CAPITA

Rother Valley Railway

Flood Risk Assessment
June 2016

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Executive Summary

1. Capita Property and Infrastructure Ltd (Capita) was commissioned by Rother Valley Railway Limited to undertake a Flood Risk Assessment (FRA) for the proposed reinstatement of the Rother Valley Railway between Robertsbridge and Udiam (Bodiam). The route is approximately 3.5 km and will link the existing railway between Bodiam and Robertsbridge. The proposed scheme includes reinstating the historic railway line with a new embankment and the addition of culverts, bridges and viaducts along its route.

2. The site is located in the Rother catchment. The River Rother flows in an easterly direction for approximately 30 km before flowing into the English Channel, at Rye. The Darwell Stream is a tributary of the Rother that joins the main flow at Robertsbridge. The area has been subjected to quite severe flooding over the last 20 years and a flood defence scheme was put in place for Robertsbridge in 2004.

3. The FRA has been prepared following guidance provided in the National Planning Policy Framework (March 2012) and the 'Planning Practice Guidance' which replaced the 'Technical Guidance to the National Planning Policy Framework' in March 2014. The site has been modelled using Flood Modeller (previously known as ISIS) and TUFLOW which are established software packages used for modelling rivers and floodplains. The modelling covered a number of flooding scenarios and compared the "without railway" baseline (i.e. the existing condition) with the Rother Valley Railway constructed "with railway" scenario.

4. The work was carried out in close liaison with the Environment Agency and the key results are based on a 1% AEP (100 year) with climate change design flood event. The modelling undertaken for this FRA (2016) and by the Environment Agency in 2011 shows that overtopping of the existing flood protection scheme occurs at some locations for a 1% AEP and larger flood events in the baseline (without railway) scenario. The river modelling techniques currently available are more advanced than those available when the flood defence scheme was designed and built.

5. The modelling found that the construction of the railway would not increase flood risk to properties during a 1% AEP with climate change design flood event in Northbridge Street and Robertsbridge. The impact across the floodplain varies with some areas benefiting from reduced flood levels and others experiencing potential increases in flood levels of up to 50mm. There are a few small isolated areas, immediately adjacent to the proposed railway where predicted increases in water levels are greater.

6. Small sections of the defences are overtopped in both the existing (baseline) and 'with railway' scenario in the 1% AEP and 1% AEP with climate change design flood events. The 'with railway' scenario predicts a reduction of up to approximately 400 mm in flood depth behind the defences in Robertsbridge in the 1% AEP with climate change design event. The 'with railway' scenarios predicts a reduction of up to approximately 50mm in flood depth behind the defences in Northbridge Street in the 1% AEP design event

7. Flooding of the existing track downstream of Udiam already occurs and is managed by the operators of the railway line. To manage the consequences of flooding between Robertsbridge and Udiam the train operators will sign up to the Environment Agency's Flood Warnings Direct service and cease any services when there is a risk of flooding.

8. The proposed railway is considered at low risk of groundwater flooding, low to medium risk of flooding from artificial sources and medium risk of flooding from surface water. The approach to managing the residual risk of flooding from artificial sources is discussed in section 5.4.

The table below summarised key aspects of the study:

Site Name	Rother Valley Railway, Robertsbridge
Location	Northbridge Street to Junction Road, Udiam
Client	Rother Valley Railway Ltd
Grid Reference	NGR TQ7380724014 to TQ7718624322
Length of Railway	3.5 km
EA Flood Zone Classification	Flood Zone 3
SFRA	Rother District Council SFRA
Current Site Use	Site of dismantled railway - farm land
Description of proposed development	Reinstate historic railway line in the Rother Valley
Vulnerability Classification	Less vulnerable
History of Flooding	The Robertsbridge area has experienced flood events in 1946, 1960, 1979, 1985, 1993, 1999, 2000, and 2008. The 2000 was severe with approximately 90 properties flooded, some to a depth of 1.5 meters.
Flood Defences	A flood alleviation scheme was constructed at Robertsbridge and Northbridge Street in 2003/4.
Summary of Risks	Fluvial – High Surface Water – Medium Groundwater – Low Artificial Sources - Low to medium

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1 Introduction

1.1 Scope of Assessment

1.1.1 Capita Property and Infrastructure Ltd (Capita) was commissioned by Rother Valley Railway Limited to undertake a Flood Risk Assessment (FRA) for the proposed reinstatement of the Rother Valley Railway between Robertsbridge and Udiam (NGR TQ 73807 24014 to TQ 77186 24322). The route length is approximately 3.5 km and will link the existing railway between Bodiam and Robertsbridge. The proposed scheme includes reinstating the old line railway line with raised embankments, culverts and bridges along the route. The propose railway scheme also include sections of track lowered close to ground level and a number of viaducts to maintain floodplain flow routes and minimise the impact on flood levels.

1.1.2 A FRA was submitted in January 2014 which is superseded by this report. Amendments to the proposed scheme including changes to the track elevations, number of culverts and viaducts have been made since 2014 and further hydraulic modelling has been undertaken. The potential impact of the railway on flood risk has been managed by these amendments to the scheme and no works are proposed to the existing defences. Further details of the proposed railway scheme and modelling undertaken for the FRA are included in the Rother Valley Railway FRA Modelling Report (June 2016).

1.1.3 The contents of this FRA describe the assessment of the proposed site redevelopment and the implications of the proposed uses on flood risk. The FRA has been prepared following guidance provided in the National Planning Policy Framework (March 2012) and 'Planning Practice Guidance' which replaced the 'Technical Guidance to the National Planning Policy Framework' in March 2014.

1.1.4 A planning application is being submitted and this assessment seeks to provide the level of detail necessary to demonstrate that the potential effects of the proposal with respect to flood risk have been addressed by:

- Identifying the source and probability of flooding to the application site, including effects of climate change;
- Determining the consequences of flooding to and from the proposed development proposal;
- Determining the consequences of flooding to the local area and advising on how this will be managed; and
- Demonstrating the flood risk issues described in this assessment are compliant with the relevant guidance.

1.1.5 An assessment of areas potentially at risk from flooding was undertaken and the proposals were examined in relation to their potential to increase flood risk. The layout of the river crossings, flood relief culverts and viaducts for the railway embankment has been developed considering flood risk at all stages throughout the process. The final development layout reflects the flood risk constraints and the need to manage, and where possible reduce, flood risk.

1.2 Responsibility

1.2.1 Rother Valley Railway Limited is promoting the reinstatement of the historic railway. The layout designers are professional volunteer members who are responsible for the formulation of the design layout and drawings. Capita are responsible for assessing the scheme with respect to its flood risk impact. The assessment is based on the scheme design and site data provided by the designers and developers.

2 Policy and Guidance

2.1 Flood and Water Management Act, 2010

2.1.1 Combined with the Flood Risk Regulations 2009, (which enact the EU Floods Directive in the England and Wales) the Act places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues. The Act and The Regulations together raise the requirements and targets Local Authorities need to meet, including:

- Playing an active role leading Flood Risk Management;
- Development of Surface Water Management Plans (SWMP);
- Implementing requirements of Flood and Water Management legislation;
- Preparation of preliminary flood risk assessments and flood risk management plans;
- Development and implementation of drainage and flooding management strategies; and
- Responsibility for first approval, then adopting, management and maintenance of Sustainable Urban Drainage System (SUDS).

2.1.2 The Flood and Water Management Act also clarifies three key areas that influence development:

1. *Sustainable drainage (SUDs)* - the Act makes provision for a national standard to be prepared on SUDS, and developers will be required to obtain local authority approval for SUDS in accordance with the standards, likely with conditions. Supporting this, the Act requires local authorities to adopt and maintain SUDS, removing any ongoing responsibility for developers to maintain SUDS if they are designed and constructed robustly.
2. *Flood risk management structures* - the Act enables the EA and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent.
3. *Permitted flooding of third party land* - The EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

2.2 National Planning Policy Framework (NPPF) March 2012

2.2.1 In determining an approach for the assessment of flood risk for the proposal there is a need to review the policy context. Government Guidance requires that consideration be given to flood risk in the planning process. The National Planning Policy Framework was issued in March 2012 and outlines the national policy on development and flood risk assessment. This replaced with immediate effect Planning Policy Statement 25.

2.2.2 The Framework states that the inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

2.2.3 The essence of NPPF is that:

- Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards;
- Polices in development plans should outline the consideration, which will be given to flood issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change;
- Planning authorities should apply the precautionary principle to the issue of flood risk, using a risk based search sequence to avoid such risk where possible and managing it elsewhere;
- The vulnerability of a proposed land use should be considered when assessing flood risk;
- Use opportunities offered by new developments to reduce the causes and impacts of flooding;
- Planning authorities should recognise the importance of functional floodplains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended floodplains;
- The concept of Flood Risk Reduction, particularly in circumstances where development has been sanctioned on the basis of the “Exception Test”.

2.3 Planning Practice Guidance (2014)

2.3.1 The Planning Practice Guidance provides additional guidance to enable the effective implementation of the planning policy set out in the National Planning Policy Framework. With respect to Flood Risk and Coastal change it advises on how planning can take account of the risks associated with flooding and coastal change in plan-making and the application process.

2.3.2 The document provides supporting information on a number of items including:

- The application of the sequential approach and Sequential and Exception Tests;
- Reducing the causes and impacts of flooding; and
- Site specific flood risk assessment.

2.4 Rother Local Plan Core Strategy

2.4.1 Rother District Council Core Strategy sets the overall vision and objectives for development in the district up to 2028. The Core Strategy was adopted by Full Council in September 2014. The Core Strategy forms part of the statutory Development Plan for the District and is used in the determination of all planning applications, alongside the saved policies in the Local Plan 2006.

2.4.2 The Objectives for Rural areas set out in the Core Strategy include 'To support sustainable tourism and recreation, including improved access to the countryside' (section 12.6). The Core Strategy also recognises tourism is an important component of the rural economy, including the Kent and East Sussex Railway. It also states there is further scope to develop business and cultural tourism and 'green tourism' particularly in the towns and High Weald. Policy EN7 in the Core Strategy relates to Flood Risk and Development.

2.4.3 The Local Plan (2006) saved policy relevant to the Rother Valley Railway reinstatement is 'EM8 - Bodiam/Robertsbridge railway' and is detailed below.

Policy EM8:
An extension to the Kent and East Sussex Steam Railway from Bodiam to Robertsbridge, along the route identified on the Proposals Map, will be supported, subject to a proposal meeting the following criteria:

1. **it must not compromise the integrity of the floodplain and the flood protection measures at Robertsbridge;**
2. **it has an acceptable impact on the High Weald Area of Outstanding Natural Beauty;**
3. **it incorporates appropriate arrangements for crossing the A21, B2244 at Udiam, Northbridge Street and the River Rother.**

2.4.4 This FRA demonstrates how the proposals meet the criteria 1 - 'it must not compromise the integrity of the floodplain and the flood protection measures at Robertsbridge'.

2.5 Strategic Flood Risk Assessment (SFRA)

2.5.1 A Strategic Flood Risk Assessment SFRA was undertaken in 2008 by Rother District Council. The primary objective of the SFRA is to inform the revision of flooding policies, including the allocation of land for future development, within the emerging Local Development Framework (LDF). The SFRA has a broader purpose however, and in providing a robust depiction of flood risk across the District, it can:

- Inform the development/developer of Council policy that will underpin decision making within the District, particularly within the areas that are affected by (and/or may adversely impact upon) flooding;
- Assist the development control process by providing a more informed response to development proposals affected by flooding, influencing the design of future development within the District;
- Help to identify and implement strategic solutions to flood risk, providing the basis for possible future flood attenuation works;
- Support and inform the Councils emergency planning response to flooding; and
- Identify what further investigations may be required in flood risk assessments for specific development proposals.

2.5.2 A number of conclusions and recommendations were drawn from the SFRA. The following are considered the most relevant to this FRA:

- The SFRA process has highlighted the importance of flood defences throughout Rother District. Future policy should seek to address how these defences are to be maintained to ensure that they are maintained to the current high level of protection.
- Review the condition of existing local defences, the dependence of additional local development on them for flood mitigation and where necessary the Council should seek to maintain and or improve defences if necessary.
- Require all flood risk assessment and sustainable drainage design to consider the impacts of climate change for the lifetime of the development at the site and downstream.

3 Development Site Planning Considerations

3.1 Development Description and Location

3.1.1 The proposed development is the reinstatement of the Rother Valley Railway between Northbridge Street and Udiam (NGR TQ7380724014 to TQ7718624322). The route is approximately 3.5 km and will link the existing railway between Bodiam and Robertsbridge. The proposed scheme includes raised embankment, bridges, culverts, viaducts and setting the track in certain locations to close to ground levels. Figure 1 shows the route of the proposed railway.

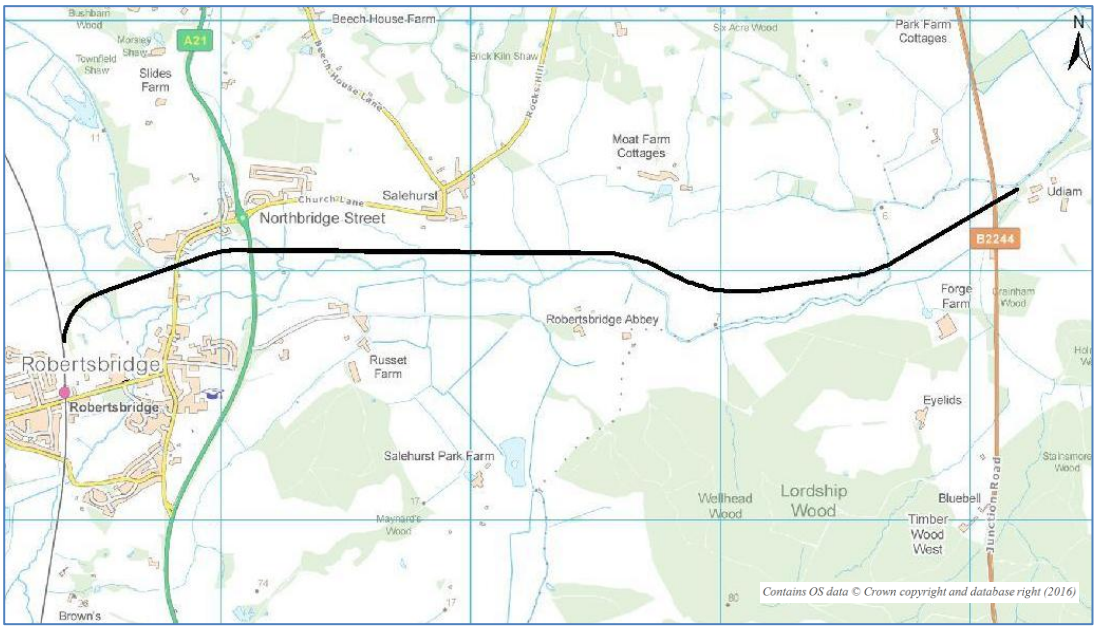


Figure 1 - Proposed Route of Railway

3.2 Vulnerability Classification

3.2.1 The site lies within the Environment Agency's Flood Zone 3, which is described within the Planning Practice Guidance Table 1: Flood Risk as having a 'High Probability' of flooding. Flood Zone 3 comprises of land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of sea flooding from the sea (>0.5%) in any year. The Environment Agency's flood zone map is provided in Figure 2.

3.2.2 The proposed railway is considered to fall under the classification of "Less Vulnerable" land use based on Planning Practice Guidance Table 2: Flood Risk Vulnerability Classification. However it should be noted that there is argument for it to be classified as water compatible as during times of flood the railway will not be operated.

3.2.3 Table 3: Flood Risk Vulnerability and Flood Zone Compatibility in that Planning Practice Guidance, states that less vulnerable land uses are compatible in Flood Zone 3a.

3.2.4 The railway does cross the 5% (1 in 20 year) AEP Flood Extent, which defines the functional floodplain. However the majority of the railway line is above the 5% AEP flood level and the construction of the railway does not increase the extent of flooding. A number of lowered sections of railway, culverts and sections of viaduct are proposed to maintain connectivity across the floodplain, allowing water to flow and be stored within the existing floodplain extents during times of flood. The consequences of flooding to the railway will be managed through the train operator signing up for flood warnings and ceasing services when there is a risk of flooding. Following correspondence with the Environment Agency we understand that given the railway location cannot be changed the Environment Agency has no objections to the railway crossing the functional floodplain.

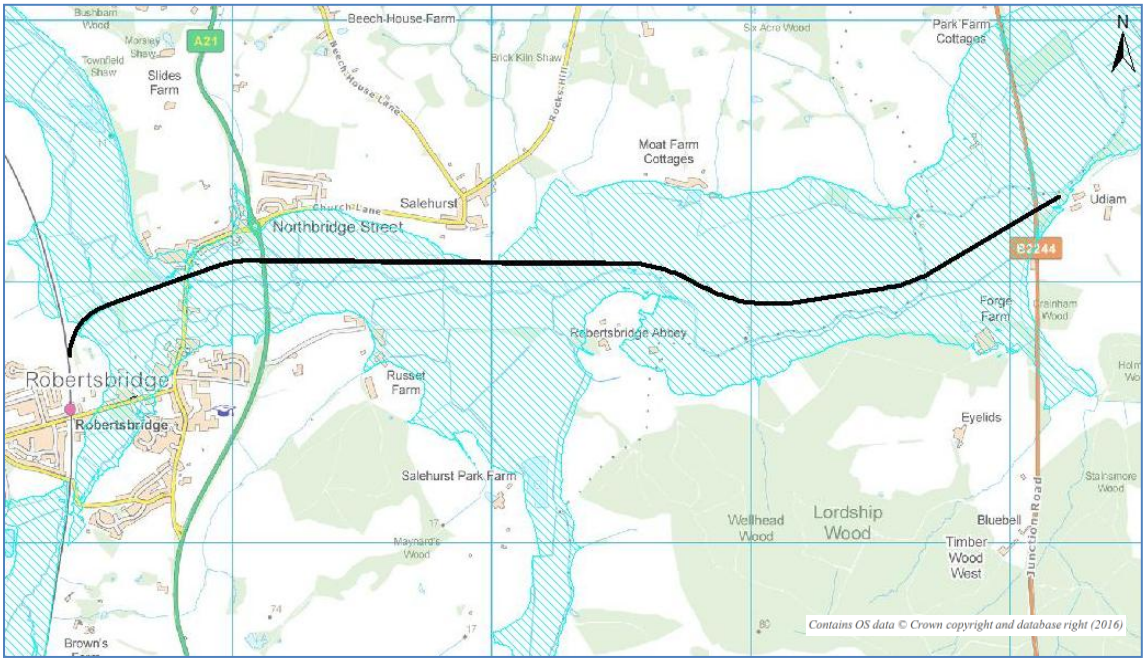


Figure 2 - Environment Agency Flood Zone 3

3.3 Sequential and Exception Test

3.3.1 The aim of the Sequential Test is to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding. Since the proposed route of the railway follows the historic route and is linking two existing sections of railway it is not possible to locate the proposed development elsewhere in a lower risk zone. Accordingly there can be "no reasonably available sites in areas with a lower probability of flooding" and the application site satisfies the Sequential Test.

3.3.2 The development is classified as less vulnerable and is appropriate in Flood Zone 3a. The proposed railway line does cross the functional floodplain as discussed in section 3.2. For completeness the criteria of the Exception Test have been considered. The proposed development will provide wider sustainability benefits to the community as identified in the Rother Local Plan (2006) including tourism and linking to main line services from Hastings to London.

3.3.3 The following chapters of this report discuss the detailed flood study that has been undertaken and the proposal to manage flood risk. This site specific flood risk assessment demonstrates that the development will be safe, and provides a small reduction in flood risk to residential property in Northbridge Street and Robertsbridge during large flood events. It is proposed that the train line is not operational during times of flooding and that the operating company (Kent and East Sussex Railway) subscribes to the Environment Agency's flood warning service.

4 Flood Probability and Hazard

4.1 Catchment Background

4.1.1 In order to assess the risk of flooding to the reinstated railway, and the wider area of Robertsbridge, it is important to understand the existing catchment characteristics and historic flow patterns.

4.1.2 The site is located in the Rother catchment. The River Rother flows in an easterly direction for approximately 30 km before flowing into the English Channel, at Rye (NGR TQ 95700 17400). The Darwell Stream is a tributary of the Rother that flows through Robertsbridge.

Local Geology

4.1.3 Robertsbridge lies on a succession of sandstones, siltstones and mudstones (commonly clays) of the Hastings Beds. The solid geology around Robertsbridge is Ashdown Sandstone Formation and the drift geology includes alluvium and river terrace deposits[1].

4.1.4 The Environment Agency "Aquifer Maps – Superficial Deposits designations map" classifies the deposits as a Secondary (undifferentiated). The Aquifer Maps - bedrock designation is Secondary A. The Environment Agency groundwater vulnerability map classifies the site as Minor Aquifer High.

Flood History

4.1.5 Table 4.1 provides information on historic local flood events in the catchment based on information provided in the Rother Strategic Flood Risk Assessment (SFRA). In the SFRA the Highway Authority's Divisional Engineer has provided a schedule of the locations most prone to highway flooding in Rother District these include the Robertsbridge area.

Table 4.1 Historic flood events at Robertsbridge

Date	Description and Source
1946. 1960, 1979, 1985, 1999, 2001	Fluvial - Insufficient storage capacity. Very intense rainfall on an already wet soil leading to rapid runoff. Recent development in the floodplains, debris in the river channel.
1993	Fluvial - Intense rainfall, properties flooded by sewage contaminated water
12th October 2000 (greater than 1% event) 31st October 2000 5th November 2000	Fluvial - Very intense rainfall on an already wet soil leading to rapid runoff. Recent development in the floodplains, debris in the river channel, backing up from road drains and surcharging of combined sewerage system (indirect source), backing up behind culverts and bridges, overtopping of low flood embankment, back up of floodwater from the floodplains, reduced storage capacity due to repeat events

4.1.6 The East Sussex County Council Preliminary Flood Risk Assessment (PFRA) indicates groundwater flooding has occurred historically in the Robertsbridge area. The PFRA also indicates sewer flooding occurred in Northbridge Street and Station Road in Robertsbridge in 2002, 2008, and 2010. In 2010 blocked culverts and drains resulted in isolated surface water flooding.

[1] Harris, R.B., 2009, Robertsbridge Historic Character Assessment Report, Sussex Extensive Urban Survey.

4.1.7 There is an existing hydraulic model of the River Rother which has been used to assess flood risk and the impact of the proposed reinstatement of the railway. The model was developed by Hyder for the Environment Agency in 2011. While reviewing the model for use in this flood risk assessment a number of opportunities for improvements were noted. The improvements made to the model are detailed in the Rother Valley Railway FRA Modelling Report (June 2016) and have been discussed with the Environment Agency.

4.2 Site Topography

4.2.1 Existing ground levels along the route of the proposed railway vary from 11.7 m AOD to 4.4 m AOD generally falling from the west towards the east.

4.2.2 The ground levels for the proposed railway will be altered along the route gradually falling from 11.53 m AOD near Northbridge Street to 5.865 m AOD to meet the existing Kent and East Sussex railway. The elevation of the railway varies along the route to maintain existing floodplain flow paths and floodplain connectivity.

4.3 Flood Zone

4.3.1 Flood Zones describe the extent of flooding that would occur on the basis that no flood defences were in existence. The definition of Flood Zones is provided in Table 1 of the Flood Risk and Coastal Change section of the Planning Practise Guidance.

4.3.2 A review of the Flood Zone Mapping undertaken by the Environment Agency has identified that the site is located within Flood Zone 3a 'Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.' The site is assessed as being at high probability of flooding.

4.4 Existing Flood Risk Management Infrastructure

4.4.1 Robertsbridge and Northbridge Street both benefit from defences on the River Rother and Darwell Stream.

4.4.2 After the autumn 2000 floods, a major flood defence scheme was implemented in Robertsbridge, consisting of raised permanent flood walls/bunds along the river, and a number of movable gates that can be used to create temporary flood walls. This scheme was completed in 2004 (Atkins, 2007). Pumps were also added to the scheme to deal with runoff resulting from incident rainfall within the defended area which was no longer able to connect directly back into the river due to the flood defences blocking flow. These pumps facilitate removal of water from within the defended area back into the river. Pumps on the Mill Stream also convey high flows over the defences and back into the Rother.[2]

4.4.3 The modelling undertaken for this FRA (2016) and by the Environment Agency in 2011 shows that overtopping of the existing flood protection scheme occurs at some locations for a 1% AEP and larger flood events. The river modelling techniques currently available are more advanced than those available when the flood defence scheme was designed and built.

4.4.4 The topographical survey shows the crest level of the defences are between 12.4 m AOD (upstream) and 11.2 m AOD (downstream) at Northbridge Street, and between 12.7 m AOD and 11.5 m AOD at Robertsbridge.

[2] Environment Agency, 2011, River Rother Final Hydraulic Modelling, ABD, and Hazard Mapping Report, Hyder.

4.5 Sources of Flooding – Actual Flood Risk

4.5.1 The NPPF describes potential sources of flooding. It is necessary to consider the risk of flooding from all sources within a FRA. This section provides a review of flooding from land, sewers, groundwater and artificial sources, in addition to rivers.

Fluvial Flood Risk

4.5.2 Fluvial flooding occurs when the amount of water exceeds the flow capacity of the river channel. Most rivers have a natural floodplain into which the water spills in times of flood. The historic route of the railway is through the Rother floodplain and therefore the proposed reinstated route is also through the floodplain.

4.5.3 The improved Environment Agency model was edited to create a version of the model with the proposed railway embankment, bridge crossings, viaducts and flood relief culverts through the embankment. This model is referred to hereafter as 'with railway' scenario. It was identified that the defences at Northbridge Street are predicted to overtop in the 1% AEP design event for both the baseline and 'with railway' scenario. The defences at Robertsbridge are predicted to overtop in the 1% AEP with climate change design event for both the baseline and 'with railway' scenario (see Figure 3).

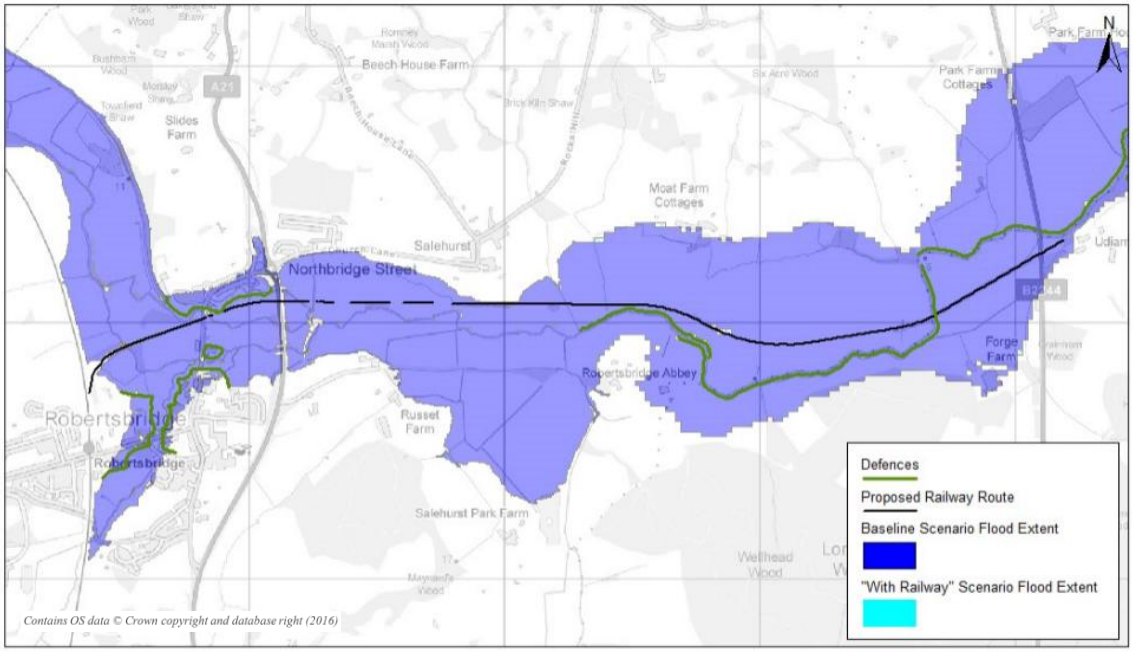


Figure 3 - 1% AEP with climate change flood extent for the 'baseline' and 'with railway' scenario.
(Note the 'with railway' scenario flood extent is drawn below the baseline flood extent shown and therefore it is only visible on the map where its extent is greater than the baseline flood extent).

4.5.4 The section of the railway between Salehurst and Robertsbridge Abbey and near Udiam between Austins Bridge and the B2244 are at risk in all the flood events modelled. The proposed railway elevations between Salehurst and Robertsbridge Abby have been lowered to maintain floodplain flow paths and connectivity. Table 4.2 provides water levels and depths of flooding along the proposed reinstated railway for the modelled flood events. The locations referred to in the table are shown in Figure 4. The management of flood risk along the proposed railway is discussed in section 5.2.

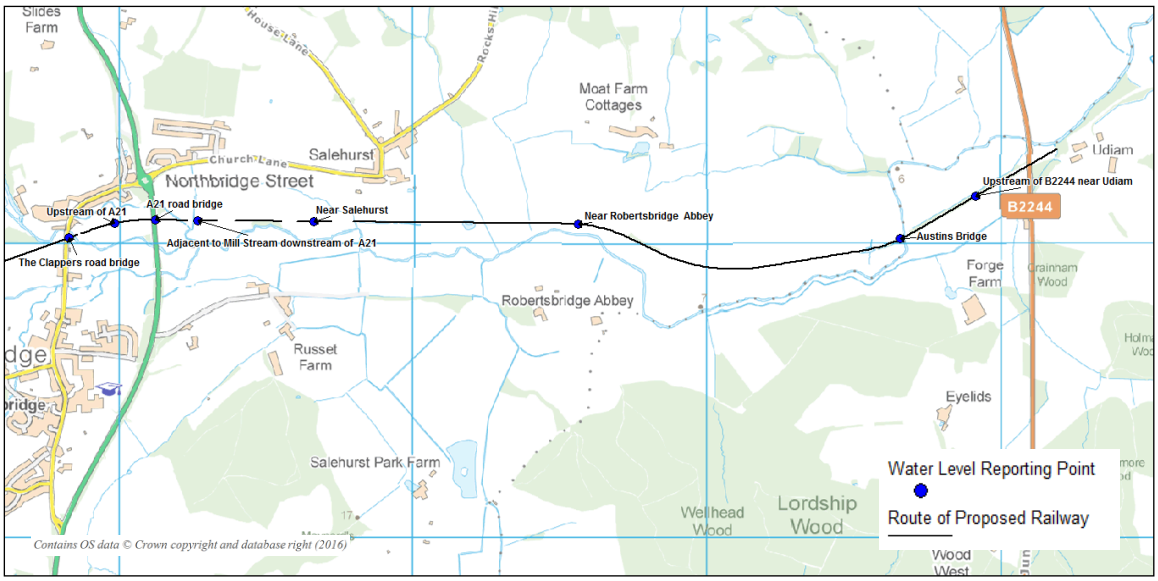


Figure 4 - The locations referred to in Table 4.2

Table 4.2 Flood Levels along the proposed reinstated railway

Location Description	NGR	Design Flood Event	Railway level (m AOD)	With Railway Flood Level (m AOD)*	Approximate depth of water on railway (m)
The Clappers road bridge	TQ7382024019	5% AEP	11.53	NA	NA
		2% AEP		11.64	0.11
		1.33% AEP		11.80	0.27
		1% AEP		11.88	0.35
		1% +CC AEP		11.99	0.46
Upstream of A21	TQ7397724069	5% AEP	11.523	NA	NA
		2% AEP		NA	NA
		1.33% AEP		NA	NA
		1% AEP		NA	NA
		1% +CC AEP		NA	NA
A21 road bridge	TQ7411524079	5% AEP	11.387	NA	NA
		2% AEP		NA	NA
		1.33% AEP		NA	NA
		1% AEP		NA	NA
		1% +CC AEP		NA	NA
Adjacent to Mill Stream downstream of A21	TQ7426124078	5% AEP	11.115	NA	NA
		2% AEP		NA	NA
		1.33% AEP		NA	NA
		1% AEP		NA	NA
		1% +CC AEP		NA	NA
Near Salehurst	TQ7465424075	5% AEP	8.78	9.07	0.29
		2% AEP		9.20	0.42

Location Description	NGR	Design Flood Event	Railway level (m AOD)	With Railway Flood Level (m AOD)*	Approximate depth of water on railway (m)
		1.33% AEP		9.27	0.49
		1% AEP		9.32	0.54
		1% +CC AEP		9.45	0.67
Near Robertsbridge Abbey	TQ7555724065	5% AEP	7.79	7.80	0.01
		2% AEP		7.89	0.10
		1.33% AEP		7.93	0.14
		1% AEP		7.96	0.17
		1% +CC AEP		8.03	0.24
Austins Bridge	TQ7665324017	5% AEP	6.55	NA	NA
		2% AEP		NA	NA
		1.33% AEP		6.57	0.02
		1% AEP		6.62	0.07
		1% +CC AEP		6.73	0.18
Upstream of B2244 near Udiam	TQ7690924161	5% AEP	5.4	6.04	0.64
		2% AEP		6.24	0.84
		1.33% AEP		6.32	0.92
		1% AEP		6.39	0.99
		1% +CC AEP		6.53	1.13

Note: 5% AEP (Annual Exceedance Probability) = 20 year Flood Event; 2% AEP = 50 year Flood Event; 1.33% AEP = 75 year Flood Event; 1% AEP = 100year Flood Event; and 1% +CC AEP = 100 year with climate change Flood Event)

4.5.5 The changes in flood risk between the 'with railway' and baseline scenarios, at key locations are listed in Table 4.3. The locations referred to in the table are shown in Figure 5. The table demonstrates that flood risk is not increased behind the defences in the Northbridge Street and Robertsbridge area in the 'with railway' scenario.

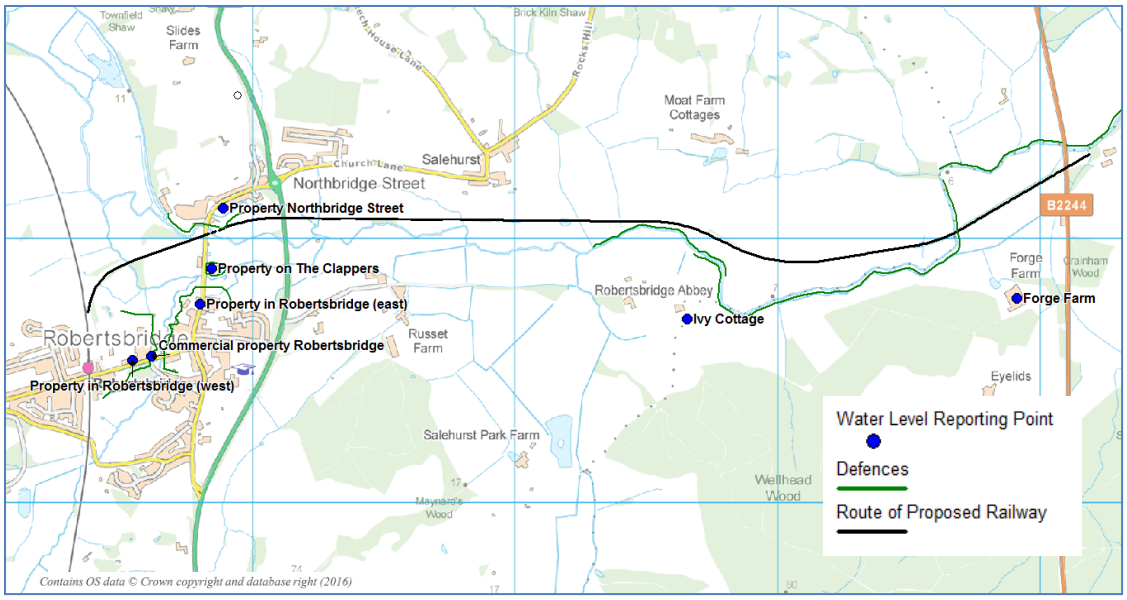


Figure 5 - The locations referred to in Table 4.3

Table 4.3 Change in Flood Risk

Location	Flood Event	Change in Flood Risk between 'with railway' and baseline scenario (mm)
Commercial property, Station Road, Robertsbridge	5%	No Change
	2% AEP	No Change
	1.33% AEP	No Change
	1% AEP	No Change
	1% AEP + CC	No Change*
Property in Robertsbridge (west)	5%	Not Flooded
	2% AEP	Not Flooded
	1.33% AEP	Not Flooded
	1% AEP	Not Flooded
	1% AEP + CC	Reduced Flood Risk - Approx. 50mm reduction in flood depths in 'with railway' scenario
Property in Robertsbridge (east)	5%	Not Flooded
	2% AEP	Not Flooded
	1.33% AEP	Not Flooded
	1% AEP	Not Flooded
	1% AEP + CC	Reduced Flood Risk - Approx. 40mm reduction in flood depths in 'with railway' scenario
Property on The Clappers (Bridge Bungalow/Museum)	5%	Not Flooded
	2% AEP	Not Flooded
	1.33% AEP	Not Flooded
	1% AEP	Not Flooded
	1% AEP + CC	No Change*
Property in Northbridge Street	5%	Not Flooded
	2% AEP	Not Flooded
	1.33% AEP	Not Flooded
	1% AEP	Reduced Flood Risk - Approx. 80mm reduction in flood depths in 'with railway' scenario
	1% AEP + CC	Reduced Flood Risk - Approx. 10mm reduction in flood depths in 'with railway' scenario
Ivy Cottage, near Robertsbridge Abbey	5%	Not Flooded
	2% AEP	Not Flooded
	1.33% AEP	Reduced Flood Risk - Approx. 40mm reduction in flood depths in 'with railway' scenario

	1% AEP	Reduced Flood Risk - Approx. 50mm reduction in flood depths in 'with railway' scenario
	1% AEP + CC	Reduced Flood Risk - Approx. 40mm reduction in flood depths in 'with railway' scenario
Forge Farm, B2244, near Udiam (Note finished floor levels in FRA)	5%	Not Flooded
	2% AEP	Not Flooded
	1.33% AEP	Not Flooded
	1% AEP	Flood depth 2mm in 'with railway' scenario**
	1% AEP + CC	No change in flood risk - Approx. 2mm change in 'with railway' scenario*** Predicted water level is 6.558 mAOD in baseline and 6.560 mAOD in 'with railway' scenario

* Where the reduction in flood depth in the 'with railway' scenario is less than 5mm, no change has been stated in the table due to the accuracies of the modelling.

** Given the accuracy and stability tolerances of the model this is not considered significant. The area shown as hatched in Figure A4, Appendix A.

*** 2mm is considered as no change in flood risk due to the accuracies of flood modelling.

4.5.6 The differences in flood levels at Forge Farm are very small and are within the stability tolerances of the model. Given the accuracy of the model flood risk is considered to be unchanged at Forge Farm. It should be noted that this area is not the focus of this FRA and a more detailed model may be required by the Environment Agency for any future development at the Forge Farm site.

4.5.7 It should be noted that a FRA was undertaken in 2008 for the Forge Farm site. This was prior to the Environment Agency Modelling and no modelling appears to have been undertaken for the FRA. The FRA reports 1% AEP and 1% AEP with climate change levels lower than those predicted by the baseline model. The FRA recommends floor slabs are set to a minimum of 6.41mOD. The Environment Agency comments on the development included a recommendation that the occupants register with the Floodline Warnings Direct service.

4.5.8 Flood extent figures for all design flood events are provided in Appendix A. The difference in predicted water depth between the 'with railway' and baseline scenarios are also in Appendix A (Figures B1 to C5). The figures illustrate the proposed railway has a negligible impact on flood levels across the majority of the floodplain.

4.5.9 The extent of flooding is very similar in all design flood events for the baseline and 'with railway' scenarios. The slight increase in flood extent at the Forge Farm site for the 1% AEP design event is due to the 2 mm depth of water above the floor levels recommend in the 2008 FRA. The area is shown as hatched in Figure A4, Appendix A. As discussed above, 2 mm is not considered significant given the accuracy and tolerances of the model.

4.5.10 The difference in flood levels across the floodplain between the baseline and 'with railway' scenario are generally less than 50 mm. There are some areas of the floodplain where the water levels are lower in the 'with railway' scenario than the baseline. There are also some small areas generally adjacent to the railway where the water levels in the 'with railway' scenario are more the 50mm above the baseline flood levels. There are no properties at these locations. This is shown in the Figure 6 below.

4.5.11 The model has demonstrated that the railway does not increase the frequency or extent of flooding. It has also demonstrated that the proposed reinstatement of the railway does not impact floodplain water levels upstream or downstream of the proposed development.

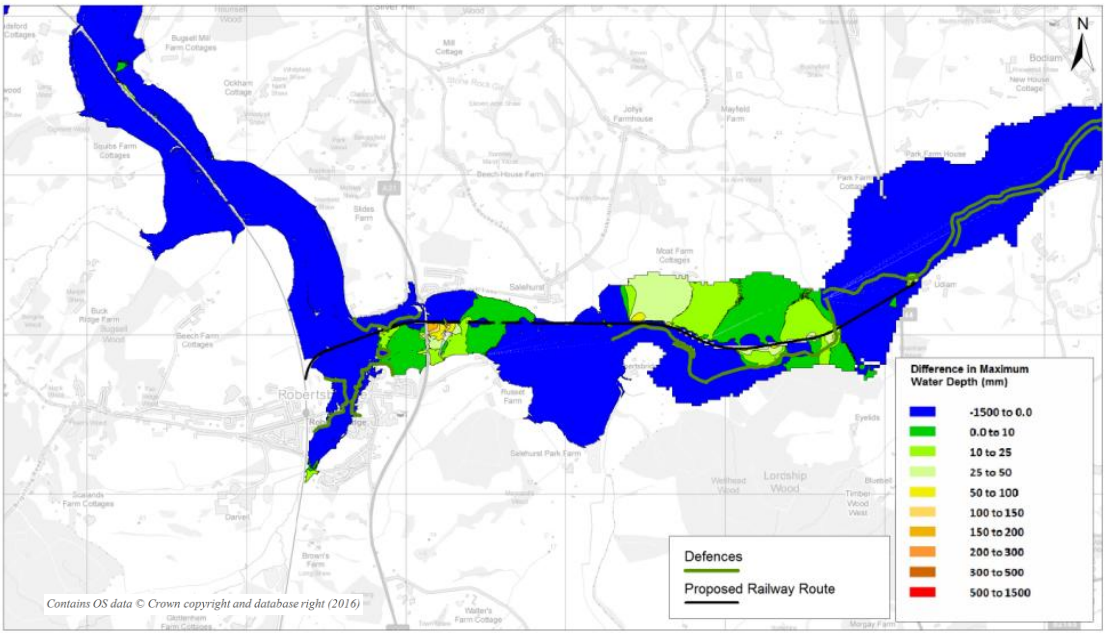


Figure 6 – Difference in water depths between 'with railway' and baseline scenarios for the 1% AEP with climate change design event

Tidal Flood Risk

4.5.12 There is no risk of tidal flooding at the site.

Flood Risk from Land, Surface Water and Sewers

4.5.13 Flooding from land can be caused by rainfall being unable to infiltrate into the natural ground or entering the drainage systems due to blockage, or flows being above design capacity. This can then result in (temporary) localised ponding and flooding. The natural topography and location of buildings/structures can influence the direction and depth of water flowing off impermeable and permeable surfaces.

4.5.14 The proposed railway is considered at low to medium risk of surface water/sewer flooding. The track for the majority if it length is higher than the surrounding ground. Where the track elevation is close to ground level to facilitate floodplain flows there is a greater risk of surface water ponding. The risk of surface water flooding to the track will be managed by the train operators and services will be stopped. The remaining sections of the railway line are unlikely to have ponding on the tracks in significant volumes. The railway line will be built on a permeable base with no significant change in surface water runoff.

4.5.15 The culverts and sections of viaduct included in the proposals to maintain connectivity across the floodplain will also act as flow paths for surface water. The areas immediately upstream of the proposed railway embankment are farmland/open spaces where local ponding of surface water adjacent to the railway embankment will not increase the risk of flooding to property.

Groundwater Flood Risk

4.5.16 Groundwater flooding occurs when water levels in the ground rise above surface elevations. It is most likely to occur in low-lying areas underlain by permeable rocks.

4.5.17 The proposed railway is considered at low risk of groundwater flooding. The proposed route is generally higher than the surrounding ground. The risk of groundwater flooding to the track will be managed by the train operators and services will be stopped.

Flood Risk from Artificial Sources

4.5.18 Artificial sources of flooding include reservoirs, canals, lakes and mining abstraction.

4.5.19 The Darwell Reservoir is the closest artificial water features to the site. Wadhurst Park lake is the second closest large artificial water feature. The Environment Agency risk of flooding from reservoirs map indicates that both these reservoirs could affect the Robertsbridge area if they were to fail and release the water they hold. The maps show the largest area that might be flooded in the worst case scenario and it is unlikely that any actual flood would be this large. The Darwell Reservoir is approximately 4 km from the proposed railway. There is no information within the SFRA to indicate that flooding from artificial water bodies is considered a significant flood risk to the site.

4.5.20 Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensures that reservoirs are inspected regularly and essential safety work is carried out.

4.5.21 The risk from artificial sources is considered low to medium.

5 Flood Risk Management

5.1 Principles of Flood Risk Management

5.1.1 NPPF requires a precautionary approach to be undertaken when making land use planning decisions regarding flood risk. This is partly due to the considerable uncertainty surrounding flooding mechanisms and how flooding may respond to climate change. It is also due to the potentially devastating consequences of flooding to the people and property affected.

5.1.2 Flood risk is a combination of the probability of flooding and the consequences of flooding. Hence 'managing flood risk' involves managing either, the probability of flooding or the consequences of flooding, or both.

5.1.3 NPPF requires flooding from tidal, fluvial, land, surface water & sewerage and from groundwater to be considered. The flood risk management measures discussed in this section are based on the sources of flooding identified in Section 4 that are considered to pose an unacceptable risk to the development proposals.

5.2 Flood Risk Management along the Rother Valley Railway

5.2.1 Section 4 identified the following sources of flooding that require management to reduce risk to an acceptable level in compliance with NPPF:

- Fluvial sources along the route of the railway; and
- Residual risk of flooding from reservoirs.

5.3 Management of Fluvial Flood Risk along the Railway

5.3.1 The flood risk to the railway will be managed through restricting operation of the railway during times of severe flood. If there is a risk of flooding to the railway line it is proposed that services along the railway between Bodiam and Robertsbridge are cancelled.

5.3.2 The proposed railway elevations, culverts, bridges and viaduct crossings maintain connectivity across the current floodplain and minimise the impact of the railway on floodplain water levels and flow paths.

5.3.3 The existing operational railway line already experiences frequent flooding along certain sections of the track. Procedures are already in place to deal with the flooding if this occurs and so these procedures will be applied to the new reinstated line. The risk of flooding to the track will be managed by the train operators and services will be stopped.

5.4 Management of Residual Risk of flooding from reservoirs

5.4.1 To manage residual risk of flooding from reservoirs it is recommended that the train operator contact East Sussex County Council and the reservoirs owners to review the procedures in the emergency plan and the processes proposed within the off-site reservoir management plan. From this review the train operator should understand what they can do in the event of flooding and/or have their name added to a contact list so that they are warned of an impending breach of the reservoir.

5.5 The Environment Flood Warning and Evacuation plan

5.5.1 The Environment Agency operates a Flood Warnings Direct service; the Robertsbridge Flood Warning area covers part of the route of the railway between Robertsbridge and Udiam and therefore if deemed appropriate, it is recommended the train operator (Kent and East Sussex Railway) subscribe to this service. It is proposed that train operator (Kent and East Sussex Railway) cancel services between Bodiam and Robertsbridge in the event of a Flood Warning or Severe Flood Warning. A Flood Alert should be the trigger for reviewing services and consulting with the Environment Agency on the expected flood levels.

6 Conclusion

6.1.1 Capita were commissioned by Rother Valley Railway Limited to undertake a Flood Risk Assessment (FRA) for the proposed reinstatement of the Rother Valley Railway between Robertsbridge and Udiam (NGR TQ 73807 24014 to TQ 77186 24322). The route is approximately 3.5 km and will link the existing railway between Bodiam and Robertsbridge. The route is located within Flood Zone 3 on the Environment Agency Flood Zone Map and is identified by Rother District Council as being an acceptable development if flood risk is managed. The proposed scheme includes reinstating the historic railway line and incorporates a number of flood relief culverts, viaducts and bridges connecting the surrounding floodplains.

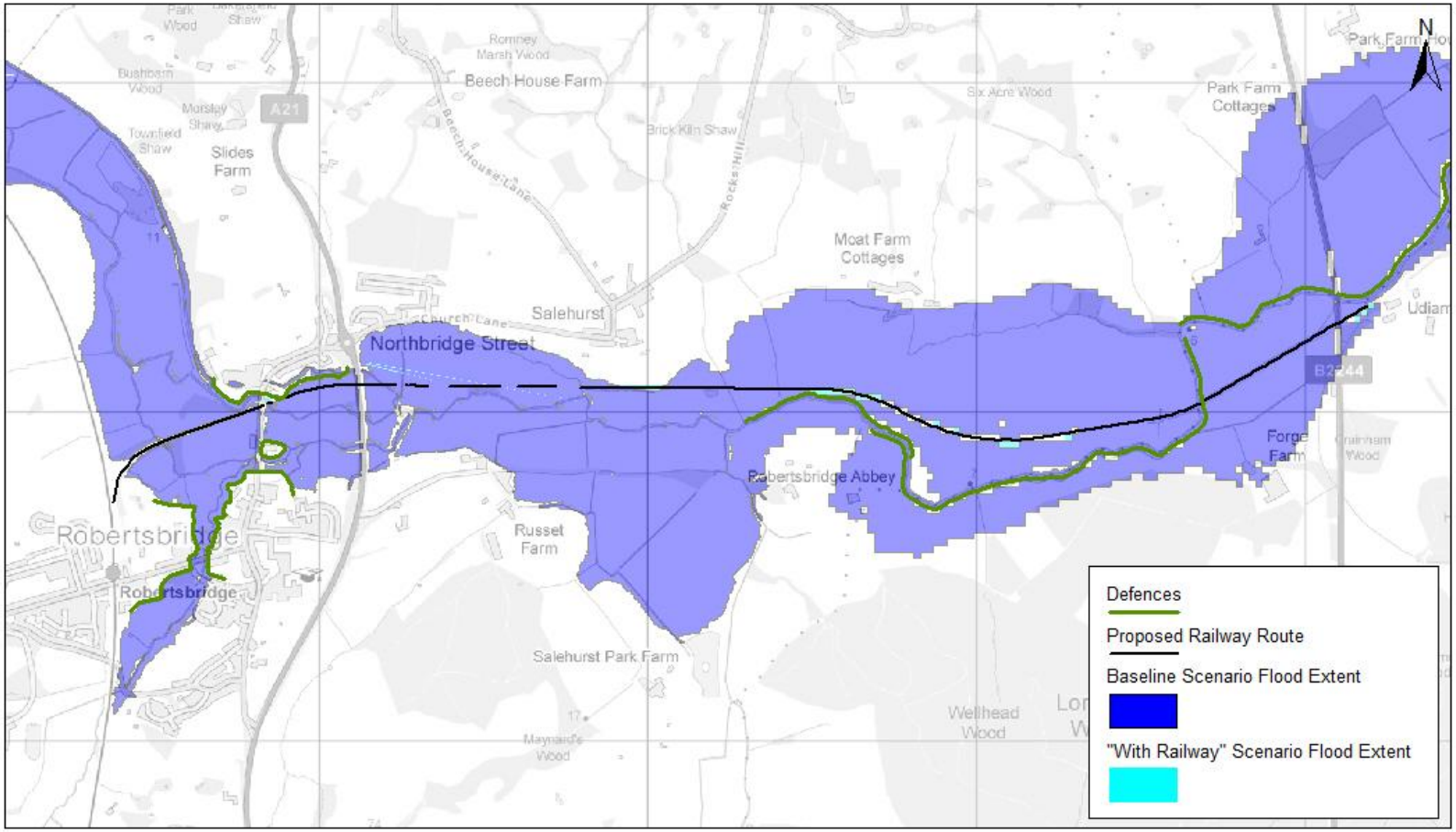
6.1.2 The modelling results have shown the flood extents between the baseline scenario and the proposed 'with railway' scenario have not changed significantly. The modelling indicates that there is a reduction in flood depths behind the Robertsbridge and Northbridge Street defences in the 1% AEP with climate change design flood events. The 'with railway' scenarios indicates some areas where water levels increase by up to 50mm, however there are also areas where the flood levels are lower in the 'with railway' scenario. The small areas where a larger increase in flood levels is predicted in the 'with railway' scenario are adjacent to the proposed railway, where no property is located.

6.1.3 In locations where the reinstated railway line ties into existing ground levels flooding is likely to inundate the track and impact on its operation. The risk from flooding to the public associated with the operation of the railway will be managed through restricting operation during times of severe flooding. If there is a risk of flooding to the railway line it is proposed that services along the railway between Bodiam and Robertsbridge are cancelled.

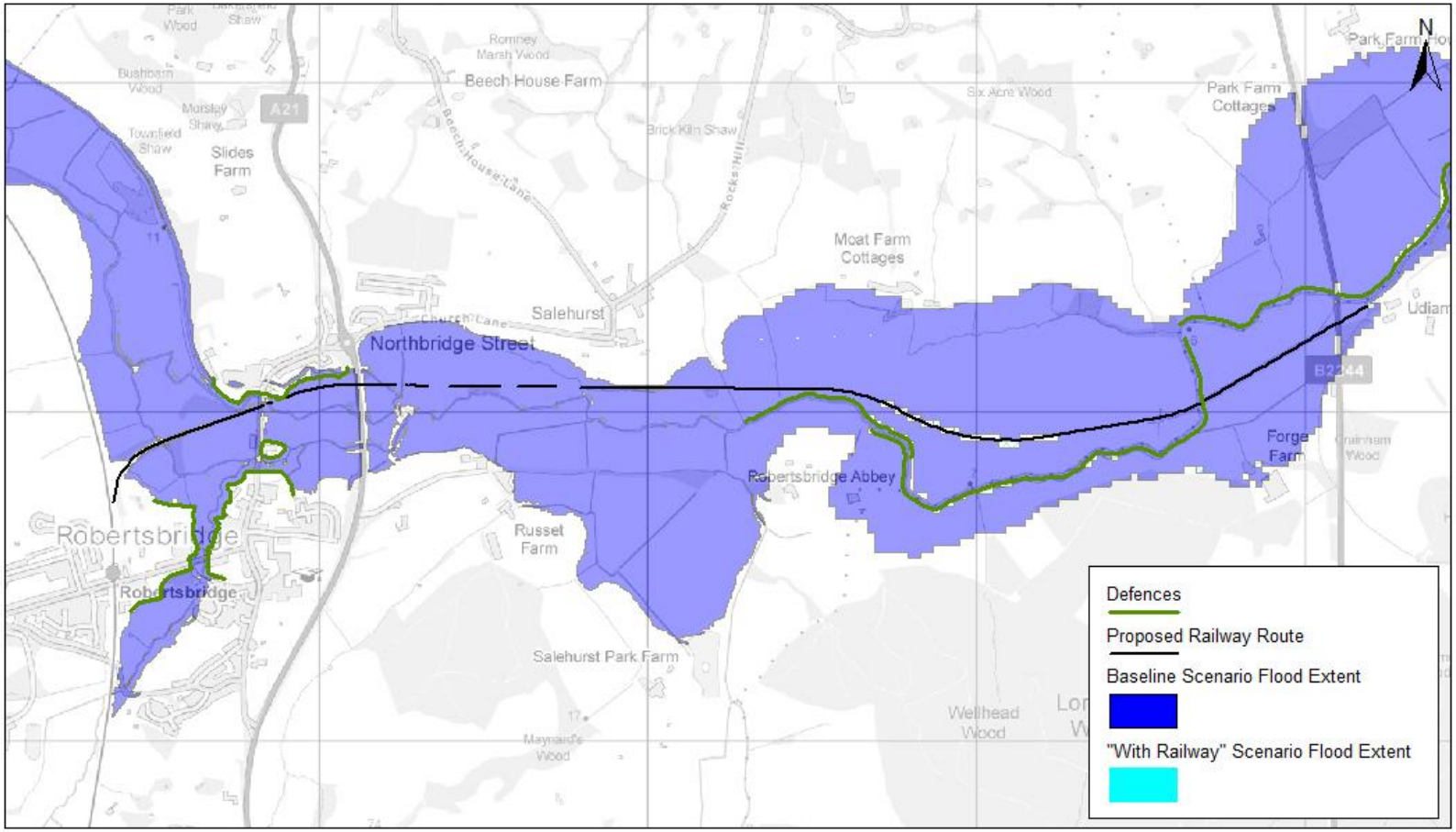
6.1.4 It is recommended the train operator Kent and East Sussex Railway register to the Environment Agency's Flood Warnings Direct service to receive early warnings and updates of any potential risk of flooding. The use of this service will help them to effectively plan and utilise their flood risk management procedures currently in place.

6.1.5 The development proposal has considered flood risk at all stages throughout the development of the final layout and reflects the flood risk constraints and the need to manage, and where possible reduce, flood risk in compliance with the guidance in the NPPF. This FRA demonstrates that the flood risk related to the proposed reinstatement of the railway can be adequately managed.

Appendix A - Flood Risk Maps



Rother Valley Railway							
Figure A-1: Comparison of baseline scenario and 'with railway' scenario 5% AEP flood extents						CAPITA	
DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
TL	SC	AC	24/05/16	1:16000	E.Grinstead	Figure A-1	1



Rother Valley Railway							
Figure A-2: Comparison of baseline scenario and 'with railway' scenario 2% AEP flood extents						CAPITA	
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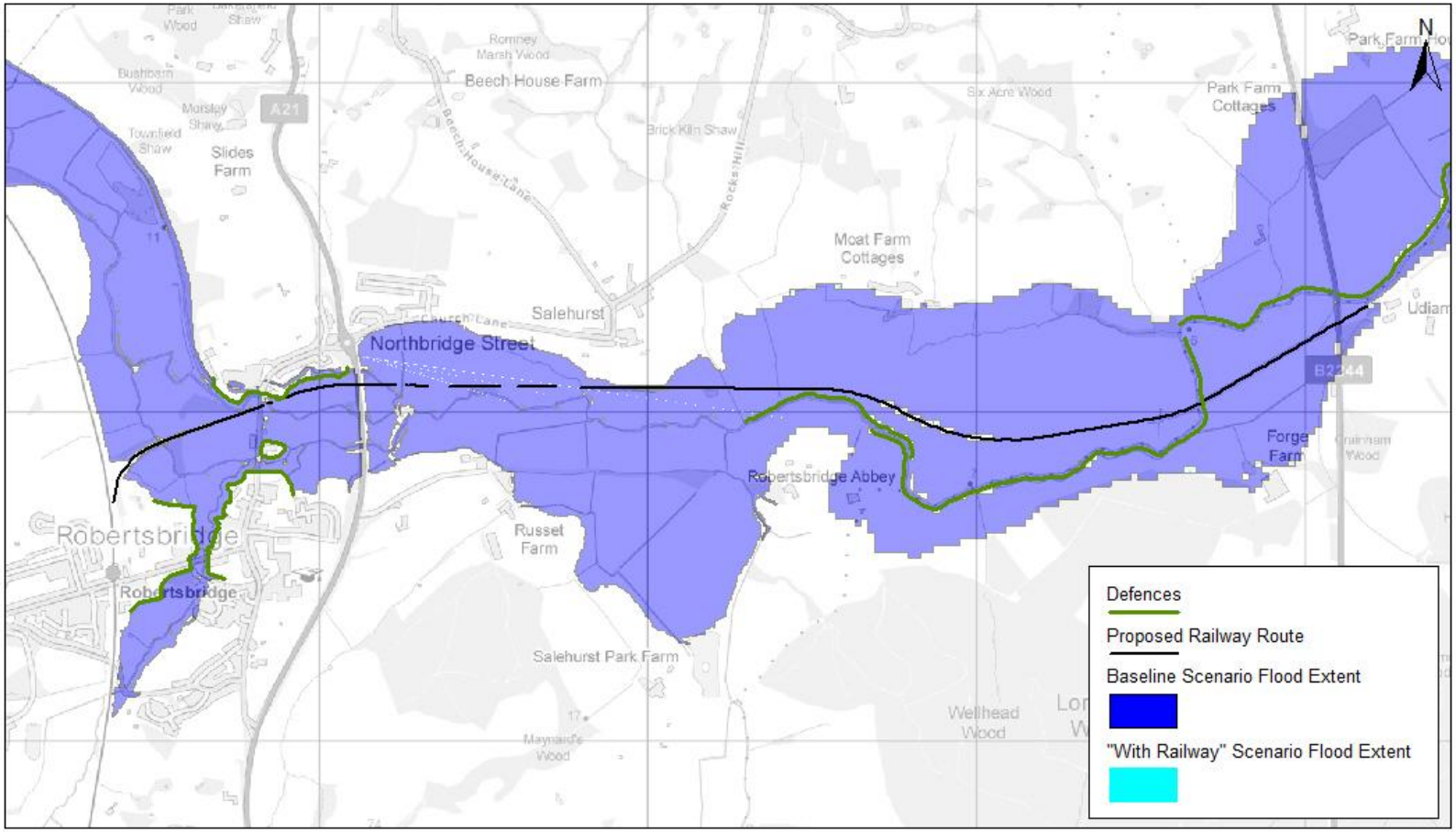

Rother Valley Railway

Figure A-3: Comparison of baseline scenario and 'with railway' scenario 1.33% AEP flood extents

CAPITA

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
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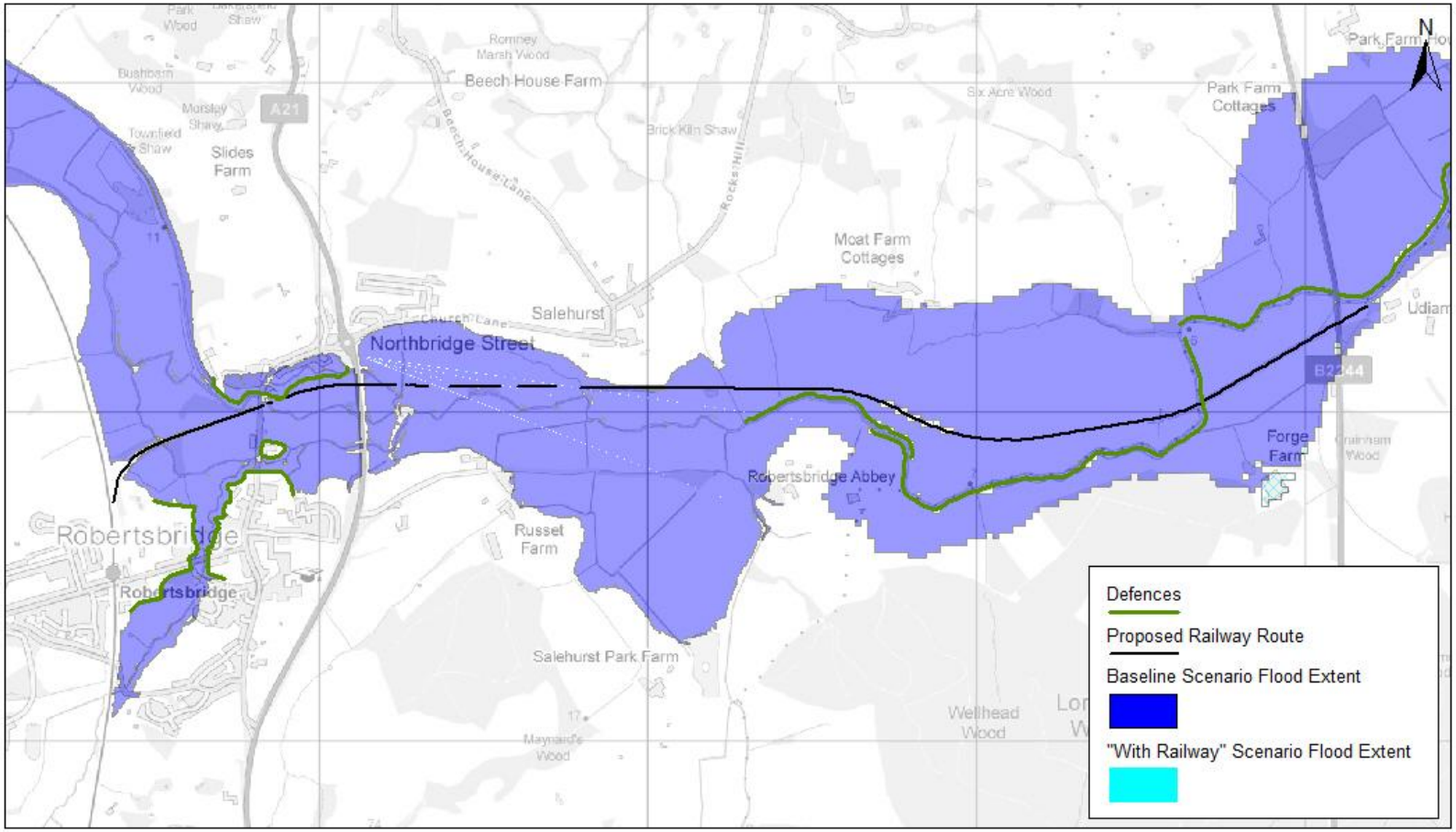

Rother Valley Railway							
Figure A-4: Comparison of baseline scenario and 'with railway' scenario 1% AEP flood extents						CAPITA	
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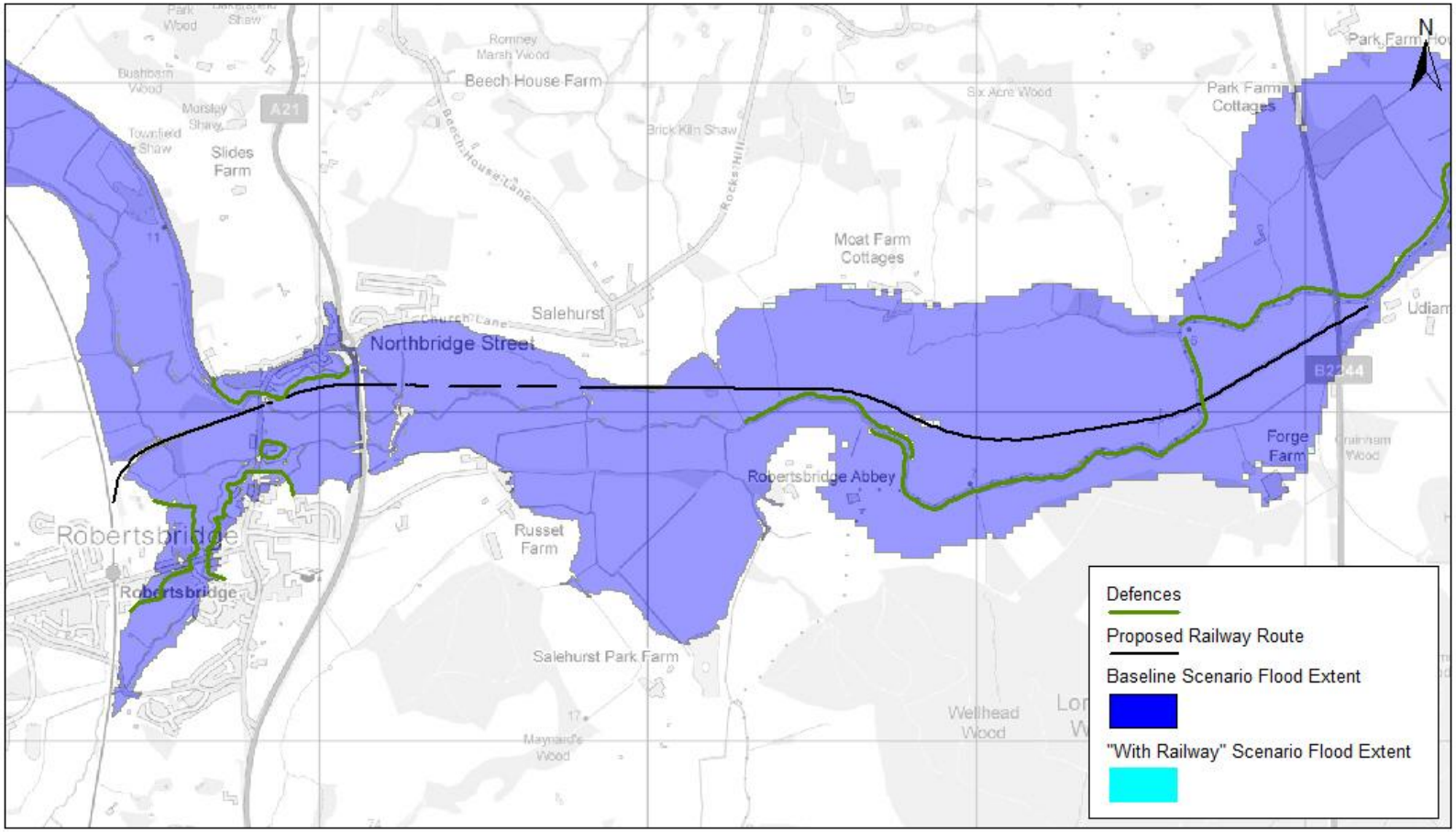

Rother Valley Railway							
Figure A-5: Comparison of baseline scenario and 'with railway' scenario 1%+CC AEP flood extents						CAPITA	
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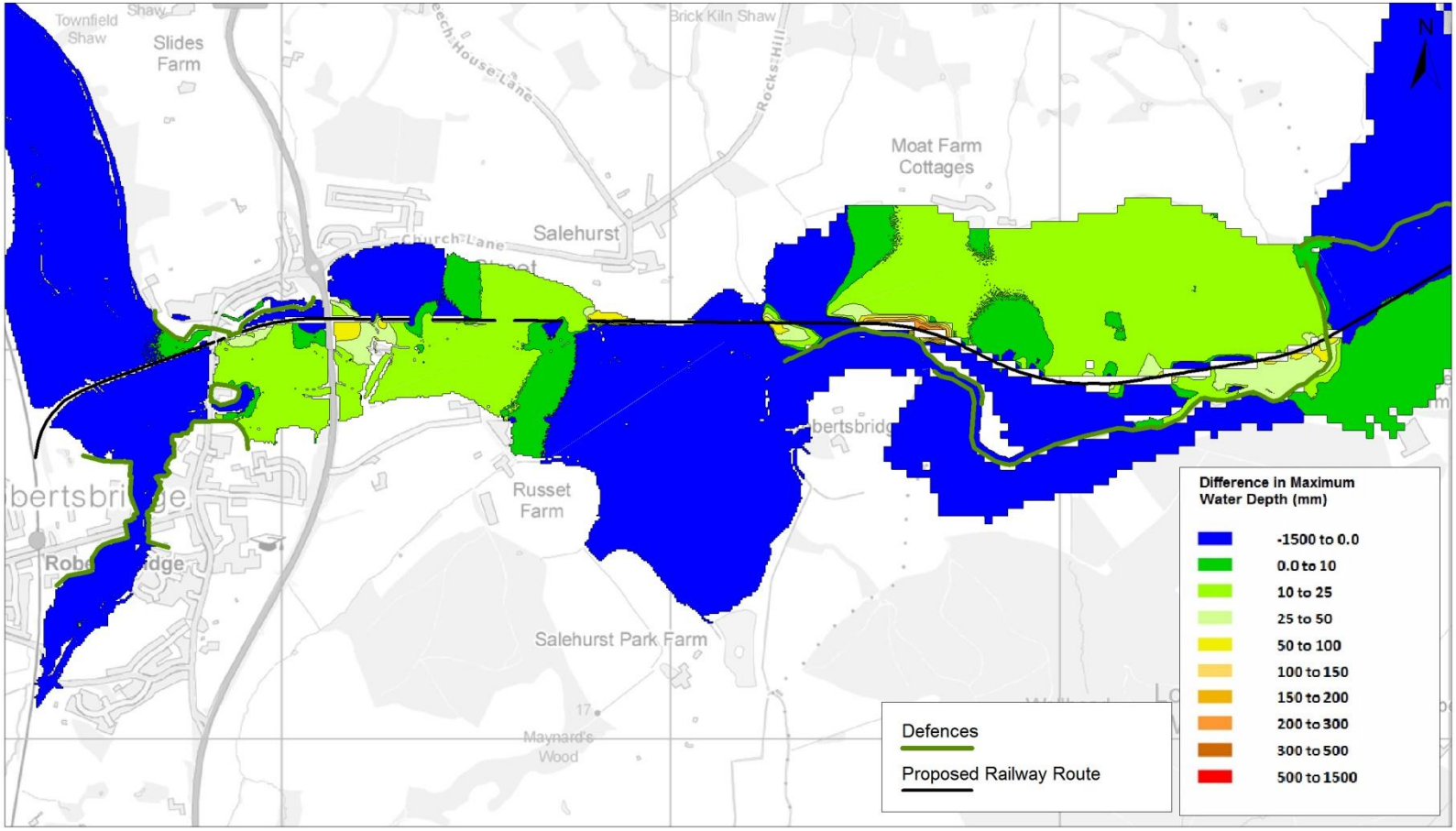

Rother Valley Railway

Figure B-1: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 5% AEP flood event

CAPITA

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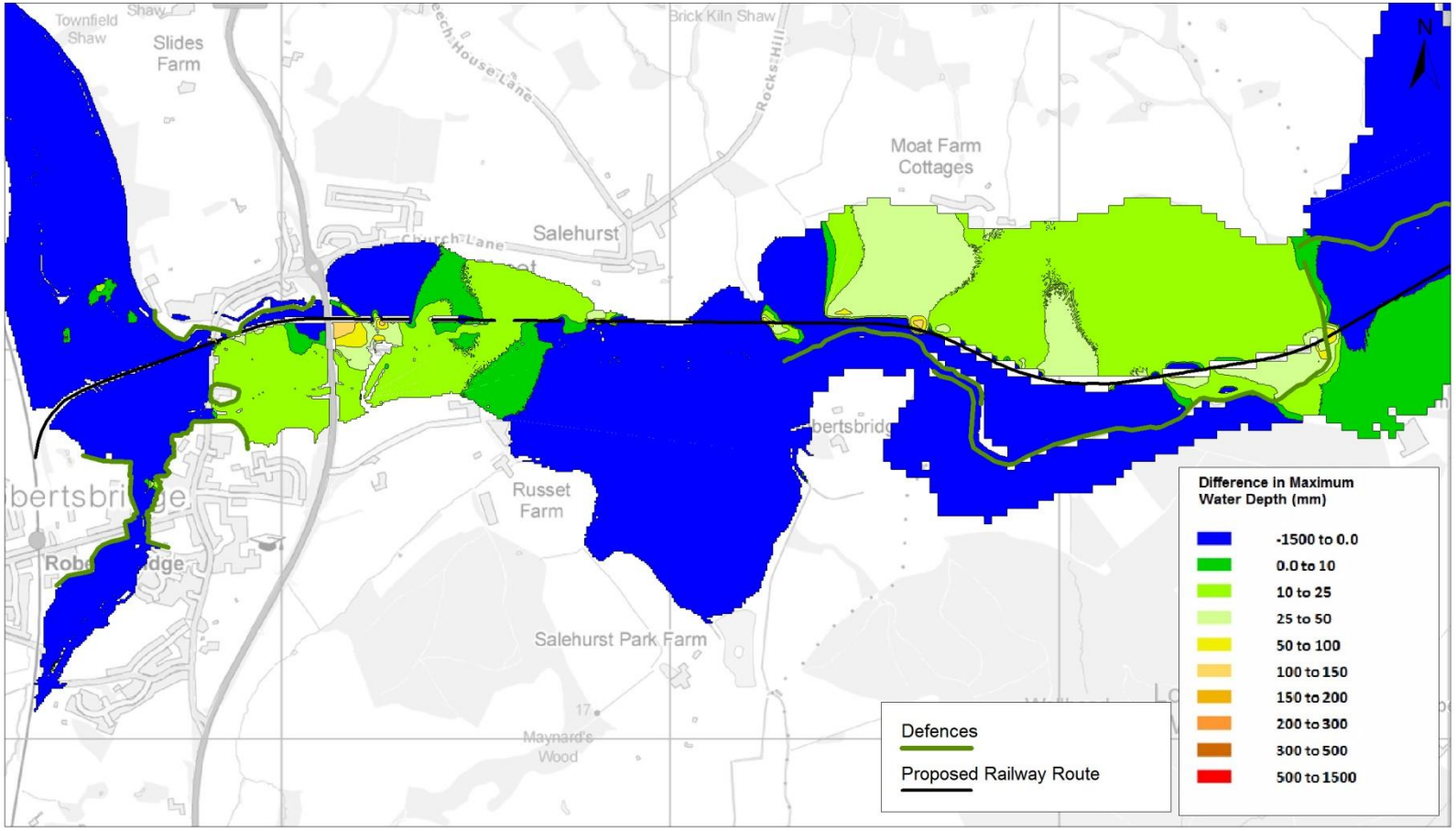

Rother Valley Railway

Figure B-2: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 2% AEP flood event

CAPITA

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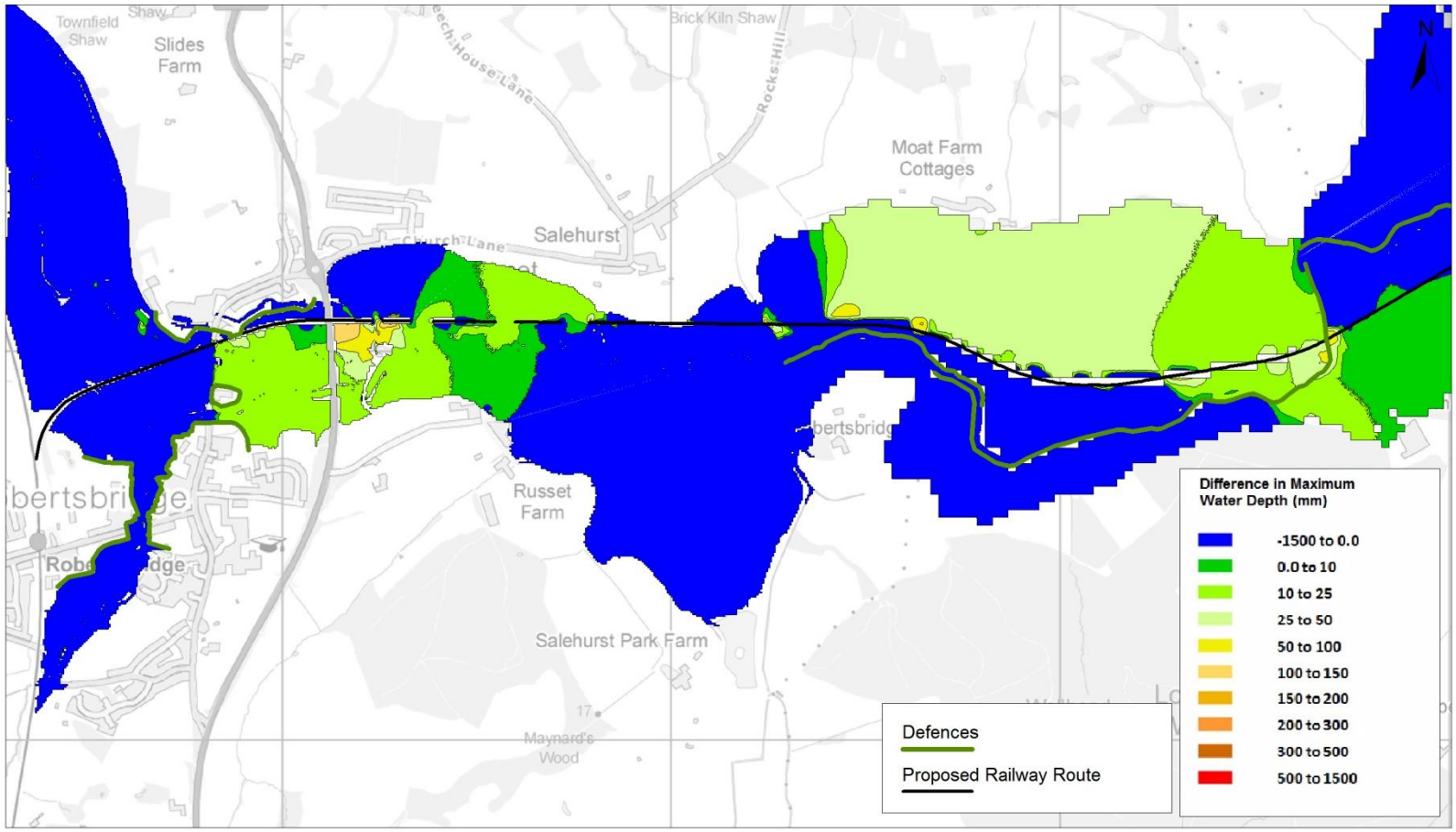

Rother Valley Railway

Figure B-3: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 1.33% AEP flood event

CAPITA

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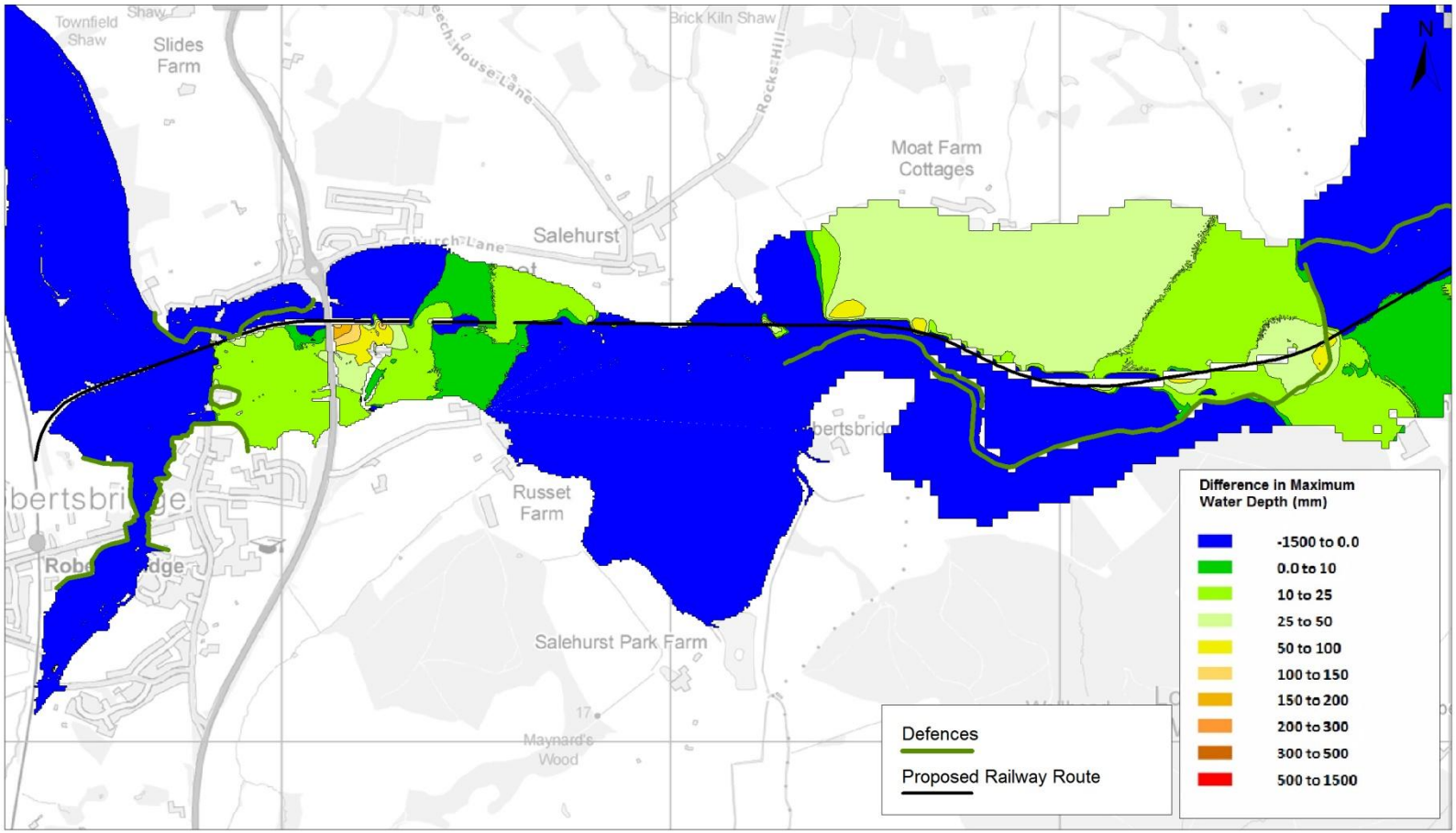

Rother Valley Railway

Figure B-4: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 1% AEP flood event

CAPITA

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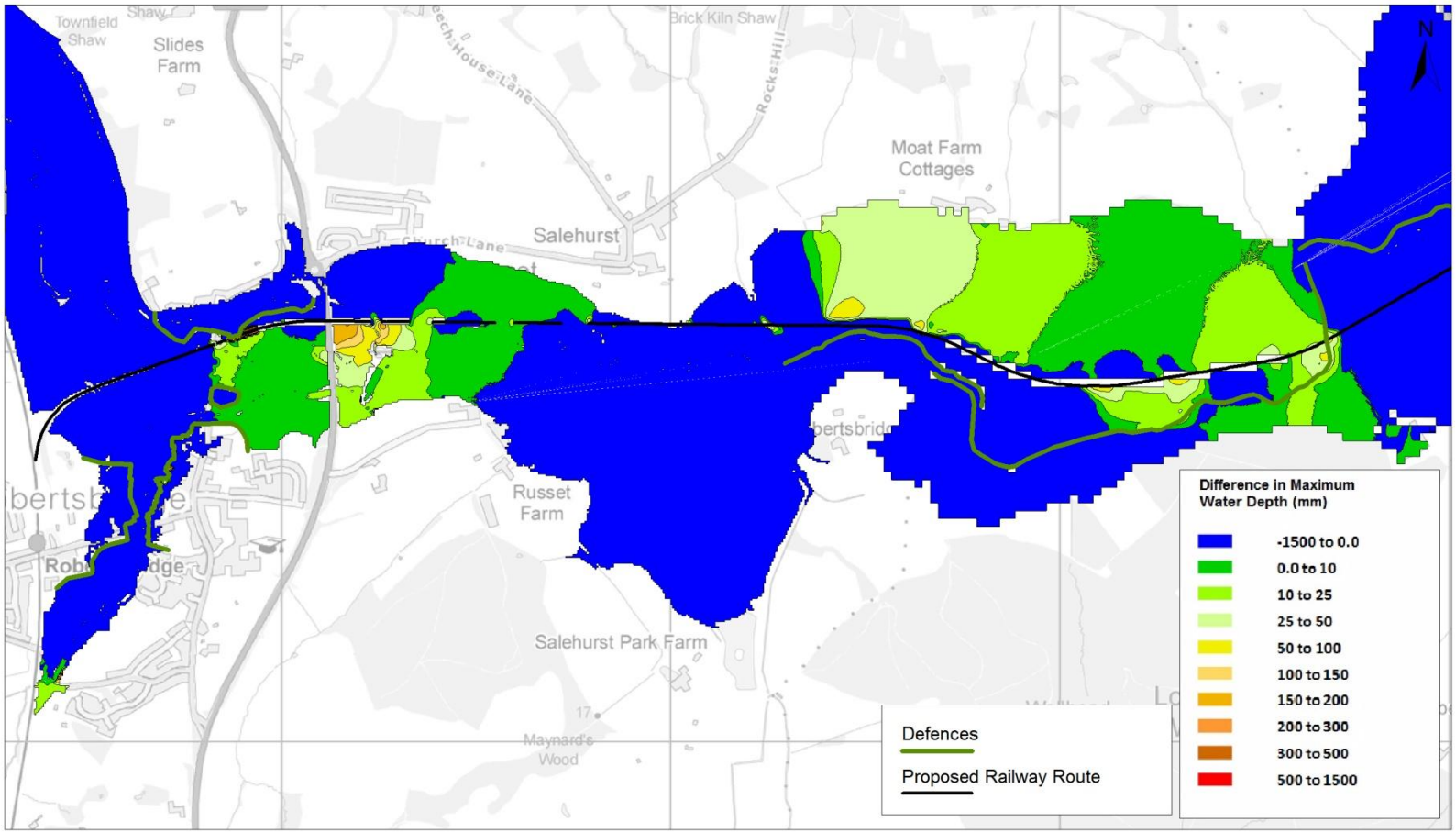

Rother Valley Railway

Figure B-5: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 1% AEP with climate change flood event

CAPITA

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
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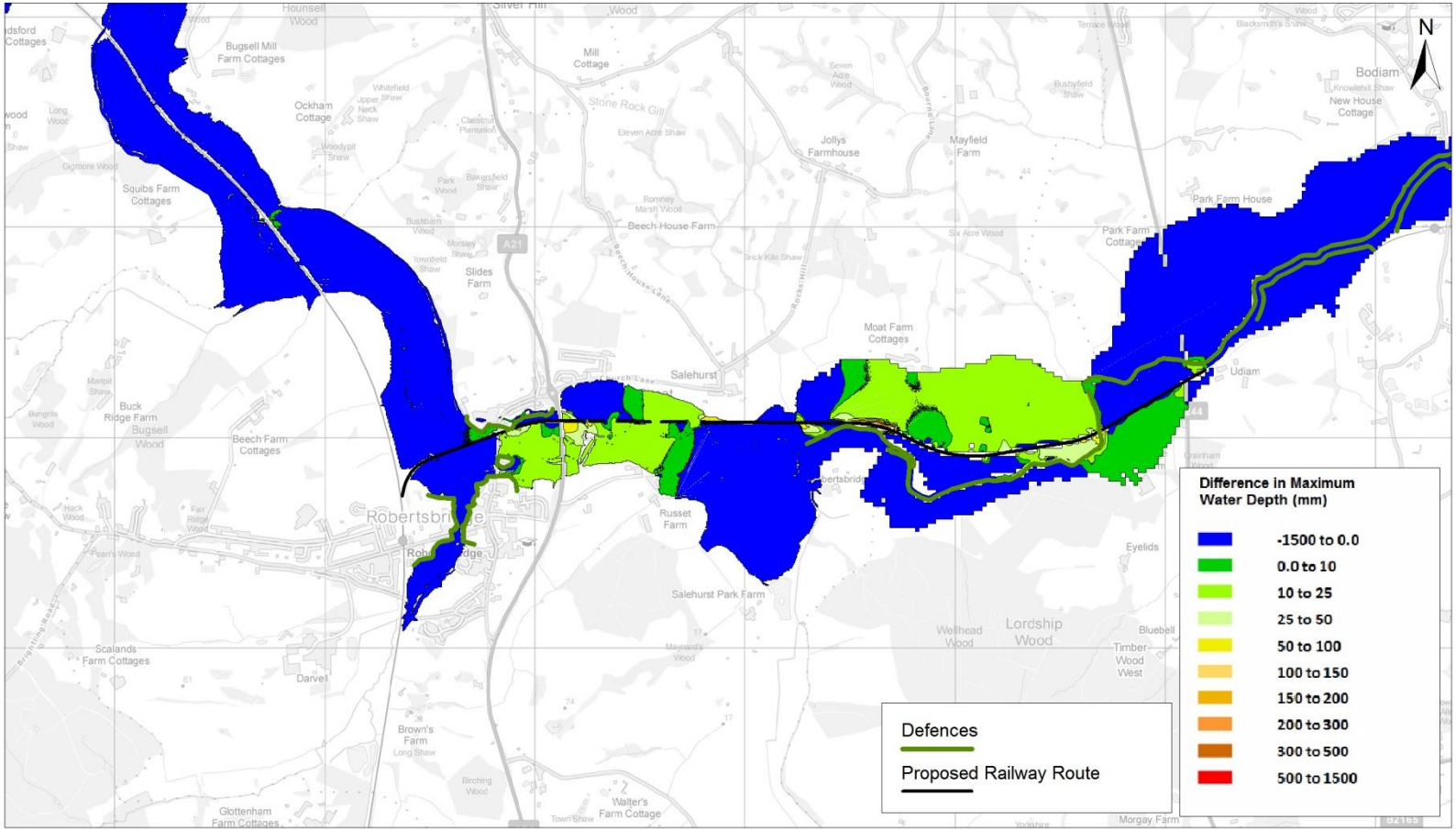

Rother Valley Railway

Figure C-1: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 5% AEP flood event

CAPITA

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
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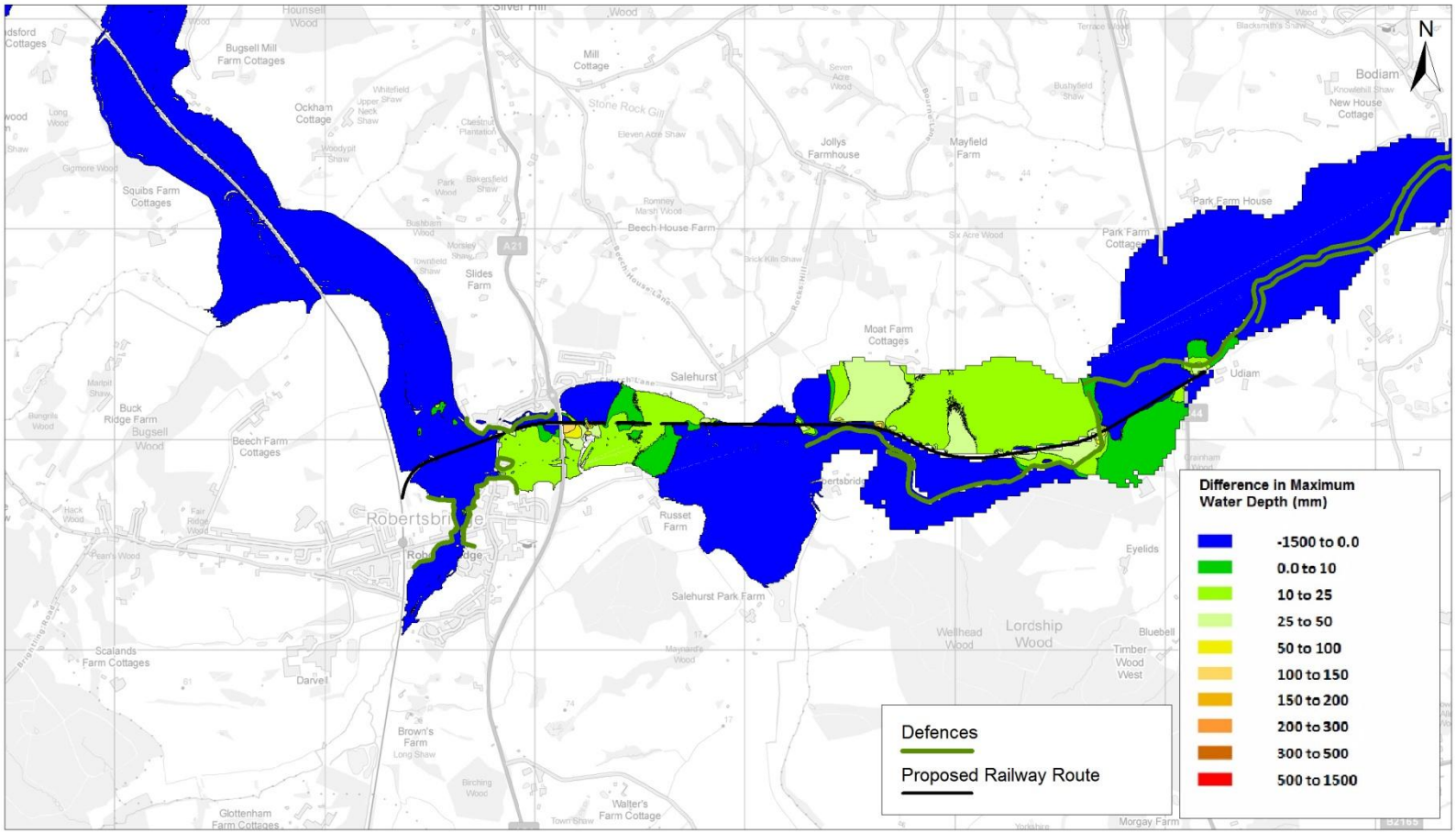

Rother Valley Railway

Figure C-2: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 2% AEP flood event

CAPITA

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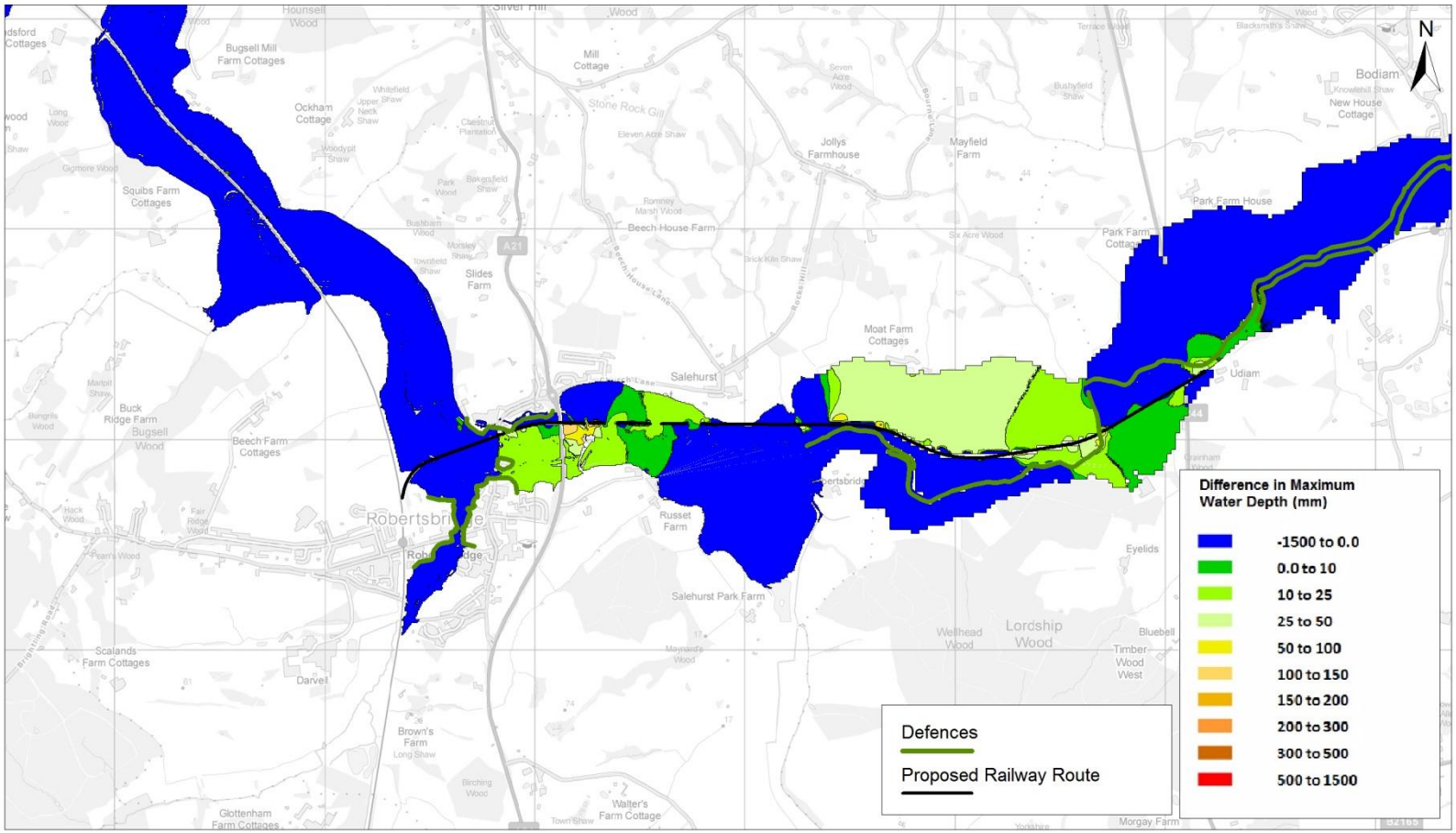

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Figure C-3: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 1.33% AEP flood event

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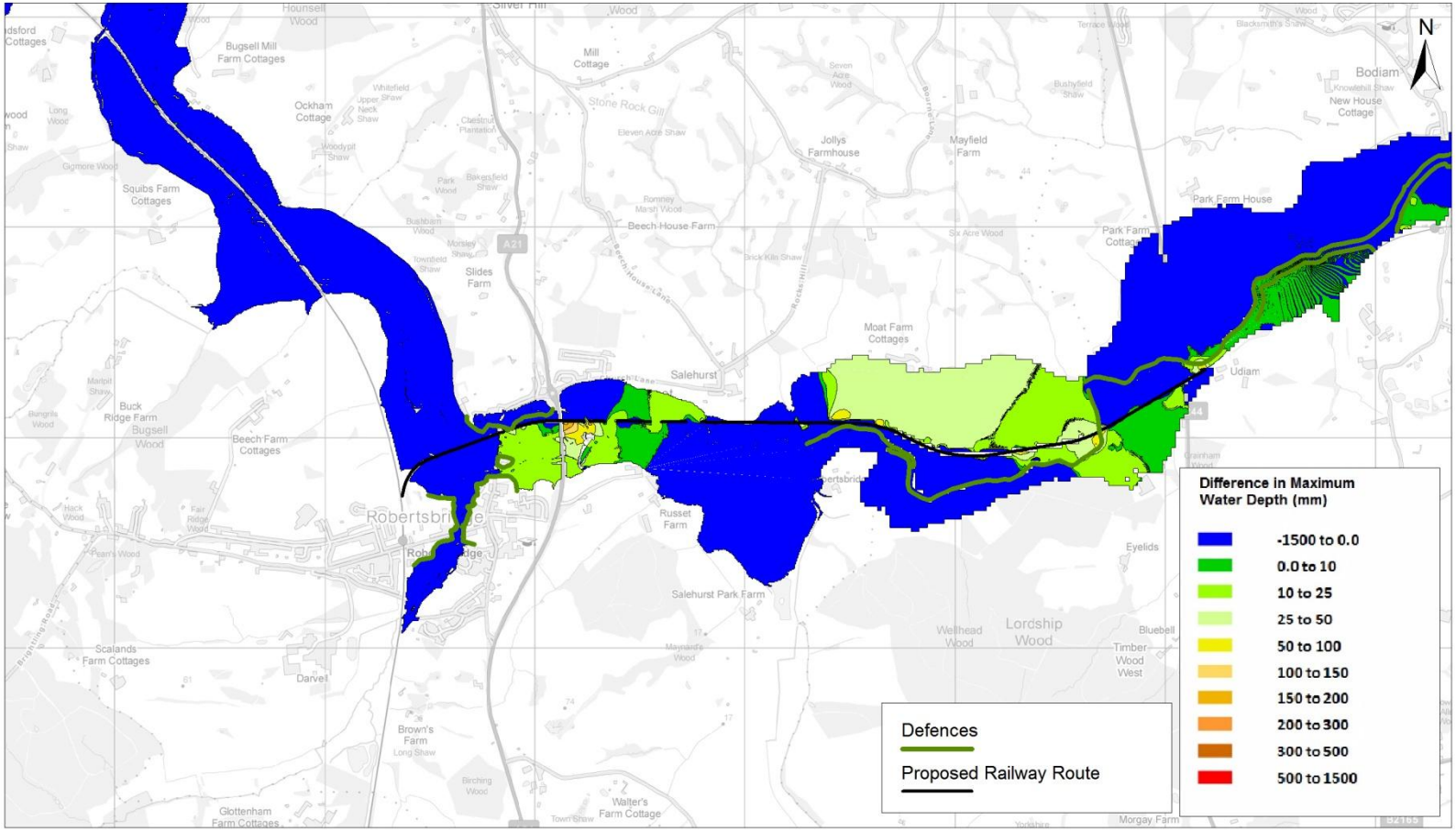

Rother Valley Railway

Figure C-4: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 1% AEP flood event

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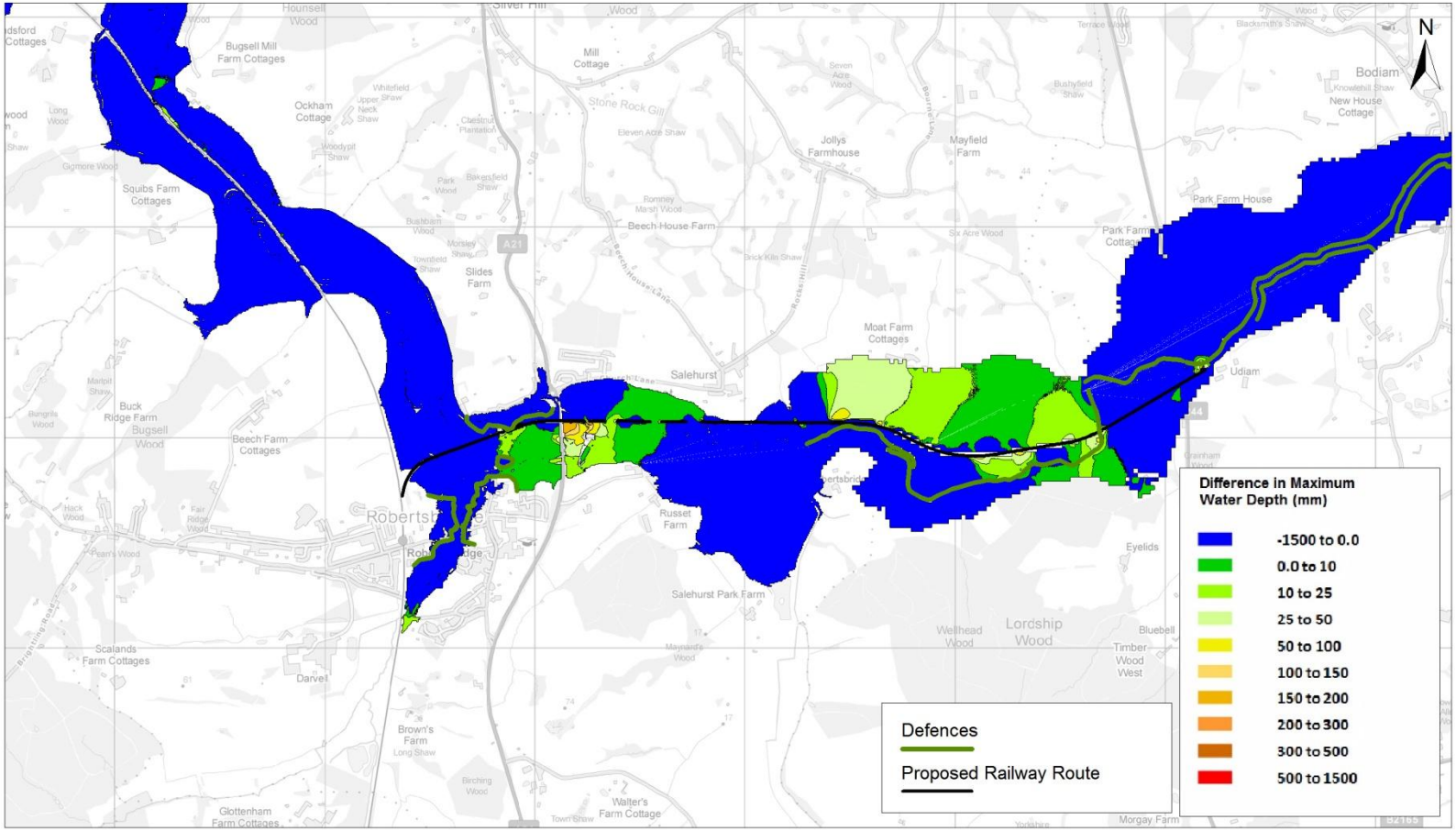

Rother Valley Railway

Figure C-5: Difference in maximum depth between 'with railway' scenario and baseline scenarios for the 1% AEP with climate change flood event

CAPITA

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