

## **Appendix B1: Landscape and Visual Addendum**

Document reference: RVBC-MH-TA-006-B1



## Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

### Supplementary Environmental Information

### Appendix B1: Landscape and Visual Addendum

January 2022



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## Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Project No: B27070CT  
Document Title: Proposed Marl Hill Section, Supplementary Environmental Information Appendix B1:  
Landscape and Visual Addendum  
Document Ref.: RVBC-MH-TA-006-B1  
Revision: 0  
Date: January 2022  
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## **1. Introduction**

- 1) This report provides supplementary information to the June 2021 Landscape and Visual Impact Assessment (LVIA) (hereafter referred to as the 'June 2021 LVIA'), which was submitted as Chapter 6: Landscape and Arboriculture, as part of the Proposed Marl Hill Section Environmental Statement for the Haweswater Aqueduct Resilience Programme (HARP) (hereafter referred to as the 'June 2021 Environmental Statement').

### **1.1 Assumptions and Limitations**

- 2) This report assesses the landscape and visual impacts of the revised development proposals when compared to the previous assessment. It should therefore be read in conjunction with the June 2021 LVIA and the June 2021 Environmental Statement.
- 3) The report does not provide supplementary arboricultural information. Supplementary arboricultural information is included within Appendix B2: Off-site Highways Arboricultural Impact assessment and Section 3.4 of the Marl Hill Supplementary Environmental Information report.
- 4) Following submission of the June 2021 planning application, the number of trees within the two construction compounds categorised as being 'at risk' was reduced when compared with number reported in the June 2021 Environmental Statement. This outcome was achieved through additional embedded mitigation measures. With fewer trees being at risk of removal within the two main construction compounds, the number of trees categorised as 'Retained with Protection Measures' (RwPM) has increased.
- 5) These changes are reflected in the updated assessment below, and in the revised Figure 20.1 Environmental Masterplan (Rev 1) (Appendix B9). A review of the photomontages presented in Volume 3 of the Environmental Statement has been undertaken. It is considered that there would be a barely perceptible change in the previously-submitted photomontages resulting from the revised number of tree losses, taking account of the landscape mitigation planting shown on the Proposed Marl Hill Section. As such, the ability to determine the visual impacts arising from the Proposed Marl Hill Section on identified receptors would not be materially altered from the situation described in Volume 2 of the Environmental Statement. The photomontages therefore remain unchanged from the June 2021 LVIA.
- 6) The assessment methodology and criteria used within this report is as per the June 2021 LVIA. Refer to Chapter 6, Section 6.4 of the Proposed Marl Hill Section Environmental Statement for further details.
- 7) Landscape baseline conditions are presented in of Chapter 6, Section 6.5 of the June 2021 Environmental Statement. It has been assumed that these baseline conditions for existing landscape and visual receptors remain as per the June 2021 LVIA.
- 8) The assessment has been undertaken as part of a desk-based exercise only. As such, landscape and visual receptors have not been revisited to reassess the potential change arising from the revised design and embedded mitigation proposals. However, it is anticipated that no material changes in the landscape and visual context of the assessment area have taken place over the intervening period.

## **2. Impacts and Mitigation**

- 9) A review of the proposed design changes described within the Proposed Marl Hill SEI Report has been undertaken to determine whether there would be any change to the landscape and visual effects reported in the June 2021 LVIA.

### **2.1 Landscape Effects**

- 10) The following section summarises the changes to the assessment of landscape effects for the Proposed Bonstone Compound, the Proposed Braddup Compound and the off-site highways works.

#### **2.1.1 Bonstone Compound**

- 11) There would be no change to the likely significant effects on the following affected landscape receptors reported in the June 2021 LVIA. As such, the anticipated landscape effects would remain consistent with those identified within the June 2021 LVIA.

- 2d. Waddington Fell LCA
- 4e. Bowland Limestone Fringes LCA
- 5a. Upper Hodder Valley LCA
- C9. Newton and Birket LCA
- G3. Upper Hodder LCA.

- 12) The amended proposals would result in some very localised changes to the existing vegetation at the Proposed Bonstone Compound with a small number of the previously surveyed trees and tree groups now being retained where previously considered at risk of removal or to be removed. No additional or other previously identified landscape receptors from the June 2021 LVIA would be impacted. This is because the effects of these changes would be negligible and non-material in the context of the landscape effects previously described in Volume 2 of the June 2021 Environmental Statement.

#### **2.1.2 Braddup Compound**

- 13) There would be no change to the likely significant effects experienced by the following affected landscape receptors reported in the June 2021 LVIA. As such, the anticipated landscape effects would remain consistent with those identified within the June 2021 LVIA.

- 4d. Bowland Gritstone Fringes LCA
- 5g. South Bowland Fringes LCA
- C9. Newton and Birket LCA
- D7. Moorcock LCA
- F2. Bolton by Bowland to Waddington LCA
- G7. Browsholme LCA.

- 14) Specific changes at the Proposed Braddup Compound would include a revised layout to the access track / site access off Slaidburn Road; a minor change to the proposed working area near Slaidburn Road; and the additional retention of previously removed trees (woodland, individual trees and tree groups). There would also be the inclusion of temporary Bailey-type bridges along the proposed access track during the enabling works, construction and commissioning phases. No additional or other previously identified landscape receptors from the June 2021 LVIA would be impacted. This is because the effects of these changes would be negligible and non-material in the context of the landscape effects previously described in Volume 2 of the June 2021 Environmental Statement.

### 2.1.3 Off-site highways works

- 15) The construction traffic access strategy through Clitheroe has been updated (refer to Section 3.2.2 and 3.2.3 of the Proposed Marl Hill Section SEI), resulting in the removal of the road widening locations (RW01-RW07) and the parking restriction (PR01).
- 16) Landscape effects would remain consistent with those identified within the June 2021 LVIA. There would continue to be no likely significant effects on identified landscape receptors when determining the impacts arising from the proposed individual works at specific locations. However, intra-project cumulative (in-combination) effects arising from the off-site highways works in combination with the construction activity for the compounds would continue to occur on landscape receptors within the wider area. The intra-project cumulative effects are discussed in Volume 2, Chapter 19 of the June 2021 Environmental Statement and its conclusions would remain the same.

## 2.2 Visual Effects

- 17) The following section summarises the changes to the assessment of visual effects for the Bonstone Compound, the Braddup Compound and the off-site highways works.

### 2.2.1 Bonstone Compound

- 18) There would be a barely perceptible change to all of the identified visual receptors from the June 2021 LVIA, which are listed below for reference. Although the proposed amendments would result in a very minor improvement to some views, they would not result in changes to the previously reported likely significant effects. Affected visual receptors would see the additional retention of a small number of existing individual trees and tree groups within the working area for the compound. However, this visual change would be experienced in the wider context of the other changes at the compound and therefore the judged impacts on visual receptors would remain unchanged from the June 2021 LVIA. No additional visual receptors would be significantly impacted.
  - T3/23: Ribble Valley FP 9
  - T3/24: Crawshaw Farm, Ribble Valley FP 11
  - T3/28: Newton settlement edge, Newton Road to Dunsop Bridge
  - T3/29: The Hearing (Farm), Ribble Valley FP 15
  - T3/30: Fober Farm, Dunsop Road
  - T3/32: The Pendle Witches Way Long distance path, Ribble Valley FP 31 and the surrounding footpath network
  - T3/33: The Hodder Way and the Pendle Witches Way Long distance paths, Ribble Valley FP 31 and the surrounding footpath network
  - T3/34: Long Stripes Farmhouse, Grade II Listed, Ribble Valley FP 26 and the surrounding footpath network
  - T3/35 / TR04\_02: Residential properties Farrowfield and surrounding properties, the Hodder Way Long distance path, Ribble Valley FP 35, FP 40, FP 43 and the surrounding footpath network, Easington Road
  - T3/36: The Hodder Way Long distance path, Ribble Valley FP 26, Hallgate Hill
  - T3/40: Properties within Easington, Tops of the North (Three Shire Heads to Carlisle) Long distance path, Ribble Valley FP 17, FP 18
  - T3/43: Tops of the North (Three Shire Heads to Carlisle) Long distance path, Open Access Land Standridge Hill, Ribble Valley FP 17 and surrounding footpath network
  - T3/44: Tops of the North (Three Shire Heads to Carlisle) Long distance path, Open Access Land Standridge Hill, Ribble Valley FP 17 and surrounding footpath network

- T4/01: Wyndfell Farm, Slaidburn Road
- T4/02: Ribble Valley FP 43
- T4/03: Newlaithe Farm, Ribble Valley FP 43
- T4/04: Ing Barn, Easington Road
- T4/05 / TR04\_01: Slaidburn Road.

### 2.2.2 Braddup Compound

- 19) As a result of the changes to the alignment of the Braddup Compound access track on Slaidburn Road, the following eight visual receptors identified in the June 2021 LVIA would experience a further slight change to their views and visual amenity:
- T4/11: Ribble Valley Bridleway BW 1
  - T4/12: Ribble Valley FP 9
  - T4/14: Ravelston House, Cross Lane
  - T4/13: Bookers Farm, Bookers Barn, A4678 Slaidburn Road
  - T4/15: Colthurst bungalow, Oak Cottage, Cross Lane
  - T4/16: Cross Lane
  - T4/17: Colthurst Farm and surrounding residential receptors
  - T4/18: Braddup House Farm, Grade II Listed, Peter Barn.
- 20) Residents at T4/13: Bookers Farm, Bookers Barn, A4678 Slaidburn Road would experience a further adverse change to views due to the additional loss of an existing length of hedgerow along Slaidburn Road, to the north-west of the properties. Although this change would result in a further deterioration to views and visual amenity, the change would not result in a change greater than the moderate adverse significance of effect reported in the June 2021 Environmental Statement.
- 21) The remaining seven visual receptors would experience an overall increase in the retention of existing trees and woodland within affected views. The proposed temporary Bailey-type bridges along the proposed access track would also be perceptible new features where present, although they would be largely seen against a backdrop of trees and woodland. On balance, this would result in an additional beneficial change to views and visual amenity for these remaining visual receptors, although this change would be experienced in the context of the other changes at the Braddup Compound (e.g. construction activity). There would therefore be no overall change to the likely significant visual effects previously reported in Volume 2 of the June 2021 Environmental Statement.
- 22) The remaining visual receptors identified in the June 2021 LVIA would experience a barely perceptible change or no change to their views and visual amenity. No additional visual receptors would be significantly impacted.

### 2.2.3 Off-site highways works

- 23) Due to the removal of the road widening locations (RW01-RW07) and the parking restriction at Chatburn (PR01), the following visual receptors would not be affected by the off-site highways works and would therefore no longer experience any visual effects from the revised design:
- The users of PRoW 3-11-FP 5 (T4A/28)
  - The users of PRoW 3-21-FP 57 (T4A/26)
  - The community of Grindleton (T4A/25).
- 24) No additional visual receptors would be impacted and the remaining visual receptors from the June 2021 ES would be unaffected by the changes to the off-site highways works through Clitheroe.



## **2.3 Environmental Masterplan**

- 25) The Environmental Masterplan (EMP) (refer to Figure 20.1: Environmental Masterplan (Rev1) (Appendix B9)) comprises a series of drawings illustrating the locations where site-specific mitigation measures are proposed, including mitigation notes to highlight the design response to reduce or offset the identified effects. The EMP covers a limited number of EIA topic areas, namely: Landscape and Arboriculture, Ecology, Cultural Heritage, Water Environment, Public Access and Recreation and Noise and Vibration.
- 26) The EMP has been updated to account for the proposed amendments to vegetation loss and retention at the Bonstone and Braddup Compounds, as well as amendments to the defined working area boundaries. This mitigation strategy follows a similar design approach to the June 2021 Environmental Statement.

### **3. Summary**

- 27) There would be no change to the likely significant effects experienced by the visual and landscape receptors as a consequence of the changes at the Proposed Bonstone and Braddup Compounds. Changes would be localised in nature and experienced in the context of the wider scheme proposals at this compound. No new landscape or visual receptors identified in the June 2021 LVIA would be significantly affected.
- 28) The removal of the road widening locations (RW01-RW07) and the parking restriction (PR01) from the off-site highways works would reduce the likely significant effects experienced by three previously identified visual receptors from the June 2021 Environmental Statement. These receptors would no longer be affected by the proposed off-site highways. No likely significant landscape effects would remain, although intra-project cumulative effects would continue to occur on landscape receptors within the wider area.

## **Appendix B2: Arboricultural Technical Note – Off-site Highways Works**

Document reference: RVBC-MH-V5-P1-B2



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

**Supplementary Environmental Information**

**Appendix B2: Arboricultural Technical Note - Off-site Highways  
Works**

January 2022



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## Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Project No: B27070CT  
Document Title: Proposed Marl Hill Section Supplementary Environmental Information Appendix B2:  
Arboricultural Technical Note - Off-site Highways Works  
Document Ref.: RVBC-MH-V5-P1-B2  
Revision: 0  
Date: January 2022  
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### Appendix A. Reference Material

### Appendix B. Scope and Methodologies

- B.1 Survey Methodology
- B.2 RAG Assessment Methodology
- B.3 Ancient/Veteran Tree Assessment Methodology

### Appendix C. Cascade Chart of Tree Quality Assessment (taken from BS5837:2012)

### Appendix D. Tree Survey Schedule Key

### Appendix E. Tree Survey Schedule including Preliminary AIA impacts

## 1. Introduction

### 1.1 Purpose of Technical Note

- 1) This Technical Note has been developed for various off-site highways works associated with the Proposed Marl Hill Section which forms part of the overall Proposed Programme of Works.
- 2) Seventeen locations across the Proposed Marl Hill Section have been proposed for off-site highways works as part of the enabling works phase. Design information and the Planning Application Boundary for these proposals are shown on RVBC-MH-FIG-V5-P1-003 ' and include the following works:
  - Construction of passing places (typical dimensions approximately 35 m long x 2.5 m wide)
  - Construction of road widening sections (typically 1-2 m widening of the existing carriageway).
- 3) The locations of these design proposals are shown on RVBC-MH-FIG-V5-P1-001 in the June 2021 Environmental Statement. Offsite highways work areas associated with Proposed Marl Hill Section are confined to a single planning authority, Ribble Valley Borough Council.

### 1.2 Basis of Assessment

- 4) The design information used to inform this assessment is referenced in Appendix A. Should further design development impacting on arboricultural resources be proposed at a later date, this technical note should be reviewed and updated accordingly by an appropriately qualified arboriculturist.

### 1.3 Scope of Assessment and Survey Methodology

- 5) As part of a wider arboricultural impact assessment, tree surveys were undertaken at the location of and in proximity to off-site highways work areas associated with the Proposed Marl Hill Section. Reference to trees in this technical note should be taken to include individual trees, woodland, tree groups and hedgerows where appropriate. The technical note has been produced with reference to '*BS 5837:2012- Trees in relation to design, demolition and construction – Recommendations*'<sup>1</sup>. Scope requirements comprised:
  - Surveying and recording information about trees that are potentially impacted by off-site highways works required for the Proposed Marl Hill Section
  - Assessing the potential impact on trees including tree removals
  - Provision of survey information within a technical report.
- 6) The survey considered trees located within and up to 15 m from the Planning Application Boundary for each off-site highways work area, referenced in Appendix A. The spatial scope of surveys is referred to as the 'assessment area' within this technical note. .
- 7) Baseline survey visits to each off-site highways location were undertaken by arboricultural surveyors between January and February 2021. The tree survey was conducted in accordance with BS 5837:2012<sup>2</sup> with the exception of the following deviations:
  - Estimated Remaining Contribution for each survey feature
  - Structural and/or physiological condition details for each survey feature. Key observations on the condition of trees considered unsuitable for retention were included
  - Canopy or branch height dimensions of tree survey features. This information may be required at a later date to determine specific associated pruning requirements. This technical note and RVBC-MH-FIG-V5-P1-003 in the June 2021 Environmental Statement should be provided as a reference

<sup>1</sup> British Standards Institute (2012). *British Standard 5837: 2012 Trees in relation to design, demolition and construction – Recommendations*. London: BSI Ltd.

<sup>2</sup> British Standards Institute (2012). *op. cit.*

document for any associated pruning works specification in line with BS3998:2010 'Tree Work – Recommendations'<sup>3</sup>.

## 1.4 Red Amber Green (RAG) Impact Assessment Methodology

8) The assessment of potential tree impacts has been informed by spatial data parameters calculated with Geographic Information Systems (GIS). The RAG assessment uses traffic light colour symbology and is based upon a survey feature's Root Protection Area (RPA) or canopy constraint relative to the indicative Planning Application Boundary. Full details on the impact assessment methodology are detailed in Section B.2 of Appendix B and are summarised below:

- Red features are trees subject to varying extents of removal based upon stem or canopy encroachment within the Planning Application Boundary. It is understood that vegetation clearance plus soil strip would be fully required within the Planning Application Boundary
- Amber features are trees considered to be a 'Removal Risk Aiming to Retain' (RRAtR) and are determined on the basis of encroachment by the Planning Application Boundary. Individual trees are identified as at risk of removal if the Planning Application Boundary encroaches upon a tree's total RPA by 20 % or over (in square metres). Contiguous/linear features i.e. tree groups, hedgerows or woodland are identified as at risk based upon canopy encroachment within an indicative 'at risk' spatial buffer external to the Planning Application Boundary. The 'at risk' buffer is determined by the RPA of encroached features located outside the Planning Application Boundary. The variable width of this buffer is calculated using the greatest radial RPA value intersected at each separate section of the Planning Application Boundary. RRAtR trees are reported to be removed within the technical note on a worst-case scenario basis
- Green features are considered to be 'Retained with Protection Measures' (RwPM). Encroached RwPM features, considered likely to require protection measures, are identified by an 'E' within the 'AIA' column of the Tree Survey Schedule of Appendix E. Individual trees are identified as RwPM if the Planning Application Boundary encroaches upon a total RPA by below 20 % (in square metres). Contiguous/linear features i.e. tree groups, hedgerows or woodland are identified as RwPM if their canopy does not intersect the indicative 'at risk' buffer outlined in the previous bullet point. Non-encroached RwPM features are identified by a 'N' within the 'AIA' column of the Tree Survey Schedule because no RPA encroachment within the At Risk Buffer is anticipated.

## 1.5 Survey Limitations

9) Limitations to the tree survey include the following key points:

- Plotting the location of trees was based on surveyor use of a GPS-enabled survey tablet and open-source aerial imagery. There was no topographical information relating to tree positions available at the time of the surveys. In common with other GPS-enabled devices GPS records are accurate to within 5 m, therefore all tree positions must be assumed to be indicative for planning purposes only. Later stage verification of all tree feature locations shall be required once a full topographical survey becomes available
- Due to restricted access and safe working limitations at some locations, the stem diameter of some trees was estimated where appropriate rather than measured. This is identified by a '#' suffix within the stem diameter at breast height (DBH) column of the Tree Survey Schedule of Appendix E
- Indicative root RPAs have been calculated for tree groups, hedgerows and woodland and are based on either the maximum or average DBH taken for a collective feature. Limited individual tree data for trees within collective features were recorded e.g. stem count for proposed mitigation
- Additional arboricultural site visits for more detailed tree data recording may be required at a later stage to inform detailed design including:

<sup>3</sup> British Standards Institute (2010). *British Standard 3998:2010 : 2012 Tree work – Recommendations*. London: BSI Ltd.



- The determination of accurate tree clearance limits where tree impacts are expected (including impacts to trees on the external margins of the Planning Application Boundary)
- The formation of a tree protection strategy (i.e. a Site Specific Arboricultural Method Statement (SS-AMS))
- A BS5837:2012 tree survey does not include a specific veteran/ancient tree assessment methodology. Refer to Section B.3 of Appendix B for more details on the adopted Ancient/Veteran Tree Assessment Methodology.

## 1.6 Assessment Limitations

10) Limitations to the assessment include the following key points:

- Indicative assessment of tree removal, trees at risk and tree retention are informed by the RAG methodology outlined in Section B.2 of Appendix B. The RAG status of a feature and spatial extent of tree removals, RRArR trees and RwPM trees are indicatively shown in RVBC-MH-FIG-V5-P1-003
- Tree surveys focus upon trees with a stem diameter of over 75 mm
- This assessment is specific to offsite highways work areas associated with the Proposed Marl Hill Section only. This technical note does not take into account any potential vegetation clearance or mitigation associated with the Arboricultural Impact Assessment submitted as Volume 3, Appendix 6.6 of the June 2021 Environmental Statement.

## 1.7 Assumptions

11) The following assumptions were adopted to support this assessment:

- This assessment is based upon a fixed design for the purposes of a detailed planning application. However, there is potential for the contractor to make amendments to the off-site highways works design at a later date, should the Proposed Marl Hill Section receive planning consent. At a later stage, the contractor may wish to take account of the following potential additional elements / construction details:
  - The provision of full topographical survey of existing tree stems and vegetation extents within the assessment area
  - Location specific detail of new or existing hard surfaced areas to be constructed / improved / demolished including passing places and road widening areas
  - Location specific detail of new/existing drainage infrastructure to be constructed / improved within the Planning Application Boundary
  - Areas requiring soil level changes within the Planning Application Boundary i.e. soil stripping activities or earthwork extents
  - The diversion / removal / reinstatement of underground or overground utility services within the Planning Application Boundary
- It is assumed that the above listed design detail will be positioned outside the constraints of retained tree features shown on RVBC-MH-FIG-V5-P1-003 with no further assessment required.

## 2. Site Observations

### 2.1 Quantitative Results of the Tree Survey

- 12) Full tree survey results are described in the Tree Survey Schedule (Appendix E) and an explanation of terms used in the schedule can be found in Appendices C and D.
- 13) Based upon the grading methodology of BS5837:2012, 'A' grade trees are of high quality and value and should be prioritised for retention where practicable. 'B' grade trees are of moderate quality and value and should be considered for retention where possible, although care should be taken to avoid misplaced retention. Any scheme should take into account the retention and protection of trees, but also the tree's future growth. The 'C' grade trees are of low quality and value and should not place a constraint on the proposals. U grade trees are those that are dead or are showing signs of significant, immediate, and irreversible overall decline.
- 14) Table 1 summarises the number of trees surveyed and their relative grading categories within the assessment area.

**Table 1: Types of tree category and grades within the off-site highways works areas**

BS5837:2012 grades	Trees	Tree Groups	Woodlands	Hedges	Subtotals
A	1	0	0	0	1
B	7	2	0	2	11
C	8	12	0	4	24
U	4	0	0	0	4
<b>Subtotals</b>	<b>20</b>	<b>14</b>	<b>0</b>	<b>6</b>	<b>40</b>

### **3. Discussion**

#### **3.1 Significant arboricultural effects**

- 15) Schedule 4(4) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 highlights the need to describe '*significantly affected...fauna...and landscape*' however there is no recognised methodology or criteria for assessing the significance of effects associated with tree loss. Chapter 6: Landscape and Arboriculture, considers tree loss in the wider context of impacts to landscape character and visual amenity.
- 16) The Woodland Trust defines 'notable trees' to be '*usually a mature tree which may stand out in the local environment because they are large in comparison with other trees around them...in parts of the UK, where trees are less common, a tree may be relatively small...but notable because it is significant in its local environment*'<sup>4</sup>. In the context of national planning policy, significant tree loss is assessed where the following notable features are considered at risk of removal:
- Veteran or ancient trees
  - Ancient woodland
  - Statutorily protected trees.

#### **3.2 Irreplaceable habitat within the assessment area**

- 17) Section 15 paragraph 180d<sup>5</sup> of the National Planning Policy Framework (NPPF, 2021) states that 'development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists'. The NPPF refers to veteran and ancient trees as irreplaceable habitat due to their '*age, size and condition, is of exceptional biodiversity, cultural or heritage value*'.
- 18) A desktop search, made on 23 March 2021, of the Woodland Trust's Ancient Tree Inventory (ATI) database indicates the absence of existing verified veteran or ancient trees within or immediately adjacent to the assessment area. While it is recognised that the ATI is not a definitive database for veteran/ancient trees, it should be noted that no potential veteran or ancient trees were identified within the assessment area, based on the criteria presented in Section B.3 of Appendix B. It should also be noted that no ancient woodland has been identified within or immediately adjacent to the assessment area.

#### **3.3 Statutorily Protected Trees within the assessment area**

- 19) Trees which provide a significant amenity value to a local area may be afforded protection under the Town and Country Planning (Tree Preservation) (England) Regulations 2012 or Town and Country Planning Act 1990. Local planning authority (LPA) checks are underway regarding the status of Tree Preservation Orders (TPOs) within or immediately adjacent to the assessment area.
- 20) Similarly, a Hedgerows Regulations 1997 appraisal is underway and will be reported under separate cover.

#### **3.4 Notable Tree Impacts - overview**

- 21) The proposed off-site highways work areas would result in the loss of trees through both permanent and temporary land-take. The locations of impacted features are indicatively shown in RVBC-MH-FIG-V5-P1-003. Based on the RAG assessment, design proposals would result in:

<sup>4</sup> Woodland Trust (2020) *Notable trees*. [online] Available at: <https://ati.woodlandtrust.org.uk/what-we-record-and-why/what-we-record/notable-trees/> [Accessed: 06 October 2020]

<sup>5</sup> Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework

- The potential cumulative loss of about 26 out of a total 40 tree features within the assessment area i.e. features considered subject to varying extents of removal or assessed to be at risk of removal.

### 3.5 RAG Assessment – preliminary tree removals

22) All features RAG assessed as 'Red' or 'Amber' are reported to be removed for the purposes of this technical note as summarised in Table 2. This table breaks down impacts into feature type, RAG status and category grading.

**Table 2: Summary RAG status table of tree removals (Red and Amber)**

Feature type	RAG status (Red and Amber)			BS5837:2012 grades			
	Removal	Partial removal	RRAtR	A	B	C	U
Tree (T)	8	0	1	0	5	2	2
Tree Group (G)	0	8	4	0	2	10	0
Hedgerow (H)	1	3	1	0	2	3	0
Woodland (W)	0	0	0	0	0	0	0
<b>Subtotals</b>	<b>9</b>	<b>11</b>	<b>6</b>	<b>0</b>	<b>9</b>	<b>15</b>	<b>2</b>

- 23) A total potential tree loss of 20 out of 26 features comprises trees categorised as 'Red'. It should be noted that the RAG assessment is a precautionary approach to reporting impacts with location-specific protection measures not available for 'Red' or 'Amber' features at planning submission stage. It is anticipated that further consideration shall be given to these features as the design process progresses and engineering constraints are further defined.
- 24) Six out of 26 features comprises trees categorised as 'Amber' i.e. margin features encroached by the Planning Application Boundary. Further consideration should be given to 'Amber' trees as the design process progresses and engineering constraints become further defined. RRAtR trees are identified by an amber colour within the 'RAG status' column of the Tree Survey Schedule.

### 3.6 RAG Assessment – preliminary tree retention

- 25) Of the remaining 14 features surveyed five are assessed as encroached but retainable with protection measures. It is understood that encroached vegetation considered RwPM will be subject to pre-construction tree protection measures specified in a SS-AMS and shown on a Tree Protection Plan (TPP). Further mitigation measures designed to protect retained features can be provided by documents listed in Table 4 of Section 3.8.
- 26) Retained trees within the assessment area are tabulated in Table 3 which breaks down tree impacts into feature type, RAG status and category grading.

**Table 3: Summary RAG status table of tree retention (Green)**

Feature type	RAG status (Green)		BS5837:2012 grades			
	RwPM - encroached	RwPM - not encroached	A	B	C	U
Tree (T)	5	6	1	2	6	2
Tree Group (G)	0	2	0	0	2	0
Hedgerow (H)	0	1	0	0	1	0
Woodland (W)	0	0	0	0	0	0
<b>Subtotals</b>	<b>5</b>	<b>9</b>	<b>1</b>	<b>2</b>	<b>9</b>	<b>2</b>

27) Non-encroached features are reported as RwPM due to a general requirement to site verify all surveyed tree feature locations against topographical information prior to construction commencing - see Section 3.7 for general recommendations.

### 3.7 General Recommendations

- 28) It is recommended that site verification of all assessed survey features should reference a full topographical survey of existing stem locations and constraints/impacts updated accordingly.
- 29) It is anticipated that final removal / protection plans would need to be provided in order to satisfy any planning conditions relating to the removal and protection of trees within the planning application boundary.
- 30) Established trees, especially those of mature and above age class, should be prioritised for retention where practicable. Ideally all works should be sited outside the more sensitive RPAs of these trees.
- 31) Alternative working practices should be considered where construction/demolition activities are in close proximity to retained tree RPAs and cannot be avoided

### 3.8 Arboricultural Action Required

32) Table 1.4 lists the standard elements, as referenced in BS5837, to satisfy arboricultural objectives for this scheme if planning permission is granted. These standard elements are recommended to enable appropriate tree protection to be considered and applied throughout the duration of the works.

**Table 4: Follow up arboricultural input relating to this scheme**

Recommended Arboricultural Input	Purpose	Timing
Continued arboricultural support for the project	Technical advice provided during the detailed design phase to avoid tree impacts.	Following any major design changes or advance works design development e.g. provision of topographical survey of existing tree stems and vegetation extents
Site Specific Arboricultural Method Statement (SS-AMS)	The SS-AMS provides contractors with works information to implement aspects of development that are either within the RPA or has the potential to result in loss of or damage to a tree to be retained e.g. ground protection, 'no-dig' construction methods, hand-dig areas or site supervision.	Following final design agreement and all construction detail being made available.

Recommended Arboricultural Input	Purpose	Timing
Tree Protection Plan (TPP)	Provide schematic details of where protective measures (i.e. fencing or ground protection) shall be installed.	Following final design agreement in conjunction with the SS-AMS.
Site monitoring and supervision by the project arboriculturist or Arboricultural Clerk of Works (ACoW)	Ensure protection measures and the method statement are being implemented correctly i.e. for encroached retained features	At agreed intervals before and during the construction phase of the project.

33) It is recommended to maintain contact with the project arboriculturist throughout the planning and design stage for the relevant additional input to be addressed at the appropriate point.

### 3.9 Site Supervision

34) Consideration should be given to a competent project arboriculturist or ACoW visiting the site and monitoring the works at a time agreed at the pre-commencement site meeting. The role of the project arboriculturist/ACoW role is to monitor compliance with arboricultural protection recommendations and providing on site advice on any tree problems that arise or modifications that become necessary.

35) A recommended programme of site supervision will be detailed within the SS-AMS.

## 4. References

Ancient Tree Inventory online database. Available at: <https://ati.woodlandtrust.org.uk/tree-search>

British Standards Institute (2010). British Standard 3998: 2010 Tree Work – Recommendations. London: BSI Ltd.

British Standards Institute (2012). British Standard 5837: 2012 Trees in relation to design, demolition and construction – Recommendations.

Hedgerows Regulations 1997. London: HMSO.

Lonsdale, D. (ed.) (2013). Ancient and other veteran trees: further guidance on management. London: The Tree Council.

Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework.

National Tree Safety Group (2011). Common Sense Risk Management of Trees.

Natural England/Forestry Commission (2018). Ancient woodland, ancient trees and veteran trees: protecting them from development. Standing advice. Available here: <https://www.gov.uk/guidance/ancient-woodland-and-veteran-trees-protection-surveys-licences>

Town and Country Planning Act 1990 (as amended). London: HMSO.

Town and Country Planning (Environmental Impact Assessment) Regulations 2017. London: HMSO.

Town and Country Planning (Tree Preservation) (England) Regulations 2012. London: HMSO.

## Appendix A. Reference Material

Reference name within technical note	Description	Document/drawing title	Document/drawing no.
Planning Application Boundary	The Planning Application Boundary is understood to be based upon the post June 2021 Environmental Statement submission amendments	Planning Application Boundary Proposed Marl Hill Section	RVBC-MH-FIG-003-001B
Off-site highways work areas	At the time of writing, the offsite highways work areas are assumed to comprise of the following layers: <ul style="list-style-type: none"> <li>• Red Line Boundary</li> <li>• Polygons</li> <li>• Polylines</li> </ul>	Marl Hill Arboriculture	RVBC-MH-FIG-V5-P1-003



## Appendix B. Scope and Methodologies

### B.1 Survey Methodology

Table 5 lists the tools and techniques used to conduct the tree survey and the parameters measured.

**Table 5: Survey tools and techniques used**

Parameters Recorded	Tools Used or Estimated
Tree height and cardinal points	Metres measured from ground level using a clinometer and laser distance measure. Cardinal points for tree groups/hedgerows and woodland features are typically reported upon the greatest single lateral crown spread found within the feature.
Stem diameter at breast height (DBH) taken from 1.5 m at ground level for trees over 75 mm DBH. (Unless specified otherwise in tree schedule).	Diameter measuring tape and recorded in millimetres (mm)
Root Protection Area (RPA)	Calculation method in BS 5837:2012 (BSI, 2012)
Tree quality assessment	Cascade chart and grading methodology in BS 5837:2012 (BSI, 2012) – see Appendix C.
Tree location data capture	ArcGIS collector app software on GPS-enabled survey tablet for plotting of features using open source high resolution aerial imagery.

Individual trees are recorded individually if they represent standout features in terms of their age class, DBH or BS5837 category grading as outlined in Appendix C.

At planning submission stage it is considered appropriate to collectively group tree stems when features are the same BS5837 category grading/feature type, similar size/age class/DBH range and are located close together. For tree group, hedgerows or woodland features, the largest or average size stem near the outer margins of each feature was measured. The DBH of this measured tree will then provide the basis of the collective RPA of this group.

The health and condition of trees can change rapidly and all trees, even healthy ones, are at risk from unpredictable climatic and man-made events. The assessment is based on the observed defects of trees at the time of survey by suitably qualified inspectors. The health, condition and safety of trees should be checked on a basis commensurate with the level of risk and preferably on an annual basis, as recommended in *Common sense risk management of trees* (National Tree Safety Group, 2011). The tree survey conducted for this report is not a tree health and safety survey and should not be used as such

## B.2 RAG Assessment Methodology

An interim assessment of potential impacts was made on the basis of the Planning Application Boundary and RAG assessment principles detailed in Table 6 below.

**Table 6: Summary table of RAG status**

RAG status	Parameter/s	Reporting
Red	<p>Survey features considered to be removed on the assumption that full vegetation clearance would be required within the Planning Application Boundary.</p> <p>For individually surveyed trees this is based upon the feature's indicative stem location within the Planning Application Boundary.</p> <p>Impacts on contiguous/linear survey features i.e. tree groups, hedgerows or woodland is based on the feature's direct canopy encroachment within the Planning Application Boundary.</p>	<p>Red features will be figuratively indicated on the below legend items of the 'RVBC-MH-FIG-V5-P1-003 reporting sheets':</p> <ul style="list-style-type: none"> <li>▪ 'Arboriculture Tree Point - RAG Impacts' – for individually surveyed trees</li> <li>▪ 'Arboriculture Tree Group Canopies - RAG Impacts' – for tree groups, hedgerows or woodlands.</li> </ul> <p>Red features are correspondingly reported within the 'RAG Status' column of the Tree Survey Schedule of Appendix E. Trees to be removed or requiring partial removal are identified within the Tree Survey Schedule's 'AIA' column with an 'R' or 'P' respectively.</p>
Amber	<p>Survey features considered at risk are determined on the basis of RPA encroachment by the Planning Application Boundary or 'at risk' buffer.</p> <p>Individual trees are identified as RRAtR if the Planning Application Boundary intersects a tree's RPA by 20 % or over (in square metres). This is based on BS5837:2012's design principle of section 7.4.2 which recommends that <i>"New permanent hard surfacing should not exceed 20% of any existing unsurfaced ground within the RPA"</i>.</p> <p>Margin impacts on contiguous/linear survey features i.e. tree groups, hedgerows or woodland are identified based upon canopy encroachment within an indicative 'at risk' buffer external from the Planning Application Boundary.</p> <p>The 'at risk' buffer is determined by the RPA of encroached features located outside the Planning Application Boundary. The variable width of this 'at risk' buffer is calculated using the greatest radial RPA value intersected at each separate section of the Planning Application Boundary.</p>	<p>Amber features will be figuratively indicated on the below legend items of the 'RVBC-MH-FIG-V5-P1-003 reporting sheets':</p> <ul style="list-style-type: none"> <li>▪ 'Arboriculture Tree Point - RAG Impacts' – for individually surveyed trees</li> <li>▪ 'Arboriculture Tree Group Canopies - RAG Impacts' – for tree groups, hedgerows or woodlands.</li> </ul> <p>Amber features are correspondingly reported within the 'RAG Status' column of the Tree Survey Schedule of Appendix E. Amber features are identified as encroached within the Tree Survey Schedule's 'AIA' column by an 'E'.</p>

RAG status	Parameter/s	Reporting
Green	<p>RwPM survey features are determined on the basis of RPA encroachment by the Planning Application Boundary or 'at risk' buffer.</p> <p>Individual trees identified as RwPM if:</p> <ul style="list-style-type: none"> <li>▪ The Planning Application Boundary intersects a tree's RPA by under 20 % (of total square metres) or</li> <li>▪ There is no RPA encroachment by the Planning Application Boundary.</li> </ul> <p>Margin impacts on contiguous/linear survey features i.e. tree groups, hedgerows or woodland are identified based upon canopy encroachment within the indicative 'at risk' buffer from the Planning Application Boundary.</p>	<p>Green features will be figuratively indicated on the below legend items of the 'RVBC-MH-FIG-V5-P1-003 reporting sheets':</p> <ul style="list-style-type: none"> <li>▪ 'Arboriculture Tree Point - RAG Impacts' – for individually surveyed trees</li> <li>▪ 'Arboriculture Tree Group Canopies - RAG Impacts' – for tree groups, hedgerows or woodlands.</li> </ul> <p>All encroached RwPM features are identified within Tree Survey Schedule's 'AIA' column by an 'E'. Non-encroached RwPM trees are identified by a 'N' within the 'AIA' column.</p>

### **B.3 Ancient/Veteran Tree Assessment Methodology**

Arboricultural surveys at this stage of the project have been undertaken based on BS5837: 2012 surveying guidance. The initial assessment of potential ancient and veteran trees is determined by surveyor experience, site surveyors' observations/comments and site photographs. Arboricultural surveyors determine this potential status of trees using visual tree assessment methods and the observation of features that include but are not limited to the list below:

- Tree species
- Life stage and tree size
- Extensive decay/hollowing
- Crown retrenchment/senescence
- Large quantity of crown deadwood
- Major limb fractures/storm damage
- Habitat spaces such as decay holes/hazard splits/crevices
- Presence of fungi, sap runs/slime flux
- Presence of epiphytic plants/lichens
- Bark loss/lightning strikes
- Water pools/aerial rooting.

Within publications and guidance offered by various organisations and government bodies such as the Woodland Trust and Natural England there is no agreed definition on what constitutes an ancient or veteran tree. Based on Annex 2 of the NPPF, the definition of an ancient or veteran tree is taken to be:

*'A tree which, because of its age, size and condition, is of exceptional biodiversity, cultural or heritage value. All ancient trees are veteran trees. Not all veteran trees are old enough to be ancient but are old relative to other trees of the same species. Very few trees of any species reach the ancient life-stage'*

The emphasis within the above statement is on the word 'exceptional', which by its own definition creates a level of subjectivity amongst arboriculturists and other disciplines e.g. Ecology.

Following on from the Veteran Tree Initiative (English Nature 1996-2000), there have been various publications detailing tree characteristics associated with aging trees. In addition, some systems have been published and used to formalise surveying of ancient, veteran and notable trees such as Special Survey Method (SSM) developed by Treework Environmental Consultancy and Recognition of Ancient Veteran and Notable Trees (RAVEN) developed by Forbes Laird Arboricultural Consultancy.

Indicative RPAs are reported based upon the guidance provided within BS5837:2012 and shown figuratively in the TCAP and PTRP. Indicative protection buffers based on Governmental Standing Advice for ancient and veteran trees in England should also be considered at a later stage to inform detailed design. These greater protection zones are also shown figuratively in the TCAP and PTRP as a separate legend item entitled 'Standing Advice Buffer Zone'. Governmental Standing Advice recommends a minimum 15 m buffer zone from Ancient Woodland and potentially larger distances for ancient and veteran trees which is:

- Calculated as a minimum of 15 times larger than the diameter of the tree; or
- 5 m from the edge of the tree's canopy if greater than the above value.

## Appendix C. Cascade Chart of Tree Quality Assessment (taken from BS5837:2012)

Category and definition	Criteria (including subcategories where appropriate)		
<b>Trees unsuitable for retention (see note)</b>			
<b>Category U</b>			
Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years	Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning)		
	Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline		
	Trees infected with pathogens of significance to health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve.		
<b>Trees to be considered for retention</b>			
	<b>1 Mainly arboricultural qualities</b>	<b>2 Mainly landscape qualities</b>	<b>3 Mainly cultural values including conservation</b>
<b>Category A</b>			
<b>Trees of high quality</b> with an remaining estimated life expectancy of at least 40 years	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands of particular visual importance as arboricultural and/or landscape features	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran or semi-formal arboricultural trees or wood-pasture)
<b>Category B</b>			
<b>Trees of moderate quality</b> with an remaining estimated life expectancy of at least 20 years	Trees that might be included in Category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage), such as they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality	Trees with material conservation or other cultural value
<b>Category C</b>			
<b>Trees of low quality</b> with an remaining estimated life expectancy of at least 10 years, or younger trees with a stem diameter below 150mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value

## Appendix D. Tree Survey Schedule Key

Column Header	Explanation
Tree ID and Est.	<p>T – Tree  G – Group  W – Woodland  H - Hedgerow  # – DBH measurements estimated due to access restrictions or safety concerns. Observations limited to those made from a distance or full access to tree impeded (e.g. prolific ivy, uneven ground, brambles etc).</p>
Diameter at breast height (DBH)	<p>Tree stem diameter measured at 1.5 m from the ground. This reported figure relates to either single stemmed trees or the calculated DBH for multi-stemmed trees. In some instances, DBH will be taken from a different height as specified in ‘Observations’</p>
Canopy spread – N E S W	<p>Canopy extents from main stem of individual tree will be shown using cardinal points in metres i.e. N (north) 7, E (east) 6, S (south) 5, W (west)7. Single largest canopy extent reported for groups/woodland/hedgerows.</p>
Age Class	<p>Young (Y) – A tree in the first quarter of its life span.  Semi Mature (SM) – A tree in the latter stages of its first quarter, well established.  Early Mature (EM) – A tree half way through its life span, significant further growth potential.  Mature (M) – A tree at or near its potential maximum size which is still growing vigorously in its third quarter of life span.  Over Mature (OM) – A tree in decline in its final quarter of life span.  Potential Veteran (V) – A tree which, because of its age, size and condition, is of exceptional biodiversity, cultural or heritage value. Refer to Section B.3 of Appendix B for more context.</p>
Root Protection Area (RPA) radius	<p>Root Protection Area dimensions as calculated using formulae in BS5837:2012. Applied as either radially from an individual tree stem (individually surveyed trees) or as an off-set from the canopy extents of a collective feature (tree group, hedgerow or woodland).</p>
AIA	<p>R - Remove  P – Partial removal  E - Encroached RPA/canopy  N - No encroachment</p>
RAG status	<p>Refer to symbology explained in Appendix B Section B.2</p>

## Appendix E. Tree Survey Schedule including Preliminary AIA impacts

Tree Ref. No.	Species	Height (m)	DBH (mm)	Canopy spread (m)				Age class	General Observations and Comments	Category grading	RPA radius (m)	AIA	RAG status
				N	E	S	W						
T76	Hawthorn	4	186	2	1	2	2	Y	Small, self-seeded roadside tree. Unremarkable. 4 stems: #150 and #110 mm DBH; 2 stems undersize.	C1	2.2	N	Green
T77	Hawthorn	2	100	2	2	2	2	SM	Small, self-seeded roadside tree. Unremarkable. 3 stems; 2 stems undersize.	C1	1.2	R	Red
T78	Hawthorn	4	100	2	2	2	2	SM	Small, self-seeded roadside tree. Unremarkable. Average stem diameter recorded.	C1	1.2	R	Red
T79	Hawthorn	5	180	3	3	3	4	M	Multi stemmed from circa 0.5 m. Roadside tree elevated above highway on sloped verge. Not particularly remarkable but good form and healthy.	B1	2.2	R	Red
T80	Common ash	6	160	1	2	2	1	SM	Beyond roadside wall, west of ditch at field boundary. Horses in field, limited inspection from roadside. Dead tree; Chalara ash dieback.	U	1.9	R	Red
T81	Hawthorn	6	443	3	4	4	2	M	Mature example of species at roadside, west of wall in verge. Twin stemmed: DBH 190 & #400. Acute union between stems; natural brace above. Crown reduced west, roadside. Healthy.	B1	5.3	R	Red
T82	Common ash	5	110	1	1	1	1	SM	Dead tree; Chalara ash dieback.	U	1.3	R	Red

Tree Ref. No.	Species	Height (m)	DBH (mm)	Canopy spread (m)				Age class	General Observations and Comments	Category grading	RPA radius (m)	AIA	RAG status
				N	E	S	W						
T83	Hawthorn	4	330	3	4	2	1	M	Mature example of species at roadside, west of wall in verge. Crown reduced west, roadside. Healthy.	B1	4.0	R	Red
T84	Common ash	9	470	3	5	4	5	EM	Roadside tree in narrow verge, immediately east of stone wall. Many lower twigs dead. Chalara ash dieback symptoms observed.	C1	5.6	E	Green
T85	Common ash	11	500	5	6	5	6	EM	Roadside tree in narrow verge, immediately east of stone wall. Many lower twigs dead. Chalara ash dieback symptoms observed. Twin stemmed: DBH 400 300. Well established basal epicormic shoots; dead with <i>Daldinia concentrica</i> fruiting bodies.	C1	6.0	E	Green
T86	Elm sp.	12	438	7	6	7	5	SM	Layered elm that has matured to notable height at roadside. 11 stems #: 150, 350, 310, 330, 190, 190, 200, 110, 140, 90 and 200 mm DBH. Ave. 132 mm DBH.	B1	5.3	N	Green
T87	Common ash	17	1100	5	7	6	3	M	Large roadside tree. Reduced vigour, Chalara ash dieback likely causal but unable to confirm, limited visibility from ground level. Dense ivy throughout entire structure into canopy, may be obscuring defects, very limited inspection. Recommend spring / summer risk and condition inspection.	B1	13.2	R	Red



Tree Ref. No.	Species	Height (m)	DBH (mm)	Canopy spread (m)				Age class	General Observations and Comments	Category grading	RPA radius (m)	AIA	RAG status
				N	E	S	W						
T88	Common ash	17	1200	7	8	8	9	M	Large roadside tree. Reduced vigour, chalara ash dieback likely causal but unable to confirm, limited visibility from ground level. Dense ivy throughout entire structure into canopy, may be obscuring defects, very limited inspection.	U	14.4	N	Green
T91	Sycamore	8	500	2	7	6	7	EM	Survey data used from main ES surveys. Decking tree east of field boundary fence line atop small bund. Exposed, damaged roots west. Limb failures. Remaining canopy biased south east. Tree in decline with stem hollow, fungal rot at base and knot holes.	C3	6.0	N	Green
T92	Pedunculate oak	12	650	6	5	5	5	M	Open grown tree atop small bund at field boundary fence. Healthy with no significant defects observed.	B1	7.8	N	Green
T97	Pedunculate oak	12	600	3	5	4	5	EM	Roadside tree set back within field. Declining with stag headed form; deadwood to c. 100mm diameter, low risk to road users. Remaining canopy healthy.	C1	7.2	N	Green
T99	Common beech	10	600	5	6	5	5	M	Roadside tree in hedgerow with moderate form. Many winter buds, bursting. Crown raised west over road; slight asymmetric crown shape biased east. Bifurcate at c. 1.5m, ivy covering unions but appear acute; may contain included bark. Healthy.	B1	7.2	E	Amber

Tree Ref. No.	Species	Height (m)	DBH (mm)	Canopy spread (m)				Age class	General Observations and Comments	Category grading	RPA radius (m)	AIA	RAG status
				N	E	S	W						
T100	Sycamore	17	900	5	8	8	7	M	Large, mature tree on third party residential land. Wide, spreading canopy. Appears healthy with no significant defects. Limited access and inspection, surveyed from distance at roadside to west. Burring on limbs. Ivy on trunk.	A1	10.8	E	Green
T101	Oak sp.	9	750	1	1	3	6	M	Large, standing dead tree at roadside, atop c. 1m high earth bund. Mature ivy cover colonised entire structure, limited visibility. Weight biased west. Recommend fell tree.	U	9	E	Green
T102	Common ash	17	450	3	4	3	3	EM	Growing from bund immediately at roadside. Reduced vigour, likely Chalara ash dieback; Limited visibility from ground level to observe symptoms. Ivy developing up trunk.	C1	5.4	E	Green
G113	Goat willow, grey willow	9	240	3	3	3	3	SM	Survey data used from main ES surveys. Fair condition. Patchy group located within working quarry.	C2	2.9	E	Amber
G114	Cypress sp.	5	90	2	2	2	2	SM	Small copse of planted trees, fenced off in field; set back from road circa 12-15 m. Limited access and inspection from roadside.	C2	1.1	N	Green
G115	Cypress sp.	4	90	2	2	2	2	SM	Small copse of planted trees, fenced off in field; set back from road. Limited access and inspection from roadside.	C2	1.1	N	Green
G116	Hawthorn, holly	4	300	3	3	3	2	EM	Self-seeded roadside trees, unremarkable. Max. DBH estimated at 0.5 m from roadside.	C2	3.6	P	Red

Tree Ref. No.	Species	Height (m)	DBH (mm)	Canopy spread (m)				Age class	General Observations and Comments	Category grading	RPA radius (m)	AIA	RAG status
				N	E	S	W						
G117	Common ash, hawthorn	12	600	6	6	6	6	M	Linear roadside group of middle aged to mature ash with hawthorn beneath. Lower canopies of ash dead with epicormic response; canopies displaying reduced vigour. Chalara ash dieback observed. Hawthorn healthy but unremarkable.	C2	7.2	P	Red
G118	Common ash, sycamore, hawthorn, holly	10	400	4	4	4	4	SM	Linear group of unremarkable roadside trees. Predominantly ash in reduced health and condition; Chalara ash dieback observed. Many stems reduced beneath utility wires. Partial screening along road but numerous gaps. Largest DBH estimated (felled tree with basal epicormic regrowth); majority of stems average 150 mm DBH.	C2	4.8	P	Red
H119	Hawthorn, holly, common beech	5	150	2	2	2	2	SM	Roadside hedgerow, outgrown but managed at roadside. Max. DBH recorded; majority of stems <100 mm DBH. Layered stems.	B2	1.8	P	Red
H121	Hazel, blackthorn	2	180	1	1	1	1	M	Section of roadside hedge. Appears historically layered with stems up to circa 180 mm diameter; majority of arising stems <75 mm DBH. Limited visibility, ivy.	B2	2.2	R	Red
G122	Hawthorn, hazel	5	200	3	3	3	3	M	Outgrown layered stems at boundary between field parcels; likely managed as hedgerow historically. Healthy. Layered stems up to circa 200 mm diameter; majority of arising stems <75 mm DBH.	C2	2.4	P	Red

Tree Ref. No.	Species	Height (m)	DBH (mm)	Canopy spread (m)				Age class	General Observations and Comments	Category grading	RPA radius (m)	AIA	RAG status
				N	E	S	W						
H123	Hawthorn	1	100	1	1	1	1	SM	Portion of roadside hedge, neatly clipped. Layered stems up to circa 100 mm diameter; numerous arising stems <75 mm DBH.	C1	1.2	E	Amber
H124	Hawthorn	1	100	1	1	1	1	SM	Roadside hedge, neatly clipped. Layered stems up to circa 100 mm diameter; majority of arising stems <75 mm DBH.	C1	1.2	P	Red
H125	Common beech, cherry laurel	1	75	1	1	1	1	SM	Third party hedge. Limited access and inspection. Majority of stems appear <75 mm diameter, limited visibility.	C1	0.9	N	Green
H126	Holly, cherry Laurel	2	75	1	1	1	1	SM	Third party hedge. Limited access and inspection. Stems may be <75 mm diameter, limited visibility.	C1	0.9	P	Red
G127	Common beech, field maple, fir sp.	7	180	2	2	2	2	SM	Some third-party conifers. Outgrown broadleaf hedge stems.	C2	2.2	P	Red
G128	Sycamore, common beech, field maple	8	300	3	3	3	3	SM	Relatively young roadside trees within outgrown hedgerow along residential garden boundary. Screening function. Healthy.	C2	3.6	P	Red
G129	Sitka spruce	9	200	2	2	2	2	SM	Linear shelter belt within third party garden, screening function roadside boundary. Healthy. Estimated from roadside.	C2	2.4	P	Red

Tree Ref. No.	Species	Height (m)	DBH (mm)	Canopy spread (m)				Age class	General Observations and Comments	Category grading	RPA radius (m)	AIA	RAG status
				N	E	S	W						
G130	Sycamore, pedunculate oak, field maple, common ash, common beech	18	600	7	7	7	7	EM	Mature roadside trees growing atop and beyond steep, circa 1, tall verge side bund; limited access and inspection from roadside. Occasional ash that lacks in vigour; likely Chalara ash dieback infection. Ivy cover on most trees	B2	7.2	E	Amber
G131	Hawthorn, holly, hazel, sycamore, common ash, goat willow	6	100	2	2	2	4	EM	Understorey trees to western edge of linear group of mature roadside trees. Located atop and beyond densely vegetated, steep roadside bund, limited access and inspection from roadside. Group bounds and slightly spills out into residential garden to south. Average stem diameter recorded.	C2	1.2	E	Amber
G132	Sycamore, common ash, pedunculate oak	11	580	5	5	5	5	EM	Large roadside trees displaying reduced vigour and structural defects. Chalara ash dieback likely causal factor of reduced vigour in ash. Ivy cover. Limited visibility and inspection from roadside.	C2	7.0	E	Amber
G133	Sycamore, pedunculate oak, field maple, common beech	12	600	5	5	5	5	M	Mature roadside trees growing atop and beyond steep, circa 1, tall verge side bund; limited access and inspection from roadside. Ivy cover on most trees. Small diameter deadwood over road, low risk.	B2	7.2	P	Red



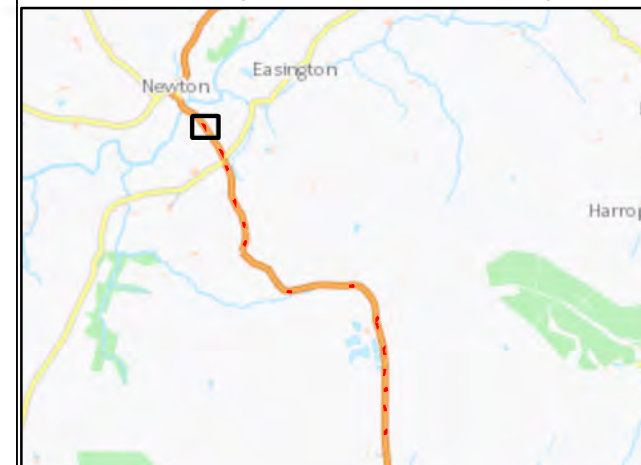
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**Label Abbreviations:**  
 PP – Passing Place, RW - Road Widening



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SCALE 1:1,000	SHEET SIZE A3
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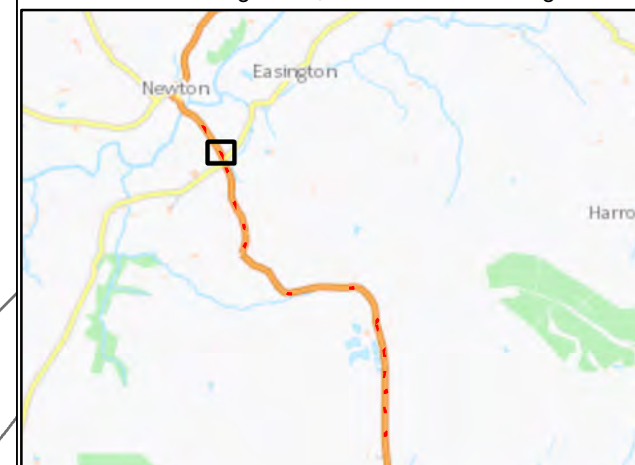
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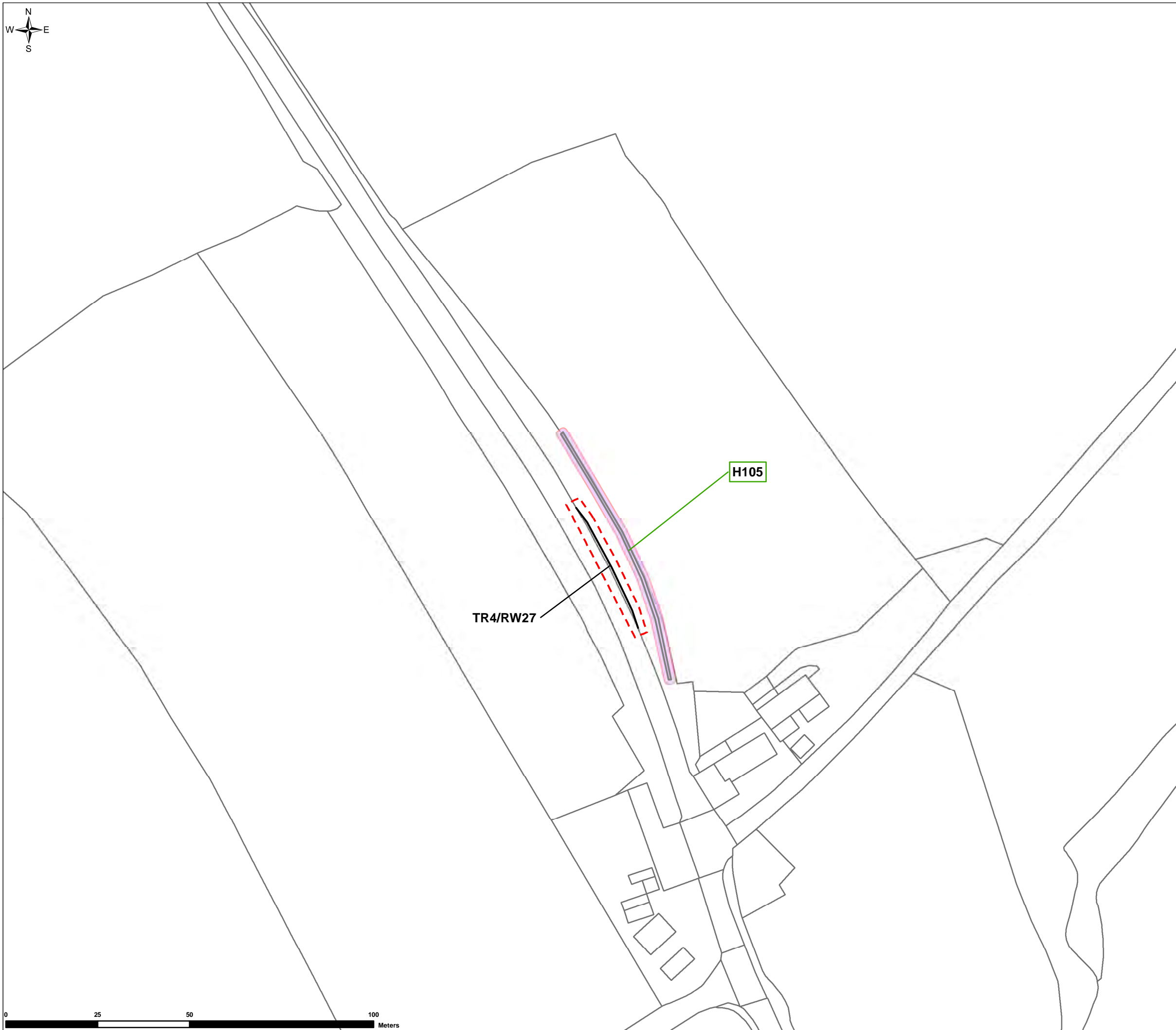


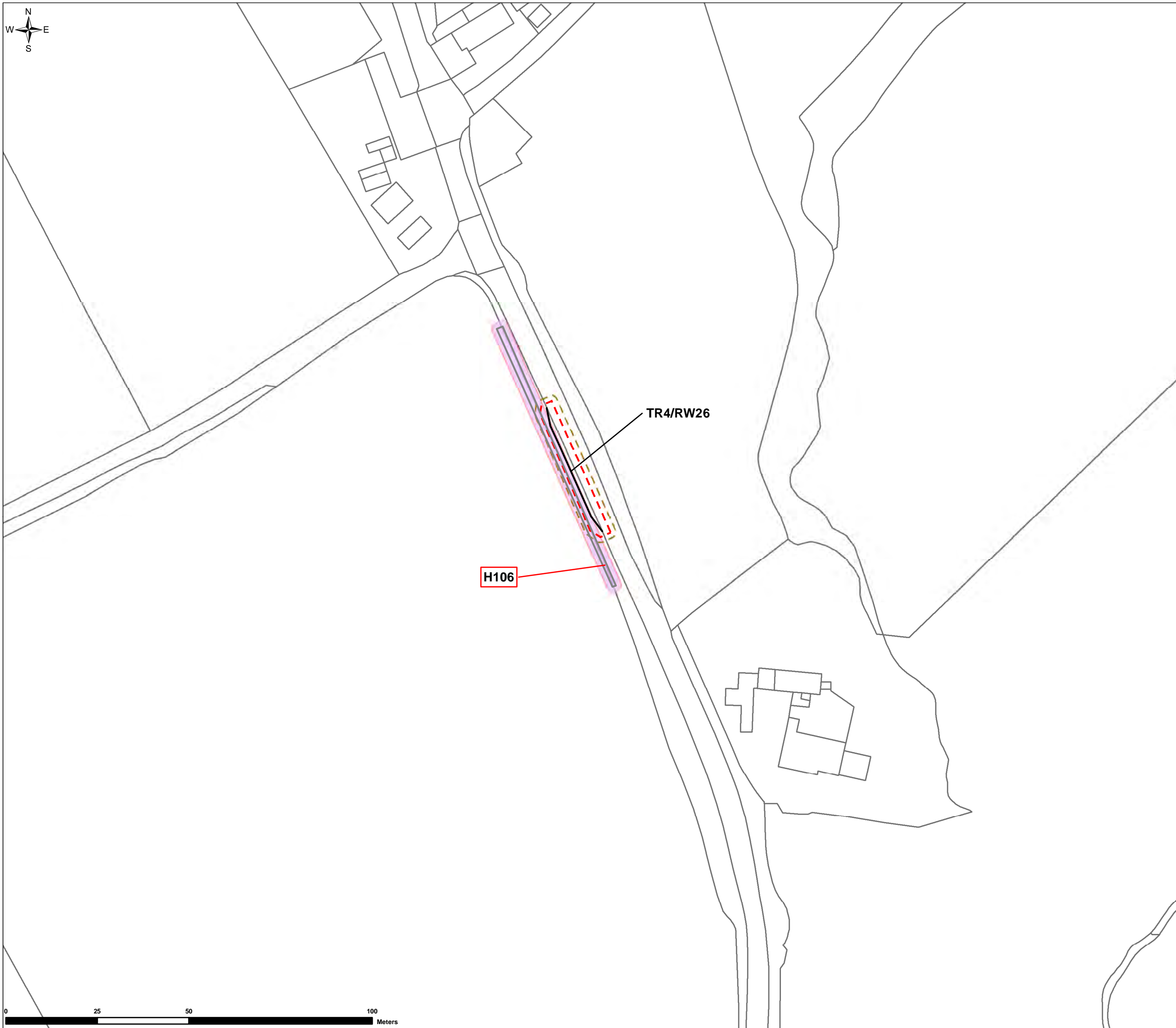
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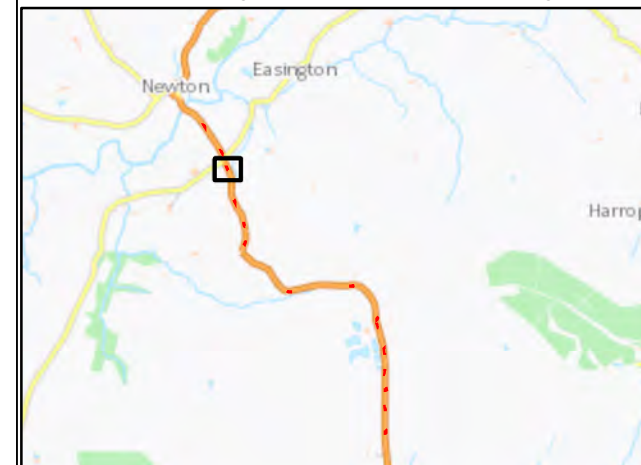
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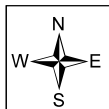


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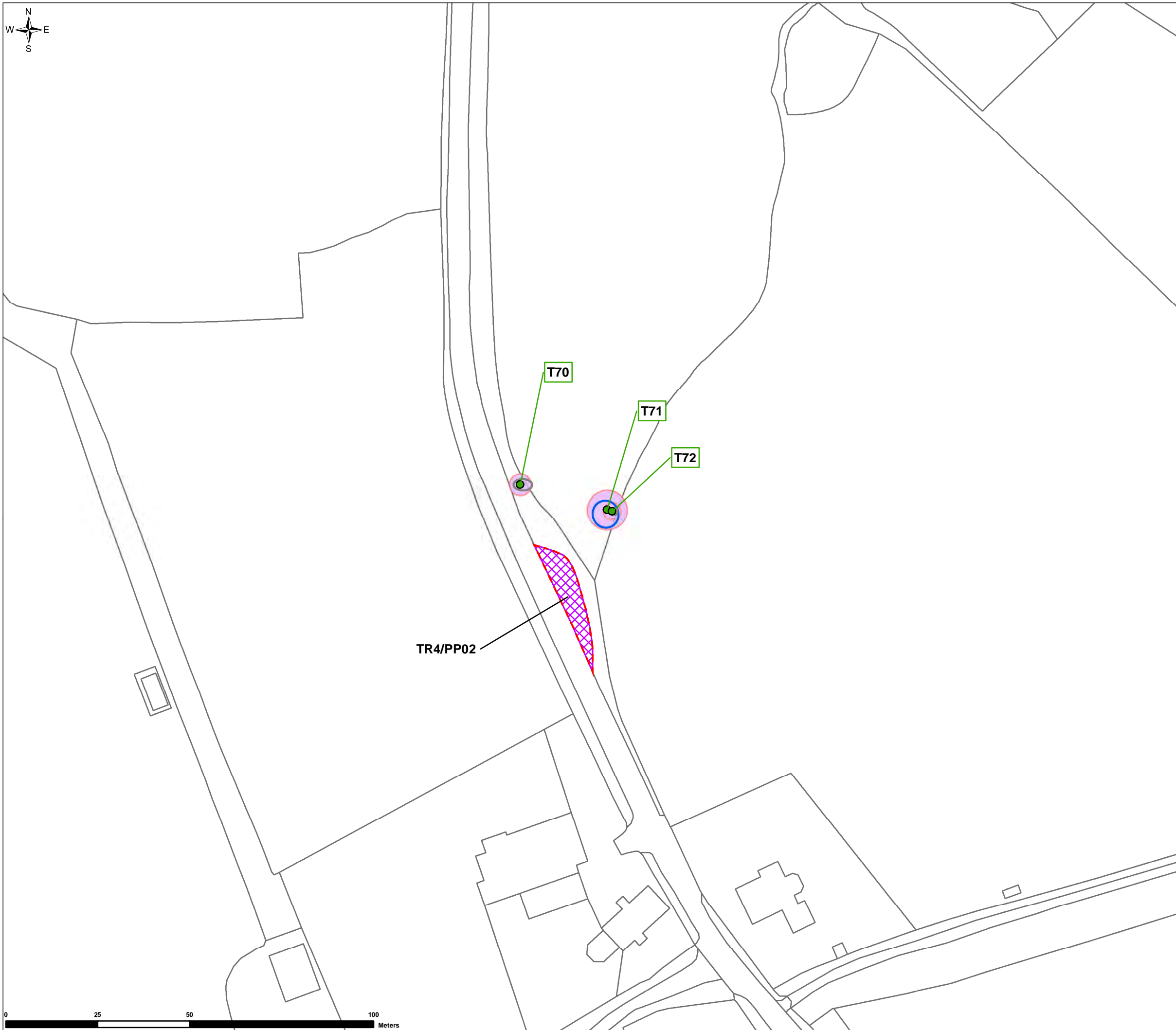


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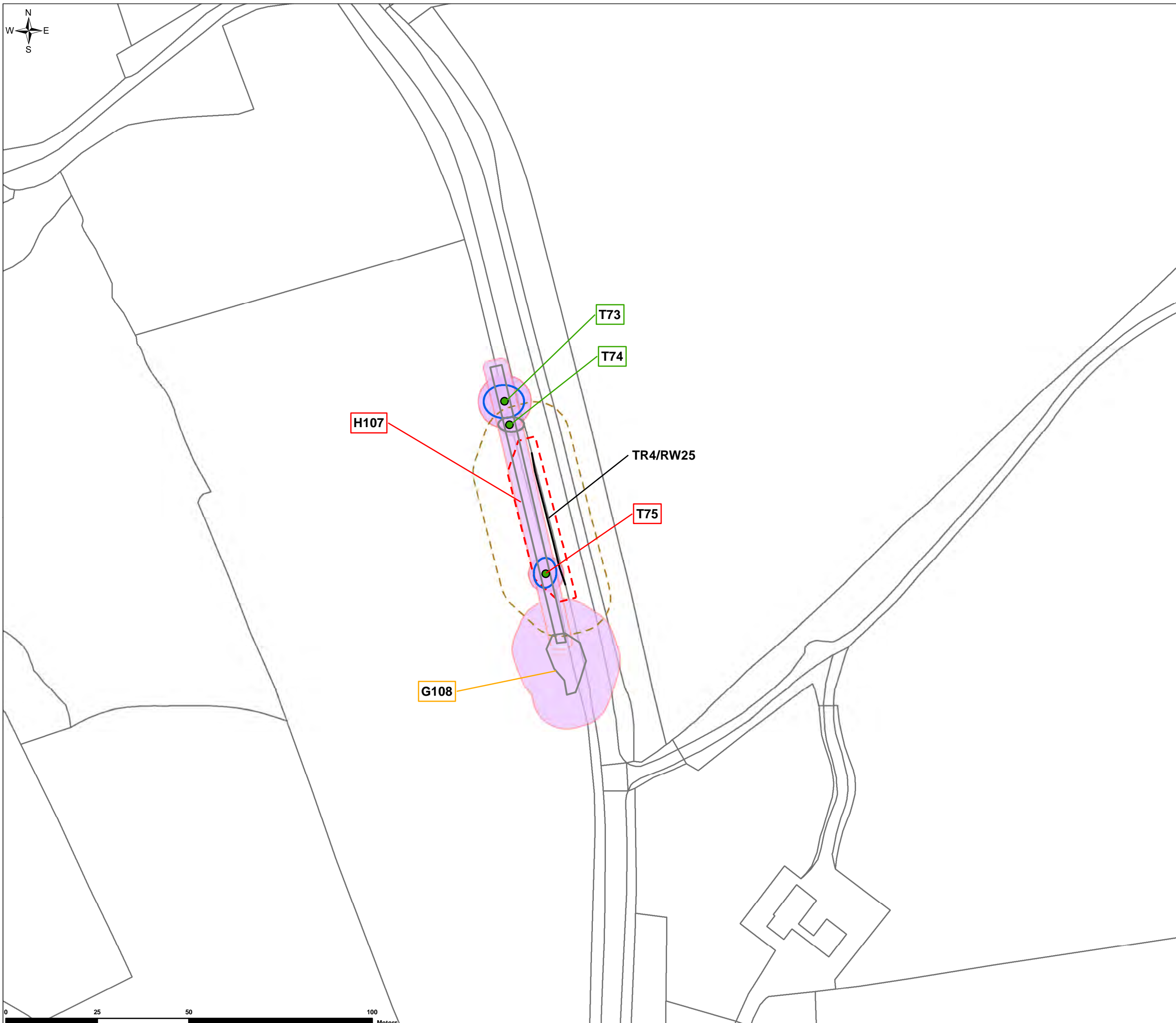
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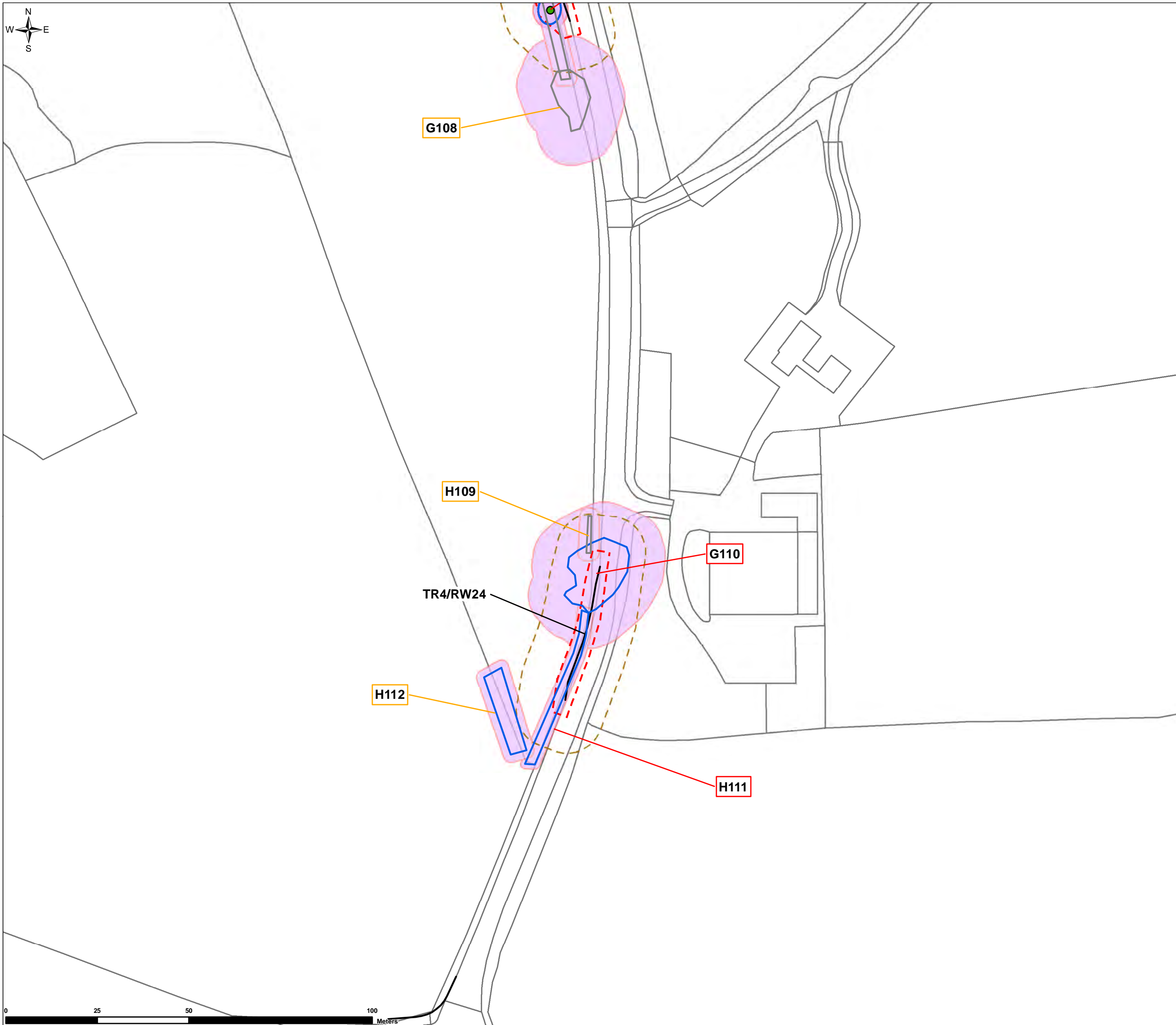
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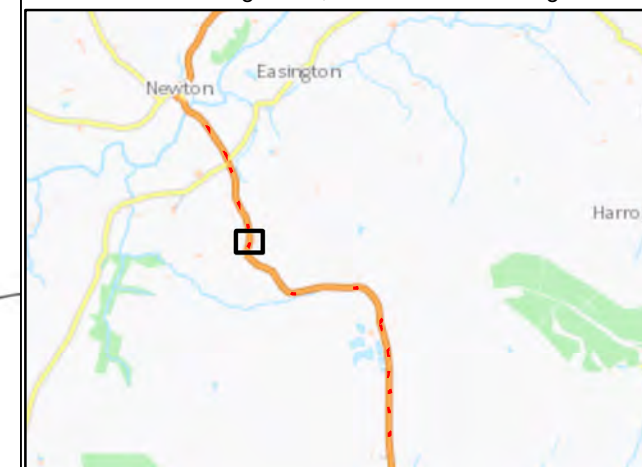
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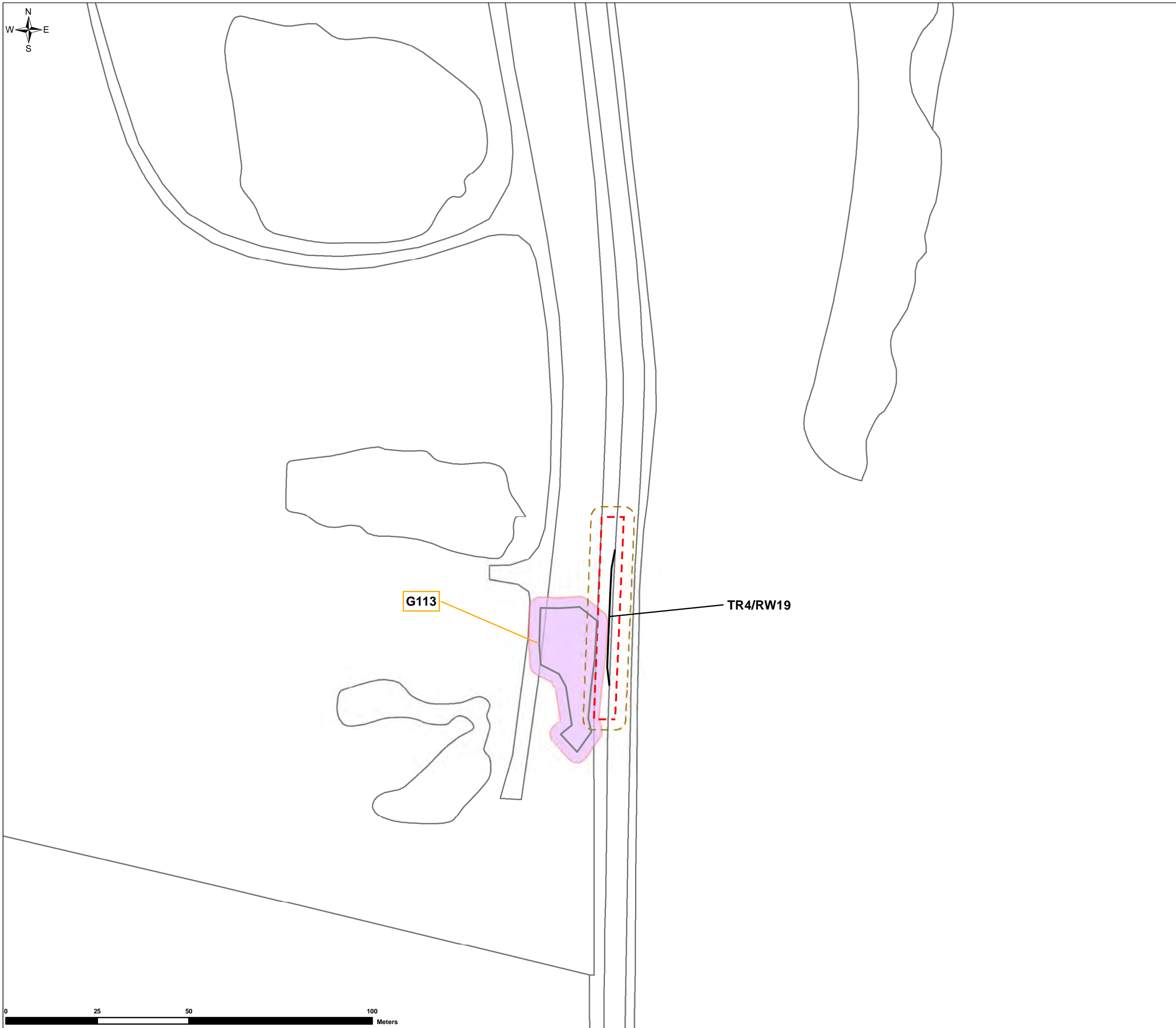
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⋮ Red Line Boundary

**Tree Survey Information**

● Individual Trees

□ Category A Feature

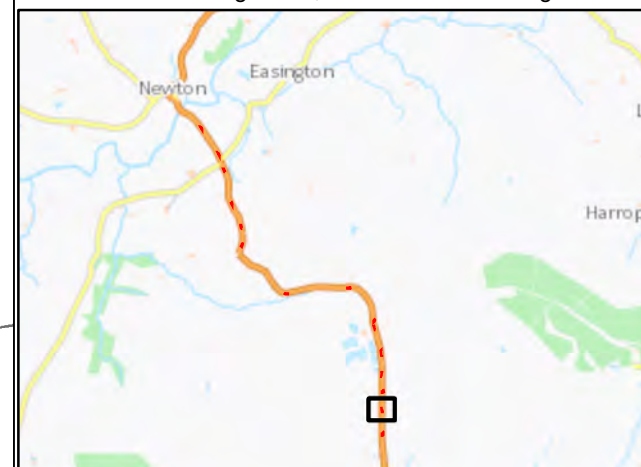
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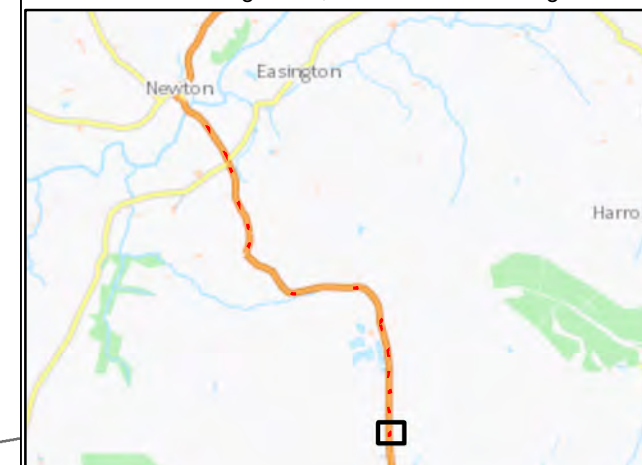
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G115

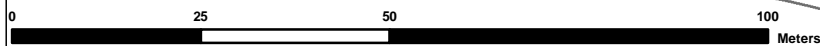


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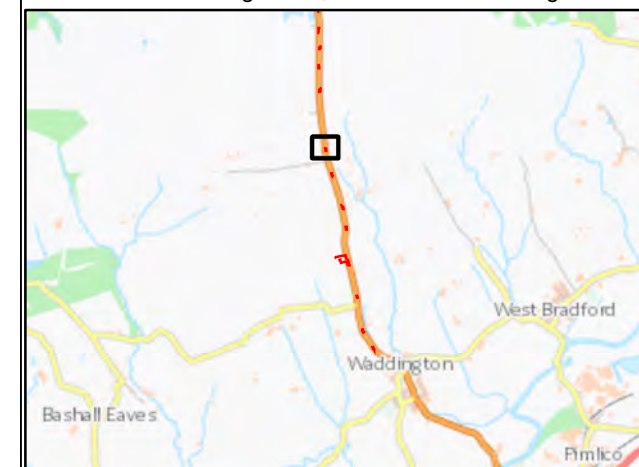
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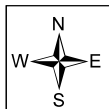


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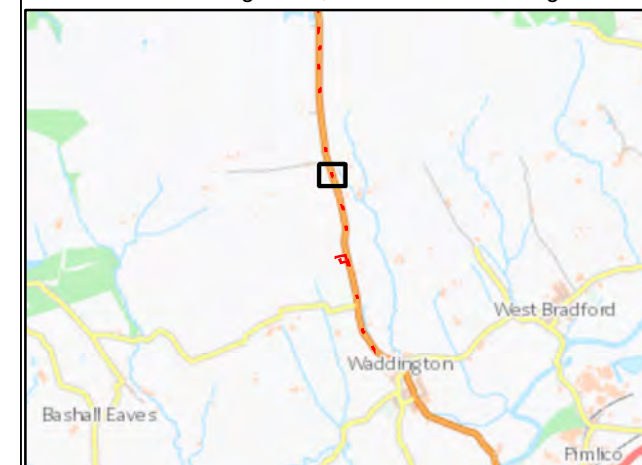
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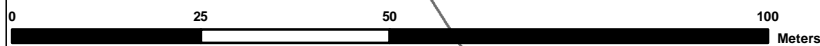
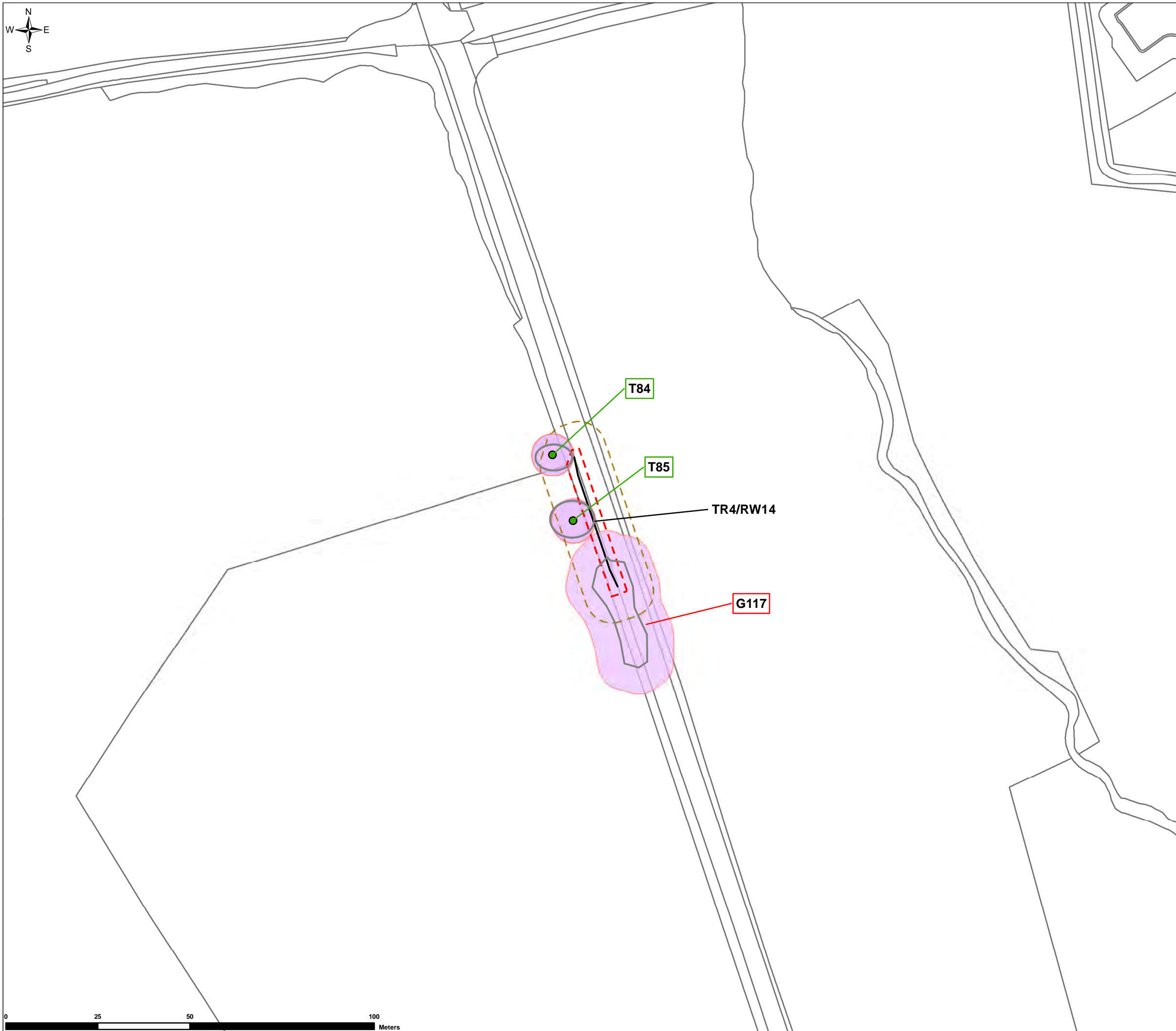


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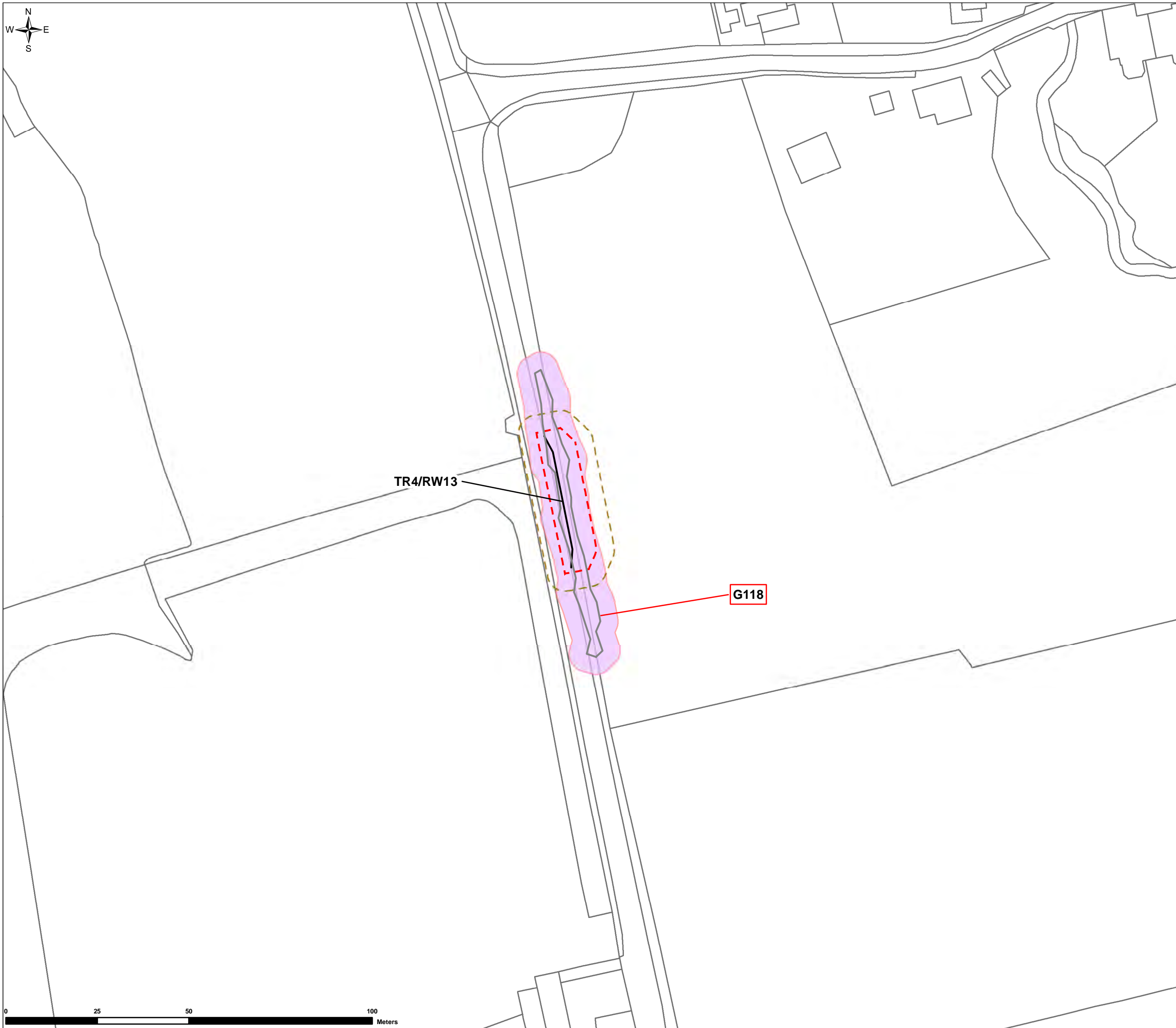


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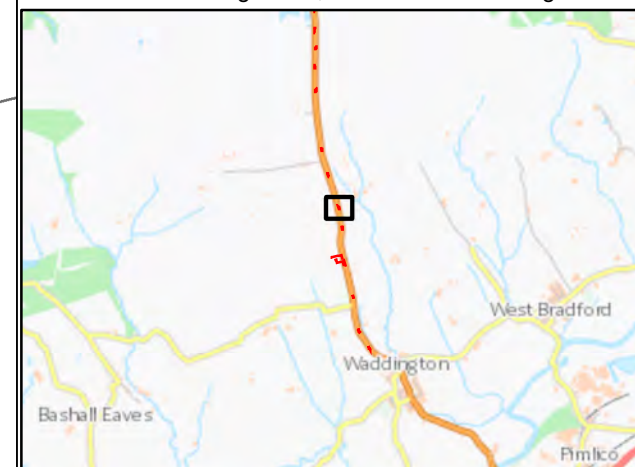
**FIGURE P1.3**

Tree survey features are prefixed with a 'T', 'G', 'H' or 'W' to identify respective feature type as an individual tree, tree group, hedgerow or woodland. Each survey feature is numbered sequentially from north to south for the Proposed Marl Hill Section Off-Site Highways Works.  
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**Legend**

- Road Widening (RW)
- Red Line Boundary
- At Risk Buffer
- Tree Survey Information**
- Individual Trees
- Category A Feature
- Category B Feature
- Category C Feature
- Category U Feature
- Root Protection Area

**Label Abbreviations:**  
 PP – Passing Place, RW - Road Widening

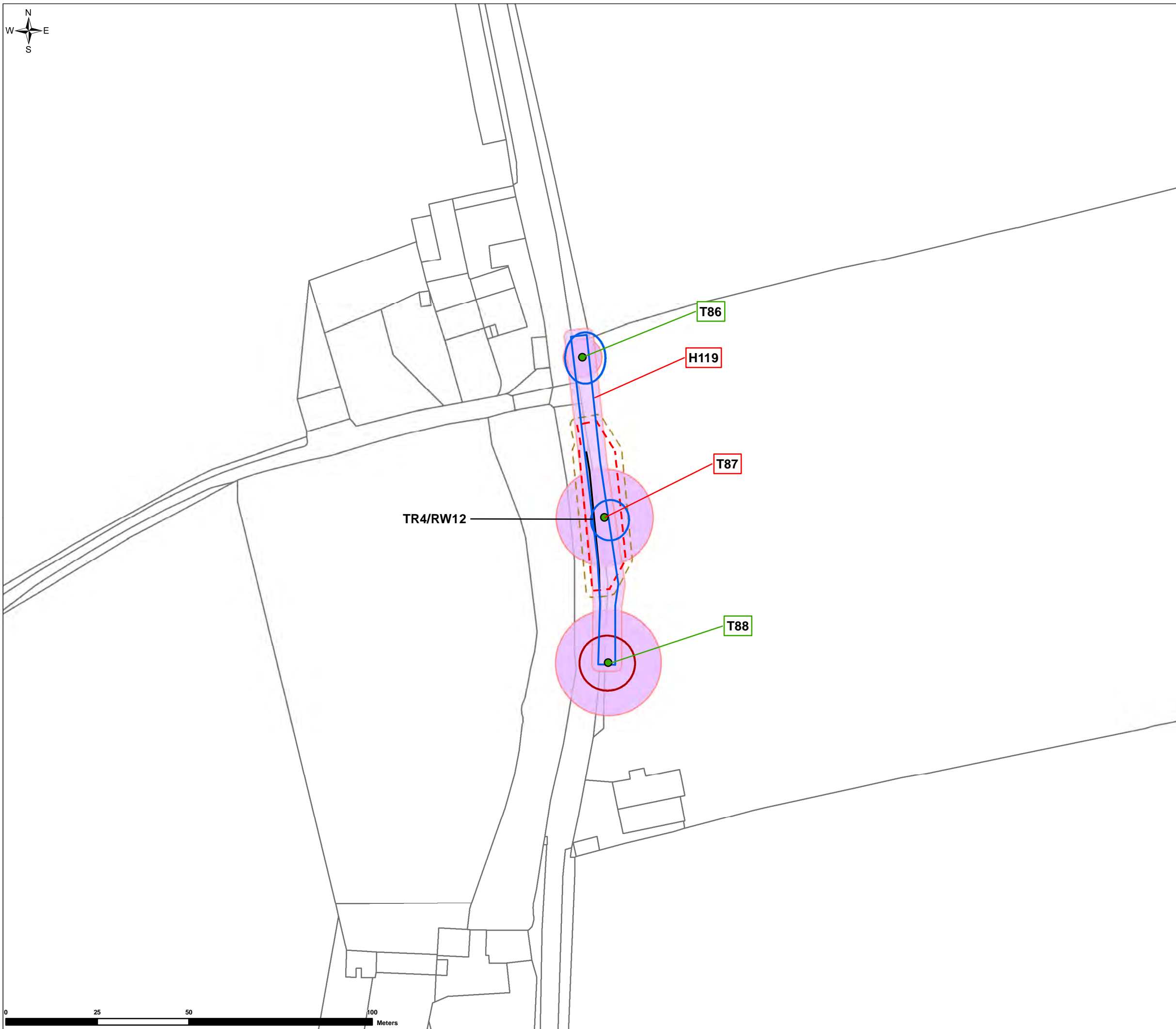


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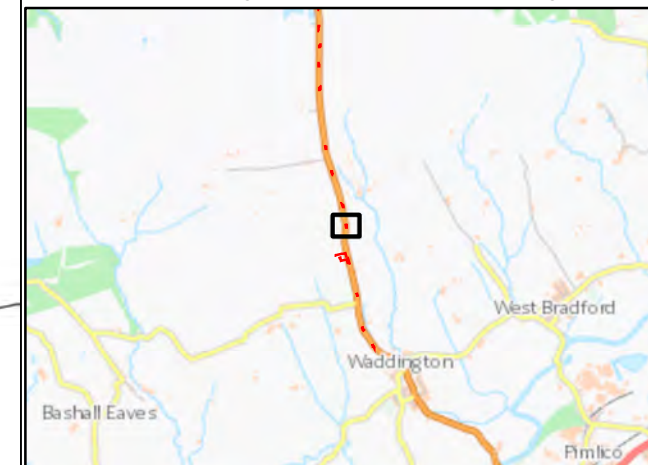
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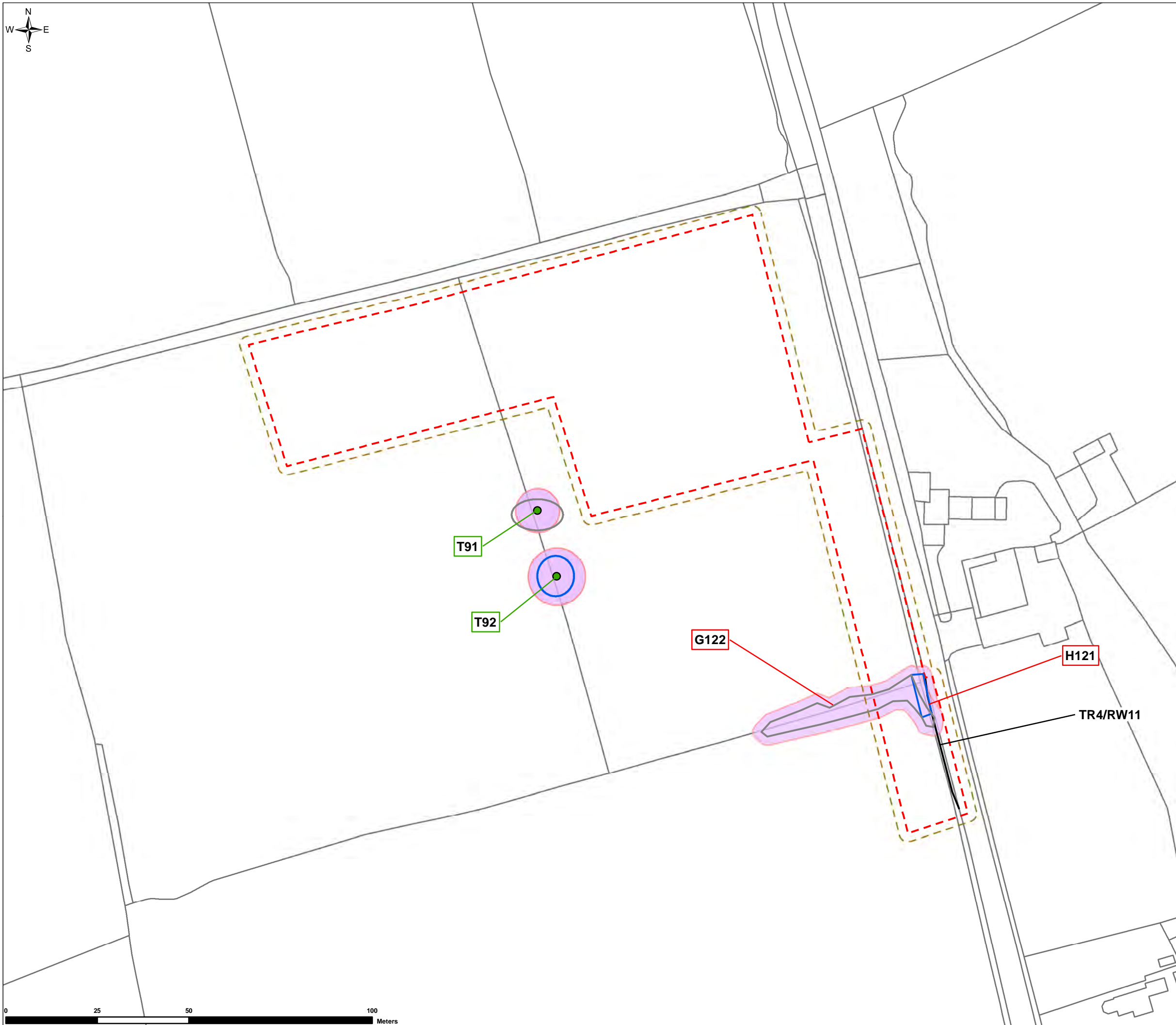
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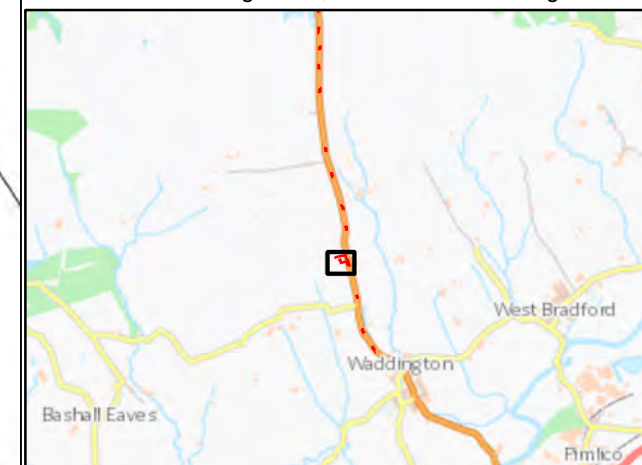
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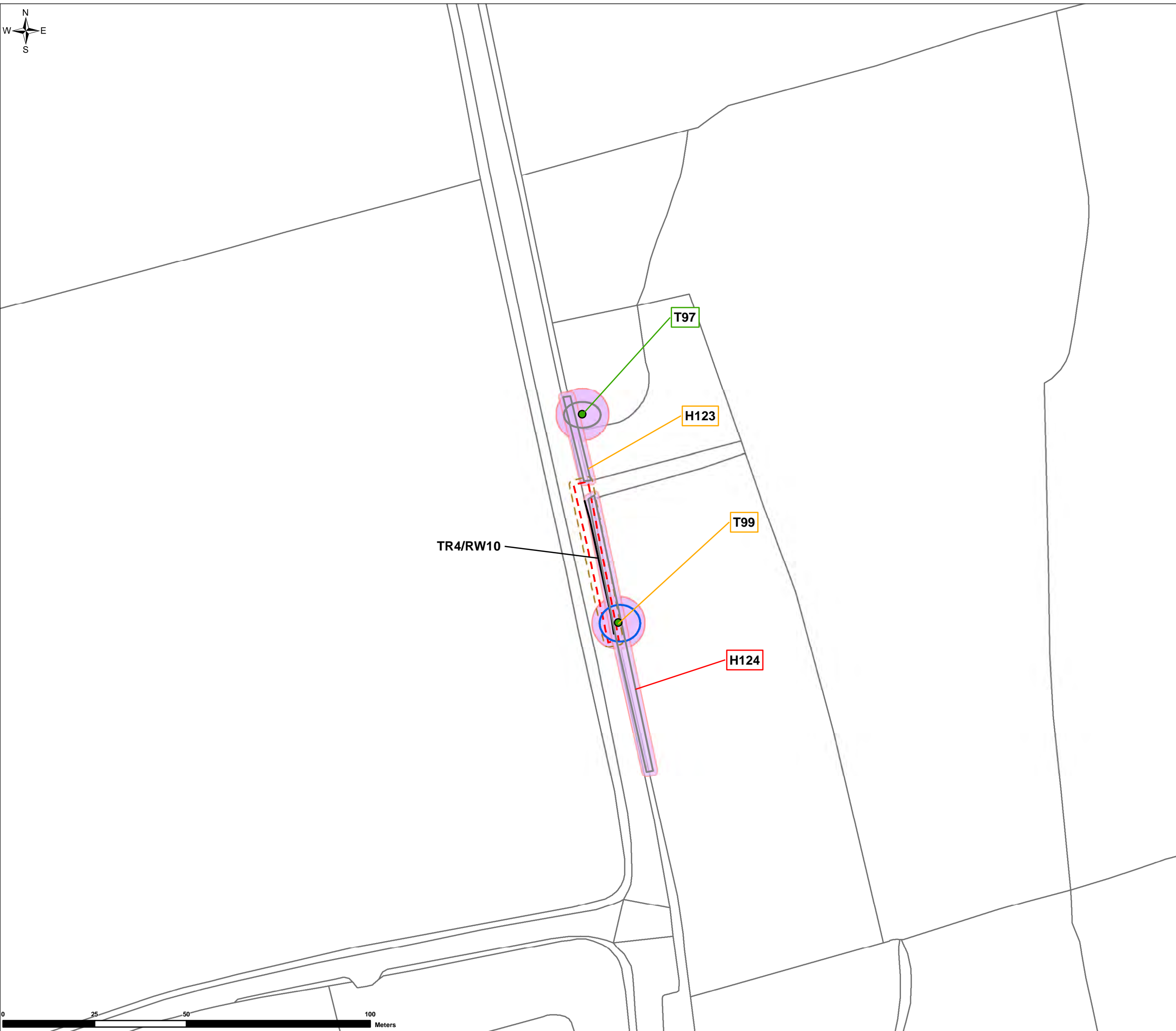
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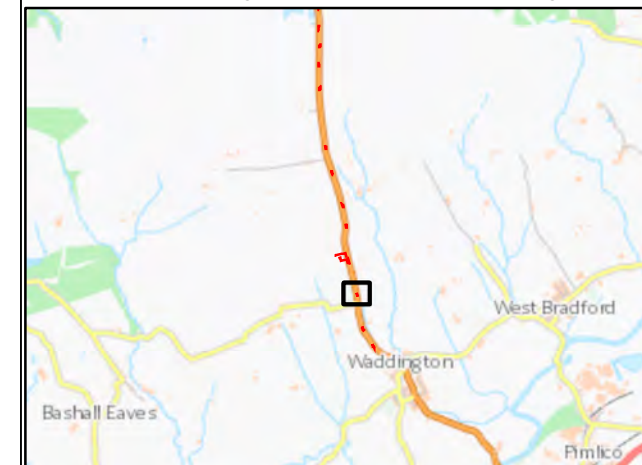
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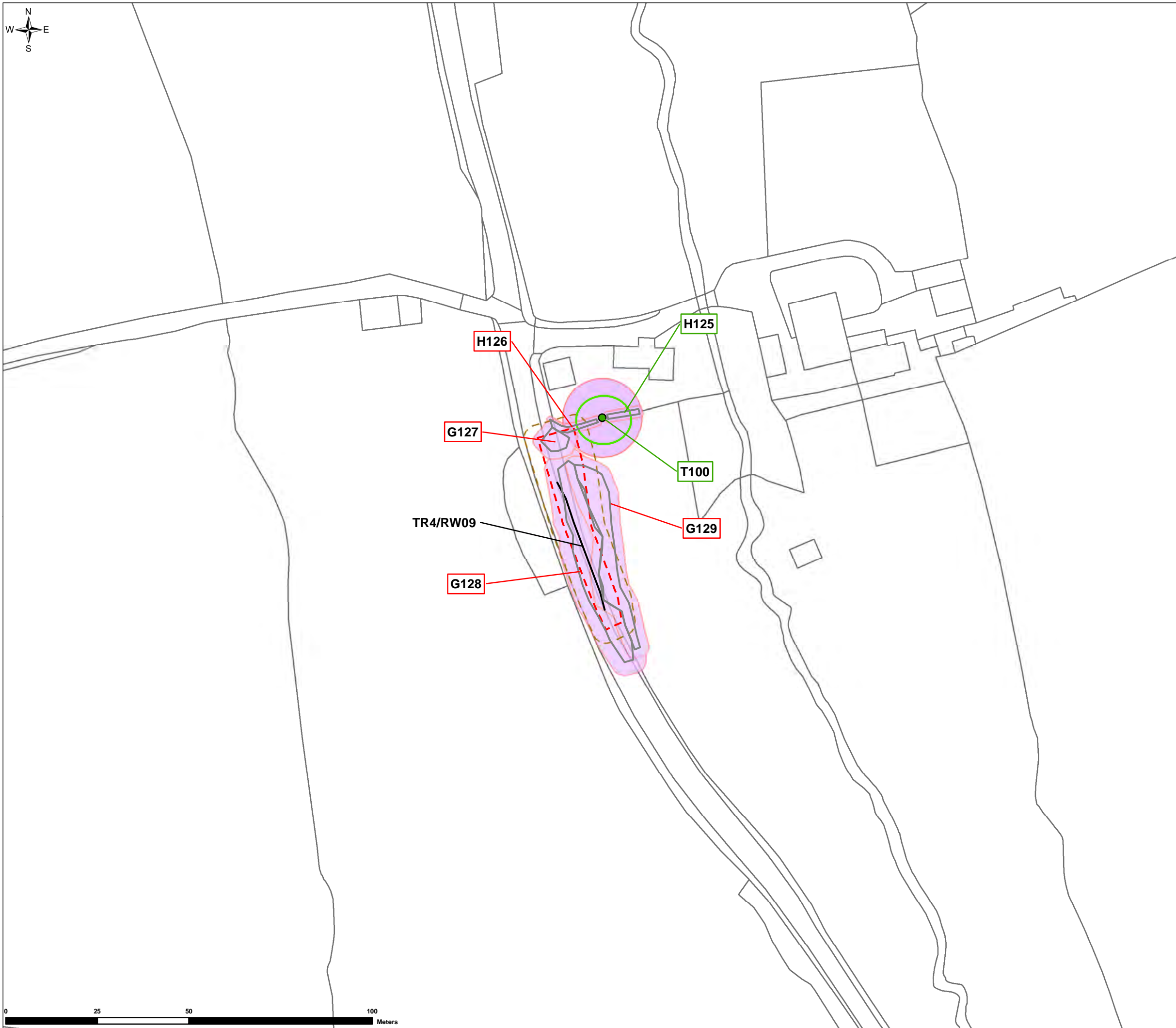


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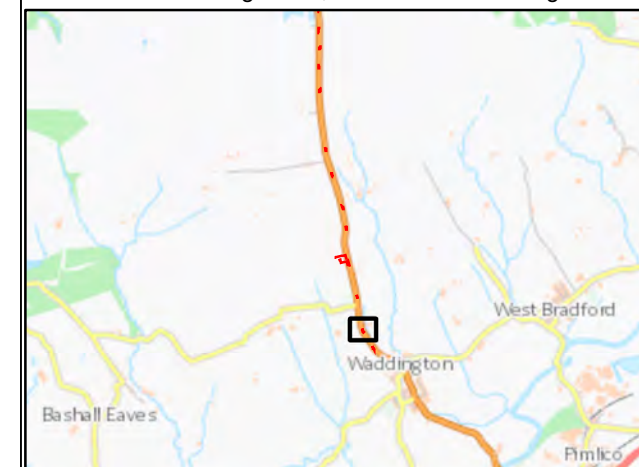
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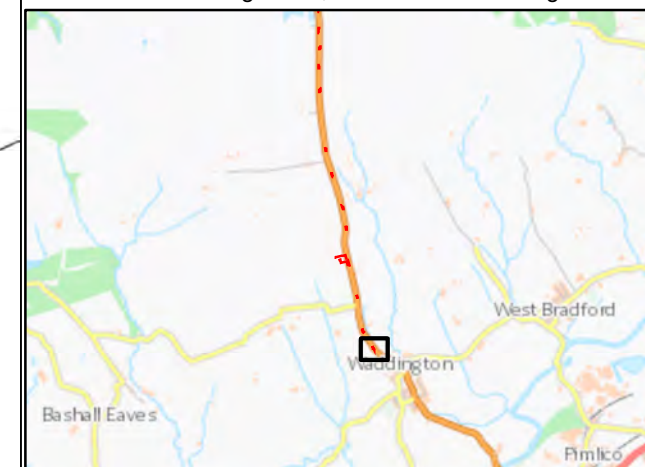
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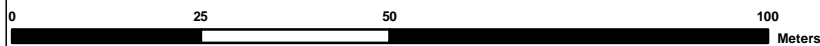
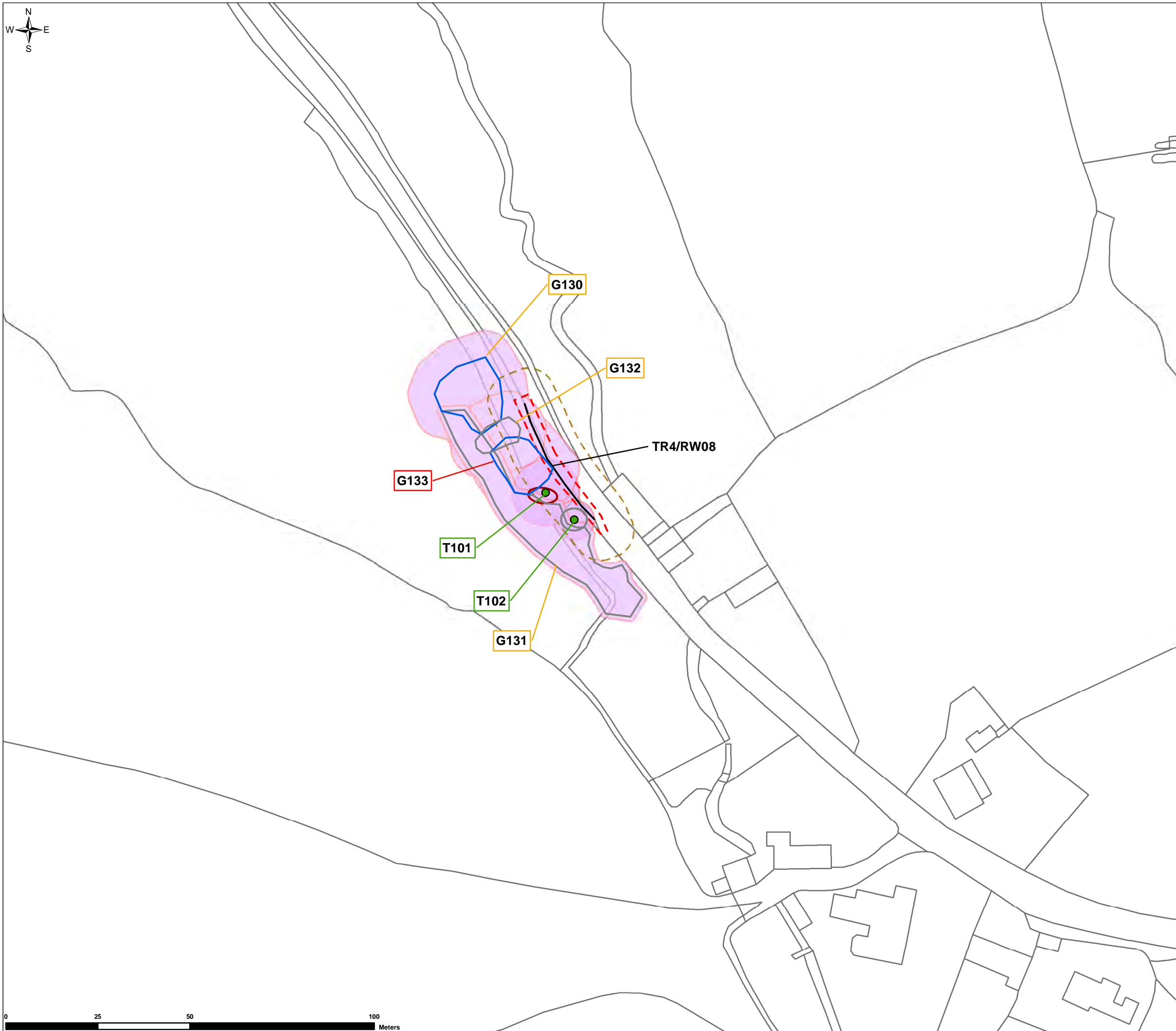


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## **Appendix B3: GWDTE Assessment of Off-site Highways Works (including Braddup Compound Access)**

Document reference: RVBC-MH-V5-P1-B3



# Haweswater Aqueduct Resilience Programme – Proposed Marl Hill Section

## Supplementary Environmental Information

### Appendix B3: GWDTE Assessment of Off-site Highways Works (including Braddup Compound Access)

January 2022





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## Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Project No: B27070CT  
Document Title: Proposed Marl Hill Section Supplementary Environmental Information Appendix B3: Off-site Highways Works GWDTE Assessment  
Document Ref.: RVBC-MH-V5-P1-B3  
Revision: 0  
Date: January 2022  
Client Name: United Utilities Water Ltd

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## 1. Introduction

### 1.1 Purpose of the Report

- 1) This report provides supplementary information to support the groundwater assessment reported in the Water Environment chapter of Volume 5 of the Proposed Marl Hill Section Environmental Statement (*the June 2021 Environmental Statement*).
- 2) The purpose of this report is to assess the potential impacts on groundwater levels and flows sustaining Groundwater Dependent Terrestrial Ecosystems (GWDTEs) that could arise during the proposed off-site highways works (planned to take place during the enabling phase of the development). The scope of the proposed off-site highways works has been reduced since submission of the June 2021 Environmental Statement. This report examines only those off-site highways works which remain within the scope of the revised planning application, and have potential to impact on GWDTEs.
- 3) The report also examines GWDTE effects associated with the proposed changes to the Braddup Compound access track, namely the construction of temporary bridges over existing culverts below the track. For the purposes of the SEI Report, the GWDTE assessment for the Braddup Compound Access has been incorporated into this off-site highways report. It is noted that elsewhere in the SEI Report, the off-site highways work is reported separately to the design change at Braddup Compound.

### 1.2 Assessment Approach

- 4) This report follows the UK Technical Advisory Group (UKTAG) guidance<sup>1</sup> to identify, prioritise and assess the impacts of the Proposed Marl Hill Section on GWDTEs, during the proposed off-site Highways Works. This is the same approach as that used in the Water Environment chapter of the June 2021 Environmental Statement and associated Appendix 7.2: GWDTE Assessment.
- 5) This report only discusses potential impacts on groundwater levels and flows that support ecosystems. Other impacts on vegetation and habitats are discussed in Volume 5 Part II Ecology of the June 2021 Environmental Statement. Only GWDTEs with the potential to experience likely significant effects have been reported here.
- 6) In some instances in this report, the ecological sites listed in Volume 5 Part II Ecology of the June 2021 Environmental Statement have been grouped together to form a larger GWDTE site. In most cases, this is due to the habitats being of similar nature, geographically connected, and/or hydrologically linked. Where this is the case, this is clearly stated in the relevant habitats and vegetation sections for each site.
- 7) The scope of the Proposed Marl Hill Section is described in the June 2021 Environmental Statement, and proposed changes to the June 2021 proposals are explained in the Supplementary Environmental Information (SEI) Report. Volume 5 of the June 2021 Environmental Statement describes the scope of the off-site highways works. While this report provides supplementary environmental information that was not contained in the June 2021 Environmental Statement, it is worth noting that there have been subsequent changes to the off-site highways works. These changes relate to the removal of Road Widening (RW) locations 1-7 in the Chatburn, Grindleton and West Bradford areas.
- 8) It has been assumed that no excavations deeper than 0.8 m would be required for most of the off-site highways works. As such, no dewatering assessment has been carried out. Based on the maximum excavation depth of 0.8 m, a 100 m buffer is considered appropriate; in accordance with the UKTAG and Scottish Environment Protection Agency (SEPA)<sup>2</sup> GWDTE guidance (which requires a 100 m buffer

<sup>1</sup> UKTAG (2005) Draft Protocol for Determining "Significant Damage" to a "Groundwater Dependant Terrestrial System"

<sup>2</sup> SEPA (2018) Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems

around all excavations less than 1 m in depth). This 100 m buffer has been used either side of the off-site highways works planning application boundary, as a way of prioritising those sites which could experience significant direct or indirect effects, and which would require the creation of individual, site-specific proformas. This location is referred to as the *GWDTE Off-site Highways Works Assessment Area*.

- 9) The proposed 'Bailey' type bridges along the Braddup Compound access track may require excavations of up to 2 m maximum depth, for foundations either side of the bridge span. These excavations are proposed to take place within areas classified as having a low groundwater dependency, or areas not considered to be groundwater dependent. The water table is therefore unlikely to be at, or close to, the ground surface during construction of the bailey bridges. As such, no dewatering assessment has been carried out for these works, although localised impacts from intercepting a slightly deeper water table are reviewed for the relevant GWDTEs potentially significantly affected.
- 10) The proforma format for reporting was chosen to reflect the high-level desk-based assessment undertaken, and the similar nature of the potential impacts expected to each GWDTE site, i.e. due to the similar construction activities proposed at each location. In addition, given that the desk-based assessment is high-level, the review of potential GWDTE sites has been carried out with no Ground Investigation (GI) data, and no information relating to site-specific groundwater features, that would otherwise be identified e.g. through hydrogeology walkover surveys. As a consequence, the level of uncertainty associated with the assessment is reflected in the initial classification of groundwater dependency for each site.
- 11) As shown on Figure 1, there are 12 sites in total within the GWDTE off-site highways Works Assessment Area with the potential to be impacted significantly, and for which individual, site-specific proformas have been developed (presented in Section 2). It should be noted that there are other potential GWDTE sites that lie within the GWDTE Off-site Highways Works Assessment Area, but no assessment is reported here. This is because they lie sufficiently upgradient, and/or are separated from the works area by the existing carriageway, watercourse, or both, and are therefore unlikely to experience significant direct or indirect effects.

## 2. Site-Specific GWDTE Proformas

- 12) Tables 2.1 to 2.12 provide the site-specific proformas for each GWDTE, compiled using a desk-based assessment of available baseline information, which includes ecological habitat (and vegetation) survey data (where present). The proformas summarise the findings to determine groundwater dependency, sensitivity, and potential impacts to each site.
- 13) The baseline for three sites (Slaidburn Road West, Blue Gates, and Whinny Lane East), is already described in Chapter 7: Water Environment of the June 2021 Environmental Statement. The CSMs are repeated here (Tables 2.10 to 2.12 and Illustrations 2.1 to 2.3) to provide context to the assessment of potential off-site highways works effects.

**Table 2.1: Site Description and Summary of Effects for Browsholme Road South RW14**

Overview	
	<p><b>NGR:</b> SD 72059 45970</p>
	<p><b>Location:</b> South of Slaidburn Road/Browsholme Road junction, adjacent to RW14</p>
	<p><b>Ecological designation(s):</b> None</p>
	<p><b>Reason for selection:</b> Phase 1 Habitat Survey classified the site as a marsh/marshy grassland habitat type</p>
<p><b>Hydrological features</b></p>	<p>None within site. An unnamed Ordinary Watercourse issues 70 m to the southwest, and a tributary of Waddington Brook is thought to enter culvert 40 m north of the site beneath Slaidburn Road</p>
<p><b>Hydrological catchment</b></p>	<p>Extends 1.4 km northwest, with a peak elevation of 383 mAOD</p>
<p><b>Soil type</b></p>	<p>Slowly permeable seasonally wet acid loamy and clayey soils</p>
<p><b>BGS superficial geology</b></p>	<p>Glacial till</p>
<p><b>BGS Bedrock geology</b></p>	<p>Pendleside Limestone Formation, comprised of limestone</p>
<p><b>BGS / GI borehole records</b></p>	<p>None available</p>
<p><b>Groundwater features</b></p>	<p>None identified (from Ordnance Survey maps/ecology data)</p>
<p><b>BGS / GI groundwater level data</b></p>	<p>None available</p>
<p><b>Initial conceptual site model</b></p>	<p><b>Groundwater dependency</b></p>
<p>Both shallow groundwater and surface water flows are expected to follow the topography and flow south. The site lies within a localised, slight dip in the topography, with field</p>	<p><b>Moderate</b></p>

Overview			
boundaries/walls along its southern, eastern, and western edges. There is potential, therefore, for both surface water and shallow groundwater to accumulate within the site. The low permeability soils may limit infiltration (in places), but the till is expected to be heterogenous in nature, and groundwater stored in the more permeable horizons may be able to locally sustain the marsh habitat present.			
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
Groundwater flows/levels (short term)	Medium	Minor (works across / up-gradient of GWDTE but red line boundary lies adjacent to the site's eastern corner)	Slight (far east of site)
Groundwater flows/levels (long term)		Negligible	Neutral
Groundwater quality		Minor	Slight

**Table 2.2: Site Description and Summary of Effects for Ringley Hey North RW15**

Overview	
	<p><b>NGR:</b> SD 72063 46199</p> <p><b>Location:</b> North of the Browsholme Road and Slaidburn Road junction. Most of the site lies to the east of Slaidburn Road, with two smaller areas situated to the west of the junction. Adjacent to RW15</p> <p><b>Ecological designation(s):</b> None</p> <p><b>Reason for selection:</b> Phase 1 Habitat Survey classified the site as a marsh/marshy grassland habitat type</p>
<b>Hydrological features</b>	An unnamed Ordinary Watercourse (and tributary of Waddington Brook), is shown to “issue” 25 m to the north, and flows south, throughout the full length of the eastern part of the site
<b>Hydrological catchment</b>	Extends 1.3 km northwest, with a peak elevation of 383 mAOD
<b>Soil type</b>	Slowly permeable seasonally wet acid loamy and clayey soils
<b>BGS superficial geology</b>	Glacial till

<b>Overview</b>			
<b>BGS Bedrock geology</b>	The Bowland Shale Formation (mudstone and siltstone) underlies most of the site. The site's southeast corner forms the boundary with the Pendleside Limestone Formation. A northwest-southeast trending fault cuts across the bedrock in the northeast of the site		
<b>BGS / GI borehole records</b>	SD74NW87 is located 210 m north, and recorded 0.3 m of hardcore, overlying sandy boulder clay with sand bands to a depth of 49 m. Bedrock (sandstone) was encountered at 60 m depth		
<b>Groundwater features</b>	None identified within the site, but the "issues" located 25 m north could be indicative of localised shallow groundwater emergence		
<b>BGS / GI groundwater level data</b>	SD74NW87 recorded a rest water level at 7.8 m depth during drilling. The borehole is noted as having a 'domestic' use		
<b>Initial conceptual site model</b>			<b>Groundwater dependency</b>
Slaidburn Road and any sub-surface structures associated with the highway may artificially alter natural groundwater (and surface water) flows within the site. Shallow groundwater is generally expected to follow the topography and flow south/southeast towards the unnamed Ordinary Watercourse in the east of the site. On the road's upgradient side, surface water and shallow groundwater accumulation is therefore possible. To the east of the road, the topography flattens, and residence times for infiltration are likely to be high (albeit limited to a degree by the low permeability clay soils). As indicated by BGS borehole SD74NW87, groundwater is likely to flow predominantly in sand bands within the glacial till. These preferential groundwater flows (if/where they approach the ground surface), could contribute to sustaining the marsh vegetation present.			<b>Moderate</b>
<b>Potential effects</b>	<b>GWDTE sensitivity</b>	<b>Magnitude of impact</b>	<b>Significance of effect</b>
Groundwater flows/levels (short term)	Medium	Major (direct but localised impact to small area in centre of site)	Large (in centre only)
Groundwater flows/levels (long term)		Moderate (direct but localised impact to small area in centre of site)	Moderate (in centre only)
Groundwater quality		Moderate (in the centre of the site, immediately downgradient)	Moderate (in centre only)

**Table 2.3: Site Description and Summary of Effects for Moorcock House East RW16**

Overview	
<p>© Crown copyright and database right 2022. All rights reserved. Ordnance Survey.</p> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Watercourse</li> <li>Planning Application Boundary</li> <li>GWDTE Site Boundary</li> <li>Groundwater Dependency <ul style="list-style-type: none"> <li>High</li> <li>Moderate</li> <li>Low</li> </ul> </li> <li>10m Contour</li> </ul>	
	<p><b>NGR:</b> SD 71989 46805</p>
	<p><b>Location:</b> Southeast of Waddington Fell and north of Moorcock House. Located either side of Slaidburn Road, adjacent to RW16</p>
	<p><b>Ecological designation(s):</b> Biological Heritage Site (area west of Slaidburn Road). Remainder of site has no designation</p>
	<p><b>Reason for selection:</b> Phase 1 Habitat Survey classified the site as a marsh/marshy grassland habitat type. This includes one large area of marsh associated with Waddington Brook (TR4.HTN38), two small patches in the northeast, and a third area in the southwest to the west of Slaidburn Road (TR4.HTN40)</p>
<p><b>Hydrological features</b></p>	<p>Waddington Brook flows south through the east of the site</p>
<p><b>Hydrological catchment</b></p>	<p>Includes two sub-catchments to the northeast and northwest, with the largest extending 1.9 km northeast, and peaking at 396 mAOD</p>
<p><b>Soil type</b></p>	<p>Slowly permeable wet very acid upland soils with a peaty surface</p>
<p><b>BGS superficial geology</b></p>	<p>Glacial till (except for a small area in the north adjacent to the eastern side of Slaidburn Road, which is absent of superficial deposits)</p>
<p><b>BGS Bedrock geology</b></p>	<p>Pendle Grit Member, comprised of sandstone. A northeast-southwest trending fault cuts across the bedrock in the north of the site</p>
<p><b>BGS / GI borehole records</b></p>	<p>SD74NW53 is located along the southern boundary of the western part of the site and provides no lithological information. SD74NW18 is located 55 m west of the site and recorded peaty clay (1.5 m thick) overlying clay with boulders. Bedrock (sandstone) was encountered in SD74NW18 at 12.2 m depth</p>
<p><b>Groundwater features</b></p>	<p>None identified (from Ordnance Survey maps/ecology data)</p>
<p><b>BGS / GI groundwater level data</b></p>	<p>SD74NW53 is recorded as a spring. SD74NW18 does not provide groundwater level information</p>



Overview			
<b>Initial conceptual site model</b>			<b>Groundwater dependency</b>
<p>The site lies on the south-eastern flank of Waddington Fell, where groundwater flows are expected to flow east towards Waddington Brook. The presence of a spring in the southwest of the site (as recorded by BGS borehole SD74NW53), indicates that groundwater contributes to sustaining the marsh habitat present. Groundwater levels may also be high in the flatter valley basin area in the east of the site, where the marsh habitat was identified surrounding Waddington Brook.</p>			<b>High</b>
<b>Potential effects</b>	<b>GWDTE sensitivity</b>	<b>Magnitude of impact</b>	<b>Significance of effect</b>
Groundwater flows/levels (short term)	High	Negligible	Neutral
	Medium	Major (direct and localised impact to small area in centre of site)	Large (in centre only)
Groundwater flows/levels (long term)	High	No impact	N/A
	Medium	Moderate (direct and localised impact to small area in centre of site)	Moderate (in centre only)
Groundwater quality	High	Negligible	Neutral
	Medium	Moderate (in the centre of the site, immediately downgradient)	Moderate (in centre only)

**Table 2.4: Site Description and Summary of Effects for Waddington Fell South RW17**

Overview	
	<p><b>NGR:</b> SD 71941 47149</p> <p><b>Location:</b> On the western side of Slaidburn Road, to the south of the access track to Waddington Fell. Adjacent to RW17</p> <p><b>Ecological designation(s):</b> Biological Heritage Site</p> <p><b>Reason for selection:</b> Phase 1 Habitat Survey classified most of the site as a wet dwarf shrub heath habitat type, with a wet heath/acid grassland mosaic in the northeast. There are two small, isolated patches of marsh/marshy grassland habitat to the south</p>
<b>Hydrological features</b>	None identified within site. Waddington Brook is located 45 m east of the site (to the east of Slaidburn Road), and flows southwards

<b>Overview</b>			
<b>Hydrological catchment</b>	Extends 550 m west, with a peak elevation of 383 mAOD		
<b>Soil type</b>	Slowly permeable wet very acid upland soils with a peaty surface		
<b>BGS superficial geology</b>	Superficial deposits are absent from most of the site, except for glacial till which extends into the north/northeast of the site		
<b>BGS Bedrock geology</b>	Pendle Grit Member, comprised of sandstone		
<b>BGS / GI borehole records</b>	SD74NW9 is located in the south of the site, between the main area of wet dwarf shrub heath and the two small patches of marsh. Peaty clay (1.5 m thick) was recorded overlying clay with boulders. Bedrock (sandstone) was encountered at 12.2 m depth		
<b>Groundwater features</b>	None identified (from Ordnance Survey maps/ecology data)		
<b>BGS / GI groundwater level data</b>	SD74NW9 does not provide groundwater level information		
<b>Initial conceptual site model</b>			<b>Groundwater dependency</b>
<p>The peaty clay horizon identified in BGS borehole SD74NW9 could locally store groundwater, with limited recharge rates likely through the underlying clay (the presence of which suggests that the glacial till extends further south than BGS geological mapping shows). Saturated conditions in the soil profile could sustain moderately groundwater dependent wet dwarf shrub heath and marsh vegetation in this location. Shallow groundwater and surface water flows are likely routed east towards Waddington Brook. However, Slaidburn Road and the access track to Waddington fell could intercept natural groundwater and surface water flow regimes, such that the storage potential is increased upgradient of the road (and within the site boundary).</p>			<b>Moderate</b>
<b>Potential effects</b>	<b>GWDTE sensitivity</b>	<b>Magnitude of impact</b>	<b>Significance of effect</b>
Groundwater flows/levels (short term)	High	Moderate (direct and localised impact to small area in east of site which lies adjacent to and across-gradient of the works)	Moderate (small area in the east only)
Groundwater flows/levels (long term)		Minor	Slight
Groundwater quality		Minor	Slight

**Table 2.5: Site Description and Summary of Effects for Waddington Fell RW18 and RW19**

Overview	
	<p><b>NGR:</b> SD 71943 47367</p>
	<p><b>Location:</b> Situated on the eastern flank of Waddington Fell, either side of Slaidburn Road. Adjacent to RW18 and RW19</p>
	<p><b>Ecological designation(s):</b> Biological Heritage Site (southwest corner). No designation throughout the remainder of the site</p>
	<p><b>Reason for selection:</b> Phase 1 Habitat Survey classified the site as a strip of marsh/marshy grassland habitat along the western edge of Slaidburn Road, with larger areas of marsh/marshy grassland to the south (either side of the highway), and an expanse of wet dwarf shrub heath in the southwest (TR4.HTN34)</p>
<p><b>Hydrological features</b></p>	<p>Waddington Brook flows along the eastern site boundary (southern part of the site) and is shown to be joined by a small tributary issuing from the eastern side of Slaidburn Road</p>
<p><b>Hydrological catchment</b></p>	<p>Includes two sub-catchments to the northeast and west, with the largest extending 1.6 km northeast, and peaking at 396 mAOD</p>
<p><b>Soil type</b></p>	<p>Slowly permeable wet very acid upland soils with a peaty surface</p>
<p><b>BGS superficial geology</b></p>	<p>Glacial till</p>
<p><b>BGS Bedrock geology</b></p>	<p>Pendle Grit Member, comprised of sandstone</p>
<p><b>BGS / GI borehole records</b></p>	<p>SD74NW16 provides no lithological information</p>
<p><b>Groundwater features</b></p>	<p>None identified (from Ordnance Survey maps/ecology data)</p>
<p><b>BGS / GI groundwater level data</b></p>	<p>SD74NW16 is located 200 m west (and upgradient) of the site, and is recorded as the 'Moorcock Inn spring'</p>
<p><b>Initial conceptual site model</b></p>	<p><b>Groundwater dependency</b></p>
<p>The site lies in a topographic low, at the base of Waddington Fell, where there is likely to be high storage potential for both groundwater and surface water flows routed from the west (enhanced by peaty soils – if / where present). The Moorcock Inn spring is located 200 m upgradient (to the west) of the site, as shown by BGS borehole SD74NW53, and indicates that</p>	<p><b>High to moderate</b></p>

Overview			
<p>shallow groundwater may be contributing to sustaining wet dwarf shrub heath and marsh vegetation in the south of the site. The small tributary issuing in the southeast of the site could also be indicative of shallow groundwater levels. The south of the site is therefore considered to have a high groundwater dependency.</p> <p>The thin strip of marsh habitat in the north of the site, along the edge of Slaidburn Road, lies across gradient from the Moorcock Inn spring, and there is no evidence (from Ordnance survey maps) of shallow groundwater levels in this location. However, given the marsh habitat present, and uncertainties associated with the absence of localised GI data, this site cannot be ruled out as being a GWDTE, or partially a GWDTE, and is conservatively assessed as having a moderate groundwater dependency.</p>			
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
Groundwater flows/levels (short term)	High	Minor (works across / downgradient)	Slight (small part of site)
	Medium	Major (direct but localised impacts in the north and southeast of site)	Large (small areas in the north and southeast)
Groundwater flows/levels (long term)	High	Negligible	Neutral
	Medium	Moderate (direct but localised impacts in the north and southeast of site)	Moderate (small areas in the north and southeast)
Groundwater quality	High	Minor	Slight
	Medium	Moderate (in the north and southeast of the site, immediately downgradient)	Moderate (small areas in the north and southeast only)

**Table 2.6: Site Description and Summary of Effects for Waddington Fell Quarries RW20**

Overview	
<p>© Crown copyright and database right 2022. All rights reserved. Ordnance Survey.</p>	<p><b>NGR:</b> SD 71983 47691</p> <p><b>Location:</b> East of Waddington Fell quarries, adjacent to RW20. The main part of the site lies to the east of Slaidburn Road, with a small area to the west</p> <p><b>Ecological designation(s):</b> None</p> <p><b>Reason for selection:</b> Phase 1 Habitat Survey classified most of the site as a wet dwarf shrub heath habitat type (TR4.HTN31), with lesser areas of marsh/marshy grassland</p>

Overview			
	habitat (including the small area to the west of Slaidburn Road)		
<b>Hydrological features</b>	Waddington Brook flows south through the east of the site		
<b>Hydrological catchment</b>	Extends 1.4 km northeast, with a peak elevation of 396 mAOD		
<b>Soil type</b>	Blanket bog peat soils (northern half), with slowly permeable wet very acid upland soils with a peaty surface in the south		
<b>BGS superficial geology</b>	Peat overlying glacial till		
<b>BGS Bedrock geology</b>	Pendle Grit Member, comprised of sandstone		
<b>BGS / GI borehole records</b>	SD74NW85 provides no lithological information		
<b>Groundwater features</b>	None identified (from Ordnance Survey maps/ecology data)		
<b>BGS / GI groundwater level data</b>	SD74NW85 is recorded as an abstraction borehole, but no yield estimates are provided		
Initial conceptual site model			Groundwater dependency
<p>Peat deposits across the site have the potential to locally store significant volumes of groundwater, with limited recharge rates likely through the underlying glacial till. Saturated conditions in the peat could sustain moderately groundwater dependent wet dwarf shrub heath and marsh vegetation in this location and provide groundwater baseflow inputs to Waddington Brook in the east. Works at the quarry, including dewatering from the licensed groundwater abstraction borehole located 100 m upgradient of the site (license no: NW/071/0309/007), could play an important role in locally altering groundwater levels and flows reaching the GWDTE, although this is not certain.</p>			<b>Moderate</b>
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
Groundwater flows/levels (short term)	Medium	Major (direct but localised impact to small area in centre of site)	Large (centre of site only)
Groundwater flows/levels (long term)		Moderate (direct but localised impact to small area in centre of site)	Moderate (centre of site only)
Groundwater quality		Moderate (in the centre of the site, immediately downgradient)	Moderate (small area in the centre of the site only)

**Table 2.7: Site Description and Summary of Effects for Walloper Well South RW21 and PP01**

Overview	
<p>© Crown copyright and database right 2022. All rights reserved. Ordnance Survey.</p> <p>SD74NW54</p> <p>Walloper Well</p> <p>Bonstone Brook</p> <p>PP01</p> <p>RW21</p> <p>Legend</p> <ul style="list-style-type: none"> <li>Watercourse</li> <li>Planning Application Boundary</li> <li>GWDTE Site Boundary</li> <li>Groundwater Dependency                     <ul style="list-style-type: none"> <li>High</li> <li>Moderate</li> <li>Low</li> </ul> </li> <li>10m Contour</li> </ul>	
	<p><b>NGR:</b> SD 71957 48174</p>
	<p><b>Location:</b> East of Waddington Fell Quarries and south of Bonstone Brook. The site lies either side of Slaidburn Road, south of Walloper Well, and adjacent to RW21 and PP01</p>
	<p><b>Ecological designation(s):</b> Biological Heritage Site (northern half of site). No designation for southern half of site</p>
	<p><b>Reason for selection:</b> Phase 1 Habitat Survey classified the site as a wet dwarf shrub heath habitat type in the northern half (TR4.HTN27), with large areas of a marsh/marshy grassland habitat (TR4.HTN28)</p>
<b>Hydrological features</b>	<p>Ordnance Survey maps show two drains in the east of the site that discharge into Waddington Brook, 50 m east of the site, and which could mark the source of the watercourse</p>
<b>Hydrological catchment</b>	<p>Extends 1.2 km northeast, with a peak elevation of 396 mAOD</p>
<b>Soil type</b>	<p>Blanket bog peat soils</p>
<b>BGS superficial geology</b>	<p>Peat is mapped in the south and east of the site. Superficial deposits shown to be absent in the northwest</p>
<b>BGS Bedrock geology</b>	<p>Pendle Grit Member, comprised of sandstone</p>
<b>BGS / GI borehole records</b>	<p>SD74NW54 lies 50 m north of the site but contains no lithological information</p>
<b>Groundwater features</b>	<p>None identified within the site, but Walloper Well (described as an unused spring is located 50 m upgradient of the site)</p>
<b>BGS / GI groundwater level data</b>	<p>SD74NW54 is recorded as an unused spring called Walloper Well</p>
<b>Initial conceptual site model</b>	<p><b>Groundwater dependency</b></p>
<p>The site lies along a topographic break in slope, at the base of Waddington Fell, where there is potential for shallow groundwater emergence along the hillside, i.e., where the water table intersects the ground surface. Walloper Well spring is located 50 m upgradient (to the north) of the site, which could provide shallow groundwater inputs and locally contribute to sustaining the potentially highly groundwater dependent wet dwarf shrub heath and marsh vegetation</p>	<p><b>High</b></p>


Overview			
present at the site. In addition, the two drains shown on Ordnance Survey maps in the southeast of the site, likely mark the source of Waddington Brook, with groundwater levels also expected to be shallow in this location.			
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
Groundwater flows/levels (short term)	High	Minor (site further downgradient)	Slight (small part of site)
	Medium	Moderate (small area in centre of site only, downgradient of PP01)	Moderate (centre only)
Groundwater flows/levels (long term)	High	Negligible	Neutral
	Medium	Minor	Slight
Groundwater quality	High	Minor	Slight
	Medium	Minor	Slight

Table 2.8: Site Description and Summary of Effects for Upper Bonstone Brook RW22

Overview	
<p>© Crown copyright and database right 2022. All rights reserved. Ordnance Survey.</p>	<p><b>NGR:</b> SD 71607 48420</p> <p><b>Location:</b> Either side of Slaidburn Road, to the north of Waddington Fell Quarries. Adjacent to RW22</p> <p><b>Ecological designation(s):</b> Biological Heritage Site</p> <p><b>Reason for selection:</b> Phase 1 Habitat Survey classified the area to the south of Slaidburn Road as a wet dwarf shrub heath habitat type, along with a small area to the north (TR4.HTN25). Four areas of marsh/marshy grassland habitat type are present, mostly around Bonstone Brook, with acid/neutral flush and fen habitat in the east</p>
<b>Hydrological features</b>	Bonstone Brook flows west through the north of the site and is joined by tributaries from the north and south, including one which issues 8 m east of the site
<b>Hydrological catchment</b>	Includes several sub-catchments to the northeast, east, and south with the largest extending 1.4 km east, and peaking at 396 mAOD
<b>Soil type</b>	Slowly permeable wet very acid upland soils with a peaty surface

Overview			
<b>BGS superficial geology</b>		Peat is mapped in the south and east of the site, while the remainder of the site is shown to be absent of superficial deposits	
<b>BGS Bedrock geology</b>		Pendle Grit Member, comprised of sandstone	
<b>BGS / GI borehole records</b>		None available	
<b>Groundwater features</b>		None identified (from Ordnance Survey maps/ecology data)	
<b>BGS / GI groundwater level data</b>		None available	
<b>Initial conceptual site model</b>			<b>Groundwater dependency</b>
<p>There are no hydrogeological features shown on Ordnance Survey maps in the south of the site. However, the peat deposits mapped to the south of Slaidburn Road, could store a significant quantity of groundwater, recharged by direct rainfall, as well as from groundwater and surface water flows routed from the south (Waddington Fell). The wet dwarf shrub heath habitat in the south of the site is therefore assessed as being moderately groundwater dependent.</p> <p>Mapped habitats in the north of the site are conservatively attributed with a high groundwater dependency. This is due to the presence of a small tributary of Bonstone Brook, which issues 8 m east of the site and could be indicative of shallow groundwater levels in this location, the large groundwater catchment to the east (Standridge Hill), the site's setting within a topographical low point (where groundwater and surface water flows can accumulate), and the presence of fen / flush vegetation, which is typically highly dependent on groundwater.</p>			<b>High to moderate</b>
<b>Potential effects</b>	<b>GWDTE sensitivity</b>	<b>Magnitude of impact</b>	<b>Significance of effect</b>
Groundwater flows (short term)	High	Minor (southern half of site is upgradient of works and northern half is further downgradient)	Slight
Groundwater flows (long term)		Negligible	Neutral
Groundwater quality		Minor	Slight

**Table 2.9: Site Description and Summary of Effects for Lower Underhand East RW23**

Overview	
	 <p><b>NGR:</b> SD 70892 48413</p> <p><b>Location:</b> East of Lower Underhand and north of Smelt Mill Clough. Adjacent to RW23 on the northern side of Slaidburn Road</p>



Overview	
	<p><b>Ecological designation(s):</b> Biological Heritage Site</p> <p><b>Reason for selection:</b> Phase 1 Habitat Survey classified the site as a marsh/marshy grassland habitat type (TR4.HTN2-1)</p>
<b>Hydrological features</b>	None within site. An unnamed Ordinary Watercourse sinks 200 m north of the site along the field boundary. Bonstone Brook flows west, 65 m south of the site
<b>Hydrological catchment</b>	Extends 1.3 km northeast, with a peak elevation of 350 mAOD
<b>Soil type</b>	Slowly permeable wet very acid upland soils with a peaty surface
<b>BGS superficial geology</b>	Absent across most of the site, with a small area of glacial till in the southwest. Glacial till is mapped adjacent to the site's western edge
<b>BGS Bedrock geology</b>	Most of the site is underlain by mudstone belonging to the Bowland Shale Formation. The bedrock in the east is the Pendle Grit Member, comprised of sandstone. A northwest-southeast trending fault cuts across the bedrock in the eastern corner of the site.
<b>BGS / GI borehole records</b>	None available
<b>Groundwater features</b>	Ecology surveys noted the presence of boggy areas which hold water
<b>BGS / GI groundwater level data</b>	None available
<b>Initial conceptual site model</b>	<b>Groundwater dependency</b>
There are no springs shown on Ordnance Survey maps, and no site-specific hydrogeological data to suggest that groundwater levels are particularly shallow in this location. However, given the marsh habitat present, and uncertainties associated with the absence of localised GI data, this site cannot be ruled out as being a GWDTE, or partially a GWDTE. The peaty soils may	<b>Moderate</b>

Overview			
become saturated following periods of prolonged or intense rainfall/recharge, which may locally sustain groundwater dependent vegetation.			
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
Groundwater flows/levels (short term)	High	Negligible (GWDTE upgradient of works)	Neutral (small part of site)
Groundwater flows/levels (long term)		Negligible	Neutral
Groundwater quality		Minor	Slight

- 14) The baseline for the next three sites is already described in Chapter 7: Water Environment of the June 2021 Environmental Statement. The CSMs are repeated here (Tables 2.10 to 2.12 and Figures 2.1 to 2.3) to provide context to the assessment of potential off-site highways works effects.

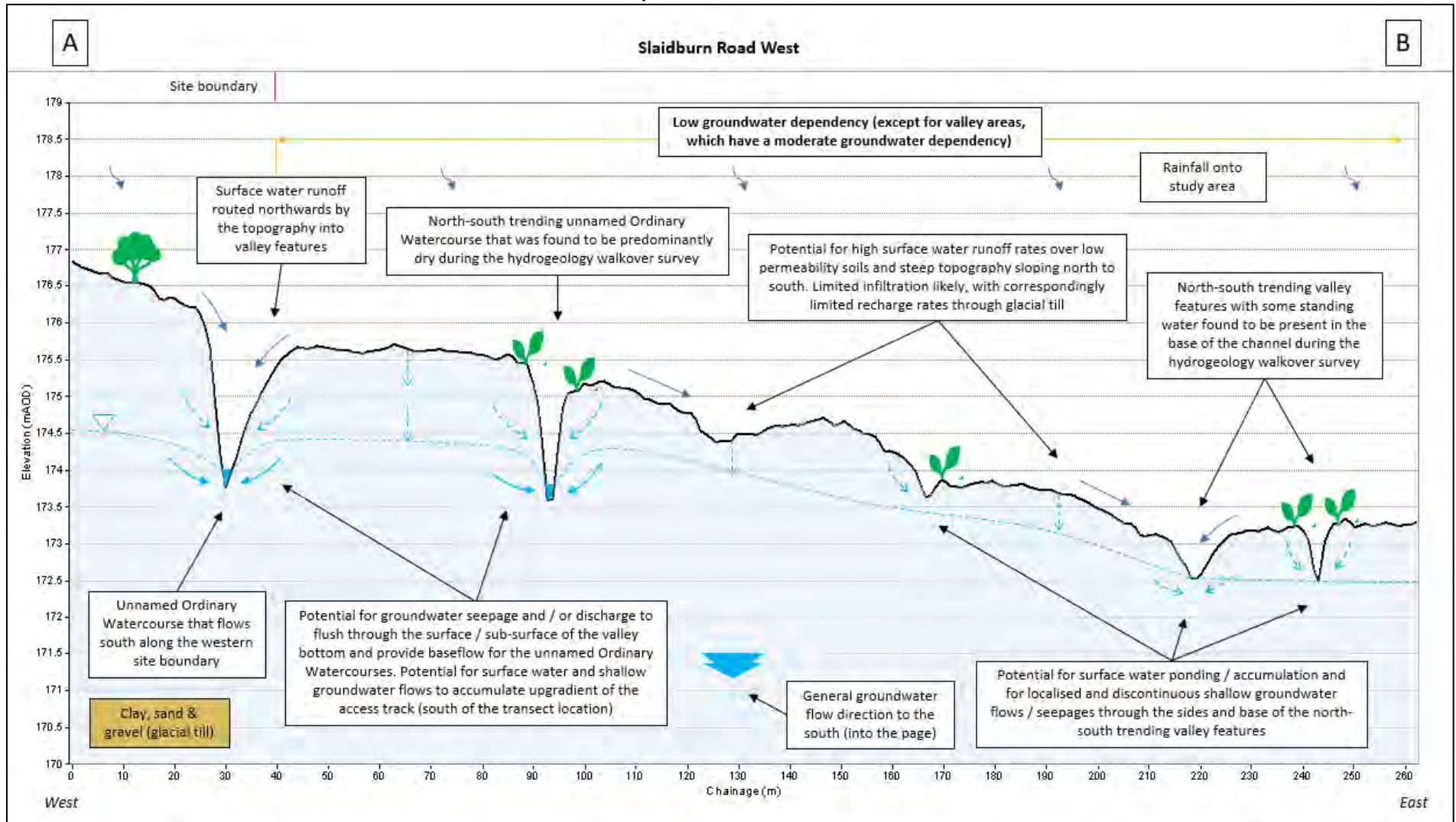
**Table 2.10: Conceptual Site Model Overview and Summary of Effects for Slaidburn Road West**

Overview			
<p>© Crown copyright and database right 2022. All rights reserved. Ordnance Survey.</p>			
<b>Location:</b> West of Slaidburn Road, situated on the northern side of the access track to the Braddup Compound			
Initial conceptual site model			Groundwater dependency
<p>Groundwater within the glacial till is expected to flow southwards, broadly following the topography. Throughout most of the site, the presence of low permeability soils, significant thicknesses of glacial till deposits and steeply sloping topography, likely limits recharge rates to the underlying superficial aquifer, such that groundwater levels are not expected to be particularly shallow. Most of the site is therefore considered to have a low groundwater dependency.</p> <p>However, where watercourses have eroded the glacial till to create incised valley features, there is potential for both surface water runoff and localised shallow groundwater flows to discharge into these topographic lows. When the water table rises following sustained recharge events in the wider catchment, shallow groundwater emergence is possible in the base and sides of the valleys. However, groundwater contributions sustaining potential GWDTEs at the site are expected to be localised and minor. The areas of marsh habitat surrounding the valleys and ditches at the site are therefore considered to be moderately groundwater dependent.</p>			<b>Moderate to low</b>
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
	Medium		Large (southeast only)

Overview			
Groundwater flows/levels (short term)	Low	Major (direct but localised impact to southeast of site)	Moderate (small part of site)
Groundwater flows/levels (long term)	Medium	Moderate (direct but localised impact to southeast of site)	Moderate (southeast only)
	Low		Slight (small part of site)
Groundwater quality	Medium	Moderate (in the southeast of the site, immediately downgradient)	Moderate (southeast only)
	Low		Slight (small part of site)

- 15) Illustration 2.1 shows a conceptualised cross-section running west to east through the centre of the site (Section A-B). The CSM highlights the indicative movement of groundwater and surface water through the site, and guideline groundwater dependencies supporting vegetation and habitats present.

Illustration 2.1: Conceptual Site Model for Slaidburn Road West

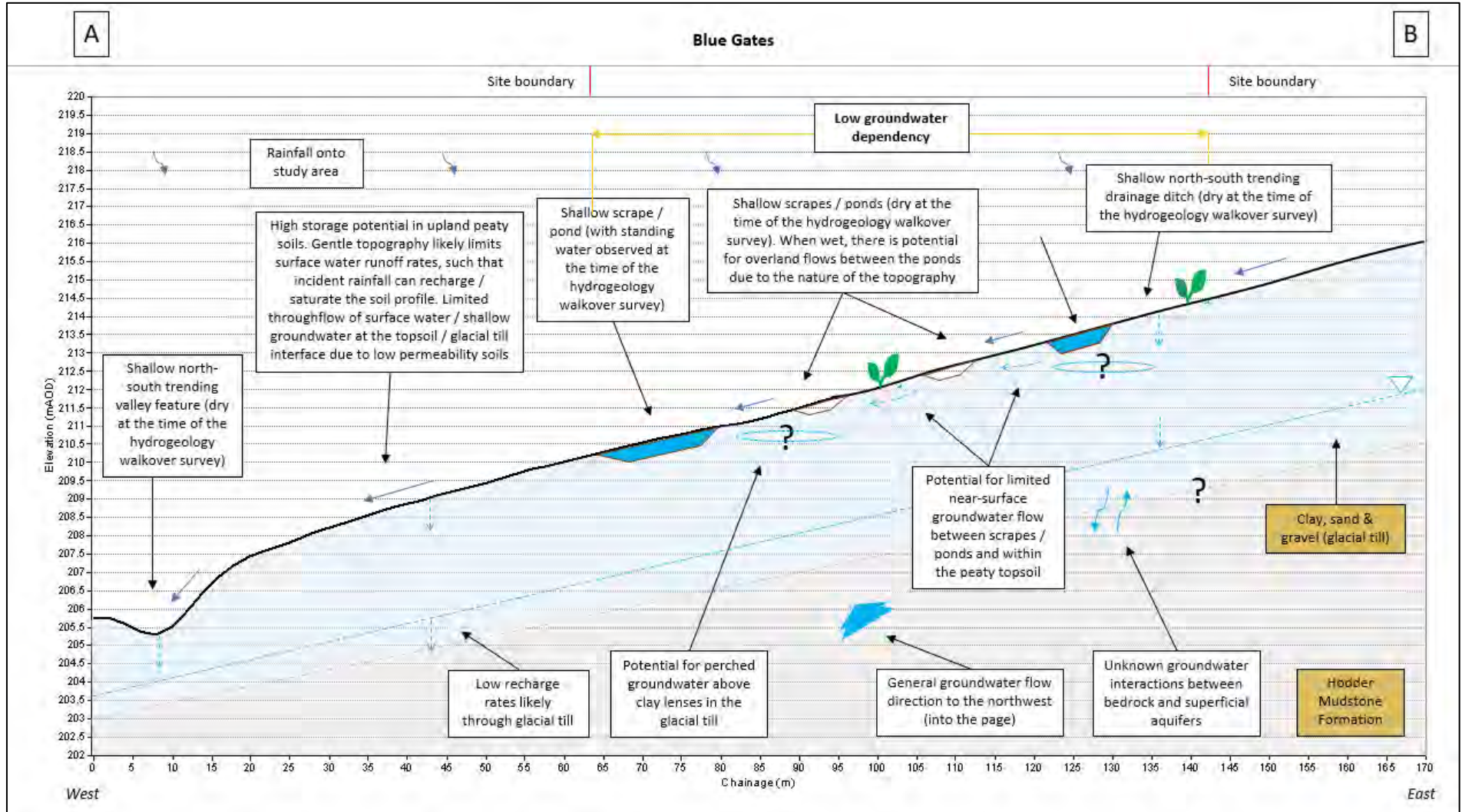


**Table 2.11: Conceptual Site Model Overview and Summary of Effects for Blue Gates**

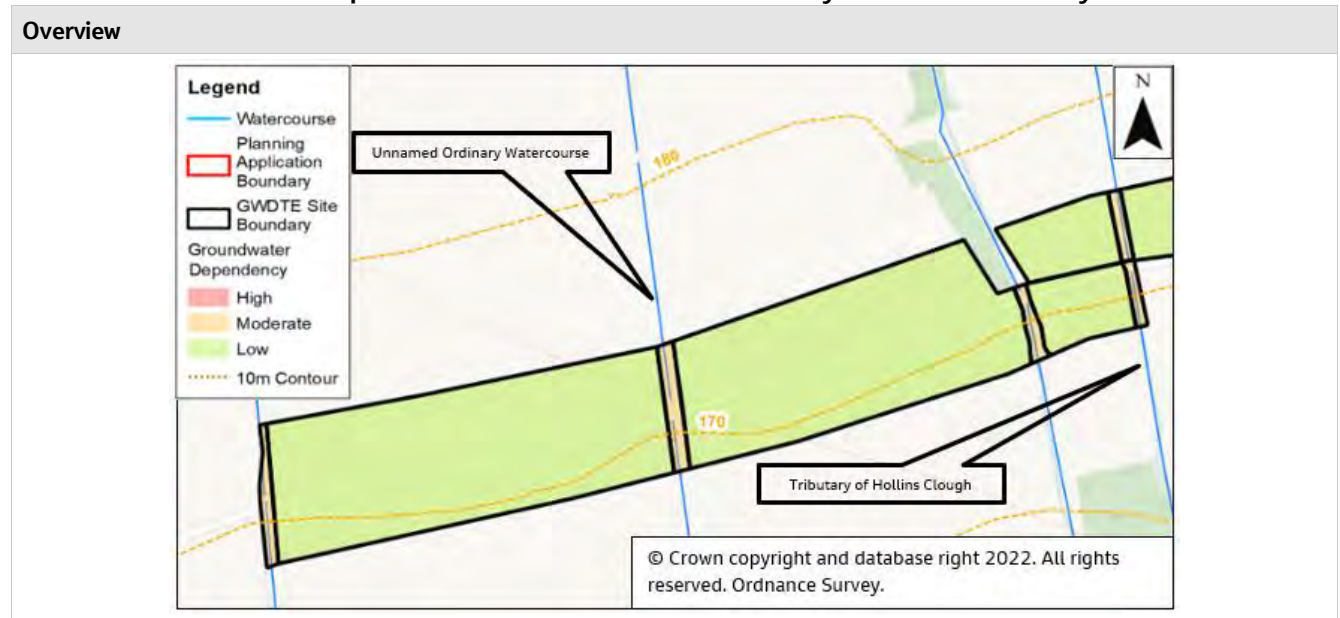
Overview			
<p><b>Location:</b> West of Slaidburn Road, 80 m downgradient of RW24 and 50 m downgradient of the Bonstone Compound access road widening</p>			
Initial conceptual site model			Groundwater dependency
<p>Surface water runoff from the large hydrological catchment to the east, would likely be captured by the shallow drainage ditches and scrapes / ponds identified during the hydrogeological walkover survey. Given the gently sloping topography in the area and the shallow sides of the scrapes / ponds, there is potential for overland flows to be routed west between these features, allowing them to be hydrologically linked. With no evidence of shallow groundwater emergence found at the site, it is unlikely that groundwater levels and flows are particularly shallow for prolonged periods of time. However, the presence of peaty soils means that rainfall could directly recharge the soil profile and saturate the ground surface. Potential for shallow groundwater flows cannot therefore be ruled out, either at the soil / glacial till boundary, or within the upper horizon of the superficial aquifer. However, shallow groundwater flows (if present) would likely be limited and discontinuous, such that the site is considered to have a low groundwater dependency.</p>			<p><b>Low</b></p>
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
Groundwater flows/levels (short term)	Low	Negligible (further downgradient)	Neutral
Groundwater flows/levels (long term)		Negligible	Neutral
Groundwater quality		Negligible	Neutral

16) Illustration 2.2 shows a conceptualised cross-section running west to east through the site (Section A-B). The CSM highlights the indicative movement of groundwater and surface water through the site, and guideline groundwater dependencies supporting vegetation and habitats.

Illustration 2.2: Conceptual Site Model for Blue Gates



**Table 2.12: Conceptual Site Model Overview and Summary of Effects for Whinny Lane East**



**Location:**

Initial conceptual site model	Groundwater dependency
-------------------------------	------------------------

In the north of the site and upgradient of the site boundary, there is potential for high surface water runoff rates over low permeability soils and steeply sloping topography. Infiltration rates are likely to be limited and corresponding recharge rates to the underlying superficial aquifer are also likely to be low, such that the water table is not expected to be particularly shallow in these areas. The north of the site is therefore considered to have a low groundwater dependency.

**Moderate to low**

Upgradient of the access track, there is a break in the topography, which may allow the water table (at times) to approach the ground surface. The presence of drainage ditches either side of the access track means that surface water runoff (from both the contributing catchment to the north, and / or the highway), could accumulate in the base of these channels. With increased residence times for infiltration, recharge to the underlying till would likely increase, further enhancing the potential for a shallower groundwater table in these locations. Within the ditches and their immediate surrounding areas, shallow groundwater emergence is therefore possible. Due to the nature of the topography at the site, this could sustain a flushing mechanism through the surface / sub-surface. The ditches, and any other localised topographic depressions at the site, could therefore be moderately groundwater dependent.

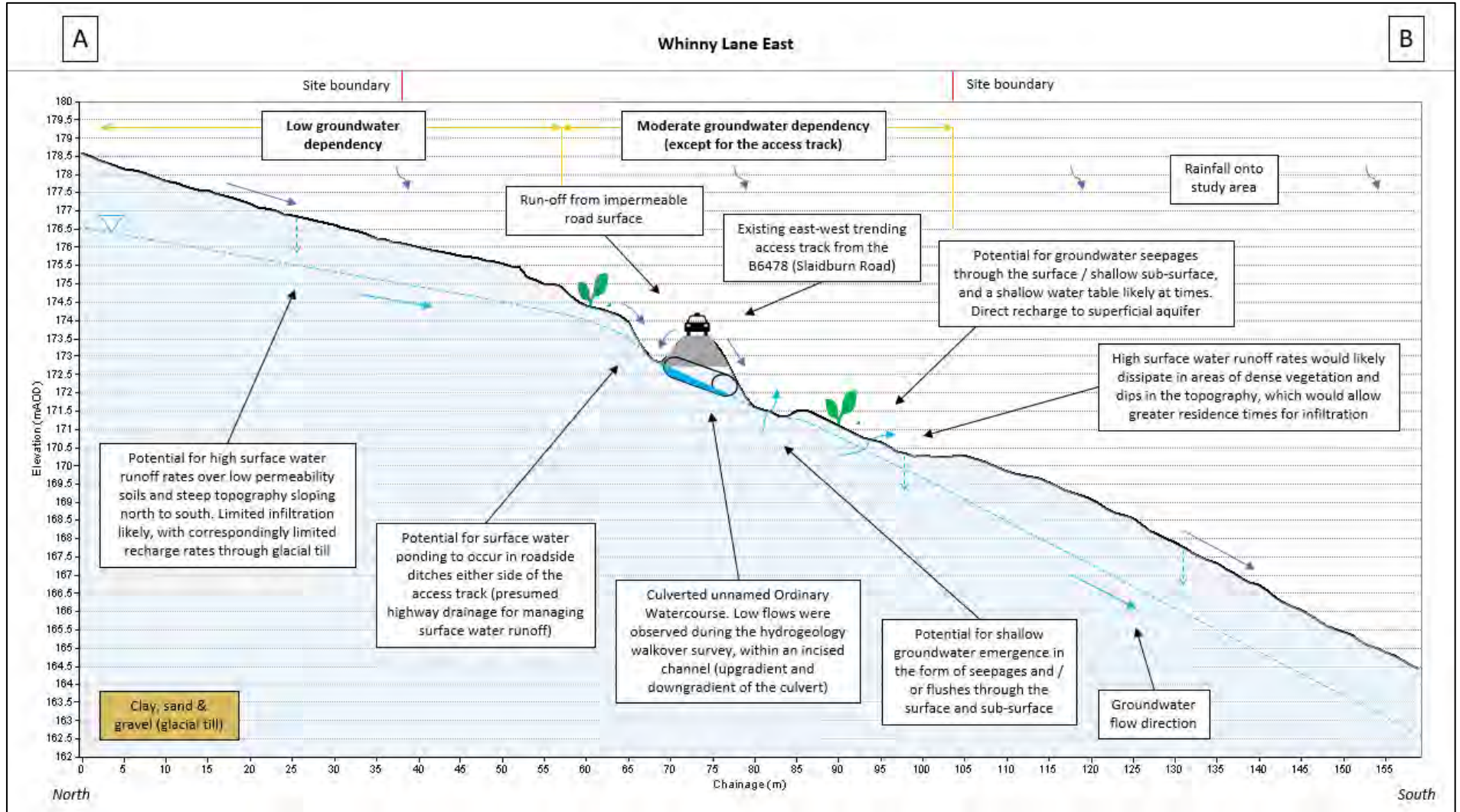
Potential effects	GWDTE sensitivity	Magnitude of impact	Significance of effect
Groundwater flows/levels (short term)	Medium	Moderate (localised impacts downgradient of excavations for bridge foundations)	Moderate (limited to localised area around bridge foundation locations)
	Low	Major (direct impact to small and localised parts of site due to excavations for bridge foundations)	Large (limited to localised area around bridge foundation locations)
Groundwater flows/levels (long term)	Medium	Minor	Slight
	Low	Moderate (direct impact to small and localised parts of site due to	Moderate (limited to localised area around

Overview			
		excavations for bridge foundations)	bridge foundation locations)
Groundwater quality	Medium	Moderate	Moderate
	Low	Moderate (to small and localised parts of site due to excavations for bridge foundations)	Slight (limited to localised area around and downgradient of bridge foundation locations)

- 17) Illustration 2.3 shows a conceptualised cross-section running north to south through the centre of the site (Section A-B). The CSM highlights the indicative movement of groundwater and surface water through the site, and guideline groundwater dependencies supporting vegetation and habitats.



Illustration 2.3: Conceptual Site Model for Whinny Lane East



### 3. Summary of Potential Effects

- 18) Table 3.1 presents a summary of the initial assessment of groundwater dependency of each GWDTE and the associated magnitudes of impacts to existing groundwater flows and quality. As mentioned in Section 2, the impacts predicted to GWDTEs from the off-site highways works are expected to be very localised in nature, with the highest impact magnitudes listed here.

**Table 3.1: Summary of GWDTE Effects – Off-site Highways Works**

Site	Off-site Highways Works ID	Groundwater Dependency	Sensitivity	Highest Magnitude of Impact	Highest Significance of Effect	Significant in the Context of the EIA Regulations 2017?
Browsholme Road South	RW14	Moderate	Medium	Minor	Slight	No
Ringley Hey North	RW15	Moderate	Medium	Major	Large	Yes
Moorcock House East	RW16	High	High to medium	Major	Large	Yes
Waddington Fell South	RW17	Moderate	High	Moderate	Moderate	No
Waddington Fell	RW18 & RW19	High to moderate	High to medium	Major	Large	Yes
Waddington Fell Quarries	RW20	Moderate	Medium	Moderate to low	Medium to low	No
Wallop Well South	RW21 & PP01	High	High to medium	Moderate	Moderate	No
Upper Bonstone Brook	RW22	High to moderate	High	Minor	Slight	No
Lower Underhand East	RW23	Moderate	High	Minor	Slight	No
<b>Braddup Compound Access</b>						
Slaidburn Road West	N/A	Moderate to low	Medium to low	Major	Large	Yes
Blue Gates	N/A	Low	Low	Negligible	Neutral	No
Whinny Lane East	N/A	Moderate to low	Medium to low	Major	Large	Yes

- 19) As discussed in Section 1.2, the assessment of potential significant effects is based on a high-level desk study, with no GI data, and no hydrogeology walkover surveys having been undertaken. As a result, the level of uncertainty associated with the assessment is reflected in the initial classification of groundwater dependency for each site.

- 20) Given that the potential significance of effect is derived from this precautionary approach to determine GWDTE groundwater dependency and corresponding receptor sensitivity, it is recommended that hydrogeology walkover surveys are carried out for each of the sites listed in Table 3.1. This would enable the groundwater dependency classifications to be refined, and perhaps in some instances, act as a second screening assessment before site-specific mitigation measures need to be identified for remaining significant effects.
- 21) Two sites listed in Table 3.1 (Slaidburn Road West and Whinny Lane East) are predicted to experience significant potential effects due to the construction of temporary 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. It should also be noted that through design evolution, the option of road widening, and culvert upsizing has been scoped out, which would have resulted in a wider impact footprint of equally significant magnitude.
- 22) Several good practice mitigation measures are embedded in the Construction Code of Practice which was presented in the June 2021 Environmental Statement. In addition, Table 3.2 provides a list of additional standard mitigation measures for reducing the potential significance of effect caused by impacts to groundwater flows and quality at GWDTE sites.

**Table 3.2: Additional Standard Mitigation to Reduce Potentially Significant Effects to GWDTEs**

Mitigation	Groundwater Flow / Quality	Benefits Provided
Stagger topsoil stripping activities, i.e. small sections at a time	Groundwater quality	Would limit the concentration of suspended solids and associated solutes entering the aquifer(s) and would reduce peak contaminant concentrations.
Monitor weather forecasts, including rainfall / flood warnings and alerts	Groundwater quality	To restrict topsoil stripping and vegetation clearance activities when heavy rainfall is forecast, to further reduce the likelihood of suspended solids entering the groundwater environment.
Minimise footprint of topsoil stripping and vegetation clearance wherever possible	Groundwater quality and flow	There is no mitigation for direct habitat loss due to topsoil stripping so minimising this area would have a direct beneficial impact on reducing the extent of potentially significance effects caused by this activity.

- 23) In summary, although impacts to groundwater flows and quality are generally expected to be minor when considering each site as a whole, localised significant residual effects would remain. It is therefore recommended that further opportunities to reduce impacts are discussed with the Environment Agency, although it is noted that this may be limited due to a number of design constraints.

#### **4. Water Framework Directive**

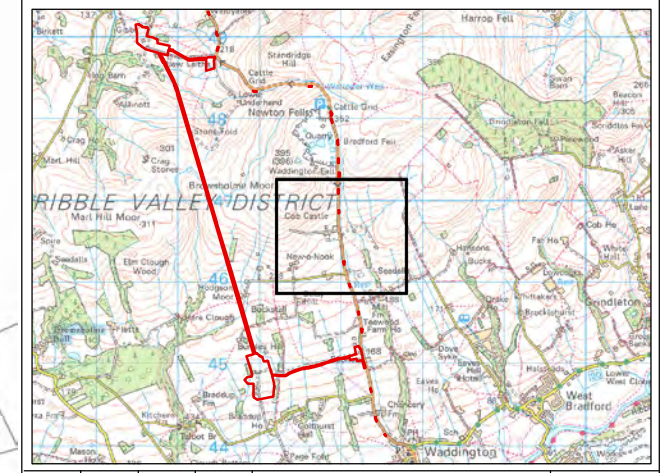
- 24) All GWDTE sites lie within the Ribble Carboniferous Aquifers (GB41202G103000) Water Framework Directive (WFD) groundwater body (Environment Agency, 2021). As of 2019, the groundwater body was achieving 'poor' overall status, with good quantitative status and poor chemical status.
- 25) As described in Section 2, excavating to a maximum depth of 0.8 m, as a result of the proposed off-site highways works, could lead to changes in shallow groundwater levels, flows, and quality, supporting the GWDTEs. With the data gaps present, precautionary short-term major and moderate changes in groundwater levels, flows, and/or quality have been predicted in parts of eight out of 12 of the GWDTE sites identified.
- 26) However, given that the GWDTEs are not nationally or internationally designated, impacts would not result in a deterioration of the groundwater body status. No additional WFD mitigation is therefore required.

FIGURE 1



**Legend**

- Planning Application Boundary
- GWDE Site Boundaries
- Watercourse
- Local Planning Authority Boundary



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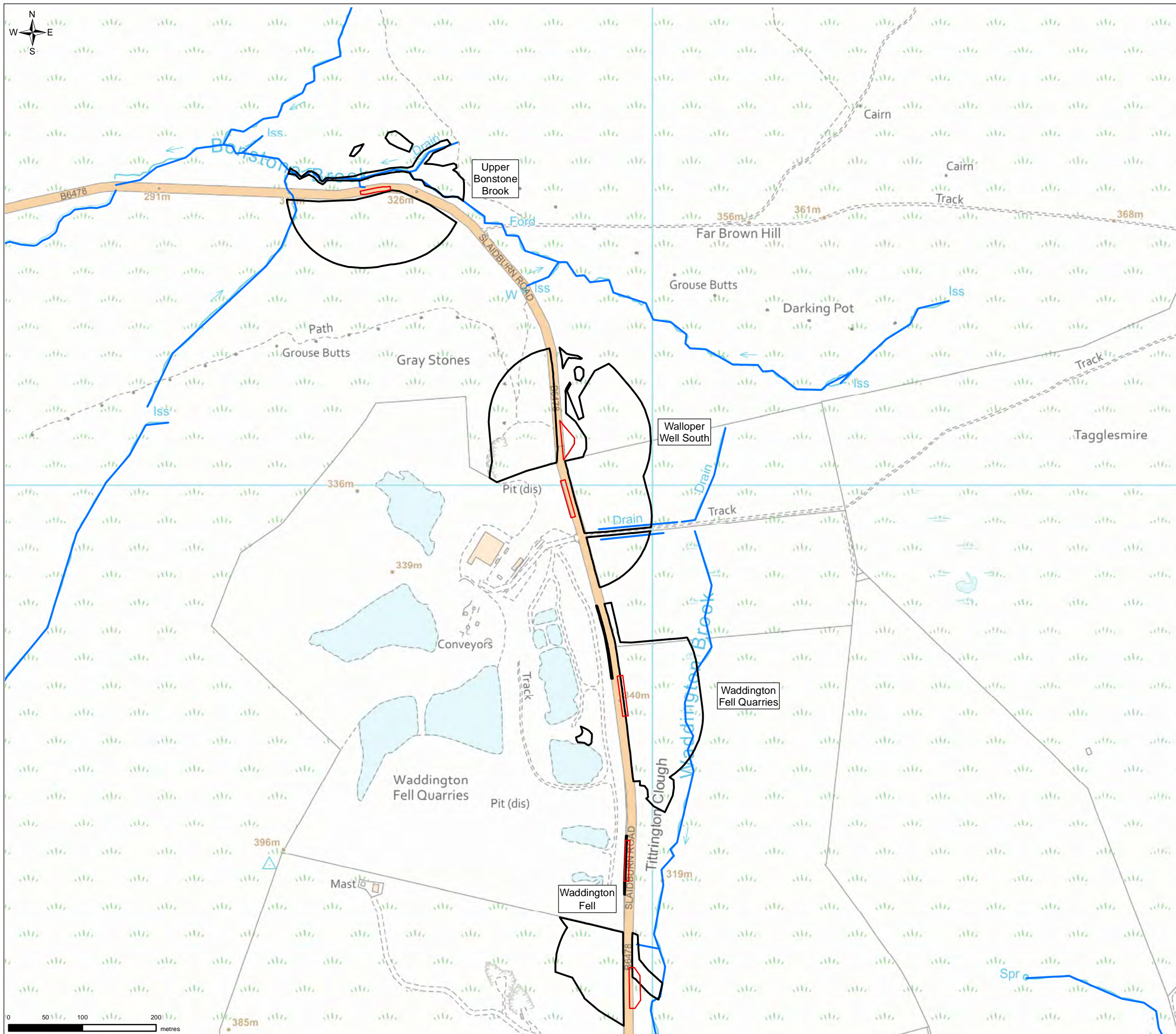


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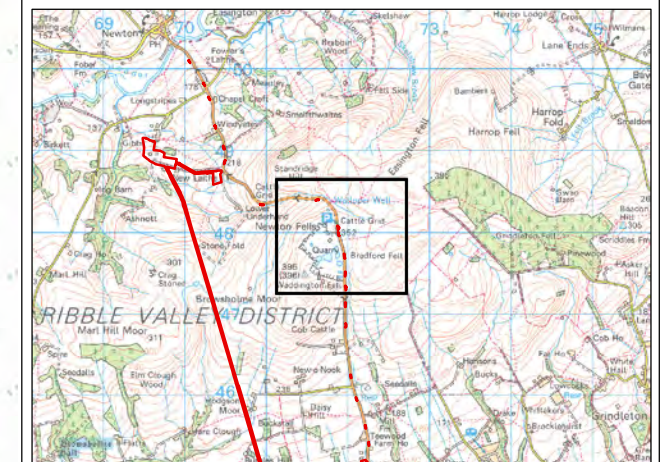
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FIGURE 1



- Legend
- Planning Application Boundary
  - GWDE Site Boundaries
  - Watercourse
  - Local Planning Authority Boundary



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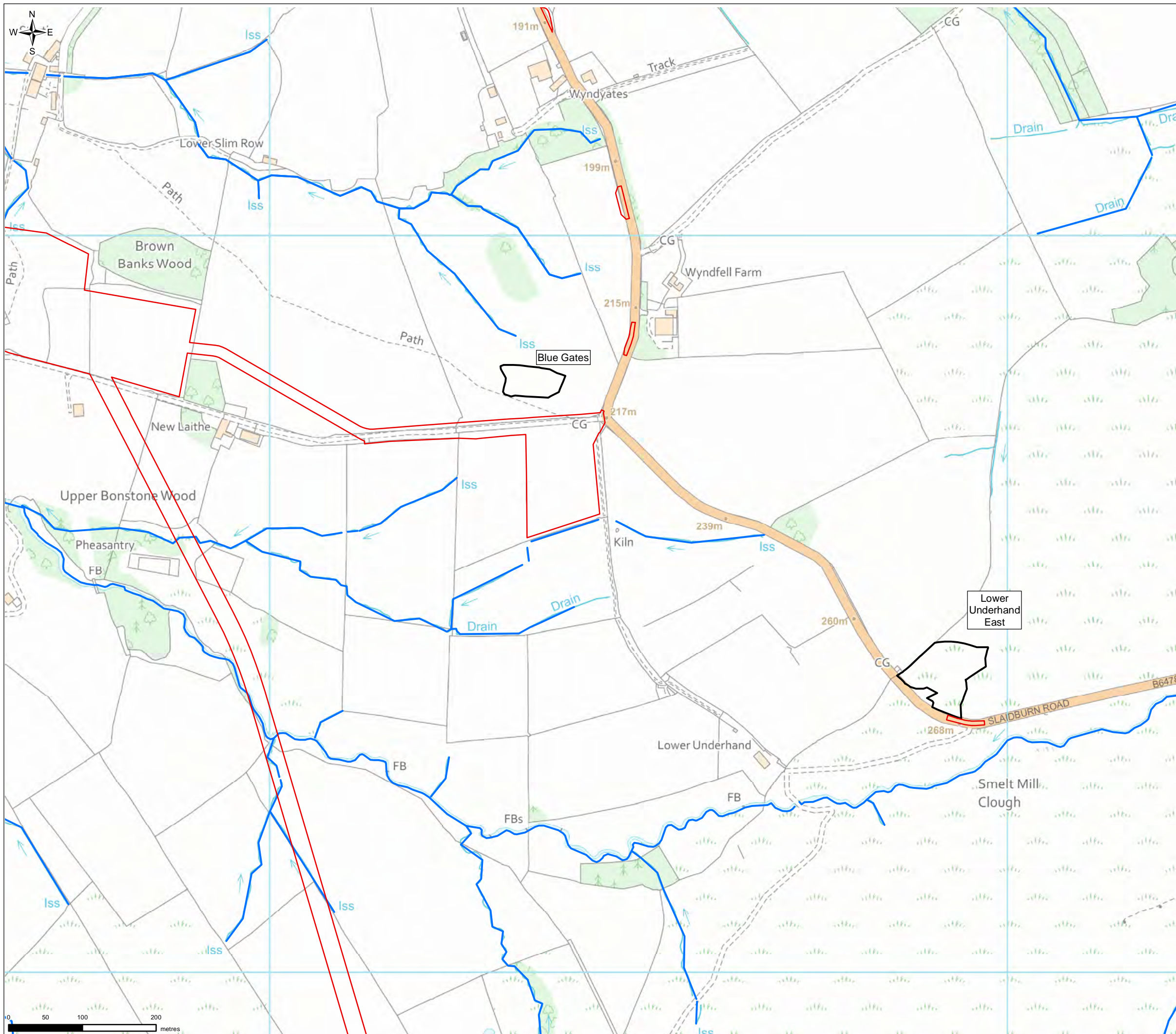


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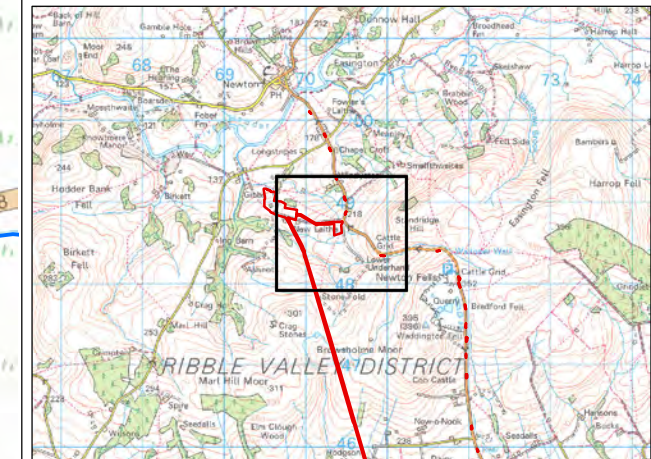
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FIGURE 1



- Legend**
- Planning Application Boundary
  - GWDTE Site Boundaries
  - Watercourse
  - Local Planning Authority Boundary



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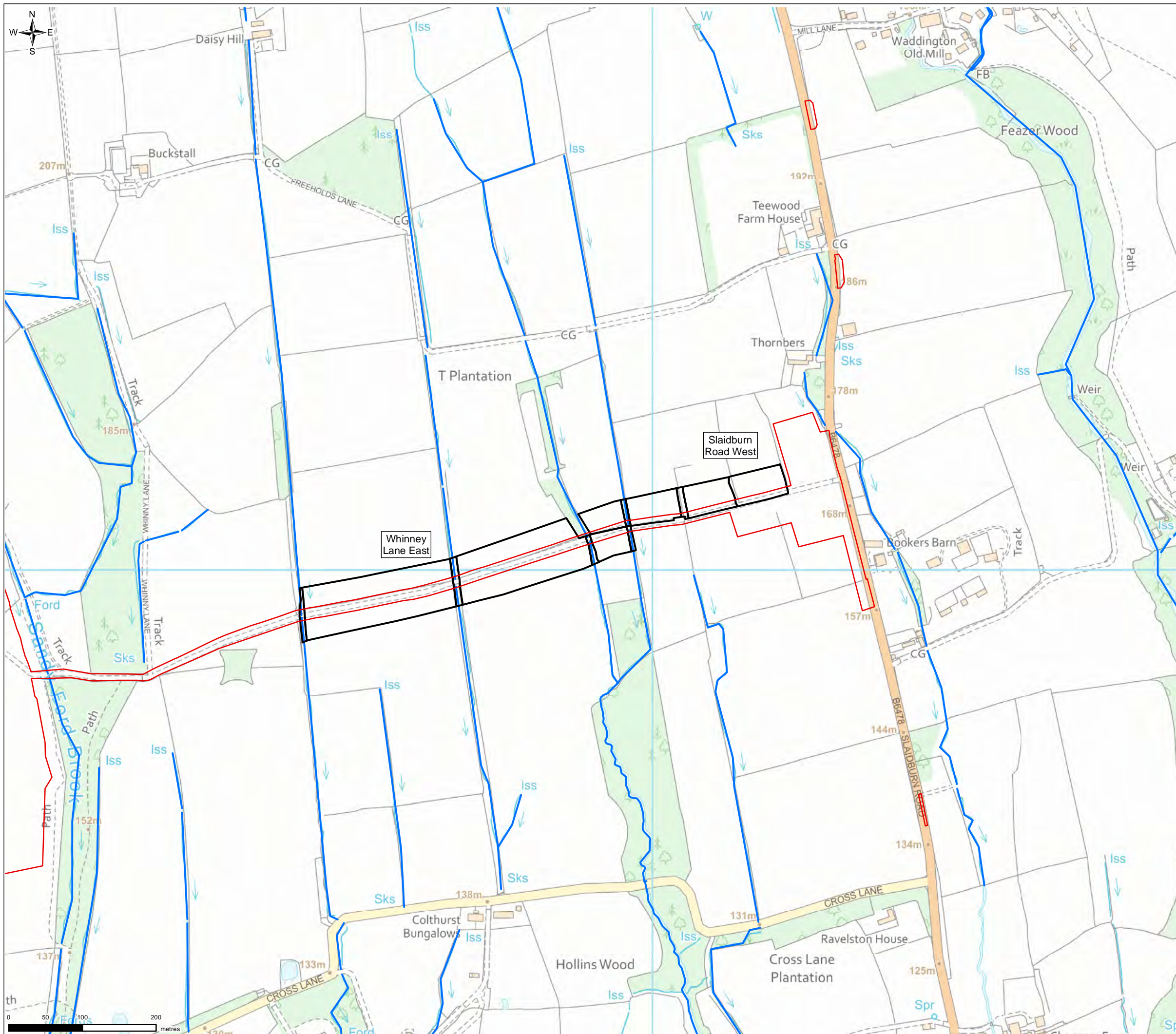


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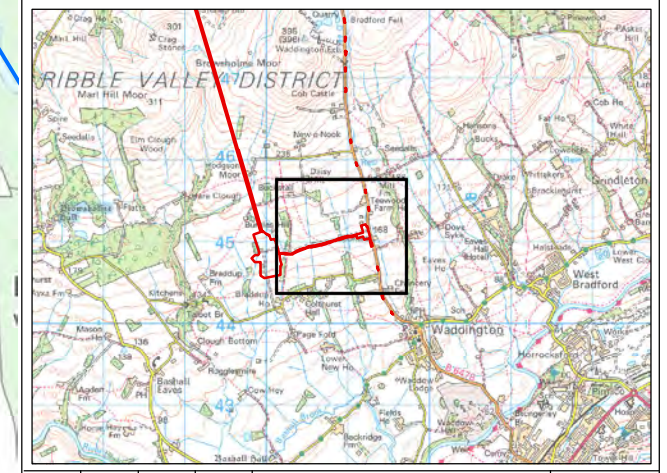
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FIGURE 1



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