

Appendix B5: Ecology Assessment – Marl Hill

Document reference: RVBC-MH_SEI-Appendix B5



**Haweswater Aqueduct Resilience Programme -
Proposed Marl Hill Section**

Supplementary Environmental Information

Appendix B5: Ecology Assessment - Marl Hill

January 2022



Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

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Contents

1.	Ecology Assessment of Marl Hill SEI	1
1.1	Introduction	1
1.2	Confirmed Construction Traffic Access.....	1
1.3	Braddup Compound Access Changes.....	1
1.4	Bonstone and Braddup Compounds Additional Avoidance of Tree Loss.....	3
1.5	Review of Additional Data	4

1. Ecology Assessment of Marl Hill 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 B5 Ecology Marl Hill 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 B6, Ecology Ribble Crossing
 - 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 B5 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 B5 relates to and should be read in conjunction with ES Volume 4 Proposed Marl Hill Section (Chapter 9A and 9B and supporting figures and appendices cover the terrestrial and aquatic ecology assessments). This SEI technical appendix B5 specifically relates to:
 - Review of confirmed construction traffic access proposals
 - Review of environmental data not available at submission of the ES in June 2021
 - Minor alterations to the access track serving the Braddup Compound
 - Additional avoidance of tree loss at the Bonstone and Braddup Compounds.

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 Braddup Compound Access Changes

- 6) Minor alterations have been made to the proposed access track serving the core construction area at the Braddup Compound, resulting in five amendments to the planning application boundary at its point along the northern edge of the access track towards the main construction compound.
- 7) Following submission of the June 2021 planning application, it was decided to install a total of five temporary bridge structures (commonly referred to as 'Bailey bridges') across the culverts along the proposed access track. These are shown at Illustration 3 within the main SEI report. At two out of five of these locations, it has been necessary to extend the planning application boundary by a short distance

(less than 10 m to the north and south) to provide additional working room to install temporary bridge structures. The purpose of the proposed temporary bridging structures is twofold:

- To span a series of existing culverts through which field drains currently flow in a north-south direction below the existing road. The culverts are located below the existing road and could be damaged by heavy vehicle movements during the course of the construction programme
- To protect the root zones of Grade A trees situated adjacent to the track.

- 8) The following ecology plans have been updated to illustrate the updated planning boundary and are included in this SEI:
- B5 Annex 1: Marl Hill – Phase 1 Habitat Plan with Updated Red Line Boundary
 - B5 Annex 2: Marl Hill – Bat Roost Potential Trees Plan with Updated Red Line Boundary.
- 9) The changed red line planning boundary does not include any habitats not previously assessed in the June 2021 ES and by habitat condition or extent does not change the value assigned to any habitats. The updated redline boundary is alongside small areas of semi-natural broadleaved woodland and mixed plantation woodland but the Arboricultural Impact Assessment confirms no impacts to these habitats. In some areas the redline boundary has moved by approximately 5 m and encompasses more areas of species-poor semi-improved grassland and tall ruderal herb. Even assuming a worst-case scenario of total loss of these additional habitat areas there is no change to the predicted significance of effect for these habitats or any associated species and no new mitigation is required.
- 10) The arboricultural review of the changes to the access road confirm they would result in no new or additional adverse arboricultural effects when compared to the likely significant effects identified in the June 2021 Environmental Statement. Furthermore, the proposed changes give rise to positive embedded mitigation outcomes: veteran trees previously reported as being at risk of removal are no longer affected, and the proposed temporary bridges span over the root zones of Grade A trees on the proposed access track. The ecology implications of this are outlined in the following section (section 1.4) alongside other changes to tree impacts at Marl Hill.
- 11) The water environment review of the changes to the access road concluded the change to using bridge spans on short sections of the Braddup Compound access track would have a beneficial impact on fluvial geomorphology and water quality when compared with the conclusions drawn in the June 2021 Environmental Statement, as there would no longer be any in-channel working proposed. Similarly, the effects on aquatic ecology features would also reduce at these locations and therefore no change to the June 2021 significance of effects on aquatic ecology is predicted and no additional mitigation measures are required.
- 12) The water environment review of the changes to the access road also outlined that the proposed 'Bailey' type bridges along the Braddup Compound access track may require excavations of up to 2 m for the bridge foundations but these are proposed to take place within areas classified as having a low groundwater dependency, or areas not considered to be groundwater dependent and dewatering impacts are scoped out. However, Appendix B3 of the SEI assesses the potential impacts on groundwater levels and flows sustaining Groundwater Dependent Terrestrial Ecosystems (GWDTEs) that could arise during the construction of the proposed off-site highways works. Two sites Slaidburn Road West and Whinny Lane East are predicted to experience significant potential effects due to the construction of bailey bridges along the Braddup Compound access track. Impacts to groundwater flows and quality would be significant due to the direct nature of the works footprint within the GWDTE boundaries, however, these impacts would be very localised in nature. The relevant habitats within the GWDTE site are limited to small areas of marshy grassland which is common and widespread in the wider area. The predicted changes to groundwater conditions are localised and will not have an ecologically significant impact on marshy grassland habitat.
- 13) Taking into account the changes to the planning boundary and the design of the watercourse crossings (and with due consideration to the arboricultural and water assessments), the avoidance of previously at-risk trees and avoidance of in-channel works are positive outcomes for ecology features. No changes

to the significance effects on ecology features identified in the June 2021 ES are likely to arise as a result of the changes to the Braddup Compound access route.

1.4 Bonstone and Braddup Compounds Additional Avoidance of Tree Loss

- 14) Following submission of the June 2021 Environmental Statement further work has been undertaken to minimise the impacts on arboricultural features within the Bonstone and Braddup Compound through embedded mitigation, this has reduced the number of trees adversely affected when compared with the June 2021 Environmental Statement. The update to the Preliminary Trees at Risk Plan is included in the SEI submission (RVBC-MH-FIG-006-006) and a summary of the changes is provided in Tables 3, 4, 5 and 6 of the main SEI report. Notably these confirm that:
- One tree feature in the Bonstone Compound (T144 veteran) has been changed from *removal / partial removal* to *retained with protection measures*
 - Two tree features in the Bonstone Compound (T153 and G157) have been changed from *at risk of removal aiming to retain* to *retain with protection measures*
 - Two veteran trees in the Braddup Compound (T190 and T187) have been changed from *removal/partial removal* to *retain with protection measures*
 - Twenty-two tree features in the Braddup Compound have been changed from being *at risk of removal aiming to retain* to *retain with protection measures*; these are T193, G188, G191, G190, G184, T186, G170, G181, G177, G178, T183, T182, T180, G174, W171, T176, T177, T178, H167 and T165 including two veterans, T185 and T184.
- 15) The following table confirms whether these changes to tree impacts result in any changes to the conclusions of the June 2021 ES.

Table 1: Review of June 2021 ES Enabling Works Assessment of Effects

Feature	June 2021 Significance of Effect Pre-Mitigation	June 2021 Significance of Effect Post-Mitigation	January 2022 Assessment
Semi-natural broadleaved woodland	Significant Adverse Less than local	Not significant	None of the changes affect this habitat type. No change to the June 2021 assessment.
Scattered broadleaved trees (veteran)	Significant Adverse Local	Significant Adverse Local	A reasonable worst-case scenario previously assumed loss of up to six veteran trees. All of these veteran trees are now confirmed as retained with protection measures. This improvement changes the residual significance of effects on veteran trees to Not Significant.
Scattered broadleaved trees (non-veteran)	Significant Adverse Local	Not significant	1 no. Tree and 1 no. tree group (T175 and G179) has moved from Amber (at risk) to Red (removed) however, the reasonable worst-case scenario already assumed Amber trees were lost. Conversely more than 20 no. trees or tree groups are now being retained. This is an improvement on the previous proposals but does not change the significance stated in the June 2021 assessment.
Bats: roosts	Significant Adverse Less than local	Not significant	A reasonable worst-case scenario previously assumed loss of nine trees or groups of trees with high, moderate or low bat roost suitability. This is

Feature	June 2021 Significance of Effect Pre-Mitigation	June 2021 Significance of Effect Post-Mitigation	January 2022 Assessment
			<p>now reduced to four trees and none of these have high suitability and only one has moderate suitability.</p> <p>This is an improvement on the previous proposals but does not change the significance stated in the June 2021 assessment.</p>
Bats: flyways and foraging	Not significant	N/A	<p>1 no. Tree, 1 no. tree group and 1 no. Hedge (T175 G179 and H172) have moved from Amber (at risk) to Red (removed), however, the reasonable worst-case scenario already assumed Amber trees were lost. Conversely more than 20 no. trees or tree groups are now being retained.</p> <p>This is an improvement on the previous proposals but does not change the significance stated in the June 2021 assessment.</p>

- 16) Table 1 confirms no change to the June 2021 assessment with the exception of veteran trees which the effect is reduced to Not Significant.

1.5 Review of Additional Data

Aquatic Ecology Surveys

- 17) A number of aquatic ecology surveys were undertaken in September 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 results of the surveys and a review against the June 2021 assessment (Chapter 9B Aquatic Ecology) are provided within the following report:
- B5 Annex 3: Marl Hill – Post Submission Aquatic Ecology Surveys
- 18) The additional fieldwork comprised aquatic habitat walkover survey, white clawed crayfish survey and otter survey and were undertaken at Coplow Brook (W2349) and are associated with proposed works at the Bonstone Compound. The findings of these surveys are summarised as follows:
- The habitats in the watercourse were typically slow flowing with the majority of the reach having no perceptible flow or glides with depth ranging from 0.05 m to 0.4 m. The substrate was coarse typically comprising boulders, cobbles, and gravel
 - One potential obstacle to fish passage was identified in the surveyed reach limiting the suitability for migratory fish
 - No macrophyte beds or in channel vegetation were recorded
 - The watercourse has potential to support white-clawed crayfish but suitable refuges which could provide habitat for crayfish (e.g. boulders) were observed in low abundance and no evidence of white-clawed crayfish was identified during the stone turning survey
 - Evidence of otter was recorded in the form of spraints and footprints. No holts or couches identified, limited suitable resting locations.
- 19) These results do not alter the conclusions of the June 2021 ES. The valuation, significance of effects and the mitigation requirements identified in Environmental Statement Chapter 9B remain valid.

GWDTE Assessment

- 20) Since the June 2021 submission the water specialists have completed the Ground Water Dependant Terrestrial Ecosystem (GWDTE) Assessment of the decommissioned asset. A provisional assessment of likely impacts ecology impacts on GWDTE was made in the June 2021 submission pending review of the technical assessment. The GWDTE report is provided in SEI appendix B3 and additional commentary provided within the main SEI report. The ecology review and assessment of this data is provided in the following paragraphs.

- 21) The Marl Hill Section comprises two sections of the existing Haweswater Aqueduct where decommissioning could likely impact surface receptors. These are located at the northern end of the Marl Hill section (where the aqueduct is between approximately 7 m and 17 m deep), and in the centre/south, leading into the Braddup Compound (where the aqueduct is between approximately 3 m and 60 m deep). As described in the ES (Chapter 7: Water Environment), these are expected to result in a localised drawdowns in groundwater levels of up to around 4.5 m along the northern conduit) and between 4.5 m and 3 m along the southern tunnel section.
- 22) The assessment identified four GWDTE sites that could be impacted by dewatering effects but concluded that minor dewatering impacts not considered to be of significance to the GWDTEs would be expected in the vast majority of cases. However geological uncertainties remain in vicinity of Braddup Moss Wood GWDTE site, and potential impacts of moderate magnitude cannot be ruled out. Unless additional site investigations were to be undertaken and demonstrate the presence of low and reasonably thick permeability layers such as mudstone between the existing aqueduct and the surface, (which was able to attenuate below ground groundwater drawdown effects), additional mitigation measures would need to be considered.
- 23) In line with Chapter 7: Water Environment and decommissioning mitigation measures identified for watercourses potentially impacted by long-term dewatering, a groundwater Monitoring Strategy should be developed for Braddup Moss Wood in consultation with the Environment Agency. The Monitoring Strategy would determine the nature and duration of monitoring at each location. The Monitoring Strategy would also identify, should any detrimental effects be detected, what additional measure could be taken to reduce these impacts.
- 24) Assuming a monitoring strategy (including identification of additional measures to reduce effects if they arise) is conditioned, significant residual ecology effects are unlikely. These results do not alter the conclusions of the June 2021 ES Chapter 9A.

Biodiversity Net Gain

- 25) The June 2021 BNG reports have been updated (January 2022) and take account of the revised red line boundary. The Marl Hill BNG On-Site Habitat Compensation revised report (RVBC-MH-APP-008_01 Rev 2) confirms baseline conditions pre and post development and the Marl Hill BNG Off-Site Habitat Compensation revised report (RVBC-MH-APP-008_02 Rev 2) confirms how 10% gain will be delivered.

HRA and SSSI Assessments

- 26) The June 2021 Marl Hill HRA assessment and SSSI assessment have both been reviewed in light of the changes to design and additional information provided. Addendums to these documents have been produced and submitted with SEI that confirm no changes to the conclusions of those June 2021 assessments.



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Proposed Marl Hill Section
Supplementary Environmental Information**

Appendix B5: Annex 1

Marl Hill – Phase 1 Habitat Survey Plan (updated red line boundary)

January 2022



Water for the North West

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

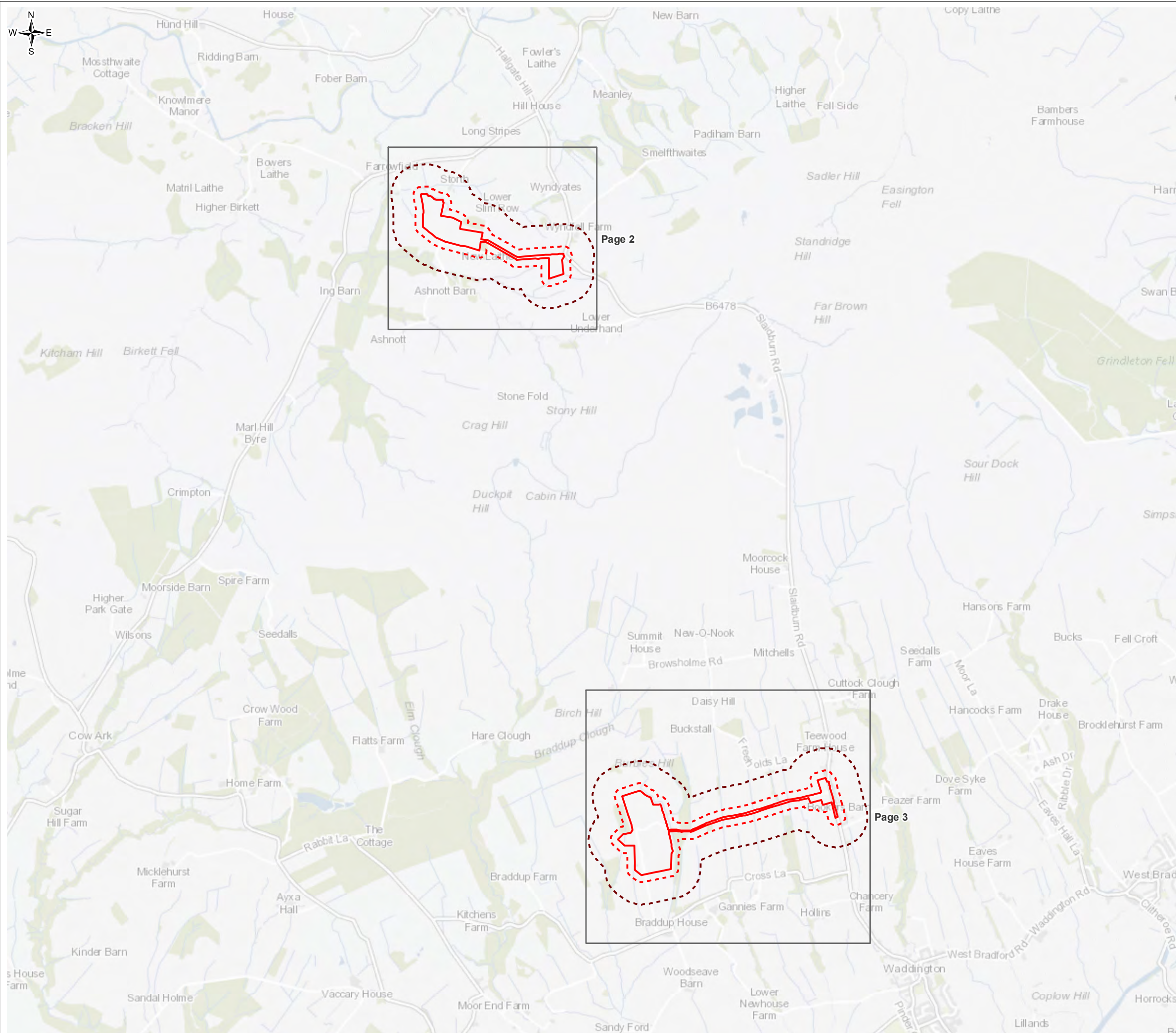
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FIGURE 9A.5A



- Legend**
- Compound location
 - Compound location - 50m buffer
 - Compound location - 200m buffer
 - Page and page number



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 PHASE 1 HABITAT SURVEY
 MARL HILL SECTION
 PAGE 1 of 3

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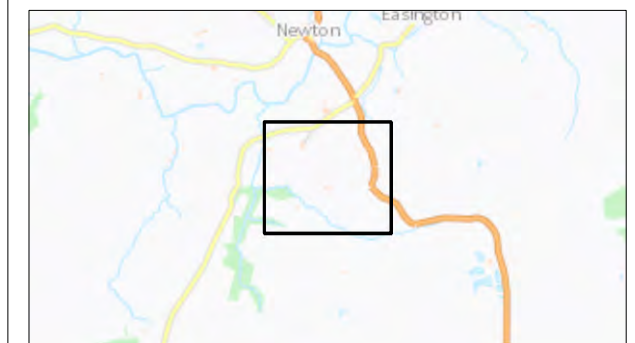
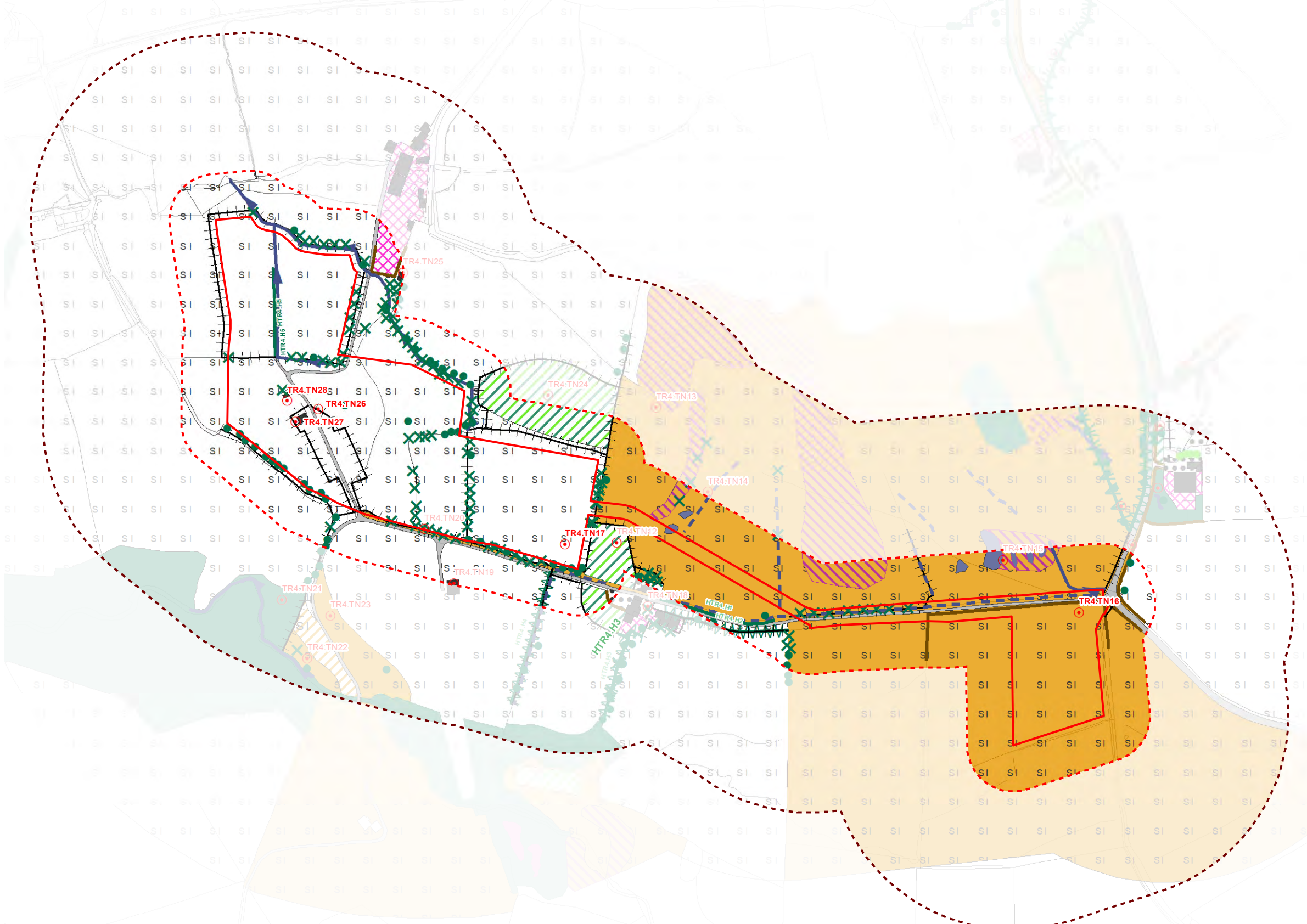
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FIGURE 9A.5A



Legend

- Compound location
- Compound location - 50m buffer
- Compound location - 200m buffer
- Target note
- X Scattered scrub
- Scattered broad-leaved tree
- Scattered coniferous tree
- ▶ Running water
- ~ Native species-rich intact hedge
- Species-poor intact hedge
- Species-poor intact hedge and dry ditch
- - Species-poor defunct hedge
- ~ Native species-rich hedge and trees
- + Fence
- Wall
- Dry ditch
- Semi-natural broad-leaved woodland
- Plantation broad-leaved woodland
- Plantation coniferous woodland
- Semi-natural mixed woodland
- Plantation mixed woodland
- Semi-improved acid grassland
- Semi-improved neutral grassland
- Marsh/marshy grassland
- Poor semi-improved grassland
- Acid/neutral flush
- Standing water
- Building
- Private garden
- Bare ground
- Hardstanding
- Not surveyed



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 PHASE 1 HABITAT SURVEY
 MARL HILL SECTION
 PAGE 2 of 3

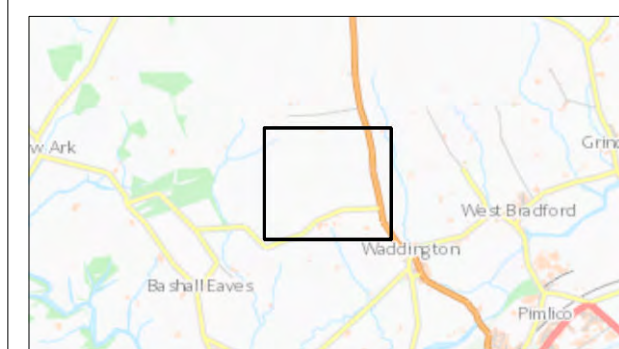
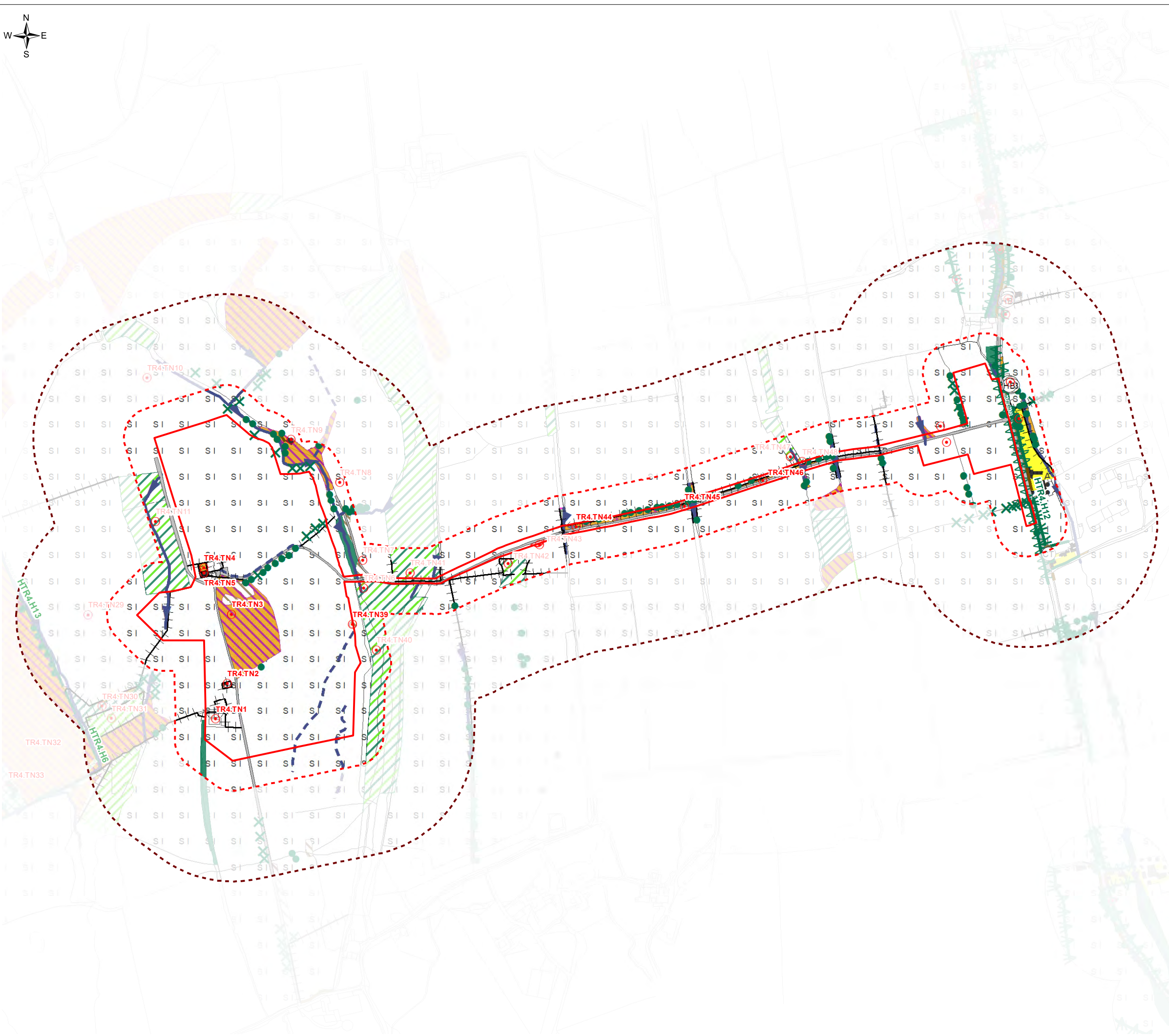
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FIGURE 9A.5A

- Legend**
- Compound location
 - Compound location - 50m buffer
 - Compound location - 200m buffer
 - Target note
 - CT Cotoneaster
 - HB Himalayan balsam
 - X Scattered scrub
 - Scattered broad-leaved tree
 - Scattered coniferous tree
 - Scattered introduced shrub
 - ▶ Running water
 - ~ Native species-rich intact hedge
 - Species-poor intact hedge
 - - - Species-poor defunct hedge
 - ~ Native species-rich hedge and trees
 - + + + Fence
 - Wall
 - Dry ditch
 - Semi-natural broad-leaved woodland
 - ▨ Plantation broad-leaved woodland
 - ▨ Plantation coniferous woodland
 - ▨ Plantation mixed woodland
 - ▨ Dense/continuous scrub
 - ▨ Coniferous recently-felled woodland
 - ▨ Semi-improved neutral grassland
 - Improved grassland
 - Marsh/marshy grassland
 - Poor semi-improved grassland
 - Tall ruderal
 - Dry modified bog
 - Standing water
 - Spoil
 - Amenity grassland
 - Building
 - Private garden
 - Bare ground
 - Hardstanding



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 PHASE 1 HABITAT SURVEY
 MARL HILL SECTION
 PAGE 3 of 3

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

Appendix B5: Annex 2

**Marl Hill – Trees with Bat Roost Potential Plan (updated red line
boundary)**

January 2022



Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

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FIGURE 9A.9A

Legend

- Compound location
- Compound location - 50m buffer
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 TREES WITH BAT ROOST SUITABILITY
 MARL HILL SECTION
 PAGE 1 of 5

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FIGURE 9A.9A



- Legend**
- Compound location
 - Compound location - 50m buffer
- Single Bat Tree Suitability**
- Low roost suitability
 - Medium roost suitability
 - High roost suitability
- Group Bat Tree Suitability**
- ◇ Medium roost suitability



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 TREES WITH BAT ROOST SUITABILITY
 MARL HILL SECTION
 PAGE 2 of 5

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FIGURE 9A.9A



Legend

- Compound location
- Compound location - 50m buffer



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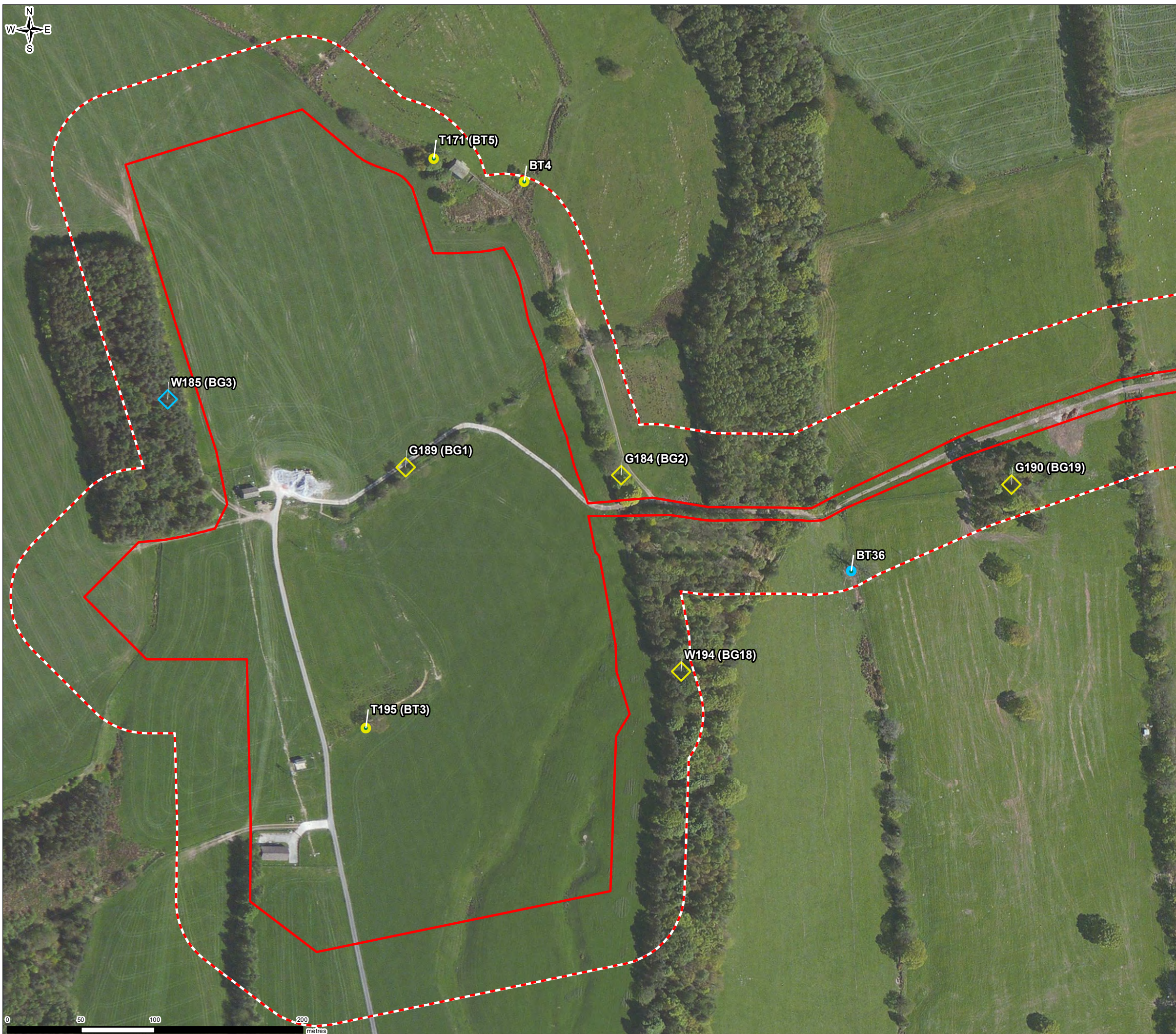


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 TREES WITH BAT ROOST SUITABILITY
 MARL HILL SECTION
 PAGE 3 of 5

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FIGURE 9A.9A



- Legend**
- Compound location
 - Compound location - 50m buffer
- Single Bat Tree Suitability**
- Low roost suitability
 - Medium roost suitability
- Group Bat Tree Suitability**
- ◇ Low roost suitability
 - ◇ Medium roost suitability



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 TREES WITH BAT ROOST SUITABILITY
 MARL HILL SECTION
 PAGE 4 of 5

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FIGURE 9A.9A

Legend

- Compound location
- Compound location - 50m buffer
- Single Bat Tree Suitability**
- Low roost suitability
- Medium roost suitability
- Group Bat Tree Suitability**
- ◇ High roost suitability



VERSION	AUTH	CHKD	REVD	REASON FOR ISSUE	DATE
A	MK	CW	LS	Updates to the southern red line boundary.	13/12/2021



UNITED UTILITIES WATER LIMITED
 HAWESWATER AQUEDUCT RESILIENCE PROGRAMME
 TREES WITH BAT ROOST SUITABILITY
 MARL HILL SECTION
 PAGE 5 of 5

SCALE 1:2,500	SHEET SIZE A3
DRAWING NUMBER RVBC-MH-FIG-009-01-09	REVISION 0

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

Appendix B5: Annex 3

Marl Hill – Post Submission Aquatic Ecology Surveys

January 2022



Proposed Marl Hill Section

Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Project No: B27070CT
Document Title: Proposed Marl Hill Section
Supplementary Environmental Information (SEI)
Appendix B5 Annex 3: Marl Hill – 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

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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 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) and **Appendix C** (White clawed crayfish Surveys).

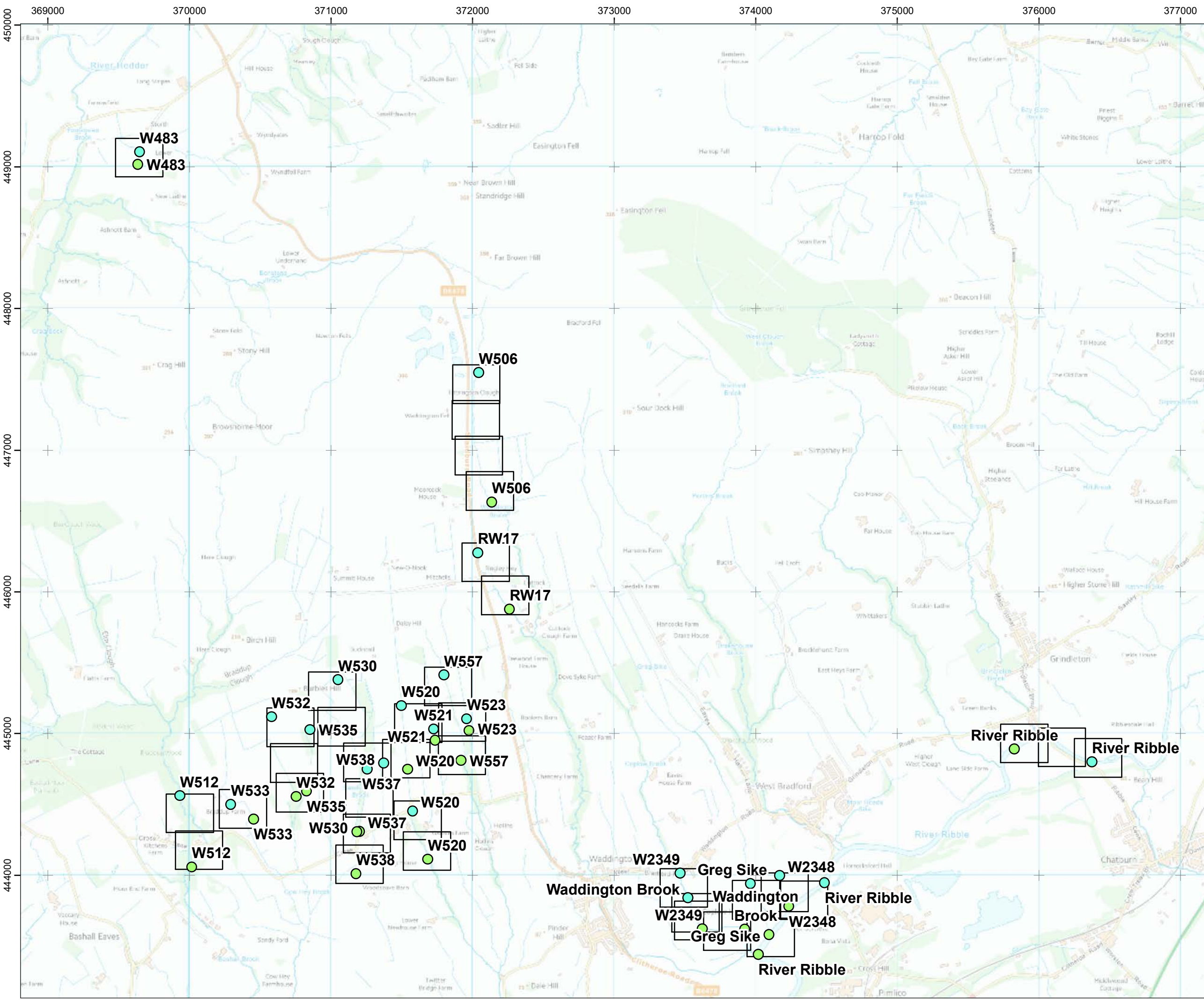
The following table presents a review by Ricardo Energy and Environment of the potential implications on the conclusions within Chapter 9B Aquatic Ecology of the Haweswater Aqueduct Resilience Programme – Proposed Marl Hill Section Environmental Statement , which was submitted in June 2021.

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
Coplow Brook (W2349)	Bonstone Compound	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 habitats in the watercourse were typically slow flowing with the majority of the reach having no perceptible flow or glides with depth ranging from 0.05 m to 0.4 m. The substrate was coarse typically comprising boulders, cobbles, and gravel. One potential obstacle to fish passage was identified in the surveyed reach limiting the suitability for migratory fish. No macrophyte beds or in-channel vegetation were recorded. 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 in low abundance. Evidence of otter was recorded in the form of spraints and footprints. No holts or couches identified, limited suitable resting locations.	None

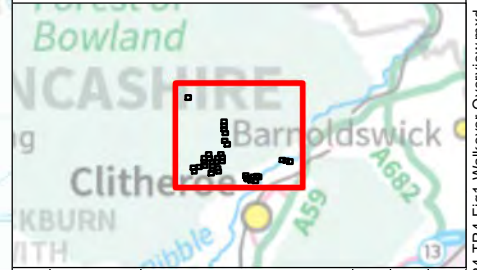
Watercourse	Relevant Scheme Component	Environmental Statement Baseline (Importance of Aquatic Receptors)	Additional Surveys Completed	Summary of Findings	Implications for Assessment
				The survey findings have not led to any changes to the assigned importance of aquatic receptors within the watercourse.	

Appendix A : Watercourse walkover survey results



- Legend:**
- Start Point
 - End Point
 - TR4 Map Views

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



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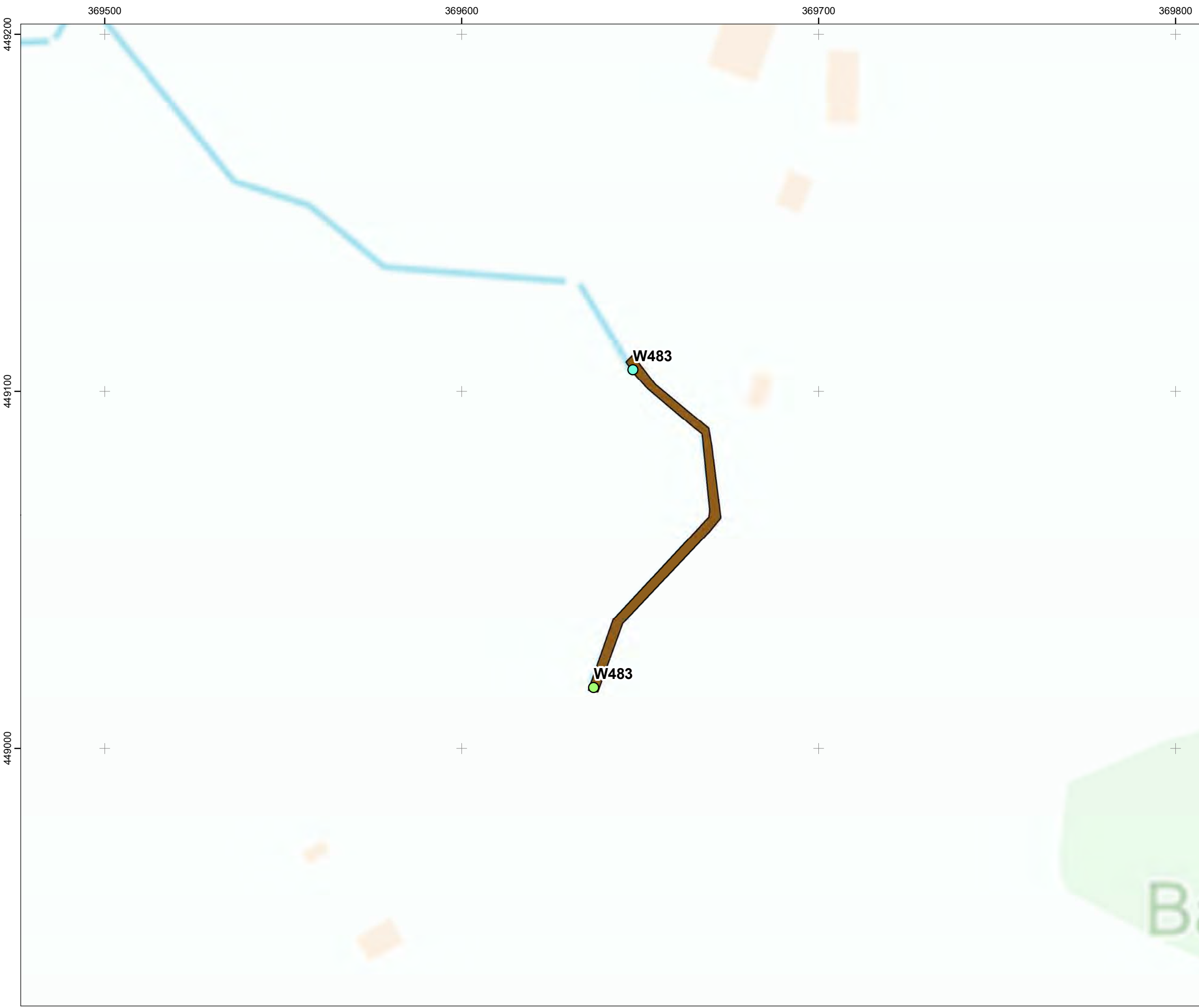
HARP Aquatics

EXPERTS IN ECOLOGY

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 Marl Hill TR4
 Walkover Survey Overview

Meters
SCALE: 1:25,000 @ A3

REV 00



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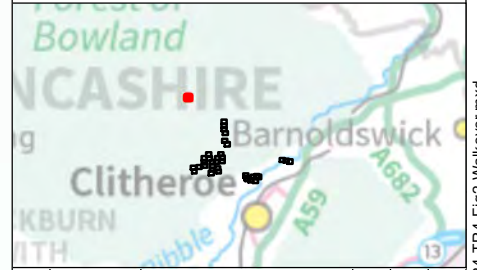
Walkover extents

- 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



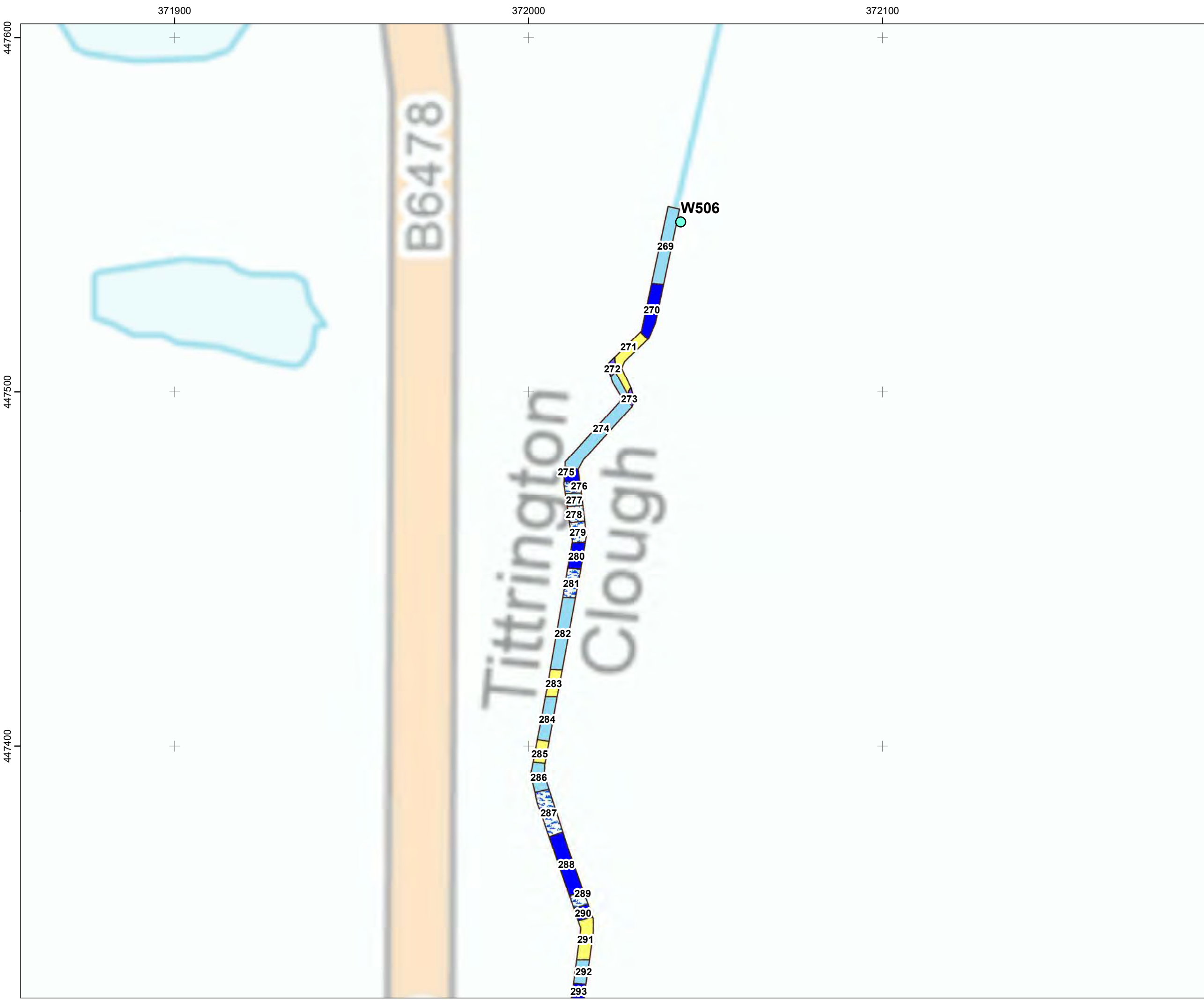
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TITLE: Figure 2:
 Marl Hill TR4
 Walkover Survey
 Map 1 of 37

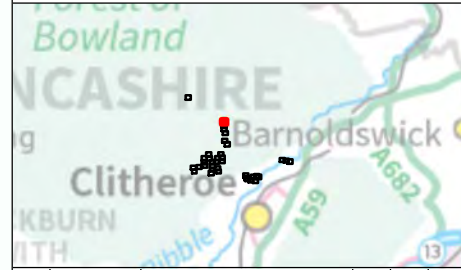
0 20 40
 Meters
 SCALE: 1:1,000 @ A3

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- 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



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

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

REV 00

371900

372000

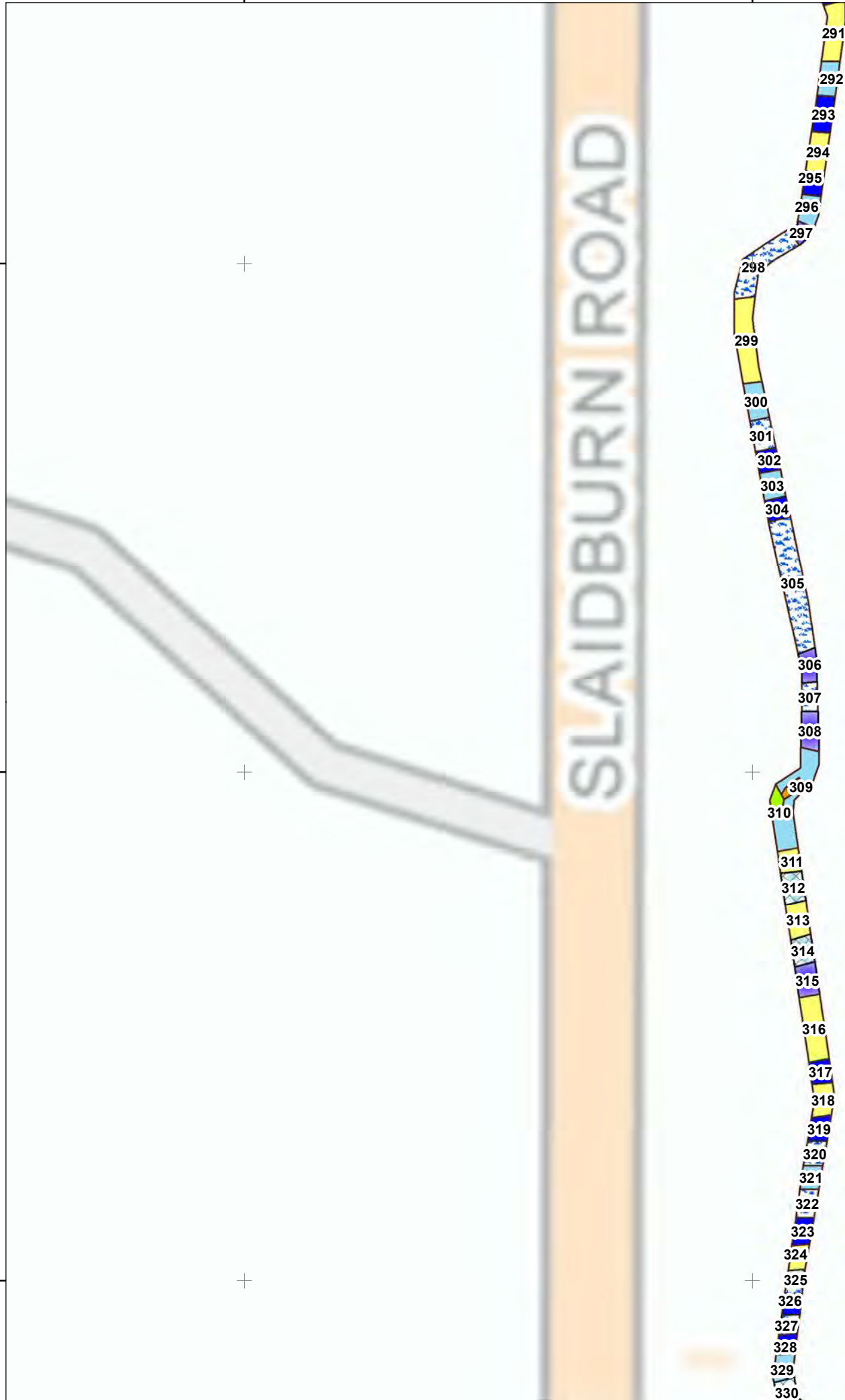
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447100

SLAIDBURN ROAD



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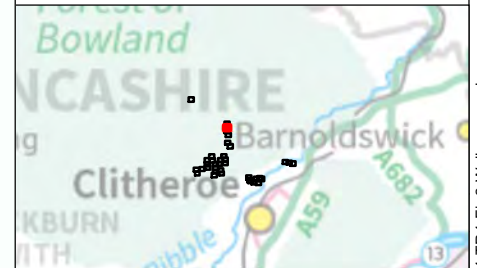
Walkover extents

- 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

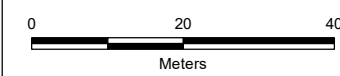


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HARP Aquatics



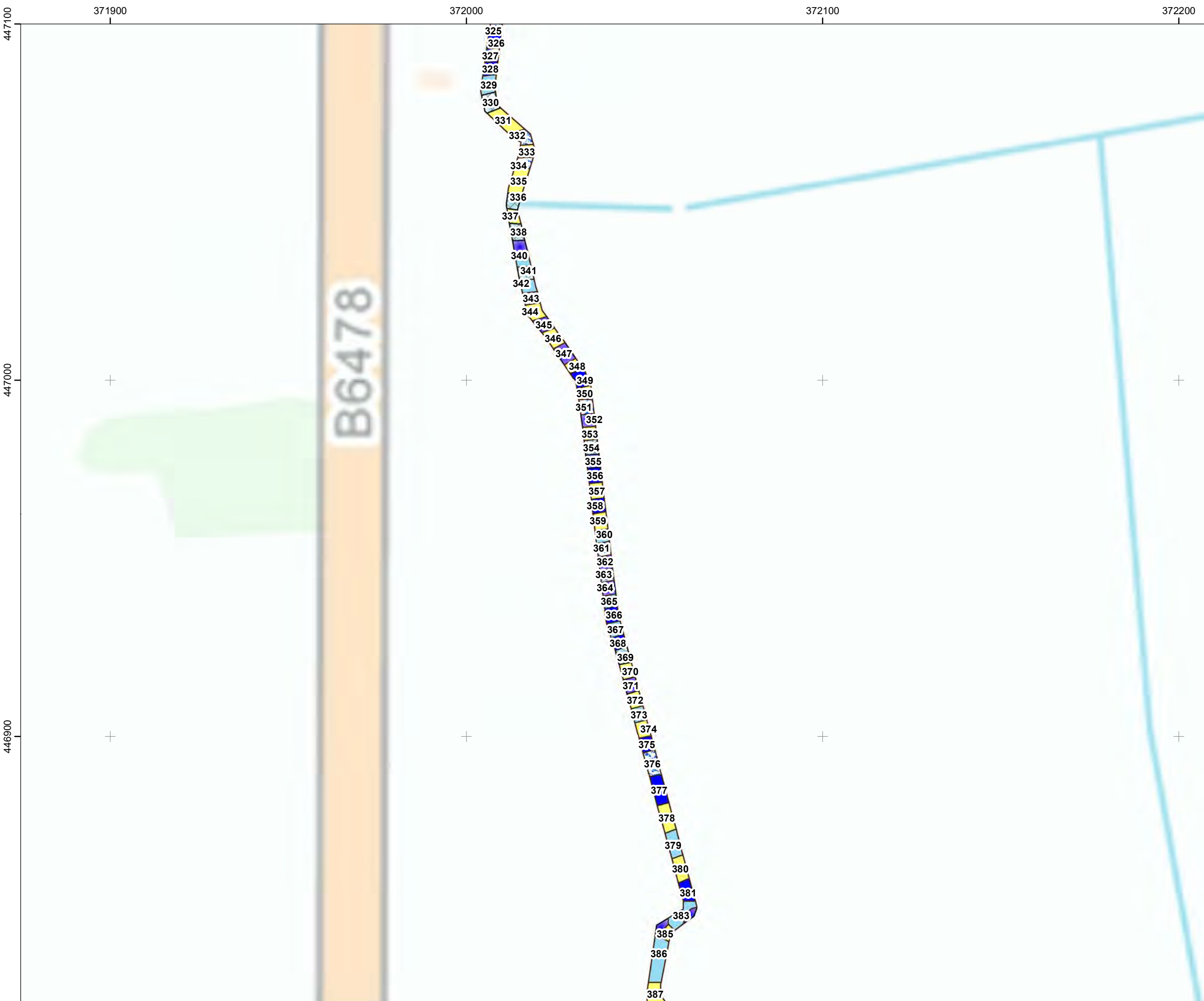
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 Marl Hill TR4
 Walkover Survey
 Map 3 of 37



SCALE: 1:1,000 @ A3



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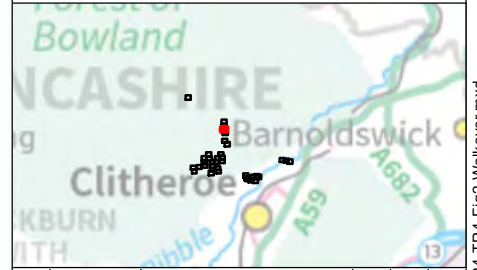
Walkover extents

- 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



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

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 SCALE: 1:1,000 @ A3

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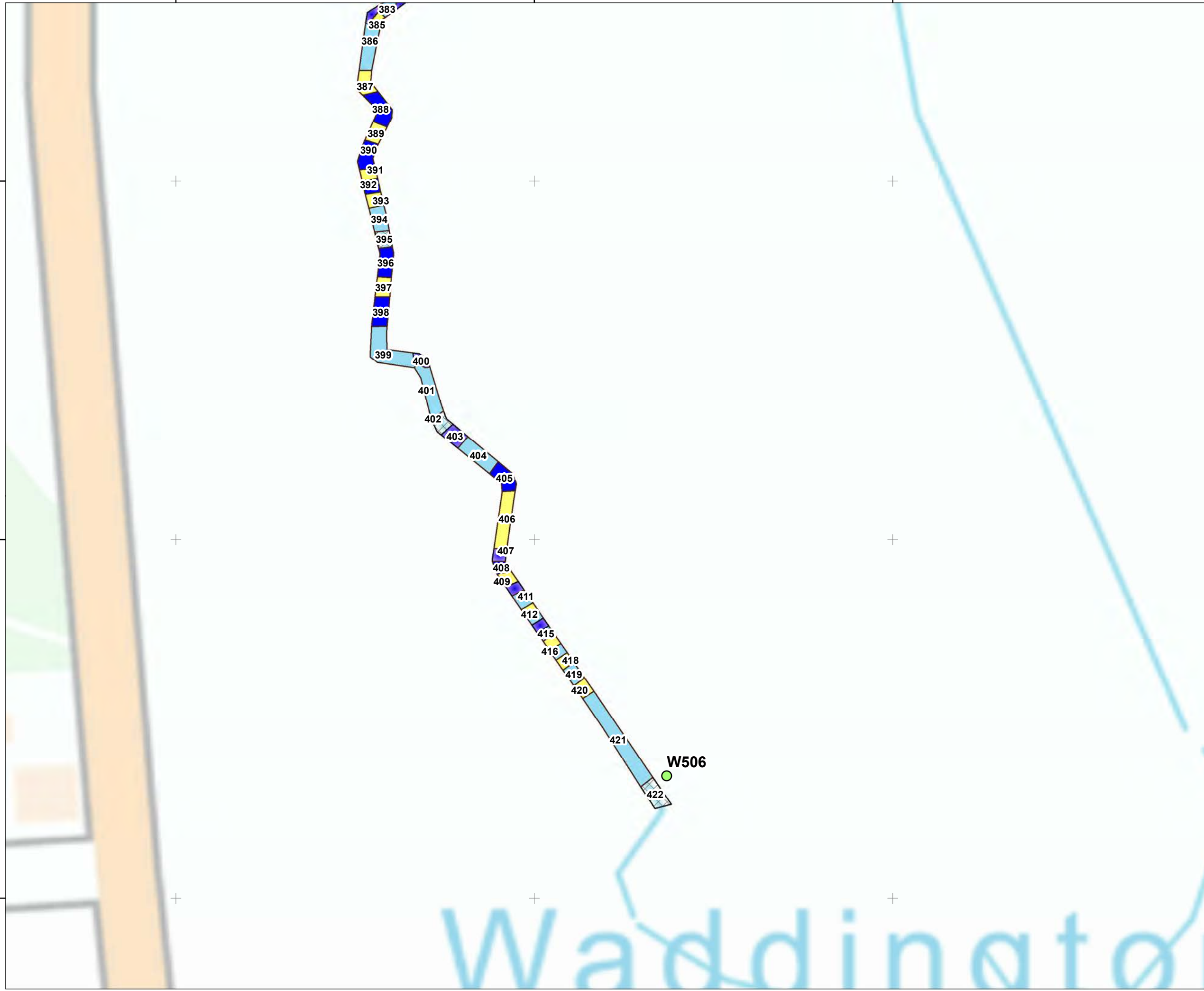
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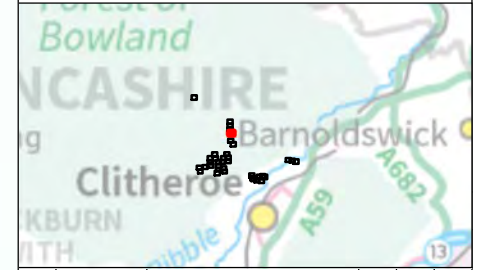
Walkover extents

- 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



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

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

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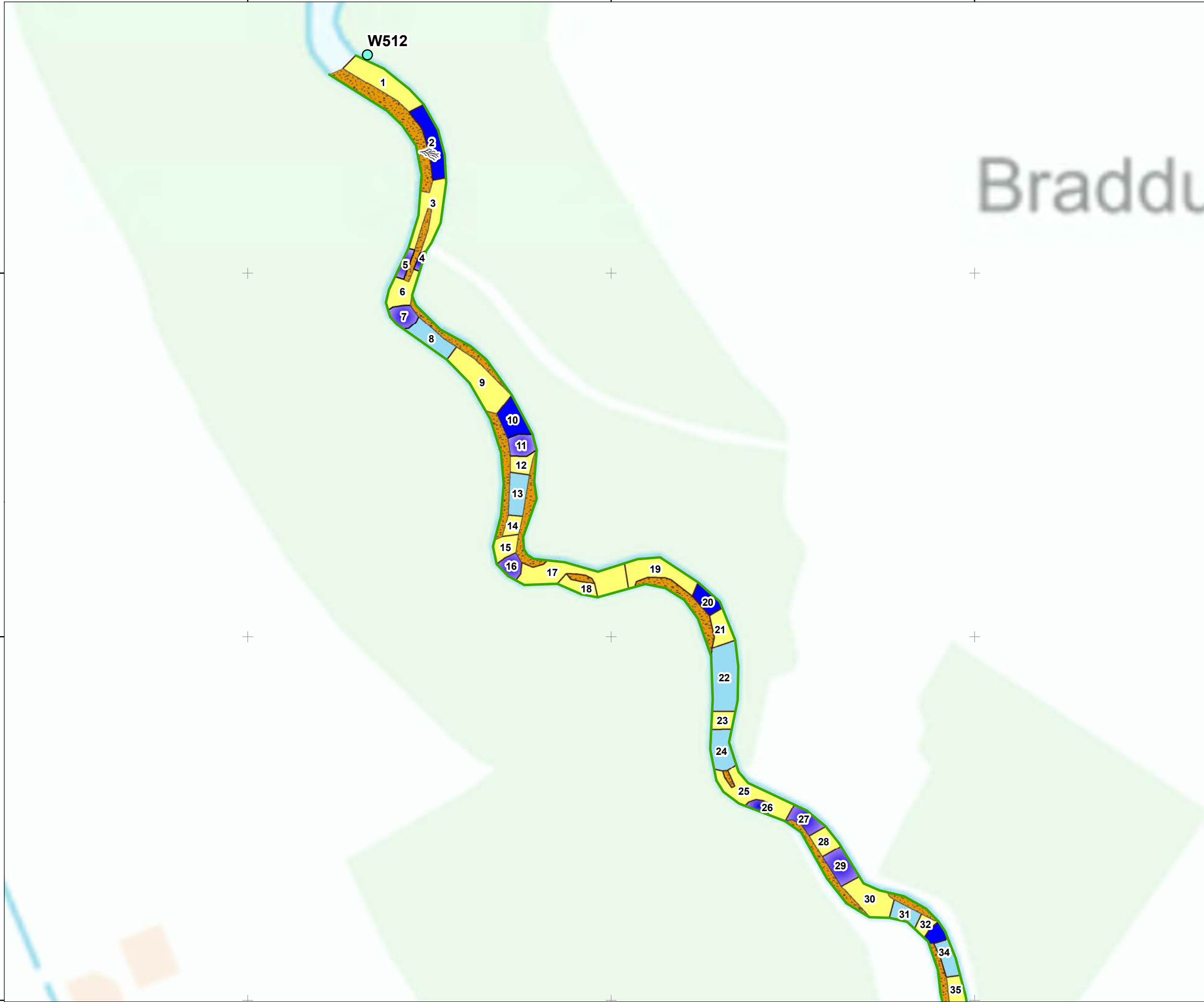
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444400

444300



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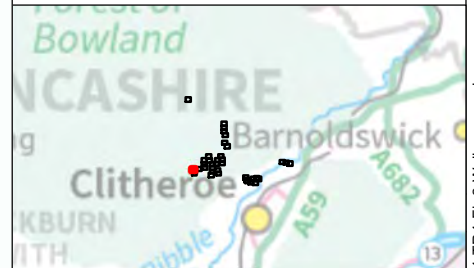
Walkover extents

- 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	Drm	Chk	App
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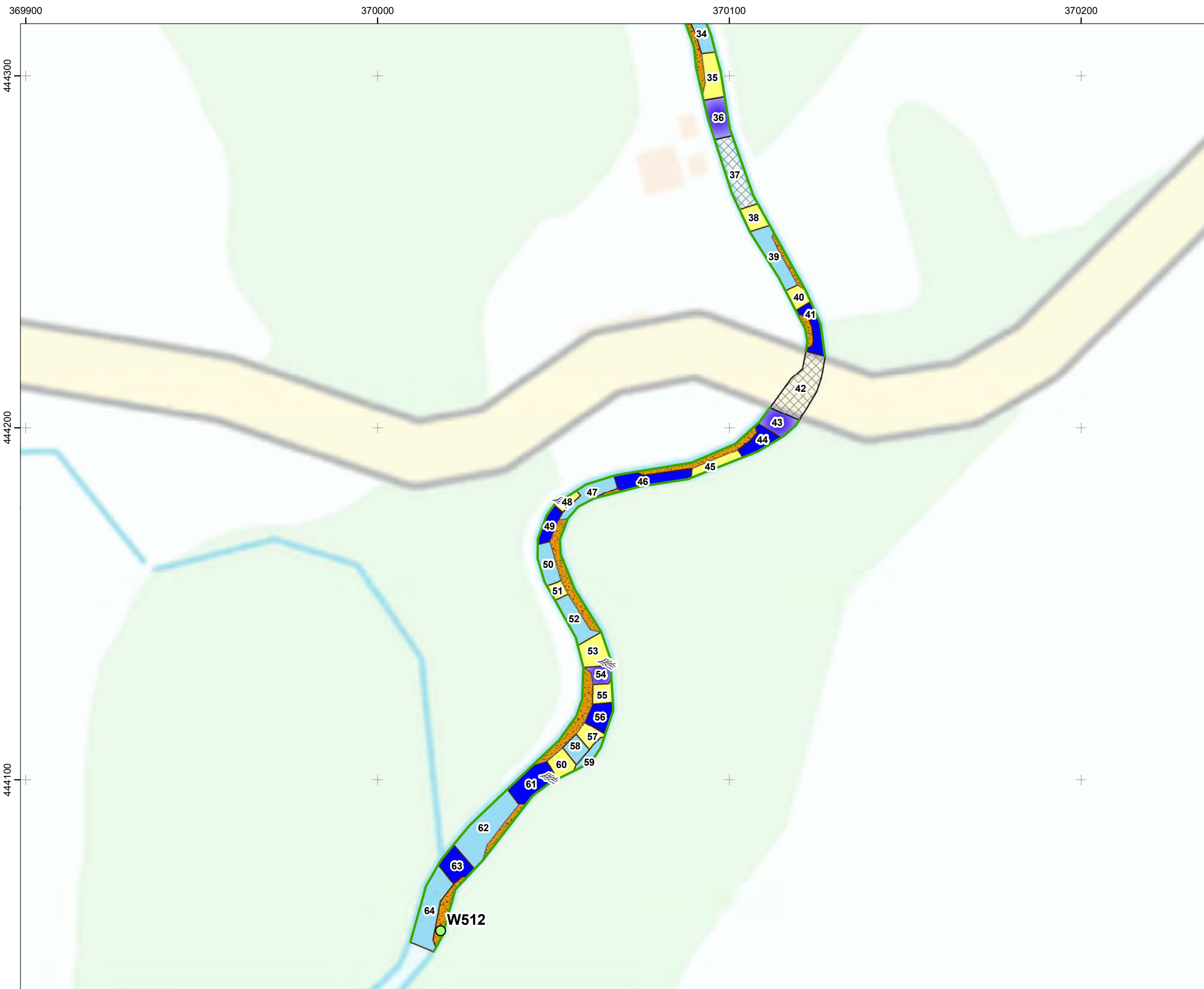
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TITLE: Figure 2:
 Marl Hill TR4
 Walkover Survey
 Map 6 of 37

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

REV 00



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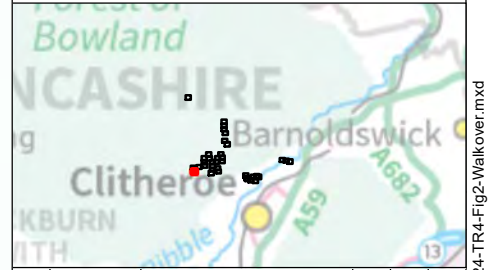
Walkover extents

- 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



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

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

REV 00



Legend:

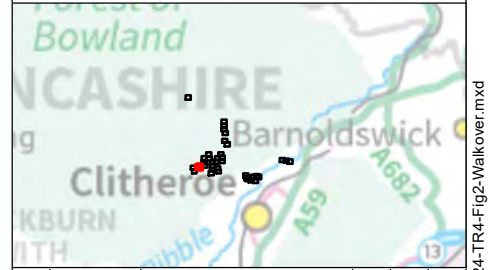
Walkover extents

- 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



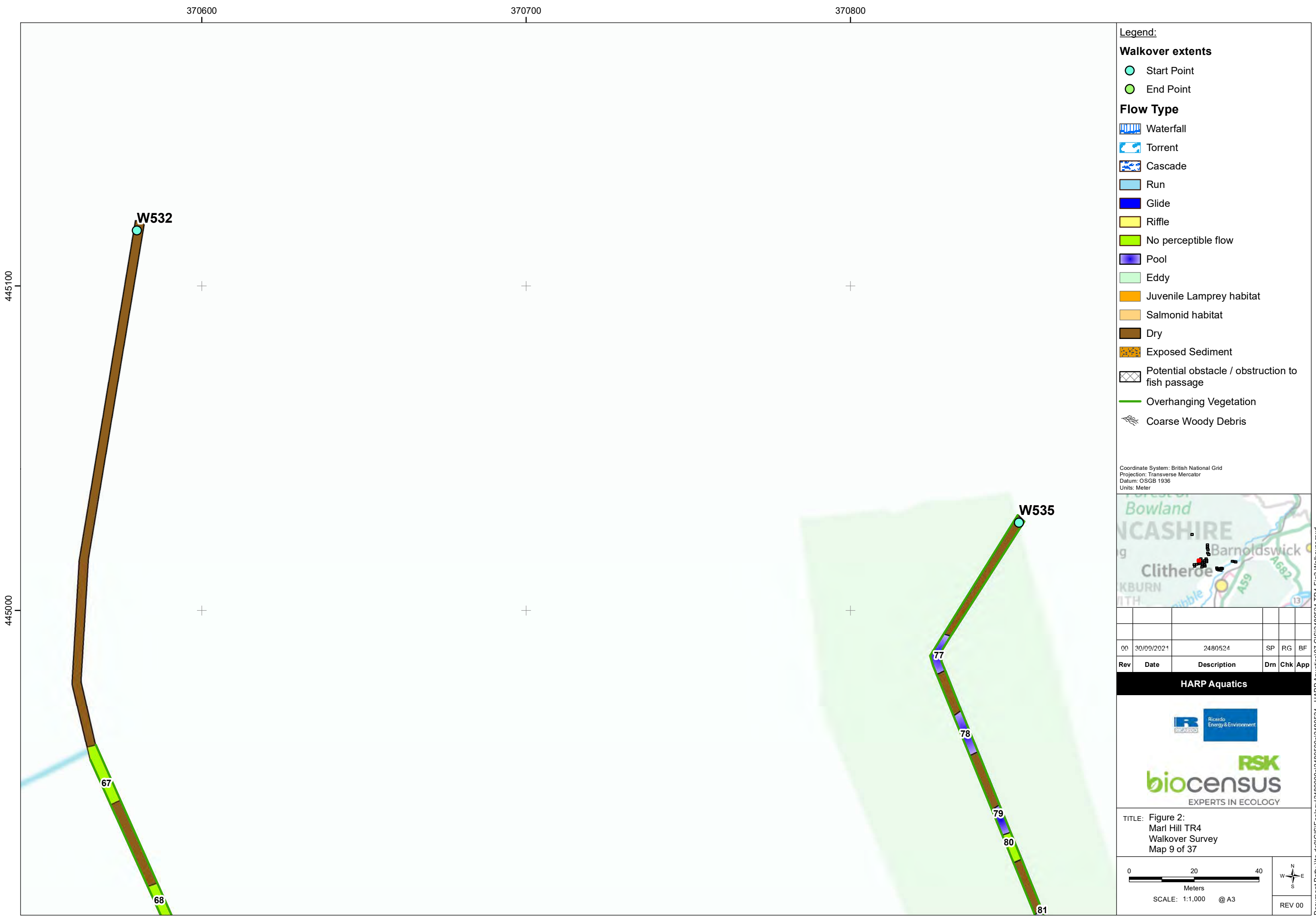
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TITLE: Figure 2:
 Marl Hill TR4
 Walkover Survey
 Map 8 of 37

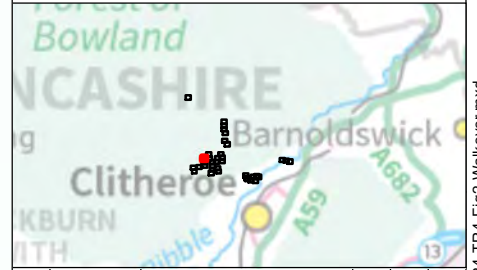
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 Meters
 SCALE: 1:1,000 @ A3

REV 00



- 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



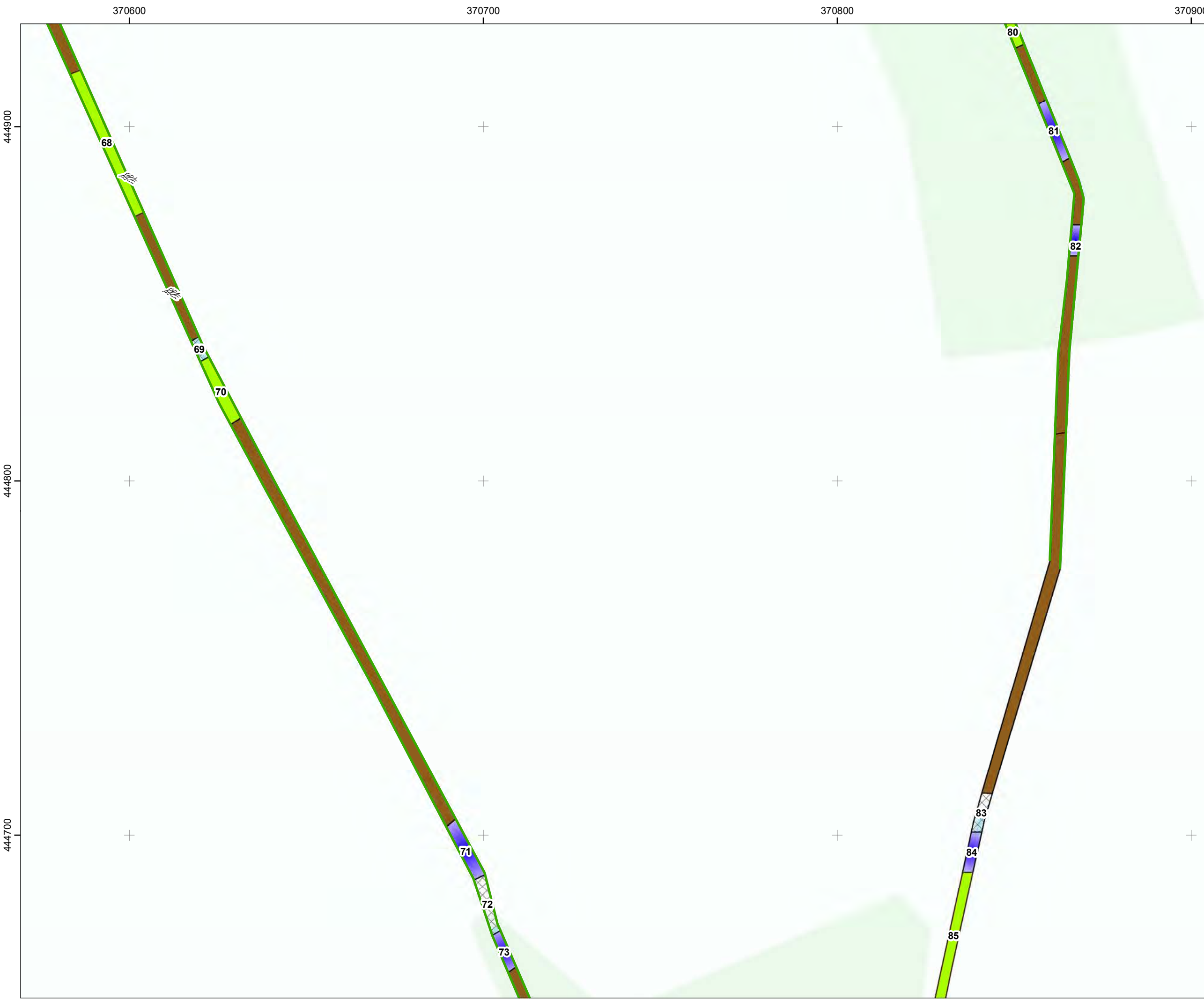
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HARP Aquatics

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 Marl Hill TR4
 Walkover Survey
 Map 9 of 37

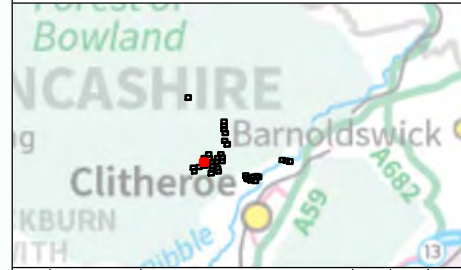
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 Meters
 SCALE: 1:1,000 @ A3

REV 00



- 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
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 - Potential obstacle / obstruction to fish passage
 - Overhanging Vegetation
 - Coarse Woody Debris

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

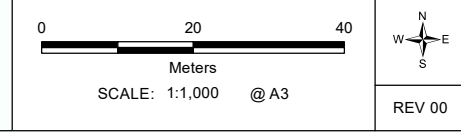


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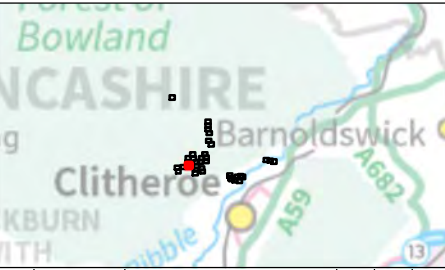
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 Marl Hill TR4
 Walkover Survey
 Map 10 of 37





- Legend:**
- Walkover extents**
- Start Point
 - End Point
- Flow Type**
- Waterfall
 - Torrent
 - Cascade
 - Run
 - Glide
 - Riffle
 - No perceptible flow
 - Pool
 - Eddy
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 - Coarse Woody Debris

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



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HARP Aquatics



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

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

REV 00



Legend:

Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy

Habitat

- 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	Drm	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

REV 00



- 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	Drm	Chk	App
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HARP Aquatics



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

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

REV 00



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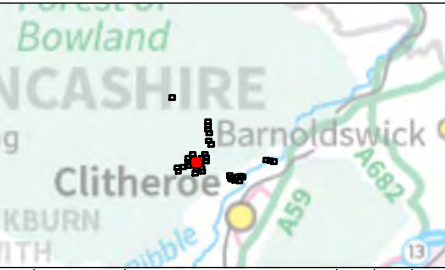
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
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- Overhanging Vegetation
- Coarse Woody Debris

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



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

HARP Aquatics

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

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

REV 00

371200

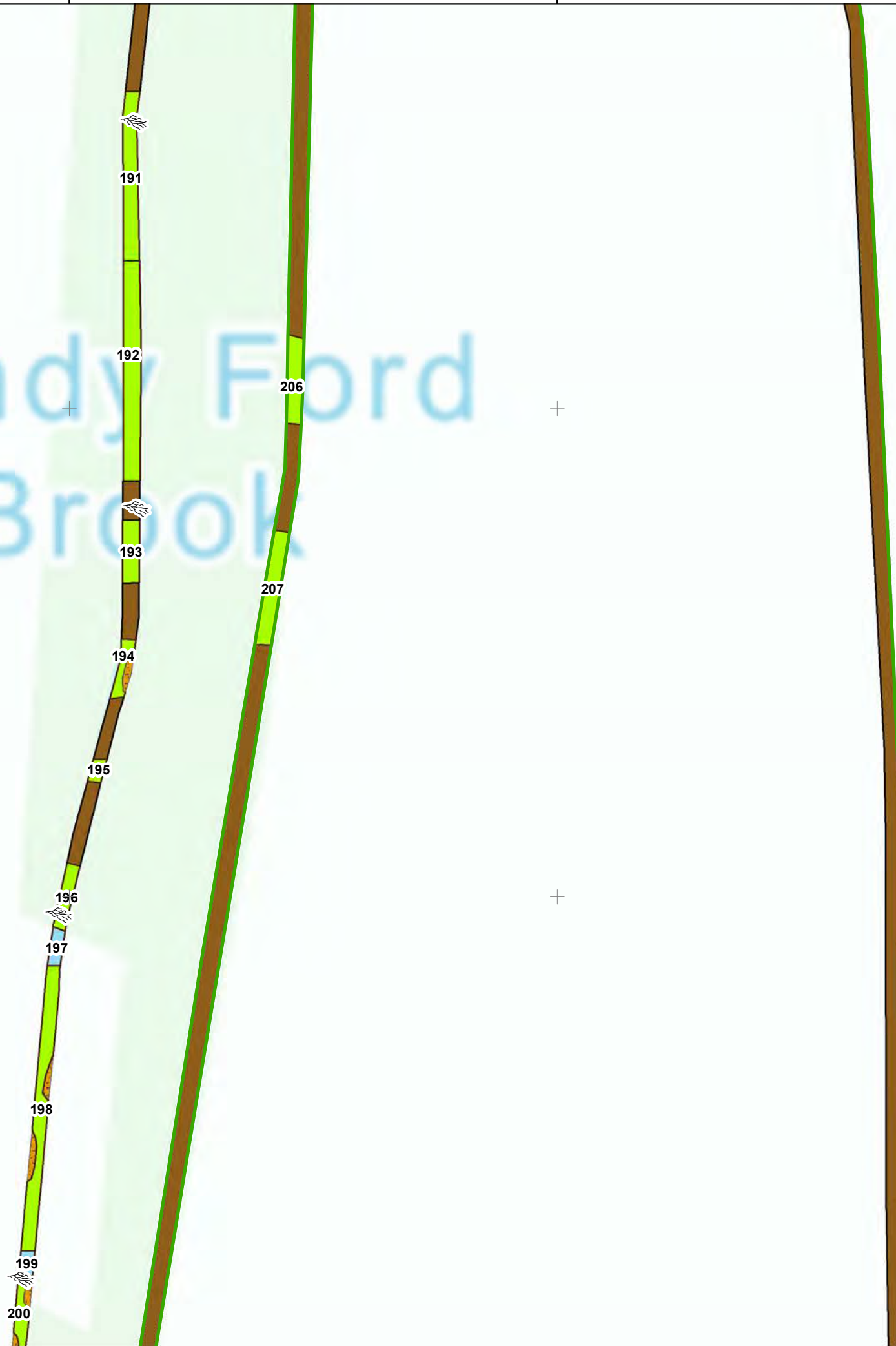
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444500

Sandy Ford Brook



Legend:

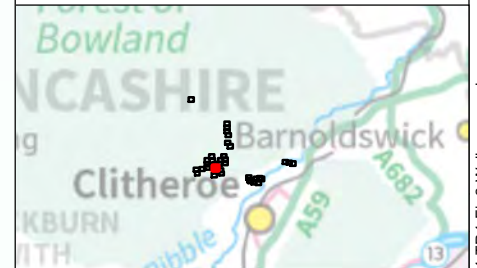
Walkover extents

- 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

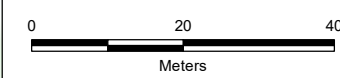


Rev	Date	Description	Drm	Chk	App
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HARP Aquatics



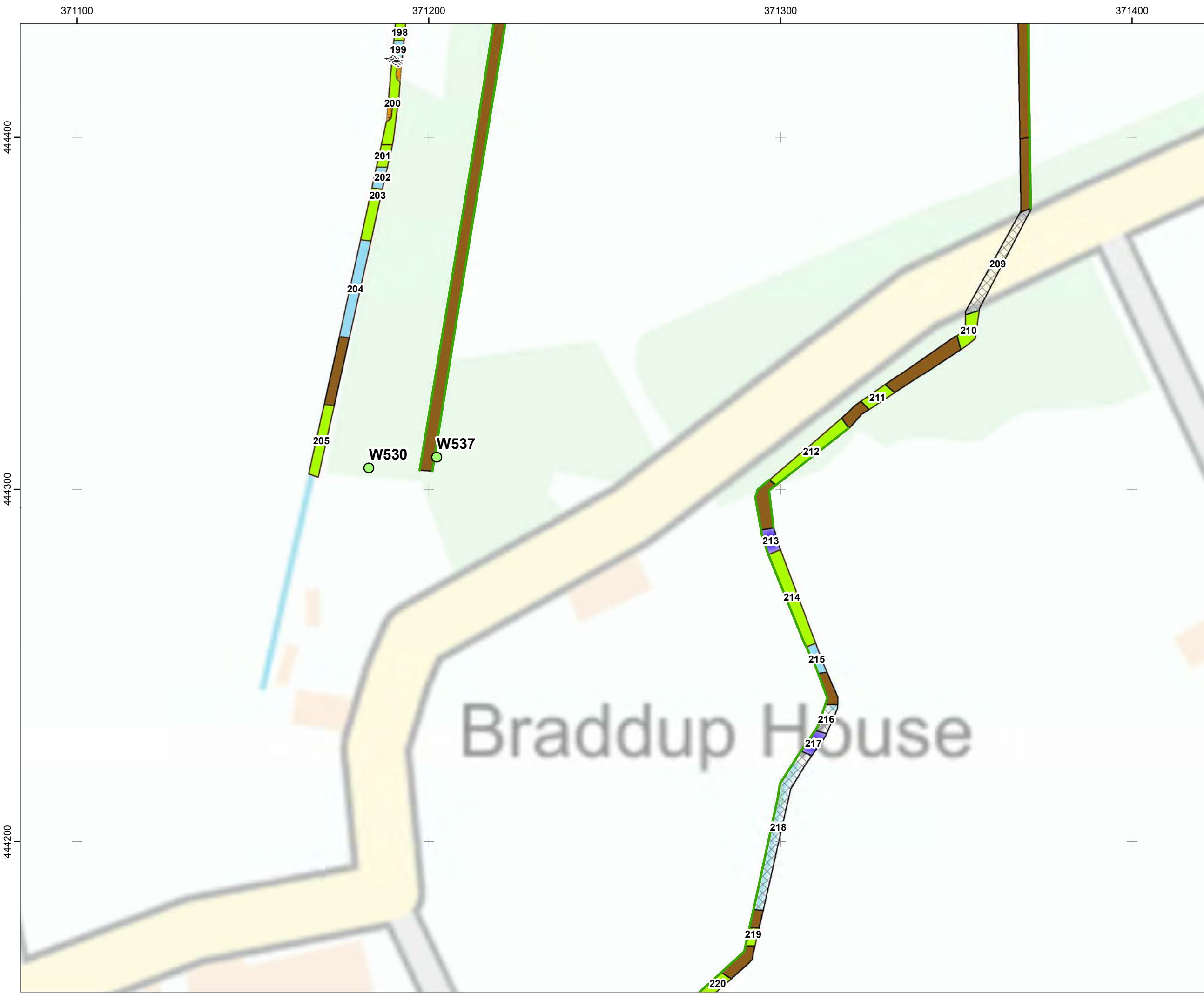
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 Marl Hill TR4
 Walkover Survey
 Map 15 of 37



SCALE: 1:1,000 @ A3



REV 00



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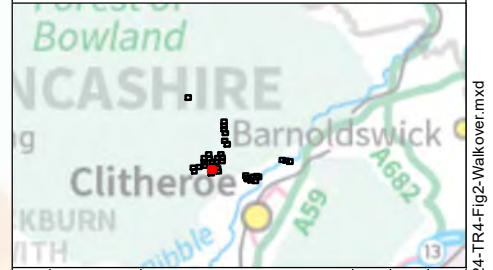
Walkover extents

- 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



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HARP Aquatics



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

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

REV 00



Legend:

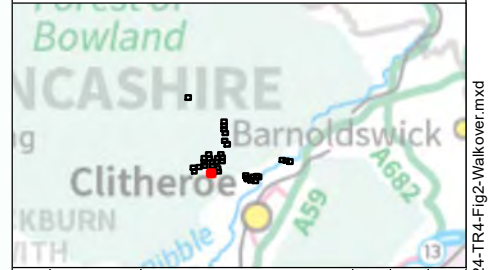
Walkover extents

- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

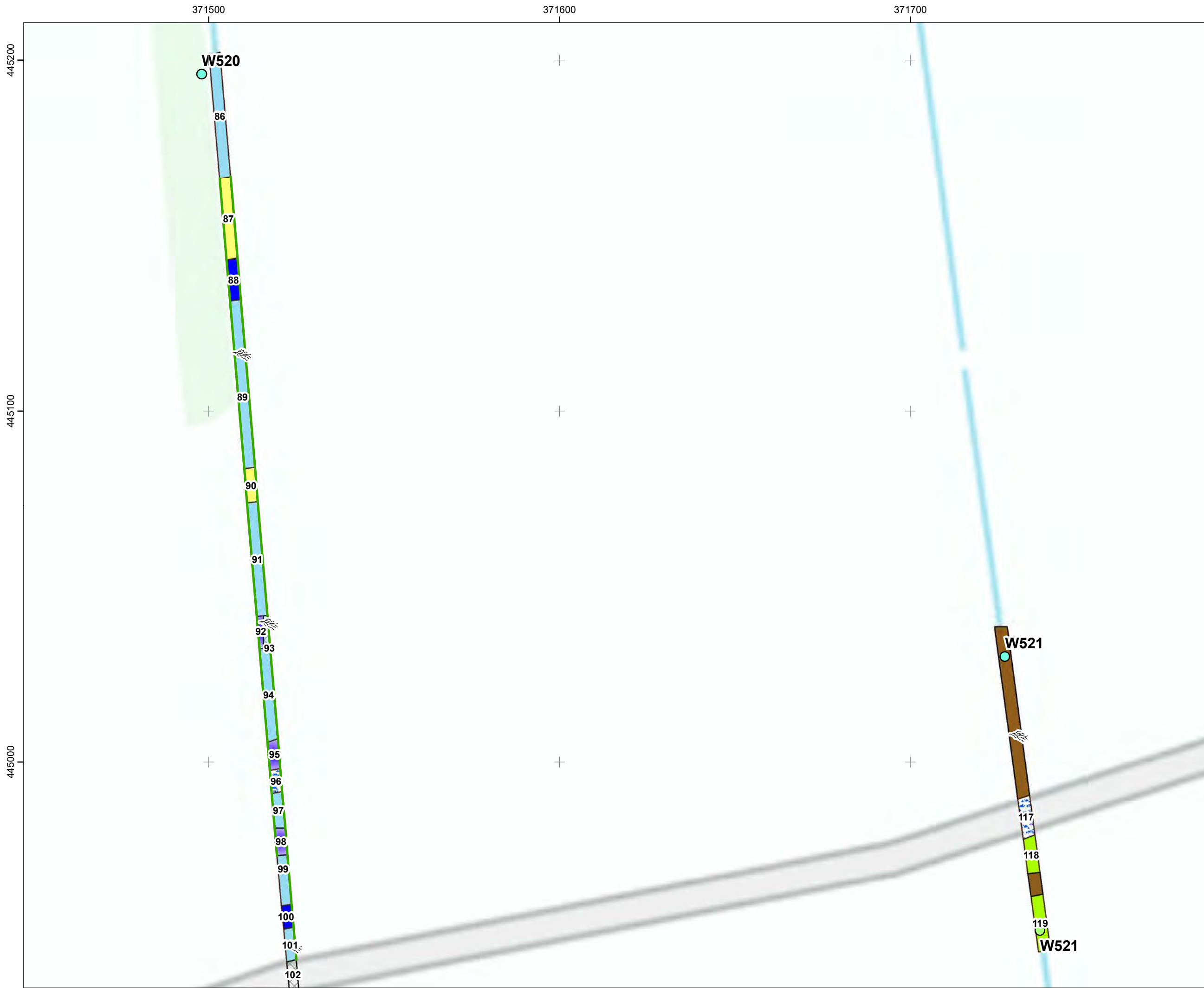
HARP Aquatics



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

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

REV 00



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



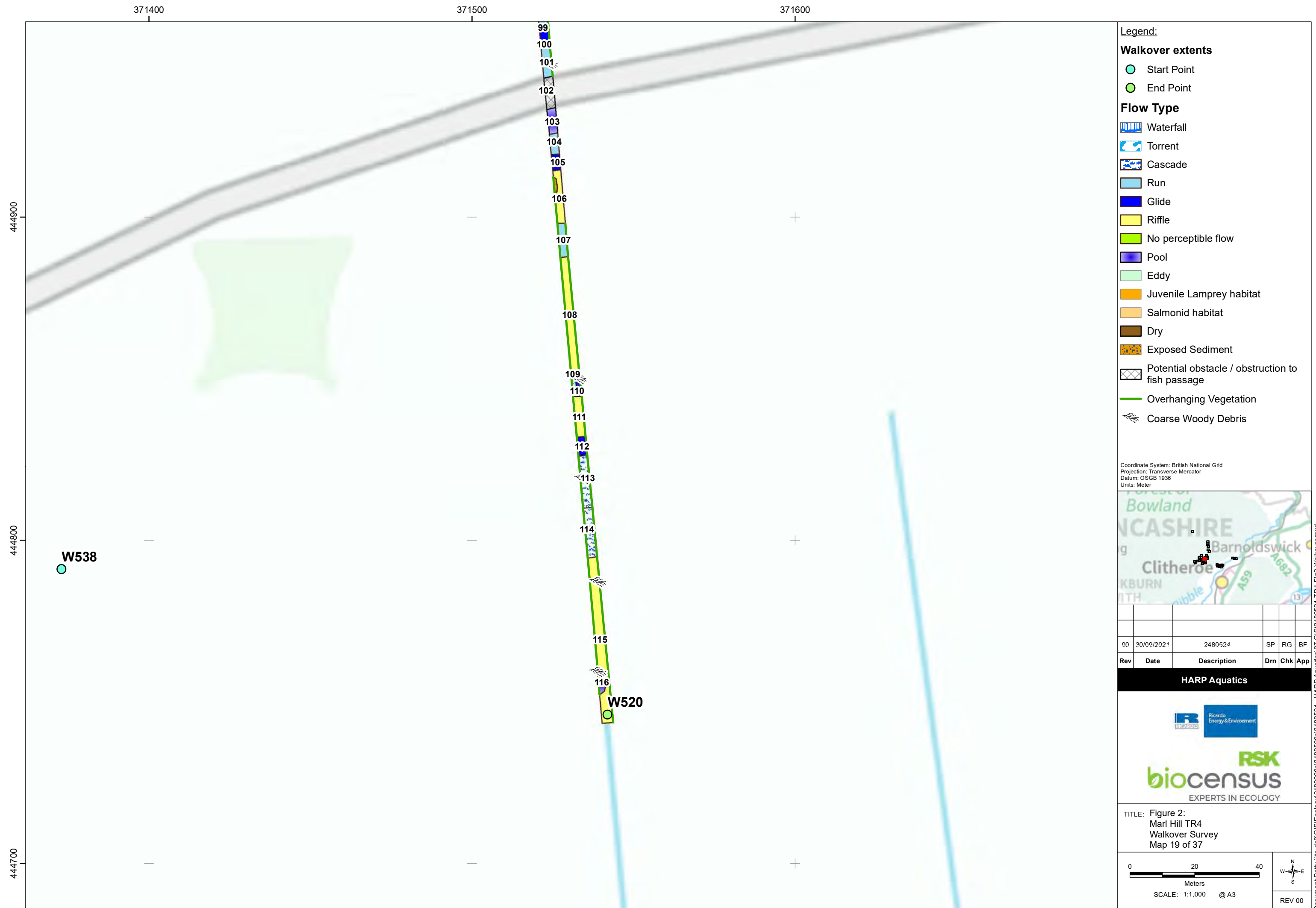
Rev	Date	Description	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

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

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

REV 00



- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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

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

REV 00



Legend:

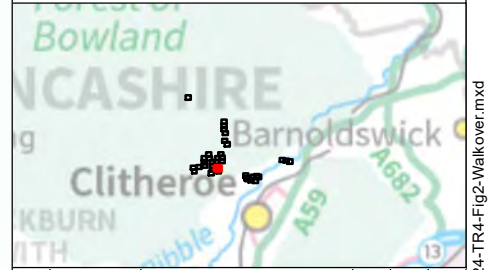
Walkover extents

- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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

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

REV 00



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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

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

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

REV 00

371700

371800

371900

445400

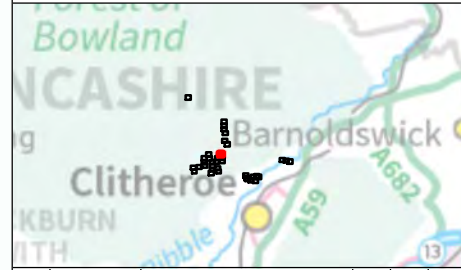
445300

445200



- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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

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

REV 00



- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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

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

REV 00

371800

371900

372000

444900

444800

Legend:

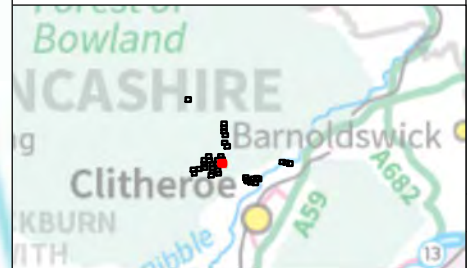
Walkover extents

- 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

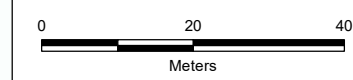


Rev	Date	Description	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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



SCALE: 1:1,000 @ A3



REV 00

375800

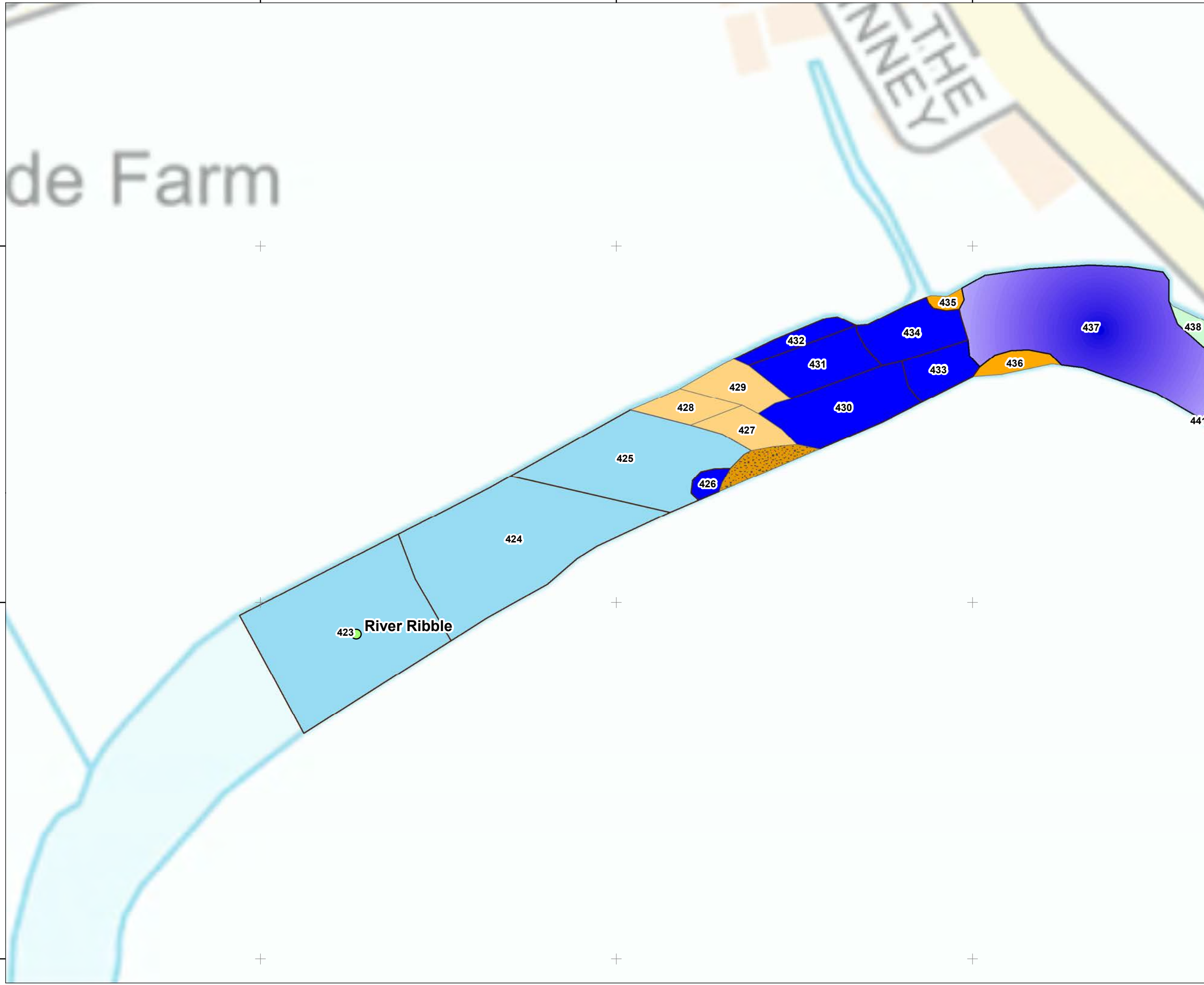
375900

376000

445000

444900

444800



Legend:

Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy

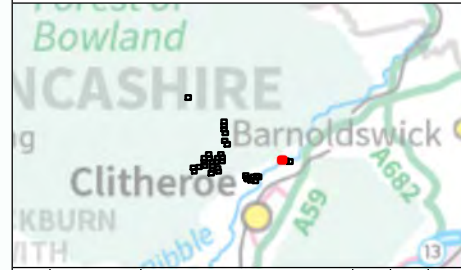
Habitat

- Juvenile Lamprey habitat
- Salmonid habitat
- Dry

Obstacles

- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

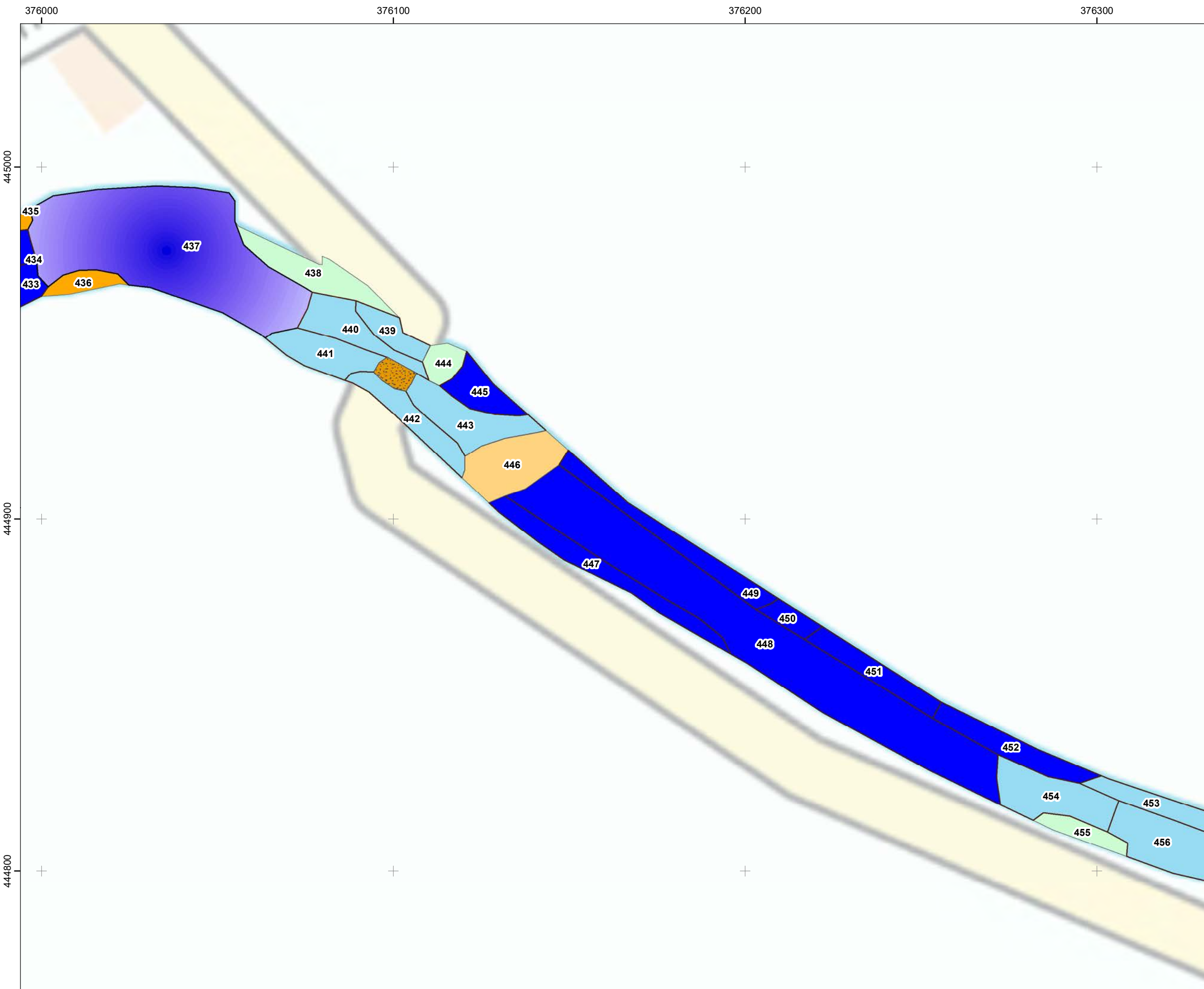
HARP Aquatics



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

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

REV 00



Legend:

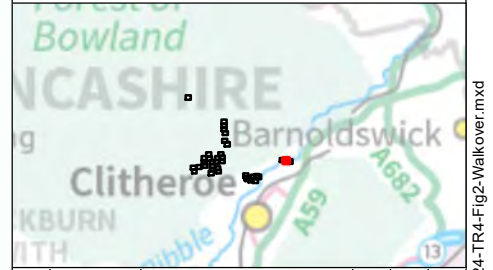
Walkover extents

- 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



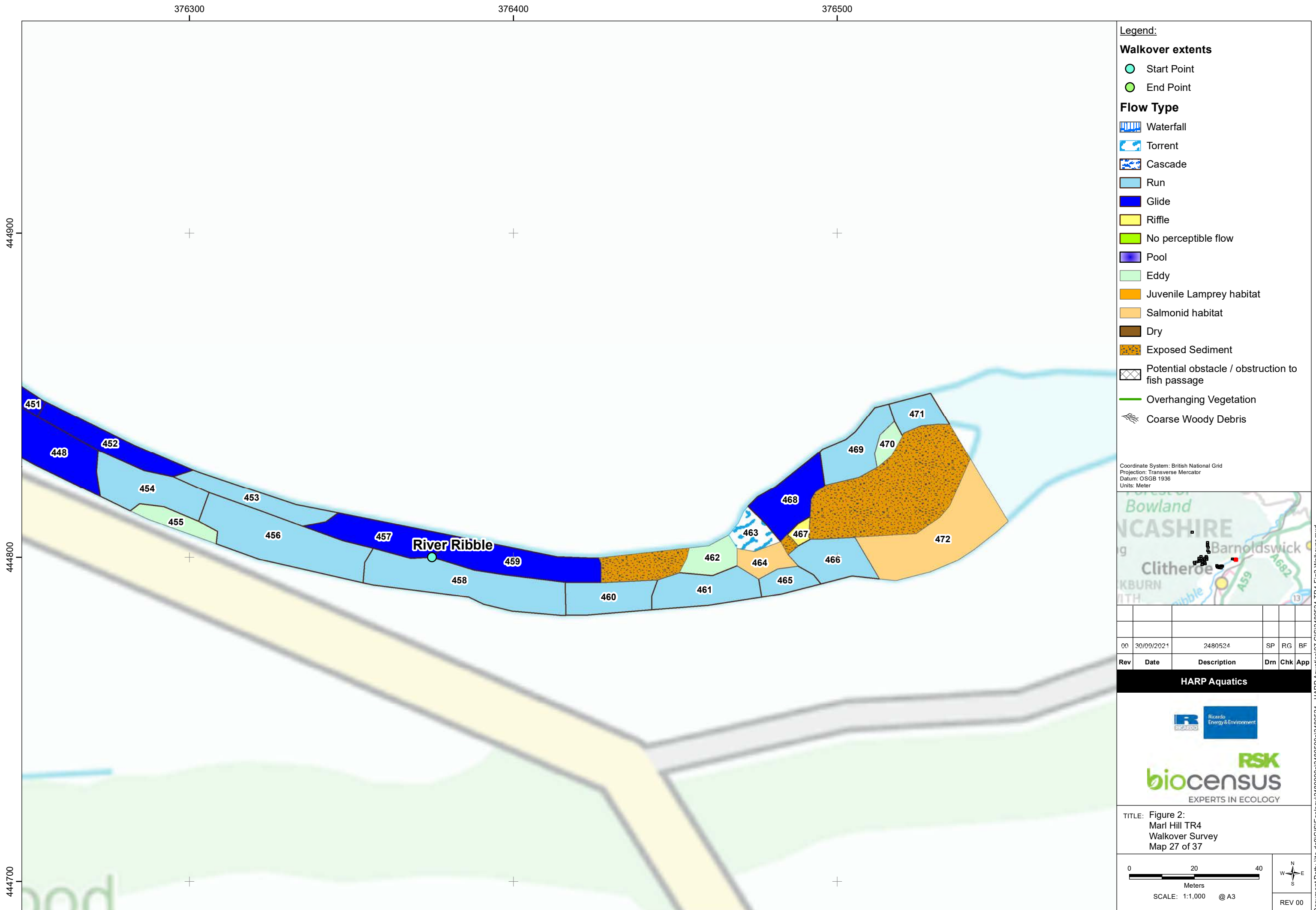
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00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

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

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

REV 00



Rev	Date	Description	Drm	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

REV 00

372000

372100

372200

446300

446200

446100



Legend:

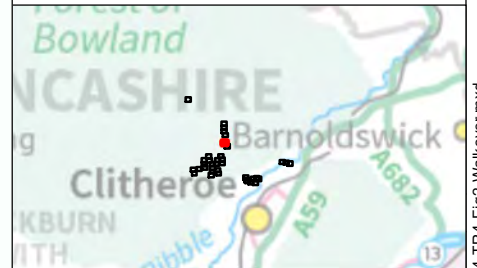
Walkover extents

- 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

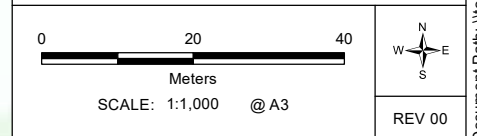


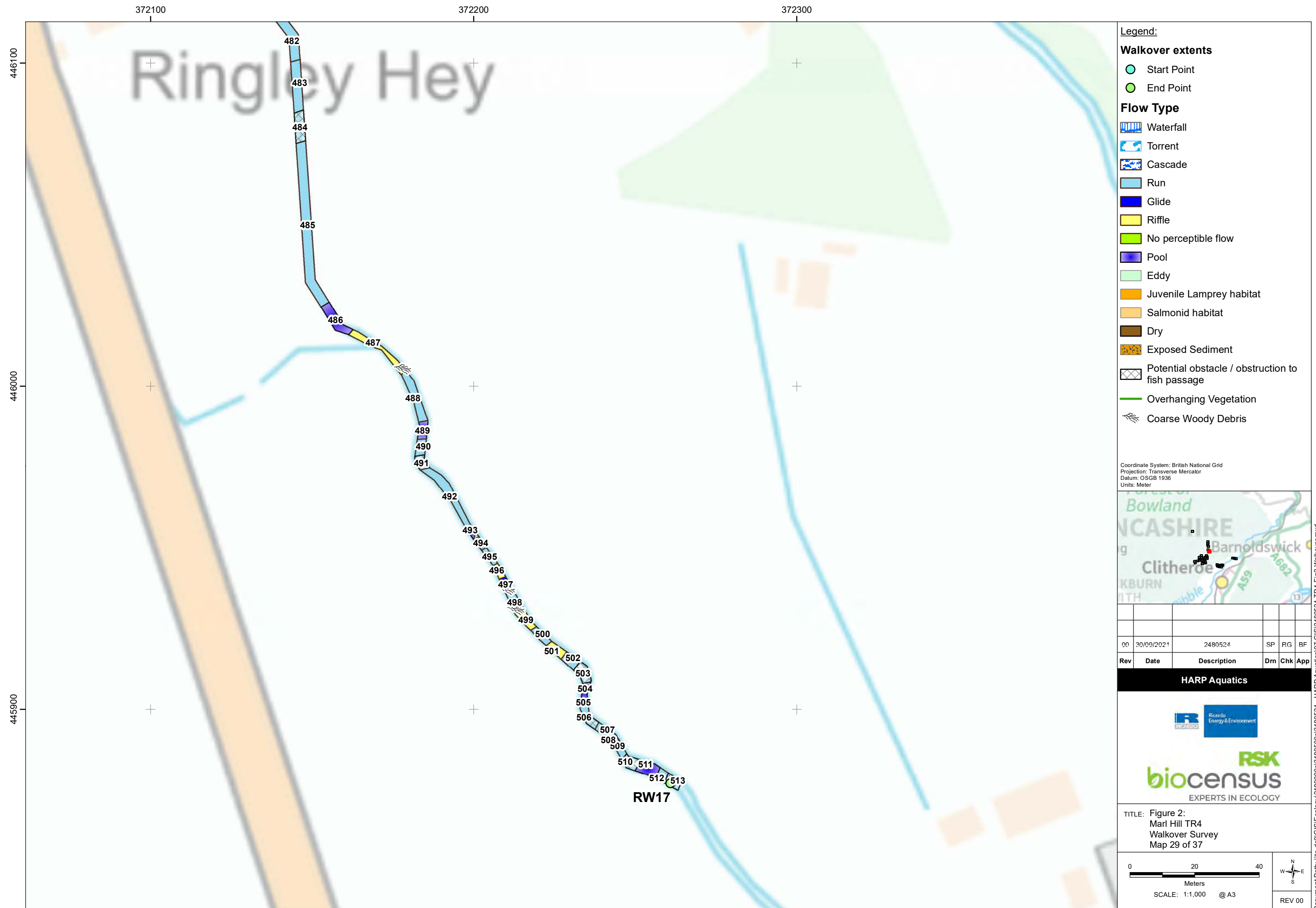
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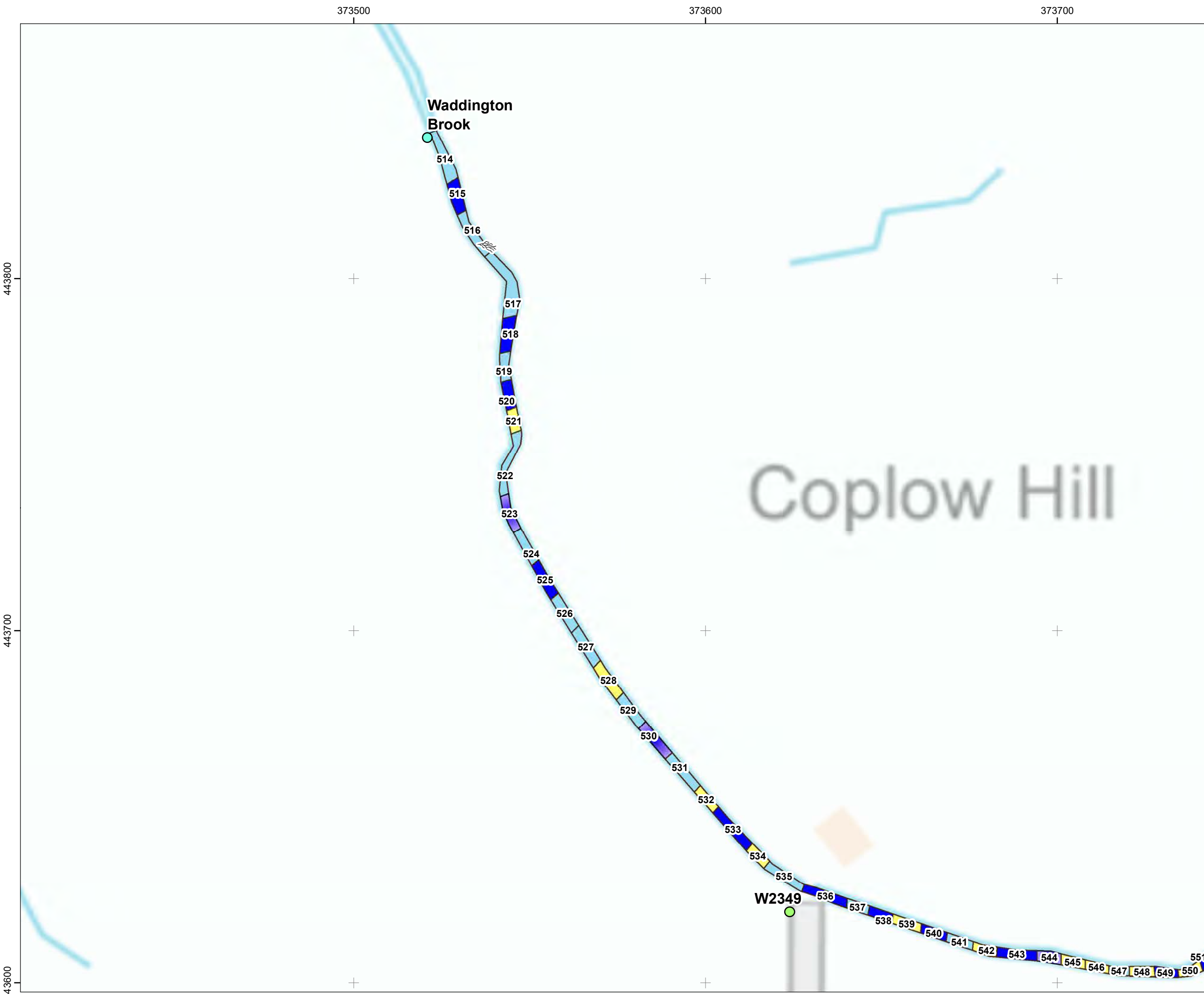
HARP Aquatics



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







- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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

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

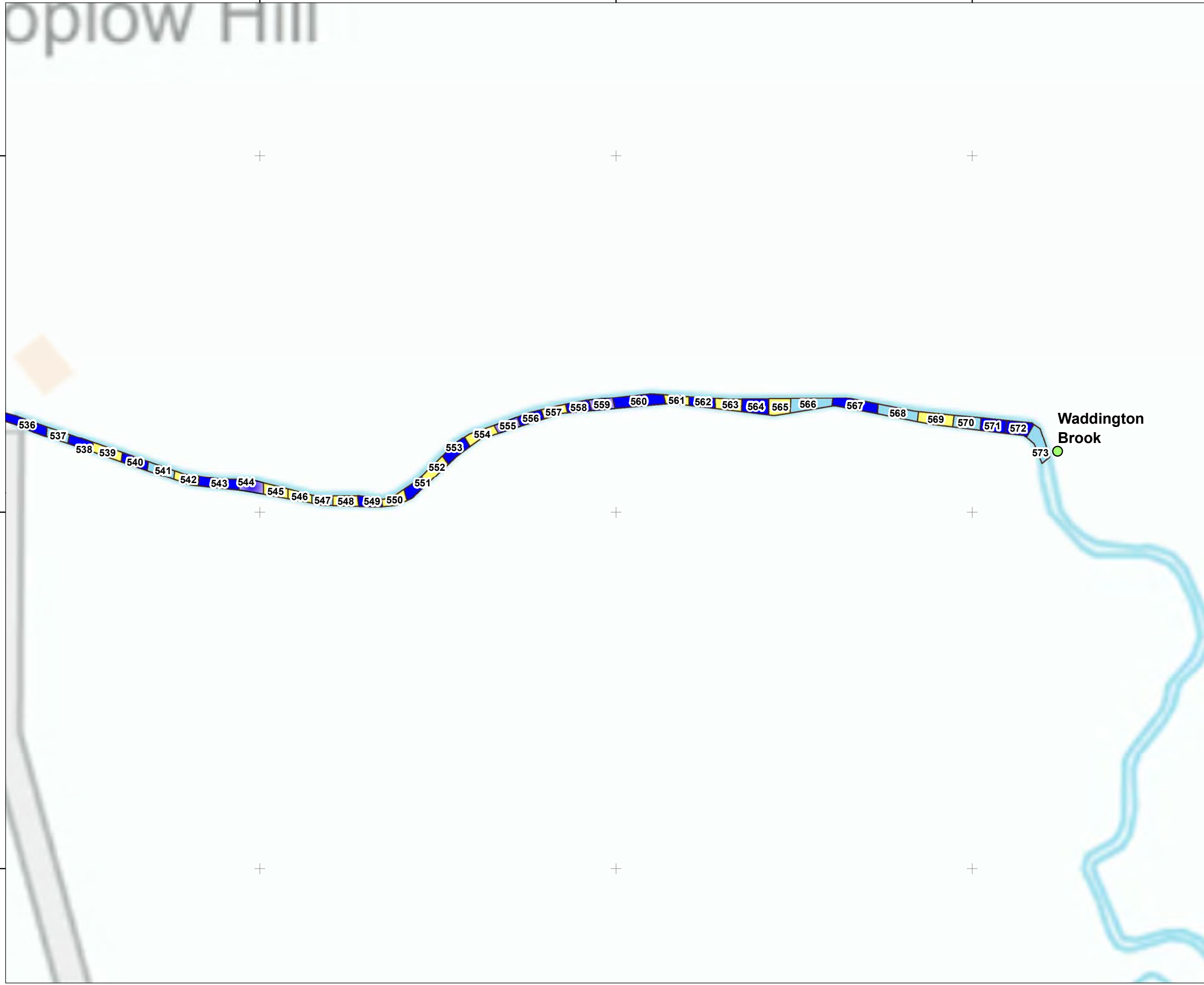
REV 00

373700 373800 373900

443700

443600

443500



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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

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

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

REV 00

373900

374000

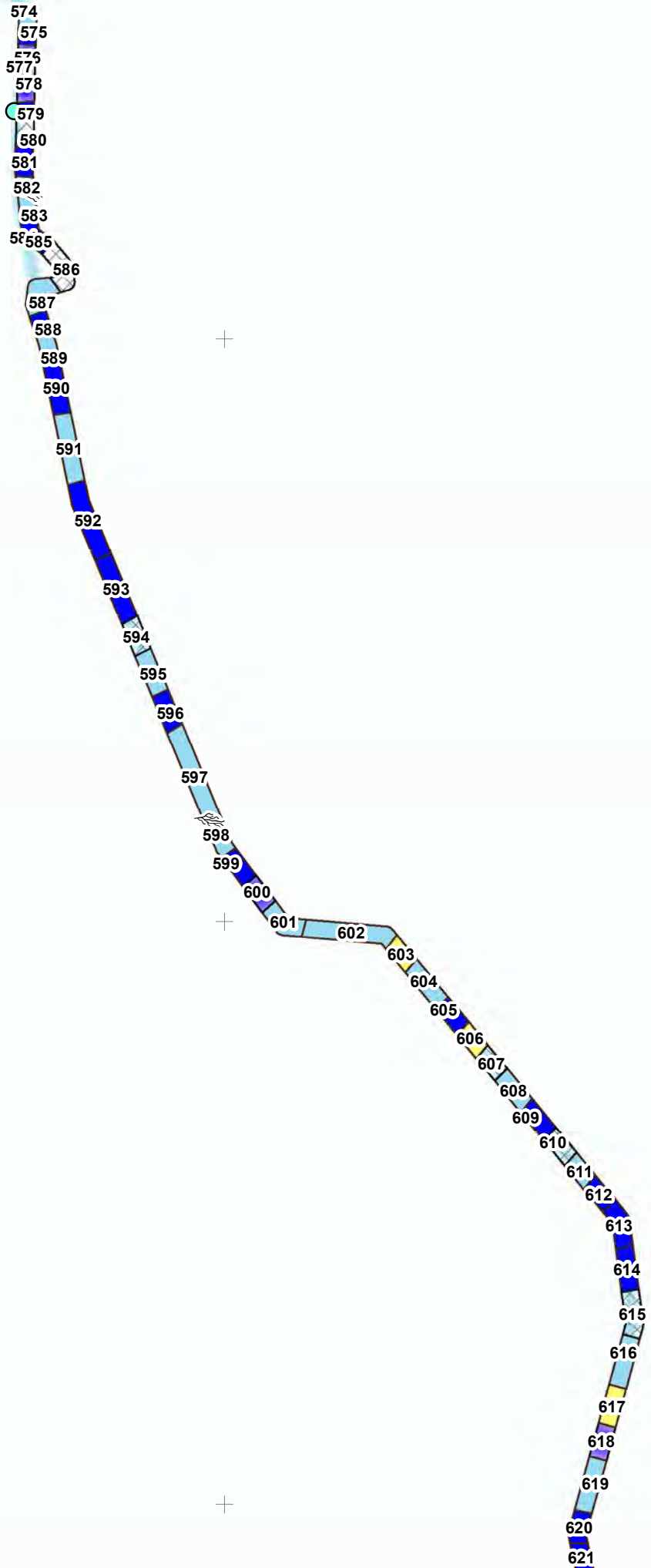
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443800

443700

Greg Sike



Legend:

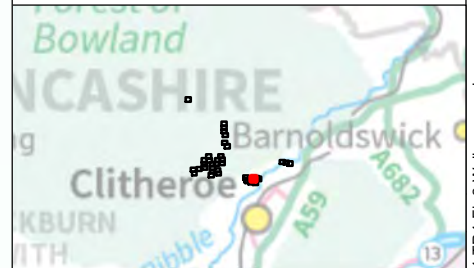
Walkover extents

- 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

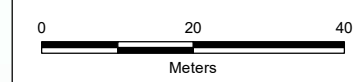


Rev	Date	Description	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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



REV 00

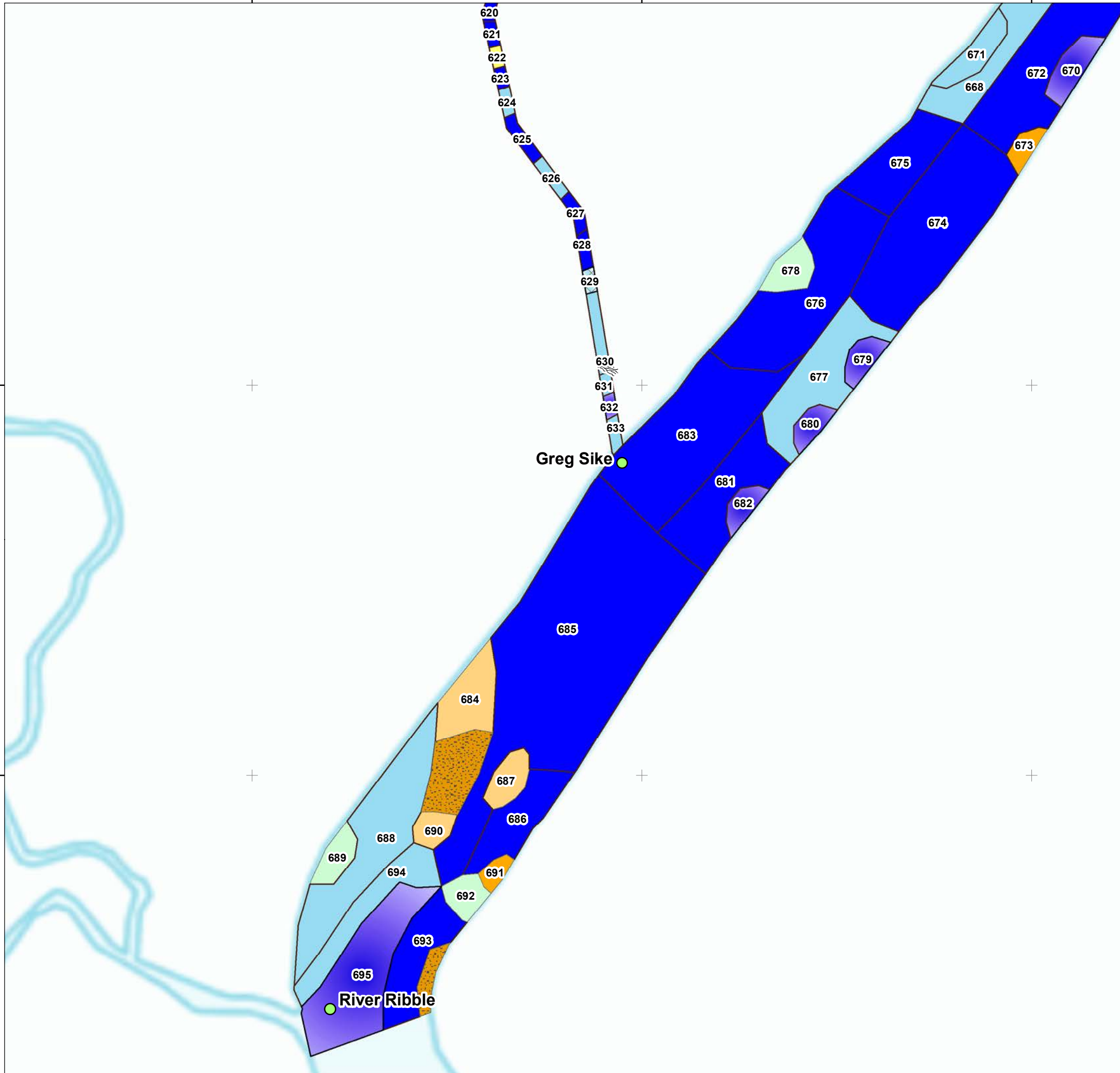
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374200

443600

443500



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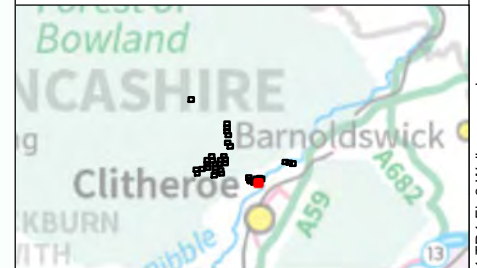
Walkover extents

- Start Point
- End Point

Flow Type

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

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

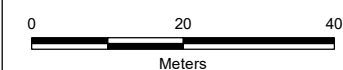


Rev	Date	Description	Drm	Chk	App
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HARP Aquatics



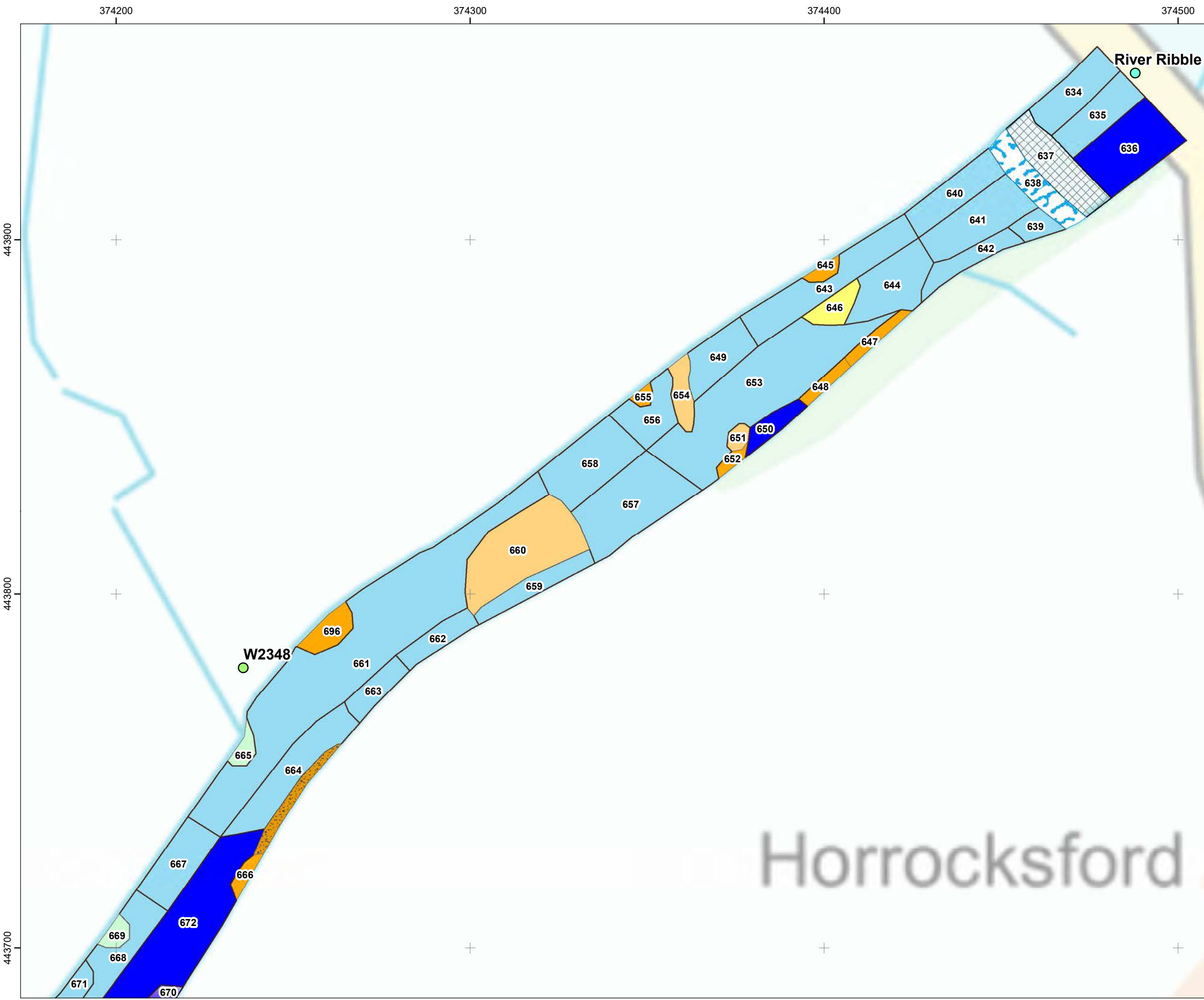
TITLE: Figure 2:
 Marl Hill TR4
 Walkover Survey
 Map 33 of 37



SCALE: 1:1,000 @ A3

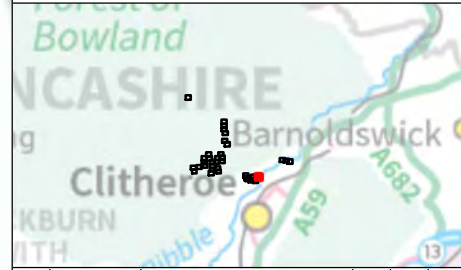


REV 00



- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

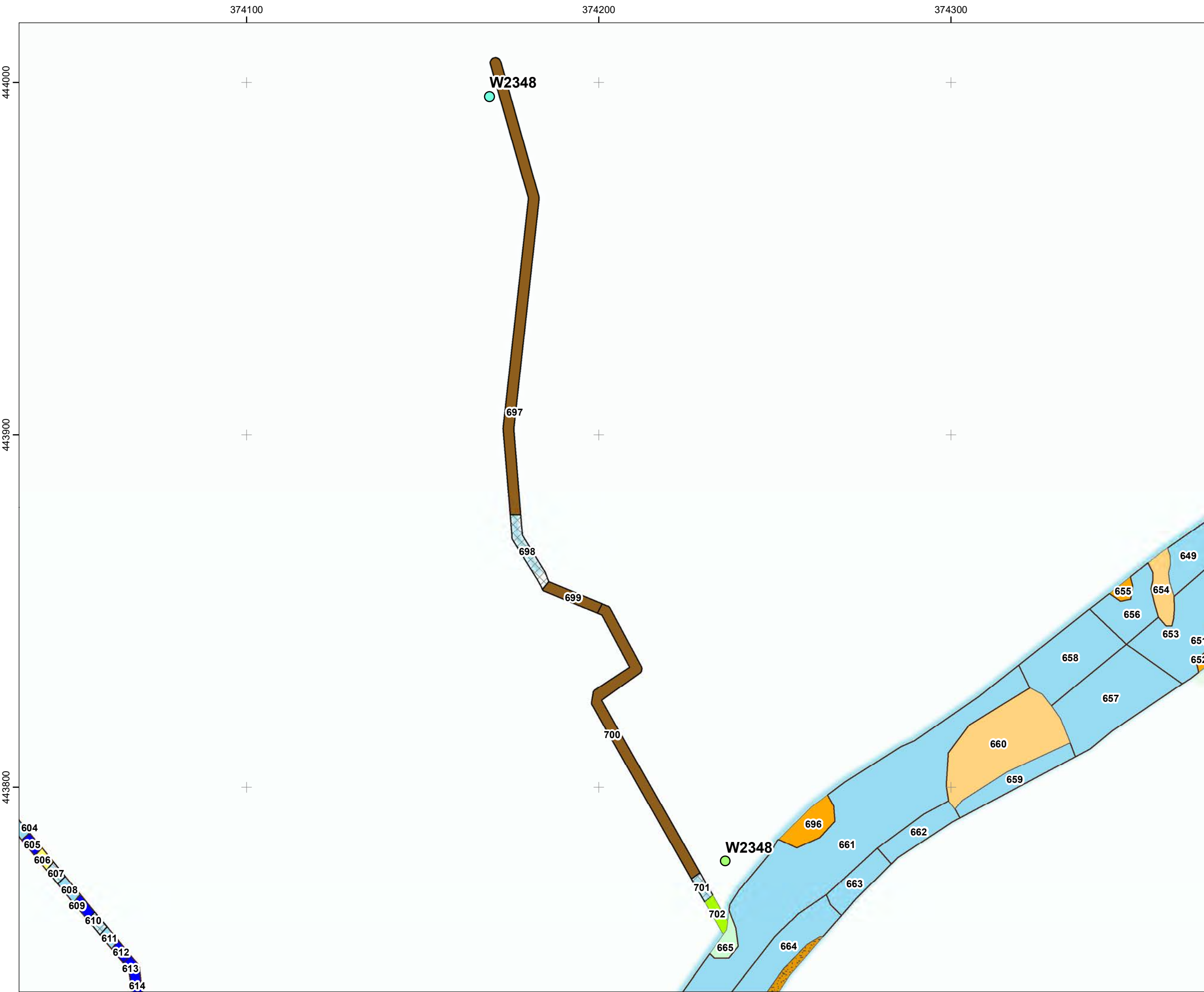
HARP Aquatics



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

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

REV 00



Legend:

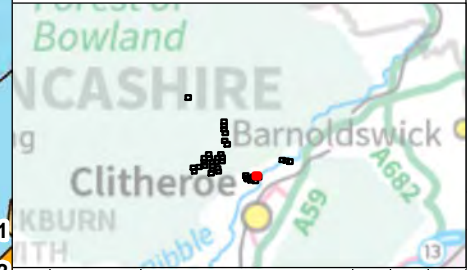
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
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- 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	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics



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

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

REV 00



Legend:

Walkover extents

- Start Point
- End Point

Flow Type

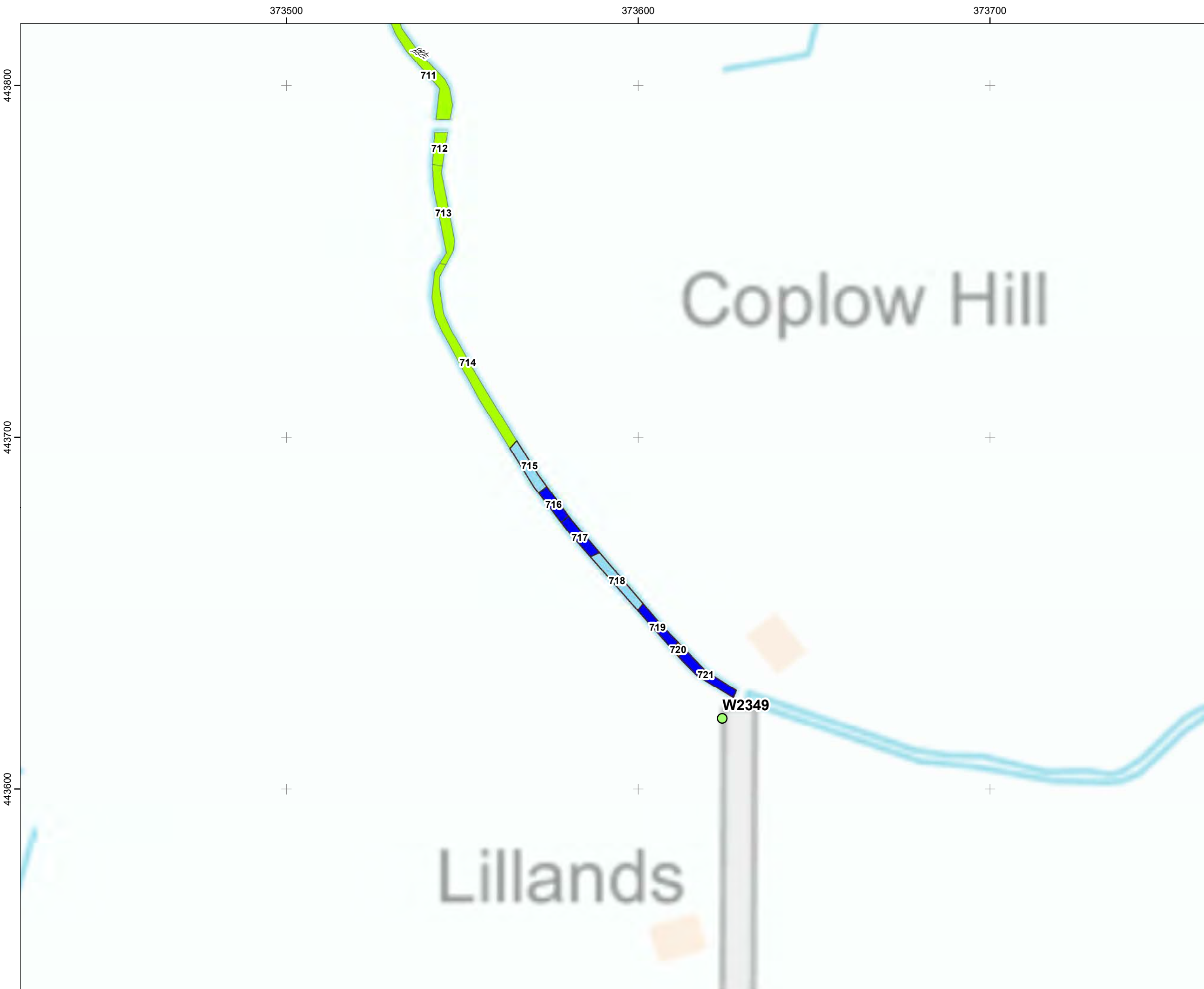
- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
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- Overhanging Vegetation
- Coarse Woody Debris

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

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

HARP Aquatics

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



Legend:

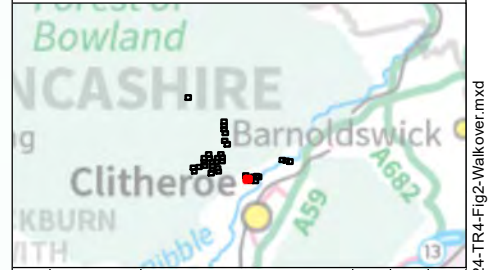
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
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- Overhanging Vegetation
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Coordinate System: British National Grid
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 Datum: OSGB 1936
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Rev	Date	Description	Drm	Chk	App
00	30/09/2021	2480524	SP	RG	BF

HARP Aquatics

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

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

REV 00

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/SA		
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 GENERAL NOTES

Project No.: 2480524



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

Client: Ricardo Energy and Environment


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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Bio census Ltd.

CONTENTS

1	INTRODUCTION	1
1.1	Purpose of this report	1
1.2	Site information.....	1
2	METHOD	3
2.1	Survey timings	3
2.2	Otter surveys	3
2.3	Water vole surveys and habitat suitability assessment.....	3
2.4	Survey constraints	4
2.5	Biosecurity	4
3	RESULTS	5
4	APPENDICES – SURVEY MAPS	18

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	Water Vole	Otter
			Upstream	Downstream			
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 2003¹. 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.*, 2016⁴):

- 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.

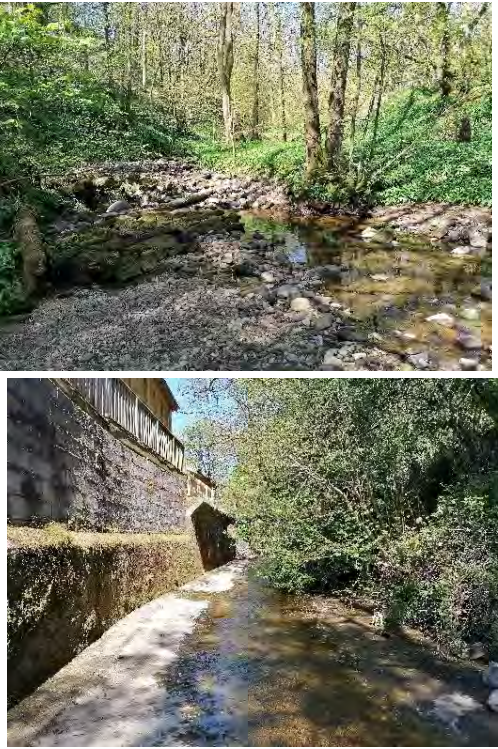
2.5 Biosecurity

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	
	<p>Eastings and Northings Upstream: X: 369928 Y: 444567 Downstream: X: 370018 Y: 444057</p> <ul style="list-style-type: none"> • Evidence of otter, suitable habitat at W512. <p>Evidence of otter was recorded at W512; four spraints were recorded (<i>Figure 2 – W512</i>). W512 is considered suitable habitat for otter.</p> <p>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.</p> <p>The majority of W512 was comprised of steep, wooded, channel sides with bankside herbs.</p> <p>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.</p>

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.

	<p>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.</p> <p>The watercourse was a steep sided, shallow flowing stream, shaded throughout with both native deciduous and non-native ever green canopy (<i>rhododendron</i> sp.). The in-channel substrate was comprised of boulder, cobble, and gravel with occasional coarse woody debris.</p> <p>A small section of W520 had artificially reinforced banks, stone walls, and a weir was present in the upstream section.</p> <p>The width of the channel was c. 2.5 m and the water depth was c. 10 cm.</p>
--	--

T04: W521 Unnamed Watercourse 431



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.

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

	<p>also frequent. Although variable, the width of the channel was 1 – 3.5 m and the water depth was c. 20 cm.</p> <p>Vegetation on the steep, sheep-grazed banks was comprised of herbs, <i>Juncus</i> sp. and ferns. No in-channel vegetation was recorded.</p>
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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.

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.

T04: W2321 Greg Sike



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.

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

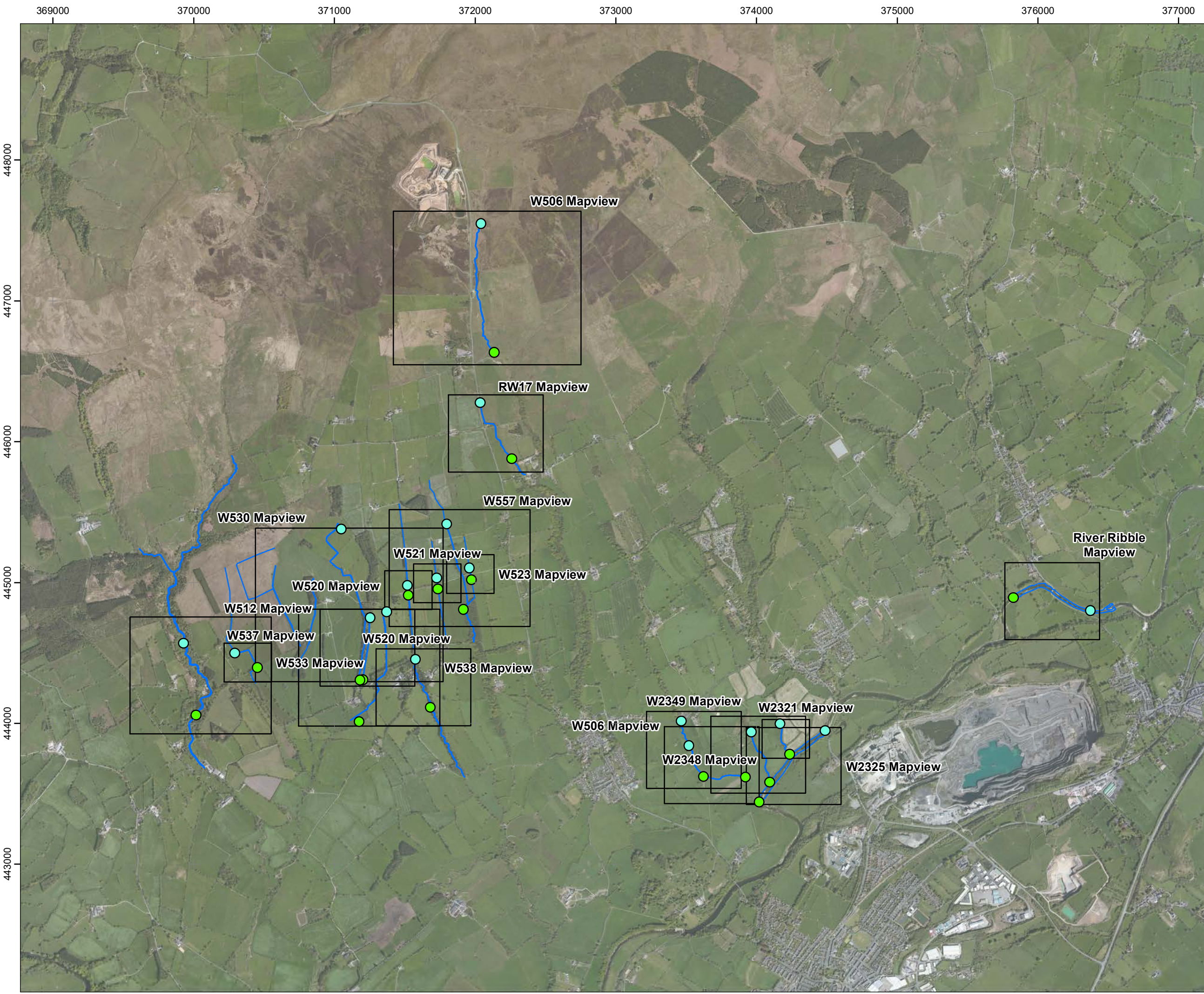
- **No evidence of otter at W2348, habitat largely unsuitable**

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



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

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

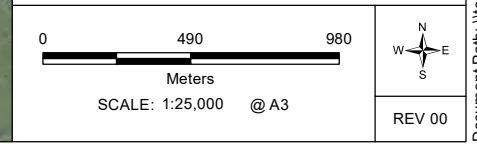


Rev	Date	Description	Drm	Chk	App
00	17/02/2021	2480524	RG	SP	BF

HARP Aquatics



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

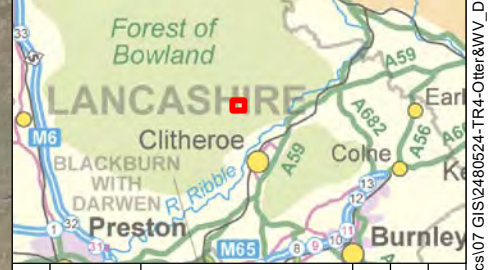


371500 371600 371700 371800 371900 372000 372100 372200 372300 372400 372500 372600 372700



- 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



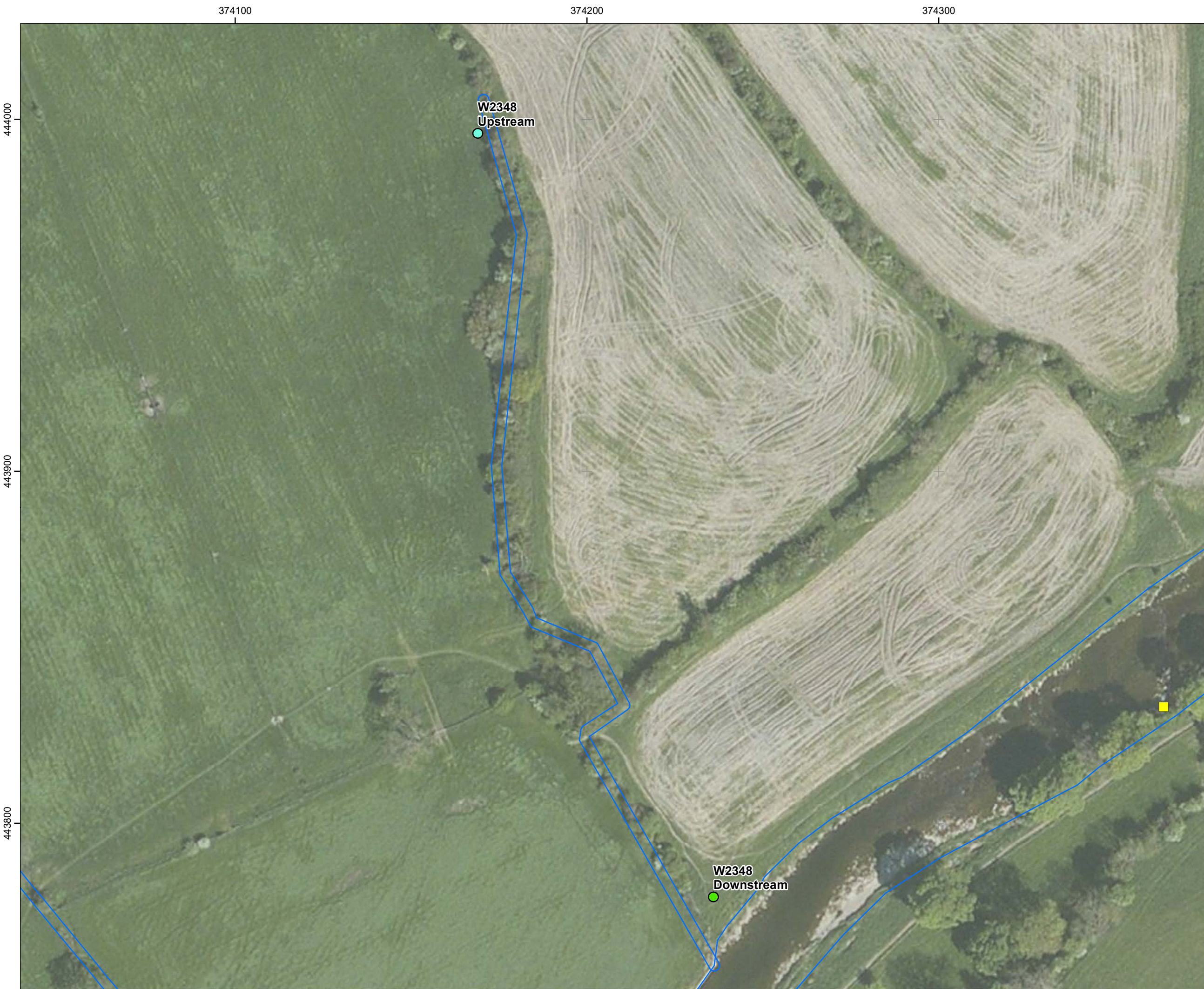
Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W506	RG	SP	BF

HARP Aquatics

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

Meters
SCALE: 1:4,000 @ A3

REV 00



- Legend:**
- Waterbody
 - Upstream Survey Extent
 - Downstream Survey Extent
- Otter Evidence**
- Potential Otter Couch

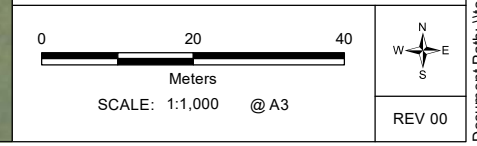
Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter



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

HARP Aquatics

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



371600

371700

371800

371900

4445100

4445000

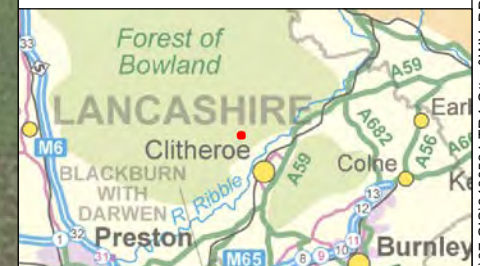
4444900



Legend:

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

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

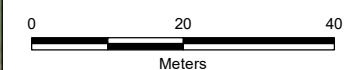


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W521	RG	SP	BF

HARP Aquatics



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



SCALE: 1:1,000 @ A3

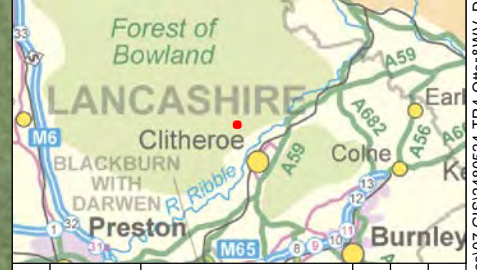


REV 00



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

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



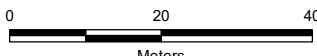
Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W523	RG	SP	BF

HARP Aquatics




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



Meters
 SCALE: 1:1,000 @ A3



N
 W E
 S

REV 00

369600 369700 369800 369900 370000 370100 370200 370300 370400 370500



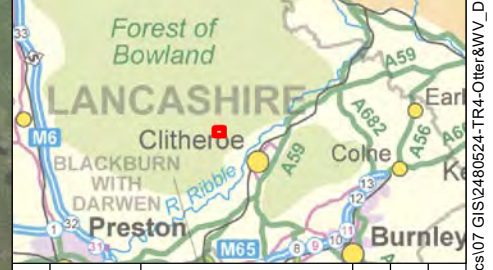
Legend:

- 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	Drm	Chk	App
00	22/04/2021	W512	RG	SP	BF

HARP Aquatics



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

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

REV 00

370300

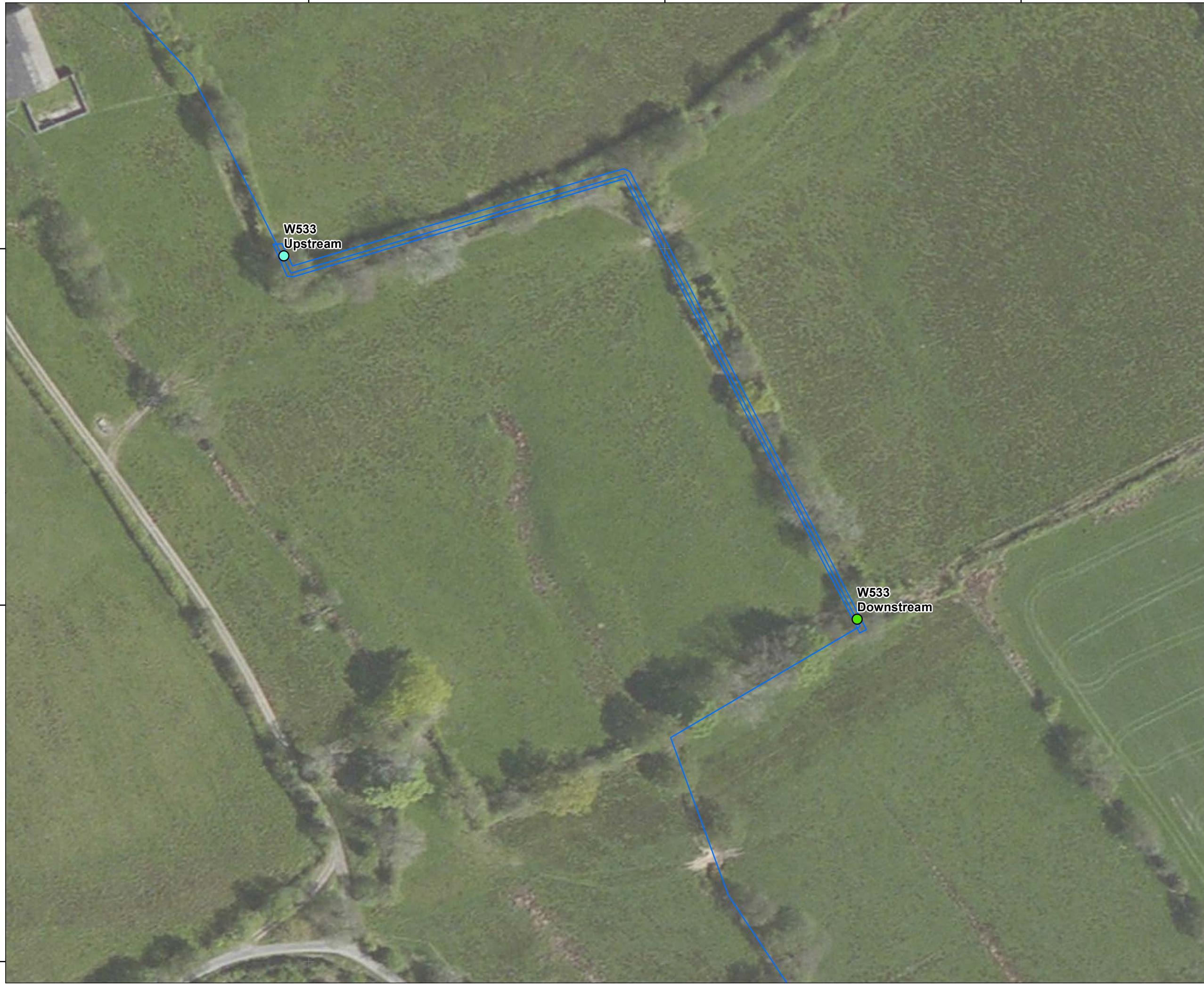
370400

370500

444500

444400

444300



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

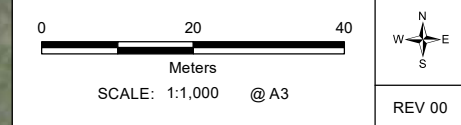
Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter



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

HARP Aquatics

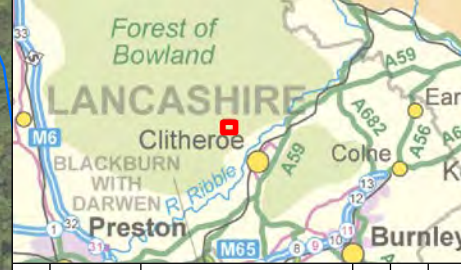
TITLE: Figure 2:
 No Otter or Water Vole Survey Results
 Marl Hill (TR4) - Watercourse W533





- Legend:**
- Waterbody
 - Upstream Survey Extent
 - Downstream Survey Extent
- Potential Water Vole Evidence**
- Burrow
 - ▲ Feeding Signs

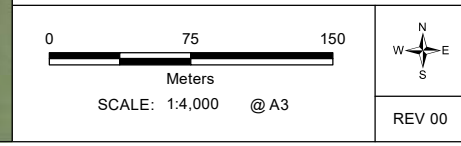
Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter

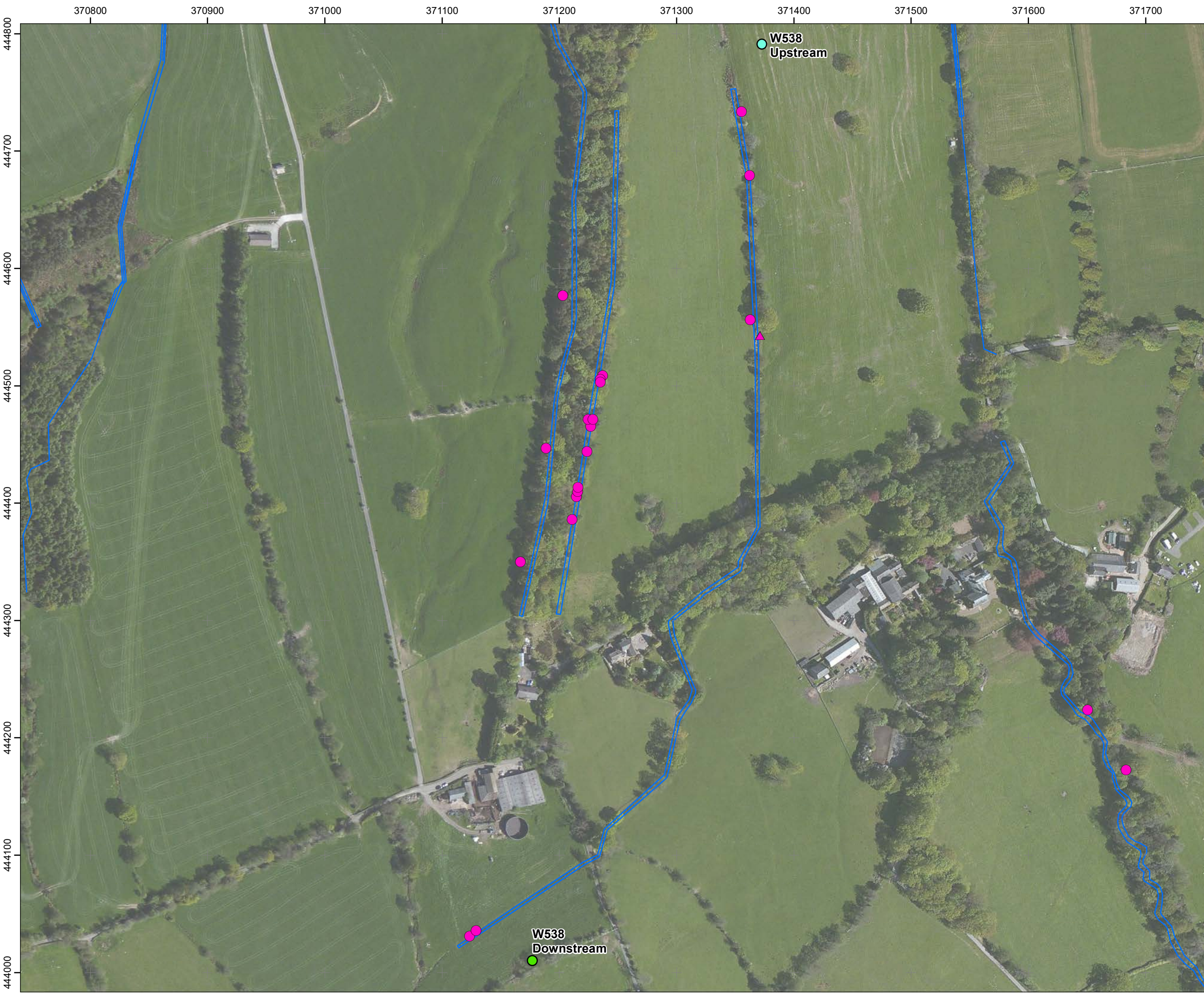


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W530	RG	SP	BF



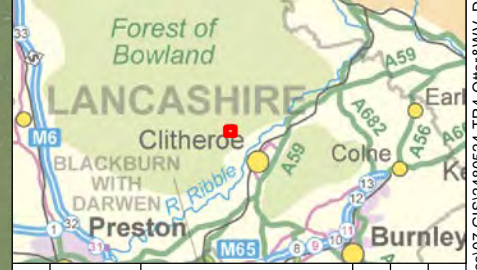
TITLE: Figure 2:
 Water Vole Survey Results
 Marl Hill (TR4) - Watercourse W530





- 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



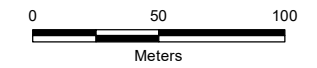
Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W538	RG	SP	BF

HARP Aquatics




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



Meters
 SCALE: 1:3,000 @ A3



REV 00

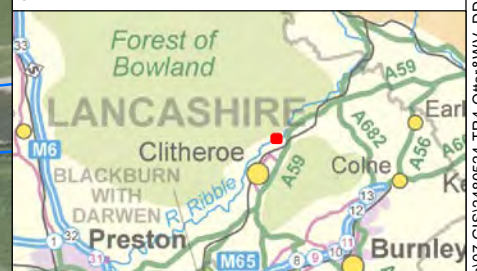
375800 375900 376000 376100 376200 376300 376400

445100
445000
444900
444800
444700
444600



- Legend:**
- Waterbody
 - Upstream Survey Extent
 - Downstream Survey Extent
- Otter Evidence**
- Potential Otter Couch
 - ▲ Otter Spraint
 - ★ Otter Footprint

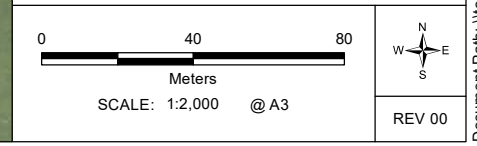
Coordinate System: British National Grid
 Projection: Transverse Mercator
 Datum: OSGB 1936
 Units: Meter



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

HARP Aquatics

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



371900

372000

372100

372200

372300

372400

446300

446200

446100

446000

445900

445800

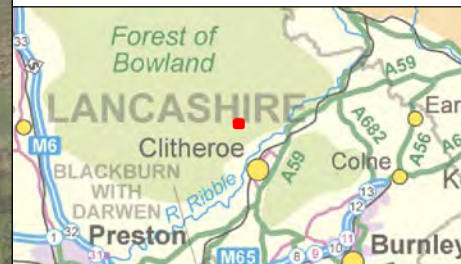
RW17
Upstream

RW17
Downstream

Legend:

- Waterbody
 - Upstream Survey Extent
 - Downstream Survey Extent
 - Potential Otter Couch
 - ▲ Otter Spraint
- Otter Evidence

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



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

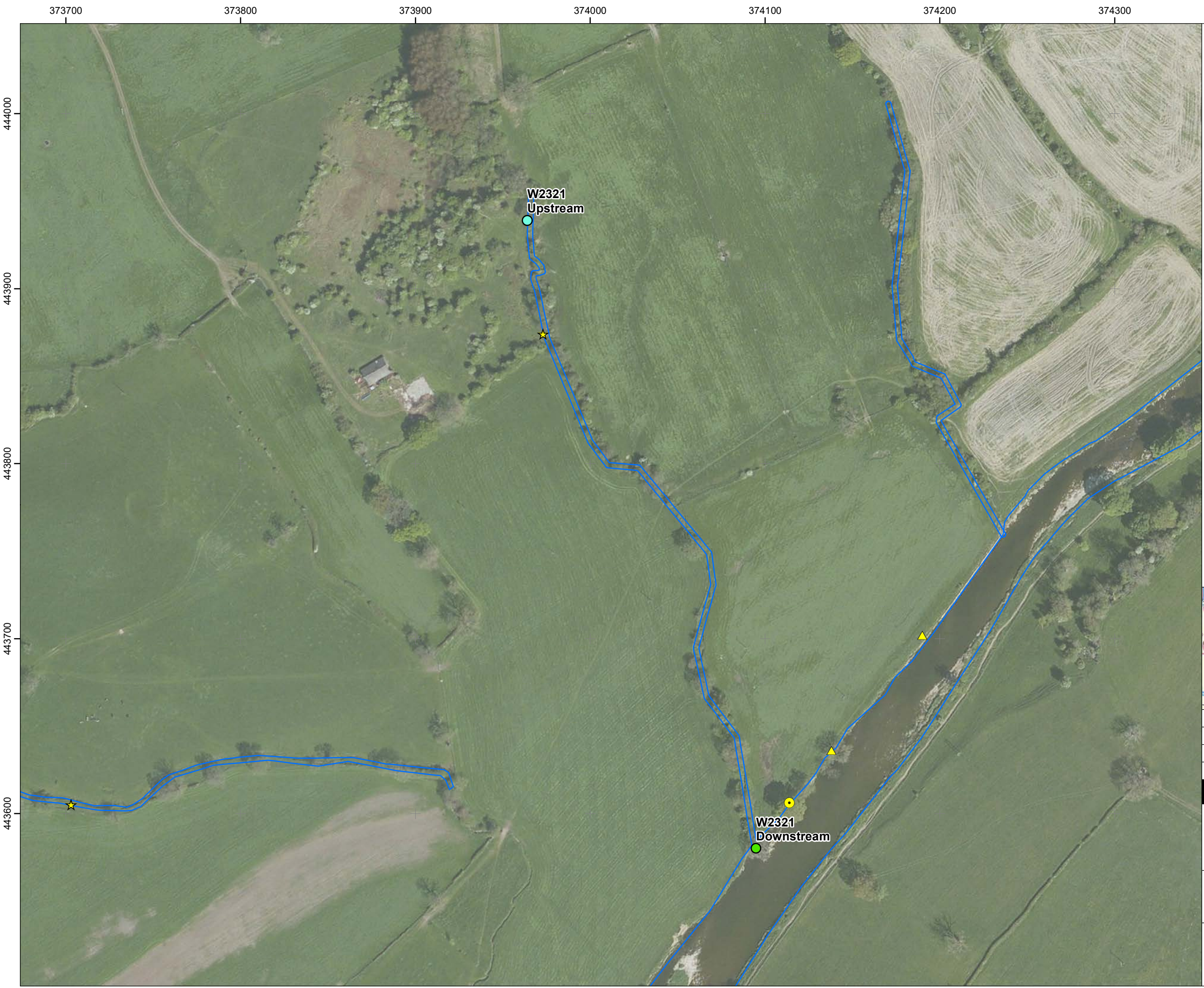
HARP Aquatics



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

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

REV 00



- 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

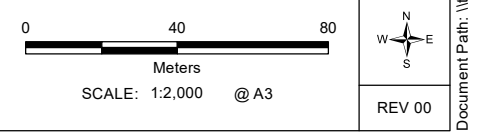


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W2321	RG	SP	BF

HARP Aquatics



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



374000

374100

374200

374300

374400

374500

374600

443900

443800

443700

443600

443500



- 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

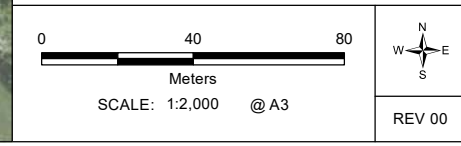


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W2325	RG	SP	BF

HARP Aquatics



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



373300

373400

373500

373600

373700

373800

444000

443900

443800

443700

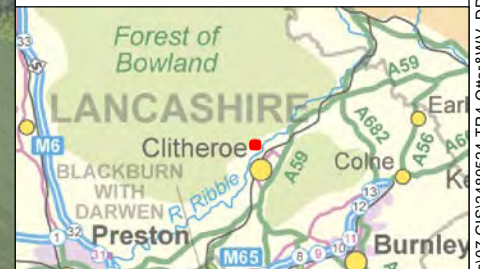
443600



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

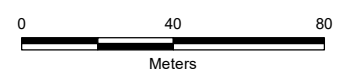


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W2349	RG	SP	BF

HARP Aquatics



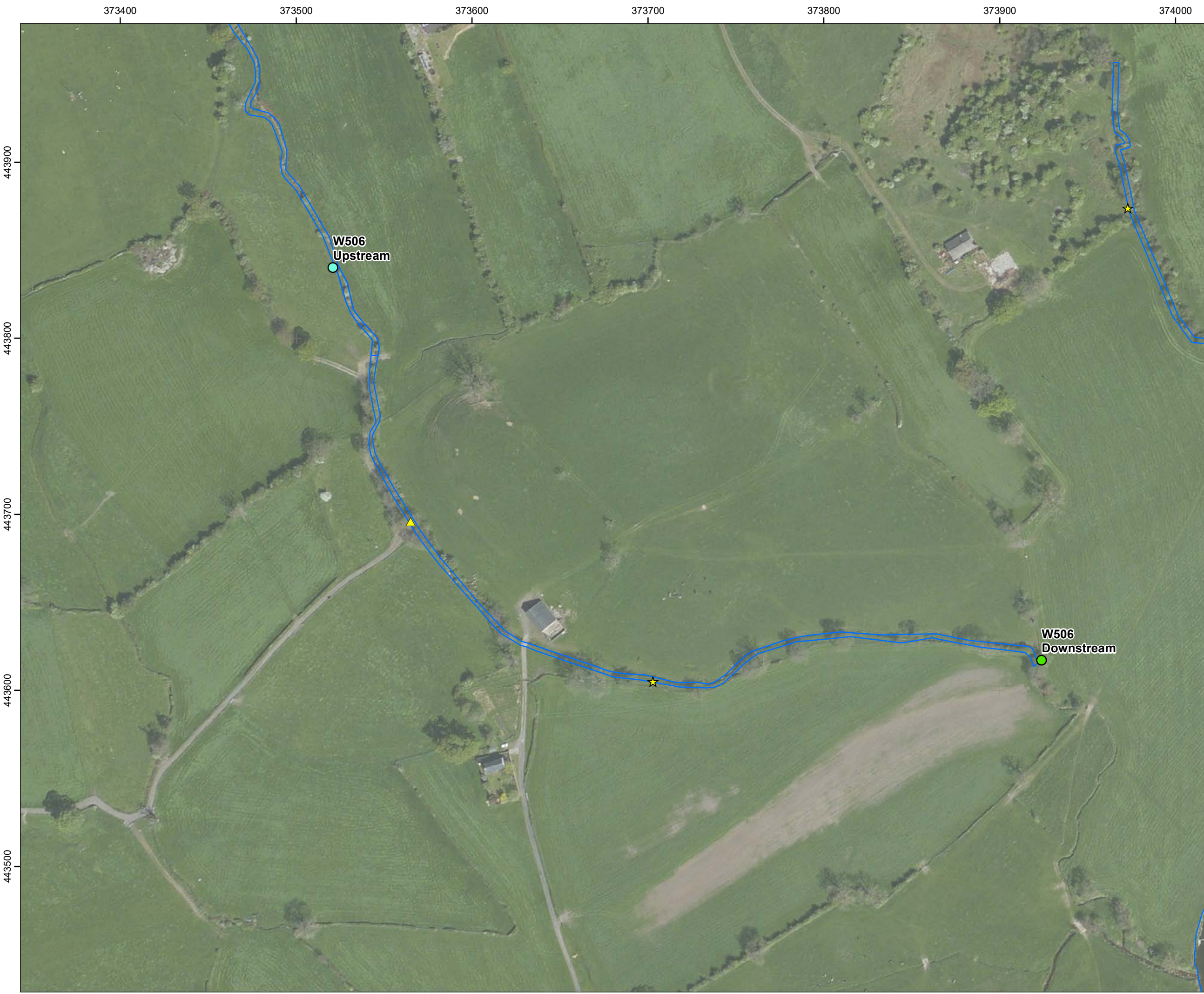
TITLE: Figure 2:
 Otter Survey Results
 Marl Hill (TR4) - Watercourse W2349



SCALE: 1:2,000 @ A3

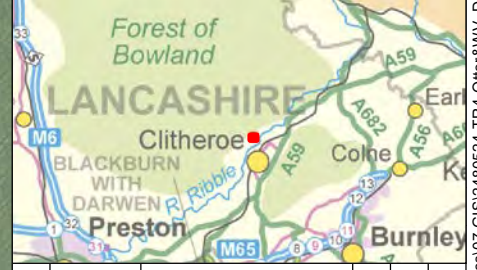


REV 00



- 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	Drm	Chk	App
00	22/04/2021	W506	RG	SP	BF

HARP Aquatics

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

Meters
SCALE: 1:2,000 @ A3

REV 00



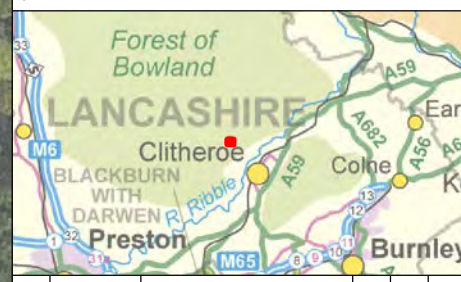
Legend:

- 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	Drm	Chk	App
00	22/04/2021	W537	RG	SP	BF

HARP Aquatics

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

Meters
SCALE: 1:2,000 @ A3

REV 00

371400

371500

371600

445000

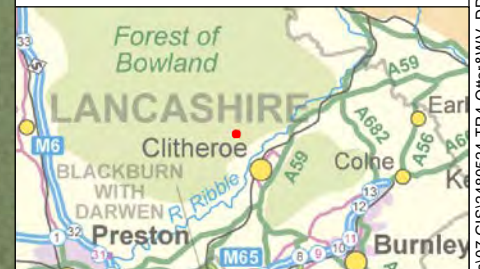
444900



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

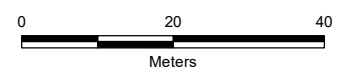


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W520	RG	SP	BF

HARP Aquatics



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



SCALE: 1:1,000 @ A3



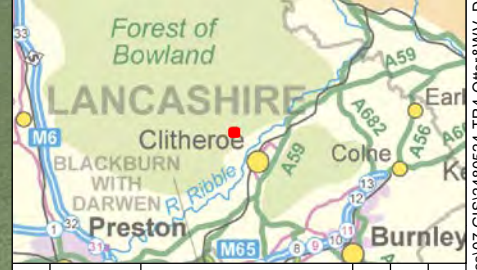
REV 00

371300 371400 371500 371600 371700 371800 371900



- 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

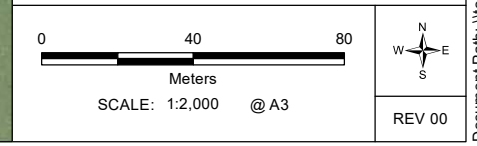


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W520	RG	SP	BF

HARP Aquatics

RSK
biocensus
 EXPERTS IN ECOLOGY

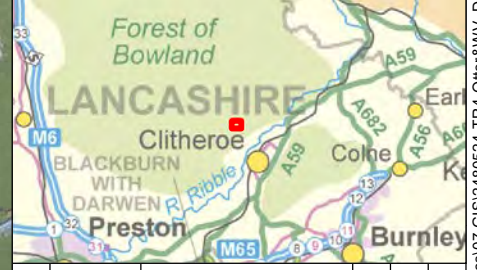
TITLE: Figure 2:
 Water Vole Survey Results
 Marl Hill (TR4) - Watercourse W520





- 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	Drm	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

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 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	<u>Ben Faulkner</u>	Technical and quality reviewer	<u>Matthew Davison</u>
Signature		Signature	
Date:	<u>21 September 2021</u>	Date:	<u>22 September 2021</u>

Project manager Ben Faulkner

Signature 

Date: 21 September 2021

RSK Bio census Ltd (RSK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and RSK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Bio census Ltd.

CONTENTS

1	INTRODUCTION	1
1.1	Purpose of this report	1
1.2	Site information.....	1
2	METHOD	3
2.1	Survey timings	3
2.2	Crayfish surveys	3
2.3	Survey constraints	3
2.4	Biosecurity	3
3	RESULTS	5

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 surveying¹. 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	
	<p>Upstream: 369186 448740 Downstream: 369719 448561</p> <p>No crayfish captured or observed. Suitable habitat present.</p> <p>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.</p> <p>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,</p> <p>The survey extent is bordered by grazed pasture and woodland.</p>
T04: W2349 Coplow Brook	
	<p>Upstream: 373624 443620 Downstream: 373466 444014</p> <p>No crayfish captured or observed. Habitat of moderate suitability at W2349.</p> <p>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.</p> <p>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.</p> <p>Cattle have direct access to the channel at multiple locations within the survey extent and during the</p>



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.

	<p>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.</p> <p>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.</p>
<p>T04: W2348 Unnamed watercourse 2097</p>	
	<p>Upstream: 374169 443996 Downstream: 374236 443779</p> <p>No crayfish captured or observed. Habitat unsuitable at W2348.</p> <p>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.</p>