Haweswater Aqueduct Resilience Programme

Chapter 9 – Appendix 9A.4

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Environmental Statement

Haweswater Aqueduct Resilience Programme

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1. NVC Technical Appendix

1.1 Introduction

1) TEP was appointed by United Utilities to complete an Ecological Impact Assessment (EcIA) for the Haweswater Aqueduct Resilience Programme – Proposed Bowland Section. The EcIA is required to inform an Environmental Impact Assessment (EIA) and support production of the Environmental Statement (ES).

2) A series of ecological surveys was undertaken to complete the EcIA. This Appendix is one of a series of Ecological Technical Reports (ETRs) produced to support the EcIA. This ETR documents the methods and findings of the National Vegetation Classification (NVC) surveys undertaken by Bowland Ecology.

1.2 Summary of Findings

3) Two areas (Area 1 and Area 2) were subject to NVC survey during 2019 and 2020. Area 1 consisted of an area of fen habitat associated with the Gamble Hole Farm BHS within the west of the Newton-in-Bowland Compound. Area 2 consisted of a strip of grassland within the construction access area associated with the Newton-in-Bowland Compound.

4) Area 1 was found to consist of a mosaic of M22a fen meadow and M26 mire habitat. This is a rare example of fen meadow/mire mosaic within the Forest of Bowland AONB, which qualifies as a S41 NERC (2006) Habitat of Principal Importance.

5) Area 2 is located adjacent to and within the construction access area to the east of the Newton-in-Bowland Compound. The area was found to consist of a shallow tufa-rich ditched stream lined with tall wetland herbs within a fenced area between pasture fields with adjacent trees and scrub in the north, expanding out into a variety of swamp and inundation habitats in the south. The tufa-rich communities in the north of Area 2 may be considered to be a form of EC Annex 1 habitat 'Petrifying springs with tufa formation (Cratoneurion). The tufa-rich area is almost entirely outside of the construction access area, but borders the north of this area. A small part of the watercourse is located within the north of the construction access area. The swamp and inundation habitats are crossed by the construction access area.

Appendix A. Bowland NVC Report – Area 1

1. Project Details			
Project Name:	Haweswater Aqueduct Resilience Programme	Project Number:	**80061155**
Written:	Jeremy James	Approved:	
Report reference:	TR3 NVC Report	Date:	05/12/19

2. Project Drawings	
See separately issued PDF.	

3. National Vegetation Classification Survey Methods	
Surveyors:	Jeremy James
Survey date:	17th September 2019
Method:	The field surveys provide detailed vegetation community and habitat descriptions including identification of the communities and sub-communities of the National Vegetation Classification (NVC) present. Detailed species lists are produced for all NVC communities identified. Vegetation communities are assessed by quadrat survey and identified to NVC community.
	In each habitat type, homogenous vegetation types are identified, and randomly placed quadrats recorded within carefully chosen representative stands. The size of the recorded quadrats (2 x 2m) followed the methodology outlined in the NVC users' manual (2006). Quadrat samples have been first analysed individually using the CEH Modular Analysis of Vegetation Information System (MAVIS). The outputs from MAVIS have been used in conjunction with the published community accounts in Rodwell (199.) in order to assign the sampled vegetation to particular plant communities. It should be noted that the mapped boundaries between different vegetation types are indicative only, whereas in reality there are often very gradual transitions between the types.
Weather Conditions:	Cloud cover (3/8), Wind Beaufort F2, 15°C, no precipitation.
Limitations:	Late in season and grazed hence not possible to identify all species particularly those flowering earlier in the year.

4. NVC Survey Results

TR3 Fen Meadow Survey Area

Description	Gently sloping, base rich spring and seepage on a thin mineral soil supporting a fen mosaic. Affinities with M22 although *Juncus subnodulosus* is notably absent and this stand of vegetation possibly represents an undescribed variant. A variable sward generally dominated by *Juncus articulata/J. acutiflorus* with stands of short grazed sedge carpets (*Carex panacea, C. nigra*), tall stands with fen species including *Cirsium palustre*. Localised patches with dominance by *Carex acutiformis*. Species of note during the survey included *Epipactis palustris*. The area is affected by grazing (sheep and cattle) and possible cutting (arisings present, possibly attempts to cut *Juncus*).

Summary of Mire NVC Survey Results

Combined Analysis of Quadrats

Quadrat number	NVC community (closest match)	NVC community description (closest match)	Goodness of fit
Q1-Q8	M22a	*Juncus subnodulosus-Cirsium palustre* fen meadow, typical subcommunity. According to MAVIS analysis similar coefficients were generated for M22a 44.93, M25c 44.48, M13a 42.78, M27c 42.01.	Poor - 44.93
Discussion	A rare example of fen meadow within the Forest of Bowland AONB which qualifies as a S41 NERC (2006) Habitat of Principal Importance. The area is spring fed and base rich. Grazing, trampling, cutting and possibly nutrient enrichment effect this area. Of note is the presence of marsh helleborine. Would strongly advise that the scheme avoids impacting on this area, particularly to ensure that there is no interruption to the hydrological regime. Furthermore, this area has **high potential** to offer biodiversity gains through more careful management (reduced grazing, cutting).	

References

J. S. Rodwell (Ed.) (1991). *British Plant Communities: Volume 2, Mires and Heaths*. Cambridge University Press

Rodwell, J.S. (2006) NVC Users' Handbook, JNCC

Appendix A: Raw Quadrat Data and MAVIS Analysis Results

Quadrat No Quadrat size	1 2x2m	2 2x2m	3 2x2m	4 2x2m	5 2x2m	6 2x2m	7 2x2m	8 2x2m
Current species name	**Domin**	**Domin**	**Domin**	**Domin**	**Domin**	**Domin**	**Domin**	**Domin**
Agrostis stolonifera	5	4	4	4	4	-	-	-
Briza media	-	-	-	4	4	-	-	-
Calliergonella cuspidata	-	-	-	5	4	4	4	5
Carex acutiformis	-	-	-	-	-	-	6	-
Carex viridula	-	-	-	-	1	1	-	-
Carex echinata	-	-	-	-	1	1	-	-
Carex nigra	-	-	-	4	4	-	-	-
Carex panicea	4	2	-	4	4	5	5	4
Cirsium palustre	2	1	-	-	-	-	2	-
Epilobium palustre	-	-	2	-	-	-	-	-
Epipactis palustris	-	-	-	-	-	1	-	4
Eupatorium cannabinum	-	-	-	-	-	-	1	-
Eriophorum angustifolium	-	-	-	-	-	-	-	6
Festuca cf arundinacea	-	2	-	-	-	-	-	-
Festuca ovina/rubra	4	5	4	-	-	-	-	-
Festuca rubra	-	-	-	-	1	1	-	-
Filipendula ulmaria	4	5	-	4	4	-	-	-
Galium palustre	-	-	-	1	1	-	-	-
Geum rivale	1	-	-	-	-	-	-	-
Holcus lanatus	4	4	2	-	-	-	-	4
Hypericum tetrapterum	-	-	-	-	-	-	4	4
Juncus articulatus/acutiflorus	6	5	7	7	4	3	4	-
Juncus inflexus	-	-	2	-	-	-	-	-
Mentha aquatica	-	-	2	1	-	4	4	-
Molinia caerulea	5	4	4	5	4	4	4	2
Parnassia palustris	-	-	-	1	4	2	-	1
Phleum pratense	4	4	-	-	-	-	-	-
Potentilla anserina	1	-	-	-	-	-	-	-
Ranunculus repens	4	1	4	-	-	-	-	-
Stachys officanlis	-	-	-	-	1	-	-	-
Succisa pratensis	-	-	-	-	4	4	4	1
Taraxacum agg	1	-	-	-	-	-	-	-
Triglochin palustre	-	-	-	1	-	-	-	2
Trifolium repens	2	-	-	-	-	-	-	-

Additional Species (DAFOR)
Anthoxanthum oderatum O
Aulacomnium palustre R
Angelica sylvestris R
Crepis sp R
Caltha palustre R
Menyanthes trifoliata R
Chara sp R
Dactylorhiza sp O
Scorpidium scorpioides lF
Juncus effusus R

Appendix B. Bowland NVC Report – Area 2

Ecology Survey Data Report: National Vegetation Classification Surveys

1. Project Details			
Project Name:	Haweswater Aqueduct Resilience Programme	Project Number:	**80061155**
Written:	Matt Clifford, *Senior Ecologist*	Approved:	Alice Helyar, *Principal Ecologist*
Report reference:	TR3 NVC Report Area 2	Date:	14/07/2020

2. Project Drawings
TBC (TR3.NVC2)

3. National Vegetation Classification Survey Methods	
Surveyors:	Matt Clifford
Survey date:	2nd July 2020
Method:	The field surveys provide detailed vegetation community and habitat descriptions including identification of the communities and sub-communities of the National Vegetation Classification (NVC) present. Detailed species lists are produced for all NVC communities identified. Vegetation communities are assessed by quadrat survey and identified to NVC community. In each habitat type, homogenous vegetation types are identified, and randomly placed quadrats recorded within carefully chosen representative stands. The size of the recorded quadrats (2 x 2m) followed the methodology outlined in the NVC users' manual (2006). Quadrat samples recorded the presence of all higher plant and bryophyte species within the quadrat using Domin[1] scores. In addition, species that were present in a particular stand but not found within the quadrat, were recorded as 'outsiders'. Vascular plant names follow Stace (2010), bryophyte names follow Smith (2004). Digital photographs of representative features were taken and locations of quadrat samples, target notes, and vegetation boundaries were recorded in the field on a tablet GIS with inbuilt GPS nominally accurate to ± 5 m.

Quadrat samples have been first analysed individually using the CEH Modular Analysis of Vegetation Information System (MAVIS). The outputs from MAVIS have been used in conjunction with the published community accounts in Rodwell (1999.) in order to assign the sampled vegetation to particular plant communities. However, it should be noted that the chosen community or sub-community was not necessarily that with the highest MAVIS coefficient, and the surveyor's previous experience of these types of wetland vegetation was used in the final determination. It should be noted that the mapped boundaries between different vegetation types are indicative only, whereas in reality there are often very gradual transitions between the types. |
| Weather Conditions: | Cloud cover (8/8), Wind Beaufort F1, 14°C, occasional light rain. |
| Limitations: | No limitations to the survey |

4. NVC Survey Results

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[1] Domin scale (*sensu* Dahl & Hadac 1941; see Rodwell 1991, p6):
1: <4% cover, with few individuals. **2:** <4% cover, with several individuals. **3:** <4% cover, with many individuals. **4:** 4-10% cover. **5:** 11-25% cover.
6: 26-33% cover. **7:** 34-50% cover. **8:** 51-75% cover. **9:** 76-90% cover. **10:** 91-100% cover.

TR3 Area 2	

Description and discussion	A shallow tufa-rich ditched stream, much of which is lined with tall wetland herbs, runs within a fenced area between pasture fields with adjacent trees and scrub. The watercourse leaves the fenced area and runs southwards across an open field, before expanding out into a variety of swamp and inundation habitats. Water eventually reaches a larger ditch to the south.
	The area subject to survey notably includes a tufa-rich ditched stream and possible tufa spring community within the northern half of the survey area, which may be considered to be a form of **EC Annex 1 habitat 'Petrifying springs with tufa formation (*Cratoneurion*)'.** It is therefore recommended that the scheme avoids impacting upon the tufa-rich communities, particularly to ensure that there is no interruption to the hydrological regime. It is also recommended that the scheme avoids the southern area where the stream expands out into the more diverse areas of swamp, fen and inundation communities. Furthermore, the southern area has **high potential** to offer biodiversity gains through more careful management (reduced grazing, trampling) to further increase the species diversity within the area.

Summary of NVC Survey Results

Analysis of Quadrats

Quadrat number	NVC community (closest match)	NVC community description (closest match)	Goodness of fit
Q1, 2 & 4	M27	A narrow strip of habitat between a fence and shallow tufa-rich ditched stream, much of which is lined with tall wetland herbs including *Filipendula ulmaria, Angelica sylvestris, Caltha palustris, Juncus inflexus, Juncus effusus* and *Geum rivale*. More open tufa rich patches *support Mentha aquatica, Veronica beccabunga, Cratoneuron filicinum, Brachythecium rivulare* and *Calliergonella cuspidate*. However, these species are interspersed with rank grasses, *Urtica dioica* and frequent bare ground (mammal paths).	M27: 52.88
Q3	M23b	A small base rich spring which has abundant coverage of *Calliergon cuspidatum* suggesting it could have affinity with M37. However, this is overtopped with rushes, herbs and grasses giving the habitat a poor affinity with M23b and M27c.	M23b: 36.77 M27c: 36.13

Q5	S22a	The ditched steam leaves the fenced area and runs southwards across an open field, with no significant channel. Glyceria fluitans and Mentha aquatica dominate where the water is slightly faster moving. The slope shallow results in the water slowing and expanding out into a variety of swamp and inundation habitats.	S22a: 48.00

Q6	M23b	Species-poor marshy grassland occurs to the west of the swamp, within the corner of two fields.	M23b: 34.51 MG9: 33.14

	S7	*Carex acutiformis* swamp occurs within a portion of the ditched stream and adjacent to the ditch located to the south. Very few other species. No quadrats required.	

| | S19 | Very small area of *Eleocharis palustris* swamp. No quadrat required. | |

| | MG13 | Seasonally inundated habitat with frequent to abundant *Alopecurus geniculatus* and *Agrostis stolonifera*. Mostly outside of the survey area. | |

| | | No Photo | |

| | MG10/MG9 | Where the ground becomes drier, the swamp and marshy grassland habitats grade into heavily grazed species-poor grassland with occasional to frequent clumps of *Deschampsia cespitosa* and *Juncus effuses.* | |

References

J. S. Rodwell (Ed.) (1991). *British Plant Communities: Volume 2, Mires and Heaths*. Cambridge University Press

Rodwell, J.S. (2006) NVC Users' Handbook, JNCC

Appendix A: Raw Quadrat Data

Quadrat ID	1	2	3	4	5	6	7
Current species name	Domin	Domin	Domin	Domin	Domin	Domin	Domin
Agrostis stolonifera					2		
Anthoxanthum odoratum							5
Brachythecium rivulare			2				
Brachythecium rutabulum		1					
Calliergon cuspidatum		2	9	4			
Caltha palustris				6			
Cardamine flexuosa	2		4	2			3
Carex hirta	2						
Carex nigra			2				
Cirsium arvense						3	
Cirsium palustre				1			
Cratoneuron filicinum	2	5					
Cruciata laevipes		5					
Cynosurus cristatus						3	
Dactylis glomerata	2						
Deschampsia cespitosa		3				4	7
Epilobium palustre						1	
Equisetum arvense			3				
Festuca rubra agg.	3					2	2
Filipendula ulmaria	7	8					
Galium aparine		2					
Galium palustre				3		4	
Geum rivale	4	6					
Geranium robertianum		3					
Glyceria fluitans					9		
Holcus lanatus		6	4	5		5	8
Juncus effusus	7		8			8	1
Juncus inflexus				5			
Juncus articulatus			3				
Lotus pedunculatus			5	2			
Mentha aquatica			3	8	7		
Mnium hornum	2	3					
Poa trivialis	3						3
Prunella vulgaris							1
Ranunculus acris							3
Rhytidiadelphus squarrosus							2
Rubus fruticosus agg.	3						
Silene dioica	1						
Trifolium repens							3
Trisetum flavescens		1					
Urtica dioica	6						3
Valeriana officinalis		5					
Veronica beccabunga			2				
Veronica montana	3						