



**Haweswater Aqueduct Resilience Programme - Proposed Bowland
Section**

Environmental Statement

Volume 4

Appendix 7.4: Water Quality Baseline Information

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1. Introduction

- 1) This Appendix provides a detailed description of the baseline conditions of the catchments referred to in Chapter 7: Water Environment of the Proposed Bowland Section. Each catchment, presented within this appendix, interacts with the Proposed Bowland Section and is classified under The Water Framework Directive (WFD).
- 2) The following data sources have been consulted in collating this baseline information:
 - The WFD information has been obtained from the Environment Agency's (EA) Data Catchment Explorer (Environment Agency, 2020), utilising the most recent classification data available (2019)
 - Information on Atlantic Salmon has been obtained from the National Biodiversity Network (NBN) Atlas online tool (NBN, 2020)
 - Data on Geological strata both lithological and superficial were obtained from The British Geological Survey online tool (BGS, 2020)
 - Protected status areas (as defined by Natural England 2020) and water quality issue areas were identified using the online Department for Environment Food and Rural Affairs mapping tool (DEFRA). For definitions of each designation please refer to the Glossary of terms at the end of this Appendix
 - Ordnance Survey (OS) Mapping.

2. Water Quality Baseline Conditions

- 3) Table 1 provides an overview of the baseline conditions for each of the WFD catchments discussed within the water quality assessment in Chapter 7: Water Environment of the Proposed Bowland Section.

Table 1: Water Quality Baseline Conditions

Catchment	Description	Project Interaction	Attribute	Summary
Watercourse (WFD ID): Hindburn (GB1120766050) Catchment length: 27.0 km Catchment area: 49.1 km ²	<p>Land use: Land use within the catchment is 100 % rural, with isolated farmsteads, residential holdings, open fields and coniferous riparian vegetation occurring in strips along the banks of watercourses, with isolated pockets of coniferous trees throughout the catchment. Local A and B roads connect the catchment area to the surrounding major road networks.</p> <p>Catchment geology: The bedrock geology within the upper catchment is dominated by the Cocklett Scar Sandstone and Close Hill Siltstone Formations, formed approximately 324-328 million years ago as part of a wider subaqueous fan system during the Carboniferous Period. Multiple large faults trend east - west, with parallel and perpendicular fault splays.</p> <p>Catchment geology is known to influence water chemistry which can significantly affect water quality. All rocks are broken down and dissolved in water. Sandstones and siltstones contain quartz and feldspars, which are resistant to weathering and dissolution, therefore if bedrock geology is a major control on water quality within the catchment. Total dissolved solids are likely to be low.</p> <p>Superficial geology on higher slopes is dominated by glacial till composed of diamicton, formed up to two million years ago during the Quaternary period. On lower slopes within the</p>	Lower Houses Compound	Water quality/supply	Overall Classification: Moderate Overall Ecological Classification: Moderate Supports High Physico-chemical quality elements Overall Chemical Classification: Fail Potential additional pollutant sources: diffuse rural sources, road drainage. The catchment does not encompass any surface water abstractions.
			Protected status area	SSSI – No SSSI's occur within the assessment area associated with the Lower Houses Compound. The southern part of the catchment and tunnel envelope encompasses part of the Bowland Fells SSSI which is the main upland block within the area of Lancashire known as The Forest of Bowland. The under lying bedrock is the Pendle Grit Member which overlies Carboniferous Limestones. These extensive upland fells support the largest expanse of blanket bog and heather moorland in Lancashire and provide suitable habitat for a diverse upland breeding bird community which includes three species (hen harrier (<i>Circus cyaneus</i>), merlin (<i>F. columbarius</i>) and peregrine (<i>peregrinus</i>)). Additional interest is provided by the existence of one of the largest lesser black-backed gull colonies in Great Britain. Nationally or locally uncommon plant species and a variety of upland habitats and their associated avifauna are also present. The most extensive plant communities within the site are dry heather-dominated heathland, generally found on the steeper slopes, and heather (<i>Calluna vulgaris</i>) and cottongrass (<i>Eriophorum</i>)

Catchment	Description	Project Interaction	Attribute	Summary
	<p>lower catchment towards The River Hindburn, superficial geology tends to be composed of river terrace deposits consisting of sands and gravels (BGS 2020) and are likely relic terraces of The River Hindburn. Towards the confluence with The River Wenning superficial geology transitions to alluvium consisting of clay, silt, sand and gravels. Superficial deposits are less resistant than bedrock to weathering. Poorly consolidated superficial deposits, if disturbed, could lead to large volumes of sediment entering surface waters thus degrading water quality.</p>			<p><i>vaginatum</i>) dominated blanket bog which covers the tops of the ridges and shallow slopes. Flushes and springs are not common but provide a habitat for the Lancashire rarities lesser twayblade (<i>Listera cordata</i>), broad-leaved cotton grass (<i>Eriophorum latifolium</i>) and pale forget-menot (<i>Myosotis stolonifera</i>) – a nationally scarce species.</p> <p>SSSI – The catchment also encompasses the Far Holme Meadow SSSI within its middle to lower reaches. The SSSI lies out with the assessment area associated with the Proposed Lower Houses Compound. The SSSI is centred on approximately SD 64573 65574 and sits in the right bank of a meander of The River Hindburn. The site supports three types of herb-rich neutral grassland in which over 80 species of plants have been recorded. The grassland plant communities present support many species characteristic of old hay meadows which have been traditionally managed and left unimproved for many years. Such communities are now scarce nationally and represent a highly vulnerable habitat.</p> <p>SSSI – The catchment also encompasses part of the Robert Hall Moor SSSI in its northern reaches. The SSSI lies out with the assessment area associated with the Proposed Lower Houses Compound. The SSSI is centred on SD 632688 and consists of an area of wet unimproved grassland, flushes and scrub situated on a drumlin (glacial mound) south west of the town of Wennington. The site is designated for a range of (over 150) plant species including two nationally rare species including blunt-flowered rush <i>Juncus subnodulosus</i> accompanied by characteristic marsh plants such as meadowsweet, water mint, marsh pennywort, angelica, ragged robin, marsh cinquefoil and marsh ragwort. The blunt-flowered rush</p>

Catchment	Description	Project Interaction	Attribute	Summary
				<p>community, which is associated with basic groundwater, is rare in Britain.</p> <p>SAC - The catchment does not encompass any SAC.</p> <p>SPA - The southern part of the catchment is part of the Bowland Fells SSSI and is also a designated SPA over the same area.</p> <p>AONB - The catchment is encompassed by the Forest of Bowland AONB.</p> <p>National Park - The upper north east of the catchment lies within the Yorkshire dales National Park.</p>
			Biodiversity	<p>Atlantic Salmon (<i>Salmon salar</i>) - The NBN Atlas (NBN 2020) indicates multiple sightings of Atlantic Salmon spawning and migrating the full reach of The River Hindburn.</p> <p>Surface water dependent habitats - Numerous surface water dependent habitats have been identified from OS (10km resolution) mapping within the catchment. However, no surface water dependent habitats occur within the assessment area associated with the Proposed Lower Houses Compound and are therefore not discussed further.</p>
			Water quality issue areas	<p>Sediment Issues Area – High priority</p> <p>Faecal Indicator Organisms Issue Area – High priority</p> <p>Phosphates Issue Area – High Priority</p> <p>Drinking Water Safe Guard Zone – Yes out with the assessment area associated with the Proposed Lower Houses Compound.</p>

Catchment	Description	Project Interaction	Attribute	Summary
<p>Watercourse (WFD ID): The River Hodder (confluence of Easington Brook to the confluence of with The River Ribble (GB112071065560) Catchment length: 34.0 km Catchment area: 69.3 km²</p>	<p>Land use: Land use within the catchment is 95% rural, with isolated residential holdings, farmsteads, areas of mixed deciduous and coniferous riparian vegetation occurring in strips along the banks of watercourses, with isolated areas of mixed coniferous and deciduous trees around property boundaries. Managed mixed wooded areas also occur throughout the catchment. Vegetated areas are separated by open fields and mountainous moorland regions interlinked by minor unnamed roads and the B6478 in the north west of the catchment.</p> <p>Catchment geology: The bedrock geology within the whole catchment is varied and complex. In the north of the catchment the bedrock geology is dominated by the Hodder Mudstone Formation, sedimentary bedrock deposited 337-347 million years ago in warm, shallow pelagic seas during the Carboniferous. The Hodder continues to flow through various Carboniferous calcareous limestone formations thought out the reach until the confluence with The River Ribble.</p> <p>Catchment geology is known to influence water chemistry which can significantly affect water quality. All rocks are broken down and dissolved in water. Mudstones contain quartz and feldspars, which are resistant to weathering and dissolution, but can often contain carbonate cements. Carbonate formations, including limestone, are more easily dissolved. If bedrock geology in the north of the catchment is a major</p>	<p>Newton-in-Bowland Compound</p>	<p>Water quality/ supply</p> <p>Protected status areas</p>	<p>Overall Classification: Moderate Overall Ecological Classification: Good Supports High Physico-chemical quality elements Overall Chemical Classification: Fail Potential additional pollutant sources: diffuse rural sources, road drainage.</p> <p>No surface water abstractions occur within the assessment area associated with the Proposed Newton-in-Bowland Compound. One surface water abstraction been identified within the catchment south of the village of Newton at approximately SD 70498 48119. The abstraction is defined as a spring located near Lower Underhand Farm – Newton, used for general domestic, and agricultural uses owned and operated by “Peel and Knowlemere Co”.</p> <p>SSSI – The western most point of the catchment encompasses part of the Bowland Fell’s SSSI. This SSSI lies out with the assessment area associated with the Newton-in-Bowland Compound. The reader is referred to the description of the Hindburn catchment within this appendix, for a detailed overview of the SSSI.</p> <p>SSSI – The catchment also encompasses the River Hodder Section SSSI. This SSSI lies out with the assessment area associated with the Newton-in-Bowland Compound. The SSSI is centred on SD 701400 and consists of a section of bedrock which the River Hodder has exposed. This locality is important for its exposures of marine Lower Carboniferous rocks. Here a sequence of turbiditic, ancient sediments of Holkerian to Asbian age, including the Bollandoceras hodderense beds is present. As well as being the type locality for these beds and the fossil which</p>

Catchment	Description	Project Interaction	Attribute	Summary
	<p>control on water quality, it is likely to contain less total dissolved solids and a more neutral pH. Where limestone formations dominate, baseline water quality is likely to have higher pH and total dissolved solids.</p> <p>Superficial geology on higher slopes is dominated by glacial till composed of diamicton. On lower slopes towards The River Hodder, superficial geology tends to be composed of numerous (up to three) river terrace deposits made up of sands and gravels. On flatter ground on the River Hodder floodplain superficial geology is generally alluvium, consisting of clay, silt, sand and gravel deposits. Superficial deposits are less resistant than bedrock to weathering and disruption. Poorly consolidated superficial deposits, if disrupted, could lead to large volumes of sediment entering surface waters and degrading water quality.</p>			<p>gives them their name, it is the type locality for a number of other fossil taxa. The rich invertebrate fauna includes trilobites, bivalves, brachiopods, bryozoans, echinoids and cephalopods.</p> <p>SAC – The catchment does not encompass any SAC's</p> <p>SPA - The catchment encompasses part of the Bowland Fells SSSI and is also a designated SPA over the same area.</p> <p>AONB - The catchment is encompassed by the Forest of Bowland AONB</p> <p>Atlantic Salmon - The NBN Atlas (NBN 2020) displays numerous sightings of Atlantic salmon spawning and migrating the full length of this reach of The River Hodder and associated tributaries within the catchment.</p> <p>Surface water dependent habitats – Two surface water dependent habitats have been identified within the assessment area associated with the Proposed Newton-in-Bowland Compound. These habitats consist of an area (0.012km²) of Lowland Fen (National Grid Reference (NGR) SD 68696 50425) and an area (0.032 km²) of Purple Moor Grass and Rush Pasture (NGR SD 69238 50344). Good Quality Semi-Improved Grassland has also been observed within the afore mentioned Lowland Fen.</p> <p>Faecal Indicator Organisms Issue Area – Medium and High priority</p> <p>Phosphates Issue Area – Medium and High priority</p>
			Biodiversity	
			Water quality issue areas	

3. References

The British Geological Survey (BGS) online tool (2020). Available at:
<https://mapapps.bgs.ac.uk/geologyofbritain/home.html>

The Environment Agency's (EA) Data Catchment Explorer (2020) Available at:
<https://environment.data.gov.uk/catchment-planning/>

Department for Environment Food and Rural Affairs (DEFRA) mapping tool Magic Map Application (2020). Available at: <https://magic.defra.gov.uk/MagicMap.aspx>

National Biodiversity Network (NBN) Atlas online tool (NBN 2020). Available at: <https://nbnatlas.org/>

Natural England, UK Government website (2020). Available at:
<https://www.gov.uk/government/organisations/natural-england>

Appendix A. Glossary of Terms

Term	Definition
Area of Outstanding Natural Beauty (AONB)	An Area of Outstanding Natural Beauty (AONB) is an area of countryside in England, Wales or Northern Ireland which has been designated for conservation due to its significant landscape value. Areas are designated in recognition of their national importance.
Drinking Water Safeguard Zones	Drinking Water Safeguard Zones (surface water) are catchment areas that influence the water quality for their respective Drinking Water Protected Area which are at risk of failing the drinking water protection objectives. These non-statutory Safeguard Zones are where action to address water contamination will be targeted, so that extra treatment by water companies can be avoided. Safeguard Zones are a joint initiative between the Environment Agency and water companies. Safeguard Zones are one of the main tools for delivering the drinking water protection objectives of the Water Framework Directive.
Faecal Indicator Organisms Issue Area – High priority	Water quality priority areas where Countryside Stewardship Agreements, under the England Rural Development Programme, could help improve Water Quality in areas identified. Incentives are offered to farmers to adopt agricultural practices which will safeguard areas and meet Water Framework Directive targets.
National Park	The Environment Act 1995 revised the original legislation and set out two statutory purposes for national parks in England and Wales: Conserve and enhance the natural beauty, wildlife and cultural heritage promote opportunities for the understanding and enjoyment of the special qualities of national parks by the public when national parks carry out these purposes they also have the duty to: seek to foster the economic and social well-being of local communities within the national parks.
Phosphates issue area – High priority	Water quality priority areas where Countryside Stewardship Agreements, under the England Rural Development Program, could help improve Water Quality in areas identified. Incentives are offered to farmers to adopt agricultural practices which will safeguard areas and meet Water Framework Directive targets.
Sediment issues Area – High priority	
Surface water nitrate issue area – High priority	
Surface water pesticide issue area – High priority	
Special Area of Conservation (SAC)	A Special Area of Conservation (SAC) is defined in the European Union's Habitats Directive (92/43/EEC). SACS are granted to protect the 220 habitats and approximately 1000 species listed in annex I and II of 92/43/ECC which are considered to be of European interest following criteria given in the directive. They must be chosen from the Sites of Community Importance by the State Members and designated SAC by an act assuring the conservation measures of the natural habitat
Site of Special Scientific Interest (SSSI)	Conservation designation denoting a protected area in the United Kingdom. Sites may be designated SSSI's based on ecological, biological and/or geological areas of interest.
Special Protection Area (SPA)	Special Protection Areas (SPAs) are protected areas for birds in the UK classified under: the Wildlife & Countryside Act 1981 (as amended) and the Conservation (Natural Habitats, & c.) Regulations 2010 (as amended) in England, Scotland and Wales, The Conservation of Offshore Marine Habitats and Species Regulations 2017

Term	Definition
	in the UK offshore area, and other legislation related to the uses of land and sea. SPAs are classified in accordance with European Council Directive 2009/147/EC on the conservation of wild birds, known as the Birds Directive. SPAs protect rare and vulnerable birds (as listed on Annex I of the Birds Directive), and regularly occurring migratory species.