M4 junctions 3 to 12 smart motorway

TR010019

5.3 Flood risk assessment

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Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
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1 INTRODUCTION

1.1 Overview

1.1.1 The Highways Agency (the "Agency") is making an application ("Application") for development consent to improve the M4 motorway ("M4") to a smart motorway between junction 12 (Theale) which is near Reading and junction 3 (Hayes), in west London, (the "Scheme") as shown on figure 1.1 below.

1.1.2 This Flood Risk Assessment ("FRA"), forms part of the Application for the Scheme.

![Figure 1: Scheme location plan](image_url)

1.2 Study areas for this FRA

1.2.1 The study area has been defined having regard to the area most likely to be directly affected by the Scheme. This encompasses the area within the proposed Order limits where the Scheme is at risk of flooding, or where the Scheme could be expected to have an effect on drainage and water resources during construction and after opening.

1.2.2 All proposed localised carriageway widenings within existing highway verges and Emergency Refuge Areas ("ERAs") (which increase the impermeable area) that are potentially at risk from all sources of flooding: rivers, tidal, surface water runoff during heavy rainfall, artificial sources, groundwater and sewers between junctions 12 and 3 have been assessed. A desk based exercise has been carried out to identify the study area using the data sources listed in the References section of this FRA.
1.3 Scheme Background and Objectives

1.3.1 The Strategic Road Network (“SRN”) in England, comprising motorways and all-purpose trunk roads, is constructed and managed by the Agency, which is an executive agency of the Department for Transport (“DfT”). The Agency is responsible for operating, maintaining and improving the SRN in England on behalf of the Secretary of State.

1.3.2 The M4 is the main strategic route between London and the west of England, and on to South Wales. Major towns and cities along the M4 include London, Reading, Swindon, Bristol, Newport, Cardiff and Swansea.

1.3.3 The M4 between junctions 12 and 3 carries over 130,000 vehicles per day on average, with more in some locations. At peak times, traffic flows on many links are close to or exceed the total flow that the link is designed to handle. Traffic on the M4 therefore suffers from heavy congestion, which leads to unpredictable journey times. Chapter 2 Scheme Context of the Environmental Statement (“ES”) provides a link-by-link breakdown of existing traffic flows and capacities. Although traffic volumes reduced in 2008 at the start of the global financial crisis, long-term traffic trends still show significant growth. Traffic flows are forecast to increase to an average of 160,000 vehicles per day over the next 20 years, which will result in more severe congestion without road improvements.

1.3.4 The Scheme will help to relieve congestion by permanently converting the hard shoulder of the M4 to a running lane and using technology to vary speed limits and manage traffic. Signs and signals will be used to inform drivers of conditions on the highway network, when and where variable speed limits are in place, and when lanes are closed.

1.3.5 The Scheme is some 51km (32 miles) in length, between junctions 12 and 3, and will have a number of principal elements:

a) conversion of the hard shoulder to a permanent running lane and, where no hard shoulder is in place at present, the construction of a new lane. This will mainly take place between junction 4b and junction 8/9;

b) replacement of overbridge structures where portals are too narrow to accommodate the improved motorway;

c) extension of underbridges and other structures such as culverts and subways to accommodate the improved motorway;

d) changes to junctions and slip roads needed to accommodate traffic joining and leaving the improved motorway, and to allow use of the hard shoulder as a running lane, as well as allowing “through junction running” (“TJR”);

e) Provision of new gantries and signs to allow the motorway to function as a smart motorway with a variable speed limit, and to provide messages to road users; and
f) other infrastructure needed for the improved motorway, such as ERAs, enhanced communication systems, closed circuit television ("CCTV") and electrical supplies, as well as works to accommodate statutory undertakers' apparatus and other parties who may be affected by the Scheme.

1.3.6 Development scheme details can be found on the following drawings:

a) general arrangement drawings (see Annex F1 of the Engineering Design Report, in Doc Ref TR010019-7.4); and

b) proposed drainage layout drawings as indicated in the Scheme's Drainage Strategy Report (Doc Ref TR010019-7.5).

1.4 National policies, guidance and drawings used for the Scheme drainage and FRA

1.4.1 This FRA is based on the technical guidance to the National Planning Policy Framework ("NPPF")¹ as this is the industry standard guidance for the FRA and the Agency guidance for assessing flood risk HD45/09². A FRA is required to investigate that flood risks to, or caused by, a proposed development can be successfully managed. A study comprising data collection, assessment of the flood risks, and flood mitigation measures was therefore undertaken. This FRA has been formatted as suggested in the Planning Practice Guidance entitled: Flood Risk and Coastal Change: Site-Specific Flood Risk Assessment Checklist.

1.4.2 The National Policy Statement for National Networks ("NN NPS") has also been used to inform the FRA. An objective of the NN NPS is for schemes to contribute towards reducing the risk of flooding in their hinterland. Guidance states that considerations during design should be areas of hard standing, design standards for drainage systems, interactions of national networks with flood plains and watercourses and maintenance standards. This FRA was also prepared for the Scheme as recommended in the Section 5.92 of the NN NPS:

5.92: Applications for projects in the following locations should be accompanied by a flood risk assessment (FRA):

- **Flood Zones 2 and 3, medium and high probability of river and sea flooding;**

- **Flood Zone 1 (low probability of river and sea flooding) for projects of 1 hectare or greater, projects which may be subject to other sources of flooding (local watercourses, surface water, groundwater or reservoirs), or where the Environment Agency has notified the local planning authority that there are critical drainage problems;**

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¹ Department for Communities and Local Government, National Planning Policy Framework, Dated March 2012
² DMRB - Volume 11, Section 3, Part 10, HD45/09, Road Drainage and Water Environment, dated November 2009
1.4.3 The Water Framework Directive (“WFD”) was given effect in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 SI 2003/2901. This FRA and the Drainage Strategy Report (Doc Ref TR010019-7.5) have been compiled to promote the fundamental principle of the WFD which is to protect water resources and to promote sustainable water use. A WFD Assessment Report (Doc Ref TR010019-7.6) has been completed, which demonstrates that the Scheme is compliant with the objectives of the WFD, provided appropriate mitigation measures are implemented prior to and during construction.

1.4.4 The Scheme will be designed in accordance with the IAN 161/13 “Managed Motorways, All Lane Running”. IAN 161/13 sets out the design parameters and the associated infrastructure and technology requirements for the Scheme.

1.4.5 The FRA is based on design information including the General Arrangement drawings (see Annex F1 of the Engineering Design Report, in Doc Ref TR010019-7.4).

1.5 Scheme wide flood risk summary

1.5.1 The potential sources of flooding for the Scheme are heavy rain, rivers, surface water, groundwater, sewers and artificial/man-made sources (e.g. reservoirs and canals). Tidal flooding has been scoped out of the assessment due to the Scheme being upstream of the tidal limit of the River Thames, and at no risk of flooding from this source.

**Fluvial flood risk**

1.5.2 The Scheme crosses a number of floodplains classified as Flood Zone 2 and Flood Zone 3, which are summarised in Table 1.

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Flood Zone</th>
<th>Component Affected</th>
<th>Source of Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kennet &amp; Holy River</td>
<td>3a, 3b</td>
<td>Junction 12 - 11</td>
<td>West Berkshire Strategic Flood Risk Assessment (“SFRA”), 2008</td>
</tr>
<tr>
<td>Kennet &amp; Avon Canal</td>
<td>3a, 3b</td>
<td>Junction 12 - 11</td>
<td>West Berkshire SFRA, 2008</td>
</tr>
<tr>
<td>Kennet and Foundry Brook</td>
<td>2, 3a, 3b</td>
<td>Junction 12 - 11</td>
<td>West Berkshire SFRA, 2008</td>
</tr>
<tr>
<td>Clayhill Brook / Foundry Brook</td>
<td>2, 3a</td>
<td>Junction 12 - 11</td>
<td>Wokingham Borough Council SFRA, 2007</td>
</tr>
<tr>
<td>Barkham Brook</td>
<td>2, 3</td>
<td>Junctions 11 - 10</td>
<td>Wokingham Borough Council SFRA, 2007</td>
</tr>
</tbody>
</table>
Table 1  List of Fluvial Flood Zones crossing Scheme between junctions 12 and 3

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Flood Zone</th>
<th>Component Affected</th>
<th>Source of Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Loddon</td>
<td>2, 3a, 3b</td>
<td>Junctions 11 - 10</td>
<td>Wokingham Borough Council SFRA, 2007</td>
</tr>
<tr>
<td>Emm Brook</td>
<td>2, 3a, 3b</td>
<td>Junctions 11 - 10</td>
<td>Wokingham Borough Council SFRA, 2007</td>
</tr>
<tr>
<td>The Cut</td>
<td>2, 3</td>
<td>Junctions 10 - 8/9</td>
<td>Royal Borough of Windsor &amp; Maidenhead SFRA, 2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Construction Compound 5</td>
<td></td>
</tr>
<tr>
<td>River Thames</td>
<td>2, 3</td>
<td>Junctions 8/9 - 7</td>
<td>Royal Borough of Windsor &amp; Maidenhead SFRA, 2009</td>
</tr>
<tr>
<td>Jubilee River</td>
<td>2</td>
<td>Junctions 8/9 - 7</td>
<td>South Bucks District Council SFRA, 2008</td>
</tr>
<tr>
<td>Roundmoor Ditch</td>
<td>2</td>
<td>Junctions 8/9 - 7</td>
<td>South Bucks District Council SFRA, 2008</td>
</tr>
<tr>
<td>Chalvey Ditch</td>
<td>2, 3</td>
<td>Junctions 7- 6</td>
<td>Slough Local Development Framework SFRA, 2007</td>
</tr>
<tr>
<td>Salthill Stream</td>
<td>2, 3</td>
<td>Junctions 6 - 5</td>
<td>Slough Local Development Framework SFRA, 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Construction Compound 6</td>
<td></td>
</tr>
<tr>
<td>Datchet Common Brook</td>
<td>2, 3</td>
<td>Junctions 6 - 5</td>
<td>Slough Local Development Framework SFRA, 2007</td>
</tr>
<tr>
<td>Horton Brook (River Colne)</td>
<td>2, 3</td>
<td>Junctions 5 - 4b</td>
<td>Slough Local Development Framework SFRA, 2007</td>
</tr>
<tr>
<td>Colne Brook</td>
<td>2, 3</td>
<td>Junctions 4b - 4</td>
<td>Slough Local Development Framework SFRA, 2007</td>
</tr>
<tr>
<td>River Colne and Grand Union Canal</td>
<td>2, 3a, 3b</td>
<td>Junctions 4b - 4</td>
<td>London Borough of Hillingdon SFRA, 2008</td>
</tr>
<tr>
<td>River Crane</td>
<td>2, 3a</td>
<td>Junctions 4 - 3</td>
<td>London Borough of Hillingdon SFRA, 2008</td>
</tr>
</tbody>
</table>

1.5.3  Works are required within the floodplain (Flood Zone 2 and 3) at the following overbridge sites:

a)  junction 8/9 - Ascot Road (The Bourne), Monkey Island Lane (River Thames) and Marsh Lane (Jubilee River/Thames);

b)  junction 7- 6 - Wood Lane (Jubilee River);

c)  junction 6- 5 - Riding Court Lane (River Thames); and
d) junction 5- 4b - Old Slade Road (Colne Brook).

1.5.4 Works are required adjacent to and within the channel of watercourses at the flowing sites:

a) junction 8/9 - Thames at Bray (River Thames) - bridge supports;
b) junction 7-6 - Chalvey Culvert (Chalvey Ditch) - culvert extension; and
c) junction 6-5 - Ashleys Arch Culvert (Datchet Common Brook) - culvert extension.

**Flood risk from artificial sources**

1.5.5 In addition to flooding from rivers, the following small sections of the Scheme are identified on the EA online mapping facility (“What’s in your backyard?”)\(^3\) as being at risk from reservoir flooding:

a) a section between junction 11 and junction 10 associated with Bearwood Lake;
b) a section immediately west of junction 10 associated with Queensmere Reservoir; and
c) the majority of areas between junction 6 and junction 4b associated with a number of reservoirs located to the south of the M4 and three areas between junction 4b and junction 4 associated with the Ruislip Lido Reservoir.

**Surface water and sewer flood risk**

1.5.6 The data within the Highways Agency Drainage Data Management System ("HADDMS") have been used to assess the flood risk from surface water and the surface water drainage system (sewers). According to the flood events register, all historic flood events occurring between junctions 12 to 3 listed below occurred due to blocked drains and ponding of surface water on the carriageway. Details of specific flood events that occurred at or near widening works are contained in the HADDMS flood events register in Annex B and discussed in Section 2. The following locations have recorded flood events:

a) junctions 12 and 11 – 21 recorded flood events;
b) junctions 11 and 10 - 21 recorded flood events;
c) junctions 10 and 8/9 - 27 recorded flood events;
d) junctions 8/9 and 7 – 45 recorded flood events;

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\(^3\) Environment Agency, What’s in your backyard Interactive Mapping Service. [http://maps.environmentagency.gov.uk/wiby/wibyController?x=357683.0&y=355134.0&scale=1\&layerGroups=default&ep=map&textonly=off&lang=_e&topic=wfd_estuaries](http://maps.environmentagency.gov.uk/wiby/wibyController?x=357683.0&y=355134.0&scale=1\&layerGroups=default&ep=map&textonly=off&lang=_e&topic=wfd_estuaries)
e) junctions 6 and 5 - 37 recorded flood events;
f) junctions 5 and 4b - 0 recorded flood events;
g) junctions 4b and 5 - 0 recorded flood events; and
h) junctions 4 and 3 – 1 recorded flood event.

**Groundwater flood risk**

1.5.7 According to the SFRAs which cover the study area, there are no known incidences of groundwater flooding. Figure 1 of the West Berkshire SFRA, covers between junctions 12 and 11. The Wokingham Borough Council SFRA, covers between junctions 11 and 10. Figure B of the Royal Borough of Windsor and Maidenhead SFRA covers between junction 10 and 7. The Slough Borough Council SFRA covers between junctions 7 and 3.

1.5.8 There have been no known incidents of flooding due to high groundwater levels within the study area. Therefore, the risk of flooding from groundwater is considered to be low.

**1.6 Widening works flood risk summary**

1.6.1 Following the desk based exercise; the junctions which were found to be at risk of potential flooding due to widening works are specified in Table 2.

<table>
<thead>
<tr>
<th>Identified junctions</th>
<th>Proposed works that are at risk of potential flooding</th>
<th>Carriageways (Westbound/Eastbound)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4 Junction 10 – 8/9</td>
<td>Addition of two ERAs and three localised carriageway widenings</td>
<td>Westbound and eastbound</td>
</tr>
<tr>
<td>M4 Junction 8/9 – 7</td>
<td>Addition of two ERAs and a localised carriageway widening</td>
<td>Westbound only</td>
</tr>
<tr>
<td>M4 Junction 7</td>
<td>Two localised carriageway widenings</td>
<td>Westbound and eastbound</td>
</tr>
<tr>
<td>M4 Junction 7 - 6</td>
<td>Addition of three ERAs and seven localised carriageway widenings</td>
<td>Westbound and eastbound</td>
</tr>
<tr>
<td>M4 Junction 6 - 5</td>
<td>One carriageway localised widening</td>
<td>Westbound only</td>
</tr>
<tr>
<td>M4 Junction 5 – 4b</td>
<td>One carriageway localised widening</td>
<td>Westbound only</td>
</tr>
</tbody>
</table>

1.6.2 More detailed descriptions of localised carriageway widening works and ERAs at these junctions are provided in Section 3 below.

1.6.3 The Scheme drainage design to mitigate the potential surface water flood risk to the Scheme and third parties as a result of widening works is discussed in the Scheme’s Drainage Strategy Report (Doc Ref TR010019-7.5).
2 DESCRIPTION OF WIDENING WORKS AND SOURCE OF FLOODING AT WIDENING BETWEEN JUNCTIONS 12 AND 3

2.1 M4 junction 12 – 11

2.1.1 The M4 junctions 12 to 11 are located approximately between CH61500 – 61860.

2.1.2 Table 3 shows Scheme widening works that are potentially at risk of flooding, source of flooding and the increase in impermeable area between junction 12 and 11. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

2.1.3 The location plan for Scheme widening works between junction 12 and 11 can be found in Annex A.

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;) Westbound (&quot;WB&quot;)</th>
<th>Flooding Source</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Existing Area (ha)</td>
</tr>
<tr>
<td>Localised carriageway widening CH55165 -55300</td>
<td>EB (slip)</td>
<td>Surface water/ sewer flooding</td>
<td>0.220</td>
</tr>
<tr>
<td>ERA - E9-A1 CH60300-60400</td>
<td>WB</td>
<td>Fluvial</td>
<td>0.155</td>
</tr>
<tr>
<td>ERA - E9-B3 CH60400 -60300</td>
<td>EB</td>
<td>Fluvial</td>
<td>0.156</td>
</tr>
<tr>
<td>Localised carriageway widening CH61505 - 61865</td>
<td>WB</td>
<td>Fluvial and historic flooding</td>
<td>0.611</td>
</tr>
<tr>
<td>Localised carriageway widening CH61748 - 61865</td>
<td>EB</td>
<td>Fluvial and surface water/ sewer flooding</td>
<td>0.180</td>
</tr>
</tbody>
</table>

2.2 M4 junction 11 – 10

2.2.1 The M4 junction 11 and 10 are located approximately between chainage 54860 and 46130.
2.2.2 Table 4 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area between junction 11 and 10. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

2.2.3 The location plan for Scheme widening works between junctions 11 and 10 can be found in Annex A.

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Westbound (&quot;WB&quot;)</td>
<td></td>
<td>Existing Area (ha)</td>
</tr>
<tr>
<td>ERA – E8-A2 CH50500 – 50600</td>
<td>WB</td>
<td>Surface water/ sewer flooding</td>
<td>0.160</td>
</tr>
</tbody>
</table>

2.3 M4 junction 10 – 8/9

2.3.1 The M4 junction 10 and 8/9 are located approximately between chainage 46130 and 34110.

2.3.2 Table 5 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area between junctions 10 and 8/9. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

2.3.3 The location plan for Scheme widening works between junctions 10 and 8/9 can be found in Annex A.

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Westbound (&quot;WB&quot;)</td>
<td></td>
<td>Existing Area (ha)</td>
</tr>
<tr>
<td>ERA – E7-A2 CH38250-38350</td>
<td>WB</td>
<td>Fluvial</td>
<td>0.155</td>
</tr>
<tr>
<td>ERA – E7-B2 CH38720 - 38820</td>
<td>EB</td>
<td>Fluvial</td>
<td>0.156</td>
</tr>
</tbody>
</table>
2.4 M4 junction 8/9 – 7

2.4.1 The M4 junctions 8/9 and 7 are located approximately between chainage 34110 and 29010.

2.4.2 Table 6 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area between junctions 8/9 and 7. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

2.4.3 The location plan for Scheme widening works between junctions 8/9 and 7 can be found in Annex A. Reservoir Flood Maps can be found in Annex D.

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;) Westbound (&quot;WB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localised carriageway widening CH29390 – 29595</td>
<td>WB</td>
<td>Surface water/ sewer flooding</td>
<td>0.345 0.022 0.367</td>
</tr>
<tr>
<td>Localised carriageway widening CH29480 – 29600</td>
<td>EB</td>
<td>Surface water/ sewer flooding</td>
<td>0.161 0.018 0.179</td>
</tr>
<tr>
<td>ERA - E6-B1 CH30450 – 30550</td>
<td>EB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>0.149 0.030 0.179</td>
</tr>
<tr>
<td>Localised carriageway widening CH30530 – 30870</td>
<td>WB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>0.187 0.021 0.208</td>
</tr>
<tr>
<td>Localised carriageway widening CH30580 – 30715</td>
<td>EB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>0.175 0.025 0.200</td>
</tr>
<tr>
<td>Localised carriageway widening CH30820 – 31765</td>
<td>EB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>1.475 0.164 1.639</td>
</tr>
<tr>
<td>ERA - E6-A1 CH31425 – 31525</td>
<td>WB</td>
<td>Fluvial</td>
<td>0.155 0.028 0.183</td>
</tr>
</tbody>
</table>
### Table 6: M4 Junction 8/9 – 7

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carriageway Westbound (&quot;WB&quot;)</td>
<td></td>
<td>Existing Area (ha)</td>
</tr>
<tr>
<td>Localised carriageway widening CH31540 – 31635</td>
<td>WB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>0.177</td>
</tr>
<tr>
<td>ERA - E6-B2 CH31800 – 31900</td>
<td>EB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>0.147</td>
</tr>
<tr>
<td>Localised carriageway widening CH33045 – 33890</td>
<td>EB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>1.198</td>
</tr>
<tr>
<td>Localised carriageway widening CH33195 – 33890</td>
<td>WB</td>
<td>Fluvial and Surface water/ sewer flooding</td>
<td>0.966</td>
</tr>
</tbody>
</table>

### 2.5 M4 junction 7

2.5.1 The M4 junction 7 is located at chainage 29010.

2.5.2 Table 7 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area at junction 7. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

### Table 7: M4 Junction 7

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carriageway Westbound (&quot;WB&quot;)</td>
<td></td>
<td>Existing Area (ha)</td>
</tr>
<tr>
<td>Localised carriageway widening CH28895 – 29090</td>
<td>WB</td>
<td>Surface water/ sewer flooding</td>
<td>0.261</td>
</tr>
</tbody>
</table>

2.5.3 The location plan for Scheme widening works at M4 junction 7 can be found in Annex A.
2.6 M4 junction 7 – 6

2.6.1 The M4 junctions 7 and 6 are located approximately between 29010 and 26130.

2.6.2 Table 8 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area between junctions 7 and 6. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

Table 8: M4 Junction 7 – 6

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Westbound (&quot;WB&quot;)</td>
<td></td>
<td>Existing Area (ha)</td>
</tr>
<tr>
<td>Localised carriageway widening CH26505 – 27095</td>
<td>WB</td>
<td>Fluvid</td>
<td>1.147</td>
</tr>
<tr>
<td>Localised carriageway widening CH26550 – 27070</td>
<td>EB</td>
<td>Fluvid</td>
<td>0.960</td>
</tr>
<tr>
<td>Localised carriageway widening CH27235 – 27375</td>
<td>WB</td>
<td>Fluvid</td>
<td>0.180</td>
</tr>
</tbody>
</table>

2.6.3 The location plan for Scheme widening works between junctions 7 and 6 can be found in Annex A.

2.7 M4 junction 6 - 5

2.7.1 The M4 junctions 6 and 5 are located approximately between 26130 and 20150.

2.7.2 Table 9 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area between junctions 6 and 5. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.
<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Existing Area (ha)</td>
</tr>
<tr>
<td>ERA E4-A1 CH22100 – 22200</td>
<td>WB</td>
<td>Fluvial and reservoir</td>
<td>0.158</td>
</tr>
<tr>
<td>Localised carriageway widening CH22385 – 22550</td>
<td>EB</td>
<td>Fluvial, reservoir</td>
<td>0.218</td>
</tr>
<tr>
<td>Localised carriageway widening CH22370 – 22500</td>
<td>WB</td>
<td>Fluvial, reservoir, surface water/ sewer flooding</td>
<td>0.170</td>
</tr>
<tr>
<td>ERA - E4-B1 CH22550 – 22650</td>
<td>EB</td>
<td>Fluvial and reservoir</td>
<td>0.148</td>
</tr>
<tr>
<td>ERA - E4-A2 CH23750 – 23850</td>
<td>WB</td>
<td>Fluvial and reservoir</td>
<td>0.161</td>
</tr>
<tr>
<td>Localised carriageway widening CH23865 – 24010</td>
<td>EB</td>
<td>Fluvial, reservoir and surface water/ sewer flooding</td>
<td>0.152</td>
</tr>
<tr>
<td>Localised carriageway widening CH23850 – 24005</td>
<td>WB</td>
<td>Fluvial and reservoir</td>
<td>0.157</td>
</tr>
<tr>
<td>Localised carriageway widening CH24190 – 24360</td>
<td>WB</td>
<td>Fluvial, reservoir and surface water/ sewer flooding</td>
<td>0.299</td>
</tr>
<tr>
<td>Localised carriageway widening CH24137 – 24360</td>
<td>WB</td>
<td>Fluvial, reservoir and surface water/ sewer flooding</td>
<td>0.152</td>
</tr>
<tr>
<td>ERA - E4-B2 CH24400 – 24500</td>
<td>EB</td>
<td>Fluvial and reservoir</td>
<td>0.147</td>
</tr>
<tr>
<td>Localised carriageway widening CH25260 – 25830</td>
<td>EB</td>
<td>Reservoir and surface water/ sewer flooding</td>
<td>0.968</td>
</tr>
</tbody>
</table>

2.7.3 The location plan for Scheme widening works and ERAs between junctions 6 and 5 can be found in Annex A. Reservoir Flood Maps can be found in Annex D.
2.8 M4 junction 5

2.8.1 The M4 junction 5 is located at chainage 20150.

2.8.2 Table 10 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area at junction 5. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Carriageway Westbound (&quot;WB&quot;)</th>
<th>Source of Flooding</th>
<th>Impermeable Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localised carriageway widening CH20000 – 20320</td>
<td>EB</td>
<td></td>
<td>Reservoir</td>
<td>0.446</td>
</tr>
<tr>
<td>Localised carriageway widening CH19990 – 20280</td>
<td>WB</td>
<td></td>
<td>Reservoir</td>
<td>0.447</td>
</tr>
</tbody>
</table>

2.8.3 The location plan for Scheme widening works at junction 5 can be found in Annex A. Reservoir Flood Maps can be found in Annex D.

2.9 M4 junction 5 - 4b

2.9.1 The M4 junctions 5 and 4b are located approximately between chainage 20150 and 16800.

2.9.2 Table 11 shows Scheme widening works that are potentially at risk of flooding, the source of flooding and the increase in impermeable area between junctions 4b and 5. The increase in impermeable areas was calculated by calculating the difference between the proposed widened/new impermeable road edge, using the Scheme General Arrangement drawings (Doc Ref TR010019-7.4, Annex F1) relative to existing road edges extracted from topographical/ Lidar survey data of the existing road.

2.9.3 The location and fluvial flood zone plans for Scheme widening works between junctions 5 and 4b can be found in Annex A. Reservoir Flood Maps can be found in Annex D.
Table 11: M4 Junction 5 – 4b

<table>
<thead>
<tr>
<th>Works potentially at risk of flooding and Chainage Reference</th>
<th>Carriageway Eastbound (&quot;EB&quot;)</th>
<th>Carriageway Westbound (&quot;WB&quot;)</th>
<th>Source of Flooding</th>
<th>Existing Area (ha)</th>
<th>Additional Area (ha)</th>
<th>Total Proposed Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERA – E3-B1 CH18500 – 18600</td>
<td>EB</td>
<td></td>
<td>Fluvial and reservoir</td>
<td>0.190</td>
<td>0.027</td>
<td>0.217</td>
</tr>
<tr>
<td>Localised carriageway widening CH17800 – 17930</td>
<td>WB</td>
<td></td>
<td>Fluvial and reservoir</td>
<td>0.249</td>
<td>0.011</td>
<td>0.260</td>
</tr>
<tr>
<td>Localised carriageway widening CH17520 – 17605</td>
<td>EB</td>
<td></td>
<td>Fluvial and reservoir</td>
<td>0.161</td>
<td>0.011</td>
<td>0.172</td>
</tr>
<tr>
<td>Localised carriageway widening CH17450– 17600</td>
<td>WB</td>
<td></td>
<td>Fluvial and reservoir</td>
<td>0.306</td>
<td>0.019</td>
<td>0.325</td>
</tr>
</tbody>
</table>

2.10 M4 junctions 4b - 3

2.10.1 Between junctions 4b and 3 widening works within the Scheme are not considered subject to:
   a) fluvial and reservoir flood risk, as can be seen in Flood Maps in Annex A and Annex D;
   b) groundwater flood risk, as the wider Scheme is not considered at risk of groundwater flood (refer to paragraph 1.5.7), and;
   c) surface water or sewer flooding, as only a single maintenance related flood event that was easily cleared was registered in the HADDMS flood events register in the central reserve at junction 4.
3 FLOOD COMPLIANCE WITH LOCAL PLANS, SEQUENTIAL TEST AND EXCEPTION TEST

3.1 Compliance Assessment

3.1.1 This section assesses the compliance of the Scheme against the relevant Local Plan flood and drainage policies along its route and, following the direction in the NN NPS, assesses whether the Scheme passes the NPPF sequential and exception tests.

3.1.2 Section 5.94 of the NN NPS states that: “In preparing an FRA the applicant should:

- provide the evidence for the Secretary of State to apply the Sequential Test and Exception Test, as appropriate”.

3.1.3 Local plans with policies relevant to water quality and flood risk have been assessed for the Scheme. Local plans include:

a) West Berkshire District Council Core Strategy Development Plan Document (2012);
b) Reading Borough Council Core Strategy Development Plan Document (January 2008);
c) Wokingham Borough Council Managing Development Delivery Local Plan (February 2014);
e) Slough Borough Council Core Strategy Development Plan Document 2006-2026 (December 2008);
f) Bracknell Forest Council Core Strategy Development Plan Document (February 2008);
g) London Borough of Hillingdon Unitary Development Plan (September 1998) Saved Policies (September 2007);
h) Hillingdon Local Plan, Part 1 – Strategic Policies (November 2012); and

3.1.4 This FRA and the Drainage Strategy Report have been developed to ensure compliance with the above Council’s local plan policies in terms of flood risk to, or from, the Scheme. This includes maintaining flood extents without restricting flood flows, applying Sustainable Drainage Systems (“SuDS”), adopting a climate change allowance, using protection measures for water quality, introducing no net increase in discharge (i.e. maintaining existing runoff to mimic natural responses to the catchment area) and the Scheme ensuring further consultation.
with the EA and all local water authorities before construction of the Scheme commences.

3.2 Sequential test and exception tests

3.2.1 In accordance with NPPF Table 2: Flood Risk Vulnerability Classification, roads fall under the category of “essential infrastructure” (Table 13). The motorway will continue to function as a road following the construction of the Scheme, and therefore the Flood Risk Vulnerability Classification will remain unchanged as “essential infrastructure”.

3.2.2 The overall aim of decision-makers should be to steer new development to areas with the lowest probability of flooding (Flood Zone 1). Where there are no reasonably available sites in Flood Zone 1, decision-makers determining applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

3.2.3 NPPF provides guidance on the suitability of each land use classification in relation to each of the Flood Zones as summarised in Table 12.

<table>
<thead>
<tr>
<th>Table 12: Flood Risk vulnerability and flood zone ‘compatibility’</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flood Zone</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Zone 1</td>
</tr>
<tr>
<td>Zone 2</td>
</tr>
<tr>
<td>Zone 3a</td>
</tr>
<tr>
<td>Zone 3b</td>
</tr>
</tbody>
</table>
### Table 13: Flood Risk Vulnerability Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Essential Infrastructure</strong></td>
<td>Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.</td>
</tr>
<tr>
<td></td>
<td>Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.</td>
</tr>
<tr>
<td></td>
<td>Wind turbines.</td>
</tr>
<tr>
<td><strong>Highly vulnerable</strong></td>
<td>Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.</td>
</tr>
<tr>
<td></td>
<td>Emergency dispersal points.</td>
</tr>
<tr>
<td></td>
<td>Basement dwellings.</td>
</tr>
<tr>
<td></td>
<td>Caravans, mobile homes and park homes intended for permanent residential use.</td>
</tr>
<tr>
<td></td>
<td>Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”)</td>
</tr>
<tr>
<td><strong>More vulnerable</strong></td>
<td>Hospitals.</td>
</tr>
<tr>
<td></td>
<td>Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.</td>
</tr>
<tr>
<td></td>
<td>Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.</td>
</tr>
<tr>
<td></td>
<td>Non-residential uses for health services, nurseries and educational establishments.</td>
</tr>
<tr>
<td></td>
<td>Landfill and sites used for waste management facilities for hazardous waste.</td>
</tr>
<tr>
<td></td>
<td>Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.</td>
</tr>
<tr>
<td><strong>Less vulnerable</strong></td>
<td>Police, ambulance and fire stations which are not required to be operational during flooding.</td>
</tr>
<tr>
<td></td>
<td>Buildings used for shops, financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the ‘More Vulnerable’ class; and assembly and leisure.</td>
</tr>
<tr>
<td></td>
<td>Land and buildings used for agriculture and forestry.</td>
</tr>
<tr>
<td></td>
<td>Waste treatment (except landfill* and hazardous waste facilities).</td>
</tr>
<tr>
<td></td>
<td>Minerals working and processing (except for sand and gravel working).</td>
</tr>
<tr>
<td></td>
<td>Water treatment works which do not need to remain operational during times of flood.</td>
</tr>
<tr>
<td></td>
<td>Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.</td>
</tr>
<tr>
<td><strong>Water-Compatible Development</strong></td>
<td>Flood control infrastructure.</td>
</tr>
<tr>
<td></td>
<td>Water transmission infrastructure and pumping stations.</td>
</tr>
</tbody>
</table>
Table 13: Flood Risk Vulnerability Classification

Sewage transmission infrastructure and pumping stations.
Sand and gravel working.
Docks, marinas and wharves.
Navigation facilities.
Ministry of Defence defence installations.
Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
Water-based recreation (excluding sleeping accommodation).
Lifeguard and coastguard stations.
Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

3.2.4 As the motorway is within areas of Flood Zone 3 and the vulnerability classification is essential infrastructure in accordance with Table 13, a Sequential Test is required. As set out in NPPF Table 3: Flood Risk vulnerability and flood zone compatibility, essential infrastructure requires an Exception Test when in Flood Zone 3. Below are the Sequential and the Exception Tests.

3.2.5 Owing to the nature of the Scheme, it is not viable to relocate the works in a zone with a lower probability of flooding. Therefore, based on this evidence it is considered that the scheme would pass the Sequential Test applied by the Local Authorities.

3.2.6 Therefore, the Scheme must be assessed against the Exception Test. For the Exception Test to be passed the development must demonstrate that it provides wider sustainability benefits to the community that outweigh flood risk.

3.2.7 In 2003, the Secretary of State endorsed the ‘Thames Valley Multi-Modal Study’\(^4\) ("TVMMS") which recommended against the widening of the M4 in favour of demand management measures.

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\(^4\) Atkins (2003) Thames Valley Multi-Modal Study
3.2.8 A feasibility study in 2008\(^5\) found that Hard Shoulder Running ("HSR") with Active Traffic Management ("ATM") could be implemented and would provide the best value solution. This study recommended that the preferred solution should be for the dynamic use of hard shoulder with through junction running ("TJR") at junctions 5, 6 and 7 only. This involves allowing traffic on the hard shoulder during peak hours to create four lanes in each direction.

3.2.9 Options work continued in 2010 and 2011 and identified that increased value could be achieved through the permanent conversion of the hard shoulder into a running lane.

3.2.10 The DfT’s first Road Investment Strategy ("RIS") sets out the Department’s longer term investment and planning, outlining how it will invest in the SRN between 2015/16 and 2020/21.

3.2.11 The DfT’s aim, set out within the RIS is that by 2040, "we will have transformed the busiest sections of the network to enable improved safety levels, smoother traffic flow, and increased capacity. Smart Motorways, which use technology to expand capacity and regulate the flow of traffic, will form the core of the SRN".

3.2.12 Looking forward to 2040, the vision RIS describes seeks an upgraded network, supported by technology, which involves "Smart Motorways becoming the standard for the busiest sections of the network, delivering smoother traffic flow, increased capacity and improved safety".

3.2.13 Smart motorways typically have a lower environmental impact than traditional motorway widening schemes as there is less physical work. This minimises the potential impact on watercourses, habitats and landscapes. Additionally, the technology used for smart motorways allows traffic flows to be regulated; reducing congestion.

3.2.14 The Scheme will relieve traffic congestion and improve journey times for all road users as a result of utilising the hard shoulder, part of the central reserve and some localised carriageway widening to create an extra running lane. The permanent addition of an extra running lane will ease traffic congestion and improve journey times for the wider community.

3.2.15 The number of people that could use the motorway may not increase significantly following development of the Scheme, however, travel journey times are anticipated to reduce, saving user’s time and potentially reducing fuel usage. Reduced congestion could also improve road safety by increasing safety distances between vehicles and allowing more opportunities for safer vehicle overtaking. The improvements would represent a positive impact for road users. Further details can be found in the ES chapter 13 Effects on All Travellers.

\(^5\) Department of Transport (2008) Advanced Motorway Signalling and Traffic Management Feasibility Study
3.2.16 In accordance with NPPF it must be demonstrated that the Scheme will be safe from flooding for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

3.2.17 Notwithstanding the fact that parts of the existing motorway may be located within fluvial Flood Zones, mitigation measures, such as flood storage, will ensure flood risk levels to surrounding properties remains the same as pre-development levels.

3.2.18 The Scheme drainage design, secured by the Drainage Strategy Report, will mitigate the potential surface water flood risk to the Scheme and third parties as a result of widening works. If an alternative motorway was to be constructed to provide the same community benefits, the impacts on the environment and community would be far greater, due to the increased land, construction and environmental costs associated with the construction of a new motorway. The use of other transport modes was considered in the TVMMS, and it was concluded that other modes were required to be improved in addition to the promotion of the Scheme.

3.2.19 As the Scheme is in accordance with the DfT’s RIS and provides maximum benefit with minimal impact on the community, environment or flood risk relative to any alternative scheme it is asserted that the Scheme passes the Exception Test.
4 ASSESSMENT OF THE FLOOD HAZARD AT WIDENING WORKS AND SIDE ROADS

4.1 Sources of flooding that could affect widening works or side roads

4.1.1 Flooding from rivers, groundwater, artificial sources, sewers and surface water runoff during heavy rainfall are the potential sources of flooding for the Scheme.

4.1.2 Tidal flooding is not considered relevant as the Scheme is not located near to any tidal water course and therefore not subject to tidal flood risk.

4.1.3 The significance of potential effects (the change in flood risk) described in the following sections in this report is based on Tables A4.5 and A4.6 of the Design Manual for Roads and Bridges (“DMRB”) HD45/09.

4.2 NPS assessment requirements in terms of flood risk:

“5.94: In preparing an FRA the applicant should:

- consider the risk of all forms of flooding arising from the project (including in adjacent parts of the United Kingdom), in addition to the risk of flooding to the project, and demonstrate how these risks will be managed and, where relevant, mitigated, so that the development remains safe throughout its lifetime;

- take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;

- consider the vulnerability of those using the infrastructure including arrangements for safe access and exit;

- include the assessment of the remaining (known as ‘residual’) risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;

- consider if there is a need to remain operational during a worst case flood event over the development’s lifetime;

4.2.1 All forms of flooding to, or from, the Scheme have been assessed within this FRA. Where proposed impermeable areas increase by more than 10% relative to existing impermeable areas from localised carriageway widening, mitigation is to be provided by oversized pipes or manhole chambers to provide attenuated flow rates. These will be restricted to existing flow rates at outfalls. Attenuation and flow restrictions to existing rates at outfalls would minimise the impact of flood risk following development of the Scheme.

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6 Updated flood maps for rivers, the sea, surface water and reservoirs are available on the Environment Agency’s website
4.2.2 Climate change has been discussed in Section 7 in terms of surface water runoff discharge. EA flood data used to assess flood extents for side road works included climate change allowances. Where new drainage augments existing drainage systems or discharges to a SuDS outfall such as a soakaway, then a 20% allowance for climate change is to be applied to additional paved areas as discussed in Section 7.

4.2.3 Existing and Scheme drainage systems are designed to convey and discharge run-off during 1 in 5 year storm events in accordance with DMRB 33/06 and MPI. Over the lifetime of the Scheme, storm water flood events greater than 1 in 5 years and less than or equal to a 1 in 100 year event (6 hour storm) should normally be contained within the road cross section without spilling onto adjacent land in accordance with MPI. Operationally, road users would not use the motorway or they would travel at very slow speeds during storms greater than 1 in 5 years due to lack of visibility from surface water spray generated by vehicles travelling ahead of a road user, and general loss of visibility from heavy rainfall.

4.2.4 Residual flood risks that remain during extreme storm events, following implementation of the Scheme and/or maintenance/repair regimes described in the Drainage Strategy Report, are considered acceptable as motorway usage would reduce as discussed in 4.2.4 above.

4.2.5 For each identified source in Section 4.1 above, flooding is described as to how it would occur, with reference to any historic records where these are available. The significance of potential effects (the change in flood risk) described in the following sections in this report are based on Tables A4.5 and A4.6 of DMRB HD45/09.

4.2.6 Table 14 describes the significance of potential effects in terms of flood risk taken from Table A4.5 of HD45/09.

<table>
<thead>
<tr>
<th>Flood Risk</th>
<th>MAGNITUDE OF IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negligible</td>
</tr>
<tr>
<td>Very High</td>
<td>Neutral</td>
</tr>
<tr>
<td>High</td>
<td>Neutral</td>
</tr>
<tr>
<td>Medium</td>
<td>Neutral</td>
</tr>
<tr>
<td>Low</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

4.2.7 Table 15 shows the qualifying conditions of overall assessment score in terms of flood risk extracted from A4.6 of HD45/09. The score used most often in this FRA has been highlighted.
Table 15: Summary of Qualifying Conditions of Overall Assessment Score in terms of Flood Risk

<table>
<thead>
<tr>
<th>Score</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Large Adverse</td>
<td>An increase in peak flood levels (1% annual probability) &gt;100 mm increasing the risk of flooding to &gt;100 residential properties.</td>
</tr>
<tr>
<td>Large Adverse</td>
<td>An increase in peak flood levels (1% annual probability) &gt;50 mm increasing the risk of flooding to &gt;100 residential properties OR increase of &gt;100 mm increasing the risk of flooding to 1-100 residential properties.</td>
</tr>
<tr>
<td>Moderate Adverse</td>
<td>An increase in peak flood level (1% annual probability) &gt;10 mm resulting in an increased risk of flooding to &gt;100 residential properties OR an increase of &gt;50 mm resulting in an increased risk of flooding to 1-100 residential properties.</td>
</tr>
<tr>
<td>Slight Adverse</td>
<td>An increase in peak flood level (1% annual probability) &gt;10 mm resulting in an increased risk of flooding to fewer than 10 industrial properties.</td>
</tr>
<tr>
<td>Neutral</td>
<td><strong>Negligible change in peak flood (1% annual probability) &lt;±/− 10 mm</strong></td>
</tr>
<tr>
<td>Slight Beneficial</td>
<td>A reduction in peak flood level (1% annual probability) &gt;10 mm resulting in a reduced risk of flooding to 1-100 residential properties.</td>
</tr>
<tr>
<td>Moderate Beneficial</td>
<td>A reduction in peak flood level (1% annual probability) &gt;10 mm resulting in a reduced risk of flooding to &gt;100 residential properties OR a reduction of &gt;50 mm resulting in a reduced risk of flooding to 1-100 residential properties.</td>
</tr>
<tr>
<td>Large Beneficial</td>
<td>A reduction in peak flood levels (1% annual probability) &gt;50 mm reducing the risk of flooding to &gt;100 residential properties OR a reduction of &gt;100 mm resulting in a reduced risk of flooding to 1-100 residential properties.</td>
</tr>
</tbody>
</table>

4.3 M4 junctions 12 – 11

Flooding from rivers

4.3.1 According to the EA Flood Map, the Scheme widening works are located wholly or partly in Flood Zone 2 between junctions 12 and 11. The EA Flood Zone and Scheme widening Maps for junctions 12 to 11 can be found in Annex A.
4.3.2 As noted in Section 2.1.3, carriageway widening will take place by using the existing hard shoulder and central reserve width to provide an extra running lane. The Scheme widening works do not change the route or levels of the existing carriageway in Flood Zone 2 and the extent of widening works relative to existing catchments, as indicated in Section 2, is generally an increase of approximately 10%. The exceptions to this are the ERAs, however, the additional impermeable areas are only approximately 400m² per ERA. It is considered therefore, that the risk of fluvial flooding to or from the Scheme will not increase significantly from the existing situation.

4.3.3 According to the West Berkshire SFRA, dated May 2008, there is no known history of flooding between junctions 12 and 11 for the areas of widening on both carriageways between chainages CH61500 – 61860 and CH61750-61860 to the east of M4 junction 12.

4.3.4 Given the above assessment, changes in the fluvial flood risk between junctions 12 and 11 are considered negligible which gives the score of **neutral**.

4.3.5 According to the HADDMS, the carriageway is shown between chainages CH61500 – 61860 and CH61750-61860 to be on an embankment. This means that the carriageway at this location is elevated relative to the surrounding land and it is unlikely to be at risk of fluvial flooding. The Scheme widening works as discussed in Section 2 would not change the route or levels of the existing carriageway with minimal widening relative to the existing motorway. It is considered that the risk of fluvial flooding will not increase significantly from the existing situation following development of the Scheme.

**Flooding from reservoir**

4.3.6 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the proposed works between junctions 12 and 11 are located outside the extent of the reservoir flooding. The impact of flooding from reservoirs between junctions 12 and 11 is considered to be negligible which gives the score of **neutral**.

**Flooding from carriageway or other sewers**

4.3.7 HADDMS flood events register has 2 recorded flood events in 2008 and 2012 around the proposed works on the eastbound carriageway between CH55165 - 55300 and CH61750 – 61860 (see Annexure B for details). According to this register, these events were caused by blocked drains and gullies.

4.3.8 In the HADDMS flood events register (Annex B) two flood events were registered at or near localised widening. However, these flood events were cleared effectively by the relevant area Asset Support Contract (“ASC”) service provider.
4.3.9 The ASC for the M4 is aware of the flood events between junctions 12 and 11 and has carried out cleaning and de-silting maintenance works to reduce the risk of flood events occurring between junctions 12 and 11. For known details of existing carriageway sewers such as pipe layouts, sizes and invert levels refer to the Drainage Strategy Report (Doc Ref TR010019-7.5).

4.3.10 Currently, the maintenance regime is to rectify the causes of flood events that impact on lane 1 of the motorway. This means that, at present, the hard shoulder may flood during storm events without affecting road users. When the hard shoulder is converted to a running lane, any enhancement or remediation measures which are required to ensure the drainage system functions correctly during storm events will be completed during the construction phase of the Scheme in accordance with the Drainage Strategy.

4.3.11 Any change in carriageway or sewer flood risk between junctions 12 and 11 is considered negligible, which gives the score of neutral. A list of the HADDMS flood events and their description can be found Annex B.

4.3.12 According to the West Berkshire SFRA, there is no known history of recorded sewer flooding incidents between junctions 12 and 11 and therefore the likelihood of sewer flooding is considered to be negligible which gives the score of neutral.

4.3.13 Where proposed impermeable areas increase by more than 10% relative to existing impermeable areas from localised carriageway widening, oversized pipes or manhole chambers are to be used to provide attenuated flow rates that are to be restricted to existing flow rates at outfalls. Attenuation and flow restrictions to existing rates at outfalls would minimize the impact of flood risk following development of the scheme.

**Flooding from groundwater**

4.3.14 According to Figure 1 of the West Berkshire SFRA, there is no known history of groundwater incidents between junction 12 and 11. The risk of flooding from groundwater between junctions 12 and 11 is negligible which gives the score of neutral.

4.4 **M4 junction 11 – 10**

**Flooding from rivers**

4.4.1 According to the EA Flood Map, the Scheme widening works on the M4 between junctions 11 and 10 are located in Flood Zone 1.

4.4.2 Wokingham Borough Council SFRA, dated February 2012, indicates that there is no known history of flooding between junction 10 and 11 where the proposed works are to take place.

4.4.3 Given the above, the impact of flooding from rivers between junctions 11 and 10 is considered to be negligible which gives the score of neutral.
**Flooding from reservoir**

4.4.4 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the Scheme widening works between junctions 11 and 10 are located outside the extent of the reservoir flooding. The impact of flooding from reservoirs between junctions 11 and 10 is considered to be negligible which gives the score of neutral.

**Flooding from carriageway or other sewers**

4.4.5 The HADDMS flood events register has 12 recorded flood events during 2004 to 2014 at or near the Scheme widening works between junctions 11 and 10. According to this register, these events were caused by blocked drains and gullies. The ASC service provider for the M4 is aware of the flood events between junctions 11 and 10 and has carried out cleaning and de-silting maintenance works to reduce the risk of flood events occurring between junctions 11 and 10. For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5).

4.4.6 Currently, the maintenance regime is to rectify the causes of flood events that impact on lane 1 of the motorway. This means that, at present, the hard shoulder may flood during storm events without affecting road users. When the hard shoulder is converted to a running lane, any enhancement or remediation measures which are required to ensure the drainage system functions correctly during storm events will be completed during the construction phase of the Scheme in accordance with the Drainage Strategy.

4.4.7 The change in the flood risk between junctions 11 and 10 is negligible, which gives the score of neutral. Full description of the HADDMS flood events can be found Annex B.

4.4.8 There are no recorded incidents of sewer flooding between junctions 11 and 10 according to the Wokingham Borough Council SFRA. The likelihood of sewer flooding is considered to be negligible which gives the score of neutral.

**Flooding from groundwater**

4.4.9 According to the Wokingham Borough Council SFRA, there are no recorded groundwater incidents between junctions 11 and 10 where the Scheme widening works take place. The risk of flooding from groundwater between junctions 11 and 10 is negligible which gives the score of neutral.

**Flooding from rivers**

4.5 **M4 junction 10 – 8/9**

4.5.1 According to the EA Flood Map, the proposed works between junction 10 and 8/9 are located in Flood Zone 1.
4.5.2 Figure B of the Royal Borough of Windsor & Maidenhead SFRA, dated April 2009, indicates there is no known history of flooding between junctions 10 and 8/9 where the Scheme widening works take place.

4.5.3 Given the lack of river flood risk between junction 10 and 8/9 near Scheme widening works, the impact of flooding from rivers is considered to be negligible, which gives the score of neutral.

**Flooding from reservoir**

4.5.4 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the Scheme widening works between junctions 10 and 8/9 are located outside the extent of the reservoir flooding. Consequently, the impact of flooding from reservoirs between junctions 10 and 8/9 is considered to be negligible, which gives the score of neutral.

**Flooding from carriageway or other sewers**

4.5.5 The HADDMS flood events register has 6 recorded flood events during 2004 to 2014 around the Scheme widening works between junctions 10 and 8/9. According to this register, these events were caused by blocked drains and gullies.

4.5.6 The ASC service provider for the M4 is aware of the flood events between junctions 10 and 8/9 and has carried out cleaning and de-silting maintenance works to reduce the risk of flood events occurring between junctions 10 and 8/9. For details of existing carriageway sewers refer to the Scheme Drainage Strategy Report (Doc Ref TR010019-7.5).

4.5.7 Currently, the maintenance regime is to rectify the causes of flood events that impact on lane 1 of the motorway. This means that, at present, the hard shoulder may flood during storm events without affecting road users. When the hard shoulder is converted to a running lane, any enhancement or remediation measures which are required to ensure the drainage system functions correctly during storm events will be completed during the construction phase of the Scheme in accordance with the Drainage Strategy.

4.5.8 This means that the change in the flood risk between junctions 10 and 8/9 is negligible, which gives the score of neutral. A full description of the HADDMS flood events can be found Annex B.

4.5.9 There are no recorded incidents of sewer flooding between junctions 10 and 8/9 according to Figure B of the Royal Borough of Windsor & Maidenhead SFRA. The likelihood of sewer flooding between junctions 10 and 8/9 is considered to be negligible which gives the score of neutral.
Flooding from groundwater

4.5.10 According to Figure B of the Royal Borough of Windsor & Maidenhead SFRA, there are no recorded groundwater incidents between junctions 10 and 8/9. The risk of flooding from groundwater between junctions 8/9 and 10 is negligible which gives the score of neutral.

4.6 M4 junction 8/9 – 7

Flooding from rivers

4.6.1 According to the EA Flood Map, the majority of the Scheme widening works are located wholly or partly in Flood Zones 2 and 3 between junctions 8/7 and 7. The EA Flood Map can be found in Annex A.

4.6.2 As noted in Section 2.1.3, carriageway widening will take place by using the existing hard shoulder and central reserve width to provide an extra running lane. The Scheme widening works do not change the route or levels of the existing carriageway in Flood Zone 2 and the extent of widening works relative to existing catchments, as indicated in Section 2, is generally an increase of approximately 10%. The exceptions to this are the ERAs. However, the additional impermeable areas are only approximately 400m² per ERA. Therefore, it is considered, that the risk of fluvial flooding to or from the Scheme will not increase significantly from the existing situation.

4.6.3 According to Figure B of the Royal Borough of Windsor and Maidenhead SFRA, dated April 2009, there is no known history of flooding between junctions 8/9 and 7.

4.6.4 Given the above assessment, the impact of flooding from rivers for Scheme widening works between junctions 8/9 and 7 is considered to be negligible, which gives the score of neutral.

Flooding from reservoir

4.6.5 According to the EA online mapping facility risk of flooding from reservoirs (see Annex C), the Scheme widening works between junctions 8/9 and 7 are located outside the extent of the reservoir flooding. Therefore, the impact of flooding from reservoirs between junctions 8/9 and 7 is considered to be negligible, which gives the score of neutral.

Flooding from carriageway or other sewers

4.6.6 The HADDMS flood events register has 28 recorded flood events during 2004 to 2014 that have occurred between junctions 8/9 and 7, where the Scheme widening works are to take place. Two minor flood events occurred during 2014 and three in 2013.
4.6.7 The ASC service provider for the M4 is aware of the flood events between junctions 8/9 and 7 and has carried out cleaning and de-silting maintenance works to reduce the risk of flood events occurring between junctions 8/9 and 7. For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5).

4.6.8 Currently, the maintenance regime is to rectify the causes of flood events that impact on lane 1 of the motorway. This means that, at present, the hard shoulder may flood during storm events without affecting road users. When the hard shoulder is converted to a running lane, any enhancement or remediation measures which are required to ensure the drainage system functions correctly during storm events will be completed during the construction phase of the Scheme in accordance with the Scheme's Drainage Strategy.

4.6.9 Provided Scheme-related enhancements and any remediation measures identified during the construction phase of the Scheme are implemented, the flood risk between junctions 8/9 and 7 is considered negligible, which gives the score of neutral. A full description of the HADDMS flood events can be found Annex B.

4.6.10 According to Figure B of the Royal Borough of Windsor and Maidenhead SFRA, there is no known history of sewer flooding between junctions 8/9 and 7. The likelihood of sewer flooding is considered to be negligible, which gives the score of neutral.

Flooding from groundwater

4.6.11 There are no recorded groundwater flooding incidents between junctions 8/9 and 7 according to Figure B of the Royal Borough of Windsor and Maidenhead SFRA. The risk of flooding from groundwater between junctions 7 and 8/9 is negligible, which gives the score of neutral.

4.7 M4 junction J7

Flooding from rivers

4.7.1 According to the EA Flood Map, the proposed carriageway widening at junction 7 is located in Flood Zone 1.

4.7.2 According to Map 3 of the Slough Borough Council SFRA, there is no known history of flooding at junction 7.

4.7.3 Given the lack of river flood risk, the impact of flooding at junction 7 is considered to be negligible, which gives the score of neutral.
4.7.4 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the Scheme widening works at junction 7 are located outside the extent of the reservoir flooding. The impact of flooding from reservoirs is considered to be negligible, which gives the score of neutral. **Flooding from carriageway or other sewers**

4.7.5 The HADDMS flood events register has a recorded flood event on the westbound carriageway at CH29100. According to this register, this was caused by blocked drains and gullies.

4.7.6 The ASC service provider for the M4 is aware of the flood events at junction 7 and has carried out cleaning and de-silting maintenance works to reduce the risk of flood events occurring at junction 7. For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5)

4.7.7 Currently, the maintenance regime is to rectify the causes of flood events that impact on lane 1 of the motorway. This means that, at present, the hard shoulder may flood during storm events without affecting road users. When the hard shoulder is converted to a running lane, any enhancement or remediation measures which are required to ensure the drainage system functions correctly during storm events will be completed during the construction phase of the Scheme in accordance with the Drainage Strategy.

4.7.8 According to the Slough Borough Council SFRA, there is no known history of sewer flooding at junction 7.

4.7.9 It is considered that any change in the sewer flood risk at junctions 7 caused by widening works is negligible, which gives the score of neutral. A full description of the HADDMS flood events can be found Annex B.

**Flooding from groundwater**

4.7.10 There are no recorded groundwater flooding incidents according to the Slough Borough Council SFRA at junction 7. The risk of flooding from groundwater at junction 7 is negligible, which gives the score of neutral.

4.8 **M4 junction 7 - 6**

**Flooding from rivers**

4.8.1 According to the EA Flood Map, the proposed carriageway widening between CH27200 - 27400 is partially located in Flood Zones 2 and 3 between junctions 7 and 6. The EA Flood Map can be found in Annex A.
4.8.2 As noted in Section 2.1.3, carriageway widening will take place by using the existing hard shoulder and central reserve width to provide an extra running lane. The Scheme widening works do not change the route or levels of the existing carriageway in Flood Zone 2 and the extent of widening works relative to existing catchments, as indicated in Section 2, is generally an increase of approximately 10%. The exceptions to this are the ERAs, however, the additional impermeable areas are only approximately 400m² per ERA. It is considered therefore, that the risk of fluvial flooding to or from the Scheme will not increase significantly from the existing situation.

4.8.3 According to the Slough Borough Council SFRA (dated May 2012); there is no known history of flooding on the M4 between junctions 7 and 6.

4.8.4 Given the above assessment, the change in the fluvial flood risk between junctions 7 and 6 is considered to be negligible, which gives the score of neutral.

Flooding from reservoir

4.8.5 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the Scheme widening works between junctions 7 and 6 are located outside the extent of the reservoir flooding. The impact of reservoir flooding between junctions 7 and 6 is considered to be negligible, which gives the score of neutral.

Flooding from carriageway or other sewers

4.8.6 The HADDMS flood events register has no recorded flood events on the M4 between junctions 7 and 6. The impact of flooding from the carriageway between junction 6 and 7 is considered to be negligible, which gives the score of neutral.

4.8.7 According to the Slough Borough Council SFRA, there is no known history of sewer flooding on the M4 between junctions 7 and 6. The likelihood of sewer flooding is considered to be negligible, which gives the score of neutral.

4.8.8 The ASC service provider for the M4 has carried out cleaning and de-silting maintenance works to reduce the risk of flood events occurring between junctions 7 and 6. For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5)

4.8.9 Currently, the maintenance regime is to rectify the causes of flood events that impact on lane 1 of the motorway. This means that, at present, the hard shoulder may flood during storm events without affecting road users. When the hard shoulder is converted to a running lane, any enhancement or remediation measures which are required to ensure the drainage system functions correctly during storm events will be completed during the construction phase of the Scheme in accordance with the Drainage Strategy.
4.8.10 There are no recorded groundwater flooding incidents according to the Slough Borough Council SFRA between junctions 7 and 6. The risk of flooding from groundwater between junctions 6 and 7 is negligible, which gives the score of neutral.

4.9 M4 junction 6 - 5

Flooding from rivers

4.9.1 According to the EA Flood Map, the majority of the Scheme widening works are located wholly or partly in Flood Zone 2 between junctions 6 and 5. The EA Flood Map can be found in Annex A.

4.9.2 As noted in Section 2.1.3, carriageway widening will take place by using the existing hard shoulder and central reserve width to provide an extra running lane. The Scheme widening works do not change the route or levels of the existing carriageway in Flood Zone 2 and the extent of widening works relative to existing catchments, as indicated in Section 2, is generally an increase of approximately 10%. The exceptions to this are the ERAs, however, the additional impermeable areas are only approximately 400m² per ERA. It is considered therefore, that the risk of fluvial flooding to or from the Scheme will not increase significantly from the existing situation.

4.9.3 According to Map 3 of the Slough Borough Council SFRA, (dated May 2012), there is known history of fluvial flooding between junctions 6 and 5.

4.9.4 The change in the fluvial flood risk between junctions 6 and 5 is negligible, which gives the score of neutral.

Flooding from reservoir

4.9.5 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the majority of the Scheme widening works between junction 6 and 5 are at risk of reservoir flooding associated with the Queen Mother Reservoir.

4.9.6 The Slough Borough Council SFRA (dated May 2012) states the following:

“Thames Water considers the risk of failure of the Queen Mother and Wraysbury Reservoirs to be extremely low and therefore should not be regarded as an issue to constrain the location of development in Slough.”

4.9.7 As indicated in the Slough Borough Council SFRA reservoir flooding should not constrain development.

4.9.8 The change in the reservoir flood risk between junctions 6 and 5 is negligible, which gives the score of neutral.
Flooding from carriageway or other sewers

4.9.9 The HADDMS flood events register has 12 recorded flood events between junctions 6 and 5 where the proposed works take place. According to this register, these events were caused by blocked drains and gullies.

4.9.10 The ASC service provider for the M4 is aware of the flood events between junctions 6 and 5 and has carried out cleaning and de-silting maintenance works to reduce the risk of flood events occurring between junctions 6 and 5. For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5).

4.9.11 Currently, the maintenance regime is to rectify the causes of flood events that impact on lane 1 of the motorway. This means that, at present, the hard shoulder may flood during storm events without affecting road users. When the hard shoulder is converted to a running lane, any enhancement or remediation measures which are required to ensure the drainage system functions correctly during storm events will be completed during the construction phase of the Scheme in accordance with the Drainage Strategy.

4.9.12 Any change in carriageway or sewer flood risk between junctions 12 and 11 is considered negligible, which gives the score of neutral. A list of the HADDMS flood events and their description can be found Annex B.

4.9.13 According to the Slough Borough Council SFRA, there is no known history of sewer flooding between junctions 6 and 5. The likelihood of sewer flooding is considered to be negligible, which gives the score of neutral.

4.9.14 Where proposed impermeable areas increase by more than 10% relative to existing impermeable areas from localised carriageway widening, oversized pipes or manhole chambers are to be used to provide attenuated flow rates that are to be restricted to existing flow rates at outfalls. Attenuation and flow restrictions to existing rates at outfalls would minimize the impact of flood risk following development of the Scheme.

Flooding from groundwater

4.9.15 There are no recorded groundwater flooding incidents according to the Slough Borough Council SFRA between junction 5 and 6. The risk of flooding from groundwater between junctions 6 and 5 is negligible, which gives the score of neutral.

4.10 M4 junction 5

Flooding from rivers

4.10.1 According to the EA Flood Map, the Scheme widening works at junction 5 are located in Flood Zone 1 Therefore, the impact of flooding at junction 5 is considered to be negligible, which gives the score of neutral.
Historical flooding

4.10.2 According to the Slough Borough Council SFRA, dated May 2012, there is no known history of flooding at junction 5. Therefore, the impact of flooding at junction 5 is considered to be negligible, which gives the score of neutral.

Flooding from reservoir

4.10.3 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the M4 junction 5 is at risk of reservoir flooding associated with the Queen Mother Reservoir.

4.10.4 The Slough Borough Council SFRA (dated May 2012) states the following:

“Thames Water considers the risk of failure of the Queen Mother and Wraysbury Reservoirs to be extremely low and therefore should not be regarded as an issue to constrain the location of development in Slough.”

4.10.5 As indicated in the Slough Borough Council SFRA reservoir flooding should not constrain development.

4.10.6 The change in the reservoir flood risk at junction 5 is negligible, which gives the score of neutral.

Flooding from carriageway or other sewers

4.10.7 The HADDMS flood events register has no recorded flood events at junction 5. Therefore, the risk of flooding from the carriageway at junction 5 is considered to be negligible, which gives the score of neutral.

4.10.8 According to the Slough Borough Council SFRA, there is no known history of sewer flooding at junction 5. The likelihood of sewer flooding is considered to be negligible, which gives the score of neutral.

4.10.9 For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5).

Flooding from groundwater

4.10.10 There is no known history of any recorded groundwater incidents at junction 5 according to the Slough Borough Council SFRA. Therefore, the risk of flooding from groundwater at junction 5 is negligible, which gives the score of neutral.

4.11 M4 junctions 5 – 4b

Flooding from rivers

4.11.1 According to the EA Flood Map, the proposed works between junctions 5 and 4b are located in Flood Zone 1. Therefore, the impact of flooding between junctions 5 and 4b is considered to be negligible, which gives the score of neutral.
Historical flooding

4.11.2 According to the Slough Borough Council SFRA, dated May 2012, there is no known history of flooding between junctions 5 and 4b. Therefore, the impact of flooding at junction 5 is considered to be negligible, which gives the score of neutral.

Flooding from reservoir

4.11.3 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the proposed works between junctions 5 and 4b are at risk of reservoir flooding associated with the Queen Mother Reservoir.

4.11.4 The Slough Borough Council SFRA (dated May 2012) states the following:

“Thames Water considers the risk of failure of the Queen Mother and Wraysbury Reservoirs to be extremely low and therefore should not be regarded as an issue to constrain the location of development in Slough.”

4.11.5 As indicated in the Slough Borough Council SFRA reservoir flooding should not constrain development.

4.11.6 The change in the reservoir flood risk between junctions 5 and 4b is negligible, which gives the score of neutral.

Flooding from carriageway or other sewers

4.11.7 The HADDMS flood events register has no recorded flood events between junctions 5 and 4b. Therefore, the risk of flooding from the carriageway between junctions 5 and 4b is considered to be negligible, which gives the score of neutral.

4.11.8 According to the Slough Borough Council SFRA, there is no known history of sewer flooding between junctions 5 and 4b. The likelihood of sewer flooding is considered to be negligible, which gives the score of neutral.

4.11.9 For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5).

Flooding from groundwater

4.11.10 There are no recorded groundwater flooding incidents between junctions 5 and 4b according to the Slough Borough Council SFRA. Therefore, the risk of flooding from groundwater at junction 5 is negligible, which gives the score of neutral.

4.12 M4 junctions 4b – 3

Flooding from rivers

4.12.1 According to the EA Flood Map, the proposed works between junctions 4b and 3 are located in Flood Zone 1. Therefore, the impact of flooding between junctions 4b and 3 is considered to be negligible, which gives the score of neutral.
4.12.2 According to the Slough Borough Council SFRA, dated May 2012, there is no known history of flooding between junctions 4b and 3. Therefore, the impact of flooding is considered to be negligible, which gives the score of neutral.

4.12.3 According to the EA online mapping tool: Risk of Flooding from Reservoirs (see Annex C), the proposed works between junctions 4b and 3 are not at risk of reservoir flooding, which gives the score of neutral.

4.12.4 The HADDMS flood events register has no recorded flood events between junctions 4b and 3. Therefore, the risk of flooding from the carriageway is considered to be negligible, which gives the score of neutral.

4.12.5 According to the Slough Borough Council SFRA, there is no known history of sewer flooding between junctions 4b and 3. The likelihood of sewer flooding is considered to be negligible, which gives the score of neutral.

4.12.6 For details of existing carriageway sewers refer to the Drainage Strategy Report (Doc Ref TR010019-7.5).

4.12.7 There are no recorded groundwater flooding incidents between junctions 4b and 3 according to the Slough Borough Council SFRA. Therefore, the risk of flooding from groundwater at is negligible, which gives the score of neutral.

4.13 Summary of flooding effects and the overall risk assessment scores.

Table 16: Summary of flooding effects and the Overall Risk Assessment Scores

<table>
<thead>
<tr>
<th>Flooding Effects and Scores</th>
<th>Flooding from Rivers (Flood Zones)</th>
<th>Flooding from Reservoir</th>
<th>Flooding from carriageway</th>
<th>Flooding from other sewers</th>
<th>Flooding from Groundwater</th>
<th>Overall Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4 Junctions 12 – 11</td>
<td>Negligible</td>
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### Table 16: Summary of flooding effects and the Overall Risk Assessment Scores

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5 FLOOD RISK TO THIRD PARTIES

5.1 Third party flood risk assessment.

5.1.1 To assess the potential impact of the widening works EA Flood Zone data was assessed against the proposed carriageway widening works.

5.1.2 For the proposed works to side roads, bridges and culverts flood level data was requested from the EA and mapped relative to design layouts to determine if the works would impact on the floodplain (Flood Zone 2 and 3).

5.1.3 The potential impact of the widening works and side road works on the floodplain between each junction link of the Scheme are discussed below.

M4 junctions 12 – 11

5.1.4 Widening works are proposed to the carriageway between junctions 12 and 11. The impacts of the works are discussed below.

5.1.5 As discussed in Section 5.3, although Scheme widening works between junctions 12 and 11 are located wholly or partially in the floodplain (Flood Zone 2), the extent of widening works is not significant compared to the existing motorway.

5.1.6 Although there is a change in the impermeable area, the effects on flood extent levels and flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.7 There is no change in flood risk from reservoir, sewer and groundwater between junctions 12 and 11. There will be no effects to third to parties.

M4 junctions 11 - 10

5.1.8 Widening works are proposed to the carriageway between junctions 11 and 10. The impacts of the works are discussed below.

5.1.9 The Scheme widening works between junctions 11 and 10 are not within the floodplain (Flood Zone 1). This junction is not at fluvial flood risk, and therefore there will be no effects to flood risk elsewhere with regards to fluvial flooding.
5.1.10 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.11 There is no change in flood risk from reservoir, sewer and groundwater between junctions 11 and 10. There will therefore be no effects to flood risk elsewhere.

M4 junctions 10 - 8/9

5.1.12 Widening works are proposed to the carriageway between junctions 10 and 8/9. The impacts of the works are discussed below.

5.1.13 The Scheme widening works between junctions 10 and 8/9 are not located in the floodplain (Flood Zone 1). The works between the junctions are not at fluvial flood risk, and therefore there will be no effects to third parties in regards to fluvial flooding.

5.1.14 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.15 There is no change in flood risk from reservoir, sewer and groundwater between junctions 10 and 8/9. There will be no effects to third to parties.

M4 junctions 8/9 – 7

5.1.16 Widening works are proposed to the carriageway. Works are also proposed to side roads and to existing bridges between junctions 8/9 and 7. The impacts of the works are discussed below.

Widening works

5.1.17 The Scheme widening works between junctions 8/9 and 7 are wholly or partially located in Flood Zones 2 and 3. The extent of widening works is not significant compared to the existing motorway. The impact on flood extent flood levels and fluvial flood risk elsewhere is not anticipated to be significant.
5.1.18 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.19 There is no change in flood risk from reservoir, sewer and groundwater between junctions 8/9 and 7. There will be no effects to third to parties.

**Side road works – Ascot Road**

5.1.20 The works to the side road at Ascot Road have been assessed against EA flood modelling which shows that only a small part of the proposed side road alignment is within the 1% Climate Change (“CC”) Annual Exceedance Probability (“AEP”) flood extent. Mitigation for fluvial flood risk for the area within the flood extent is possible by providing flood storage.

5.1.21 The proposed works to Ascot Road and Ascot Road overbridge include a new earthwork embankment within the 1% climate change AEP flood extent. Current designs indicate that 1400m² of works to the new embankment are located within the floodplain. Mitigation to compensate for any loss of floodplain as a result of these works can be provided by removal of part of the existing Ascot Road embankment to create floodplain compensation. The indicative flood storage area available by removal of the existing embankment is 3800m². Consequently, sufficient land is available adjacent to the proposed works to provide flood compensation. The precise arrangement of any required floodplain compensation will be confirmed following further assessment during the detailed design phase. The 1% CC AEP and the area of land available for flood storage are shown on the Ascot Road AEP Flood Extent Assessment Map 514451-MUH-SR-ZZ-DR-DR-301319 in Annex C.
Bray Bridge widening

5.1.22 Works are proposed to the Thames Bray underbridge over the River Thames. Widening of the Thames Bray underbridge would result in a total river bed displacement of 50m². The impact of this displacement is considered to be negligible. However, to minimise the impact on any hydraulic conveyance capacity of the river, if required, mitigation measures such as floodplain compensation may be provided. The need for such floodplain compensation will be confirmed during the detailed design phase. Any displacement effect can be accommodated within the flood storage areas adjacent to the new Monkey Island Lane embankment. Bray Bridge AEP Flood Extent Assessment Map 514451-MUH-SR-ZZ-DR-DR-301326 in Annex C shows the 1% CC AEP.

Side road works – Marsh Lane

5.1.23 The works at Marsh Lane were assessed against EA flood modelling which shows that there will not be a significant change between existing and proposed flood extent. Marsh Lane is unlikely to have a significant impact on the 1% CC AEP flood extent and as such mitigation measures will not be required.

5.1.24 Marsh Lane AEP Flood Extent Assessment Map 514451-MUH-SR-ZZ-DR-DR-301321 in Annex C shows the 1% CC AEP.

Side road works – Monkey Island Lane

5.1.25 The proposed works to Monkey Island Lane and Monkey Island Lane overbridge include works within the 1% climate change AEP flood extents. These works include a new earthwork embankment for Monkey Island Lane and the associated realignment of the flood relief channels running parallel to the M4. Current designs indicate that 2000m² of works to the new embankment are located within the floodplain.

5.1.26 Mitigation to compensate for any loss of floodplain as a result of these works can be provided by removal of part of the existing Monkey Island Lane embankment to create floodplain compensation. The indicative flood storage area available by removal of the existing embankment is 3300m². Consequently, sufficient land is available adjacent to the proposed works to provide flood compensation. The precise arrangement of any required floodplain compensation will be confirmed following further assessment during the detailed design phase. The 1% CC AEP and the area of land available for flood storage are shown on the Monkey Island Lane AEP Flood Extent Assessment Map in Annex C.

M4 junction 7

5.1.27 Widening works are proposed to the carriageway at junction 7. The impacts of the works are discussed below.
5.1.28 The works at junction 7 are not located in the floodplain (Flood Zone 1). This junction is not at fluvial flood risk, and therefore there will be no effects to third parties in regards to fluvial flooding.

5.1.29 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.30 There is no change in flood risk from reservoir, sewer and groundwater at junction 7 and therefore there will be no effects to third parties.

**M4 junctions 7 - 6**

5.1.31 Widening works are proposed to the carriageway, works are also proposed to the side roads of the M4 and to existing culverts between junctions 7 and 6. The impacts of the works are discussed below.

**Widening works**

5.1.32 The works between junctions 7 and 6 are partially located in the floodplain (Flood Zones 2 and 3). However, the extent of widening works is not significant in comparison to the existing motorway. The impact on flood levels and flood risk elsewhere is not anticipated to be significant.

5.1.33 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.34 There is no change in flood risk from reservoir, sewer and groundwater between junction 7 and 6. There will be no effects to third to parties.

**Side road – Wood Lane**

5.1.35 The proposed works to Wood Lane and Wood Lane overbridge include a new earthwork embankment within the 1% climate change AEP flood extents. Current designs indicate that 2100m² of works to the new embankment are located within the floodplain.
5.1.36 Mitigation to compensate for any loss of floodplain as a result of these works can be provided by removal of part of the existing Wood Lane embankment to create floodplain compensation. The indicative flood storage area available by removal of the existing embankment is 4000m². Consequently, sufficient land is available adjacent to the proposed works to provide flood compensation. The precise arrangement of any required floodplain compensation will be confirmed following further assessment during the detailed design phase. The 1% CC AEP and the area of land available for flood storage are shown on the Wood Lane AEP Flood Extent Assessment Map in Annex C.

**Chalvey culvert**

5.1.37 The Chalvey culvert on the Chalvey Ditch is to be extended to accommodate the Scheme. As the works involve extending the existing culvert, the impact on the surrounding floodplain will be negligible and as such mitigation measures will not be required.

**M4 junctions 6 - 5**

5.1.38 Widening works are proposed to the carriageway. Works are also proposed to the side roads and to existing culverts between junctions 6 and 5. The impacts of the works are discussed below.

**Widening works**

5.1.39 The Scheme works between junctions 6 and 5 are located in the floodplain (Flood Zone 2). However, the extent of widening works is not significant in comparison to the existing motorway. The impact on flood levels and flood risk elsewhere is not anticipated to be significant.

5.1.40 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.41 There is no change in flood risk from reservoir, sewer and groundwater between junctions 6 and 5. There will be no effects to third to parties.

**Side road – Datchet Road and Recreation Grounds**

5.1.42 The Scheme works at Datchet Road and Recreation Grounds were assessed against EA flood modelling which shows the works are not within the 1% CC AEP flood extent and as such mitigation measures will not be required.

5.1.43 Datchet Road and Recreation Grounds AEP Flood Extent Assessment Map 514451-MUH-SR-ZZ-DR-DR-301320 in Annex C shows the 1% CC AEP.
Side Road – Ridings Court Road

5.1.44 The proposed works to Riding Court Road and Riding Court Road overbridge include a new earthwork embankment within the 1% climate change AEP flood extent. Current designs indicate that 800m² of works to the new embankment are located within the floodplain. The proposed works to Wood Lane and Wood Lane overbridge include a new earthwork embankment within the 1% climate change AEP flood extents. Current designs indicate that 2100m² of works to the new embankment are located within the floodplain.

5.1.45 Mitigation to compensate for any loss of floodplain as a result of these works can be provided by removal of part of the existing Wood Lane embankment to create floodplain compensation. The indicative flood storage area available by removal of the existing embankment is 4000m². Consequently, sufficient land is available adjacent to the proposed works to provide flood compensation. The precise arrangement of any required floodplain compensation will be confirmed following further assessment during the detailed design phase. The 1% CC AEP and the area of land available for flood storage are shown on the Wood Lane AEP Flood Extent Assessment Map in Annex C.

Ashley Arch culvert

5.1.46 The Ashley Arch on Datchet Common Brook is to be extended to accommodate the Scheme. As the works involve extending the existing culvert, the impact on the surrounding floodplain will be negligible and as such mitigation measures will not be required.

M4 junction 5

5.1.47 Widening works are proposed to the carriageway at junction 5. The impacts of the works are discussed below.

5.1.48 The works at junction 5 are not located in the floodplain (Flood Zone 1). This junction is not at fluvial flood risk, and therefore there will be no effects to third parties in regards to fluvial flooding.

5.1.49 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.50 There is no change in flood risk from reservoir, sewer and groundwater at junction 5 and therefore there will be no effects to third to parties.
**M4 junctions 5 – 4b**

5.1.51 Widening works are proposed to the carriageway, and works are also proposed to a side road between junctions 6 and 5. The impacts of the works are discussed below.

**Widening works**

5.1.52 The works between junctions 5 and 4b are not located in the floodplain (Flood Zone 1). The works between the junctions are not at fluvial flood risk, and therefore there will be no effects to third parties in regards to fluvial flooding.

5.1.53 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.

5.1.54 There is no change in flood risk from reservoir, sewer and groundwater between junctions 5 and 4b, and therefore there will be no effects to third to parties.

**Side road – Old Slade Lane**

5.1.55 The works at Old Slade Lane were assessed against EA flood modelling which shows that there are no significant changes between existing and proposed road alignment extent and as such mitigation measures will not be required.

5.1.56 Old Slade Lane AEP Flood Extent Assessment Map 514451-MUH-SR-ZZ-DR-DR-301323 in Annex C shows the 1% CC AEP.

**M4 junctions 4b – 3**

5.1.57 Widening works are proposed to the carriageway between junctions 4b and 3. The impacts of the works are discussed below.

**Widening works**

5.1.58 The works between junctions 4b and 3 are not located in the floodplain (Flood Zone 1). The works between the junctions are not at fluvial flood risk, and therefore there will be no effects to third parties in regards to fluvial flooding.

5.1.59 Although there is a change in the impermeable area, the effects on flood risk elsewhere are not anticipated to be significant. However, mitigation will be included to manage the surface water runoff from the new impermeable area. Discharge rates at outfalls will not exceed existing discharge rates. So far as practicable, discharge rates will be restricted to less than 5 l/s by flow control devices. Therefore, there will be no increase in surface water flooding risk to third parties in regards to drainage.
5.1.60 There is no change in flood risk from reservoir, sewer and groundwater between junctions 4b and 3, and therefore there will be no effects to third to parties.

**Frogs Ditch**

5.1.61 As a result of the ERA at between junctions 4 and 3, works will be required to Frogs Ditch. The existing ditch can be made hydraulically contiguous with upstream and downstream ditches by installing pipe culverts where required. The design will ensure that the ditch is geomorphically stable and maintains the current hydraulic capacity.
6 SURFACE WATER RUNOFF

6.1 Surface water run-off rates and volumes

6.1.1 The NN NPS paragraph 5.113 states: "The surface water drainage arrangements for any project should be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, unless specific off-site arrangements are made and result in the same net effect".

6.1.2 The Scheme will increase the volume of surface water runoff entering the drainage system due to an increase in road pavement area. This will be mitigated by designing attenuation into the drainage system to mimic the natural response of the catchment area as provided for in the Drainage Strategy Report (Doc Ref TR010019-7.5).

6.1.3 The Drainage Strategy provides that the runoff from the Scheme will not result in a net increase in discharge (i.e. discharge at outfalls with the Scheme in place will be at the same rate as the existing outfalls). Therefore, there will be no increase in flooding to third parties as a result of carriageway drainage discharge.
7 CLIMATE CHANGE

7.1 Effect of climate change

7.1.1 Climate change is discussed below in accordance with NN NPS 5.93:

“This should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account.”

7.1.2 NN NPS paragraph 4.41 also states that “Where transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood) against the 2080 projections at the 50% probability level.”

7.1.3 The life span of a road is typically 60 years; hence, drainage systems are assumed also to have a 60 year life span.

7.1.4 Figures from the 'UK Climate Projections: Briefing report', dated December 2010, indicate that a climate change allowance of between 10 to 30% should be used in relation to winter storms on the M4 between junctions 12 to 3.

7.1.5 A 20% allowance for climate change is to be applied in accordance with Agency’s guidance HD33/06. The climate change allowance is applied to runoff calculations for all additional paved areas, but not to runoff from paved areas within the Scheme that are unchanged, as these are not considered to be new "development" which requires consent.

7.1.6 The additional paved areas are the impermeable areas created when the carriageway is widened or existing paved areas within the Scheme which are not currently captured by an existing drainage pipe system, but will be following construction of the Scheme.

7.1.7 Proposed drainage collection and carrier pipe systems will be designed for a 1 in 5 year storm event with a 20% allowance for climate change on additional paved areas only, but not to runoff from paved areas within the Scheme that are unchanged in terms of their existing drainage collection system catchment.

7.1.8 Mitigation of climate change for surface water runoff is provided in 7.1.5 and the Drainage Strategy Report (Doc Ref TR010019-7.5).

7.1.9 The Scheme will have a neutral effect on fluvial flood levels as carriageway levels have not been designed at significantly different levels to the levels of the existing motorway. Widening extents are not significant in comparison to the current M4 motorway influence on fluvial flood levels.
7.1.10 From the above it can be see that climate change is to be mitigated for surface runoff from new paved areas by providing a 20% allowance and flood plain extents with climate change allowance have been mitigated for development areas within flood plains such as side roads. Therefore, there will be no increase in flood risk to and from the Scheme taking climate change into account.
8 FLOOD RISK MANAGEMENT MEASURES

8.1 How the site will be protected from flooding

8.1.1 The risk of flooding from carriageway will be alleviated by improving the existing drainage system where impermeable areas are increased and ensuring regular maintenance is undertaken during the lifespan of the Scheme using the outcome based approach to maintenance, based on Asset Maintenance and Operational Requirements (“AMOR”) and Technology Maintenance Management Manual (“TMMM”). This maintenance will be completed by an ASC who provides maintenance services on the SRN and secured by a requirement attached to the proposed development consent order.

8.1.2 Proposed drainage collection system will be designed for a 1 in 5 year storm event with a 20% allowance for climate change in accordance with the guidance in Section 6.2 of HD33/06. Existing carrier pipes would be checked for 1 in 5 year storm event with 20% allowance for climate change against new impermeable areas only.
9 RESIDUAL RISKS

9.1 Flood-related risks remaining after implementation of measures to protect the site from flooding

9.1.1 There will be a residual risk of reservoir flooding to the Scheme. As stated previously, the proposed works will not increase the reservoir flood risk to the M4. If reservoir flooding happens, the consequences have a potential to be high. There is a local emergency plan in place for the Queen Mother Reservoir, which is maintained by the Slough Borough Council.

9.1.2 There will be a residual risk of flooding to and from the Scheme during extreme storm events. During this situation, surface water runoff may overload the drainage system and any excess runoff may flood the motorway. This might cause ponding on the carriageway for a short duration. However, as an allowance for climate change is built into the assessment, it is considered that this risk will be mitigated by the use of overflows to SuDS such as soakaways.

9.1.3 There is also residual risk to the Scheme from failure or improper function of the drainage system due to blockages. This will be avoided by ensuring maintenance processes are strictly adhered to, all further remedial measures identified during the additional drainage asset surveys are implemented during the construction of the Scheme. The Scheme’s technology is to be used to inform drivers of flood conditions on the highway network and manage the risk to traffic by varying speed limits and closing lanes.

9.2 How, and by whom, these risks are to be managed over the lifetime of the development

9.2.1 The Agency will ensure regular maintenance is undertaken during the lifespan of the Scheme using the outcome based approach to maintenance based on AMOR and TMMM. This maintenance will be completed by an ASC service provider who provides maintenance services on the SRN.

9.2.2 As discussed in 9.1.3 above the Agency will also use the Scheme’s technology to reduce the risk to road users over the lifetime of the Scheme.
REFERENCES

General Arrangement drawings (514451-MUH-ML-ZZ-DR-GA-300325 to 354) This drawing includes the entire M4 J3-12 SM-ALR scheme.


Drainage Strategy Report (Doc Ref TR010019-7.5).

Interim Advice Note (IAN) 161/13 Managed Motorways, All Lanes Running, Dated August 2013.

Technical guidance to the National Planning Policy Framework, Dated March 2012.


Design Manual for Road and Bridges (DMRB), Volume 11, Section 3, Part 10, HD45/09, Road Drainage and Water Environment, dated November 2009.

Design Manual for Road and Bridges (DMRB), Volume 4, Section 2, Part 3, HD33/06, Surface and Sub-Surface Drainage System for Highways, dated May 2006.

Slough Borough Council Strategic Flood Risk Assessment (SFRA), Dated May 2012.

Royal Borough of Windsor & Maidenhead SFRA, dated April 2009.

The Wokingham Borough Council SFRA, dated February 2012.


# Abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>ALR</td>
<td>All Lane Running</td>
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<tr>
<td>CH</td>
<td>Chainage</td>
</tr>
<tr>
<td>DCO</td>
<td>Development Consent Order</td>
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<tr>
<td>DMRB</td>
<td>Design Manual for Roads and Bridges</td>
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<tr>
<td>EA</td>
<td>Environment Agency</td>
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<tr>
<td>EAR</td>
<td>Environmental Assessment Report</td>
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<tr>
<td>EB</td>
<td>Eastbound</td>
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<tr>
<td>ERA</td>
<td>Emergency Refuge Area</td>
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<tr>
<td>FRA</td>
<td>Flood Risk Assessment</td>
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<tr>
<td>GA</td>
<td>General Arrangement</td>
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<tr>
<td>HADDMS</td>
<td>Highways Agency Drainage Data Management System</td>
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<tr>
<td>IAN</td>
<td>Interim Advice Note</td>
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<tr>
<td>J</td>
<td>Junction</td>
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<tr>
<td>MAC</td>
<td>Managing Agent Contractor</td>
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<td>SM</td>
<td>Smart Motorway</td>
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<td>MP</td>
<td>Marker Posts</td>
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<td>NPPF</td>
<td>National Planning Policy Framework</td>
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<td>PINS</td>
<td>Planning Inspectorate</td>
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<tr>
<td>SFRA</td>
<td>Strategic Flood Risk Assessment</td>
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<tr>
<td>WB</td>
<td>Westbound</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
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<tr>
<td>FRA</td>
<td>A Flood Risk Assessment Report documents the assessment of risk of flooding from rivers, sea, surface water, groundwater, sewer and reservoir</td>
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<tr>
<td>EAR</td>
<td>An Environmental Assessment Report documents the findings of an Environmental Assessment.</td>
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<tr>
<td>Flood Zone 3</td>
<td>This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (&gt;1%), or a 1 in 200 or greater annual probability of flooding from the sea (&gt;0.5%) in any year.</td>
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<tr>
<td>Flood Zone 2</td>
<td>This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.</td>
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<tr>
<td>Flood Zone 1</td>
<td>Flood Zone 1 comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding.</td>
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<tr>
<td>1% CC AEP</td>
<td>1 in 100 or greater Annual Exceedance Probability of river flooding levels with climate change allowance adjustment.</td>
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</tbody>
</table>
Annex A: Widening Works and Flood Maps
Annex B: Description of HADDMS Flood Events Register
Annex C: Side Road Flood Extent Assessment Maps
Annex D: Reservoir Flood Maps