Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Environmental Statement

Volume 4

Appendix 7.4: Water Quality Baseline Conditions

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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 Marl Hill Section Environmental Impact Assessment Report. Each catchment, presented within this appendix, interacts with the Proposed Marl Hill 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 (EA 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
- Ordinance 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 Volume 2 Chapter 7: Water Environment of the Proposed Marl Hill Section.

Table 1: Water Quality Baseline Conditions

Catchment	Description	Project Interaction	Attribute	Description
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 km^2	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. 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. Catchment geology is known to influence water chemistry which can significantly affect water quality. All rocks are broken down and dissolved in water. Mudstones	Proposed Bonstone Compound	Water quality/supply	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. No surface water abstractions occur within the assessment area associated with the Proposed Bonstone Compound. One surface water abstraction been identified within the catchment south of the village of Newton at approximately National Grid Reference (NGR) 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".
			Protected status areas	SSSI – The western most point of the catchment encompasses part of the Bowland Fells SSSI. This SSSI lies out with the assessment area associated with the Proposed Bonstone Compound. The SSSI is centred on (NGR) SD 620570 and consists of extensive upland fells which support the largest expanse of blanket bog and heather moorland in Lancashire. This habitat provides a range of diverse habitats for a number of bird and plant species including hen harrier (Circus cyaneus), merlin *(Falco columbarius)* and peregrine *(Falco Peregrinus)*. On lower slopes, dense bracken stands suppress the growth of ground based fauna, allowing the growth of Bilberry and other plant species including wood sorrel *(Oxalis Acestosello)* and climbing corydalis *(Corydalis cloviculote)*.

Catchment	Description	Project Interaction	Attribute	Description
	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 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. 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.			SSSI – The catchment also encompasses the River Hodder Section SSSI. This SSSI lies out with the assessment area associated with the Proposed Bonstone Compound. The SSSI is centred on NGR 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 gives them their name, it is the type locality for a number of other fossil taxa. The rich invertebrate fauna includes trilobites, bivalves, brachipods, bryozoans, echinoids and cephalopods.
				SAC – The catchment does not encompass any SAC's
				SPA - The catchment encompasses part of the Bowland Fells SSSI and is also a designated SPA over the same area.
				AONB - The catchment is encompassed by the Forest of Bowland AONB.
			Biodiversity	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.
				Surface water habitats – Two habitats consisting of Good Quality Semi-Improved Grasslands centred on NGR SD 70014 48596 and NGR SD 69724 48248 with areas of 0.049 km^2 and 0.11 km^2 respectively have been identified within the study area associated with the Proposed Bonstone Compound. Of the two habitats identified, only Good Quality Semi-Improved Grassland centred on NGR SD

Catchment	Description	Project Interaction	Attribute	Description
				70014 48596 has the potential to interact with above-ground activities.
			Water quality issue areas	Faecal Indicator Organisms Issue Area – Medium and High priority Phosphates Issue Area – Medium and High priority
Watercourse (WFD ID): Bashall Brook (GB112071065520) Catchment length: 11.4 km Catchment Area: 17.7 km^2	Land use: Land use within the catchment is approximately 90 % rural with isolated farmsteads and small residential holdings surrounded by fields and separated by marshland in lowland areas and deciduous riparian vegetation occurring in strips along the banks of watercourses, with isolated areas of deciduous trees. The catchment also encompasses areas of managed mix coniferous and deciduous woodland, including Blackhill and Braddup wood. The catchment is interlinked by a minor road network. Southern parts of the catchment encompass part of the small village of Waddington. Catchment geology: The bedrock geology within the catchment is complex and made up of a series of calcareous Carboniferous limestone formations formed 331 – 347 million years ago in an environment dominated by warm shallow seas. In the upper catchment the mudstones and sandstones of the Bowland Shale and Pendle grit member dominate. The Bowland Shale and Pendle Grit formations were	Proposed Braddup Compound	Water quality/supply	Overall Classification: Moderate Overall Ecological Classification: Moderate Supports Moderate Physico-chemical quality elements Overall Chemical Classification: Fail Potential additional pollutant sources: diffuse rural sources, road drainage. The catchment encompasses two surface water abstractions one of which occurs within the assessment area associated with the Proposed Braddup Compound. This abstraction is located at approximately NGR SD 72113 45686 near unnamed watercourse W525. The abstraction is termed "Rushy Well" and is described as a spring which is primarily used for general agricultural and domestic purposes. The second abstraction occurs to the north and out with the assessment area associated with the Proposed Braddup Compound at NGR SD 71405 46491. The abstraction is described as a natural spring, west of Moorcock inn, used for general agricultural and domestic purposes.
			Protected status areas	SSSI – No SSSI's have been identified within the assessment area associated with the Proposed Braddup Compound, or the catchment as a whole.
				SAC – The catchment does not encompass any SAC's

Catchment	Description	Project Interaction	Attribute	Description
	deposited 319 – 337 million years ago in pelagic open seas (BGS 2020). Catchment geology is known to influence water chemistry which can significantly affect water quality. All rocks are broken down and dissolved in water. Sandstones contain quartz and feldspars which are resistant to weathering and dissolution. Carbonate formations including limestone are more easily dissolved. If bedrock geology in the north of the catchment is a major control on water quality, it is likely to contain less total dissolved solids. Where limestone formations dominate, baseline water quality is likely to have higher pH and total dissolved solids. Superficial deposits within the catchments are dominated by glacial till with isolated pockets of alluvium. 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.			SPA – The catchment does not encompass any SPA's
				AONB - The catchment is encompassed by the Forest of Bowland AONB
			Biodiversity	Atlantic Salmon - The NBN Atlas (NBN 2020) displays numerous sightings of Atlantic Salmon spawning and migrating within the catchment. Surface water dependant habitats - Numerous surface water dependant habitats have been identified from OS (10 km resolution) mapping within the catchment. No surface water dependant habitats occur within the assessment area associated with the Braddup Compound and therefore are not discussed further.
			Water quality issue areas	Surface Water Pesticide Issue Area – High priority Faecal Indicator Organisms Issue Area – High priority

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.
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.
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/EEC 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 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.