sustainable. The options appraisal identified that only two options were viable. This is partly down to the benefits provided from the existing flood risk infrastructure and actions in the catchment.

Next Steps

Q25. What is the process (and estimated timeline) from this point to any future works being carried out?

Amey Consulting will finalise their flood study and the Council will report the outcome to the Climate Change and Sustainability Committee on 27th November 2023.

The Council will also submit details of the proposed option to SEPA for prioritisation (within the national list of flood schemes) and inclusion within the next Tay FRM Plan and Local FRM Plan covering the period from 2028 to 2036. This process is essential to secure the necessary capital grant funding to design and construct the scheme.

There are no current plans to progress the proposed scheme until sometime between 2028 and 2034. At that point, funding will need to be secured before the necessary design work and community and stakeholder consultation can be undertaken and statutory approval can be secured under the Flood Risk Management (Scotland) Act. Further detailed design work will be required thereafter before tenders can be issued and construction can take place. This flood study is therefore the first phase in a long process required to deliver any flood protection scheme/works.

Q26. Why does the Council have to seek funding from the Scottish Government? Could the recommendations not be funded from the uncommitted amount in the Council's Capital budget?

This is not a question that the Council's Flooding officers can answer, as the Council's Capital budget is agreed annually by local elected members. It was noted at the Climate Change & Sustainability committee on 27 November 2023 that Councillors requested Officers explore options to potentially accelerate the recommendations of the study.

The Flood Risk Management (Scotland) Act 2009 sets out a plan-led, evidence- and risk-based approach to managing flood risk in Scotland. The Council's flood risk actions are set out in the Local Flood Risk Management Plans that cover the Council's area and set out the actions. Once an action is committed to through its inclusion within a local flood risk management plan, this enables the Council to access capital grant funding from the Scottish Government. The current arrangement allows for up to 80% funding from the Scottish Government, with the Council funding the remaining 20% of costs.

Q27. How will the Flood study be used to inform decision-making in the future?

The flood study will be used to inform future flood risk management in the catchment. The study provides the best available baseline understanding of current flood risk along the Craigie Burn, as well as an understanding of the future impacts from climate change.

The study will be used to inform the assessment of future development, such as through the next iteration of the Local Development Plan, as well as through the review of individual planning applications.

The study will also be used to inform future inspection and maintenance work along the watercourse, with an improved understanding of the flood risk mechanisms and where maintenance may be more beneficial compared to other locations.

New Developments and Flood Risk

Q28. Many comments expressed concern that new development is responsible for the flooding along the Scouring and Craigie Burns, and that the sustainable urban drainage systems (SUDS) for these sites are ineffective.

Concerns about flooding in connection with new development are commonplace, but as has been noted above, flooding has historically occurred in the Craigie Burn catchment. Three of the five most significant floods in the last 40+ years (1981, 1993 and 2002) have occurred prior to any development of the land around Cherrybank and Broxden.

Since 2011, all new developments must manage surface water at source within the development site using sustainable urban drainage systems (SuDS). These systems ensure that the surface water generated on the site is gathered, stored, and attenuated before being released slowly to a receiving drainage system or watercourse. Any release of water from a development must match the pre-development 'greenfield' runoff rate for the site, ensuring that the new development will not increase the existing flood risk elsewhere and will have a neutral impact.

The capacity of some local SuDS ponds was observed to have been exceeded during the flood event on 8 September 2022 and water was noted temporarily flowing onto the Glasgow Road. All flood defences and drainage systems have a finite capacity and when that is exceeded flooding will occur. This was the case during this event.

The design standards for surface water drainage are continually updated in line with the most-up-to-date understanding, particularly around the impact of climate change. The Council's planning requirements are updated in line with the latest guidance, which should ensure new SuDS features have more capacity in future to deal with increased frequency/intensity of rainfall due to climate change. The drainage design for any development will be based on the current guidance/standards in place at the time planning permission was granted. This is important to recognise in terms of the older development which forms a large portion of the lower urban catchment for the Craigie Burn. These areas were developed before the legal requirements for SuDS and as such, do not have the same capacity to store water during intense rainfall events.

Q29. Why did the study not assess the impact of development (new and proposed)?

The impact of new development on existing flood risk is controlled through the planning process. As noted above in Q28, Developers must demonstrate that their proposals are not at flood risk, and also do not increase flood risk to others. The flood study therefore considers that any proposed development will have a neutral, at worst, impact on existing flood risk, in line with the requirements of the National Planning Framework for new developments.

The drainage infrastructure for existing 'new' development (e.g. Cherrybank and Broxden) is built into our hydraulic model, where available. Therefore, the study accounts for these developments in the baseline understanding of flood risk. The study does not retrospectively check the surface water design of these developments.

Q30. Who is responsible for the ongoing maintenance of SUDS?

Surface Water Drainage systems may remain under private ownership or adopted by the local authority, Scottish Water or, in the case of residential development, through a joint maintenance agreement between the Council and Scottish Water.

The developer of a site remains legally responsible for the drainage infrastructure until such time that it is adopted.

Q31. Does the design of SUDS consider the future impact of climate change on our rainfall patterns (i.e. Increased intensity and frequency of storm events)?

SUDS are designed to replicate the natural (pre-development) run-off rate of a site. They do so by restricting any surface water discharge from a new development to what is called the 'greenfield run-off rate'. A number of methods exist to derive the greenfield run-off rate for a site. These are based on historical rainfall records, and other parameters to represent the natural characteristics of a catchment/site.

In order to account for climate change an uplift is applied to the peak rainfall. This is currently 39% for locations within the River Tay catchment (i.e. Perth), based on the latest climate change guidance. The understanding of climate change impacts is constantly developing, and as such, the uplift factors applied have changed through time. The drainage design for any development will be based on the current guidance/standards in place at the time planning permission was granted.

Q32. The storage tanks at Darnhall Park overflow all the time, and there is no planning permission for these to be located there. Who is responsible for these?

The large diameter pipes installed beneath Darnhall Park, provide additional storage on the combined sewer network. Similar features have also recently been installed at Low Road. These were required to mitigate the impact of additional foul flows from upstream areas. They were constructed by the developer (Bellway Homes) and will be adopted by Scottish Water.

Due to the high frequency of overflow incidents, the storage tanks have been investigated and some defects were found. The developer has now resolved these issues and will provide ongoing monitoring to ensure they don't arise again, before Scottish Water will take over the long-term maintenance. Bellway Homes remain responsible for these assets until they are adopted/vested.

The works were considered lawful development by the Council as Planning Authority. Scottish Water have Permitted Development Rights, and these can be conferred to others undertaking works on the sewer network. The storage tanks have now been in situ for more than four years meaning that no planning enforcement action can now be taken in any case.

Perth Flood Protection Scheme

Q33. What evidence is there to support the statement about the significant benefit already provided by the Perth Flood Protection Scheme. Is that scheme not specific to the River Tay and not for the benefit of this study catchment.

The Perth Flood Scheme was completed in 2002. It was designed to primarily address flood risk from the River Tay across Perth; however as part of the Scheme, three flood storage ponds were created in the Broxden area at the top of the Craigie Burn catchment. As part of the same Scheme, flood walls and embankments were also erected around the South Inch (including South Inch terrace and Croft Park) to create a flood storage area and manage flood risk to adjacent properties.

These features offer significant flood attenuation and reduce flows downstream along the Scouring and Craigie Burns, and without them the risk (and impact) of flooding downstream would be even greater. Currently fluvial flooding is predicted for the 20% AEP storm event at Queen's Avenue, Tennis courts at Orchard Place, Woodside Crescent and the woodland area to the north of Craigie Hill Golf Course, and without the Perth Flood Scheme the risk of flooding would be higher.

Q34. How much consideration did the study give to the online flood storage ponds that form part of the Perth Flood Scheme?

The flood storage ponds/areas situated near Broxden were fully considered through the flood study. They were fully detailed within the hydraulic model so their benefit is captured within the baseline flood risk. We did not run a scenario in the hydraulic model where these features were removed. This is because they are part of a formal flood protection scheme, and the Council is committed to maintaining these, and their ongoing operation is considered fundamental to managing the existing flood risk.

Options as shown in Q12, were also considered as to how these areas may be improved to increase the benefit they already provide. However, the study found that there was no feasible option to further enhance these storage areas.

Perth Surface Water Management Plan

Q35. Why are there two separate projects that cover the Craigie Burn area of Perth - the Craigie Burn flood study and the Perth Surface Water Management Plan and why are Amey not delivering these at the same time?

The Tay Local FRM Plan identifies two distinct actions for these projects. The Perth Surface Water Management Plan is also a Perth-wide action, and so the focus will be on areas of highest surface water flood risk across the city.

The projects were procured separately, although Amey Consulting won both contracts. There are clear benefits in having the same consultants deliver both projects, particularly given that the same hydraulic model is being used in both projects.

The Perth SWMP has been progressed alongside the Craigie Burn flood study, but as this covers a much wider areas, the timescales for delivery are longer. We are aiming to produce draft outputs by summer 2024, but again it must be reinforced that the project will focus on the areas of highest risk across Perth, and not specifically on the Craigie Burn catchment.

Q36. Does this mean that surface water flooding has not been considered in the Craigie Burn flood study?

No. Surface water flood risk (both overland flows and sewer flooding) were fully considered in the study's assessment of total flood risk in the catchment.

Q37. Will the outcomes of the Perth Surface Water Management Plan impact the Craigie Burn flood study, and require it to be re-visited at that point?

No. The Perth SWMP will consider the recommendations of the Craigie Burn flood study, and where appropriate consider this in any actions it recommends. We do not envisage that the Perth SWMP will have any impact on the flood study recommendations.

Q38. The Council's letter to home owners of October 2022 mentions a Perth Integrated Catchment Study Project being delivered by the Council and Scottish Water. How does this Craigie Burn Flood Study integrate with that project?

The Perth Integrated Catchment study (ICS) was carried out by Scottish Water, in partnership with Perth & Kinross Council. This study focussed on improving the understanding of flood risk from the city's drainage systems, and the interaction between above- and below-ground drainage infrastructure (and watercourses).

The Perth ICS developed the initial hydraulic flood model that has been used for the Craigie Burn flood study, and provided a baseline understanding of the various flood mechanisms affecting the urban parts of the catchment. The Craigie Burn flood study built on this, and previous work.

The Perth ICS more closely integrates with the ongoing Perth Surface Water Management Plan.

Existing Maintenance

Q39. Who is responsible for maintaining the watercourses?

Riparian landowners have a responsibility to maintain the bed and banks of any watercourse as it passes through their property. This includes preventing any material entering the watercourse that could become an obstruction to the flow of water and/or cause a flood risk elsewhere. It is also the responsibility of the riparian landowner to remove any such debris from their section of the watercourse even if it has been transported downstream from another property.

The responsibility for clearing, improving or increasing the capacity of a watercourse lies with the riparian landowner, who may need to acquire a licence from SEPA before proceeding.

Under the Flood Risk Management (Scotland) Act, the Council carries out routine watercourse inspections and the condition of each watercourse is assessed with respect to flood risk. If it is found that the condition of a particular body of water gives rise to a risk of flooding, and clearance and repair works would substantially reduce that risk, then a schedule of those works will be prepared, and the Council will carry them out. Any identified works are carried out in order of priority and as budgets allow.

Q40. The flood study highlights that the Council's existing maintenance regime already provides significant flood risk benefits; however we are doubtful this is actually done. The burn is never cleared and vegetation is left on the bank sides and able to wash back in. What evidence is there to support this, and can the public see this?

As noted above in Q12, where clearance and repair works are identified that will substantially reduce flood risk, then these are placed on a schedule of works. This can be viewed on the Council's website at <https://www.pkc.gov.uk/article/14718/Flooding-duties-and-responsibilities>. The schedule is a list of identified works due to be carried out, it does not provide a historic record of all watercourse clearance works across Perth & Kinross.

The Council's Flooding team has carried out a significant amount of clearance and repair works within the Craigie Burn catchment over the last 10 years.

A number of sediment management works have been carried out, with roughly £105k being spent from 2012 to present day. Further works are due to commence along the reach between Glenearn Road and Edinburgh Road imminently (March 2024). This is detailed below:

Year	Cost	Location
2012/13	£22,800	Balmoral Place, Queens Avenue, Croft Park and South Inch
2014/15	£9050	Croft Park and South Inch
2017/18	£5600	South Inch
2020/21	£40000	Buckie Burn culvert (Low Rd), Balmoral Place, Windsor Terrace, Croft Park and South Inch
2021/22	£26600	Queens Avenue and Windsor Terrace

In addition, approximately £40k has been spent on the removal of debris and overgrown vegetation from the watercourse since 2012. This includes figures from the 2022/23 and 2023/24 financial years which were not factored into the study due to timing.

This does not include the fortnightly inspection and clearance of trash screens along the watercourses, which is carried out by the Council's Roads Maintenance Partnership (RMP). The RMP also inspect the Council's flood protection schemes annually and have carried out a significant amount of maintenance work on the Perth Flood Protection Scheme from these inspections.

Q41. Will the Council be increasing its inspection and maintenance regime until the proposed works take place?

The Council will not be increasing the frequency of its planned inspections for the Craigue Burn (and its tributaries), which are carried out on a six-monthly basis. However, the study has provided further understanding of the critical areas along the watercourse which will inform future inspection and maintenance. This is in addition to the fortnightly trashscreen clearing schedule and annual flood protection scheme inspections.

Between planned inspections, the Council will also inspect and assess any issues that are reported to us. Any concerns you have regarding the condition of the watercourses can be reported to the Council either by e-mailing flood@pkc.gov.uk, or through the Council's customer contact centre on 01738 475000 (8.45am to 5pm).

Q42. A council-owned garage situated on Glamis Place is being severely undercut by the Craigue Burn. This is at risk of collapsing into the watercourse and causing a significant blockage. What is the Council doing about this?

The Council is aware of this issue and action has been taken to demolish the unsafe structure.

Q43. The road gullies and drains are never cleared. Following the last large flood event, Queens Street was not cleared up properly, leaving the road drains blocked. Will this not add to the flooding issues?

Drainage systems are only able to cope with a certain volume of water and can be quickly overwhelmed during high rainfall. This does not always mean that the drains are blocked.

Surface water systems across large areas of Perth connect into the combined sewer network, which is a common situation across all towns/cities. When the sewer is at capacity, surface water has nowhere to drain until capacity returns to take it away.

The Council cleans out the gullies that collect surface water from the road and footways. These are cleaned out by a schedule of works and reactive visits by gully tankers to respond to blockages where they give greatest risk to property. In general, gullies on A class roads are cleaned out once per year; those on other roads are cleaned out at least once every two years.

Road drainage problems are identified by the regular inspections of the network, by calls to Clarence, or as a result of reports from the public; and appropriate action is taken to deal with the problems that are identified. For enquiries, or to report a problem with a gully (e.g. blockages), contact Clarence by telephone on 01738 476476 or 01738 475000.

It must be noted that in the context of significant flooding, such as August 2020 and September 2022, a small number of blocked gulleys will have no significant impact on the level of flooding, particularly where the receiving combined sewer is already over-capacity.

Community Resilience

Q44. Is any grant funding available to homeowners/residents to install property flood resilience measures?

There is no grant funding available from the Council for residents to access for the purpose of installing property resilience measures.

Q45. The Council has set out that it is the responsibility of homeowners to protect their own property from flooding. Has there been house to house visits to check people's knowledge or ability to do this?

We are aware that individual circumstances can affect people's ability to prepare and protect themselves and their properties from flooding. Unfortunately, the Council does not have the resources available to undertake individual assessments of resident's knowledge or ability to defend their properties from flooding, such as using property flood resilience measures.

The Council will provide advice where we are contacted by residents, and also direct people to other sources of information and assistance, such as the Scottish Flood Forum. We also aim to raise the overall awareness of flood risk in affected communities, through events such as flood study drop-in sessions, and the information contained on our website.

Community resilience groups are often best placed to provide the necessary support to those who may need additional assistance. The Council's Resilience Co-ordinator can help such groups set up emergency action plans to help focus actions to where they are most needed.

Q46. Who is accountable for the flooding that occurs from the Craigie Burn, particularly where elderly and vulnerable people are put at risk? Surely PKC has a duty of care to its residents? There is a genuine risk to life from the flooding experienced (both from an accident during a flood and from the long-term impacts associated with living under the threat of flood risk). Does someone need to lose their life before more robust action is taken?

Flooding is a natural phenomenon that can never be entirely prevented. However, action can be taken to reduce the risk of flooding and its impact.

The Council has no statutory duty to prevent properties from flooding but will help residents and communities as much as we can. The primary responsibility for avoiding or managing flood risk lies with land and property owners, but certain public bodies are expected to take a proactive role in managing and, where achievable, lowering overall flood risk.

SEPA, local authorities and Scottish Water have developed and published flood risk management strategies and plans. These are available to view at <https://www2.sepa.org.uk/frmplans/> and www.pkc.gov.uk/frmplans.

By working together we can all achieve more.

Q47. The study notes that a flood warning system for the catchment is not feasible due to the 'flashy' nature of the catchment. What is the evidence for this, and why does the study refer to the community-led Rivertrack system that is being installed?

The Craigie Burn has been observed responding very rapidly to previous rainfall events. For example, the flood event on 6 August 2002 occurred from an intense 1-hour rainfall event. Existing water level gauges along the watercourse also provide evidence of the quick response observed in the watercourse following heavy rainfall. The flashy nature is due to its small catchment size, steep topography and high level of urbanisation.

The limited response time to flooding along the Craigie Burn is why a formal flood warning scheme is not a viable recommendation. There is too little time to enable any action from authorities in advance of flooding. The flood study acknowledges the good work of the community groups in the catchment, and in particular the installation of a river-track system. These community-led systems will enable residents to monitor flood levels in real-time and act as necessary, but the rapid onset of flooding in this catchment must be recognised in terms of setting expectations that can be achieved.

Q48. Parked cars influence the flow of water on Queen Street, as well as being put at risk of damage from the flood water. Can a ban on parking on Queen Street be put in place during a flood warning?

This is not something that the Council considers to be practical. Flood warning times are very short on the Craigie Burn, particularly during intense summer storms, limiting the ability to warn people in advance. This would also be impractical to enforce in reality.

The Perth Community Flood Aid group is working with the Scottish Flood Forum and SEPA to install Rivertrack gauges on the watercourses, which will enable residents to make their own assessment of the necessary actions required, such as moving parked vehicles to higher ground.

Meeting Attendances

Q49. Scottish Water, SEPA and the Scottish Flood Forum were not in attendance at the drop-in session that I attended, despite what was advertised. There were only two representatives actually present (one from Amey and one from PKC). We felt this showed a lack of commitment to engage with the community.

Two representatives from each of Scottish Water, SEPA and the Scottish Flood Forum attended the drop in session held on 20 June 2023. Due to pre-arranged commitments their attendance was not possible at the second drop-in held on 28 June 2023. Given the limited specific questions directed to these organisations during the first event, the Council agreed, in the absence of suitable alternative representatives, that their attendance was not required for the second event. All organisations were happy for the Council to take a note of any specific questions for them to respond to and feedback to residents.

Both events were also attended by at least two representatives for the Council's flooding team, and two representatives of Amey Consulting at all times.

Q50. Why were no representatives from PKC, or other organisations, in attendance at the meeting arranged by Pete Wishart on 14 July 2023?

The Council responded to Mr Wishart's office in advance of the public meeting he had arranged. We advised that due to pre-arranged annual leave of the required members of staff that we would not be able to attend. The Council had also held two community drop-in sessions, which were extremely well attended just prior to the public meeting. The display information from these sessions was also available on the Council's consultation hub from 16 June to 16 July 2023.

Questions from Public Meeting Hosted by MP Pete Wishart

A list of 10 questions were provided to the Council following MP Pete Wishart's public meeting held in July, and this mirrored the feedback already received through the above events (either in person or online). These have been covered by the above questions:

1. *Why have the Craigie Burn Flood Study and the Perth Surface Water Management Plan not been integrated when flooding in the area is impacted by both issues? (This question was raised several times at the meeting)?* **Please refer to Q35 of the Question & Answer report.**
2. *If there is leftover money from the £32m additional funding for the Cross Tay Link Rd, is there a possibility for the remaining funds to be redistributed to tackle the flooding issue?* **Please refer to Q26 of the Question & Answer report.**
3. *Who is adopting the Persimmon and Belway SuDS in the area? Who is responsible for their maintenance?* **Please refer to Q30 of the Question & Answer report. The SUDS are to be put to Scottish Water and the Council for adoption. The developer remains responsible for their maintenance until they are formally adopted.**
4. *Would it be possible to see the full AMEY report that informed the Craigie Burn Flood Study? Does Pete Wishart need to submit an FOI for this?* **The final study reports are available upon request.**
5. *Who made the decision not to assess six of the 13 options in the study, and what was the reasoning for this?* **Please refer to Q's 10, 11 and 12 of the Question & Answer report.**
6. *Is the £310,000 available imminently or will PKC need to wait until 2026 for the next round of ScotGov funding?* **Please refer to Q26 of the Question & Answer report.**
7. *Would PKC consider introducing schemes to incentivise owners to take action on an individual level? Example given at public meeting was a discount to water and sewage bills for owners who they have been helping out by doing things like storing water in butts and using it for personal use like car washing etc.* **This is not something PKC Flooding officers can answer and is beyond the scope of the flood protection study. Any consideration of this would likely have to be delivered through a national-scale policy.**
8. *Why was there no mention of development issues (e.g. Craigie Hill Golf Club & new Aldi) in the study when further developments will likely impact flooding?* **It is not within the scope of the flood protection study to assess individual development sites. See Q's 28 and 29 of the Question & Answer report.**
9. *What is the flooding risk of the 4 sites at Broxden with planning applications?* **It is not clear what sites are being referred to, but it is not within the scope of the flood protection study to assess individual development sites. See Q's 28 and 29 of the Question & Answer report.**
10. *What is the timeframe for PKC publishing the final Craigie Burn Flood Study and implementing its recommendations?* **Please refer to Q25 of the Question & Answer report.**