

Low Crosby Flood Risk Management Scheme Engagement Pack

Low Crosby has suffered from several flooding events, including Storm Desmond in 2015. As a result, the Environment Agency have been looking at options to address this risk of flooding. We have undertaken an assessment of various options and this engagement pack presents the outcome of this assessment alongside a general project update. This pack will look to explain why the embankment re-profile at Warwick Holme has been selected to be the chosen flood risk management option.

We are continuing to work under extraordinary circumstances during the COVID-19 pandemic. Our key priorities are: to protect the Health, Safety and Wellbeing of our staff, public, businesses, and partners we work with. For this reason, and in line with Government guidelines, we are not consulting or engaging face-to-face until it is safe to do so, instead we have included all the relevant information in this engagement pack.

Background

The village of Low Crosby is subject to flood risk, primarily from the River Eden, and it has suffered flooding on multiple occasions historically. The village has flooded due to high flows in the River Eden in January 2005, November 2009, December 2015 and most recently, February 2020. The flood map below and the accompanying aerial photo, show the extent of flooding caused by Storm Desmond. The last (Eastern) defence scheme for the Village was developed in 2009 and was in response to the 2005 flooding. At the time it was stated that a whole village scheme did not generate a cost benefit analysis strong enough, for the whole village, using the funding criteria.

High water levels in the River Eden during an extreme storm event causes an additional issue in that it stops the Willow Beck from discharging flows into the River Eden and therefore, causes increased water levels in the beck.

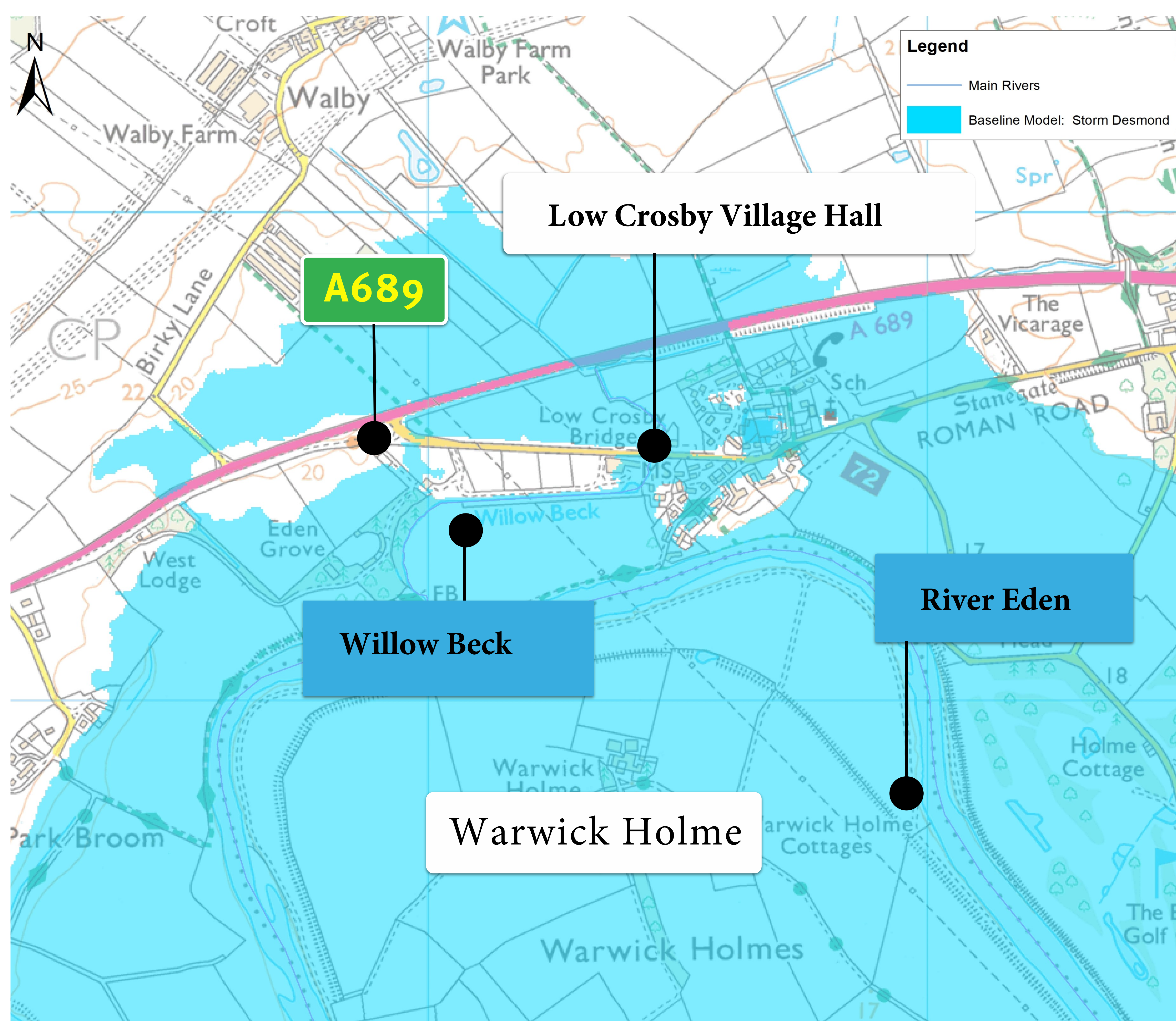


Fig. 1: Storm Desmond (2015) flood extent.

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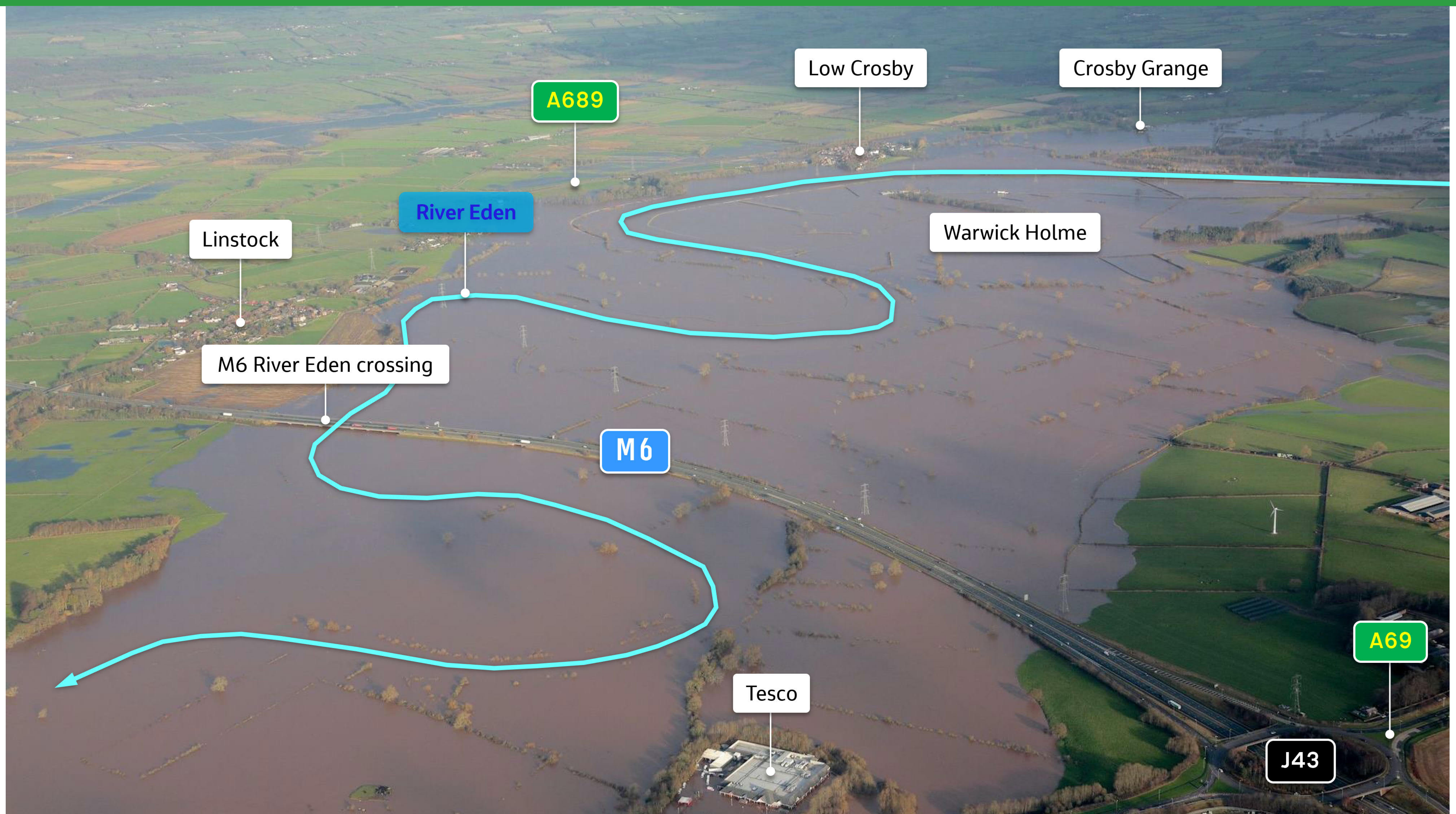


Fig. 2: Aerial photograph of the Storm Desmond flood extents with key locations highlighted.

How Can we tackle this flooding problem?

Following Storm Desmond, we have been working with our consultants and the Flood Action Group to identify and appraise flood risk management solutions. The first step of this process was to identify a long list of options which would reduce flood risk in Low Crosby. The outcome of this process was a shortlist that comprised three options.

Option 1 - Small Improvements

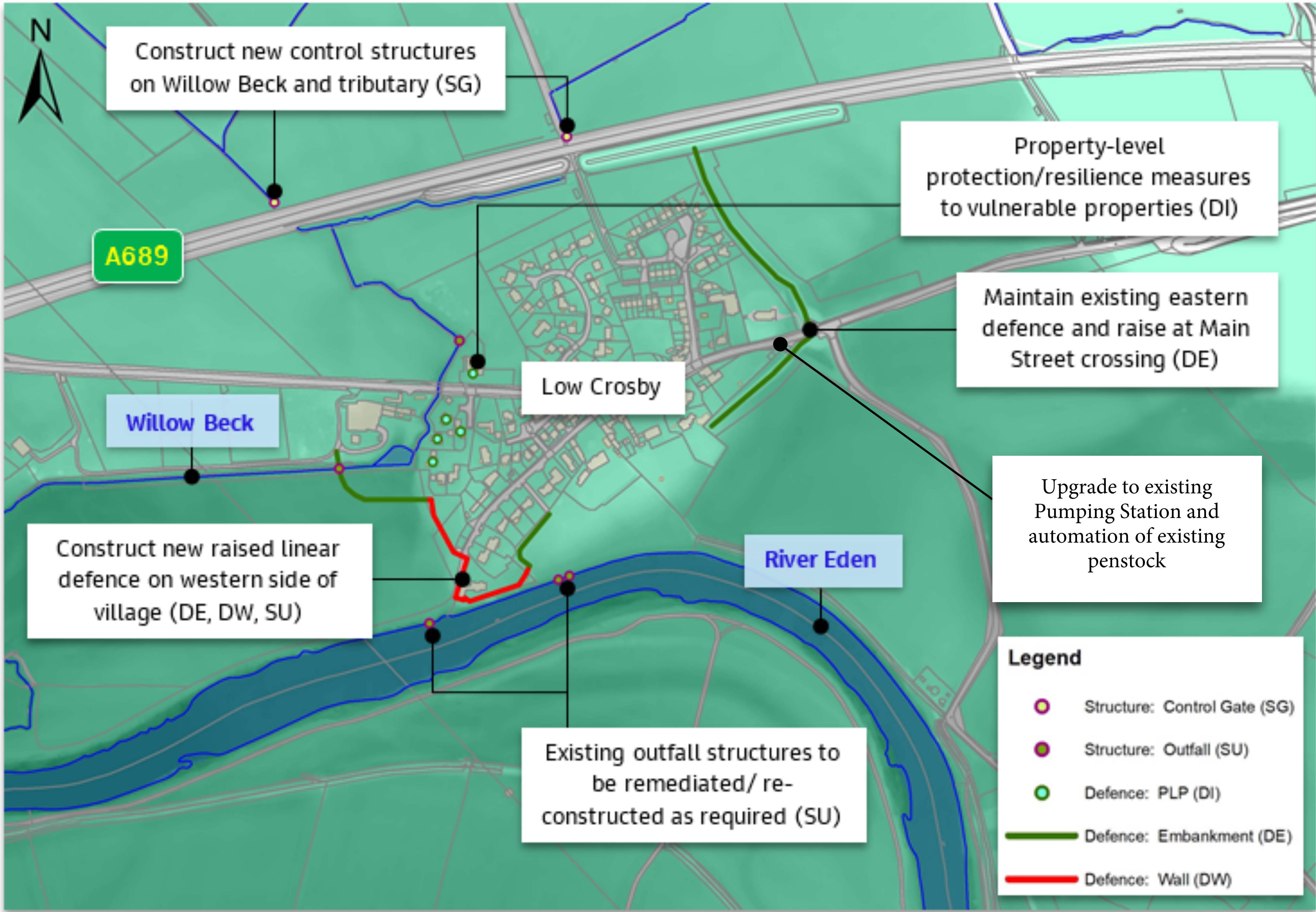
This option aims to deliver small scale interventions within Low Crosby to target known vulnerable areas. This includes drainage network repairs, pumping station upgrades and installation of non-return valves at key locations to stop river water entering the drainage network. We have obtained approval to progress these advanced works and they are programmed for delivery this year and updates will be given via our six weekly newsletters. The intention is to deliver these works as soon as possible. These improvements will take place in addition to either option 2 or option 3.

Option 2 - The Village Defence Scheme

This option would see a raised linear defence constructed around the western side of the village. This has the aim of preventing back-flow from the River Eden up the channel of the Willow Beck, which acts as a pathway for floodwater to enter properties on Primrose Bank and the Low Crosby Village Hall. The proposed defence would be a continuation of the existing eastern village defence. We expect additional control structures would need to be installed on Willow Beck and a small tributary upstream of the A689 in order to manage flood risk from this source. Please refer to Fig. 3.

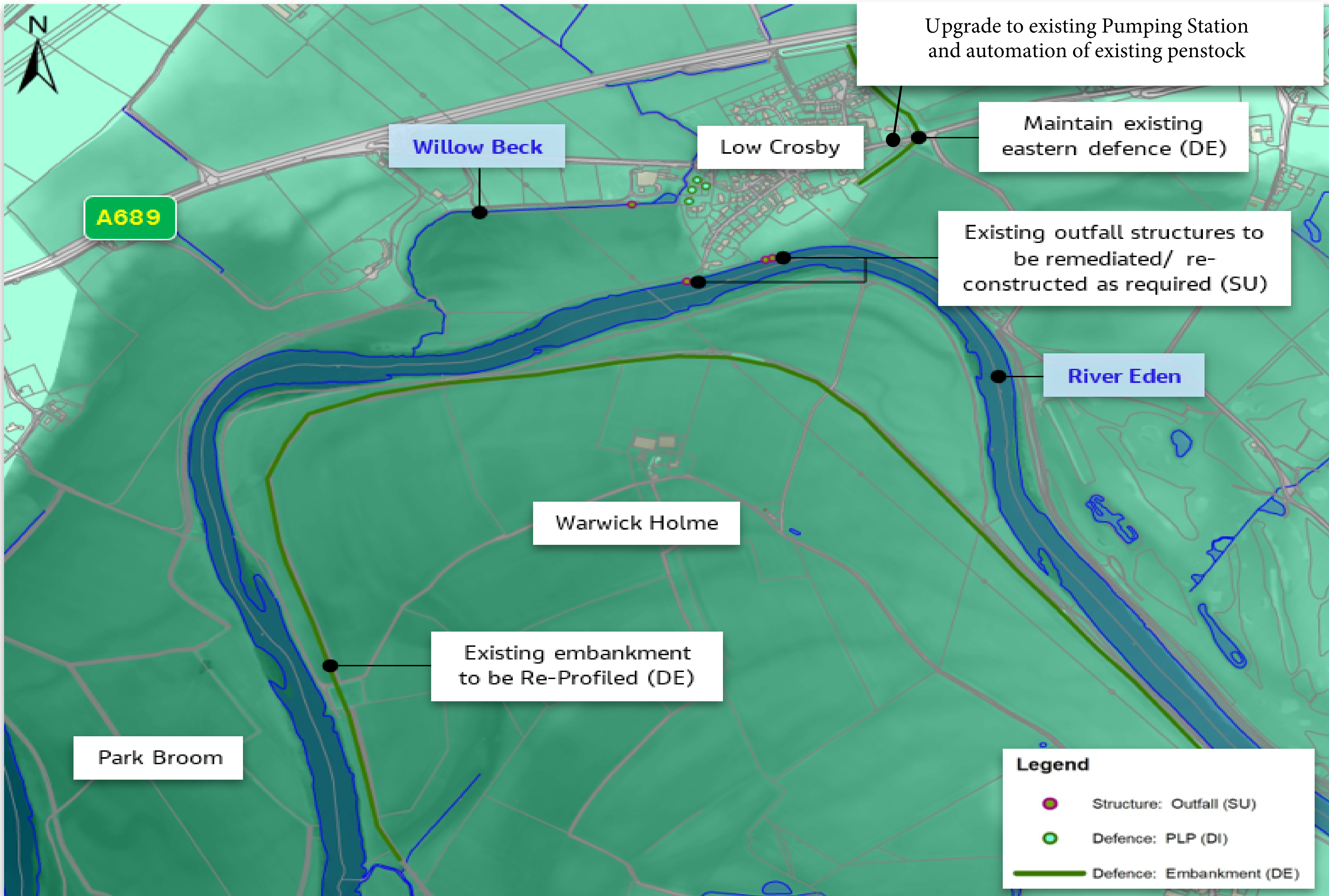
Option 3 - Warwick Holme

This option focuses on the re-profiling (please see indicative cross section) of an existing 3km embankment on the opposite bank of the River Eden to Low Crosby, at Warwick Holme. This involves lowering existing flood embankments at Warwick Holme by spreading the material over a determined width and depth. This allows the water to flow across the farmland on the river's natural flood plain, which will reduce the water levels on the River Eden at times of flood and will significantly reduce the risk of flooding to homes in Low Crosby. We have now entered into the Detailed Design phase in order to establish the most effective way to achieve the objective of lowering water levels by allowing flow onto the newly connected flood plain. Please refer to Fig. 4



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Fig. 3: Option 2 - The Village Defence



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Fig. 4: Option 3 - Warwick Holme Embankment Re-Profile

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Shortlist Options Assessment

Having identified the options shortlist, the project team have undertaken an assessment to identify the preferred way forward. This assessment and the criteria used to undertake this assessment (which consider national strategic Environment Agency objectives) are presented in the table below.

During the assessment process the Environment Agency have liaised closely with our partners, the local Flood Action Group and other members of the community for their welcomed suggestions and input.

Table 1: Shortlist options assessment.

Criteria / Objective	Outcome(s)	Village Defence	Warwick Holme Embankment Re-profile
Deliver key flood risk management outcomes	Flood damages are avoided over the investment period.		
	Reduced flood risk to ~100 residential properties. Resilient to future impacts of climate change and reduce flood risk to local business premises where appropriate.	Protection up to a 1 in 75 return period storm event based on current data. Refer to Appendix A for an illustration.	Protection up to a 1 in 200 return period storm event based on current data. Refer to Appendix A for an illustration.
	The long-term resilience of critical infrastructure to flooding is not adversely affected and improved where possible.	Road and utilities infrastructure better protected.	Road and utilities infrastructure better protected.

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Criteria / Objective	Outcome(s)	Village Defence	Warwick Holme Embankment Re-profile
Protect and enhance the environment	The natural environment is protected and conserved or restored.	No quantifiable improvement.	~180 hectares floodplain restored. Over 100% biodiversity net gain.
	Water Framework Directive objectives for relevant waterbodies are achieved (full or in part).	Detriment to Willow Beck would require mitigation.	3km of river improved.
	Scheme compliments the natural landscape and enhances it where possible.	New defences designed to complement landscape.	Natural landscape restored. Reinstate natural processes and facilitate land management change. Collaboration enabled between DEFRA organisations, such as Natural England.
Promote health and wellbeing	Positive impact on the mental health and well-being of residents due to reduced flood risk.	In comparison with the Warwick Holme Scheme, this option would provide some reassurance to residents albeit some flood risk would remain.	Due to the considerable reduction in flood risk, this option would significantly reduce any anxiety and provide a positive impact on mental health.

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Criteria / Objective	Outcome(s)	Village Defence	Warwick Holme Embankment Re-profile
Delivery	Alleviating flood risk in a timely manner.	This option would have to be progressed through detailed design followed by a planning application and a potential Environmental Impact Assessment. This could take up to 24 months before construction is started.	In comparison with the Village Defence Scheme, the detailed design for this option could be undertaken within a shorter duration and we could potentially progress this option via our permitted development rights. Therefore, a planning application may not be required.
Implement a sustainable low carbon solution	The solution balances social, environmental and economic factors over the long term.	Partial alignment to key global, national and local business strategies.	Strong alignment to key global, national and local business strategies.
	Minimise emissions of climate change gases throughout the whole life of the scheme, including the reduction of the carbon footprint associated with flood recovery and property repair.	4,534 CO2e calculated embodied whole-life carbon.	1,186 CO2e calculated embodied whole-life carbon, as modeled by the removal of the Warwick Holme embankment. This is likely to be improved by the re-profiling of the embankment.

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Understanding the Standard of Protection

The probability that events such as floods or storms will occur is often expressed as a return period. The longer the return period, the more infrequent the flood event will be. The most extreme events, for example, the 1 in 100 year, occur infrequently, i.e. have a 1% chance of occurring in any given year.

A 1 in 100 year Standard of Protection does not mean that a property is protected for the next 100 years. It means (based on current data) that the property is protected up to the worst storm that could happen within a 100 year timeframe.

Currently, the Standard of Protection communicated within this engagement pack does not include uncertainty. However, we will update the community once this assessment has been completed.

All Standard of Protection communicated within this engagement pack are estimates for the present day. Climate change impacts may reduce the Standard of Protection throughout time.

How to visually assess the impact of each option on your property

The engagement website includes the following flood visualisation animations:

- The present day flood risk extent if a storm similar to Storm Desmond occurred in Low Crosby.
- The present day flood risk extent if a 1 in 75 year storm event occurred in Low Crosby.
- The impact of a storm of similar to Storm Desmond if Option 2 was implemented (i.e. the village defence scheme).
- The impact if a 1 in 75 year storm event occurred if Option 2 was implemented.
- The impact of a storm similar to Storm Desmond if Option 3 was implemented (i.e. Re-profile of the Warwick Holme embankment).
- The impact if a 1 in 75 year storm event occurred if Option 3 was implemented (i.e. Re-profile of the Warwick Holme embankment).

We have also uploaded section drawings showing the difference in flood levels if Option 2 or Option 3 was implemented. These drawings focus on the area of Primrose Bank because this area has the lowest land level and is susceptible to flood risk.

Modelling Disclaimer

It should be noted that hydraulic models are mathematical tools used to represent the complex behaviour of river and floodplain flows. The mathematics that underpin how a hydraulic model represents river flows is based on various, well-tested theories that can normally be relied on to approximate reality. However, this does require judgement by the modeller on how best to build a model of a specific river and for a particular purpose.

As a result, various assumptions, approximations and simplifications have to be made to balance accuracy with practicality. It must, therefore, be recognised that while a hydraulic model is always developed using the best available real world flood data, it will never be able to perfectly replicate a real incident. Therefore, it should be used as a guide for decision making only.

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Summary and outcome of the short-list assessment

Following completion of the options appraisal against the project objectives and criteria, the preferred way to reduce flood risk in the village of Low Crosby is to progress with Option 3 (i.e. re-profile the Warwick Holme embankment in order to reconnect a floodplain). As demonstrated within Table 1, this option provides numerous benefits in comparison with Option 2 (i.e. the Village Defence scheme). This option delivers multiple benefits as follows:

- It achieves the primary objective outcome with respect to flood risk management; delivering a 1 in 200 year Standard of Protection and reduced flood risk to about 100 residential properties, critical infrastructure and local businesses.
- Through collaborative working with landowners, it offers a unique opportunity to create ~180 Hectares of floodplain, providing protection and substantial environmental enhancement.
- It is the lowest carbon option.
- Offers a long term solution to the residents of Low Crosby. The long term management of the option will be addressed via agreement with the landowner.

Please note: The FLAG's position has always been clear that their support is for a scheme that offers all properties in the village protection against a Storm Desmond event. In the event that Option 3 cannot be delivered for whatever reason, in order to secure FLAG support for Option 2, FLAG would seek reassurance/confirmation, through the detailed design process, that the Storm Desmond standard of protection is being achieved.

National Drive for Floodplain Management

Historically, many engineering solutions have been addressed to create flood protection for communities, including hard defences, dredging, river straightening and others. These have benefitted many communities but can, in some instances, serve to increase the flow of water downstream. Latterly natural flood management has looked at a number of measures such as: to create river meanders where flow can return to its natural state and spill out onto flood plains when the channel has exceeded its capacity, thus reducing the flood risk downstream.

Addressing the situation at Low Crosby, this environment creates the perfect opportunity to use the course of the river to allow this above situation to happen naturally. This allows for a process of water to dissipate energy by the slowing of water, it widens the cross sectional area channel to not only include the river but also the flood plain thus reducing the flood level. Importantly, it creates areas rich in biodiversity and can store carbon. The reconnection of floodplains also has further benefits in that unlike hard defences, less maintenance is required, which in turn reduces the carbon footprint of the scheme. In order to secure the long term flood risk management benefits the Environment Agency will need to develop an agreement with the landowner committing them to the necessary maintenance regime and preserving the required ground levels. This proposal will allow for the Environment Agency to stick to its core principles of creating better places for people and wildlife.

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Frequently Asked Questions

Is there enough funding to deliver a scheme?

The preferred option currently attracts approximately £5 million of funding. This includes £250k of Department for Education Funding and £2.7 million of Government Grant in Aid Booster funding.

Although this option is the most economical, there remains a funding gap of £2 million. We have applied for additional funding from various sources and are confident this funding gap will be closed shortly.

Where are we currently in the scheme delivery programme?

In order to develop the recently identified preferred option in more detail, we require the approval of our Outline Business Case from the EA's Assurance Board. This document summarises our optioneering and appraisal assessments to date. Once approval has been sought, we would be looking to start the detailed design of the preferred option.

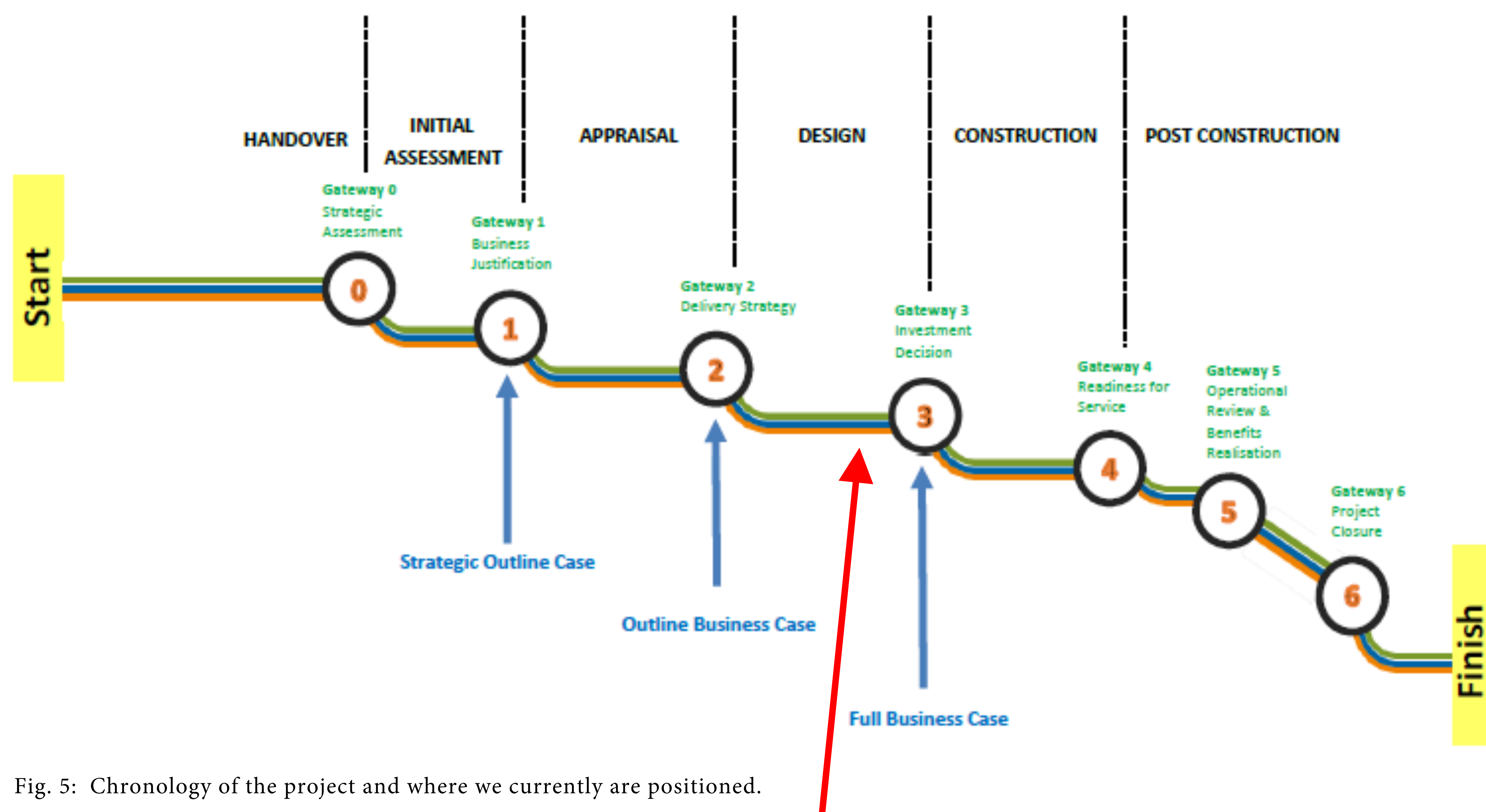


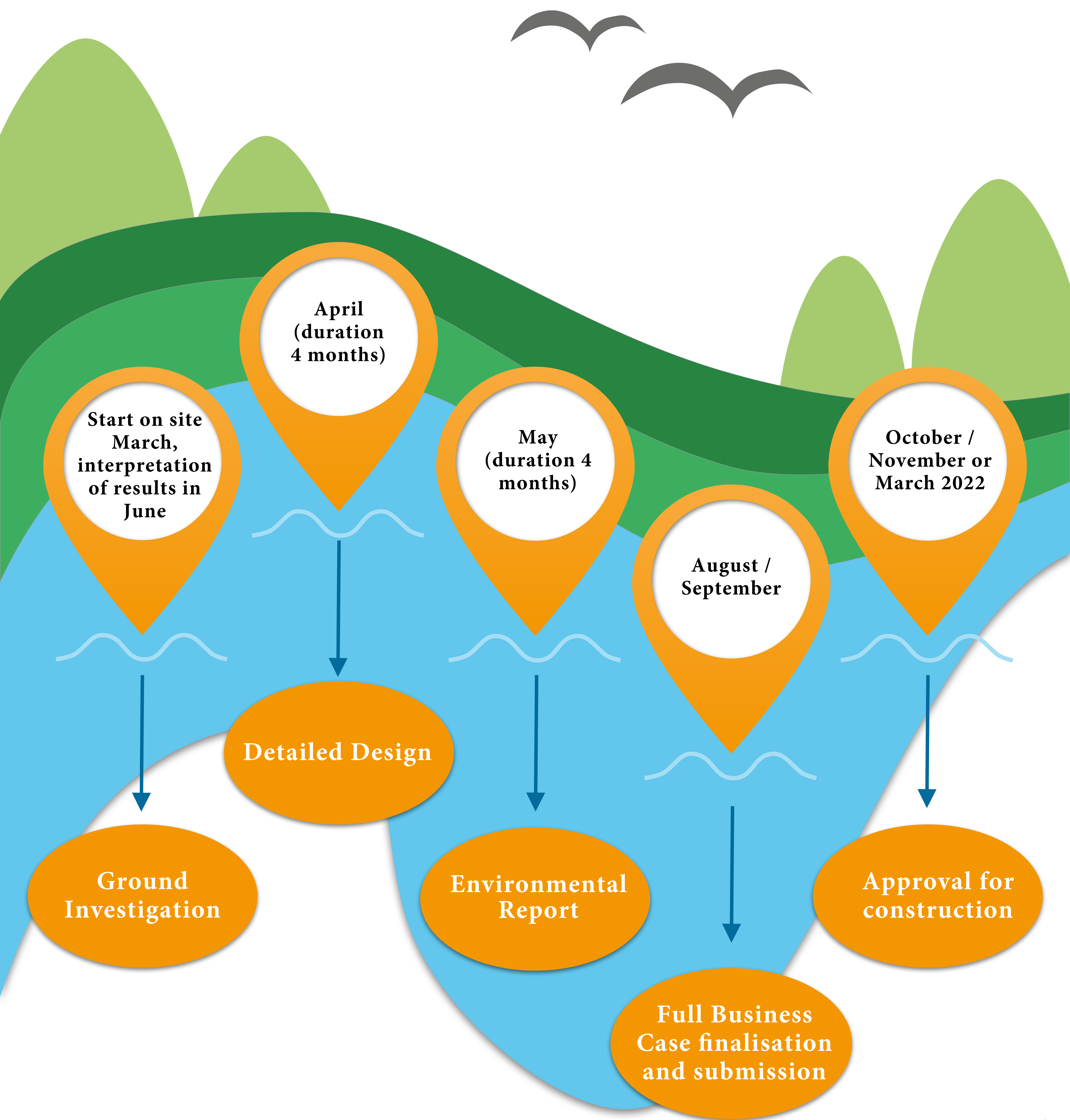
Fig. 5: Chronology of the project and where we currently are positioned.

We are here

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How long will it take to reach Gateway 3 (Approval for Construction) for the Warwick Holme embankment re-profile?

The following timeline is a current best estimate. It should be noted that there are a number of programme uncertainties which are explained in the next section.



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It should be noted that the above timescales are specifically associated with the re-profile of the embankment – with the works undertaken via our Permitted Development Rights, which removes the need for planning. If our scope of works is increased or amended (i.e. the Environment Agency are required to undertake further works at Warwick Holme), Planning may be required and this could increase the programme by approximately 6 months.

Why has this project taken so long?

A requirement of the options appraisal process is to investigate as many options as possible, including various standards of protection, so we can determine the option which provides the tax-payer the best value for money. This is known as the nationally preferred option.

In order to determine this, we are required to develop hydraulic models and undertake various simulations so we can then undertake further engineering, environmental and economic assessments.

The time required to undertake this process depends on the state of the model and supporting data at the start of the project.

Further information can be found in the accompanying covering letter.

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Are there any other factors that could affect the scheme programme?

Due to the nature of this project, there are a number of programme uncertainties:

- The River Eden is a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC). There are planning related risks associated with a SSSI and SAC being within the vicinity of the scheme, which inevitably could result in delays. However, we feel that there is low likelihood of the Local Planning Authority and stakeholders requiring an Environmental Impact Assessment or Habitats Regulations Assessment. There may also be Heritage related constraints.
- Outside of the delivery programme, we are yet to conclude negotiations with landowners and stakeholders.
- Due to the nature of the area where works are proposed, earthwork during the winter may be too difficult. The main works may have to be postponed to Spring 2022, with breaches potentially in place prior to the end of the calendar year. This will help mobilise the floodplain and start to introduce some flood risk benefits.
- As previously mentioned, our current programme is based on the scope of works comprising the re-profiling of the Warwick Holme embankment only. If the scope of works was to change through the stakeholder agreement process (or by any unforeseen risks being realised), planning permission may well be required.

Why do the drawings on the engagement webpage focus around Primrose Bank?

Our drawings, which we have shared on the engagement webpage focus on 1 Primrose Bank because it is the lowest point on the western side of the village. However, we acknowledge that there are areas of the village which have flooded more than the depth experienced at 1 Primrose Bank.

The Warwick Holme embankment re-profile option will prevent water entering the village from both the western and eastern flood routes for all events up to the design standard. Therefore, no flooding should be observed as a cause of the high levels within the River Eden.

By developing additional resilience measures (i.e. Option 1 – Advanced Works Package) we will also be helping to reduce the issues around the performance of the local drainage system that the village has historically observed.

What about the flood risk from the Willow Beck?

The water level in Willow Beck during big floods like Storm Desmond is driven by the water level on the River Eden. Water seen to the north of A689 and around the Parish Hall is essentially water from the River Eden that has flown the 'wrong' way up Willow Beck and spread out until it has reached the level of the River Eden. There will be some water from Willow Beck itself but the main driver for the flood levels and extents is the River Eden.

By delivering a scheme which lowers the levels in the River Eden, it will prevent the Willow Beck from river-locking and will enable the Beck to discharge flows into the River Eden during extreme events. This will therefore reduce flood risk to properties from the Willow Beck.

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How are the Advanced Works (i.e. Option 1) progressing?

We have identified a number of additional resilience measures to reduce flood risk caused by surface water drainage issues, which include:

Existing Cumbria County Council Pumping Station

Closing the penstock during high river levels causes the pumps to lift detritus that comes into the system from the gullies and ditches. This causes problems with running of the pumps. In addition, closing the penstock causes the village system to backfill to a level that causes concerns to residents who have French drain runs overflowing into gardens behind the existing Environment Agency flood defences.

In order to solve these issues, we are moving forward with changing the pumping station so it can cope with detritus and with a new sump, it can prevent the existing system backfilling and overflowing into the surrounding area before the pumps are triggered.

We are currently obtaining quotes to undertake the design of these works. This will be subsequently followed by construction / installation. Ownership, operation and maintenance will remain with Cumbria County Council.

Highways drainage network and United Utilities (UU) network

We have recently undertaken a CCTV survey of the United Utilities network and have observed no issues.

However, there may be manholes which are susceptible to river water inundation during extreme events. We have discussed with UU about how to seal these manholes covers.

We have identified issues in the highways drainage network that are currently being rectified. This includes the installation of a flap valve on the outfall to the River Eden from Green Lane, and works to improve the performance of the existing Cumbria County Council pumping station on the eastern side of the village.

Parish Hall

Our Consultants have recently undertaken a survey of the Parish Hall and have identified a number of areas where there are vulnerabilities to flooding. The survey identified 14 options to remove such vulnerabilities and provide protection for up to 600mm of flood depth. Options include flood boards, re-pointing, sealing of vulnerable points and the fitting of non-return valves. We have appointed a contractor to undertake the supply and installation and work will commence this summer.

Summary

Thank you for taking the time to read this pack. We hope you now have a clear understanding of the proposal for the village's Flood Risk Management Scheme. We would love to hear your feedback on the proposal and ask, if you can, to visit the Flood Hub website, where you can see the visualisations and leave your responses.

We would also like to take this opportunity to thank the Flood Action Group for their continued support during the appraisal and for reviewing this engagement pack before its wider distribution to the community.

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Appendix A

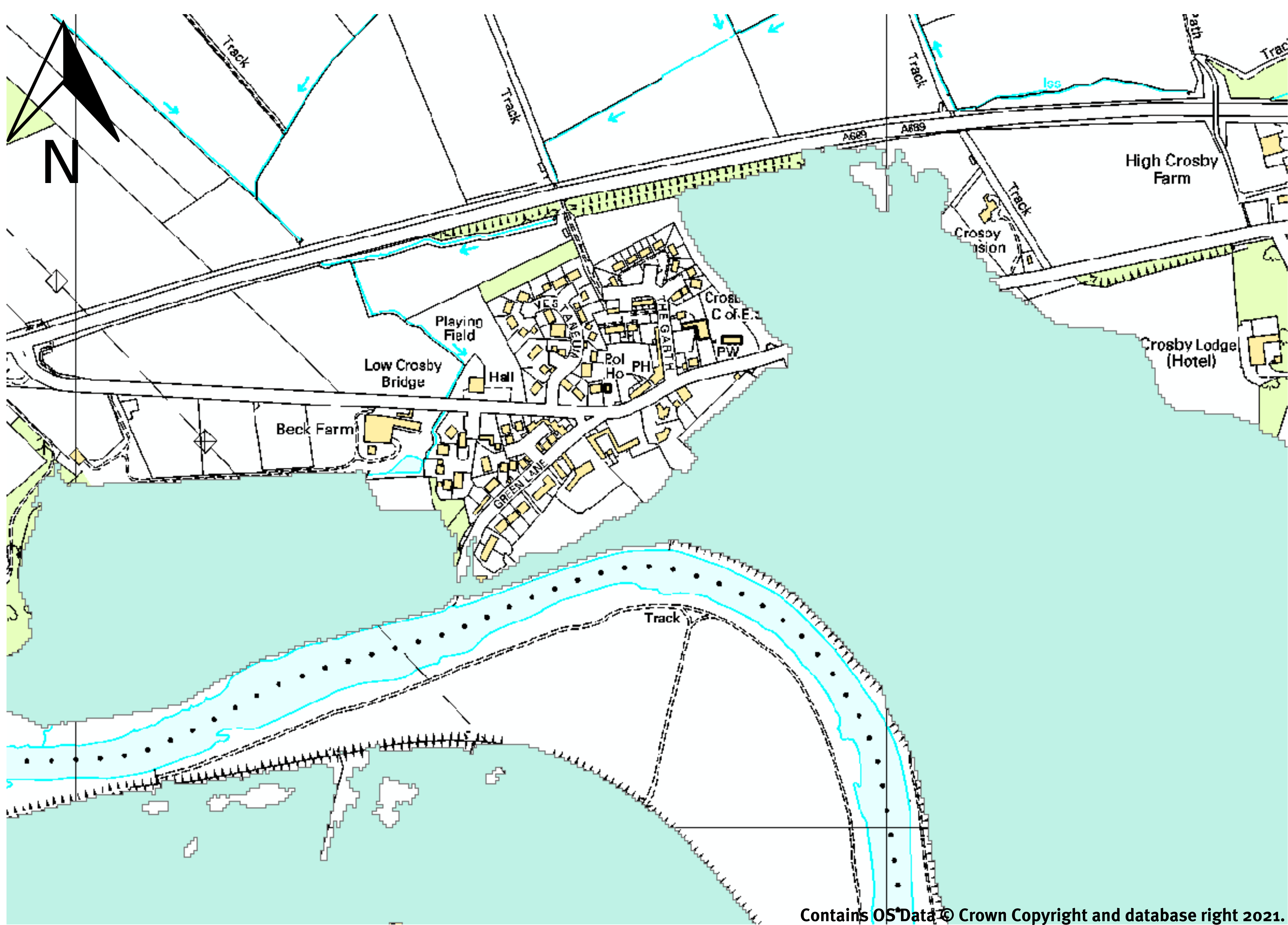


Fig. 6: Flood outline for Village Defence for a present day 1 in 75 return period.

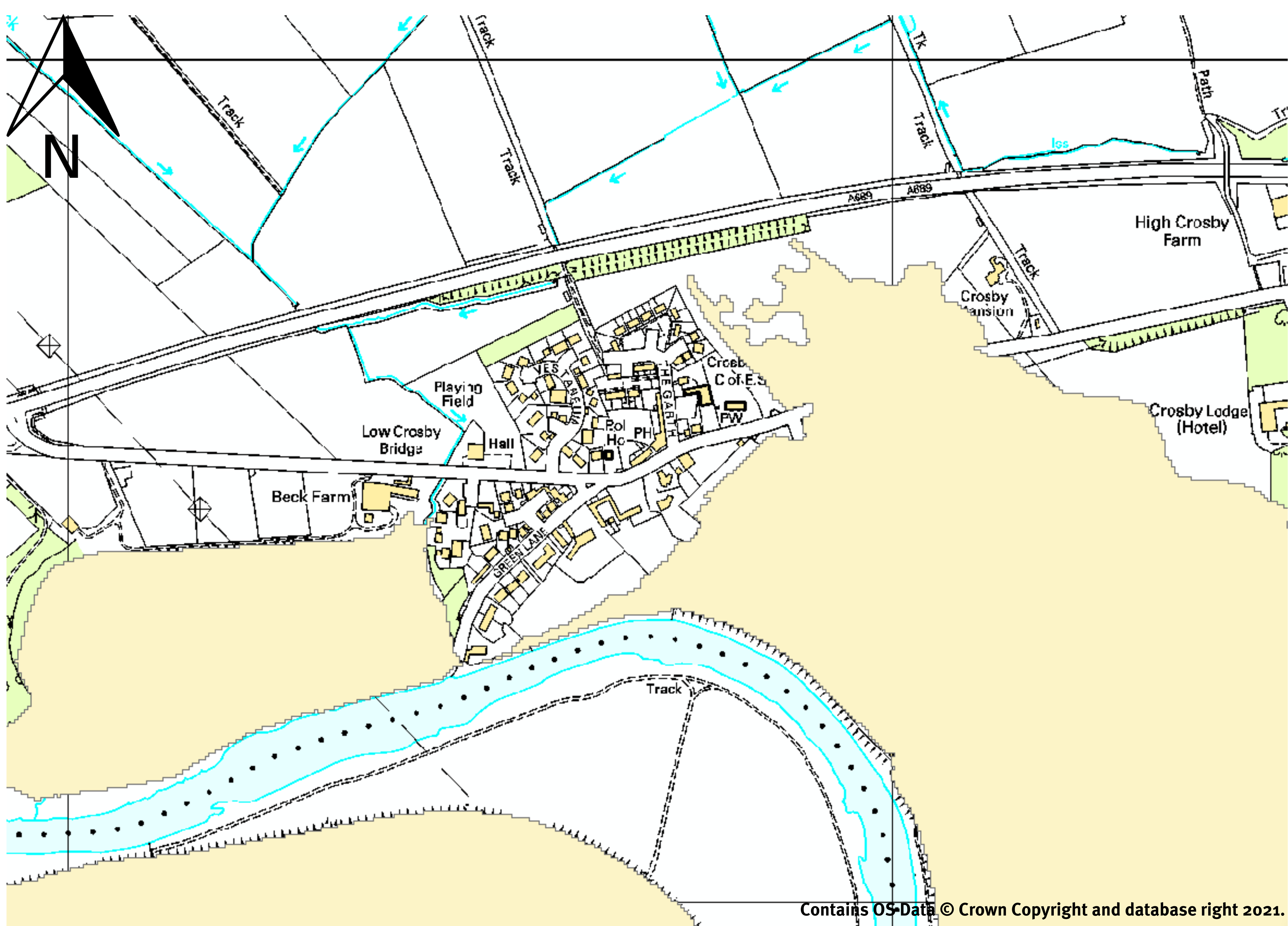


Fig. 7: Flood outline for Warwick Holme Embankment Re-profile for a present day 1 in 200 return period. Please note this was initially modeled on the removal of the Warwick Holme Embankment.

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Glossary Page

Baseline model	A model used for the representation of the flood extents and depths experienced in Storm Desmond.
Breaches	Gaps created in the existing embankment to allow flood water to pass through the embankment and onto the flood plain.
CCTV Survey	A camera system which records the structural condition of the drainage network.
CO2e	Carbon Dioxide Equivalent, standard unit for measuring Carbon footprints.
Control Structure	Controls Flow
DEFRA	Department for Environment, Food and Rural Affairs
Detritus	Waste or Debris of any kind
Dredging	Removal of sediment from the river bed
EA	Environment Agency
FLAG	Flood Action Group
Flood risk management options appraisal	Evidenced based process which looks to identify the best value for money flood risk management option.
Ground Water Table	An aquifer which is below ground level which is topped up by rain and ground water.
Heads of Terms	Head of Terms is a document that sets out a summary of the intended terms of a transaction. They are generally not legally binding, but act to show the intent to complete the transaction and can act as a starting point for further negotiations between parties. (for info - EA would then develop a Partnership Agreement based on the Heads of Terms)
Optioneering	Consideration, in appropriate depth, of various options in order to identify the best option to take forward to delivery
Non-return valves	Making sure that water does not enter the drainage network from the river. Therefore, allows water to only discharge into the river and not to back up.
Penstock	Making sure that water does not enter the drainage network from the river. Therefore, allows water to only discharge into the river and not to back up.

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Permitted Development	In certain circumstances, the EA has Permitted Development rights which negates the requirement for planning.
Property Flood Resilience (PFR)	Mixture of Active and Passive measures which are designed to prevent entry of water into the property up to a level of 600mm above ground level. Can include: flood boards/ doors, repointing, non-return valves on drains etc.
Re-Pointing	Re-pointing is the process of replacing mortar in the brickwork of a building/structure to prevent water entry.
Re-profiling	To change the profile of something, in this instance the existing flood embankment.
River-Locking	The point at which the height of the river level prevents entry of tributaries to flow into it.
SAC	Special Area of Conservation
SSSI	Site of Special Specific Interest
UU	United Utilities
Uncertainty / Freeboard	There are unknowns/uncertainties in the estimation of extreme water levels. The quantifying these unknowns/uncertainties informs the additional height that it is necessary to add in order to have confidence that a flood risk management scheme will deliver the standard of protection it has been designed to deliver.