Appendix B6: Ecology Assessment – Ribble Crossing

Document reference: RVBC-MH_SEI-Appendix B6

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Supplementary Environmental Information

Appendix B6: Ecology Assessment - Ribble Crossing

January 2022

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Project No:	B27070CT
Document Title:	Proposed Marl Hill Section Supplementary Environmental Information (SEI) Appendix B6: Ecology Assessment – Ribble Crossing
Document ID:	RVBC-MH_SEI-Appendix B6
Revision:	0
Date:	January 2022
Client Name:	United Utilities Water Ltd
Author:	Mike Walker
Author:	Liz Seal

TEP Limited
Genesis Centre
Birchwood Science Park
Warrington
WA3 7BH
Tel: 01925 844004
Fax: 01925 844002
E-mail: tep@tep.uk.com

Contents

1. Ecology Assessment of Ribble Crossing SEI

1.1 Introduction

1) United Utilities plc is seeking planning consent for the Haweswater Aqueduct Resilience Programme (HARP), which is a proposal to replace the underground tunnel sections of the existing 110 km Haweswater Aqueduct.

2) This is Appendix B6 Ecology Ribble Crossing and is a technical appendix of the Main Marl Hill Supplementary Environmental Information (SEI) report. Further SEI ecology information can be found in the following documents:

- SEI technical appendix B5, Ecology Marl Hill
- SEI technical appendix B7, Ecology Off-Site Highways Works
- Marl Hill HRA addendum
- Marl Hill SSSI addendum
- Marl Hill BNG On-Site Habitat Compensation revised report
- Marl Hill BNG Off-Site Habitat Compensation revised report

3) This SEI technical appendix B6 provides information to be read in conjunction with the Environmental Statement (ES) and associated planning application for the Marl Hill Section of the Haweswater Aqueduct Resilience Programme (HARP), which were submitted to Ribble Valley Borough Council in June 2021. Specifically technical appendix B6 relates to and should be read in conjunction with ES Volume 6 Proposed Ribble Crossing (Chapter 9A and 9B and supporting figures and appendices cover the terrestrial and aquatic ecology assessments). This SEI technical appendix B6 specifically relates to:

- Review of confirmed construction traffic access proposals
- Review of environmental data not available at submission of the ES in June 2021
- Review of consultation responses

1.2 Confirmed Construction Traffic Access

4) The June 2021 Environmental Statement (Volume 4 Appendix 3.1) made reference to two transport route options to serve the main construction compounds on the Proposed Marl Hill Section. It was confirmed in the June 2021 Environmental Statement that one of the two options would be selected prior to determination of the Proposed Marl Hill Section planning application. It is now possible to confirm that Route Option 2 (referred to in the June 2021 Environmental Statement as the Ribble Crossing) has been adopted in preference to Route Option 1, albeit with a need to use local roads for a short period of approximately nine months to enable construction of the temporary crossing.

5) Because the Ribble Crossing option was included and fully assessed in the June 2021 ES, the confirmation of this option being taking forward does not require and additional assessment.

1.3 Review of Additional Data

6) The following additional technical reports have become available after the June 2021 submission:

- B6 Annex 1: Ribble Crossing – Breeding Bird Survey Report
- B6 Annex 2: Ribble Crossing – Post Submission Aquatic Ecology Surveys

Breeding Bird Survey

7) Since the June 2021 submission a breeding bird survey of the Proposed Ribble Crossing has been completed. A provisional assessment of likely impacts on birds was made in the June 2021 submission pending review of the completed survey. The breeding bird survey report is provided in Annex 1 of this

SEI Appendix B6 and the following paragraphs confirm whether or not the findings change the previously submitted assessment.

8) The June 2021 ES description of the breeding bird baseline stated:

> *A review of habitats found that the section of the river that the proposals cross and run alongside does not contain suitable banks for nesting kingfisher or sand martin, nor do they contain suitable shingle banks for nesting waders such as common sandpiper, little ringed plover and ringed plover. Adjacent fields are enclosed by hedges and trees and contain improved grassland, sub-optimal for wader species such as curlew.*
>
> *The grassland within or near to the site could potentially support small numbers of breeding oystercatcher. A range of common passerine species are likely to nest within the trees and hedgerows present, including SPI and BoCC species such as dunnock, house sparrow, song thrush and tree sparrow*

9) This description remains largely correct following the 2021 breeding bird survey, however common sandpiper, curlew and oystercatcher have all been classed as 'possible' breeders within 100m of the site. It is likely that each of these species nested further than 100m from the site, but used this area for feeding.

10) The June 2021 ES valued the breeding bird community at the Ribble Crossing at the Local level stating:

> *Due to the low suitability of the habitats present there are unlikely to be significant numbers of ground nesting species such as lapwing, oystercatcher or skylark present within the site. The trees and hedgerows are likely to support a range of nesting passerine species, including SPI and BoCC species, however it is highly unlikely that these would be present in numbers notable at County level.*

11) This valuation remains correct. The survey recorded 43no. species, with 35 confirmed, probable or possible breeders (County level threshold is 49no. confirmed, probable or possible breeding species). Five BoCC species were confirmed to breed within 100m and nine BoCC species were possible breeders within 100m.

12) The June 2021 ES identified the following pre mitigation effects on breeding birds:

Table 1: June 2021 ES Breeding Bird Assessment of Effects Extract

Feature	Value	Description of Effects	Significance of effect
Breeding birds	*Local*	*It is likely that small numbers of common bird species nest within the scattered trees, scrub and short sections of hedgerow within the site, and it is possible that a pair of oystercatcher may nest within open grassland within the site.* *Vegetation clearance could result in disturbance of nests and while the destruction of active nests would be avoided through embedded mitigation the clearance works would result in the loss of some potential nesting habitat, although this is not extensive in the context of the wider landscape (reversible with intervention). Reducing to Not significant in the long term following reinstatement.*	*Significant Adverse Less than local Reducing to Not significant*
		Species nesting in retained habitats offsite, or utilising habitats within or surrounding the compounds to support nesting, may be subject to disturbance from noise, visual or vibration effects, resulting in possible localised displacement. Reversible (with intervention). *Disturbance events may result in needless expenditure of energy and may expose species to increased risk of predation, resulting in increased mortality of individuals. Although the extent and*	*Significant Adverse Less than local*

Feature	Value	Description of Effects	Significance of effect
		duration of disturbance is not significant. Irreversible (loss of individuals).	
		Small additional loss of improved grassland habitat (along the road route) during the construction phase, although some improved grassland will be reinstated (at the construction compounds) on completion of this phase (effects not significant). Disturbance / displacement effects commenced during the enabling phase will continue.	*Significant Adverse Less than local*

13) The only change required is that the description "*it is possible that a pair of oystercatcher may nest within open grassland within the site*" should now read "*it is possible that a pair of oystercatcher and curlew nest within open grassland within 100m of the site*". The significance of effects are unchanged by this minor update.

14) The description of mitigation requirements stated in the June 2021 ES are unchanged by the breeding bird survey. Similarly, the assessment of residual effects in the June 2021 ES are also unchanged by the breeding bird survey. The survey findings confirm the conclusions made in the original assessment that residual effects on the breeding bird community associated with the Proposed Ribble Crossing are Not Significant.

Otter Survey

15) Since the June 2021 submission a repeat otter survey of the Proposed Ribble Crossing has been undertaken to add to the information obtained during the initial survey. An assessment of likely impacts on otter was made in the June 2021submission where features with potential to be used by otter for shelter were identified along the banks of the Ribble River in the vicinity of the proposed bridge crossing. Otters are a highly mobile species and the additional otter survey (report provided within Annex 1 of this SEI Appendix B6) builds upon the findings of the previous survey.

16) As with the original survey, the repeat otter survey confirmed the presence of otter activity (prints and spraints) along with multiple features amongst tree roots along the riverbank with potential to be used by otter for shelter. The location of otter signs and potential holts are shown on Figure 1 in Appendix D of Annex 2. In addition, one location had evidence of activity and therefore is classed as a confirmed holt. This is located under the roots of a twin stemmed mature sycamore tree T68, on the riverbank approximately 15 m northeast of the proposed Ribble Crossing location. T68 will be retained as will the other trees identified as providing features with potential to be used by otter. One potential holt location is beneath the proposed bridge alignment, however, this a tree stump and is over sailed by the bridge.

17) The Ribble crossing location has been selected following a review of the potential options taking into account geography of the land/river, routes for traffic, engineering, flood risk, and environmental considerations. Further information on the choice of crossing location can be found in the planning application and associated documents including the Environmental Statement.

18) The location of the potential and confirmed holts is already subject to some degree of disturbance with an existing road bridge adjacent to the northern edge of the red line boundary and a well-used footpath running along the river immediately adjacent to them (it was noted that dog prints were abundant in the sand of the riverbank during site visits). The potential for disturbance from construction activity will be reduced by the need to minimise activities within the floodplain and will be limited to construction and removal of the bridge. Operation of the temporary bridge is unlikely to have significant disturbing effects and the open span construction (which allows the footpath along the riverbank to remain in place except for a temporary diversion during construction) will ensure otters can move along the riverbank and are not forced to come inland and cross the haul road. This confirms the findings of the previous survey undertaken in February 2021 (presented in Appendix B) and the mitigation and licencing requirements identified in the Environmental Statement Chapter 9B.

19) Although there is potential for disturbance to an otter resting place the proposed crossing place has been chosen and designed to reduce the potential for impacts to the habitats and aquatic communities in the River Ribble, maintain connectivity along the river, minimise flood risk, and minimise impacts on local residents. Thereby reducing the potential for impacts to the otters supporting habitat and reducing the overall impact to otters within the catchment.

20) Due to the delay between the application and the proposed commencement of works at the site it is not possible to fully confirm if a licence would be required for the works. As identified in the Environmental Statement (ES) Chapter 9B otters are highly mobile and utilise a range of resting places and holts across their home range. Therefore, it is not known if the potential holts and confirmed holt identified will be present (could be naturally altered during high flow) or in use when the enabling works start, additionally new otter holts may be present and need accounting for. For this reason the June 2021 ES proposed additional pre commencement monitoring work to support a licence application if required. The survey findings do not change the valuation of the otter population nor the otter impact assessment made in the June 2021 ES. Potential mitigation requirements to reduce disturbance to otter are still relevant and deliverable within the planning boundary and therefore the conclusions made in the original assessment remain valid.

1.4 Clarification on Bat Roost Potential Trees

21) A query was raised in the consultation response regarding potentially conflicting statements, Table 2 clarifies the position and confirm the statements are not in conflict.

Table 2: Clarification on Bat Text Within the June 2021 ES

Extract	Clarification
Vol 6 Chapter 9A, Table 9A.7 *"There are no trees with high, moderate or low bat roost suitability present within the construction route for the temporary haul road".*	This is true, within the proposed footprint of the haul road there are no trees with bat potential. There are trees with bat potential within the red line boundary however.
Vol 6 Chapter 9A, Table 9A.4 *"Several trees with bat roosting potential are present within the Proposed Ribble Crossing"*	This is referring to trees within the red line boundary for the Ribble Crossing (i.e. not just within the proposed route of the haul road).
Vol 6 Chapter 9A, Section 9.7.4 Para 76 *"Suitable bat roost habitat features have been identified in numerous trees within and adjacent to the proposed Ribble crossing, some of which would require removal during the enabling and construction works phases".*	This is referring to trees within the red line boundary for the Ribble Crossing (i.e. not just within the proposed route of the haul road). This time it is referring to the red line boundary and 20m buffer.
Vol 6 Appendix 9A.3: Bats, Section 3.1 Para 8 *"Mature Trees are peppered across the site with various levels of suitability for roosting bats".*	This is referring to trees within the red line boundary for the Ribble Crossing (i.e. not just within the proposed route of the haul road).

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section Supplementary Environmental Information

Appendix B6: Annex 1

Ribble Crossing – Breeding Bird Survey 2021 Report

January 2022

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Project No:	B27070CT
Document Title:	Proposed Marl Hill Section Supplementary Environmental Information (SEI) Appendix B6 Annex 1: Ribble Crossing – Breeding Bird Survey 2021 Report
Document ID:	RVBC-MH_SEI-Appendix B6 Annex 1
Revision:	0
Date:	January 2022
Client Name:	United Utilities
Author:	Mike Walker
Author:	Liz Seal

TEP Limited
Genesis Centre
Birchwood Science Park
Warrington
WA3 7BH
Tel: 01925 844004
Fax: 01925 844002
E-mail: tep@tep.uk.com

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved

Contents

1. Birds 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 Breeding Bird and Wintering Bird surveys undertaken by Bowland Ecology.

1.2 Summary of Findings

1.2.1 Breeding Birds

3) The breeding bird survey was carried out between April and June 2021 using a transect survey method. A wider area was surveyed than will be potentially impacted by the proposed works at the Ribble Crossing. Consequently only parts of the overall area surveyed by Bowland Ecology and presented within the following Technical Appendix will be used to inform the breeding bird assessment within the EcIA.

4) Within 100m of the proposed Ribble Crossing access route, a total of 43 no. species were recorded during surveys, with 35 species recorded as confirmed, probable or possible nesting species in this area. Sixteen of these are BoCC, including black-headed gull (Amber), common sandpiper (Amber), curlew (SPI, Red), dunnock (SPI, Amber), grey wagtail (Amber), house sparrow (SPI, Red), lesser black-backed gull (Amber), mallard (Amber), oystercatcher (Amber), song thrush (SPI, Red), starling (SPI, Red), stock dove (Amber), swift (Amber), tawny owl (Amber), tree sparrow (SPI, Red) and willow warbler (amber). Of these 5 no. species were confirmed or probable breeders within the compound and buffer (dunnock, song thrush, swallow, tree sparrow and willow warbler) and 9 no. were possible breeders (common sandpiper, curlew, grey wagtail, house sparrow, mallard, oystercatcher, starling, stock dove and tawny owl).

Table 1. Breeding birds recorded at the Ribble Crossing Area

Ribble Crossing – Breeding Birds			
Species	**Conservation Status**	**Likely Breeding Status**	
		Site	**Site + 100 m buffer**
Blackbird		Po	C (1) Pr (4)
Blackcap		Po	Po
Black-headed gull	BAm	N	N
Blue tit		Po	Pr (1)
Canada goose		N	N
Carrion crow		Po	C (4)
Chaffinch		Po	Pr (3)

Ribble Crossing – Breeding Birds			
Species	**Conservation Status**	**Likely Breeding Status**	
		Site	**Site + 100 m buffer**
Chiffchaff		Po	Po
Common sandpiper	BAm	Po	Po
Curlew	S41 BRd	Po	Po
Dunnock	S41 BAm	Po	Pr (3)
Goldcrest		Po	Po
Goldfinch		Po	Pr (3)
Goosander		N	Po
Great spotted woodpecker		Po	Po
Great tit		Po	Pr (2)
Greenfinch		Po	Po
Grey wagtail	BRd	Po	Po
Greylag goose	WCA1*	N	N
House martin		N	N
House sparrow	S41 BRd	N	Po
Jackdaw		N	Po
Kestrel		N	N
Lesser black-backed gull	BAm	N	N
Long-tailed tit		Po	C (1)
Magpie		Po	Po
Mallard	BAm	Po	Po
Nuthatch		Po	Po
Oystercatcher	BAm	Po	Po
Pheasant		Po	Po
Pied wagtail		Po	Po
Robin		Po	Pr (3)
Siskin		N	N
Song thrush	S41 BRd	Po	Pr (1)

Ribble Crossing – Breeding Birds			
Species	**Conservation Status**	**Likely Breeding Status**	
		Site	**Site + 100 m buffer**
Starling	S41 BRd	N	Po
Stock dove	BAm	N	Po
Swallow		N	Pr (1 col)
Swift	BAm	N	N
Tawny owl	BAm	N	Po
Tree sparrow	S41 BRd	Po	C (2)
Willow warbler	BAm	Po	Pr (2)
Woodpigeon		Po	Pr (4)
Wren		Po	Pr (7)

C = confirmed breeding, Pr = Probable breeding, Po = Possible breeding, N = Not breeding

*This species is only protected under Part 2 of the WCA1981 in certain parts of Scotland

Appendix A. Bowland Ecology Breeding Bird Report

Ribble Crossing Ecology Survey Data Report: Breeding Bird Survey

1 Project Details			
Project Name:	Haweswater Aqueduct Resilience Programme	Project Number:	80061155
Written:	Mark Breaks, *Ecologist* Eve Loxham, *Ecologist*	Approved:	Alice Helyar, *Principal Ecologist*
Report reference:	Ribble Crossing Breeding Bird Survey Report 2021	Date:	14/07/2021
2 Project Drawings			
Ribble Crossing Bird Survey Plans – April 2021		Sheet 1 of 1	
Ribble Crossing Bird Survey Plans – May 2021		Sheet 1 of 1	
Ribble Crossing Bird Survey Plans – June 2021		Sheet 1 of 1	
3 Ecology Surveys			
Surveyors:	Mark Breaks BSc (Hons)		
Survey Visits:	Visit 1: Date 27/04/2021 Start time 07:10 End time 09:20 Visit 2: Date 11/05/2021 Start time 07:00 End time 09:15 Visit 3: Date 11/06/2021 Start time 07:30 End time 09:40		
Survey Method:	A modified breeding bird survey was conducted in line with the specifications detailed by the British Trust for Ornithology (Gilbert *et al.* 1998). This methodology follows that stated by Gilbert for the Breeding Bird Survey (BBS) where a transect is walked encompassing the whole ecological survey area. The survey frequency comprised three visits throughout the breeding season. Mapping methodology comprised plotting the identity and activity of birds recorded within the survey area as the Common Bird Census (CBC) approach defined in Gilbert *et al.* (1998). The surveys were undertaken under appropriate weather conditions (avoiding heavy rain or strong wind). During the surveys, all birds showing signs of 'confirmed' or 'probable' breeding within the site boundary are mapped showing their location along with 'possible' breeders and other birds that showed no signs of breeding being recorded. The survey area at the time of scoping comprised one transect that covered the entire site within the development envelope.		
Weather Conditions:	Visit 1: 8/8 cloud, F1 westerly wind, light rain, approximately 8°C. Visit 2: 1-3/8 cloud, F1-2 southerly wind, dry, approximately 7°C. Visit 3: 8/8 cloud, F2 south westerly wind, drizzle, approximately 14°C.		
Limitations to the survey:	Ecological surveys are limited by factors that affect the presence of birds, such as the time of year and weather conditions. Therefore, the list of species that may potentially use the site may not be complete, though the survey provides a good indication of the species present and a confident way of identifying the value of the area for birds.		
4 Existing data			
No historic bird records were available at the time of writing this report.			
5 Habitat Description			

Farmland comprising improved and semi-improved grassland, river, small watercourses, hedgerows, scattered trees/scrub and woodland.

6 Breeding bird survey results – number of territories (number of individuals)					
Species	**Visit 1**	**Visit 2**	**Visit 3**	**Cons. status**	**Breeding status**
blackbird (B.)	18	10	7	None	C
blackcap (BC)	4	3	2	None	Pr
black-headed gull (BH)	(5 birds)		(3 birds)	A	N
blue tit (BT)	6	5	3	None	C
bullfinch (BF)			1	S41, A	Po
Canada goose (CG)	(11 birds)	(8 birds)	(6 birds)	None	N
carrion crow (C.)	3 nests (23 birds)	4 nests (15 birds)	(12 birds)	None	C
chaffinch (CH)	9	9	7	None	Pr
chiffchaff (CC)	2	1		None	Pr
collared dove (CD)			1	None	Po
common sandpiper (CS)	1			A	Po
curlew (CU)	1 (5 birds)		2 (4 birds)	S41, R	C
dunnock (D.)	7	6	1	S41, A	Pr
goldcrest (GC)		1		None	Po
goldfinch (GO)	9	7	5	None	Pr
goosander (GD)	(1 bird)	(3 birds)	(1 bird)	None	Po
great spotted woodpecker (GS)		1		None	Po
great tit (GT)	3	2	3	None	C
greenfinch (GR)		2		None	Po
grey heron (H.)	(1 bird)	(1 bird)	(1 bird)	None	N
grey wagtail (GL)	1	1	1	R	Pr
greylag goose (GJ)	(8 birds)			A	N
herring gull (HG)	(2 birds)			S41, R	N
house martin (HM)	(3 birds)		(3 birds)	A	N
house sparrow (HS)	3	2	6	S41, R	Pr
jackdaw (JD)	2	2 (6 birds)	2	None	Pr
kestrel (K.)		1		A	Po
lapwing (L.)	1	1		S41, R	C
lesser black-backed gull (LB)	(44 birds)	(3 birds)	(4 birds)	A	N
long-tailed tit (LT)	2	2	2	None	C
magpie (MG)	2	2	1	None	Pr
mallard (MA)	(11 birds)	(5 birds)	(9 birds)	A	Po
moorhen (MH)	1			None	Po
Species	**Visit 1**	**Visit 2**	**Visit 3**	**Cons. status**	**Breeding status**
nuthatch (NH)	2	1	1	None	Pr
oystercatcher (OC)	1 (3 birds)	1	(10 birds)	A	Po
pheasant (PH)	1	1		None	Po
pied wagtail (PW)	4		1	None	Po
reed bunting (RB)	1			S41, A	Po
robin (R.)	11	11	7	None	Pr
sand martin (SM)	8 nests	8 nests	(6 birds)	None	C
siskin (SK)	(1 bird)			None	N

song thrush (ST)	1	6	5	S41, R	Pr
starling (SG)	1 (13 birds)	(8 birds)	(10 birds)	S41, R	C
stock dove (SD)	1	2	1	A	Pr
swallow (SL)	3	2	3	None	Pr
swift (SI)		(2 birds)	(2 birds)	A	N
tawny owl (TO)		1		A	Po
tree sparrow (TS)	2	2	1	S41, R	C
willow warbler (WW)	5	3	3	A	Pr
wood pigeon (WP)	6 (16 birds)	1 (29 birds)	3 (17 birds)	None	C
wren (WR)	18	19	14	None	Pr

Key: *C = Confirmed; Pr = Probable; Po = Possible; N = Not; R = Red List; A = Amber List; Sch 1 = Schedule 1; S41 = NERC Act conservation priority species; Cons. = Conservation*

7 Summary

A total of 51 bird species were recorded using the survey area:

- 11 species were confirmed breeding as follows: blackbird, blue tit, carrion crow, curlew (S41, Red listed), great tit, lapwing (S41, Red listed), long-tailed tit, sand martin, starling (S41, Red listed), tree sparrow (S41, Red listed) and wood pigeon;
- 16 species were identified to be probable breeding on site including: blackcap, chaffinch, chiffchaff, dunnock (S41, Amber listed), goldfinch, grey wagtail (Red listed), house sparrow (S41, Red listed), jackdaw, magpie, nuthatch, robin, song thrush (S41, Red listed), stock dove (Amber listed), swallow, willow warbler (Amber listed) and wren;
- 15 species were recorded as possible breeders on site including: bullfinch (S41, Amber listed), collared dove, common sandpiper (Amber listed), goldcrest, goosander, great spotted woodpecker, greenfinch, kestrel (Amber listed), mallard (Amber listed), moorhen, oystercatcher (Amber listed), pheasant, pied wagtail, reed bunting (S41, Amber listed) and tawny owl (Amber listed); and
- Nine species were sighted using the survey area, however, they were considered to be non-breeding, including, herring gull (S41, Red listed) and the following Amber listed species, black-headed gull, greylag goose, house martin, lesser black-backed gull and swift were recorded using the habitat for foraging.

8 Evaluation

Fuller (1980) devised a method of classifying the ornithological interest of sites for conservation based on three site attributes: population size, rarity and diversity. These criteria were followed in the evaluation of the results.

The total number of confirmed, probable and possible breeding bird species recorded within a site also indicates its significance. Table 1 includes the breeding diversity criteria devised by Fuller (1980).

Table 1: Significance of the total number of breeding species recorded at a site

	Local	County	Regional	National
	25-49	50-69	70-84	85+

No significant breeding bird concentrations (i.e. 1% or more of the national breeding population) or nationally rare breeding bird species (i.e. between 1 and 1,000 breeding pairs; Musgrove *et al*., 2013) were recorded during the survey.

Based on Fuller's criteria, the 42 confirmed, probable and possible breeding bird species recorded within the survey area indicates that it is of local significance for breeding birds. Weight is added to this evaluation by the presence of seven species of high (Red listed) conservation concern and ten species of medium (Amber listed) conservation concern within the site. **This site and surrounding area has great importance with confirmed presence of two breeding pairs of curlew and one breeding pair of lapwing, which are S41 priority species (NERC Act, 2006) and Red listed conservation concern**

Species. These species nest in open grassland areas in the western half of the site. In addition, two breeding pair of tree sparrow and a minimum of one breeding pair of starling that inhabit areas of broad-leaved trees/hedgerows and farm buildings were also recorded; these species are S41 priority species (NERC Act, 2006) and Red listed conservation concern species. In addition, up to six probable breeding pairs of both house sparrow and song thrush (S41 priority species and Red listed conservation concern species) were recorded.

9 References

Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. & Gregory, R. (2015). *Birds of Conservation Concern 4: The Population Status of Birds in the UK, Channel Islands and Isle of Man*. British Birds 108: 708-746

Fuller, R.J. (1980). *A method for assessing the ornithological interest of sites for conservation*. Biological Conservation, 17(3), pp.229-239.

Gilbert G, Gibbons DW and Evans J (1998). *Bird Monitoring Methods: A manual of techniques for key UK species*. RSPB, Bedfordshire

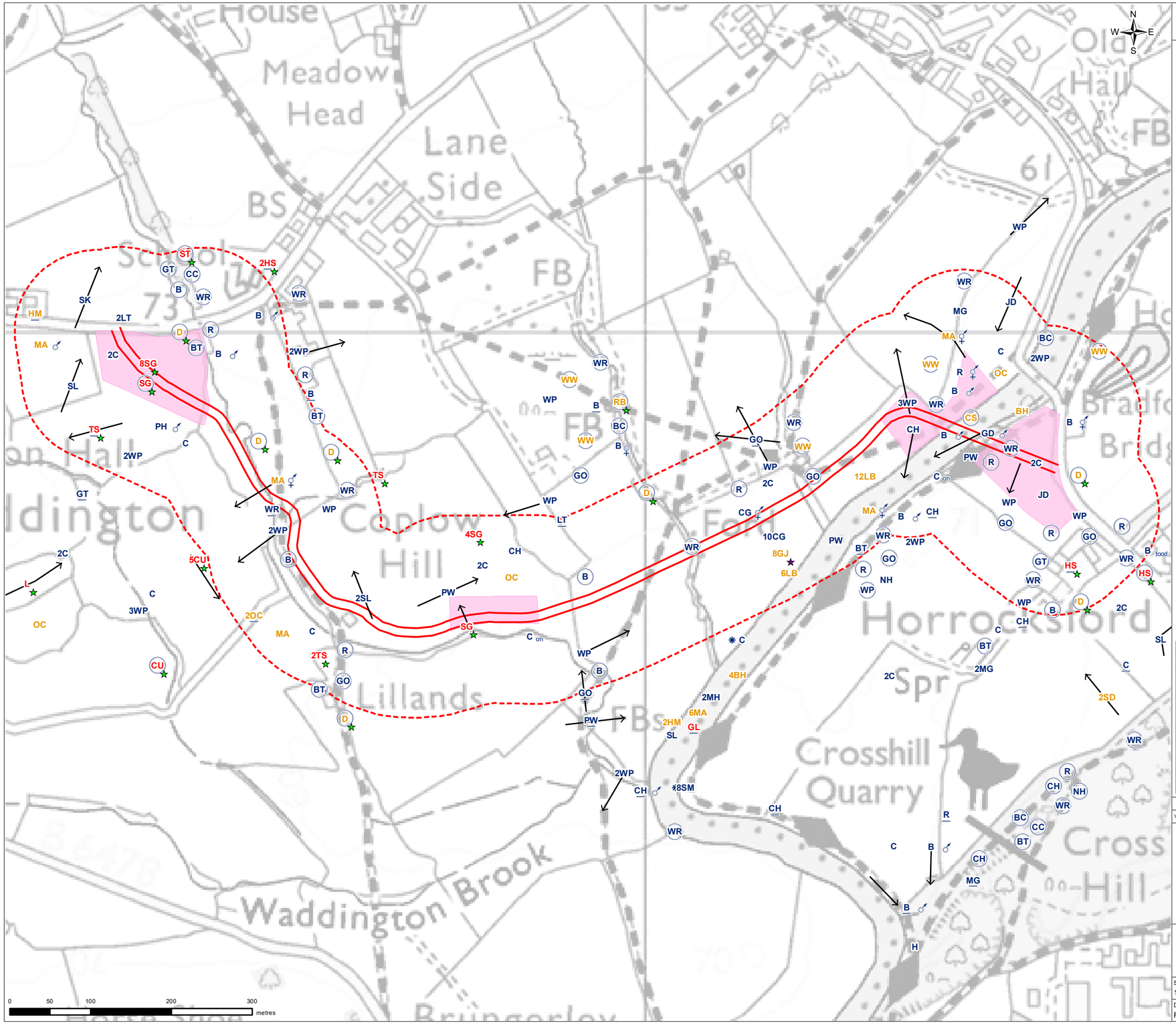
CIEEM. (2006). *Guidelines for Ecological Impact Assessment in Britain and Ireland (Terrestrial, Freshwater and Coastal)*. Chartered Institute of Ecology and Environmental Management, Winchester.

Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, D. (2013). *Population estimates of birds in Great Britain and the United Kingdom*. British Birds, 106, pp.64-100.

Species listed under section 41 (England) of the NERC Act (2006) https://webarchive.nationalarchives.gov.uk/20140605093420tf_/http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/habsandspeciesimportance.aspx

RSPB. (2021). *The Farmland Bird Indicator.* https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/farming/near-you/farmland-bird-indicator/ [accessed online on 31.03.21].

FIGURE 9A.13



Legend

- Proposed route alignment
- Construction laydown area
- Proposed route alignment and construction laydown area - 100m buffer

Protected Species

- Section 41 species
- Schedule 1 species

Species Activity

- Directional flight line
- A bird calling
- food — A bird carrying food
- A bird in song
- A nest occupied with eggs/brood
- on — An adult bird sitting on eggs/brood
- ♀ A female
- ♂ A male
- ♀♂ Male and female pair

Species Codes

B	Blackbird	GO	Goldfinch	PW	Pied wagtail
BC	Blackcap	GT	Great tit	R	Robin
BH	Black-headed gull	H	Grey heron	RB	Reed bunting
BT	Blue tit	HM	House martin	SD	Stock dove
C	Carrion crow	HS	House sparrow	SG	Starling
CC	Chiffchaff	JD	Jackdaw	SK	Siskin
CG	Canada goose	L	Lapwing	SL	Swallow
CH	Chaffinch	LB	Lesser black-backed gull	SM	Sand martin
CS	Common sandpiper	LT	Long-tailed tit	ST	Song thrush
CU	Curlew	MA	Mallard	TS	Tree sparrow
D	Dunnock	MG	Magpie	WP	Woodpigeon
GD	Goosander	MH	Moorhen	WR	Wren
GJ	Greylag goose	NH	Nuthatch	WW	Willow warbler
GL	Grey wagtail	OC	Oystercatcher		
		PH	Pheasant		

Note

Red Red List Species **Amber** Amber List Species

VERSION	AUTH	CHKD	REVD	REASON FOR ISSUE	DATE
0	MK	CW	MW	Initial Issue	03/09/2021

United Utilities
Water for the North West

UNITED UTILITIES WATER LIMITED
HAWESWATER AQUEDUCT RESILIENCE PROGRAMME
BREEDING BIRD SURVEY - VISIT 1 - APRIL 2021
RIBBLE CROSSING

SCALE	SHEET SIZE
1:4,500	A3
DRAWING NUMBER	REVISION
RVBC-MH-RC-FIG-009-01-013	0

FIGURE 9A.14

Legend

- Proposed route alignment
- Construction laydown area
- Proposed route alignment and construction laydown area - 100m buffer

Protected Species

- Section 41 species

Species Activity

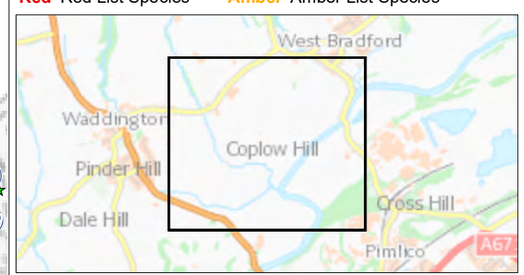
- Directional flight line
- A bird repeatedly giving alarm-calls/other vocalisations
- A bird calling
- mat — A bird carrying nesting material
- A bird in song
- A nest occupied with eggs/brood
- on — An adult bird sitting on eggs/brood
- ♀ A female
- ♂ A male
- ♂♀ Male and female pair

Species Codes

B	Blackbird	LB	Lesser black-backed gull
BC	Blackcap	LT	Long-tailed tit
BT	Blue tit	MA	Mallard
C	Carrion crow	MG	Magpie
CC	Chiffchaff	NH	Nuthatch
CG	Canada goose	OC	Oystercatcher
CH	Chaffinch	PH	Pheasant
D	Dunnock	R	Robin
GC	Goldcrest	SD	Stock dove
GD	Goosander	SG	Starling
GL	Grey wagtail	SI	Swift
GO	Goldfinch	SL	Swallow
GR	Greenfinch	SM	Sand martin
GS	Great spotted woodpecker	ST	Song thrush
GT	Great tit	TO	Tawny owl
H	Grey heron	TS	Tree sparrow
HS	House sparrow	WP	Woodpigeon
JD	Jackdaw	WR	Wren
K	Kestrel	WW	Willow warbler
L	Lapwing		

Note

Red Red List Species **Amber** Amber List Species



VERSION	AUTH	CHKD	REVD	REASON FOR ISSUE	DATE
0	MK	CW	MW	Initial Issue	03/09/2021

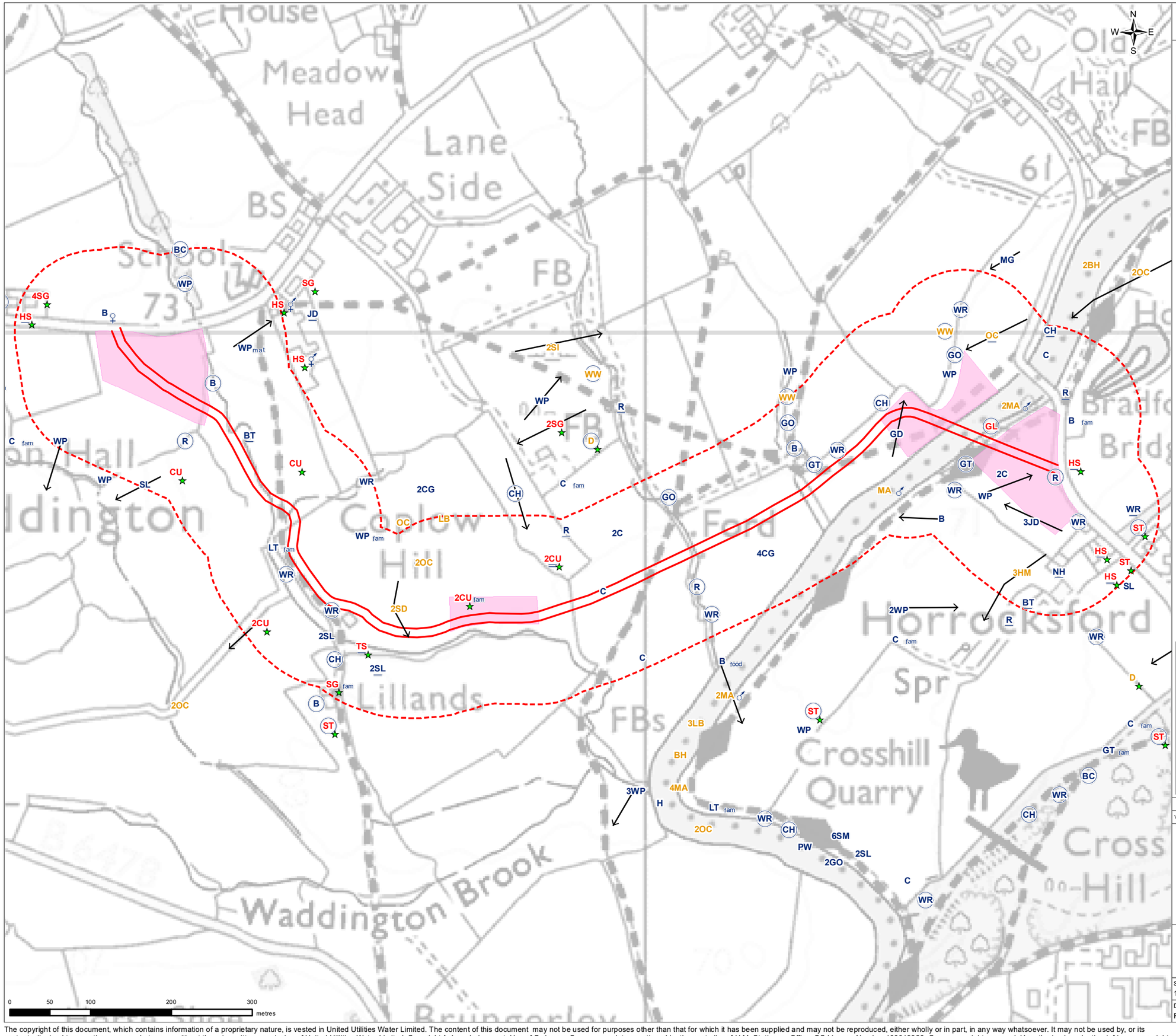
United Utilities
Water for the North West

UNITED UTILITIES WATER LIMITED
HAWESWATER AQUEDUCT RESILIENCE PROGRAMME
BREEDING BIRD SURVEY - VISIT 2 - MAY 2021
RIBBLE CROSSING

SCALE	SHEET SIZE
1:4,500	A3
DRAWING NUMBER	REVISION
RVBC-MH-RC-FIG-009-01-014	0

0 50 100 200 300 metres

FIGURE 9A.15



Legend

- Proposed route alignment
- Construction laydown area
- Proposed route alignment and construction laydown area - 100m buffer

Protected Species

- Section 41 species

Species Activity

- Directional flight line
- A bird repeatedly giving alarm-calls/other vocalisations
- A bird calling
- food — A bird carrying food
- mat — A bird carrying nesting material
- A bird in song
- A female
- A male
- fam — Family group of birds
- Male and female pair

Species Codes

B	Blackbird	LB	Lesser black-backed gull
BC	Blackcap	LT	Long-tailed tit
BH	Black-headed gull	MA	Mallard
BT	Blue tit	MG	Magpie
C	Carrion crow	NH	Nuthatch
CG	Canada goose	OC	Oystercatcher
CH	Chaffinch	PW	Pied wagtail
CU	Curlew	R	Robin
D	Dunnock	SD	Stock dove
GD	Goosander	SG	Starling
GL	Grey wagtail	SI	Swift
GO	Goldfinch	SL	Swallow
GT	Great tit	SM	Sand martin
H	Grey heron	ST	Song thrush
HM	House martin	TS	Tree sparrow
HS	House sparrow	WP	Woodpigeon
JD	Jackdaw	WR	Wren
		WW	Willow warbler

Note

Red Red List Species **Amber** Amber List Species

VERSION	AUTH	CHKD	REVD	REASON FOR ISSUE	DATE
0	MK	CW	MW	Initial Issue	03/09/2021

United Utilities
Water for the North West

UNITED UTILITIES WATER LIMITED
HAWESWATER AQUEDUCT RESILIENCE PROGRAMME
BREEDING BIRD SURVEY - VISIT 3 - JUNE 2021
RIBBLE CROSSING

SCALE 1:4,500	SHEET SIZE A3
DRAWING NUMBER RVBC-MH-RC-FIG-009-01-015	REVISION 0

Creating a world fit for the future

RICARDO

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section Supplementary Environmental Information

Appendix B6: Annex 2

Ribble Crossing – Post Submission Aquatic Ecology Surveys

January 2022

United Utilities

Water for the North West

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Project No:	B27070CT
Document Title:	Proposed Marl Hill Section Supplementary Environmental Information (SEI) Appendix B6 Annex 2: Ribble Crossing – Post Submission Aquatic Ecology Surveys
Document ID:	RVBC-MH_SEI-Appendix B6 Annex 1
Revision:	0
Date:	January 2022
Client Name:	United Utilities
Author:	Ricardo

Ricardo Energy & Environment
Bright Building,
First Floor Manchester Science Park
Manchester,
M15 6GZ
Tel: +44 (0) 1235 753 488
E-mail: anne.fairhead@ricardo.com

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved

Post Submission Aquatic Ecology Surveys - Review of Implications for Impact Assessment

A number of aquatic ecology surveys were undertaken in September 2021 and December 2021 in order to complete the baseline surveys required for the Haweswater Aqueduct Resilience Programme. These surveys were not able to be completed prior to the submission of the planning application due to seasonal constraints. The survey reports are provided in **Appendix A** (Aquatic Walkover Results), **Appendix B** (Otter and Water Vole Surveys), **Appendix C** (White clawed Crayfish Surveys), and **Appendix D** (River Ribble Otter Survey Update).

The following table presents a review by Ricardo Energy and Environment of the potential implications on the conclusions within Chapter 9B Aquatic Ecology of the Haweswater Aqueduct Resilience Programme –Proposed Ribble Crossing Environmental Statement, which was submitted in June 2021.

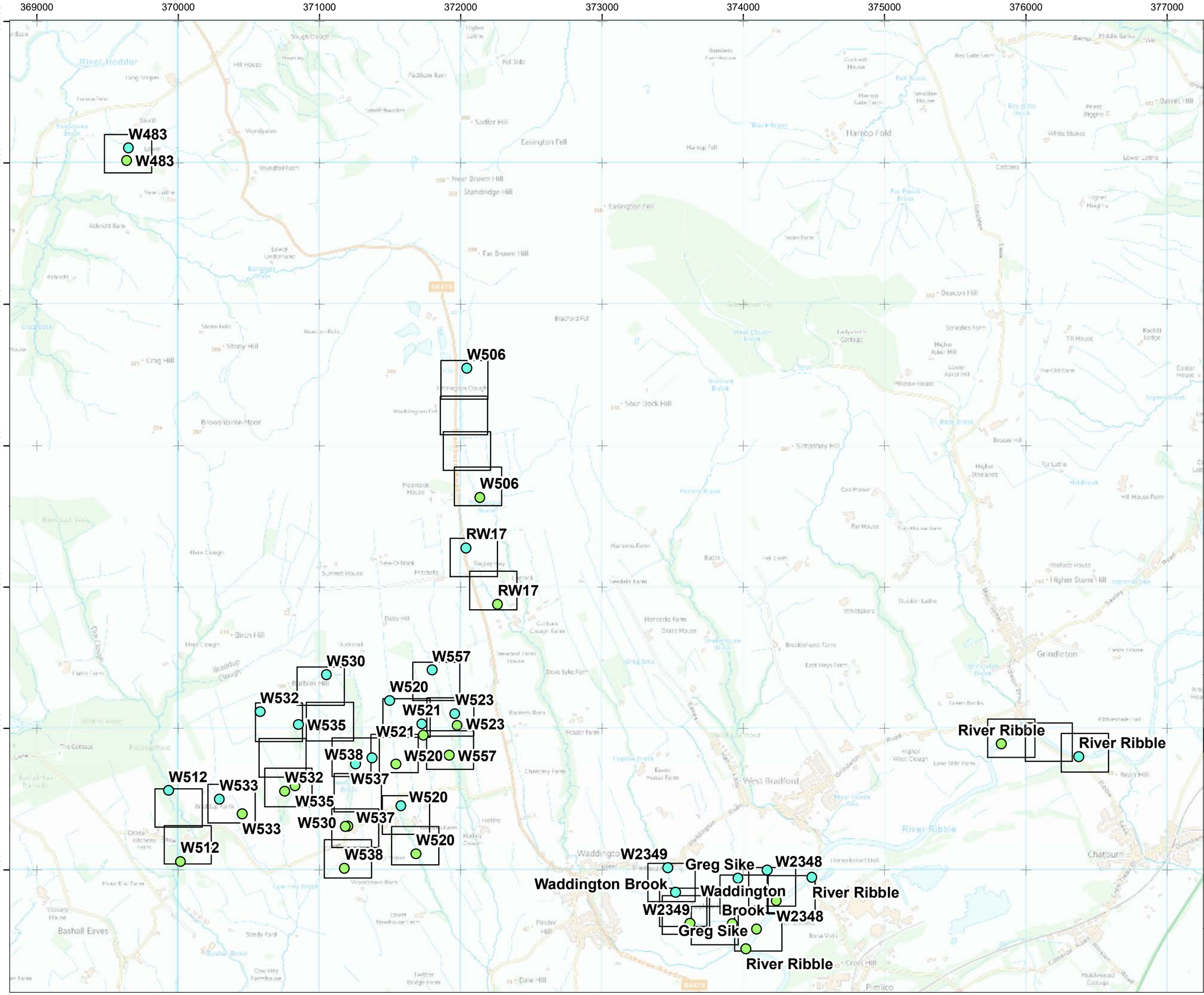
In summary, no changes to the submitted assessment have been identified.

Watercourse	Relevant Scheme Component	Environmental Statement Baseline (Importance of Aquatic Receptors)	Additional Surveys Completed	Summary of Findings	Implications for Assessment
Greg Sike (W2321)	Ribble Crossing - Temporary road crossing, within 5 m of temporary road at several locations, within 10 m of two construction laydown areas	**Macrophytes** – Local **Fish** - Local **Macro-invertebrates** – Local **White clawed crayfish** -Local **Otter** – Intermediate **Water vole** – Not applicable (not present)	White clawed crayfish survey	No evidence of white-clawed crayfish was identified during the stone turning survey. The watercourse has potential to support white-clawed crayfish. Suitable refuges which could provide habitat for crayfish (e.g. boulders and undercut banks) were observed in low abundance. The survey findings have not led to any changes to the assigned importance of aquatic receptors within the watercourse.	None
River Ribble (W2325)	Ribble Crossing - Temporary road crossing, within 10 m of two construction laydown areas. Receiving	**Macrophytes** – River Basin District **Fish** - River Basin District **Macro-invertebrates** – River Basin District **White clawed crayfish** -Local **Otter** – Local **Water vole** – Not applicable (not present)	White clawed crayfish survey Otter	No evidence of white-clawed crayfish was identified during the stone turning survey. The watercourse has potential to support white-clawed crayfish. Suitable refuges which could provide habitat for crayfish (e.g. boulders) were observed.	None

Watercourse	Relevant Scheme Component	Environmental Statement Baseline (Importance of Aquatic Receptors)	Additional Surveys Completed	Summary of Findings	Implications for Assessment
	discharge from temporary roads, through four outfalls			Evidence of otter identified including a holt, multiple prints, and spraints throughout the surveyed reach of the River Ribble adjacent to the Ribble Crossing. The location of otter signs and hots and potential holts are shown on Figure 1 in Appendix D. There were multiple potential holt locations under tree roots adjacent to the compound area and proposed bridge location including one with confirmed activity. The otter holt with evidence of activity was identified under the roots of two joined mature sycamore trees on the riverbank approximately 15 m north east of the proposed Ribble Crossing location. Evidence of otter activity was recorded regularly along the surveyed reach of the River Ribble (500m downstream form the existing West Bradford road bridge). This confirms the findings of the previous survey undertaken in February 2021 (presented in Appendix B) and the mitigation and licencing requirements identified in the Environmental Statement Chapter 9B. The survey findings have not led to any changes to the assigned importance of aquatic receptors within the watercourse.	

Watercourse	Relevant Scheme Component	Environmental Statement Baseline (Importance of Aquatic Receptors)	Additional Surveys Completed	Summary of Findings	Implications for Assessment
Unnamed Watercourse 2097 (W2348)	Ribble Crossing - Temporary road crossing.	**Macrophytes** – Local **Fish** - Local **Macro-invertebrates** – Local **White clawed crayfish** - Local **Otter** – Immediate site **Water vole** – Not applicable (not present)	Aquatic habitat walkover, white clawed crayfish survey and otter survey	The majority of the watercourse way dry during the walkover survey with occasional areas with no perceptible flow. This indicates the watercourse dries periodically but the drying frequency is not known. One potential obstacle to fish passage was recorded in the surveyed reach which along with temporary drying limits the suitability for migratory fish species. No evidence of white-clawed crayfish was identified during the stone turning survey. This watercourse is not considered to provide suitable habitat for crayfish. No holts or resting places identified. Limited suitable habitat for holts and resting places. The survey findings have not led to any changes to the assigned importance of aquatic receptors within the watercourse.	None

Appendix A : Watercourse walkover survey results



Legend:

Walkover extents

- Start Point
- End Point
- TR4 Map Views

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

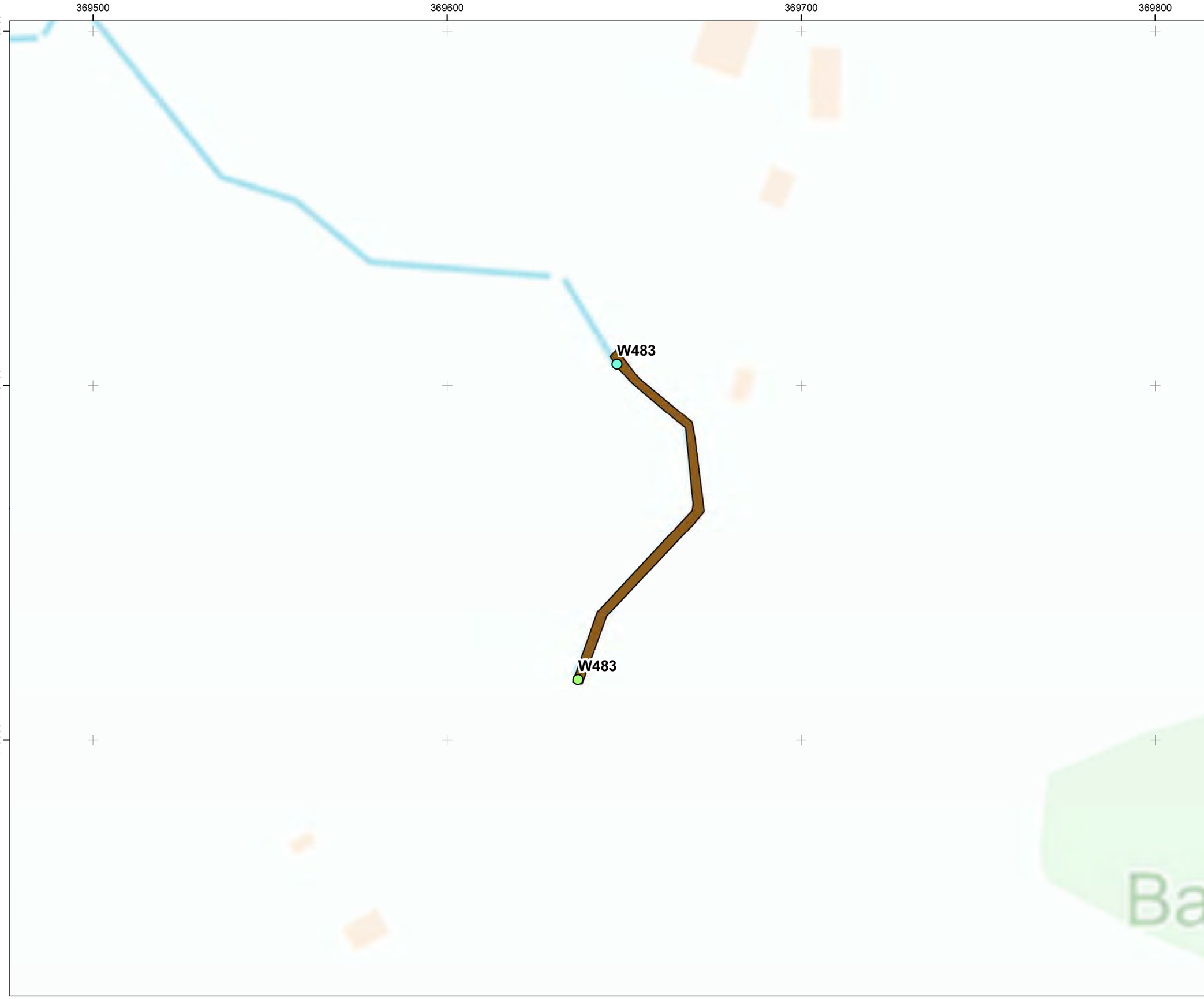
TITLE: Figure 1:
Marl Hill TR4
Walkover Survey Overview

0 490 980
Meters
SCALE: 1:25,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig1-Walkover Overview.mxd



Legend:

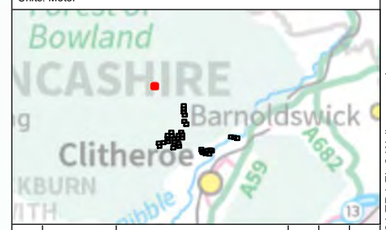
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 1 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371900
372000
372100
447600
447500
447400
B6478
Tittrington
Clough
W506
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293

Legend:

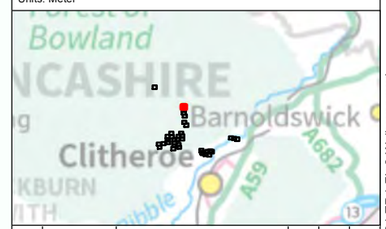
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 2 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371900
372000
372100
447300
447200
447100
SLAIDBURN ROAD
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330

Legend:

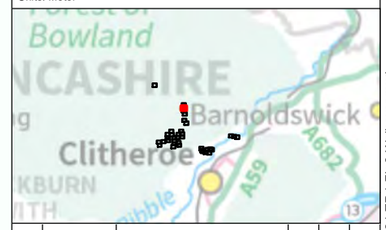
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 3 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371900 372000 372100 372200

447100 447000 446900

B6478

325 326 327 328 329 330 331 332 333 334 335 336 337 338 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 383 385 386 387

Legend:

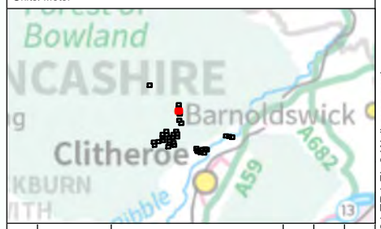
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 4 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

372000
372100
372200
446800
446700
446600
383
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
411
412
415
416
418
419
420
421
422
W506
Waddington

Legend:

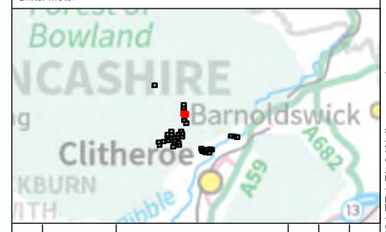
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 5 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

369900 370000 370100

444500 444400 444300

W512

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 34 35

Braddup

Legend:

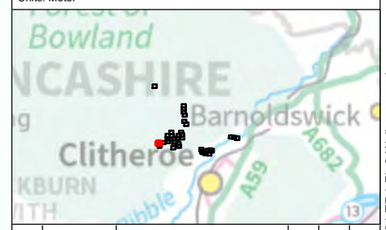
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 6 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

369900 370000 370100 370200

444300 444200 444100

34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64

W512

Legend:

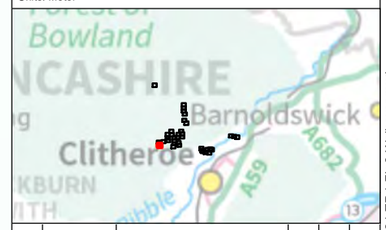
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 7 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

370300
370400
370500
444600
444500
444400
W533
65
66
W533
Legend:
Walkover extents
Start Point
End Point
Flow Type
Waterfall
Torrent
Cascade
Run
Glide
Riffle
No perceptible flow
Pool
Eddy
Juvenile Lamprey habitat
Salmonid habitat
Dry
Exposed Sediment
Potential obstacle / obstruction to fish passage
Overhanging Vegetation
Coarse Woody Debris
Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter
Bowland
NCASHIRE
Barnoldswick
Clitheroe
A682
A59
KBURN
13
Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF
HARP Aquatics
Ricardo Energy & Environment
RSK biocensus
EXPERTS IN ECOLOGY
TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 8 of 37
0 20 40
Meters
SCALE: 1:1,000 @ A3
N
W E
S
REV 00
Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

370600
370700
370800
445100
445000
W532
W535
67
68
77
78
79
80
81

Legend:

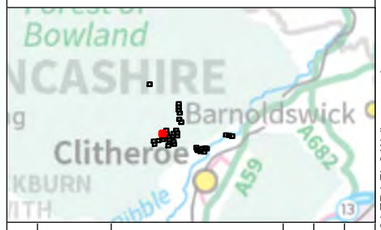
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 9 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

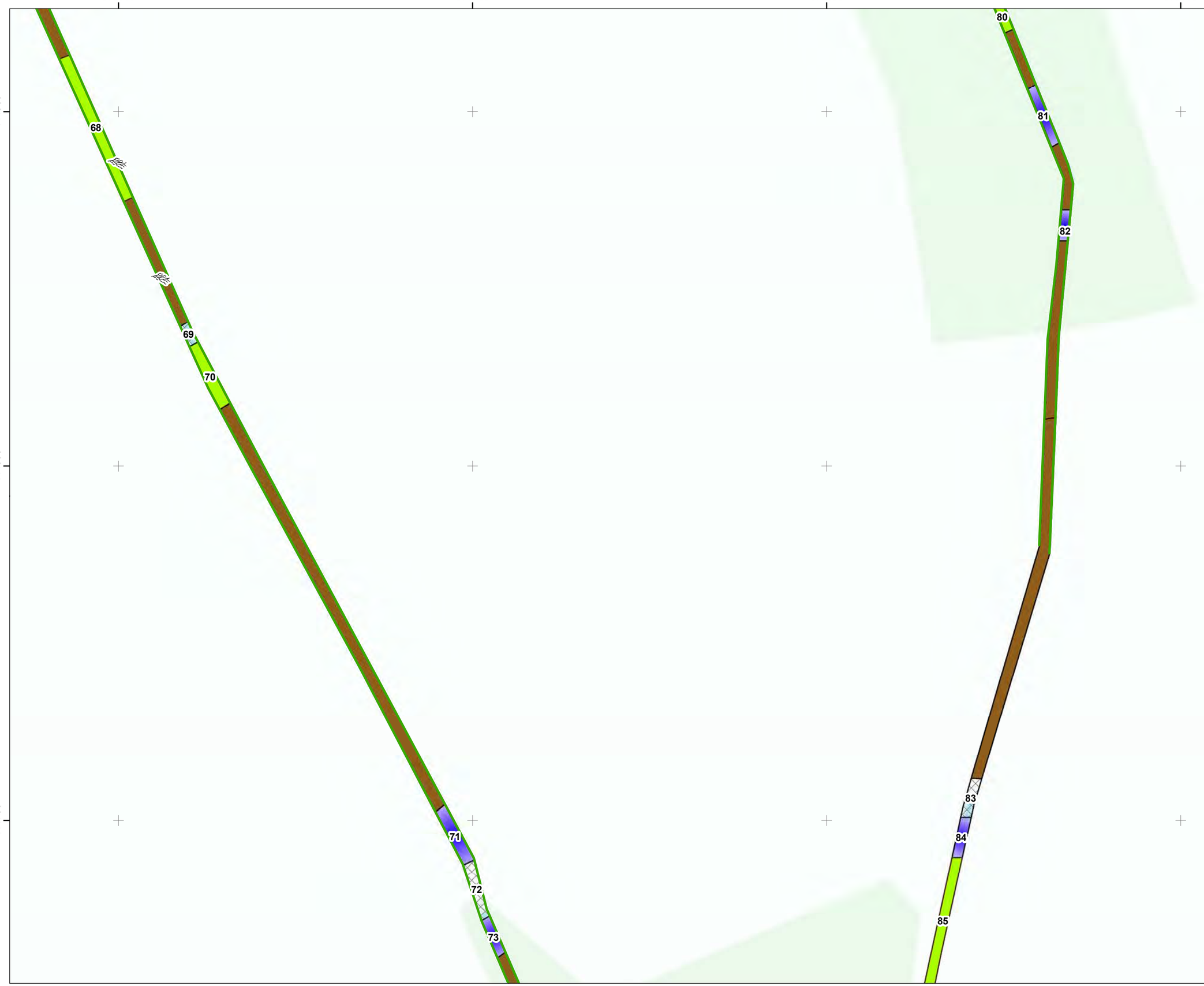
N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

370600 370700 370800 370900

444900 444800 444700



Legend:

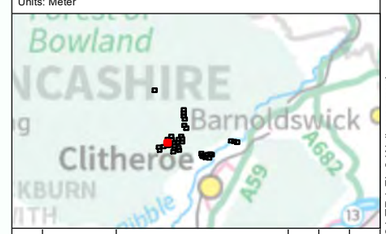
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 10 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

370700
370800
370900
444700
444600
444500
71
72
73
74
75
76
83
84
85
W535
W532

Legend:

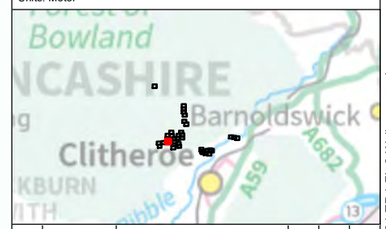
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 11 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

370900
371000
371100
445400
445300
445200
les Hill
W530
155
156
157
158
159

Legend:

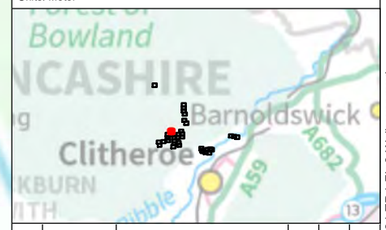
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 12 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371000
371100
371200
445100
445000

158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182

Legend:

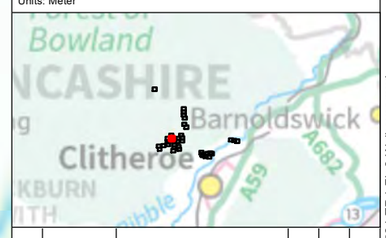
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 13 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371100 371200 371300 371400

444900 444800 444700

182 183 184 185 186 187 188 189 190 191 208

W537 W538

Legend:

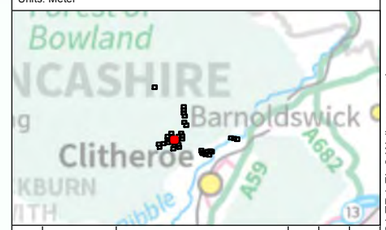
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 14 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371200
371300
371400
444600
444500

Sandy Ford Brook

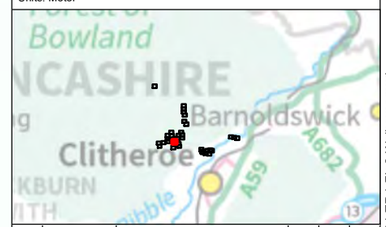
191
192
193
194
195
196
197
198
199
200
206
207

Legend:

Walkover extents
- Start Point
- End Point

Flow Type
- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 15 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371100 371200 371300 371400

444400 444300 444200

198 199 200 201 202 203 204 205 209 210 211 212 213 214 215 216 217 218 219 220

W530 W537

Braddup House

Legend:

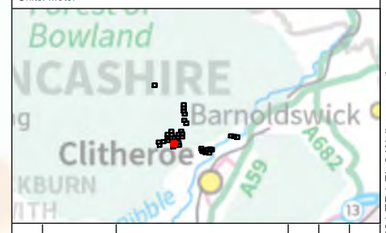
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 16 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371100 371200 371300

444200 444100 444000

LANE

218 219 220 221 222 223 224 225 226 227

W538

Legend:

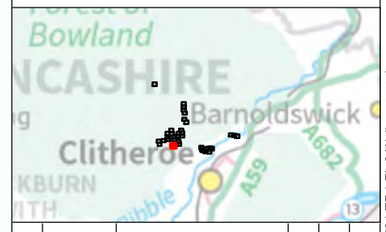
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 17 of 37

0 20 40
Meters

SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371500
371600
371700
445200
445100
445000
W520
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
W521
117
118
119
W521

Legend:

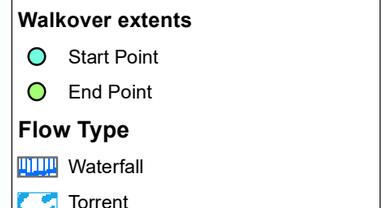
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 18 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371400
371500
371600
444900
444800
444700
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
W538
W520

Legend:

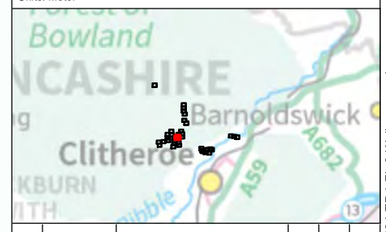
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 19 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371500 371600 371700

444500 444400 444300

W520
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
251

Gannie

Legend:

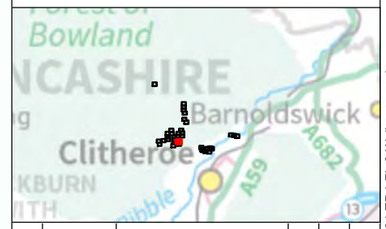
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 20 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371600
371700
371800
444300
444200
444100

244
245
246
247
248
249
250
252
253
254
256
257
258
259
260
261
262
263
264
265
266
267
268
W520

Legend:

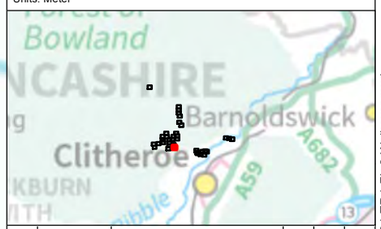
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 21 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371700
371800
371900
445400
445300
445200
FREEHOLDS LANE
W557
120
121
122
123
124
125
126
127
T Plantation

Legend:

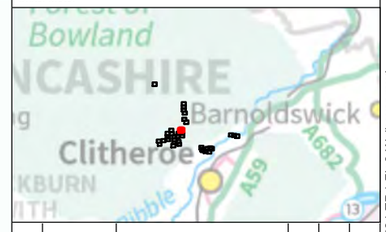
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 22 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371800
371900
372000
445200
445100
445000

126
127
128
129
130
131
132
133
134
135
136
137
145
W523
146
147
148
149
151
150
152
154
153
W523

Legend:

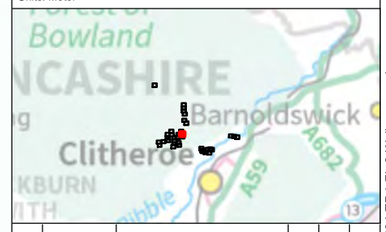
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 23 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

371800
371900
372000
444900
444800
137
138
139
140
141
142
143
144
W557

Legend:

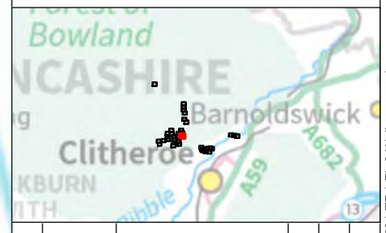
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 24 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

375800 375900 376000

445000 444900 444800

de Farm

423 River Ribble

424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 441

Legend:

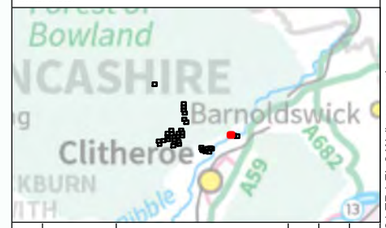
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 25 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

376000 376100 376200 376300

445000 444900 444800

435 437 438 434 433 436 440 439 441 444 445 442 443 446 447 449 450 448 451 452 454 453 455 456

Legend:

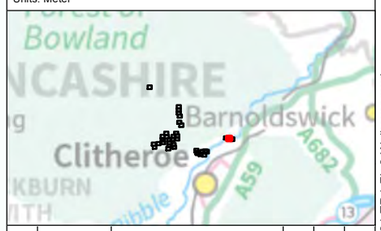
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 26 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

376300
376400
376500
444900
444800
444700

448
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
River Ribble

Contains Ordnance Survey data © Crown copyright and database right 2020
Contains OS data © Crown Copyright and database right 2020

Legend:

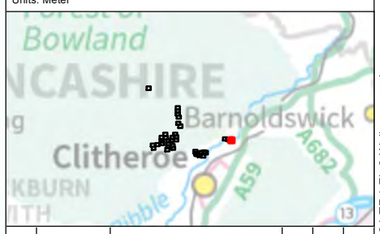
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 27 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

372000
372100
372200
446300
446200
446100

B6478

RW17
473
474
475
476
477
478
479
480
481
482
483
484
485

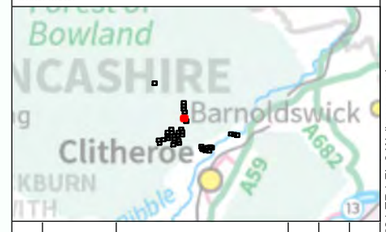
Ringley Hey

Legend:

Walkover extents
- Start Point
- End Point

Flow Type
- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 28 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

372100
372200
372300
446100
446000
445900
Ringley Hey
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
RW17

Legend:

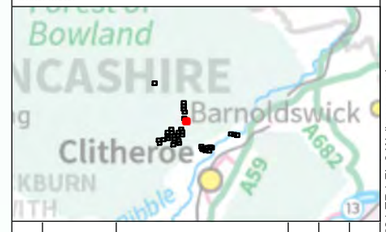
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 29 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

373500 373600 373700

443800 443700 443600

Waddington Brook

514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551

W2349

Coplow Hill

Legend:

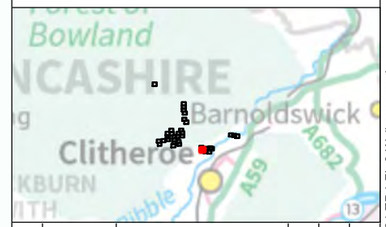
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 30 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

373700 373800 373900

443700 443600 443500

oplow Hill

536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573

Waddington Brook

Legend:

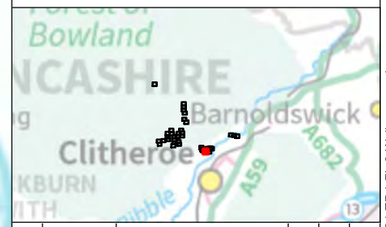
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 31 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

373900 374000 374100

443900 443800 443700

Greg Sike

574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621

Legend:

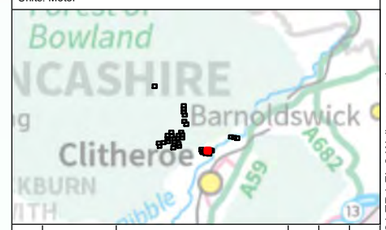
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 32 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

374000
374100
374200
443600
443500

620
621
622
623
624
625
626
627
628
629
630
631
632
633
Greg Sike
683
681
682
685
684
687
686
688
690
689
694
691
692
693
695
River Ribble
671
668
672
670
673
675
674
678
676
679
677
680

Legend:

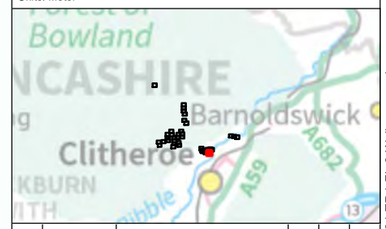
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 33 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

374200 374300 374400 374500

443900 443800 443700

River Ribble

W2348

634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 696

Legend:

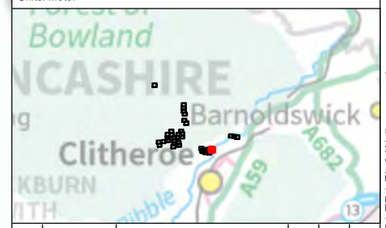
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 34 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

374100
374200
374300
444000
443900
443800

W2348
697
698
699
700
701
702
W2348
604
605
606
607
608
609
610
611
612
613
614
696
661
662
663
664
665
649
655
654
656
653
651
652
658
657
660
659

Legend:

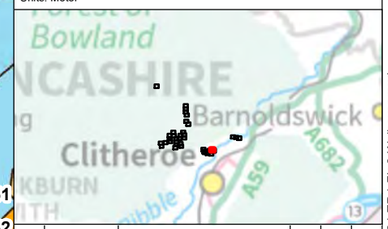
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 35 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

373400 373500 373600

444000 443900 443800

OAD

W2349

703 704 705 706 707 708 709 710 711 712 713

Waddington Brook

Legend:

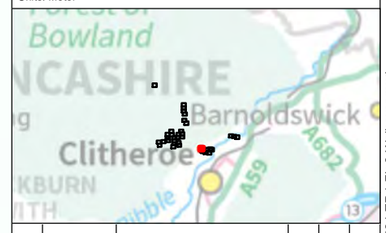
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 36 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

373500 373600 373700

443800 443700 443600

Coplow Hill

Lillands

711 712 713 714 715 716 717 718 719 720 721 W2349

Legend:

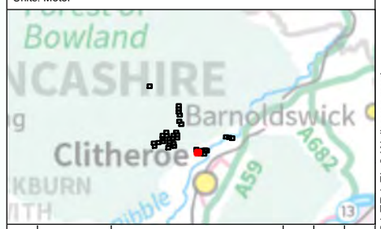
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 37 of 37

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Fig2-Walkover.mxd

Table 1: Habitat classifications and abbreviations

	Flow Type		Depth		Velocity		Substrate		Notable/species specific habitat		Macrophyte (% cover)		Other features
GL	Glide	A	0.05 - 0.1 m	0	0.01 - 0.05 m/s	BE	Bedrock	Pr	Salmonid parr habitat	SFL	Submerged fine-leaved	Obstruction	Potential obstacle/obstruction to fish passage
R	Run	B	0.1 - 0.2 m	1	0.05 - 0.15 m/s	BO	Boulder (> 256 mm)	Fr	Salmonid fry habitat	SLL	Submerged linear-leaved		
RI	Riffle	C	0.2 - 0.4 m	2	0.15 - 0.3 m/s	CO	Cobble (64 - 256 mm)	Pr/Fr	Mixed juvenile salmonid habitat	SBL	Submerged broad-leaved		
P	Pool	D	0.4 - 1.0 m	3	0.3 - 0.5 m/s	GR	Gravel (2 - 64 mm)	SPO	Optimal salmonid spawning habitat	ELL	Emergent linear-leaved		
CAS	Cascade	E	> 1.0 m	4	0.5 - 0.7 m/s	SA	Sand (< 2 mm)	SPSO	Sub optimal salmonid spawning habitat	EBL	Emergent broad-leaved		
ED	Eddy			5	> 0.7 m/s	SI	Silt	LO	Optimal juvenile lamprey habitat	FL	Filamentous algae		
TOR	Torrent					CL	Clay	LSO	Sub optimal juvenile lamprey habitat	FLO	Floating		
NP	No perceptible flow					AR	Artificial			FLR	Floating-leaved rooted		
DRY	Dry					NV	Not visible			CHOKED	Channel choked (veg)		

Table 2: HARP Marl Hill (TR4) walkover data

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
1	Riffle	A	2	BO/CO/GR		
2	Glide	B	2	BO/CO/GR	FL 40%	
3	Riffle	A	3	BO/CO/GR		
4	Pool	C	1	BO/CO/GR		
5	Pool	C	1	BO/CO/GR		
6	Riffle	A	3	BO/CO/GR		
7	Pool	D	1	BO/CO/GR		
8	Run	B	3	BO/CO/GR	FL 10%	
9	Riffle	A	3	BO/CO/GR		
10	Glide	B	2	BO/CO/GR	FL 10%	
11	Pool	C	1	BO/CO/GR		
12	Riffle	A	3	BO/CO/GR	FL 10%	
13	Run	B	2	BO/CO/GR	FL 30%	
14	Riffle	A	3	BO/CO/GR	FL 5%	
15	Riffle	A	3	BO/CO/GR	FL 10%	
16	Pool	C	1	BO/CO/GR	FL 40%	
17	Riffle	B	3	BO/CO/GR		
18	Riffle	A	3	BO/CO/GR		
19	Riffle	A	3	BO/CO/GR	FL 10%	
20	Glide	B	1	CO/BO/BE	FL 10%	
21	Riffle	A	2	BO/CO/GR	FL 10%	
22	Run	B	2	BO/CO/GR	FL 10%	
23	Riffle	A	3	BO/CO/GR		
24	Run	B	2	BO/CO/GR	FL 10%	
25	Riffle	A	3	BO/CO/GR		
26	Pool	C	1	BO/CO/GR	FL 10%	
27	Pool	C	1	BO/CO/GR	FL 10%	
28	Riffle	A	3	BO/CO/GR	FL 10%	
29	Pool	D	1	BO/CO/GR	FL 20%	
30	Riffle	A	3	BO/CO/GR	FL 20%	
31	Run	B	2	BO/CO/GR	FL 20%	
32	Riffle	A	3	BO/CO/GR	FL 10%	
33	Glide	B	2	CO/BO/BE	FL 40%	
34	Run	B	2	BO/CO/GR		
35	Riffle	A	2	BO/CO/GR	FL 10%	
36	Pool	C	1	BO/CO/GR		
37	Potential obstacle/obstruction to fish passage					
38	Riffle	A	2	BO/CO/GR	FL 10%	
39	Run	B	2	BO/CO/GR		
40	Riffle	A	2	BO/CO/GR	FL 10%	
41	Glide	B	1	BO/CO/GR		
42	Potential obstacle/obstruction to fish passage					
43	Pool	C	1	BO/CO/GR		
44	Glide	B	2	BO/CO/GR	FL 10%	
45	Riffle	A	2	BO/CO/GR		
46	Glide	B	2	BO/CO/GR		
47	Run	A	2	BO/CO/GR		
48	Riffle	A	2	BO/CO/GR		
49	Glide	B	2	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
50	Run	B	2	BO/CO/GR		
51	Riffle	A	2	BO/CO/GR		
52	Run	B	2	BO/CO/GR	FL 10%	
53	Riffle	A	2	BO/CO/GR		
54	Pool	C	1	BO/CO/GR	FL 10%	
55	Riffle	A	2	BO/CO/GR		
56	Glide	B	2	BO/CO/GR		
57	Riffle	A	2	BO/CO/GR		
58	Run	B	2	BO/CO/GR		
59	Run	B	2	BO/CO/GR		
60	Riffle	A	2	BO/CO/GR		
61	Glide	B	2	BO/CO/GR		
62	Run	B	2	BO/CO/GR		
63	Glide	B	2	BO/CO/GR		
64	Run	B	2	BO/CO/GR		
65	Pool	B	1	BO/CO/GR	FL 10%	
66	No perceptible flow	A	0	BO/CO/GR	FL 20%	
67	No perceptible flow	A	0	GR/CO/SI		
68	No perceptible flow	A	0	GR/CO/SI		
69	Potential obstacle/obstruction to fish passage					
70	No perceptible flow	A	0	SA/SI/GR		
71	Pool	B	1	SA/SI/GR		
72	Potential obstacle/obstruction to fish passage					
73	Pool	B	1	GR/CO/SI		
74	No perceptible flow	A	0	GR/CO/SI		
75	Run	A	1	SI/BO/CO		
76	No perceptible flow	A	0	GR/CO/SI		
77	Pool	B	0	SI		
78	Pool	B	0	SI		
79	Pool	B	0	SI/BO/CO		
80	No perceptible flow	A	0	SI/BO/CO		
81	Pool	B	1	SI/BO/CO		
82	Pool	B	1	SI/BO/CO		
83	Potential obstacle/obstruction to fish passage					
84	Pool	C	0	BO/CO/GR		
85	No perceptible flow	A	0	BO/CO/GR		
86	Run	A	1	BO/CO/GR		
87	Riffle	A	2	SA/BO/CO		
88	Glide	B	1	SA/BO/CO		
89	Run	A	2	SA/BO/CO		
90	Riffle	A	2	SA/BO/CO		
91	Run	A	2	SA/BO/CO		
92	Pool	C	0	SA/BO/CO		
93	Potential obstacle/obstruction to fish passage					
94	Run	B	2	SI/BO/CO		
95	Pool	C	1	SA/BO/GR		
96	Cascade	A	2	BO/CO		
97	Run	B	2	BO/CO/GR		
98	Pool	C	1	SA/BO/CO		
99	Run	B	2	SA/BO/CO		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
100	Glide	B	1	SA/BO/CO		
101	Run	A	2	BO/CO/GR		
102	Potential obstacle/obstruction to fish passage					
103	Pool	C	1	BO/CO/GR		
104	Run	A	2	BO/CO/GR		
105	Glide	B	1	BO/CO/GR		
106	Riffle	A	2	SA/BO/CO		
107	Run	B	2	BO/CO/GR		
108	Riffle	A	2	SA/BO/CO		
109	Potential obstacle/obstruction to fish passage					
110	Pool	C	1	SA/BO/CO		
111	Riffle	A	2	BO/CO/GR		
112	Glide	B	1	BO/CO/GR		
113	Cascade	A	1	BO/CO		
114	Cascade	A	1	BO/CO		
115	Riffle	A	2	BO/CO/GR		
116	Pool	C	1	SA/BO/CO		
117	Cascade	A	1	BO/CO		
118	No perceptible flow	A	0	BO/CO/GR		
119	No perceptible flow	A	0	BO/CO/GR		
120	Potential obstacle/obstruction to fish passage					
121	Pool	C	1	SI		
122	Pool	B	1	CL/CO		
123	No perceptible flow	A	0	BO/CO/GR		
124	Pool	A	0	BO/CO/GR		
125	Cascade	A	2	BO/CO		
126	No perceptible flow	A	0	BO/CO/GR		
127	Pool	A	1	BO/CO/GR		
128	Pool	B	1	BO/CO/GR		
129	Pool	A	1	BO/CO/GR		
130	Pool	A	1	BO/CO/GR		
131	Pool	C	1	BO/CO/GR		
132	Pool	C	1	BO/CO/GR		
133	Potential obstacle/obstruction to fish passage					
134	No perceptible flow	B	0	BO/CO/GR		
135	Waterfall	A	2	BO/CO		
136	Pool	B	0	BO/CO/GR		
137	No perceptible flow	A	0	BO/CO/GR		
138	Potential obstacle/obstruction to fish passage					
139	No perceptible flow	A	0	BO/CO/GR		
140	Pool	A	0	BO/CO/GR		
141	No perceptible flow	A	0	BO/CO/GR		
142	Run	A	1	BO/CO/GR		
143	No perceptible flow	A	0	BO/CO/GR		
144	Pool	B	1	BO/CO/GR		
145	Run	A	1	BO/CO/GR		
146	Waterfall	A	2	BO/CO		
147	Pool	C	1	CL/GR/BO		
148	Potential obstacle/obstruction to fish passage					
149	Glide	B	1	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
150	Run	A	2	BO/CO/GR		
151	Pool	B	1	BO/CO/GR		
152	Potential obstacle/obstruction to fish passage					
153	Pool	B	1	BO/CO/GR		
154	Run	A	1	BO/CO/GR		
155	No perceptible flow	A	0	CL/BO/SA		
156	No perceptible flow	A	0	CL/BO/SA		
157	No perceptible flow	A	0	BO/CO/GR		
158	No perceptible flow	A	0	BO/CO/GR		
159	No perceptible flow	A	0	BO/CO/GR		
160	Pool	B	1	BO/CO		
161	Run	A	1	BO/CO/GR		
162	No perceptible flow	A	0	CL/BO		
163	Potential obstacle/obstruction to fish passage					
164	Pool	C	1	CL		
165	No perceptible flow	A	0	BO/CO/GR		
166	Run	A	1	BO/CO/GR		
167	No perceptible flow	C	0	BO/GR/SA		
168	Potential obstacle/obstruction to fish passage					
169	Glide	A	1	BO/CO/GR		
170	Run	A	1	BO/CO/GR		
171	No perceptible flow	A	0	BO/CO/GR		
172	Run	A	1	BO/CO/GR		
173	No perceptible flow	A	0	BO/CO/GR		
174	No perceptible flow	D	0	SI		
175	No perceptible flow	B	0	SI		
176	Run	B	2	SI		
177	No perceptible flow	B	0	BO/CO/GR		
178	Run	A	1	BO/CO/GR		
179	No perceptible flow	A	0	BO/CO/GR		
180	No perceptible flow	B	0	BO/CO/GR		
181	No perceptible flow	A	0	BO/CO/GR		
182	No perceptible flow	B	0	BO/CO/GR		
183	No perceptible flow	C	0	BO/CO/GR		
184	No perceptible flow	B	0	BO/CO/GR		
185	Potential obstacle/obstruction to fish passage					
186	Potential obstacle/obstruction to fish passage					
187	No perceptible flow	B	0	BO/CO/SA		
188	No perceptible flow	B	0	BO/CO/GR		
189	Potential obstacle/obstruction to fish passage					
190	No perceptible flow	B	0	BO/CO/GR		
191	No perceptible flow	B	0	BO/CO/GR		
192	No perceptible flow	B	0	BO/CO/GR		
193	No perceptible flow	B	0	BO/CO/GR		
194	No perceptible flow	B	0	BO/CO/GR		
195	No perceptible flow	C	0	BO/CO/GR		
196	No perceptible flow	B	0	BO/CO/GR		
197	Run	A	2	BO/CO/GR		
198	No perceptible flow	B	0	BO/CO/GR		
199	Run	A	1	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
200	No perceptible flow	B	0	BO/CO/GR		
201	No perceptible flow	B	0	BO/CO/GR		
202	Run	A	1	BO/CO/GR		
203	No perceptible flow	B	0	BO/CO/GR		
204	Run	A	1	BO/CO/GR		
205	No perceptible flow	B	0	BO/CO/GR		
206	No perceptible flow	B	0	BO/CO/GR		
207	No perceptible flow	B	0	BO/CO/GR		
208	Potential obstacle/obstruction to fish passage					
209	Potential obstacle/obstruction to fish passage					
210	No perceptible flow	B	0	BO/CL		
211	No perceptible flow	A	0	BO/GR/SA		
212	No perceptible flow	A	0	BO/GR/SA		
213	Pool	C	1	BO/CO/GR		
214	No perceptible flow	A	0	BO/CO/GR		
215	Run	A	1	BO/CO/GR		
216	Potential obstacle/obstruction to fish passage					
217	Pool	C	1	BO/CL		
218	Potential obstacle/obstruction to fish passage					
219	No perceptible flow	B	0	BO/CO/GR		
220	No perceptible flow	C	0	BO/CO/GR		
221	No perceptible flow	B	0	BO/CO/GR		
222	Potential obstacle/obstruction to fish passage					
223	No perceptible flow	C	0	BO/GR		
224	No perceptible flow	B	0	BO/CL		
225	No perceptible flow	C	0	BO/CL		
226	No perceptible flow	B	0	BO/CL		
227	No perceptible flow	B	0	BO/CL		
228	Run	B	2	BO/CO/GR		
229	Pool	C	1	GR/SA/BO		
230	Glide	B	1	GR/BO/SI		
231	Pool	C	1	SA/CO/BO		
232	Glide	A	1	GR/SA/BO		
233	Pool	C	1	GR/SA		
234	Potential obstacle/obstruction to fish passage					
235	Pool	C	1	GR/SA		
236	Run	A	2	GR/SA/BO		
237	Potential obstacle/obstruction to fish passage					
238	Run	B	2	BO/GR/SA		
239	Pool	B	1	SA/BO		
240	Run	B	2	BO/GR/SA		
241	Pool	B	1	SA/BO		
242	Run	B	2	BO/GR/SA		
243	Potential obstacle/obstruction to fish passage					
244	Glide	B	1	BO/GR/SA		
245	Potential obstacle/obstruction to fish passage					
246	Pool	D	1	BE/BO/SA		
247	Potential obstacle/obstruction to fish passage					
248	Glide	B	1	BE/SA		
249	Potential obstacle/obstruction to fish passage					

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
250	Glide	B	1	BO/CO/SI		
251	Run	B	2	CO/BO/GR		
252	Pool	C	1	BO/CO/SA		
253	Run	B	2	BO/CO/GR		
254	Potential obstacle/obstruction to fish passage					
255	Glide	B	1	BO/CO/GR		
256	Run	B	2	BO/CO/GR		
257	Pool	C	1	BO/CO/GR		
258	Run	B	2	BO/CO/GR		
259	Glide	C	1	GR/BO/SA		
260	Run	B	2	CO/BO/SA		
261	Potential obstacle/obstruction to fish passage					
262	Pool	C	1	BO/SA		
263	Glide	B	1	BO/SA		
264	Run	B	2	BO/GR/SA		
265	Pool	C	1	BO/SA/CO		
266	Potential obstacle/obstruction to fish passage					
267	Glide	B	1	BO/SA		
268	Run	B	2	BO/CO/SA		
269	Run	B	2	SI/CO/BO		
270	Glide	B	1	SI/CO/BO		
271	Riffle	A	2	BO/CO/GR		
272	Pool	C	1	CL/BO		
273	Pool	C	1	CL/BO		
274	Run	B	2	CL/BO/GR		
275	Glide	B	1	CL/BO/GR		
276	Cascade	A	2	BO/CO		
277	Run	B	2	GR/SI/BO		
278	Cascade	A	2	BO/CO		
279	Cascade	A	3	BO/CO		
280	Glide	B	1	BO/SI	FL 60%	
281	Cascade	A	2	BO/CO		
282	Run	B	2	CO/BO/SI		
283	Riffle	A	2	CO/BO/SI		
284	Run	B	2	BO/GR/SI		
285	Riffle	A	2	CO/BO/SI		
286	Run	A	2	CO/BO/SI		
287	Cascade	A	2	BO/CO		
288	Glide	B	1	GR/SI/BO		
289	Cascade	A	2	BO/CO		
290	Glide	B	1	GR/SI/BO		
291	Riffle	B	2	GR/SI/BO		
292	Run	B	2	CO/BO/SI		
293	Glide	B	1	GR/SI/BO		
294	Riffle	B	2	BO/CO/GR		
295	Glide	B	1	BO/CO/SI		
296	Run	B	2	BO/CO/GR		
297	Pool	C	1	BO/CO/GR		
298	Cascade	A	3	BO/CO		
299	Riffle	B	2	BO/GR/BE		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
300	Run	B	2	BE		
301	Cascade	A	3	BE		
302	Glide	C	1	BO/CO/SI		
303	Run	B	2	BO/GR/SA		
304	Glide	B	1	BO/CO/SI		
305	Cascade	A	3	BO/CO		
306	Pool	C	1	BO/GR/SI		
307	Cascade	A	3	BO/CO		
308	Pool	B	1	BE/BO		
309	Run	A	2	BE		
310	No perceptible flow	A	0	BE		
311	Riffle	A	2	BE/BO/GR		
312	Potential obstacle/obstruction to fish passage					
313	Riffle	A	2	BO/CO/GR		
314	Potential obstacle/obstruction to fish passage					
315	Pool	B	1	BO/GR/CO		
316	Riffle	A	2	BO/CO/GR		
317	Glide	B	1	BO/GR/SA		
318	Riffle	A	2	BO/SA/GR		
319	Glide	B	1	BO/GR/SA		
320	Cascade	A	3	BO		
321	Run	A	2	BE/BO		
322	Cascade	A	2	BE/BO		
323	Glide	B	1	BO/GR/SA		
324	Riffle	A	2	BO/SA/GR		
325	Cascade	A	3	BO/CO		
326	Glide	B	1	BO/GR/SA		
327	Cascade	A	3	BO/CO		
328	Glide	B	1	BO/GR/SA		
329	Run	B	2	BO/GR/SA		
330	Potential obstacle/obstruction to fish passage					
331	Riffle	A	2	BO/SA/GR		
332	Cascade	A	3	BO/CO		
333	Riffle	A	2	BO/SA/GR		
334	Cascade	A	3	BO		
335	Riffle	A	2	BO/SA/GR		
336	Potential obstacle/obstruction to fish passage					
337	Riffle	A	2	BO/SA/GR		
338	Potential obstacle/obstruction to fish passage					
339	Pool	C	1	BO/SA		
340	Run	B	2	BO/GR/SA		
341	Potential obstacle/obstruction to fish passage					
342	Run	B	2	BO/GR/SA		
343	Cascade	A	2	BO		
344	Riffle	A	2	BO/SA/GR		
345	Pool	C	1	BO/SA/GR		
346	Riffle	A	2	BO/SA/GR		
347	Pool	C	1	BO/SA/GR		
348	Riffle	A	2	BO/SA/GR		
349	Glide	B	1	BO/GR/SA		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
350	Riffle	A	2	BO/SA/GR		
351	Cascade	A	3	BO/CO		
352	Pool	C	1	BO/SA		
353	Riffle	A	2	BO/SA/GR		
354	Potential obstacle/obstruction to fish passage					
355	Pool	C	1	BO/SA		
356	Glide	B	1	BO/GR/SA		
357	Riffle	A	2	BO/SA/GR		
358	Glide	B	1	BO/GR/SA		
359	Riffle	A	2	BO/SA/GR		
360	Run	B	2	BO/GR/SA		
361	Cascade	A	3	BO		
362	Pool	C	1	BO/SA		
363	Cascade	A	2	BO		
364	Pool	C	1	BO/SA		
365	Run	B	2	BO/GR/SA		
366	Glide	B	1	BO/SA/GR		
367	Run	B	2	BO/GR/SA		
368	Glide	B	1	BO/SA/GR		
369	Potential obstacle/obstruction to fish passage					
370	Riffle	A	2	BO/CO/GR		
371	Pool	C	1	BO/CO/GR		
372	Riffle	A	2	BO/CO/GR		
373	Run	B	2	BO/GR/SA		
374	Riffle	A	2	BO/CO/GR		
375	Glide	B	1	BO/GR/SA		
376	Cascade	A	3	BO		
377	Glide	B	1	BO/GR/SA		
378	Riffle	A	2	BO/CO/GR		
379	Run	B	2	BO/GR/SA		
380	Riffle	A	2	BO/CO/GR		
381	Glide	B	1	BO/GR/SA		
382	Pool	B	1	BO/CO/SA		
383	Run	B	2	BO/GR/SA		
384	Pool	C	1	BO/GR/SA		
385	Riffle	A	2	BO/CO/GR		
386	Run	B	2	BO/GR/SA		
387	Riffle	A	2	BO/CO/GR		
388	Glide	B	1	BO/GR/SA		
389	Riffle	A	2	BO/CO/GR		
390	Glide	B	1	BO/GR/SA		
391	Riffle	A	2	BO/CO/GR		
392	Glide	B	1	BO/GR/SA		
393	Riffle	A	2	BO/CO/GR		
394	Run	B	2	BO/GR/SA		
395	Potential obstacle/obstruction to fish passage					
396	Glide	B	1	BO/GR/SA		
397	Riffle	A	2	BO/CO/GR		
398	Glide	B	1	BO/GR/SA		
399	Run	B	2	BO/GR/SA		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
400	Pool	C	1	BO/CO/GR		
401	Run	B	2	BO/GR/SA		
402	Potential obstacle/obstruction to fish passage					
403	Pool	C	1	BO/CO/GR		
404	Run	B	2	BO/GR/SA		
405	Glide	B	1	BO/CO/GR		
406	Riffle	A	2	BO/CO/GR		
407	Pool	C	1	BO/CO/GR		
408	Glide	B	1	BO/CO/GR		
409	Riffle	B	2	BO/CO/GR		
410	Pool	C	1	BO/CO/GR		
411	Run	B	2	BO/CO/GR		
412	Riffle	B	2	BO/CO/GR		
413	Run	B	2	BO/CO/GR		
414	Pool	C	1	BO/CO/GR		
415	Run	B	2	BO/CO/GR		
416	Riffle	B	2	BO/CO/GR		
417	Run	B	2	BO/CO/GR		
418	Riffle	B	2	BO/CO/GR		
419	Run	B	2	BO/CO/GR		
420	Riffle	B	2	BO/CO/GR		
421	Run	B	2	BO/CO/GR		
422	Potential obstacle/obstruction to fish passage					
423	Run	C	3	BO/CO/GR		
424	Run	B	3	BO/CO/GR		
425	Run	C	3	BO/CO/GR		
426	Glide	B	1	BO/CO/GR		
427	Salmonid	B	4	BO/CO/GR		Fry
428	Salmonid	C	4	BO/CO/GR		Parr
429	Salmonid	D	3	BO/CO/GR		Sub optimal spawning
430	Glide	B	1	BO/CO/GR		
431	Glide	C	1	BO/CO/GR		
432	Glide	B	1	BO/CO/GR		
433	Glide	D	1	BO/CO/GR		
434	Glide	E	1	BO/CO/GR		
435	Lamprey	C	1	SI/SA/GR		Sub optimal
436	Lamprey	C	1	SI/SA/GR		Sub optimal
437	Pool	E	1	BO/CO/GR		
438	Eddy	C	0	BO/CO/SA	EFL-10	
439	Run	B	2	BO/CO/GR		
440	Run	D	2	BO/CO/GR		
441	Run	E	3	BO/CO/GR		
442	Run	C	4	BO/CO/GR		
443	Run	B	3	BO/CO/GR		
444	Eddy	D	0	BO/CO/GR		
445	Glide	B	2	BO/CO/GR		
446	Salmonid	C	2	BO/CO/GR		Sub optimal spawning
447	Glide	E	3	BO/CO/GR		
448	Glide	E	2	BO/CO/GR		
449	Glide	D	2	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
450	Glide	E	1	BO/CO/GR		
451	Glide	D	1	BO/CO/GR		
452	Glide	C	1	BO/CO/GR		
453	Run	C	2	BO/CO/GR		
454	Run	E	2	BO/CO/GR		
455	Eddy	E	0	BO/CO/GR		
456	Run	E	3	BO/CO/GR		
457	Glide	C	2	GR/CO/SA		
458	Run	E	4	BO/CO/GR		
459	Glide	B	2	GR/CO/SA		
460	Run	D	4	BO/CO/GR		
461	Run	C	4	BO/CO/GR		
462	Eddy	C	0	BO/CO/SA		
463	Torrent	C	5	BO/CO/GR		
464	Salmonid	B	3	BO/CO/GR		Parr/Fry
465	Run	A	3	BO/CO/GR		
466	Run	D	3	BO/CO/GR		
467	Riffle	A	2	BO/CO		
468	Glide	C	2	BO/CO/SA		
469	Run	C	3	BO/CO/SA		
470	Eddy	C	0	BO/CO/SA		
471	Run	D	4	BO/CO/GR		
472	Salmonid	C	4	BO/CO/GR		Parr
473	Run	A	2	CO/GR/SA		
474	Riffle	A	2	CO/GR/SA		
475	Run	A	2	CO/GR/SA		
476	Potential obstacle/obstruction to fish passage					
477	Potential obstacle/obstruction to fish passage					
478	Run	B	2	BO/SA/GR		
479	Riffle	A	2	BO/SA/GR		
480	Run	B	2	BO/SA/GR		
481	Riffle	A	2	BO/SA/GR		
482	Run	B	2	BO/SA/GR		
483	Run	B	3	BO/SA/GR		
484	Potential obstacle/obstruction to fish passage					
485	Run	B	2	BO/SA/GR		
486	Pool	C	1	BO/SA/GR		
487	Riffle	B	3	BO/CO/SA		
488	Run	B	3	BO/CO/SA		
489	Pool	C	1	BO/SA/SI		
490	Run	B	3	BO/CO/SA		
491	Potential obstacle/obstruction to fish passage					
492	Run	B	3	BO/CO/SA		
493	Pool	C	1	BO/SA/SI		
494	Potential obstacle/obstruction to fish passage					
495	Run	B	3	BO/CO/GR		
496	Riffle	B	3	BO/SA/GR		
497	Glide	C	1	BO/SA/CO		
498	Run	B	3	BO/SA/CO		
499	Riffle	B	3	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
500	Run	B	3	BO/SA/CO		
501	Riffle	B	3	BO/CO/GR		
502	Run	B	3	BO/SA/CO		
503	Potential obstacle/obstruction to fish passage					
504	Pool	B	1	BO/SA/CO		
505	Run	A	2	BO/CO/GR		
506	Potential obstacle/obstruction to fish passage					
507	Run	A	2	BO/CO/GR		
508	Potential obstacle/obstruction to fish passage					
509	Run	B	3	BO/CO/GR		
510	Potential obstacle/obstruction to fish passage					
511	Pool	C	1	BO/CO/SA		
512	Run	B	2	BO/CO/GR		
513	Potential obstacle/obstruction to fish passage					
514	Run	B	2	BO/CO/GR		
515	Glide	B	1	BO/CO/GR		
516	Run	B	2	BO/CO/GR		
517	Run	B	3	BO/CO/GR		
518	Glide	B	2	BO/CO/GR		
519	Run	B	2	BO/CO/GR		
520	Glide	B	1	CO/GR/SA		
521	Riffle	B	2	BO/CO/GR		
522	Run	B	2	BO/CO/GR		
523	Pool	C	1	BO/CO/GR		
524	Run	B	2	BO/CO/GR		
525	Glide	B	2	CO/GR/SA		
526	Run	B	2	CO/GR/SA		
527	Run	B	3	BO/CO/GR		
528	Riffle	B	3	BO/CO/GR		
529	Run	B	3	BO/CO/GR		
530	Pool	C	1	CO/GR/SA		
531	Run	B	2	CO/GR/SA		
532	Riffle	B	2	BO/CO/GR		
533	Glide	C	1	BO/CO/GR		
534	Riffle	B	2	BO/CO/GR		
535	Run	B	2	BO/CO/GR		
536	Glide	C	2	CO/GR/SA		
537	Run	B	2	BO/CO/GR		
538	Glide	B	3	BO/CO/GR		
539	Riffle	B	3	BO/CO/GR		
540	Glide	B	2	BO/CO/GR		
541	Run	B	2	BO/CO/GR		
542	Riffle	B	3	BO/CO/GR		
543	Glide	B	2	BO/CO/GR		
544	Pool	D	1	BO/CO/GR		
545	Riffle	B	1	BO/CO/GR		
546	Riffle	B	3	BO/CO/GR		
547	Run	C	3	BO/CO/GR		
548	Riffle	B	3	BO/CO/GR		
549	Glide	C	2	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
550	Riffle	B	3	BO/CO/GR		
551	Glide	C	2	CO/GR/SI		
552	Riffle	B	3	CO/GR/SA		
553	Glide	C	2	CO/GR/SA		
554	Riffle	B	2	BO/CO/GR		
555	Pool	D	1	CO/GR/SA		
556	Glide	C	2	CO/GR/SA		
557	Riffle	B	2	CO/GR/SA		
558	Glide	C	2	CO/GR/SA		
559	Pool	C	1	CO/GR/SA		
560	Glide	C	2	CO/GR/SA		
561	Riffle	B	3	CO/GR/SA		
562	Glide	B	2	CO/GR/SA		
563	Riffle	B	3	CO/GR/SA		
564	Glide	B	2	CO/GR/SA		
565	Riffle	B	3	CO/GR/SA		
566	Run	B	2	CO/GR/SA		
567	Glide	B	2	CO/GR/SA		
568	Run	B	2	CO/GR/SI		
569	Riffle	B	2	CO/GR/SI		
570	Run	B	2	CO/GR/CL		
571	Glide	B	1	CO/GR/SI		
572	Glide	C	1	CO/GR/SI		
573	Run	A	2	CO/GR/SI		
574	Run	B	2	CO/GR/SA		
575	Glide	B	2	CO/GR/SA		
576	Pool	C	1	GR/SA/SI		
577	Potential obstacle/obstruction to fish passage					
578	Pool	C	1	GR/SA/SI		
579	Glide	B		CO/GR/SA		
580	Potential obstacle/obstruction to fish passage					
581	Glide	B	1	CO/GR/SA		
582	Run	B	2	CO/GR/SA		
583	Run	B	3	CO/GR/SA		
584	Glide	C	1	BO/CO/GR		
585	Glide	B	1	CO/GR/SA		
586	Potential obstacle/obstruction to fish passage					
587	Run	B	2	BO/CO/GR		
588	Glide	B	2	BO/CO/GR		
589	Run	B	3	BO/CO/GR		
590	Glide	C	2	BO/CO/GR		
591	Run	B	2	CO/GR/SA		
592	Glide	B	2	CO/GR/SA		
593	Glide	B	2	GR/SA/SI		
594	Potential obstacle/obstruction to fish passage					
595	Run	B	2	GR/SA/SI		
596	Glide	C	2	GR/SA/SI		
597	Run	B	2	CO/GR/SA		
598	Run	B	3	CO/GR/SA		
599	Glide	B	2	GR/SA/SI		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
600	Pool	C	1	GR/SA/SI		
601	Run	B	3	BO/CO/GR		
602	Run	B	2	BO/CO/GR		
603	Riffle	B	3	BO/CO/GR		
604	Run	B	2	BO/CO/GR		
605	Glide	B	1	BO/CO/GR		
606	Riffle	B	2	BO/CO/GR		
607	Potential obstacle/obstruction to fish passage					
608	Run	B	2	BO/CO/GR		
609	Glide	C	2	CO/GR/SA		
610	Potential obstacle/obstruction to fish passage					
611	Run	B	2	BO/CO/GR		
612	Glide	B	1	GR/SA/SI		
613	Glide	C	1	GR/SA/SI		
614	Glide	B	1	GR/SA/SI		
615	Potential obstacle/obstruction to fish passage					
616	Run	B	2	CO/GR/CL		
617	Riffle	B	3	CO/GR/SA		
618	Pool	C	1	CO/GR/SA		
619	Run	B	2	CO/GR/SA		
620	Glide	B	3	CO/GR/SA		
621	Glide	B	2	CO/GR/SA		
622	Riffle	A	1	CO/GR/SA		
623	Glide	B	2	CO/GR/SA		
624	Run	B	2	CO/GR/SA		
625	Glide	C	2	CO/GR/SA		
626	Run	B	2	CO/GR/SA		
627	Glide	B	2	CO/GR/SA		
628	Glide	C	1	SA/SI		
629	Potential obstacle/obstruction to fish passage					
630	Run	B	2	CO/GR/SA		
631	Run	C	2	CO/GR/SA		
632	Pool	C	1	CO/GR/SA		
633	Run	B	2	CO/GR/SA		
634	Run	C	3	BO/CO/GR		
635	Run	E	3	BO/CO/GR		
636	Glide	D	2	BO/CO/BE		
637	Potential obstacle/obstruction to fish passage					
638	Torrent			BO/CO		
639	Run	D	3	BE/CO/BO		
640	Run	D	4	BO/CO/GR		
641	Run	E	3	BE/CO/BO		
642	Run	C	2	BE/CO/GR		
643	Run	D	3	BO/CO/GR		
644	Run	B	2	BO/CO/GR		
645	Lamprey	C	0	SA/SI/GR	Sub-optimal	
646	Riffle	B	3	BO/CO/GR		
647	Lamprey	B	1	SA/SI/GR	Sub-optimal	
648	Lamprey	B	1	SA/SI	Optimal	
649	Run	C	3	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
650	Glide	B	2	BO/CO/GR		
651	Salmonid	B	3	BO/CO/GR		Fry
652	Lamprey	C	1	SI/SA/GR		Sub-optimal
653	Run	C	3	BO/CO/GR		
654	Salmonid	C	4	BO/CO/GR		Parr
655	Lamprey	B	0	SI/SA/GR		Sub-optimal
656	Run	C	3	BO/CO/BE		
657	Run	C	3	BO/CO/GR		
658	Run	C	3	BO/CO/BE		
659	Run	D	4	BO/CO/GR		
660	Salmonid	C	4	BO/CO/GR		Parr
661	Run	D	4	CO/GR/SA		
662	Run	B	2	CO/GR/SA		
663	Run	C	2	CO/GR/SA		
664	Run	C	3	CO/GR/SA		
665	Eddy	D	0	BO/CO/GR		
666	Lamprey	C	1	SI/SA/GR		Sub-optimal
667	Run	D	3	CO/GR/SA		
668	Run	C	3	BO/CO/GR		
669	Eddy	E	0	BO/CO/GR		
670	Pool	D	3	BO/CO/GR		
671	Run	D	3	BO/CO/GR		
672	Glide	D	3	BO/CO/GR		
673	Lamprey	C	1	SI/SA/GR		Sub-optimal
674	Glide	C	2	BO/CO/GR		
675	Glide	C	3	BO/CO/GR		
676	Glide	D	2	BO/CO/GR		
677	Run	D	1	BO/CO/GR		
678	Eddy	C	0	BO/CO/GR		
679	Pool	C	1	BO/CO/GR		
680	Pool	E	1	BO/CO/GR		
681	Glide	D	2	BO/CO/GR		
682	Pool	D	1	BO/CO/GR		
683	Glide	C	3	BO/CO/GR		
684	Salmonid	B	3	BO/CO/GR		Fry
685	Glide	C	2	BO/CO/GR		
686	Glide	C	3	BO/CO/GR		
687	Salmonid	C	3	BO/CO/GR		Sub-optimal spawning
688	Run	C	4	BO/CO/GR		
689	Eddy	D	0	BO/CO/GR		
690	Salmonid	B	4	BO/CO/GR		Fry
691	Lamprey	C	1	SI/SA		Optimal
692	Eddy	C	0	BO/CO/GR		
693	Glide	D	2	BO/GR/CO		
694	Run	C	3	BO/CO/GR		
695	Pool	E	1	BO/GR/CO		
696	Lamprey	C	1	SI/SA/GR		Sub-optimal
697	Dry	N/A	N/A	N/A		
698	Potential obstacle/obstruction to fish passage					
699	Dry	N/A	N/A	N/A		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
700	Dry	N/A	N/A	N/A		
701	Potential obstacle/obstruction to fish passage					
702	No perceptible flow	B	0	SI/GR		
703	No perceptible flow	B	0	BO/CO/GR		
704	No perceptible flow	C	0	BO/CO/GR		
705	No perceptible flow	B	0	BO/CO/GR		
706	No perceptible flow	C	0	BO/CO/GR		
707	No perceptible flow	B	0	BO/CO/GR		
708	No perceptible flow	A	0	BO/CO/GR		
709	Potential obstruction to fish passage					
710	No perceptible flow	C	0	BO/CO/GR		
711	No perceptible flow	B	0	BO/CO/GR		
712	No perceptible flow	C	0	BO/CO/GR		
713	No perceptible flow	A	0	BO/CO/GR		
714	No perceptible flow	B	0	BO/CO/GR		
715	Run	A	2	BO/CO/GR		
716	Glide	B	1	BO/CO/GR/SI		
717	Glide	A	1	BO/CO/GR		
718	Run	A	2	BO/CO/GR/SA		
719	Glide	A	1	BO/CO/GR/SA		
720	Riffle	A	2	BO/CO/GR		
721	Glide	C	1	BO/CO/GR		

Appendix B: Otter and Water vole survey results

Haweswater Aqueduct Resilience Programme

Otter and Water Vole Survey Report – TR4 Marl Hill

Project No. 2480524

SEPTEMBER 2021

RSK biocensus
EXPERTS IN ECOLOGY

RSK GENERAL NOTES

Project No.: 2480524

Title: Haweswater Aqueduct Resilience Programme: Otter and Water Vole Survey Report – TR4 Marl Hill

Client: Ricardo Energy and Environment

Date: September 2021

Office: Helsby

Status: REV4

Author	Ben Faulkner	**Technical and quality reviewer**	Dr Peter Walker
Signature		Signature	
Date:	30/09/2021	Date:	30/09/2021

Project manager	Ben Faulkner
Signature	
Date:	30/09/2021

CONTENTS

1 INTRODUCTION

1.1 Purpose of this report

RSK Biocensus (RSK) was commissioned by Ricardo Environment and Energy (Ricardo) to provide specialist aquatic ecological support in relation to the Haweswater Aqueduct Resilience Programme (HARP). Otter (*Lutra lutra*) and water vole (*Arvicola amphibius*)) surveys are required to inform a Water Framework Directive (WFD) assessment, Environmental Impact Assessment (EIA) and mitigation strategy for the scheme.

As part of the scheme United Utilities propose to replace several sections of the existing single line aqueduct. The replacement sections are proposed to be delivered over five distinct sections. From north to south these sections are named as follows:

- Docker (TR1);
- Swarther (TR2);
- Bowland (TR3);
- Marl Hill (TR4); and
- Haslingden to Walmersley (TR5/6).

Nine planning applications are required to cover all five sections. These will be accompanied by an Environmental Statement (ES) for each section and a Habitat Regulations Assessment (HRA) as required for each section.

This report details surveys undertaken on watercourses within the Marl Hill (TR4) section which will likely be impacted by the proposed works.

1.2 Site information

Figure 1 shows the location of the survey reaches and the survey extents for each watercourse identified that will be impacted by the works for section TR4 of the scheme. *Table 1* summarises the survey requirements at each watercourse which were specified by Ricardo.

Table 1. Site information and survey requirements, TR4 Marl Hill

Name	Watercourse ID	Section	Eastings and Northings		Date of survey		
			Upstream	Downstream		Water Vole	Otter
Bashall Brook	W512	T04	X: 369928 Y: 444567	X: 370018 Y: 444057	24/04/2020	-	Yes
Unnamed Watercourse 430	W520	T04	X: 371521 Y: 444978	X: 371527 Y: 444907	24/04/2020	Yes (x2)	Yes
Unnamed Watercourse 431	W521	T04	X: 371727 Y: 445030	X: 371737 Y: 444952	24/04/2020	-	Yes
Unnamed Watercourse 433	W523	T04	X: 371960 Y: 445103	X: 371975 Y: 445019	24/04/2020	-	Yes
Unnamed Watercourse 442	W533	T04	X: 370293 Y: 444498	X: 370454 Y: 444396	24/04/2020	-	Yes
Unnamed Watercourse 463	W557	T04	X: 371799 Y: 445413	X: 371919 Y: 444809	24/04/2020	-	Yes
Waddington Brook	W506	T04	X: 372043 Y: 447548	X: 372137 Y: 446634	05/06/2020	Yes	Yes
Coplow Brook	W506	T04	X: 373521 Y: 443840	X: 373924 Y: 443617	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
Unnamed Watercourse 430 (downstream)	W520	T04	X: 371578 Y: 444453	X: 371684 Y: 444111	05/06/2020	Yes	Yes
Unnamed Watercourse 446	W538	T04	X: 371373 Y: 444791	X: 371177 Y: 444010	09/06/2020	Yes	Yes
Unnamed Watercourse 445	W537	T04	X: 371255 Y: 444749	X: 371200 Y: 444302	05/06/2020	Yes	Yes
Sandy Ford Brook	W530	T04	X: 371051 Y: 445379	X: 371183 Y: 444306	09/06/2020	Yes	Yes
Greg Sike	W2321	T04	X: 373964 Y: 443939	X: 374095 Y: 443580	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
River Ribble	RW03-05	T04	X: 372037 Y: 446276	X: 372261 Y: 445877	24/11/2020	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
River Ribble	W2325	T04	X: 374488 Y: 443947	X: 374020 Y: 443440	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
Waddington Brook	RW17	T04	X: 372037 Y: 446276	X: 372261 Y: 445877	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
Coplow Brook	W2349	T04	X: 373624 Y: 443620	X: 373466 Y: 444014	31/08/2021	No	Yes
Unnamed watercourse 2097	W2348	T04	X: 374169 Y: 443996	X: 374236 Y: 443779	31/08/2021	No	Yes

2 METHOD

2.1 Survey timings

Surveys were undertaken by two experienced aquatic ecologists. All presence absence surveys were undertaken during optimal seasons and in the weeks preceding each of the presence absence surveys no significant rainfall was recorded.

2.2 Otter surveys

Otter surveys followed an amended methodology derived from that detailed within Chanin 2003[1]. Where access permitted, both banks of each watercourse were surveyed to look for and record signs of otter. Emphasis was given to investigating prominent features such as bridge arches, fallen trees and root systems as well as rocks and ledges along the banks where spraints, footprints, evidence of resting or breeding sites and feeding remains were most likely to be present. Presence of access points, such as slides or runs, were also recorded. The location of any evidence was marked using a hand-held tablet device allowing the data to be mapped using GIS software. Photographs were taken to evidence sign of otter as well as the habitat present on the site.

2.3 Water vole surveys and habitat suitability assessment

The water vole surveys followed the standard methods outlined within Strachan (2011)[2] and Dean *et al*. (2016)[3] respectively. Where accessible, surveyors searched both banks of each watercourse for evidence of water voles including burrows, feeding platforms, grazing (including food remains), latrines and footprints.

The location of any water vole evidence was recorded using a hand-held tablet device allowing the data to be mapped using GIS software. Photographs were also taken to evidence water vole activity as well as the habitat present on site.

Where surveys were undertaken outside the survey season for water vole (April – September) the suitability of the habitat for water voles was assessed using the following criteria (Dean *et al.,* 2016[4]):

- Bank profile;
- Bank substrate, specifically its suitability for burrowing;
- Water depth;
- Likely frequency and height of water level changes, relative to bank height;
- Amount of shading from trees/shrubs;

[1] Chanin, P. 2003. Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

[2] Strachan, R. (2011). Water Vole Conservation Handbook – The Third Edition. Wildlife Conservation Research Unit, Oxford

[3] Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London

[4] Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series).* Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.

- Bankside herbaceous vegetation type (tall tussocky grass, mown grass etc.);
- Bankside herbaceous vegetation density;
- In-channel herbaceous vegetation type;
- In-channel herbaceous vegetation width (from toe of bank to the point at which the Bank meets water level);
- In-channel herbaceous vegetation density;
- Percentage of the channel with in-channel herbaceous vegetation;
- Evidence of current or recent management, and the likely effects of management; and
- Any other relevant factors.

Classification of habitat suitability was made as follows:

- ***Excellent*** – optimal habitat with good cover, food sources and other features that would allow water vole populations to thrive throughout the year.
- ***Suitable*** – habitat that has all the elements required by water vole, certainly in the summer, and probably through most winters.
- ***Moderate*** – habitat that has some of the features that are suitable for water vole, but with some constraints so that suitability throughout the year is not certain.
- ***Unsuitable*** – habitat lacking one or more crucial element for use by water voles. This category does not necessarily preclude the habitat being used by water voles, but it would not be able to support a resident population.

2.4 Survey constraints

There were no obvious constraints to undertaking the surveys. Where presence absence surveys were undertaken, the timings were considered suitable for water vole and otter and the surveys were not compromised by poor weather. Surveyors were also able to access the full extent of each watercourse.

2.5 Biosecurity

All RSK ecologists have undertaken internal training on biosecurity practices, which are in accordance with those described by the Great Britain Non-Native Species Secretariat's (GB NNSS) check-clean-dry policy. Furthermore, they have all completed, as a minimum, modules 1 and 3 of the GB NNSS e-learning modules on biosecurity. In addition to adhering to this procedure, surveyors worked in a downstream direction in flowing watercourses to further minimise risk. All equipment was thoroughly checked, cleaned (and disinfected) and dried before it was used in a different watercourse.

3 RESULTS

Table 2 summarises the results of the surveys at each respective site.

Table 2. Otter and water vole survey results – TR4 Marl Hill

T04: W512 Bashall Brook	
 	**Eastings and Northings** Upstream: X: 369928 Y: 444567 Downstream: X: 370018 Y: 444057 • **Evidence of otter, suitable habitat at W512.** Evidence of otter was recorded at W512; four spraints were recorded (*Figure 2* – W512). W512 is considered suitable habitat for otter. W512 was a moderately flowing stream with varying flow types and pools. The channel substrate was predominantly comprised of bedrock, boulder, cobble, and gravel. Filamentous algae was occasionally present throughout the surveyed reach. The width of the channel was variable ranging from *c.* 2.4 - 4.5 m. Similarly, the depth was also variable ranging from *c.* 0.03 - 0.45 m. Large woody debris and side bars were present throughout the watercourse providing heterogeneous flow and aquatic habitat. The majority of W512 was comprised of steep, wooded, channel sides with bankside herbs. W512 had a section of artificial substrate and vertical embankment with a culvert present immediately upstream of the bridge. Downstream of the bridge a large man-made cascade was present. A fish ladder was adjacent to this obstruction but was blocked by boulders and cobbles at the time of the survey.

T04: W520 Unnamed Watercourse 430 (Upstream reach)

Eastings and Northings

Upstream: X: 371521 Y: 444978

Downstream: X: 371527 Y: 444907

- **No evidence of otter and moderate habitat suitability at W520.**
- **Potential water vole evidence but low habitat suitability.**

No evidence of otter was observed.

Three burrows were recorded (*Figure 2* – W520). Notwithstanding this, most of the site is considered of low suitability for water voles due to the extensive tree cover throughout the section surveyed and limited food resources.

Despite the burrows being found, in the absence of definitive evidence i.e. latrines, it is considered unlikely that water vole are present at the site.

The watercourse was a shallow, slow-flowing stream with steep earth and rock banks. Abundant tree cover and woody debris was present throughout with ground flora consisting of grass, herbs and *Juncus* sp. (a Rush).

The channel substrate was a mix of boulder, cobble, sand and gravel. The stream was bordered by sheep-grazed pasture. The width of the channel was *c.* 0.5 m and the water depth was *c.* 2 cm.

T04: W520 Unnamed Watercourse 430 (Downstream reach)

Eastings and Northings

Upstream: X: 371578 Y: 444453

Downstream: X: 371684 Y: 444111

- **No evidence of otter or water vole.**
- **W520 is unsuitable for water vole, but of low to moderate suitability for otter.**

No evidence of water vole was found during surveys. Due to heavy shading throughout and lack of available foraging resources, the reach was considered unsuitable for water vole.

<table>
<tr><td></td><td>No evidence of otter was recorded on W520, however, the watercourse possessed suitable resting sites (exposed tree roots and cavities below large boulders) and commuting potential for otters.

The watercourse was a steep sided, shallow flowing stream, shaded throughout with both native deciduous and non-native ever green canopy (rhododendron sp.). The in-channel substrate was comprised of boulder, cobble, and gravel with occasional coarse woody debris.

A small section of W520 had artificially reinforced banks, stone walls, and a weir was present in the upstream section.

The width of the channel was c. 2.5 m and the water depth was c. 10 cm.</td></tr>
<tr><td colspan="2">T04: W521 Unnamed Watercourse 431</td></tr>
<tr><td>  </td><td>Eastings and Northings
Upstream: X: 371727 Y: 445030
Downstream: X: 371737 Y: 444952

• No otter evidence, low habitat suitability at W521.

No evidence of otter was recorded at W521 during the surveys (Figure 2 – W521).

W521 was predominantly dry with areas of shallow standing water. The width of the channel was c. 0.3 m and the water depth was c. 1 cm, where water was present.

The shallow sloping banks were vegetated with grasses and trees with occasional Juncus sp., herbs and scrub. The ditch was bordered by sheep-grazed pasture. The in-channel substrate was comprised of boulder, cobble and gravel.</td></tr>
</table>

T04: W523 Unnamed Watercourse 433	
	**Eastings and Northings** Upstream: X: 371960 Y: 445103 Downstream: X: 371975 Y: 445019 • **No evidence of otter at W523, habitat of moderate suitability.** No evidence of otter was recorded during the surveys (*Figure 2* – W523). The watercourse was a shallow, slow flowing stream with no in-channel vegetation. The width of the channel was *c.* 0.5 m and the water depth was *c.* 2 cm. The channel substrate was a mix of boulder, cobble, and gravel with occasional mud. The banks were steep and principally bare earth or grass. The bordering vegetation was comprised of grass, *Juncus* sp., scrub and trees.
T04: W533 Unnamed Watercourse 442	
	**Eastings and Northings** Upstream: X: 370293 Y: 444498 Downstream: X: 370454 Y: 444396 • **No evidence of otter at W533, habitat of low suitability.** No evidence of otter was recorded during the surveys (*Figure 2* – W533). W533 was predominantly dry with occasional standing water and some filamentous algae present. The substrate was boulder, cobble, and gravel. The width of the channel was *c.* 0.3 m and the water depth was *c.* 1 cm. The channel cuts through grazed pasture and follows a line of trees. Bank growth mainly consists of trees, grass and *Juncus* sp. with occasional scrub and herbs (dominated by nettles).

T04: W557 Unnamed Watercourse 463	
	**Eastings and Northings** Upstream: X: 371799 Y: 445413 Downstream: X: 371919 Y: 444809 • **No evidence of otter at W557, habitat of moderate suitability.** No evidence of otter was recorded during the surveys at W557 (*Figure 2* – W557). W557 was a wooded, shallow ditch with intermittent reaches of ponded water or water with no perceivable flow. The substrate consisted of boulder, cobble, and gravel. The width of the channel was *c.* 0.4 m and the water depth was *c.* 3 cm where water was present. Bankside vegetation was comprised mostly of grasses and *Juncus* sp. with areas of bare ground and occasional scrub or tree cover. The stream was bordered by sheep grazed pasture. No in-channel vegetation was observed and there was evidence of trampling and poaching on the banks.
T04: W506 Waddington Brook	
	**Eastings and Northings** Upstream: X: 372043 Y: 447548 Downstream: X: 372137 Y: 446634 • **No evidence of water vole recorded on W506.** • **Two otter spraints were recorded at the upstream extent of the reach.** • **Habitat within the survey reach was generally unsuitable for both species.** No evidence of water vole was recorded on W506. The brook does however provide some suitable foraging and burrowing habitat. The watercourse was generally, a moderately flowing, shallow brook with a substrate comprised predominantly from boulders, cobble, gravel, silt, and bedrock. Bedrock cascades and pools were

	also frequent. Although variable, the width of the channel was 1 – 3.5 m and the water depth was *c.* 20 cm. Vegetation on the steep, sheep-grazed banks was comprised of herbs, *Juncus* sp. and ferns. No in-channel vegetation was recorded.
T04: W506 Coplow Brook	
  	**Eastings and Northings** Upstream: X: 373521 Y: 443840 Downstream: X: 373924 Y: 443617 • **Evidence of otter at W506, some suitable habitat present.** • **No evidence of water vole, habitat of low suitability.** The channel width was *c.* 1.25 m, and, at the time of survey, the water depth was *c.* 10 cm, although both of these were variable. The substrate comprised mostly of boulder, cobble, gravel, and sand, with some silt at the downstream end. Sewage fungus was recorded over a large stretch of the reach indicating a water quality issues may be a problem within the watercourse. Evidence of otter was recorded in the form of spraint and footprints (*Figure 2 – W506*). Habitat was not considered to be of high suitability for otter, but there were sections of woody and anthropogenic debris on the bank which otters may choose to use for refuge. No evidence of water vole was recorded during the survey and habitat was largely unsuitable at W506.

T04: W538 Unnamed Watercourse 446	
 	**Eastings and Northings** Upstream: X: 371373 Y: 444791 Downstream: X: 371177 Y: 444010 • **No evidence of otter or water vole on W538.** W538 was largely unsuitable for water vole with no definitive water vole evidence recorded during the survey i.e. latrines. No evidence of otter was recorded on W538. Although the habitat was regarded as being largely unsuitable for otter with few foraging and resting opportunities at this location, the watercourse could still be used for commuting. The channel width was *c.* 2 m and the water depth was *c.* 5 cm. The upstream section of W538 was a dry, tree-bordered ditch between cattle-grazed, improved / semi-improved pasture. The substrate was predominantly boulder, cobble, gravel, and clay. The channel passed under a road into a rhododendron dominated plantation. Areas of shallow ponded water were present within the channel at this location. W538 passed under another road and entered another cattle-grazed, semi-improved / improved pasture. The bank was poached through trampling.
T04: W537 Unnamed Watercourse 445	
	**Eastings and Northings** Upstream: X: 371255 Y: 444749 Downstream: X: 371200 Y: 444302 • **No evidence of otter or water vole on W537.** • **Habitat largely unsuitable for both species.** The channel width was *c.* 1.0 m, and, at the time of survey, the channel was predominantly dry with some ponded areas with no flow.

No evidence of water vole was found during surveys. Due to heavy shading throughout and a lack of suitable foraging resources, the reach is considered largely unsuitable for water vole. A small section of channel is unshaded providing suitable bankside habitat for water vole (pictured). This is located towards the downstream extent of the survey reach and was dry at the time of the survey.

No evidence of otter was recorded on W537. Due to the lack of available foraging and resting opportunities, the habitat was regarded as being unsuitable for otter.

W537 was a predominantly shaded channel with trees growing along both banks. A short section of the channel entered a meadow where herbs, grass and *Juncus* sp. dominate the banks. The channel was dry with a few sections of ponded water. The substrate was boulder, cobble, and gravel.

T04: W530 Sandy Ford Brook

Eastings and Northings

Upstream: X: 371051 Y: 445379

Downstream: X: 371183 Y: 444306

- **No evidence of otter or water vole at W530.**
- **Habitat generally unsuitable for both species.**

No evidence of otter was found at W530. The habitat was generally unsuitable for otter because, although suitable resting areas were identified (cavities under bankside trees), low flows currently limit aquatic foraging opportunities.

The upper section of W530 was potentially suitable for water vole with lush bankside vegetation present and bankside substrate for burrowing. Small mammal activity was observed in the form of burrows and feeding evidence (pictured) but this was characteristic of bank voles (*Myodes glareolus*).

The channel width ranged from 2 - 5 m and the water depth remained shallow throughout at *c.* 3 cm.

The upper reaches of the stream bisect pasture and at this point there was little, or no flow observed.

<table>
<tr><td></td><td>The gently sloping banks were vegetated with herbs, grasses and Juncus sp.. The in-channel substrate was comprised of boulder, cobble, gravel, silt, and clay.

As the watercourse flows downstream, the gently sloping banks are replaced by steep forested banks which have minimal herbaceous vegetation. The substrate was boulder, cobble, and gravel, with frequent coarse woody debris.</td></tr>
<tr><td colspan="2">T04: W2321 Greg Sike</td></tr>
<tr><td> 
  </td><td>Eastings and Northings
Upstream: X: 373964 Y: 443939
Downstream: X: 374095 Y: 443580

• Evidence of otter present at W2321.
• No evidence of water vole and habitat largely unsuitable.

The channel width was c. 1 m, and, at the time of survey, the water depth was c. 10 cm, although both of these were variable. The substrate comprised mostly of cobble, gravel, and sand with boulders in some sections. The downstream reach comprised of finer sediment and was composed mostly of sand and silt.

No holts, couches or spraint were recorded at W2321. A single otter footprint (pictured) was however recorded in an area of sand adjacent to the watercourse (Figure 2 – W2321). Although the watercourse provides limited opportunities for refuge this evidence suggests that otter could use the watercourse for foraging.

As the banks of the watercourse were mostly shallow, heavily shaded and lacking herbaceous vegetation the habitat was assessed to be largely unsuitable for water vole.</td></tr>
</table>

T04: W2325 River Ribble

Eastings and Northings

Upstream: X: 374488 Y: 443947
Downstream: X: 374020, Y: 443440

- **Evidence of otter at W2325, suitable habitat present.**
- **No evidence of water vole, habitat of moderate suitability.**

The channel width at W2325 was c. 35 m and, at the time of survey, the water depth was mostly *c.* 30 - 40 cm. The substrate comprised mainly of boulders, large cobbles, and gravel.

On the left-hand bank of the watercourse a well-used public footpath was present that encompassed the entire survey reach. During the survey several members of the public, including dog walkers, were observed using this right of way.

Evidence of otter was present in the form of spraint (5 separate locations), two suspected couches and 3 potential holts (*Figure 2 – W2325*). Otter footprints were observed that lead from beneath one of the potential holts (cavity beneath tree roots – pictured left), heading towards the watercourse (*Figure 2 – W2325*).

Although habitat is largely unsuitable for water vole a densely vegetated area (pictured) is present on the right-hand bank of the watercourse (immediately downstream of the road bridge). This area could provide suitable burrowing and foraging habitat for water vole. As this area is likely to be inundated when the river is in spate, it is not optimal habitat for water voles.

There were several marginal sections where the substrate was comprised of sand and silt and provided either optimal or sub-optimal habitat for lamprey.

T04: RW03-RW05	
  	**Eastings and Northings** Upstream: X: 372037 Y: 446276 Downstream: X: 372261 Y: 445877 • **Evidence of otter, suitable habitat present at RW03-RW05.** • **No evidence of water vole, habitat of moderate suitability.** Evidence of otter was observed on the river Ribble at RW03-RW05 in the form of spraint and footprints (both pictured). No otter holts or resting areas (couches) were recorded (*Figure 2 – RW03-RW05*). A cavity was present beneath some tree roots at the upstream extent of the reach (left bank) but there was no evidence to suggest it was being used by otters as refuge. Habitat within the reach was assessed to be of moderate suitability for water voles. The site contains steep banks suitable for burrowing, however certain sections of the reach have bank reinforcements in place which inhibit burrowing. At the time of survey, the bankside and emergent vegetation was sparse (partly owing to the timings of the survey). A small area of emergent reeds was present downstream of the road bridge (right bank), which could provide foraging habitat for water vole.
T04: RW17	
	**Eastings and Northings** Upstream: X: 372037 Y: 446276 Downstream: X: 372261 Y: 445877 • **Evidence of otter, suitable habitat present at RW17.** • **No evidence of water vole, habitat of moderate suitability.** Three otter spraints were observed during the survey and one potential couch was recorded at the base of a tree trunk (*Figure 2 – RW17*). Habitat within the survey extent is suitable for otter but due to the size of the watercourse foraging opportunities could be limited.

Habitat was largely unsuitable for water vole as large sections of the channel were shaded by tree cover, inhibiting the growth of low-lying herbaceous plants. Bank substrate was also primarily large boulders and therefore often unsuitable for burrowing.

Upstream of the main confluence on the reach the watercourse flows adjacent to an area of open grassland for approximately 100 m (pictured). The left-hand bank is reasonably steep at this point and is comprised of earth making it suitable for burrowing. Juncus sp. is abundant in this location, which does provide potential foraging habitat.

At this location with the watercourse averages just 0.4 m in width and 0.15 m in water depth. No areas of deep open water (which water vole could use to evade predation) were recorded adjacent to the suitable burrowing habitat.

T04: W2349 Coplow Brook

Eastings and Northings

Upstream: X:373624 Y:443620

Downstream: X:373466 Y:444014

- **No evidence of otter at W2349, some suitable habitat present.**

The channel width was *c.* 1.25 m, and, at the time of survey, the water depth was *c. 0.05* cm. The substrate comprised mostly of boulder, cobble, gravel, and sand, with some silt at the downstream end. The survey reach at W2349 is situated immediately upstream of reach W506.

No evidence of otter was recorded during the surveys. Habitat was not considered to be of high suitability for otter, but there were sections of woody and anthropogenic debris on the bank which otters may choose to use for refuge. Minnows were abundant throughout the survey extent providing a potential source of food for otters.

The invasive species Himalayan Balsam (*Impatiens glandulifera)* and Japanese Knotweed (*Fallopia japonica)* were both recorded within the survey extent.

T04: W2348 Unnamed watercourse 2097	
 	**Eastings and Northings** Upstream: X:374169 Y:443196 Downstream: X:374236 Y:443779 • **No evidence of otter at W2348, habitat largely unsuitable** Aquatic foraging opportunities (e.g., fish and crayfish) are likely to be limited at W2348 as at the time of the surveys the watercourse was dry. An area of dense scrub is present at the upstream extent of the watercourse which could provide refuge for otters. A public footpath does however bisect this area which could cause disturbance to otters. The invasive species Himalayan Balsam was recorded throughout the survey extent.

4 APPENDICES – SURVEY MAPS

369000 370000 371000 372000 373000 374000 375000 376000 377000

448000 447000 446000 445000 444000 443000

W506 Mapview
RW17 Mapview
W557 Mapview
W530 Mapview
W521 Mapview
W523 Mapview
W520 Mapview
W512 Mapview
W537 Mapview
W520 Mapview
W533 Mapview
W538 Mapview
River Ribble Mapview
W2349 Mapview
W2321 Mapview
W506 Mapview
W2348 Mapview
W2325 Mapview

Legend:
- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent
- Map View

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	17/02/2021	2480524	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 1:
Otter and Water Vole Survey
Overview Map - Marl Hill (TR4)

0 490 980
Meters
SCALE: 1:25,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV Overview Map.mxd

371500 371600 371700 371800 371900 372000 372100 372200 372300 372400 372500 372600 372700

447600 447500 447400 447300 447200 447100 447000 446900 446800 446700 446600

W506
Upstream

W506
Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

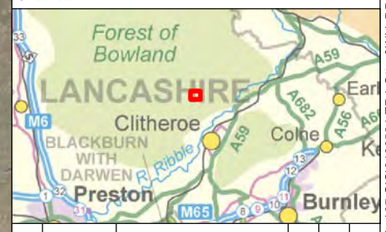
Otter Evidence

- Otter Spraint

Potential Water Vole Evidence

- Burrow
- Feeding Signs

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W506	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter and Water Vole Survey Results
Marl Hill (TR4) - Watercourse W506

0 75 150
Meters
SCALE: 1:4,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

374100
374200
374300
444000
443900
443800

W2348
Upstream

W2348
Downstream

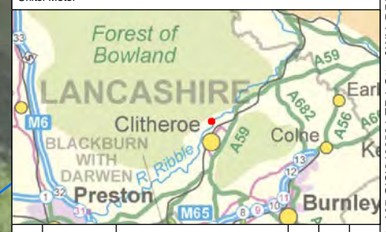
Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Potential Otter Couch

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W2348	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
No Otter or Water Vole Survey Results
Marl Hill (TR4) - Watercourse W2348

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

371600
371700
371800
371900
445100
445000
444900

W521
Upstream

W521
Downstream

Legend:
- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W521	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
No Otter or Water Vole Survey Results
Marl Hill (TR4) - Watercourse W521

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

371800 371900 372000 372100

445100

445000

W523
Upstream

W523
Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W523	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
No Otter or Water Vole Survey Results
Marl Hill (TR4) - Watercourse W523

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Otter Spraint

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W512	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter Survey Results
Marl Hill (TR4) - Watercourse W512

0 50 100
Meters
SCALE: 1:3,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

370300 370400 370500

444500 444400 444300

W533
Upstream

W533
Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W533	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
No Otter or Water Vole Survey Results
Marl Hill (TR4) - Watercourse W533

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\248000s\248050s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

370500 370600 370700 370800 370900 371000 371100 371200 371300 371400 371500 371600 371700

445300 445200 445100 445000 444900 444800 444700 444600 444500 444400 444300

W530 Upstream

W530 Downstream

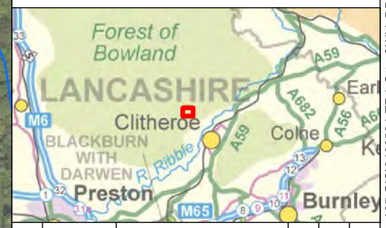
Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Potential Water Vole Evidence

- Burrow
- Feeding Signs

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W530	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Water Vole Survey Results
Marl Hill (TR4) - Watercourse W530

0 75 150
Meters
SCALE: 1:4,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

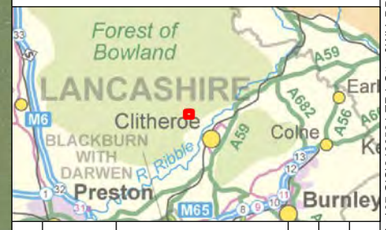
Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Potential Water Vole Evidence

- Burrow
- Feeding Signs

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W538	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Water Vole Survey Results
Marl Hill (TR4) - Watercourse W538

0 50 100
Meters
SCALE: 1:3,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

375800 375900 376000 376100 376200 376300 376400

445100 445000 444900 444800 444700 444600

River Ribble Downstream

River Ribble Upstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Potential Otter Couch
- Otter Spraint
- Otter Footprint

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	River Ribble	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter Survey Results
Marl Hill (TR4) - Watercourse River Ribble

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc6fs\IS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

371900 372000 372100 372200 372300 372400

446300 446200 446100 446000 445900 445800

RW17
Upstream

RW17
Downstream

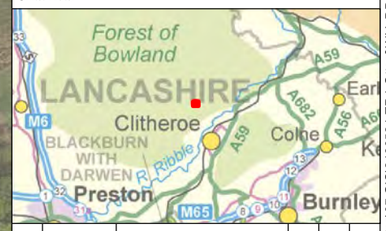
Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Potential Otter Couch
- Otter Spraint

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	22/04/2021	RW17	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter Survey Results
Marl Hill (TR4) - Watercourse RW17

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

373700 373800 373900 374000 374100 374200 374300

444000 443900 443800 443700 443600

W2321
Upstream

W2321
Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Potential Otter Holt
- Otter Spraint
- Otter Footprint

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W2321	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter Survey Results
Marl Hill (TR4) - Watercourse W2321

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

374000 374100 374200 374300 374400 374500 374600

443900 443800 443700 443600 443500

W2325 Upstream

W2325 Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Potential Otter Holt
- Potential Otter Couch
- Otter Spraint
- Otter Footprint

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W2325	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter Survey Results
Marl Hill (TR4) - Watercourse W2325

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

373300 373400 373500 373600 373700 373800

444000 443900 443800 443700 443600

W2349
Upstream

W2349
Downstream

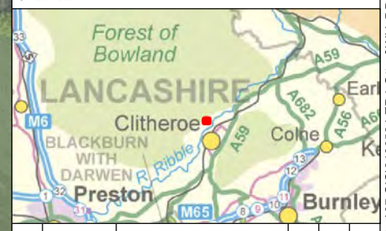
Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Otter Spraint
- Otter Footprint

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W2349	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter Survey Results
Marl Hill (TR4) - Watercourse W2349

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

373400 373500 373600 373700 373800 373900 374000

443900 443800 443700 443600 443500

W506
Upstream

W506
Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Otter Evidence

- Otter Spraint
- Otter Footprint

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W506	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Otter Survey Results
Marl Hill (TR4) - Watercourse W506

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\248000s\248500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

370900 371000 371100 371200 371300 371400 371500

444800 444700 444600 444500 444400 444300

W537
Upstream

W537
Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Potential Water Vole Evidence

- Burrow
- Feeding Signs

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W537	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Water Vole Survey Results
Marl Hill (TR4) - Watercourse W537

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

371400
371500
371600
445000
444900
W520
Upstream
W520
Downstream

Legend:
- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Potential Water Vole Evidence
- Burrow

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W520	RG	SP	BF

HARP Aquatics

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Water Vole Survey Results
Marl Hill (TR4) - Watercourse W520

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

371300 371400 371500 371600 371700 371800 371900

444500 444400 444300 444200 444100 444000

W520
Upstream

W520
Downstream

Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Potential Water Vole Evidence

- Burrow

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W520	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Water Vole Survey Results
Marl Hill (TR4) - Watercourse W520

0 40 80
Meters
SCALE: 1:2,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

371400 371500 371600 371700 371800 371900 372000 372100 372200 372300

445500 445400 445300 445200 445100 445000 444900 444800 444700

W557
Upstream

W557
Downstream

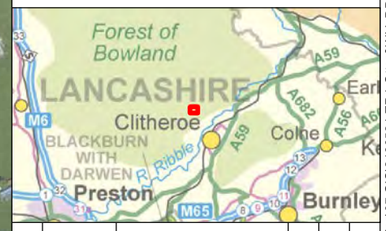
Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Potential Water Vole Evidence

- Burrow

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	22/04/2021	W557	RG	SP	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
No Otter or Water Vole Survey Results
Marl Hill (TR4) - Watercourse W557

0 50 100
Meters
SCALE: 1:3,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV_DDP.mxd

Appendix C: White clawed crayfish survey results

Haweswater Aqueduct Resilience Programme

White-Clawed Crayfish Survey Report – TR4 Marl Hill

Project No. 2480524

SEPTEMBER 2021

RSK biocensus
EXPERTS IN ECOLOGY

RSK GENERAL NOTES

Project No.: 2480524

Title: Haweswater Aqueduct Resilience Programme: White-Clawed Crayfish Surveys – TR4 Marl Hill

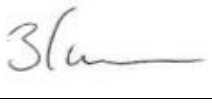
Client: Ricardo Energy and Environment

Date: September 2021

Office: Helsby

Status: REV00

Author	Ben Faulkner	**Technical and quality reviewer**	Matthew Davison
Signature		Signature	
Date:	21 September 2021	Date:	22 September 2021

Project manager	Ben Faulkner
Signature	
Date:	21 September 2021

CONTENTS

1 INTRODUCTION

1.1 Purpose of this report

RSK Biocensus (RSK) was commissioned by Ricardo Environment and Energy (Ricardo) to provide specialist aquatic ecological support in relation to the Haweswater Aqueduct Resilience Programme (HARP). White-clawed crayfish (*Austropotamobius pallipes*) surveys are required to inform a water framework directive (WFD) assessment, environmental impact assessment (EIA) and mitigation strategy for the scheme.

As part of the scheme, United Utilities propose to replace several sections of the existing single line aqueduct. The replacement sections are proposed to be delivered over five distinct sections. From north to south these sections are named as follows:

- Docker (TR1)
- Swarther (TR2)
- Bowland (TR3)
- Marl Hill (TR4)
- Haslingden to Walmersley (TR5/6)

Nine planning applications are required to cover all five sections. These will be accompanied by an environmental statement (ES) for each section and a habitat regulations assessment (HRA), as necessary, for each section.

This report details surveys undertaken on watercourses within the Marl Hill (TR4) section of the scheme.

1.2 Site information

Table 1 summarises the site information for each watercourse which was provided by Ricardo.

Table 1. Site information and survey requirements, TR4 Marl Hill

Name	Watercourse ID	Section	Date	Upstream Grid Ref	Downstream Grid Ref
Bonstone Brook	W498	T04	02/09/2021	369186 448740	369719 448561
Coplow Brook	W2349	T04	31/08/2021	373624 443620	373466 444014
Greg Sike	W2321	T04	31/08/2021	373964 443939	374095 443580
River Ribble	W2325	T04	31/08/2021	374488 443947	374020 443440
Unnamed watercourse 2097	W2348	T04	31/08/2021	374169 443996	374236 443779

2 METHOD

2.1 Survey timings

Surveys were undertaken by two experienced aquatic ecologists including a Natural England licenced (NE), white-clawed crayfish surveyor. At the time of the September surveys the weather was fair with ambient air temperature of *c.*22 degrees Celsius. In the week preceding the surveys no rainfall was recorded.

2.2 Crayfish surveys

The surveys followed the methodology within Survey and Monitoring Protocol for white-clawed crayfish (Peay, 2003)[1]. This comprised manual searching: carefully lifting suitable stones and debris on the channel bed which crayfish may use as refuge sites. Initially 100 refugia were searched within a 50 m stretch of riverbed. If five or more crayfish were observed (and captured) searching ceased. If fewer than five crayfish were observed, searching continued to 250 refugia.

Refuge searching took place in an upstream direction to avoid poor visibility caused by disturbing silt/sediment. All crayfish captured were identified to species level, sexed, checked for signs of disease or injury and their carapace length (mm) recorded. A record of the approximate size/age class of crayfish observed but not captured was also made. Photographs were taken to document crayfish evidence as well as habitat presence on site. Evidence of invasive crayfish species was also recorded.

2.3 Survey constraints

The recommended survey period for white-clawed crayfish is May-October inclusive with July to September considered to be the optimal months for surveying[1]. Survey timings were therefore considered optimal for white-clawed crayfish.

At the time of the survey turbidity was low at all of the surveyed watercourses providing good visibility for observation.

At the River Ribble (W2325) it was not possible to survey the full array of aquatic habitats present using manual searching due to water depths in excess of 0.5 m. An abundance of suitable crayfish habitat was however present within the reach, including in shallower marginal habitat where manual searching could safely be undertaken, therefore this is not considered to have impacted the results of the survey.

2.4 Biosecurity

All RSK ecologists have undertaken internal training on biosecurity practices, which are in accordance with those described by the Great Britain non-native species secretariat's (GB NNSS) check-clean-dry policy. Furthermore, they have all completed, as a minimum, modules 1 and 3 of the GB NNSS e-learning modules on biosecurity. In addition to

[1] Peay S (2003). Monitoring the White-Clawed Crayfish Austropotamobius pallipes. Conserving Natura 2000 Rivers Monitoring Series No. 1, English Nature, Peterborough.

adhering to this procedure, surveyors worked in an upstream to downstream direction in flowing watercourses to further minimise risks. All equipment was thoroughly checked, cleaned (and disinfected) and dried before it was used in a different watercourse.

3 RESULTS

Table 2 summarises the results of the surveys at each respective site.

Table 2. Crayfish survey results, TR4 Marl Hill

T04: W498 Bonstone Brook	
 	Upstream: 369186 448740 Downstream: 369719 448561 **No crayfish captured or observed. Suitable habitat present.** Suitable refuges were observed throughout the survey extent including boulders, undercut banks and coarse woody debris. During the surveys more than 250 refuges were searched but no crayfish were recorded at W498. Several otter spraints were also observed during the survey of which none contained remains of crayfish. Within the survey extent the width of the channel is *c.* 4 m and at the time of the survey the depth was *c.* 0.2 m. Instream habitats included run, riffle, cascade, pool and glide. Dominant substrate types included boulder, cobble, gravel and bedrock, The survey extent is bordered by grazed pasture and woodland.
T04: W2349 Coplow Brook	
	Upstream: 373624 443620 Downstream: 373466 444014 **No crayfish captured or observed. Habitat of moderate suitability at W2349.** Suitable refuges which could provide habitat for crayfish (e.g. boulders) were observed in low abundance. No crayfish were recorded during the surveys at W2349. Within the survey extent the width of the channel is *c.* 1.5 m and at the time of the survey the depth was *c.* 0.05 m. The survey extent is bordered on both banks by grazed pasture. Cattle have direct access to the channel at multiple locations within the survey extent and during the

	survey cattle faeces was observed in the channel at two locations. This is likely to reduce the sites suitability to support white-clawed crayfish which prefer to inhabit streams with good water quality.
T04: W2321 Greg Sike	
 	Upstream: 373964 443939 Downstream: 374095 443580 **No crayfish captured or observed. Habitat of moderate suitability at W2321.** Although suitable refuges were recorded (boulders and undercut banks) they were infrequent. More than 25 refuges were searched during the survey but no evidence of crayfish was found on W104. Food sources such as macroinvertebrates however were readily available providing suitable foraging for crayfish. Within the survey extent the width of the channel is *c.* 1.0 m and at the time of the survey the depth was *c.* 0.1 m. The survey extent is bordered on both banks by grazed pasture. A narrow strip of riparian vegetation comprising trees, bushes and low-lying herbaceous plants is however retained on both banks.
T04: W2325 River Ribble	
	Upstream: 374488 443947 Downstream: 374020 443440 **No crayfish captured or observed. Suitable habitat present at W2321.** Suitable refuges were observed, predominantly boulders but no crayfish were recorded at W498. Otter spraint also was observed during the survey, none of which contained crayfish remains.

<table>
<tr><td>  </td><td>It was not possible to survey certain sections of channel (using manual searching) as water depths frequently exceeded 0.5 m. As suitable refuges were also present in shallower marginal areas this is not considered to have impacted the survey.

Within the survey extent the channel is c. 30 m in width and the depth is c. 0.75 m. The channel substrate comprises a mixture of boulder, cobble, gravel and bedrock. Instream habitats included run, riffle, glide and pool.</td></tr>
<tr><td colspan="2">T04: W2348 Unnamed watercourse 2097</td></tr>
<tr><td>  </td><td>Upstream: 374169 443996
Downstream: 374236 443779

No crayfish captured or observed. Habitat unsuitable at W2348.

At the time of the survey W2348 was dry with no evidence of recent or sustained flow. The site is therefore considered unsuitable for white-clawed crayfish.</td></tr>
</table>

Appendix D: River Ribble Otter Surveys Update

Creating a world fit for the future

RICARDO

Haweswater Aqueduct Resilience Programme

River Ribble – Otter Survey Update

ED13654 | Issue number 2 | Date 20/01/2022

Customer:

United Utilities

Customer reference:

3500183975

Contact:

Anne Fairhead
Ricardo Energy & Environment
Bright Building, First Floor
Manchester Science Park
Manchester, M15 6GZ
United Kingdom

T: +44 (0) 1235 753 488

E: anne.fairhead@ricardo.com

Author:

Eve Loxham, Tom Priestley

Approved by:

Anne Fairhead

Date:

20 January 2022

Ref: ED13654

Ricardo is certified to ISO9001, ISO14001, ISO27001 and ISO45001

Table of Contents

1 Introduction

1.1 Purpose of this report

Ricardo was commissioned by United Utilities to undertake a walkover survey of the River Ribble in relation to the Haweswater Aqueduct Resilience Programme (HARP) Proposed Ribble Crossing. Consultation with the local authority following submission of the planning application for the Proposed Ribble Crossing identified the requirement for an update to the otter *Lutra lutra* survey undertaken at the River Ribble in February 2021 to inform the conclusions and recommendation identified in Chapter 9B of the Environmental Statement for the Proposed Ribble Crossing (Volume 6 Proposed Ribble Crossing Chapter 9B: Aquatic Ecology Document Ref.: LCC_RVBC-BO-RC-ES-009-02)

This report details a repeat otter survey undertaken on the River Ribble relating to the Proposed Ribble Crossing. The aim of the survey was to determine the presence and or status of otter holts/resting places or the presence/absence of potential resting places or suitable features in areas which would be subject to vegetation removal and or disturbance from the proposed scheme. The presence of otter activity in these areas of the River Ribble was identified by the previous surveys undertaken in February 2021.

1.2 Site information

The map in **Appendix 1** shows the location of the survey extent.. The watercourse details are shown in **Table 1.1** below.

Table 1.1: Watercourse information

Watercourse name	Watercourse ID	Survey area	NGR
River Ribble	W2325	Ribble crossing	SD 74383 43862

2 Methodology

2.1 Otter survey and habitat suitability assessment

The methodology for surveying otters broadly follows the guidance set out by Chanin (2003)[1] and includes an assessment of the (relative) suitability of the habitat for otters and a search for field signs indicating the presence, or possible presence.

Searches were undertaken for field signs as described by Chanin (2003). Surveys were carried out where possible during periods of low rainfall. The presence of Otter may be indicated by the following signs:

- Potential and actual holt locations
- Potential and actual couch locations
- Spraints (droppings)
- Footprints/ tracks
- Slides
- Evidence of feeding (fish carcasses)
- Direct observation of otter

Photographs were taken to document otter evidence as well as the habitats present on site.

2.2 Survey Meta data

The survey was undertaken on 20 December 2021 by experienced ecologists Tom Priestley and Eve Loxham. Weather conditions are detailed in **Table 2.1** below.

[1] Chanin P. (2003) *Monitoring the Otter, Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series 10.

Table 2.1: Surveys dates and weather conditions for the 2021 otter surveys

Watercourse	Cloud cover	Wind speed (Beaufort scale)	Temperature (°C)	Precipitation
River Ribble – Ribble crossing (W2325)	6/8	F2	4°C	No precipitation

2.3 Limitations

Surveyors were not able to access the north bank of the River Ribble at the Proposed Ribble Crossing; this is not considered to be a constraint as the aim of the survey was to update the finding of the previous otter survey and monitor the status of the potential otter holts identified during the initial otter survey conducted on the 1 February 2021[2] rather than identify if otter activity was present on the river. No potential otter holts were identified on the north bank and there is an absence of suitable features on this bank at or immediately adjacent to the crossing and lay down areas.

[2] Ricardo Energy and Environment (2021) Haweswater Aqueduct Resilience Programme Proposed Marl Hill Section, Volume 6, Proposed Ribble Crossing Protected Species Survey Report Technical Appendix 9B.2 Report reference: RVBC-MH-RC-TA-009-02-002.

3 Survey Results

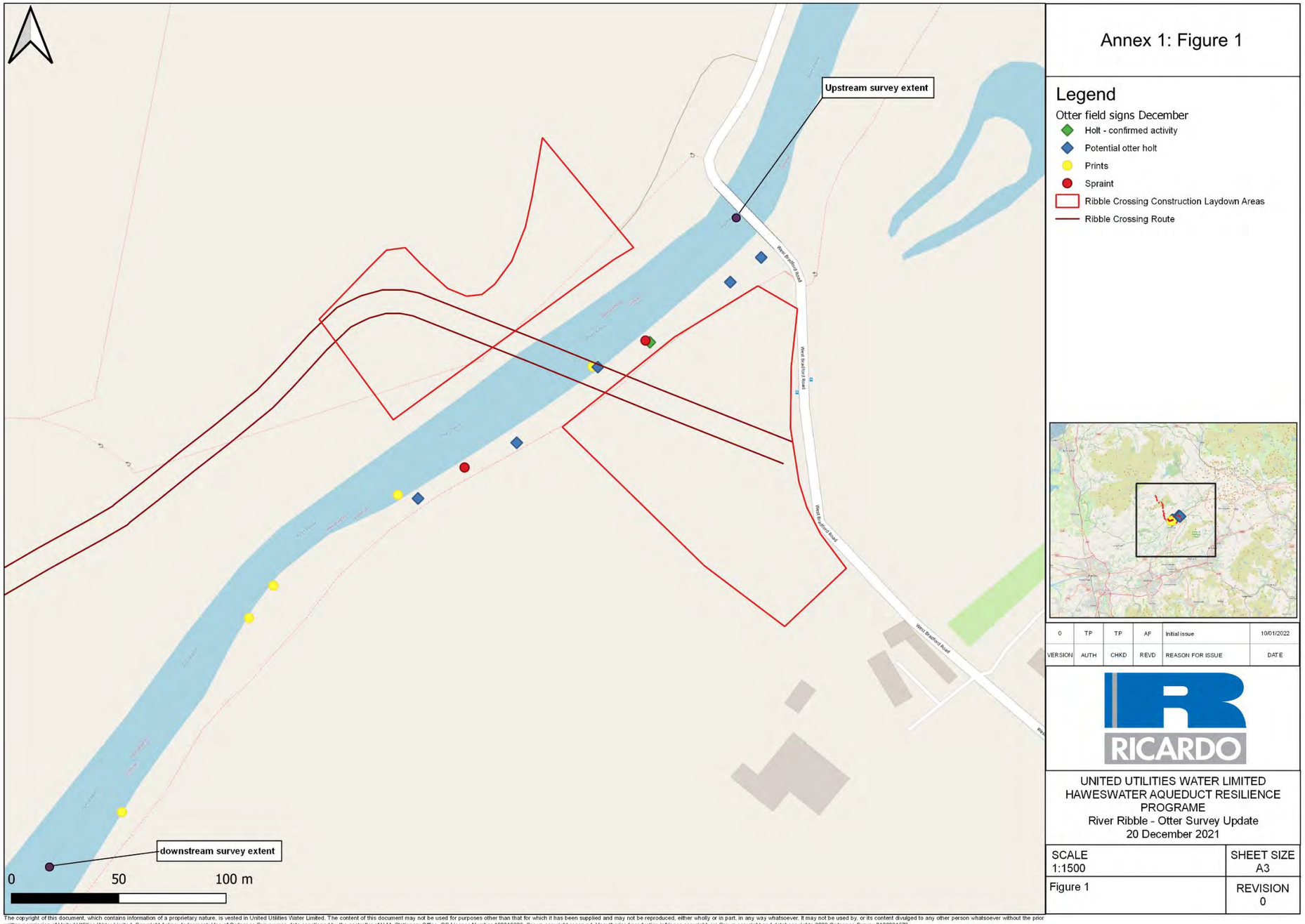
The results of the otter survey undertaken at the River Ribble on 20 December 2021 are presented in **Table 3.1** and Figure 1 in Annex 1. Site photographs are presented in Annex 2.

Table 3.1 Otter surveys results

Survey Site	Survey Results
River Ribble (W2325) – Proposed Ribble Crossing	Eastings and Northings: Upstream: X: 374488 Y: 443947 Downstream: X: 374020 Y: 443440 • **Evidence of otter identified including a holt, multiple prints, and spraints throughout the surveyed reach of the River Ribble.** The location of otter signs and hots and potential holts are shown on Figure 1 in Annex 1, photographs of the site are presented in Annex 2 Photos 1 to 7. As with the previous survey undertaken in February 2021[2] there were multiple potential (eight in total) holt locations under tree roots adjacent to the compound area and proposed bridge location including one with confirmed activity. The otter holt with evidence of activity was identified under the roots of two joined mature sycamore trees on the riverbank approximately 15 m north east of the proposed bridge location. The main cavity under the tree roots was approximately 2 m by 3 m. The was evidence of recent use by an otter including prints in the main cavity under the roots and a fresh spraint in entrance to main cavity. In addition to otter prints inside another smaller entrance (potentially to a separate cavity) on north-east side of trees. A suitable location for an otter resting place was identified under a large tree stump (diameter approximately 1.5 m) with exposed roots on the riverbank at the proposed crossing point. No evidence of otter activity was identified within the spaces under the tree stump and a hole in stump limited the amount of cover provided above. However, prints were present on riverbank with 2-5 m of the tree stump. Evidence of otter activity was recorded regularly along the surveyed reach of the River Ribble (500m downstream form the existing West Bradford road bridge) including prints and another spraint under the undercut bank approximately 70 m downstream of the proposed Ribble Crossing.

Annex 1: Survey map

Figure 1 River Ribble – Proposed Ribble Crossing otter survey results 20 December 2021



Annex 1: Figure 1

Legend

Otter field signs December

- Holt - confirmed activity
- Potential otter holt
- Prints
- Spraint
- Ribble Crossing Construction Laydown Areas
- Ribble Crossing Route

VERSION	AUTH	CHKD	REVD	REASON FOR ISSUE	DATE
0	TP	TP	AF	Initial issue	10/01/2022

RICARDO

UNITED UTILITIES WATER LIMITED
HAWESWATER AQUEDUCT RESILIENCE PROGRAME
River Ribble - Otter Survey Update
20 December 2021

SCALE	SHEET SIZE
1:1500	A3
Figure 1	REVISION 0

Annex 2: Site Photographs

Description	Photograph
Photo 1. River Ribble (Ribble crossing) at upstream survey extent	
Photo 2. Joined sycamore (*Acer pseudoplatanus*) trees with confirmed otter holt in cavities below roots immediately upstream of Ribble crossing location.	

Photo 3. Ribble crossing – otter holt - spraint and print in entrance to cavity under tree.	
Photo 4. Potential holt location under tree stump at crossing location	

Photo 5. Otter prints in sand on south bank of the River Ribble at the Crossing location	
Photo 6. Undercut banks and exposed tree roots with otter spraint downstream of proposed crossing location	

Photo 7. River Ribble (Ribble crossing) view upstream from downstream survey extent	

T: +44 (0) 1235 753000

E: enquiry@ricardo.com

W: ee.ricardo.com