



**WESTNEWTON BRIDGE
WFD ASSESSMENT**

**Prepared for
Environment Agency**

**Prepared by
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1. INTRODUCTION

1.1 PROJECT BACKGROUND

The College Burn at Westnewton Bridge has been subjected to historical human intervention that confined the burn into a narrowed active corridor through flood embankments constructed on either side of the channel. This has restricted sediment storage to a confined area which, over time, has resulted in this river corridor being raised relative to the adjacent floodplain. This situation now presents an increased flood risk to Kirknewton (situated under a kilometre to the east of the burn) and a direct erosion risk to Westnewton Bridge (dynamic geomorphic processes causing the river to approach the bridge at an oblique angle, presenting a structural risk to central pier and foundations). As a consequence of this, the Northumberland County Council (NCC) undertook emergency river engineering works to realign (straighten) the channel back through the centre major bridge arch and repair the damage to the bridge pier foundations. However, there are concerns that this alignment is unstable given the highly dynamic character of the river in this area.

As a result of these processes, NCC commissioned an assessment of the hydrodynamic and sediment transport processes on the College Burn with the subsequent development of measures to protect the bridge and reduce flood risk to Kirknewton (cbec, 2014). The options assessment process has determined that designs for alleviation of flood risk and management of dynamic geomorphic processes at Westnewton Bridge should aim to:

1. 'Train' the channel upstream of the bridge so that it approached the central arch normal to the orientation of the structure.
2. As much as was practicable, utilise a 'soft' engineering approach that considered natural fluvial processes.
3. Ensure unhindered fish passage beyond the bridge under normal flow conditions.
4. Enhance an embankment to prevent flow onto the right hand floodplain.
5. Modify the abutments of the dismantled railway bridge ~100 m north (downstream) of Westnewton Bridge.

1.2 REGULATORY BACKGROUND

The Water Framework Directive (WFD) (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted by the European Commission in December 2000. The WFD requires that all EU Member States must prevent deterioration and protect/ enhance the status of aquatic ecosystems. This means that Member States must ensure that new schemes do not adversely impact upon the status of aquatic ecosystems, and that historical modifications that are already impacting need to be addressed. The directive was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which mean that the requirements of the WFD need to be considered at all stages of the planning and development process.

Unlike the EU Birds and Habitats Directives (EC Directive on the Conservation of Wild Birds (2009/147/EC) and EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC), respectively), which apply only to designated sites, the WFD applies to all water bodies, including those that are man-made. The consideration of the proposals under the WFD will, therefore,

apply to all surface and groundwater bodies that have the potential to be impacted by the Westnewton Bridge project.

In addition, the location of proposed works overlays the Tweed Catchment Rivers – England: Till Catchment SAC and SSSI nature conservation designations. Potential effects from the scheme may result in an adverse impact on the species and features supporting these designations. An assessment of the potential effects from the proposed scheme on these habitats and species is, therefore, included in this report.

1.3 PROPOSED CONSTRUCTION ACTIVITIES TO BE IMPLEMENTED

The proposed measures defined in the preferred option of the report include:

- Installation of large wood structures to ‘train’ the channel in the section upstream of the bridge. In natural settings, large wood structures can provide a significant stabilising effect in dynamic river environments, training flow towards the channel centre and protecting banks composed of otherwise highly erodible material. For the Westnewton design, it was proposed that a series of large logs (with root balls intact) were to be introduced to the channel margins.
- Roughening of the concrete apron structure with cobble and boulder sized material and the associated construction of a low elevation ‘slot’ to provide variation of flow depths and velocities that could be exploited by fish for safe upstream/ downstream passage, ensuring suitable appropriate/ suitable hydraulic characteristics are provided across the bridge apron.
- Raising of an embankment upstream (approximately 40m extent) where existing conditions modelling indicated a significant preferential flood route. This will be achieved by raising the local level at the breach to the 200-year return interval flood level (71.8 m AOD) plus 0.5 m freeboard.
- Remodelling the railway abutment on the left bank downstream of the bridge. Here, an approximately 2 m wide shelf will be created by levelling a portion of the abutment. This increases conveyance and removes a large part of the restriction to flow caused by the abutment that currently results in a significant backwater effect upstream under flood flows.



Figure 1.1. Westnewton Bridge scheme location.

2. METHODS

Following the recommendations made by Murphy et al. (2012), the approach adopted in this assessment is to determine whether the scheme has:

- Potential to cause deterioration in surface water body status by adversely affecting biological, hydromorphological and/or physico-chemical quality elements;
- Potential to cause deterioration in groundwater body status by adversely affecting quantitative and chemical quality elements;
- Potential to prevent achieving WFD status objectives by impacting upon proposed mitigation measures already identified for water bodies in the area; and
- Potential to incorporate WFD mitigation measures where possible.

Article 4(6) of the WFD states that temporary deterioration in the status of a water body will not be in breach of the WFD if all practicable steps are taken to prevent further deterioration and measures taken will not compromise the recovery of the quality of the water body once the temporary change in conditions is over.

2.1 APPROACHES TO COMPLIANCE ASSESSMENT

There is no formally published methodology for the assessment of plans or projects in relation to undertaking WFD compliance assessments. There are, however, several sets of guidance that have developed in relation to undertaking such assessments, predominantly written by the Environment Agency. Considered to be the most relevant to the Westnewton Bridge project proposals is 'Assessing new modifications for compliance with WFD' (NEAS Operational Instruction 488_10) (Environment Agency, 2010b), an Environment Agency internal operational instruction which has been produced to guide WFD assessment of new modifications to surface waters.

For the purposes of undertaking the WFD compliance assessment for the Westnewton Bridge project, it is proposed that the broad methodologies outlined in NEAS Operational Instruction 488_10 is used in order to undertake the assessment.

3. BASELINE INFORMATION

The water bodies that could potentially be affected by the scheme were identified using the Environment Agency's online WFD mapping system (part of the 'What's in your backyard?' tool) and SEPA's RBMP Interactive Map. Water bodies were selected for inclusion in the initial stages of the compliance assessment using the following criteria:

- All surface water bodies (including rivers, lakes, transitional and coastal waters) that could potentially be directly impacted by the scheme (i.e. those within the scheme footprint);
- Any surface water bodies further upstream that have direct connectivity and could potentially be affected by the proposed works;
- Any surface water bodies downstream that have direct connectivity and could potentially be affected by the proposed works; [and]
- Any groundwater bodies that underlie the proposed scheme.

3.1 SCREENING OF RIVER WATER BODIES FOR ASSESSMENT

The following river water bodies have been identified as relevant in geographical and hydrological terms to take through the WFD compliance assessment process because they have the potential to be affected by the proposed scheme:

College Burn from Lamden Burn to River Glen (GB102021072940): The College Burn water body is currently at Good ecological status. The proposed works are located on this water body. Assessment of proposed activities is therefore required to assess whether any impacts with the potential to compromise the maintenance of Good water body ecological status can be expected. Detailed quality element classification for this water body is presented in **Table 3.1**.

River Glen from College Burn to River Till (GB102021072950): The River Glen is a heavily modified water body, currently at Moderate ecological potential. The proposed works are located in close proximity to this water body (approx. 200m upstream). Given the close geographical proximity and direct hydrologic connectivity to the location of proposed works, any impacts are likely to propagate downstream, potentially causing deterioration in ecological potential in the Glen water body. This water body is, therefore, screened in for assessment in **Section 4** of this report. Quality element classification is detailed in **Table 3.2**.

There are several other river water bodies in the project area, but these have been ruled out of the preliminary assessment because construction activities are not considered to represent potential impacts to their ecological status:

College Burn from Source to Lambden Burn (GB102021072870): Proposed works are located approximately 7km downstream of this water body. No activities with the potential to impact the quantity and dynamics of flow, the present sediment regime or with the potential to create barriers to river continuity that extend upstream to this water body are proposed. This water body will, therefore, not be considered for further assessment under this report.

River Till from River Glen to River Tweed (GB102021073050): This water body is located approximately 15km downstream of proposed works. Given the large geographical distance separating the two water bodies and the small relative contribution of the College Burn to the

catchment area of this water body, no impacts with the potential to cause deterioration on this water body are expected.

Table 3.1 – College Burn from Lamden Burn to River Glen (GB102021072940) classification

Water body details (from Solway Tweed RBMP)			
Water body name	College Burn from Lamden Burn to River Glen		
Water body ID	GB102021072940		
River Basin District	Solway Tweed		
Hydromorphological designation (and reason)	Not Heavily Modified/ Artificial Water Body		
Current Overall Status	Good Status		
Status Objective	Good Status to be maintained		
Justification if not good by 2015	N/A		
Sensitive habitats/ Protected areas	Tweed Catchment Rivers – England: Till Catchment SAC and SSSI		
Element	Current Status (and confidence)	Predicted Status by 2015	Reason for Failure
Biological quality elements			
Fish	-	-	
Invertebrates	High	High	-
Macrophytes	-	-	-
Phytobenthos	High	High	-
Hydromorphological quality elements			
Hydrology	High	High	
Morphology	Good	Good	
Physico-chemical quality elements			
Ammonia	-	-	-
Dissolved Oxygen	High	High	-
pH	High	High	-
Soluble reactive phosphorus	High	High	-
Temperature	High	High	-
Specific Pollutants	High	High	

Reasons for failure

None

Table 3.2 – River Glen from College Burn to River Till (GB102021072950) classification

Water body details (from Solway Tweed RBMP)			
Water body name	River Glen from College Burn to River Till		
Water body ID	GB102021072950		
River Basin District	Solway Tweed		
Hydromorphological designation (and reason)	Heavily Modified Water Body (Flood Protection)		
Current Overall Status	Moderate Status		
Status Objective	Good Status by 2027		
Justification if not good by 2015	N/A		
Sensitive habitats/ Protected areas	Tweed Catchment Rivers – England: Till Catchment SAC and SSSI		
Element	Current Status (and confidence)	Predicted Status by 2015	Reason for Failure
Biological quality elements			
Fish	-	-	
Invertebrates	High	High	-
Macrophytes	-	-	-
Phytobenthos	-	-	-
Hydromorphological quality elements			
Hydrology	High	High	
Morphology	Moderate	Moderate	Technically infeasible (M3a)
Physico-chemical quality elements			
Ammonia	-	-	-
Dissolved Oxygen	High	High	-
pH	High	High	-
Soluble reactive phosphorus	High	High	-
Temperature	High	High	-
Specific Pollutants	High	High	
Mitigation Measures			
Mitigation measures assessment	Moderate		
Measures in place	<ul style="list-style-type: none"> - Retain marginal aquatic and riparian habitats 		
Measures not in place	<ul style="list-style-type: none"> - Set-back embankments - Improve floodplain connectivity - Sediment management strategies 		

Reasons for failure

M3a – Morphology: Physical modification – Flood protection

3.2 SCREENING OF GROUNDWATER BODIES FOR ASSESSMENT

The area of proposed works is underlain by this single groundwater body, the Till Devonian and Lower Carboniferous (GB40202G700100). This is currently at Good Chemical and Quantitative Status. No groundbreaking activities with the potential to impact these quality elements are proposed as part of this project. This groundwater body is, therefore, screened out from further assessment under this report.

4. ASSESSMENT OF EFFECTS FROM WESTNEWTON BRIDGE PROJECT

This section summarises the results of the assessment used to determine whether the proposed scheme has the potential to cause deterioration in status or prevent the achievement of WFD objectives for the water bodies screened in **Section 3**.

The assessment presented in **Tables 4.1** and **4.2** details potential impacts from each proposed restoration activities.

Assessment tables key:

Effect on quality elements or Mitigation Measures (MM)
No deterioration/ Positive benefit/ No impact on or contributes to delivery of MM
Does not impact quality elements / contribute to MM or prevent delivery - No change
Deterioration-further assessments needed/ conflicts with or prevents delivery of MM

Table 4.1 Assessment of impacts in the College Burn from Lamden Burn to Glen (GB102021072940)

Water body Name & ID: College Burn from Lamden Burn to Glen (GB102021072940)				
Activities	Installation of large wood structures	'Roughening' of concrete apron at bridge	Raising of embankment	Re-profiling of downstream bridge abutment
Element (current and predicted status)	Predicted Effect			
Biological Quality Elements				
Fish	<ul style="list-style-type: none"> Improved spawning and nursery habitat as a result of increased flow heterogeneity and localised 'flushing flows' in areas of narrowed flow. Improvement of habitats through localised trapping of fine sediments and development of marginal cover 	<ul style="list-style-type: none"> Enhancement of fish passage through creation of diverse flow depth and velocity through concrete apron structure design. 	<ul style="list-style-type: none"> Localised raising of embankments is not expected to impact in-channel habitats or floodplain connectivity to at a water body level. 	<ul style="list-style-type: none"> This activity is expected to result in localised positive effects through the creation of a two-stage channel cross-sectional - 'shelf' section. However, effect is deemed too localised to significantly contribute to water body level classification.
Invertebrates	<ul style="list-style-type: none"> Improved in-channel habitat diversity is expected to support a more diverse range of species, contributing to the maintenance of 'High' ecological status. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> Localised raising of embankments is not expected to impact habitats for invertebrates at a water body level. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element.

Phytobenthos	<ul style="list-style-type: none"> The effect upon Phytobenthos is expected to be positive in association with improved flow heterogeneity. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element.
Macrophytes	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 			
Hydromorphological quality elements				
Quantity and Dynamics of river flow	<ul style="list-style-type: none"> Introduction of large wood structures and creation of localised flow heterogeneity is expected to positively benefit geomorphic processes (i.e. towards a more natural state) 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> Localised raising of embankments is not expected to significantly impact this quality element, given their limited geographical extent (approximately 0.5% of total water body extent). 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element.
Connection to Groundwater bodies	<ul style="list-style-type: none"> No ground-breaking activities with the potential to impact this quality element are proposed within the scope of works. 			
River Continuity	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> Redesign of bridge abutments is expected to improve conveyance through Westnewton Bridge. However, potential effects to river continuity are deemed too localised to result in improvements to

				river continuity at a water body level.
River depth and width variation	<ul style="list-style-type: none"> Introduction of large wood structures is expected to positively contribute through direct variation in channel geometry (constructions and expansions relating to wood structures) and towards assisted natural recovery of channel form through promotion of more dynamic morphology throughout the study reach. 	<ul style="list-style-type: none"> Introduction of cobbles and boulders at concrete apron structure is expected to positively impact this quality element. However, given the limited geographical extent of proposed implementation, this improvement is not expected to be significant at a water body level. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> Re-profiling of bridge abutments is expected to improve river width variation through creation of the 'shelf' section. However, given the limited geographical extent of proposed implementation, this improvement is not expected to be significant at a water body level.
Structure and substrate of the river bed	<ul style="list-style-type: none"> Through the influence on increased physical channel heterogeneity (and, therefore, hydraulics), the introduction of large wood structures is expected to support the localised 'flushing' of fine sediments, improving structure and substrate of the river bed throughout the study reach. 	<ul style="list-style-type: none"> Introduction of cobbles and boulders is expected to support improvements to the substrate and structure of the river bed through the Westnewton Bridge. However, given the limited geographical extent of proposed implementation, this improvement is not expected to be significant at a water body level. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> No significant effect at a water body level for this quality element.

<p>Structure of the riparian zone</p>	<ul style="list-style-type: none"> • Introduction of large wood structures is expected to result in localised areas of marginal sediment deposition with the potential to support the establishment of riparian vegetation. 	<ul style="list-style-type: none"> • No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> • Changes in extent and height of existing embankments is expected to result in short-term detrimental impacts to quality of riparian habitats. However, given their limited geographical extent (approximately 0.5% of total water body extent), proposed measures are not expected to impact this quality element at a water body level. 	<ul style="list-style-type: none"> • No significant effect at a water body level for this quality element.
<p>Physico-chemical quality elements</p>				
<p>Dissolved Oxygen/ Ammonia/ pH/ Temperature/ Specific pollutants</p>	<ul style="list-style-type: none"> • No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> • No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> • No significant effect at a water body level for this quality element. 	<ul style="list-style-type: none"> • There is potential for the release of contaminants into the watercourse during the redesign of bridge abutments, which could potentially impact upon the physico-chemical quality elements. Implementation of Pollution Prevention guidelines 5 (PPG5 – Works and maintenance in or near

				water) should be adopted to decrease likelihood of accidental contamination of water body. Given the small likelihood of impacts associated with this element of construction following implementation of PPG5, any potential effects are unlikely to be of sufficient significance to cause deterioration in water body status
Critical/ Sensitive Habitats	Reference to important populations of Salmon, Brown Trout and Lamprey have been included in the Tweed Catchment Rivers – England: Till Catchment SAC and SSSI citation. The proposed scheme is expected to result in improvements to fish passage through Westnewton Bridge, benefiting migratory species and contributing to a favourable condition assessment within these designations. In addition, no significant detrimental impact to in-channel and riparian habitats that support the diverse macrophyte species assemblage present in these designations has been identified.			
Mitigation measures	Given the small likelihood of impacts associated with all elements of construction and operation of the scheme, any potential changes are unlikely to be of sufficient significance to cause deterioration in water body status. Additional mitigation measures are, therefore, not required.			
Achievement/ Maintenance of GES	No proposed project activities have been identified that are contrary to the maintenance of Good Ecological Status in this water body.			
Cumulative impacts	No other related schemes are proposed for this water body and the project team have not identified any others in the area which may have an in-combination impact.			
Delivery of WFD objectives	The proposed scheme can be expected to contribute towards the delivery of WFD objectives in this water body through improvements to flow heterogeneity (associated with installation of large wood structures) and improvements to fish passage at Westnewton Bridge (associated with ‘roughening’ of concrete apron structure).			

Table 4.2 Assessment of impacts in River Glen from College Burn to River Till (GB102021072950)

Water body Name & ID: Glen from College Burn to Till (GB102021072950)				
Activities	Installation of large wood structures	'Roughening' of concrete apron at bridge	Raising of embankment	Redesign of bridge abutment
Element (current and predicted status)	Predicted Effect			
Biological Quality Elements				
Fish/ Invertebrates/ Phytobenthos/ Macrophytes	<ul style="list-style-type: none"> No projected disturbance to the hydromorphological or physico-chemical elements with the potential to propagate downstream to this water body has been identified. Therefore, no detrimental impacts to the classification of biological quality elements or implementation of measures to achieve good ecological potential is expected. 			
Hydromorphological quality elements				
Quantity and Dynamics of river flow/ Connection to Groundwater bodies/ River Continuity/ River depth and width variation/ Structure and substrate of the river bed	<ul style="list-style-type: none"> Proposed works are not expected to result in long-term effects on flow and sediment dynamics at a water body level. No significant hydromorphological impacts with the potential to propagate downstream to this water body are, therefore, expected. In addition, no impact to the mitigation measures defined in Table 3.2 is deemed likely given the absence of direct intervention on embankments and flood defence structures in this water body. 			
Physico-chemical quality elements				
Dissolved Oxygen/ Ammonia/ pH/ Temperature/ Specific pollutants	<ul style="list-style-type: none"> There is potential for the release of contaminants into the watercourse during construction of proposed scheme, which could propagate downstream, impacting upon the physico-chemical quality elements of this water body. Pollution Prevention Guidelines 5 (PPG5 – Works and maintenance in or near water) should be adopted to decrease likelihood of accidental contamination of upstream water body. Given the small likelihood of impacts associated with this element of construction following implementation of PPG5, any potential effects are unlikely to be of sufficient significance to propagate downstream to this water body, causing deterioration in ecological potential. 			

Critical/ Sensitive Habitats	Reference to important populations of Salmon, Brown Trout and Lamprey have been included in the Tweed Catchment Rivers – England: Till Catchment SAC and SSSI citation. The proposed scheme is expected to result in improvements to fish passage through Westnewton Bridge, benefiting migratory species and contributing to a favourable condition assessment within these designations. In addition, no significant detrimental impact to in-channel and riparian habitats that support the diverse macrophyte species assemblage present in these designations has been identified.
Mitigation measures	Given the absence of direct interventions in this water body or long term effects on flow and sediment regimes during the construction and operation of the scheme, any potential changes are unlikely to be of sufficient significance to cause deterioration in water body status. Additional mitigation measures are therefore not required.
Achievement/ Maintenance of GES	No proposed project activities have been identified that are contrary to the achievement of Good Ecological Potential in this water body.
Cumulative impacts	No other related schemes are proposed for this water body and the project team have not identified any others in the area which may have an in-combination impact.
Delivery of WFD objectives	No contributions to the delivery of WFD objectives in this water body are predicted in association with the implementation of proposed scheme.

5. CONCLUSION

Following the assessment presented in this document it was concluded that no detrimental impacts to quality elements or the capability to achieve good ecological potential are to be expected from proposed works. No further assessment is required.

The assessment presented in this report demonstrates that the proposed works are compliant with the WFD and contribute towards the delivery of water body objectives in the College Burn (GB102021072940). The nearest downstream water body (River Glen from College Burn to River Till - GB102021072950) has been assessed as receiving no detrimental impacts from upstream works with the potential to compromise the delivery of its WFD objectives. No further assessment of impacts from this scheme is, therefore, deemed necessary.

6. REFERENCES

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