



OCTOBER 1979.



OCTOBER 1979.



DECEMBER 2012



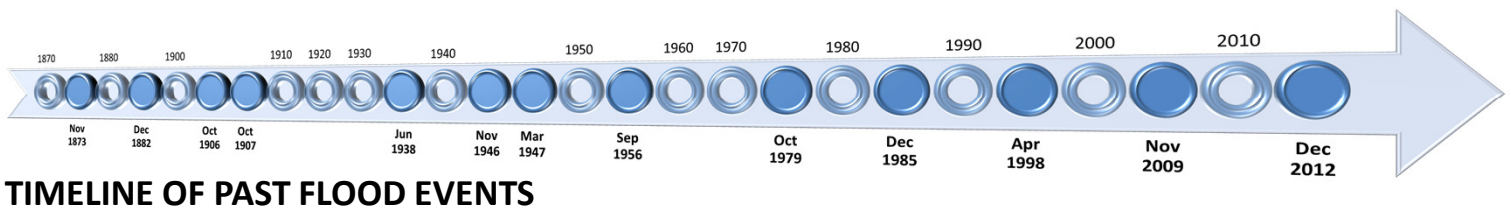
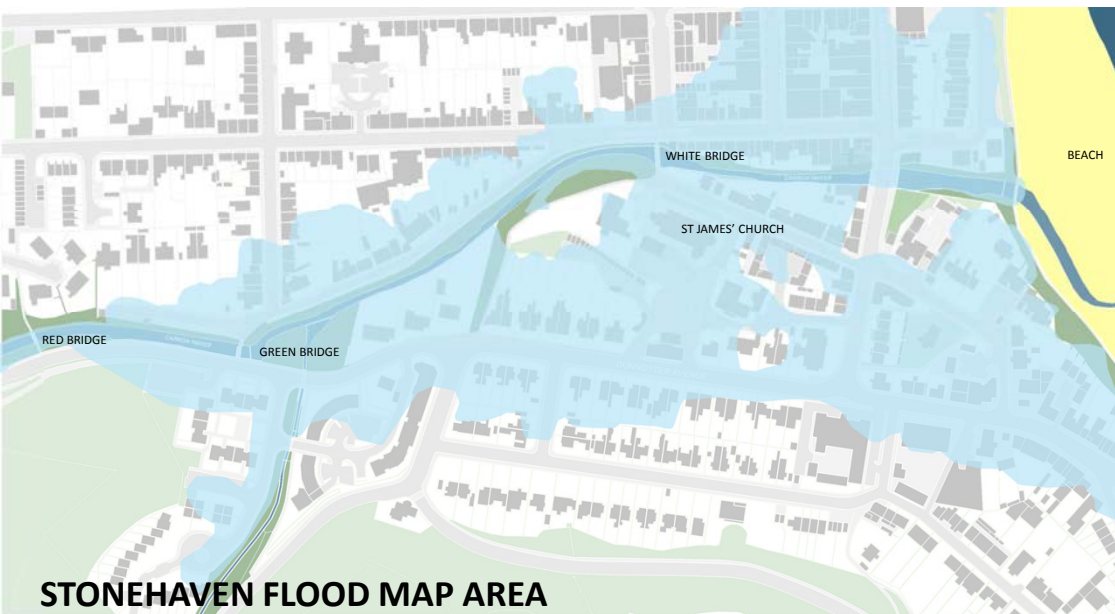
HIGH STREET 2012.



NOVEMBER 2009



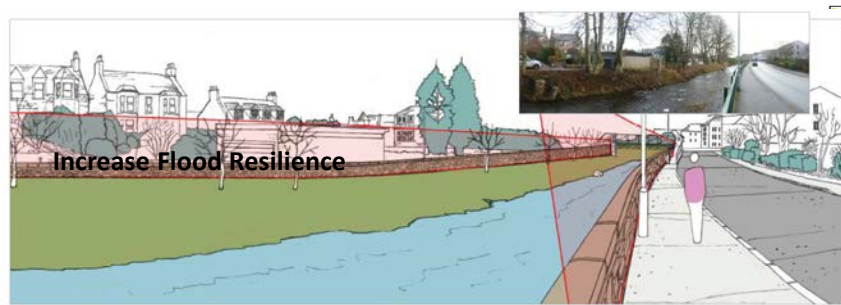
DECEMBER 2012



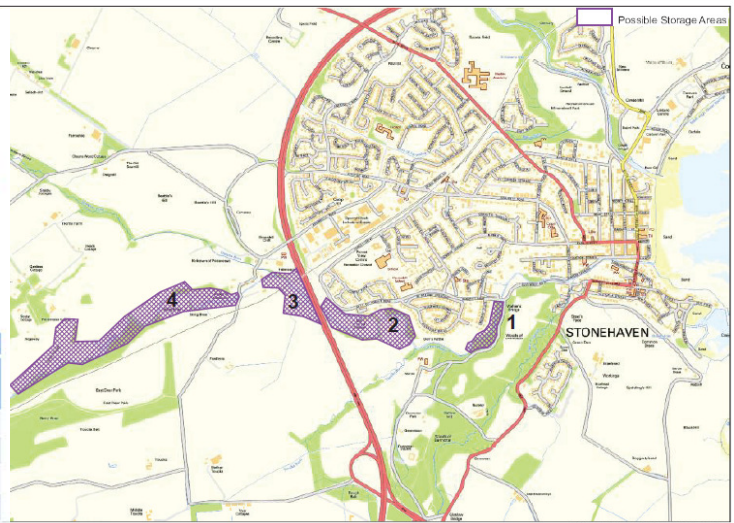
PAST FLOODING AND SCHEME OBJECTIVES

Scheme Objectives:

- To provide long term flood alleviation to Stonehaven.
- To reduce the likelihood and impact of fluvial flooding from the Carron Water.
- To enhance or maintain the existing environment.
- To avoid adverse environmental and geomorphological impacts.
- 372 properties at risk.
- Scheme estimated to avert over £14m of flood damages.



Increase Flood Resilience



Plan showing possible locations of flood storage areas: **Upstream Storage**

	Defence Heights Option 2		Defence Heights Option 3	
	Average Defence Height (m)	Maximum Defence Height (m)	Average Defence Height (m)	Maximum Defence Height (m)
Carron Terrace on left bank (when looking downstream) upstream of Green Bridge	2.7	3.9	1.9	2.5
Low Wood Road on right bank (when looking downstream) upstream of Green Bridge	2.4	3.0	1.0	1.6
Carron Terrace on left bank (when looking downstream) downstream of Green Bridge	0.7	0.9	0.7	0.9
Cameron Street on left bank (when looking downstream) downstream of White Bridge	1.2	2.1	1.2	2.1

Direct Defences with Bridge/Channel Modifications

Option	Pros	Cons
Option 1 Continued Maintenance and Repairs	<ul style="list-style-type: none"> Low initial expenditure 	<ul style="list-style-type: none"> No real alleviation Recurring costs can add up
Option 2 Direct Defences	<ul style="list-style-type: none"> Good cost-benefit ratio Low operational and maintenance requirements 	<ul style="list-style-type: none"> Very high walls required Possible impact on cultural heritage Loss of connection with river
Option 3 Direct Defences with Channel & Bridge Modifications	<ul style="list-style-type: none"> Good cost-benefit ratio Improvements to footbridges Low operational and maintenance requirements Opportunity for streetscaping 	<ul style="list-style-type: none"> Raised walls Possible impact on cultural heritage
Option 4 Upstream Storage	<ul style="list-style-type: none"> Construction outwith Stonehaven Possible creation of wetlands 	<ul style="list-style-type: none"> Potential impact on fisheries and geomorphology Complex design and high maintenance costs Operational requirement during flood event
Option 5 Direct Defences with Upstream Storage	<ul style="list-style-type: none"> Improvement to footbridges Possible creation of wetlands 	<ul style="list-style-type: none"> Potential impact on fisheries and geomorphology Complex design and high maintenance costs Operational requirement during flood event Construction in and out of Stonehaven
Option 6 Increase Flood Resilience	<ul style="list-style-type: none"> Low initial expenditure Community ownership of risk reduction Minimal environmental impact 	<ul style="list-style-type: none"> Limited effectiveness Low cost-benefit ratio Disruption during flood event Advanced warning may be limited

SCHEME DEVELOPMENT – OPTIONS APPRAISAL

- A review of options was undertaken in 2013.
- A number of options were reviewed, provided in the table above.
- These options were assessed on a number of criteria, including cost-benefit, impact on habitats, complexity and cultural heritage.
- **Option 3** was chosen to be taken to detailed design.

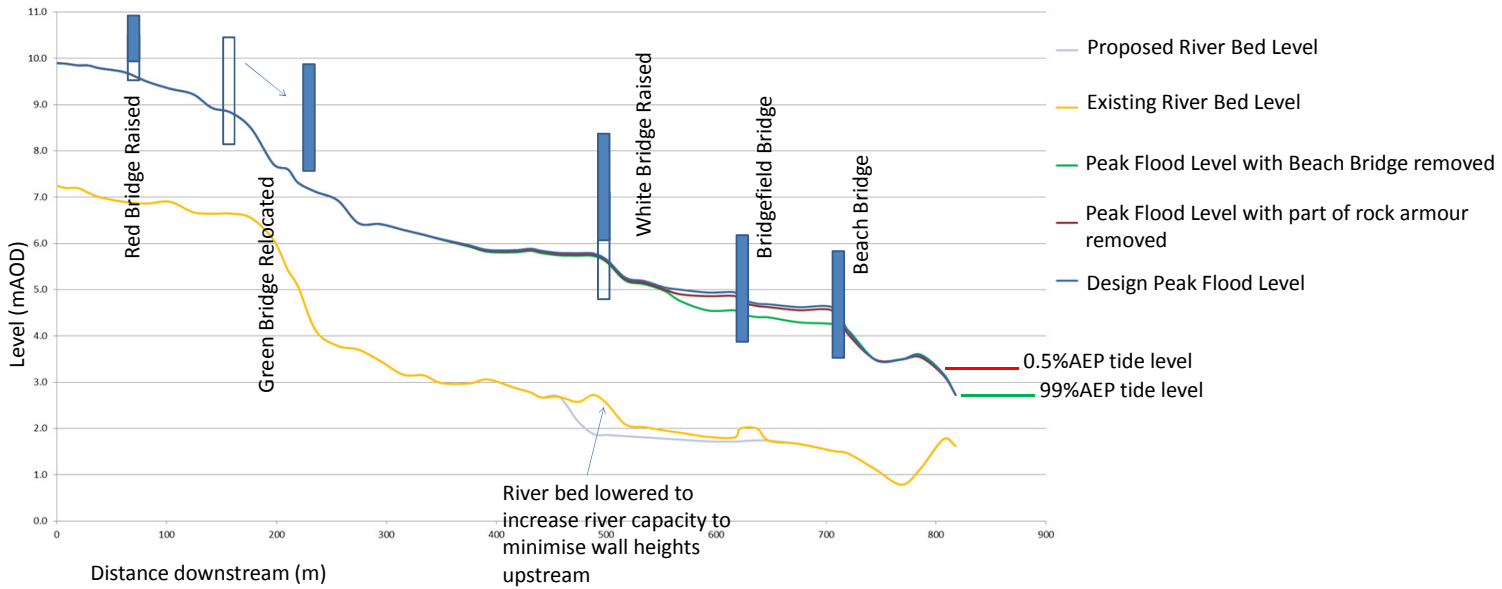




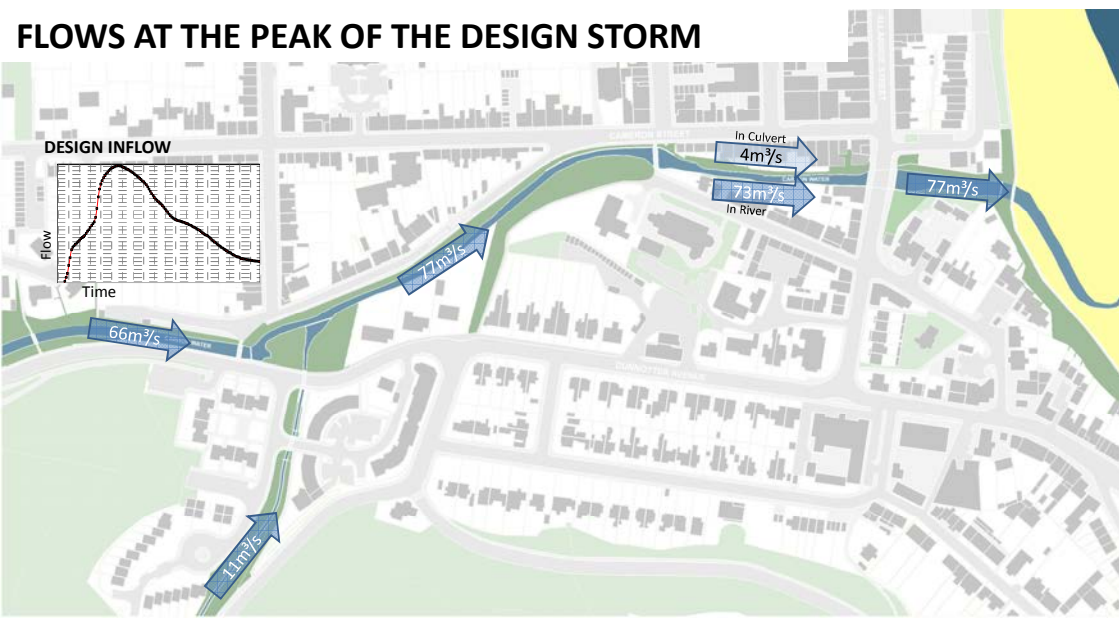
EXISTING SITUATION

- The built environment in Stonehaven contains a patchwork of materials and styles.
- Predominant historic building material is sawn or bush-hammered sandstone with a colour mix between pink and yellow.
- The predominant historic free-standing wall material is grey granite in a random-rubble style.
- The proposed wall finishes aims to preserve or enhance the aesthetic value of the area, considering listed buildings, trees and other walls.
- A number of bridges span Carron Water and Burn of Glaslaw, including the Grade C listed White Bridge.

LONG SECTION ON CARRON WATER

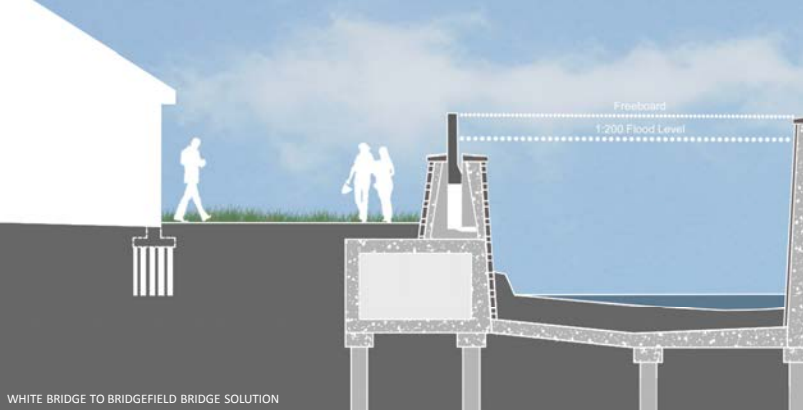


FLows AT THE PEAK OF THE DESIGN STORM

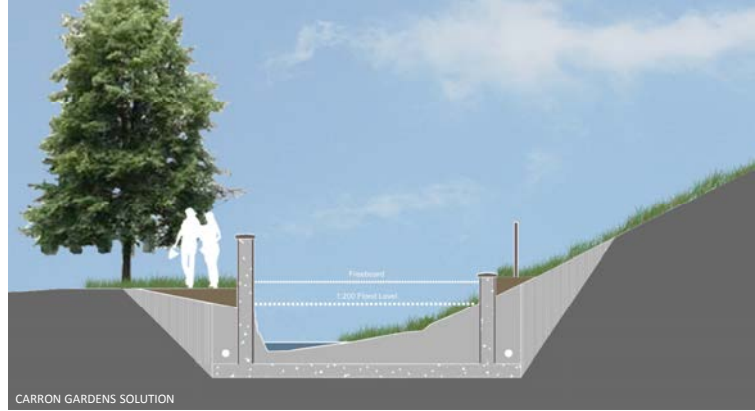


HYDRAULICS

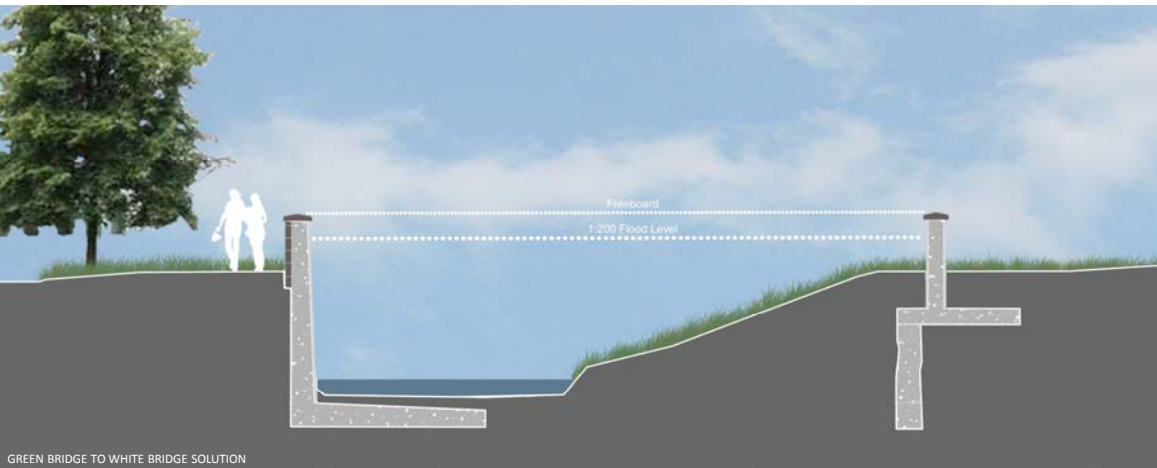
- White Bridge and Red Bridge will be raised to reduce water levels upstream.
- Walls will be raised in some areas to accommodate high water levels upstream of unraised bridges – such as at Bridgefield Bridge.
- The works are designed using a hydraulic model to accommodate the peak river flow for the 0.5% annual exceedance probability (AEP) flood event.
- An allowance for future climate change is included
- Options are hydraulically modelled to determine optimum layout in terms of wall height, environment effects and cost.
- Self raising flood barriers will be installed where new wall heights would have a significant impact.
- The tide level is much lower than design flood levels, and so design flood levels are not influenced by tides.



WHITE BRIDGE TO BRIDGEFIELD BRIDGE SOLUTION

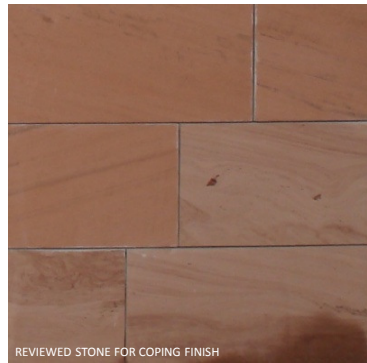
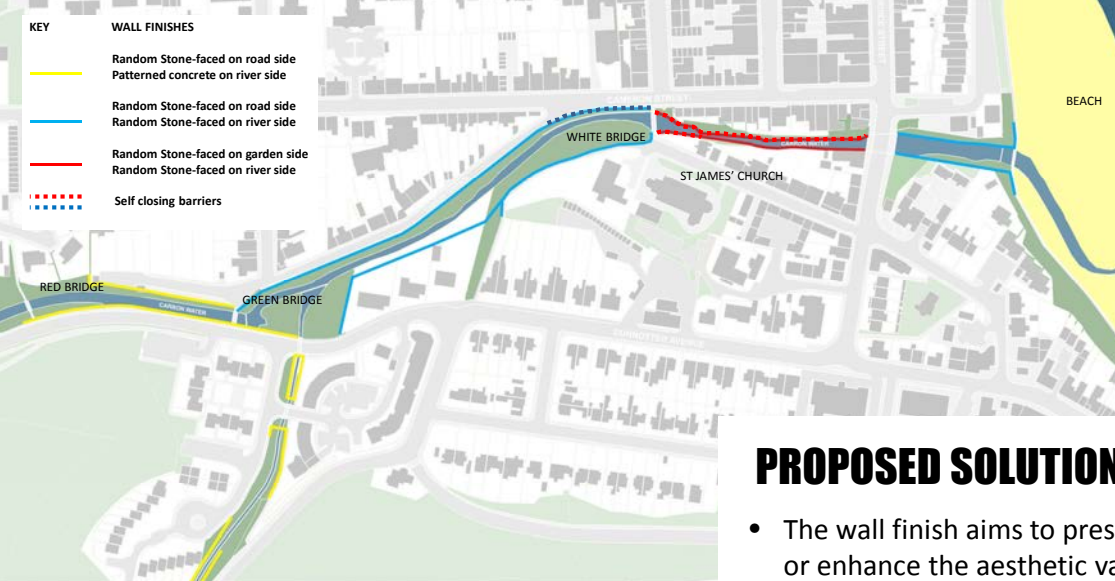


CARRON GARDENS SOLUTION

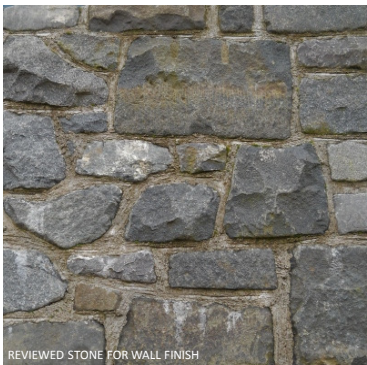


GREEN BRIDGE TO WHITE BRIDGE SOLUTION

Outline Wall Solutions



REVIEWED STONE FOR COPING FINISH

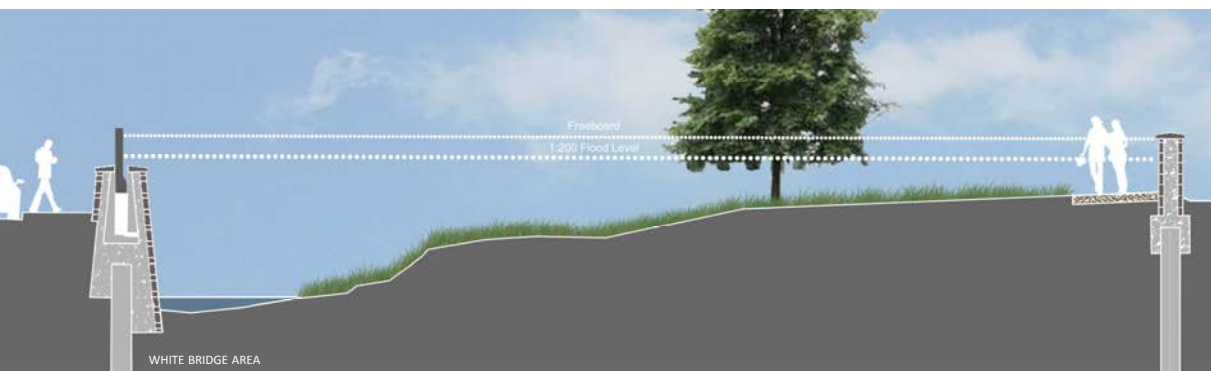


REVIEWED STONE FOR WALL FINISH



PROPOSED SOLUTIONS

- The wall finish aims to preserve or enhance the aesthetic value of the area, considering listed buildings and other walls
- A random rubble finish with an undressed coping stone is proposed for the majority of areas.
- Dressed copings have been proposed in some area where appropriate or required for self closing barriers.



WHITE BRIDGE AREA



BURN OF GLASLAW AND RED BRIDGE TO GREEN BRIDGE



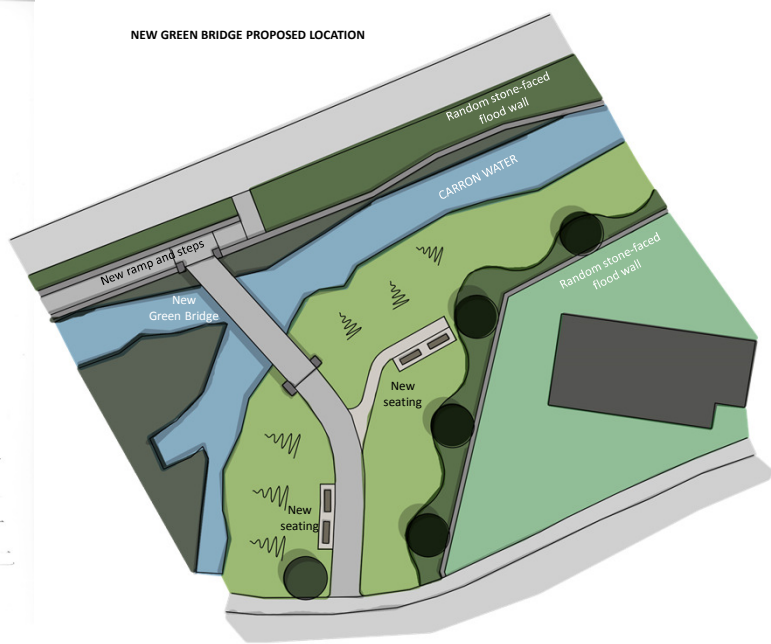
PROPOSED RANDOM STONE WALL FACING ON ROAD SIDE OF WALL



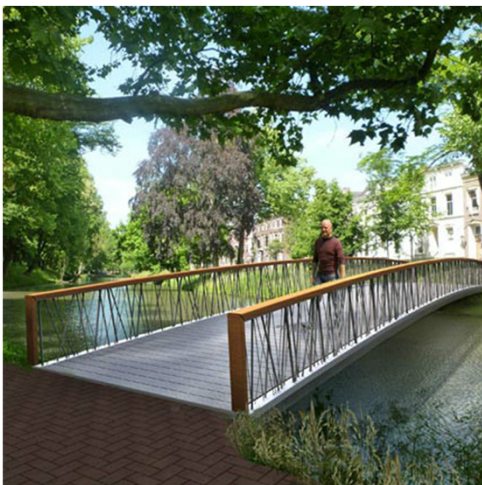
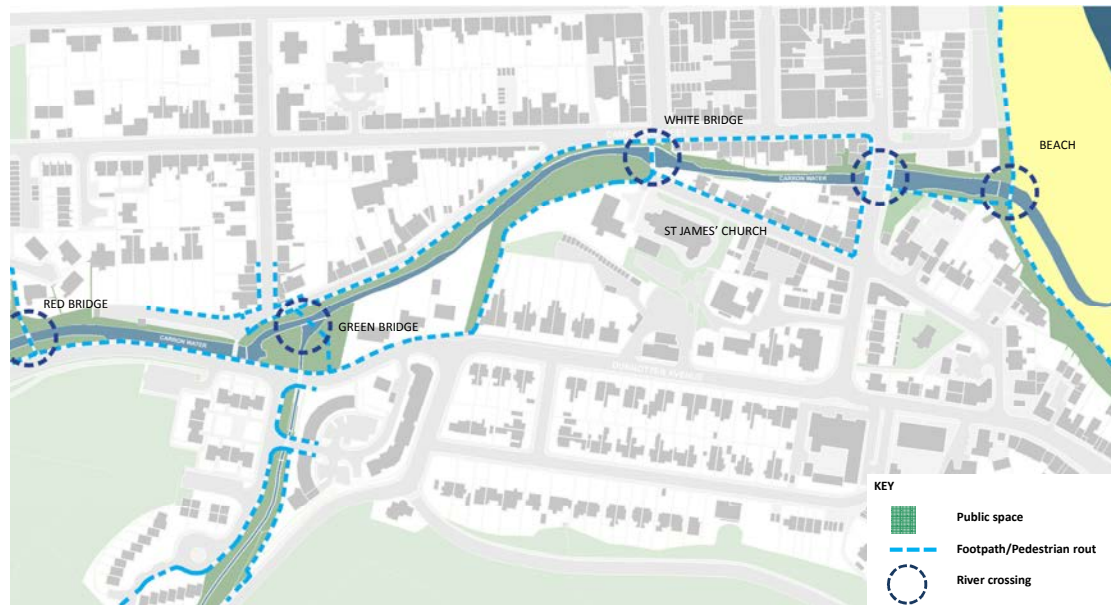
PROPOSED PATTERNED CONCRETE WALL FACING ON RIVER SIDE OF WALL

- Red Bridge is to be replaced with a similar bridge at a higher level at the same location.
- The culverts on the Burn of Glaslaw are to be replaced with larger culverts to improve the conveyance of the watercourse.
- The Burn of Glaslaw will be widened to improve efficiency along with the widened culverts.
- As this section is outwith the Conservation Area of Stonehaven patterned concrete will be used as a finish to the walls, using a similar pattern and colour to the walls nearby.





PEDESTRIAN ROUTES AND OPEN SPACE



GREEN BRIDGE TO WHITE BRIDGE

- The existing green bridge is to be removed.
- The new Green Bridge is to be located downstream of the existing bridge, helping to activate an area of open space on Dunnottar Avenue.
- The wall will be to the riverside of the existing trees on Carron Terrace, allowing the trees to remain and providing a widened grass area for increased amenity value.

POSSIBLE BRIDGE OPTIONS

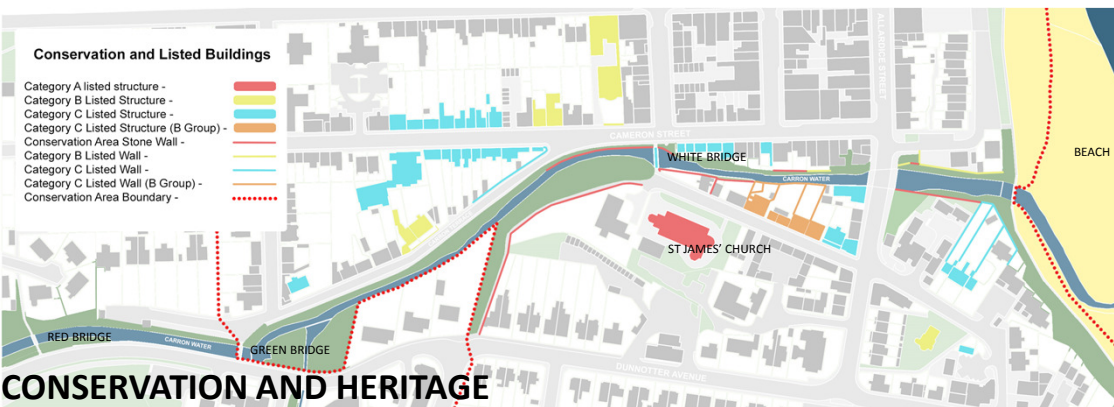
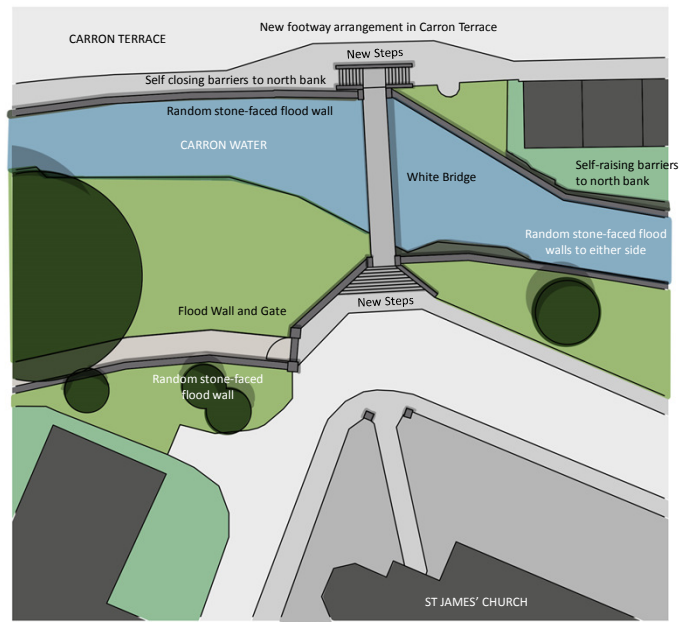


Contemporary bridge with stainless steel balusters and galvanised steel handrail, coloured green.

Contemporary "green" bridge with incorporated planter units.

Contemporary bridge with stainless steel handrail and galvanised steel balusters, coloured green.





WHITE BRIDGE

- The narrow river channel here constrains the river. A buried culvert is proposed to assist in construction and to improve the conveyance of flood waters in this area.
- White Bridge is to be raised and the channel lowered to help increase the capacity of the river.
- St James' Church is a dominant feature in this area and the preservation of its setting is a critical consideration for the design of flood defences here. The flood walls are to remain a similar height to existing, with self closing barriers used to provide a high level flood defence which are activated during a flood event.

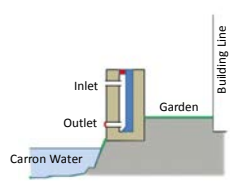




Proposed flood defence solution looking west from Bridgefield. View is indicative of walls without self-raising barrier in operation.

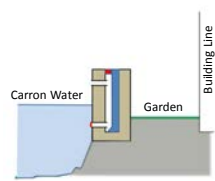


Proposed flood defence walls looking east from Bridgefield.

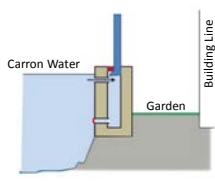


In the default position, the self closing barrier is concealed within the wall unit at the end of the garden.

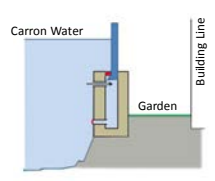
An outlet and inlet pipe are located within the wall unit.



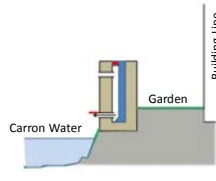
As the flood water rises the outlet pipe is blocked by a flap.



Once the flood water reaches the inlet pipe, it flows into the concealed reservoir within the wall unit.



As the concealed reservoir fills with water, it lifts the self closing barrier through hydraulic force.



Once the flood water recedes, the water in the reservoir flows from the outlet pipe allowing the self closing barrier to return to its default position



BRIDGEFIELD BRIDGE TO BEACH BRIDGE

- The bed of the river under Bridgefield Bridge is to be lowered to increase river capacity.
- Self closing barriers are proposed to minimise wall heights along Cameron Street.
- Downstream of Bridgefield Bridge, a new footpath is proposed on the right bank to improve links to Stonehaven seafront.



WALL FACING ON RIVER SIDE AND ROAD SIDE OF WALL



Q

Why is the Flood Protection Scheme required?

A

To defend the centre of Stonehaven from fluvial flooding, similar to that experienced in 2012

Q

How many properties will be affected by the Flood Protection Scheme?

A

372 properties will be defended by the scheme.

Q

Why can't flood water be stored upstream, instead of having walls through Stonehaven?

A

The catchment of Carron Water is short and steep and does not lend itself to flood storage. Storage has been looked at upstream, but would require similar works to walls through Stonehaven, as well as the construction of the dam, which is not viable.

Q

How will the scheme be constructed? How much disruption will there be?

A

The works will be constructed from the watercourse and the roads next to the watercourse. There will need to be closures, diversions and restrictions on the roads next to the river for vehicles. However, pedestrian access will be maintained on all roads.

Q

How high are the walls?

A

The walls vary in height. In general wall are between 1.2 and 1.8m higher than ground level on the dry side of the wall. The scheme is designed to minimise wall heights as much as possible, limiting heights to below 1.5m, which can still be seen over by an average adult. Self raising barriers have been used where wall heights are considered particularly sensitive.

Q

Can we not just open up the outlet to the sea, that must cause flooding upstream?

A

The hydraulic modelling indicates that lowering of the rock armour downstream of White Bridge does not significantly reduce water levels upstream. The bridges and channel width are the main constrictions to river flow, that dictate the design water levels on the river.

Q

What are the extents of the flood protection works?

A

From Beach Bridge to Red Bridge on Carron Water and along the Burn of Glaslaw to beyond houses on Carron Gardens, defending properties in Stonehaven.

Q

How will the scheme/flood barriers work? Can the barriers become lodged or fail?

A

The barriers work under hydraulic pressure and can lift a car if necessary. The barriers are interlinked, so if one fails it will be lifted by its adjacent gates. Numerous connections to the river will be made to minimise risk of failure.

Q

Will risk of flooding be transferred upstream?

A

No, there is no increase in flood water levels upstream of the flood scheme.

Q

Why are there no ramps at White Bridge?

A

Ramps were considered for White Bridge. The inclusion of a ramp would require higher walls on Cameron Street over its 20m length and would require the pavement to be widened for this length, removing car parking. Due to the important visual setting of this section of the works steps are proposed to minimise the impact and minimise wall height.

Q

Will I still be able to cross the river during construction?

A

A crossing will be maintained in a similar location to the existing bridges during the works except for Red Bridge which will be closed for a few months.

Q

When will the scheme be completed? How long do the works take?

A

The works are likely to take 2 years to complete once on site, but this depends on the number of objections and the nature of those objections. If construction started in 2017, then it is likely to be completed in 2019.

Q

What does 0.5%AEP flood defence mean? Why this level of protection?

A

0.5%AEP is the annual exceedance probability, so the chance that a flood event of that size of flow coming down the river in any given year, based on a statistical analysis of past flood events. This is the standard level of protection required by the Scottish Government and SEPA for a residential area.

Q

What measures are there to protect fish and other wildlife that may be affected?

A

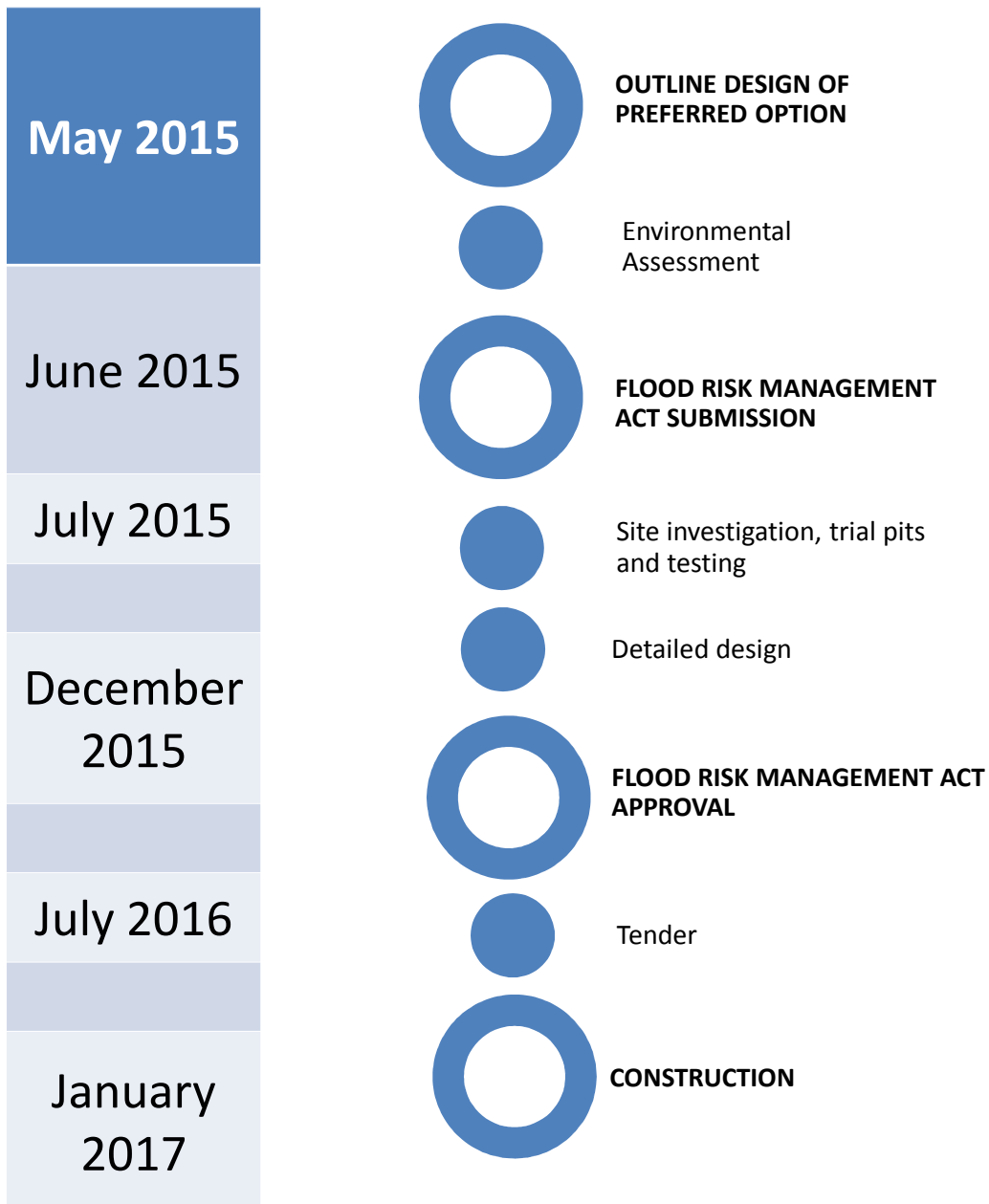
The scheme aims to maintain or enhance the ecology of the river, such as by removing fish obstructions at Green Bridge. During the works, the river channel will be diverted through culverts and pipes to maintain the river flow and maintain fish passage during the works, whilst allowing construction to continue.

Q

How is the scheme funded?

A

Aberdeenshire Council is funding the scheme, but are seeking funding from Scottish Government.



WHAT NEXT?

- The scheme now needs consent to be constructed from the Scottish Government under the Flood Risk Management (Scotland) Act 2009.
- The time to deliver the project will be dependent on the number and nature of any objections received.
- Site investigations and detailed design of the scheme will be undertaken during the consenting period to refine proposals.