

# Westnewton Bridge – Permanent scour protection works

HB127276

## Pre-application process - Record of discussions with Claire Patterson, Environment Agency geomorphologist

As part of the design process, a model was developed of the river corridor to understand the hydrological and geomorphological issues that could arise from the proposed works.

The below is a record of correspondence with the Environment Agency's geomorphologist, Claire Patterson, to points raised during the pre-application process.

### Initial comments from Claire Patterson (CP)

Dear Peter,

Many thanks for sending through the information relating to Westnewton Bridge, Kirknewton. We are pleased to see that due thought and consideration has been given to the proposals and the local fluvial geomorphology has been considered. We are at the pre-application stage at the moment and so it would be good to get final tweaks sorted out now before the Land Drainage Consent is submitted. Our comments below primarily relate to the need for training the water through the centre bridge arch, the options appraisal thought process to come up with this design and the impact of a build up of sediment behind the logs and potential scour.

CP Comments in green 04/03/2015

PaB comments 11 3 15 in purple

Comment	Author	Date
i) Where is the method statement? - it says on Preliminary Drawing no. HB127276/B/B6351/06/29 point 1.4 that a method statement has been approved. This would have all the details of sediment management etc in the river and will be needed as part of the land drainage consent.	CP	04/03/2015
Method statement version 4 issued to CP. Includes Sediment management plan 1.	PB	11/3/15
i) Concentrating the flow through the centre arch – promoting scour	CP	27/02/2015
It is our understanding that the training work is intended to address an erosion (scour) issue. But the method of doing this is to concentrate the flow, which will promote scour. It is noted that NCC realise the apron under the bridge is a critical element, otherwise the piers could be undermined.	CP	27/02/2015
The scour protection is required around the bridge foundations but, it is also intended to limit the build-up of gravel deposition to the centre arch of the bridge.	PB	04/03/2015
2.		
If a new concrete apron is being installed under the bridge, under all three arches, more detail should be provided as to why the flow needs to be trained so much through the centre of the bridge. What was the thought process and options appraisal for this design?	CP	27/02/2015
There is a history, particularly since 2008, for the centre and south span of the bridge to become partially blocked with shoaling gravels of which the flood events of Sept 2008 and July 2009 worsened the situation substantially. A report by MNV titled College Burn Flood and Sediment Management MNV/TF009/1411 dated 08/03/2011 recommended removal of the gravel to the bridge and soft engineering to the banks upstream. The report stated in the conclusions page 48, <i>Scenario 1, doing nothing, showed that in the existing situation there is a high flood risk caused by the sediment accumulation around the bridge. Flood levels show that if the flood bank immediately upstream of the bridge breached the 1 in 10 year and higher floods would spill through the</i>	PB	04/03/2015

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<i>breach and cause significant inundation to the fields and properties to the east of the river. In this situation there is also a risk that the right arch could become blocked with tree debris. This would result in an even greater risk of flooding.</i>		
<p>The MNV report MNV/TF009/1411 modelled 8 scenarios that concluded the above comment on the situation in 2011. It recommended that <i>The favoured option was to reduce the height of the sediment deposition feature which has developed upstream, downstream and under the bridge.</i></p> <p>However, the report states (p48) that <i>This indicated that there would be further changes in the sediment deposits after the sediment management had been carried out which would probably require regular maintenance.</i></p> <p>It is this conclusion that has driven the justification for training the river alignment straight through the bridge and keeping the large span free of sediment deposits. The Cbec report U13-1003 states (p33) <i>The flow direction is therefore stabilised through the bridge by the design log pairs.</i></p>	PB	11/3/15
<i>The persons responsible for management of gravel at this site did not take the opportunity to remove the sediments under the bridge, even when Cheviot Futures installed flood protection measures to the existing bund in Summer 2012.</i>	PB	04/03/2015
<i>During the flood event of Sept 2012 the bridge arches become perilously close to blocking with woody debris, a scenario forecast by the Cbec report mentioned above. See photo 1 that shows the large gravel shoal that substantially blocked the centre and east arch of the bridge during the flood event of Sept 2012.</i>	PB	04/03/2015
<i>The Council proposals recognise that the cause of blockage of the bridge arches is deposition of gravel on the inside of the bends of meandering. The emergency works carried out after the flood event of September 2012 straightened the section of river immediately above the bridge. This has limited the potential for deposition in the short term.</i>	PB	04/03/2015
<i>Looking ahead for a permanent solution, it is considered that maintaining the straight alignment of the river will limit its potential for shoaling and deposition particularly around the centre arch of the bridge and retain the largest cross sectional area for flow through the bridge. Also, this will minimise the risk of localised scour to the rip rap protection of the downstream riparian owner together with the risk of flooding to public infrastructure and the community. The Cbec report states these facts.</i>	PB	04/03/2015
3.		
<i>The normal flow wetted channel might move laterally around, but the apron should be able to cope with that. Flow in floods would pass though all the arches and by training the flow, it seems this is putting more pressure on the central part of the apron. If this bit of apron can take those shear stresses, surely the apron elsewhere could cope with the shear stresses if the river were not trained?</i>	CP	27/02/2015
<i>This is correct, but the problem is not just one of scour, it is a problem of gravel as stated above.</i>	PB	04/03/2015

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4.		
There is a risk of scour immediately downstream of the new apron (depending on its extent), this issue is identified and factored in, but there is a risk here. The bed shear stresses stay high for some distance downstream of the apron.	CP	27/02/2015
This is correct. The proposals will also include for scour protection of 200 to 400 mm cobbles as per the Cbec report.	PB	04/03/2015
5.		
At the moment it looks as though an idea has been proposed and CBEC have been commissioned to make this work. We would recommend more justification in this report as to why the river should be trained through the central arch, rather than other possible options.	CP	27/02/2015
Please see above comments with regard to limiting gravel deposition around the bridge.	PB	04/03/2015
Possible alternative options to that proposed are as follows:	PB	04/03/2015
The MNV report MNV/TF009/1411 is primarily concerned with the risk of flooding to Kirknewton. However, their report has, through consideration of various scenarios that limit flow through the bridge arches, shown that it is critical that sediment deposition is not permitted to build up beyond a particular level (p54).  To this end, as Highway Authority, the brief for this proposal is to ensure that the College Burn passes through the centre arch that maximises the available water way section of the bridge.	PB	11 3 15
<b>Option 1 Provide no works other than scour protection to bridge.</b> There would be a high risk of deposition and blockage of the cross sectional area of the bridge as demonstrated flood events 2008 to 2012.	PB	04/03/2015
<b>Option 2 Provide protection to flood bunds so that the river flow meandering is limited and provide scour protection to bridge.</b> This would allow the river to meander to the same degree as exists now. There would be a high risk of deposition and blockage of the cross sectional area of the bridge as demonstrated flood events 2008 to 2012.	PB	04/03/2015
<b>Option 3 Provide no works other than scour protection to bridge but carry out local gravel management as suggested in the Till RRS, Phased Delivery Programme 3 (p72).</b> Historically, gravel was removed from this location and was an action born out of local knowledge of the problem and successfully implemented by the Environment Agency and its predecessors from c1920's to 2000. Current environmental legislation makes this difficult to justify and is stated as being unsustainable by Natural England. Also, the flood defence bund approx. 75 metres above the bridge on the RH bank has been scoured severely and the effective remaining width is minimal. Any significant flood event with meandering to this bank has a high risk of waters breaking through to surrounding agricultural land and inundating the community. Cheviot Futures recognised this risk and a £30k proposal to protect the bund with soft engineering was implemented in August 2012 but was ineffective and a 30 metre length was washed out in September 2012, 3 weeks after being installed.	PB	04/03/2015
6.		
We understand the bridge is a historic structure, there may be concern of it	CP	27/02/2015

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HB127276

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becoming out flanked upstream for instance but this needs to be discussed more clearly in the report.		
This needs to be discussed NCC/EA. The issues are as follows:	PB	04/03/2015
<ul style="list-style-type: none"> <li>The Council has to maintain the public Highway for the safe passage of the general public.</li> </ul>	PB	04/03/2015
<ul style="list-style-type: none"> <li>There is no other route for the Highway to take and a magistrates court is unlikely to permit closure of the Highway therefore the river has to be trained through the bridge.</li> </ul>	PB	04/03/2015
<ul style="list-style-type: none"> <li>Who is responsible for maintaining the alignment of the river through the bridge, and further upstream? The Council is prepared to accept the responsibility to maintain the proposed log arrays.</li> </ul>	PB	04/03/2015
Rivers adjust laterally and vertically; we have no obligation to "maintain an alignment" of the river in this instance.	CP	04/03/2015
<p>Responsibility for the maintenance of the channel is – and always has been, that - of the riparian landowner, see “Living on the edge” guidance attached.</p> <p>Maintenance - all ongoing maintenance will be the responsibility of the Council. This will require Land Drainage Consent each time you go in the river.</p> <p>Similarly, because the channel is designated as a Site of Special Scientific Interest (SSSI), written agreement with Natural England will also be required.</p>	CP	04/03/2015
<ul style="list-style-type: none"> <li>Landowners have an interest to manage the river alignment for the benefit of their land in accordance with HLS agreements but have no wider obligation to intervene for the benefit of the community or Highway Authority.</li> </ul>	PB	04/03/2015
7.		
This is especially important bearing in mind the anticipated monitoring and maintenance which will be required in relation to the current proposal given the high sediment load and dynamic nature of the College Burn, especially after a large single flood event.	CP	27/02/2015
Agreed. Cbec’s monitoring proposals are to be proposed and implemented by the Council.		
A monitoring schedule should be set up as part of this LDC. What we don't want to happen is that the site isn't monitored, a large flood comes down, logs jams become displaced, and the repairs are done under emergency works.	CP	04/03/2015
Agreed, I will get Hamish Moir Cbec to give me a monitoring proposal for the recommendations in their report that follows the guidance of PRAGMO. Thanks for the reference.	PB	11 3 15
8.		
ii) Increased pressure along the right bank – property located here	CP	27/02/2015
There may be potential for increased pressure along the right bank downstream of the bridge. The model seems to suggest not, but Figures 3.3 and 3.4 show flow concentration along the right side of the channel. More discussion required, especially as there is property located here.	CP	27/02/2015
The model demonstrates the reduction in shear bed stresses due to the removal of the constraining pinch point of the old railway abutment. Recent river meanderings prior to the artificial realignment in 2012 resulted in catastrophic scour of the LH bank downstream of the bridge. See photo 3	PB	04/03/2015

## Westnewton Bridge – Permanent scour protection works

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enclosed. Woodland was lost and the flows were directed across into the private owners armour protection. The owner of Bridge House, Mr Reed-Jones is strongly in support of the Council's proposals.		
9.		
iii) Pg 4 notes evidence of lateral migration within the upstream straightened section of the channel, where is this? Are there any photographs or documentation? I couldn't see this when on site.	CP	27/02/2015
This was the situation the existed prior to the river realignment in Sept 2012. See attached photo 1.	PB	04/03/2015
10.		
iv) Pg 18 – error reference	CP	27/02/2015
Noted		
11.		
v) Figures 2.14 and 2.15, 2.16 and 2.17 flood inundation, flow routing and bed shear; this screen dumps are really useful to understand where the pressures lie. More interpretation would be useful here though to describe what are the consequences of having areas of increased bed shear stress in relation to the 4 vulnerable areas identified for attention.	CP	27/02/2015
Do you need anything more than section 3.2.3 in Cbec report?	PB	04/03/2015
Yes, more interpretation as to what the pattern of shear stress means in relation to the 4 areas of work. They have acknowledged that at the apron higher shear stresses mean that increased armouring may be required. Similar interpretation for the other 3 areas required.	CP	04/03/2015
12.		
i.e. in the areas where shear stress is greatest, could we expect more bed scour, does this have consequences for the banks, and then what does this mean in terms of breaching the bank and flood flow?	CP	27/02/2015
NCC/EA to discuss. – Responsibilities for flood bund and maintenance.	PB	04/03/2015
Flood Risk Assessment has been carried out that states River Catchment Services review by Malcom Newson has concluded that the proposed works represents the best predictive and designs going forward.	PB	04/03/2015
13.		
vi) Is the model assuming an undefended scenario?	CP	27/02/2015
Defended scenario. The model includes all of the flood bunds surveyed, principally those that exist on the RH bank for up to 450 metres upstream of the bridge. These were all constructed c1949-52 after Kirknewton village was inundated by a flood in 1948.	PB	04/03/2015
14.		
vii) It is guaranteed that cobbles and boulders will become trapped behind the log jams which will confine the flow to centre arch further, the channel becomes narrower, making it more difficult for high flows to be directed towards the outside arches.	CP	27/02/2015
It is understood that this will happen but is considered to be less onerous than allowing the river to meander and hence encourage deposition that could block or restrict the flow capacity of the centre arch.	PB	04/03/2015
The Cbec report p44 states that the river has a highly dynamic geomorphic character and no design can be guaranteed to be stable in the long term. It recommends post construction monitoring and the potential for adaptive management. To this end Cbec will be asked for a monitoring proposal along	PB	11 3 15

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the lines of the recommendations in the report conclusion.		
15.		
More detailed required as to what are the implications here in terms of flow velocity, scour upstream of the bridge, potential for reduced sediment supply, maintenance etc.	CP	27/02/2015
Comment required here from scheme geomorphologist?		
16.		
Or, is this the point, is this what the project is designed to do? Further clarification would be appreciated.	CP	27/02/2015
Project is primarily designed to prevent scour to centre arch of bridge and limit gravel deposition that could block the same arch.	PB	04/03/2015
17.		
vii) Figure 3.6 – more interpretation on what does the pattern of bed shear stress mean in terms of local bed scour, especially in the upstream section of the reach where it is most noted	CP	27/02/2015
No works proposed in upstream section	PB	04/03/2015
Comment required here from scheme geomorphologist?	PB	04/03/2015
18.		
viii) A map showing the location of the 4 activities	CP	27/02/2015
Scheme drawing enclosed with these notes.	PB	04/03/2015

I will be in touch about the notch you described in the apron for fish passage.

If you would like to discuss any of the points above, please do not hesitate to call.

Regards,

Claire