



Flood and Coastal Resilience Innovation Programme: Expression of interest application form

Please read the Flood and Coastal Resilience Innovation Programme – Invitation for Expression of Interest guidance on .GOV.UK at <https://www.gov.uk/guidance/flood-and-coastal-resilience-innovation-programme> prior to completion of this form.

If you require any additional information please email the team - InnovativeResilience@environment-agency.gov.uk

NOTE – This form is read only, so please save a version to edit. The completed form must not exceed 25 pages in length.

Please return this to InnovativeResilience@environment-agency.gov.uk by the 15 January 2021.

Applicant summary

Project title (one line only)

Project Title

Frome Catchment Innovation Programme

Lead authority name and contact information

Note. All applications must be led by a lead local flood authority (LLFA) or coastal protection agency (CPA).

Lead Organisation

Bristol City Council

Project owner and champion

Contact details for Owner (senior officer)

Full Name

Zoe Willcox (Director, Development of Place and BCC rep on the Bristol Avon Catchment Partnership)

Organisation

Bristol City Council

Email

Zoe.willcox@bristol.gov.uk

Expression of Interest - Flood and Coastal Resilience Innovation Programme

Contact details for Champion (political champion)

Full Name Cllr Nicola Beech (Cabinet Member with responsibility for Spatial Planning and City Design, including Flood Risk)

Organisation Bristol City Council

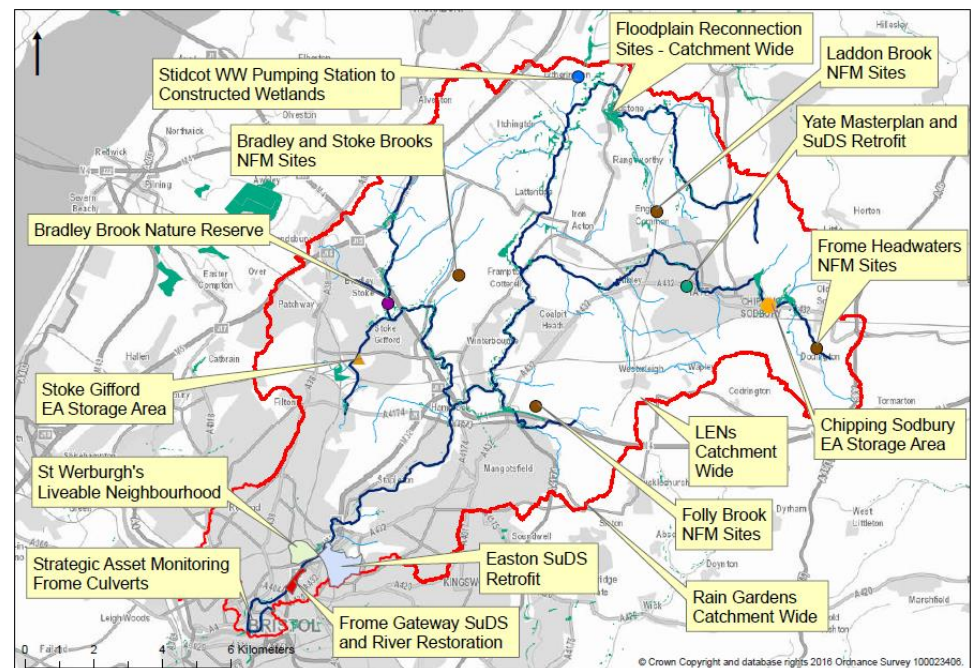
Email cllr.nicola.beech@bristol.gov.uk

Project location or locations

Details and a descriptions of the full extent of the project area. If you would like to include a map of the project area please submit as part of this form.

Project location(s)

This Programme will focus on interventions across the Bristol River Frome catchment, which is a cross-boundary catchment located within the Bristol City Council (BCC) and South Gloucestershire Council (SGC) administrative areas. It is located within the Wessex EA area. A map of the catchment and key project locations is shown below, and in Appendix A1.



Project partners

Please list the names of all partner organisations.

Project partners	Bristol City Council South Gloucestershire Council Environment Agency Wessex Water Bristol Avon Catchment Partnership
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Nature of the threat that requires resilience action

Please select the primary source of risk this project is seeking to address, by putting a cross in one of the check boxes below.

Coastal flooding	Fluvial flooding	Surface /groundwater	Coastal erosion
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please select any secondary sources of risk (if applicable) this project is seeking to address, by putting a cross in one of the check boxes below.

Coastal flooding	Fluvial flooding	Surface /groundwater	Coastal erosion
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Summary of the justification for the project

Summarise in bullet points why the project should be considered and taken forward to the project development stage.

Project summary in bullet points	<ul style="list-style-type: none"> • Our proposal will deliver currently unfunded resilience measures in the Bristol Frome catchment, an EA priority catchment; • The actions have been identified and scoped through the River Frome Reconnect Partnership, which reports to the Bristol Avon Catchment Partnership; • We propose a mix of flood resilience measures that mirrors the rural to urban nature of the Frome catchment with citizen sciences and engagement at the core; • The proposed measures will achieve flood resilience and deliver multiple benefits; • We are ready to commence delivery of the measures, we have undertaken feasibility work or surveys in many cases and have clear partnership arrangements in place that will quickly steer and establish formal project governance;
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- Our proposed long term monitoring regime will provide sound evidence and data of the benefits of NBS;
- In addition to building evidence of known NFM, we propose genuine innovation through trialling new products and ways of engaging business communities
- Bristol and South Gloucestershire are well placed to share the learning from the programme nationally and internationally.

Application detail

Section A - Assessment of risks and needs

Explain the need for funding in the specified area.

Provide a clear, evidence-based explanation of current and evolving flooding or coastal erosion risks in the area.

Identify the risks the project will address, for example fluvial flooding, coastal flooding, coastal change, surface water flooding or groundwater flooding.

Explain what actions to improve flood and coastal erosion resilience the area already has and where the gaps are.

River Frome Catchment

The Bristol River Frome (River Frome) is sourced in the southern Cotswolds, the headwaters of the river flowing through predominantly rural (agricultural) land, the towns of Yate and Chipping Sodbury before flowing downstream and entering the heavily urbanised area of Bristol to the north of the city. Its course through much of the city is modified, flowing through culverts and canalised sections beside and under the M32 motorway (a key infrastructure corridor to the city). Flood flows in this location are diverted by the Northern Stormwater Interceptor (NSWI). The river then flows through a network of culverts and control structures (including the Floating Harbour, a unique engineering and cultural asset which attracts investment and tourism to the city) before reaching its confluence with the River Avon in the city centre.

The **River Frome has been identified as a priority catchment by the Environment Agency (EA)** and Bristol Avon Catchment Partnership (BACP) to address multiple environmental challenges over the coming years. As a result, the partners established the River Frome Reconnected Partnership (RFR) in 2018 (membership from South Gloucestershire (SGC) and Bristol City (BCC) Councils (both LLFAs), EA and Wessex Water (WW) amongst others) to oversee and co-ordinate action in the Frome catchment to make it, its tributaries and communities a more healthy and resilient system, with flood risk management as a key theme. A draft [RFR storymap](#) is available to describe the RFR Partnership and the various aspirations it is promoting.

The RFR project has **identified a number of interventions that will reduce flood**

risk, as well as capture multiple benefits, throughout the catchment. Estimates suggest it would take many years for these interventions to be delivered under current funding arrangements. **Including the interventions in this Resilience Innovation Programme will accelerate their delivery and therefore benefits realisation in the catchment.** Without significant investment the local communities and the fast-growing economy and urban environment in this highly populated area of the country will not have the provision or capacity to build resilience and adapt to the increasing risk of climate change.

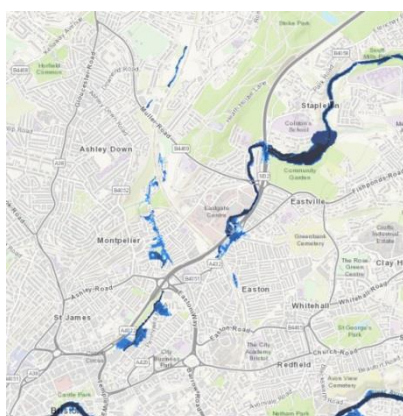
The EA has commenced a Catchment Investment Strategy for the Frome, which is a key action of the RFR and is **complimentary to this bid**. The Investment Strategy will identify and assess the various ongoing, proposed and aspirational projects in the catchment. It will essentially produce a Strategic Outline Case for priority projects in the catchment. The work under the Investment Strategy will be a key building block for this Programme that will help to provide a comprehensive evidence base that identifies the highest priority flood risk interventions that can be delivered within a strategy framework.

Current and evolving flood risk

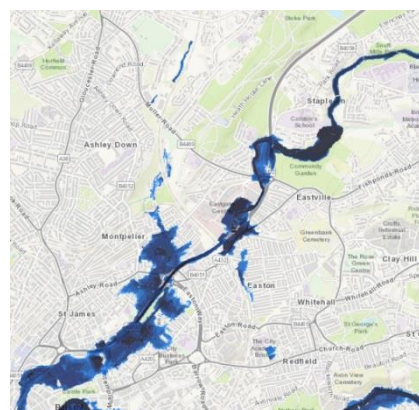
Fluvial Flood Risk

The River Frome presents a risk of flooding to communities, business and infrastructure in areas along its course. Appendix A2 provides additional information on the catchment.

Peak river flows for the region are forecast to increase by 70% for the upper end climate change scenario (UKCP18) by the end of the century. Our hydraulic modelling indicates that the **flood risk posed from the Frome in Bristol will go from being relatively manageable to city headliner** as we progress through the century, as demonstrated in the below figure. This is primarily due to existing infrastructure (such as the NSWI) becoming overwhelmed and increasingly tide-locked due to sea level rise.



Present day flood risk to central Bristol from the Frome



Future (2120) flood risk to central Bristol from the Frome

Surface Water and Sewer Flood Risk

The mix of urban and rural land use within the Frome catchment results in a risk of flooding from surface water and sewer flood risk resulting from both prolonged (rural) and intense (urban) rainfall events. The urbanisation of much of the river corridor and catchment means that surface water management predominantly utilises traditional (single benefit) infrastructure. This is particularly the case in the more historic urban centres, which are drained via a combined sewer network and therefore likely to have limited resilience.

Both BCC and SGC have recently completed integrated 1D-2D modelling to estimate and quantify the potential risk of surface water flooding to urban centres (citywide for BCC and Yate in SGC). As the 1D element of this modelling incorporates the underground sewer network, the results provide a reasonable estimate of potential sewer flooding as well as flooding from overland flow. Using this modelling, **BCC has identified two specific High Risk Areas and up to 800 properties to be at risk of surface water flooding** within the BCC area of the Frome catchment. The SGC modelling results have only recently been received but they indicate **over 5,000 properties would be at risk** in the SGC area.

Wessex Water has a number of **sewer flooding incidents caused by hydraulic incapacity within the Bristol Frome catchment**. The Wessex Water incident records will be used to help identify and target areas that are at risk from both foul and surface water flooding. Given that ~65% of flooding incidents within the Bristol Frome catchment are caused by sewer misuse (i.e. flushing wet wipes down toilets or putting fat down the drains) there is the opportunity to deliver multiple messages as part of integrated flood focused engagement campaigns.

The river is culverted through central Bristol in a network of tunnels and culverts that interact with each other, the Floating Harbour and the tidal river Avon. While some survey work has been carried out on some of these structures, regular monitoring of these structures is a key gap in the resilience of the system.

The worsening flood risk in this catchment is currently constraining the Frome Gateway regeneration site in BCC and Yate Masterplan area in SGC. Establishing a more comprehensive flood resilience package (from interventions to reduce the risk, building community resilience, establishing emergency plans and innovating through policy changes), we can investigate ways to encourage sustainable development of key brownfield regeneration sites.

Risks and gaps that will be addressed

The project aims to address the following risks and gaps, focussing on fluvial and surface water/sewer flooding:

- The existing and future risk of fluvial flooding to properties throughout the catchment (**over 1,700 properties are risk of flooding during a 1 in 1000 annual chance event**, present day);
- Surface water and sewer flood risk, particularly in areas with historic urban drainage systems (e.g. combined sewer network) that have limited capacity and

resilience (we estimate **over 5,800 properties in the Frome catchment to be at risk** during a 1 in 100 annual chance event, present day);

- Reliance on traditional (single benefit) flood risk management infrastructure;
- Poor or moderate status waterways due to land management practices, often high sediment levels, urbanisation and 'traditional' engineering solutions throughout the catchment;
- Low community (including local businesses) awareness of flood risk and the benefits of climate adaptation using NBS or property resilience measures; and
- Irregular inspections and maintenance of key culverts and assets in the lower (urban) extent.

Section B - Project description and mix of activities

Set out the objectives and timeline of your project.

Summarise the resilience actions listed in the in the expression of interest guidance that you plan to undertake to meet these objectives.

Summarise which risks and resilience gaps which your activities will help to overcome.

This Programme will **establish and deliver a forward thinking whole river corridor approach** which has transferability to other catchments and cities. We will seek to develop a model with replicability from this Frome catchment that journeys from upper rural catchment through dense urban areas into a city centre powerhouse. We will also employ smart technology and utilise the power of the community for monitoring while delivering integrated solutions that tackle twin climate and ecological emergencies declared by both BCC and SGC - investment in NBS being the crux and delivery mechanisms with multiple benefits for all.

Adapting the aims of the RFR, we would utilise this Programme to address the following key objectives:

- A. Increase the resilience of communities and infrastructure at risk of flooding in the Frome catchment
- B. Demonstrate and quantify the benefits of natural flood management measures and retrofitting SuDS
- C. Demonstrate the deliverability of retrofit SuDS through non-flood risk programmes
- D. Support sustainable growth and regeneration throughout the Frome catchment area
- E. Improve local monitoring systems to increase flood resilience
- F. Engage with home owners and businesses to understand flood risk and measures they can take to reduce it
- G. Engage with businesses to facilitate innovative funding mechanisms to contribute towards NBS

This Programme proposes a workstream approach to delivering the objectives. The workstreams are summarised below.

Installing nature-based solutions – Objectives A, B and F

The RFR Partnership is an established group that has helped to co-ordinate NFM and riparian enhancement surveys identifying nature based solutions that this Programme would enable. By the end of March 2021 the River Frome Reconnected Partnership will have completed NFM and riparian enhancement opportunities surveys across all Frome headwaters.

Natural Flood Management (NFM)

The RFR has been working with the EA, SGC and Farming and Advisory Wildlife Group (FWAG) to co-ordinate and align separate NBS feasibility studies on the Laddon, Bradley and Folly brooks and Frome headwaters. From these initial investigations we have identified NFM interventions to slow the flow and reduce priority highway flooding. We will include these NFM measures in this Programme.

Some measures within the catchment have already been implemented, **demonstrating an ability to deliver**. However further funding is required to deliver more NFM solutions, as outlined above. The RFR feasibility work and its [Catchment Plan and Draft Future Funding Needs Report](#) has also identified the following actions that we would seek to include within this Programme to deliver more benefits for the Frome catchment:

- Riparian and in-stream habitat restoration opportunities including floodplain reconnection, peri-urban SuDS, direct practical works (fencing etc.) and presence of invasive weeds.
- Opportunities to enhance the Stoke Gifford Flood Attenuation Area for biodiversity gain and NFM.
- Utilise local partners, such as the Bristol Avon Rivers Trust (BART), to complete a woodland planting strategy. Target and prioritise locations in the catchment (including in urban areas) that would balance benefits realisation with deliverability using a mapping and modelling process. Work with landowners to implement woodland planting and monitor their benefits, aiming to trial different approaches or planted species in the various locations and monitor their impact on reducing flood risk and/or river flows.

Delivering NBS Through Regeneration – Yate Masterplan and Frome Gateway

South Gloucestershire Council's Yate Masterplan (YM) is developing a vision for future growth and development within Yate. Working with the EA, WW and other partners, the RFR is supporting the masterplan by **exploring options for river restoration of the Frome**. This will enable the development of measures to **mitigate future flood risk** from fluvial sources, **improve climate change and ecological resilience** underpinning future economic growth potential and enhanced GI. As part of this Programme, working alongside the YM process we also aim to retrofit SuDS in two key areas - Riverside Retail Park and Station road. The Programme will build on significant stakeholder engagement already undertaken within these areas is to yield better community involvement, co-design and uptake with these techniques.

In central Bristol, the Frome Gateway regeneration site located along the banks of the river Frome is the first point of arrival for many visitors to Bristol City centre. The site has flood risk constraints with adjacent existing residential properties (located in an area of high deprivation) also being at risk of flooding. BCC have already completed a

river restoration pre-feasibility study and a Flood Risk Assessment (including specific modelling) to inform the emerging aspirations for the site. As part of this Programme we will:

- Deliver the first phase of a river restoration scheme that will also **reduce fluvial flood risk to approximately 30 existing residential properties**;
- Work with the emerging Spatial Framework to **embed proposed river restoration**; sustainably manage the flood risk to the regeneration area; use the site as a test case for **encouraging innovation through the planning process** in terms of sustainable development of flood-constrained brownfield sites, building on learning from Europe and beyond
- **Build on the existing 'grassroots' community engagement process**, currently being utilised for the emerging Spatial Framework, to the river restoration design process.

Integrated water management solutions – Objectives A, B, C and E

SuDS Retrofit

Retrofitting sustainable drainage systems (SuDS) to deliver multiple benefits is an integral part of achieving our strategic green infrastructure plans (such as the West of England GI Strategy). Therefore they will be included in our proposals under this Programme.

Within the urban areas of the catchment, SGC and BCC propose to pilot the installation of raingardens and SuDS around public buildings, with the intent that such sites will be used to train, inspire and engage with other organisations to take action to **reduce surface water flows and enhance biodiversity**. We will use innovative tools such as the BCC GIS Vulnerability Mapping Tool or the Atkins SuDS Studio to prioritise locations, buildings or assets (e.g. car parks) to establish a **prioritised programme of installation under this Programme and beyond**. This approach closely aligns with the various existing council's plans, from the climate and ecological emergency plans and the BCC initiative to make its property estate carbon neutral and climate resilient by 2030.

SuDS retrofit can often be **challenging to fund using traditional funding arrangements**. This Programme will allow us to target areas where there are greatest opportunities to reduce flood risk from sewer and surface water flooding, demonstrating the wider benefits of retrofitting SuDS, and **informing the quantification of benefits**. By taking a catchment based approach, using innovative tools to focus our interventions on targeted areas of the River Frome catchment, and combining this with ongoing and proposed monitoring (see Section H), we aim to demonstrate the river scale benefits of street level interventions.

We have experience of retrofitting SuDS schemes across BCC and SGC and can bring many lessons learnt from previous and ongoing projects to ensure successful delivery and maximise benefits. In particular we will:

- Take advantage of ground conditions to remove surface water sewer

connections. For example, we have installed infiltration-type SuDS in parts of Easton;

- Target measures locally based on the surface water and sewer flood risk using innovative tools / opportunity mapping to assist prioritisation;
- Focus interventions (e.g. rain gardens etc.) on council owned estate (such as properties, car parks and highways) to maximise efficiency. We have identified a number of libraries, youth centres, primary schools, car parks etc. that could be feasible locations for SuDS interventions;
- Be informed by utilities and other constraints to reduce delivery costs;
- Design measures to minimise maintenance requirements;
- Use pilot/showcase sites constructed under this Programme to train, inspire and enable other organisations/individuals to take action to reduce surface water flooding and enhance biodiversity;
- Actively encourage uptake of property-level measures through the Programme via the use of incentive schemes, such as reverse auctions or incentivising the connection of property down pipes to rain gardens/planters instead of directly to the sewer network;
- Target measures that contribute to nature recovery as part of the Local Nature Recovery Network; and
- Trial innovative solutions (see below), assessing their maintenance, whole life cost and efficiency against more traditional methods.

At this stage, we envisage focussing on Easton as it is a location with areas of high deprivation, is drained via a combined network but has known levels of good community engagement.

We will **seek creative solutions to efficiently deliver wide scale SuDS retrofit projects**. Opportunities to develop proprietary products that utilise multiple benefits are a gap in the market we believe could bring fresh innovation to the industry. An example product we will look to work with is **pre-cast bio-retention 'pods'**. These 'pods' are traditionally designed by engineers and constructed on site by a contractor and planted and maintained by landscaping companies. By bringing together the entire supply chain early on in the project design stage, we aim to develop a product and / or way of working that more efficiently enables retrofit of such features. **This innovation will have the ability to be replicated in future projects.**

Liveable Neighbourhoods

We aim to co-ordinate SuDS retrofit with wider city aspirations (e.g. the Bristol Once City Plan and Local Cycling and Walking Infrastructure Plan) to deliver [Liveable Neighbourhoods](#). Such initiatives have been described as the single most effective method of **increasing active travel**, the physical and mental health benefits of which are well-documented. SuDS retrofit can be used as a way to implement such schemes by, for example, introducing point closures at one end of a residential street through the installation of pocket parks, rain gardens or other SuDS to provide a physical barrier to motorised traffic, as shown in the photograph below, taken from an existing scheme in Bristol.



We believe this is a hugely innovative way to embed SuDS to provide not only the established **benefits associated with water quality and quantity**, but at the same time serve to **connect habitats, improve air quality, reduce traffic, increase physical activity and provide quantifiable health benefits**. We propose to focus on St Werburgh's in Bristol, an area with some levels of high deprivation and a history of flood risk issues. BCC installed measures in St Werburgh's in 2020 to assist segregated cycling as part of the COVID-19 Emergency Access Fund. This process included positive engagement with the local community and hence BCC will be building on this through the Liveable Neighbourhoods trial.

Landscape Enterprise Networks

We proposed to implement a [Landscape Enterprise Networks \(LENs\)](#) process, which is an innovative and relatively unique method of driving private investment in NBS. Working with our local business community we will demonstrate the benefits of NBS to their business so, justifying their investment in NBS to deliver benefits including reducing flood risk to their business, improvements to work productivity due to associated mental and physical health benefits, provide opportunities for up-skilling, apprentices and training and attracting more visitors, bringing retail and leisure spending, attracting further investment. The RFR is well placed to commence a LENs process immediately as we have already started a project scoping exercise.

Investigate policy challenge areas – Objective D

Linked to the river restoration and flood mitigation proposals in the Frome Gateway, we will seek innovative ways to meet the **need for much-needed regeneration of brownfield land in areas with flooding challenges**. We will seek pilots on the Frome catchment that can be applied elsewhere. In particular we are interested in seeking **innovative ways in which to make development safe for its lifetime**. We will therefore investigate the following policy challenge area(s):

- **Adaptive/adaptation pathways approach.** Seeking new ways to incorporate adaptive approaches and resilience measures, we will investigate how development could be enabled to adapt over time (for example in response to new climate projections or behavioural change), and mechanisms to ensure that such an adaptive approach can be monitored and enforced to the satisfaction of regulators e.g. through innovative management plans.

- **Emergency Response.** Linked with the above challenge, ensuring a robust emergency response procedure can be secured that responds to the design needs of a development and our changing climate but also regulators will be explored
- **Water sensitive urban design.** Utilise the Frome Gateway Spatial Framework and YM to demonstrate how SuDS, flood risks, green infrastructure and water management can be embedded within regeneration masterplans, including a Liveable Neighbourhood approach, to ensure realistic delivery

Monitoring and management of local assets – Objective E

The River Frome flows through central Bristol in a network of culverts, some of which date back to the medieval period. The system is crucial for maintaining flow through the city, and is controlled by a number of weirs, overflows, underground trash screens, syphons and interactions with the sewer network. While parts of the system are routinely maintained, there is no established monitoring of the overall asset.

Technology exists (such as Ferrosan, LiDAR and ground penetrating radar techniques) that can provide **in-situ monitoring of reinforced concrete structures**, and implementing such innovative solutions could be an effective way of targeting maintenance interventions in a cost effective, timely manner that **avoid the need for expensive capital repair works**. Having such asset information can also help to better inform regeneration in a dynamic city centre as well as better engage with the local community to reveal the hidden River Frome.

Furthermore, the Frome system interacts with Bristol's Floating Harbour, River Avon New Cut and the public sewer system. The Floating Harbour is a nationally important waterbody and popular tourist destination. It also serves as the home for people that live on boats moored in the harbour, and is a popular culture and leisure facility with many bars, restaurants and nightclubs moored on its water. Unexplained and uncontrollable water level rises in the harbour during periods of high tides when it is not possible to allow water out of the system, are believed to be caused by flow from the river Frome. This can often cause a nuisance, and a more severe increase in levels could put property and lives at risk. This Programme will put in place monitoring in the system at crucial locations to increase our **understanding of the influence of the underground network on the harbour**. This will enable future investment decisions and operating regimes to be taken on a quantified understanding of the system observed through the project, and will increase the resilience of the harbour to water level fluctuations that will deliver significant social and economic benefits to the very popular Floating Harbour area of Bristol city centre.

The draft, high level, **timescales** for our Programme are shown in the below figure and in Appendix A3.

Expression of Interest - Flood and Coastal Resilience Innovation Programme

Workstream	Activity	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
NFM	Surveys/designs/engagement						
	Construction						
Frome Gateway	Investigate Policy						
	NBS Designs/ planning/ engagement/ approvals						
	NBS Construction						
Yate Masterplan	NBS Designs/planning/engagement						
SuDS Retrofit (incl. Liveable Neighbourhoods)	Surveys/designs/engagement						
	Construction						
Engagement	LENS						
	Wider project engagement						
Monitoring	Install monitors						
	Water monitoring						
	Asset monitoring feasibility						
	Asset monitoring installation and operation						

Section C - Project potential and resilience gain

Set out the outcomes of your project.

Explain what difference you expect the proposed resilience actions to make. How will these actions contribute to reducing the likely damage or disruption costs associated with flooding and coastal erosion?

Explain the time over which these improvements will be achieved, and why they are the appropriate actions for addressing the risks and needs identified.

Explain the potential for 'value-added' as a result of the funding, as well as the wider benefits the actions will bring.

This funding will be crucial in enabling all of the organisations and existing partnerships to come together and deliver an ambitious, integrated project that will deliver flood risk benefits that cannot be currently realised or delivered due to a lack of available funding and investment. The **value-added** by delivering the project outcomes below will not only better protect properties and infrastructure but also demonstrate how partners can work together with our communities and wider non-flood risk programmes to deliver actions that help meet the climate and ecological emergencies. This Programme will expand existing networks to drive **support and buy-in from local communities and businesses** to be part of the solution and drive further investment and resilience gain.

Installing nature based solutions

Natural Flood Management

Our proposed NFM measures will include woodland planting, floodplain reconnection, storage and leaky dams to slow the flow, particularly in lower magnitude events. **In addition to reducing flooding to properties**, the measures

will aim to **improve the resilience and reduce disruption of our local highways.**

Through taking a catchment based approach to NFM we aim to also reduce the burden, and increase the resilience of, key assets and infrastructure along the river corridor, such as the NSWI.

We would use the Programme to identify and confirm the specific beneficiaries from the NFM measures. It is accepted that the **delivery of the benefits from these solutions may not be realised within the six year Programme timescale.**

Therefore we propose a **long term and robust monitoring package** (see Section H) that would extend beyond the Programme to capture the benefits.

NBS through Regeneration – Frome Gateway and Yate Masterplan

Our proposals to include river restoration not only increase the **flood resilience** of the Frome but will **deliver multiple benefits** from biodiversity to amenity and recreation. The river restoration scheme will reduce flood risk to approximately **30 existing residential properties in the area.** At the same time, the scheme will enable growth in the area by reducing flood risk and supporting development of this important brownfield site in central Bristol. The **benefits of this scheme to existing properties are expected to be achieved by the end of this Programme,** but the river health and other wider benefits will continue to be released beyond this Programme as the restored habitat establishes.

Integrated water management solutions

SuDS Retrofit and Liveable Neighbourhoods

Our proposals for SuDS retrofit will bring **multiple benefits locally which will be realised immediately** upon completion of each retrofit. Over the life of the Programme and beyond, as individual schemes are delivered, the **cumulative effects of the proposals will start to be realised over a wider area.** Therefore, at this stage it is difficult to estimate the number of properties or infrastructure better protected as a result of the retrofit SuDS but we will seek to **refine and quantify the benefits during completion of the business case and project.** Retrofitting SuDS on a catchment scale will provide:

- Localised reduction in surface water and sewer flood risk and reduced CSO operations
- Improved water quality, biodiversity, abundance of wildlife and habitat connectivity and pollinator corridors
- Street level interventions targeted on the same catchment leading to reduction in peak river flows
- Behavioural change and public health improvements including increased active travel
- Enable growth and integrate flood mitigation and enhanced resilience of brownfield sites and their neighbouring communities

Investigate policy challenge areas

Meeting the policy challenges will help to achieve delivery of key regeneration sites (Frome Gateway and YM) in the short term. **By the end of the Programme**, we expect to secure an approved Spatial Framework and planning permission for some of the sites within the framework areas. However, the **economic growth** to the region enabled by unlocking land for development will **continue for generations to come**. By adopting an adaptive approach will also allow flood risk management costs to be delayed or avoided, **potentially resulting in increased contributions to wider environmental improvements** from costs avoided. We expect such contributions would be added towards the end of the Programme or beyond. **The wider learning and policy benefits from this workstream will also be realised beyond the project timescale.**

Monitoring and management of local assets

By adopting a more robust and in-situ monitoring regime we will improve the long term flood resilience of our urban centres through evidence based investment decisions. It is likely the **benefits of the monitoring would be realised beyond the Programme timescales.**

There is specific **added value** from the proposed monitoring regime through improved understanding of our assets, thus more efficient advice and management of regeneration and **public engagement and support in our activities** through understand the challenges we face.

Section D - Innovation and learning

We want to use the programme to generate evidence about the actual costs and benefits of different resilience actions both individually and in combinations.

Outline your approach to assessing the costs and benefits of your project in both planning and implementation.

Explain what new evidence you believe you would be able to provide over the life of the project and post implementation.

Across all workstreams, we will use a consistent method to **assess costs and benefits**, following the Treasury Green Book approach for consistency with existing programmes. We recognise, however, that it can be difficult to justify the benefits of NBS through traditional funding routes. Therefore, we will work with existing tools such as the CIRIA [B£ST](#) tool or the EA's Natural Account Toolkit to **build evidence of the benefits** of NBS in terms of hydrology and wider benefits. We will use the [Ecosystems Knowledge Network](#) to appraise existing available tools for fitness for purpose, using or amending as required to meet our Programmes' objectives. We will also use a citizen sciences approach to monitor and **evidence engagement with our communities** (see Section H). By its very nature this is innovative territory so further work will be needed to integrate with existing/planned initiatives by BART, Bristol Natural History Consortium, BRERC (Bristol Regional Environmental Records Centre) and any new initiatives which may emerge during the life of the project such as creation of citizen observatories.

Installing Nature Based Solutions

Natural Flood Management

For the NFM proposals (including woodland planting), we will use this programme to **build our evidence of the whole life costs and benefits** of using different species to reduce runoff. We will follow the advice outlined in the EA's [NFM Toolbox document](#) to develop a monitoring strategy for the NFM sites (see Section H). The costs of planning and installing NFM proposals will be relatively easy to assess so our work through this Programme would focus more on **normalising the costs** during and after construction, i.e. accounting for the site-specific actions that may inflate or reduce costs of working in some locations to others. We will do this through robust and consistent reporting of costs.

Integrated water management solutions

SuDS Retrofit and Liveable Neighbourhoods

The Liveable Neighbourhoods approach is being promoted through BCC transport policy teams. It is an **innovative method of delivering against multiple agendas** – from traffic management to climate resilience. It also has community co-design and involvement at its centre. BCC are seeking to develop Liveable Neighbourhoods and natural streets across the city. Therefore, we will use this Programme to develop a pilot Liveable Neighbourhoods scheme, feeding the learning from the pilot into future schemes. The pilot will, through a citizen science approach, appraise the design and construction as well as monitoring (e.g. sewer flow monitoring; traffic, cycling and walking monitoring - see Section H) process to **demonstrate the benefit cost ratio to multiple partners and funding regimes** and therefore increase the deliverability across the city.

Our proposal revolves around the facilitation of NBS to reduce flood risk and climate and ecological challenges, therefore so will our efforts on innovation and learning. Through completion of NBS such as Embleton Road SuDS, Whitehouse Lane cycling improvements and Southmead Regeneration SuDS, we have a reasonable understanding of the cost of designing and constructing SuDS. We will therefore use this fund to gain **whole-life comparison of costs when utilising more innovative solutions** such as pre-cast bio retention pods. We have an opportunity to use the [Wessex Water Market Place](#) to challenge industry to overcome issues or constraints.

Landscape Enterprise Network

The LENs is an innovative, replicable and relatively unique method of driving investment in NBS. Working with our local business community we will **demonstrate the benefits of NBS to their businesses** therefore justifying their investment in NBS to deliver benefits including (but not limited to):

- Reducing flood risk and increasing resilience to their business,
- Improvements to work productivity due to associated mental and physical health benefits,

- Opportunities for up-skilling, apprentices and training leading to higher skilled workforce
- Increased visitors/customer through public realm improvements and associated increases in walking, cycling and dwell time, bringing retail and leisure spending, attracts further investment

The RFR Partnership is well placed to commence a LENS process immediately as we have already started a project scoping exercise.

Investigate policy challenge areas

The Frome Gateway regeneration will require the use of **innovative and community focussed planning and design** to ensure it delivers the Mayor of Bristol's vision for it to be [climate resilient](#), building on learning from the [UK](#) and the [Netherlands](#). Through development of the Frome Gateway Spatial Framework we will work with planning authorities and regulators to devise a masterplanning approach that **includes the community, encourages innovation and is replicable to other areas or sites**.

Replicability

A key aspect of our learning through this Programme would be ensuring the catchment based approach is scalable and replicable across other river corridors and catchments in the two LLFA areas and beyond. For example, the complimentary work on a revised Local Flood Risk Management Strategy and blue-green infrastructure strategy in BCC would significantly benefit from the learning and insights gained from the Programme.

Other learning from this Programme that would be shared:

- Data management – NBS and GI requires good data management, we will build on the data collaboration exercise completed as part of the Blue Green Bristol Feasibility Study to ensure interventions are data led; linking to the West of England Joint GI Strategy (endorsed by Natural England and the EA) and ongoing riparian headwaters storymap
- Use of the Environment Agency Natural Account Tool kit to test suitability to an urban environment and evidence change in value of natural assets.
- Engagement with local communities on monitoring biodiversity- habitats and species building on previous university research (Respire), Citizen Science and City Challenge initiatives.

Section E - Readiness of project partnership

Explain how well established the proposed partnership is, the extent to which relevant partners are committed to supporting this project over the next 5 to 6 years. For example;

Does any partnership governance already exist?

How decisions will be made and disputes managed?

How roles and responsibilities will be agreed?

Is there local community support for the approach?

Expression of Interest - Flood and Coastal Resilience Innovation Programme

If there is not currently support, how do you intend to build this and over what timescales?

Evidence, such as letters of support, should be appended to this expression of interest (EOI).

This Programme proposes to utilise the existing RFR and BACP governance structures to help steer the development of the project through a collaborative approach. The draft governance of the RFR is shown in Appendix A4. As the RFR is a voluntary and advisory group, we will establish formal governance and reporting arrangement that compliments the existing RFR/BACP governance. The formal governance will ensure the decision making, budget management, **all partner roles and responsibilities, delegated authorities, project** reporting etc. is clear and agreed between all parties. We anticipate BCC to be the Lead Partner, with SGC, EA and WW as Associate Partners. We have experience in setting up similar arrangements through the Avonmouth Severnside Ecology Mitigation and Flood Defences Project (between SGC, EA, BCC). Therefore, if we are successful, we anticipate agreeing the governance for this Programme **within three months** of commencement of the business case.

As with all partnership working, the RFR promotes projects through a collaborative approach, which enables any issues to be identified at an early stage. Projects are developed through sharing of relevant data, information and joint decision making at partnership meetings. We would mirror such arrangements for this Programme. The formal project governance will establish a clear and efficient mechanism in the unlikely event of **dispute resolution**.

There is **support for the RFR Partnership** from other organisations (some of which are listed above) as well as the wider community and various friends groups, parish councils or volunteers through the existing connections with organisations such as the Avon Wildlife Trust and the Bristol Avon Rivers Trust. We propose to include officer time of at least 0.5FTE to engage with and further gain support from the community and other organisations.

For delivery of this Programme, we will use a workstream approach, with an allocated workstream lead reporting to an overall Programme Manager (1 FTE, funded by the Programme) who in turn will report through the project governance.

Appendix A5 provides **letters of support** from relevant organisations.

Section F - Readiness of project business case

Explain the current status of your project plans and business case, and set out how you intend to further develop both of these if they need it.

Please note - It is not necessary to demonstrate a high level of readiness for your area to be selected. It is important to identify potential challenges and demonstrate how you and your team have relevant plans and strategies for managing them.

This Programme is proposing to deliver pipeline projects that are identified and

ready to be developed further. Many of these projects have been identified by previous works undertaken by the RFR Partnership (see Section A). The Partnership has developed a [Draft Catchment Plan document](#), the final Catchment Plan (which is in the process of being published) and a Draft Future Funding Needs Report (which is yet to be finalised). The above documents identify:

- Projects across the catchment – these are mapped in the [River Frome Reconnected Storymap](#) and summarised in the Catchment Plan;
- Funding needs for Project Development and Implementation;
- Existing emerging business cases and frameworks, such as the EA's Investment Strategy and Liveable Neighbourhoods which will be using the Treasury Green Book approach, therefore consistent with this Programme
- Spatial Frameworks for Yate and Frome Gateway regeneration sites have commenced.

The above documents will be used as the basis to develop the business case for this Programme along with updating the Terms of Reference agreed by the RFR Partnership. By utilising and developing upon existing arrangements (see Section E) and documents, we would be ready to start immediately.

A business plan will need to be developed for each of the proposed workstreams. We propose that each workstream will have a Project Manager/Lead who will be responsible for that workstream, any challenges and issues which occur throughout these workstreams can be referred through the project governance for discussion and resolution. Examples of challenges and solutions the Bid Project group may face are:

- Business Case approach – as each workstream and the Programme will need a business case written in accordance with the same green book approach so they will have strong links to each other and avoid discrepancies or double counting.
- Current Policy challenges – where innovative approaches may not be automatically approved within current policy the projects may challenge this through the use of Development Frameworks which actively encourage such solutions.

Section G - Capacity for delivery

Explain what existing or potential capacity exists within your partnership to support successful delivery of the project?

What other skills and resources will you use to support the development and delivery of the actions?

If capacity needs to be developed, how will you do this?

Please note - Priority will not necessarily be given to areas that already have higher levels of capacity and resources. It is recognised that some areas may have limited resources – we are looking to ensure plans are proportional to resource availability.

All partners are well placed to commit resources to this Programme, as summarised below:

- We will mirror the RFR Partnership and BACP governance and networks;
- Through these partnerships, we have an excellent coverage of skills from hydrology and flood risk, SuDS, urban drainage, water quality, environmental assessments, economics, community engagement, amongst others;
- We will employ or redistribute a dedicated Programme Manager (1 FTE);
- We will employ or redistribute a dedicated community engagement officer (0.5 FTE);
- We will nominate, employ or redistribute workstream leaders;
- All partners have identified the Frome as a priority catchment and have existing resource allocated towards key projects (e.g. Frome Gateway, YM, Liveable Neighbourhoods), with the commitment to provide additional resource if we are successful;
- We have a number of procurement routes to market available, including:
 - EA CDF – Atkins have been appointed to complete the EA’s Investment Strategy
 - Strategic Partner collaboration between BCC and Arcadis consultants (supported by Arup and Mott MacDonald), which is in place to facilitate delivery of large projects
 - West of England Combined Authority Professional Services Framework
 - Existing/continued construction frameworks e.g. highways maintenance and construction frameworks (currently delivering NBS)
 - Hydrological monitoring contract due to go to tender soon to maintain existing monitors and install and maintain new hardware
- BCC and SGC have internal Direct Labour (e.g. parks or highways)
- Utilise placements (BCC currently employs undergraduate placements), apprenticeships (e.g. using the Kickstart programme) or others to provide opportunities for young people;
- Development of collaborative surface water and sewer flood alleviation schemes for inclusion in Wessex Water’s Drainage and Wastewater Management Plan
- BCC and SGC utilise a business plan approach to managing resources in financial year, we would ensure sufficient staff time is dedicated
- Utilise other delivery partners capacity such as FWAG, BART, Avon Wildlife Trust

Section H - Monitoring, evaluation and dissemination

Explain how you intend to:

- monitor progress
- capture evidence about the costs and benefits of the resilience actions
- identify and share learning from your project

Across all workstreams, we will monitor progress against the Programme objectives via the specific project governance.

We will use community-based monitoring and [citizen science](#) to engage local communities in our whole river corridor approach. We’ll be guided by projects such as [RESPIRES](#) (BCC are steering group members) and [PARCOS](#) which proposes the use a six-step methodology the ‘Bristol approach for Citizen Science’. We’ll explore using engagement techniques such as participatory GIS, GIS story maps,

undertaking workshops on values and perceptions of urban blue spaces including benefits of interventions, using citizen science tools for ecological monitoring, and **routes for involving local volunteers** in physical monitoring of the river system. These techniques will also allow us to track progress against key workstreams such as SuDS retrofit (e.g. uptake of property-level SuDS).

Given the partnerships that would be involved in this project (RFR, BACP, WENP etc.) and therefore organisations that recognise the Frome as a priority catchment, we are well placed to ensure the **learning from the project** reaches a wide audience. The ambitious community engagement activities (e.g. LENS and Liveable Neighbourhoods) proposed would ensure learning of the benefits of NBS and NFM would reach our communities. The primary RMAs involved in the project (WW, BCC, SGC, EA) are all producing, monitoring or renewing strategic plans (e.g. Local FRMS, Investment Strategies and Drainage and Wastewater Management Plans, One Climate Strategy, Ecological Emergency Strategy). Therefore the learning from this Programme would directly influence these strategies and plans. In addition, Bristol is a well-connected city, internationally recognised as a leader in environmental innovation. Therefore, through partnerships like the Green Capital Partnership and the UK Core Cities, we have networks and platforms available to **share the learning from this Programme internationally**.

In addition to the above cross-workstream monitoring, we propose the following workstream-specific monitoring.

Installing Nature Based Solutions

Natural Flood Management

We will build on work undertaken by FWAG and implement a 'before and after' **monitoring regime** at each of our NFM sites. We would ensure installation of monitors would be an early activity to ensure we monitor baseline ('before') characteristics. The techniques we utilise will be as consistent as possible between the sites whilst balancing any site-specific requirements. We will use a mix of techniques such as:

- Fixed point photography (e.g. time lapse) to monitor growth and change
- Topographical surveys to monitor physical channel form change
- Monitor water levels and flows using water level loggers
- Bed and substrate particle size sampling
- Habitat assessment - River Habitat Survey, invertebrate sampling, etc.

In addition to monitoring the physical characteristics of the NFM sites, we will also **monitor the potential community benefits** of NFM through:

- Monitor 'before and after' structural maintenance costs, especially emergency clearances, resulting from reduced sediment and debris entering the system.
- Citizen sciences approach to monitoring the positive impact of NFM on flood risk assets and community resilience – for example trash screen blockages to perception of reduced flood risk and an increase in volunteers or community engagement

Integrated Water Management Solutions

SuDS Retrofit and Liveable Neighbourhoods

As with the NFM monitoring, we will focus on monitoring the ‘before and after’ impact of SuDS on water flows, water quality and pollutants through expansion of BCC’s recently commenced [SmartWater](#) highway gully monitoring system as well as installation of surface water sewer flow monitoring. The data collected will be fed into the benefits assessments (see Section D). The Liveable Neighbourhoods pilot will utilise a citizen sciences approach to monitor and evaluate the impacts of the scheme on **wider benefits such as traffic calming, active travel and community cohesion.**

Landscape Enterprise Network

The LENs process is **specifically designed to monitor and evaluate** commitment and interest from the **business community** and develop appropriate monitoring with them to monitor progress against the key outcomes (see Section D).

Monitoring and Management of Local Assets

The purpose of this workstream would be to investigate methods of monitoring our key assets. However, we have a number of potential options and technologies to use. As founding partners of the FORT reporting tool, we could add a module to this. Our recent large scale Floating Harbour Asset Inspection project utilised a web based mapping tool developed by Mott MacDonald consultants (who are part of our Strategic Partner team, see Section G) which we could replicate.

Section I. Cost estimate and other sources of funding

Cost estimate

Complete the cost estimate table below. We are not expecting a fully costed proposal, only a high level cost estimate. Figures should be rounded to the nearest thousand pounds unless otherwise stated.

Costs per year (£ thousands)	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	TOTAL (£ thousands)
Staff costs	0	50	50	50	50	50	250
External Consultant costs	60	216	216	216	108	108	925
Surveys, land, construction, materials and delivery costs of resilience actions	30	30	444	444	444	1500	2891
Risk contingency	12	28	110	110	100	311	671

Expression of Interest - Flood and Coastal Resilience Innovation Programme

Future maintenance costs	-	-	-	3	3	3	8
Future Capital replacement costs	-	-	-	-	-	-	0
Project Total Whole Life Costs	102	324	820	823	704	1971	4745

Provide an indication of further work you will do in the development phase to improve this cost estimate. State what resources you will use to maintain the actions after the 6 year funding period.

Many of our NFM proposals have already been costed at a high level so we will continue to develop these in collaboration with landowners and FWAG through the design process. We will continue with prioritisation and feasibility surveys, including installing monitors, services searches etc. to refine locations for retrofit SuDS schemes before we commence with the design process. To achieve this, we will require a mix of internal officer time, external design consultants, community engagement officers and early supplier engagement. The first two years on the Programme will be largely design and consultation. As the Programme progresses from year two, we will be constructing and installing interventions as well as continuing to design more. Therefore we will be utilising suppliers, site supervisors and contract managers from this phase of the Programme. From year four, we expect the design aspect to reduce but construction increase, and our resource requirement will mirror this change.

The effort required, and therefore resource allocation, for engagement (including LENS), monitoring and project management is likely to remain relatively consistent throughout the Programme.

Optimism bias and inflation

Please complete the optimism bias and inflation table. We suggest that for most actions authorities should use an optimism bias of 40%. For those actions which have a particularly high degree of innovation in construction/delivery, please use an optimism bias of 60%.

Please refer to the Green Book guidance for further information on optimism bias. We expect that the level of optimism bias will be reduced in future development phases.

Percentage per year	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	TOTAL (£ thousands)
Optimism Bias	36	119	284	285	242	664	1630
Inflation rate	0	6	15	15	13	35	85

Other sources of funding

Expression of Interest - Flood and Coastal Resilience Innovation Programme

Complete the other sources of funding table. Figures should be rounded to the nearest thousand pounds unless otherwise stated.

Income per year (£ thousands)	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	TOTAL (£ thousands)
Resilience Fund	138	448	1119	1123	958	2671	6460
Contributions	200	275	35	100	200	40	850
Total Income	538	998	1189	1323	1358	2751	7310
Variance between expenditure and income	NA	NA	NA	NA	NA	NA	NA

We are particularly interested in projects which seek to develop innovative and/or commercial funding sources.

What other sources of funding (or in-kind contributions) will contribute to this project?

How will the other sources of funding link together with the programme funding?

Has other funding already been secured?

If other funding has not been secured, how likely is it to happen and when will you know?

We have **secured contributions** from SGC (through the YM and their Climate Emergency fund), BCC (through the Frome Gateway project) and included these in the above table.

In addition, **BCC will commit** to at least £40k p/a from 2022/23 onwards which will go towards future maintenance costs (and therefore haven't been included in the above table).

WW have identified **potential contributions** (if our bid is successful) through partnership contributions towards the development and construction of SuDS retrofit projects where there would be a reduction in flow to public sewers. If we are successful, WW will also consider developing a parallel bid for the OFWAT Innovation Resilience Fund.

The purpose of our proposed LENS process is to **leverage funding from private sources** (businesses) so we fully expect including such contributions during completion of the project.

Data protection

We are the Environment Agency and we run the Flood and Coastal Resilience Innovation Programme. We are the data controller for this service. A data controller determines how and why personal data (personal information) is processed. Our personal information charter (www.gov.uk/government/organisations/environment-agency/about/personal-information)

Expression of Interest - Flood and Coastal Resilience Innovation Programme

[charter](#)) explains how we deal with your personal information. Go to GOV.UK and search 'Environment Agency personal information charter'.

The personal data we collect about you includes:

- Full name
- Organisation
- Work email address
- Work phone number

We are allowed to process your personal data because it is needed to be able to manage this programme. By completing this Expression of Interest form and the signed and dated declaration below, you consent to us doing so. We will keep your details until the project is closed or until you withdraw your consent.

Declaration

I provide my consent for my data to be held and processed by the Environment Agency for the purposes Flood and Coastal Resilience Innovation Programme only.

Signature

Date