

## High Speed Rail (West Midlands - Crewe)

Supplementary Environmental Statement 2 and  
Additional Provision 2 Environmental Statement

Volume 5: Technical appendices

CA1: Fradley to Colton  
Flood risk assessment (WR-003-001)

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## Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Structure of this appendix	1
1.2	Assessment methodology	2
<b>2</b>	<b>Flood risk baseline</b>	<b>3</b>
<b>3</b>	<b>AP2 amendments and flood risk implications</b>	<b>4</b>
<b>4</b>	<b>Flood risk assessment</b>	<b>5</b>
4.1	Additional land required for the amendment to a National Grid Electricity Transmission 400kv overhead power line and a new utility compound, near Kings Bromley viaduct (AP2-001-007) and Additional land required for the diversion of a National Grid Gas Transmission gas pipeline and a new utility compound, north of Pipe Ridware (AP2-001-010)	5
4.2	Additional land and a change to Bill powers required to divert Common Lane to the A515 Lichfield Road (AP2-001-006)	7
<b>5</b>	<b>Flood risk management measures</b>	<b>9</b>
5.1	Introduction	9
5.2	Additional land required for the amendment to a National Grid Electricity Transmission 400kv overhead power line and a new utility compound, near Kings Bromley viaduct (AP2-001-007) and Additional land required for the diversion of a National Grid Gas Transmission gas pipeline and a new utility compound, north of Pipe Ridware (AP2-001-010)	9
5.3	Additional land and a change to Bill powers required to divert Common Lane to the A515 Lichfield Road (AP2-001-006)	9
<b>6</b>	<b>Conclusions</b>	<b>11</b>
<b>7</b>	<b>References</b>	<b>12</b>

## List of tables

Table 1: AP2 changes with implications for flood risk	4
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## List of figures

Figure 1: Flood risk to construction compounds on Luth Burn and Bourne Brook	6
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Figure 2: Changes in peak flood level resulting from AP2 revised scheme including Common Lane diversion 8

# 1 Introduction

## 1.1 Structure of this appendix

- 1.1.1 This document is an appendix to the water resources and flood risk assessment which forms part of Volume 5 of the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) for the Fradley to Colton community area (CA1).
- 1.1.2 This appendix provides details of changes to the flood risk assessment (FRA) since the production of the High Speed Two (HS2) Phase 2a (West Midlands - Crewe) Environmental Statement (ES)<sup>1</sup> published in July 2017 (the main ES), as well as the Supplementary Environmental Statement (SES1) and Additional Provision Environmental Statement (AP1 ES) published in March 2018<sup>2</sup>.
- 1.1.3 This report should be read in conjunction with Volume 5, Appendix WR-003-001 of the main ES.
- 1.1.4 In order to differentiate between the original scheme and the subsequent changes, the following terms are used:
- 'the original scheme' – the Bill scheme submitted to Parliament in July 2017, which was assessed in the main ES;
  - 'the SES1 scheme' – the original scheme with the changes described in the SES1 submitted in March 2018;
  - 'the AP1 revised scheme' – the SES1 scheme as amended by the AP1 submitted in March 2018;
  - 'the SES2 scheme' – the SES1 scheme with the changes described in the SES2; and
  - 'the AP2 revised scheme' – the SES2 scheme as amended by the AP2.
- 1.1.5 This FRA considers three AP2 amendments, no SES2 changes were identified in the Fradley to Colton area that had implications for flood risk.
- 1.1.6 Separate reports describing the original hydraulic modelling of Bourne Brook and Luth Burn described in this assessment can be found in Background Information and Data (BID) which accompanied the main ES (see BID WR-004-007<sup>3</sup>).
- 1.1.7 Maps referred to in this appendix are contained in the SES2 and AP2 ES Volume 5, Water resources and flood risk Map Book.

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<sup>1</sup> HS2 Ltd (2017), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Environmental Statement*, <https://www.gov.uk/government/collections/hs2-phase-2a-environmental-statement>

<sup>2</sup> HS2 Ltd (2018), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Supplementary Environmental Statement and Additional Provision Environmental Statement*, <https://www.gov.uk/government/collections/hs2-phase-2a-supplementary-environmental-statement-and-additional-provision-environmental-statement>

<sup>3</sup> HS2 Ltd (2017), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data to accompany Environmental Statement, Hydraulic modelling report - Filly Brook*, [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/627377/E137\\_BID-WR-004-007\\_WEB.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/627377/E137_BID-WR-004-007_WEB.pdf)

## 1.2 Assessment methodology

- 1.2.1 This FRA has been carried out in general accordance with the requirements of the National Planning Policy Framework (NPPF)<sup>4</sup>. The NPPF aims to prevent inappropriate development in areas at risk of flooding and to ensure that, where development is necessary in areas at risk of flooding, it is safe from flooding, does not increase flood risk elsewhere and reduces flood risk where possible.
- 1.2.2 The methodology, design criteria and data sources used in this FRA are set out in the main ES Environmental Impact Assessment Scope and Methodology Report (SMR)<sup>5</sup> and its Addendum<sup>6</sup>.

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<sup>4</sup> Department for Communities and Local Government (2018), *National Planning Policy Framework*, <https://www.gov.uk/government/collections/revised-national-planning-policy-framework>

<sup>5</sup> HS2 Ltd (2017), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Environmental Impact Assessment Scope and Methodology Report, Main ES, Volume 5: Appendix CT-001-001*,

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/627187/E23\\_EIA\\_SMR\\_CT-001-001\\_WEB.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627187/E23_EIA_SMR_CT-001-001_WEB.pdf)

<sup>6</sup> HS2 Ltd (2017), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Environmental Impact Assessment Scope and Methodology Report Addendum, Main ES, Volume 5: Appendix CT-001-002*,

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/627188/E24A\\_CT-001-002\\_Part\\_1\\_WEB.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627188/E24A_CT-001-002_Part_1_WEB.pdf)

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## 2 Flood risk baseline

2.1.1 The flood risk baseline is set out in the main ES Volume 5, Appendix WR-003-001<sup>7</sup>. This information includes:

- relevant national, regional and local policy (Section 2);
- Flood Zone 2 and Flood Zone 3 areas<sup>8</sup> associated with Bourne Brook and Luth Burn; and
- all communities and infrastructure assets currently at risk of flooding from Bourne Brook and Luth Burn.

2.1.2 The extent of Flood Zones 2 and 3 on the Environment Agency's Flood Map for Planning (rivers and sea) are shown in the main ES Volume 5, Water resources and flood risk Map Book, Map WR-01-101<sup>9</sup>.

2.1.3 A hydraulic model of Bourne Brook, the River Trent and Luth Burn was developed to inform the design, and assess the impacts, of the scheme in the main ES submission. This was adapted from the model received from the Environment Agency. The model developed provides a more accurate representation of the potential inundation extents associated with a 1 in 100 (1%) annual probability flood, including an allowance for climate change. In accordance with the Environment Agency's climate change guidance<sup>10</sup>, a 50% increase in peak river flow has been applied. This allowance reflects potential upper end estimates for potential increases beyond 2070.

2.1.4 The original analysis is described in Background Information and Data (BID) reports BID WR-004-007 which accompanied the main ES. The flood extents derived by this model are shown in the main ES Volume 5, Map Series WR-05. This flood risk assessment makes use of these outputs.

<sup>7</sup> HS2 Ltd (2017), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Environmental Statement, Flood risk assessment, Volume 5: Appendix WR-003-001*, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/628304/E96.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/628304/E96.pdf)

<sup>8</sup> Flood Zone 2 comprises land assessed as having between a 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding; Flood Zone 3 comprises land assessed as having a 1 in 100 (1%) or greater annual probability of river flooding

<sup>9</sup> HS2 Ltd (2017), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Environmental Statement, Volume 5, Water Resources and Flood Risk Map Book, Map Series WR-01, WR-02, WR-03, WR-05, WR-06*, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/628090/E79\\_VOL5\\_WR\\_WATERMARKED.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/628090/E79_VOL5_WR_WATERMARKED.pdf)

<sup>10</sup> Environment Agency (2016) last updated 2017, *Flood risk assessments: climate change allowances*, <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>



## 3 AP2 amendments and flood risk implications

3.1.1 Table 1 shows the AP2 amendments in the Fradley to Colton area that have implications for flood risk.

Table 1: AP2 changes with implications for flood risk

AP2 Reference	Description	Implications
Additional land and a change to Bill powers required to divert Common Lane to the A515 Lichfield Road (AP2-001-006)	Diversion of Common Lane across Bourne Brook, and its associated floodplain, with installation of a new culvert crossing on Bourne Brook. This would be configured similarly to the culverts on the A515 Lichfield Road realignment upstream.	The new culvert would affect peak flood levels in the channel and floodplain of Bourne Brook, which could adversely affect existing property owners in the area.
Additional land required for the amendment to a National Grid Electricity Transmission 400kv overhead power line and a new utility compound, near Kings Bromley viaduct (AP2-001-007)	Temporary construction compound, required to undertake a utility diversion, near Bourne Brook.	Both of these temporary compounds are partially in Flood Zone 3 of the Environment Agency's Flood Map for planning (rivers and sea). If they are in the floodplain, this has implications for the contractor's operations and could make things worse for others if a major flood occurs during the construction period.
Additional land required for the diversion of a National Grid Gas Transmission gas pipeline and a new utility compound, north of Pipe Ridware (AP2-001-010)	Temporary construction compound, required to undertake a utility diversion, near Luth Burn.	

3.1.2 This FRA focuses on:

- verifying the severity of the flood risk issues associated with the two temporary construction compounds and identifying if any additional mitigation is required to manage these risks; and
- assessing the potential impacts of the Common Lane Bourne Brook culvert on local flood risk and identifying any additional mitigation required.

## 4 Flood risk assessment

### 4.1 Additional land required for the amendment to a National Grid Electricity Transmission 400kv overhead power line and a new utility compound, near Kings Bromley viaduct (AP2-001-007) and Additional land required for the diversion of a National Grid Gas Transmission gas pipeline and a new utility compound, north of Pipe Ridware (AP2-001-010)

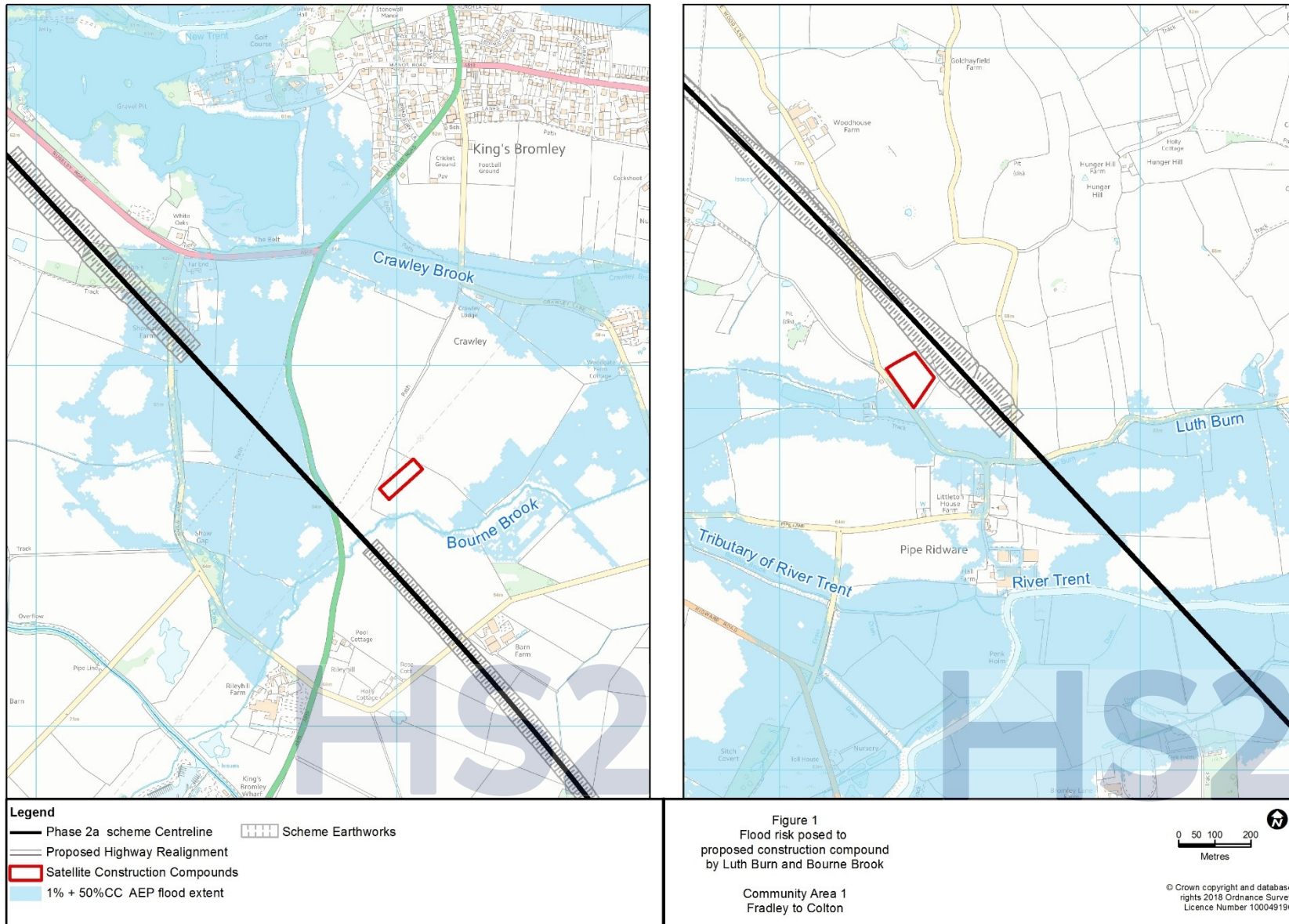
4.1.1 Figure 1 shows the floodplain extents associated with a 1 in 100 (1%) annual probability flood, including an allowance for climate change, on the Luth Burn and Bourne Brook adjacent to the two proposed temporary site compounds. The Lichfield Road temporary compound adjacent to Bourne Brook is wholly outside of this flood zone. The flood extent impinges very slightly on the southern corner of the Pipe Lane temporary compound, near Luth Burn. The climate change allowance used to generate these extents is based on current upper end estimates of increases in peak flow in the period 2070-2115. The risk to both compound areas is therefore low and the chances of these compounds making flood risk worse for others, by impeding flood flows or reducing floodplain storage volumes, is negligible. This takes account of the flood risk associated with access provision to the compounds and the stockpiling of material, which will be managed in line with the measures included in the draft Code of Construction Practice (CoCP)<sup>11</sup>.

4.1.2 It should be noted that these works will be completed ahead of the works associated with the creation of a new access track on Common Lane, the impacts of which are discussed in the next section.

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<sup>11</sup> HS2 Ltd (2017), *High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Draft Code of Construction Practice, Volume 5: Appendix CT-003-000*, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/627182/E26\\_CT-003-000\\_WEB.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627182/E26_CT-003-000_WEB.pdf)

Figure 1: Flood risk to construction compounds on Luth Burn and Bourne Brook

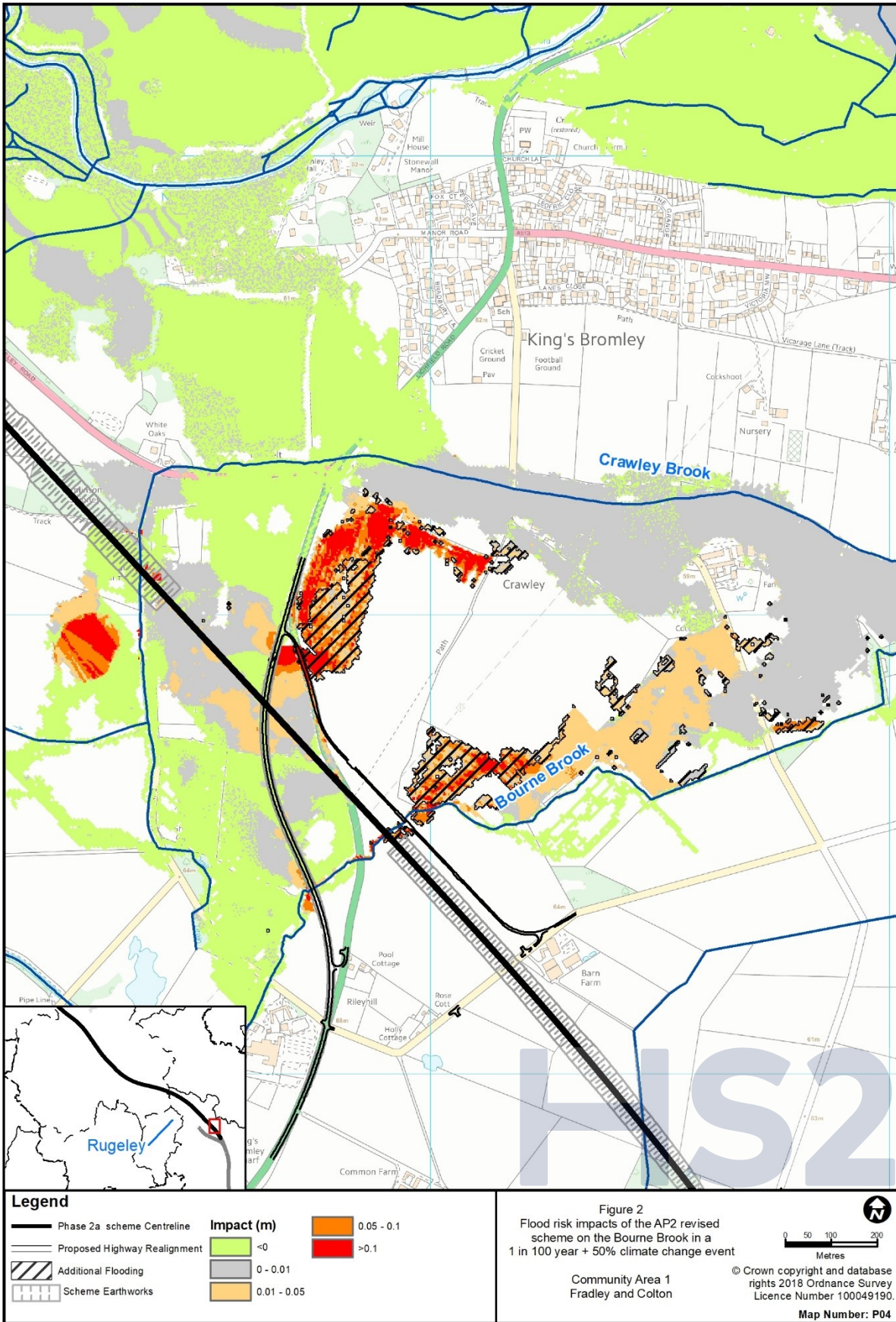


## **4.2 Additional land and a change to Bill powers required to divert Common Lane to the A515 Lichfield Road (AP2-001-006)**

- 4.2.1 Figure 2 shows the impact of the configuration of the AP2 revised scheme on the peak flood levels associated with a 1 % (1 in 100) annual probability flood, with an allowance of 50% increase in peak flows for climate change. The figure identifies areas that were unaffected by the original scheme.
- 4.2.2 The modelling indicates that the AP2 amendment would result in a larger area of flooding, and changes in peak flood levels, downstream of the Common Lane diversion, east of the A515 Lichfield Road. This is likely to be caused by the need to raise the level of the proposed Common Lane diversion, at its northern end, in order to tie-in to the existing A515 Lichfield Road.
- 4.2.3 The modelling also indicates that the peak flood levels, and the area potentially inundated, would increase downstream of the new culvert on Common Lane as a result of the amendment. This is due to the local widening of the Bourne Brook channel required to accommodate the new culvert. The increases in flood level downstream occur where the channel returns to its original cross section and the flow contracts.
- 4.2.4 The changes in peak flood level and in the pattern of flooding is restricted to areas of undeveloped agricultural land and the A515 Lichfield Road. A permanent moderate adverse significant effect related to flood risk on the A515 Lichfield Road was reported in the main ES. However, the changes will cause a major impact (> 100mm) to a wider area of agricultural land, which is a moderate value receptor. This results in a different moderate adverse effect, which is significant.



Figure 2: Changes in peak flood level resulting from AP2 revised scheme including Common Lane diversion



## 5 Flood risk management measures

### 5.1 Introduction

5.1.1 The overall approach to flood risk mitigation on the original scheme is set out in the main ES Volume 5, Appendix WR-003-001. The need for additional measures arising from the AP2 revised scheme is considered for each of the two amendments below.

### 5.2 **Additional land required for the amendment to a National Grid Electricity Transmission 400kv overhead power line and a new utility compound, near Kings Bromley viaduct (AP2-001-007) and Additional land required for the diversion of a National Grid Gas Transmission gas pipeline and a new utility compound, north of Pipe Ridware (AP2-001-010)**

5.2.1 Modelling work undertaken to inform the original scheme indicates that neither of the two temporary construction compounds required to undertake utility diversions, near Bourne Brook and required to undertake a utility diversion, near Luth Burn are at unacceptable risk of flooding. The measures within the draft CoCP requires the designers and contractors to prepare construction works proposals that are safe and ensure that flood risk (including that to third parties and the proposed works) is managed appropriately. These measures are adequate to mitigate any potential for these compounds to result in new significant effects related to flood risk.

### 5.3 **Additional land and a change to Bill powers required to divert Common Lane to the A515 Lichfield Road (AP2-001-006)**

5.3.1 The changes in flood risk resulting from the AP2 revised scheme are such that additional measures are required to manage the issues associate with changes to peak flood level along the Bourne Brook and within the floodplain.

5.3.2 The next stage of the design process will involve the incorporation of additional topographical survey information into the hydraulic model of Bourne Brook to improve how the watercourse and floodplain is represented. The design of the watercourse crossing will be developed, incorporating further localised channel geometry amendments if necessary, to provide additional hydraulic capacity.

5.3.3 If the updated model continues to indicate a potential for increases in flood risk, localised refinement to the design may be required. This might include creation of a two-stage enlarged channel, incorporating a berm along Bourne Book. The aim of these refinements will be to distribute floodwater in a manner that better replicates existing patterns of flooding.

5.3.4 The design will be developed in consultation with the Environment Agency and Staffordshire County Council, acting as the Lead Local Flood Authority. If any residual effects are identified, which will not be significant, the affected landowners will also be consulted. The aim will be to ensure that no parties are affected by unacceptable increases in flood risk.

5.3.5 The Water Framework Directive (WFD) related impacts and effects of this culvert are reported in the SES2 and AP2 ES Volume 2, Community area 1 report, Fradley to

Colton. The implications for WFD legislation compliance are reported in the SES2 and AP2 ES Volume 5, Appendix WR-001-000, which forms an addendum to the WFD compliance assessment report submitted in the main ES (see main ES Volume 5, Appendix: WR-001-000).

## 6 Conclusions

- 6.1.1 Additional hydraulic analysis has determined that the proposed utility diversion compounds adjacent to Bourne Brook and Luth Burn are not located in the modelled extent for the 1 in 100 (1%) annual probability flood, including an allowance for climate change. The measures outlined in the draft CoCP are adequate to mitigate any potential for these compounds to result in adverse effects related to flood risk.
- 6.1.2 The results of a hydraulic modelling exercise of the new Bourne Brook culvert crossing, indicates that this proposal does have the potential to result in a new significant effect related to flood risk. The next stage of the design process will involve refined hydraulic modelling, based on additional detailed topographical survey data, and refinement of the design of this watercourse crossing. If the updated model continues to indicate a potential for increases in flood risk, localised refinement to the design may be required. The aim of these refinements will be to distribute floodwater in a manner that better replicates existing patterns of flooding.
- 6.1.3 Detailed design will be undertaken in consultation with the Environment Agency and Staffordshire County Council acting as the Lead Local Flood Authority. The design will take into consideration the mitigation identified to avoid significant adverse effects related to supporting WFD objectives for the Bourne-Bilson Brook Catchment. If any residual effects are identified, the affected landowners will also be consulted.
- 6.1.4 It is currently anticipated that it will be possible to mitigate the impacts identified such that the AP2 revised scheme will not result in significant adverse effects related to flood risk.



## 7 References

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