

**TRANSPORT AND WORKS ACT 1992**  
**NETWORK RAIL (HUDDERSFIELD TO WESTTOWN  
(DEWSBURY) IMPROVEMENTS) ORDER**

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**STATEMENT OF COMMON GROUND**  
***NETWORK RAIL INFRASTRUCTURE LIMITED & THE  
ENVIRONMENT AGENCY***

Document Reference	NR/SOCG/2
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**The Network Rail (Huddersfield to Westtown (Dewsbury) Improvements) Order December 2021**

*Statement of Common Ground - Network Rail Infrastructure Limited & the Environment Agency*

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## **1. INTRODUCTION**

- 1.1 Network Rail Infrastructure Limited (“NR”) made an application on 31<sup>st</sup> March 2021 for an order under the Transport and Works Act 1992 to authorise the construction, maintenance and operation by NR of works on the Transpennine Line between Huddersfield and Westtown (Dewsbury) for the purposes of increasing capacity and improving journey time and performance reliability of rail services on the Transpennine Line both between Huddersfield and Westtown (Dewsbury) and Manchester, Leeds and York. The order applied for entitled “The Network Rail (Huddersfield to Westtown (Dewsbury) Improvements Order” (“the Order”).
- 1.2 In connection with NR’s application for the Order, a request has also been made by NR to the Secretary of State for Transport under section 90(2A) of the Town and Country Planning Act 1990 that planning permission, so far as it is required, shall be deemed to be granted for the development proposed to be authorised by the Order (**NR12**).
- 1.3 The Environment Agency (“the EA”) submitted a representation on 17<sup>th</sup> May 2021 (given reference REP/03) (“the Representation”) and a Statement of Case dated 6<sup>th</sup> July 2021 (“the SoC”) in relation to NR’s application for the Order.
- 1.4 This Statement of Common Ground is intended to provide a succinct summary of the matters that have been resolved between the EA and NR in relation to NR’s Order application and the request for deemed planning permission for the development proposed to be authorised by the Order.
- 1.5 This Statement of Common Ground is also intended to provide a succinct summary of the matters that remain unresolved between the EA and NR in relation to NR’s Order application and the request for deemed planning permission for the development proposed to be authorised by the Order. For these matters see Sections 4 and 5.

## **2. STRUCTURE OF STATEMENT**

2.1 This Statement is structured so to address the following matters raised by the EA in the Representation and/or the SoC by reference to the following themes:-

- Disapplication of legislative provisions – Flood Risk Activity and Order protective provisions (**see section 3**).
- Disapplication of legislative provisions – Surrender of an Environmental Permit (Article 6) and the Forge Lane Quarry (**see section 4**).
- Flood Risk (**see section 5**):-
  - Assessment of Risk (**see section 5.1**);
  - Compensatory Flood Storage (**see section 5.2**);
  - Flood Risk Mitigation Measures (**see section 5.3**); and
  - Safe Access and Egress (**see section 5.4**).
- Biodiversity (**see section 6**).
- Water Quality (**see section 7**).
- Groundwater & Contaminated Land (**see section 8**).
- Code of Construction Practice (Part A) (**see section 9**).
- Planning Conditions (**see section 10**):-
  - Planning Condition – Landscape and Ecology (**see section 10.2**);
  - Planning Condition – Code of Construction Practice (**see section 10.3**);
  - Planning Conditions – Contaminated Land and Unexpected Contaminated Land (**see section 10.4**); and
  - Planning Condition – Scheme Wide Drainage Strategy (**see section 10.5**).

### **3. DISAPPLICATION OF LEGISLATIVE PROVISIONS – FLOOD RISK ACTIVITY AND ORDER PROTECTIVE PROVISIONS**

#### **3.1 Statement of Common Ground - Disapplication of Legislative Provisions – Flood Risk Activity**

3.1.1 NR and the EA agree to the inclusion in the draft Order (**NR02**) of the disapplication sought by Article 5(1)(a) (*disapplication of legislative provisions*) of the requirement for a flood risk activity permit under Regulation 12(1)(a) of Environmental Permitting (England and Wales) Regulations 2016 in relation to any works executed under the powers conferred by the draft Order.

3.1.2 In consequence of NR and the EA agreeing to the inclusion in the draft Order (**NR02**) of the disapplication sought by Article 5(1)(a), NR and the EA have further agreed by way of agreement between the parties a process for managing the submission by NR to the EA of relevant design details pursuant to the protective provisions provided to the EA in Part 3 of Schedule 19 to the draft Order (**NR02**):

- In utilising the disapplication provisions given by Article 5(1)(a), NR shall submit the required design information using the standard EA format for permit applications for ease of processing;
- Applications shall be submitted to the relevant EA planning point / portal; and,
- Article 5(1)(a) remains in force and NR will comply with the protective provisions provided to the EA in Part 3 of Schedule 19 to the draft Order (**NR02**).

3.1.3 There are therefore no matters outstanding regarding the inclusion of Article 5(1)(a) in the Order.

#### **3.2 Statement of Common Ground - Order Protective Provisions**

3.2.1 NR and the EA have agreed amendments to the form of the protective provisions for the protection of the EA that were included in Part 3 of Schedule 19 to the draft Order (**NR02**). The agreed amendments to these protective provisions are shown by way of tracked amendments in **Appendix 1** of this Statement. NR and the EA agree that NR will submit to the Inquiry for NR's application for the Order these agreed amendments and that NR will propose that these amendments are included in the made Order.

3.2.2 There are therefore no matters outstanding regarding the protective provisions for the protection of the EA to be included in Part 3 of Schedule 19 to the draft Order (**NR02**).

#### **4. DISAPPLICATION OF LEGISLATIVE PROVISIONS – SURRENDER OF AN ENVIRONMENTAL PERMIT (ARTICLE 6) & THE FORGE LANE QUARRY**

##### **4.1 Statement of Common Ground - Forge Lane Quarry**

4.1.1 NR and the EA agree that there are no matters outstanding in considering the non-compliance notices issued by the EA to the current operator of the Forge Lane Quarry site.

4.1.2 The EA and NR agree that it is for NR to manage this item in consultation with the operator when temporary possession is taken for the site under the recommended mitigation and Condition 10: Contaminated Land as proposed by NR to be attached to the request for deemed planning permission (see Appendix 2 of this document).

##### **4.2 Matters Outstanding - Disapplication of legislative provisions – Surrender of an environmental permit (Article 6)**

4.2.1 NR and the EA do not agree on the requirement for the inclusion in the draft Order (**NR02**) of Article 6 (*Disapplication of legislative provisions relating to the surrender of an environmental permit*).

###### *NR's Position*

4.2.2 NR's justification for the requirement to include Article 6 in the draft Order (**NR02**) for the purposes of the works authorised by the Order is detailed in the Explanatory Memorandum (**NR03**) (see page 4) and in the Environment Proof of Evidence of Jim Pearson (**NR/PoE/JP/8.2**) (see sections 8.8 to 8.10). NR's position is detailed further below.

###### *NR's justification for the inclusion of Article 6*

4.2.3 Regulation 25 of, and Part 1 of Schedule 5 to, the Environmental Permitting (England and Wales) Regulations 2016 ("the 2016 Regulations") make provision to regulate applications for the surrender of an environmental permit by an operator of a regulated facility (as defined by the 2016 Regulations). Such environmental permits do not run with the land on which the regulated facility is operated. Therefore, where land within the Order limits is compulsorily acquired by NR under the powers to be conferred by the Order for the purposes of the construction and operation of the authorised works, any environmental permit relating to that land will remain with the original permit holder and the terms of such an environmental permit will continue to apply to the use of the land notwithstanding its compulsory acquisition by NR for the purposes of the authorised works. Such an environmental permit can then only be surrendered under the 2016 Regulations by the original permit holder regardless of the compulsory transfer to NR of the land to which the permit applies. In addition, whilst an existing environmental permit may be transferred to NR (with the agreement of the existing permit holder and the EA) the 2016 Regulations do not contemplate the

subsequent surrender by NR of a permit transferred to NR in the context of NR using the land subject to the permit not for operation of a regulated facility but for the purposes of the authorised railway works.

4.2.4 The Order will authorise the construction and operation of new railway lines (Work No.15) and ancillary railway works required to support the electrification of the railway between Huddersfield and Westtown (Dewsbury) on land within the Order limits which is currently subject to the operation of existing environmental permits. These railway and electrification works form part of the core purpose of the works to be authorised by the Order. Therefore, in order to provide certainty that the core purposes of the project can proceed and be delivered provision is required in the Order to enable NR to address the operation of such existing environmental permits in the context of the works authorised by the Order.

*NR's proposed operation of Article 6*

4.2.5 As set out in the Explanatory Memorandum (**NR03**) (see page 4), Article 6 as applied for (see **NR02**) would operate as follows:-

- Paragraph (1) of Article 6 disapplies the operation of Regulation 25 of, and Part 1 of Schedule 5 to, the 2016 Regulations in relation to an application made by NR to the EA for the surrender of an environmental permit under Paragraph (2) of Article 6. Paragraph (2) of Article 6 then replaces the disapplied provisions and authorises NR, on application to the EA, to request the surrender of an environmental permit issued to the original permit holder or transferred to NR by the EA under the 2016 Regulations for the operation of a regulated facility on the land specified in Paragraph (6) of Article 6.
- In relation to such an application Paragraph (3) of Article 6 then replaces the disapplied provisions and instead provides for the EA's acceptance of such an application to be subject to the requirement for NR to obtain the approval of plans by the EA. The plans to be approved by the EA are for details of the measures for avoiding a pollution risk from the use of the site of the regulated facility for the authorised works or from its former operation as a regulated facility and for returning the site to a satisfactory state upon completion of the construction of the authorised works. In approving such plans Paragraph (4) of Article 6 provides for the EA to give such approval subject to such reasonable requirements as the EA may make for the avoidance of a pollution risk resulting from the construction of the authorised works on the site of the regulated facility or from the former use of the site as a regulated facility. These approval provisions being based on the management measures identified in Paragraph 14 of Part 1 of Schedule 5 to the 2016

Regulations for determining the surrender of environmental permit for a regulated facility.

- Paragraph (5) of Article 6 then provides confirmation that the approval of these plans by the EA overrides any requirement under the 2016 Regulations for any further environmental permit in consequence of the construction and operation of the authorised works on the site of the regulated facility subject of such an approval under Paragraph (3) of Article 6.

4.2.6 Accordingly, Article 6 is intended to operate so as to provide an equivalent level of environmental protection and certainty for the surrender of such environmental permits as would be provided where such environmental permits were surrendered under the 2016 Regulations. In addition, the surrender approval process provided by Article 6, whilst adapted to reflect the context of the future use of land for railway works, is based upon on the same management measures identified in Paragraph 14 of Part 1 of Schedule 5 to the 2016 Regulations so as to provide that any surrender application sought by NR pursuant to Article 6 is subject to the same tests before the EA accept any such application.

*NR's proposed amendments to Article 6*

4.2.7 Following discussions with the EA NR is proposing to amend Article 6 as applied for (see **NR02**) to provide the EA with further assurance as regards the operation of Article 6. In summary the amendments proposed by Network Rail are:-

- *New Paragraph (5)* – That works on the site of a regulated facility which is subject of an approval under Article 6 must be constructed in accordance with plans approved under article 6 and to the reasonable satisfaction of the EA. In addition to allow for an officer of the EA, on giving such notice as may be reasonable in the circumstances, to inspect and watch the construction of such works.
- *New Paragraph (6)* – That NR must give the EA not less than 14 days' notice of its intention to commence the construction of works on the site of a regulated facility which is subject of an approval under Article 6 and notice of the completion of such works not less than 7 days' after the *date* on which such works are first brought into public use.
- *New Paragraph (8)* - Any dispute arising between NR and the EA under Article 6, if the parties agree, is to be determined by arbitration under article 57 of the Order, but otherwise is to be determined by the Secretary of State for Environment, Food and Rural Affairs and the Secretary of

State for Transport acting jointly on a reference to them by NR or the EA, after notice in writing by one to the other.

- 4.2.8 The full terms of these amendments are set out in **Appendix 3** of this document. NR will submit to the Inquiry for NR's application for the Order these agreed amendments and that NR will propose that these amendments are included in the made Order.
- 4.2.9 NR will continue to work with existing permit holders and the EA to seek to agree through the EA's pre-application service, where practicable, a means for managing the future operation of such permits in relation to land which NR will permanently acquire, or permanently acquire rights over, for the construction and operation of the Order works. However, in the absence of such agreement NR requires the inclusion in the Order of the mechanism provided by Article 6 (as proposed to be amended) for the reasons set out above. In addition, should NR need to place reliance on Article 6 (as proposed to be amended) NR will continue to engage with the EA on pre-application discussions to assist with the EA's handling of any potential application made by NR under Article 6.
- 4.2.10 It should also be noted that NR have also proposed in its application for deemed planning permission for the works to be authorised by the Order planning conditions to address works carried out on contaminated land (see planning conditions 10 and 11 (**NR12**) as amended by **INQ/12** and **INQ/12B**). In particular these planning conditions will regulate NR's carrying out of works on land which NR only proposes to take temporary possession of for the purposes of construction of the project. This land then returning to the existing landowner after NR's temporary possession.

#### *EA's Position*

- 4.2.11 The EA's position is that Article 6 is unacceptable in principle. The Environmental Permitting (England and Wales) Regulations 2016 provide a regime for the control of landfill sites to appropriately protect the environment from potential pollution. We consider that NR needs to demonstrate a compelling case and particular reasons that the EPR should be disapplied by the TWAO in this case. The EA does not consider that it has done so.
- 4.2.12 NR's concern appears to be centred on their belief that the EPR do not contemplate a situation where the permit is transferred to an operator who will not be operating a landfill site but using the land for a different purpose. We disagree with this interpretation of the EPR.
- 4.2.13 Advice relating to the surrender of environmental permits is set out in the Defra Core Guidance on Environmental Permitting. In particular paragraph 7.32 of this guidance states:-

*“7.32 Other than in exceptional circumstances operators should remove any contamination and return the site to the original condition. However, where an operator can robustly demonstrate that is unsustainable or not practical to do this, then the contamination should be removed as far as practicable.”*

4.2.14 We would also refer to guidance from Defra on this issue contained in ‘Environmental Permitting Guidance: The Landfill Directive’ and, in particular, to paragraphs 4.216 and 4.217 regarding surrender of permits:-

*“Surrender*

*4.216 The Environment Agency must satisfy the requirements of Article 13(d) (Schedule 10, paragraph 11) [of the Landfill Directive] when it determines an application to surrender the environmental permit.*

*4.217 It is important to note that at surrender, a site may not be suitable for all development. It simply confirms that the Environment Agency considers that additional or active control measures are unlikely to be required to prevent pollution or harm as a result of emissions from the undisturbed site. Development work which disturbs the contents of the site or which introduces a new receptor will not have formed part of that decision.”*

4.2.15 Our current view is that if a development has planning approval then the surrender application for the environmental permit must consider the impact of that development on the pollution risk.

4.2.16 The EA has published regulatory guidance to clarify our position at landfill sites. This is in [Regulatory Guidance Note, RGN 9: Surrender](#). This recognises that the waste cannot be removed from a landfill. It confirms that the EA will make a risk-based decision based on the completion criteria developed for a particular site (paragraph 4.2). The EA has also published guidance on the standards we expect for landfill permit surrender applications. That includes those completion criteria standards. This is in [‘Landfill \(EPR 5.02\) and other permanent deposits of waste; how to surrender your environmental permit.](#)

4.2.17 We can see no reason that NR cannot achieve what it needs to for the purposes of the proposed development in the normal way under the EPR. If NR is concerned that the operators of the two sites will not agree to transfer the permits to NR, we would have no objection to a provision that such a transfer will happen automatically on the granting of the TWAO.

4.2.18 We are concerned that if Article 6 is included in the TWAO in its current form this will potentially result in a lower standard of protection for the environment, especially as it would be cited as a precedent for other applications for TWAOs, development consent orders and similar legislation.



4.2.19 We would comment further that:-

- Article 6 provides for approval to be deemed if the EA does not meet timescales. This is contrary to the normal approach in the EPR where a failure to meet such timescales give rise to a right of appeal. This approach ensures that environmental protection remains secure.
- There are no enforcement provisions within Article 6 equivalent to those within the EPR.
- With regard to the dispute clause in Article 6, under EPR if the EA refuses a surrender of an environmental permit any appeal against the decision would be made to the Secretary of State for the Environment and the appeal would be considered by an Inspector with the appropriate expertise and who would be aiming to uphold the legal requirements, rather than simply resolve a dispute between parties. We do not consider therefore that arbitration is an appropriate means of dispute resolution.

## **5. FLOOD RISK**

### **5.1 Statement of Common Ground – Assessment of Risk**

5.1.1 NR has held discussions with the EA to address the questions of clarification raised by the EA regarding the Flood Risk Assessment (FRA) undertaken by NR for the Order Scheme as reported in the Environmental Statement (**NR16A and 16B**). NR has supplied further FRA clarification information to the EA, as requested by the EA, that satisfies these questions of clarification raised by the EA regarding the FRA. The further information provided by NR to the EA in the form of an FRA clarification document is attached at **Appendix 4** of this document. This being the FRA clarification document (version 4) November 2021.

5.1.2 The EA raised a specific question of clarification regarding the approach in the FRA to the assessment of flood risk along Blackhouse Dyke (situated in Route Section 2). NR set out its approach to the modelling of Blackhouse Dike in the absence of any flood level data being available for this watercourse in the existing River Colne model. Further clarification was provided verbally to the EA to agree the approach to using design flow data for the assessment of risk to and from the development associated with increased flows attributed to climate change to support the FRA conclusion that no flood risk arises in relation to the Blackhouse Dyke from the Order works. The approach taken was agreed with the EA and will be formally reflected in the flood risk assessment clarification document. NR and the EA agree that this is an acceptable way to proceed and so this matter does not constitute a matter outstanding for the purposes of this document.

5.1.3 In consideration of the further FRA clarification information provided by NR the EA currently have no matters outstanding regarding the FRA undertaken by NR for the Order scheme subject to the resolution of the matters detailed in Sections 5.4 and 5.5 below.

### **5.2 Statement of Common Ground – Flood Risk Mitigation Measures**

5.2.1 NR has supplied further information to the EA that satisfies the questions of clarification that the EA asked regarding flood risk mitigation measures. In summary at the end of each Route Section assessment in the Environmental Statement (**NR16A**) is confirmation of where the FRA includes required mitigation measures. In addition NR have provided the EA with mapping information to help clarify with the EA the mitigation measures proposed.

5.2.2 NR has agreed with the EA that the following mitigation measures requested by the EA will be considered by NR in its development of the pollution prevention and incident control plan (see also paragraph 7.1.1 below). These measures

will be considered by NR as applicable to any compounds, laydown areas or other areas required for a temporary use by NR in connection with the construction of the Order that are located in 1%AEP<sup>1</sup> flood extent, including an allowance for Climate Change ("CC"):

- Any non-moveable structures, including but not limited to site offices, stockpiles, plant or ground raising etc. will only be acceptable within 1%AEP + CC flood extent if shown by assessment to not increase flood risk;
- Any moveable items must be moved out of the 1%AEP + CC flood extent following a flood warning and prior to the onset of flooding. An assessment of time of onset of flooding is needed for this, to show that it is feasible;
- A requirement for NR to demonstrate that there are measures in place to stop any plant or other items, that can't be evacuated, from floating offsite and causing flood risk increases; and
- That the principles set out above will be reflected within the pollution prevention and incident control plan, which will be included within Part B of the Code of Construction Practice.

5.2.3 On the basis of the updated information sent to the EA and the commitments identified in section 5.2.1 and 5.2.2, it can be stated there are no matters outstanding in relation to flood risk mitigation measures.

### **5.3 Statement of Common Ground – Safe Access and Egress at Mirfield Station**

5.3.1 NR has provided further clarity to the EA on the proposals at Mirfield Station for safe access and egress in the event of flooding and have confirmed to the EA that discussions are ongoing with the Lead Local Flood Authority ("LLFA").

5.3.2 On the basis of the updated information sent to the EA there are no matters outstanding. The EA has been advised by NR that Kirklees Council as the LLFA is discussing these safe access and egress proposals at Mirfield Station with NR and on that basis no further comment from the EA is required.

### **5.4 Matter Outstanding – Flood Modelling**

5.4.1 NR have confirmed with the EA that the FRA undertaken for the Order scheme was based on the EA's provided flood model with Order scheme details included where required. While the EA agree with the principles within the FRA, the EA has reviewed the outputs of the flood model, based on the further flood modelling data which has been provided by NR to the EA to date, that underpins

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<sup>1</sup> "AEP" means Annual Exceedance Probability.

the FRA, however the EA cannot, at this stage, determine whether it is appropriate to base the FRA on the modelling undertaken.

- 5.4.2 NR has agreed with the EA that to assist the EA's ongoing review of NR's flood model NR will provide the EA with such further flood modelling clarifications as may be necessary and agreed between NR and the EA. However, the EA cannot say for certain whether there will be any required changes to the modelling that may affect the outputs. If the outputs do change as a result, the assessment and mitigation proposed within the FRA may also be subject to change. For this reason, at this stage the EA cannot yet agree that there has been an accurate assessment of flood risk to and from the Order scheme.
- 5.4.3 NR acknowledge that the EA have raised this issue of the EA needing to undertake further validation of the modelling that underpins the FRA. It is NR's position that the modelling that has been undertaken by NR is valid and that in consequence the assessment and compensatory flood storage reported in the FRA represents an accurate and valid assessment of flood risk to and from the Order scheme.
- 5.4.4 NR has received a request from the EA for the provision of a model log which identifies the modelling files that will confirm the requirements for compensatory flood storage identified by NR to be provided as part of the Order scheme. NR is responding to this request from the EA with the intention to provide the EA with this information by 2<sup>nd</sup> December 2021.

## **5.5 Compensatory Flood Storage**

- 5.5.1 NR has supplied further information to the EA to answer the questions of clarification that the EA asked regarding compensatory flood storage. The FRA presented in the Environmental Statement (**NR16B**) has been updated by NR to provide the flood modelling data in an alternative format as requested by the EA to make clear to the EA the justification for the absence of flood risk in Route Sections 1 to 5.
- 5.5.2 The proposed compensatory flood storage in Route Section 6 is acceptable to the EA. NR has agreed with the EA that the full design details associated with the compensatory floodplain storage area to be provided in Route Section 6 will be submitted by NR for approval under Condition 14 of the conditions to be attached to the direction for deemed planning permission sought by NR (**NR12**). This change is included as Condition 14(a)(v) in **INQ/12B**.
- 5.5.3 The provision of compensatory flood storage is dependent upon the modelling outputs. As detailed in Section 5.4, we are at this stage unable to agree that the modelling provides a suitable basis for determining the compensatory flood storage required.

5.5.4 As stated in paragraph 5.4.3, it is NR's position that the modelling that has been undertaken by NR is valid and that in consequence the assessment and compensatory flood storage reported in the FRA represents an accurate and valid assessment of flood risk to and from the Order scheme. As also stated in paragraph 5.4.4, NR has received a request from the EA for the provision of a model log which identifies the modelling files that will confirm the requirements for compensatory flood storage identified by NR to be provided as part of the Order scheme. NR is responding to this request from the EA with the intention to provide the EA with this information by 2<sup>nd</sup> December 2021.

## **6. BIODIVERSITY**

### **6.1 Statement of Common Ground**

- 6.1.1 The EA is satisfied with the assessment and mitigation for biodiversity as outlined in the Environmental Statement (**NR16A**) and the EA agrees that the mitigation can be implemented through proposed condition 4 to the Deemed Planning Permission (DPP) and the provision of a Landscape and Ecological Management Plan (LEMP).
- 6.1.2 Proposed condition 4 (as amended) is described further in section 10.2 of this document and is included in Appendix 2 to this document.
- 6.1.3 There are no matters outstanding regarding biodiversity.

## **7. WATER QUALITY**

### **7.1 Statement of Common Ground**

- 7.1.1 The EA is satisfied with the assessment and mitigation for water quality as outlined in the Environmental Statement (**NR16A**) and agrees that the mitigation can be implemented through proposed condition 5 to the DPP which requires Part B of the Code of Construction Practice (as defined in the Environmental Statement) to include a pollution prevention and incident control plan (PPICP) (condition 5(ii)) and an Environmental Design Plan (Land Contamination and Hydrogeology) (condition 5(ix)).
- 7.1.2 Proposed condition 5 (as amended) is described further in section 10.3 of this document and is included in Appendix 2 to this document.
- 7.1.3 NR has agreed with the EA to include a consideration in the PPICP of NR's "Pollution Prevention (Land and Water)" in managing potential pollutants on site.
- 7.1.4 It is agreed between NR and the EA that the hydromorphology mitigation (including the incorporated mitigation) detailed in the Environmental Mitigation Plan (Figure 2-3 of Volume 4, Figures to the Environmental Statement (**NR16C**)) is appropriate and that the detail of the provision of further mitigation will be secured by proposed condition 4 to the DPP and the production of the LEMP and proposed condition 5 to the DPP and the production of the Environmental Design Plan (Land Contamination and Hydrogeology) (Condition 5(ix)).
- 7.1.5 There are no matters outstanding regarding water quality.

## **8. GROUNDWATER & CONTAMINATED LAND**

### **8.1 Statement of Common Ground**

- 8.1.1 Paragraph 9.1.2 of this document confirms that the Environmental Design Plan (as required to be approved pursuant to condition 5 to the DPP) is already required to include the items requested by the EA for inclusion in the Environmental Design Plan. Therefore, on this basis it is agreed between NR and the EA that these matters will be addressed.
- 8.1.2 There are no matters outstanding regarding groundwater and contaminated land.

## **9. CODE OF CONSTRUCTION PRACTICE (PART A)**

### **9.1 Statement of Common Ground**

- 9.1.1 The general use of the Code of Construction Practice to manage environmental mitigation during the construction of the Order works is accepted by the EA.
- 9.1.2 The EA in the Representation identified matters that should be included in the Environmental Design Plan which is to be prepared as part of the Code of Construction Practice (see condition 5(ix) at Appendix 2 to this document). NR have confirmed with the EA that the matters identified by the EA are required to be addressed in the development of the Environmental Design Plan as confirmed in the Environmental Statement Volume 2i: Chapter 23 (Summary of Mitigation) (**NR16A**), which identifies the following for inclusion in the Environmental Design Plan:
- Coal mining risk assessment (see Volume 2i: Chapter 23: Table 23-3, Page 24).
  - EA's Piling into contaminated land (see Volume 2i: Chapter 23: Table 23-5, Page 29).
  - Hydrological Risk Assessment: Deep foundations / piling (see Volume 2i: Chapter 23: Table 23-5, Page 29).
  - Hydrological Risk Assessment de-watering (see Volume 2i: Chapter 23: Table 23-11, Page 45).
  - Groundwater monitoring (see Volume 2i: Chapter 23: Table 23-1, Page 12).
  - Soil sampling (see Volume 2i: Chapter 23: Table 23-1, Page 13).

- Water Framework Directive benefits assessment (see WFD Compliance assessment submitted as Appendix 11-2 in Volume 3: Technical Appendices the Environmental Statement (**NR16B**)).

9.1.3 There are no matters outstanding regarding the Code of Construction Practice.



## **10. PLANNING CONDITIONS**

### **10.1 Introduction**

10.1.1 In relation to the matters raised by the EA in the Representation and/or the SoC regarding the conditions proposed by NR to be attached to the direction for deemed planning permission sought by NR (**NR12**) this section summaries the Statements of Common Ground between the EA and NR. The conditions referred to in this section (with the amendments that have been agreed by NR with Kirklees Council shown by tracked changes (see **NR/SOCG/1**)) are reproduced in **Appendix 2** of this Statement.

### **10.2 Statement of Common Ground - Planning Condition 4 – Landscape and Ecology**

10.2.1 The inclusion of this condition (Condition 4 in **NR12**) was agreed by the EA in the Representation. NR and the EA confirm that the subsequent amendments proposed by NR to this condition, as agreed by NR with Kirklees Council (see **NR/SOCG/1**), and which are shown by tracked changes in **Appendix 2** are also agreed by the EA.

10.2.2 There are no matters outstanding regarding this planning condition.

### **10.3 Statement of Common Ground - Planning Condition 5 – Code of Construction Practice**

10.3.1 The amended wording for this condition (Condition 5 in **NR12**) as shown in Appendix 2 as agreed between NR and Kirklees Council (see **NR/SOCG/1**), is also agreed to by the EA.

10.3.2 As regards the proposed additional wording for condition 5(ix) as recommended by the EA in the Representation, the EA agree that this is not required in consideration that the mitigation requested by the EA is already secured through the incorporated mitigation identified in Chapter 23 (Summary of Mitigation) of the Environmental Statement (**NR16A**) and through the production of the Environmental Design Plan, as outlined in Section 9.1.2 above, required by condition 5(ix).

10.3.3 There are no matters outstanding regarding this planning condition.

### **10.4 Statement of Common Ground - Planning Conditions 10 and 11 – Contaminated Land and Unexpected Contaminated Land**

10.4.1 The inclusion of these conditions (Conditions 10 and 11 in **NR12**) was agreed by the EA in the Representation. NR and the EA confirm that the subsequent amendments proposed by NR to these conditions, as agreed by NR with

Kirklees Council (see **NR/SOCG/1**), and which are shown by tracked changes in **Appendix 2** are also agreed by the EA.

10.4.2 There are no matters outstanding regarding these planning conditions.

#### **10.5 Statement of Common Ground – Former Planning Condition 15 – Scheme Wide Drainage Strategy**


10.5.1 NR and Kirklees Council agreed to remove this condition (formerly Condition 15 in **NR12**) as it was agreed by NR and the Council that it did not add benefit to the planning process (see **NR/SOCG/1**). The reason being that this condition did not allow for any flexibility to deviate away from the original Scheme Wide Drainage Strategy.

10.5.2 Kirklees Council preferred the process of engagement and agreement that would be followed by the submitting of effectively agreed designs in accordance with the protective provisions provided to Kirklees Council as Lead Local Flood Authority by Part 4 of Schedule 19 to the draft Order (**NR02**).

10.5.3 For the benefit of this document, NR and the EA agree that all Order Scheme designs, as are applicable, will be in compliance with the original Scheme Wide Drainage Strategy unless otherwise agreed with Kirklees Council in accordance with the approval of details pursuant to the process provided by Part 4 of Schedule 19 to the draft Order (**NR02**).

10.5.4 There are no matters outstanding regarding this former planning condition.

**SIGNED BY (ON BEHALF OF NETWORK RAIL):**



---

**POSITION:** HEAD OF CONSENTS & ENVIRONMENT PLANNING

**DATE:** 2 DECEMBER 2021

**SIGNED BY (ON BEHALF OF ENVIRONMENT AGENCY):**



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**POSITION:**

**DATE:**



## APPENDIX 1

### **Agreed amendments to the protective provisions for the protection of the Environment Agency to be included in Part 3 of Schedule 19 to the draft Order (NR02)**

#### **SCHEDULE 19** Article 54

#### **PROTECTIVE PROVISIONS**

#### **PART 3**

#### **FOR THE PROTECTION OF THE ENVIRONMENT AGENCY**

**17.**—(1) The following provisions of this Part of this Schedule apply for the protection of the Agency unless otherwise agreed in writing between Network Rail and the Agency.

(2) In this Part of this Schedule—

“the Agency” means the Environment Agency;

“construction” includes execution, placing, altering, replacing, relaying and removal and “construct” and “constructed” are to be construed accordingly;

“drainage work” means any ~~waterecourse~~ main river and includes any land which provides or is expected to provide flood storage capacity for any ~~waterecourse~~ main river and any bank, wall, embankment or other structure, or any appliance, constructed or used for land drainage, flood defence or tidal monitoring;

“the fishery” means any waters containing fish and fish in, or migrating to or from such waters and the spawn, spawning grounds, habitat or food of such fish;

“main river” has the same meaning ~~As~~ as in section 221 (general interpretation) of the Water Resources ~~Land Drainage Act 1991(a);~~

“plans” includes sections, drawings, specifications and method statements; and

“specified work” means so much of any work or operation authorised by this Order as is in, on, under, over or within 16 metres of a drainage work or is otherwise likely to—

(a) affect any drainage work or the volumetric rate of flow of water in or flowing to or from any drainage work;

(b) affect the flow, purity or quality of water in any watercourse or other surface waters or ground water;

(c) cause obstruction to the free passage of fish or damage to any fishery; ~~or~~

(d) affect the conservation, distribution or use of water resources; or

~~(d)~~ (e) affect the conservation value of any main river and habitats in its immediate vicinity.

**18.**—(1) Before beginning to construct any specified work, Network Rail must submit to the Agency plans of the specified work and such further particulars available to it as the Agency may within 28 days of the ~~receipt~~ submission of the plans reasonably ~~request~~ require.

(2) Any such specified work must not be constructed except in accordance with such plans as may be approved in writing by the Agency, or determined under paragraph ~~29~~ 8.

(3) Any approval of the Agency required under this paragraph—

(a) must not be unreasonably withheld or delayed;

(b) is deemed to have been given if it is neither given nor refused within 2 months of the submission of the plans for approval or where further particulars are submitted under sub-paragraph (1) within 2 months of the submission of those particulars, and, in the case of a refusal, accompanied by a statement of the grounds of refusal; and

(c) may be given subject to such reasonable requirements as the Agency may make for the protection of any drainage work or the fishery or for the protection of water resources, or for the prevention of flooding or pollution or in the discharge of its environmental duties.

(4) The Agency must use its reasonable endeavours to respond to the submission of any plans before the expiration of the period mentioned in sub-paragraph (3)(b).

**19.** Without limitation on the scope of paragraph 18, the requirements which the Agency may make under that paragraph include conditions requiring Network Rail at its own expense to construct such protective works, whether temporary or permanent, before or during the construction of the specified works (including the provision of flood banks, walls or embankments or other new works and the strengthening, repair or renewal of existing banks, walls or embankments) as are reasonably necessary—

(a) to safeguard any drainage work against damage; or

(b) to secure that its efficiency for flood defence purposes is not impaired and that the risk of flooding is not otherwise increased,

by reason of any specified work.

**20.—**(1) Subject to sub-paragraph (2), any specified work, and all protective works required by the Agency under paragraph 19, must be constructed—

(a) without unreasonable delay in accordance with the plans approved or deemed to have been approved or settled under this Part of this Schedule; and

(b) to the reasonable satisfaction of the Agency,

and an officer of the Agency is entitled to watch and inspect the construction of such works.

(2) Network Rail must give to the Agency not less than 14 days' notice in writing of its intention to commence construction of any specified work and notice in writing of its completion not later than 7 days after the date on which it is completed~~brought into use~~.

(3) If any part of a specified work or any protective work required by the Agency is constructed otherwise than in accordance with the requirements of this Part of this Schedule, the Agency may by notice in writing require Network Rail at Network Rail's own expense to comply with the requirements of this Part of this Schedule or (if Network Rail so elects and the Agency in writing consents, such consent not to be unreasonably withheld or delayed) to remove, alter or pull down the work and, where removal is required, to restore the site to its former condition to such extent and within such limits as the Agency reasonably requires.

(4) Subject to sub-paragraph (5) and paragraph 24, if within a reasonable period, being not less than 28 days from the date when a notice under sub-paragraph (3) is served upon Network Rail, it has failed to begin taking steps to comply with the requirements of the notice and subsequently to make reasonably expeditious progress towards their implementation, the Agency may execute the works specified in the notice and any expenditure incurred by it in so doing is recoverable from Network Rail.

(5) In the event of any dispute as to whether sub-paragraph (3) is properly applicable to any work in respect of which notice has been served under that sub-paragraph, or as to the reasonableness of any requirement of such a notice, the Agency must not except in an emergency exercise the powers conferred by sub-paragraph (4) until the dispute has been finally determined in accordance with paragraph 29.

**21.—**(1) Subject to sub-paragraph (5) Network Rail must from the commencement of the construction of the specified works maintain in good repair and condition and free from obstruction any drainage work which is situated within the limits of deviation and~~or~~ on land held by Network Rail for the purposes of or in connection with the specified works, whether or not the drainage work is constructed under the powers conferred by this Order or is already in existence.

(2) If any such drainage work which Network Rail is liable to maintain is not maintained to the reasonable satisfaction of the Agency, the Agency may by notice in writing require Network Rail to repair and restore the work, or any part of such work, or (if Network Rail so elects and the Agency in writing consents, such consent not to be unreasonably withheld or delayed), to remove the work and restore the site to its former condition, to such extent and within such limits as the Agency reasonably requires.

(3) Subject to paragraph 24, if, within a reasonable period being not less than 28 days beginning with the date on which a notice in respect of any drainage work is served under sub-paragraph (2) on Network Rail, Network Rail has failed to begin taking steps to comply with the reasonable requirements of the notice and has not subsequently made reasonably expeditious progress towards their implementation, the Agency may do what is necessary for such compliance and may recover any expenditure ~~reasonably~~ incurred by it in so doing from Network Rail.

(4) In the event of any dispute as to the reasonableness of any requirement of a notice served under sub-paragraph (2), the Agency must not except in a case of [an](#) emergency exercise the powers conferred by sub-paragraph (3) until the dispute has been finally determined [in accordance with paragraph 29](#).

(5) This paragraph does not apply to—

- (a) drainage works which are vested in the Agency, or which the Agency or another person is liable to maintain and is not precluded by the powers of the Order from doing so; or
- (b) any obstruction of a drainage work for the purpose of a work or operation authorised by this Order and carried out in accordance with the provision of this Part of this Schedule.

**22.** Subject to paragraph 24, if by reason of the construction of any specified work or of the failure of any such work the efficiency of any drainage work for flood defence purposes is impaired, or that drainage work is otherwise damaged, such impairment or damage must be made good by Network Rail to the reasonable satisfaction of the Agency and if Network Rail fails to do so, the Agency may make good the same and recover from Network Rail the expense reasonably incurred by it in so doing.

**23.—**(1) Network Rail must take all such measures as may be reasonably practicable to prevent any interruption of the free passage of fish in the fishery during the construction of any specified work.

(2) If by reason of—

- (a) the construction of any specified work; or
- (b) the failure of any such work,

damage to the fishery is caused, or the Agency has reason to expect that such damage may be caused, the Agency may serve notice on Network Rail requiring it to take such steps as may be reasonably practicable to make good the damage, or, as the case may be, to protect the fishery against such damage.

(3) Subject to paragraph 24, if within such time as may be reasonably practicable for that purpose after the receipt of written notice from the Agency of any damage or expected damage to a fishery, Network Rail fails to take such steps as are described in sub-paragraph (2), the Agency may take those steps and may recover from Network Rail the expense reasonably incurred by it in doing so.

(4) Subject to paragraph 24, in any case where immediate action by the Agency is reasonably required in order to secure that the risk of damage to the fishery is avoided or reduced, the Agency may take such steps as are reasonable for the purpose, and may recover from Network Rail the reasonable cost of so doing provided that notice specifying those steps is served on Network Rail as soon as reasonably practicable after the Agency has taken, or commenced to take, the steps specified in the notice.

**24.** Nothing in paragraphs 20(4), 21(3), 22, 23(3) and 23(4) authorises the Agency to execute works on or affecting an operational railway forming part of Network Rail's network without the prior consent in writing of Network Rail, such consent not to be unreasonably withheld or delayed.

**25.** If by reason of the construction of any specified work the Agency's access to flood defences or equipment maintained by the Agency for flood defence purposes is materially obstructed, Network Rail must as soon as reasonably practicable provide such alternative means of access as will (so far as reasonably practicable) allow the Agency to maintain the flood defence or use the equipment no less effectively than was possible before the obstruction.

~~25.~~26. Network Rail must indemnify the Agency in respect of all costs, charges and expenses which the Agency may reasonably incur or have to pay or which it may sustain—

- (a) in the examination or approval of plans under this Part of this Schedule; and
- (b) in the inspection of the construction of the specified works or any protective works required by the Agency under this Part of this Schedule.

~~26.~~27.—(1) Without affecting the other provisions of this Part of this Schedule, Network Rail must indemnify the Agency from all claims, demands, proceedings, costs, damages, expenses or loss, which may be made or taken against, recovered from, or incurred by, the Agency by reason of—

- (a) any damage to any drainage work so as to impair its efficiency for the purposes of flood defence;
- (b) any damage to the fishery;
- (c) any raising or lowering of the water table in land adjoining the authorised works or any sewers, drains and watercourses;
- (d) any flooding or increased flooding of any such lands; or
- (e) inadequate water quality in any watercourse or other surface waters or in any groundwater,

which is caused by the construction of any of the specified works or any act or omission of Network Rail, its contractors, agents or employees whilst engaged upon the work.

(2) The Agency must give to Network Rail reasonable notice of any such claim or demand and no settlement or compromise may be made without the agreement of Network Rail which agreement must not be unreasonably withheld or delayed.

~~27.~~28. The fact that any work or thing has been executed or done by Network Rail in accordance with a plan approved or deemed to be approved by the Agency, or to its satisfaction, or in accordance with any directions or award of an arbitrator, does not relieve Network Rail from any liability under the provisions of this Part of this Schedule.

~~28.~~29. Any dispute arising between Network Rail and the Agency under this Part of this Schedule, if the parties agree, is to be determined by arbitration under article 58 (arbitration), but otherwise is to be determined by the Secretary of State for Environment, Food and Rural Affairs and the Secretary of State for Transport acting jointly on a reference to them by Network Rail or the Agency, after notice in writing by one to the other.



## **APPENDIX 2**

### **Agreed amendments to the conditions proposed to be attached to the direction for deemed planning permission**

The following are the amendments (shown as tracked changes) agreed by NR and the EA to the conditions that were proposed by NR to be attached to NR's request for deemed planning permission. See Appendix 2 to **NR12**.

The amendments below are the same amendments as agreed by NR with Kirklees Council. See **NR/SOCG/1**.

#### **Condition 4: Landscape and Ecological Management Plan**

No development within the relevant stage (including preliminary works) is to commence until a Landscape and Ecological Management Plan (LEMP) has been submitted to and approved in writing by the local planning authority.

The proposed LEMP for each Stage will include the following details:

- A plan of existing trees and tree features (such as groups of trees or woodland) to be retained and to be removed in accordance with BS5837(2012);
- A plan of ecological mitigation details including areas of new plantings and details of any habitats created or enhanced.
- Implementation timetable and a programme for initial aftercare, long-term management and maintenance responsibilities for a period of five years post-completion
- Details of organisation(s) responsible for maintenance and monitoring.

The LEMP must reflect the survey results and ecological mitigation and enhancement measures set out in the Environmental Statement, and must also include the following ecological measures:

- a) The aims and objectives of the management to be undertaken.
- b) A programme of monitoring with thresholds for action as required.
- c) Full details of measures to ensure protection and suitable mitigation to all relevant protected species and those species identified as being of importance to biodiversity (including licensing mitigation requirements) including bats; Luronium Natans (Floating Water Plantain); badgers; reptiles, otter and water vole, where appropriate.

The LEMP must include both hard and soft landscaping works, covering the locations where landscaping will be undertaken, and must also include the following details:

- Full detailed landscape plans indicating full planting specification, including layout, species, number, density and size of trees, shrubs, plants, hedgerows and/or seed mixes and sowing rates, including extensive use of native species;
- any structures, such as street furniture, any non-railway means of enclosure and lighting;
- any details of regrading, cut and fill, earth screen bunds, existing and proposed levels;
- any areas of grass turfing or seeding and depth of topsoil to be provided
- a timescale for the implementation of hard landscaping works;
- Details of monitoring and remedial measures, including replacement of any trees, shrubs or planting that fail or become diseased within the first five years from completion;

The measures within the LEMP must be implemented in accordance with the approved details.

~~No development within the relevant stage (including preliminary works) is to commence until a Landscape and Ecological Management Plan (LEMP) has been submitted to and approved in writing by the local planning authority. The development must only take place in complete accordance with the approved LEMP and/or any subsequent revisions as may be approved in writing by the local planning authority.—~~

~~The LEMP must reflect the survey results and ecological mitigation and enhancement measures set out in the Environmental Statement, and must also include;—~~

- ~~A plan of existing trees and tree features (such as groups of trees or woodland) to be retained and to be removed in accordance with BS5837(2012);—~~
- ~~Detail extent, type and provenance of new planting;—~~
- ~~Timescale for the implementation of hard landscaping works;—~~
- ~~Full details of method statement for treatment and removal of invasive species;—~~
- ~~Implementation timetable and a five year post-completion monitoring schedule;—~~
- ~~Draft maintenance schedules for all landscape areas;—~~
- ~~Details of organisation(s) responsible for maintenance and monitoring;—~~
- ~~A plan of environmental mitigation details including areas of new plantings and details of any new habitats created;~~
- ~~Details of location, design and construction of the wet features (ponds and Sustainable Drainage Systems); and~~

- ~~• Full details of mitigation measures for relevant protected species (including licensing mitigation requirements) including bats; Luronium Natans (Floating Water Plantain); badgers; great crested newt, reptiles, otter and water vole, where appropriate.~~

**Reason:** *In the interests of the visual appearance and biodiversity of the area in accordance with the Kirklees Local Plan policies LP30, 31, 32 and 33. This is to secure the correct implementation of the measures identified in the Environmental Statement.*

### **Condition 5: Code of Construction Practice**

No stage of the development (including preliminary works) is to commence until a Code of Construction Practice (CoCP) for that stage, including the relevant plans and programmes referred to in (b) below (which incorporates the means to mitigate the construction impacts identified by the Environmental Statement), has been submitted to and approved in writing by the local planning authority. For the avoidance of doubt this does not include approval for Part A of the CoCP (a general overview and framework of environmental principles and management practice to be applied to the scheme along with all construction-led mitigation identified in the Environmental Statement) which has been submitted as part of the Order.

Part B of the CoCP (as defined in the Environmental Statement) must include the following plans and programmes, for each stage as defined in condition 3:-

- An external communications programme;
- A pollution prevention and incident control plan;
- A waste management plan;
- A materials management plan including a separate soils mitigation plan;
- A nuisance management plan concerning dust, wheel wash measures, air pollution and temporary lighting;
- A noise and vibration management plan including a construction methodology assessment;
- details of the precise measures put in place to protect the Hillhouses listed coal chutes during the construction phase.
- ~~An Environmental Design Plan (Land Contamination & Hydrogeology);~~
- A demolition methodology statement for relevant buildings; and

- ix. An Environmental Design Plan (EDP) (Land Contamination and Hydrogeology) – setting out the environmental requirements during the detailed design stage.

The development must be implemented in accordance with the approved CoCP and the relevant plans or programmes unless otherwise agreed in writing with the local planning authority shall be implemented in full throughout the period of the works.

**Reason:** *To mitigate expected construction impacts arising from the development and to protect local and residential amenity and to ensure the development is carried out in accordance with Kirklees Local Plan policies LP51 and 52.*

### **Condition 10 Contaminated Land**

In relation to contaminated land:

- a) Where the Environmental Statement indicates that intrusive investigation is necessary for that stage, development in the relevant stage is not to commence until a Phase II Site Investigation Report for that stage has been submitted to, and approved in writing by, the Local Planning Authority,
- b) Where remediation measures are shown to be necessary in the Environmental Statement or Phase II Reports undertaken pursuant to (a) above confirm remediation measures are necessary for the relevant stage, development in the relevant stage is not commence until a Remediation Statement demonstrating how the site will be made suitable for the intended use has been submitted to, and approved in writing by, the Local Planning Authority. The Remediation Statement must include a programme for all works and for the provision of Verification Reports.
- c) Remediation of the site shall be carried out and completed in accordance with the approved Remediation Strategy. In the event that remediation is unable to proceed in accordance with the approved Remediation Strategy, the Local Planning Authority must be notified in writing immediately and where agreed as necessary, operations on the affected part of the site must cease. An amended or new Remediation Statement must be submitted to, and approved in writing by, the Local Planning Authority prior to any further remediation works which must thereafter be carried out in accordance with the revised approved Statement.

**Reason:** *To ensure that the presence of contamination is identified, risks assessed and proposed remediation works are agreed in order to make the site suitable for use.*

### **Condition 11 Unexpected Contamination**

Where significant\* unexpected contamination is encountered, the Local Planning Authority must be notified in writing immediately and where agreed as necessary operations on the affected part of the site must cease. An amended or new Remediation Statement must be submitted to, and approved in writing by, the Local Planning Authority prior to any further remediation works which must thereafter be carried out in accordance with the revised approved Statement.

(\* significant within this context of this condition is taken to mean visual or olfactory evidence of contamination not previously encountered in the intrusive ground investigation.)

**Reason:** *To ensure that the presence of unexpected contamination is identified, risks assessed and proposed remediation works are agreed in order to make the site suitable for use in accordance with Policy LP53 of Kirklees Local Plan and Chapter 15 of the National Planning Policy Framework.*

#### **Condition 15 – Scheme Wide Drainage Strategy**

~~The development is to be undertaken in accordance with the scheme wide drainage strategy appended to the Flood Risk Assessment as submitted in the Environmental Statement.~~

~~**Reason:** *To prevent the increased risk of flooding through an appropriate hierarchy of drainage & flood risk management and in accord with Policy LP27 of the Kirklees Local Plan.*~~

## **APPENDIX 3**

### **Network Rail's proposed amendments to Article 6 as applied for in the draft Order (NR02)**

6. (1) The following provisions do not apply in relation to any application made by Network Rail pursuant to paragraph (2)—

- (a) regulation 25 (application for the surrender of an environmental permit) of the 2016 Regulations; and
- (b) part 1 of schedule 5 (Environmental Permits) of the 2016 Regulations.

(2) Subject to paragraph (3) Network Rail may by application to the Environment Agency request the surrender in whole or in part of any environmental permit—

- (a) issued by the Environment Agency to any person; or
- (b) transferred by the Environment Agency to Network Rail,

under the 2016 Regulations for the operation of a regulated facility on the relevant land.

(3) The Environment Agency must accept any application from Network Rail for the surrender in whole or in part of an environmental permit under paragraph (2) provided that Network Rail have submitted to the Environment Agency, and the Environment Agency have approved, plans detailing in relation to the site of the regulated facility subject of an application under paragraph (2) the measures—

- (a) to avoid a pollution risk resulting from the construction and operation of the authorised works on the site of the regulated facility or from the former use of the site as a regulated facility; and
- (b) to return the site of the regulated facility to a satisfactory state upon completion of the construction of the authorised works.

(4) Any approval of the Environment Agency required under paragraph (3)—

- (a) must not be unreasonably withheld or delayed;
- (b) is deemed to have been given if it is neither given nor refused within 2 months of the submission of the plans for approval and, in the case of a refusal, accompanied by a statement of the grounds of refusal; and
- (c) may be given subject to such reasonable requirements as the Environment Agency may make for the avoidance of a pollution risk resulting from the construction of the authorised works on the site of the regulated facility or from the former use of the site as a regulated facility.

(5) The construction of any authorised works on the site of a regulated facility which is subject of an approval under paragraph (3) must be constructed—

- (a) in accordance with the plans approved or deemed to have been approved under this article; and
- (b) to the reasonable satisfaction of the Environment Agency,  
and an officer of the Environment Agency is entitled, on giving such notice as may be reasonable in the circumstances, to inspect and watch the construction of such works.

(6) Network Rail must give the Environment Agency—

- (a) not less than 14 days' notice in writing of its intention to commence the construction of any authorised works on the site of a regulated facility which is subject of an approval under paragraph (3); and
- (b) notice in writing of the completion of such works not less than 7 days' after the date on which such works are first brought into public use.

(7) Any approval given or deemed to have been given by the Environment~~at~~ Agency to a request for approval under paragraph (3) is to be treated as overriding any requirement under the 2016 Regulations for any further environmental permit in consequence of the construction and operation of the authorised works on the site of the regulated facility subject of such an approval.

(8) Any dispute arising between Network Rail and the Environment Agency under this article, if the parties agree, is to be determined by arbitration under article 57 (arbitration), but otherwise is to be determined by the Secretary of State for Environment, Food and Rural Affairs and the Secretary of State for Transport acting jointly on a reference to them by Network Rail or the Environment Agency, after notice in writing by one to the other.

~~(8)~~(9) In this article—

- (a) “the relevant land” means the land numbered 21-086, 21-092, 21-094, 21-101, 21-114, 23-024, 23-035, 23-035a, 23-036, 23-046, 23-050, 23-054, 23-055, 23-056, 23-065, 24-003, 24-004 and 24-006 in the district of Kirklees as shown on the deposited plans
- (b) “regulated facility” has the same meaning as in the 2016 Regulations; and
- (c) “plans” has the same meaning given in paragraph 17(2) of Part 3 of Schedule 19 to this Order.

## **APPENDIX 4**

### **FRA CLARIFICATION DOCUMENT (VERSION 4) NOVEMBER 2021**



# Infrastructure Projects

## Northern Programmes



## The Network Rail (Huddersfield to Westtown (Dewsbury) Improvements) Order

### Environmental Statement Volume 3: Appendices

#### Appendix 11-1 Flood Risk Assessment

Network Rail

March 2021 (Clarification update [v4](#)  
[November](#) 2021)



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# 1. INTRODUCTION

## 1.1 Scheme background

- 1.1.1 The Scheme is part of the wider programme of works known as the Transpennine Route Upgrade (TRU), which will improve the Transpennine railway between Manchester, Huddersfield, Leeds and York. The Scheme aims to create a more reliable railway which provides greater capacity benefits for passengers by enabling the provision of more frequent and faster train journeys. The Scheme will also provide sustainability benefits because this section of the railway will be electrified.
- 1.1.2 The Scheme will provide four fully accessible, and compliant stations (Huddersfield, Deighton, Mirfield and Ravensthorpe), with step-free access, drop-off arrangements, and blue badge parking available
- 1.1.3 As part of the TRU Programme, a section of the railway between Huddersfield and Westtown (Dewsbury) (hereafter referred to as the “Scheme”) will be subject to a submission under The Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006 (TWA0). An Environmental Impact Assessment (EIA) has been undertaken and an Environmental Statement (ES) prepared to support the application for the TWA0.
- 1.1.4 This document is a Flood Risk Assessment (FRA), and forms an appendix to Chapter 11 (Water environment) of the ES. This report considers the Scheme in its entirety and has been prepared in accordance with the National Planning Policy Framework (NPPF).
- 1.1.5 The proposed works for the Scheme are detailed in Chapter 2 (Scheme description) in Volume 2i of the ES, and are summarised as follows:
- Four tracking and upgrading of the existing railway line including track realignment (currently the majority of the railway in the Scheme area has two tracks);
  - Electrification of the line;
  - Increase in line speeds;
  - Provision of sections of new railway;
  - Provision of a new grade-separated junction within the Ravensthorpe area;
  - Remodelling of stations including platform extension works at Deighton, Mirfield and Huddersfield; and
  - Provision of a replacement station at Ravensthorpe.
- 1.1.1 As well as the works identified above, various other engineering works are necessary including strengthening and replacement of bridge decks (rail and highway); electrification of the line and provision of associated infrastructure will require raising the height, demolition of or replacement of bridge structures.
- 1.1.2 The footprint of the Scheme includes the physical extent of the permanent works including maintenance rights, together with land required temporarily to construct the works; this footprint is referred to as the “Scheme” and is delineated by the Scheme boundary, as presented in Figure 1-1. The Scheme passes through a variety of land uses, the majority of which are commercial and industrial in nature.
- 1.1.3 The Scheme has been split into six Route Sections listed as follows and shown on Figure 1-1, which also highlights the flood zone designations across the Scheme:
- Route Section 1 – Huddersfield;
  - Route Section 2 – Hillhouse and Fartown;

- Route Section 3 – Deighton and Bradley;
- Route Section 4 – Colne Bridge and Battysford;
- Route Section 5 – Mirfield and Lower Hopton; and
- Route Section 6 – Ravensthorpe and Westtown.

- 1.1.4** Highways works are also required across the Scheme. This work comprises construction of junction improvement works and bridge deck replacements along existing highways. Restrictions around these works will be in place for the duration of construction of the Scheme and then removed. Temporary construction access routes will be utilised throughout the construction period and temporary traffic regulation orders (e.g. parking restrictions, land closures) may be required during this time.
- 1.1.5** The majority of the Scheme lies within the administrative bounds of Kirklees Council, however a small section of the Scheme boundary in Route Section 4 lies within the bounds of Calderdale Council. There are no flood risk elements associated with the Scheme for which Calderdale Council have Lead Local Flood Authority (LLFA) responsibilities for.
- 1.1.6** There are no Internal Drainage Boards that cover any watercourses that are crossed by the Scheme.



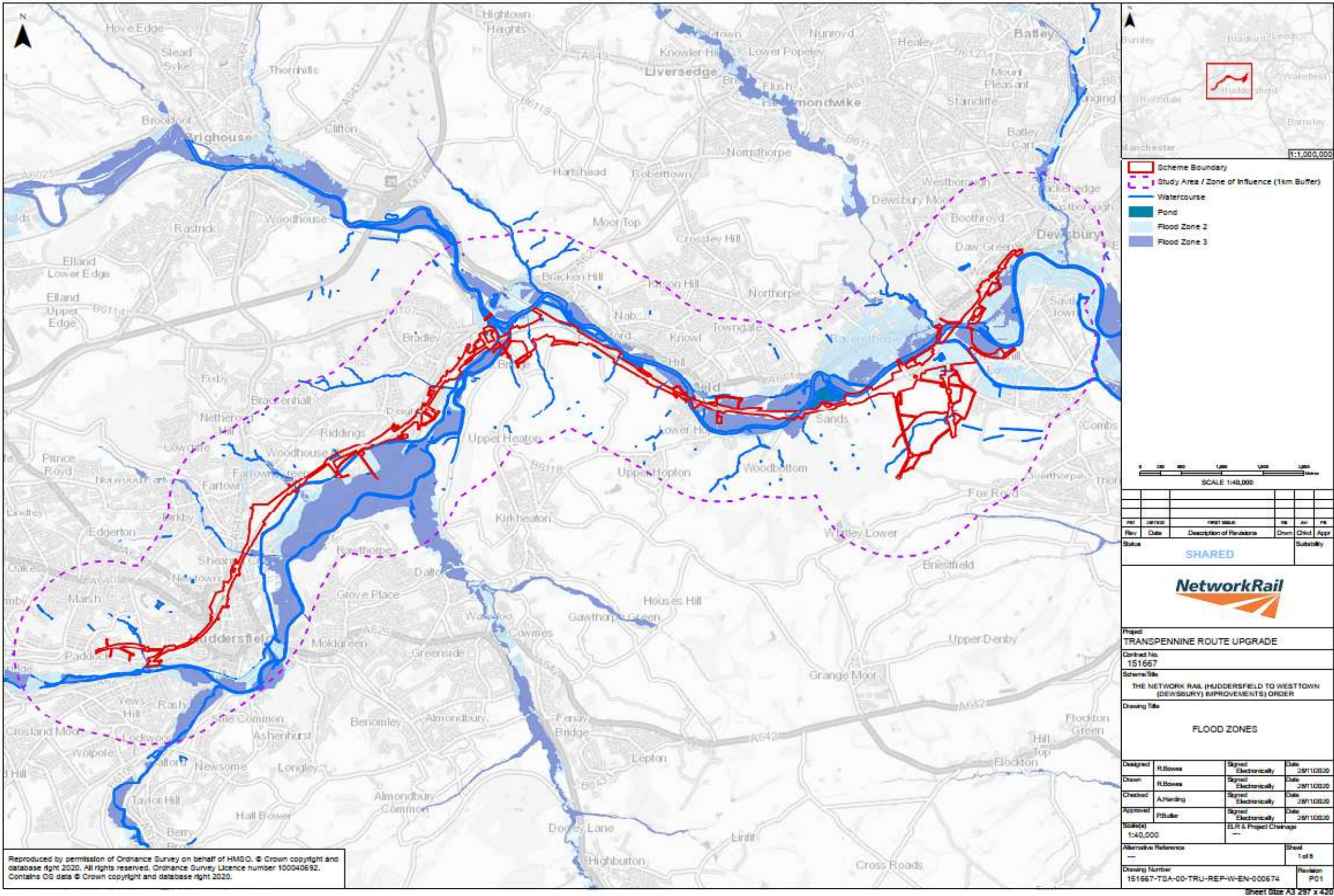


Figure 1-1 Scheme boundary and EA Flood Zones



## 1.2 Scheme overview

- 1.2.1 The Scheme drawings are shown in Figure 2-1 in Volume 4 of the ES. The main features of the Scheme are set out in Table 1-1.

**Table 1-1 Main features of the Scheme**

Feature	Description
Track	Installation and realignment of new and existing track
Earthworks and retaining structures	Construction of new earthworks including embankments and cuttings (Ravensthorpe Viaduct crossing and embanked approach, Heaton Lodge), retaining walls at Deighton Station, refurbishment of existing earthworks and provision of retaining structures
Stations and affected properties	Station works at Huddersfield, Deighton, Mirfield and Ravensthorpe.
Structure crossings	Construction of new structures and reconstruction of existing structures. This includes highway and railway bridges, footbridges.
Signalling	Provision of new signalling and associated cabling
Electrical, power and plant	Provision of facilities and power cables to serve rail-side and station Infrastructure.
Drainage, culverts and watercourse realignments	Construction of new drainage channels and culverts, and refurbishment and reconstruction of existing culverts and track drainage.
Ancillary infrastructure	Additional elements to ensure the Scheme is built and operated in a safe, efficient manner, such as fencing, walkways and lighting.
Maintenance infrastructure	Provision of permanent and semi-permanent maintenance compounds and rail access points for vehicles and railway workers.

- 1.2.2 The Scheme comprises the areas of land required to construct, operate and maintain the Scheme. Chapter 2 (Scheme description) of the Scheme-wide Assessment in Volume 2i of the ES provides more detail on the works proposed.

## 1.3 Flood Risk Assessment

- 1.3.1 The FRA considers the risk to the Scheme from all sources of flooding, along with the potential flood risk impacts of the Scheme.
- 1.3.2 The approach uses hydraulic modelling or other quantitative assessment to better understand likely significant effects where possible. The approach assesses what measures are planned to avoid or minimise flood risk both to the Scheme and receptors in the catchments through which it passes. The approach finally describes the key residual route-wide flood risks to the Scheme.
- 1.3.3 A FRA should consider all types of flooding to satisfy the following three key objectives:
- To assess flood risk to the Scheme and to demonstrate that any residual risk to the development and its users would be acceptable;
  - To assess the potential impact of the Scheme on flood risk elsewhere and to demonstrate that the development would not increase flood risk elsewhere; and
  - To satisfy the requirements of the National Planning Policy Framework (NPPF).
- 1.3.4 There are three levels of FRA:
- Level 1 FRA (Screening Study): To identify if there are any flooding issues related to a development site which may warrant further consideration. The screening study will ascertain whether a Level 2 or Level 3 FRA is required;



- Level 2 FRA (Scoping Study): Undertaken if a Level 1 study indicates that the site may lie within an area which is prone to flooding or that the site may increase flood risk due to increased runoff; and to confirm the possible sources of flooding which may affect the site. The Scoping Study will identify residual risks that cannot easily be controlled and, if necessary, will recommend that a Level 3 FRA is undertaken; and
- Level 3 FRA (Detailed Study): Undertaken if the Level 2 study concludes that quantitative analysis is required to assess flood risk issues related to the development site. This may include detailed hydraulic modelling of rivers or drainage systems.

1.3.5 This assessment forms a Level 3 FRA.

## 1.4 Overview of flood risk

1.4.1 In accordance with the NPPF, the following sources of flooding have been considered in this assessment:

- Fluvial flooding from watercourses;
- Overland surface water runoff from adjacent sites;
- Groundwater; and
- Artificial sources (reservoirs and canals).

1.4.2 Given the inland nature of the Scheme, flooding from tidal or coastal sources are not considered to be relevant and thus is scoped out of further assessment.

1.4.3 Existing flood risk to the Scheme from fluvial, surface, groundwater, sewers and artificial sources has been assessed. Existing flood risk is predominantly associated with fluvial flood risk where the Scheme crosses existing watercourses, and surface water flooding as a result of water ponding against embankments or within cuttings. Table 1-2 provides a summary of the key flood risk issues across the Scheme by Route Section.

**Table 1-2 Summary of flood risk to the Scheme**

Route Section	Source of flood risk				
	Fluvial	Surface water	Groundwater	Sewers	Reservoirs
1 – Huddersfield	✓	✓	✗	✓	✗
2 – Hillhouse and Fartown	✓	✓	✗	✓	✗
3 – Deighton and Bradley	✗	✓	✗	✓	✗
4 – Colne Bridge and Battyeford	✓	✓	✗	✓	✓
5 – Mirfield and Lower Hopton	✓	✓	✗	✓	✓
6 – Ravensthorpe and Westtown	✓	✓	✗	✓	✓

## 1.5 Consultation

- 1.5.1 Consultation with key stakeholders has been undertaken throughout this assessment process. Key stakeholders and their key points of discussion are summarised in Table 1-3.

**Table 1-3 Summary of flood risk consultation**

Date	Type	Organisation	Key issues/outcomes	Outcomes/agreements
31 July 2019	Scoping opinion	Department for Transport	<p>“Any supporting Flood Risk Assessment must include a comprehensive analysis of how it is predicted that the Scheme will alter flood risk near the site and what measures are required to mitigate risk to neighbouring land.</p> <p>Separate modelling for river flood risk and surface water flood risk should be undertaken, including an assessment of reservoir flooding and an analysis of public sewer flooding and how this may be affected by the Scheme.</p> <p>The Lead Local Flood Authority and Yorkshire Water should be contacted prior to the preparation of the ES so that all available relevant Flood Risk Data is available to inform the ES.”</p>	<p>The points raised have been considered as part of the assessment.</p> <p>Flood risk data was obtained from Kirklees Council and the EA to inform the assessment.</p>
31 July 2019	Scoping opinion	Canal & River Trust	<p>“All works that 'affect' the Trust must comply with the Code of Practice (Code of Practice for Works Affecting the Canal &amp; River Trust). This includes but is not limited to construction works on the property of the Trust, works undertaken on neighbouring property, works requiring access across the property of the Trust and works that over sail the property of the Trust.”</p>	Canal & River Trust have been consulted throughout the development of the Scheme.
31 July 2019	Scoping opinion	Environment Agency (EA)	<p>“The Scoping Report identifies an appropriate range of flood risk impacts and the EA does not wish to add to this information at this stage.</p> <p>Flood Risk Activity Permit The Environmental Permitting (England and Wales) Regulations 2016 require a permit to be obtained for any activities which will take place:</p>	The EA have been fully consulted throughout the production of the ES and this FRA.

Date	Type	Organisation	Key issues/outcomes	Outcomes/agreements
			<ul style="list-style-type: none"> <li>• on or within 8 metres of a main river (16 metres if tidal)</li> <li>• on or within 8 metres of a flood defence structure or culverted main river (16 metres if tidal)</li> <li>• on or within 16 metres of a sea defence</li> <li>• involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert</li> <li>• in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if it's a tidal main river) and you don't already have planning permission</li> </ul> <p>For further guidance please visit <a href="https://www.gov.uk/guidance/flood-risk-activitiesenvironmental-permits">https://www.gov.uk/guidance/flood-risk-activitiesenvironmental-permits</a> or contact our National Customer Contact Centre on 03708 506 506.</p> <p>The applicant should not assume that a permit will automatically be forthcoming once planning permission has been granted, and we advise them to consult with us at the earliest opportunity."</p>	
31 July 2019	Scoping opinion	Kirklees Council	<p>"Any supporting Flood Risk Assessment must include:</p> <ul style="list-style-type: none"> <li>• A comprehensive analysis of how it is predicted the Scheme will alter flood risk in the vicinity of the site and what measures will be required to mitigate this and dose not simply relate to flood risk relating to the Scheme itself.</li> <li>• Overland surface water flow paths from existing surface water flood risk mapping and planned drainage, how any works may alter such paths, how it is proposed to mitigate such risk and not increase flood risk to neighbouring land and uses.</li> <li>• Separate modelling for river flood risk and surface water flood risk</li> </ul>	This has been considered as part of the Flood Risk Assessment.

Date	Type	Organisation	Key issues/outcomes	Outcomes/agreements
			<ul style="list-style-type: none"> <li>An assessment of reservoir flooding and how this could be affected by the Scheme</li> <li>An analysis of public sewer flooding and how this may be affected by infrastructure provided as part of this Scheme and any mitigation proposed</li> <li>It is strongly recommended that both the Lead Local Flood Authority and Yorkshire Water are contacted prior to the production of the ES to ensure that all relevant available Flood Risk Data is used to inform the ES"</li> </ul>	
25 September 2019	Face to face meeting	EA	<ul style="list-style-type: none"> <li>Flood Risk Assessment and modelling approach discussed with EA Flooding Officer.</li> </ul>	Approach to the development to the FRA was discussed with EA and agreement on methodology with required models identified and provided.
25 October 2019	Face to face meeting	Kirklees Council LLFA	<ul style="list-style-type: none"> <li>FRA and Modelling approach discussed.</li> <li>Ordinary watercourse crossings discussed.</li> <li>Flooding at Mirfield and sensitivity of area discussed</li> </ul>	Kirklees Council agreed approach to consent to works on these ordinary watercourses.
December 2019	Face to face meeting	Canal & River Trust	<ul style="list-style-type: none"> <li>Culvert drainage to canals discussed</li> </ul>	No outcomes/agreements following consultation. No queries raised by Canal & River Trust during or after this meeting.
23 January 2020		EA	<ul style="list-style-type: none"> <li>Presentation of preliminary Ravensthorpe viaduct options.</li> </ul>	Implications on flood risk raised and discussed with flood risk officer. No change in agreement to approach made in previous consultations with the EA
22 October 2020	Teleconference	EA	<ul style="list-style-type: none"> <li>Presented proposed designs and potential implications on the flood risk</li> </ul>	Overall agreement from EA regarding Flood Risk assessment and proposed mitigation measures.

Date	Type	Organisation	Key issues/outcomes	Outcomes/agreements
			<ul style="list-style-type: none"> <li>Also presented proposed mitigation measures for agreement with EA</li> </ul>	
19 November 2020	Teleconference	Canal & River Trust	<ul style="list-style-type: none"> <li>Presented summary of ES and FRA findings including proposed mitigation measures</li> </ul>	No formal feedback received to date

## 2. METHODOLOGY AND DESIGN PRINCIPLES

### 2.1 Introduction

- 2.1.1 The FRA draws on a range of disciplines and designs, including, drainage, earthworks, culverts, and previous hydrological and hydraulic modelling to ensure all sources of flood risk are assessed as part of the FRA.
- 2.1.2 This report is based on the current Scheme design developed to support the Transport and Works Act Order (TWAO) application. Design development will continue until construction however this development will be within the parameters of the Scheme assessed by the FRA.
- 2.1.3 The Risk of Flooding from Surface Water (RoFSW) mapping<sup>1</sup>, first published in 2013, replaces the updated Flood Map for Surface Water (uFMfSW) and provides an indication of surface water flood risk across England. Whilst it is not a substitute for detailed hydrological and hydraulic modelling, the RoFSW mapping is suitable to identify where more detailed modelling may be required. Detailed hydraulic modelling will be undertaken as part of the Scheme-wide drainage strategy.
- 2.1.4 As a national scale model, structures and culverts were beyond the scope of the RoFSW assessment. This can result in overestimates of flooding upstream of embankments through which flow would be conveyed by a structure and as such the ponding and depth of flooding indicated does not occur. Where the track is on a bridge or viaduct the Digital Terrain Model (DTM) used in the RoFSW mapping may not have picked up the deck level, but the lower ground levels beneath the deck; this can result in the Scheme being shown to be at risk of flooding when in fact it is above surrounding ground levels.
- 2.1.5 The FRA has defined fluvial flooding as all flood risk associated with Main Rivers and Ordinary Watercourses, this includes where flood risk from the RoFSW mapping has been used to define the Ordinary Watercourse flood extents (owing to a lack of hydrological and hydraulic model data in these areas).

### 2.2 Data sources

- 2.2.1 Scheme data has been supplemented by the following sources to inform the assessment of flood risk to the Scheme.

**Table 2-1 Key data sources**

Data description	Date	Data owner
Calder Catchment Strategic Flood Risk Assessment – Volume 2 (Kirklees Council) <sup>2</sup>	July 2016	Kirklees Council
EA indicative flood risk maps, the EA Flood Zones, Risk of Flooding from Surface Water (RoFSW), Risk of Flooding from Reservoirs (RoFR), Historic Flood Map and EA Flood Map for Planning <sup>3</sup>	2016	EA
Preliminary Assessment Report for Kirklees <sup>4</sup>	2009	Kirklees Council

<sup>1</sup> <https://flood-warning-information.service.gov.uk/long-term-flood-risk/postcode>

<sup>2</sup> JBA Consulting 2016, Calder Catchment Strategic Flood Risk Assessment Final (Level 1 SFRA) Report Volume II Version 3.0

<sup>3</sup> EA (2016a, 07 04). Environmental Spatial Data Catalogue. Retrieved from gov.uk: <https://environment.data.gov.uk/>

<sup>4</sup> Flood Risk Regulations 2009 Preliminary Assessment Report for Kirklees

Data description	Date	Data owner
JBA Groundwater Flood Risk Maps <sup>5</sup>	July 2016	Kirklees Council
Kirklees Local Flood Risk Management Strategy <sup>6</sup>	2013	Kirklees Council
EA Calder Model	2015	EA
EA Huddersfield Models	2011	EA

### Flood risk modelling

- 2.2.2 Table 2-2 summarises the hydraulic model data provided by the EA and subsequently developed as part of the design works for the Scheme.

**Table 2-2 Available flood risk models**

Watercourse name	Modelling package
River Calder	Flood Modeller – TufLOW
Huddersfield	Flood Modeller
Grimscar Dyke	Flood Modeller

- 2.2.3 The EA were consulted to enquire if any of the above hydraulic models were due to be updated in the short term. It has been confirmed that no updates are planned.

## **2.3 Methodology**

### Flood risk

- 2.3.1 Each Route Section has been assessed for flood risk. Each assessment aims to:
- Assess the existing flood risk to the Scheme from fluvial, surface water and groundwater sources, to ensure the proposed design takes into account existing flood risk issues;
  - Evaluate the potential impact of the proposed Scheme on flood risk; and
  - Identify any further mitigation measures required additional to those embedded into the design.
- 2.3.2 The existing flood risk has been assessed by reviewing the EA's RoFSW mapping and Flood Zones 2 and 3 [\(including 3ai and 3b\)](#) and existing EA 1D/2D hydrological and hydraulic models. The assessment focuses on the Scheme and the proposed works and how these may impact on flood risk.

### Limitations

- 2.3.3 This assessment has relied upon the accuracy and level of detail of the documented data sources. Detailed topographical survey data was not available for many of the watercourse locations where crossings and outfalls are proposed.
- 2.3.4 The watercourse features and processes observed may vary over time/seasons and high flow events. Site surveys were undertaken under relatively dry conditions, and the overall watercourse function and stability were inferred through professional judgement and the interpretation of features on site.
- 2.3.5 The accuracy of hydraulic modelling is primarily dependent on the quality of hydrological and

<sup>5</sup> JBA Consulting 2016, Calder Catchment Strategic Flood Risk Assessment Final (Level 1 SFRA) Report Volume II Version 3.0

<sup>6</sup> Kirklees Council 2013, Kirklees Local Flood Risk Management Strategy



topographical data, such as LiDAR<sup>7</sup> data. Key factors include the resolution of the topographic data (for example LiDAR), the accuracy of surveys of hydraulic structures, the availability of data on past flooding and the limitations of the modelling software.

### Groundwater flood risk mapping

- 2.3.6 Groundwater flooding generally occurs as a result of long duration rainfall events, when the associated recharge of permeable geological deposits raises the water table until it is above ground level. Groundwater flooding is generally of longer duration than fluvial or surface water flooding and may take weeks or months to recede. Flooding of subsurface structures can also occur where groundwater levels rise to just below ground level. Groundwater flooding can be associated with both permeable bedrock and superficial deposits.
- 2.3.7 JBA's groundwater flood map provides a detailed national assessment of groundwater flood hazard. This is based on groundwater modelling and a ground surface DTM, a groundwater flood hazard classification is generated for the 1% annual chance flood event. The map has been used to determine the existing groundwater flood risk along the Scheme.
- 2.3.8 This groundwater FRA relies upon the JBA groundwater flood risk mapping and the EA aquifer designation mapping. The JBA mapping has been calibrated using observed data where possible.
- 2.3.9 The JBA mapping predicts areas of groundwater emergence during a 1% annual chance event. Once above ground, the groundwater behaves as surface water and the area affected is the same as for surface water flood mapping.
- 2.3.10 JBA's groundwater flood risk mapping is only available for a 1% annual chance event due to the lack of groundwater data generally available, therefore more frequent and more extreme groundwater events have not been assessed. The complexities of groundwater flood modelling mean that groundwater flood risk mapping is not a direct comparison to fluvial and surface water flood risk map.

### Flood resilience and resistance

- 2.3.11 Flood resilience is defined as designing or adapting an infrastructure asset so that although it comes into contact with floodwater, no permanent damage is caused, structural integrity is maintained and, if operational disruption does occur, normal operation can resume rapidly. Flood resistance is defined as designing or adapting infrastructure so that floodwater is excluded during flood events and normal operation can continue with no disruption caused.
- 2.3.12 Options are available to manage flood risk, including embankment raising, flood warning, limiting placement of assets in the floodplain, and raising assets above the predicted flood level. The Scheme will aim to provide resistance to flooding where possible, considering key constraints including:
- Interface with existing property and infrastructure which may limit the ability to raise embankment levels;
  - Land take restrictions; and
  - Financial constraints.
- 2.3.13 It is important to consider flood risk to the Scheme at all stages of design, construction and operation, to ensure the route is resilient to flooding. Clear, specific guidance relating to

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<sup>7</sup> LiDAR is a method of measuring distances using laser light which can be used to make digital 3-D representations of the target



clearances for the track and trackside equipment is not available; hence a risk based, proportionate approach is proposed. This approach focuses on ensuring assets are resilient, whilst balancing the economic, technical and environmental viability of increasing track levels with the level of flood risk. For example, if there are practical and disproportionate financial implications as to why the track level cannot be raised any further where the existing infrastructure or environmental constraints are present, then resilience measures may need to be considered to ensure that the railway can readily be put back into service with minimum intervention.

- 2.3.14 Table 2-3 outlines the proposed hierarchy of measures to manage flood risk to the Scheme, with the table structure based on Table 6.2 within the CIRIA guidance document C6884<sup>8</sup> entitled Flood resilience and resistance for critical infrastructure.

**Table 2-3 Flood risk management (FRM) measures**

FRM measure category	Description	Risk management measures
Assess	Identify sources of flooding, mechanisms and impacts on receptor	FRA making use of available EA data to inform existing flood risk extents, depths and levels to establish the flood risk to the Scheme, including an allowance for climate change.
Avoid	Locate assets in areas of lowest risk	Track junctions located outside of flood zone Signalling/communication/power equipment is located outside of flood zone.
Substitute	Substitute assets which are incompatible with flooding with less vulnerable or water compatible uses	Preferential siting of less vulnerable assets in the flood zone.
Control	Reduce likelihood of flooding – floodwalls, embankments	If possible, achieve a clearance of 300mm from top of rail to the 1% annual chance event flood (including climate change) flood level. There is a potential to undertake limited track raising to reduce the likelihood of flooding, but which may not mitigate entirely for climate change impacts over lifetime of the Scheme. Where not possible it is likely that additional resilience and resistance measures will be required. Where located in a flood zone, signalling/communication/power equipment is 600mm above the 1% annual chance event flood (including climate change) flood level.
Mitigate	Assess residual risks and adopt mitigation measures – flood warning, emergency and recovery plans	All rail mounted equipment (axle counters/ AWS/TPWS) to be submersible resilient where possible. Assess performance of embankments and track bed under flood conditions – asset condition surveys. Follow operational procedures during floods. Making use of existing EA data and services to provide flood warning, and

<sup>8</sup> McBain, W., Wilkes, D., Retter, M. (2010) Flood resilience and resistance for critical infrastructure. CIRIA publication C688

FRM measure category	Description	Risk management measures
		potentially develop Flood Management Plan (or include in the Operation and Maintenance Plan actions, monitoring etc. to be undertaken).

### Drainage strategy

- 2.3.15 The Scheme-wide drainage strategy included in Appendix A is provided to inform the drainage provision. It provides a description of the existing drainage systems and the assumed outfalls. It discusses the current assumptions on the location of railway drainage outfalls. It considers the potential ways storm water impacts on the current railway corridor, through rainfall, storm water surface flows and groundwater. It looks at the interventions assumed to be necessary along the proposed railway corridor to mitigate these storm water impacts and to maintain the operation of the railway.
- 2.3.16 The assessment looks primarily at the railway drainage systems, which includes:
- Track drainage: drainage provided alongside the railway tracks to provide drainage for the track support;
  - Stations: drainage provided for the platforms and other infrastructure alongside the railway. These include the re-modelled Huddersfield, Deighton and Mirfield Stations, plus the new Ravensthorpe Station;
  - Earthworks: drainage requirements for proposed earthworks and to protect the railway from the ingress of storm water flows;
  - Tunnels: drainage provisions within existing tunnels; and
  - Drainage provisions for the Hillhouse construction compound site.

### 3. FLOOD RISK POLICY

3.1.1 This section outlines flood risk planning policy and guidance, with further detail provided in Kirklees Local Flood Risk Management Strategy<sup>6</sup>.

### 3.2 Flood risk and flood probability

3.2.1 Flooding is a natural process that can present a range of different risks depending on its form. Flood practitioners and professionals define the risks presented by flooding according to an Annual Chance Event, or as having a 'return period'.

3.2.2 Flood risk includes the statistical probability of an event occurring and the scale of the potential consequences. Flood risk is estimated from historical data and expressed in terms of the expected frequency of a flood of a given magnitude. The 10-Year, 50-Year and 100-Year annual chance event floods have a 10%, 2% and 1% chance of occurring in any given year, respectively. However, over a longer period, the probability of flooding is considerably greater.

3.2.3 For example, for the 1% annual chance flood:

- There is a 1% chance of the 1% annual chance event flood occurring or being exceeded in any single year;
- There is a 26% chance of the 1% annual chance event flood occurring or being exceeded in a 30- year event period;
- There is a 51% chance of the 1% annual chance event flood occurring or being exceeded at least once in a 70-year period.

3.2.4 Table 3-1 provides a summary of the relevant annual chance event and corresponding return period events.

**Table 3-1 Definition of annual chance event and return period events**

Annual chance (%)	Return period (years)
100%	1 in 1-year (annual)
10%	1 in 10-year
5%	1 in 20-year
2%	1 in 50-year
1%	1 in 100-year
0.5%	1 in 200-year
0.1%	1 in 1000-year

### 3.3 National policy overview

3.3.1 The NPPF is the Government's overarching planning policy document for England and sets out the Government's policy on development relating to flood risk. The broad aim of the NPPF is to reduce the number of people and properties within the natural and built environment at risk of flooding. The NPPF protects people and property from flooding by steering development to areas at lowest risk. Where development needs to be in locations that are at risk from flooding, the NPPF ensures that the development is safe without increasing flood risk elsewhere and, where possible, reducing flood risk overall.

3.3.2 The developer must prove to the Local Planning Authority and the EA that any existing flood risk or flood risk associated with the proposed development can be satisfactorily managed.

3.3.3 In accordance with the NPPF, a site-specific FRA is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development

and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems; and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

### 3.4 Flood zones and vulnerability classification

3.4.1 The EA's Flood Map is divided into three separate Flood Zones. These Flood Zones are used by NPPF in determining the appropriateness of proposed developments when considering flood risk through the application of the Sequential Test. They represent the probability of flooding without flood defences in place. The Flood Zones are defined in Table 3-2.

**Table 3-2 Definitions of EA Flood Zones**

Flood Zone	Definition
Flood Zone 1: Low Probability	Land where the annual chance of flooding is lower than 0.1% for either fluvial or sea flooding.
Flood Zone 2: Medium Probability	Land where the annual chance of flooding is between 0.1 and 1.0% for fluvial flooding
Flood Zone 3a: High Probability	Land where the annual chance of flooding is 1.0% or greater for fluvial flooding. Or, land where the annual chance of flooding is 0.5% or greater for flooding from the sea
Flood Zone 3b: Functional Floodplain	Land where water has to flow or be stored in times of flooding. Local planning authorities identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA.
<u>Flood Zone 3ai</u>	<u>Land where water would flow in times of flood were it not prevented from doing so by infrastructure based on an annual probability of 1 in 20 (5% AEP) or greater</u>

3.4.2 The EA's Flood Map also defines Areas Benefitting from Defences (ABDs) within Flood Zone 3, however this category is not expressly determined within NPPF or the Sequential Test process.

3.4.3 NPPF provides guidance on assessing the vulnerability of land uses in relation to flood risk and classifies new developments into one of five categories:

- Essential Infrastructure;
- Water Compatible;
- Less Vulnerable;
- More Vulnerable; and
- Highly Vulnerable.

3.4.4 The Scheme is classified as Essential Infrastructure.

### 3.5 Compatibility

3.5.1 Table 3-3 sets out the NPPF flood risk vulnerability and flood zone compatibility assessment, as taken from the NPPF Planning Practice Guidance, and indicates which development types are appropriate within each Flood Zone. Essential Infrastructure is acceptable in all Flood Zones, however within Flood Zone 3a and 3b an exception test is required. The exception test forms part of this Level 3 FRA. The Scheme is utilising an existing railway and there are parts of the existing route which fall within Flood Zone 3.

**Table 3-3 Flood risk vulnerability and Flood Zone compatibility**

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	x	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	x	x	x

## 3.6 Climate change

- 3.6.1 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. NPPF and supporting Planning Practice Guidance on Flood Risk and Coastal Change<sup>9</sup> explain when and how FRA should be used. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account. Local planning authorities refer to this when preparing local plans and considering planning applications.
- 3.6.2 As of February 2016, the Government updated the climate change guidance which is to be considered during the planning process. The guidance states how climate change should be assessed as part of this FRA.
- 3.6.3 The following sets out which climate change allowance needs to be applied according to the development type and Flood Zone.
- 3.6.4 The relevant allowances for the Humber catchment which apply to the Scheme are 20% for the central band and 50% for the upper.

**Table 3-4 Climate change allowances for the Scheme**

River basin	Key Main Rivers	Route Sections	Climate change allowance (upper end)
Humber	River Colne River Calder Hebble Beck Blackhouse Dike Spen Beck	All Route Sections	50%

## 3.7 Local planning policy overview

- 3.7.1 Under the Flood and Water Management Act 2010 (FWMA)<sup>10</sup>, the unitary authority or county council for an area is designated the LLFA with responsibility for managing flood risk from surface water, groundwater and Ordinary Watercourses within their area. The LLFA is also the consenting authority for works near or within Ordinary Watercourses.
- 3.7.2 In relation to flood risk from the Scheme, the EA has operational jurisdiction over Main

<sup>9</sup> Department for Communities and Local Government, Technical Guidance to the National Planning Policy Framework (March 2012)

<sup>10</sup> Flood and Water Management Act 2010, <https://www.legislation.gov.uk/ukpga/2010/29/contents>

Rivers and LLFAs have jurisdiction over Ordinary Watercourses and flooding from surface water and groundwater sources. LLFAs may be either Unitary Authorities or County Councils. The area of jurisdiction for Kirklees and Calderdale LLFA is identified in Figure 1-1. The following sets out some key definitions as stated in the Flood and Water Management Act 2010:

- Watercourse: includes all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows;
- Main River: Watercourse shown as such on a Main River map; these are the responsibility of the EA; and
- Ordinary Watercourse: 'A 'watercourse' that does not form part of 'a 'Main River'. These are the responsibility of the LLFA.

**3.7.3** The Scheme passes through land that falls under the jurisdiction of Kirklees Council and Calderdale Council. Flood risk has therefore been assessed with respect to the specific flood risk policy of these local authorities.

**3.7.4** Given the timescales associated with the preparation of the FRA, policies may change or be updated over this period. Local planning policies will be reviewed and updated as necessary.

## 4. ASSESSMENT OF FLOOD RISK

### 4.1 Introduction

4.1.1 The following sections describes the existing flood risks within each Route Section for all flood risk sources, followed by an assessment of flood risks to the Scheme, mitigation measures and lastly residual flood risk.

4.1.2 Baseline information which applies to the entire Scheme (all Route Sections) is outlined in the following section.

4.1.3 Scheme information is provided on drawing 1% PLUS CLIMATE CHANGE ALLOWANCE (50%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING WITH SCHEME DESCRIPTION, Drawing No. TSA-15166700-TRU-REP-W-EN-00XXXX, which was submitted under separate cover (hereafter referred to as Drawing - Climate Change Allowance plus Scheme description).

#### Topography

4.1.24.1.4 The topography of the area has been assessed using LiDAR data (2m resolution).

#### Geology and hydrogeology

4.1.34.1.5 A summary of geology and hydrogeology underlying the Scheme is based on a review of the regional geology using the British Geological Survey (BGS) 1:50,000 scale bedrock and superficial deposits mapping.

4.1.44.1.6 The bedrock geology underlying the Scheme largely comprises the Pennine Lower Coal Measures Formation. Interbedded mudstone, siltstone and sandstone underlies the majority of the Scheme with pockets of Middle Band Rock.

4.1.54.1.7 The EA aquifer designations indicate that the Pennine Lower Coal Measures Formation is a Secondary A Aquifer; "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".

#### History of flooding

4.1.64.1.8 The Historic Flood Map (HFM) shows areas of past fluvial flooding. Where there is no flood outline indicating that flooding has occurred in a given area it does not mean that the area has never flooded.

4.1.74.1.9 The HFM shows historic flood outlines and does not account for a change in the pattern of flooding and therefore cannot be relied upon to inform whether a Route Section would flood or not flood under different circumstances.

4.1.84.1.10 The HFM takes account of flood defences and structures where they existed at the time of flooding. The flood extents presented may be affected by overtopping and breaches.

#### Climate Change

4.1.94.1.11 The scheme has been assessed against a 50% climate change allowance in line with EA guidance (2020). A further sensitivity test has been undertaken against the H++ allowance of 65% to assess whether the scheme remains operational during this event. There is no change in maximum flood extent when considering the proposed scheme within Route section 1-5 against the climate change allowances. However, there is a change in the



flood extent in Route Section 6 including allowance for climate (50%) for which compensatory flood storage provision has been provided (Detailed in section 4.14) The H++ climate change scenario indicates that the scheme remains operational during this event.

### Flooding from sewers

**4.1.104.1.12** The Calder Catchment Strategic Flood Risk Assessment (SFRA)<sup>11</sup> does not report any records of flooding from sewers near the Scheme.

**4.1.114.1.13** The Kirklees Council Preliminary Flood Risk Assessment (PFRA) does not identify any records of historic flooding from sewers near the Scheme<sup>12</sup>.

**4.1.124.1.14** The Scheme-wide drainage strategy is provided in Appendix A of this FRA.

### Flooding from groundwater

**4.1.134.1.15** Flooding from groundwater is based on the JBA groundwater flooding map which was developed as part of the SFRA.

**4.1.144.1.16** Risk of groundwater flooding within each Route Section is detailed in the following sections; however, across the Scheme there could be localised problems in other areas which are not identified on this strategic map. Kirklees Council has not specified any significant issues associated with groundwater flooding within the SFRA.

**4.1.154.1.17** The EA Aquifer Designation indicates that underlying the track is a Secondary A Aquifer, which has the potential for groundwater emergence.

### Flood risk sources scoped out

**4.1.164.1.18** Consideration of the baseline flood risk for the Scheme has led to Tidal flooding and Sewer flooding being scoped out of further analysis for all Route Sections.

**4.1.174.1.19** Reservoir Flooding is also scoped out for Route Sections 1, 2 and 3.

### Mitigation summary

**4.1.184.1.20** The Scheme design seeks to ensure that any adverse impacts will be avoided or minimised, as far as practicably possible. The overall Scheme seeks to ensure that there is no increase in flood risk to existing vulnerable receptors. This is achieved through embedded mitigation and additional mitigation measures incorporated to minimise any impact as far as reasonably practicable.

**4.1.194.1.21** Additional mitigation measures include the use of appropriate construction site practice to minimise flood risk and drainage impacts as far as reasonably practicable. Measures to protect the water environment during construction will be employed through application of the Code of Construction Practice (CoCP). Part A of the CoCP is included in Appendix 2-1 in Volume 3 of the ES. Part B of the CoCP will incorporate a Pollution Prevention and Incident Control Plan (PPICP) and Environmental Design Plan (EDP) (Land Contamination and Hydrogeology). The content of these documents will be submitted to and agreed by the Local Authority pursuant to a condition to be attached to the deemed planning permission<sup>13</sup>,

<sup>11</sup> <https://www.kirklees.gov.uk/beta/planning-policy/strategic-flood-risk-assessment.aspx>

<sup>12</sup> <https://www.kirklees.gov.uk/beta/flooding-and-drainage/pdf/PreliminaryFloodRisk.pdf>

<sup>13</sup> On making an order under the Transport and Works Act 1992, the Secretary of State may direct that planning permission shall be deemed to be granted, subject to such conditions (if any) as may be specified in the direction.



before construction works commence.

**4.1.204.1.22** Further Scheme-wide construction mitigation measures are reported in detail in Chapter 11 (Water environment) of Volume 2i of the ES. The Scheme-wide drainage strategy is included in Appendix A of this FRA.

**4.1.214.1.23** The principal purpose of the flood risk mitigation measures is to maintain the existing hydrological behaviour as far as is reasonably possible. The finalised plan for mitigating flood risk will be reviewed and approved by the EA and LLFAs.

**4.1.224.1.24** Any mitigation measures which are specific to a particular Route Section are outlined in the respective sections, as follows.

### Residual flood risk

**4.1.234.1.25** There will always be the potential for residual flood risk to occur above and beyond the standard of protection for which the proposed mitigation is designed.

## **4.2 Route Section 1 – Huddersfield**

### Overview

**4.2.1** The Route Section 1 area comprises the existing railway, partly within a cutting, bordered by undeveloped vegetated land. The track leads from Branch Street, through Gledholt Tunnel in the west of Route Section 1, passing through Huddersfield Station and across Huddersfield Viaduct (MVL3/92). Springwood Footpath runs through Route Section 1 parallel to the track and residential properties are present to the east end. Springwood car park and two ventilation shafts surrounded by grass are present over the existing Huddersfield Tunnels.

**4.2.2** Surrounding land uses are predominantly commercial and residential properties. Land uses surrounding the three areas of Route Section 1 include:

- North: Residential properties and bowling green/recreational area, beyond which is Greenhead College and Greenhead Park;
- East: A62, commercial properties, Huddersfield town centre;
- South: Huddersfield Leisure Centre and residential/commercial areas, with some woodland bordering the railway; and
- West: The Triangle Business Park that includes vehicle repair/servicing, beyond which are residential properties.

**4.2.3** The nearest surface water feature to Route Section 1 is the Huddersfield Narrow Canal. The canal is not classified by the EA. The River Colne runs to the south.

### Topography

**4.2.4** The topography of the area has been assessed using LiDAR data. This shows that the Scheme is at approximately 105m Above Ordnance Datum (AOD), at the western extremity of Route Section 1. Following the Scheme in a north-easterly direction, ground level decreases to approximately 81m AOD to the north of Huddersfield.

### Geology and hydrogeology

**4.2.5** The bedrock geology for the Scheme is outlined in paragraph 4.1.5.

**4.2.6** There are few mapped superficial deposits underlying Route Section 1. Head – Clay Silt and

Gravel are mapped within Huddersfield with Alluvium strands associated with the Hebble Beck crossing the rail alignment.

- 4.2.7 The bedrock is classified by the EA as a Secondary A Aquifer which is described as “permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.” The BGS hydrogeology 1:625,000 scale map describes the underlying aquifer as a moderately productive aquifer comprising “Regional, cyclic multi-layered aquifer with moderate yields from sandstones and many springs. Mine water quality poor but elsewhere reasonable”. The Groundwater Vulnerability Map indicates the underlying aquifer is classified as a high vulnerability minor aquifer.

### Works in Route Section 1

- 4.2.8 In summary, Route Section 1 includes the following works:
- Track works (horizontal and vertical alignment alterations);
  - Localised earthworks including retaining walls;
  - Provision of overhead line equipment (OLE) and signal infrastructure;
  - Station remodelling;
  - Structural works on Huddersfield Viaduct including bridge reconstruction and bridge deck replacements;
  - Construction compounds;
  - Provision of electricity substation, Distribution Network Operator (DNO) equipment and Traction Power Equipment; and
  - Utility diversions.

### Existing flood risk in Route Section 1

- 4.2.9 Table 4-1 summarises the key flood risks in Route Section 1.

**Table 4-1 Flood risk summary for Route Section 1**

Feature	Jurisdiction	Description
Main River (Hebble Beck)	EA	Main River flows west to east beneath track alignment in culvert, culverted through residential area to the west, maybe used as outfall location as required.
Ordinary Watercourse (Gledholt Beck)	LLFA	Ordinary Watercourse flows north to south beneath track alignment in culvert, runs in open channel through residential area to the north.
Surface water	LLFA	Pockets of surface water flood risk along the alignment.
Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures groundwater body	EA	Secondary A Aquifer

- 4.2.10 The following figures show the EA Flood Zone maps and surface water flood risk areas on Route Section 1.



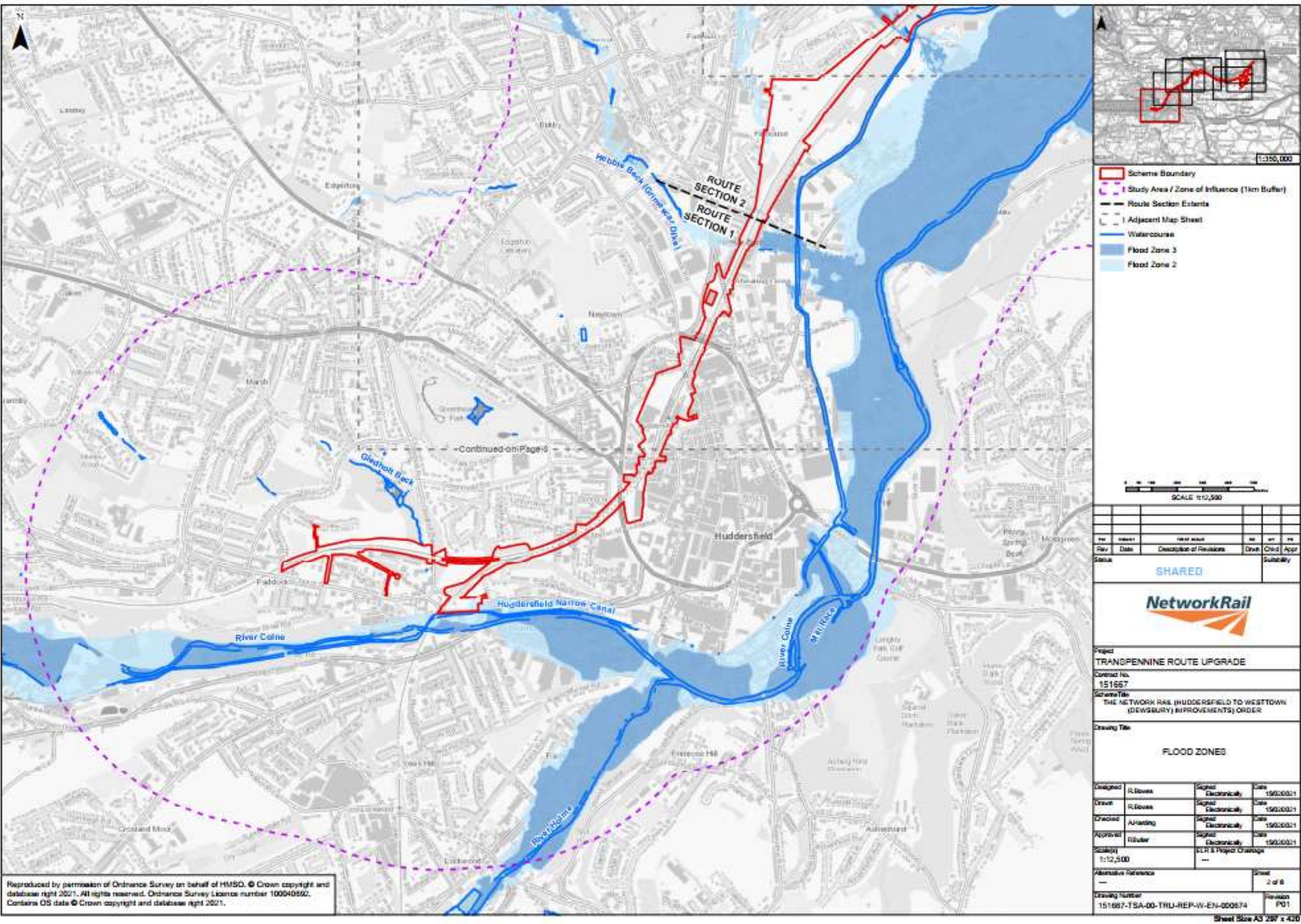


Figure 4-1 EA Flood Zones in Route Section 1



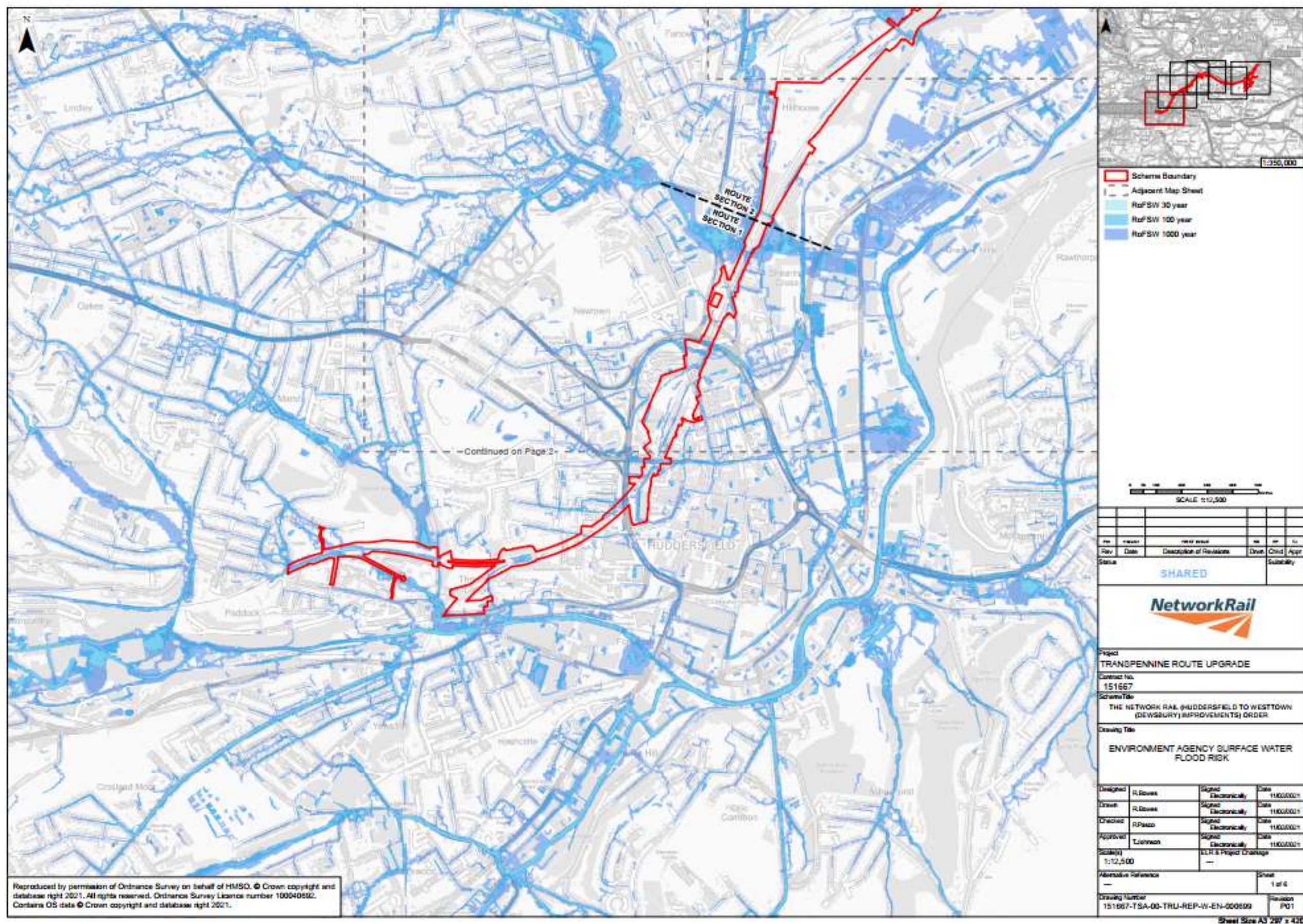


Figure 4-2 Risk of Flooding from Surface Water Map for Route Section 1



### History of flooding

- 4.2.11 The HFM indicates there is no record of flooding from fluvial sources within Route Section 1.

### Flooding from rivers

- 4.2.12 A review of the EA's Flood Map for Planning indicates that the majority of the Route Section 1 is located in the low risk fluvial Flood Zone 1.
- 4.2.13 There is no interaction with Scheme elements and flood zone 3b or 3ai in Route Section 1 including an allowance for climate change (See Appendix B for Flood Risk Maps including Climate Change). There is a small area of land on Longroyd Lane where works are proposed that is designated as flood zone 2. The proposals here are for a site compound, the details of which are discussed in section 4.3.

### Main Rivers

- 4.2.14 The Scheme crosses Hebble Beck, which is designated as a Main River. It flows in a southerly direction and discharges into the River Colne. The area to the north of the Scheme at this location is subject to surface water flooding, this risk includes residential and industrial properties. The interaction with the Scheme at this location is limited to two existing routes under Huddersfield Viaduct (MVL3/92) including Hillhouse Lane and Lower Viaduct Street.

### Ordinary Watercourses

- 4.2.15 The RoFSW mapping show areas along both sides of the Scheme, including the tracks, at risk of flooding from surface water.
- 4.2.16 To the west of Route Section 1, the Scheme crosses Gledholt Beck at National Grid Reference (NGR) 413343 416376, approximately 1km south-west of Huddersfield Station. The watercourse flows in a southerly direction through woodland before entering a structure under the rail embankment. Water is shown to pond upstream of the culvert inlet, however the track is elevated at this location. The area to the north of the crossing is susceptible to surface water flooding from the 3.3% annual chance event upwards. The track is shown to be at risk according to the RoFSW mapping, whilst a flow route is identified along Gledholt Beck which passes under the railway alignment.

### Flooding from groundwater

- 4.2.17 Parts of Huddersfield are deemed as being at high risk from groundwater flooding. Risk within Route Section 1 varies between greater than 25% and up to a 75% risk of groundwater emergence.

### Flooding from surface water

- 4.2.18 A review of the EA's RoFSW mapping indicated overland flow routes within or near the Scheme.
- 4.2.19 Moving from west to east along Route Section 1, the EA's RoFSW mapping indicates the presence of surface water flood risk in the following areas of the Scheme:
- At Longroyd Lane (Longroyd Viaduct) the RoFSW mapping indicates risk from the 3.3% annual chance event impacts the area surrounding the Scheme. The risk appears to be associated with the Huddersfield Narrow Canal. Since the Scheme (alignment of the railway) is raised at this location by way of viaduct it is not shown to flood. Assets within the flood extent include industrial properties such as metal fabricators and textiles;

- To the north of the Scheme at Gledholt Beck an area is shown to be at risk from the 3.3% annual chance event upwards. However, the Scheme is embanked at this location and is therefore not categorised as high risk. The railway embankment is steep at this location causing what appears to be a flood flow route along the track, this is shown to be at risk during at the 0.1% annual chance event;
- An overland flow route is shown to cross the track in the vicinity of Viaduct Street. The area at risk is limited in its extent and appears at the 0.1% annual chance event. At this location railway is atop the Huddersfield Viaduct (MVL3/92), and therefore the flood flow routes identified pass through underbridges and do not impact the track; and
- To the north of the Scheme at Hebble Beck an area is shown to be at risk from the 3.3% annual chance event upwards. However, the Scheme is atop a viaduct at this location and is therefore not categorised as high risk. The flood flow routes displayed as crossing the RoFSW mapping at this location traverse under the viaduct via Lower Viaduct Street and Hillhouse Lane.

4.2.20 The RoFSW mapping show limited amounts of shallow flooding along further locations along the route, where the Scheme is in cutting and entering Gledholt and Huddersfield tunnels. This is expected given the methodology used to produce the surface water flood maps.

#### Flooding from other sources

4.2.21 The Main River within Route Section 1 is the River Colne, for the majority of the watercourse there are no formal flood defences, in excess of bank heights. However, in the vicinity of Birkhouse Lane there is a flood wall which does not provide a sufficient level of protection to create an ABD.

4.2.22 The risk of flooding along Huddersfield Broad Canal and Huddersfield Narrow Canal is dependent on a number of factors. As canals are man-made systems and heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with residual risks, similar to those associated with river defences, such as overtopping of canal banks.

4.2.23 The EA's Risk of Flooding from Reservoirs (RoFR) map indicates that the Scheme is not at risk in Route Section 1.

#### Drainage

4.2.24 Details regarding drainage are set out in the detailed Scheme-wide drainage strategy in Appendix A of this FRA.

### **4.3 Flood risk for Route Section 1**

4.3.1 The baseline flood risk for Route Section 1 is described in preceding sections. Elements of the Scheme constructed within an area identified as being at risk of flooding may lead to an increased risk of flooding.

4.3.2 The design approach and principles adopted in relation to mitigating flood risk for both permanent and temporary works are described in Section 2 of this FRA. The Scheme elements which could potentially increase flood risk for Route Section 1 are outlined in the following section along with proposed mitigation works.

4.3.3 All works in Route Section 1 fall outside the 1% Plus Climate Change Allowance (50%) – see drawing Climate Change Allowance plus Scheme description, with only a small portion of Longroyd Lane compound falls within Flood Zone 2.

## Station works

**4.3.24.3.4** The works at Huddersfield Station are comprised of the following;

- Station to be remodelled to accommodate a fourth through platform and new island platform proposed. Platforms to be lengthened at Leeds end;
- Main train shed (Roof A) to be maintained and strengthened. Two bays at Manchester end to be demolished to suit new railway alignment. Reinstatement of lantern within main trainshed. Two new bays to be added to roof structure at Leeds end (main trainshed);
- Small train shed (Roof B) to be demolished and replaced with new roof structure;
- Canopies to be provided at Leeds end of station;
- Lighting and OLE – freestanding infrastructure proposed on platforms;
- Relay room to be demolished. Basement to be infilled to create new platform area; and
- Tea rooms to be retained but relocated within island platform. Timber structure to be dismantled and reconstructed.

**4.3.34.3.5** All proposed works at Huddersfield Station are located within Flood Zone 1.

## Structures

**4.3.44.3.6** There are several locations where works are proposed to existing structures in Route Section 1:

- Westgate Overbridge (MVL3/90);
- Huddersfield Viaduct (Span 1) Underbridge (MVL3/92(1));
- Huddersfield Viaduct (Span 4) Underbridge (MVL3/92(3)); and
- MVL3/92 Huddersfield Viaduct (Span 29) Underbridge (MVL3/92(9)).

**4.3.54.3.7** The majority of works to structures fall within Flood Zone 1. The exception is the eastern extent of works to the Huddersfield Viaduct (adjacent to Hillhouse Lane), where embankment stabilising works are required (in the form of soil nailing) due to the 4-tracking. This will be limited to the existing embankment footprint.

## Compounds

**4.3.64.3.8** Temporary construction activities may also increase flood risk within Route Section 1; construction compounds are expected to be in situ for up to four years. These have been located outside of floodplain areas where possible.

**4.3.9** There are seven proposed compounds in Route Section 1: Cross Church Street, Longroyd Lane (Bow Street), Springwood Street, Westgate Road, Fitzwilliam Street, John William Street and Bradford Road. The potential increase in runoff as a result of increase in hardstanding areas will be managed as part of a series of mitigation measures set out in the CoCP.

**4.3.74.3.10** The proposed Longroyd Lane construction compound falls partially within Flood Zone 2 according to the EA flood map for planning. The area of Flood Zone 2 lies to the south east of the site. The layout and operation of the compound will ensure that any hazardous or sensitive materials will be positioned out of the flood zone. In addition, the compound will sign up to the EA's Floodline.



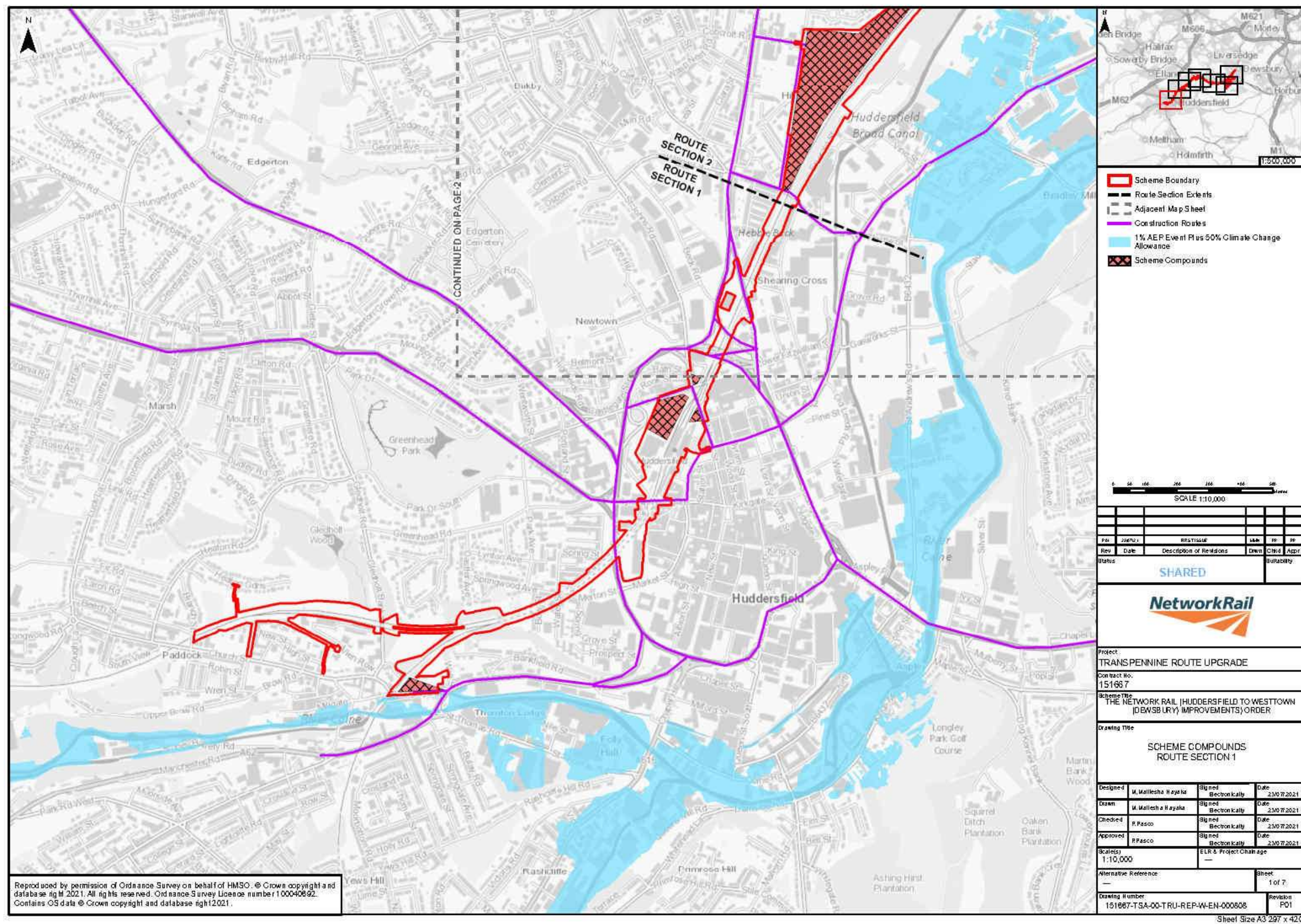


Figure 4-3 Route Section 1 compound locations in relation to flood zones



## Drainage

- 4.3.84.3.11** The proposed drainage works in Route Section 1 include proposals associated with the platform extensions at Huddersfield Station, where drainage for the platform extensions will maintain existing runoff rates.
- 4.3.94.3.12** Works to remodel Huddersfield Station will result in permanent alteration to the existing storm water and foul water drainage systems.
- 4.3.104.3.13** The existing storm water drainage system at Huddersfield Station is to remain for the principal station building, forecourt area, platform 1 and the half of the existing canopy draining to the principal station building.
- 4.3.114.3.14** Surface water runoff from the station development is to be collected in a drainage network and conveyed in the direction of the existing water tank building (west of the Scheme). A flow control chamber will restrict the rate of discharge with an attenuation tank providing storage during storm events where runoff is greater than the agreed rate.
- 4.3.124.3.15** There are no proposed changes to the quantity of drainage points and expected flows are likely to be similar to existing flows. Drainage connections to the cellar pipe for the station building services shall remain in operation or new connections made where necessary. A new connection from the island platforms will be provided similar to those in current operation to minimise impact on downstream drainage.
- 4.3.134.3.16** The discharge to sewer is a permitted discharge and no outfalls to surface waters are expected.

## Mitigation summary

- 4.3.144.3.17** In addition to the mitigation measures set out in paragraphs 4.1.19 to 4.1.23, the mitigation measures to be adopted in Route Section 1 are presented in Table 4-2.

**Table 4-2 Summary of impacts and proposed mitigation measures for Route Section 1**

Description of works	Watercourse affected	Impact of works	Mitigation measures
Construction compound at Longroyd Lane in Flood Zone 2	River Colne	Increase in surface water runoff	<ul style="list-style-type: none"> <li>The PPICP under Part B of the CoCP will ensure that the compound signs up to the EA's Floodline;</li> <li>The Scheme-wide drainage strategy will be adhered to in order to manage temporary flood risk associated with potential increases in surface water runoff; and</li> <li>Part A of the CoCP will ensure that hazardous materials and sensitive equipment should be stored outside of flood zone within the compound.</li> </ul>
New rail track on existing rail footprint, location may be used as outfall for new track drainage	Hebble Beck ( <a href="#">main river</a> )	Potential increase in runoff	<ul style="list-style-type: none"> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>

## Flood Risk Conclusion –Route Section 1

4.3.18 No additional river modelling has been undertaken within this route section as there are no proposed changes to the river or flood plain associated with the Scheme. Where Scheme extents do fall within the flood extent (Flood Zone 2), these are limited to compound areas at Longroyd Lane where no ground raising is proposed. Table 4.2 details the proposed flood mitigation measures and approach to managing surface water flood risk. Drawing - Climate Change Allowance plus Scheme description shows the location of the Scheme elements and the proximity of the flood zone including an allowance for climate change.

## **4.4 Route Section 2 – Hillhouse and Fartown**

### Route Section 2 overview

- 4.4.1 The Scheme within Route Section 2 comprises the area south-west of Fartown. The land to the north-west, between the operational railway and Alder Street is within Network Rail ownership. It is retained as operational railway land though some non-rail related transport and storage activity takes place on the site, including concrete, fuel and aggregate suppliers and a truck repair centre.
- 4.4.2 To the east of Fartown, Route Section 2 is dominated by the operational railway and areas of vegetation (predominantly hedgerow). A public bridleway (Birkby Bradley Greenway) runs parallel to the railway. Public Rights of Way (PRoW) pass under the railway at Red Doles Road Underbridge (MVL3/96) and Ridings Underbridge (MVL3/99) in addition to Field House Overbridge (MVL3/98). To the south, the boundaries encompasses two bridges that cross the Huddersfield Broad Canal as well as an area of undeveloped land.
- 4.4.3 Surrounding land uses include:
- North: Residential estates occupy the adjacent land;
  - East: Refuse tip, Huddersfield Broad Canal, beyond this commercial and residential properties;
  - South: Recycling centre, with commercial businesses and residential properties beyond; and
  - West: Alder Street Waste transfer depot, commercial premises, beyond which are residential areas.
- 4.4.4 Route Section 2 includes the main rivers of River Colne, Huddersfield Broad Canal, Hebble Beck, Blackhouse Dike, and crosses the Ordinary Unnamed Watercourse at Fieldhouse Culvert.

### Topography

- 4.4.5 The Scheme is at approximately 81m AOD at the western extremity of Route Section 2. Following the Scheme in a north-easterly direction, ground level decreases to approximately 75m AOD to the east of Fartown.

### Geology and hydrogeology

- 4.4.6 The bedrock geology for the Scheme is outlined in paragraph 4.1.5.
- 4.4.7 There are little mapped superficial deposits underlying Route Section 2. Superficial deposits of Alluvium associated with the River Colne are indicated to be in close proximity to the Scheme alignment.

## Works in Route Section 2

### 4.4.8 Route Section 2 includes the following works:

- Track works (horizontal and vertical alignment alterations);
- Localised earthworks including retaining walls;
- Provision of OLE and signal infrastructure;
- Structural works for bridges – including bridge reconstruction, deck replacements and infill works of underbridges;
- Construction compounds;
- Drainage and culvert works (replacement/remediation/new);
- Provision of DNO equipment; and
- Utility diversions.

## Existing flood risk in Route Section 2

### 4.4.9 Table 4-3 summarises the key flood risks in Route Section 2.

**Table 4-3 Flood risk summary in Route Section 2**

Feature	Jurisdiction	Description
Main River (Blackhouse Dike)	EA	Main River flows north to south beneath track alignment in culvert, runs in open channel through residential area to the north, assumes drains into canal.
Main River (Hebble Beck)	EA	Main River flows west to east beneath track alignment in culvert, culverted through residential area to the west, <del>maybe to be</del> used as outfall location as required.
Ordinary Watercourse (Unnamed Watercourse at Fieldhouse Culvert)	LLFA	Ordinary Watercourse flows north to south beneath track alignment in culvert, runs through rural area to the north.
Huddersfield Broad Canal	Canal & River Trust, LLFA	Located south of the track alignment receiving flow from watercourses to the north.
Surface water flood prevalence	LLFA	Pockets of surface water flood risk along the alignment.
MVL3/96AA Topaz Close Culvert	LLFA/ Network Rail	Flows beneath track alignment in culvert. Culvert likely to be required for track drainage.
Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures groundwater body	EA	Secondary A Aquifer

### 4.4.10 Figures 4-4 and 4-5 show the EA Flood Zone maps and the surface water flood risk areas in Route Section 2.



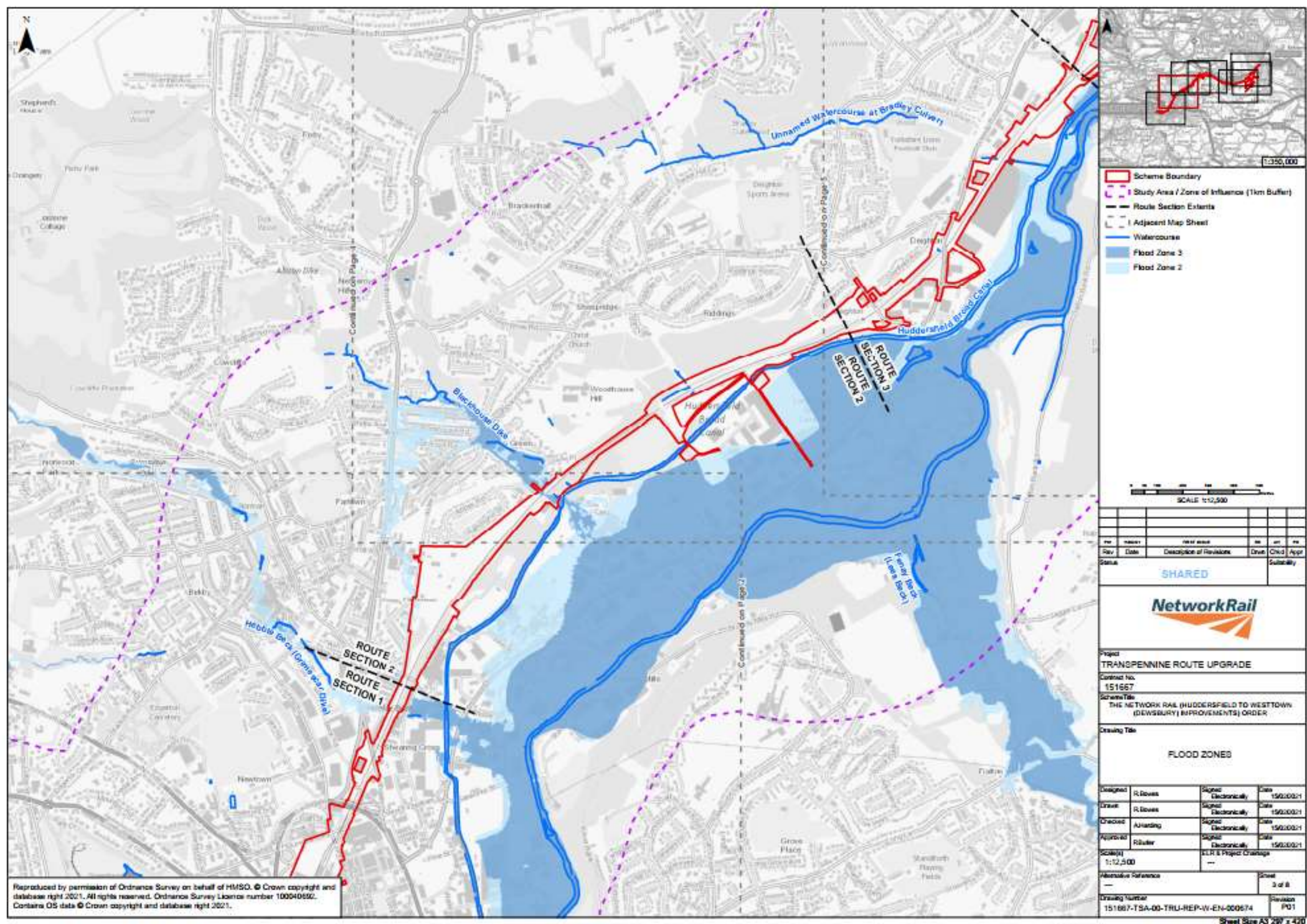


Figure 4-4 EA Flood Zones in Route Section 2



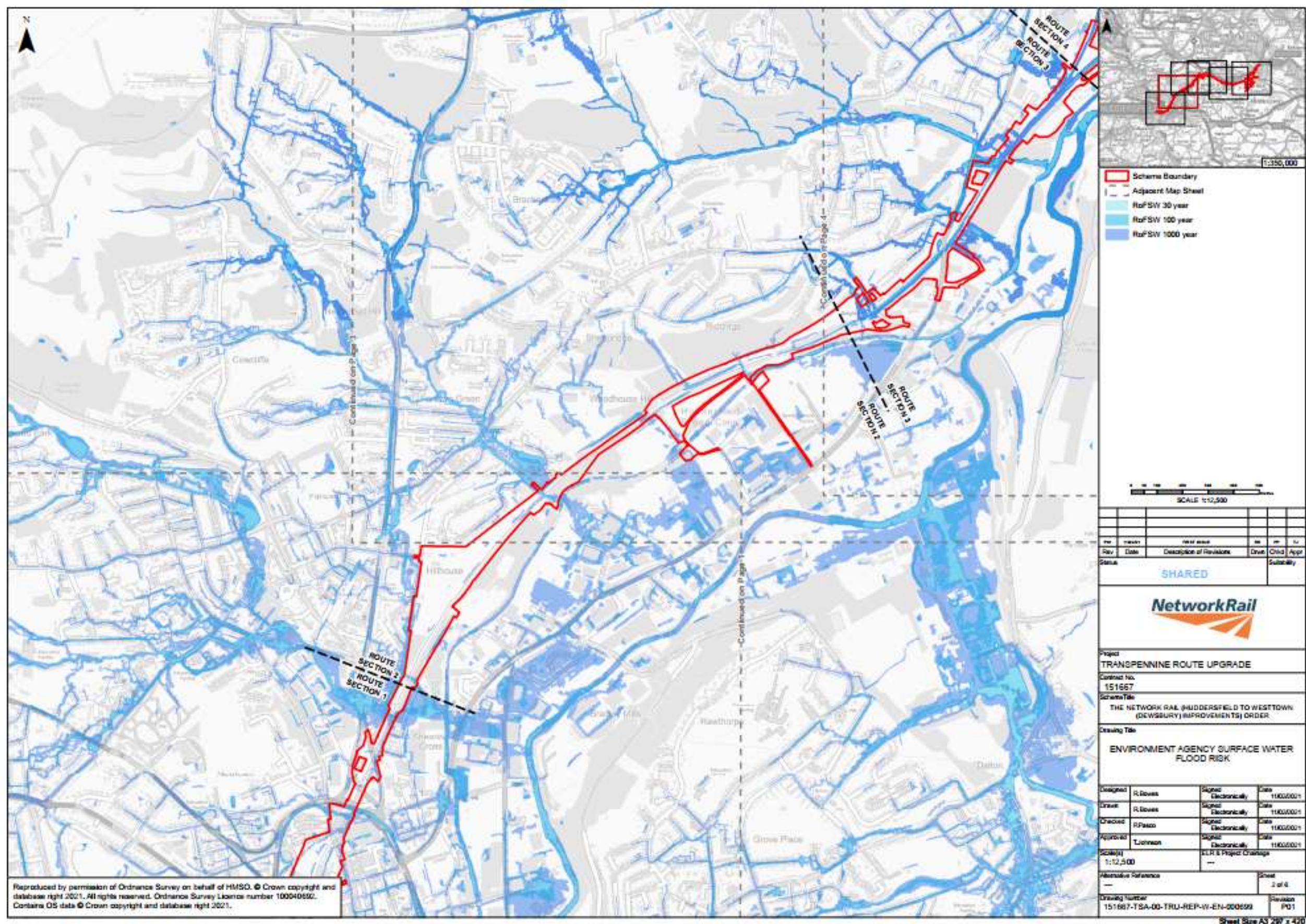


Figure 4-5 Risk of Flooding from Surface Water Map in Route Section 2



### History of flooding

- 4.4.11 There are no formal flood defences in Route Section 2, and no areas benefitting from defences.
- 4.4.12 The HFM indicates there is no record of flooding from fluvial sources within Route Section 2.

### Flooding from rivers

- 4.4.13 A review of the EA's Flood Map for Planning indicates that the majority of the Route Section 2 is located in the low risk fluvial Flood Zone 1.

~~4.4.134.4.14 There is no interaction with scheme elements and flood zone 3b or 3ai in Route Section 2 nor is there any interaction with the 1% AEP flood extent including an allowance for climate change including an allowance for climate change (See Appendix B for Flood Risk Maps including Climate Change). The scheme crosses flood zone 2 and 3 in the vicinity of Blackhouse Dike.~~

### Main Rivers

- 4.4.144.4.15 The Scheme crosses Blackhouse Dike, which is designated as a Main River. It flows in a southerly direction through residential properties and greenspace towards the River Calder. The EA's RoFSW mapping indicates there is a flood risk associated with Blackhouse Dike that is linked to the flood extent of Hebble Beck. RoFSW mapping supports the flood flow paths shown here, however the Scheme is embanked at this location and would likely be in excess of the peak flood level, from the flood sources at Blackhouse Dike and Hebble Beck.

### Ordinary Watercourses

- 4.4.154.4.16 The RoFSW mapping indicates isolated areas along both sides of the Scheme, including the railway tracks, at risk of flooding from surface water. This risk is mainly associated with the Ordinary Watercourses that pass beneath the Scheme.
- 4.4.164.4.17 To the east of Route Section 2, the Scheme crosses the Unnamed Watercourse at Fieldhouse Culvert. The area on the north side of the crossing is shown not to be affected by fluvial flooding. The RoFSW mapping indicates a ponding in the vicinity of the culvert, and a flow path is evident flowing parallel to the track alignment.

### Flooding from groundwater

- 4.4.174.4.18 Parts of Route Section 2 are deemed as having high risk from groundwater flooding. Risk within Route Section 2 is between 25% and equal to or greater than a 75% risk of groundwater emergence.

### Flooding from surface water

- 4.4.184.4.19 A review of the EA's RoFSW mapping indicated overland flow routes within or near the Scheme.
- 4.4.194.4.20 Moving from west to east along the Scheme, the EA's RoFSW mapping indicates the presence of surface water flood risk in the following areas of Route Section 2:
- At Red Doles Road an area on the northern side of the railway and the road itself is shown to be at risk 3.3% annual chance event upwards. Flood depths at the 0.1% annual chance event are predicted to be between 0.9m against the northern side of the embankment. Since the Scheme is raised on embankment it is not shown to

flood. The existing railway underbridge at this location conveys overland flow in the direction of the Huddersfield Broad Canal.

- Overland flow routes are shown to flood within the Scheme boundary and at the 0.1% annual chance event flood the track. In the vicinity of Unnamed Watercourse at Fieldhouse culvert the RoFSW mapping indicates the presence of existing track drainage ditches. This risk of flooding from the Ordinary Watercourse is linked to the ditches themselves, this surface water flood risk is contained within the drainage ditches up to the 1% annual chance event, however the 0.1% annual chance event indicates depths of 0.3m will be sufficient for flood waters to spill out across the track.

### Flooding from other sources

**4.4.204.4.21** There are no formal flood defences in Route Section 2 and no areas benefitting from defences; therefore, there is no flood risk from failure of a raised flood defence.

**4.4.214.4.22** The risk of flooding along Huddersfield Broad Canal is dependent on a number of factors. As canals are man-made systems and heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with residual risks, similar to those associated with river defences, such as overtopping of canal banks.

**4.4.224.4.23** The EA's Risk of Flooding from Reservoirs map indicates that no part of Route Section 2 is within an area at risk of flooding from reservoirs.

## **4.5 Flood risk for Route Section 2**

**4.5.1** The baseline flood risk for Route Section 2 is described in preceding sections.

**4.5.2** The design approach and principles adopted in relation to mitigating flood risk for both permanent and temporary works are described in Section 2. Elements of the Scheme which could potentially increase flood risk for Route Section 2 are outlined as follows, along with proposed mitigation works.

**4.5.3** All works in Route Section 2 fall outside the 1% Plus Climate Change Allowance (50%) – see drawing Climate Change Allowance plus Scheme description with only a small portion of Hillhouse construction compound falling within Flood Zone 2.

### Retaining walls

**4.5.24.5.4** The existing soil cutting will be replaced near Hillhouse construction compound and sidings. The replacement structure is a gabion wall.

**4.5.34.5.5** Retaining wall works are not within an area at risk of flooding.

### Earthworks

**4.5.44.5.6** No earthworks proposed in Route Section 2 are at risk of flooding.

### Structures

**4.5.54.5.7** Along Route Section 2 there are ~~five~~four locations where new works to structures are proposed:

- ~~Hillhouse Lane Underbridge (MVL3/94);~~
- Red Doles Road Underbridge (MVL3/96) see drawing NR13 Planning Drawing - Red Doles Road MVL3-96 Elevation and Cross Sections.pdf (windows.net);

- Field House Overbridge (MVL3/98) [see drawing NR13 Planning Drawing - Field House MVL3-98 Elevations and Cross Sections.pdf \(windows.net\)](#);
- Ridings Underbridge (MVL3/99) [see drawing NR13 Planning Drawing - Ridings Underbridge MVL3-99 Elevations and Cross Sections.pdf \(windows.net\)](#); and
- Peel's Pit Underbridge (MVL3/100) [see drawing NR13 Planning Drawing - Peels Pit MVL3-100 Existing and Proposed Sections and Elevations.pdf \(windows.net\)](#).

**4.5.64.5.8** At Red Doles Road Underbridge (MVL3/96) the current railway corridor is too narrow to support four tracking therefore structural works are proposed to support new fast lines on the existing (unused) abutments/cills. During works, a crane is to be located in the carriageway resulting in temporary closure of the PRow.

**4.5.9** Proposed works at Red Doles Road Underbridge (MVL3/96) are [above the River Colne and not in flood zone The abutments of the existing structure are to remain with no change in footprint and therefore no change in risk to and from the underbridge works.](#)

**4.5.74.5.10** There is no change in terms of runoff at Field House Overbridge (MVL3/98), Ridings Underbridge (MVL3/99) and Peel's Pit Underbridge (MVL3/100).

### Compounds

**4.5.84.5.11** Temporary construction activities may also increase flood risk within Route Section 2; construction compounds are expected to be in situ for up to three years (maximum period applies to Hillhouse construction compound, however the majority of compounds will be in use for shorter periods).

**4.5.94.5.12** There are five proposed construction compounds in Route Section 2:

- Hillhouse Lane;
- Hillhouse construction compound;
- Red Doles Road;
- Fieldhouse Lane; and
- Ridings.

**4.5.104.5.13** The compounds have the potential to increase runoff as a result of additional hardstanding areas, which will be managed through application of Part A of the Code of Construction Practice (CoCP). Part B of the CoCP incorporates a Pollution Prevention and Incident Control Plan (PPICP).

**4.5.114.5.14** These compounds have been located outside of flood zone areas where possible. Further details are provided in Table 4-4.

**4.5.124.5.15** The proposed Hillhouse construction compound falls partially within Flood Zone 2 according to the EA flood map for planning. [The area of Flood Zone 2 lies to the west of the site, parallel to Alder Street and falls mainly within the area of the historic coal chutes. This asset is Grade II listed and embedded mitigation has been employed, and is reported in the Historic environment section of the ES \(Chapter 6, Vol 2i\) such that a 10m buffer zone is employed around the coal chutes within which no works related to the Scheme will be undertaken. The layout and operation of the compound will ensure that](#) any hazardous or sensitive materials be positioned out of the flood zone. In addition, the compound will sign up to the EA's Floodline.

**4.5.134.5.16** Any additional surface water runoff associated with permanent operational phase is assessed in the detailed Scheme-wide drainage strategy in Appendix A.



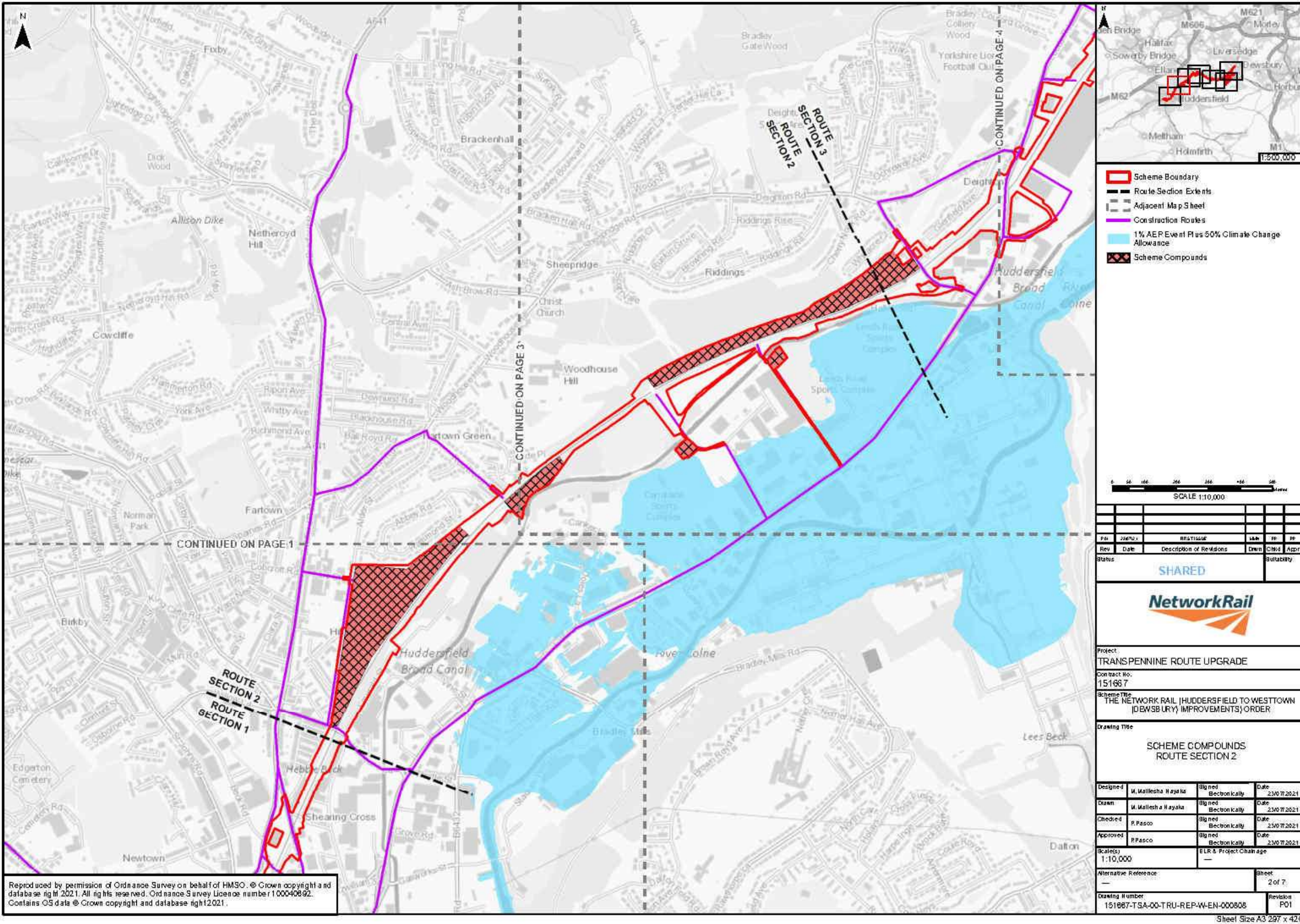


Figure 4-6 Route Section 2 compound locations in relation to flood zones

## Culverts

**4.5.144.5.17** Two of the culverts located within Route Section 2 are associated with the following watercourses:

- Blackhouse Dike; and
- Unnamed Watercourse at Field House Culvert.

**4.5.154.5.18** Blackhouse Dike flows beneath the railway at Red Doles Culvert (MVL3/96A). This culvert will be extended by approximately 10m downstream of the existing railway crossing to accommodate embankment widening works near Red Doles Road. These embankment widening works are required in relation to the engineering works to provide 4 tracks in this section of the railway corridor. The embankment widening works are confined to the works around the extension of the culvert outlet which, in addition, are located within FZ1 and are outside of FZ2 and FZ3 (see Figure 4-7).

**4.5.164.5.19** In the absence of any specific flood model data for Blackhouse Dike, this FRA has made an assessment on the likely extent of climate change outline using design flow extracted from the River Colne Model. The River Colne model has Blackhouse Dike represented as a direct inflow. The 1% AEP flow from Blackhouse Dike is 23.57m<sup>3</sup>/sec and the 1% AEP +CC flow is 35.35m<sup>3</sup>/sec, with the 0.1%AEP flow at 43.15m<sup>3</sup>/sec. In the absence of any modelled flood level data we can assume that the CC flood outline is in between the 1% and the 0.1% flood outline as shown below, indicating that the works associated with the headwall are within FZ1 and outside of the 1% AEP+CC.



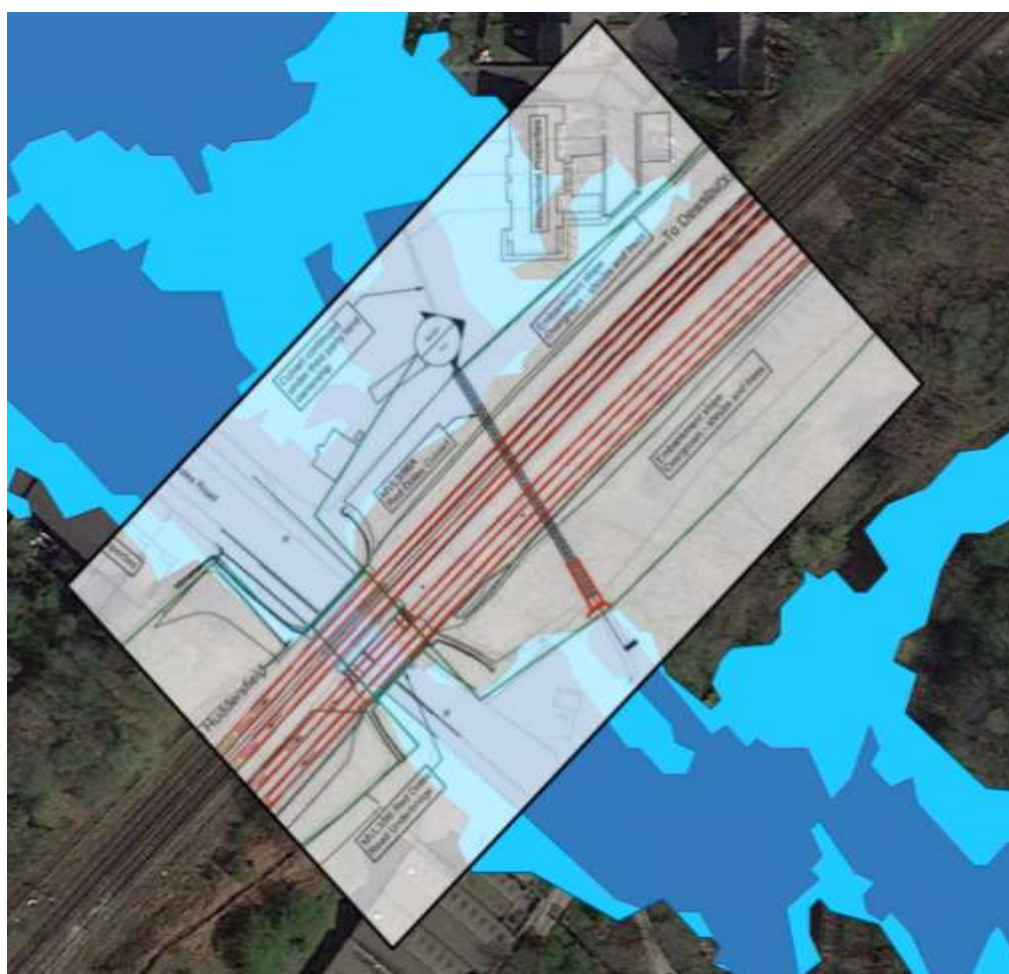


Figure 4-7 Red Doles culvert extension located in FZ1 (Dark Blue 1% AEP flood outline/Light Blue is the 0.1% AEP flood outline).

**4.5.174.5.20** Potential effects on biodiversity are covered within the ES Chapter 9 for Route Section 2 – and also in the submitted WFD Compliance Assessment Appendix 11-2 ( App 11-2 Water Framework Directive) which was approved in principal by the EA prior to submission of the Order.

**4.5.184.5.21** There are no proposed works at Field House Culvert (MVL3/98A) and therefore no construction impacts on the Unnamed Watercourse in this location have been identified at this stage.

**4.5.194.5.22** Red Doles Culvert (MVL3/96A) will be extended by approximately 10m, with a new headwall constructed. The cross-sectional area of the new part will be similar to the existing

**4.5.204.5.23** Red Doles Road Culvert (MVL3/94B) is also located within Route Section 2 but is not associated with watercourses. There are no proposed works to this culvert.

**4.5.214.5.24** Topaz Close Culvert (MVL3/96AA) is not associated with a watercourse. The culvert will be extended by approximately 11m to accommodate the widening of the embankment near Red Doles Road, with a new headwall constructed. The cross-sectional area of the new part will be similar to the existing. These embankment widening works are required in relation to the engineering works to provide 4 tracks in this section of the railway corridor. Potential effects on biodiversity are covered within the ES Chapter 9 for Route Section 2 – and also in

the submitted WFD Compliance Assessment Appendix 11-2 ( App 11-2 Water Framework Directive) which was approved in principal by the EA prior to submission of the Order.

~~4.5.224.5.25~~ Table 4-4 summarises the culverts to be replaced, rehabilitated or extended for Route Section 2.

### Drainage

~~4.5.234.5.26~~ Given the nature of the works there is unlikely to be any significant change along Route Section 2 contributing storm water runoff to the drainage, therefore it is assumed that there will be little change in the overall discharge rates or volumes during the operation phase of the Scheme.

~~4.5.244.5.27~~ Track drainage will be designed to the appropriate standard to maximise its operational life, including provisions for safe maintenance.

~~4.5.254.5.28~~ Culvert extensions will retain a similar gradient to the existing gradient. Design best practice will be adhered to for culvert extension/replacement works (e.g. box culverts with depressed invert levels preferred over pipe culverts).

~~4.5.264.5.29~~ Red Doles Culvert (MVL3/96A) (at Blackhouse Dike) is assumed to currently act as an outfall to railway track drainage and that it operates to the required standard, its function will be retained. The drainage provision discharging to this location will replicate the existing drainage provision, therefore there should be no significant change in flows and volumes.

~~4.5.274.5.30~~ Topaz Close Culvert (MVL3/96AA) not currently an outfall for railway track drainage and will not become an outfall. No permanent river alignments are expected (vertical or lateral) as part of this work.

~~4.5.284.5.31~~ At Fieldhouse Culvert (MVL3/98A) there is no existing drainage discharge and no new drainage discharge proposed.

### Mitigation summary

~~4.5.32~~ In addition to the generic mitigation measures set out in paragraphs 4.1.19 to 4.1.23, the mitigation measures to be adopted in Route Section 2 are presented in Table 4-4.

**Table 4-4 Summary of impacts and proposed mitigation measures for Route Section 2**

Description of works	Watercourse affected	Impact of works	Mitigation measures
New rail track on existing rail footprint. Red Doles Culvert (MVL3/96A) may be used as outfall for new track drainage. <u>Increase in length of approximately 10m due to widening of embankment and construction of new headwall.</u>	Blackhouse Dike	<u>Increase in length of approximately 10m due to widening of embankment.</u> Potential increase in runoff	<ul style="list-style-type: none"> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff</li> <li>The EDP (Land Contamination and Hydrogeology) under Part B of the CoCP will ensure that culvert flow capacity is maintained</li> </ul>
Hillhouse construction compound	Blackhouse Dike Flood Zone 2 Floodplain	Potential increase in runoff	<ul style="list-style-type: none"> <li>The PPICP under Part B of the CoCP will ensure that the compound signs up to the EA's Floodline;</li> <li>The Scheme-wide drainage strategy will be adhered to in order to manage temporary flood risk associated with potential increases in surface water runoff; and</li> <li>Part A of the CoCP will ensure that hazardous materials and sensitive equipment within the compound should be stored outside of flood zone.</li> </ul>
Culvert extension at Topaz Close Culvert (MVL3/96AA) associated with embankment widening. <u>Construction of new headwall</u>	Topaz Close Culvert	<u>Culvert is not currently an outfall for railway track drainage and will not become an outfall.</u> Potential increase in runoff	<ul style="list-style-type: none"> <li><del>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff; and</del></li> <li>The EDP (Land Contamination and Hydrogeology) under Part B of the CoCP will ensure that culvert flow capacity is maintained.</li> </ul>
New rail track on existing rail footprint. Location may be used as outfall for new track drainage.	Unnamed Watercourse at Field House Culvert	<u>Culvert is not currently an outfall for railway track drainage and will not become an outfall.</u> Potential increase in runoff	The Scheme-wide drainage strategy will be adhered to <del>in order to manage any increase in runoff.</del>
New rail track on existing rail footprint. Location may be used as outfall for new track drainage.	Huddersfield Broad Canal	Potential increase in runoff	

## Flood Risk Conclusion –Route Section 2

4.5.33 No additional river modelling has been undertaken within this route section as there are no proposed changes to the river or flood plain associated with the Scheme. Where Scheme extents do fall within the flood extent (Flood Zone 2), these are limited to compound areas at Hillhouse construction compound where no ground raising is proposed. Table 4.4 details the proposed flood mitigation measures and approach to managing surface water flood risk. Drawing- Climate Change Allowance plus Scheme description shows the location of the Scheme elements and the proximity of the flood zone including an allowance for climate change.

## 4.6 Route Section 3 – Deighton and Bradley

### Route Section 3 overview

- 4.6.1 The western end of Route Section 3 comprises the existing railway and adjacent undeveloped vegetated land and residential areas of Deighton, beyond which is the Huddersfield Broad Canal and the Leeds Road Sports Complex, before reaching Deighton Station. The Birkby Bradley Greenway (an adopted highway) forms part of the National Cycle Network (NCN) Route 69 and passes to the north of Deighton Station.
- 4.6.2 Land to the east is generally occupied by commercial/retail units and their associated yards and car parks as well as residential properties.

### Topography

- 4.6.3 The topography of the area is at approximately 74m AOD, at the western extremity of Route Section 3. Following the Scheme in a north-easterly direction, ground level decreases to approximately 56m AOD to the north-east of Deighton.

### Geology and hydrogeology

- 4.6.4 The bedrock geology for the Scheme is outlined in paragraph 4.1.5.
- 4.6.5 There are little mapped superficial deposits underlying Route Section 3. Superficial deposits of Alluvium associated with the River Colne are indicated to be in close proximity to the Scheme alignment.

### Works in Route Section 3

- 4.6.6 In summary, Route Section 3 includes the following works:
- Track works (horizontal and vertical alignment alterations);
  - Localised earthworks including retaining walls;
  - Provision of OLE and signal infrastructure;
  - Structural works for bridges – including bridge reconstruction, deck replacements and infill works of underbridges;
  - Construction compounds;
  - Drainage and culvert works (replacement/remediation/new);
  - Provision of DNO equipment;
  - Utility diversions; and
  - Deighton Station remodelling.

## 4.7 Existing flood risk in Route Section 3

- 4.7.1 Table 4-5 summarises the key flood risks in Route Section 3.

**Table 4-5 Flood risk summary for Route Section 3**

Feature	Jurisdiction	Description
Unnamed Watercourse at Bradley Culvert	LLFA	Ordinary Watercourse flows north to south beneath track alignment in culvert, runs in open channel through residential area to the north
Huddersfield Broad Canal	LLFA	Located south of the track alignment receiving flow from watercourses to the north

Feature	Jurisdiction	Description
MVL3/101A Deighton Culvert	LLFA	Culvert beneath track alignment running north to south, realignment proposed.
Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	EA	Secondary A Aquifer

4.7.2 Figures 4-[8](#) and 4-[9](#) show the EA Flood Zone maps and the surface water flood risk areas in Route Section 3.



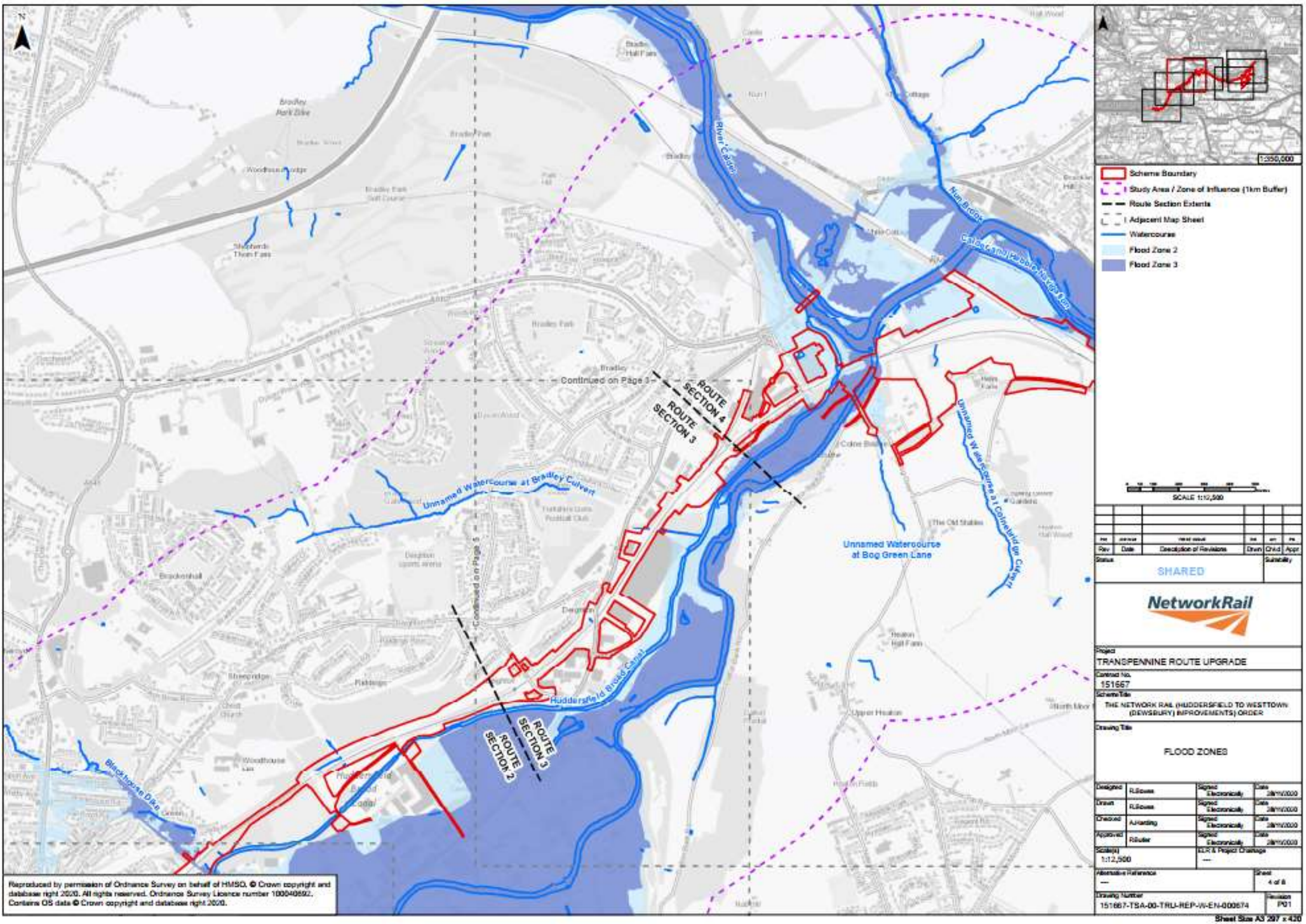


Figure 4-8 EA Flood Zones in Route Section 3



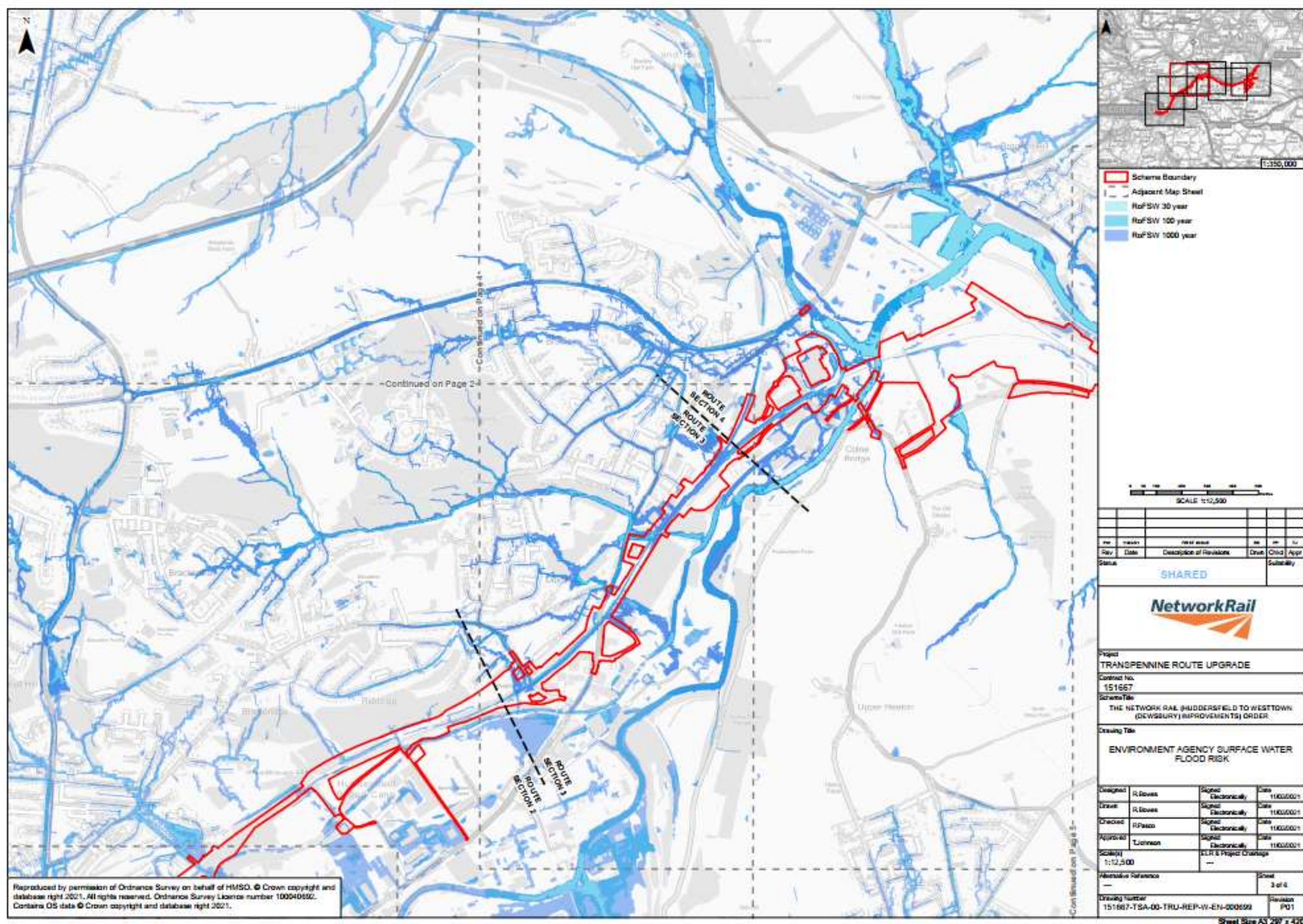


Figure 4-9 Risk of Flooding from Surface Water map for Route Section 3



### History of flooding

- 4.7.3 The HFM indicates there is no record of flooding from fluvial sources within Route Section 3.

### Flooding from rivers

- 4.7.4 A review of the EA's Flood Map for Planning indicates that the majority of Route Section 3 is located in the low risk fluvial Flood Zone 1.

- 4.7.5 There is no interaction with scheme elements and flood zone 3b or 3ai in Route Section 3 including an allowance for climate change (See Appendix B for Flood Risk Maps including Climate Change).

### Main Rivers

- 4.7.54.7.6 There are no watercourses designated as Main River within Route Section 3, however, the proximity of the flood zones associated with the River Colne are within close proximity to the Scheme.

### Ordinary Watercourses

- 4.7.64.7.7 The RoFSW mapping shows areas along both sides of the Scheme, including the tracks, at risk of flooding from surface water. This risk is mainly associated with the Ordinary Watercourses that are in the locality or that pass beneath the Scheme.

- 4.7.74.7.8 The Scheme crosses the Unnamed Watercourse at Bradley Culvert. The watercourse flows southerly through a woodland area crossing the A62 before entering a structure under the railway alignment, flowing toward the Huddersfield Broad Canal. Overland flow routes are evident with both upstream and downstream of the crossing susceptible to surface water flooding from the 3.3% annual chance event upwards. At this location the track is shown to be at risk according to the RoFSW mapping, whilst a flow route is identified through Bradley Junction Industrial Estate which passes flow toward the railway alignment.

### Flooding from groundwater

- 4.7.84.7.9 The majority of Route Section 3 is deemed as having low risk from groundwater flooding. Risk within Route Section 3 is equal to or less than a 25% risk of groundwater emergence.

### Flooding from surface water

- 4.7.94.7.10 A review of the EA's RoFSW mapping indicated overland flow routes within or near Route Section 3.

- 4.7.104.7.11 Moving from west to east along the Scheme, the EA's RoFSW mapping indicates the presence of surface water flood risk in the following areas of Route Section 3:

- At Whitacre Street, overland flow routes are shown within the Scheme boundary at the 3.3% annual chance event. The track alignment is susceptible to flood depths of up to 0.9m at the 0.1% annual chance event. At this location the track is in cutting and is shown to convey flow along the track before spilling into Trident Business Park. The track is shown to be susceptible to surface water flooding along the entire alignment in Route Section 3;
- Overland flow routes are shown to flood within the Scheme boundary and at the 0.1% annual chance event flood the track. In the vicinity of Unnamed Watercourse at Bradley Culvert the RoFSW mapping indicates the presence of existing track drainage ditches; and

- An area north of the Scheme at Bradley Culvert (MVL3/102A) is shown to be at risk from the 3.3% annual chance event upwards. Flood depths at the 1% annual chance event are predicted to be up to 0.3m against the Scheme boundary. Flood flow paths appear to be associated with a mixture of watercourse and overland sources at this location.

### Flooding from other sources

**4.7.114.7.12** The Main River within Route Section 3 is the River Colne. For the majority of the watercourse there are no formal flood defences, in excess of bank heights. However, in the vicinity of Dalton Bank Road there is a flood wall which does not provide a sufficient level of protection to create an ABD.

**4.7.124.7.13** The risk of flooding along Huddersfield Broad Canal is dependent on a number of factors. As they are man-made systems and heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with asset failure, similar to those associated with river defences, such as overtopping of canal banks.

**4.7.134.7.14** The EA's RoFR map indicates that no part of Route Section 3 is within an area at risk of flooding from reservoirs.

## **4.8 Flood risk for Route Section 3**

**4.8.1** The baseline flood risk for Route Section 3 is described in preceding sections.

**4.8.2** The design approach and principles adopted in relation to mitigating flood risk for both permanent and temporary works are described in Section 2. The Scheme elements which could potentially increase flood risk for Route Section 3 are outlined as follows, along with proposed mitigation works.

**4.8.3** All works in Route Section 3 fall outside the 1% Plus Climate Change Allowance (50%) – see drawing Climate Change Allowance plus Scheme description.

### Station works

**4.8.24.8.4** Upgrades to Deighton Station will include the proposed station forecourt at the south of the station, which is to be constructed on engineered fill. Soil nailing is proposed, both sides of Whitacre Street, and will be undertaken by an extractor with a drill attachment facing the wall. Excavation will be progressed in stages, with nailing following down the wall. Earthworks (1-in-2 slope angle) are proposed at the forecourt (south). A retaining wall with earth back filled to temporary cutting is proposed at the revised platforms.

**4.8.34.8.5** Land immediately north of Deighton Station is to be modified (1-in-2 slope angle) including the realignment of the) NCN Route 69. Due to the prevalence of surface water flow toward the station, there are proposals for the provision of a 5m wide zone dedicated to a cut off ditch to minimise the risk of flood flows from adjacent properties flowing down the embankments.

**4.8.44.8.6** All works are within Flood Zone 1.

### Retaining walls

**4.8.54.8.7** A replacement retaining structure is proposed at A62 Leeds Road Overbridge (MVL3/102). This is required at the base of the cutting replacing existing rock with wall at the toe of cutting slope.

**4.8.64.8.8** An existing soil cutting is to be replaced with an embedded wall at the base of the cutting on land between A62 Leeds Road Overbridge (MVL3/102) and Wheatley's Overbridge (MVL3/103). Works are required to avoid overloading and to minimise the impact to the adjacent third-party property.

**4.8.74.8.9** A replacement retaining structure is proposed at Bradley Junction Industrial Units. A soil/rock cutting is anticipated to be replaced by a gravity wall at the base of the slope. Retaining wall works are not within an area at risk of flooding. Where widening the track is the purpose of works this has the potential to increase the runoff as a result of additional hardstanding.

### Earthworks

**4.8.84.8.10** Earthworks are not within an area at risk of flooding, however, widening the footprint has the potential to increase the runoff as a result of additional hardstanding.

### Structures

**4.8.94.8.11** New overbridges are to be constructed to replace existing overbridges in Route Section 3:

- Whitacre Street Overbridge (MVL3/101);
- A62 Leeds Road Overbridge (MVL3/102); and
- Wheatley's Overbridge (MVL3/103).

**4.8.104.8.12** Works at Whitacre Street Overbridge (MVL3/101) and Wheatley's Overbridge (MVL3/103) include sub-surface construction practices. Given the geological description in the locality groundwater flood risk emergence is likely at the surface from the superificials and the above ground flood water would likely impact receptors similar to fluvial flood risk. It is assumed that these activities will be undertaken in line with best practice guidance set out in the CoCP, with risk assessments and hydrogeological risk assessments undertaken if appropriate. Minor works are required at Bradley's No. 2 (BBW/1) Overbridge (MVL3/105) including parapet raising (to 1.8m).

**4.8.114.8.13** The detailed Scheme-wide drainage strategy can be found in Appendix A of this FRA.

### Compounds

**4.8.124.8.14** Temporary construction activities may also increase flood risk within Route Section 3 associated with new hardstanding areas; construction compounds are expected to be in situ for up to two years. These have been located outside of floodplain areas where possible.

**4.8.134.8.15** There are three proposed compounds in Route Section 3:

- Deighton Station and Whitacre Street;
- A62 Leeds Road; and
- Bradley Junction Road.

**4.8.144.8.16** Deighton Station compound will be used as part of the proposed relocation of platforms, footbridge construction, forecourt construction and other works at Deighton Station, in addition to the demolition and reconstruction of Whitacre Street Overbridge (MVL3/101). The compound is adjacent to the Huddersfield Broad Canal.

**4.8.154.8.17** The remaining two compounds are not adjacent to any watercourses but are in proximity (around 200m) to the Huddersfield Broad Canal.

4.8.18 The potential increase in runoff as a result of increase in hardstanding areas will be managed as part of a series of mitigation measures set out in the CoCP.



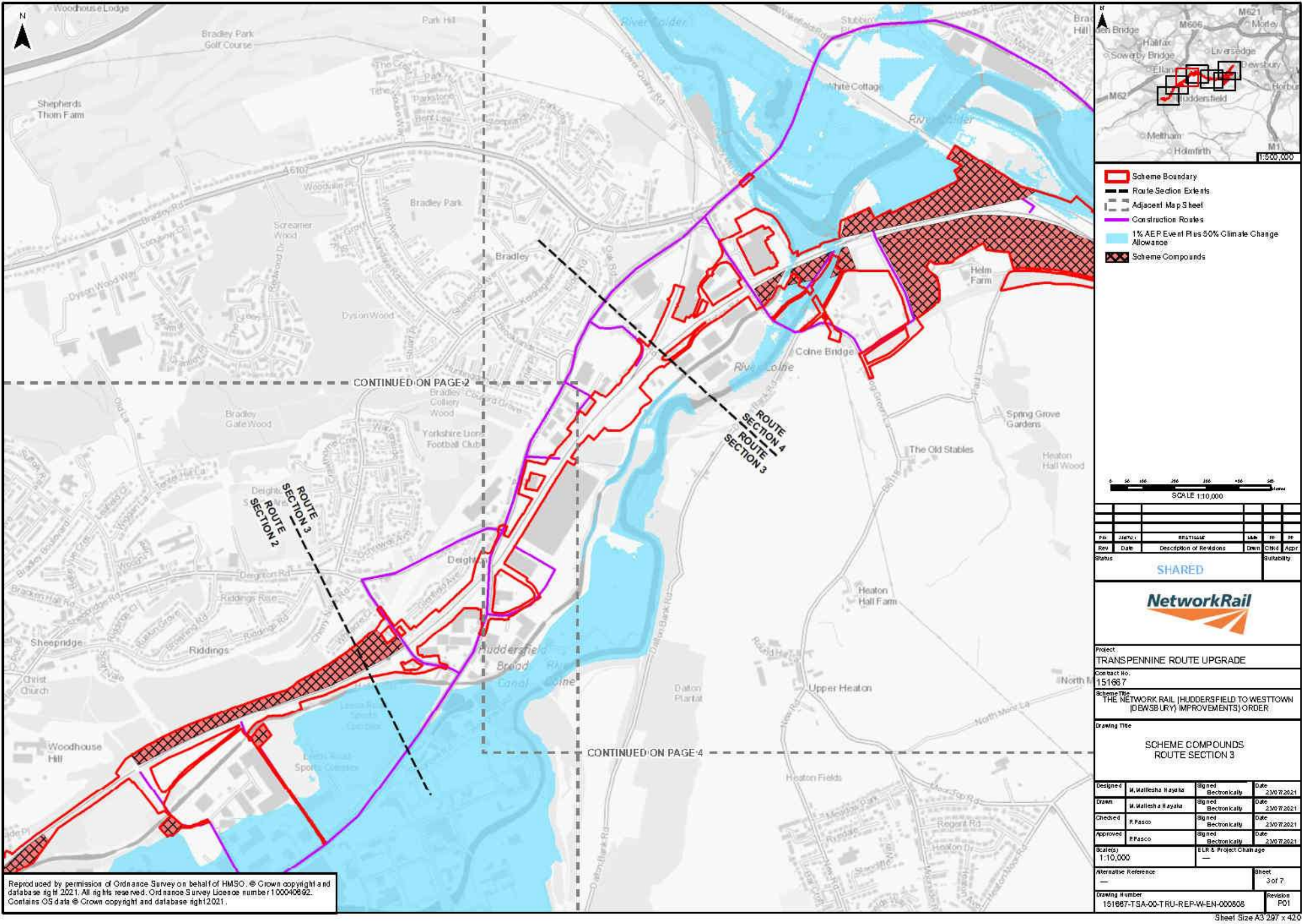


Figure 4-10 Route Section 3 compound locations in relation to flood zones

## Culverts

**4.8.164.8.19** New drainage is required along Route Section 3. Drainage is to be discharged to existing outfalls where possible.

**4.8.174.8.20** The following culverts located in Route Section 3 are likely to be required as outfalls for railway track drainage:

- Deighton Culvert (MVL3/101A); and
- Bradley Culvert (MVL3/102A).

**4.8.184.8.21** Bradley Culvert (MVL3/102A) is associated with the Unnamed Watercourse at Bradley Culvert and Deighton Culvert (MVL3/101A) is a drainage culvert with no associated watercourse.

**4.8.194.8.22** Construction activity is expected at Deighton Culvert (MVL3/101A) as the culvert is currently partially collapsed and is proposed to be removed as part of wider works to A62 Leeds Road Overbridge (MVL3/102). There is no proposal to replicate the culvert at this location.

**4.8.204.8.23** Works are proposed to extend the existing Bradley Culvert (MVL3/102A) by approximately 5m with a new headwall constructed. The cross-sectional area of the new part will be similar to the existing and is likely to have a cross section of 1200mm diameter. Approximately 2m of the existing culvert will be removed to form a structural tie-in.

**4.8.214.8.24** Existing connection pipes will be used where possible, with new pipe connections into the culvert if required. If existing connection pipes cannot be reused, a potential new watercourse outfall through headwalls or directly into the watercourse may be required to minimise the impact on the culvert.

**4.8.224.8.25** The Scheme-wide drainage strategy in Appendix A sets out the approach for culverts based on an assessment of depth of cover, the impact of proposed earthworks solutions, and condition. Table 4-6 summarises the culverts to be replaced, rehabilitated or extended for Route Section 3.

## Drainage

**4.8.234.8.26** In general, track drainage provision will replicate the existing provision. Existing connection pipes will be used where possible. Standard drainage systems will be provided along the cess. These will outfall either into the culvert, with suitable chambers provided for maintenance, or into the adjacent headwalls and watercourses.

**4.8.244.8.27** Drainage will be required where surface water may be a problem, such as along cutting slopes. There is unlikely to be any significant change in area contributing storm water runoff to the drainage, therefore it is assumed there will be little change in the overall discharge rates or volumes.

**4.8.254.8.28** Proposed works at Deighton Station will result in a substantial increase in impermeable area alongside the track (new platform and access ways).

**4.8.264.8.29** No specific storm water drainage exists at this location within the railway area. Existing drainage provides only limited storm water management and relies on a storm water connection to local storm water drain or sewer.

**4.8.274.8.30** The new storm water drainage system required for the re-modelled platforms area will



discharge to the south and will be combined with the storm water runoff from the station drop-off area. Attenuation will be provided within the platforms prior to discharge to a new connection in the re-aligned Yorkshire Water sewer which will pass under the station. This would require a new storm water discharge consent with Yorkshire Water.

### Mitigation summary

**4.8.284.8.31** In addition to the generic mitigation measures set out in paragraphs 4.1.19 to 4.1.23, the mitigation measures to be adopted in Route Section 3 are presented in Table 4-6.

**Table 4-6 Summary of impacts and proposed mitigation measures for Route Section 3**

Description of works	Watercourse affected	Impacts of works	Mitigation measures
New rail track on existing rail footprint. Location may be used as outfall for new track drainage at Bradley Culvert (MVL3/102A) which is to be extended.	Unnamed Watercourse at Bradley Culvert	Potential increase in runoff	The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff. <u>Any new drainage will be attenuated to ensure the overall flow rates into the canal are not increased</u>
Deighton Station works	Surface water flow paths	Potential increase in runoff	
Sub-surface engineering works	Groundwater	Localised change in surface water flooding	Works will be undertaken in line with best practice guidance, with piling risk assessments and hydrogeological risk assessments undertaken if appropriate. Details of these assessments will be included in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP.
New rail track on existing rail footprint, location may be used as outfall for new track drainage	Huddersfield Broad Canal	Potential increase in runoff	The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.

### Flood Risk Conclusion –Route Section 3

**4.8.32** No additional river modelling has been undertaken within this route section as there are no proposed changes to the river or flood plain associated with the Scheme. There are no Scheme elements located within the Flood Zones 2, 3 including and allowance for climate change. Table 4.6 details the proposed flood mitigation measures and approach to managing surface water flood risk. Drawing Climate Change Allowance plus Scheme description shows the location of the Scheme elements and the proximity of the flood zone including an allowance for climate change.

## 4.9 Route Section 4 – Colne Bridge and Battysford

### Route Section 4 overview

- 4.9.1 Route Section 4 runs from land to the west of the B6118 Bridge Road Overbridge (MVL3/107) to Woodend Road Overbridge (MVN2/191) (west of Mirfield).
- 4.9.2 Surrounding land uses vary; however, the western extent of the Scheme is predominantly industrial in nature. As the Scheme progresses east the land becomes predominantly rural. Land uses surrounding Route Section 4 include:
- Sewage treatment infrastructure, green space, commercial and residential premises are located adjacent to the boundary, with the Calder ~~and~~ & Hebble Navigation and River Calder further to the east. Beyond these are commercial, residential and agricultural properties;
  - West: Commercial services and properties, beyond which are residential properties;
  - South: Immediately south is agricultural land, farm and other properties, with a shooting centre and more agricultural land towards Upper Hopton; and
  - East: commercial premises and the village of Mirfield.
- 4.9.3 The closest surface water feature is the River Calder which flows in close proximity to the Scheme in Route Section 4. The River Calder was given an overall classification of 'moderate', ecological status of 'moderate' and a chemical status of 'fail' in 2016<sup>14</sup> and flows east discharging into the River Aire approximately 25km to the east. Adjacent to Route Section 4 in the west is the River Colne, a tributary to the River Calder. The River Colne was given overall classification of 'moderate', ecological status of 'moderate' and a chemical status of 'good' in 2016.

### Topography

- 4.9.4 The Scheme is at approximately 55m AOD, at the western extremity of Route Section 4. Following the Scheme in a north-easterly direction, ground level decreases to approximately 51m AOD to the west of Lower Hopton.

### Geology and hydrogeology

- 4.9.5 The bedrock geology for the Scheme is outlined in paragraph 4.1.5.
- 4.9.6 There are little mapped superficial deposits underlying Route Section 4. Superficial deposits of Alluvium associated with the River Colne are indicated to be in close proximity to the Scheme alignment.
- 4.9.7 The MAGIC website<sup>15</sup> indicates the Alluvium deposits across the area are classed as a Secondary A Aquifer which is described as "permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers." The Head deposits to the south west are classified as a Secondary Undifferentiated Aquifer, this classification "has been assigned in cases where it has not been possible to attribute either category A or B to a rock type".
- 4.9.8 The Pennine Lower Coal Measures underlying the site are classified as a Secondary A Aquifer which is described as "permeable strata capable of supporting water supplies at a

<sup>14</sup> <http://environment.data.gov.uk/catchment-planning/>

<sup>15</sup> <https://magic.defra.gov.uk/MagicMap.aspx>

local rather than strategic scale and in some cases forming an important source of base flow to rivers.” The BGS hydrogeology 1:625,000 scale map describes the underlying rock aquifer as a moderately productive aquifer comprising “Regional, cyclic multi-layered aquifer with moderate yields from sandstones and many springs. Mine water quality poor but elsewhere reasonable”. The Groundwater Vulnerability Map indicates the underlying aquifer is classified as a high vulnerability minor aquifer but is on the boundary of a low vulnerability major aquifer.

### Works in Route Section 4

4.9.9 In summary, Route Section 4 includes the following works:

- A new section of railway (Heaton Lodge Curve);
- Structural works to bridges and earthworks for retaining walls;
- Construction compounds; and
- Utility diversions.

### Existing flood risk in Route Section 4

4.9.10 Table 4-7 summarises the key flood risks in Route Section 4.

**Table 4-7 Flood risk summary for Route Section 4**

Receptor	Jurisdiction	Description
River Colne	EA	Main River flows under Colne Viaduct Underbridge (MVL3/109) through industrial and agricultural land.
Huddersfield Broad Canal	Canal & River Trust	Crossed by the track alignment at Huddersfield Broad Canal Underbridge (MVL3/108 and MVL3/108S).
Bradley Culvert (MVL3/106A)	LLFA	Culvert beneath track alignment, 8m of culvert replacement proposed including new headwall.
Unnamed watercourse at Colne Bridge Culvert	LLFA	Ordinary Watercourse flows south to north beneath track alignment in culvert, runs through agricultural area to the south. Track widening at this location requiring culvert extension.
Cooper Bridge Culvert (MVL4/1A)	LLFA	No works are proposed at this culvert.
Colne Bridge Road Outfall (MVL3/TBC)	LLFA	No works are proposed at this culvert.
Heaton Lodge Culvert (MVL4/4A)	LLFA	A new culvert is required on the watercourse upstream of this under the MVN lines.
Unnamed Watercourse at Heaton Lodge Junction	LLFA	Ordinary Watercourse flows south to north beneath track alignment in culvert, runs through agricultural area to the south.
River Calder	EA	Main River to the north of the track alignment flowing through commercial and industrial land use.
Calder and Hebble Navigation	Canal & River Trust	Located north of the track alignment receiving flow from watercourses to the south.
Mirfield No.1 Culvert (MVN2/190B)	LLFA	Culvert beneath track alignment.
Mirfield No.2 Culvert (MVN2/190C)	LLFA	Culvert beneath track alignment. Extension of Mirfield No.2 Culvert (MVN2/190C).

4.9.11 Figures 4-1<sup>1</sup> to 4-1<sup>3</sup> show the EA Flood Zones, surface water flood risk and historic flood map for Route Section 4.



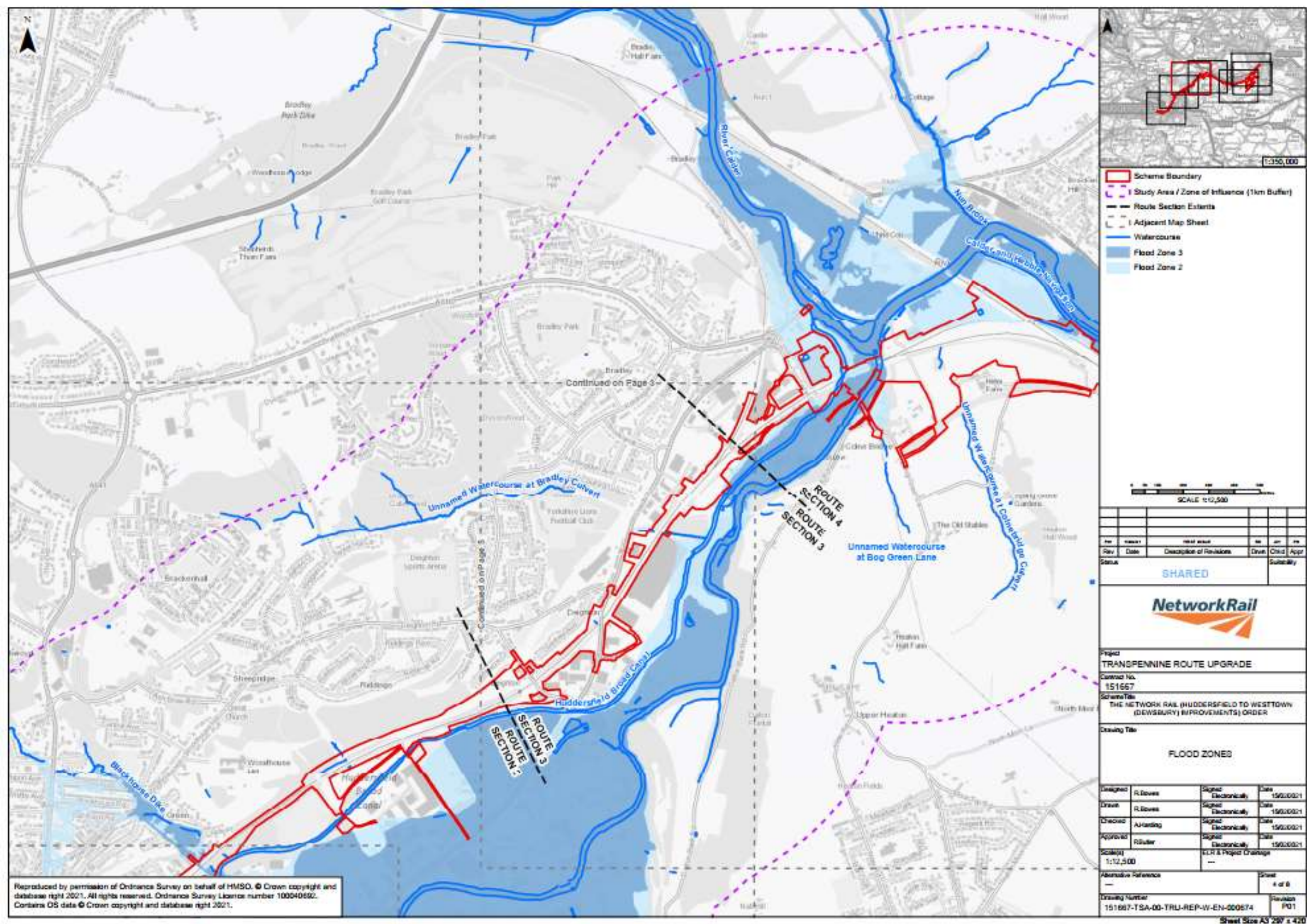


Figure 4-11 EA Flood Zones for Route Section 4



**Figure 4-12 Risk of Flooding from Surface Water Map for Route Section 4**



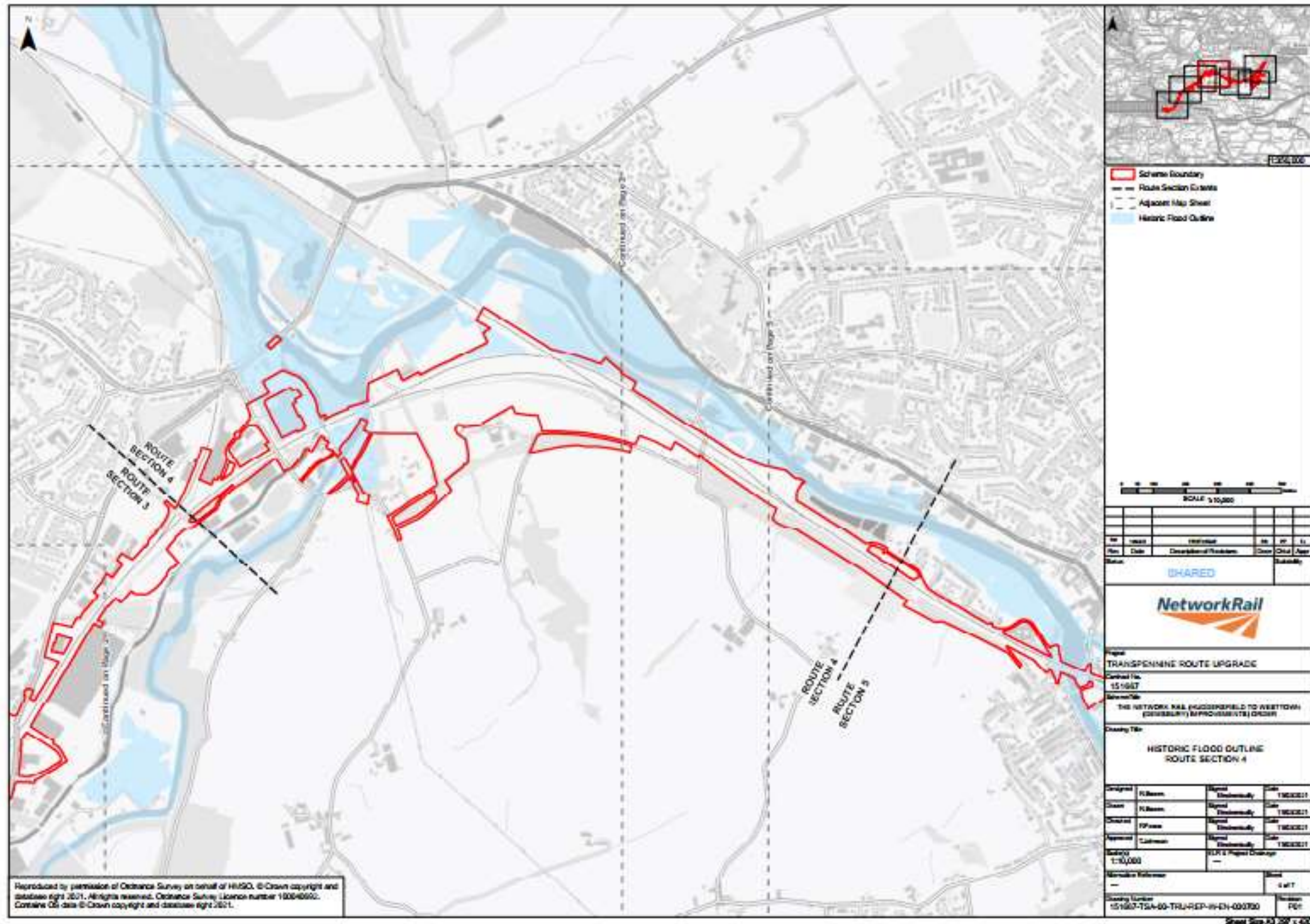


Figure 4-13 Historic Flood Map for Route Section 4

### History of flooding

- 4.9.12 The HFM shows areas of past fluvial flooding. These outlines can be viewed on Figure 4-9 in relation to the Scheme boundary associated with Route Section 4. There are several flood outlines sourced from the confluence of the River Colne and River Calder where flooding has occurred. The date of maximum flooding in this area is associated with the December 2015 events. Further information in the SFRA details the occurrence of significant flooding in February 2002 between Brighouse and Dewsbury.
- 4.9.13 The Kirklees PFRA states that due to limited funding and a lack of foresight in appreciating the value of recording and assessing historic flood incidents has resulted in the Council possessing very limited and incomplete records of past flood events.

### Flooding from rivers

- 4.9.14 A review of the EA's Flood Map for Planning indicates that the majority of the Route Section 4 is located in the low risk fluvial Flood Zone 1, however areas of Flood Zone 2 and 3 are crossed by the railway alignment but no works are proposed in the flood zone. Where the Scheme crosses flood zone 2 and 3, this is confined to bridge deck repairs and new track alignment on existing footprint.-
- 4.9.144.9.15 There is no interaction with scheme elements and flood zone 3b or 3ai in Route Section 4 including an allowance for climate change (See Appendix B for Flood Risk Maps including Climate Change).

### Main Rivers

- 4.9.154.9.16 The Scheme crosses the River Colne, which is designated as a Main River. It flows in an easterly direction through Route Section 4 to its confluence with the River Calder. The Scheme crosses the River Colne by way of the Colne Viaduct Underbridge (MVL3/109).
- 4.9.164.9.17 The Scheme crosses the Huddersfield Broad Canal near to the confluence of the River Colne and Calder. Risk arising from the canal is limited; it is notable that at this location the railway alignment is elevated high above the flooding mechanism.

### Ordinary Watercourses

- 4.9.174.9.18 The RoFSW mapping indicates isolated areas along both sides of the Scheme, including the tracks, at risk of flooding from surface water. This risk is mainly associated with the Ordinary Watercourses that pass beneath the Scheme.
- 4.9.184.9.19 The Unnamed Watercourse at Helm Farm is crossed by the railway alignment and flows northerly to join the River Calder approximately 200m north of the Scheme. The RoFSW mapping shows there is a risk of flooding up against the embankment however this is limited to the 0.1% annual chance event. Assets within the floodplain are Network Rail land and agricultural land.
- 4.9.194.9.20 Approximately 300m south-east of Battysford, the Scheme crosses the Unnamed Watercourse at Heaton Lodge Junction. The RoFSW mapping shows flooding of the track at the 3.3% annual chance event upwards; flood depths at the 1% annual chance event are shown as up to 0.9m on the track.

### Flooding from groundwater

- 4.9.204.9.21 The majority of Route Section 4 is deemed as having low to medium risk from groundwater flooding. Risk within Route Section 4 is between 25% and up to 75% risk of groundwater emergence.



### Flooding from surface water

**4.9.214.9.22** The EA's RoFSW mapping indicates the presence of surface water flood risk in the following areas of Route Section 4, moving from west to east along the Scheme:

- A flow route is shown to flood the track at the 3.3% annual chance event in the vicinity of B6118 Colne Bridge Road. The surface water appears to be associated with overland flows with no watercourses or ditches on the northern side of the track. Flood depths at the 1% are mostly below 0.3m and flow toward the Huddersfield Broad Canal; and
- At Woodend Road an area of the southern side of the railway, and local cycleway is shown to be at risk from the 3.3% annual chance upwards. Flood depths at the 1% annual chance event are predicted to be up to 0.9m along the track and over 0.9m on the adjacent cycleway. The surface water flooding in this location appears to be associated with the Unnamed Watercourse at Heaton Lodge Junction.

### Flooding from other sources

**4.9.224.9.23** The Main Rivers within Route Section 4 are the River Colne and River Calder. For the majority of the watercourses there are no formal flood defences, in excess of bank heights. However, in the vicinity of Cooper Bridge Road there is a flood wall and embankment creating an ABD.

**4.9.234.9.24** The risk of flooding along Huddersfield Broad Canal is dependent on a number of factors. As canals are man-made systems and heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with asset failure, similar to those associated with river defences, such as overtopping of canal banks.

**4.9.244.9.25** The EA's Risk of Flooding from Reservoirs map indicates that the Scheme will be at risk of reservoir failure and this is linked to the River Colne and the River Calder in Route Section 4.

## **4.10 Flood risk for Route Section 4**

**4.10.1** The baseline flood risk for Route Section 4 is described in preceding sections.

**4.10.2** The design approach and principles adopted in relation to mitigating flood risk for both permanent and temporary works are described in Section 2 of this FRA. The Scheme elements which could potentially increase flood risk for Route Section 4 are outlined in the following section along with proposed mitigation works.

**4.10.3** All works in Route Section 4 fall outside the 1% Plus Climate Change Allowance (50%) – see drawing Climate Change Allowance plus Scheme description. Where the Scheme crosses flood zone 2 and 3, this is confined to bridge deck repairs and new track alignment on existing footprint.

### Permanent way

**4.10.24.10.4** A section of new railway is proposed at Heaton Lodge to facilitate provision of the fast lines. The slow lines will be located within the existing operational railway boundary whereas the new fast lines will be constructed to the south of the existing track passing through a new 12m deep cutting.

**4.10.34.10.5** There is no fluvial flood risk to the proposed new railway alignment at Heaton Lodge. Without mitigation there could be a risk that an overland surface water flood flow route is



interrupted. This includes localised groundwater flooding as a result of significant ground engineering works and pilling activity.

**4.10.44.10.6** There may be localised impacts on surface water flow routes which could potentially increase flood risk. Scheme elements in Route Section 4 which could result in an increased risk are outlined below along with associated mitigation works.

### Structures

**4.10.54.10.7** There are six bridges with proposed works which may affect the water environment within Route Section 4:

- B6118 Bridge Road Overbridge (MVL3/107);
- Huddersfield Broad Canal Underbridge (MVL3/108S);
- Colne Viaduct Underbridge (MVL3/109);
- Parks Overbridge (MVL3/110 and MVL4/1);
- Heaton Lane Footbridge (MVL4/4); and
- Helm Lane Underbridge (MVN2/188).

**4.10.64.10.8** A new bridge with reinforced concrete abutments will be constructed fully offline to the east of the existing B6118 Bridge Road Overbridge (MVL3/107). The existing abutments will be left in place as part of the permanent works and the approach roads will be reinforced with earth retaining walls. The depth below ground of these proposed works is currently unknown. Design details are shown in NR13 Planning Drawing - Colne Bridge Road Overbridge - Existing and Proposed Elevations.pdf (windows.net).

**4.10.9** Reconstruction of the deck superstructure only is required ~~on the existing substructure~~ at Huddersfield Broad Canal Underbridge (MVL3/108S). A temporary compound will be sited at this location to allow construction access. ~~A Yorkshire Water sewer main will also be diverted in advance of these works.~~ This bridge is located over the Huddersfield Broad Canal. The bridge soffit level is at 52.3m AOD and the 1%AEP+CC flood level of 50.07m AOD. The existing Yorkshire Water sludge main requires diversion due to works to construct the new bridge deck. A separate pipe crossing will be provided to carry the Yorkshire Water pipe and to provide a safe walking route for railway maintenance personnel..The depth below ground of the proposed works is currently unknown. Design details are shown in NR13 Planning Drawing - Huddersfield Broad Canal MVL3-108S Elevation and Cross Section.pdf (windows.net).

**4.10.10** Strengthening works and deck refurbishment works are proposed at Colne Viaduct Underbridge (MVL3/109) located over the River Colne. New fast lines will be constructed to the south side of the existing railway corridor and use the existing redundant spans to cross the river. Diversion of the existing Yorkshire Water sewer main (also referenced in paragraph 4.10.8 is required. The two existing structures (masonry and steel) will need to be modified to include cantilever structures for walkway and for the line of the diverted sewer main, to the south of the railway. The works require a Yorkshire Water sewer main to be diverted. Site access is proposed from the south. ~~The depth below ground of the proposed works is currently unknown.~~ Design details are shown in NR13 Planning Drawing - Colne Viaduct MVL3-109 Elevation and Cross Section.pdf (windows.net). The bridge soffit level is at 52.3m AOD and the 1%AEP+CC level is at 50.04m AOD.

**4.10.74.10.11** Figure 4-14 Copper Intersection Bridge (MVN2/187) below shows the 1% AEP+CC flood outline against the proposed works at this structure. The main works are a reworking of the face of this new structure. There will be a reworking of the retaining walls but as can be seen on the image below, the retaining wall will be on exiting footprint, retaining higher ground behind and as such, there will be no change in flood flows or displacement of flood volume,

even at 1% AEP+CC. There will also be new stepped access to the railway sidings, but this will be along the profile of the existing banks sides and as such, there will be no change in flood flows or displacement of flood volume even at the 1% AEP+CC flood. There will also be reworking of the roof of the structure but this is to be set at approximately 54.5m AOD with a flood level of 49.6m AOD for the 1% AEP+CC.

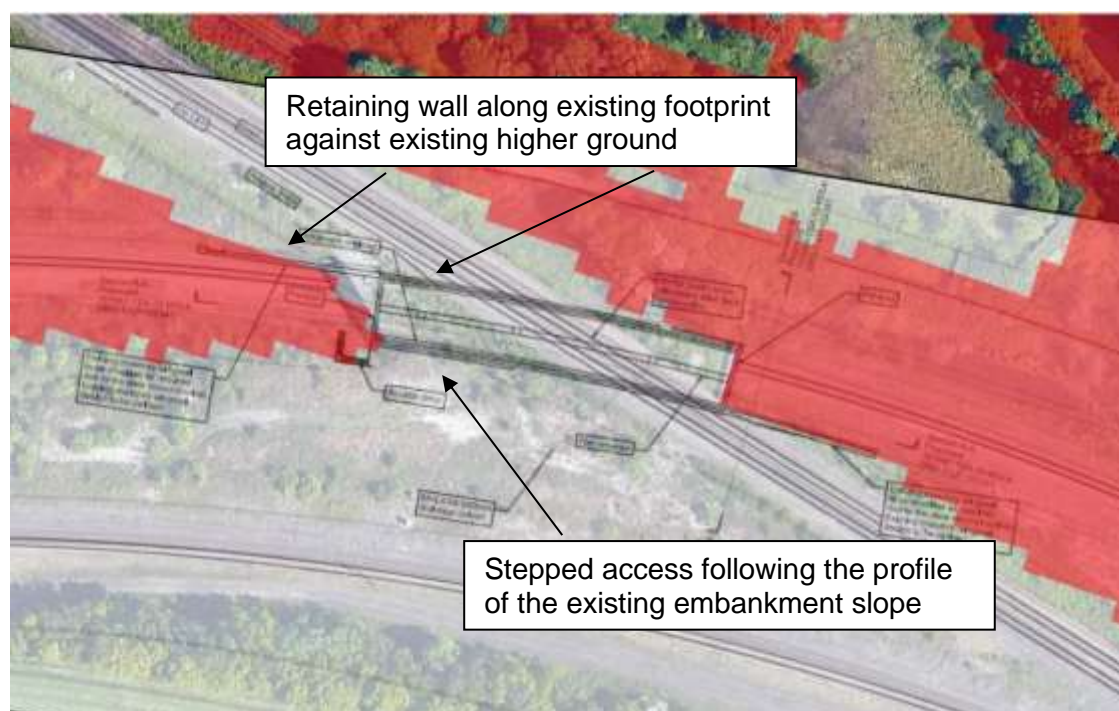


Figure 4-14 Cooper Intersection Bridge MV2/187 with 1% AEP+CC

**4.10.84.10.12** A new two to three span replacement bridge will be constructed directly to the east of the existing Parks Overbridge (MVL3/110 and MVL4/1), which will subsequently be demolished. The depth below ground of the proposed works is currently unknown. Design details are shown in NR13 Planning Drawing - Parks (MVL3-110 and MVL4-1) - Elevations and Cross Sections.pdf (windows.net).

**4.10.13** Construction of a new footbridge is proposed at the location of the existing Heaton Lane Footbridge (MVL4/4), which will be demolished. A half through deck type structure on steel columns is proposed with a span length of approximately 12m and a parapet height of 1.8m. The depth below ground of the proposed works is currently unknown. These works should be considered in partnership with the proposed works at Helm Lane Underbridge (MVN2/188). Design details are shown in drawing NR13 Planning Drawing - Heaton Lodge (MVL4-4) Elevations and Cross Sections 1 of 2.pdf (windows.net) and NR13 Planning Drawing - Heaton Lodge (MVL4-4) Elevations and Cross Sections 2 of 2.pdf (windows.net).

**4.10.14** Offline construction of a new subway is proposed 100m east of the existing underpass at Helm Lane Underbridge (MVN2/188). The subway will comprise concrete box culverts of approximately 50m in length. Works will require earthworks and installation of retaining walls. The existing underpass will be infilled. The depth below ground of the proposed works is currently unknown. These works should be considered in partnership with the proposed works at Heaton Lane Footbridge (MVN4/4). Design details are shown in drawing NR13 Planning Drawing - Helm Lane (MVN2-188) - Elevations and Cross Sections.pdf (windows.net).

**4.10.94.10.15** Scheme details are provided in the Scheme description (Chapter 2 of the ES (Vol 2i))

~~and the The Scheme-wide drainage strategy has a full description of the work undertaken and is strategy. i~~included ~~in as~~ Appendix A of this FRA.

## Compounds

~~4.10.104.10.16~~ Temporary construction activities may also increase flood risk within Route Section 4, construction compounds are expected to be in situ for up to three years. In general, these have been located outside of floodplain areas. Where compounds are located within a flood zone, a series of mitigation measures are detailed within Part A of the CoCP.

~~4.10.114.10.17~~ There are five planned construction compounds within Route Section 4:

- Bradley Junction;
- Colne Bridge Road;
- Heaton Lodge Water Treatment Works (WTW);
- Paul Lane; and
- Woodend Road.

~~4.10.124.10.18~~ For all compounds, the potential increase in runoff as a result of increase in hardstanding areas will be managed as part of a series of mitigation measures set out in Part A of the CoCP.



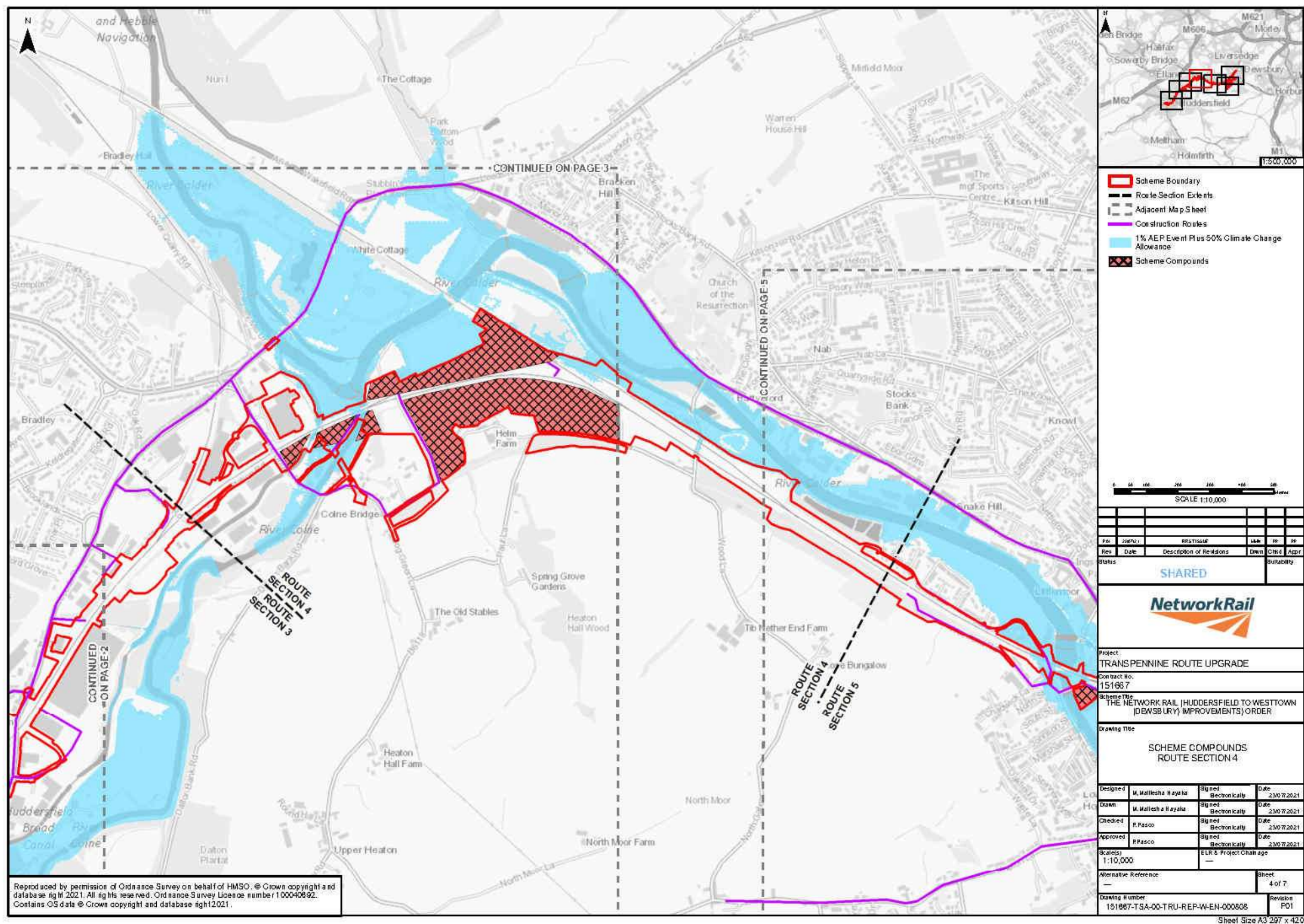


Figure 4-15 Route Section 4 compound locations in relation to flood zones



## Culverts

**4.10.134.10.19** A number of culverts are located within Route Section 4, with the following expected works:

- Bradley Culvert (MVL3/106A) – The culvert will remain although requires extensive modification for the project. The cross-sectional area of the new part will be similar to the existing. No watercourse is associated with this culvert;
- Cooper Bridge Culvert (MVL4/1A) – no works are proposed at this culvert;
- Colnebridge Culvert (MVL3/110A) – the existing culvert will remain largely intact with a proposed 15m extension to the south to take the existing watercourse under the new fast lines. The existing headwall is to be removed and a new headwall provided. Existing drainage connections are to be retained. A new drainage system for the new fast line cutting is to be provided. The culvert is associated with the Unnamed Watercourse at Colnebridge Culvert;
- Cooper Bridge Culvert (MVL4/3A) – modification and repair of culvert at existing location. The existing pipe drainage system is carried under the railway discharging into a downstream watercourse (Unnamed Watercourse at Heaton Lodge Underpass). The connectivity of Unnamed Watercourse at Heaton Lodge Underpass is unknown and the existing Cooper Bridge Culvert (MVL4/3A) will be modified and repaired;
- Heaton Lodge Culvert (MVL4/4A) – No works are required to this culvert. However, a new culvert is required on the watercourse upstream of this under the MVN lines;
- Heaton Lodge Junction, Mirfield Culvert (MVN2/190A) – ~~a 2m extension is proposed at both the upstream and downstream ends with replacement of the existing chambers.~~ The culvert is associated with the Unnamed Watercourse at Heaton Lodge Junction. ~~The culvert extension is to be constructed online with no temporary river realignments required (vertical or lateral). Construction best practice will be adhered to for culvert extension works and all in-channel works on culvert extensions will be carried out under EA permits/licences; No amendment to the drainage outfall arrangement or culvert will be required. The chambers at each end will be assessed for their condition and clearance from the railway, some modifications may be necessary.~~
- Mirfield No.1 Culvert (MVN2/190B) – ~~This structure comprises an existing flume on the cutting slope to the south of the railway which discharges to Mirfield No.2 Culvert (MVN2/190C). No amendment to the drainage outfall arrangement or culvert will be required. A replacement is required as the current structure is too close to the proposed railway. No watercourse is associated with this culvert; and~~
- Mirfield No.2 Culvert (MVN2/190C) – ~~no amendment to the drainage outfall arrangement or culvert will be required. The chambers at the upstream (south end) will be assessed for their condition and clearance from the railway, some modifications may be necessary. the upstream chamber in the up cess has been identified as being too close to the proposed railway and will require replacing with a new chamber. The existing culvert is to be extended by approximately 2m.~~ A direct drainage link from Mirfield No.1 Culvert (MVN2/190B) flume into this culvert is proposed. Flows and volumes may be impacted at this location. No watercourse is associated with this culvert.

## Retaining walls

**4.10.144.10.20** A retaining wall is proposed at Heaton Lodge, adjacent to Colne Viaduct Underbridge (MVL3/109) to replace an existing soil/rock cutting with wall at toe of cutting. It is anticipated to be an embedded wall of length 80m and height 3m. The depth below

ground of the proposed works is estimated to be approximately 5.5m.

**4.10.154.10.21** Retaining wall works are not within an area at risk of flooding.

### Earthworks

**4.10.164.10.22** Earthworks adjacent to Bradley's No.2 (BBW/1) Overbridge (MVL3/105) are proposed to widen the existing cutting. The earthworks are proposed to be 150m in length, with a slope angle of 1-in-2 and a slope height of 2.5m.

**4.10.174.10.23** Earthworks are proposed between Huddersfield Broad Canal Underbridge (MVL3/108 and MVL3/108S) and Colne Viaduct Underbridge (MVL3/109) to widen the existing embankment. The earthworks are proposed to be 80m in length, with a slope angle of 1-in-2 and a slope height of 5m.

**4.10.184.10.24** Earthworks at Heaton Lodge Cutting are proposed as part of a major new cutting. The new cutting is proposed to be 900m in length, with a slope angle of 1-in-2 and a slope height of 12m. The base of the cutting is estimated to be approximately 53m AOD. A slope angle of 1-in-2 applies to all earthworks within Route Section 4.

**4.10.194.10.25** No earthworks proposed in Route Section 4 are at risk of flooding.

### Drainage

**4.10.204.10.26** Track drainage will be designed to the appropriate standard to maximise its operational life, including provisions for safe maintenance.

**4.10.214.10.27** Culvert extensions will retain a similar gradient to the existing gradient. Design best practice within the CIRIA guidance document C6884 entitled Flood resilience and resistance for critical infrastructure will be adhered to for culvert extension/replacement works (e.g. box culverts with depressed invert levels preferred over pipe culverts).

**4.10.224.10.28** In general, track drainage provision will replicate the existing provision. Railway track drainage will be required where surface water may be a problem, such as along cutting slopes. Standard drainage systems will be provided along the cess. These will outfall into culverts with suitable chambers provided for maintenance.

**4.10.234.10.29** Bradley Culvert (MVL3/106A) is assumed to be an outfall to railway track drainage and that it operates to the required standard and its function will be retained.

**4.10.244.10.30** Colnebridge Culvert (MVL3/110A) is assumed to be an outfall to railway track drainage and that it operates to the required standard and its function will be retained. New drainage connections will be provided to service the proposed fast line cutting.

**4.10.254.10.31** Heaton Lodge Culvert (MVL4/4A) carries an existing watercourse under the railway. The culvert will remain unaltered, however additional flow will be added.

**4.10.264.10.32** Heaton Lodge Junction Culvert (MVN2/190A) is required as part of the standard drainage systems that will be provided along the cess. These will outfall into the culvert.

**4.10.274.10.33** The drainage provision discharging at these locations will replicate the existing drainage provision, therefore there should be no significant change in flows and volumes to this location.

**4.10.284.10.34** Mirfield No.1 Culvert (MVN2/190B) will no longer be operational under proposals, with a new drainage path connecting flow to the nearby Mirfield No.2 Culvert

(MVN2/190C). It is anticipated that there will be a subsequent increase in flow/volume, it is therefore necessary that the culvert provides sufficient capacity to convey any expected increase in flow.

#### Mitigation summary

**4.10.294.10.35** In addition to the generic mitigation measures set out in paragraphs 4.1.19 to 4.1.23 , the mitigation measures to be adopted in Route Section 4 are presented in Table 4-8.

**Table 4-8 Summary of impacts and proposed mitigation measures for Route Section 4**

Description of works	Watercourse affected	Impacts of works	Mitigation measures
<p>Increase in runoff due to new track alignment</p> <p>Possible new outfall location associated with track drainage at Cooper Bridge Culvert (MVL4/3A) and Heaton Lodge Culvert (MVL4/4A)</p>	Calder and Hebble Navigation	Potential increase in runoff	<ul style="list-style-type: none"> <li>Part A of the CoCP will include provision for drainage systems which will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways.</li> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>
<p>Increase in runoff due to new track alignment</p> <p>Possible new outfall location associated with track drainage</p>	Huddersfield Broad Canal	Potential increase in runoff	
<p>Increase in runoff due to new track alignment</p> <p>Change in floodplain functionality and capacity due to construction compound</p>	River Colne	<p>Potential loss of floodplain, and floodplain conveyance</p> <p>Increase in surface water runoff</p>	<ul style="list-style-type: none"> <li>Part A of the CoCP will include provision for drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways;</li> <li>The PPICP under Part B of the CoCP will ensure that the compounds sign up to the EA's Floodline;</li> <li>Part A of the CoCP will be adhered to in order to manage temporary flood risk associated with potential increases in surface water runoff;</li> <li>Part A of the CoCP will ensure that there is no temporary raising of ground levels, so as not to reduce floodplain storage capacity;</li> <li>Part A of the CoCP will ensure that hazardous materials and sensitive equipment will be stored outside of flood zone within the compound where possible; and</li> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>
<p>Increase in runoff due to new track alignment</p> <p>Change in floodplain functionality and capacity due to construction compound</p>	River Calder	<p>Potential loss of floodplain, and floodplain conveyance</p> <p>Increase in surface water runoff</p>	<ul style="list-style-type: none"> <li>Part A of the CoCP will include provision for drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways.</li> <li>The PPICP under Part B of the CoCP will ensure that the compounds sign up to the EA's Floodline.</li> </ul>



Description of works	Watercourse affected	Impacts of works	Mitigation measures
			<ul style="list-style-type: none"> <li>Part A of the CoCP will manage temporary flood risk associated with potential increases in surface water runoff.</li> <li>Part A of the CoCP ensures that there is no temporary raising of ground levels, so as not to reduce floodplain storage capacity;</li> <li>Part A of the CoCP will ensure that hazardous materials and sensitive equipment will be stored outside of flood zone within the compound where possible.</li> </ul>
Culvert to be extended by 15m passing under the proposed fast lines, new headwalls to be provided. Culvert to be 900mm pipe with existing and new drainage connections	Unnamed Watercourse at Colnebridge Culvert MVL3/110A	Potential increase in runoff	<ul style="list-style-type: none"> <li>Part A of the CoCP will include provision for drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways.</li> <li>The EDP (Land Contamination and Hydrogeology) under part B of the CoCP will ensure that culvert flow capacities are maintained.</li> </ul>
No works proposed	MVL3/TBC Colnebridge Road Outfall	Potential increase in runoff	<ul style="list-style-type: none"> <li>Part A of the CoCP will include provision for drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways;</li> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>
Extension of Heaton Lodge Junction, Mirfield Culvert (MVN2/190A). <u>Extension of 4m is proposed as outfalls too close to the proposed railway. The chambers will be assessed for their condition and clearance from the railway and modifications may be necessary.</u>	Unnamed Watercourse at Heaton Lodge Junction	Potential increase in runoff	
Works at Cooper Bridge Intersection (MVN24/187MVL4/2) may result in repair or replacement of Cooper Bridge Culvert (MVL4/3A).	Unnamed Watercourse at Heaton Lodge Underpass	Potential increase in runoff	
Heaton lodge cutting and associated pilling and retaining wall activity	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Localised surface water flooding	A hydrogeological risk assessment will be carried out and used to inform the detailed drainage design which should be sized for groundwater flows and surface water runoff flow. The Ground investigation (GI) will be used to determine level of mitigation required but includes channelling of surface flows and intercepting ground water flows at the surface and track resilience measures.

Description of works	Watercourse affected	Impacts of works	Mitigation measures
			The GI will also inform the hydrogeological risk assessment. Details of the GI and hydrogeological risk assessment will be included in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP.
Culvert is in disrepair, replacement of 5m is proposed with 750mm pipe.	Bradley Culvert (MVL3/106A)	Potential increase in runoff	<ul style="list-style-type: none"> <li>Part A of the CoCP will include provision for drainage systems which will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways;</li> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>
Culvert to be removed/redundant	Mirfield No.1 Culvert (MVN2/190B)	Potential change in flow arrangement	<ul style="list-style-type: none"> <li>Flows will be diverted to Mirfield No.2 Culvert (MVN2/190C). Details will be included in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP.</li> </ul>
<p>Extension of Mirfield No.2 Culvert (MVN2/190C). <u>The chambers at the upstream (south end) will be assessed for their condition and clearance from the railway, some modifications may be necessary. Extension of 4m is proposed as outfalls too close to the proposed railway.</u></p> <p>Flow from Mirfield No.1 Culvert (MVN2/190B) to be diverted to Mirfield No.2 Culvert (MVN2/190C).</p>	Mirfield No.2 Culvert (MVN2/190C)	Potential change in flow arrangement	<ul style="list-style-type: none"> <li>Part A of the CoCP will include provision for drainage systems which will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways;</li> <li>Culvert is to be appropriately sized given the potential increase in flow/volume from the diverted drainage at Mirfield No.1 Culvert (MVN2/190B). Details will be included in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP; and</li> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>

### Flood Risk Conclusion –Route Section 4

4.10.36 No additional river modelling has been undertaken within this route section as there are no proposed changes to the river or flood plain associated with the Scheme. Where Scheme extents do cross the flood extent, the scheme activities are confined to bridge strengthening activities and `new track alignment on exiting track footprint. No ground raising is proposed. Table 4.8 details the proposed flood mitigation measures and approach to managing surface water flood risk. Drawing Climate Change Allowance plus Scheme description shows the location of the Scheme elements and the proximity of the flood zone including and allowance for climate change.

## 4.11 Route Section 5 – Mirfield and Lower Hopton

### Route Section 5 overview

- 4.11.1 At the western end, Route Section 5 comprises the existing railway and adjacent undeveloped vegetated land. The housing development at Calder View forms a residential area to the north of the railway. On the opposite site, the Calder Valley Greenway recreational route runs parallel to the railway. Further to the east, sports pitches associated with Lower Hopton Football Club, and Hopton Primary School are located to the south.
- 4.11.2 Further to the east, the railway crosses the River Calder over the Grade II listed Mirfield Viaduct Underbridge (MVN2/192) on the approach to Mirfield Station. Surrounding land uses in this area are predominantly commercial and residential properties. The area of Mirfield between the canal and the River Calder has a history of flooding. The existing station entrance under the bridge at Station Road is particularly susceptible to surface water flooding as it is a low point in the surrounding area.
- 4.11.3 To the north of Mirfield Station, adjacent land uses include a builder's yard, supermarket (and car park), oil works, car spare parts/scrap yard. To the south is a mix of residential, allotments, commercial, and agricultural land.
- 4.11.4 Further to the east of Mirfield, the area comprises existing railway infrastructure and adjacent land which is largely undeveloped and vegetated. Dr. Reddy's Laboratories is situated to the north of the railway, beyond which are a boat yard, housing, commercial premises and the Calder ~~and~~ & Hebble Navigation.
- 4.11.5 The railway crosses the River Calder for a second time before passing Ladywood Lakes at Sands Lane. Agricultural land dominates the southern section at the western extent.

### Topography

- 4.11.6 The Scheme is at approximately 51m AOD, at the western extremity of Route Section 5. Following the route in an easterly direction, ground level decreases to approximately 46m AOD to the south of Ravensthorpe.

### Geology and hydrogeology

- 4.11.7 The bedrock geology for the Scheme is outlined in paragraph 4.1.5.
- 4.11.8 There are few mapped superficial deposits underlying Route Section 5. Head – Clay Silt and Gravel are mapped around Mirfield with Alluvium strands associated with the River Calder crossing the rail alignment.

### Works in Route Section 5

- 4.11.9 In summary, Route Section 5 includes the following works:
- Station remodelling;
  - Structural works to bridges and earthworks;
  - Construction compounds; and
  - Utility diversions.

### Existing flood risk in Route Section 5



4.11.10 Table 4-9 summarises the key flood risks in Route Section 5.

**Table 4-9 Flood risk summary in Route Section 5**

Receptor	Jurisdiction	Description
Unnamed Watercourse at Chadwick Close Culvert	LLFA	Ordinary Watercourse flows south to north beneath the track alignment in culvert. Runs through an agricultural area to the south.
Wood Lane Culvert (MVN2/191B)	LLFA	Assumed no works
River Calder and associated Flood Zones 2 and 3 (Mirfield Viaduct Underbridge (MVN2/192) and Wheatley's Underbridge (MVN2/196))	EA	Main River flows under Mirfield Viaduct Underbridge (MVN2/192) and Wheatley's Underbridge (MVN2/196). Flows through residential and commercial areas. Large areas of land within Flood Zone 2 and Flood Zone 3. Flood flow routes apparent through Route Section 3 impacting the area around Mirfield Station works. Construction compounds at Ledgard Bridge and Steanard Lane are located in both Flood Zone 2 and Flood Zone 3.
Unnamed Watercourse at Steanard Lane Culvert	LLFA	Ordinary Watercourse flows south to north beneath the track alignment in the culvert. Runs through agricultural area to the south
Sands Lane Culvert (MVN2/198)	LLFA	Track drainage

4.11.11 Figures 4-16 to 4-19 show the EA Flood Zones, surface water flood risk, historic flood map and depth difference modelling output for Route Section 5.

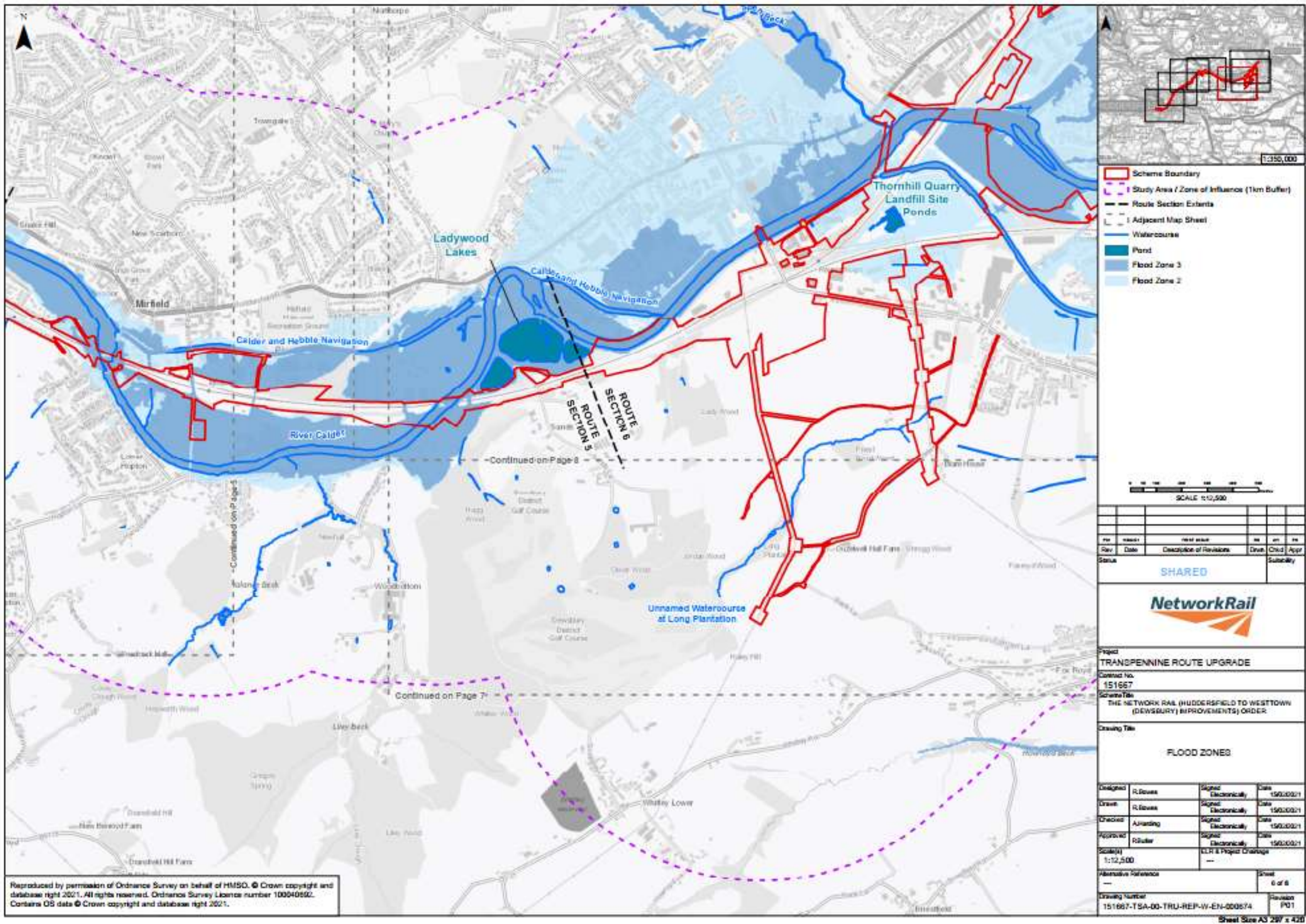


Figure 4-16 EA Flood Zones in Route Section 5



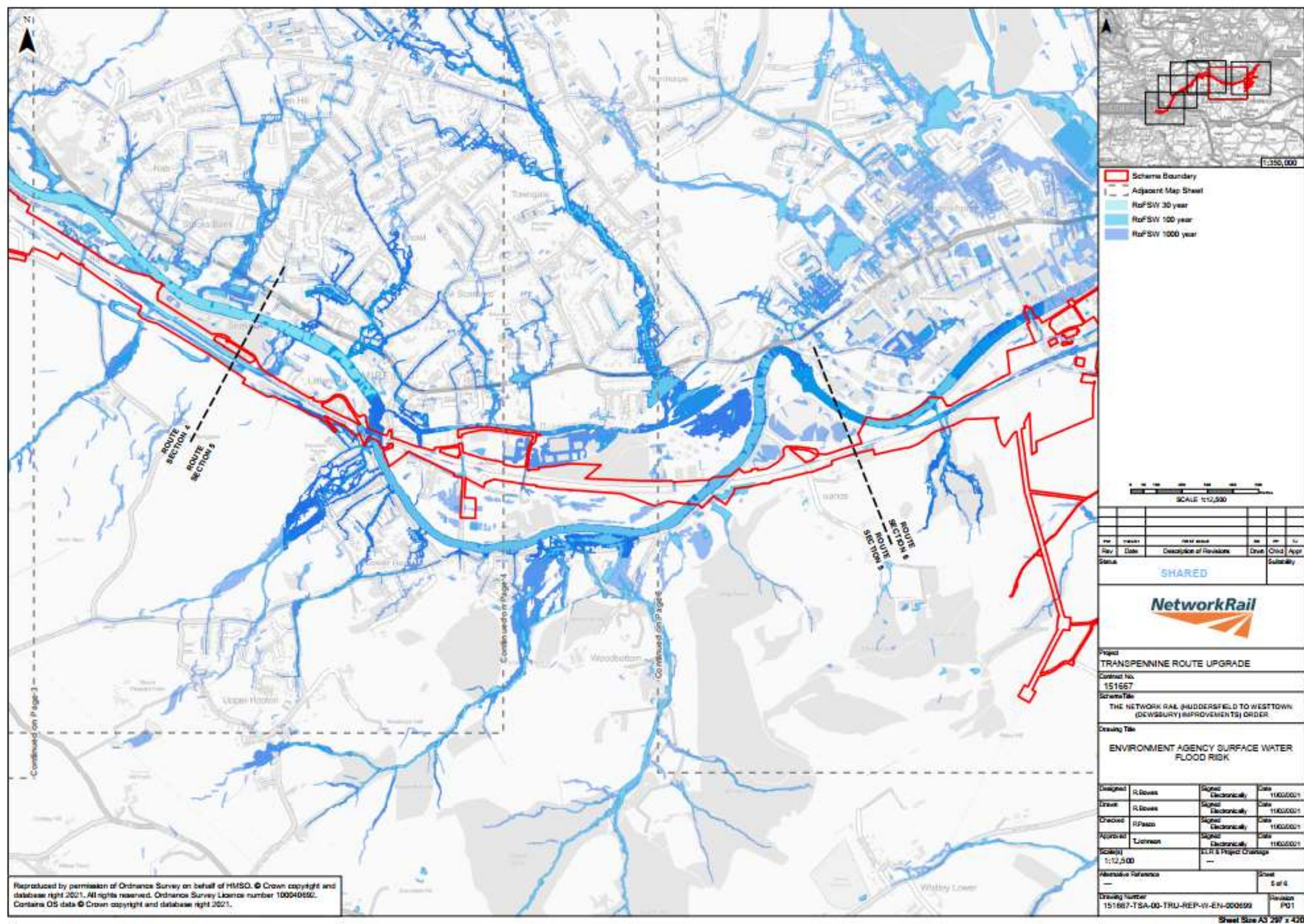


Figure 4-17 Risk of flooding from surface water for Route Section 5



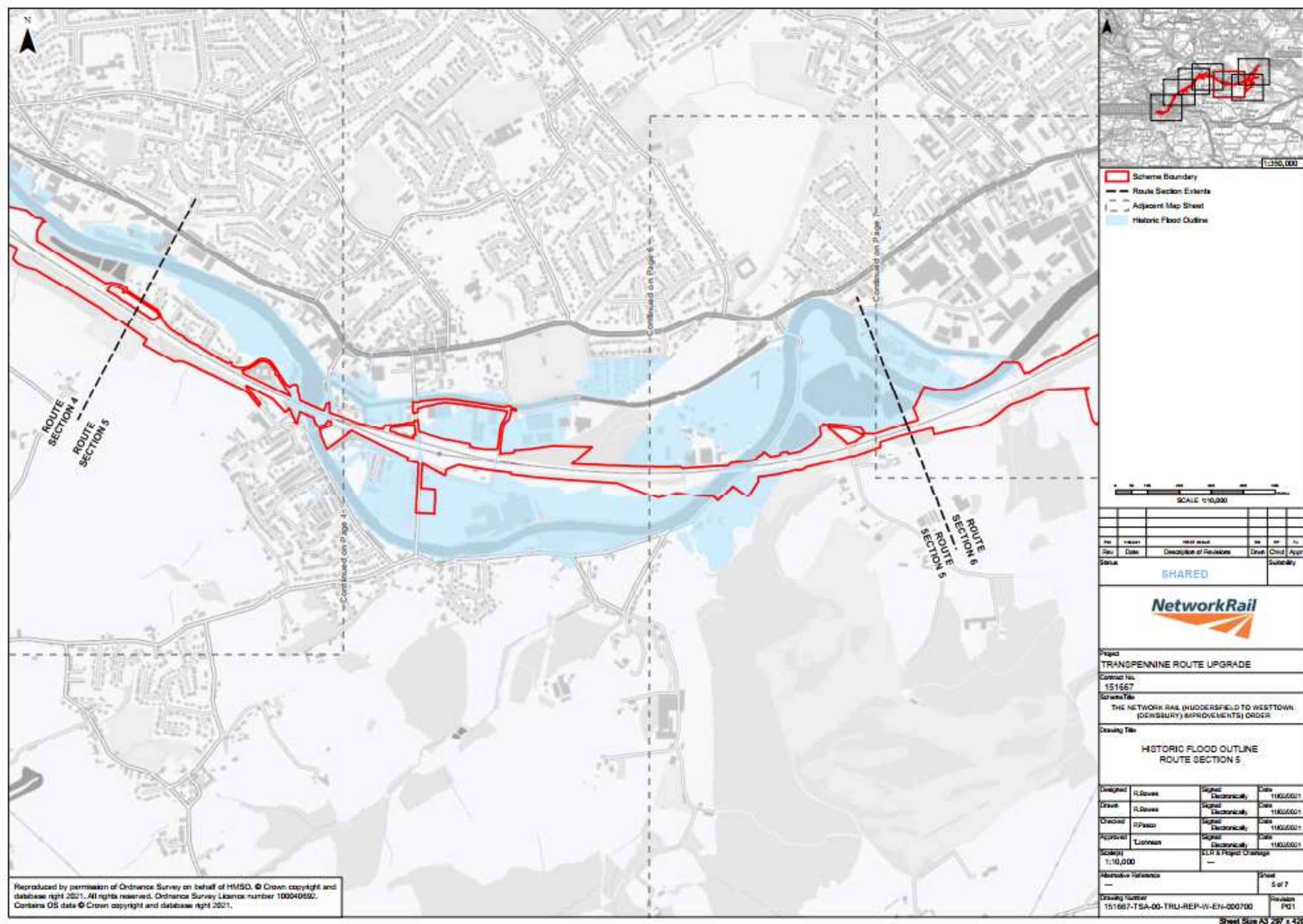


Figure 4-18 Historic flood map for Route Section 5



**Figure 4-19 Maximum Flood Depth Difference between Baseline and Scheme for the 1% AEP plus climate change (50%) in Route Section 5**

## History of flooding

- 4.11.12 There are several flood outlines sourced from the River Calder where flooding has occurred, with the largest flood extent occurring in December 2015 and as recent as February 2020. The SFRA details the occurrence of flooding in February 2002 between Brighouse and Dewsbury.
- 4.11.13 Areas known to flood include Caldergate, Newgate and Station Road where flood depths make roads impassable, including areas around Mirfield Station that is located in the middle of the floodplain.
- 4.11.14 Within Route Section 5, modelling suggests there are locations where river bank levels are breached and flood flow routes develop. These include the right bank of the River Calder upstream of the Mirfield Viaduct Underbridge (MVN2/192) and along the right bank of the River Calder upstream and downstream of Steanard Lane Underbridge (MVN2/197). From initial flood locations preferential flow routes develop including a further point of flooding at Newgate Bridge. This flow route travels down Back Station Road connecting with increasing left bank flooding on the Calder in the vicinity of Hopton New Road Bridge. The river model indicates that a flow route develops with increasing flood depths which passes through Station Road Underbridge (MVN2/193) restricting access to Mirfield Station (peak flood level on Station Road 1% Annual exceedance probability (AEP) event 44.7m AOD).
- 4.11.15 The Kirklees PFRA states that due to limited funding and a lack of foresight in appreciating the value of recording and assessing historic flood incidents has resulted in Kirklees Council possessing very limited and incomplete records of past flood events.

## Flooding from rivers

- 4.11.16 The majority of the Scheme within Route Section 5 is indicated to be in the Low Risk Flood Zone 1, however the Scheme boundary intersects with Flood Zone areas that are classified as having Medium (Flood Zone 2) to High (Flood Zone 3) probability of flooding.
- 4.11.164.11.17 There is interaction between scheme elements and flood zone 3ai or 3b in Route Section 5. The proposed works that are located within flood zone 3ai and 3b are limited to a site compound (Ledgard Bridge - Mirfield Viaduct) and a temporary car park facility (Hopton New Road) respectively (See Appendix B for Flood Risk Maps including Climate Change). Further works details are provided below in section 4-12.

## Main Rivers

- 4.11.174.11.18 Land by the Scheme's River Calder crossing is located in the high-risk Flood Zone 3. This includes approximately 200m of the Scheme. The alignment crosses the floodplain which includes industrial and residential properties. Downstream of this crossing, the River Calder flows under Newgate Bridge and passes the residential properties within South Brook Gardens. Upstream, the River Calder is flanked by commercial properties and greenspace.
- 4.11.184.11.19 River modelling indicates there are issues with flooding in the vicinity of Newgate Bridge. These issues proliferate along the Calder and & Hebble Navigation Channel with flooding possible along the right bank. The maximum flood extent joins flow routes north of the railway alignment and south with both flow routes converging at Station Road Underbridge (MVN2/193). The interaction with the Calder &and Hebble Navigation channel and the River Calder at this location provides conduits and routes for flooding across this floodplain.
- 4.11.194.11.20 The Scheme crosses an Unnamed Watercourse at Hagg Wood around 1km to



the east of Mirfield Station, flowing north through woodland, connecting to the River Calder. To the south of the Scheme this location is subject to surface water flooding from the 3.3% annual chance event upwards, however the impact is limited to agricultural land.

~~4.11.204.11.21~~ The Scheme crosses back over the meandering River Calder. Notable at this location is the floodplain associated with the Main River. The floodplain at this location is well defined with formal flood storage areas designated on both banks within the area. The alignment crosses the floodplain and intersects Flood Zones 2 and 3. The track is embanked at this location and traverses the River Calder by viaduct.

~~4.11.214.11.22~~ It is notable that Mirfield Station falls within the maximum flood extent. The track alignment and station are elevated at this location, however access and egress to the station is restricted during times of flood. The floodplain and the flooding mechanisms in the Mirfield area are complex and mechanism of flood flow routes are apparent. Station Road and access under Mirfield Viaduct Underbridge (MVN2/192) at Calder View are liable to flooding.

### Ordinary Watercourses

~~4.11.224.11.23~~ The RoFSW indicates isolated areas along both sides of the Scheme, including the tracks, at risk of flooding from surface water. This risk is mainly associated with the Ordinary Watercourses that pass beneath the Scheme.

~~4.11.234.11.24~~ The Unnamed Watercourse at Chadwick Close Culvert to the west of Mirfield Station is crossed by the railway alignment and flows northerly to join the River Calder approximately 200m to the north of the Scheme. The RoFSW mapping shows there is no risk of flooding associated with the watercourse.

### Flooding from groundwater

~~4.11.244.11.25~~ Route Section 5 is deemed as having high risk from groundwater flooding. Risk within Route Section 5 is equal to or greater than a 75% risk of groundwater emergence.

### Flooding from surface water

~~4.11.254.11.26~~ The EA's RoFSW mapping indicates the presence of surface water flood risk in the following areas of Route Section 5, moving from west to east along the Scheme:

- A flow route is shown to flood the track at the 0.1% annual chance event at Woodend Road and Sands Lane. The area at risk is limited and only at the 0.1% annual chance event; flood depths are predicted to be up to 0.3m along the track; and
- Overland flow routes are shown to impact the track at Hopton New Road and Hurst Lane and a small area in the vicinity of Dr. Reddy's Laboratories. Flood risk here is classified as medium to low risk, however the Scheme is elevated at these locations and the flood paths flow through the existing underbridges.

### Flooding from other sources

~~4.11.264.11.27~~ There are no formal flood defences in Route Section 5, and no areas benefitting from defences; therefore, there is no flood risk from failure of a raised flood defence.

~~4.11.274.11.28~~ The risk of flooding along the Calder and Hebble Navigation is dependent on a number of factors. As canals are man-made systems and heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with asset failure, similar to those associated with river defences, such as overtopping of canal banks.

**4.11.284.11.29** The EA's RoFR map indicates that the Scheme will be at risk at both crossings of the River Calder in Route Section 5. It is notable that Mirfield Station falls within Flood Zone 3. The track alignment and station are elevated at this location, however access and egress to the station is restricted during a flood event.

## 4.12 Flood risk for Route Section 5

**4.12.1** The baseline flood risk for Route Section 5 is described in preceding sections.

**4.12.2** The design approach and principles adopted in relation to mitigating flood risk for both permanent and temporary works are described in Section 2. The Scheme elements which could potentially increase flood risk for Route Section 5 are outlined as follows, along with proposed mitigation works.

**4.12.3** Drawing Climate Change Allowance plus Scheme description shows that there are elements of the Scheme that are located within Flood Zone 2 and 3, including an allowance for climate change. The proposed works that are located within flood zone 3ai and 3b are limited to a site compound (Ledgard Bridge - Mirfield Viaduct) and a temporary car park facility (Hopton New Road) respectively (See Appendix B for Flood Risk Maps including Climate Change). Further works details are provided below in section 4-14.

**4.12.4** No additional river modelling has been undertaken along this reach of the River Calder. There are no scheme elements that would require input into the model to assess change in flood prevalence. There are no intentions for ground raising or displacement of flood storage provisions within Route Section 5.

### Station works

**4.12.24.12.5** The proposed four-track alignment cannot be accommodated by Mirfield Station's existing arrangement and therefore Mirfield Station will be reconstructed to accommodate the proposed track alignment. This presents an opportunity to significantly improve access to the station.

**4.12.34.12.6** The station footprint remains as per its current location; however, proposals are to relocate the station platforms. This will enable the slow lines to be platformed with greater accessibility for passengers. The fast lines are proposed to run to the south of the station footprint and will not be platformed as services do not stop at this location.

**4.12.44.12.7** It is proposed to retain the existing car park (56 spaces including 4 blue badge spaces) and improve its connectivity to the station by means of a new dedicated footbridge. This footbridge forms routes of dry egress to the existing car park which sits outside of flood zone 2 and 3. The revised layout will also provide improved connectivity with existing bus routes and Mirfield town centre. Step-free access to be provided on eastern side of Station Road, maintaining existing distance from the station entrance to Mirfield town centre.

**4.12.54.12.8** During the construction phase, the car park will be utilised as a compound with a temporary car park located south of Mirfield Station on the east of ~~Station Road~~Hopton New Road. This temporary car park location sits within a dedicated flood storage area within Flood Zone 3b. This car park is temporary during the construction phase at Mirfield Station, there are no proposals to alter ground levels and affect current flood storage volumes. The operator of this temporary car park provision (assumed to be the Train Operating Company (TOC) responsible for the station) should seek to add it to the current flood warning arrangement for Mirfield. During times of flood this car park should be closed. Once works have completed at the station, then the car park will revert to the permanent provision and this land will be reinstated to existing conditions.



**4.12.64.12.9** The works at Mirfield Station include a new access provision along Station Road beneath the rail bridge to the station. This proposed access is opposite the existing access point along Station Road. The proposals include a high containment kerb and ramped access to the lift shaft which will be set at 44.2m AOD above the 25-year maximum flood level, the lift will take passengers to platform level. The lift shaft is designed with appropriate flood resilience measures. It is understood that Mirfield Station is closed during times of flood and this operation must be maintained.

**4.12.74.12.10** Where excavation is proposed, piling activity and subsurface engineering is required as part of the works at Mirfield Station. A hydrogeological risk assessment is required following site-specific ground investigation.

### Structures

**4.12.84.12.11** Along Route Section 5 there are five locations which have been identified where structural works or OLE works are proposed:

- At the western extent of Route Section 5, deck removal is planned at Woodend Road Overbridge (MVN2/191) (abutments will be retained);
- Mirfield Viaduct Underbridge (MVN2/192) and Wheatley's Underbridge (MVN2/196) are both Grade II listed structures with proposed works to install OLE portals into the existing bridge deck, [see drawings NR13 Planning Drawing - MVN2 - 192 – Mirfield Viaduct North Elevation \(1\).pdf \(windows.net\)](#), [NR13 Planning Drawing - MVN2 - 192 – Mirfield Viaduct North Elevation \(2\).pdf \(windows.net\)](#) and [NR13 Planning Drawing - MVN2 - 192 – Mirfield Viaduct North Elevation \(3\).pdf \(windows.net\)](#);
- OLE portal installation is also proposed at Mirfield Viaduct (Steel Spans) Underbridge (MVN2/192A), in addition to strengthening works, ballast works, blast cleaning and repainting of the accessible underside steelwork ([see drawing details above](#)); and
- Works to Station Road Underbridge (MVN2/193) include deck replacement as part of the wider Mirfield Station redevelopment.

**4.12.12** The Scheme-wide drainage strategy has a full description of the work undertaken and is included in Appendix A of this FRA.

**4.12.94.12.13** [All works proposed to Mirfield Viaduct underbridge \(MVN2/192 and MVN2/192A\) are above the modelled 1% AEP+CC flood level. All works including in the proposed strengthening works, ballast works and the installation of the OLE portals are set above the bridge soffit of 47.88m AOD with a 1%AEP +CC flood level of 46.65m AOD.](#)

### Compounds

**4.12.104.12.14** There are five construction compounds proposed within Route Section 5:

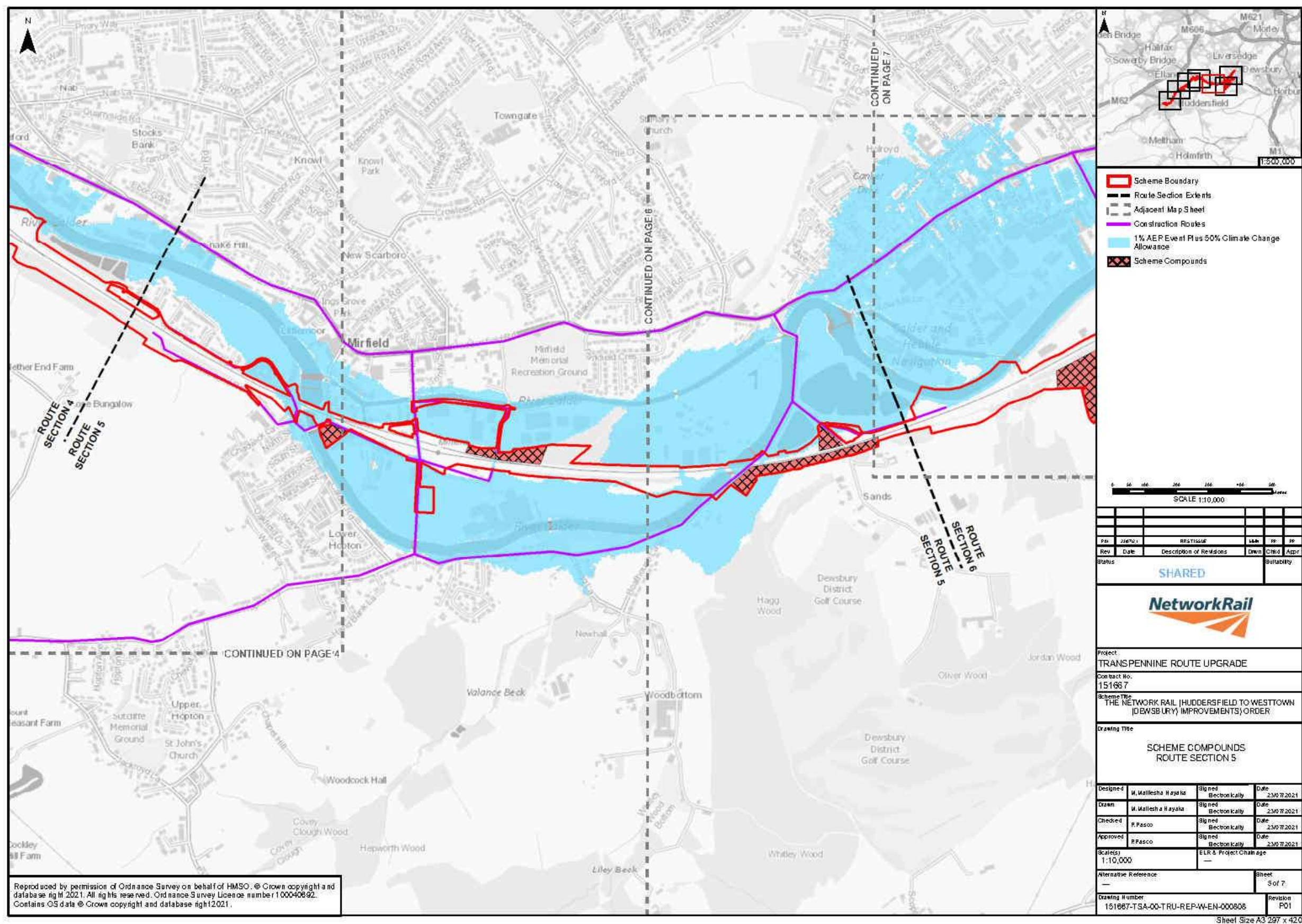
- Woodend Road;
- Ledgard Bridge (Mirfield Viaduct);
- Station Road (Mirfield);
- Steanard Lane; and
- Sands Lane.

**4.12.114.12.15** All five compounds are intended for civils uses. Ledgard Bridge (Mirfield Viaduct), Station Road (Mirfield) and Steanard Lane compounds are all adjacent to the River Calder. The proposed compound at Woodend Road is not adjacent to any watercourses. Sands Lane compound is adjacent to Ladywood Lakes.

**4.12.124.12.16** Temporary construction activities may also increase flood risk within Route

Section 5. Construction compounds are expected to be in situ for up to two years. Where compounds are located within flood zone a series of mitigation measures are detailed within Part A of the CoCP to ensure there are no adverse impacts. These measures will prevent the compound increasing surface water runoff and prevent any reduction in flood storage provision. Further details are provided in Table 4-10.

**4.12.17** For all compounds, the potential increase in runoff as a result of increase in hardstanding areas will be managed as part of a series of mitigation measures set out in Part A of the CoCP.

Figure 4-20 Route Section 5 compound locations in relation to flood zones



## Culverts

**4.12.134.12.18** Two culverts are located within Route Section 5. Chadwick Close Culvert (MVN2/191A) is associated with the Unnamed Watercourse at Chadwick Close Culvert and Steanard Lane Culvert (MVN2/198A) is associated with the Unnamed Watercourse at Steanard Lane Culvert.

**4.12.144.12.19** Wood Lane Culvert (MVN2/191B) and Sands Lane Culvert (MVN2/198B) are located within Route Section 5, however no watercourses are associated with the structures.

**4.12.154.12.20** Sands Lane Culvert (MVN2/198B) requires repair and modification to the structure. The culvert will remain an outfall for railway track drainage.

## Drainage

**4.12.164.12.21** There are no existing assets at the remodelled Mirfield Station, therefore a new drainage system is required.

**4.12.174.12.22** The new platform area is larger than the existing and made up of more traditional solid construction, rather than the existing timber platforms. Surface water discharge from these is therefore likely to be much greater. The use of channel drainage and storm water storage within the platforms will allow control of discharge flows.

**4.12.184.12.23** A new storm water drainage system is required for the re-modelled platforms and additional track drainage. These will both discharge out to the drainage systems for the station car park, to be attenuated and discharged to local sewers. The Scheme-wide drainage strategy in Appendix A sets out the approach for culverts based on an assessment of depth of cover, the impact of proposed earthworks solutions, and condition. Table 4-10 summarises the culverts to be replaced, rehabilitated or extended for Route Section 5.

## Mitigation summary

**4.12.194.12.24** In addition to the generic mitigation measures set out in paragraphs 4.1.19 to 4.1.232, the mitigation measures to be adopted in Route Section 5 are presented in Table 4-10.



**Table 4-10 Summary of impacts and proposed mitigation measures for Route Section 5**

Description of works	Watercourse affected	Impacts of works	Mitigation measures
New rail track on existing rail footprint. Location may be used as outfall for new track drainage.	Unnamed Watercourse at Chadwick Close Culvert	Potential increase in runoff	<ul style="list-style-type: none"> <li>• Part A of the CoCP will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways.</li> <li>• The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>
<p>New rail track on existing rail footprint.</p> <p>Construction compounds in Flood Zone 2 and Flood Zone 3</p> <p>Change in hardstanding arrangement at Mirfield Station.</p>	River Calder and associated Flood Zone 2 and Flood Zone 3	<p>Potential loss of floodplain, and floodplain conveyance</p> <p>Increase in surface water runoff</p>	<ul style="list-style-type: none"> <li>• The PPICP under Part B of the CoCP will ensure that the compound signs up to the EA's Floodline;</li> <li>• Part A of the CoCP will be adhered to in order to manage temporary flood risk associated with potential increases in surface water runoff.</li> <li>• Part A of the CoCP will ensure that there is no temporary raising of ground levels, so as not to reduce floodplain storage capacity;</li> <li>• Part A of the CoCP will ensure that hazardous materials and sensitive equipment will be stored outside of flood zone within the compound where possible.</li> <li>• The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff</li> </ul>
New rail track on existing rail footprint.	Unnamed Watercourse at Steanard Lane Culvert	Potential increase in runoff	<ul style="list-style-type: none"> <li>• Part A of the CoCP will include provision for temporary drainage systems which will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways.</li> <li>• The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>

Description of works	Watercourse affected	Impacts of works	Mitigation measures
New rail track on existing rail footprint and modification to culvert, location may be used as outfall for new track drainage	MVN2/198B Sands Lane Culvert	Potential increase in runoff	<ul style="list-style-type: none"> <li>• Risk of increased runoff from new track would be managed through the Scheme-wide drainage strategy.</li> <li>• The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>
Piling activity and retaining walls and sub-surface engineering	Aire and Calder Carb. Limestone/ Millstone Grit/ Coal Measures WFD groundwater body	Potential increase in runoff due to groundwater surface flows developing	<ul style="list-style-type: none"> <li>• A Hydrogeological risk assessment will be undertaken following site-specific ground investigation to allow temporary drainage systems to be designed to accommodate groundwater derived flow as well as surface runoff. Details will be included in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP;</li> <li>• Part A of the CoCP will include provision for temporary drainage systems which will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways and development of new ones.</li> </ul>

## Flood Risk Conclusion –Route Section 5

**4.12.204.12.25** No additional river modelling has been undertaken within this route section as there are no proposed changes to the river or flood plain associated with the Scheme. Where Scheme extent do fall within the flood extent, these are limited to the temporary carpark facility, temporary compound areas where no ground raising is proposed. The ground works at the station are confined to excavations down from the existing platform area to ground level and not in flood zone. All other ground works and retaining wall activity are to the south of the route alignment outside of the flood zone including and allowance for climate change. Table 4.10 details the proposed flood mitigation measures and approach to managing surface water flood risk. [Drawing Climate Change Allowance plus Scheme description](#) shows the location of the Scheme elements and the proximity of the flood zone including an allowance for climate change.

## 4.13 Route Section 6 – Ravensthorpe and Westtown

### Route Section 6 overview

- 4.13.1 In Route Section 6, the existing route approaching from Huddersfield/Mirfield currently consists of three non-electrified tracks on an historic four-track formation. Surrounding land uses within this area are predominantly commercial, residential and agricultural properties. Commercial premises, including a concrete plant are located to the north of the railway near Ravensthorpe Station. The area to the south of the railway is dominated by agricultural land, woodland and a public bridleway, however the site to the south of the railway at Ravensthorpe is designated for housing through the Kirklees Local Plan in conjunction with the Dewsbury Riverside development, with works proposed to commence in the near future.
- 4.13.2 Calder Road/Ravensthorpe Road crosses the railway, where the tracks split towards the south-east (MVN2 to Wakefield) and the north-east (MDL1 to Dewsbury). A grade-separated junction (Flyover Intersection (RBA/1)) is required at this point to accommodate the Scheme.
- 4.13.3 Immediately to the east of the station and Calder Road, Thornhill Power Station (non-operational) occupies the majority of the land to the north of the railway.
- 4.13.4 An inert waste landfill site and quarry are located between the grade separation and the Calder and Hebble Navigation Canal.
- 4.13.5 Further to the east, the Scheme crosses the Calder and Hebble Navigation Canal, the River Calder Floodplain and the River Calder. The Baker Viaduct Underbridge (RBA/2) is proposed in this location to accommodate the proposed alignment of the railway. A currently active sand/gravel quarry, which is due to be fully restored in line with the quarry's restoration plans prior to construction of the Scheme commencing, also forms part of the river's floodplain between the Calder and Hebble Navigation and River Calder. Land to the east of the River Calder comprises the Kirklees Council Waste Recycling Centre and other industrial units.
- 4.13.6 The railway alignment continues in a north-east orientation crossing over Thornhill Road. Realignment of Thornhill Road is required along with the expansion of B6117 Fall Lane, Thornhill Road Underbridge (MDL1/9). This area generally comprises a mix of commercial and residential properties, with vegetated areas.

### Topography

- 4.13.7 The Scheme is at approximately 46m AOD at the western extremity of Route Section 5. Following the Scheme in a north-easterly direction, ground level increase to approximately 51m AOD to the south-west of Dewsbury.

### Geology and hydrogeology

- 4.13.8 The bedrock geology for the Scheme is outlined in paragraph 4.1.5.
- 4.13.9 There are few mapped superficial deposits underlying Route Section 6. Head – Clay Silt and Gravel are mapped around Mirfield with Alluvium strands associated with the River Calder crossing the rail alignment.

### Works in Route Section 6

- 4.13.10 In summary, Route Section 6 includes the following works:
- Ravensthorpe Station relocation;



- Grade separated junction (Flyover Intersection (RBA/1));
- Construction of new track (viaduct);
- Construction compounds; and
- Utility diversions.

### Existing flood risk in Route Section 6

4.13.11 Table 4-11 summarises the key flood risks in Route Section 6.

**Table 4-11 Flood risk summary for Route Section 6**

Receptor	Jurisdiction	Description
Calder and Hebble Navigation	LLFA	Culvert discharge proposed to canal and new Baker Viaduct Underbridge (RBA/2) crossing.
River Calder	EA	Main River flows under River Calder Underbridge (MDL1/8) through commercial and industrial land use. New Baker Viaduct Underbridge (RBA/2) crossing intersecting the floodplain and designated flood storage area. New piled embankment to be constructed within floodplain. Construction compounds are located in both Flood Zone 2 and Flood Zone 3.
Unnamed Watercourse at Long Plantation	LLFA	Ordinary Watercourse flows southwest to northeast beneath the Scheme boundary through mostly agricultural area.
Ladywood Road Culvert (MVN2/199B)	LLFA, Network Rail	Existing culvert. No works proposed.
Ladywood Culvert (MVN2/200C)	LLFA, Network Rail	Drainage pathway flows south to north beneath track alignment in culvert, runs through agricultural area to the south.
Thornhill Quarry ponds	EA, LLFA	Waterbody with no known connections or outflows at landfill site that is located within the Scheme boundary and proposed alignment of Wakefield Intersection embankment.
Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	LLFA	Localised groundwater flood risk.

4.13.12 Figures 4-21 to 4-23 show the EA Flood Zones, surface water flood risk and historic flood map for Route Section 6.



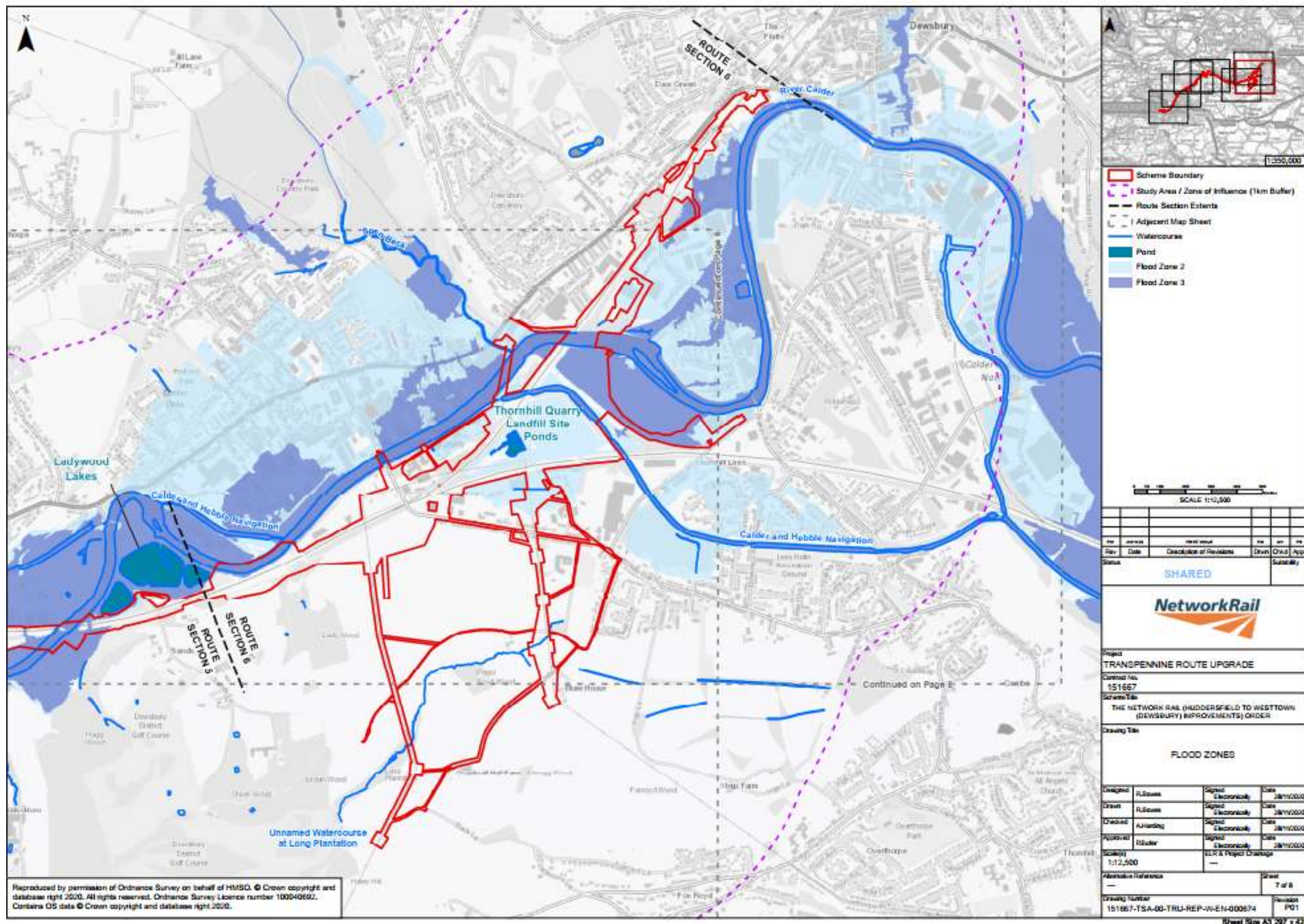


Figure 4-21 EA Flood Zones in Route Section 6



**Figure 4-22 Risk of flooding from surface water for Route Section 6**



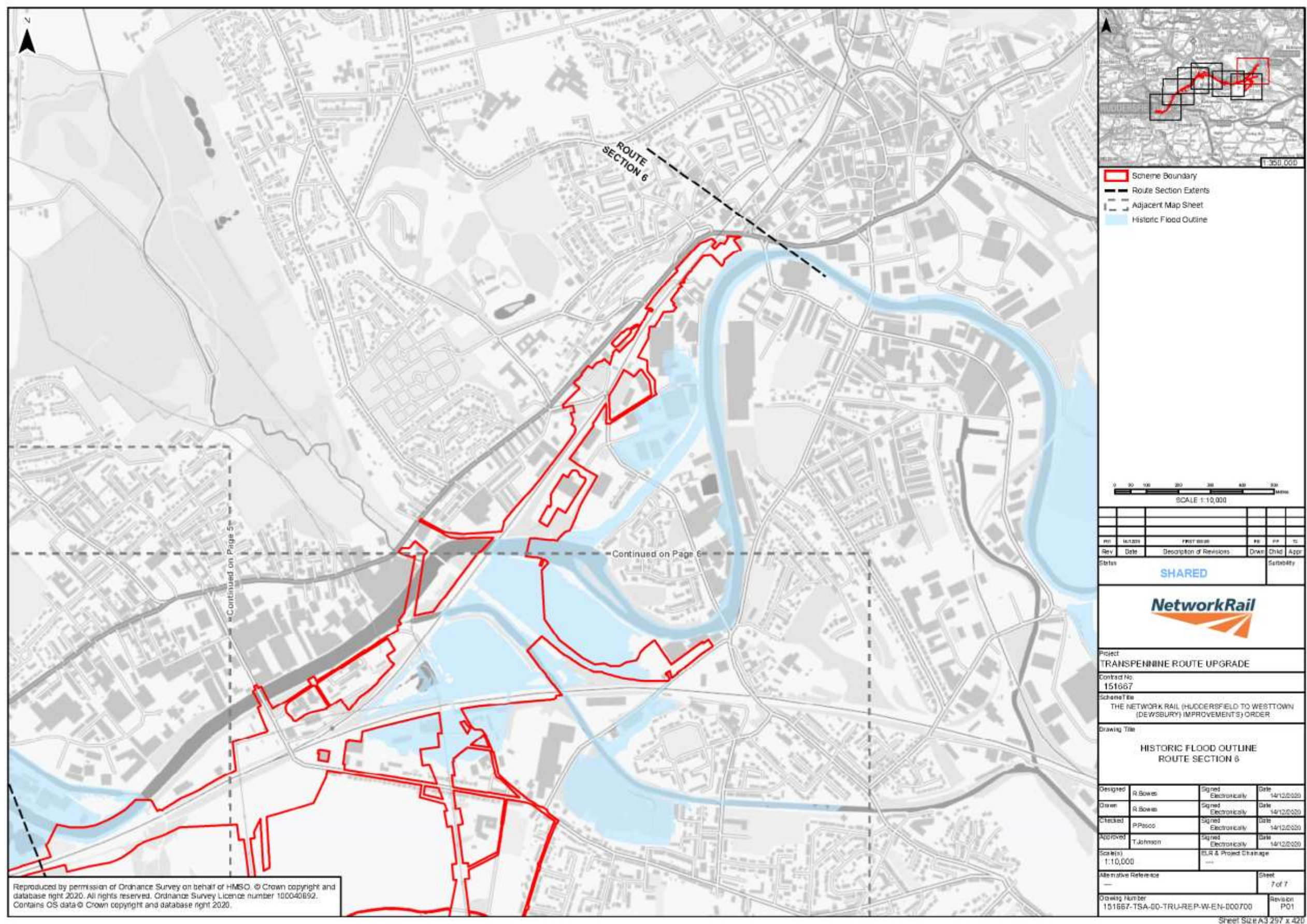


Figure 4-23 Historic flood map for Route Section 6



### History of flooding

- 4.13.13 The HFM shows areas of past fluvial flooding. These outlines can be viewed in Figure 4-15 in relation to the Scheme boundary within Route Section 6. There are several flood outlines sourced from the River Calder where flooding has occurred, with the largest flood extent occurring in December 2015. The SFRA details the occurrence of flooding in February 2002 between Brighouse and Dewsbury, 2004 at Ravensthorpe and 2007. The 2007 event included widespread flooding with up to 500 properties including hotspots in Ravensthorpe.
- 4.13.14 The Kirklees PFRA states that limited funding and a lack of foresight in appreciating the value of recording and assessing historic flood incidents has resulted in Kirklees Council possessing very limited and incomplete records of past flood events.

### Flooding from rivers

- ~~4.13.15~~ A review of the EA's Flood Map for Planning indicates that the majority of the Route Section 6 is located in the fluvial Flood Zone 2, however areas of Flood Zone 3 are crossed by the proposed railway alignment (See Appendix B for Flood Risk Maps).
- ~~4.13.16~~ There is interaction between scheme elements and flood zone 3b including allowance for climate change in Route Section 6 (See Appendix B for Flood Risk Maps including Climate Change). The proposed works that are located within flood zone 3b relate to structural pier components of the proposed Ravensthorpe viaduct. Further details are provided below in section 4-14.

### Main Rivers

- ~~4.13.15~~~~4.13.17~~ The Scheme crosses the River Calder, which is designated as a Main River. It flows in an easterly direction through Route Section 6 towards Dewsbury. The Scheme crosses the River Calder via River Calder Underbridge (MDL1/8) in the vicinity of Scout Hill Road. At this location Flood Zone 2 is shown adjacent to the embankment. Since the Scheme is elevated above floodplain it is not shown to flood.
- ~~4.13.16~~~~4.13.18~~ A review of the EA's Flood Map for Planning indicated that land within the Ravensthorpe triangle is located predominantly in Flood Zone 2. This area includes the Wakefield Intersection, railway crossing of the Thornhill Quarry site and Calder ~~and~~ & Hebble Navigation and River Calder crossings. Within the immediate vicinity of the Scheme, the floodplain is located adjacent to industrial and commercial properties at Thornhill Industrial Units, Calder Road. The map also shows that the area of the Scheme within the Ravensthorpe triangle is at risk of flooding from the River Calder, being partially located in Flood Zone 3 and Flood Zone 2. The right bank of the River Calder is designated as a Flood storage area and Flood Zone 3b.
- ~~4.13.17~~~~4.13.19~~ The flooding mechanism in this location is primarily through overtopping of the right bank in the vicinity of River Calder Underbridge (MDL1/8) crossing. Overtopping occurs along the left bank further downstream and enters a flood alleviation channel providing additional storage.
- ~~4.13.18~~~~4.13.20~~ A detailed 1D-2D ISIS TUFLOW hydraulic model of the River Calder was obtained from the EA. The model was updated in 2016 and considers flood scenarios for a range of return period fluvial flood events. The River Calder is located within the Humber river basin and therefore, in accordance with the EA's climate change guidance, the potential impacts of climate change on flood risk to the Scheme have been assessed using a 50% increase in peak river flows. Figure 4-~~24~~ shows the modelled flood ~~depths~~ extents for the 1% plus climate ~~s~~ change of 50%.

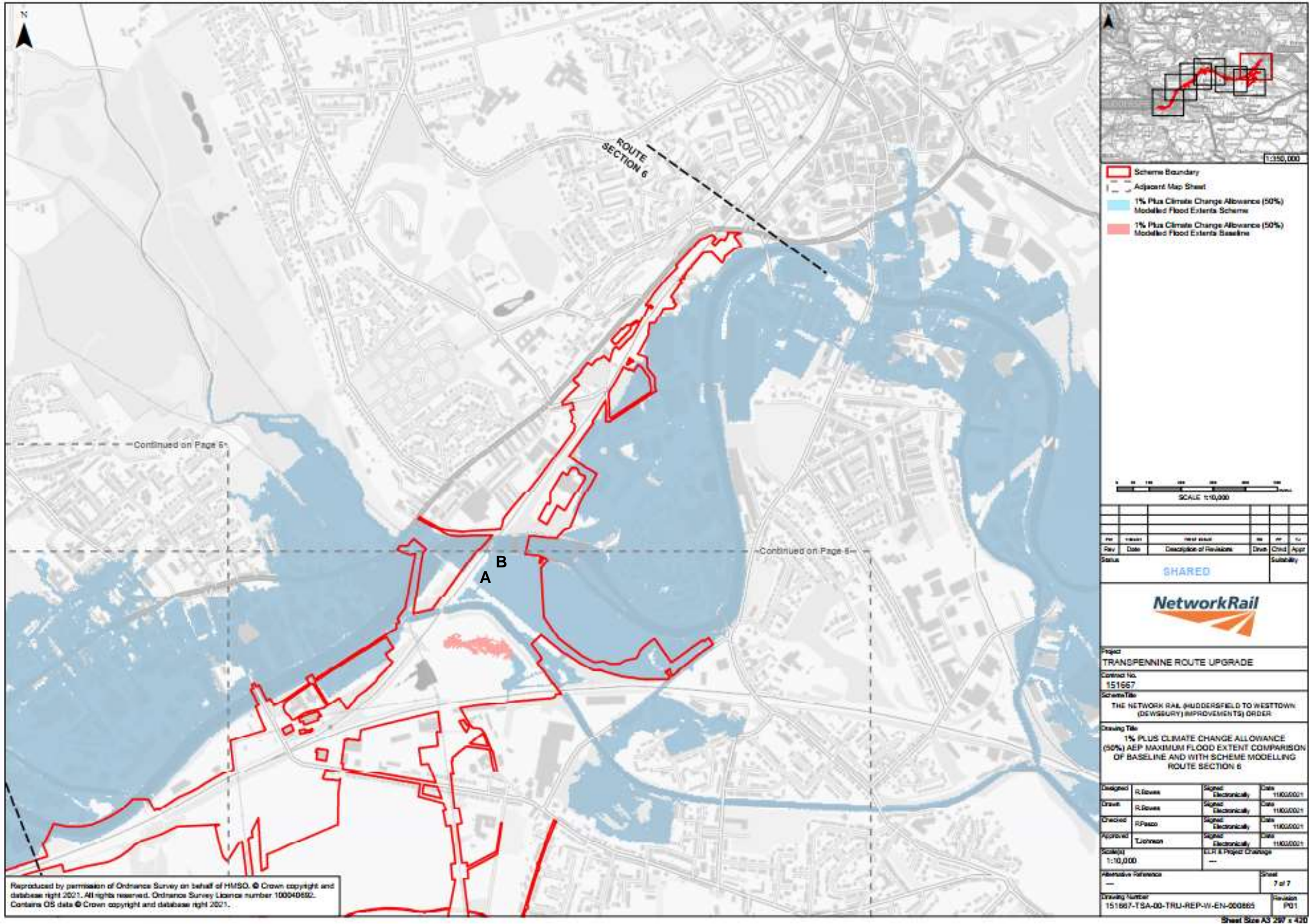


Figure 4-24 Modelled flood extent displaying the comparison pre and post Scheme for the 1% AEP event plus 50% climate change allowance (A and B are location where flood level comparisons have been detailed in Figures 4-30 and 4-31)



~~4.13.194.13.21~~ The maximum flood level at the existing railway embankment (floodplain) on the approach to MDL1/8 River Calder crossing ([shown on drawing 5185387 TRU W3 FRA MaxFloodExtentCompCCSchDesc 00 221021 for issue, page 22](#)) is estimated to be 40.53m AOD for the 1% annual chance event, including an upper end (50%) allowance for the effects of climate change. This is 6.48m below the proposed bridge soffit level 47.05m AOD.

~~4.13.204.13.22~~ The difference in maximum peak water levels on the railway embankment between the 1% AEP and 1% AEP plus climate change is approximately 1.5m. This is because of the land-use of the right bank floodplain adjacent to the embankment and the preferential flood flow routes encouraging flood water to fill the quarry (designated flood storage area).

~~4.13.214.13.23~~ The 1% AEP plus 50% climate change flood level at the proposed River Calder Crossing is 40.86m AOD. This is 6.19m below the proposed bridge soffit level 47.05m AOD. Peak water levels for the 1%, 1% plus climate change and 0.1% AEP events are shown in table 4-12, stage hydrographs for the 1% and 1% plus climate change event are shown on Figure 4-~~25~~ and Figure 4-~~26~~ respectively.

**Table 4-12 Modelled flood levels at the proposed crossing location of the River Calder**

Return period	Peak water level (mAOD)
1% annual chance event	39.96
1% annual chance event plus climate change allowance 50%	40.86
0.1% annual chance event	41.14

~~4.13.224.13.24~~ Downstream of the Baker Viaduct Underbridge (RBA/2) crossing of the River Calder is the Dewsbury flood relief channel. This asset alleviates elevated flood levels upstream of the weir. Figures 4-~~27~~ and 4-~~28~~ show the comparison pre- and post-Scheme of stage (mAOD) in the flood relief channel. The modelling results show there is no change in stage associated with the Scheme.

~~4.13.234.13.25~~ The Scheme crosses the Calder ~~and~~ & Hebble Navigation. A bypass channel from the River Calder feeds the canal 500m downstream of Calder Road crossing. The canal alignment is crossed at two locations by the railway which is constructed of embankment and bridge structures. Risk arising from the canal is limited. It is notable that at this location the railway alignment is elevated high above the flooding mechanism, with the maximum flood extent passing beneath the railway. However, the Scheme boundary in Route Section 6 is intersected by Flood Zone 2 to the east of the railway spur.



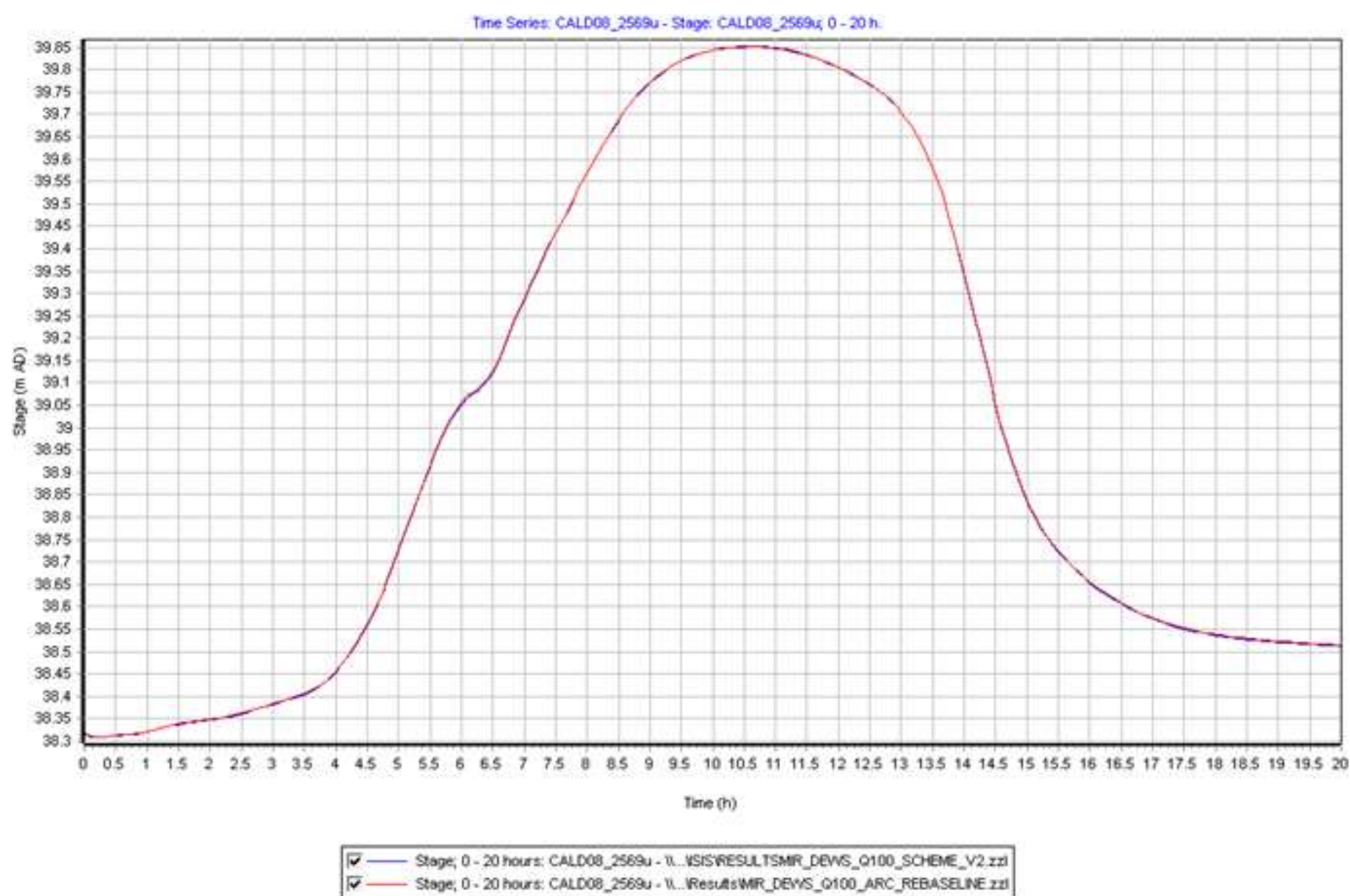


Figure 4-25 1D Model results displaying a comparison of the 1% AEP event pre and post Scheme of stage (mAOD) at the proposed crossing of the River Calder

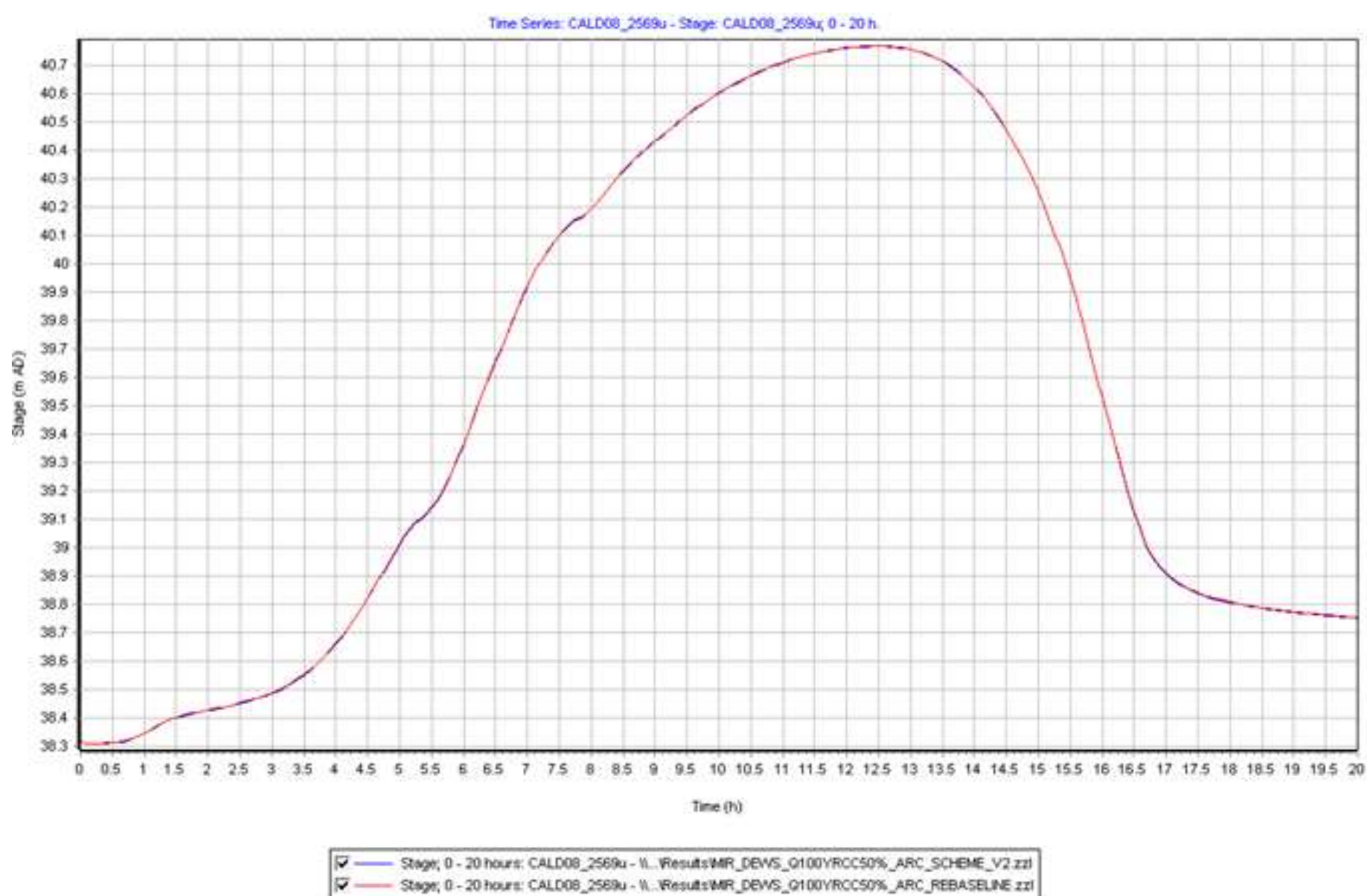


Figure 4-26 1D Model results displaying a comparison of the 1% AEP plus climate change (50%) event pre and post Scheme of stage (mAOD) at the proposed crossing of the River Calder

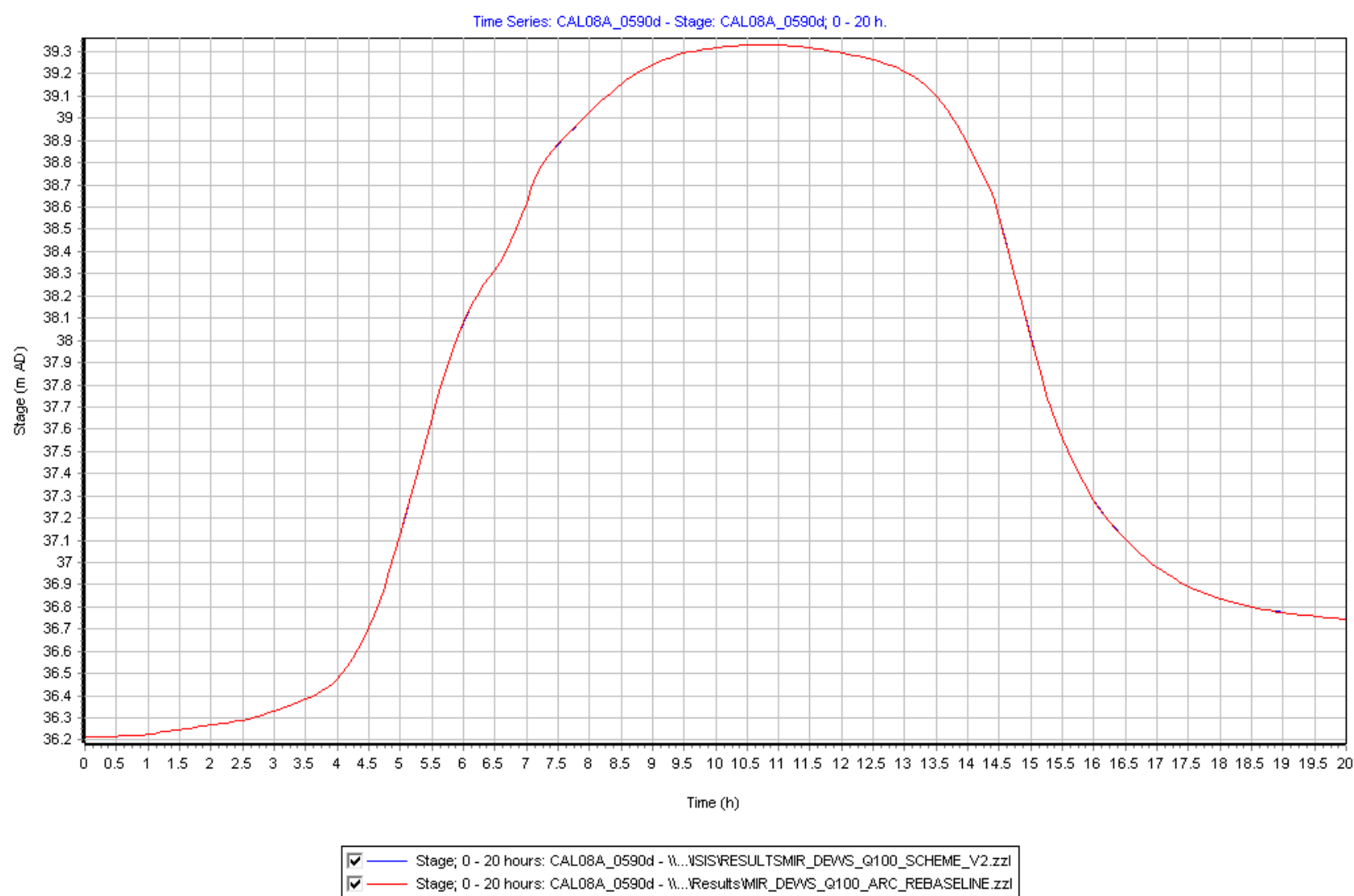


Figure 4-27 1D Model results displaying a comparison of the 1% AEP event pre- and post-Scheme of stage (mAOD) at the Dewsbury Flood Alleviation Channel

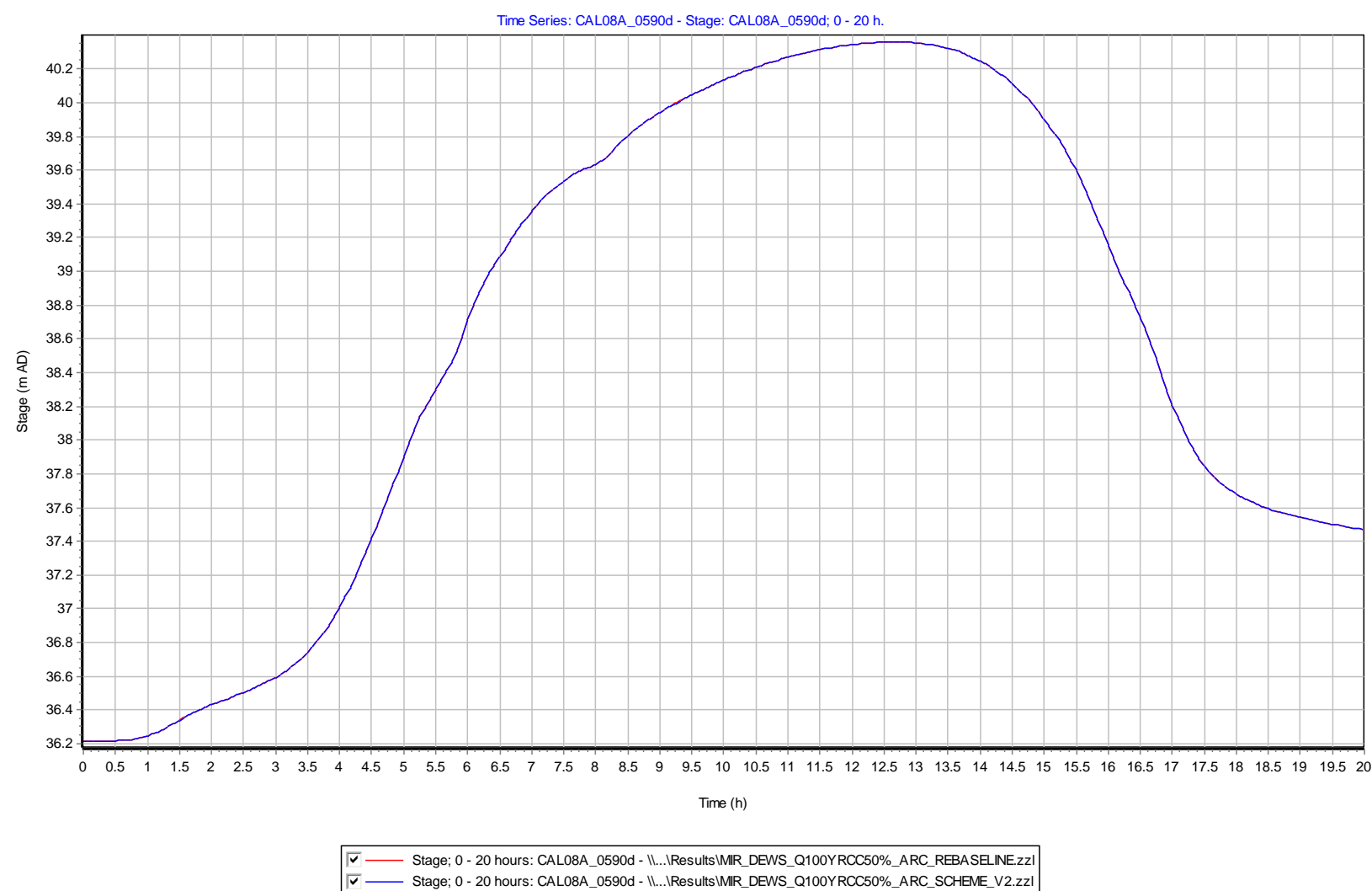


Figure 4-28 1D Model results displaying a comparison of the 1% AEP plus climate change (50%) event pre- and post-Scheme of stage (mAOD) at the Dewsbury Flood Alleviation Channel

## Ordinary Watercourses

**4.13.244.13.26** The RoFSW mapping indicates isolated areas along both sides of the Scheme, including the tracks, at risk of flooding from surface water. This risk is mainly associated with the Ordinary Watercourses that pass beneath the Scheme.

**4.13.254.13.27** The Scheme crosses the Unnamed Watercourse at Ladywood Culvert. The area on the northern side of the crossing is susceptible to surface water flooding from the 3.3% annual chance event upwards. The watercourse flows in a northerly direction through woodland before entering a structure under the railway. At this location the track is shown to be at risk according to the RoFSW mapping, with 1% annual chance event depths predicted to be below 0.3m.

**4.13.264.13.28** The Unnamed Watercourse at Long Plantation situated to the south of Ravensthorpe, in the vicinity of Ouzelwell Farm flows through the Scheme boundary. The watercourse flows in a north-easterly direction through woodland before entering culvert and discharging into the River Calder. According to the EA's RoFSW mapping, the risk of flooding is shown to be between 1% and 3.3% annual chance with flood depths ranging between >0.3m and 0.9m.

## Flooding from groundwater

**4.13.274.13.29** The majority of Route Section 6 is deemed as having medium to high risk from groundwater flooding. Risk within Route Section 6 varies between 50% and equal to or greater than a 75% risk of groundwater emergence.

## Flooding from surface water

**4.13.284.13.30** The EA's RoFSW mapping indicates the presence of surface water flood risk in the following areas of the Scheme, moving from west to east along the Scheme:

- An overland flow route is shown to cross the track in the vicinity of Weaving Lane. An area adjacent to the railway appears to be susceptible to ponding at the 3.3% annual chance event. At the 0.1% annual chance event flood flow routes are predicted to cross the track and flows via Weaving Lane, this is shown to flow overland to the junction of Thornhill Road whereby it joins another flow path before pooling near industrial and residential properties. However, it is assumed the flow path passes beneath the railway due to the alignment being embanked at this location;
- Overland flow routes are shown to impact the track in the vicinity of Ravensthorpe. Isolated flood risk is identified at the 3.3% annual chance event. At the 0.1% annual chance event flood flow routes become more prominent and link to wider overland flow paths. At this location the source of flooding does not appear to be linked to any watercourses; and
- Thornhill Quarry is located within the Scheme boundary. The RoFSW mapping indicates that flood depths at this location are up to 0.9m at the 3.3% annual chance event. This is to be expected with the ground level manipulation associated with landfill sites. From here flood flow routes are shown to cross the track, however the railway is embanked and the flow routes are expected to pass through existing underbridges.

## Flooding from other sources

**4.13.294.13.31** The Main River within Route Section 6 is the River Calder. For the majority of the watercourse there are no formal flood defences, in excess of bank heights. However, in



the vicinity of Thornhill Road, Dewsbury there is a flood wall and embankment, these flood defences do not provide a sufficient level of protection to create an ABD. Dewsbury flood relief channel alleviates elevated flood level upstream of the weir [\(this flood relief channel sits outside of the Scheme boundary\)](#).

~~4.13.304.13.32~~ The risk of flooding along Calder ~~and~~ Hebble Navigation is dependent on a number of factors. As canals are man-made systems and heavily controlled, it is unlikely they will respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with asset failure, similar to those associated with river defences, such as overtopping of canal banks.

~~4.13.314.13.33~~ The EA's RoFR map indicates that the Scheme will be at risk of reservoir failure and this is linked to the Calder and Hebble Navigation in Route Section 6.

~~4.13.324.13.34~~ The existing Thornhill Quarry contains a waterbody with unknown connections or outfalls. This waterbody is located within the footprint of the proposed embanked track alignment. It is assumed for this FRA that this waterbody is an environmental feature only with no flood risk associated to it.

## 4.14 Flood risk for Route Section 6

4.14.1 The baseline flood risk for Route Section 6 is described in preceding sections.

4.14.2 The design approach and principles adopted in relation to mitigating flood risk for both permanent and temporary works are described in Section 2 of this FRA. The Scheme elements which could potentially increase flood risk for Route Section 6 are outlined as follows, along with proposed mitigation works.

~~4.14.3~~ Elements of the Scheme constructed within an area identified as being at risk of flooding may lead to an increased risk of flooding, for example earthworks associated with Baker Viaduct Underbridge (RBA/2). EA historical flood extents have indicated that there have been flooding problems within Ravensthorpe associated with the River Calder. As a result, suitable mitigation is to be provided for works that may impact on flood risk.

~~4.14.4~~ [The viaduct works, including the crossing and its associated ground engineering works \(embankment and piers and in-channel training walls and localised ground raising works\) have all been modelled to examine the impact the scheme has on flood risk to and from the Scheme. The proposed mitigation measures have also been modelled and this modelling approach and conclusions have all been presented below. In addition, Drawing Climate Change Allowance plus Scheme description shows where all the scheme elements sit within flood zone including an allowance for climate change.](#)

### Permanent way and station works

~~4.14.34.14.5~~ The Scheme will be four-tracked from Bradley Junction up to the east of the River Calder where the railway reverts to two-tracks at Ravensthorpe East Junction.

~~4.14.44.14.6~~ There are proposed reconfiguration works at Ravensthorpe Station, where the station will be moved to the west of its current location to a new position to the west of Calder Road. The new station will include an 85m long retaining wall, with unknown depth of below ground works. On commissioning of the new station, the existing station will be demolished (including the removal of the footbridge, platforms and facilities). The existing Ravensthorpe Footbridge (MDL1/4) is to be demolished and includes the proposed removal of the structure and foundations. Depth below ground of the proposed works are unknown. [Design details are shown in NR13 Planning Drawing - Ravensthorpe Station - Proposed Footbridge Elevations.pdf \(windows.net\)](#).

**4.14.54.14.7** The fast lines are positioned to the south of the railway alignment throughout, with a vertical grade separation required at Ravensthorpe (Flyover Intersection (RBA/1)) due to the proposed track alignment conflicting with the existing Wakefield Lines.

**4.14.64.14.8** The grade separation and associated works in this area also result in a requirement for the relocation of Ravensthorpe Station platforms to the west of Calder Road. Station design is aligned with the Access for All programme, fire safety, emergency evacuation and security requirements. The existing Ravensthorpe Station Footbridge (MDL1/4) will be demolished and re-provided within the proposed station footprint. A new station approach road and forecourt area is proposed to the south of the railway.

**4.14.74.14.9** The new Flyover Intersection (RBA/1) will accommodate the grade separation. The structure will be approximately 120m long with variable width (10m–16m). A retaining wall at Ravensthorpe Junction is proposed comprising a new reinforced concrete box structure for Wakefield lines to pass beneath the railway lines. [Design details are shown in NR13 Planning Drawing - Flyover \(RBA 1\) - Proposed Elevation Cross Section.pdf \(windows.net\).](#)

**4.14.10** A new multi-span viaduct (Baker Viaduct Underbridge (RBA/2)) approximately 350m long between is proposed to carry the fast and slow lines over the Calder and Hebble Navigation Canal, River Calder flood plain and the River Calder, with associated piers and a retaining wall. [Design details are shown in NR13 Planning Drawing - Baker Viaduct Detailed Elevation \(2 of 2\).pdf \(windows.net\) and a snapshot is presented in Figure 4-29.](#)

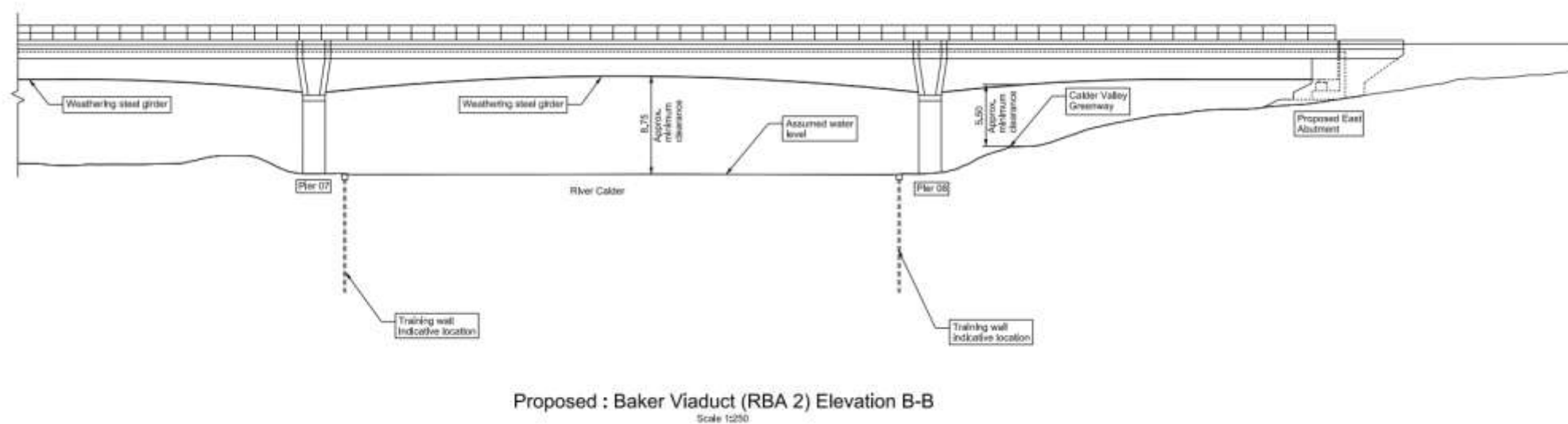


Figure 4-29 Baker Viaduct (RBA 2) Elevation over River Calder



4.14.11 The railway at this point is currently carried by the viaduct formed of the Calder & Hebble Navigation Underbridge (MDL1/6) and River Calder Underbridge (MDL1/8). These two underbridges span the Calder & Hebble Navigation and River Calder respectively between Ravensthorpe and Dewsbury. As these existing assets are unable to carry the proposed new four track arrangement due to horizontal space constraints and also from a loading perspective the railway needs to be diverted and this takes the form of the new viaduct.

4.14.12 The following options were considered to minimise impacts on the River Calder:

- Option 1 – Span over river, access track and Calder Valley Greenway (90m span), depth of beam is 6.5m;
- Option 2 – Piers outside river but within the track/Greenway (65m span), depth of beam is 4.5m; and
- Option 3 – encroachment into the edges of river (55m span), depth of beams: 3.6m.

4.14.13 The option to build piers within the river was discounted due to the potential environmental effects on aquatic ecology and impacts on the hydromorphology, water quality and flood risk of the River Calder.

4.14.14 The preferred option is Option 3 (the 55m span). It has been necessary to position piers in the banks of the River Calder due to the span width across the river. (Further details are provided in the Scheme Description (Chapter 2 of this ES (Vol 2i)) and Consideration of Alternatives (Chapter 3 of this ES)).

4.14.15 The area of land in between the canal and river comprises a strip of vegetation (which includes the Spen Valley Greenway) and a large area of disturbed ground. This will result in the requirement for permanent land take within an authorised landfill).

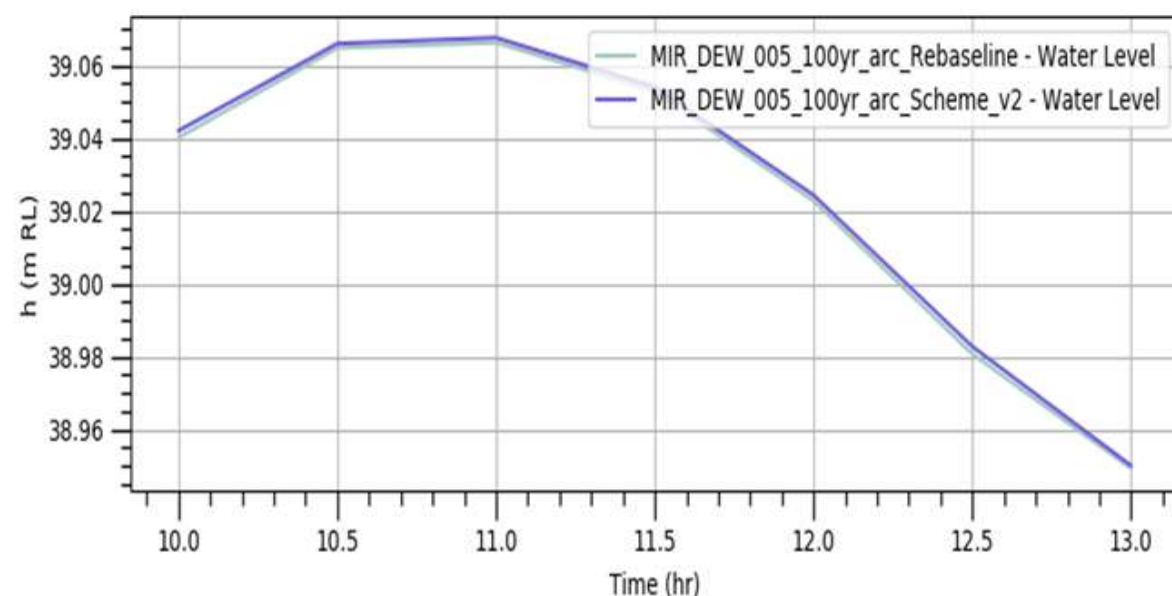
4.14.16 The Scheme modelling has been undertaken using data contained within the design drawings. Earthworks associated with the Scheme have resulted in a change in schematisation of the river network; this includes representation of:

- -in-channel training walls. The training walls have been represented in within the 1D flood modeller model to enable any impact of the channel constriction to be quantified.
- Piers placed in the floodplain. The piers have been represented within the Tuflow 2D domain as a FCSH line which models a constriction with an associated constriction percentage, this constriction is calculated based on an area relationship between the dimensions of the piers and the resolution of the ground model. and
- A new embankment, the footprint (including traction feeder station) of which has been modelled as a 'glass wall' - as features included on the footprint are critical and require lifting out of the flood plain.

4.14.84.14.17 The Scheme elements have been examined to assess the possible interruption to the development of the flood flow routes and any resultant change in flood prevalence.

4.14.94.14.18 The proposed footprint of the embanked track alignment sits within Flood Zone 2 whilst the piers sit within Flood Zone 3b.

4.14.19 The modelling suggests there is no increase in in-channel peak water level (39.85m AOD) at the 1% AEP design flood event in the vicinity of the Scheme (floodplain). In addition, there is a negligible change (<10mm) of peak water level within the adjacent flood storage area. Furthermore, this does not increase risk to others i.e. does not result in additional flood risk areas elsewhere.



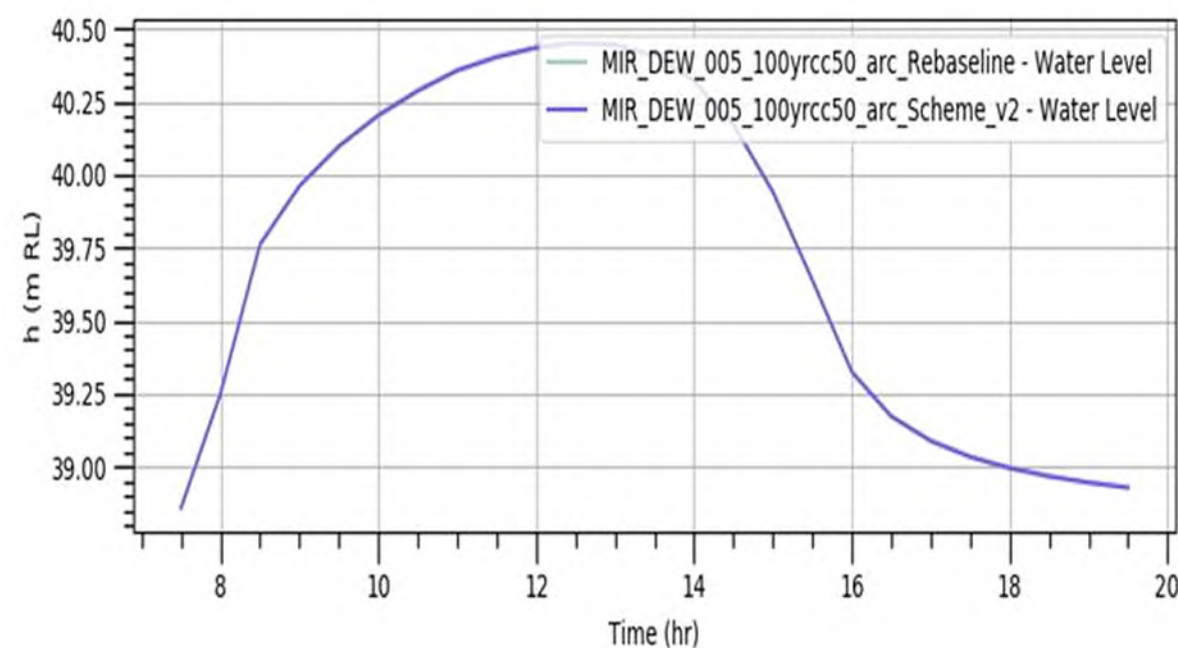
**Figure 4-30 Peak water level within the flood storage area for the 1% annual chance event, (Location is noted by A on Figure 4-24)**

4.14.104.14.20 Figure 4-30 displays that the Scheme does not impact peak water level during the 1% annual chance event, however there is a localised nominal change in depth around the piers estimated to be approximately <10mm.

4.14.21 The maximum flood level in the 1% AEP, including an upper end (50%) allowance for the potential effects of climate change, is 40.77m AOD at the location of the proposed River Calder crossing. The Baker Viaduct Underbridge (RBA/2) crossing of the River Calder is required to be set sufficiently high enough as not to create an obstruction during times of flood flow. The modelling indicates that the freeboard to the proposed Viaduct crossing is approximately 6.19m (soffit level 47.05m AOD) at the at the 1% annual chance event including an allowance for climate change (50%).

4.14.114.14.22 A sensitivity check has been undertaken on the H++ climate change scenario of 65% and the railway crossing of the River Calder continues to stay flood free and operational under this scenario.

4.14.124.14.23 The modelling results show that the Scheme does not impact peak water level during the 1% annual chance event including climate change allowance, however there is a localised nominal change in depth around the piers estimated to be approximately 20mm.



**Figure 4-31 Peak water level within the flood storage area for the 1% annual chance event including climate change allowance (50%) (Location is noted by B on Figure 4-24)**

4.14.24 Figure 4-32 and Figure 4-33 shows the difference in flood risk across the wider Calder area within Route Section 6 and it shows that the change in flood risk area is confined to the areas of works at the flood compensation area. This is where we see a depth difference between baseline and scheme design with mitigation. There is a small area of depth difference shown at the location of the training walls on the River Calder but this is a modelling difference in the interface of the 1D/2D scheme model and not a relative change associated with the scheme.



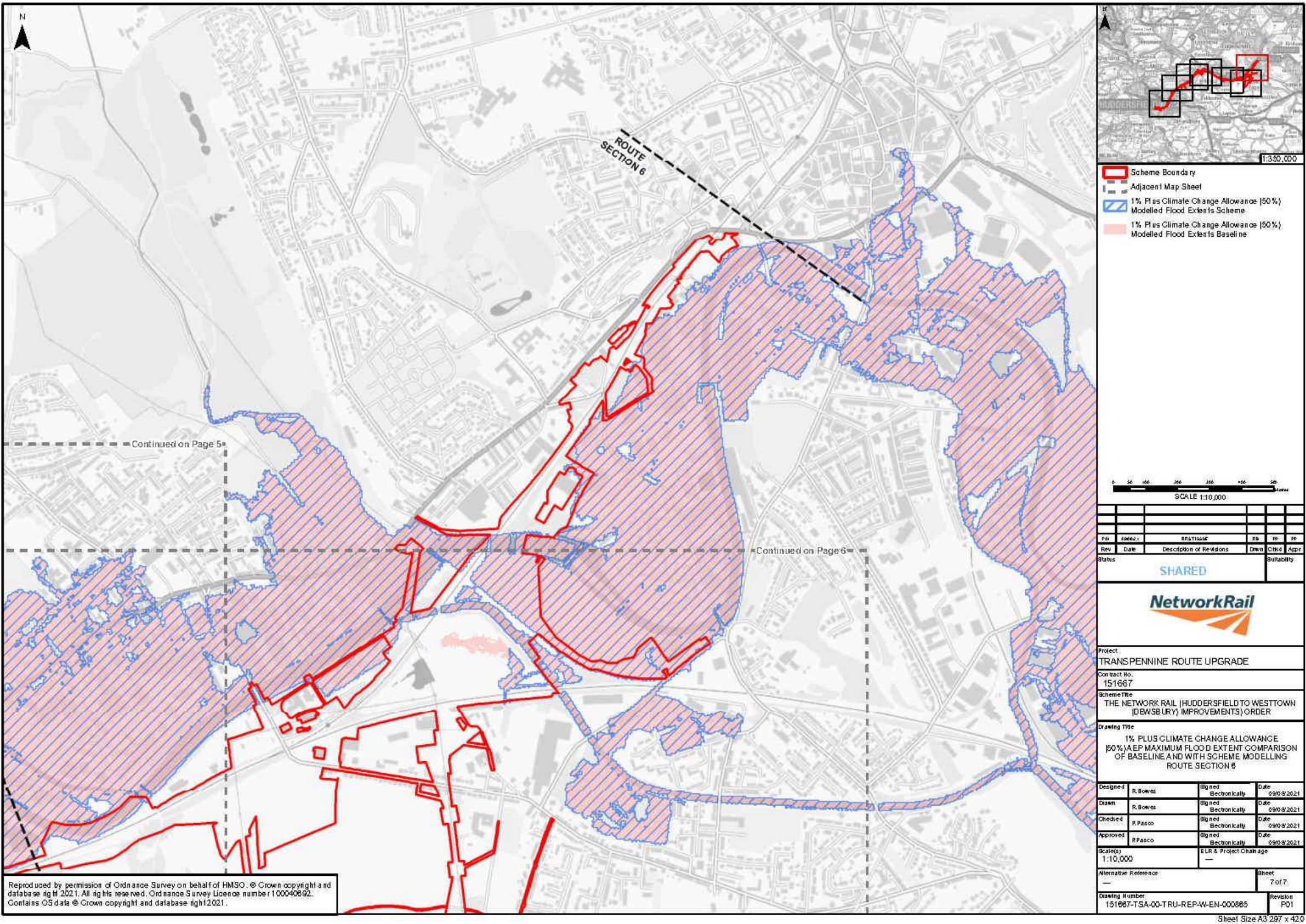


Figure 4-32 Proposed Scheme elements overlaying pre-Scheme model results (red) and post-Scheme model results (blue hatch) for the 1% AEP plus climate change (50%) event



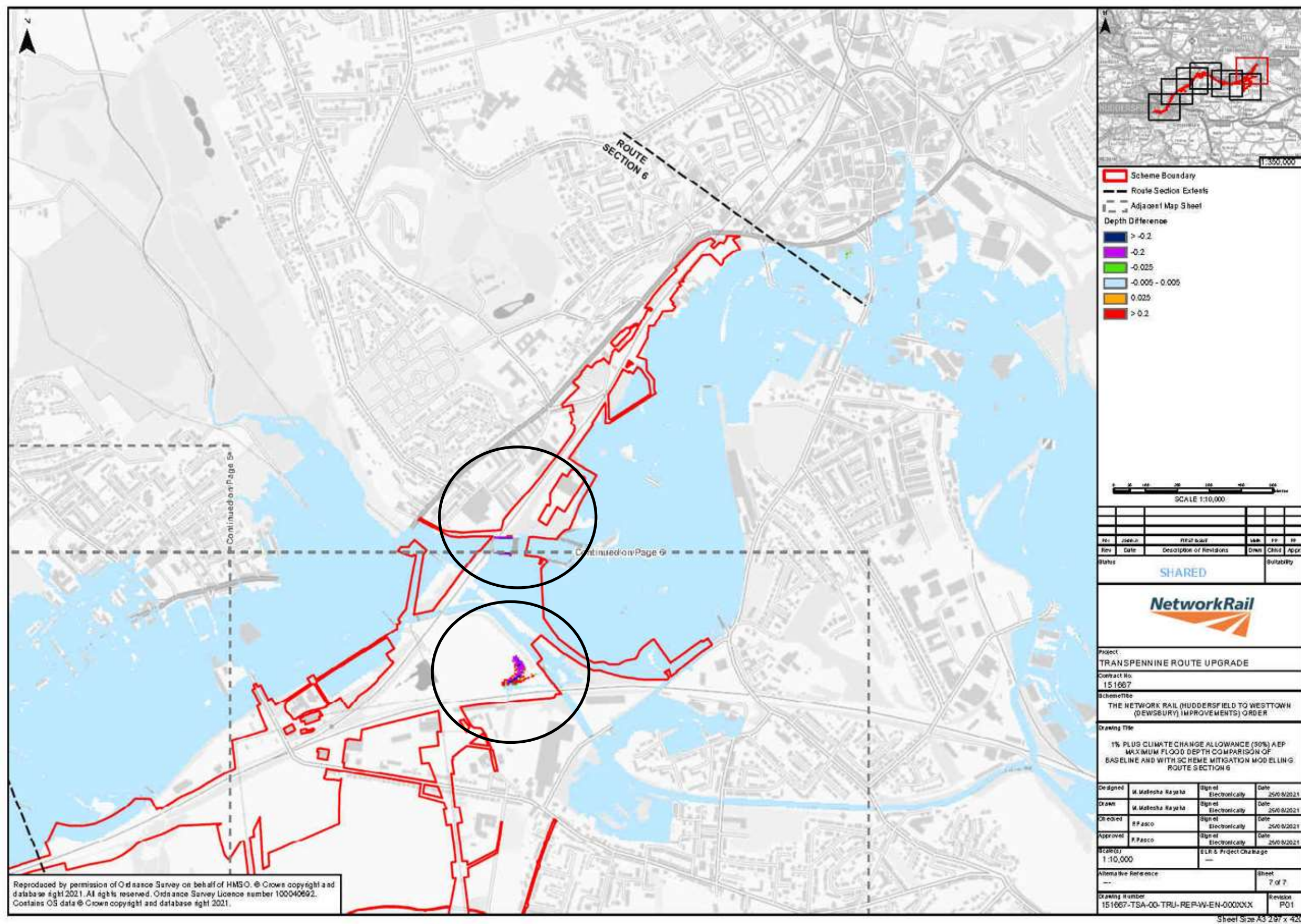
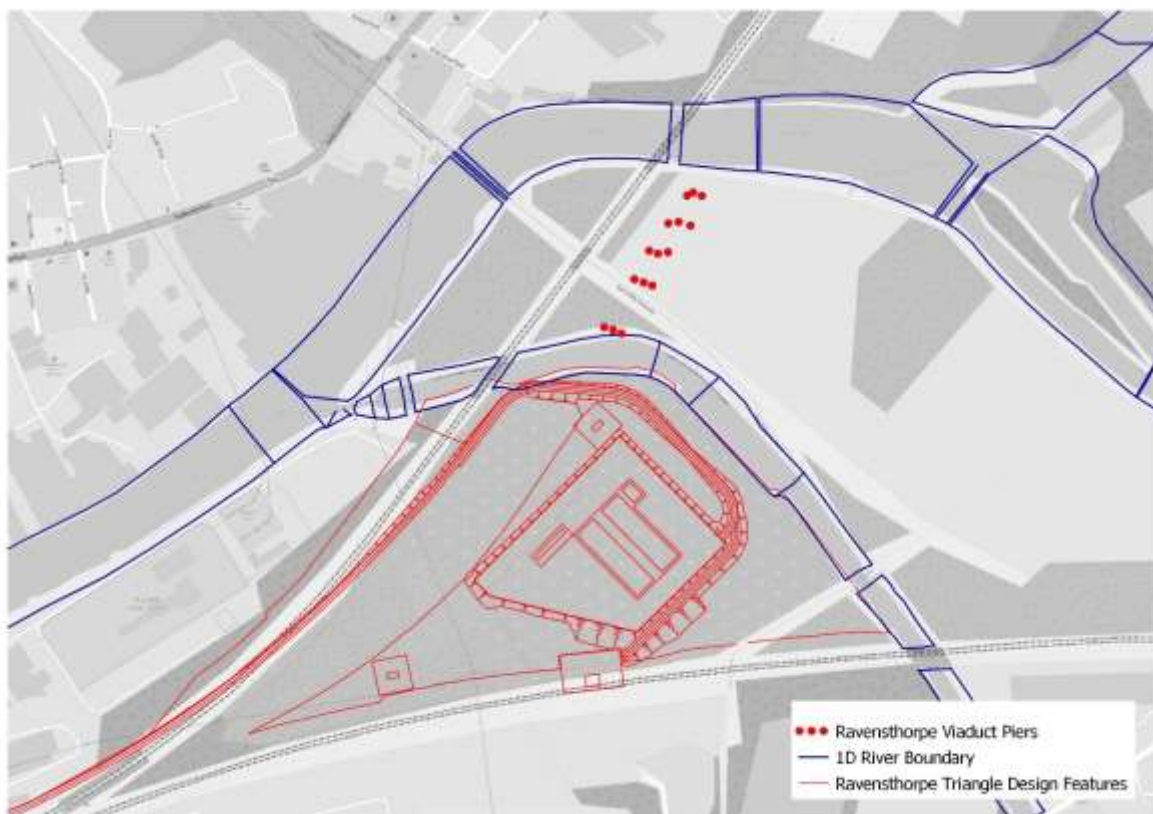


Figure 4-33 Depth difference map showing Proposed Scheme elements overlaying pre-Scheme model results for the 1% AEP plus climate change (50%) event





**Figure 4-34 Proposed Ravensthorpe Viaduct crossing Scheme elements**

4.14.25 The earthworks at Thornhill Quarry include a major new embankment, and footprint of the raised ground levels associated with the Power Supply Unit (PSU). The modelling indicates that Scheme sits on the maximum flood envelope at the 1% annual chance event including an allowance for climate change (50%) as shown in Figure 4-35.

4.14.134.14.26 Any loss of flood volume will require replacing on a level for level and volume for volume basis. The model indicates an average depth of lost floodplain is estimated to be 80mm across an area an area of around 8,130m<sup>2</sup>. shown blue in figure 4-35. This would require a compensatory flood storage replacement of approximately 700m<sup>3</sup>. As shown in Figure 4-35 this can be incorporated into the Ravensthorpe Triangle ground works in the form of 'reduced ground levels' in the vicinity of the proposed works in an area that sits outside of the 1% annual chance event plus climate change allowance (50%) maximum extent.

4.14.27 To calculate the required ground cut for the required flood storage area the ground elevations in the area show on Figure 4-34 have been lowered (brown polygon). To achieve the required compensatory flood storage area would floodbe approximately 2,200m<sup>2</sup> in area and involve 2,500m<sup>3</sup> of cut activity. The ground invert of this would be approximately 36.2m AOD and would provide sufficient storage as to reduce post Scheme peak flood level to that of baseline conditions as seen in Figures 4-36 and 4-37.

4.14.144.14.28 Figure 4-36 is the 1% AEP flood level pre and post scheme with flood storage mitigation at location C shown in **Error! Reference source not found.** 4-35 below. Figure 4-37 shows the 1% AEP flood level pre and post scheme with flood storage mitigation at location D-D on Figure 4-35 below. As can be seen, the peak flood levels are the same post scheme with mitigation against the baseline conditions.

**4.14.29** In the baseline, this area drains towards the flooded area that is now displaced by the scheme footprint where is ponds and does not drain from the site as can be seen in [Figure 4-38](#). This is the reason for the differing shapes in hydrographs as can be seen in the area proposed for the flood compensation area. It is not the case that the area now does not drain due to the proposed compensation area. It is the case that the ponding flood waters now pond in the compensation area rather than ponding in the area the is now displaced by the scheme (Figure 4-39 )



**Figure 4-35** Proposed Scheme elements overlaying pre-Scheme 100 year plus climate change model results (Blue) with required area for Compensatory Flood Storage delineated (Brown) (A and B indicate the location of model results displayed in Figures 4-25 and 4-26) C and D indicate the location of model results displayed in Figures 4-36 and 4-37)



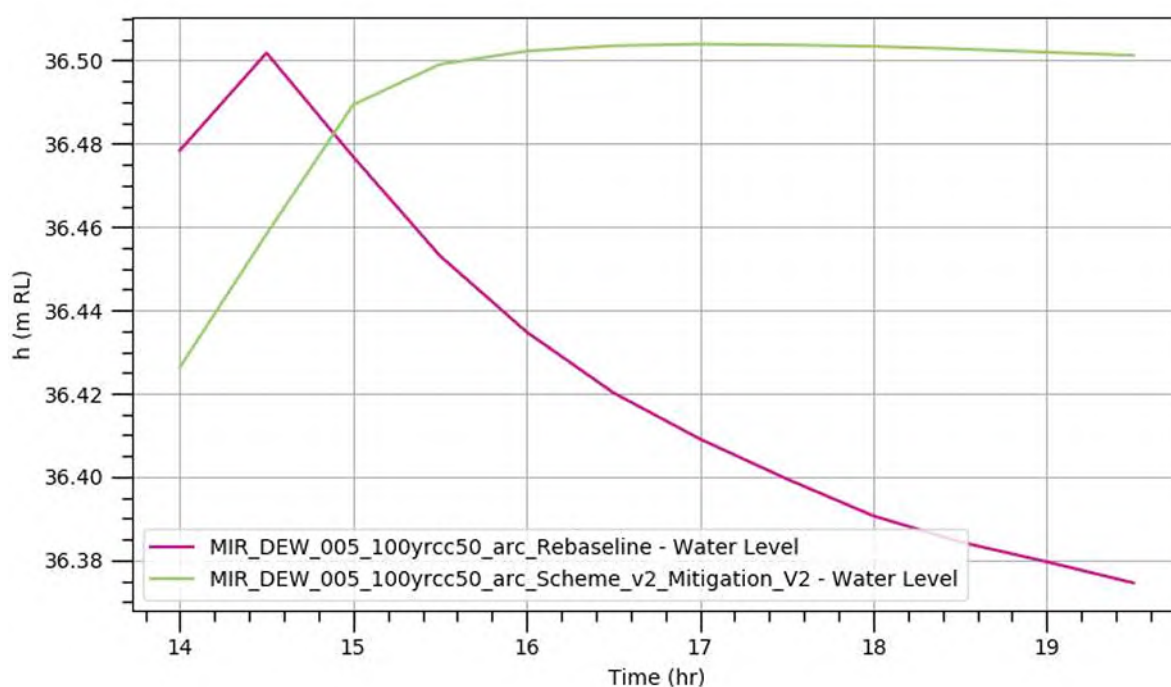


Figure 4-36 Peak water level for baseline and mitigation- (compensatory flood storage area) for the 1% annual chance event including climate change allowance (50%) at Location **CA** (see Figure 4-35 for reference)

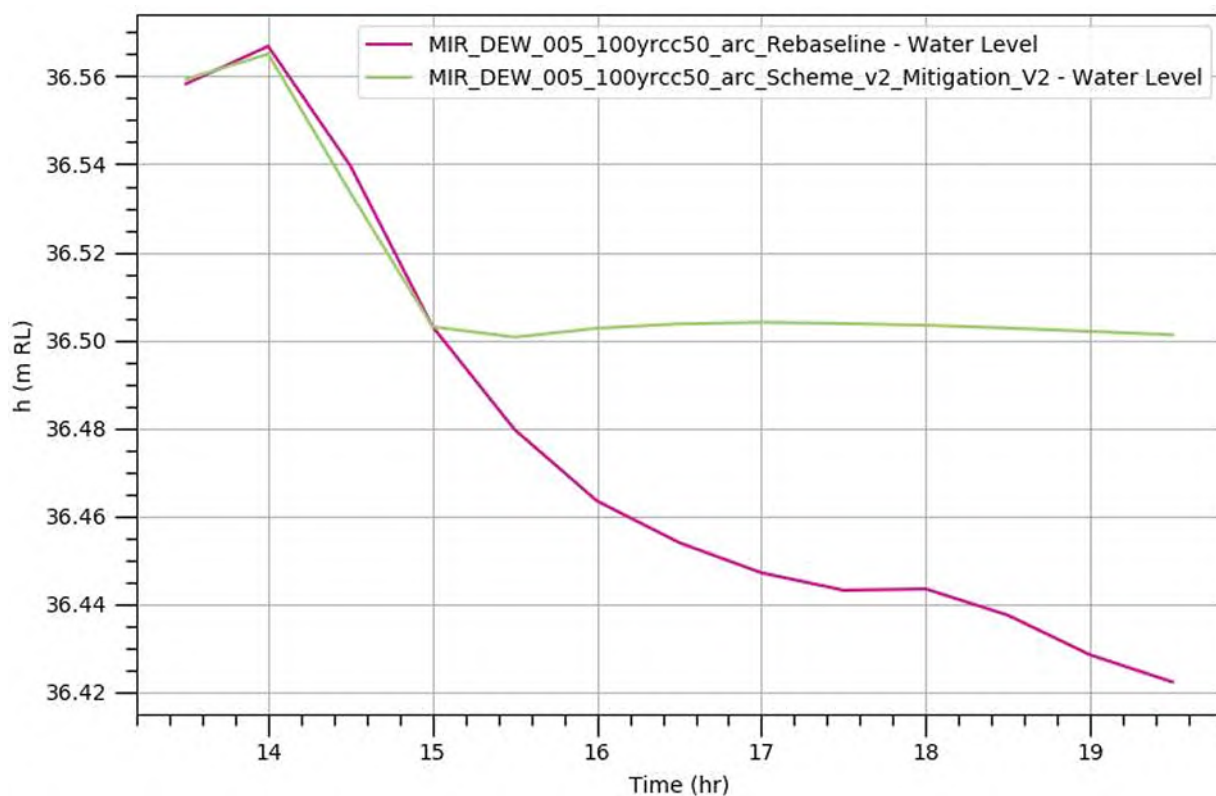


Figure 4-37 Peak water level for baseline and mitigation (compensatory flood storage area) for the 1% annual chance event including climate change allowance (50%) at Location **BD** (see Figure 4-24-35 for reference)

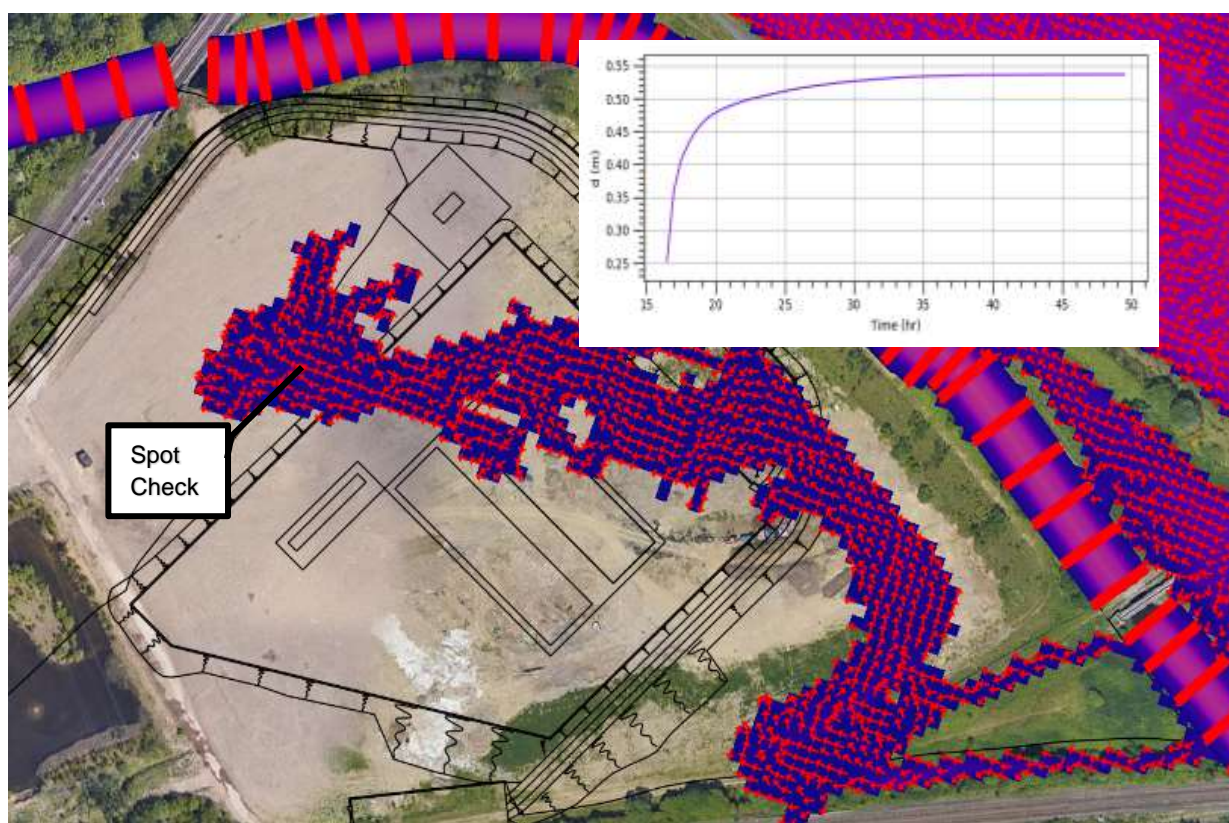


Figure 4-38 Baseline Flood Flow Routes showing ponding water at 1% AEP + CC

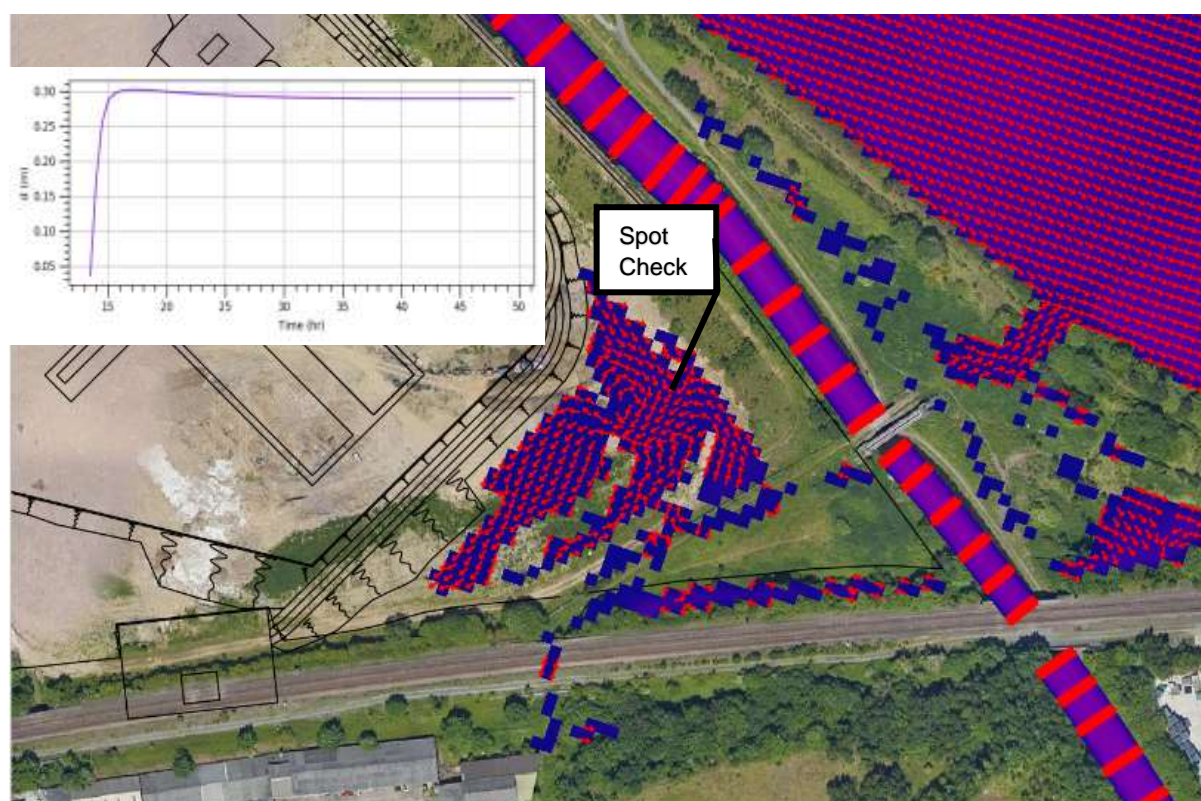


Figure 4-39 Baseline Flood Flow Routes showing ponding water at 1% AEP + CC



## Structures

**4.14.154.14.30** Six locations in Route Section 6 have been identified where remedial works are required to structures, or new bridge structures are to replace existing overbridges:

- Calder Road Overbridge (MVN2/202) is to be demolished and replaced. Proposed works will include the removal of abutments, a contiguous pile wall for the southern abutment, excavation of embankment for construction of central pier, a 70m long retaining wall along the western edge of the road to the north and a 7m high wingwall to the northern bridge abutment. [Design details are shown in NR13 Planning Drawing - Calder Road Bridge \(MVN2-202\) - Bridge Alignment- Elevation.pdf \(windows.net\)](#);
- Lees Hall Farm Underbridge (MVN2/204) is proposed to be infilled and the embankment either side of the structure is to be widened and built up to the infilled structure. [Design details are shown in NR13 Planning Drawing - Lees Hall Farm Existing and Proposed Section.pdf \(windows.net\)](#);
- B6117 Fall Lane, Thornhill Road Underbridge (MDL1/9) includes the proposed new single span underbridge with reinforced concrete abutments to the existing underbridge. The new abutments are proposed to match the existing span and skew. Abutment spread footing foundation is preferred to a piled solution, however the shape of the footing would need to be modified to accommodate the existing northwest wingwall and foundations. [Design details are shown in NR13 Planning Drawing - B6117 Fall Lane, Thornhill Road \(MDL1-9\) - Cross Section.pdf \(windows.net\)](#);
- Occupation Underbridge (MDL1/10) requires modifications (track slew) to achieve increased line speeds. Proposed works in infilling of the structure, with a fill volume of 156m<sup>3</sup>. A new masonry cladded blockwork retaining wall is to be constructed and a new embankment is proposed to the north. [Design details are shown in NR13 Planning Drawing - Occupation Underbridge \(MDL 1-10\) - North Elevation.pdf \(windows.net\)](#) and [NR13 Planning Drawing - Occupation Underbridge \(MDL 1-10\) - South Elevation.pdf \(windows.net\)](#); and
- Toad Holes Underbridge (MDL1/12) and Ming Hill Underbridge (MDL1/14) will require demolition of existing partial infill which is to be replaced with total infill using foam concrete. [Design details are shown in NR13 Planning Drawing - Toad Holes Underbridge \(MDL 1-12\) - Existing and Proposed Sections.pdf \(windows.net\)](#).

**4.14.164.14.31** The removal of the existing Ravensthorpe Footbridge (MDL1/4) and associated foundations may impact groundwater flow paths.

**4.14.174.14.32** The Scheme-wide drainage strategy has a full description of where proposed works to structures requires remediation of drainage and is included in Appendix A of this FRA.

## Compounds

**4.14.184.14.33** Temporary construction activities may also increase flood risk within Route Section 6. Construction compounds are expected to be in situ for up to four years. These have been located outside of floodplain areas where possible.

**4.14.194.14.34** There are six planned construction compounds within Route Section 6:

- Ravensthorpe Area;
- Ravensthorpe Triangle (Thornhill Quarry);
- Thornhill Road;
- Occupation Underbridge;



- Toad Holes Underbridge; and
- Ming Hill Underbridge.

**4.14.204.14.35** The Thornhill Road, Occupation Underbridge, Toad Holes Underbridge and Ming Hill Underbridge construction compounds are not adjacent to any watercourses within Route Section 6. The Ravensthorpe Area/Ravensthorpe Triangle construction compounds (and associated access routes) are located directly adjacent to the Calder and Hebble Navigation and the River Calder. Additionally, two temporary bailey bridges (each around 30m span and running parallel to each other), are proposed across the Calder and Hebble Navigation in order to allow access to the Ravensthorpe construction compounds. The bailey bridges are expected to be in place for the duration of the construction period (approximately four years). No in-channel works will be required to install the bridge and no in-channel structures will be required during its operation.

**4.14.36** For all compounds, the potential increase in runoff as a result of increase in hardstanding areas will be managed through a surface water management plan, which may require approval from the EA or LLFA.

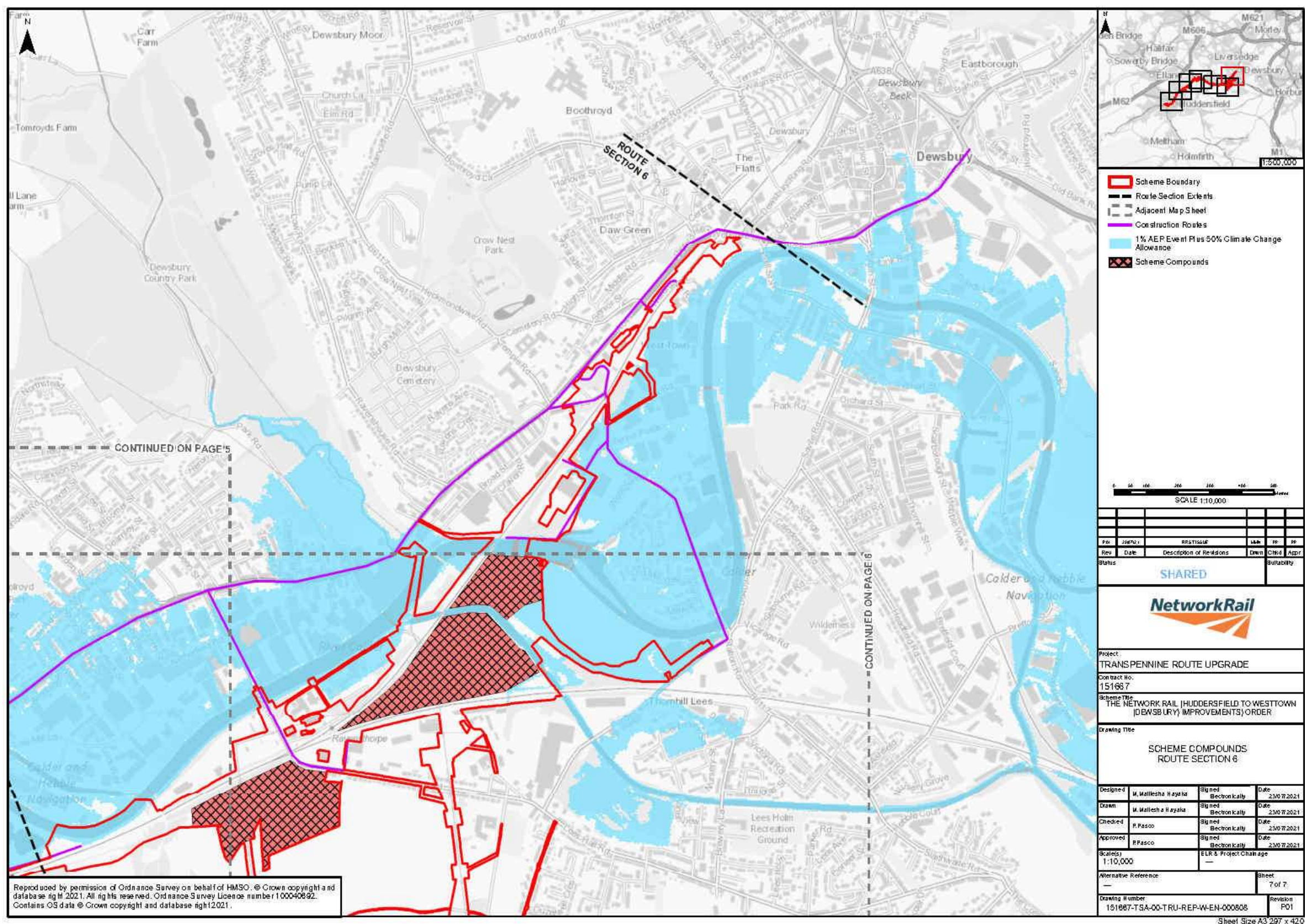


Figure 4-40 Route Section 6 compound locations in relation to flood zones



## Drainage

- 4.14.214.14.37** The proposed Baker Viaduct Underbridge (RBA/2) will result in a permanent viaduct across the Calder and Hebble Navigation, River Calder and the Calder floodplain. Permanent in-channel river training walls in the River Calder are proposed, in addition to an embankment across the floodplain.
- 4.14.224.14.38** The provision of the new fast lines overbridge will lower tracks locally and create embankments which will require drainage.
- 4.14.234.14.39** Discharge of storm water drainage from track and land drainage systems is proposed through a series of infiltration (soakaway) systems, to replicate the existing site storm water drainage principle.
- 4.14.244.14.40** A new drainage system is required for the relocated Ravensthorpe Station. A significant area of pavement currently discharges unattenuated. It is proposed to discharge storm water from the proposed new station platforms to the existing Ravensthorpe Station Outfall. The proposed increase in paved area including that of new platforms will result in increased surface water runoff which will be managed and detailed in the Scheme-wide drainage strategy in Appendix A.
- 4.14.254.14.41** Existing piped drainage outfall for both railway track drainage and (unattenuated) storm water runoff from the station access road discharging to downstream third party piped drainage system.
- 4.14.264.14.42** The proposed new platforms at Ravensthorpe Station are to be drained by gravity into Ladywood Culverts (MVN2/200C and MVN2/199B), which discharge into the River Calder.
- 4.14.274.14.43** Highway drainage in the locality of the proposed Ravensthorpe Station will require attenuation and a new connection into existing sewer in Calder Road.
- 4.14.284.14.44** A new storm water outfall is required for railway infrastructure within the triangle of land that comprises the Thornhill Quarry site to the east of the existing Ravensthorpe Station. The area is bounded on two sides by railway lines, with the Calder and Hebble Navigation on the third. The current site drains by infiltration, with excess storm flows flowing to the canal and on to the river. The proposed drainage outfall will replicate these with the use of storm water attenuation structures and infiltration basins. Permeable paving will be used as much as possible to minimise concentrated flows. This arrangement is described in more detail in the Scheme-wide drainage strategy in Appendix A.

## Earthworks/retaining walls

- 4.14.294.14.45** Several retaining walls are proposed within Route Section 6 at the proposed locations as follows:
- Ravensthorpe Station – proposed replacement of existing soil/ rock cutting with wall to support new station car park, the 85m wall is to be embedded;
  - Flyover Intersection (RBA/1) – two proposed walls at toe of new fast line embankment, gravity wall type, both of length 100m;
  - Ravensthorpe Junction – proposed wall at toe of new fast line embankment, gravity wall type;
  - Kirklees Waste Recycling Centre – proposed new retaining wall, gravity type;
  - New wall near Weaving Lane – existing soil embankment to be replaced with wall at



base of the new slope. Gravity wall, length 120m, height 9m; and

- King post wall at top of embankment – proposed replacement of existing soil embankment with ballast retention wall. The wall is to be embedded.

4.14.304.14.46 Several areas of earthworks are proposed within Route Section 6 at the following locations. All slope angles are 1 in 2.

- Before Hunger Hill Overbridge (MVN2/201) – the existing rock cutting is to be widened with a proposed earthworks length of 340m;
- Approach to Ravensthorpe Station – the existing rock cutting is to be widened with a proposed earthworks length of 310m. There is significant risk from historic mining in this area;
- Adjacent to Calder Road – the existing rock cutting is to be widened with a proposed earthworks length of 85m;
- Between Calder Road and new interaction structure – a new embankment is proposed on approach to new intersection, with an earthwork length of 120m;
- Existing Ravensthorpe Station – a new embankment is proposed with an earthwork length of 150m;
- Thornhill Quarry – a major new embankment within the former landfill is proposed, with an earthwork length of 390m. Proposed volumes are based on existing ground levels assuming landfill has been re-instated in accordance with the planning drawing. Ground improvement expected to be required over former landfill (anticipated to be driven piles);
- Behind Armley Chairworks and Shackletons – the existing embankment is to be widened, with a proposed earthwork length of 120m;
- East of Thornhill Road – the existing soil embankment is to be widened with a proposed earthwork length of 260m; and
- Wakefield Lines – the existing soil embankment is to be widened with a proposed earthwork length of 480m.

4.14.314.14.47 The hydraulic modelling indicates that the proposed embankment at Thornhill Quarry sits on the maximum flood envelope at the 1% annual chance event including an allowance for climate change (50%). This requires a compensatory flood storage replacement of approximately 700m<sup>3</sup> located within the Ravensthorpe Triangle.

4.14.324.14.48 To achieve the requirements of the EA with regards to the compensatory flood storage an area approximately 2,200m<sup>2</sup> has been delineated requiring approximately 2,500m<sup>3</sup> of cut activity to reduce peak flood level during the 100 year plus climate change allowance to pre-Scheme levels.

4.14.334.14.49 Construction activities for the retaining wall and earthworks may act as a barrier to groundwater and may affect local groundwater levels and thus groundwater flooding. Permanent presence of sub surface structure associated with retaining wall and earthworks may act as a barrier to groundwater and may affect local groundwater levels and thus emergence of groundwater flooding.

4.14.344.14.50 Drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface pathways and development of new ones.

## Utilities

~~4.14.354.14.51~~ Northern Powergrid 132kV overhead power lines (OHP) are present in the Ravensthorpe area crossing the railway at four locations, twice across the MVN railway line and twice across the MDL line. Numerous OHP towers to the west of Calder Road and in the area of Thornhill Quarry are to be dismantled and diverted. Two sections are proposed to be diverted underground.

4.14.364.14.52 An underground diversion section commences within the Thornhill Power Station site, crosses under the MDL railway line, across Thornhill Quarry, under the MVN railway line and terminates at a terminal tower north of Ravensthorpe Road. A second underground diversion section commences south of Ravensthorpe Road, to the west of Ouzelwell Lane, then routes along Back Lane, connecting into the existing OHP to the west at Long Plantation.

4.14.374.14.53 Where works risk displacement of the Unnamed Watercourse at Long Plantation, flows may be required to be pumped over works to maintain downstream flow during construction. Cables to be at sufficient depth not to impact the culverted section of the watercourse during operation.

## Mitigation summary

4.14.384.14.54 In addition to the generic mitigation measures set out in paragraphs 4.1.198 to 4.1.223 the mitigation measures to be adopted in Route Section 6 are presented in Table 4-13.

**Table 4-13 Summary of impacts and proposed mitigation measures in Route Section 6**

Description of works	Watercourse affected	Impacts of works	Mitigation measure
Possible new outfall location associated with station drainage	Unnamed Watercourse at Ladywood Road Culvert	Potential increase in runoff	<ul style="list-style-type: none"> <li>The Scheme-wide drainage strategy will be adhered to in order to manage any increase in runoff.</li> </ul>
Increase in runoff due to new track alignment and filter drain at toe of embankment (Earthworks at Thornhill Quarry) Increase in hardstanding from new road and proposed Ravensthorpe Station. New Ravensthorpe viaduct crossing.	Calder and Hebble Navigation	Potential increase in runoff	
Excavation and laying of underground power cables along Ouzelwell Lane	Unnamed Watercourse at Long Plantation	Displacement of waterbody	<ul style="list-style-type: none"> <li>The EDP (Land Contamination and Hydrogeology) under Part B of the CoCP will ensure that cables are located at sufficient depth not to impact the culverted section of the watercourse during operation.</li> </ul>

Description of works	Watercourse affected	Impacts of works	Mitigation measure
New Baker Viaduct (RBA/2) crossing Change in floodplain functionality and capacity resulting from construction of piled embankment associated with new track alignment	River Calder and associated flood plain	Potential loss of floodplain, change in channel flow conveyance and floodplain conveyance Increase in surface water runoff	<ul style="list-style-type: none"> <li>Where flood plain is lost, compensatory flood storage shall be provided on a volume for volume and level for level basis, as shown in Figure 4-<a href="#">3124</a>.</li> </ul>
Piling activity and retaining walls and sub surface engineering	Aire & Calder Carb. Limestone/ Millstone Grit/ Coal Measures WFD groundwater body	Potential increase in runoff due to groundwater surface flows developing	<ul style="list-style-type: none"> <li>A hydrogeological risk assessment will be carried out to following site-specific ground investigation to allow temporary drainage systems to be designed to accommodate groundwater derived flow as well as surface runoff and alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways and development of new ones. Details will be included in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP.</li> </ul>

### Residual flood risk

[4.14.394.14.55](#) The impact of the Scheme on fluvial flood risk is predominantly associated with earthworks encroaching into floodplain areas. This will be mitigated through the provision of a compensatory flood storage area.

[4.14.56](#) There will always be a residual flood risk above and beyond the standard of protection for which the proposed mitigation is designed.

### Flood Risk Conclusion –Route Section 6

[4.14.57](#) There are several elements of the Scheme that impact flood risk locally. This has been demonstrated through river modelling to show that the change in flood risk associated with the Scheme is confined to the floodplain (See Figure 4-30 showing change in localised flood envelope). Figures 4-23 to 4-26 shows the scheme does not change in-channel water levels (including an allowance for climate change) on the River Calder in the vicinity of the Calder viaduct crossing and at the location of the Dewsbury Flood Alleviation Channel. Figures 4-32 to 4-394 show the location of the proposed compensatory flood storage area and the effect this has on water levels keeping the same flood risk-risk level, including an allowance for climate change, the same as baseline flood levels. Drawing Climate Change Allowance plus



Scheme description shows the location of the Scheme elements and the proximity of the flood zone including an allowance for climate change.

## 5. CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

- 5.1.1 The Scheme comprises works proposed along approximately 14km of the existing railway corridor between Huddersfield and Westtown (Dewsbury). The works will predominantly comprise new track along existing track footprint, culvert extensions, new track in cutting, bridge strengthening and new viaduct crossing across the River Calder.
- 5.1.2 Temporary works will comprise construction compounds and access tracks and a bailey bridge crossing of the Calder & Hebble Navigation.
- 5.1.3 Assessment of existing flood risk information has indicated that the Scheme passes through locations identified as being at risk of flooding from various sources. In accordance with local and national planning policy, this FRA has been undertaken to identify flood risk to the Scheme and the impact of the Scheme on flood risk elsewhere, within these locations.
- 5.1.4 Flood risk to the Scheme is generally considered to be low during construction and operation, the most significant sources are fluvial and surface water flooding. The Scheme is defined as “Essential Infrastructure” and parts of the Scheme lie in Flood Zones 2 and 3 but are considered to be an acceptable development within these flood zones.
- 5.1.5 The EA and LLFA have been consulted to identify key requirements and data.
- 5.1.6 Allowances for climate change have been incorporated in accordance with the latest guidance.
- 5.1.7 The impact of the Scheme on fluvial flood risk will predominantly be associated with earthworks encroaching into floodplain areas, specifically in Route Section 6.
- 5.1.8 The Scheme appears not to significantly impact peak water level during the 1% annual chance event including climate change allowance in the vicinity of the proposed earthworks in the Ravensthorpe Triangle.
- 5.1.9 Any loss of flood volume will require replacing on a volume for volume and level for level basis. The average depth of lost floodplain is estimated to be 80mm across an area of around 8,130m<sup>2</sup>. This would require a compensatory flood storage replacement of approximately 700m<sup>3</sup> which is delineated in Figure 4-[3124](#).
- 5.1.10 To achieve the requirements of the EA with regards to the compensatory flood storage an area approximately 2,200m<sup>2</sup> has been delineated requiring approximately 2500m<sup>3</sup> of cut activity to reduce peak flood level during the 100 year plus climate change allowance to pre Scheme levels.
- 5.1.11 Surface water flood risk to the Scheme will predominantly be associated with sections of track in cutting. The proposed surface water drainage measures will mitigate flood risks elsewhere associated with the Scheme.

### 5.2 Recommendations

- 5.2.1 As further information becomes available (for example culvert extensions, detailed drainage strategy, embankment footprints, training walls, pier footprints affected by the Scheme), the FRA will be used to assess the detailed design of the Scheme.
- 5.2.2 Under the TWAO the EA retains protected provisions powers. Detailed designs for relevant

works will be submitted to the EA and LLFA where specific areas of risk are identified, including the impact of the Scheme on existing culverts, Ordinary Watercourses and Main Rivers. The proposed mitigation measures will continue to ensure potential opportunities to manage flood risk is explored through this detailed design stage.



## **APPENDIX A – SCHEME-WIDE DRAINAGE STRATEGY**

# Infrastructure Projects

## Northern Programmes



## Transpennine Route Upgrade

Drainage Strategy

Work Package W3

Huddersfield to Westtown (Dewsbury)

Reference No: 151667-TSA-00-TRU-REP-W-DR-270276

Issue Date: 16/10/2020

Version: P01



Huddersfield to Westtown (Dewsbury) - Drainage Strategy  
 Project W3

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Project W3

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Huddersfield to Westtown (Dewsbury) - Drainage Strategy  
Project W3

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Project W3

## Huddersfield to Westtown (Dewsbury) - Drainage Strategy

### Project W3

## 1. INTRODUCTION

### 1.1 Transpennine Route Upgrade

Network Rail has commissioned the Transpire Alliance to design and deliver the West of Leeds section of the Transpennine Route Upgrade (TRU).

Project W3 is a major intervention to provide greater capacity, higher resilience and journey time benefits to TRU. These are achieved predominantly by four-tracking, introducing a grade separated junction, remodelling stations, electrification, a new signalling system and line speed increases.

### 1.2 Purpose of this Report

This document gives the overall drainage strategy for the proposed W3 project. This particularly concentrates on the impact the drainage will have on the receiving watercourse and sewers. It also addresses how the sustainability aspects of the drainage system have been developed.

At time of writing limited dialogue has been held with the Lead Local Flood Authority (Kirklees Council) and correspondence is on-going with Yorkshire Water over proposed sewer connections.

This report has been prepared in accordance with:

- The Non-Statutory Technical Standards for Sustainable Drainage Systems, published by The Department for Environment, Food and Rural Affairs, March 2015.
- National Planning Policy Framework, The Department for Communities and Local Government
- Sewers for Adoption 7<sup>th</sup> Edition
- Building Regulations Document H
- Network Rail Drainage Standards contained in NR/L2/CIV/005

It is provided in order to describe the principles and current layout of the proposed drainage systems for the TRU W3 project. It follows the criteria set out in the Non-Statutory Technical Standards (above). Its purpose is to inform the Regulatory Authorities of the design process that has been used to develop the principles of the project drainage systems and to provide justification for the systems currently chosen. This is provided for discussion with a view to gaining Regulatory Authority approval.

This report should be read in conjunction with the following documents:

- Huddersfield Station Drainage Form 001
- Railway Track Drainage Form 001
- Ravensthorpe Area Drainage Form 001
- Proposed Drainage Layout Sheets
  - TBC



## Huddersfield to Westtown (Dewsbury) - Drainage Strategy

### Project W3

## 2. OVERVIEW OF THE DRAINAGE REQUIREMENTS

### 2.1 Scope of this Drainage Strategy

This report is provided to inform the drainage provision for Project W3. It provides a description of the existing drainage systems and the assumed outfalls. It discusses the current assumptions on the location of railway drainage outfalls. It considers the potential ways storm water impacts on the current railway corridor, through rainfall, storm water surface flows and groundwater. It looks at the interventions assumed to be necessary along the proposed railway corridor to mitigate these storm water impacts and to maintain the operation of the railway.

The assessment looks primarily at the railway drainage systems for the W3 Project. This includes;

- Track drainage: drainage provided alongside the railway tracks to provide drainage for the track support.
- Stations: drainage provided for the platforms and other infrastructure alongside the railway. These include the re-modelled Huddersfield and Mirfield Stations, plus the new Deighton and Ravensthorpe Stations.
- Earthworks: drainage requirements for proposed earthworks and to protect the railway from the ingress of storm water flows.
- Tunnels: drainage provisions within existing tunnels.
- Drainage provisions for the new Hillhouse Depot site.

The following drainage aspects for the W3 Project are not covered in this assessment;

- Drainage to all highways works necessary for the project, including re-alignment of existing highways and new private vehicle routes outside the railway corridor.
- Drainage to existing and proposed station forecourts, buildings, car parks and access roads.
- Drainage to be provided specifically for bridge and viaduct structures, these will form part of the structural scope.
- Existing railway corridors to which the W3 Project will have no significant impact. It is assumed these will have their own existing drainage systems where necessary and that these are sufficiently operational to the required standard.
- The structural condition of existing culverts and other drainage structures.

The information provided in this report is subject to data which will be provided in various surveys. This includes drainage surveys, topographical surveys, geotechnical investigations and structural assessments. Assumptions have been made which will have to be verified as part of future design stages.

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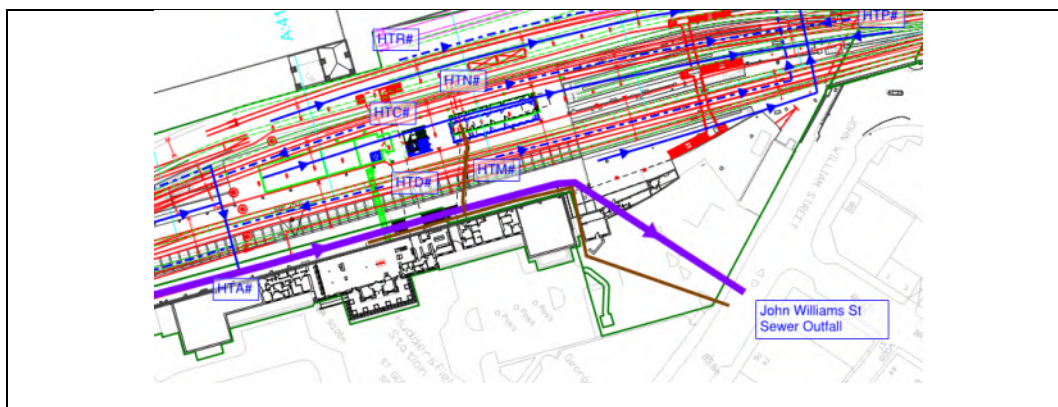
### 3. EXISTING AND PROPOSED DRAINAGE OUTFALLS

There are a variety of existing drainage infrastructure throughout the TRU W3 project. Many existing outfalls will remain in operation or be modified, some new outfalls are required. Some are not thought to play any part in the drainage of the railway, but are provided for third party reasons. The following are descriptions of all the existing known operational and proposed outfalls;

#### 3.1 John Williams Street sewer (storm water) (Existing)

This is located within W3 Area 1 at chainage MVL3 41560m. It currently doesn't have a NR reference.

The location is OS Grid Ref SE 1442 1697, Postcode HD1 1EH.

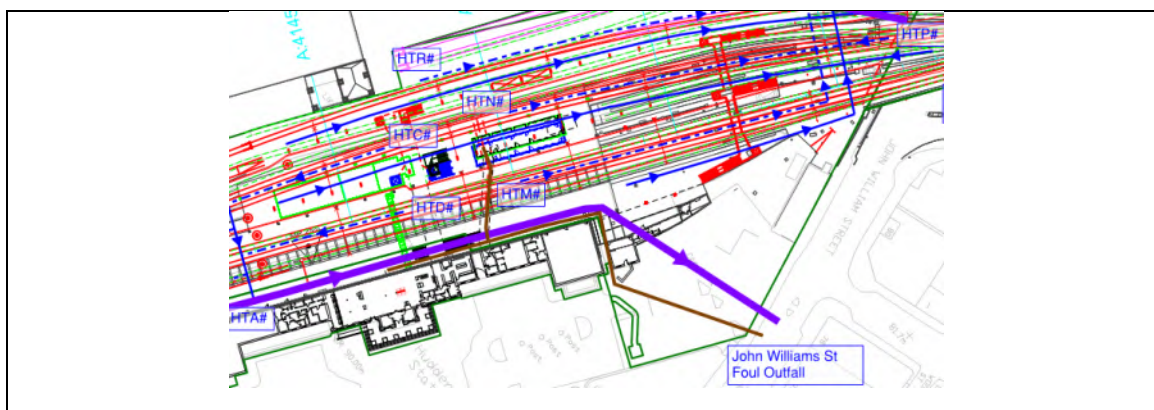


It is an existing storm water drainage outfall and will remain operational following the project. It is a piped outfall from Huddersfield Station area which connects directly into the sewer within the highway. It is not proposed to modify the outfall.

#### 3.2 John Williams Street sewer (foul drainage) (Existing)

This is located within W3 Area 1 at chainage MVL3 41560m. It currently doesn't have a NR reference.

The location is OS Grid Ref SE 1442 1697, Postcode HD1 1EH.



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It is an existing foul water drainage outfall and will remain operational following the project. It is a piped outfall from Huddersfield Station area which connects directly into the sewer within the highway. It is not proposed to modify the outfall.

### 3.3 John Williams Street Culvert (Existing)

This is located within W3 Area 1 at chainage MVL3 41620m. The NR reference is MVL3/91B.

The location is OS Grid Ref SE 1438 1708, Postcode HD1 5AY

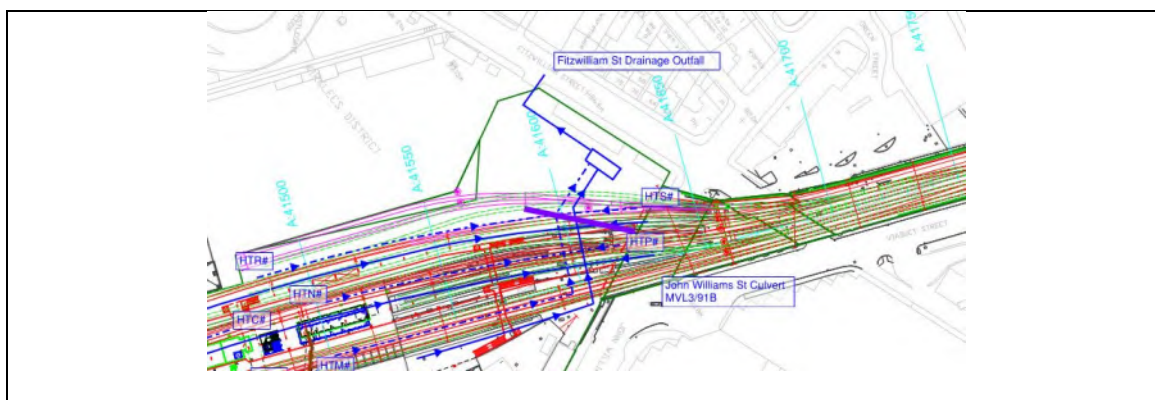


It is an existing storm water drainage structure. It has been blocked off and its current purpose is unconfirmed, although it probably acts as a land drainage outfall for the northern part of Huddersfield Station. It will remain unaltered following the project.

### 3.4 Fitzwilliam Street sewer outfall (New)

This is will be within W3 Area 1 at chainage MVL3 41600m. It currently doesn't have a NR reference.

The location is OS Grid Ref SE 1430 1707, Postcode HD1 5BE.



It will be a new storm water drainage outfall for the re-modelled areas of Huddersfield Station. It will be a piped outfall from the drainage system, either directly into the sewer in the highway, or into an



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existing culvert within Network Rail land which connects into this sewer. A new manhole will be provided at the outfall.

### 3.5 Hebble Beck Culvert (Existing)

This is located within W3 Area 1 at chainage MVL3 42200m. The NR reference is MVL3/93.

The location is OS Grid Ref SE 1461 1757, Postcode HD1 6JA



This is a long culvert, extending well beyond the railway boundaries. It carries an existing watercourse. It is not understood to be a railway drainage outfall and will remain unaltered following the project.

### 3.6 Hillhouse Depot Site (Existing)

This is located within W3 Area 2 at chainage MVL3 42750m. There is no NR reference.

The location is OS Grid Ref SE 1473 1818, Postcode HD2 1BD



The existing industrial estate will be replaced by a railway depot and sidings. The existing drainage outfall to the sewer in Alder Street will be reused for the proposed storm and foul drainage. Storm water flow rates will be controlled to the existing rates and an attenuation tank provided on site.

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### 3.7 Red Doles Road Culvert (Existing)

This is located within W3 Area 2 at chainage MVL3 43220m. The NR reference is MVL3/94B.

The location is OS Grid Ref SE 1519 1843, Postcode HD2 1ZY



It is a former storm water outfall which is now understood to be redundant. It is thought to have discharged to the drainage within the highway. Previous surveys have indicated it is partially collapsed and not operational. It will remain unaltered following the project.

### 3.8 Red Doles Culvert (Existing)

This is located within W3 Area 2 at chainage MVL3 43270m. The NR reference is MVL3/96A.

The location is OS Grid Ref SE 1523 1845, Postcode HD2 1ZJ



This culvert carries an existing watercourse under the railway. A short distance downstream the watercourse enters the Huddersfield Broad Canal. The culvert will be extended by approximately 10m, with a new headwall constructed. The cross-sectional area of the new part will be similar to the existing. It is currently an outfall for railway track drainage, this will remain after the project.

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### 3.9 Topaz Close Culvert (Existing)

This is located within W3 Area 2 at chainage MVL3 43330m. The NR reference is MVL3/96AA.

The location is OS Grid Ref SE 1527 1849, Postcode HD2 1DP



This culvert does not carry a watercourse, it is thought to drain the adjacent housing area. A short distance downstream the discharge enters the Huddersfield Broad Canal. The culvert will be extended by approximately 11m, with a new headwall constructed. The cross-sectional area of the new part will be similar to the existing. It is not currently an outfall for railway track drainage and will not become an outfall.

### 3.10 Field House Culvert (Existing)

This is located within W3 Area 2 at chainage MVL3 43940m. The NR reference is MVL3/98A.

The location is OS Grid Ref SE 1578 1883, Postcode HD2 1FA



This culvert is not thought to carry a watercourse, it is most likely to have been provided for flood relief purposes. The culvert will not be altered. It is currently not outfall for railway track drainage and will not become an outfall.



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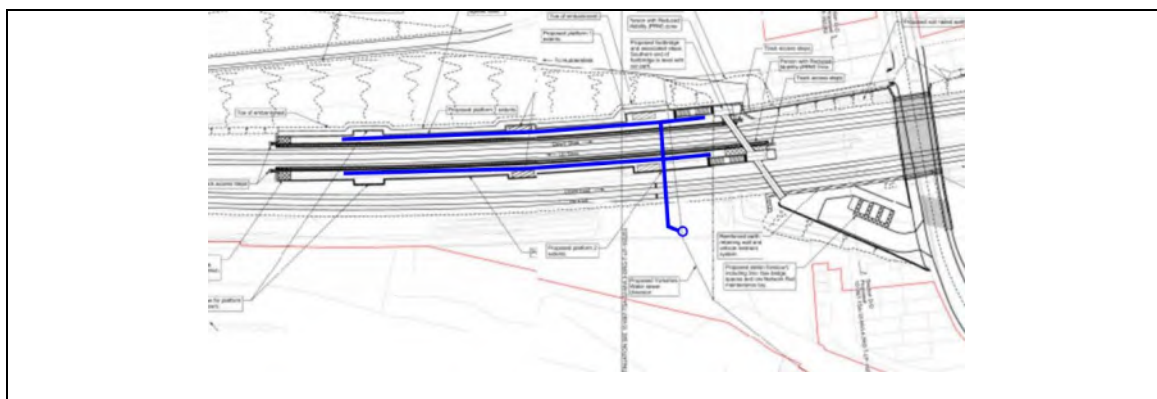
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#### 3.11 Deighton Station Sewer Outfall (New)

This is located within W3 Area 3 at chainage MVL3 44670m. There is no current NR reference.

The location is OS Grid Ref SE 1645 1911, Postcode HD2 1LX



There is no known drainage outfall from the existing Deighton Station. A new storm water drainage system is required for the re-modelled platforms area. This will discharge to the south to be combined with the storm water runoff from the Station drop-off area. Attenuation will be provided within the platforms prior to discharge to a new connection in the re-aligned Yorkshire Water sewer which will pass under the station.

#### 3.12 Leeds Road Culverts and Flumes (Existing)

This is located within W3 Area 3 at chainage MVL3 45100m. The NR reference is MVL3/101A.

The location is OS Grid Ref SE 1677 1939, Postcode HD2 1UE



This comprises a variety of pipes and flumes, the purpose of these is currently unknown. The discharge location is also unknown, although it might have been the Leeds Road sewer. This infrastructure will be removed by the reconstruction of the Leeds Road overbridge and it is not proposed to replace it.

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### 3.13 Bradley No1 Culvert (Existing)

This is located within W3 Area 3 at chainage MVL3 45520m. The NR reference is MVL3/102A.

The location is OS Grid Ref SE 1700 1974, Postcode HD2 1UL



This culvert carries an existing watercourse under the railway. A short distance downstream the watercourse enters the Huddersfield Broad Canal. The culvert will be extended by approximately 5m, with a new headwall constructed. The cross-sectional area of the new part will be similar to the existing. It is currently an outfall for railway track drainage, this will remain after the project.

### 3.14 Bradley No2 Culvert (Existing)

This is located within W3 Area 3 at chainage MVL3 46180m. The NR reference is MVL3/106A.

The location is OS Grid Ref SE 1747 2020, Postcode HD2 1UW



This culvert carries an existing culverted watercourse under the railway. The downstream pipeline destination is unknown, however it could be the Huddersfield Broad Canal. The culvert will remain although requires extensive modification for the project. The cross-sectional area of the new part will be similar to the existing. It is currently an outfall for railway track drainage, this will remain after the project.

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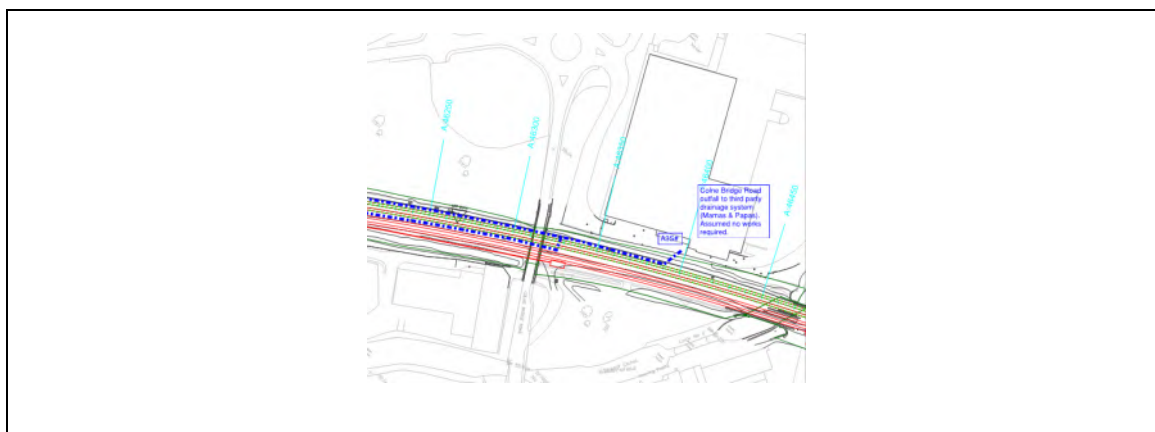
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### 3.15 Outfall to Third Party Drainage off Colne Bridge Road (Existing)

This is located within W3 Area 3 at chainage MVL3 46400m. There is no current NR reference.

The location is OS Grid Ref SE 1765 2031, Postcode HD5 0RH



This is a railway drainage outfall which discharges to a drainage system within an adjacent property, the Mamas and Papas site on Calder Bridge Road. No works are proposed to this outfall, it will remain an outfall following the project. The destination of the discharge is unknown.

### 3.16 Colnebridge Culvert (Existing)

This is located within W3 Area 4 at chainage MVL3 46870m. The NR reference is MVL3/110A.

The location is OS Grid Ref SE 1810 2048, Postcode HD5 0PU



This culvert carries an existing watercourse under the railway, crossing under both the MVL3 and MVL4 lines. Downstream it discharges to a piped drainage system within the sewage works. A new section of culvert is to be constructed at the upstream end to carry the watercourse under the new fast lines. The cross-sectional area of the new part will be similar to the existing. It is currently an outfall for railway track drainage, this will remain after the project.



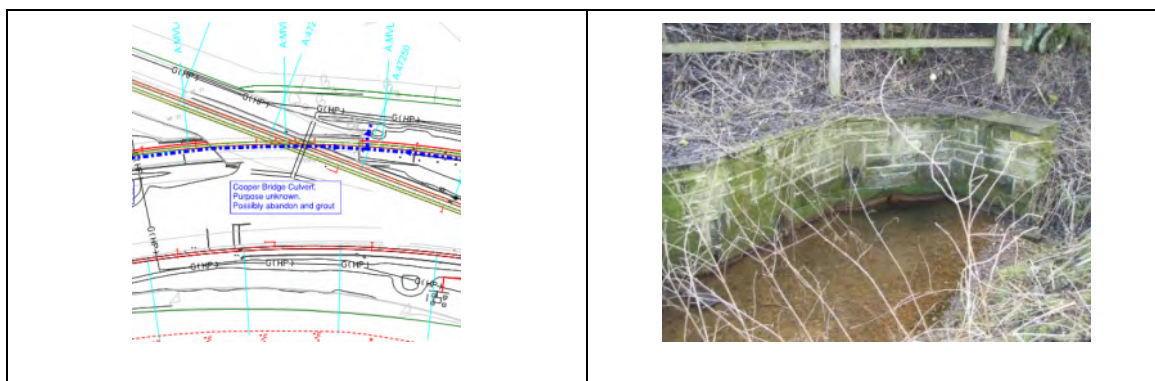
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### 3.17 Cooper Bridge Culvert (Existing)

This is located within W3 Area 4 at chainage MVL4 47270m. The NR reference is MVL4/3A.

The location is OS Grid Ref SE 1844 2057, Postcode HD5 0BX

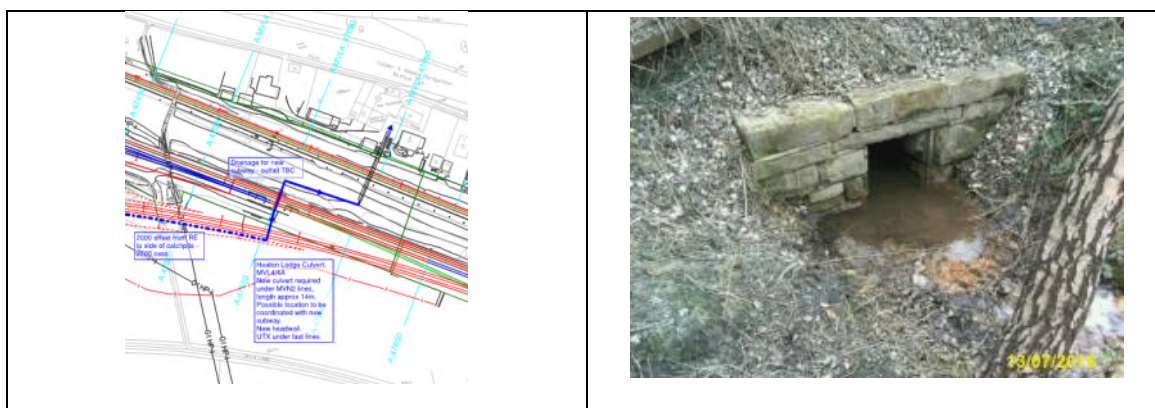


This culvert is located under the MVN4 line, also under the underpass structure carrying the MVN2 line over this. It does not appear to carry a watercourse, upstream the drainage is piped but of unknown origin. Downstream it discharges into a watercourse which flows into the Calder and Hebble Navigation. The culvert is currently submerged and blocked with silt, so assumed to be non-operational. It is not proposed to reuse the culvert, but a new track drainage outfall may be located at a higher level close-by.

### 3.18 Heaton Lodge Culvert (Existing)

This is located within W3 Area 4 at chainage MVL4 47650m. The NR reference is MVL4/4A.

The location is OS Grid Ref SE 1880 2038. Postcode WF14 0EB



This culvert carries an existing watercourse under the railway. Downstream the watercourse is piped but is assumed to outfall to the Calder and Hebble Navigation. The culvert will remain unaltered. It is assumed to be an outfall for railway land drainage, this will remain but additional flows will be added.

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### 3.19 Heaton Lodge Junction Culvert (Existing)

This is located within W3 Area 4 at chainage MVN2 48070m. The NR reference is MVN2/190A.

The location is OS Grid Ref SE 1919 2009, Postcode WF14 9DH



This culvert and cascade carries an existing watercourse under the railway. Downstream the watercourse flows into the River Calder. The culvert will remain, but with repairs and modifications for the proposed project. The cross-sectional area of the existing culvert will be maintained. It is currently an outfall for railway track drainage, this will remain after the project.

### 3.20 Mirfield Culvert (Existing)

This is located within W3 Area 4 at chainage MVN2 48380m. The NR reference is MVN2/190B&C.

The location is OS Grid Ref SE 1944 1993, Postcode WF14 8QJ



This culvert and cascade carries an existing watercourse under the railway. Downstream the watercourse flows into the River Calder. The culvert will remain, but with repairs and modifications for the proposed project. The cross-sectional area of the existing culvert will be maintained. It is currently an outfall for railway track drainage, this will remain after the project.

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### 3.21 Chadwick Close Culvert (Existing)

This is located within W3 Area 5 at chainage MVN2 48700m. The NR reference is MVN2/191A.

The location is OS Grid Ref SE 1971 1976, Postcode WF14 8JF



This culvert carries an existing watercourse under the railway. Downstream it discharges to drainage within the new residential development and presumably into the River Calder. The culvert will remain for the proposed project. It is currently an outfall for railway track drainage, this will remain after the project.

### 3.22 Wood Lane Culvert (Existing)

This is located within W3 Area 5 at chainage MVN2 48840m. The NR reference is MVN2/191B.

The location is OS Grid Ref SE 1984 1969, Postcode WF14 8JD



This culvert carries an existing watercourse under the railway. Downstream it discharges to drainage within the new residential development and presumably into the River Calder. The culvert will remain for the proposed project. It is currently an outfall for railway track drainage, this will remain after the project.



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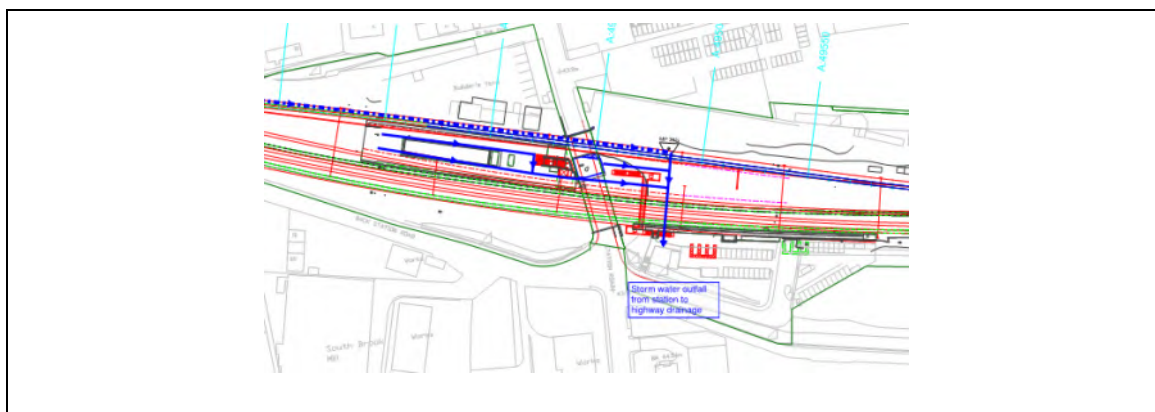
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### 3.23 Mirfield Station storm water outfall (New)

This is located within W3 Area 5 at chainage MVN2 49480m. There is no current NR reference.

The location is OS Grid Ref SE 2044 1947, Postcode WF14 8QF

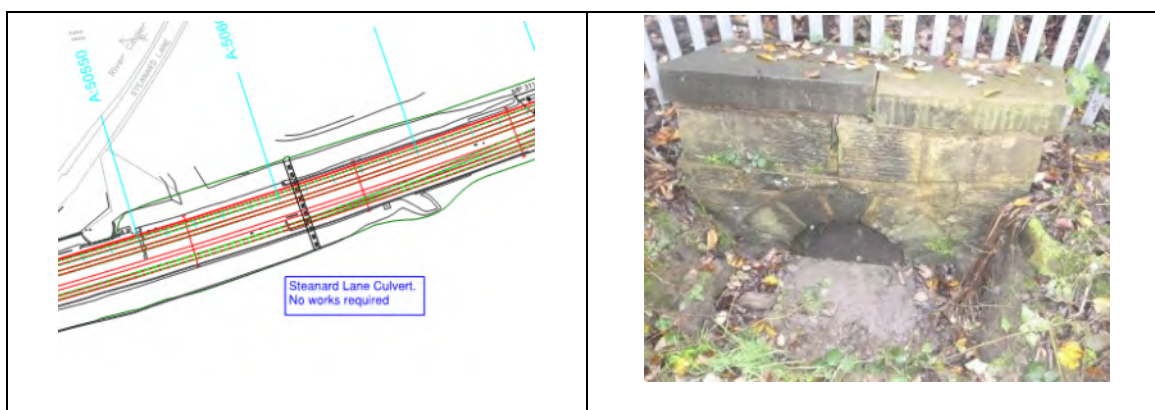


There is no known drainage outfall from the existing Mirfield Station. A new storm water drainage system is required for the re-modelled platforms and additional track drainage. These will both discharge out to the drainage systems for the station car park, to be attenuated and discharged to local sewers.

### 3.24 Steanard Lane Culvert (Existing)

This is located within W3 Area 5 at chainage MVN2 50610m. The NR reference is MVN2/198AA.

The location is OS Grid Ref SE 2159 1943, Postcode WF14 8HZ



This culvert does not carry a watercourse and is blocked by gabions at its upstream end. It is assumed it was provided for flood relief purposes. The culvert will remain for the proposed project. It is not an outfall for railway drainage and will not be after the project.

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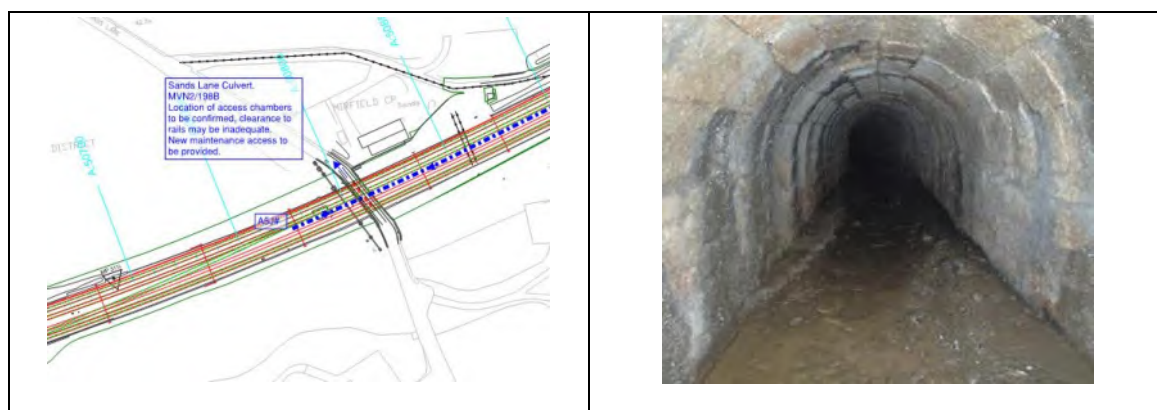
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### 3.25 Sands Lane Culvert (Existing)

This is located within W3 Area 5 at chainage MVN2 50810m. The NR reference is MVN2/198B.

The location is OS Grid Ref SE 2175 1947, Postcode WF14 8HJ

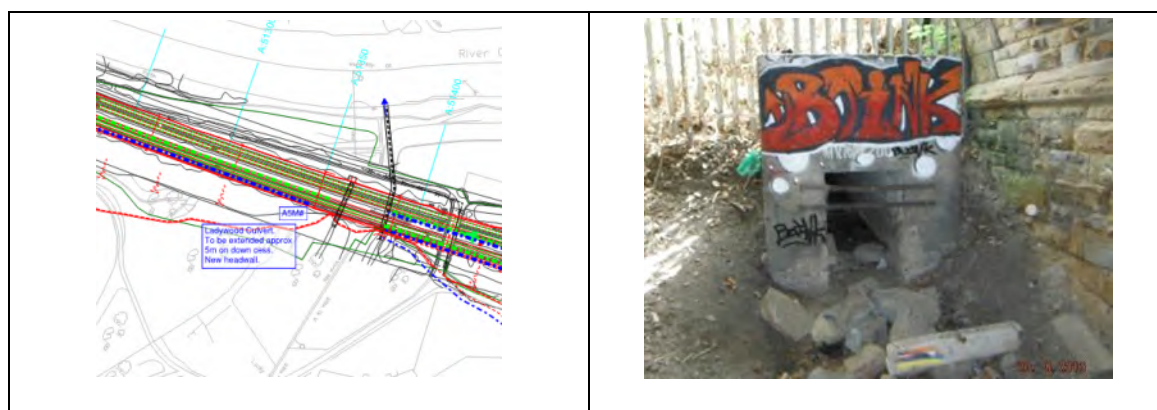


This culvert carries an existing culverted watercourse under the railway, it is located under the Sands Lane overbridge and follows the line of the highway. The culvert will remain for the proposed project, although requires repair and modification for the project. It is currently an outfall for railway track drainage, this will remain after the project.

### 3.26 Ladywood Culvert (Existing)

This is located within W3 Area 6 at chainage MVN2 51370m. The NR reference is MVN2/200C.

The location is OS Grid Ref SE 2224 1965, Postcode WF13 3SX



This culvert does not carry a watercourse, it is assumed it was provided for flood relief purposes. The culvert will remain for the proposed project. It is not an outfall for railway drainage and will not be after the project. It will need extending by approximately 5m as part of the project, the existing cross-sectional area will remain.

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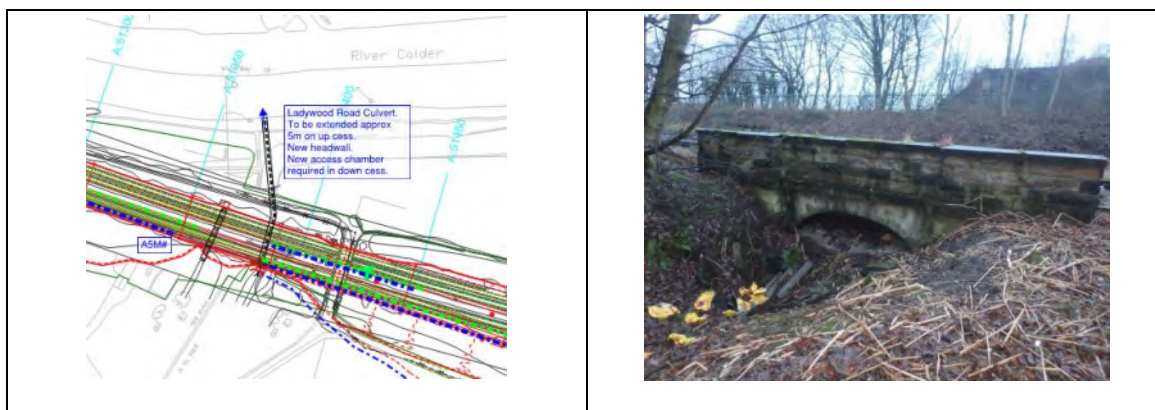
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#### 3.27 Ladywood Road Culvert (Existing)

This is located within W3 Area 6 at chainage MVN2 51380m. The NR reference is MVN2/200.

The location is OS Grid Ref SE 2228 1967, Postcode WF13 3SX

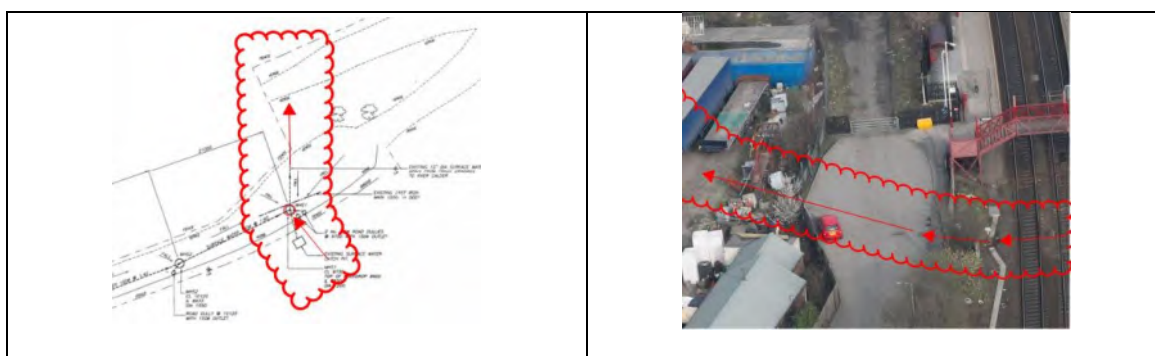


This culvert carries an existing watercourse under the railway. Downstream it continues for some distance to discharge directly into the River Calder. The culvert will remain for the proposed project, although will require extending with a new headwall, the existing cross-sectional area will remain. It is currently an outfall for railway track drainage, this will remain after the project.

#### 3.28 Ravensthorpe Station storm water outfall (Existing)

This is located within W3 Area 6 at chainage MVN2 51950m. There is no current NR reference.

The location is OS Grid Ref SE 2282 1995, Postcode WF12 9ED



The existing station drains into the drainage system of the commercial estate to the north. It is proposed to re-use this outfall for the storm water drainage from the new station and track drainage. Due to the level of the proposed railway being significantly lower than the existing, re-grading of this existing drainage within the adjacent property will be required. The hydraulic capacity of the drainage system will be maintained and the proposed flows will be attenuated to match existing.



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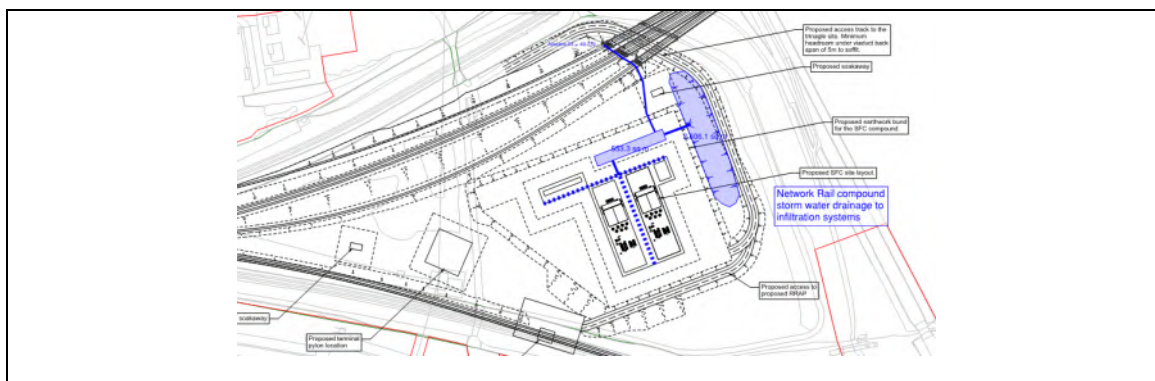
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### 3.29 Ravensthorpe Triangle Infiltration systems (New)

This is located within W3 Area 6 between chainages MVN2 52200m and 52600m.

The location is OS Grid Ref SE 2331 2026, Postcode WF13 3RD



A new storm water outfall is required for railway infrastructure within the triangle of land that comprises the landfill site to the east of the existing Ravensthorpe Station. The area is bounded on two sides by railway lines, with the Calder and Hebble Navigation on the third. The current site drains by infiltration, with excess storm flows flowing to the canal and on to the river. The proposed drainage outfall will replicate these with the use of storm water attenuation structures and infiltration basins. Permeable paving will be used as much as possible to minimise concentrated flows. This arrangement is described in more detail later.

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## 4. STORM WATER DRAINAGE STRATEGY

### 4.1 Introduction

The following text provides a description of the surface water drainage systems for the project, along with justifications in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems. It has been set out to correspond with the layout of the Non-Statutory Technical Standards for Sustainable Drainage Systems to allow for clarity in the descriptions and justifications outlined, the overall requirements of the Standards being provided in the boxes at the start of each section for reference.

### 4.2 Runoff Destinations

Surface runoff not collected for reuse must be discharged to one or more of the following, listed in order of priority;

- Discharge into the ground (infiltration); or where not reasonably practicable,
- Discharge to a surface water body; or where not reasonably practicable,
- Discharge to a surface water sewer, highway drain, or another drainage system; or where not reasonably practicable,
- Discharge to a combined sewer.

### Railway Track Drainage

The project includes extensive lengths of standard railway track drainage. These are primarily infiltration systems, comprising perforated filter pipes within gravel trenches. Their purpose is to draw storm water away from the railway track foundation and allow it to infiltrate naturally away from the loaded area beneath the railway sleepers. These pipes are provided as overflows, to transfer extreme storm runoff, where it exceeds the infiltration rate of the ground and may cause an operational risk to the railway, to a safe outfall. The railway drainage therefore satisfies the first criteria, above.

For many areas of track drainage, the pipework will divert the excess storm water to either surface water bodies or to culverted watercourses which lead to surface water bodies. Generally these are existing drainage outfalls which will be re-used.

Some areas of new track drainage will discharge to existing storm water drainage systems. These are generally in the areas of Hillhouse Depot, Heaton Lodge, Mirfield Station and Ravensthorpe Station. Some of this drainage will reuse existing outfalls and any increased impact on the downstream watercourse will be mitigated by the use of storage and flow restrictions where appropriate. Where new outfalls are required these will be agreed with the sewer and/or the highway authority as appropriate.

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### **Huddersfield Station and Tunnels**

The existing station and tunnel drainage discharges to the combined sewer in John Williams Street. The station is located in an elevated position within the dense historic area of Huddersfield. Virtually all the station area has at some time been used for rail sidings and other associated rail purposes, therefore the risks of contamination are high. Therefore infiltration as a primary solution to storm water disposal is not feasible. The railway drainage will comprise conventional filter drainage and will therefore allow some degree of infiltration, as with the existing situation. But this is currently assumed to be fairly low. This drainage will discharge to the site storm water drainage outfall, which could be the current outfall to the John Williams Street sewer or a new outfall proposed onto the Fitzwilliam Street combined sewer. This will be agreed with Yorkshire Water and the LLFA, refer to later discussion for the overall Station drainage strategy.

### **Ravensthorpe Triangle Area**

As this area is currently a landfill site, the existing storm water drainage generally takes the form of informal infiltration. There is currently no railway infrastructure across this area, there are existing railways to the south and west. The new railways across this area will require some track drainage, but it is assumed this will outfall to infiltration systems so as to replicate the existing situation. These locations will have to be coordinated with the layout of the existing landfill site and the risks presented by its contents. The drainage is also likely to be combined with that for the railway compounds and other infrastructure within the Triangle area. See later discussion in this document.

## **4.3 Flood Risk Outside the Development**

**S1** The design of the drainage system must mitigate any negative impact of surface water runoff from the development on the flood risk outside the development boundary.

Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood from that surface water body (e.g. the sea or a large estuary) the peak flow control Standards (S2 and S3) and the volume control Standards (S4 to S6) do not apply.

Two aspects of flooding outside the railway are being assessed. Firstly, the impact of storm water originating from within the site flooding, out into adjacent properties. Secondly there are locations where there is a risk of storm water flooding entering the railway from adjacent hill-side catchments and passing through. These are both discussed below.

### **4.3.1 Flood Risk from the Railway.**

Drainage infrastructure has been provided to extensive areas of the TRU project, where there is a requirement to manage storm water. Where there is a risk of flooding causing an adverse impact on users or the operation of the railway, on-site storage will be provided. These areas are described below.



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### **Huddersfield Station and Tunnels**

There are no records of flooding originating from the station area or the tunnels, therefore it is currently assumed the risk of this occurring is reasonably small. The station will be drained by a combination of the existing outfall pipe and an additional new sewer connection. The existing outfall will remain in operation as it is, although with reduced flows. The new outfall will be provided with on-site storm water attenuation and flow restriction in accordance with current guidance. This is described below as part of the Peak Flow Control discussion.

In accordance with the National Planning Policy Framework, this drainage system will be designed to contain all storm water safely within the site for a storm scenario of return period up to the 1 in 100 years plus an additional 40% on storm intensity for climate change. Discharge to the sewers will be reduced by 30% below the existing for comparable storm scenarios to reduce flood risk downstream. These criteria have to be finalised with the Lead Local Flood Authority and Yorkshire Water PLC.

### **Railway Track Drainage Systems**

Much of the drainage on the TRU project comprises railway track drainage systems, which are essentially filter drains within gravel trenches. Flow from these types of systems are generally low, even for storm events, and the duration of the storm flows tend to be elongated. Therefore it is unlikely these systems would cause any flooding. Generally new railway drainage systems will be provided to replace existing ones where necessary, although some new and extended drainage systems are required.

The railway drainage systems shall be designed to the standard NR/L2/CIV/005/09 which requires storm water to be contained within the system for a storm scenario of up to the 1 in 50 year storm event plus an additional 40% on storm intensity for climate change. For more extreme events the National Planning Policy Framework will apply, requiring all storm water to be safely contained within the site for a storm scenario of return period up to the 1 in 100 years plus an additional 40% on storm intensity for climate change. These criteria have to be finalised with the Lead Local Flood Authority.

### **Culverts**

Some work is required to the existing culverts along the project to accommodate the introduction of the new railway lines. This primarily required the lengthening of culverts and the modifications to the chambers at each side to maintain clearances to the railway. It is currently understood there are no known issues of flooding resulting from storm water passing under the railway through any of the culverts. On this basis, all modifications to existing culverts shall be designed to maintain the existing hydraulic capacity of the culvert. This should minimise the risk of any additional flooding both upstream and downstream of the culvert.

### **Hillhouse Depot Site**

This site is elevated above the surrounding urban environment, supported by retaining walls on its south and west sides. It currently contains a small commercial properties and hardstanding areas and has its own drainage system which discharges to the sewer in the adjacent highway (Alder Street). The new depot site will have its own drainage systems, re-using the existing discharge point. In

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accordance with the National Planning Policy Framework, this drainage system will be designed to contain all storm water safely within the site for a storm scenario of return period up to the 1 in 100 years plus an additional 40% on storm intensity for climate change. Discharge to the sewers will be reduced by 30% below the existing for comparable storm scenarios to reduce flood risk downstream. These criteria have to be finalised with the Lead Local Flood Authority and Yorkshire Water PLC.

### **Minor Stations**

The minor stations at Deighton, Mirfield and Ravensthorpe will have new drainage systems provided for the platform and accessway areas. Where feasible, these systems will be separate from the railway track drainage systems with specific outfall locations. However they may be combined with the highways elements of the stations, discharging to the station frontage of car park drainage systems. Where this is the case, the flood water containment criteria will be that agreed for the overall station area. Otherwise, it shall be in accordance with the National Planning Policy Framework, designed to contain all storm water safely within the site for a storm scenario of return period up to the 1 in 100 years plus an additional 40% on storm intensity for climate change. These criteria have to be finalised with the Lead Local Flood Authority and Yorkshire Water PLC.

### **Ravensthorpe Triangle Area**

The existing storm water runoff from this landfill area discharges by infiltration to groundwater, or seepage and storm over-land flow to the canal. It is proposed to replicate the infiltration aspects of this area for the proposed development. Permeable surfaces will be used as far as practical to minimise the need for formal drainage systems. Storm drainage within developments will discharge to an infiltration area which will be designed to retain all storm water for up to the 1 in 100 years plus an additional 40% on storm intensity for climate change

Due to the topography and the location of existing railway lines surrounding this site, the only feasible directions of storm water discharge from this area will either be via infiltration or to the canal to the north. Beyond this storm level, overland flow paths will be provided to the canal.

#### **4.3.2 Flood Risk onto the Railway from Adjacent Catchments**

At some locations there is a risk of storm water flood flows entering the railway corridor from hillside catchment areas adjacent to the railway. These could impact on the operation of the railway and on properties downhill beyond the railway.

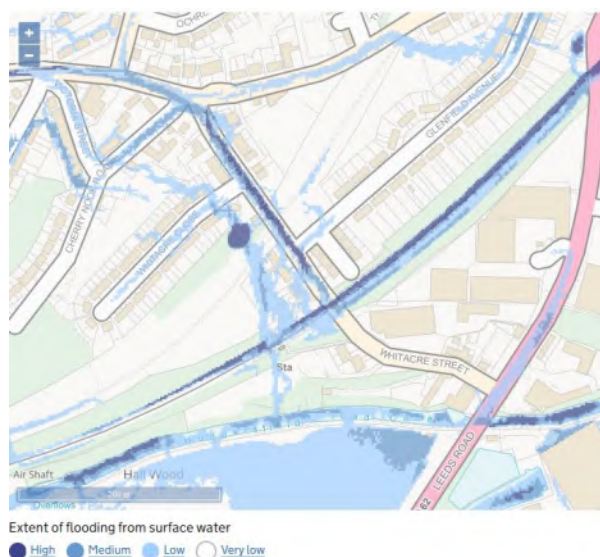
### **Deighton Station**

Flood records indicate potential storm water flows from a shallow valley catchment uphill of this station, entering the station area via both a grass valley and from the adjacent highway. Whilst there is no known evidence of this occurring to date, proposed modifications to the station will impact on this flood route, potentially increasing the risks to the railway infrastructure.

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The risk and flood quantity are to be assessed and the infrastructure at the station will be modified to incorporate a safe route to minimise impact on the railway. The primary concerns are flood flows down the new embankments, particularly the soil nail walls. Measures to limit the storm water approaching the station area will be discussed with the relevant Authorities. Cut-off ditches and walls will be provided along the top of the embankments and a specific spillway or similar will be provided.

### Cut-off Ditches to New Cutting Slopes

At two locations new cutting slopes are to be provided where the adjacent land slopes towards the railway. These are at the new fast lines cutting at Heaton Lodge and in the proposed Ravensthorpe Station area. An allowance has been made to the land boundaries to accommodate cut-off ditches along the tops of the new embankments in these locations to minimise the risk of flood flows from adjacent properties flowing down the embankments.

## 4.4 Peak Flow Control

**S2** For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must not exceed the peak greenfield runoff rate for the same event

**S3** For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but must not exceed the rate of discharge from the development prior to the redevelopment for that event.

For most of the extent of the TRU W3 project, the proposed works can be assumed to be on previously developed land, as most of it will be within the existing railway corridor. There is one significant area of development on greenfield land at Heaton Lodge. This is described further below.



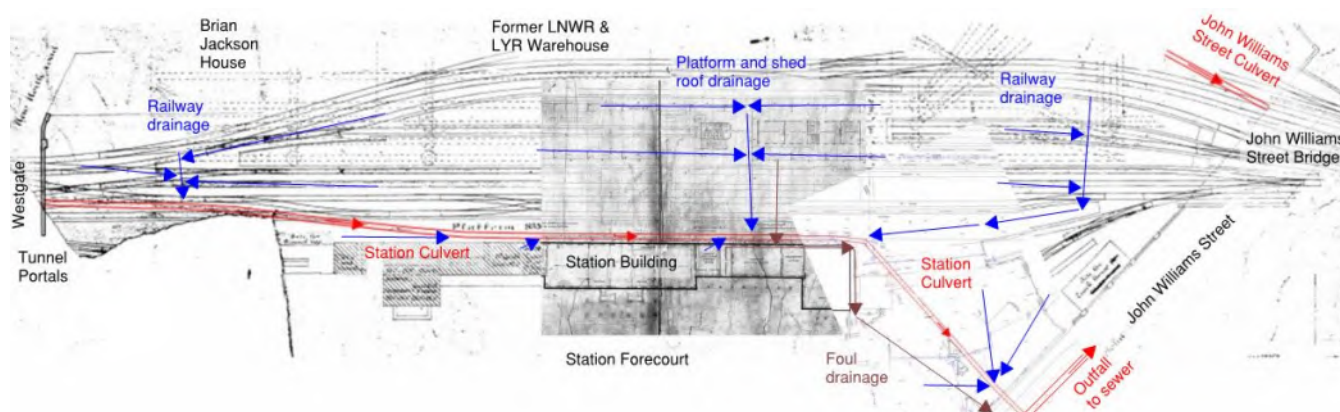
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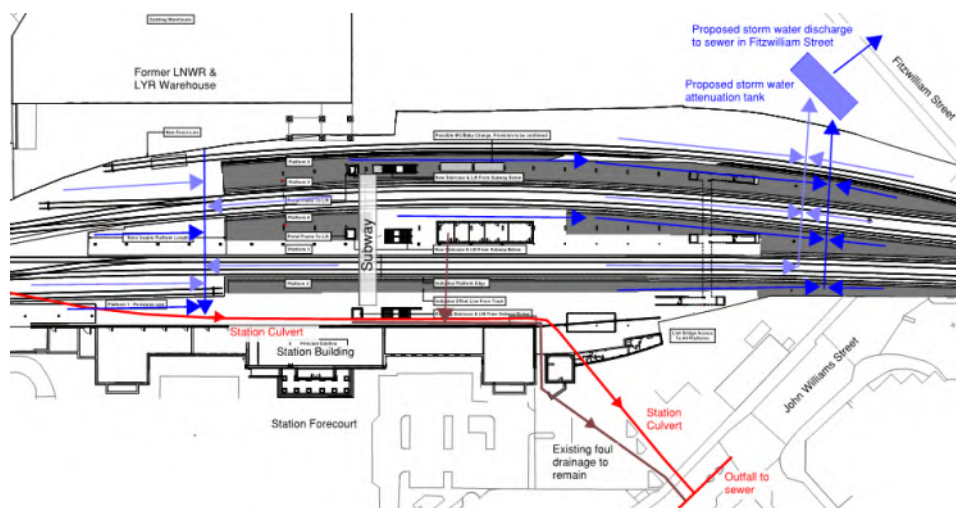
### Huddersfield Station and the Tunnels

Storm water from the tunnels enters the station drainage system. Currently all storm drainage from platforms, shed roofs and railway track is directed to a culvert along Platform 1. This discharges to a sewer in John Williams Street. This is currently understood to be the only significant storm water outfall for the station and tunnels.



For the proposed drainage system, this culvert will remain operational. It will carry storm water from the tunnels, part of the existing shed roof and the southern part of the railway drainage systems. There will therefore be a reduction in flows to this culvert, hence to the existing outfall into the John Williams Street sewer.

A new outfall is proposed, in the form of a sewer connection into Fitzwilliam Street. Storm water from the re-modelled station platform area, the new canopies and the northern part of the railway track drainage will discharge to an attenuation tank, located in the depot site to the north of the station.



The attenuation tank and flow restriction into Fitzwilliam Street will be designed to contain all storm water below ground for a storm scenario of return period up to the 1 in 100 years plus an additional 40% on storm intensity for climate change. Additionally it will restrict the proposed peak flows from this part of the site by 30% to reduce impact on the sewer. These criteria have to be finalised with the Lead Local Flood Authority and Yorkshire Water PLC.

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#### **Hillhouse Depot Site**

There is an existing stormwater drainage system for this site, the proposed development drainage system will use the same outfall. The discharge agreement will be based on a peak flow rate from the proposed development being a 30% reduction from the existing peak flow rate for the 1 in 30 and 1 in 100 year storm scenario return periods plus an additional 40% on storm intensity for climate change. These criteria have to be finalised with the Lead Local Flood Authority and Yorkshire Water PLC.

#### **Minor Stations**

Deighton Station is likely to require a new outfall to a sewer, which will be combined with the station drop off and road access area drainage. An application will be made for a connection based on a peak flow rate from the proposed drainage being a 30% reduction for the 1 in 30 and 1 in 100 year storm scenario return periods plus an additional 40% on storm intensity for climate change.

Mirfield and Ravensthorpe Stations will discharge to existing storm water outfalls within local drainage/sewer networks. The discharge agreement will be based on a peak flow rate from the proposed development being a 30% reduction from the existing peak flow rate for the 1 in 30 and 1 in 100 year storm scenario return periods plus an additional 40% on storm intensity for climate change.

These criteria have to be finalised with the Lead Local Flood Authority and Yorkshire Water PLC.

#### **Railway Track Drainage**

Railway track drainage systems are generally filter drainage systems designed to be permeable and to collect sub-surface water. The flow rates are generally low compared to the storm intensities, and the duration of the storm water discharge is much longer than the storm. They are effectively discharging at a rate equivalent to the greenfield runoff rate. On this basis, where new drainage systems will be provided of equivalent extent and area as the existing, no flow restriction is proposed. The peak discharge rate will be equivalent to the existing, therefore there will be no overall change to the flows in the receiving watercourses. Where there are significant increases in new drainage extent or area, some form of on-site storage and flow restriction will be provided to reduce the peak flow rate to the existing peak rate for the equivalent storm scenarios.

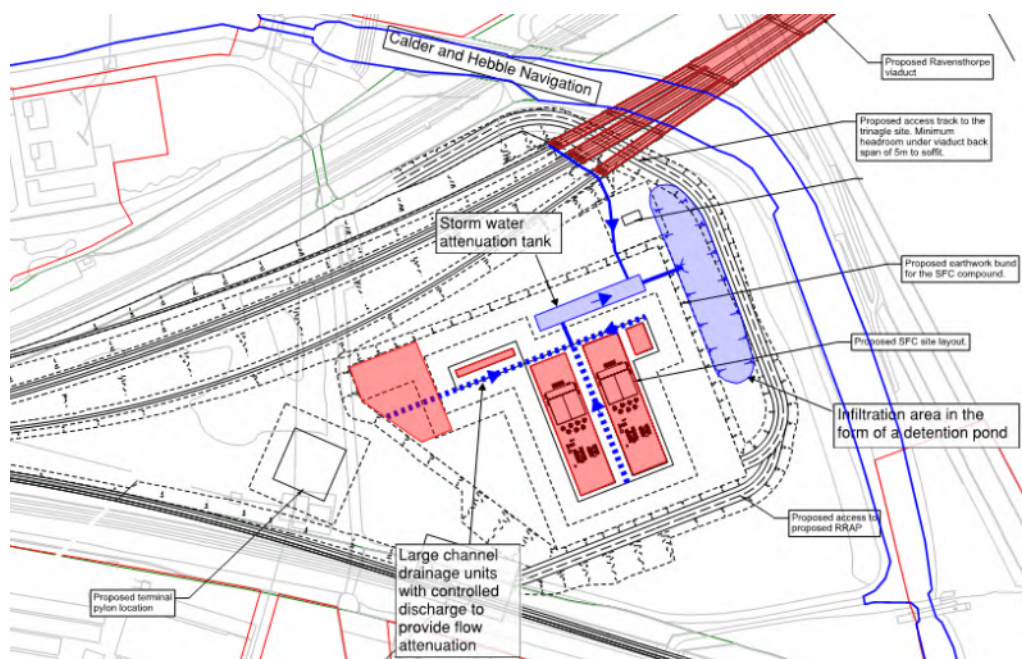
#### **Ravensthorpe Triangle Area**

This area currently drains by infiltration to groundwater or by seepage and overland flows to the adjacent canal. The existing drainage can therefore be described as greenfield runoff. It is not seen as appropriate to provide a new discharge of storm water direct to the canal. Therefore an infiltration pond area will be provided to store storm water up to the 1 in 100 year storm scenario plus an additional 40% on storm intensity for climate change. Discharge from this will be by infiltration to replicate the existing drainage. Overland flow paths will be provided for storms in excess of this. Thus the proposed drainage system will seek to discharge at greenfield peak rates.

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#### 4.5 Volume Control

**S4** Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must not exceed the greenfield runoff volume for the same event.

**S5** Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a volume as close as is reasonably practicable to the greenfield runoff volume for the same event, but must not exceed the runoff volume from the development site prior to redevelopment for that event.

**S6** Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with Suds NS6 or NS7 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

For the most part of this area, it is unlikely any form of infiltration drainage will be significantly viable for the reduction in storm water volumes. Generally the underlying ground conditions are clay and rock which are not compatible with infiltration. Much of the surrounding area is developed with many residential and commercial properties within close proximity. Whilst opportunities for infiltration will be used where possible, the current drainage strategy seeks to avoid large-scale infiltration systems, with the exception of Ravensthorpe.



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#### **Huddersfield Station**

The station is located within a densely developed area, in an elevated position. It was formally largely covered in railway sidings and similar land-usage, therefore the risk of contamination is high. It is therefore not seen as appropriate to adopt infiltration drainage. Small-scale opportunities may be available, such as part of the station landscaping scheme, but these would have negligible impact on the overall storm water drainage. Rainwater recycling may also be considered on a small scale, but would also have limited impact. The proposed storm water drainage system seeks to reduce flows from the development to reduce the overall storm risk.

#### **Hillhouse Depot Site**

Similar to Huddersfield Station, this is a former railway sidings area in an elevated location within an urban landscape. Large scale infiltration systems are not considered appropriate, therefore there would be little opportunity to reduce the volume of storm water leaving the site.

#### **Minor Stations**

Due to their small size, urban locations and proximity to the railway and other properties, opportunities for significant infiltration are very limited. Small scale infiltration and water re-cycling for landscaping within the station may be possible, but the impact on the overall, volumes of storm water discharge would be negligible. There is therefore little opportunity to reduce the volume of storm water in these locations.

#### **Railway Track Drainage**

Railway track drainage is effectively an infiltration system, comprising perforated pipes within gravel filled trenches. The primary methods of disposal of storm water from a railway is either by infiltration through the track foundation or through the base of the drainage trench. The pipework is only provided to manage storm water in excess of the infiltration rates for the ground. However, given the likely ground conditions, it is assumed infiltration rates will be low. But a significant proportion of the storm water landing on the railway corridor will not appear at the outfall, therefore there will be significant reductions in volume within the track areas. These areas therefore comply with the requirements for storm water volume management.

#### **Ravensthorpe Triangle Area**

The proposed drainage system for this area will seek to replicate as far as practical the existing, which mainly comprises infiltration, ground seepage and overland flows for extreme storms. Permeable surfacing will be used to allow storm water to soak into the ground. Where impermeable surfaces are necessary, drainage systems provided will store the water and discharge gradually to an infiltration basin. This will be designed to hold all storm water up to the 1 in 100 year storm scenario plus an additional 40% on storm intensity for climate change, allowing it to discharge through infiltration. Therefore the proposed drainage system seeks to replicate the existing greenfield runoff rates of the existing site.

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#### 4.6 Flood Risk within the Development

**S7** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for the 1 in 30 year rainfall event.

**S8** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during the 1 in 100 year rainfall event in any part of: a building (including basement) or in any utility plant susceptible to water (erg. pumping station or electricity substation) within the development.

**S9** The design of the site must ensure that so far as is reasonably practicable, flows resulting from rainfall in excess of the 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people and property.

#### Huddersfield Station

There will be two systems comprising the proposals for the re-modelled station.

The existing drainage system is via a deep culvert alongside the existing station building, close to other historic buildings, passing out under a retaining wall into John Williams Street. There are no known records of flooding within the station area from this drainage. The proposed station re-modelling will reduce the quantity of storm water entering this system. Given the depth and proximity to historic buildings, it is not considered appropriate to provide storm water attenuation to this part of the drainage.

The drainage system for the re-modelled platform area and its outfall to Fitzwilliam Street will be entirely new. An attenuation tank will be provided to store storm water and allow it to discharge at a reduced rate. There is no opportunity to allow surface storage of storm water in excess of the 1 in 30 year storm within the site. Therefore the tank will be designed to store all runoff for the 1 in 100 year storm scenario plus an additional 40% on storm intensity for climate change.

Given the urban nature of the area and the gradients of the topography, there is little opportunity to provide safe exceedance routes. Storm water will find its way out of vehicle routes from the station area and use the highway as exceedance routes.

#### Hillhouse Depot Site

The situation for this drainage system will be very similar to that for Huddersfield Station. There is little opportunity to allow surface storage of storm water in excess of the 1 in 30 year storm within the site. Therefore an attenuation tank will be designed to store all runoff for the 1 in 100 year storm scenario plus an additional 40% on storm intensity for climate change.

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### **Minor Stations**

Space will be limited at these locations, but there will be opportunity to provide stormwater attenuation within the platforms. The aim will be to store all runoff for the 1 in 100 year storm scenario plus an additional 40% on storm intensity for climate change within the proposed drainage system. This may be incorporated into an overall station storm water attenuation system, such as at Mirfield Station.

### **Railway Track Drainage**

The Network Rail Drainage Standard NR/L2/CIV/005/09 requires that storm water levels should not exceed the base of the railway sleepers for storm scenarios up to the 1 in 50 year return period including an additional 40% on storm intensity for climate change. This effectively requires all storm water to be held within the railway construction without surface flooding for this return period. For storms exceeding this, short term flooding is allowable up to the level of the rails with minimal operational impact. However any level of flooding within the railway corridor for storms over the 1 in 50 year return period is likely to result in surface flows out of the railway boundary, impacting on adjacent properties. Where significant works are to be carried out to railways, this could contravene the intentions of the National Planning Policy Framework which requires storm water to be retained on site up to the 1 in 100 year storm event plus climate change. Therefore, where there is likely to be an impact on adjacent properties, the drainage system will seek to maintain water levels below the base of the sleeper for the 1 in 100 year storm scenario plus an additional 40% on storm intensity for climate change.

### **Ravensthorpe Triangle Area**

The proposed drainage system for this area will provide large amounts of storm water storage. It will seek to contain all storm water runoff from impermeable areas up to the 1 in 100 year storm scenario plus an additional 40% on storm intensity for climate change. This is dependent on ground conditions, particularly on infiltration rates.

## **4.7 Structural Integrity**

**S10 Components** must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

**S11** The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use.

All components of the drainage systems will be designed and specified to set standards required by Network Rail. The specification shall be in accordance with Network Rails Standard Clauses. Additionally and where necessary, materials and workmanship will comply with standard water industry specifications, such as Sewers for Adoption 7<sup>th</sup> Edition and the Civil Engineering Specification for the Water Industry.



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Proprietary products such as storm water channels and attenuation tanks will be detailed and specified by the manufacturers through the use of performance specifications.

All drainage will be designed for the depth and applied loading likely to be imposed. Geotechnical and Geo-environmental considerations will be taken into account, particularly concerning areas where there is a risk of aggressive ground conditions.

### 4.8 Designing for Maintenance Considerations

**S12** Pumping must only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.

The drainage system must be designed to take account of the construction, operation and maintenance requirements of both surface and subsurface components, allowing for any personnel, vehicle or machinery access required to undertake this work.

There are no proposed pumping stations within the storm water drainage.

The drainage design has been developed with construction in mind. Construction and maintenance teams have been engaged to develop the current proposals. The primary area of engagement has been Huddersfield Station, where there were two options. One of these was to re-use the existing outfall for the whole station drainage, but this was discounted by the construction team due to the depth of excavations, the proximity of historic buildings and the impact on the phasing of the construction works. Liaison will continue through the following design stages.

All drainage will be designed as far as practical to allow safe access for maintenance. Chambers will be detailed with appropriate cover sizes to allow access, plus steps into chambers will be provided where necessary. Non-man access drainage will be used wherever practical.

Maintenance access to drainage will be provided as appropriate. Cess walkways and access points will be provided throughout the project and the drainage will be coordinated with these. Drainage within the 6-foot will be avoided wherever possible and shall be restricted to station areas and within restricted structures. On station platforms, drainage will be located clear of pedestrian routes and away from the operational areas wherever practical.

Where culverts are to be modified, safe access routes (in the form of steps and paths) will be provided. New access chambers will be provided into existing culverts where there is currently no access within the railway corridor, where appropriate.

The design of railway drainage pipes will be based on the velocity of the water in the pipe, not the quantity. This should allow pipes to be designed to self-cleaning criteria, thus minimising the risk of drainage becoming blocked by silt. It is recognised that at the heads of drainage runs, there is not enough flow to generate self-cleaning velocities. These extents will be discussed with Network Rail to make them aware of the extent and to inform their maintenance programs.

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#### 4.9 Water Quality

The drainage system must be designed and constructed so surface water discharge does not adversely impact on the water quality of receiving water bodies, both during construction and when operational.

There are no known areas of ecological interest or protected areas in the immediate vicinity of the project.

Drainage from car parks and vehicle standing areas will be provided with the appropriate protection measures against spillage of hydrocarbons, such as pollution separators or similar.

High risk electrical components, such as within power supply compounds and similar, will be protected from the storm water drainage system. Bunds and similar will be provided and highly contaminated runoff will be removed by means other than the storm water systems.

It is not proposed to provide pollution separators on all railway drainage outfalls. These are mostly existing outfalls and there will be no significant change on water discharge quality. Railway ballast and filter drainage aggregate can act as agents to the remediation of hydrocarbons, the slow flow rates allow the settlement of larger granular materials. Therefore railway drainage systems can provide significant levels of pollution remediation. Additionally, the project is to provide substantial electrification of the railway, the removal of most diesel trains will significantly improve the quality of storm water runoff.

#### 4.10 Pumped Drainage Systems

Currently there is no requirements for any pumped storm water drainage systems within the project.

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## 5. FOUL DRAINAGE STRATEGY

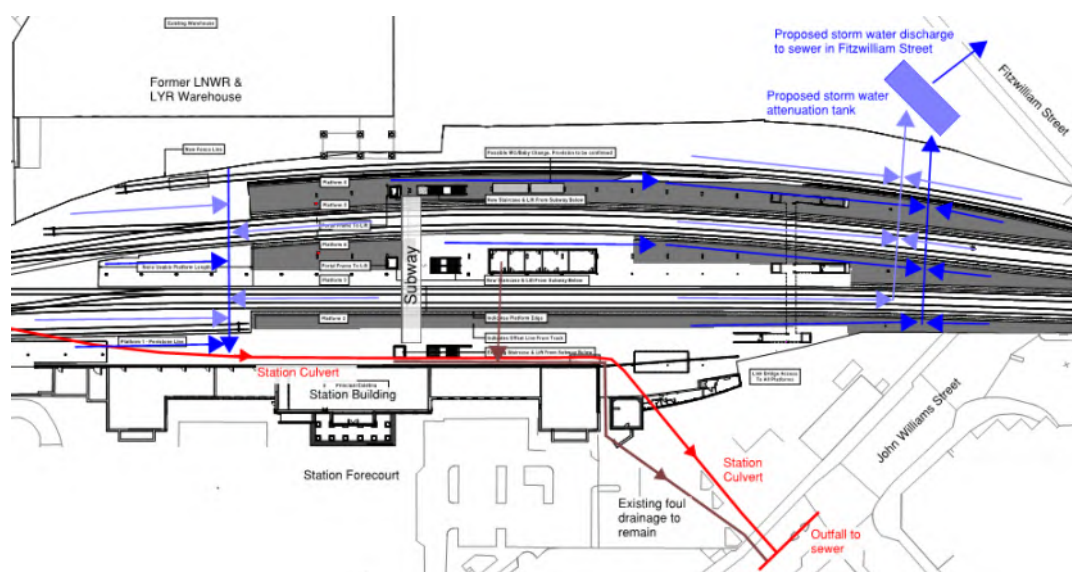
### 5.1 Overview

The main foul drainage system required for this project is at Huddersfield Station. There may also be other minor foul drainage requirements throughout the project, to be confirmed at a later date. These are discussed below.

#### Huddersfield Station

There are currently three areas of foul drainage within the existing station, within the main building, from the tea rooms and within the signal box (the latter two being on platforms 3&4). The main drainage pipe for the station building is supported on the wall of the cellar walkway which runs along the side of the station building beneath platform 1. This heads north before crossing the car park and discharging into the sewer in John Williams Street. There is pipework within platforms 3&4 which crosses the railway to platform 1 supported on the wall of the redundant parcel subway. This then discharges into the pipework in the cellar walkway.

The project will remove the signal box from platforms 3&4, but the other foul drainage requirements will remain, although with modifications. It is currently assumed the foul drainage flow rates for the station will remain similar to the existing, therefore there will be no significant change to the quantity of foul drainage discharging to the sewer. The pipework within the cellar walkway will remain largely the same, it may have to be repositioned to achieve required falls from the island platform but in principle the foul drainage arrangement will remain as existing. The connection from platforms 3&4, which will only serve the tea rooms, will also remain largely the same. The parcel subway is to be partially backfilled, but the drain pipe will be ducted and will remain along roughly the same route. The details for these works will be confirmed at a later design stage.





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#### **Other requirements for foul drainage**

There are various compounds and other minor buildings required for the operation of the railway, primarily for the OLE power supply. These could be fairly isolated and may require toilet and washing facilities. This could be provided by the use of portable toilet units. It is not currently proposed to provide foul drainage connections to any of these locations.

These compounds could also contain large electrical equipment containing fluid and chemicals. Infrastructure containing these fluids would have to be located in an isolating bund to contain any spillages. Vehicle parking and delivery areas would also be of a high pollution risk. These area would have to have separate drainage systems isolated from the other surface water drainage systems. Effluent would have to be collected in separate storage tanks and either treated on site or stored for controlled disposal. The requirement for such facilities will be confirmed at a later date.



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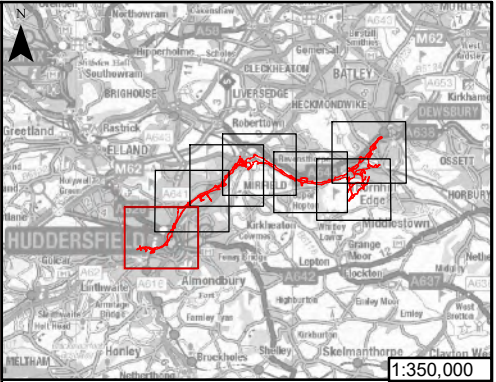
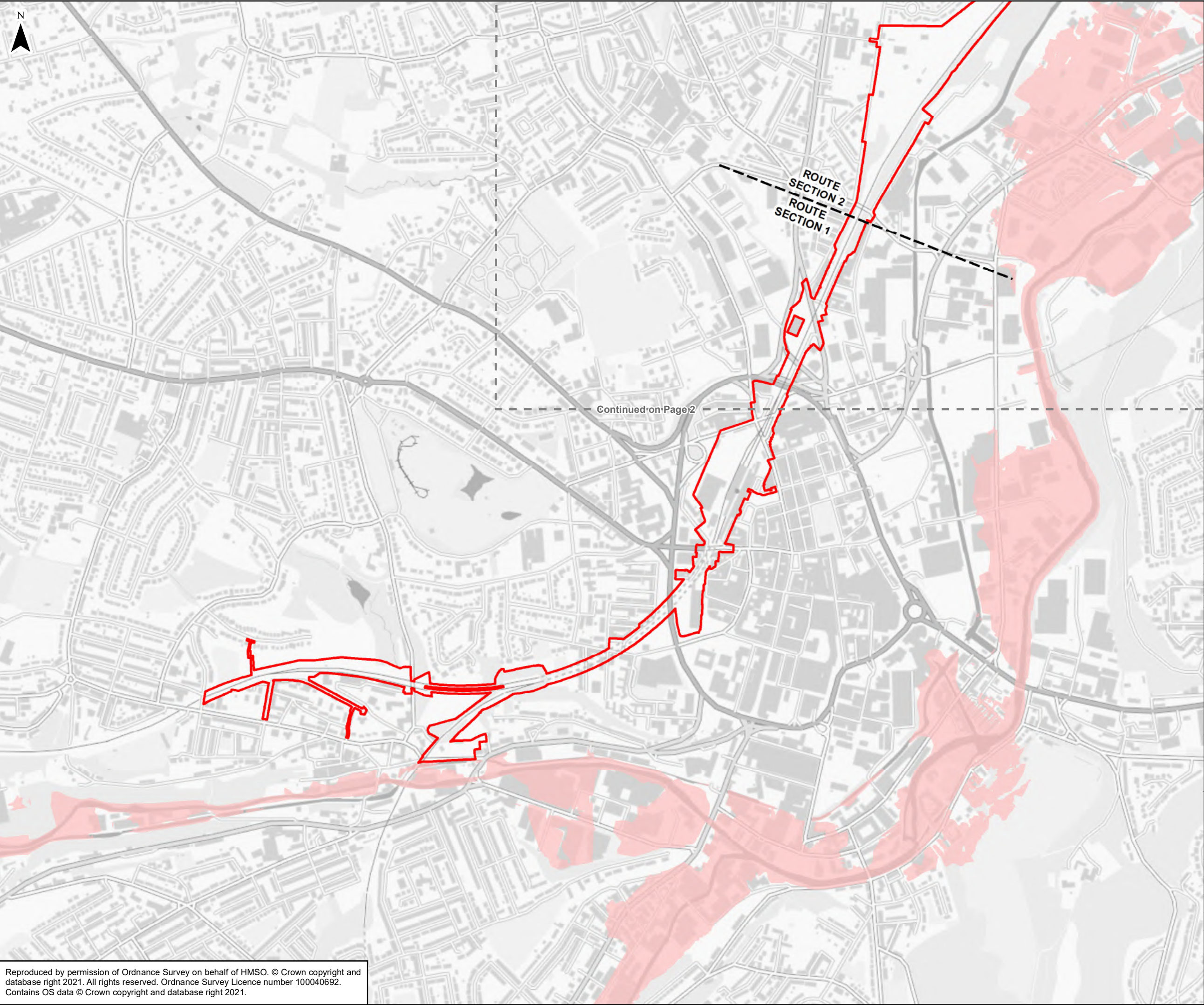
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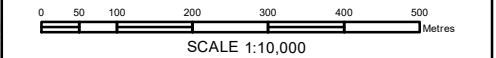
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## **APPENDIX B – FLOOD RISK MAPPING**





- Scheme Boundary
- Route Section Extents
- Adjacent Map Sheet
- 1% Plus Climate Change Allowance (65%)  
Modelled Flood Extents Baseline



P01	08/09/21	FIRST ISSUE	MMN	PP	PP
Rev	Date	Description of Revisions	Drwn	Chkd	Appr
Status	SHARED			Suitability	



Project  
TRANSPENNINE ROUTE UPGRADE

Contract No.  
151667

Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (65%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 1

Designed	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Checked	P.Pasco	Signed Electronically	Date	08/09/2021
Approved	P.Pasco	Signed Electronically	Date	08/09/2021

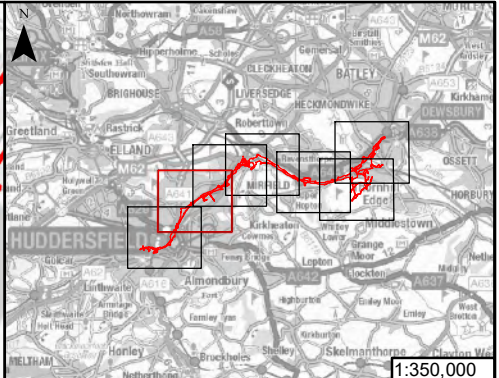
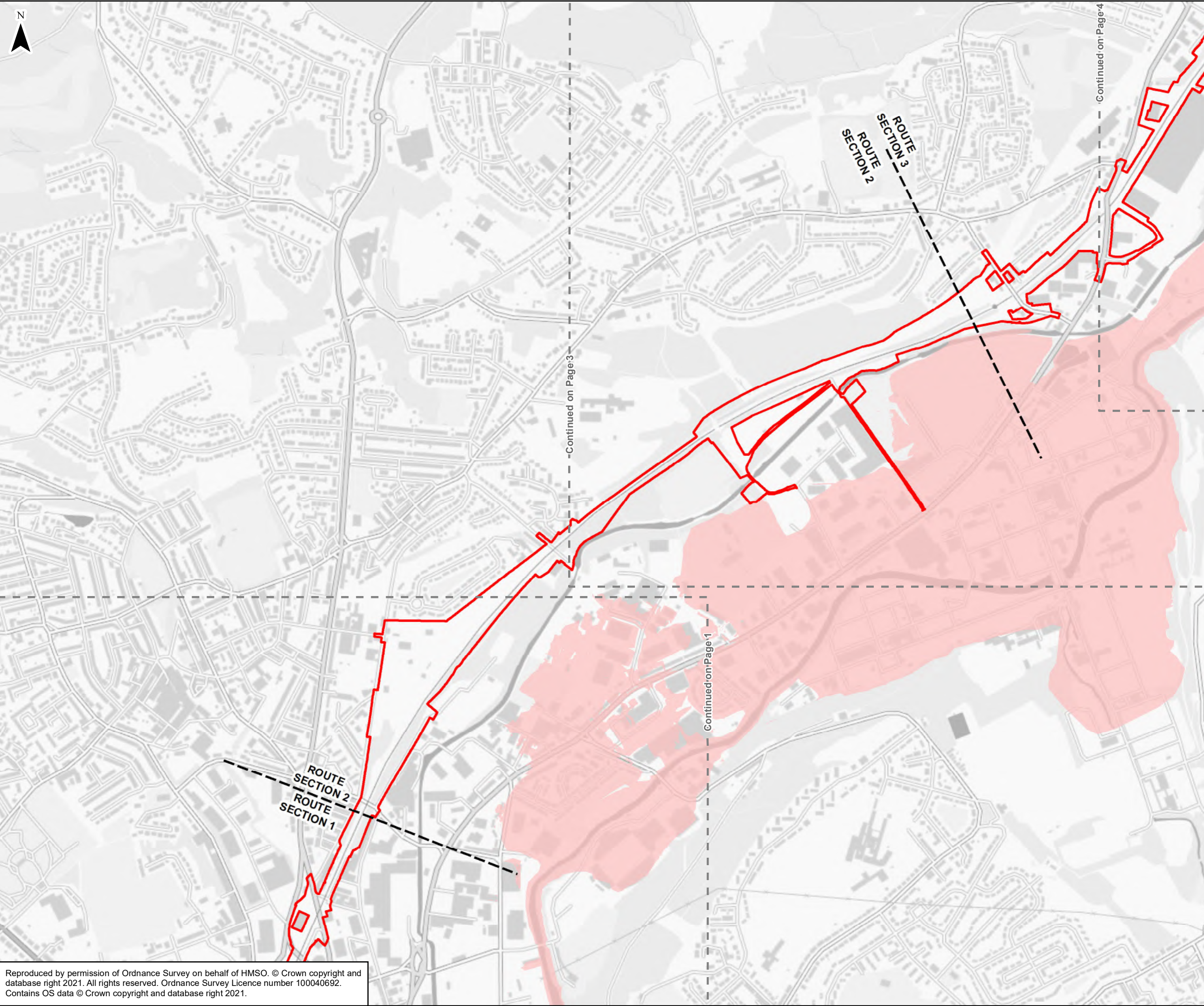
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Alternative Reference  
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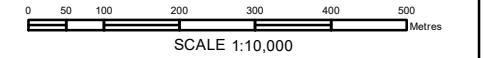
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Revision  
P01





- Scheme Boundary
- Route Section Extents
- Adjacent Map Sheet
- 1% Plus Climate Change Allowance (65%) Modelled Flood Extents Baseline



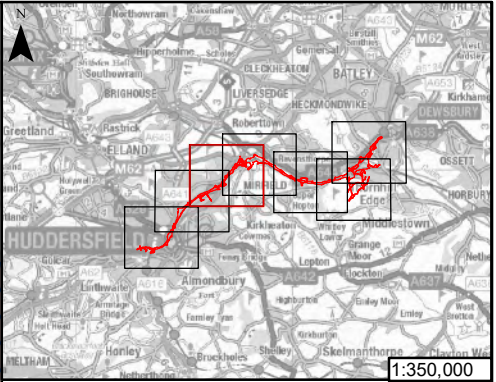
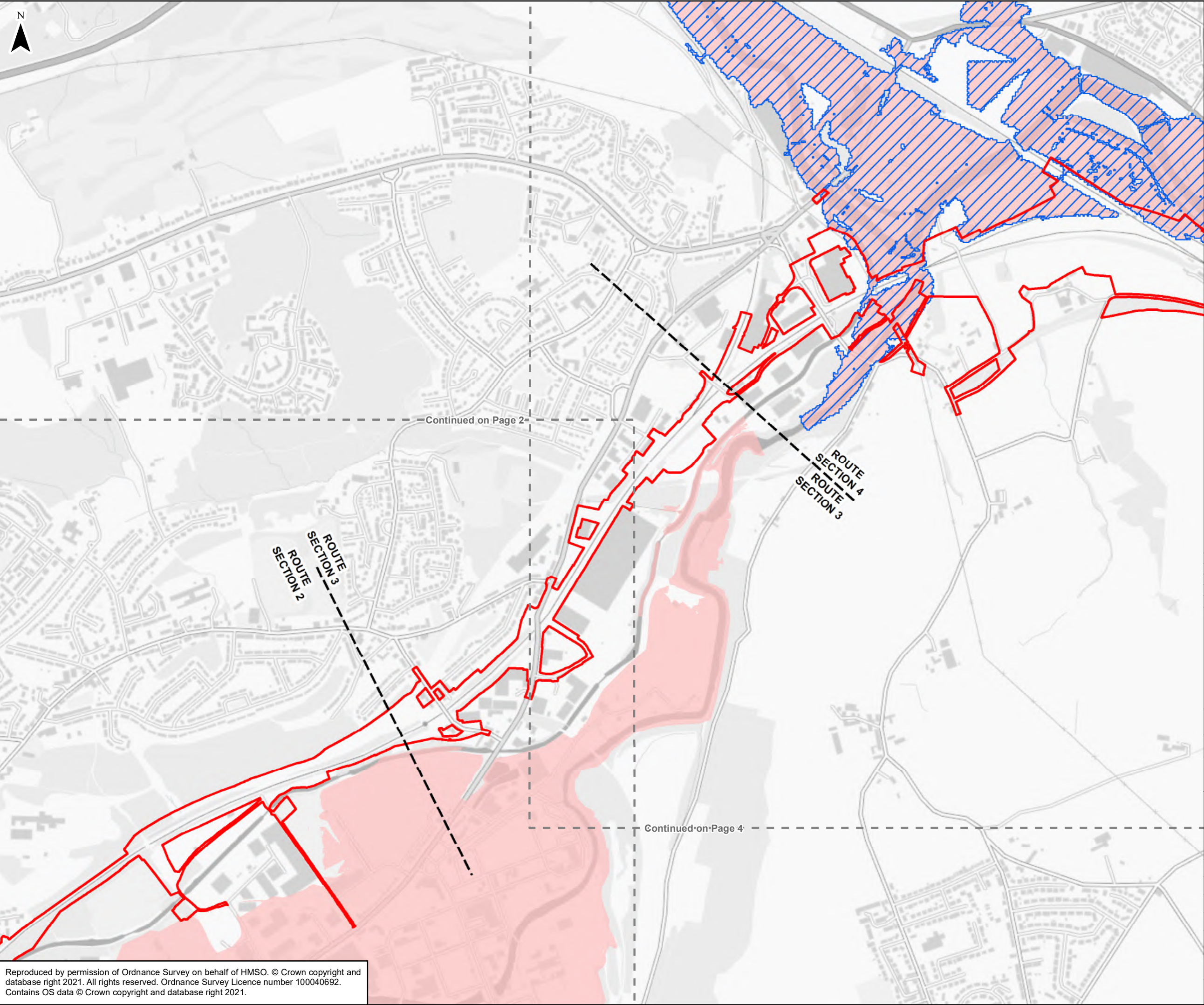
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Status	SHARED			Suitability	



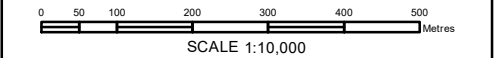
Project TRANSPENNINE ROUTE UPGRADE			
Contract No. 151667			
Scheme Title THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER			
Drawing Title 1% PLUS CLIMATE CHANGE ALLOWANCE (65%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 2			
Designed	M.Mallesha Nayaka	Signed Electronically	Date 08/09/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date 08/09/2021
Checked	P.Pasco	Signed Electronically	Date 08/09/2021
Approved	P.Pasco	Signed Electronically	Date 08/09/2021
Scale(s) 1:10,000		ELR & Project Chainage ---	
Alternative Reference ---			Sheet 2 of 7
Drawing Number 151667-TSA-00-TRU-REP-W-EN-000XXX			Revision P01

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- Scheme Boundary
- Route Section Extents
- Adjacent Map Sheet
- 1% Plus Climate Change Allowance (65%) Modelled Flood Extents Scheme
- 1% Plus Climate Change Allowance (65%) Modelled Flood Extents Baseline



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Scheme Title  
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Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (65%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 3

Designed	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Checked	P.Pasco	Signed Electronically	Date	08/09/2021
Approved	P.Pasco	Signed Electronically	Date	08/09/2021

Scale(s)  
1:10,000

ELR & Project Chainage  
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Alternative Reference  
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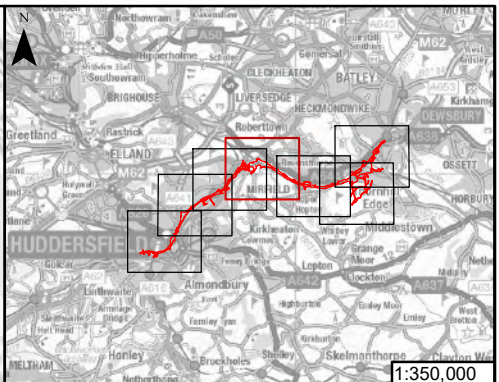
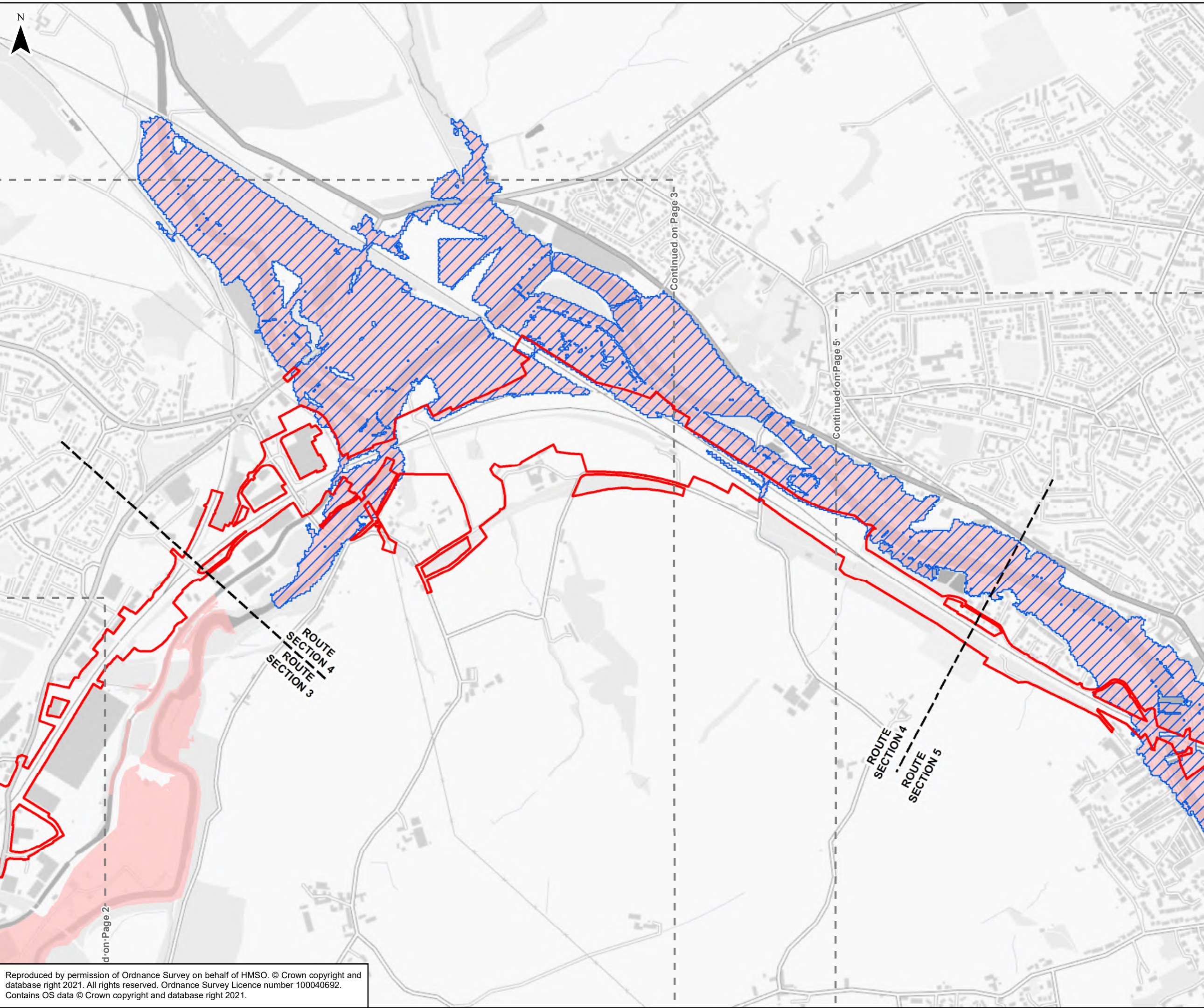
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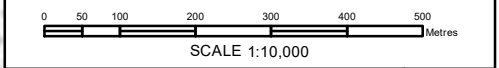
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- Scheme Boundary
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Scheme Title  
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Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (65%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 4

Designed	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Checked	P.Pasco	Signed Electronically	Date	08/09/2021
Approved	P.Pasco	Signed Electronically	Date	08/09/2021

Scale(s)  
1:10,000

ELR & Project Chainage  
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Alternative Reference  
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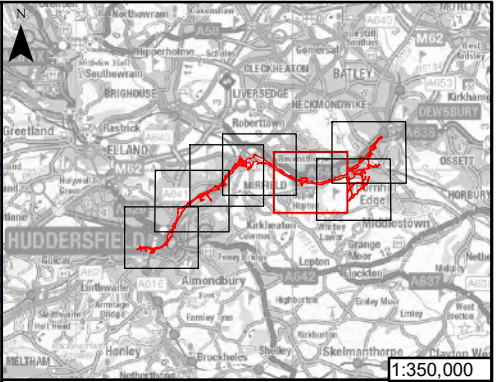
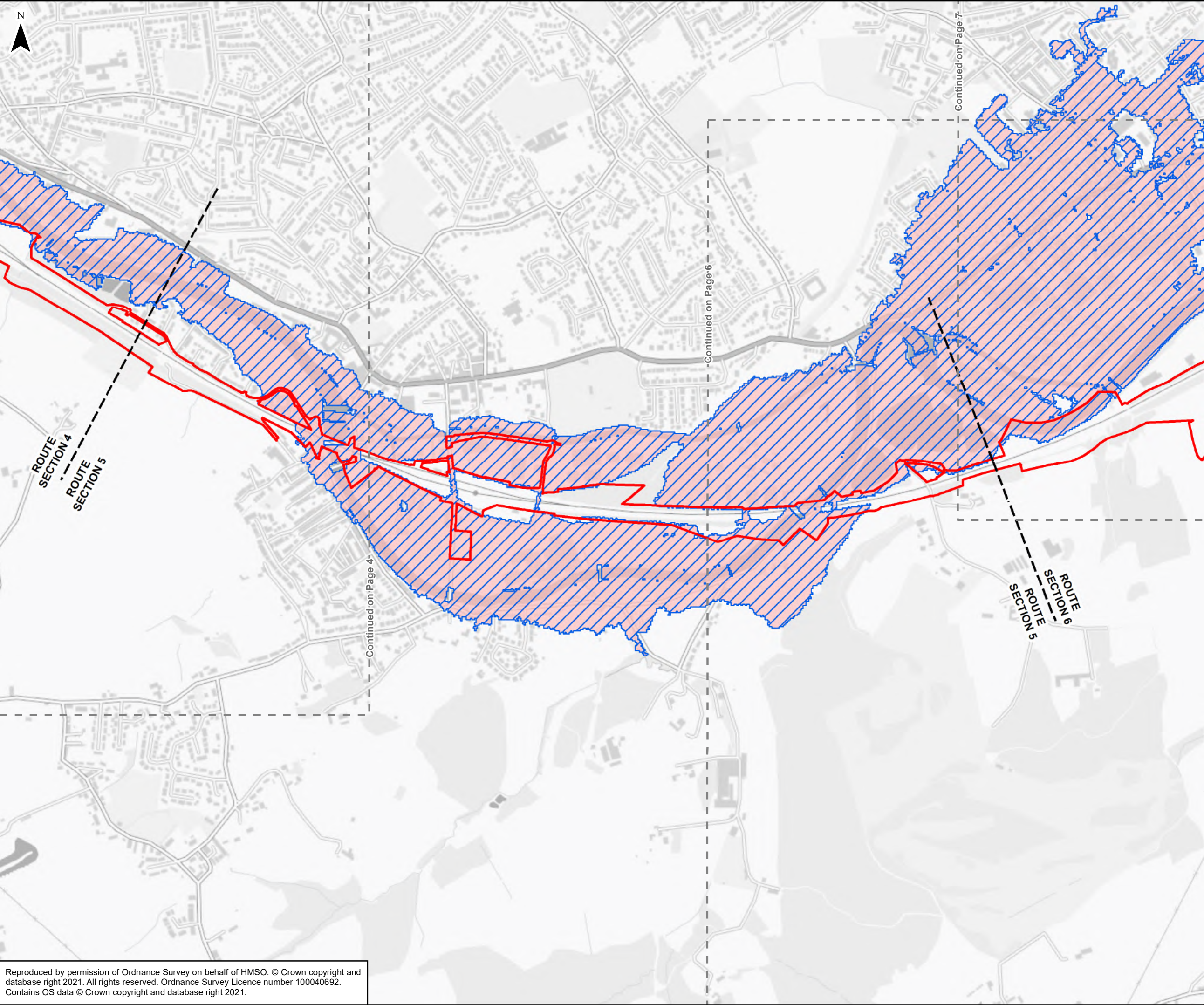
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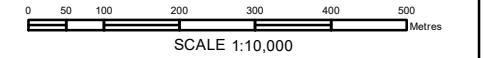
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- Scheme Boundary
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Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (65%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 5

Designed	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Checked	P.Pasco	Signed Electronically	Date	08/09/2021
Approved	P.Pasco	Signed Electronically	Date	08/09/2021

Scale(s)  
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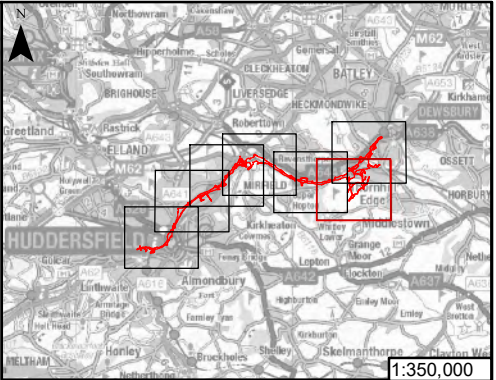
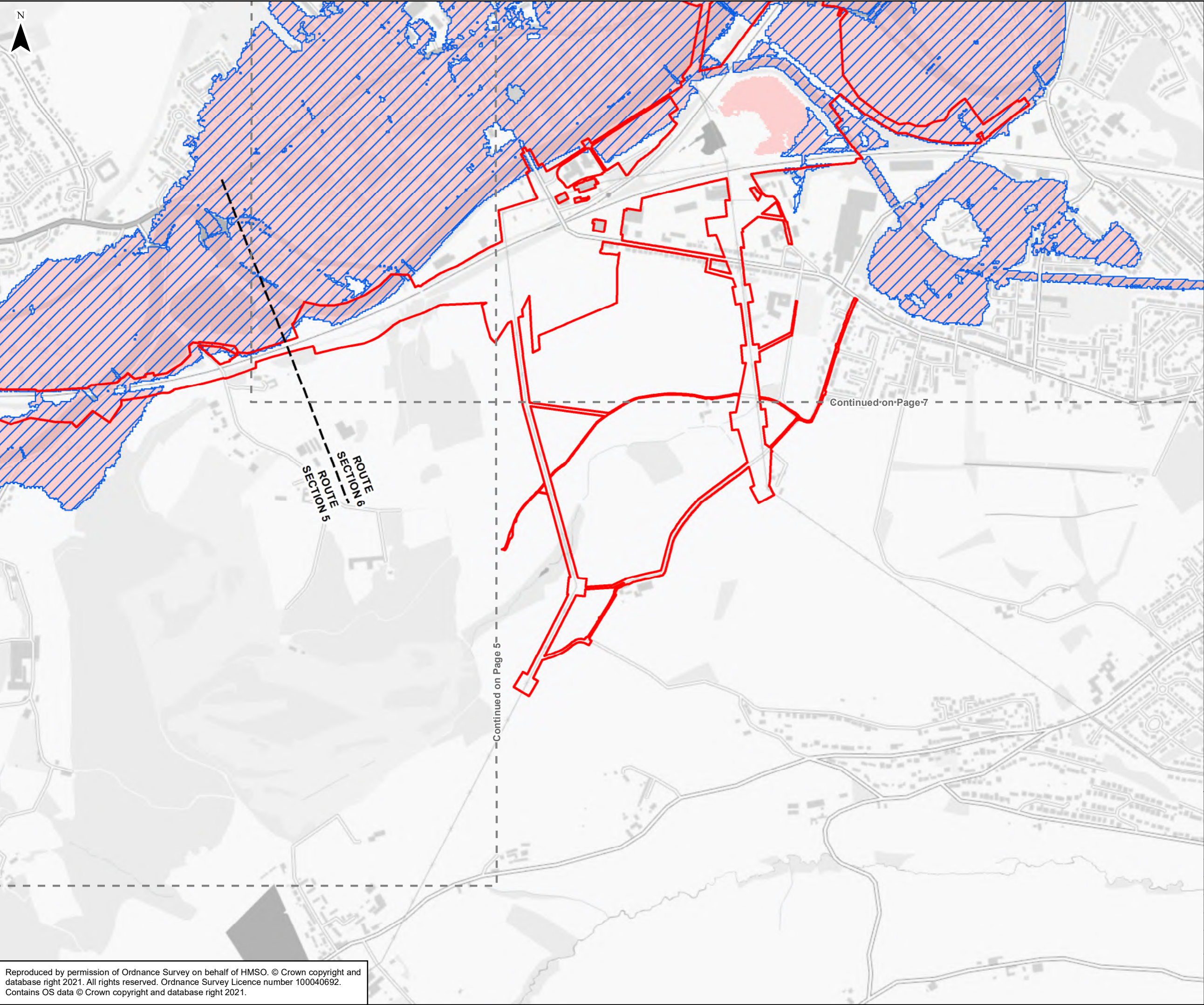
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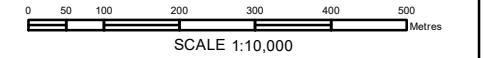
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- Scheme Boundary
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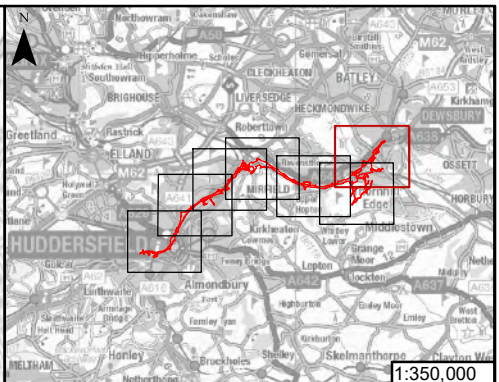
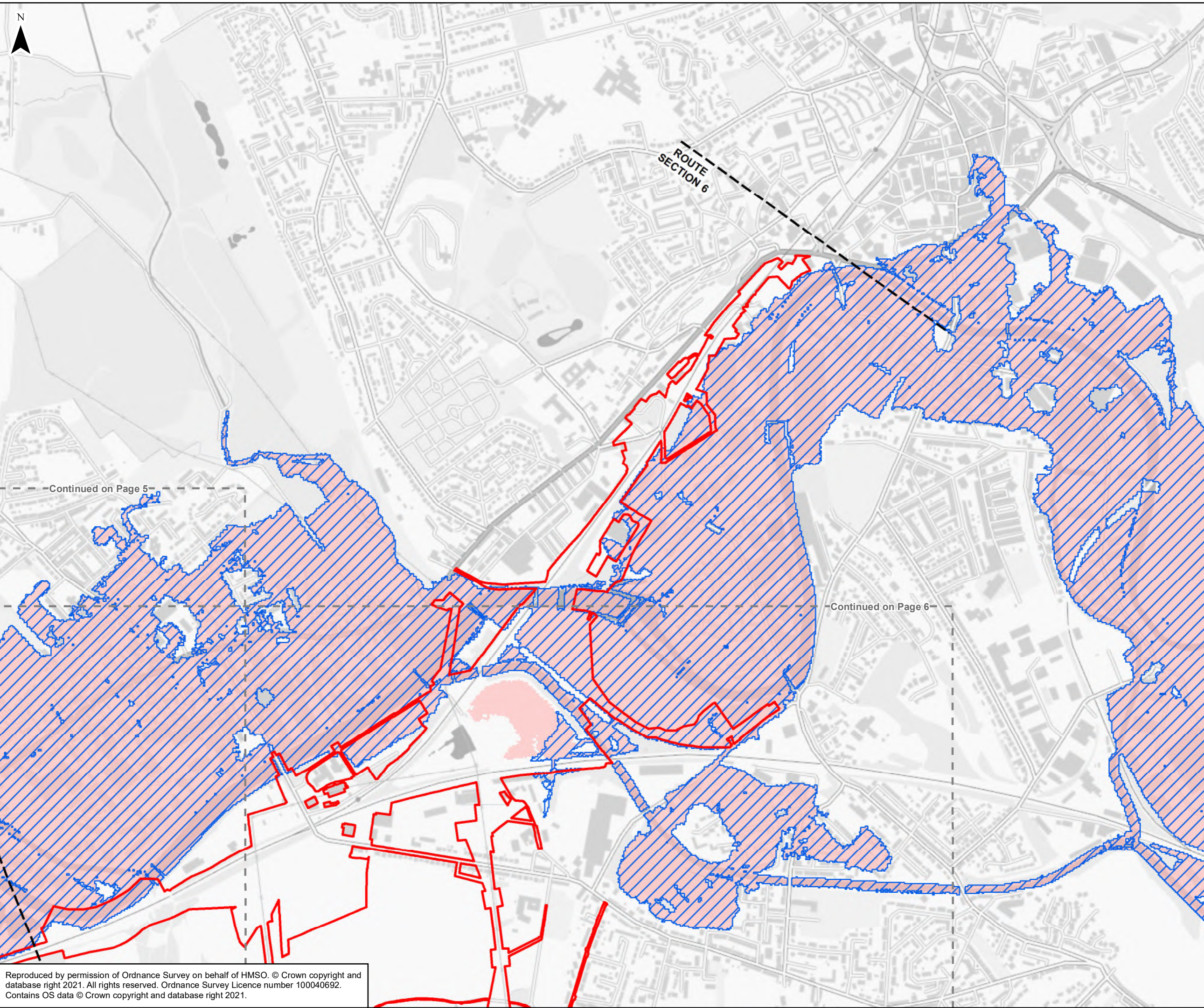
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Drawing Title  
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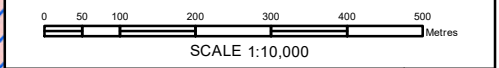
Designed	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Checked	P.Pasco	Signed Electronically	Date	08/09/2021
Approved	P.Pasco	Signed Electronically	Date	08/09/2021
Scale(s)	1:10,000	ELR & Project Chainage	---	
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Drawing Number	151667-TSA-00-TRU-REP-W-EN-000XXX	Revision	P01	

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- Scheme Boundary
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Designed	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	08/09/2021
Checked	P.Pasco	Signed Electronically	Date	08/09/2021
Approved	P.Pasco	Signed Electronically	Date	08/09/2021

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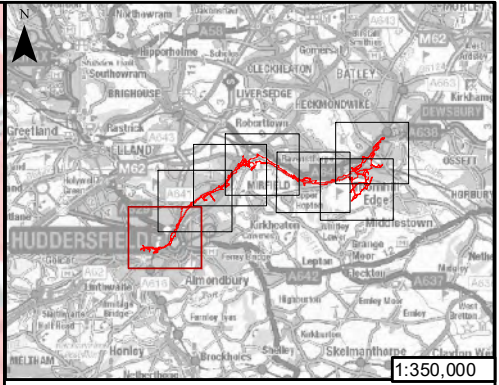
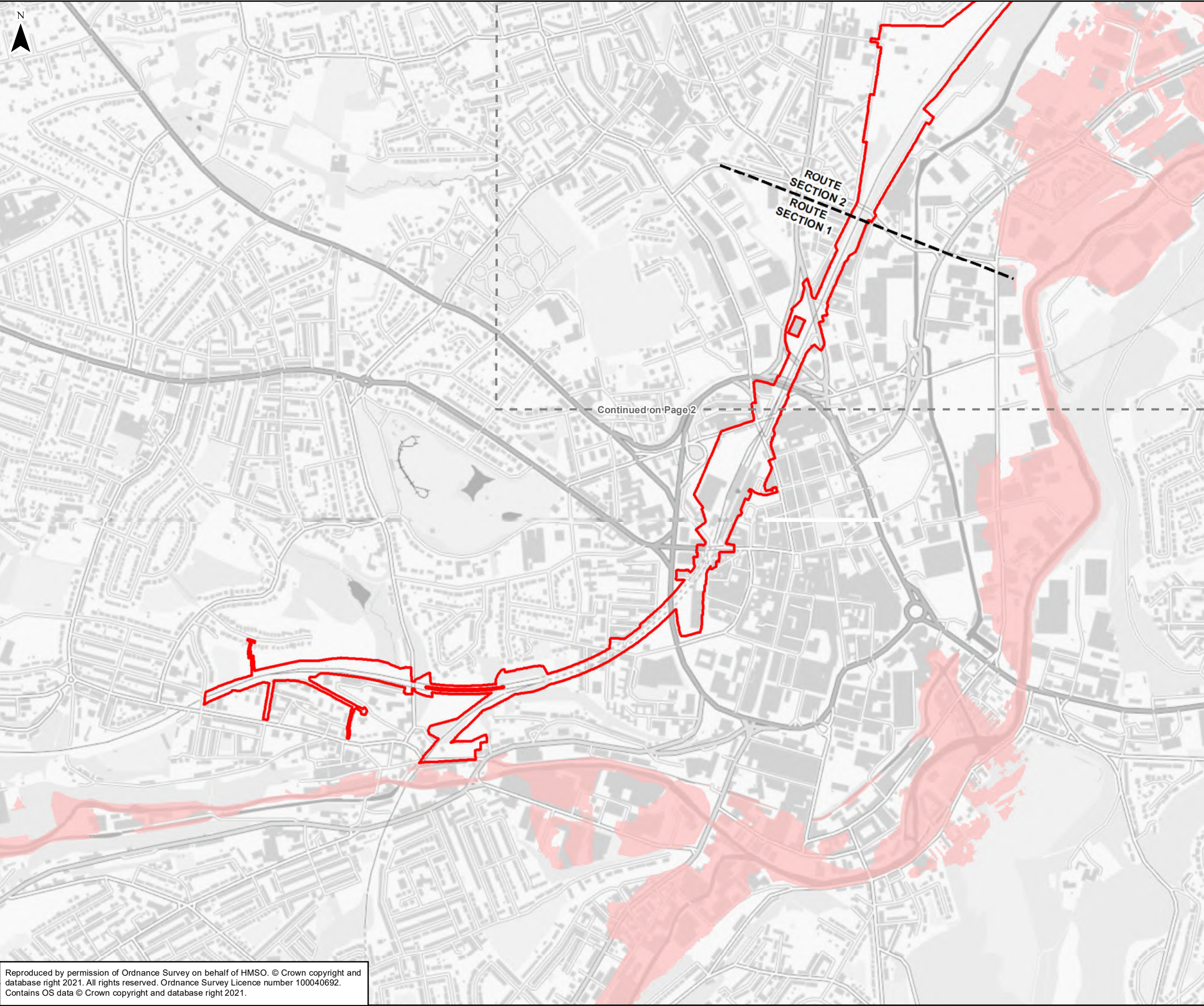
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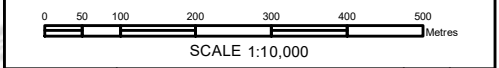
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- Scheme Boundary
- Adjacent Map Sheet
- 1% Plus Climate Change Allowance (50%) Modelled Flood Extents Baseline



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Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (50%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 1

Designed	R.Bowes	Signed Electronically	Date	09/08/2021
Drawn	R.Bowes	Signed Electronically	Date	09/08/2021
Checked	P.Pasco	Signed Electronically	Date	09/08/2021
Approved	P.Pasco	Signed Electronically	Date	09/08/2021

Scale(s)  
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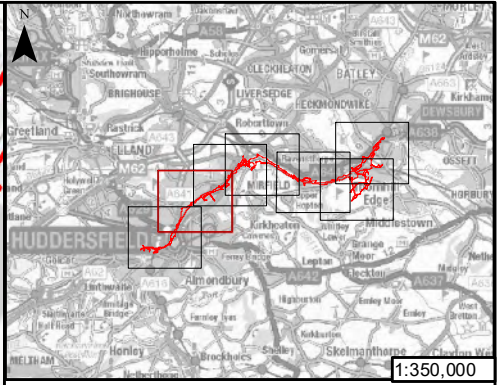
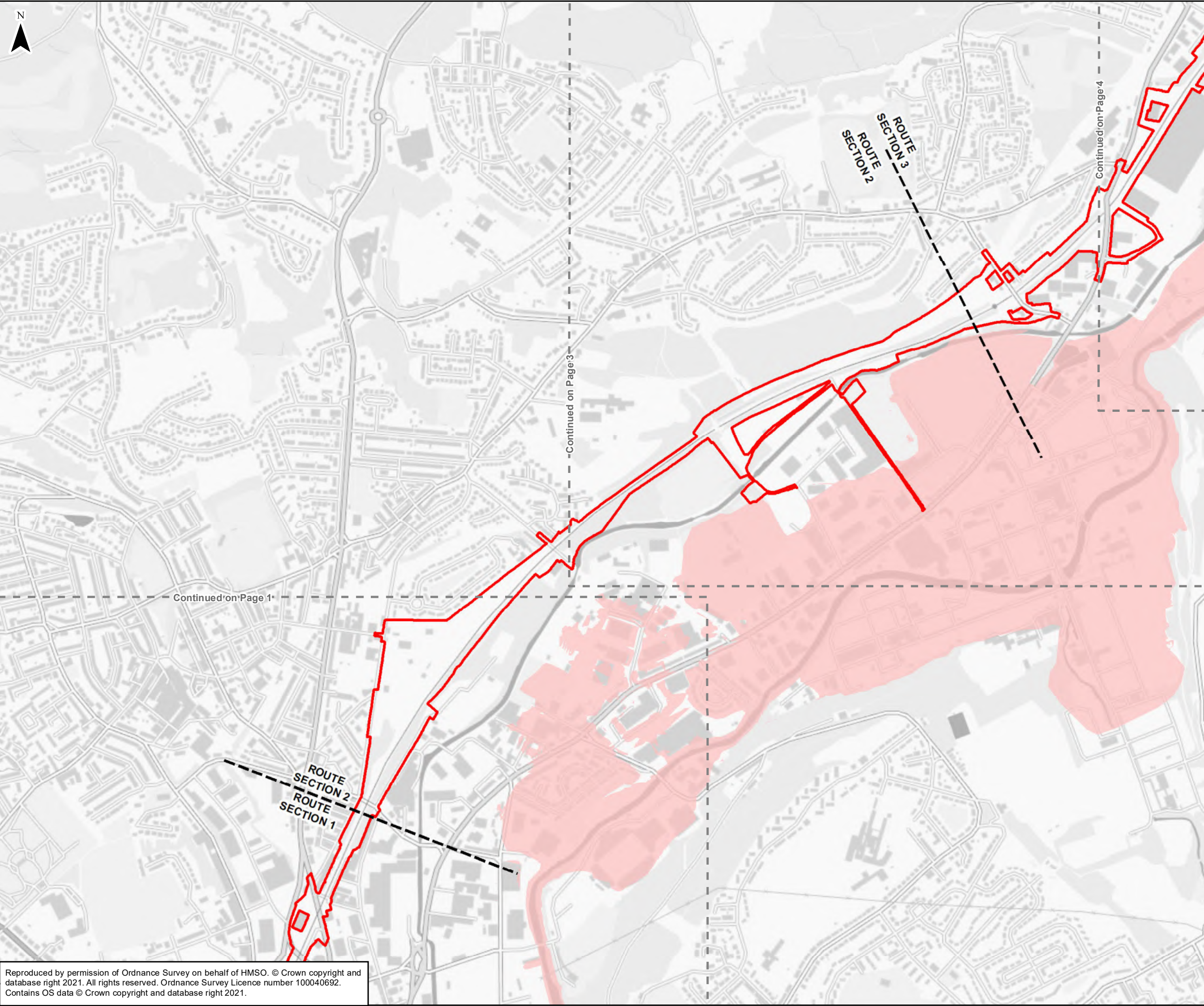
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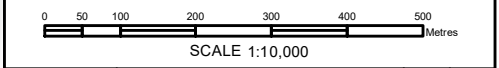
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- Scheme Boundary
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Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (50%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 2

Designed	R.Bowes	Signed Electronically	Date	09/08/2021
Drawn	R.Bowes	Signed Electronically	Date	09/08/2021
Checked	P.Pasco	Signed Electronically	Date	09/08/2021
Approved	P.Pasco	Signed Electronically	Date	09/08/2021

Scale(s)  
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ELR & Project Chainage  
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Alternative Reference  
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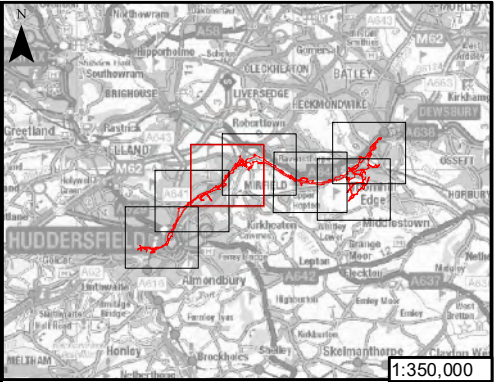
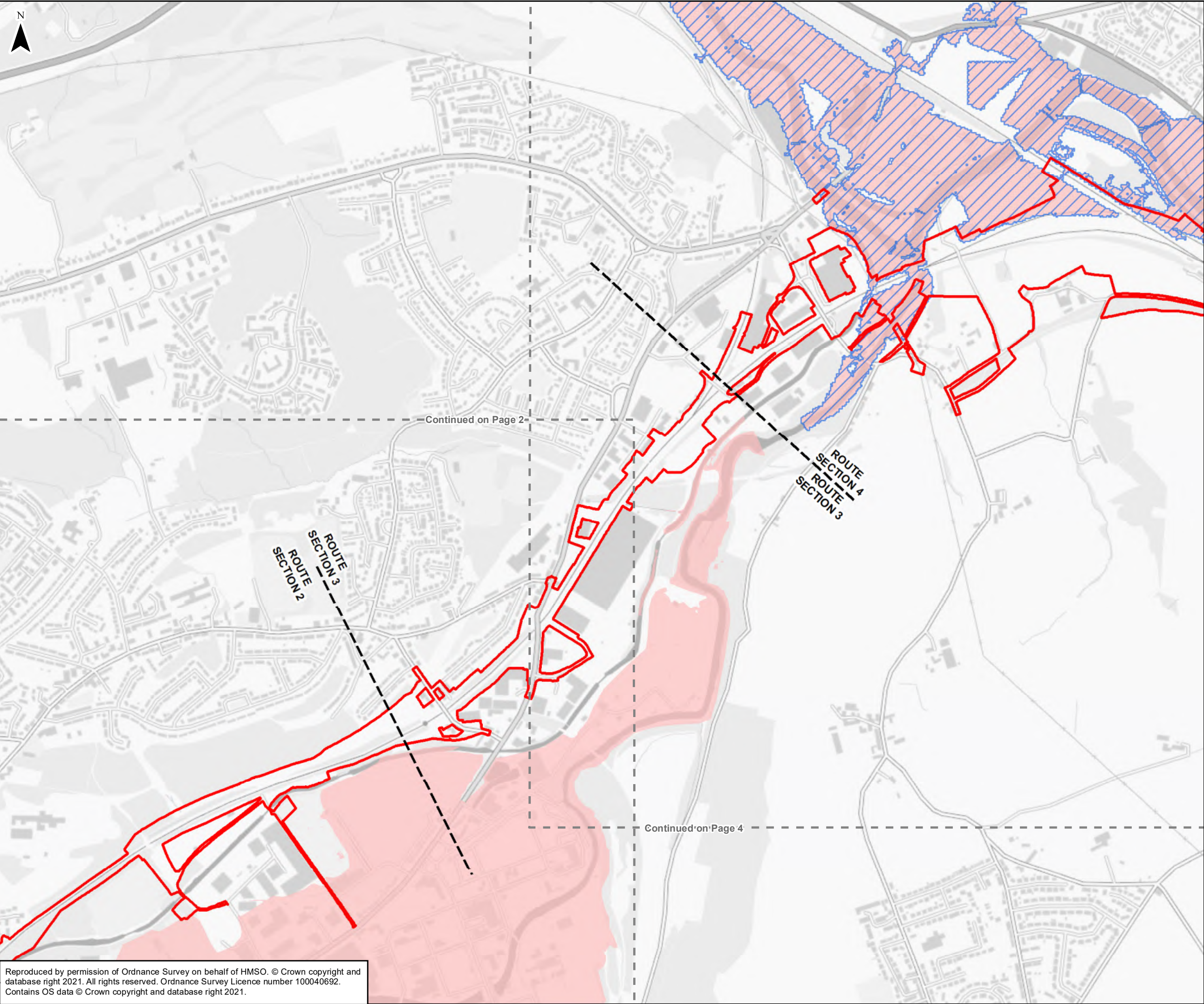
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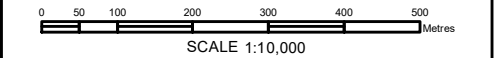
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- Scheme Boundary
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Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (50%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 3

Designed	R.Bowes	Signed Electronically	Date	09/08/2021
Drawn	R.Bowes	Signed Electronically	Date	09/08/2021
Checked	P.Pasco	Signed Electronically	Date	09/08/2021
Approved	P.Pasco	Signed Electronically	Date	09/08/2021

Scale(s)  
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ELR & Project Chainage  
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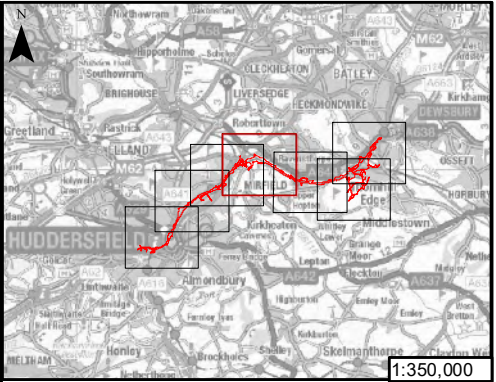
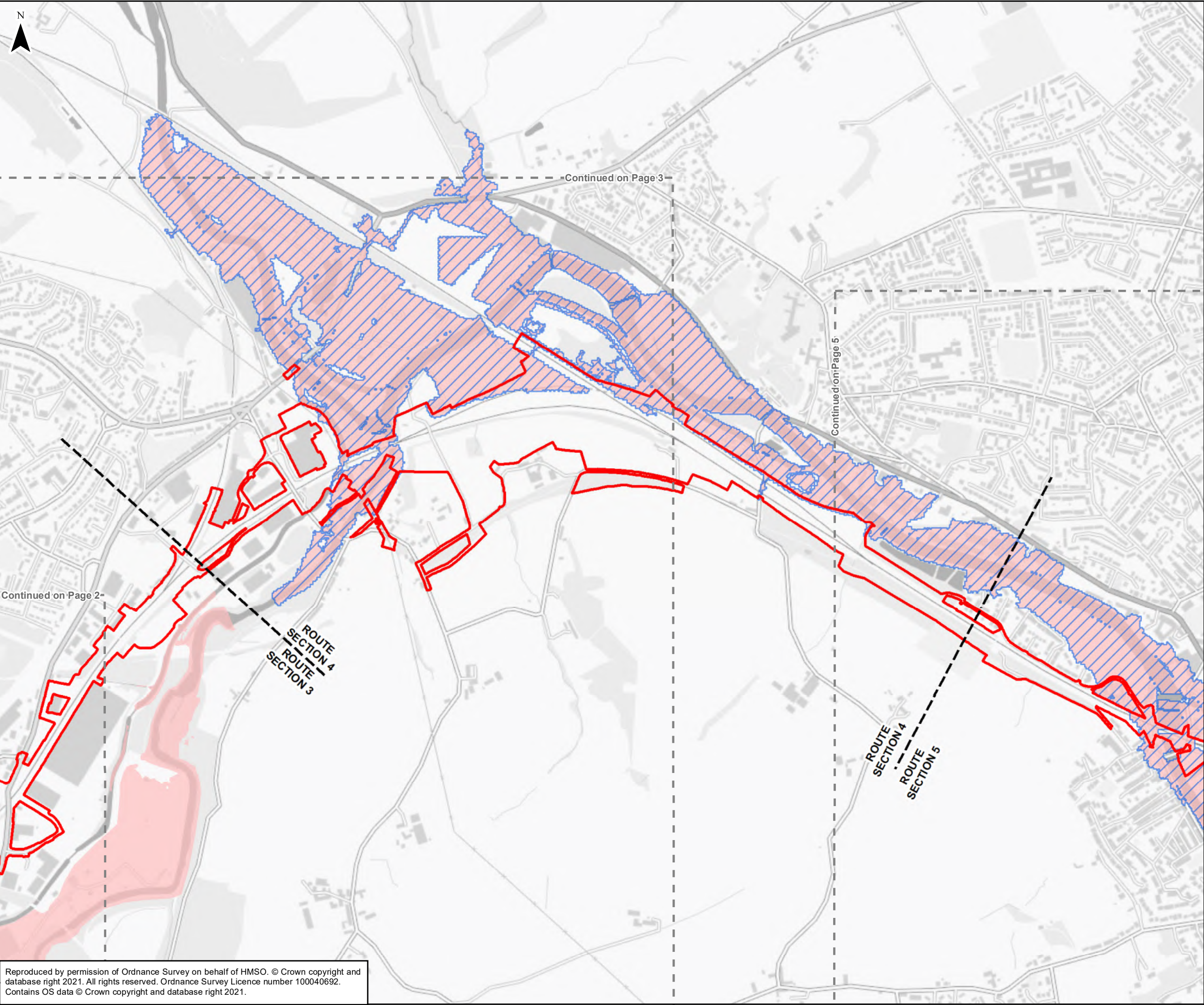
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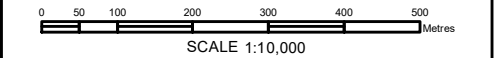
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- Scheme Boundary
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Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (50%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 4

Designed	R.Bowes	Signed Electronically	Date	09/08/2021
Drawn	R.Bowes	Signed Electronically	Date	09/08/2021
Checked	P.Pasco	Signed Electronically	Date	09/08/2021
Approved	P.Pasco	Signed Electronically	Date	09/08/2021

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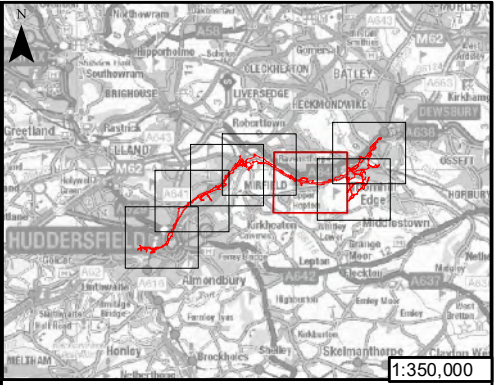
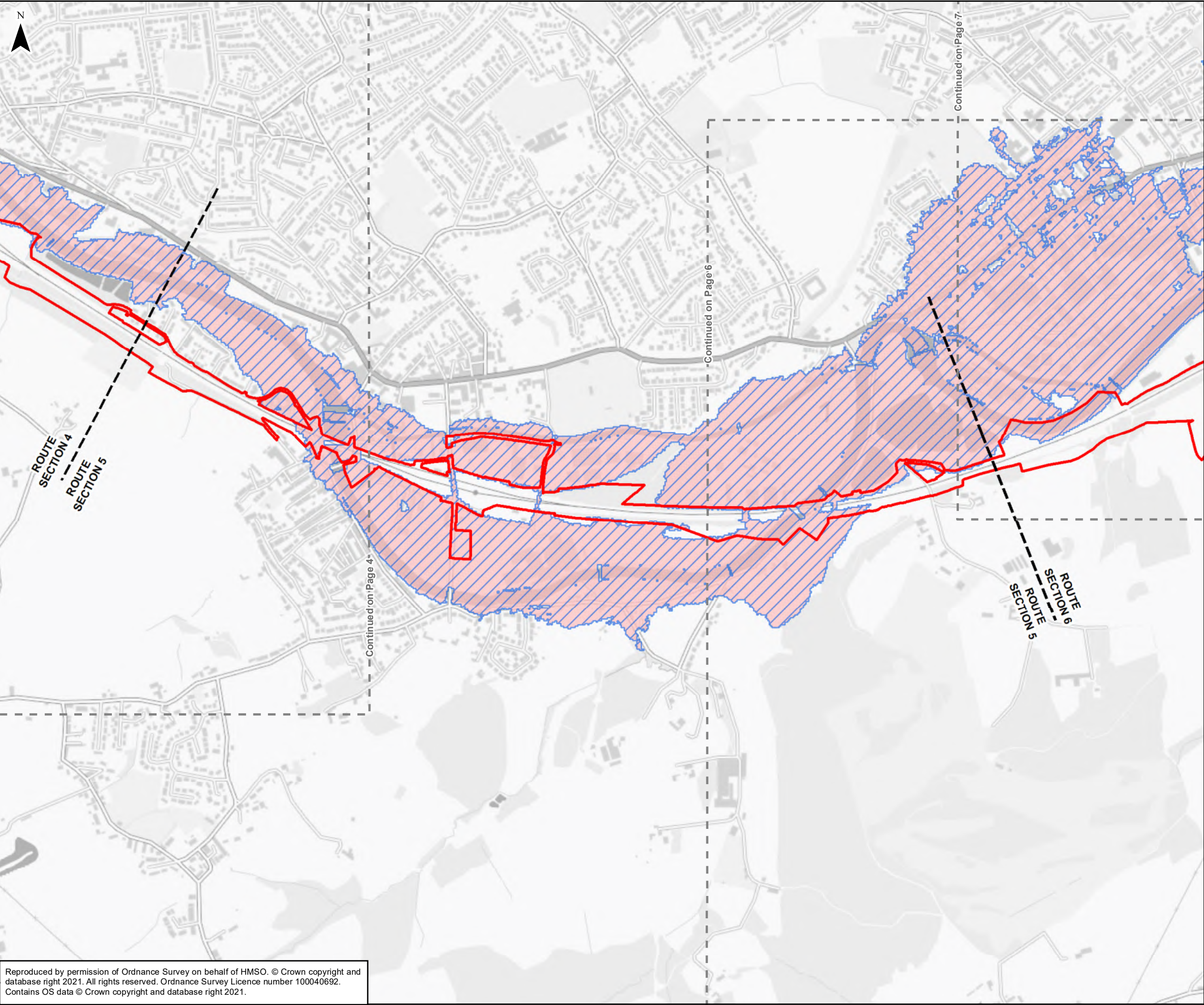
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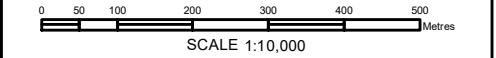
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1% PLUS CLIMATE CHANGE ALLOWANCE (50%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 5

Designed	R.Bowes	Signed Electronically	Date	09/08/2021
Drawn	R.Bowes	Signed Electronically	Date	09/08/2021
Checked	P.Pasco	Signed Electronically	Date	09/08/2021
Approved	P.Pasco	Signed Electronically	Date	09/08/2021

Scale(s)  
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ELR & Project Chainage  
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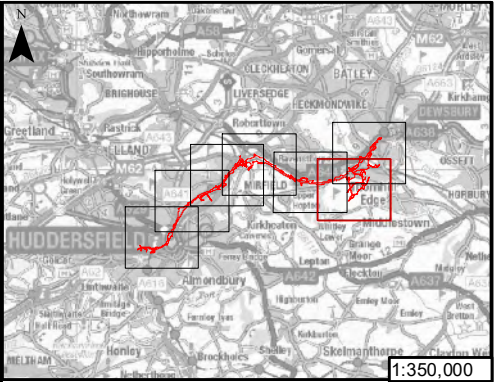
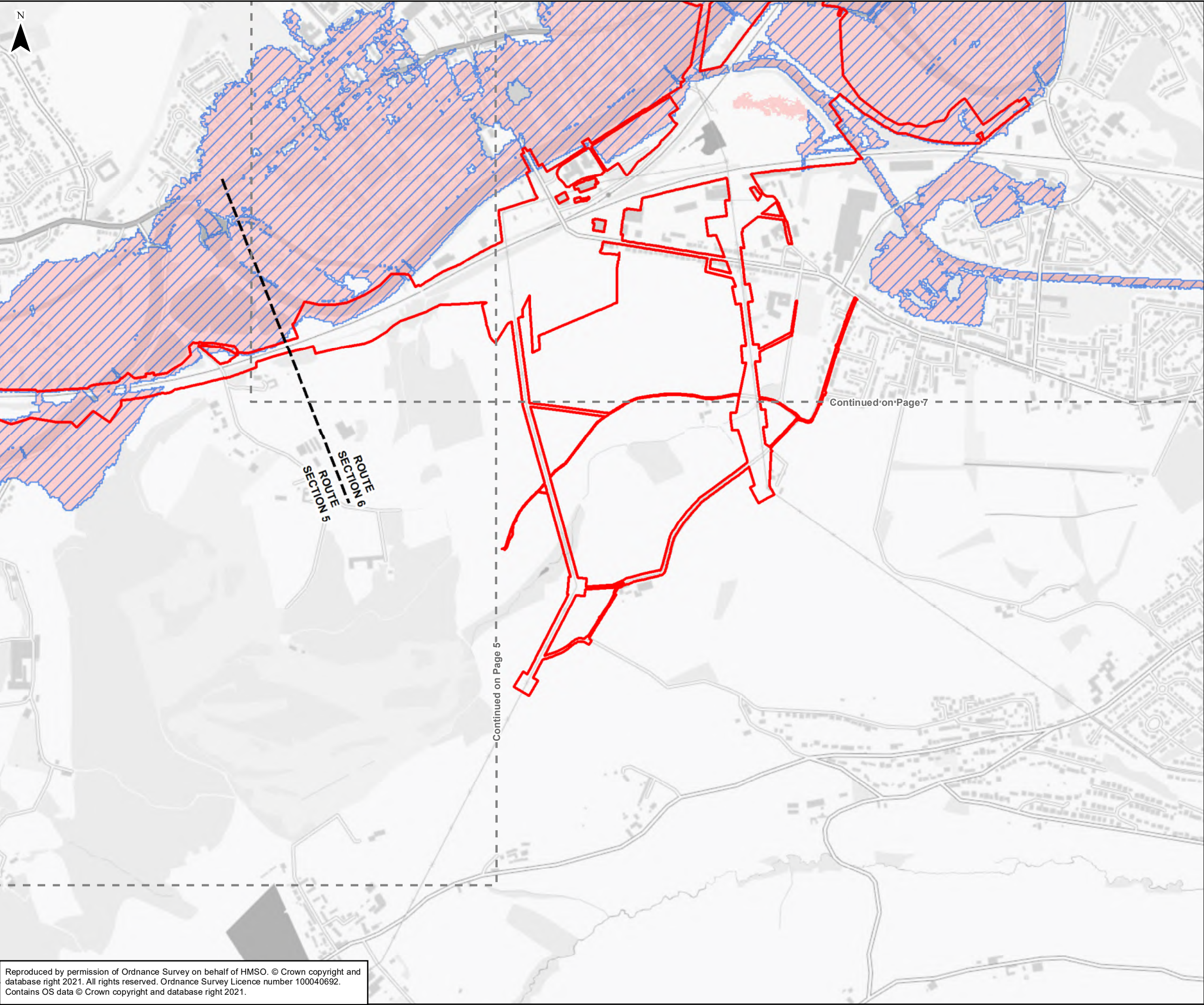
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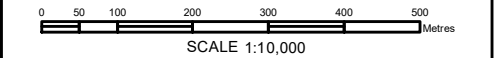
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Designed	R.Bowes	Signed Electronically	Date	09/08/2021
Drawn	R.Bowes	Signed Electronically	Date	09/08/2021
Checked	P.Pasco	Signed Electronically	Date	09/08/2021
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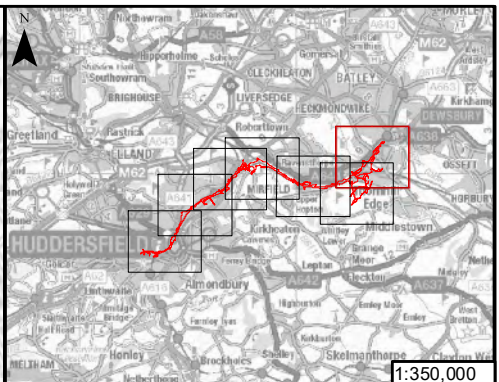
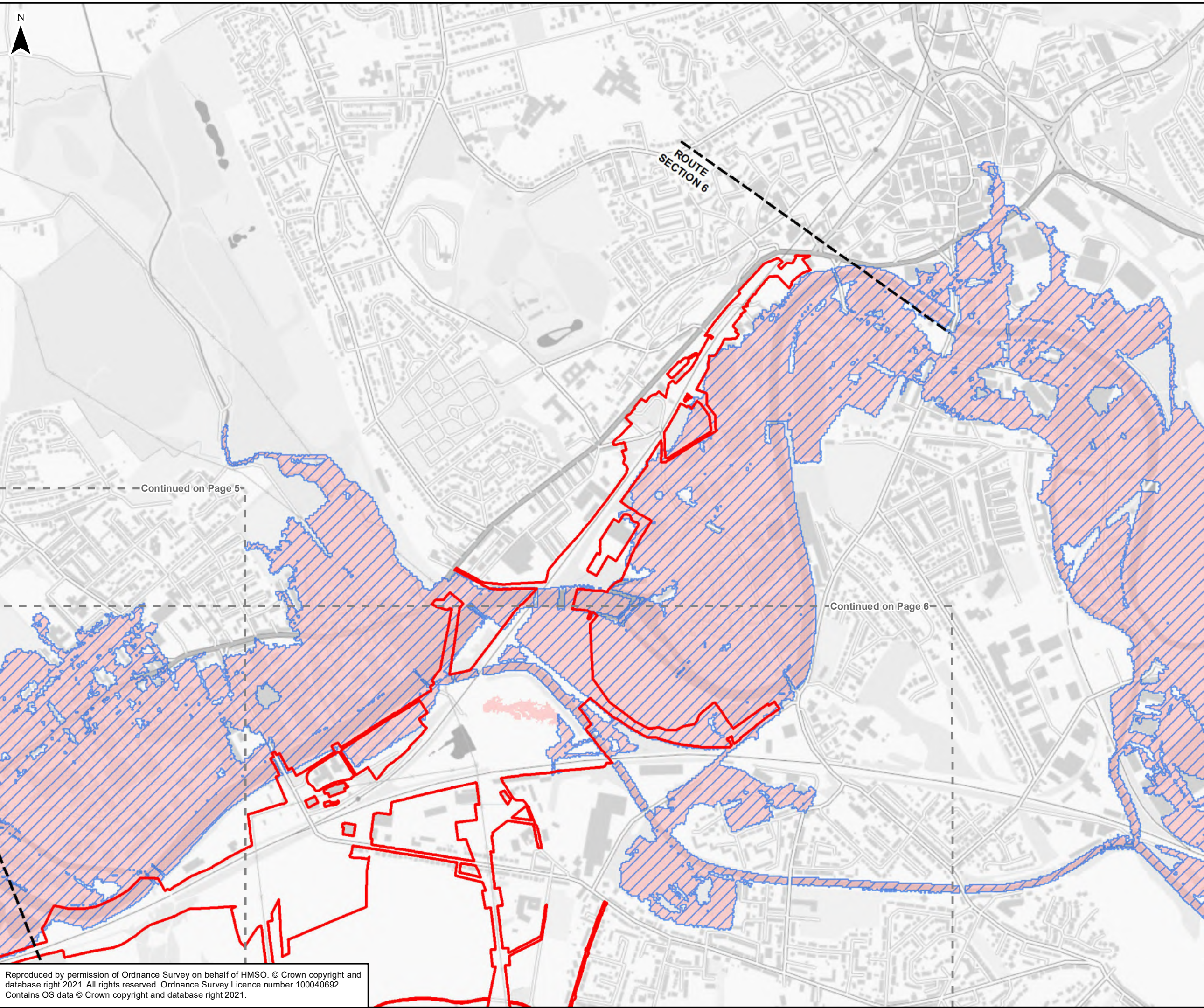
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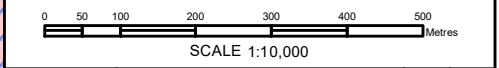
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THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
1% PLUS CLIMATE CHANGE ALLOWANCE (50%) AEP MAXIMUM FLOOD EXTENT COMPARISON OF BASELINE AND WITH SCHEME MODELLING ROUTE SECTION 6

Designed	R.Bowes	Signed Electronically	Date	09/08/2021
Drawn	R.Bowes	Signed Electronically	Date	09/08/2021
Checked	P.Pasco	Signed Electronically	Date	09/08/2021
Approved	P.Pasco	Signed Electronically	Date	09/08/2021

Scale(s)  
1:10,000

ELR & Project Chainage  
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Alternative Reference  
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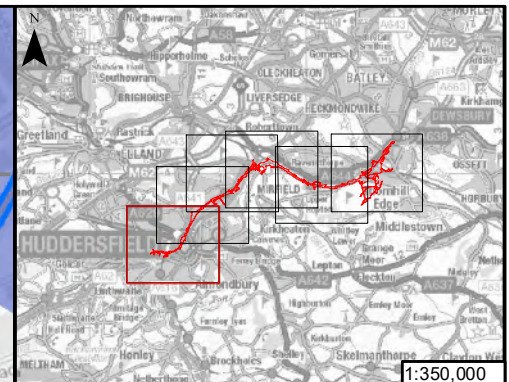
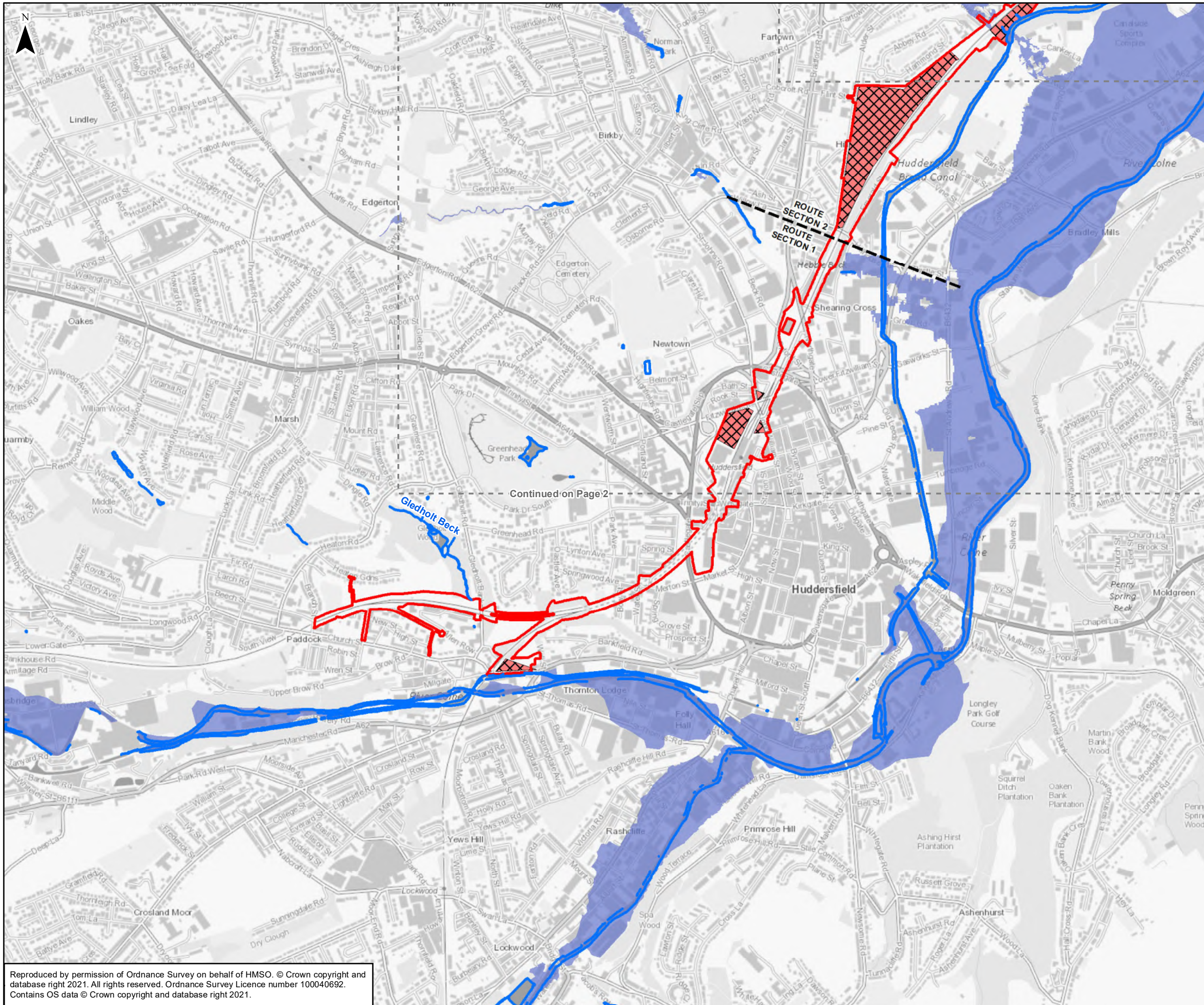
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Drawing Number  
151667-TSA-00-TRU-REP-W-EN-000865

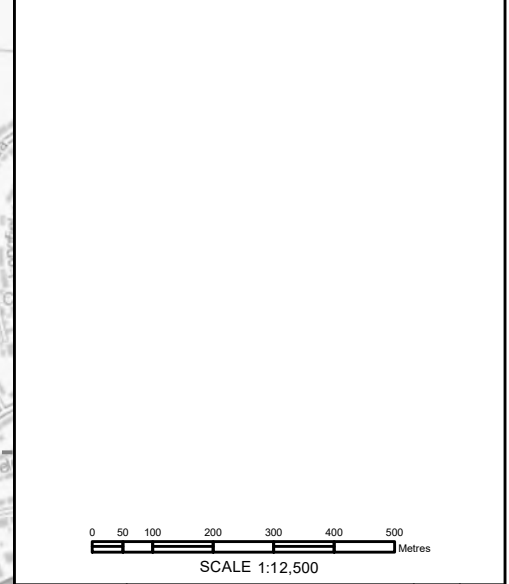
Revision  
P01

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- Scheme Boundary
- Route Section Extents
- Adjacent Map Sheet
- River/Canal
- Flood Zone 3
- Scheme Compounds



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Rev	Date	Description of Revisions	Drwn	Chkd	Appr
Status	SHARED				Suitability



Project  
**TRANSPENNINE ROUTE UPGRADE**

Contract No.  
**151667**

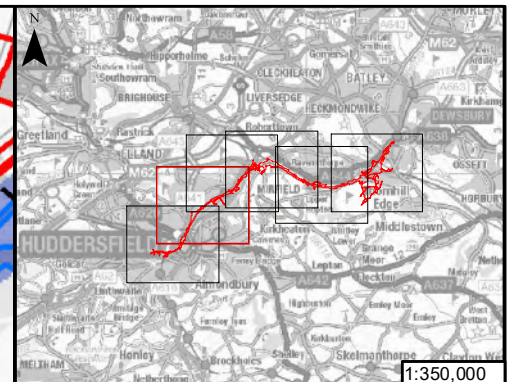
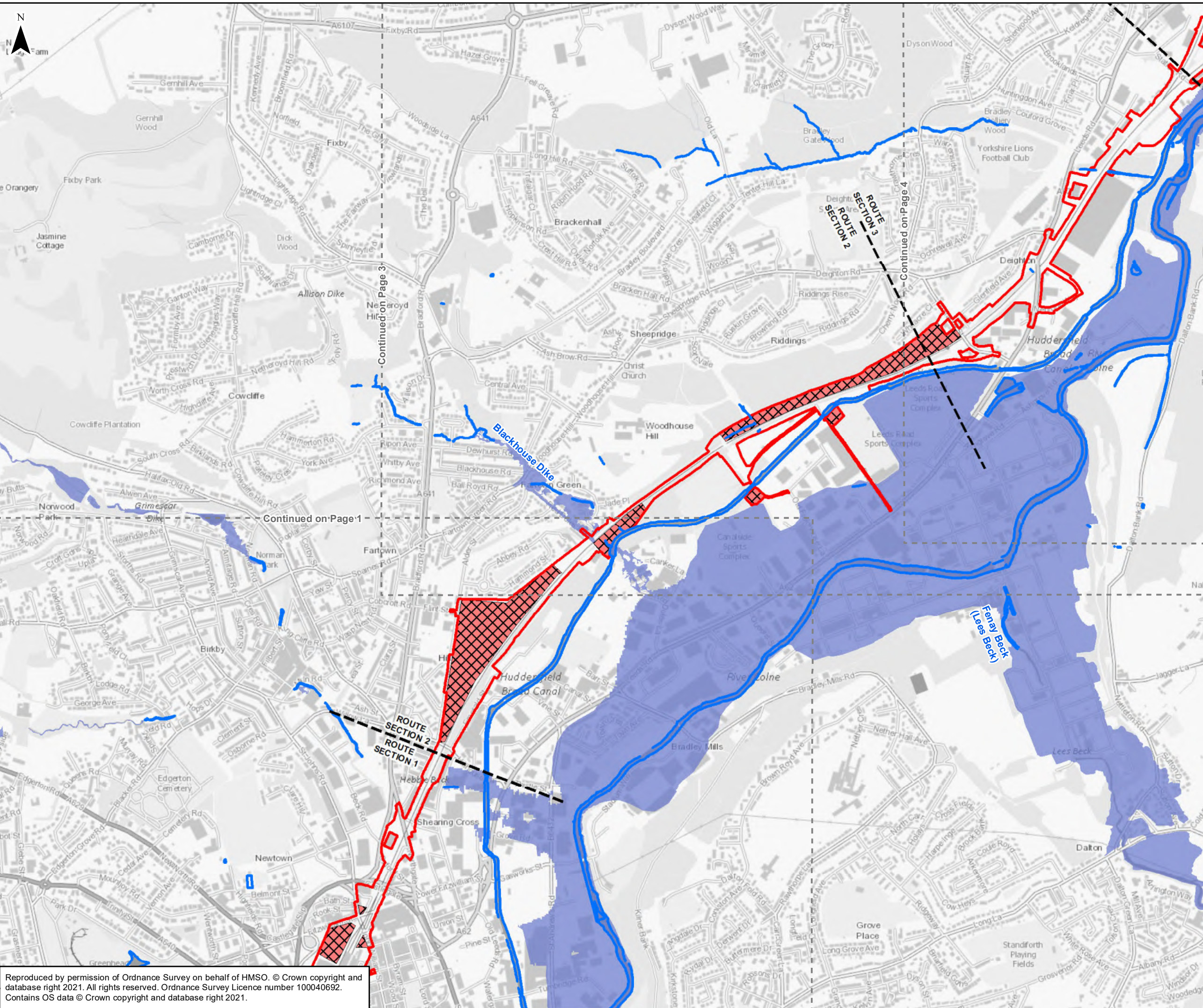
Scheme Title  
**THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER**

Drawing Title  
**SCHEME COMPOUNDS AND ENVIRONMENT AGENCY FLOOD ZONE 3 ROUTE SECTION 1**

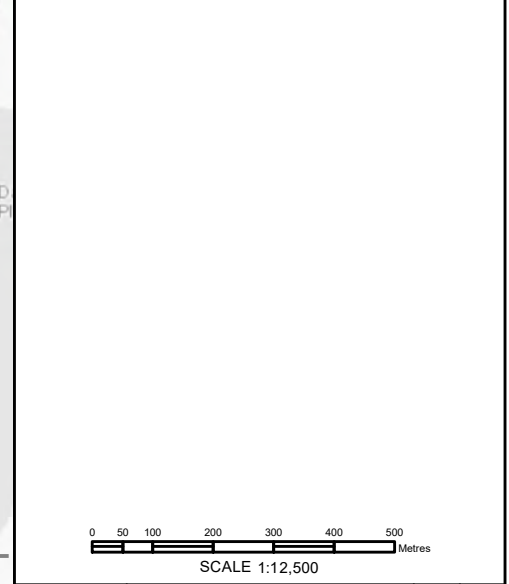
Designed	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Checked	P.Pasco	Signed Electronically	Date	04/08/2021
Approved	P.Pasco	Signed Electronically	Date	04/08/2021
Scale(s)	1:12,500	ELR & Project Chainage	---	
Alternative Reference	---	Sheet	1 of 6	
Drawing Number	151667-TSA-00-TRU-REP-W-EN-000XXX	Revision	P01	

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Rev	Date	Description of Revisions	Drwn	Chkd	Appr
Status	SHARED				Suitability



Project  
TRANSPENNINE ROUTE UPGRADE

Contract No.  
151667

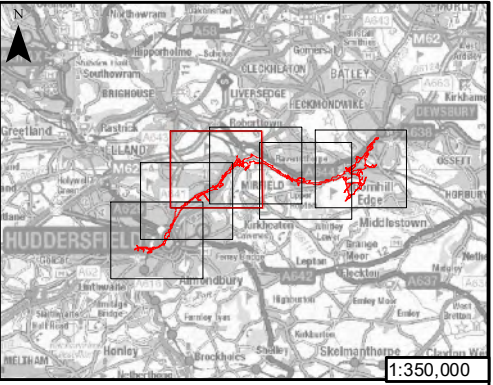
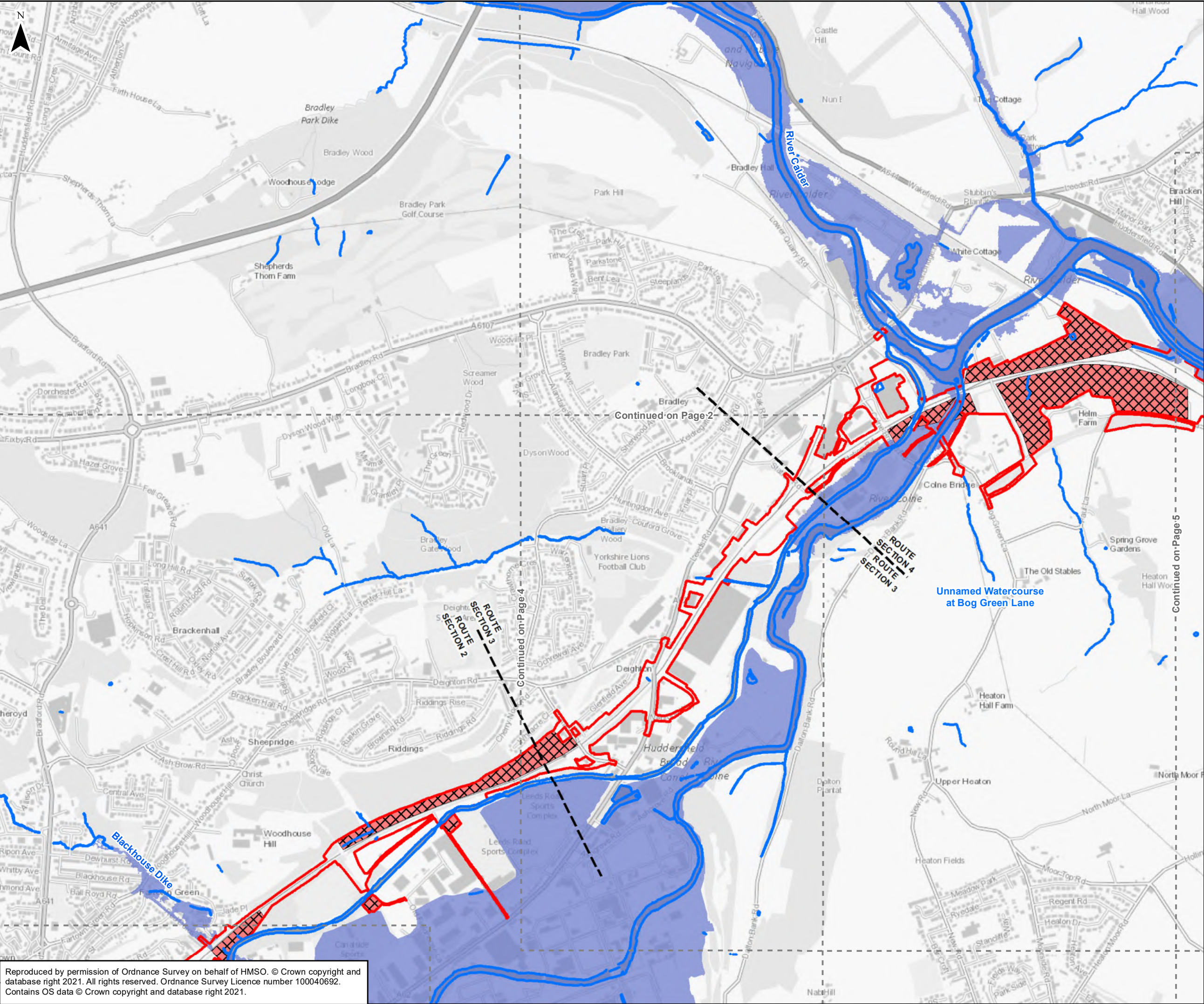
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THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
SCHEME COMPOUNDS AND ENVIRONMENT AGENCY FLOOD ZONE 3 ROUTE SECTION 2

Designed	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Checked	P.Pasco	Signed Electronically	Date	04/08/2021
Approved	P.Pasco	Signed Electronically	Date	04/08/2021
Scale(s) 1:12,500		ELR & Project Chainage ---		
Alternative Reference ---			Sheet 2 of 6	
Drawing Number 151667-TSA-00-TRU-REP-W-EN-000XXX			Revision P01	

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- Scheme Boundary
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TRANSPENNINE ROUTE UPGRADE

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151667

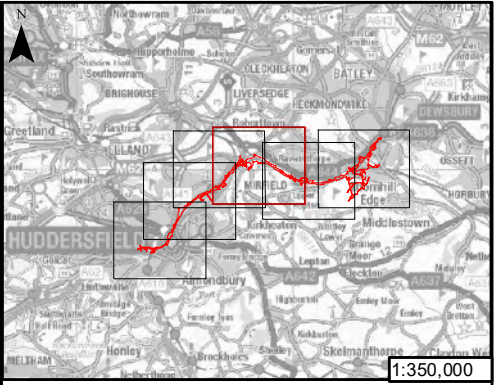
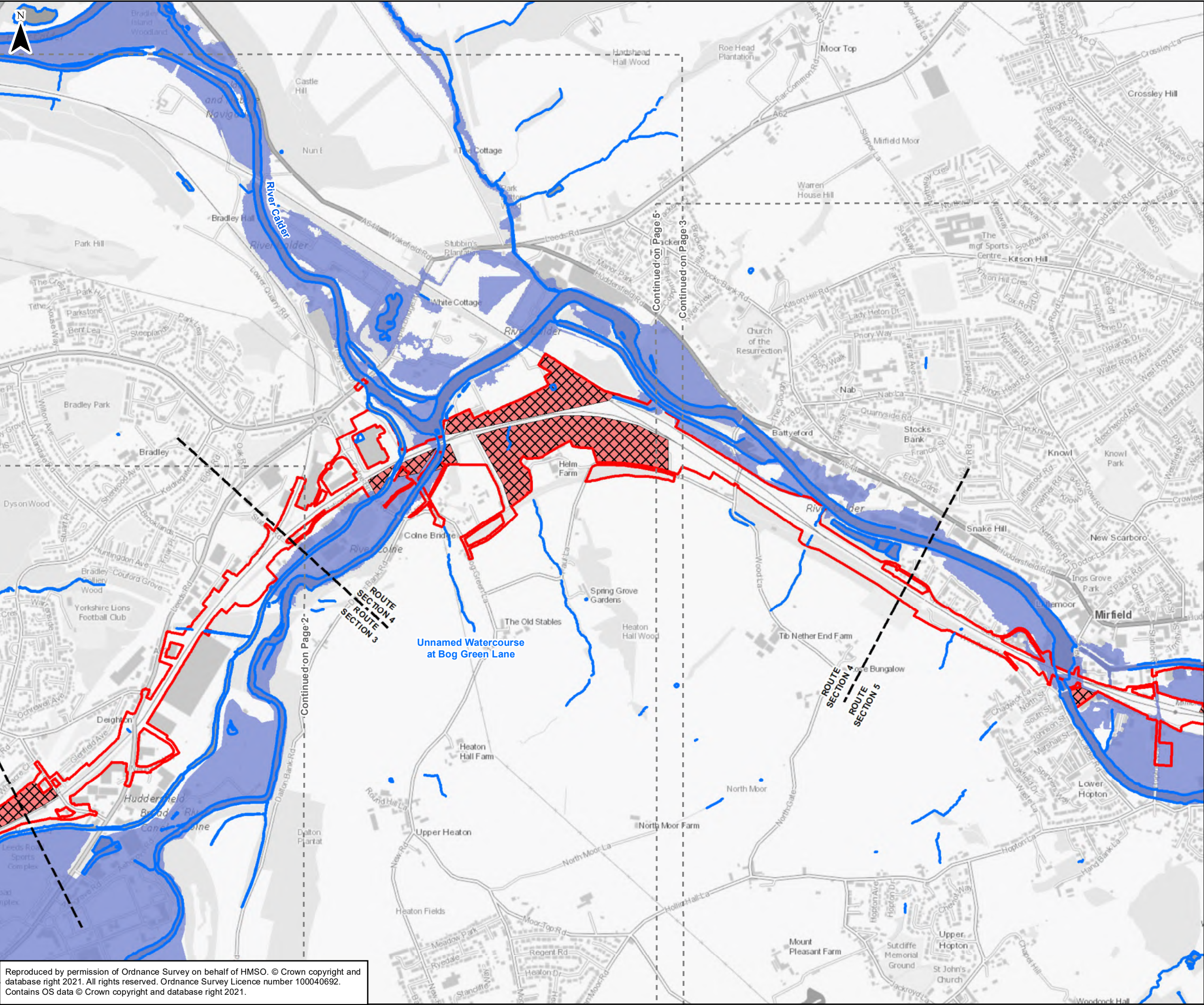
Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
SCHEME COMPOUNDS AND ENVIRONMENT AGENCY FLOOD ZONE 3 ROUTE SECTION 3

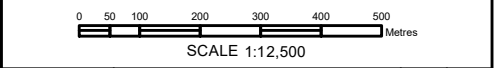
Designed	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Checked	P.Pasco	Signed Electronically	Date	04/08/2021
Approved	P.Pasco	Signed Electronically	Date	04/08/2021
Scale(s)	1:12,500	ELR & Project Chainage		
Alternative Reference				Sheet
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Drawing Number				Revision
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Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
SCHEME COMPOUNDS AND ENVIRONMENT AGENCY FLOOD ZONE 3 ROUTE SECTION 4

Designed	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Checked	P.Pasco	Signed Electronically	Date	04/08/2021
Approved	P.Pasco	Signed Electronically	Date	04/08/2021

Scale(s)  
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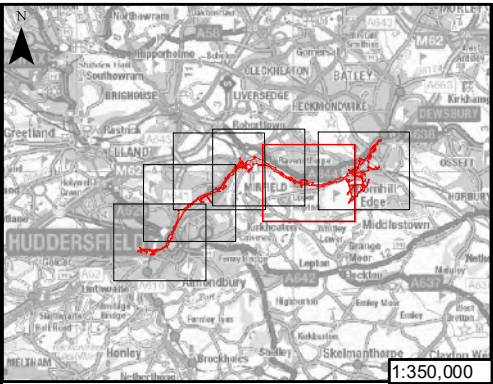
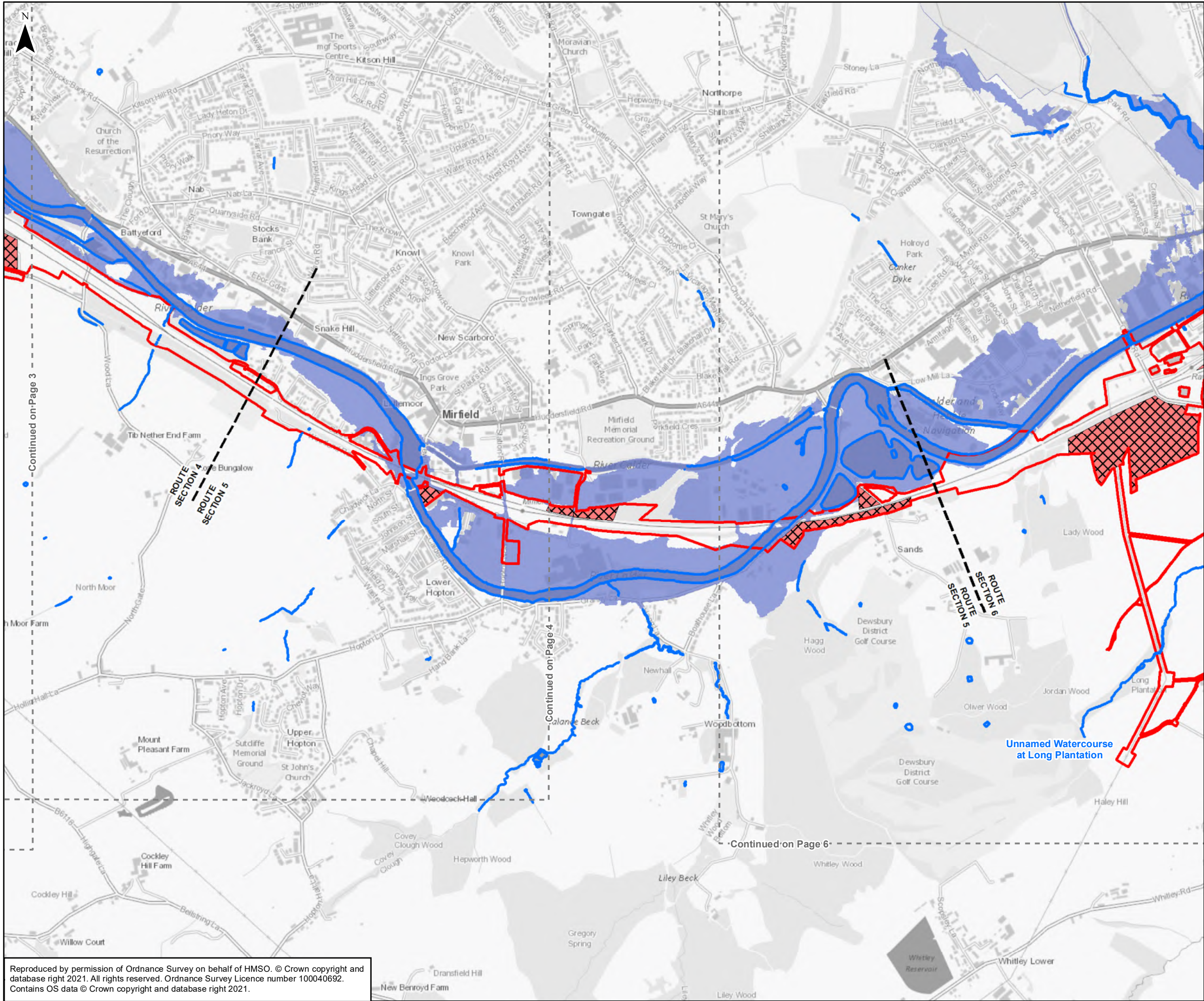
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151667-TSA-00-TRU-REP-W-EN-000XXX

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- Scheme Boundary
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Project  
TRANSPENNINE ROUTE UPGRADE

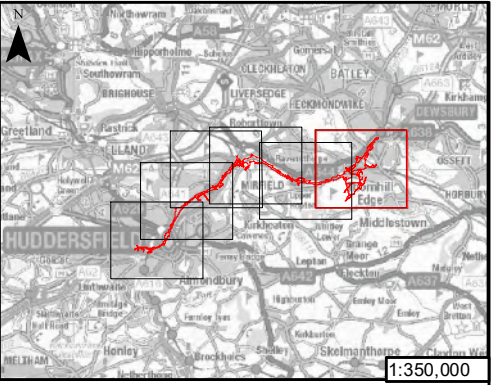
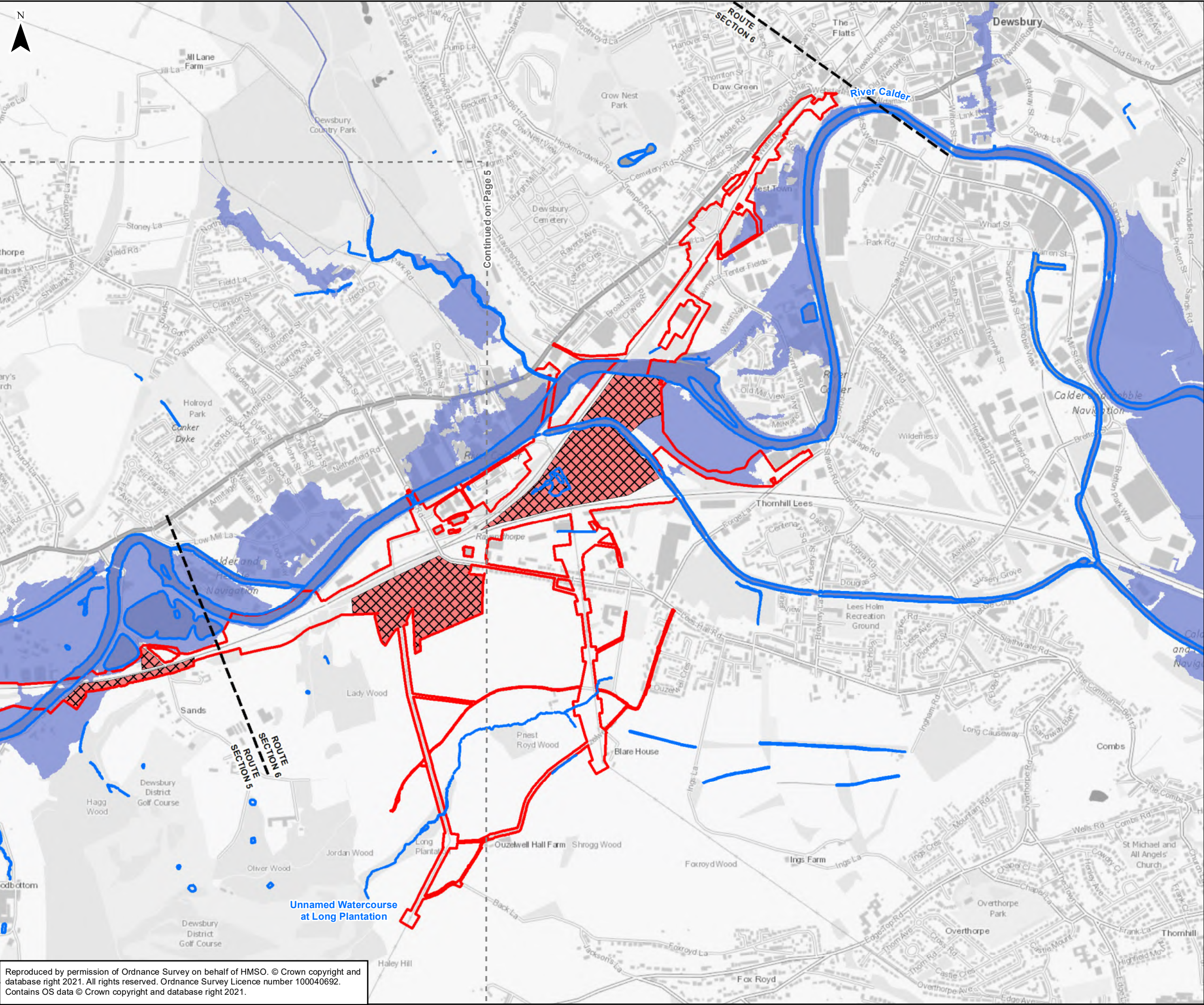
Contract No.  
151667

Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

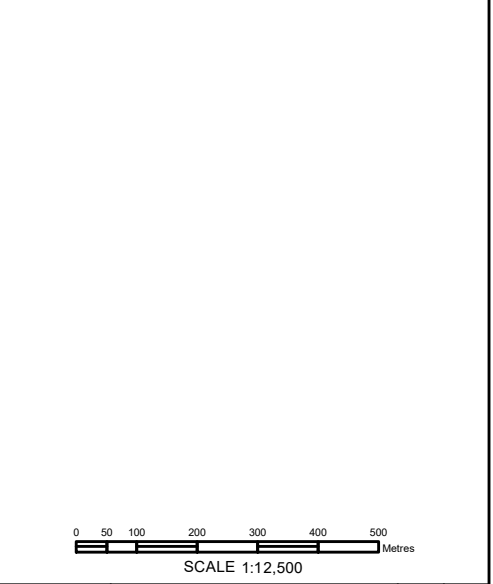
Drawing Title  
SCHEME COMPOUNDS AND ENVIRONMENT AGENCY FLOOD ZONE 3 ROUTE SECTION 5

Designed	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Checked	P.Pasco	Signed Electronically	Date	04/08/2021
Approved	P.Pasco	Signed Electronically	Date	04/08/2021
Scale(s)	1:12,500	ELR & Project Chainage	---	
Alternative Reference	---	Sheet	5 of 6	
Drawing Number	151667-TSA-00-TRU-REP-W-EN-000XXX	Revision	P01	





- Scheme Boundary
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Rev	Date	Description of Revisions	Drwn	Chkd	Appr
Status	SHARED				Suitability



Project  
TRANSPENNINE ROUTE UPGRADE

Contract No.  
151667

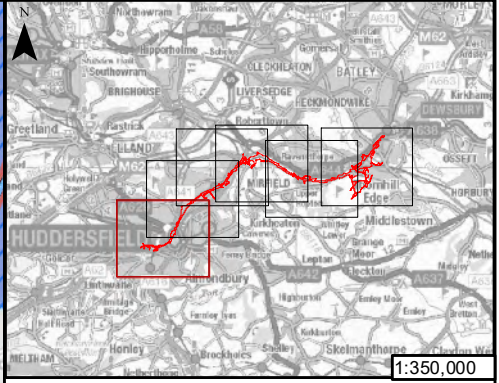
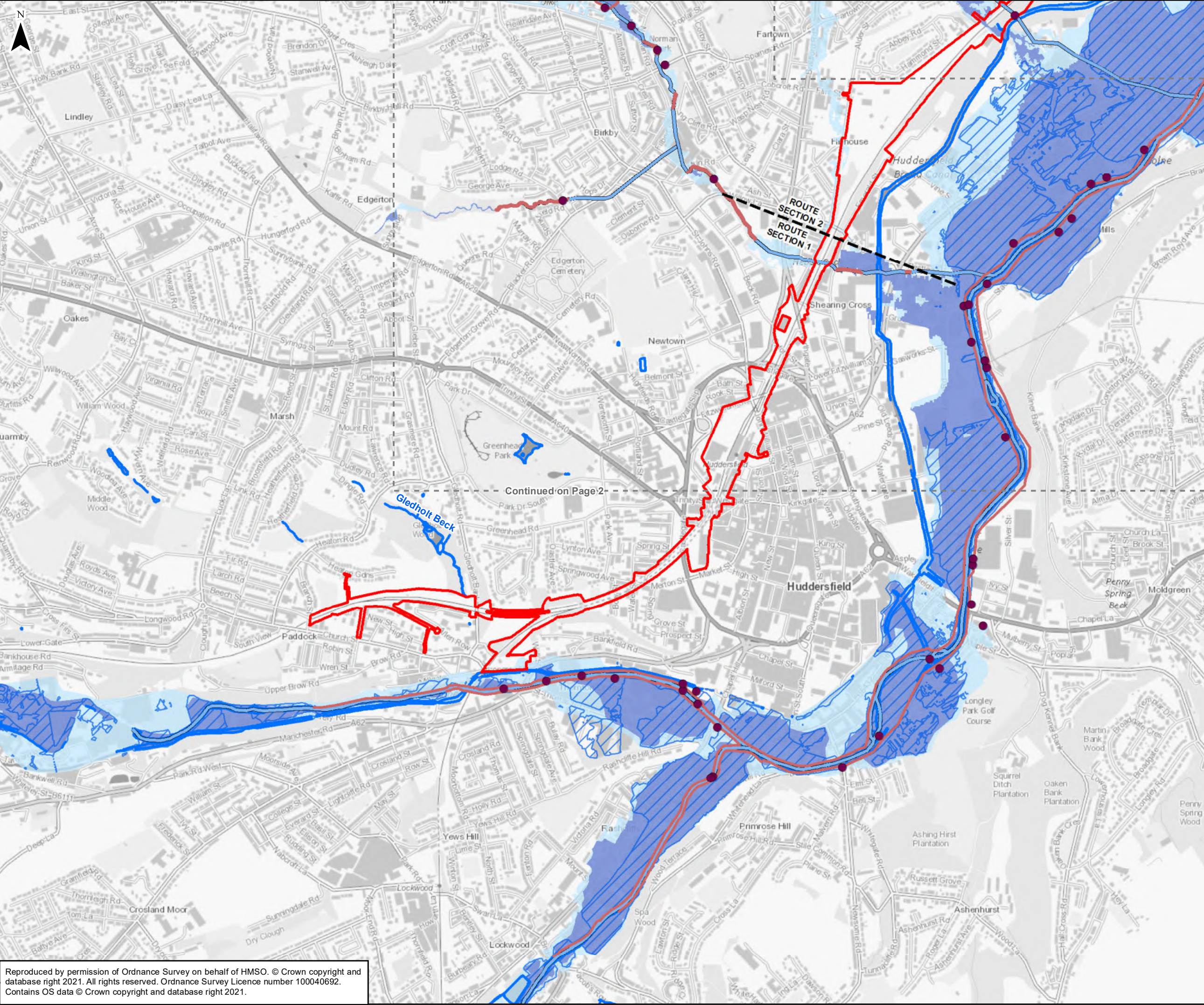
Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
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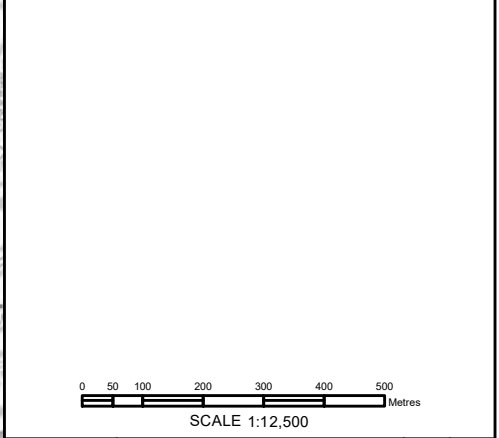
Designed	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	04/08/2021
Checked	P.Pasco	Signed Electronically	Date	04/08/2021
Approved	P.Pasco	Signed Electronically	Date	04/08/2021
Scale(s)	1:12,500	ELR & Project Chainage	---	
Alternative Reference	---	Sheet	6 of 6	
Drawing Number	151667-TSA-00-TRU-REP-W-EN-000XXX	Revision	P01	

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- Defences
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- River/Canal
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- Flood Zone 3
- ▨ 1% AEP Event Plus 50% Climate Change Allowance



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Project  
**TRANSPENNINE ROUTE UPGRADE**

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**151667**

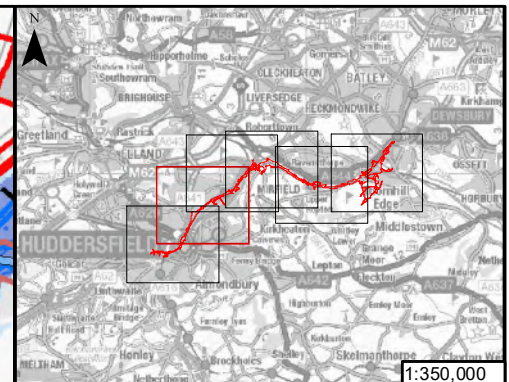
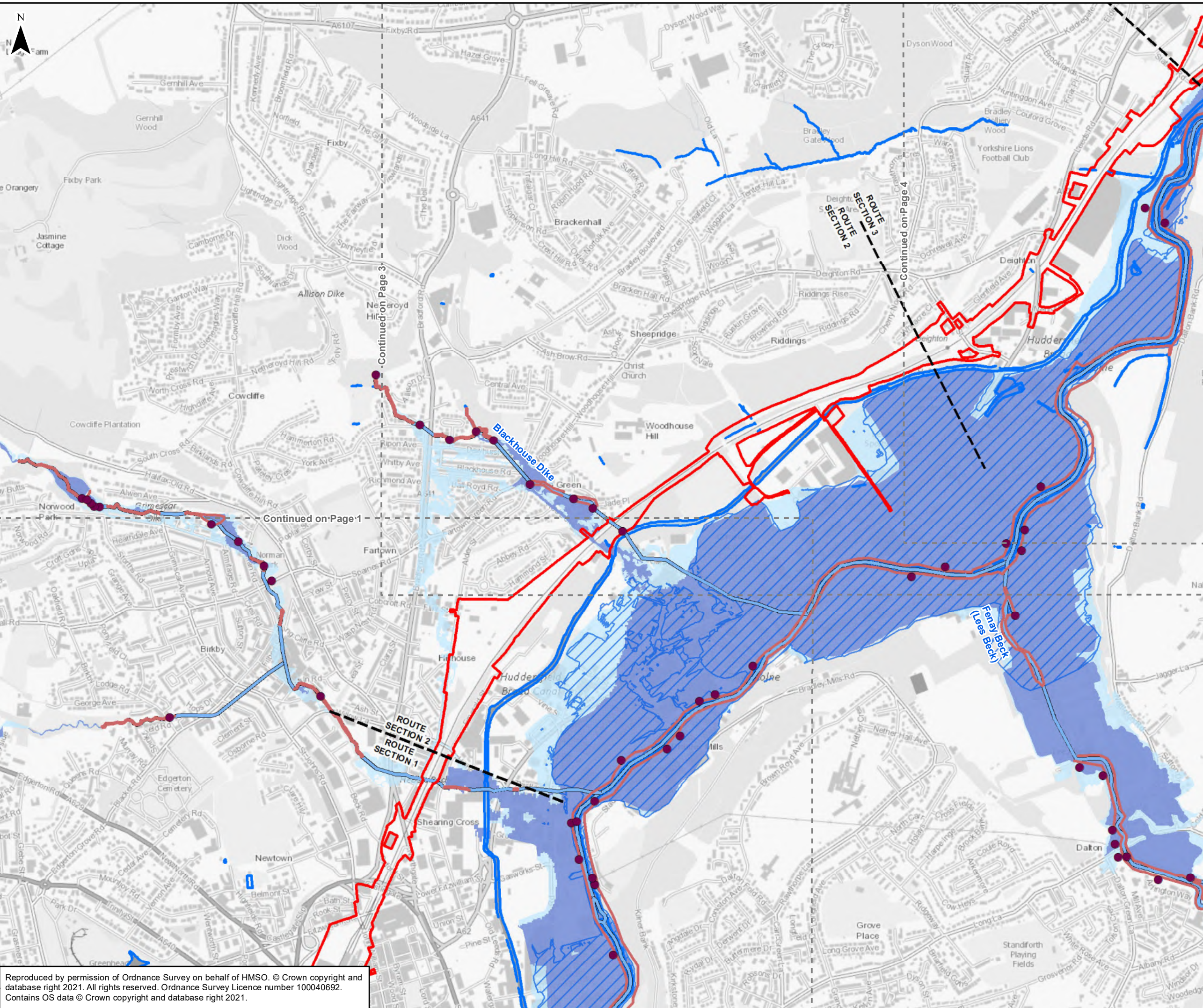
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**THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER**

Drawing Title  
**ASSETS AND STRUCTURES  
ROUTE SECTION 1**

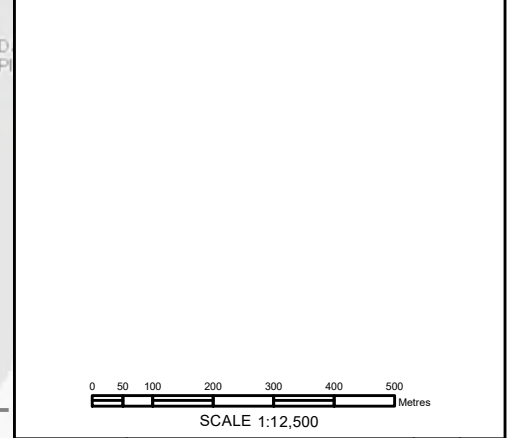
Designed	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Checked	P.Pasco	Signed Electronically	Date	05/08/2021
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Drawing Number	151667-TSA-00-TRU-REP-W-EN-000XXX	Revision	P01	

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- Scheme Boundary
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Project  
**TRANSPENNINE ROUTE UPGRADE**

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**151667**

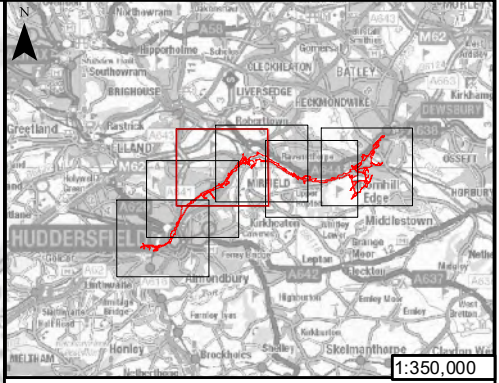
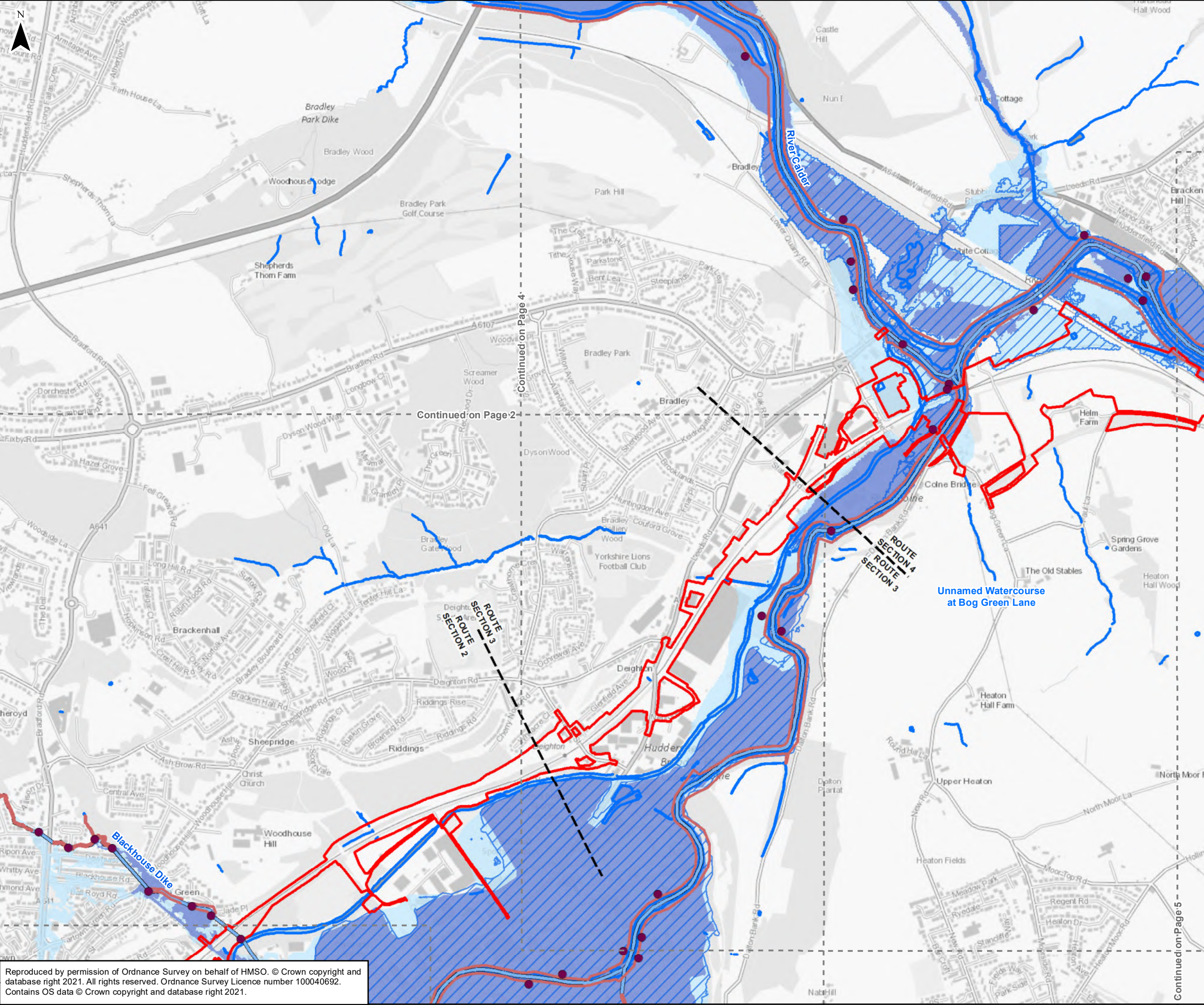
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**THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER**

Drawing Title  
**ASSETS AND STRUCTURES  
ROUTE SECTION 2**

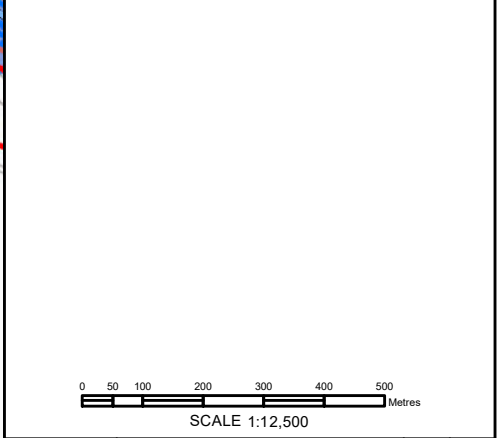
Designed	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Checked	P.Pasco	Signed Electronically	Date	05/08/2021
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Scale(s) 1:12,500		ELR & Project Chainage ---		
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Drawing Number 151667-TSA-00-TRU-REP-W-EN-000XXX			Revision P01	

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Rev	Date	Description of Revisions	Drwn	Chkd	Appr
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151667

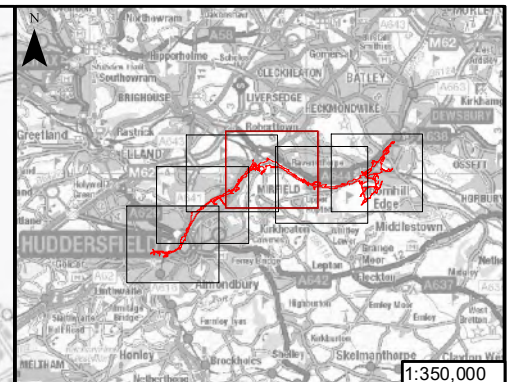
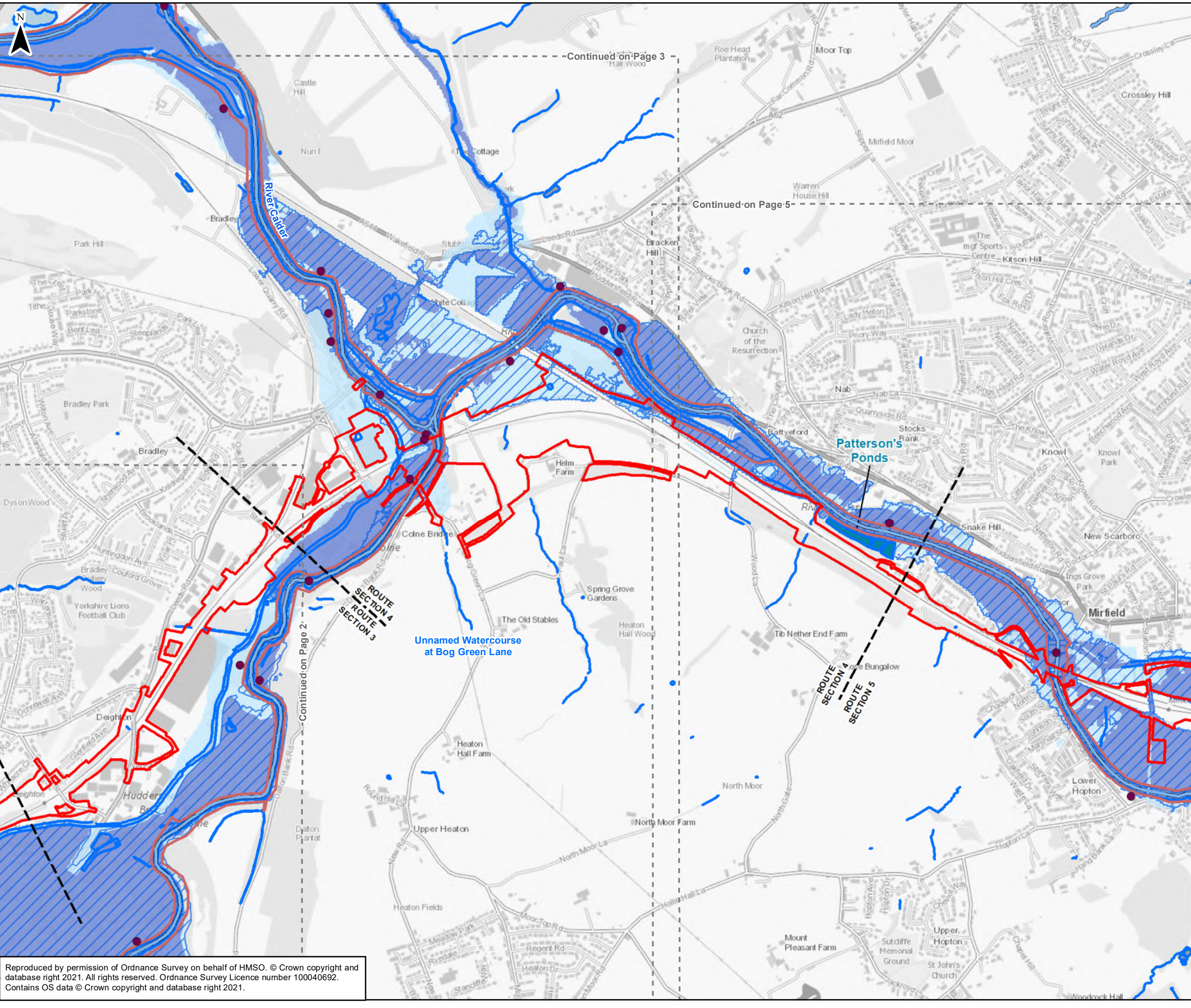
Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
ASSETS AND STRUCTURES  
ROUTE SECTION 3

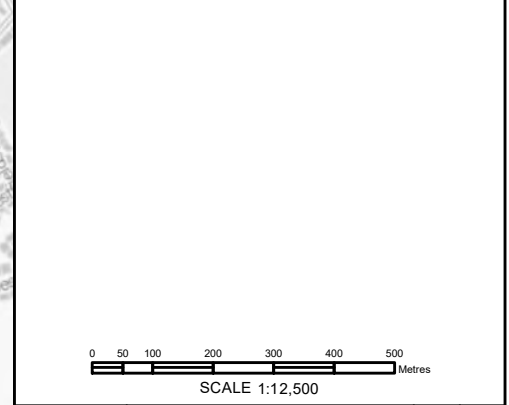
Designed	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Checked	P.Pasco	Signed Electronically	Date	05/08/2021
Approved	P.Pasco	Signed Electronically	Date	05/08/2021
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Drawing Number				Revision
151667-TSA-00-TRU-REP-W-EN-000XXX				P01

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- ▨ 1% AEP Event Plus 50% Climate Change Allowance



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TRANSPENNINE ROUTE UPGRADE

Contract No.  
151667

Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

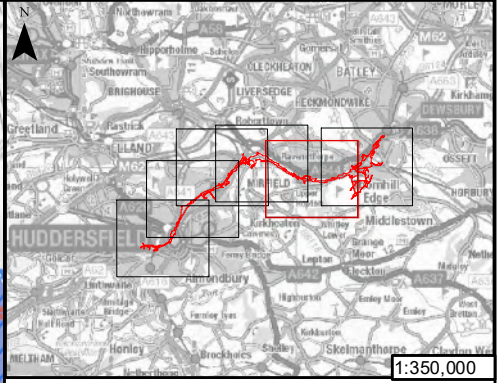
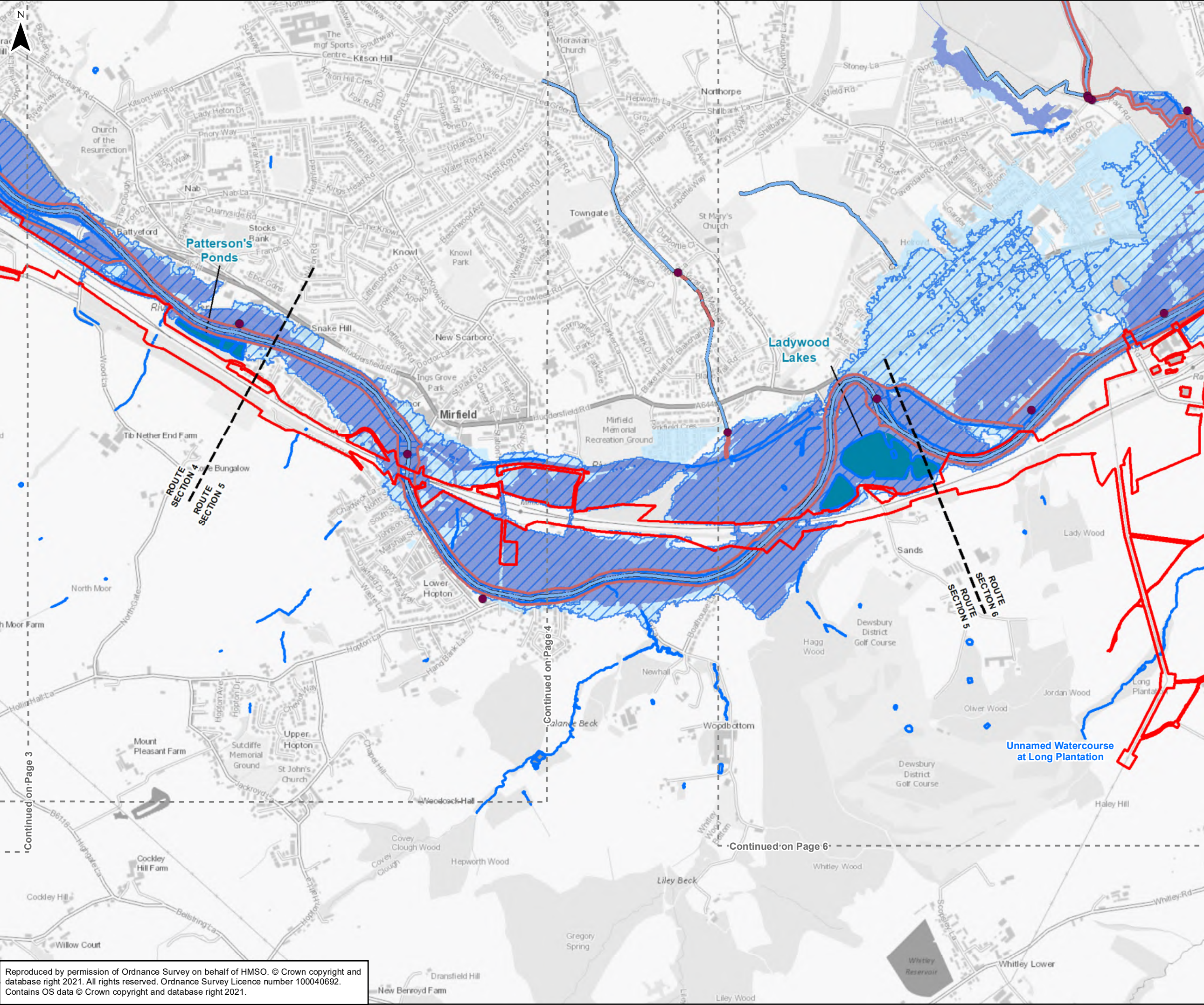
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**ASSETS AND STRUCTURES  
ROUTE SECTION 4**

Designed	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Checked	P.Pasco	Signed Electronically	Date	05/08/2021
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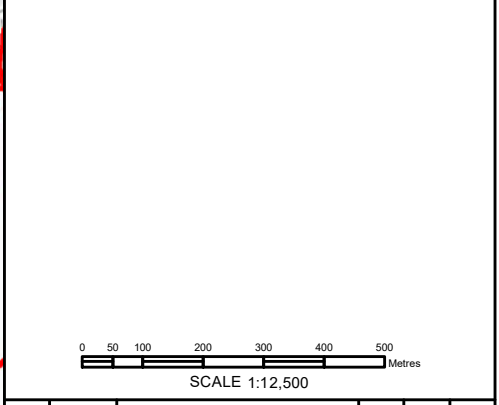
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Project  
TRANSPENNINE ROUTE UPGRADE

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151667

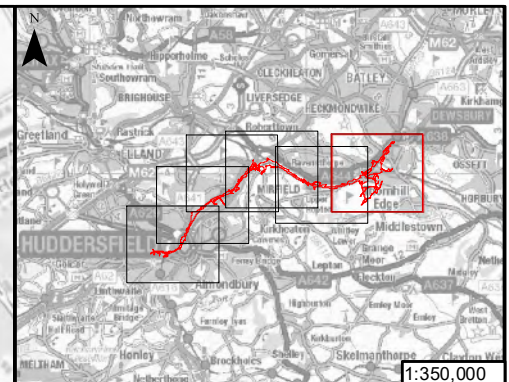
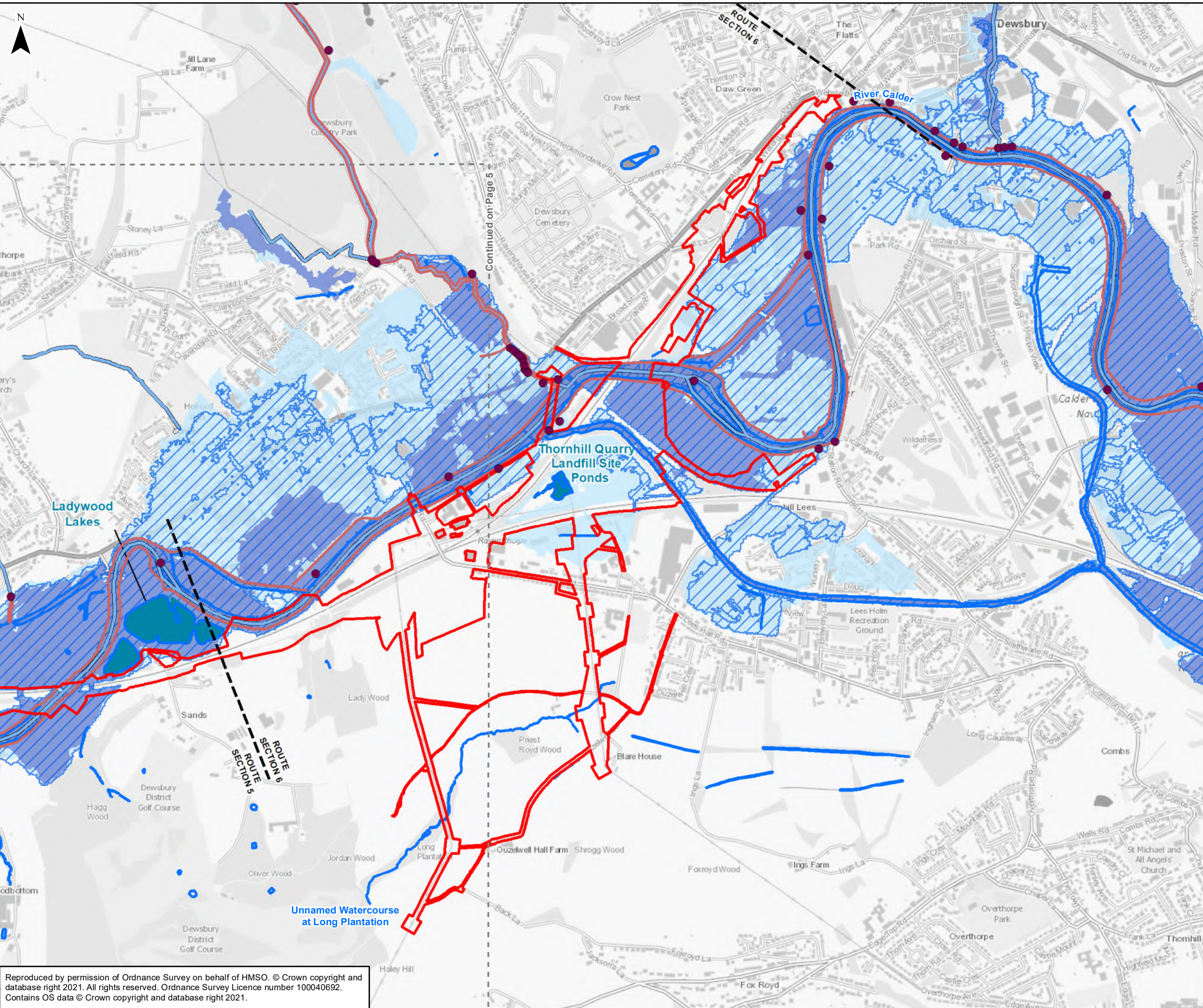
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THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
ASSETS AND STRUCTURES  
ROUTE SECTION 5

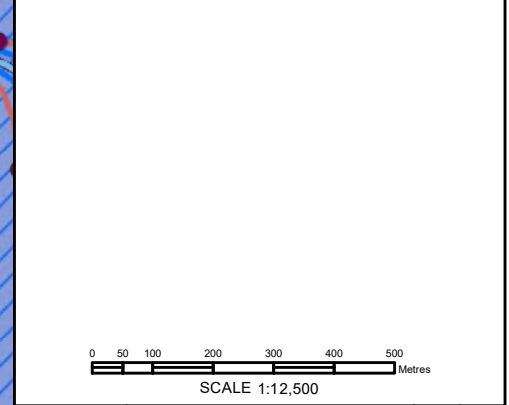
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Checked	P.Pasco	Signed Electronically	Date	05/08/2021
Approved	P.Pasco	Signed Electronically	Date	05/08/2021
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Alternative Reference				Sheet
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Drawing Number				Revision
151667-TSA-00-TRU-REP-W-EN-000XXX				P01

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TRANSPENNINE ROUTE UPGRADE

Contract No.  
151667

Scheme Title  
THE NETWORK RAIL (HUDDERSFIELD TO WESTTOWN (DEWSBURY) IMPROVEMENTS) ORDER

Drawing Title  
  
ASSETS AND STRUCTURES  
ROUTE SECTION 6

Designed	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Drawn	M.Mallesha Nayaka	Signed Electronically	Date	05/08/2021
Checked	P.Pasco	Signed Electronically	Date	05/08/2021
Approved	P.Pasco	Signed Electronically	Date	05/08/2021
Scale(s)	1:12,500	ELR & Project Chainage		
Alternative Reference				Sheet
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Drawing Number				Revision
151667-TSA-00-TRU-REP-W-EN-000XXX				P01

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