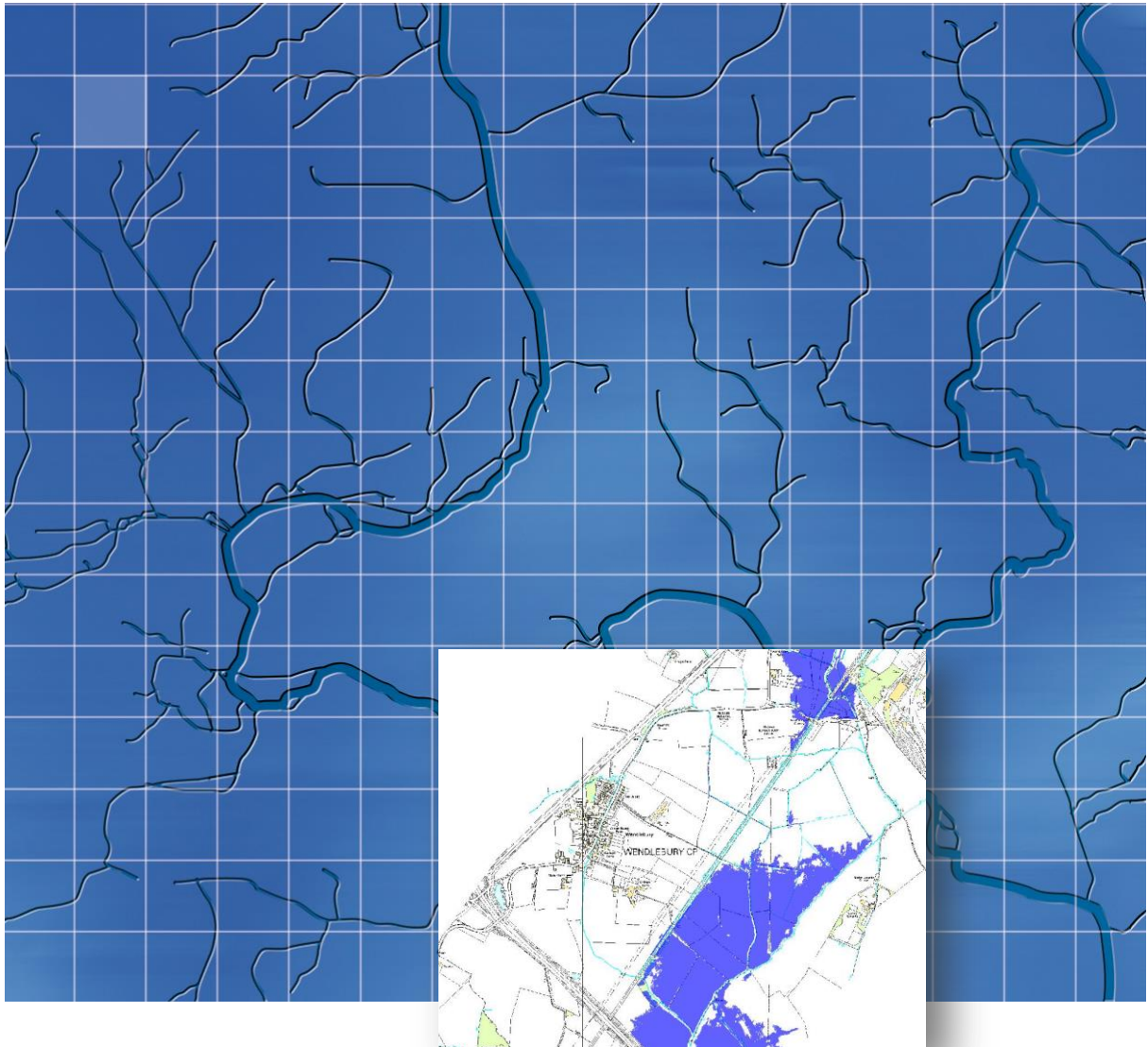


Network Rail and Chiltern Railways

July 2014

EWR-P1-Level 3 FRA: M40 to MOD Embankment Works



Wallingford HydroSolutions Limited

Network Rail and Chiltern Railways

EWR P1 - Level 3 FRA: M40 to MOD Embankment Works

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For and on behalf of Wallingford HydroSolutions Ltd.

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1 Introduction

1.1 Background

Environmental Resources Management (ERM) and Wallingford HydroSolutions Ltd. (WHS) completed a Level 2 Flood Risk Assessment (FRA) in 2009 (including a revision in July 2010), together with a Technical Paper¹ outlining potential flood storage mitigation requirements for the proposed Chiltern Railways Bicester to Oxford improvement scheme in support of an application for an Order under the Transport and Works Act 1992 (TWA) by Chiltern Railways (CRCL). The TWA Order was granted by the Secretary of State for Transport in October 2012. This gives statutory powers to authorise the East West Rail Phase 1 (EW R P1) project, comprising the redevelopment and operation of the railway between Oxford and Bicester. The project seeks to introduce a new, fast service between London and Oxford.

The Level 2 FRA was conducted in accordance with Planning Policy Statement 25: Development and Flood Risk (PPS25), and its Practice Guide companion. The Level 2 FRA document highlighted a number of locations along the railway corridor where proposed developments lie within Flood Zones 2 or 3 and could potentially have impacts upon the incidence of local flooding. The report identified a number of assessment points (AP's) along the route of the EW R P1 that require further consideration in a Level 3 FRA. However, the proposed works to the embankments along the route was not included within this original Level 2 FRA study as the extent of embankment widening and cutting works was not clearly identified at the time. Subsequently, Atkins have provided details on the locations of where embankment widening work is proposed and where this coincides with active flood zone areas an additional Level 3 FRA is required. The proposed works to the embankments between the M40 and the Ministry of Defence (MOD) compound were not included within the original Level 2 FRA but this Level 3 FRA is required to assess and provide mitigation for the flood risk impacts of this work.

1.2 Scope of Level 3 FRA

This document constitutes a Level 3 FRA for the proposed embankment widening works between the M40, northwards to the MOD compound, which lies to the south of Bicester town, as required by Planning Conditions 12 of deemed planning permission granted alongside the Order under the Transport and Works Act 1992.

This document also provides the information required by the National Planning Policy Framework (NPPF) and the associated requirements of PPS25.

As part of the improvement works, the existing railway embankment is to be strengthened to allow for a dual mainline track between Oxford and Bicester. This FRA document has been commissioned to address the flood risk issues that result from the proposed embankment widening work within active flood zone areas. The location of these works considered within this FRA is between the M40 and the MOD compound and is shown in Figure 1. The purpose of this FRA is to quantify any adverse impacts on flood risk and provide sustainable and effective mitigation where required.

The scope and method of analysis for this FRA have been agreed in discussions with the Environment Agency (EA).

¹ WHS. 2010. Chiltern Railways Bicester to Oxford Improvements Level 2 Flood Risk Assessment

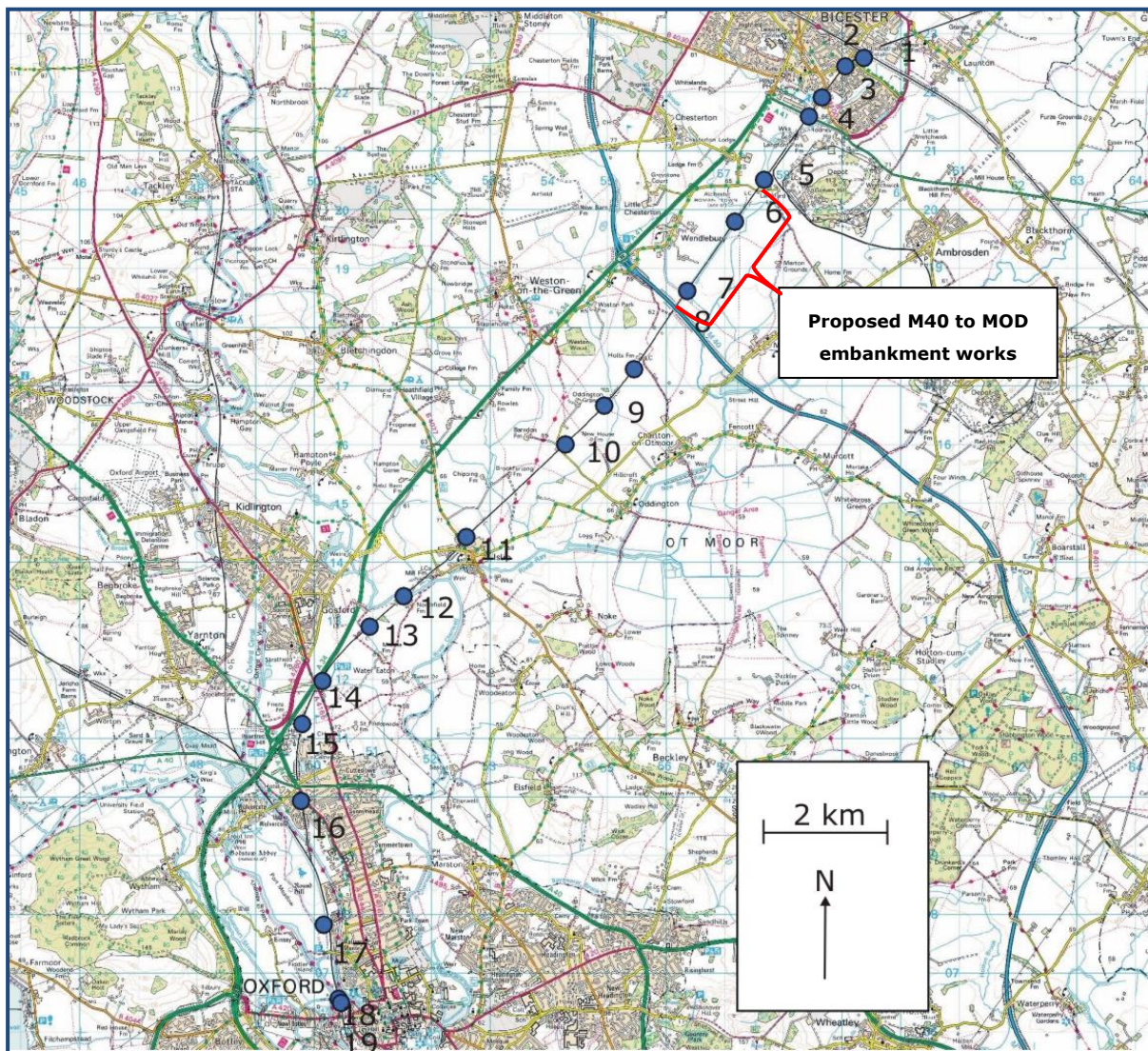


Figure 1 – Scheme Overview Showing Assessment Points.

2 Site Description

2.1 Overview

The proposed development area is located between the M40 to the south west and the MOD compound to the north east. A summary of the location is provided by Figure 2.

This site specific Level 3 FRA considers the proposed embankment works within the active floodplain between the M40 and the MOD compound. This report will quantify flood impacts and ensure suitable mitigation is provided to ensure flood risk is effectively managed.

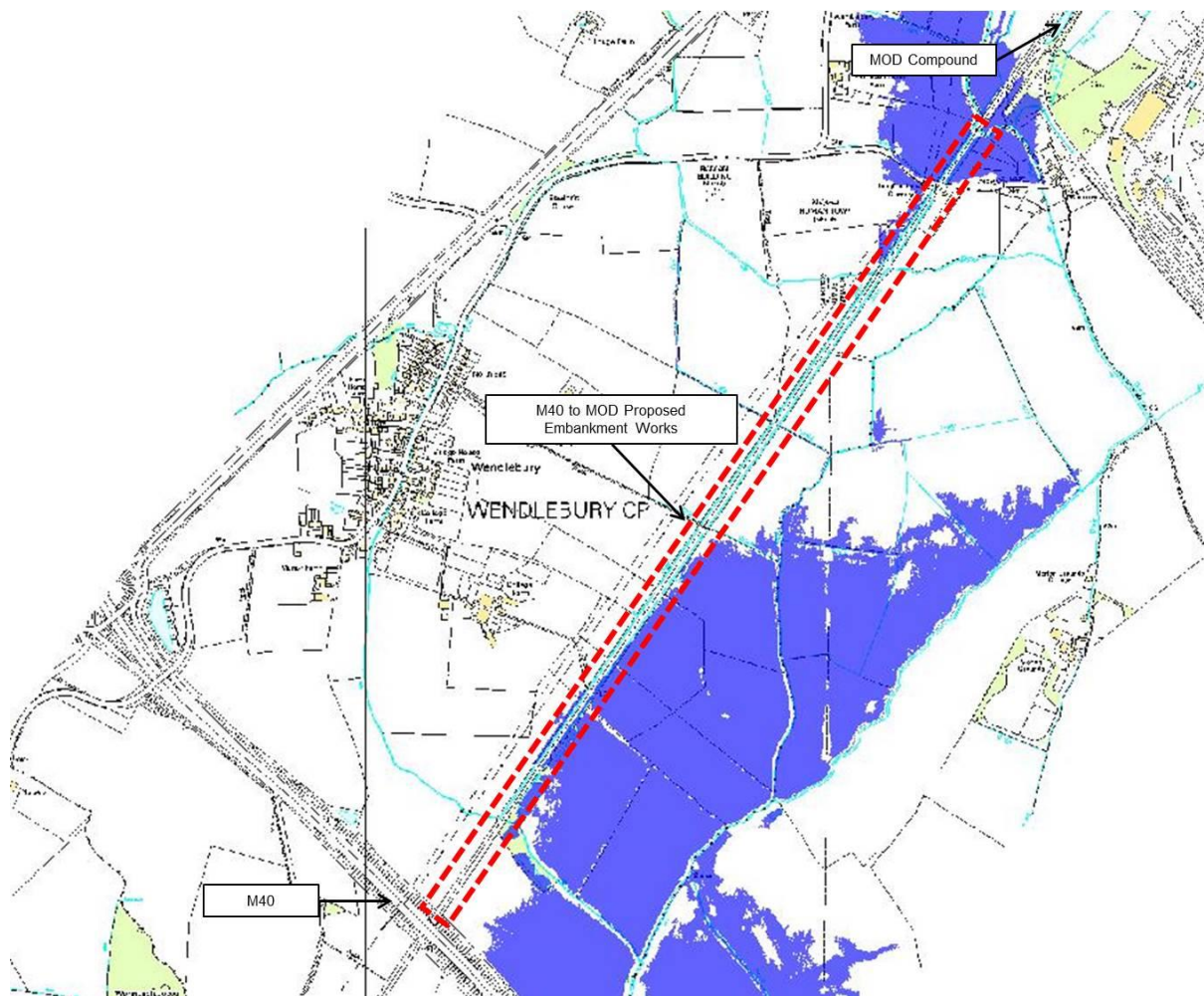


Figure 2 – M40 to MOD Development Area.

2.2 Description of the Proposed Works

In order to allow the dual tracking of the line between Oxford and Bicester embankment strengthening works are required. This will be achieved through a number of construction methods. For the section between the M40 and MOD compound Atkins had originally proposed to implement a conventional regrade solution that involved adding engineered fill material to the outer margins of the embankment to form a wider section at cess level. Based on this original proposal WHS undertook a preliminary storage volume analysis. Due to the existing drainage ditches that run adjacent to the toe of the embankment this solution resulted in very large losses of floodplain storage. However, there was not sufficient land available at the appropriate level to provide compensatory storage.

As a result of this, alternative embankment strengthening solutions were considered. The chosen solution involves the installation of sheet piles along an alignment that ensures that there is no increase in footprint within the floodplain. This avoids the need for any flood mitigation measures including the need to provide compensatory floodplain storage. A typical section is shown in Figure 3.

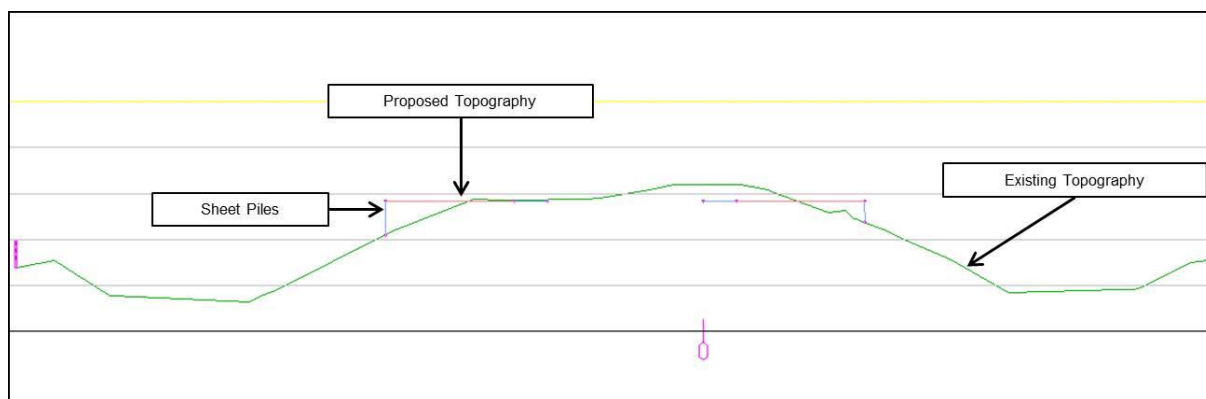


Figure 3 – Typical Cross Section Representing the Sheet Piling Earthwork Stabilisation Solution.

3 Flood Risk Impacts

3.1 Data Sources Used and Proposed Methodology

This section outlines the methodology used in undertaking the flood impact assessment for the proposed work between the M40 and the MOD compound. This involves an assessment of the floodplain storage volume lost as a result of embankment widening and includes recommendations for mitigation measures to provide compensatory floodplain storage (if required). The methodology, parameters and working assumptions, together with the results and recommendations for mitigation are all described in the following sections. An outline of the procedure used to calculate floodplain storage loss is presented below:

- Calculation of the predicted flood level adjacent to the proposed embankment widening using the best available data which is taken from the WHS Langford Lane Hydraulic Model²
- Calculation of the subsequent flood storage volumes lost as a result of the embankment widening works. This uses detailed earthworks design sections provided by Atkins³ to assess volumes of floodplain lost.
- Assessment of the potential for level for level storage within the current Limits of Deviation boundary (LOD).

The approach used in this assessment has been discussed and agreed with the EA.

A number of data sources have been used in the current assessment, which include:

- Detailed earthworks cross sections³ of the proposed works within the 1 in 100 year (plus an allowance for climate change) predicted flood zone at 20m intervals.
- LiDAR data have been obtained through Geomatics Group. This has a 2m resolution, with a vertical accuracy of +/- 0.15 m;
- The Scheme Boundary, this boundary incorporates land within the Limits of Deviation (LOD) and those areas of the Limits of Land to be Acquired and Used (LLAU) where Chiltern Railways has the legal powers to install flood mitigation, without further land acquisition.
- Hydraulic modelling outputs from the WHS Langford Lane Hydraulic Model² are used to delineate the inundation area and obtain design flood levels for the 1 in 100 year (plus an allowance for climate change) event.

3.2 Predicted Flood Level

The EA Flood Maps in the area are based on JFLOW data. JFLOW is acknowledged as providing a relatively coarse indication of flood extent and is generally not to be used for design purposes. As such there is scope for refinement of the flood level data available for the area in the vicinity of the proposed embankment works.

² WHS. 2014. EWR P1 Level 3 FRA: Langford Lane. Submitted to the EA 24th January 2014 and approved as part of Cherwell District Council Planning Ref: 14/00087/DISC

³ Atkins. 2014. Provided detailed earthworks sections between the M40 and MOD compound in AutoCAD format.

As part of a previous study, WHS undertook new 1D-2D hydraulic modelling to inform an FRA for the Langford Lane development area. This report and modelling has been accepted by the Environment Agency as part of the Langford Lane FRA submission. Further detailing of the modelling undertaken is provided within the Langford Lane FRA report² (submitted and approved as part of Cherwell District Council Planning Ref: 14/00087/DISC). The updated Langford Lane model covers an area that includes much of the Lower Langford Brook starting from immediately south of Bicester town at the upstream extent down to the confluence with the river ray situated downstream of the M40 motorway. Therefore this hydraulic model covers the entire area of interest in regards to the proposed embankment works between M40 to the MOD compound and provides the most accurate flood modelling data available to inform this FRA.

The Langford Lane model flood level grid has been used to obtain the predicted flood levels adjacent to the railway embankment between the M40 and the MOD compound. This grid has been examined within a GIS software package resulting in a predicted flood level of 60.55mAOD on the downstream side of the embankment adjacent to Wendlebury, 63.55mAOD on the downstream side of the embankment adjacent to the OXD40 Underbridge and 63.80mAOD on the upstream side of the railway embankment adjacent to the OXD40 Underbridge, as shown in Figure 4. This FRA has only considered the embankments situated to the south west of the OXD40 Underbridge located on the Langford Brook down to the M40 motorway. A separate FRA⁴ was submitted in June 2014 to Cherwell District Council to address the flood zone to the north east of the Langford Brook.

⁴ WHS. 2014. EW R. P1 Level 3 FRA: MOD Sidings (West). Submitted 10th June 2014. The EA have reviewed this FRA and have recommended its discharge to Cherwell DC. No decision was available as of the 9th July 2014.

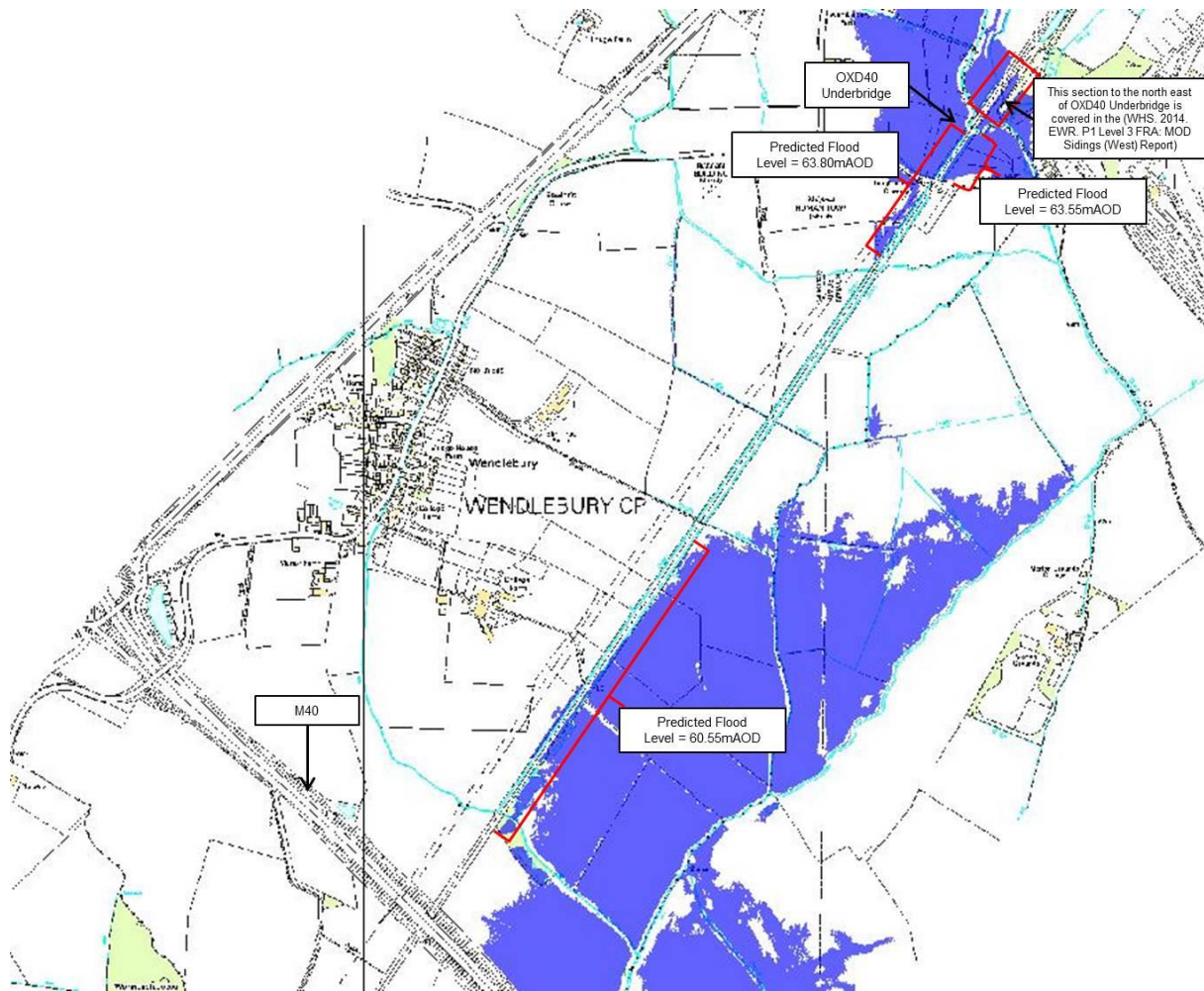


Figure 4 – 1 in 100 year (plus an allowance for climate change) Predicted Flood Level Adjacent to the Railway Embankment between the M40 and MOD Compound.

3.3 Floodplain Storage Loss Analysis

The updated WHS modelling² has confirmed that much of the railway embankment between M40 to the MOD compound is sited outwith of the active 1 in 100 year (plus an allowance for climate change) flood zone. However, there are some locations where the 1 in 100 year (plus allowance for climate change) predicted flood zone reaches the toe of the existing embankment and could potentially lead to a reduction in floodplain storage volume. Therefore, to quantify any loss of floodplain storage an assessment of floodplain volume lost as a result of embankment stabilisation has been undertaken. This has been undertaken within AutoCAD by plotting the predicted flood level against the detailed earthwork sections³ along the railway embankment.

This assessment confirmed that there is no loss of floodplain storage as the sheet piling has been designed so that the toe line of the new piles is sited above the predicted flood level. Please see Figure 5 for details of typical earthworks sections through the railway embankment showing the predicted flood level plotted against the sheet pile location. From this analysis it is clear that the sheet piling solution is to be constructed outwith of the flood zone for the entire section between the M40 to MOD compound and no compensatory floodplain storage is required.

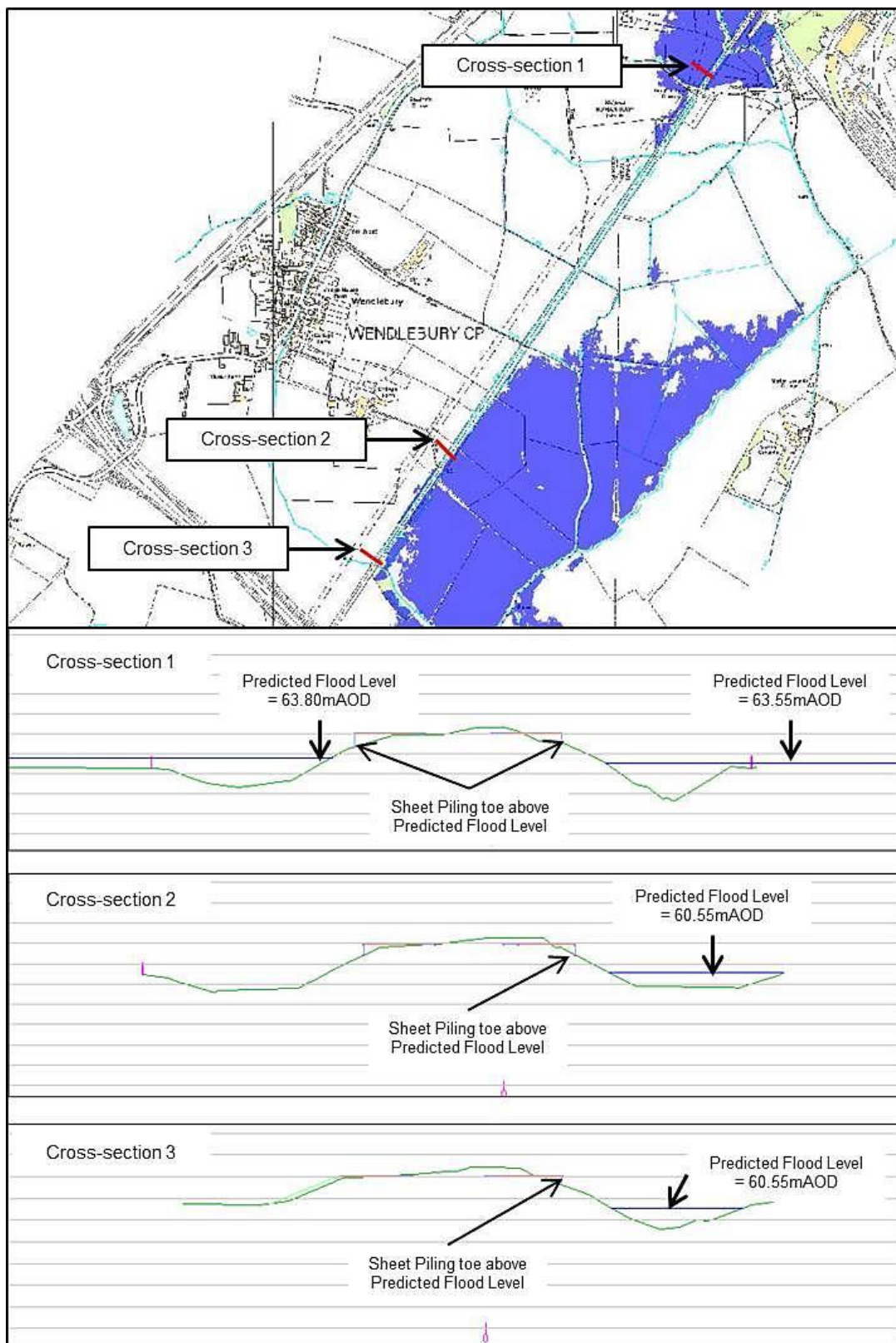


Figure 5 – Cross Sections through the Railway Embankment within Active Flood Zone Areas Showing the Predicted Flood Level in Relation to the Proposed Embankment Stabilisation Works.

4 Conclusions

This FRA has confirmed that the proposed embankment strengthening works between the M40 and the MOD compound is to be constructed outwith of active flood zones and above the predicted flood level meaning that no compensatory floodplain storage will be required.

4.1 Future Considerations

A 'Works Approval' is to be submitted separately in due course for the proposed works in this area, under the provisions of Schedule 15 of the TWA Order. Works Approvals will also be required for any temporary works within flood zones 2 and 3.

There are some points that need to be considered by the contractor in relation to the temporary works required during the construction phase of the M40 to MOD embankment stabilisation works. These include:

- All compounds, stockpiles and other works will need to be kept outside Flood Zones 2 & 3 and be sited within Flood Zone 1.

- All temporary haul roads within Flood Zones 2 and 3 will need to be kept at grade to avoid any requirement for compensatory flood storage.

- All roads should be constructed with a permeable hard-core or stone surface to avoid increasing the impermeable footprint of the site.

Chiltern Railways and Network Rail will submit applications for the permanent Works Approvals and the Contractor will submit applications for temporary works approvals, where necessary.