Wokingham Borough Council

SOUTH WOKINGHAM DISTRIBUTOR ROAD - CENTRAL & WESTERN SECTION

Flood Risk Assessment (Version 3)

66439-FRA-001 (V3)
FEBRUARY 2021

PUBLIC

Wokingham Borough Council

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REPORT (ISSUE 3) PUBLIC

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DATE: FEBRUARY 2021

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Flood Risk Assessment (Version 3)

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EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) was commissioned by Wokingham Borough Council (WBC) to assess the implications of the proposed Central and Western section of the South Wokingham Distributor Road (SWDR) on flood risk.

The proposed road alignment passes through Flood Zones 1, 2 & 3 associated with the Emm Brook and its tributaries, including the Luckley Brook. WSP has undertaken hydraulic modelling to determine the baseline fluvial flood extent, and to identify a strategy to mitigate the effects of the Central and Western section on flood risk.

These effects are mainly caused by loss of floodplain as the road alignment travels through it, the construction of a 40m bridge crossing over the Emm Brook and the infilling of a Thames Water Balancing Pond (required to facilitate both the SWDR and Consortium developments).

Model results show that by providing a floodplain compensation area comprising two basins in the land to be used as Suitable Alternative Natural Greenspace (SANG) to the south of the SWDR the effects can be mitigated.

The Environment Agency's Risk of Surface Water Flooding map indicates that most of the surface water flood risk is associated with the fluvial extents of the Emm Brook and its tributaries. The overland flow routes that are outside of these corridors will be accommodated within the scheme.

Intrusive geotechnical investigations show groundwater levels close to ground level in some areas. Appropriate construction techniques and mitigation measures should effectively manage the potential ground water flood risk.

The Scheme is classified as 'Essential Infrastructure' and it is located in Flood Zones 1, 2 & 3. As such, the Exception Test needs to be applied. Regarding part 1 of the test, the SWDR is included within Policy CP21 of Wokingham Borough Adopted Core Strategy and will facilitate residential growth and expansion to the south of Wokingham; helping the Borough to meet its objectives for housing, educational and economic growth, and job creation; and improving existing routes and creating new connections for pedestrians and cyclists.

In terms of part two, this Flood Risk Assessment includes details of measures to mitigate the effect of the proposals on flood risk onsite and offsite over its lifetime and accounting for the effects of climate change.

Based on the findings of this Flood Risk Assessment, the requirements of the National Planning Policy Framework have been achieved with respect to flooding. The proposals will not be at risk from flooding for the lifetime of the development, and furthermore, the proposals will reduce flood risk to others.

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INTRODUCTION

1 INTRODUCTION

1.1 APPOINTMENT AND BRIEF

1.1.1. This Flood Risk Assessment (FRA) was commissioned by Wokingham Borough Council (WBC) to assess flood risk associated with the Central and Western section (hereafter referred to as the "Scheme" or "Application Site") of the South Wokingham Distributor Road (SWDR). It includes details of proposed flood mitigation and refers to a surface water drainage strategy for the Scheme.

1.1.2. The Central and Western section is the third of four phases of the SWDR and runs along an east – west route from the Waterloo Road in the east (where it ties into Phase 2 – the Eastern Gateway) to a new Tesco Roundabout in the west (from which Phase 4 – the Western Gateway works will take place).

1.1.3. The SWDR forms part of Wokingham's Phase 2 of the Strategic Development Location (SDL) in the local plan. The SDL, along with the SWDR, is one of the areas intended for major development in Wokingham, with plans comprising approximately 1,750 homes and associated infrastructure, on a site of approximately 100 hectares (Ha).

1.1.4. A planning application for the SWDR was submitted in November 2019 (Planning Ref. 192928) and included a FRA, however subsequent design changes have resulted in this update to the FRA.

1.1.5. Alongside the planning application for the SWDR two separate planning applications (Planning Application Nos. 190914 and 191068) have been submitted by a Consortium of developers for a mixed-use development which will be accessed from the proposed SWDR. There has been close collaboration between WSP, Wokingham Borough Council and the Consortium to ensure that the mitigation measures proposed for the road are appropriate against the backdrop of the overall SWDR / Consortium developments.

1.2 OBJECTIVE OF STUDY

1.2.1. The aim of this FRA is to assess flood risks to the Application Site, which require assessment under the NPPF, and those that may arise as a result of the proposed development. Where risks are identified, mitigation measures are proposed to manage the risks over the lifetime of the development, accounting for the effects of climate change.

1.2.2. Hydraulic modelling has been undertaken in support of this FRA to understand the effects of the SWDR scheme on fluvial flood risk and develop mitigation proposals. This FRA should be read in conjunction with the hydraulic modelling report (Report Ref. 66439-HMA-01).

1.2.3. This FRA refers to a surface water drainage strategy produced by Tony Gee and Partners as a separate document. This document should also be read in conjunction with this FRA (refer to Report No. WMHP-TG-SRWG1-RP-HI-0504 Rev. P02 dated August 2020).

1.2.4. The FRA has been produced in line with the requirement of the National Planning Policy Framework (NPPF) and associated Flood Risk and Coastal Change Planning Practice Guidance (PPG), the Environment Agency Standing Advice, as well as through consultation with the Environment Agency, Wokingham Borough Council (WBC) [the Lead Local Flood Authority (LLFA)], and Thames Water (TW).

1.3 STUDY METHODOLOGY

1.3.1. The Environment Agency, WBC and TW have provided background information to inform the production of this FRA. Copies of correspondence received and exchanged with these stakeholders are provided within Appendix B of this FRA.

1.3.2. The report has also been informed by and makes reference where appropriate to the following documents and policies:

- The National Planning Policy Framework (NPPF) (2019);
- The NPPF Flood Risk and Coastal Change Planning Practice Guidance (PPG);
- Thames River Basin Management Plan (2015);
-
- Wokingham Borough Council Strategic Flood Risk Assessment (2012);
- Wokingham Borough Council Local Flood Risk Management Strategy (2015);
- Magic Map; and
- British Geological Survey Map

1.3.3. This FRA makes partial use of third-party information and contains Environment Agency information © Environment Agency.

1.3.4. This study contains public sector information licensed under the Open Government Licence v3.0.

1.4 CAVEAT

1.4.1. WSP has prepared this report in accordance with the instructions of our client, Wokingham Borough Council, for their sole and specific use relating solely to the above site. Any person who uses any information contained herein does so at their own risk and shall hold WSP harmless in any event.

1.4.2. Whilst this report was prepared using the reasonable skill and care ordinarily exercised by engineers practicing under similar circumstances and reasonable checks have been made on data sources and the accuracy of the data, WSP accepts no liability in relation to the report should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP. In any event, WSP shall not be liable for any loss or damages arising under or in connection to the use of this report.

2

SITE LOCATION

2 SITE LOCATION

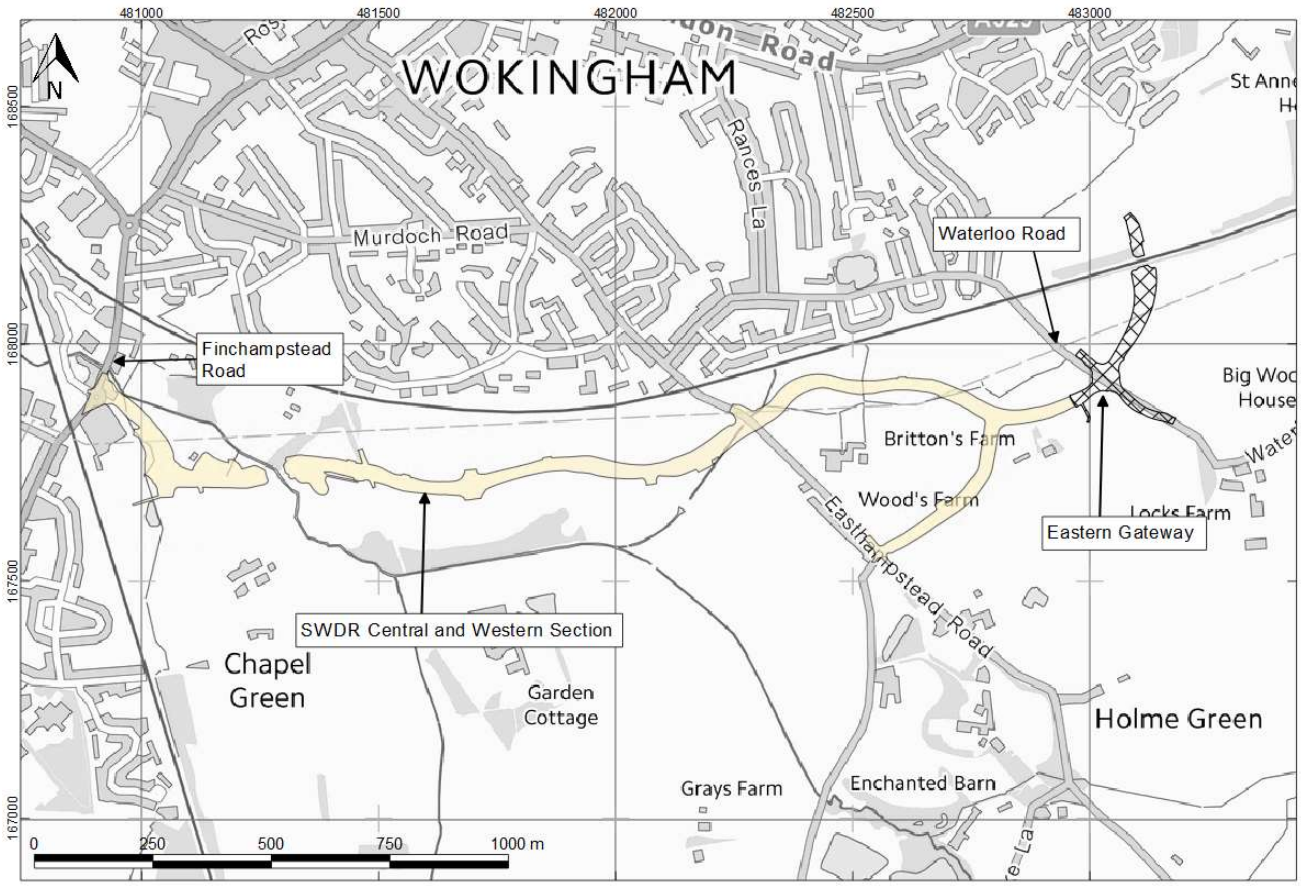
2.1 SITE LOCATION

2.1.1. The Application Site is located to the south of Wokingham, approximately 100m south of the Waterloo – Reading railway and is comprised of the Central and Western section of the SWDR. It extends from Waterloo Road in the east, where it ties in with the Eastern Gateway, to the Tesco superstore in the west, where a new link will be provided to Finchampstead Road. The proposed road will also form a junction with Easthampstead Road along its route.

2.1.2. The Ordnance Survey (OS) grid reference for the Application Site is 481875, 167749 and a nearby post code is RG40 2HF.

2.1.3. The overall site area, as contained within the red line boundary, is approximately 32 Ha and the approximate area of the Scheme alignment is 10 Ha. Refer to Drawing No. 66439-LOC-001 in Appendix A and Figure 2-1 below for a site location and proposed alignment plans.

Figure 2-1 - Proposed Alignment of the Southern Distributor Road



2.2 BACKGROUND TO THE SCHEME

2.2.1. The SWDR is being delivered in four phases:

- Phase 1: Montague Park;
- Phase 2: Eastern Gateway;

- **Phase 3: Central and Western section**; and
- Phase 4: Western Gateway.

2.2.2. The first phase of the SWDR was constructed as part of the Montague Park residential development. This comprised a section of new roadway (William Heelas Way) running southwards from the east-west orientated London Road and passing through Montague Park towards the Waterloo-Reading railway.

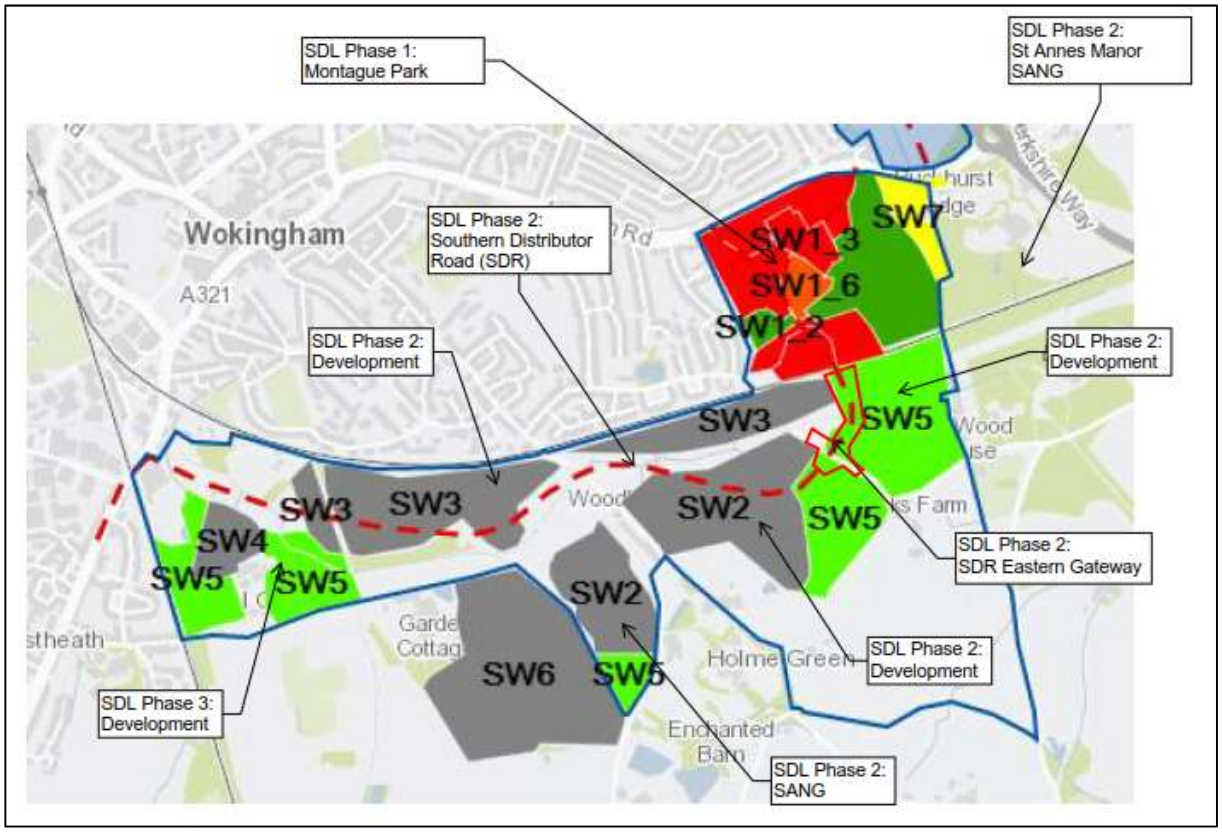
2.2.3. The second phase (Eastern Gateway) will extend William Heelas Way southwards over the railway line to connect via a new roundabout with Waterloo Road.

2.2.4. The third phase (the focus of this FRA) is the Central and Western section, which connects with the Eastern Gateway via the roundabout junction on Waterloo Road and the Western Gateway (in the west) via the existing Tesco roundabout on Finchampstead Road.

2.2.5. The fourth phase (Western Gateway), is expected to involve a series of online improvements to the section of roadway between the new Tesco roundabout and the roundabout junction between Molly Millars Lane and Finchampstead Road.

2.2.6. The Central and Western section is surrounded by land which will be developed through a consortium of developers as part of the Strategic Development Land (SDL). Refer to Figure 2-2 which indicates the main areas of development.

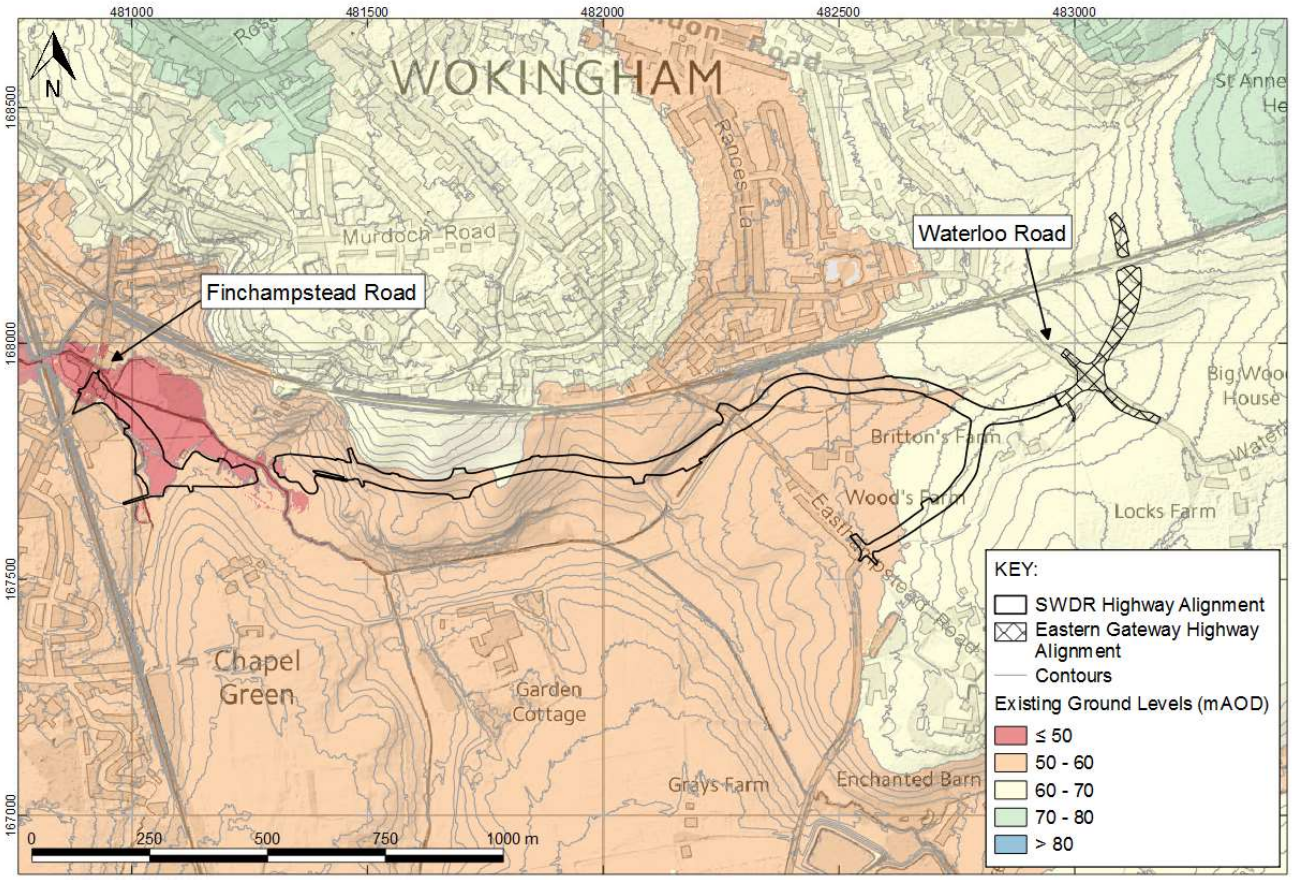
Figure 2-2 - SDL (extract from WBC South Wokingham Major Development Progress Map)



2.3 TOPOGRAPHY

2.3.1. The topography of the site, west of Easthampstead Road, falls from the north at approximately 65m Above Ordnance Datum (AOD) to approximately 49m AOD in the south, towards the alignment of the Emm Brook and its tributaries. To the east of Easthampstead Road, the site falls from north east, at approximately 62m AOD, to the south west and the Upper Emm Brook tributary, at approximately 54.8m AOD. Refer to Figure 2-3 below (also available in Appendix C), which shows the Environment Agency 1m LiDAR Digital Terrain Model (DTM) for the Application Site. Topographical Survey plans are provided in Appendix C.

Figure 2-3 - Environment Agency 1m LiDAR Digital Terrain Map



2.4 GEOLOGY AND HYDROGEOLOGY

2.4.1. British Geological Survey (BGS) maps indicate that the majority of the site is situated on bedrock of London Clay Formation comprising clay, silt and sand. A small section of the site is situated on bedrock of Bagshot Formation comprising sand. The bedrock is overlain by superficial deposits of Alluvium (clay, silt, sand and gravel) and Head (clay, silt sand and gravel) around the alignment of the watercourses.

2.4.2. European Soil Bureau (ESB) information suggests that much of the Application Site is covered with clayey loam to silty loam Prequaternary Marine / Estuarine Sand and Silt. Along the alignment of the watercourses there is clay to sandy loam Riverine Clay, and Floodplain Sands and Gravel, as well as clayey loam to sandy loam colluvium.

2.4.3. Environment Agency online sources indicate that the Application Site is located within a groundwater vulnerability zone of Minor Aquifer High in the west.

2.4.4. Due to the ground conditions identified by the BGS and ESB, infiltration techniques are considered unlikely to be suitable across the Application Site.

2.4.5. Groundwater monitoring has been undertaken at the site to determine the proximity of groundwater to ground level. High groundwater levels were recorded in all boreholes which were inspected from the period March 2018 to April 2019. Refer to Table 2-1 for the latest groundwater monitoring results. Refer to Drawing Nos. Geo-PC-187196-001 Sheets 1 to 3 in Appendix D for the locations of each borehole.

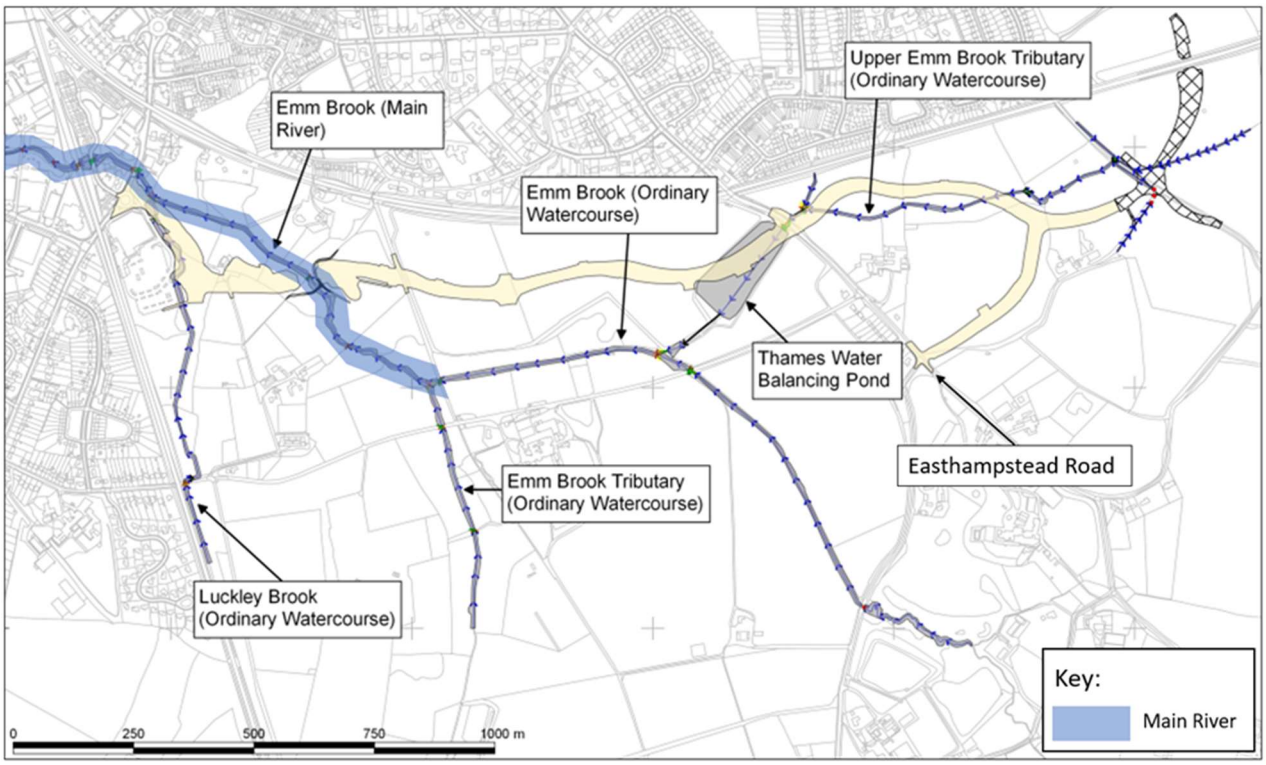
Table 2-1 - Groundwater Monitoring Levels (March 2018 – April 2019) – Extracted from WSP's Groundwater Level Monitoring Report (June 2019). Refer to Appendix D.

Borehole	Ground Level (mAOD)	Groundwater Level Minima (mAOD)	Groundwater Level Maxima (mAOD)	Difference between Ground Level and Maximum Recorded Groundwater Level (m)
BH105	50.14	48.57	49.95	0.19
BH106	57.21	55.61	56.35	0.86
BH112	60.55	57.60	59.82	0.73
BH113	62.41	61.04	62.08	0.33
BH114	62.58	60.31	62.57	0.01

2.5 EXISTING WATERCOURSES

The site is crossed east to west by the Emm Brook and several of its tributaries, including the Luckley Brook. Refer to Figure 2-4 below which shows the existing watercourses that cross the site.

Figure 2-4 – Proposed Highway and Existing Watercourses



2.5.1. The Emm Brook and its tributaries are classified as Ordinary Watercourse east of the confluence with the Emm Brook Tributary (also Ordinary Watercourse). WBC, as the Lead Local Flood Authority (LLFA), is responsible for consenting works on Ordinary Watercourses. The Emm Brook is classified as Main River to the west of the confluence with the Emm Brook Tributary. The Environment Agency is responsible for consenting works on Main Rivers.

2.5.2. To the west of Easthampstead Road there exists a TW Balancing Pond which was designed to alleviate flood risk associated with the Upper Emm Brook tributary which conveys combined fluvial and surface water runoff flows at this location. The fluvial flows emanate from the ordinary watercourse's small upstream catchment and the surface runoff flows emanate from two TW sewers (1200mm diameter) serving existing development to the north of the Waterloo – Reading railway.

2.6 EXISTING FLOOD DEFENCES

2.6.1. The Environment Agency online flood mapping does not show any known formal (Environment Agency maintained) flood defences protecting the site and no parts of the site are marked as Areas Benefitting from Flood Defences.

2.7 EXISTING SEWER AND DRAINAGE INFRASTRUCTURE

2.7.1. The Application Site is classified as a Greenfield site, currently draining via infiltration, groundwater flow and natural overland runoff towards field drains and the watercourse network outlined above.

2.7.2. Inspection of the TW Sewer Records included in Appendix B.3 confirms that a 1200mm diameter surface water sewer flows immediately to the south of, and parallel to, the Waterloo – Reading railway between Waterloo Road and Easthampstead Road.

2.7.3. A separate 1200mm diameter TW surface water sewer is conveyed below the railway line (via a 1750mm Network Rail culvert) immediately to the east of Easthampstead Road. The sewers combine to the south of the railway line and outfall into an open ditch that runs southwards to a confluence with the Upper Emm Brook tributary just upstream of Easthampstead Road. The ditch is culverted below Easthampstead Road and outfalls into the TW Balancing Pond referred to in 2.5.2 above.

2.7.4. A low flow channel passes through the base of the pond and most flows are constrained within this channel. At the downstream end of the basin there exists a 350mm culvert that bypasses a spillway and allows flows to re-enter the tributary further downstream.

2.7.5. Other surface water and foul water sewers are indicated on the TW mapping as being located in existing development to the north and west of the Application Site.

2.7.6. Refer to Appendix B.3 for copies of TW record plans.

2.8 HISTORIC FLOOD RECORDS

2.8.1. The Environment Agency Historic Flood map (refer to Product 4 data in Appendix B.1), shows two recorded incidents of fluvial flooding at the Application Site. These occurred in 1947 and 2007.

2.8.2. The Historic flood data provided by the Environment Agency confirms the source of this flooding was caused by '*channel capacity being exceeded (no raised defences)*'.

2.8.3. The 2012 Wokingham SFRA includes Maps 6a-2 and 6B which identifies flooding incidents within Wokingham Borough over the period 1947 to 2009. The mapping also shows that the Application Site was flooded in 1947 and 2007 from fluvial flooding from the Emm Brook.

2.8.4. WBC has reported incidents of flooding in Finchampstead Road and Gipsy Lane in various flood events that occurred from 2000 – 2014. Refer to Appendix B.2.

2.8.5. TW has previously confirmed that their flooding records indicate there have been no incidents of flooding as a result of surcharging sewers within the scheme area. Refer to Appendix B.3.

3

PROPOSED DEVELOPMENT

3 PROPOSED DEVELOPMENT

3.1 DEVELOPMENT PROPOSALS

Highway

3.1.1. The proposed alignment for the Scheme is shown in Figure 2-1 above and on Drawing No. WMHP-TG-SRWG1-SK-HI-0110-P02 in Appendix A.

3.1.2. The east-west orientated part of the Scheme is a single carriageway of circa 2.4 km length, located approximately 100 m south of, and broadly parallel to, the Waterloo - Reading railway (intersecting the existing Easthampstead Road).

3.1.3. The current access to the Tesco superstore will be realigned with the construction of a new four-arm roundabout (referred to as 'the new Tesco roundabout') on the east-west orientated part of the Scheme.

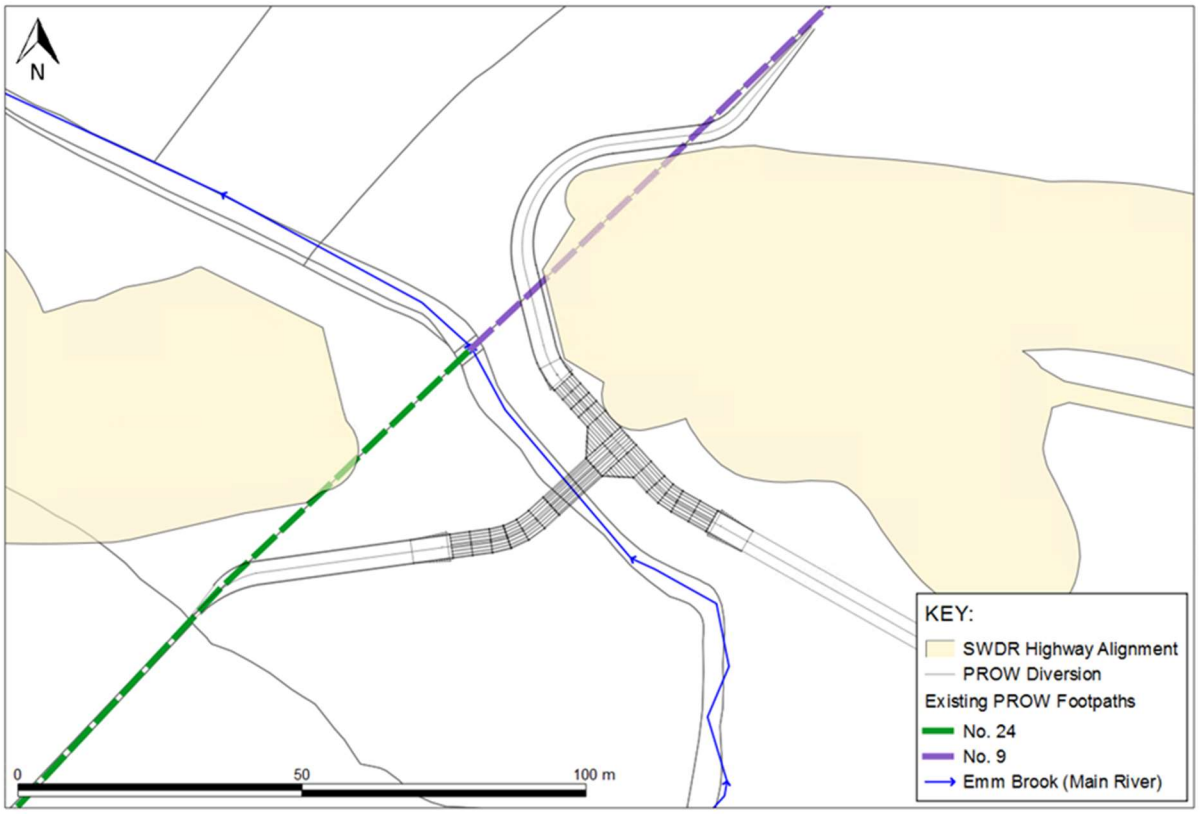
3.1.4. Where the proposed alignment crosses the Emm Brook to the east of the Tesco Roundabout, a new road bridge (referred to as 'the Emm Brook bridge') will be constructed. The Emm Brook bridge will be a single span structure of 15.3 m width and 40 m length, supported by abutments with an 8m offset from the banks of Emm Brook.

3.1.5. The carriageway will be flanked by a combined 3m wide footway and cycleway present on both sides of the east - west orientated part of the Scheme, and one side (the northwest side) of the link to Easthampstead Road. The footway and cycleway will be separated from the carriageway (through the majority of the route) by a 3m wide landscaped verge. A further verge of 1m width on the east-west orientated part of the Scheme and 0.5 m width on the link to Easthampstead Road will be developed on the outer edge of the footway and cycleway.

Public Right of Way Diversion

3.1.6. As part of the scheme proposals an existing Public Right of Way (PROW) (linked WOKI FP24 and WOKW FP9) is required to be diverted to facilitate the SWDR bridge. The PROW is proposed to be diverted to the south of the SWDR bridge, with a new footbridge being provided across the Emm Brook (refer to Figure 3-1 below). The PROW is also proposed to be upgraded to accommodate both cyclists and pedestrians. The footbridge is proposed to be a timber boardwalk with screw piles, and a clear span section where the footbridge crosses the channel.

Figure 3-1 - Location of PROW Diversion



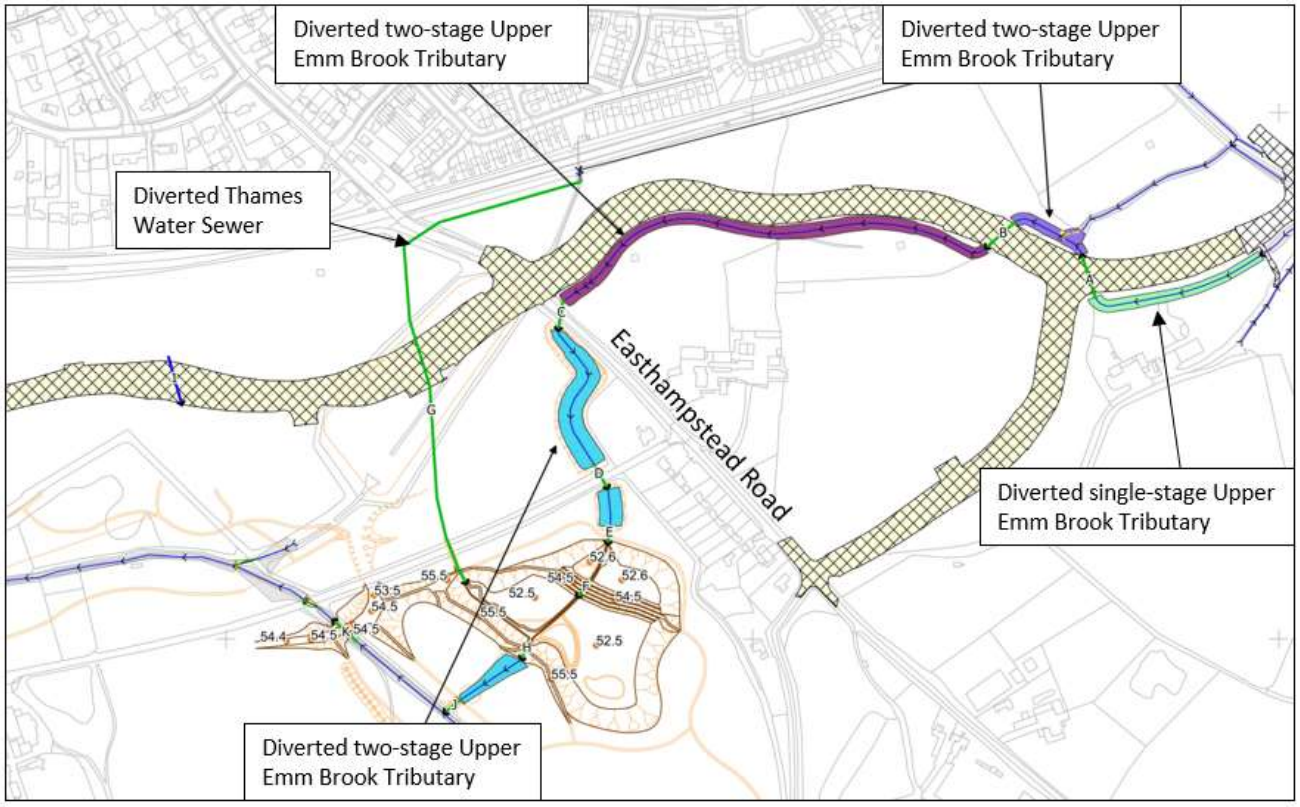
DITCH / SEWER RE-ALIGNMENT

3.1.7. The eastern part of the proposed road, in-between the tie-in with the Eastern Gateway roundabout on Waterloo Road and Easthampstead Road, crosses the existing Upper Emm Brook tributary at various locations (refer to Figure 2-4).

3.1.8. In order to satisfy technical and environmental requirements it is proposed to re-align and upgrade the existing Upper Emm Brook tributary, constructing a two-stage channel where possible, along the route shown on Drawing No. 66439-HMS-001 in Appendix E of the hydraulic modelling report (Report Ref. 66439-HMA-01). Refer to Figure 3-2 below.

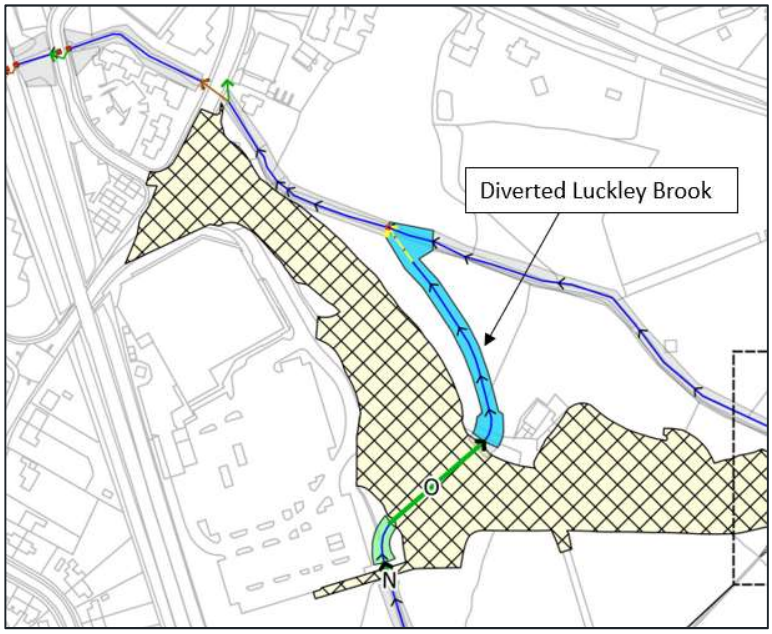
3.1.9. Section 2.7 above describes how flow conveyed via two TW sewers currently discharges into an open ditch to the south of the Waterloo – Reading railway before being combined with fluvial flows in the Upper Emm Brook tributary immediately upstream of Easthampstead Road. As part of the scheme it is proposed to separate these flows and culvert them to the south, mainly following proposed access routes that will be constructed as part of the Consortium development, towards a proposed flood compensation area that will be located within a proposed Suitable Alternative Natural Greenspace (SANG) (refer to Figure 3-2 and Flood Compensation Area description below).

Figure 3-2 - Proposed Upper Emm Brook Tributary and Thames Water Sewer Diversions



3.1.10. Luckley Brook, which flows south to north and has a confluence with the Emm Brook at the downstream end of the Scheme will also be diverted to the north of the proposed SWDR route as part of the proposals. Refer to Figure 3-3 below.

Figure 3-3 - Proposed Luckley Brook Diversion



INFILLING OF THAMES WATER BASIN

3.1.11. Part of the Central and Western section road alignment passes through the TW Balancing Pond located to the west of Easthampstead Road. This proposal requires infilling of the pond which will subsequently remove the attenuation potential provided for extreme flood events. The infilling is also required to satisfy Consortium development requirements.

3.1.12. TW has been consulted on the requirement to infill the pond and has confirmed that the proposals are acceptable. Refer to TW correspondence dated 1st May 2019 in Appendix B.3.

FLOOD COMPENSATION AREA

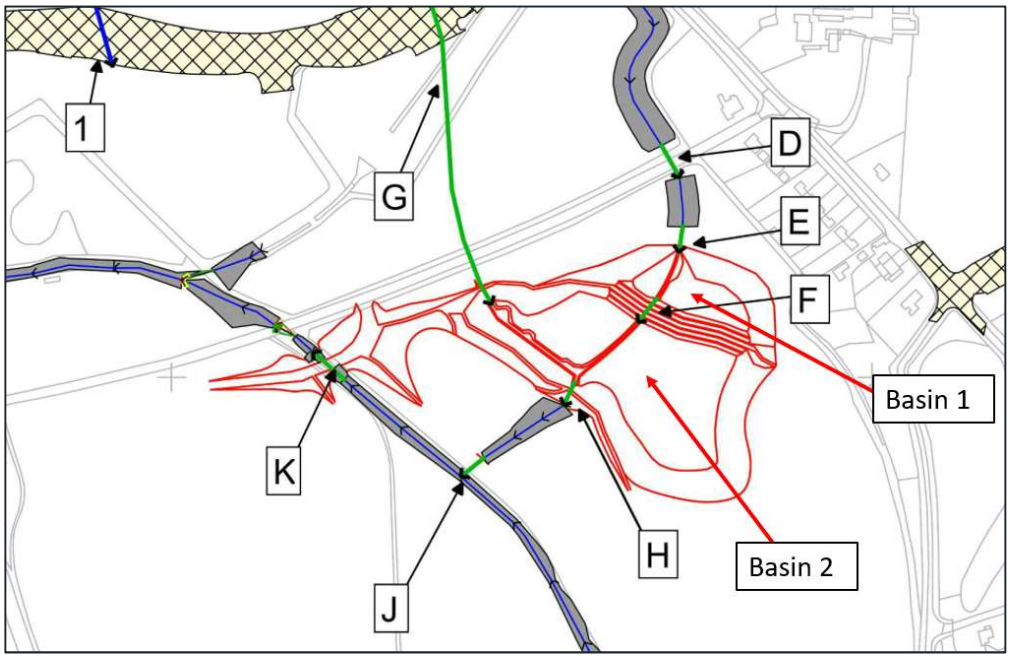
3.1.13. In addition to the infilling of the TW Balancing Pond the proposed road alignment passes through areas of Flood Zone 2 & 3 associated with the Emm Brook (Main River), including at the location of the proposed 40m bridge crossing east of the new Tesco Roundabout, and its tributaries (Ordinary Watercourses), particularly within the western half of the scheme.

3.1.14. In order to mitigate the increase in flood risk associated with the scheme, and compensate for the loss of flood storage, it is proposed to construct an online flood compensation area, made up of two basins, within an area of land proposed to be used as a SANG to the south of the SWDR.

3.1.15. To utilise the flood compensation area the Upper Emm Brook tributary will be diverted immediately to the west of Easthampstead Road, along a new southerly route mainly following land boundaries to optimise developable land, towards the SANG where it will discharge via a 1.5m x 1.2m rectangular culvert into the first basin (refer to Figure 3-4). These flows will discharge into a low flow channel which has an approximate depth of between 100-300mm.

3.1.16. The outlet of the first basin is via a 300mm diameter culvert (Culvert Ref. F on Figure 3-4) and a spill provided via an embankment which separates the two basins. The second basin receives flows from the first basin and the outlet of the TW culvert.

Figure 3-4 - Location of Flood Compensation Area (Extract of Drawing No. 66439-CUL-001)



3.1.17. The eastern FCA basin has an approximate area of 5,900m^2 and a maximum depth of approximately 2.2m (~8,940m^3); the western FCA basin has an approximate area of 20,500m^2 and a maximum depth of 3.4m (~39,860m^3). This compares with an approximate area of the TW pond of 20,325m^2 and a maximum depth of approximately 2.3m (~30-35,000m^3).

3.1.18. An area of ground raising is required along the lowest (western) edge of the compensation area (i.e. in-between the second basin and the Emm Brook (Ordinary Watercourse)) to provide sufficient freeboard above design water levels. The embankment will also prevent flows from overspilling the basin, flowing directly into the Emm Brook and, potentially, increasing flood risk on Ludgrove School lane. Measures will need to be taken to remove the risk of ingress from groundwater into the compensation area, e.g. by means of a clay or concrete liner.

3.1.19. A 450mm diameter culvert (Culvert Ref. H on Figure 3-4) is proposed at the outlet of the second basin and will act as a flow control. The culvert will discharge into a new channel which will discharge via a 525mm diameter culvert into the existing Emm Brook (Ordinary Watercourse).

3.1.20. A 2.1m diameter culvert is also proposed beneath the sports hub access road and an embankment upstream of the access road to restrict flows on the Emm Brook (Ordinary Watercourse) to make use of available storage within the SANG.

3.2 VULNERABILITY CLASSIFICATION

3.2.1. The vulnerability classification of the Scheme is defined in Table 2 of the Flood Risk and Coastal Change PPG to the NPPF. The purpose of the vulnerability classification is to identify appropriate land use activities relative to the level of flood risk at a site.

3.2.2. According to Table 2 the Scheme is classified as 'Essential Infrastructure' as it will provide essential transport links to new development proposed as part of the SDL.

3.3 SEQUENTIAL AND EXCEPTION TESTS

3.3.1. Table 3 of the PPG identifies different land use vulnerabilities that are appropriate within each of the Flood Maps for Planning flood risk classification, see Table 3-1 below.

Table 3-1 - Flood risk vulnerability and flood zone compatibility (PPG Table 3)

Flood Zone	Zone 1	Zone 2	Zone 3A	Zone 3B
Essential Infrastructure	Development is appropriate	Development is appropriate	Exception test required	Exception test required

3.3.2. As the proposals are classified as Essential Infrastructure and are located partly within Flood Zone 3 the Exception Test needs to be applied.

3.3.3. The purpose of the Exception Test is to demonstrate how flood risks to people and property will be proportionately managed, while enabling necessary development to progress, where lower flood risk sites are not available.

3.3.4. For the Exception Test to be passed, both of the following parts of the test must be passed:

- "it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared"
- "a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall"

3.3.5. As far as part one is concerned Wokingham Borough Local Development Framework Adopted Core Strategy Development Plan Document (January 2010) includes a specific policy (Policy CP21) for the South Wokingham SDL.

3.3.6. Part 7 of Policy CP21 states the following:

'Improvements to transport capacity along the A321 and A329 including the provision of south Wokingham relief road from the vicinity of the Coppid Beech roundabout to the Finchampstead Road'

3.3.7. The completed SWDR will facilitate residential (and associated infrastructural) growth and expansion to the south of Wokingham. It will help the Borough meet its objectives for housing, educational and economic growth, and job creation. The new road will also improve existing routes and create new connections for pedestrians and cyclists.

3.3.8. As far as part two is concerned this Flood Risk Assessment includes details of measures to mitigate the effect of the proposals on flood risk onsite and offsite over its lifetime and accounting for the effects of climate change.

3.3.9. This FRA therefore demonstrates that both parts of the Exception Test are met.

4

DEFINITION OF THE FLOOD HAZARD

4 DEFINITION OF THE FLOOD HAZARD

4.1 INTRODUCTION

4.1.1. The following section provides an overview of flood risk to the Application Site, and risk arising to and from the Scheme. An assessment has been undertaken in accordance with the NPPF Flood Risk and Coastal Change Planning Practice Guidance (PPG) and this assessment has taken due consideration of the necessary policy and guidance documents.

4.1.2. Flood risks have been qualitatively assessed on the following basis:

- Negligible risk (e.g. coastal flood risk posed to inland areas);
- Very Low risk (e.g. Flood Zone 1 or <0.1% annual probability of flooding from surface water);
- Low risk (e.g. Flood Zone 2 or between 0.1% and 1.0% annual probability of flooding from surface water);
- Medium risk (e.g. Flood Zone 3a or between 1.0% and 3.3% annual probability of flooding from surface water); and,
- High risk (e.g. Flood Zone 3b or >3.3% annual probability of flooding from surface water).

4.1.3. Reference to consultation with the Environment Agency, WBC and TW is made in the following sections and correspondence is attached in Appendix B.

4.2 FLOODING FROM COASTAL AND TIDAL SOURCES

4.2.1. Tidal and coastal flooding occurs when sea levels rise above the level of the land or beyond the operational level of flood defences.

4.2.2. The Environment Agency's detailed flood mapping (refer to Environment Agency Product 4 data in Appendix B.1) shows that the Application Site is located within Flood Zone 1, 2 and 3 but does not distinguish between fluvial and tidal risk.

4.2.3. Environment Agency climate change allowances[1] identify that current sea levels should be subject to a 1.6m increase in the Thames area by 2115. Review of the Environment Agency's current Extreme Sea Levels information identifies the present day 1 in 10,000 (0.01%) sea level is 6.3 m AOD at the Thames Estuary, which is the highest tidal level in the South East region. Increasing this to account for climate change gives a 2115, 1 in 10,000 flood level of 7.8 m AOD. Existing ground levels at the Application Site are above 40m AOD, and therefore the site will not be affected by the predicted increases in sea level rise.

4.2.4. Based on the information reviewed the Application Site is not considered to be at risk of flooding from tidal or coastal sources.

[1] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

4.3 FLOODING FROM FLUVIAL SOURCES

4.3.1. Fluvial flooding occurs when flows within a watercourse exceed the capacity of the watercourse causing out of bank flows.

4.3.2. The Environment Agency's current Flood Map for Planning (included in the Flood Map Pack at Appendix B.1) shows that the Application Site lies mainly in Flood Zone 1. Flood Zone 1 is classified as areas with an annual probability of flooding from rivers of less than 0.1% (1 in 1,000 AEP).

4.3.3. There are also areas alongside the Emm Brook and its tributaries which are located in Flood Zones 2 and 3. Flood Zone 2 is classified as those areas with an annual probability of flooding from rivers of between 1% and 3.3% and Flood Zone 3 is classified as areas with an annual probability of flooding from river of more than 3.3%.

4.3.4. To assess the effects of the proposed Central and Western section of the SWDR, and to predict the effects of increased fluvial flows as a result of climate change, hydraulic modelling has been carried out as part of the flood risk assessment process.

4.3.5. The post development modelling for the latest Scheme is provided within a separate report (refer to Report No. 66439-HMA-001) and builds on the previous modelling work undertaken.

HYDRAULIC MODELLING

4.3.6. Hydraulic modelling has been undertaken to develop the proposed mitigation, as described above, to support this Flood Risk Assessment. As stated, a separate modelling report has been prepared to describe the modelling and its results. The results of the modelling (Report No. 66439-HMA-01) are summarised below.

4.3.7. The effects of the scheme are mainly caused by loss of floodplain as the highway alignment travels through it, the diversion of the PROW, the construction of a 40m bridge crossing over the Emm Brook, east of the new Tesco Roundabout (the western extent of the Central and Western section), and the infilling of the TW Balancing Pond (required to facilitate both the SWDR and Consortium developments).

4.3.8. The difference in predicted flood levels between the Baseline and Post Development models, at key locations across the site, for the 1% AEP + 70% climate change event are presented in Figure 4-1 and Table 4-1.

Figure 4-1 – Results of Hydraulic Modelling of Flood Compensation (extract of Drg. No. 66439-HMR-206-D)

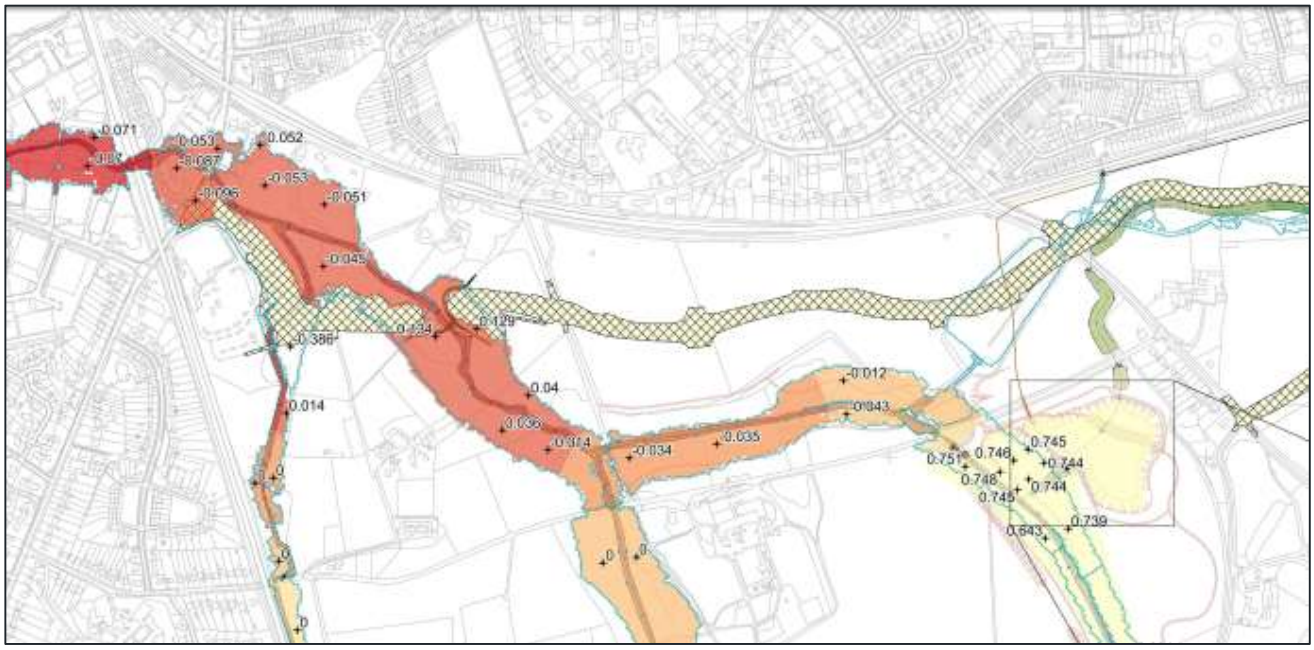


Table 4-1 - Difference between Baseline and Post Development Predicted Flood Levels (1% AEP + 70% Climate Change)

Location Number	Location Description	Baseline Model: Flood Levels (mAOD)	Post Development Model: Flood Levels (mAOD)	Difference (m)
1	Upstream of sports hub access road	53.350	54.101	0.751
2	Downstream of sports hub access road	52.134	52.091	-0.043
3	Upstream of the proposed road bridge and PROW footbridge over Emm Brook	50.521	50.655	0.134
4	Luckley Brook adjacent to Tesco	50.730	50.744	0.014
5	North of Emm Brook (Main River) east of Finchampstead Road	50.382	50.330	-0.052

4.3.9. The results from the hydraulic modelling show that flood levels have not increased for much of the site. However, there are localised areas, upstream of where restrictions are proposed (culvert and embankment at sports hub access road, and the proposed bridge over the Emm Brook), where flood levels have increased.

4.3.10. Table 4-1 shows that flood levels will increase by approximately 750mm within the SANG area upstream of the sports hub access road, as designed. However, the increased extents and levels are contained within SANG area and will not extend upstream of Heathlands Road, which is at the southern boundary of the SANG.

4.3.11. Future development, as part of the Consortium masterplan, is not proposed within the SANG area (refer to Report Ref. 66439-HMA-01 and Drawing No. 66439-HMR-208 in Appendix F which shows the Consortium masterplan and the 1% AEP plus 70% climate change flood extents) and flood risk to existing properties is not increased as part of the mitigation measures.

4.3.12. Table 4-1 also shows that flood levels are increased by approximately 135mm upstream of the proposed road bridge and PROW footbridge over the Emm Brook. However, flood risk to existing properties is not increased. Furthermore, the results of the post development modelling have been shared with Persimmon to ensure that any future masterplan within the area takes regard of the updated flood extents.

4.3.13. Fundamentally, despite increases in flood levels at key points along the SWDR route the modelling shows betterment in terms of flood extents and levels downstream of the Application Site (refer to Report No. 66439-HMA-01 and Drawing No. 66439-HMR-208 in Appendix E).

4.3.14. The highway proposals will raise the carriageway level above the flood level (1% AEP plus 70% climate change) for the majority of the route, except at the tie in point at the western end of the Central and Western section. From the model results this section of road will be free from flooding up to at least the 5% AEP.

4.3.15. The Post Development option is therefore considered to provide sufficient compensation to mitigate the effect of the scheme on flood risk

4.3.16. As the Application Site is at risk of fluvial flooding, the mitigation measures highlighted in this section will need to be implemented in advance of the road construction where it effects flood risk, and the residual risk of fluvial flooding (for events beyond the design standard) will need to be managed through appropriate emergency planning, as necessary.

4.4 FLOODING FROM PLUVIAL / OVERLAND FLOW SOURCES

4.4.1. Surface water flooding may arise during extreme storms, when ground may become saturated, and the drains and sewers which carry away surface water may not be able to accommodate these flows.

4.4.2. The Environment Agency's Risk of Surface Water Flooding mapping indicates surface water flow routes within the Application Site. These flow routes generally follow the alignment of the watercourses that cross the Application Site and are generally accommodated within the fluvial flood zone outlines. Refer to Appendix B.1 for the Flood Map Pack.

4.4.3. As part of the Scheme, diversions of the Upper Emm Brook tributary and Luckley Brook are proposed. Therefore, the surface water flow routes in relation to these watercourses, as indicated on

Environment Agency mapping, are likely to change. Culverts are proposed beneath the highway where the diverted tributaries are required to cross the proposed SWDR which will accommodate both fluvial and surface water flows.

4.4.4. As mentioned in Section 3.1, flood mitigation in the form of an online flood compensation area and associated features are proposed within the SANG to restrict flows on the Emm Brook (Ordinary Watercourse) and make use of storage available within the SANG. Whilst the primary function of this mitigation is to compensate for the effect of the Scheme on fluvial flood risk it will also serve to mitigate the risk of surface water flood risk where it is associated with the Emm Brook and its tributaries.

4.4.5. Separate to the surface water flood risk associated with the watercourses, an overland flow route exists with a medium risk (annual probability of flooding between 1% and 3.3%), approximately 160m to the west of the Easthampstead Road Balancing Pond. This overland flow route flows from north to south, towards the Emm Brook (Ordinary Watercourse) and is associated with a natural valley feature in the topography. A culvert (600mm diameter) is proposed below the highway in this location to serve future Consortium development needs and will ensure that this flow route is maintained.

4.4.6. A second medium risk overland flow route exists north of the proposed bridge over the Emm Brook. This overland flow route enters the site from the north and generally follows the alignment of an existing Public Right of Way. This overland flow route will be intercepted and managed through the provision of a toe drain which is required at the base of the road embankment. The toe drain will direct flow towards the Emm Brook.

4.4.7. Management of surface water arising from the proposed highway is explained within a separate document (Report Ref. WMHP-TG-SRWG1-RP-HI-0504 Rev. P02) produced by Tony Gee and Partners.

4.4.8. Consequently, it is considered that the Scheme will not be at risk of pluvial flooding, and the proposals will not increase pluvial flood risk to others. Pluvial flood risk will not adversely impact access and egress from the site, and will not pose a significant residual risk.

4.5 FLOODING FROM GROUNDWATER SOURCES

4.5.1. Groundwater flooding occurs when the water table rises above the level of the ground.

4.5.2. The site is situated on London Clay Formation bedrock which is associated with low risk of ground water flows. However, groundwater flows may be associated with superficial deposits of Alluvium (clay, silt, sand and gravel) and Head (clay, silt sand and gravel) that generally follow the alignment of the existing watercourses.

4.5.3. The groundwater level monitoring report, Report No. 70032441-001 (an extract of which has been provided in Appendix D), has confirmed that groundwater is less than 1m below ground level for all the boreholes that were tested. The shallowest depth was found at a borehole (BH114) in the eastern part of the site where groundwater was recorded within 0.01m of the ground surface. A depth of 0.2m was also recorded close to the proposed bridge over the Emm Brook (BH105).

4.5.4. The proposed road will be elevated along its length and as such the risk of flooding from groundwater to the road will be low. However, the risk of groundwater flooding to any SuDS

features will be moderate and as such mitigation measures should be incorporated to ensure that this risk of flooding is reduced to an acceptable level.

4.5.5. The Scheme will be designed so that there is no increase in groundwater flood risk to others, as it will be designed to enable groundwater flows as appropriate. Appropriate construction techniques and mitigation measures should effectively manage the potential groundwater flood risk.

4.6 FLOODING FROM SEWER AND DRAINAGE INFRASTRUCTURE SOURCES

4.6.1. The TW and WBC Asset records show that there are only a few surface water sewers located within the Application Site. Refer to Appendix B.3 for TW and WBC third party drainage records. As described in Section 2.7 above, these are mostly located to the east of Easthampstead Road.

4.6.2. TW has previously confirmed that their flooding records indicate there have been no incidents of flooding as a result of surcharging sewers within the scheme area. Refer to Appendix B.3.

4.6.3. The WBC SFRA map 6b (Historical Spot Flooding), included in Appendix B.2, shows an incident of '*house and garage flooding outside flood zones*' in the vicinity of the White Horse public house along Easthampstead Road to the south of the Application Site during 2007.

4.6.4. The risk of flooding from this source to the Application Site is considered to be low.

4.6.5. The Scheme comprises a largely raised road alignment with a drainage system that will allow surface water flows to be conveyed and discharged to watercourses rather than to adopted TW Sewers.

4.6.6. As described in Section 3.1 above, the scheme includes a proposal to culvert the open ditch into which the 1200m diameter TW surface water sewers are discharged south of the Waterloo – Reading railway. Two 1200mm diameter sewers are proposed to convey the combined flows from these sewers southwards and into the SANG area as part of the Consortium development plans. Design of the sewers should ensure that they can accommodate design flows to ensure the risk of flooding is minimised.

4.6.7. Once they reach the SANG area the sewers will discharge into the second flood compensation area basin before outfalling into the existing Emm Brook tributary.

4.6.8. With the inclusion of the proposed mitigation it is not considered that the risk of flooding resulting from sewer and drainage infrastructure sources as a result of the Scheme will be increased.

4.7 FLOODING FROM ARTIFICIAL SOURCES

4.7.1. The Environment Agency's online map (available online at https://flood-warning-information.service.gov.uk/long-term-flood-risk/map accessed in October 2020) indicates that the Application Site lies within the extreme inundation area of a reservoir (Queen's Mere). The extent of flooding indicated on the plan is restricted to the Emm Brook and the Emm Brook tributary.

4.7.2. Hydraulic modelling underpinning the Risk of Flooding from Reservoirs mapping is based on an instantaneous and complete failure of a control dam at any given reservoir. Consequently, the peak extents shown on the Environment Agency's mapping represent a conservative estimate of the potential impact of reservoir failure, an event which has a very low probability of occurring.

4.7.3. Furthermore, there has been no loss of life in the UK from reservoir flooding since 1925. In accordance with the Reservoirs Act 1975 all large reservoirs must be inspected and supervised by reservoir panel engineers. In England the Environment Agency is the enforcement authority for the Reservoirs Act 1975, and in this role they ensure that reservoirs are inspected regularly and essential safety work is carried out.

4.7.4. The Application Site is not located within the vicinity of a canal and is not influenced by canal infrastructure.

4.7.5. In light of the management requirements in relation to reservoirs the risk of flooding to the Scheme is considered to be low, although there remains a residual risk of reservoir flooding. However, the proposed road will be elevated along its length above the 1% AEP plus 70% climate change fluvial event and therefore is unlikely to be subject to a residual risk of reservoir flooding.

4.7.6. The Scheme will not increase flood risk from artificial sources to others. Flood risk from artificial sources will not adversely impact access and egress from the Site, and will not pose a significant residual risk.

5

CLIMATE CHANGE

5 CLIMATE CHANGE

5.1 BACKGROUND INFORMATION

5.1.1. As explained in the Climate Change Adaptation Sub-Committee Progress Report 2014, increased flood risk is the greatest threat to the UK resulting from climate change. Models of the climate system suggest floods of the type experienced in England and Wales in Autumn 2000, and between December 2013 and February 2014, have become more likely because of increased concentrations of greenhouse gases in the atmosphere.

5.1.2. More frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall could be expected. Sea levels are also expected to continue to rise.

5.1.3. Environment Agency guidance '*Flood risk assessments: climate change allowances'* last updated in July 2020, provides up to date information on expected changes in rainfall, river flows and sea level rise as a consequences of climate change.

5.1.4. For peak rainfall the Environment Agency guidance provides an upper end and central allowance depending on epoch; the guidance recommends assessing both the central and upper end allowances to understand the range of possible impacts.

5.2 DEVELOPMENT LIFESPAN

5.2.1. A typical lifespan for a residential development is 100 years. However, for other types of developments an assessment needs to be made to determine the lifespan. As the proposed development is for a proposed highway which will support a future residential development 100 years is appropriate.

5.2.2. Based on this the contingency allowances for climate change that are applicable to this Application Site, and agreed with WBC are:

Peak River Flow:

- Central – 25%
- Higher Central – 35%
- Upper End – 70%

Peak Rainfall Intensity:

- Central – 20%
- Upper End – 40%

5.3 IMPACT OF CLIMATE CHANGE ON DEVELOPMENT

5.3.1. Surface water flood risk is generally expected to increase in the future because of climate change and the expected increase in extreme rainfall events. In order to consider the latest climate change guidance, the proposed surface water drainage strategy, as designed by Tony Gee and Partners, is required to cater for the 1% AEP rainfall event, including a 40% climate change allowance.

6

SURFACE WATER DRAINAGE STRATEGY

6 SURFACE WATER DRAINAGE STRATEGY

6.1 SURFACE WATER DRAINAGE STRATEGY

6.1.1. A surface water drainage strategy has been prepared by Tony Gee and Partners for the proposed SWDR and is detailed in Report No. WMHP-TG-SRWG1-RP-HI-0504 Rev. P02 dated August 2020.

6.1.2. In summary, the strategy comprises a linear system of features and gullies located within the highway corridor that will capture runoff from the road and discharge it via a filter drain to detention basins or, via the Upper Emm Brook Tributary, to the flood compensation area located with the SANG and discussed earlier in this report.

The strategy, including proposed flows and water treatment measures, are discussed in more detail in Report No. WMHP-TG-SRWG1-RP-HI-0504 Rev. P02.

6.2 ADOPTION AND MAINTENANCE

6.2.1. As the proposed SWDR will be owned by Wokingham Borough Council, the proposed drainage elements for the highway will be adopted Wokingham Borough Council.

6.2.2. The general maintenance regime of the proposed system should be in accordance with manufacturer's recommendations, and subject to agreement with the Highways Authority.

6.2.3. Regular inspection and maintenance is required to ensure the effective long-term operation of SuDS; these requirements are detailed in the SuDS Manual CIRIA 753. An extract is provided within Table 6-1.

Table 6-1 - Operation and Maintenance Schedule (extracted from Table 16.1 and 17.1 of the SuDS Manual)

SuDS Feature	Maintenance Schedule	Required Action	Typical Frequency
Basin	Regular Maintenance	Remove litter and debris	Monthly
		Cut grass – for spillways and access routes	Monthly (during growing season), or as required
		Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
		Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
		Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
		Inspect banksides, structures, pipework	Monthly

		etc for evidence of physical damage	
		Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
		Check any penstocks and other mechanical devices	Annually
		Tidy all dead growth before start of growing season	Annually
		Remove sediment from inlets, outlet and forebay	Annually or as required
		Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23 of The SuDS Manual)
	Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required
		Prune and trim any trees and remove cuttings	Every 2 years, or as required
		Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
	Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
		Realignment of rip-rap	As required
		Repair/rehabilitation of inlets, outlets and overflows	As required
		Re-level uneven surfaces and reinstate design levels	As required
Swale	Regular Maintenance	Remove litter and debris	Monthly or as required

		Cut grass – to retain grass height within specified design range	Monthly (during growing season) or as required
		Manage other vegetation and remove nuisance plants	Monthly at start, then as required
		Inspection of inlets, outlets and overflows for blockages, clear if required	Monthly
		Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
		Inspection of vegetation coverage	Monthly for 6 months, quarterly for 2 years and then every 6 months
		Inspection of inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Every 6 months
	Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required or if base soil is exposed over 10% or more of the swale treatment area
	Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required
		Re-level uneven surfaces and reinstate design levels	As required
		Scarify and spike topsoil layer to improve infiltration performance. Break up silt deposits and prevent compaction of the soil surface	As required
		Remove build-up of sediment on upstream gravel trench, flow	As required

		spreader or at top of filter strip	
		Remove and dispose of oils or petrol residues using safe standard practises	As required
Filter Drain	Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly or as required
		Inspection of filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
		Inspection of pre-treatment systems, inlets and perforated pipework for silt accumulation and establish appropriate silt removal frequencies	Every 6 months
		Removal of sediment for pre-treatment devices	Every 6 months or as required
	Occasional Maintenance	Removal or control of tree roots where they are encroaching the sides of the filter drain using recommended methods	As required
		Clear perforated pipework of blockages	As required

6.2.4. Flow control devices, such as orifice plates and hydrobrakes, should be inspected and maintained every 4 – 6 months (subject to agreement with the Highways Authority), and as required after significant leaf fall and significant rainfall events to minimise the risk of blockages.

7

CONCLUSIONS

7 CONCLUSIONS

7.1.1. This Flood Risk Assessment (FRA) was commissioned by WBC to assess the implications of the proposed Central and Western section of the South Wokingham Distributor Road (SWDR) on flood risk. To this end WSP has prepared a site-specific Flood Risk Assessment (FRA), which refers to a surface water drainage strategy, undertaken by Tony Gee and Partners, in accordance with the guidelines set out in the National Planning Policy Framework (NPPF).

7.1.2. The SWDR forms part of Wokingham's Phase 2 of the Strategic Development Location (SDL) in the local plan. The Central and Western section is the third of four phases of the SWDR and runs along an east – west route from Waterloo Road to the east to a new Tesco Roundabout to the west.

7.1.3. The Ordnance Survey (OS) grid reference for the Application Site is 481875, 167749 and a nearby post code is RG40 2HF. The overall site area, as contained within the red line boundary is approximately 32 Ha and the approximate area of the alignment is 10 Ha.

7.1.4. The proposed road alignment passes through Flood Zones 1, 2 & 3. Flood Zones 2 & 3 are associated with the Emm Brook (Main River) and its tributaries, including the Luckley Brook, which are all ordinary watercourses.

7.1.5. The Environment Agency's Risk of Surface Water flooding map indicates that there is a risk of surface water flooding at the site. However, most of the flood risk is associated with the Emm Brook (Main River and Ordinary Watercourse) and its tributaries, and is concentrated within the confines of the fluvial Flood Zones 2 & 3 outlines. The overland flow routes that are outside of these corridors will be accommodated within the scheme; either by the provision of toe drains along the base of the road embankment, or by culverts set below it, as part of the Scheme and Consortium developments.

7.1.6. Intrusive geotechnical investigations have indicated that groundwater levels are close to the ground surface in some areas. Appropriate construction techniques and mitigation measures, as appropriate, should effectively manage the potential ground water flood risk.

7.1.7. Hydraulic modelling has been undertaken to determine the baseline fluvial flood extent, and to identify a strategy to mitigate for the effects of the Central and Western section on flood risk. These effects are mainly caused by loss of floodplain as the road alignment travels through it, the diversion of the PROW, the construction of a 40m bridge crossing over the Emm Brook east of the new Tesco Roundabout and the infilling of the TW Balancing Pond (required to facilitate both the SWDR and Consortium developments).

7.1.8. Model results show that by providing a floodplain compensation area comprising two basins in the land to be used as a SANG (as part of the Consortium development), the effects will be mitigated. Moreover, there will be a betterment in terms of flood extent and levels downstream of the scheme.

7.1.9. The Scheme is classified as 'Essential Infrastructure' in accordance with Table 2 of the NPPF Flood Risk and Coastal Change Planning Practice Guidance (PPG). As the proposals are classified as Essential Infrastructure and are located within Flood Zone 3 the Exception Test needs to be applied.

7.1.10. In terms of part 1 of the Exception Test the SWDR is included within Policy CP21 of Wokingham Borough Adopted Core Strategy and will facilitate residential (and associated infrastructural) growth and expansion of south of Wokingham. It will help the Borough to meet its objectives for housing,

educational and economic growth, and job creation. The new road will also improve existing routes and create new connections for pedestrians and cyclists.

7.1.11. In terms of part two, this Flood Risk Assessment includes details of measures to mitigate the effect of the proposals on flood risk onsite and offsite over its lifetime and accounting for the effects of climate change.

7.1.12. In summary, the surface water drainage strategy proposed by Tony Gee and Partners comprises a linear system of features and gullies located within the highway corridor that will capture runoff from the road and discharge it via a filter drain to detention basins or, via the Upper Emm Brook Tributary, to the flood compensation area located with the SANG and discussed earlier in this report.

7.1.13. Based on the findings of this Flood Risk Assessment, the requirements of the National Planning Policy Framework have been achieved with respect to flooding. The proposals will not be at risk from flooding for its lifetime, and furthermore, the proposals will reduce the flood risk to others.