A2 Bean and Ebbsfleet Junction Improvements

Environmental Statement

Volume 2 – Appendix H.4 Flood Risk Assessment

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Table of contents

Chapter

Pages

Tables

Figures

Executive Summary

As part of the Department for Transports (DfT) Road Investment Strategy for 2015-2020 the upgrade of the A2 Bean and Ebbsfleet Junction Improvements was identified as a high priority. Consent for the Scheme will follow the Highways Act 1980 and to support the application, a Flood Risk Assessment (FRA) is required to demonstrate that the Scheme would be at an acceptable level of flood risk and would not increase flood risk elsewhere.

This FRA has been completed to provide a qualitative assessment of flood risk and demonstrate that proposed mitigation (where necessary) would achieve the requirement above. This FRA has also been completed in line with current national planning policy in relation to development and flood risk, namely the National Planning Policy Framework (NPPF) and with Highways England's Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 10 Road Drainage and the Water Environment (Highways England et al, 2009). This FRA addresses all sources of flood risk, both under current conditions and taking climate change into account.

Environment Agency flood risk mapping and both the Kent Thameside Strategic Flood Risk Assessment (SFRA) and the Thameside Stage 1 Surface Water Management Plan (SWMP) were used as the main sources of flood risk information to inform the understanding of flood risk within the study area, specifically within the Scheme boundary.

Fluvial flood risk arises when watercourses exceed capacity and significant areas at risk are shown by the Environment Agency Flood Zone mapping. This Flood Zone mapping identifies that the Scheme boundary is within Flood Zone 1, and hence at Low Probability of flood risk from fluvial and coastal flooding. However, in the eastern extent of the Scheme there is an area bordering with Flood Zones 2 and 3. For this area, there are no proposed works that would impact on flood risk, and hence no mitigation is required.

The other key source of flood risk requiring consideration is surface water runoff. The existing drainage system manages the current surface water flood risk to the road network and this will be upgraded and supplemented with additional drainage systems (where necessary) to accommodate the Scheme. The drainage system, designed in line with DMRB requirements is outlined in detail within the drainage strategy, but in summary will prevent onsite flooding and increased runoff from the site, which complies with current planning policy requirements; i.e. will prevent onsite flooding during the 1 in 30 (3.3) rainfall event and more frequent, and prevent runoff from the site above greenfield rates up to the 1 in 100 (1%) annual probability rainfall event, with both scenarios including an allowance for climate change.

Flood risk from all other sources is considered low, although requirements will be included within the construction method statement to ensure that this risk remains low.

H.1 Introduction

Background

H.1.1 In December 2014 the Department for Transport (DfT) published its Road Investment Strategy (RIS) for 2015-2020. The RIS sets out the list of schemes that are to be delivered by Highways England over the period covered by the RIS (2015 - 2020). The Secretary of State announced the 'Preferred Route' for the A2 Bean and Ebbsfleet Junction Improvements Scheme in July 2017.

H.1.2 Improvements are required at both Bean and Ebbsfleet Junctions and on the A2 to improve capacity and manage forecasted increases in traffic. The Scheme forms part of the Kent Thameside Transport Programme (STP) and is needed to support significant predicted future growth in the area that includes development already underway at Dartford and Ebbsfleet Garden City.

H.1.3 The Scheme provides increased capacity at the A2 roundabout by enlarging the existing roundabouts and converting to full traffic signal control at both junctions, widening the slip roads and including additional lanes, a bridge and new accesses.

H.1.4 Consent for the Scheme will follow the Highways Act 1980 and to support the application, a Flood Risk Assessment (FRA)is required to demonstrate how the impacts of flood risk both to the Scheme and that can result from the Scheme, have been assessed and the proposed mitigation options, where necessary.

Scope

H.1.5 This FRA has been completed in line with current planning policy in relation to development and flood risk, namely the National Planning Policy Framework (NPPF) and associated guidance documents. This FRA has also been completed in line with the Highways England's Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 10 Road Drainage and the Water Environment (Highways England et al, 2009).

H.1.6 Complying with this planning policy and design manual promotes a Scheme that would be at an acceptable level of flood risk, whilst not increasing flood risk both on site and elsewhere, and where possible reducing flood risk overall. This is required for all sources of flood risk and over the life time of the development (i.e. taking into account climate change).

H.1.7 This FRA is a qualitative appraisal to demonstrate that the development complies with the above requirements. Therefore, this FRA:

- Defines flood risk to the site;
- Determines the impact of the development on flood risk;
- Outlines the proposed mitigation measures; and
- Provides evidence demonstrating that the development is at an acceptable risk of flooding, whilst ensuring the development will not increase flood risk elsewhere.

Scheme location and description

H.1.8 As shown on Figure H.1.1, the Scheme is located between Dartford and Gravesend in north Kent. Bean Junction is the first junction on the A2 to the east of the M25.

H.1.9 The existing A2 through the study area is a 4-lane dual all-purpose road that reduces to 3-lanes through Bean Junction. The grade-separated junctions at Bean and Ebbsfleet are approximately 1.2 miles (2 km) apart on the A2. The Bean Junction connects the A296 and B255 and provides access to the Bluewater Retail Park, a regional shopping centre. The Ebbsfleet Junction connects the A2260 and Southfleet Road. Ebbsfleet Junction was constructed in 2005 to serve the Ebbsfleet International Rail Station and the surrounding Ebbsfleet Valley and Eastern Quarry developments that form part of Ebbsfleet Garden City.

H.1.10 The proposed improvements at Bean and Ebbsfleet Junctions broadly retain the existing layout. Existing roundabouts will be significantly enlarged and converted to full traffic signal control at both junctions. Existing slip roads will be retained and will be widened to include additional lanes along with roundabout links and approaches. Between Bean and Ebbsfleet, the existing hard shoulder is being converted to a running lane along the eastbound carriageway of the A2.

H.1.11 At Bean, improvements include an additional bridge over the A2 adjacent to the existing bridge and a new slip road on to the A2 for eastbound traffic. Enlarging the Bean North Roundabout will result in the demolition of all eleven Ightham Cottages. At Ebbsfleet Junction the proposed improvements will include additional access to current and new developments.

Figure H.1.1: Scheme location plan

Flood risk policy

H.1.12 In addition to compliance with the DMRB, the NPPF and associated guidance is the key policy in relation to flood risk and development to ensure that flood risk is adequately considered as part of development design.

H.1.13 The NPPF requires a Sequential test when determining the location of the new development to promote development away from areas at risk of flooding. The Highways England RIS for 2015-2020 identifies the significant need for capacity improvements at both junctions and therefore works are required at this location.

H.1.14 The NPPF categorises development type based on vulnerability to flooding. The Scheme falls under these classifications as 'Essential Infrastructure'. This means that the Scheme would be considered acceptable for construction in Flood Zones 1 and 2, hence areas at risk from fluvial (river) flooding during the 1 in 1000 (0.1%) annual probability event and rarer. This type of development could be proposed within higher risk areas, i.e. Flood Zone 3 (both 3a and 3b) if a passed Exception Test is demonstrated.

H.1.15 A passed Exception Test demonstrates that:

1. The development is required for wider benefits that outweigh flood risk; and
2. That the development is safe from flooding without increasing flood risk elsewhere.

H.2 Assessment of Flood Risk

Overview

H.2.1 As outlined in the NPPF, flood risk from all sources must be addressed within the FRA to ensure that potential flood risk has been considered during the design of the Scheme. This section provides a list of the data sources used for this assessment and flood risk to and from the development from all sources. This section also outlines mitigation measures, as appropriate, to achieve this requirement.

Data sources

H.2.2 The assessment makes use of readily available information as follows:

- The Environment Agency Flood Zones, surface water mapping and historical flood extents, taken from the Environment Agency data catalogue[1];
- JBA Groundwater Flood Risk mapping (JBA Consulting, 2018);
- Kent Thameside Strategic Flood Risk Assessment (SFRA) (Kent Thameside Deliery Board, 2005);
- Kent Thameside Water Cycle Study Phase 1, Appendix J, SFRA updated (Kent Thameside Delivery Borard, 2009);
- Thameside Stage 1 Surface Water Management Plan (SWMP) (Kent County Council, 2013); and

[1] (Environment Agency (EA), 2018), http://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue, accessed on 11/06/2018

- PPS25 Flood Risk Sequential test Dartford's Borough-Wide Assessment (Dartford Bourough Council, 2010).

Historic flooding

H.2.3 Areas that have been affected by flooding in the past often indicate areas that are vulnerable to flooding in the future. The Environment Agency publish mapping that indicates areas which have historically been inundated from Main Rivers. In relation to the Scheme, this shows that the areas of improvement works are outside areas that have experienced fluvial flooding in the past.

H.2.4 The Kent Thameside Strategic Flood Risk Assessment (SFRA) provides accounts of past flooding, indicating that large areas of the River Darent floodplain were subject to extensive flooding during the 1953 tidal surge and that the River Darent flooded extensively in 1958,1968, 1974 and 1978. However, none of these events affected land within the Scheme boundary.

H.2.5 The Thameside Stage 1 SWMP identifies the location of past flooding from different sources (fluvial, coastal, surface water and sewer). There is no flooding recorded within the area of the Scheme.

Fluvial and tidal flood risk

H.2.6 Fluvial flood risk occurs when the capacity of a watercourse is exceeded such that water overspills the channel.

Baseline flood risk

H.2.7 At the eastern end of the site the Scheme crosses the River Ebbsfleet, which is designated Main River under the permissive and regulatory powers of the Environment Agency. The River Ebbsfleet drains into the tidal Thames Estuary at Northfleet, 2.5 km downstream of the Ebbsfleet Junction. As a result, the River Ebbsfleet will have a strong tidal influence.

H.2.8 The initial source of information used to determine fluvial flood risk to a proposed development is the Environment Agency Flood Zone mapping. The Flood Zones are defined as:

- Flood Zone 1 – Areas with a 'Low Probability' of flooding and where the annual probability of flooding is lower than 1 in 1000 (0.1%) for either fluvial or tidal flooding. The NPPF imposes no constraints upon the type of development within Flood Zone 1;
- Flood Zone 2 – Areas with a 'Medium Probability' of flooding and where the annual probability of flooding is between 1 in 1000 (0.1%) and 1 in 100 (1%) for fluvial flooding or between 1 in 1000 (0.1%) and 1 in 200 (0.5%) for tidal flooding. The NPPF recommends that Flood Zone 2 is suitable for most types of development with the exception of 'Highly Vulnerable' land uses; and
- Flood Zone 3 – Areas with a 'High Probability' of flooding and where the annual probability of flooding is 1 in 100 (1%) or greater for fluvial flooding or 1 in 200 (0.5%) or greater for tidal flooding. The NPPF recommends that appropriate development is based upon a further classification of Flood Zone 3 into 3a 'High Probability' and 3b 'Functional Floodplain' (where water has to flow or be stored in times of flood during the 1 in 20, 5%, event).

H.2.9 Figure H.2.1 shows that there are no areas of Flood Zone 2 or 3 within the Scheme boundary. Therefore, the site is within Flood Zone 1, a Low Probability of flooding for either fluvial or tidal flooding and we recommend that it is passed the sequential test. However, in the eastern part of the Scheme, at Ebbsfleet Junction, there is an area of Flood Zone 2 and 3 associated with the Ebbsfleet river corridor which borders the Scheme boundary.

H.2.10 The Environment Agency mapping also indicates areas that benefit from flood defences. None of these areas are located within the Scheme. However, approximately 0.6 km to the north east of Ebbsfleet Junction, there are some areas in the proximity of the River Ebbsfleet benefiting from flood defences as shown in Figure H.2.2

Figure H.2.1 Environment Agency Flood Zone

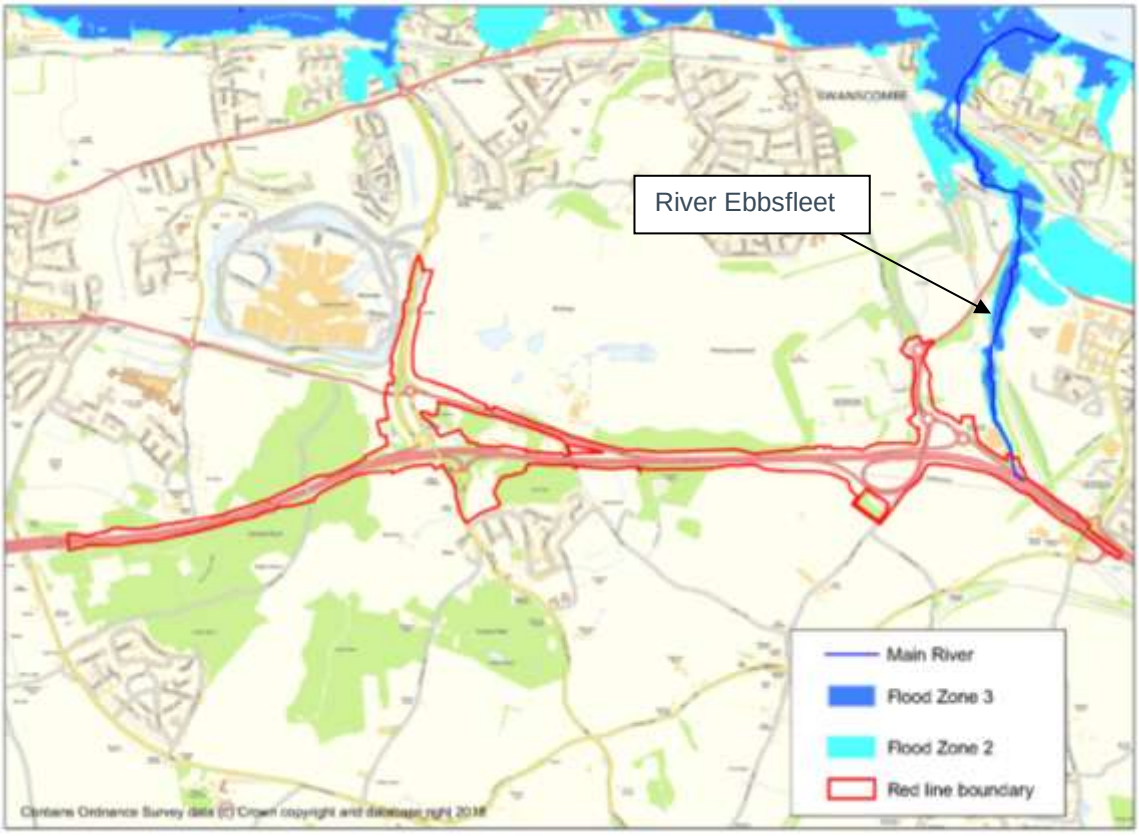


Figure H.2.2 Environment Agency areas that benefit from flood defences

Post Scheme impacts

H.2.11 Any development that encroaches into Flood Zones 2 or 3, or works to watercourse crossings have the potential to increase fluvial flood risk. This can be a result of flood water displacement when development is located within the floodplain, or owing to constriction of flood flows at watercourse crossings. Where there is an impact on flood risk, flood compensation is required.

H.2.12 None of the proposed works are located within Flood Zones 2 or 3. An area of the Scheme boundary close to Ebbsfleet Junction borders Flood Zones 2 and 3, but as no works are proposed along the Scheme boundary, no increase in flood risk is anticipated.

H.2.13 The Scheme in this area involves modifications, realignment and improvement in both the Pepper Hill link road and the eastbound slip road, in where the A2 eastbound on-slip will be widened to two lanes. There is an existing culvert under both roads, however no upgrades to the culvert inlet and outfall points are proposed.

H.2.14 Additionally, at this location there will be a drainage outfall into the watercourse, using an existing outfall point. As demonstrated in the drainage strategy, shown in Volume 2 Appendix H.2, the proposed drainage design will ensure that the runoff from the scheme is attenuated before reaching the watercourse for the 1 in 100 annual probability event (1%) taking into account a 20% allowance for climate change and hence no increase in runoff from the site and no increase in flood risk.

Construction impacts

H.2.15 As identified in H.1.11, there are no works within the Scheme boundary that lie within Flood Zone 2 or 3. However there is an area, in the eastern part of the boundary, that borders with both Flood Zones (Section H.1.1.12). This area will be used as a temporary work site although no permanent works are proposed. Due to the proximity with the River Ebbsfleet and the Flood Zones, and to ensure that both the works and construction staff are at an acceptable level of flood risk, and that the construction activities do not impact on fluvial flood risk, the following actions are recommended for inclusion in the construction method statement:

- The Environment Agency flood warning system should be signed up to. A suitable plan should be put in place to ensure effective and safe evacuation of personnel (and plant if safe to do so) from the areas at risk on receipt of a flood warning; and
- Site compounds, plant and materials will be located as far from the eastern boundary which is close to Flood Zone 3, as possible. Furthermore, the works within 8 m from the Main River Ebbsfleet will need an additional Environmental Permit.

Surface water flood risk

H.2.16 Surface water flooding occurs when rainfall intensities exceed the infiltration capacity such that water collects on the ground surface. Therefore, there is a greater risk of flooding from this source within urbanised areas, where there is a higher proportion of impermeable surfacing.

Baseline flood risk

H.2.17 The Environment Agency publish mapping showing areas at risk from surface water flooding. This data set is based on broad scale mapping, often identifying areas of low lying land, which would be vulnerable to surface water accumulation. Figure H.2.3 shows the predicted extents of surface water flooding during three event categories:

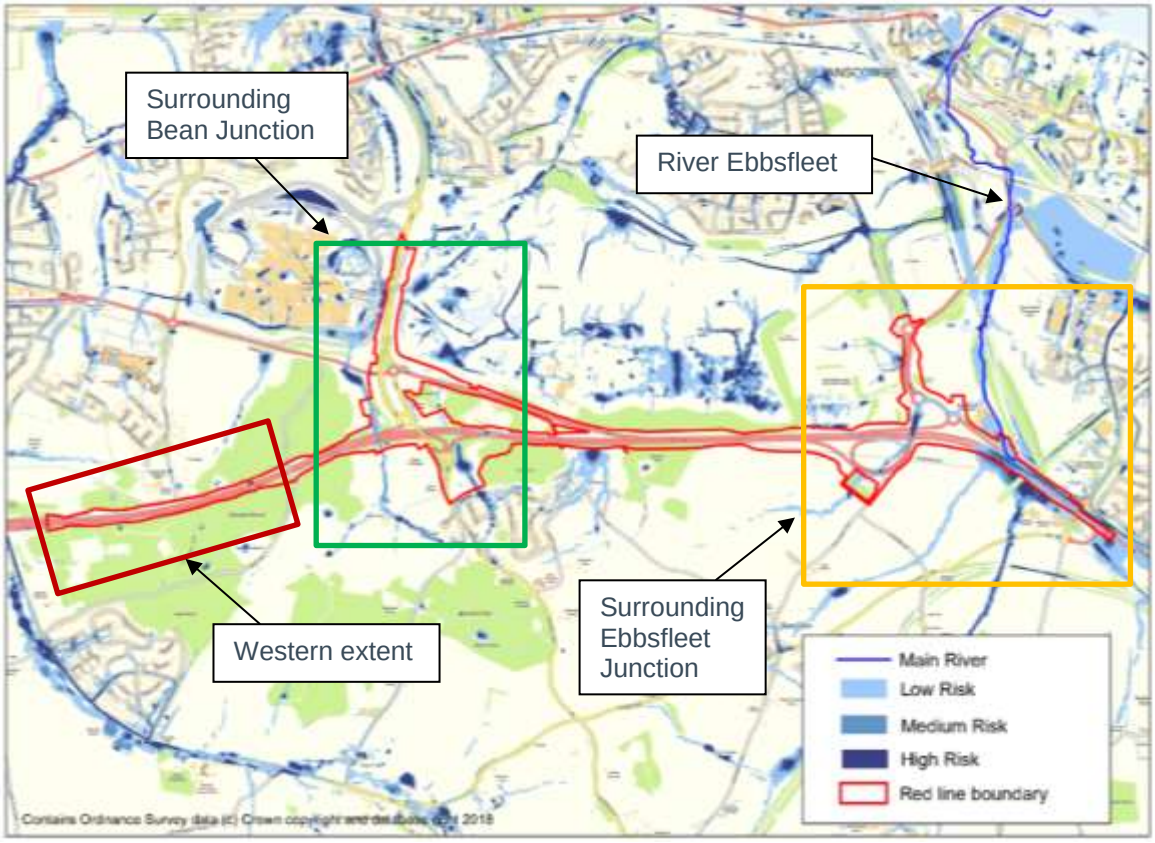
- High risk – At risk during the 1 in 30 (3.3) annual probability event and more frequent;
- Medium risk – At risk during events between the 1 in 30 (3.3) and 1 in 100 (1%) annual probability events; and
- Low risk – At risk during events between the 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability events.

H.2.18 Figure H.4 identifies that there are areas at risk of surface water flooding throughout the Scheme area. Some areas in the eastern part are associated with the River Ebbsfleet, also considered within the fluvial flood risk assessment. The other areas shown to be at risk of surface water flooding are either associated with isolated depressions in topography, or areas along the A2, which are at slightly lower elevation than other sections of the road. The notable areas at risk from surface water flooding that are not associated with watercourses are:

- Western extent of the Scheme - At this location there is an isolated area shown to be at risk, however it is likely to be associated with a localised depression in the A2. There also appears to be a 500 m flow route, parallel to the A2, at low risk along the northern lane;
- Bean Junction - At this location there appears to be a flow path connecting the downstream extent with the waterbody close to the Bluewater Shopping Centre in the north west area of the junction. This flow path represents a low-medium flood risk within the Scheme boundary. In the south east part of the junction there is a ponded area with a high risk of surface water flooding. It is considered that the ponded area is hydraulically connected with another pond and flow route upstream that drains into the watercourses that conformed the Ebbsfleet Valley. Furthermore, some isolated areas along the A2 are shown to be at risk, however it is likely to be associated with localised depressions; and
- Ebbsfleet Junction - At this location there are different flow routes that drain into the River Ebbsfleet. As a result, some areas in the A2 are identified to be at high risk from surface water flooding.

H.2.19 The flood risk in the areas described above are shown to be at risk from surface water flooding. However, it is assumed that the existing drainage of the road network adequately addressed this risk, and hence it will reduce the risk to an acceptable level along the road network as no historic flooding is recorded within the Scheme boundary.

Figure H.2.3 Environment Agency surface water mapping



Post Scheme impacts

H.2.20 Any new development has the potential to impact on ground permeability and therefore surface water flood risk. This is of primary importance where development will increase the impermeable ground coverage within a site, and therefore will require mitigation.

H.2.21 The Scheme involves additional roads, access tracks, road widening and enlarging the existing roundabouts, which will involve an increase in impermeable surfacing.

H.2.22 To ensure that the proposed works will not cause an increase in surface water flooding, the surface water drainage system will be upgraded where appropriate and a new system installed for areas of new road/access. The proposed drainage system involves a number of solutions such as retaining structures, soakaways, ponds and filter drains.

H.2.23 The drainage system will be designed in line with current standards of the DMRB (HA, 2009) to ensure that runoff from the site does not exceed the greenfield rate. Longitudinal drains will be designed to take into account a 1 in 5 year annual probability event plus 20% climate change. The attenuation structures will be sized for a 1 in 100 year storm event plus an allowance of 20% climate change.

H.2.24 Further details associated with the drainage design are included within the drainage strategy, shown in Volume 2 Appendix H.2.

H.2.25 Therefore, the proposed drainage design will ensure that the Scheme is at an acceptable risk from surface water flooding, and will not increase flood risk elsewhere. This will be true for present day scenarios and over the lifetime of the development taking climate change into account.

Construction impacts

H.2.26 Based on the risk identified in the baseline and post-scheme subsections, it is considered that the risk during the construction phase is low. However, there is a risk of compaction of currently permeable areas from plant movement, and the infiltration potential temporarily reduced. Similarly, site compounds have the potential to temporarily increase surface water runoff.

H.2.27 Given the nature of the works, these risks are likely to be short term and not extensive. Nevertheless, the construction method statement will identify this risk and put in place necessary mitigation to prevent a temporary increase in surface water flood risk on site and elsewhere. Furthermore, the phasing plan for the temporary works will have to ensure that surface water flood risk is not increased.

Groundwater flood risk

H.2.28 Groundwater flooding generally occurs as a result of long duration rainfall events, when the associated recharge of permeable geological deposits raises the water table until it is above ground level. Groundwater flooding is generally of longer duration than fluvial or surface water flooding and may take weeks or months to recede as groundwater flow is much slower. Flooding of subsurface structures can also occur where groundwater levels rise to just below ground

level. Groundwater flooding can be associated with both permeable bedrock and superficial deposits.

Baseline flood risk

H.2.29 The JBA Groundwater Flood Map (JBA Consulting, 2018) provides a detailed national assessment of groundwater flood hazard. This is based on groundwater modelling and a ground surface Digital Terrain Model (DTM), a groundwater flood hazard classification is generated for the 1% annual chance flood event. The classes are set out in Table H.2.1. The JBA Groundwater Flood Map has been used to determine the existing groundwater flood risk along the Scheme.

Table H.2.1: Groundwater flood hazard classification

Groundwater level difference from ground surface (m)	Class	Description	Flooding risk
0 to 0.025	4	Groundwater levels are either at or very near (within 0.025 m of) the ground surface in the 1% annual chance flood event.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	3	Groundwater levels are between 0.025 and 0.5 m below the ground surface in the 1% annual chance flood event.	Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	2	Groundwater levels are between 0.5 and 5 m below the ground surface in the 1% annual chance flood event.	There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
>5	1	Groundwater levels are at least 5 m below the ground surface in the 1% annual chance flood event.	Flooding from groundwater is not likely.
N/A	0	Very low / Negligible flood risk	This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the geological deposits.

Table Source: (JBA Consulting, 2018)

H.2.30 Based on the JBA Groundwater flooding map, the majority of the area within the Scheme boundary is classed as being at risk of groundwater flooding in a 1% annual chance flood event (Figure H.5 and D.6).

Bean Junction

H.2.31 There are several areas of existing carriageway around the Bean Junction, within the Scheme boundary, which are shown as being at risk of groundwater flooding in a 1% flood event. Groundwater levels on the A2 carriageway to the west of Bean Junction are predicted to be between 0.05 and 5 m of the ground surface (GW flood risk Class 2). The Bean North and South Roundabouts, as well as the A2 carriageway between the roundabouts, are within flood risk Class 2, as defined in **Error! Reference source not found.**. The onslip from Watling Street t o the A2 is also under Class 2. In these areas, there is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.

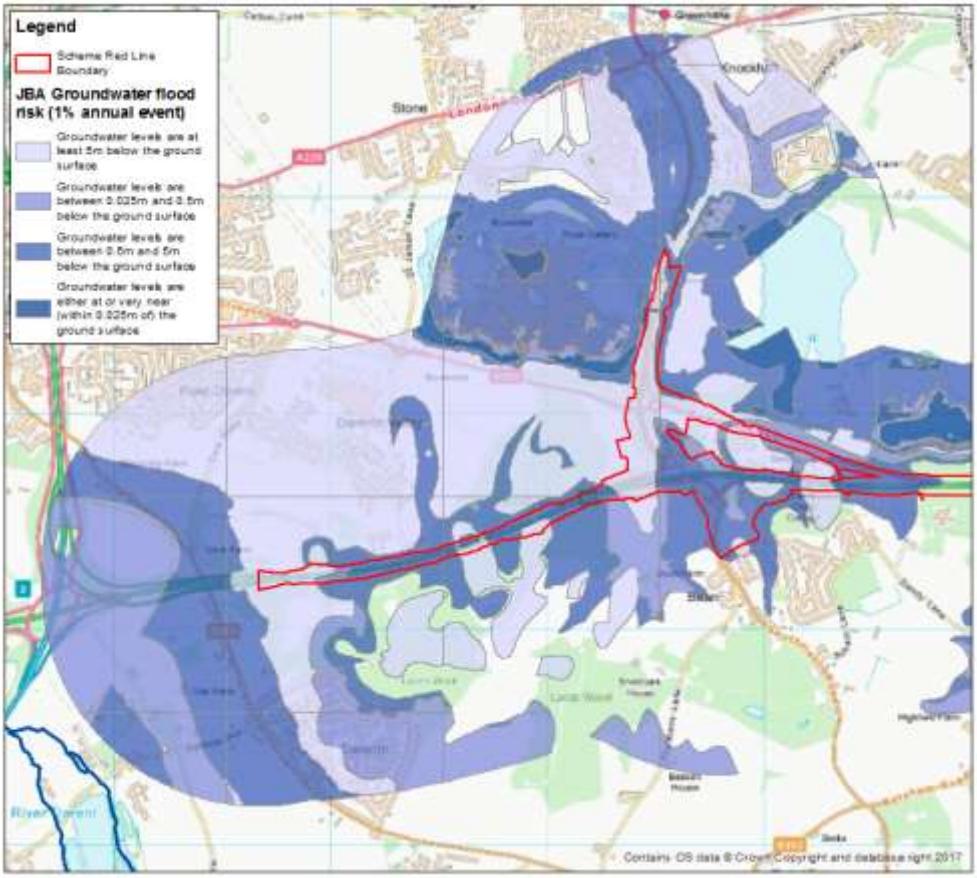
H.2.32 There are some isolated areas of Class 3 groundwater flood risk (groundwater levels are between 0.025 and 0.5 m below the ground surface in the 1% flood event), such as on the A296 Watling Street, before the onslip to the A2. Here the groundwater flood risk is higher and there is a risk of groundwater flooding to surface and subsurface assets.

H.2.33 The rest of the highways associated with Bean Junction are not likely to be affected by groundwater flooding as the predicted groundwater levels are more than 5 m below ground level.

H.2.34 Although the JBA mapping suggests the existing risk of groundwater emergence is notable around Bean Junction where the highway is raised on an embankment, the mapping may be considered to over-estimate the risk of flooding from groundwater. There has been no historical groundwater flooding recorded within the red line boundary and the groundwater flood risk methodology does not take into account the ground surface material, and the extensive hard standing in this existing area of highway. Additionally, although there is no available groundwater level data for the study area itself, Environment Agency groundwater level data suggests depth to groundwater could be as much as 13.6 m[2] under peak conditions in this area.

[2] Recorded at Betsham Rd OBH on 24th March 2014

Figure H.2.4 JBA Groundwater flood risk mapping – Bean Junction

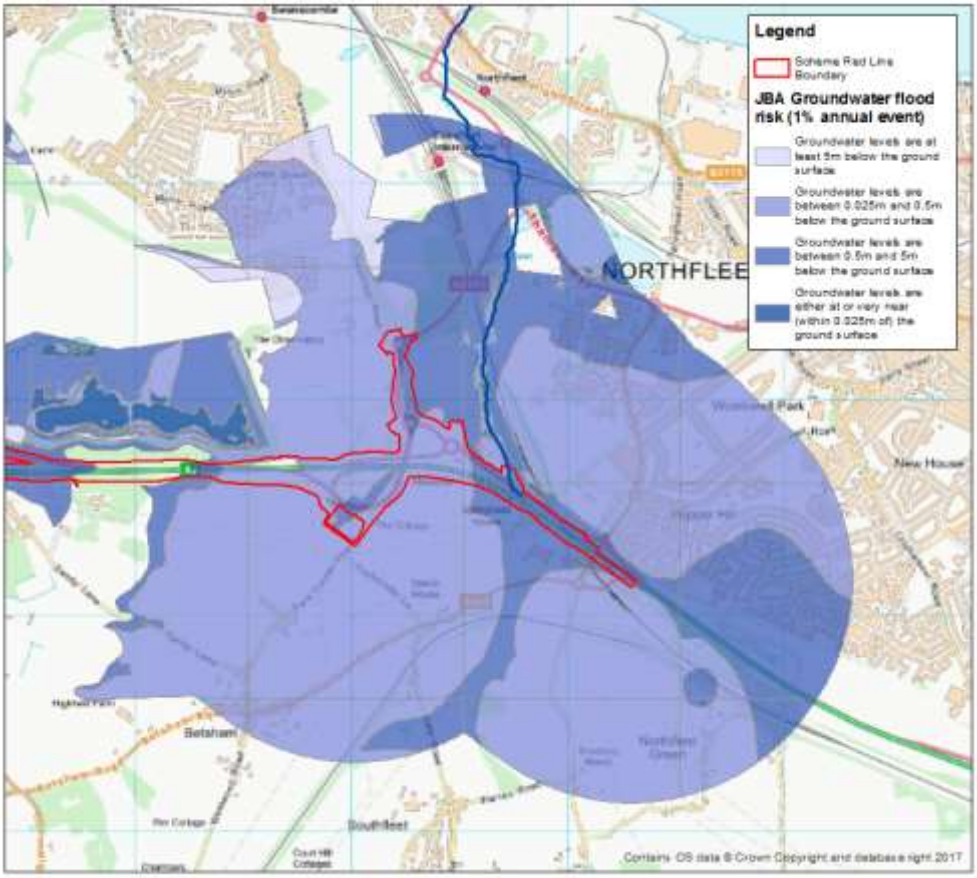


Ebbsfleet Junction

H.2.35 The majority of the existing carriageway associated with Ebbsfleet Junction is mapped as having groundwater flood risk Class 3: Groundwater levels are between 0.025 and 0.5 m below ground level. However, there are some areas along Watling Street, east of Ebbsfleet Junction which are of lower groundwater flooding risk (Class 2), with a risk of flooding to subsurface assets only.

H.2.36 Although the JBA mapping suggests the existing risk of groundwater emergence is notable around Ebbsfleet Junction, where the existing highway is raised on an embankment, as with the area around Bean Junction, the mapping may be considered to over-estimate the risk of flooding from groundwater. However, although there are no recorded historical groundwater flood events here, the depth to groundwater is low, supporting to some extent, the groundwater flood risk mapping.

Figure H.2.5 JBA Groundwater flood risk mapping – Ebbsfleet Junction



Post Scheme impacts

H.2.37 Where Scheme elements coincide with areas of existing groundwater flood risk, these may lead to an increased risk of groundwater flooding. Where subsurface activities are in an area of significant groundwater presence, risk of groundwater flooding is increased.

H.2.38 Where deep foundations for new overbridges and gantries or sheet piling is located within areas of existing groundwater flood risk, these have potential to form a barrier to groundwater flow, thereby locally increasing the groundwater flood risk up gradient.

Construction impacts

H.2.39 During construction, where subsurface works are required, depending on the groundwater levels at the time of construction, localised dewatering may be required. No temporary discharge to ground is planned, which would increase the groundwater flood risk.

Other sources of flooding

Reservoir flooding

H.2.40 The Environment Agency produce flood risk mapping indicating areas at risk of inundation should a designated reservoir fail. This mapping shows that in the location of the Scheme boundary no reservoir flooding is expected to occur, as

the closest area flooding from a reservoir is 3.3 km to the south-west of the Scheme.

Canal flooding

H.2.41 There are no canals located either within the Scheme boundary or in adjacent areas. Therefore, it is considered that there is no risk within the Scheme boundary from this source of flooding.

Water transmission infrastructure

H.2.42 There is an inherent risk of flooding from water transmission infrastructure, both potable and sewerage, owing to burst or leaking pipes. The risk will be dependent on the location and age of the network in this area. The Kent Thameside SFRA and the Thameside Stage 1 SWMP indicate that there have been no incidents of sewer flooding within the Scheme boundary.

H.2.43 Therefore, the existing risk, particularly of significant flooding that would cause disruption, is considered low.

H.2.44 There is potential that proposed works could impact on risk from this source during the construction phase. However, the location of the network will be established as part of the design phase, and associated requirements to prevent impact on this infrastructure proposed as part of the construction method statement.

Other sources of flood risk summary

H.2.45 The flood risk from reservoirs, canals and water transmission infrastructure is low. Consideration of these risks, specifically water transmission infrastructure will need to be considered as part of the design, but following standard construction principles these risks will remain low during the construction and operational phases of the Scheme. Furthermore, this risk is anticipated to remain low over the life time of the development, taking climate change into account.

H.2.46 There are no other known sources of flooding that would pose a risk to the Scheme or would be impacted as a result of the works. This remains true for the current situation and over the life time of the development taking climate change into account.

Flood risk summary

H.2.47 A summary of all known sources of flood risk to the scheme and that could arise from the works is provided in Table H.2.2. This table is based on the DMRB categorisations of importance, impact magnitude and significance, which are defined in the Environmental Statement.

Table H.2.2: Flood risk summary based on DMRB categorisation

Source of flood risk	Importance	Impact magnitude taking into account mitigation	Mitigation details	Significance of effect
Fluvial	Low	Negligible	Construction actions to mitigate flood risk during the construction phase.	Neutral
Surface water	Low to High	Negligible	As outlined within the drainage strategy (Volume 2 Appendix H.2).	Neutral
Groundwater	Low	Low	Undertake intrusive investigations during detailed design phase to determine local groundwater levels and flow directions; Deep foundations should be designed in accordance with industry standards, taking into account the site-specific water level data obtained from intrusive ground investigation;	Neutral
Reservoir	Low	Negligible	None	Neutral
Canal	Low	Negligible	None	Neutral
Water transmission infrastructure	Low	Negligible	Standard construction principals.	Neutral

H.3 Conclusions and recommendations

Conclusions

H.3.1 The conclusions that have been made from this FRA are:

- The Scheme is considered as essential infrastructure and based on the principles of current national planning policy (the NPPF) would be acceptable based on flood risk, if a passed Exception test can be demonstrated;
- This FRA provides evidence for the second part of the Exception test, whereby the development would remain safe and not increase flood risk elsewhere, over the life time of the development taking into account climate change;

- Fluvial flood risk mapping indicates that the Scheme boundary is within Flood Zone 1 i.e. at low risk from fluvial flooding. However, in the eastern extent of the Scheme there is a bordering area within Flood Zone 3. No works that would impact on flood risk are proposed in the vicinity of that neighbouring area and hence, no mitigation is required. During the construction phase this area will be used for temporary works and it is therefore recommended that the Environment Agency flood warning system is signed up to;
- Current surface water flood risk mapping shows a high proportion of the area within the Scheme boundary as being at risk from surface water flooding. There are some areas in localised isolated depressions in topography and along the road network (already managed by the existing drainage network);
- The proposed drainage strategy (Volume 2 Appendix H.2) will be completed in line with current planning policy requirements and will ensure that the new and upgraded drainage system will serve to prevent unacceptable surface water flood risk to the Scheme. The drainage strategy will also present a system that would prevent an unacceptable increase in runoff from the site;
- Groundwater flood risk across the majority of the Scheme is mapped as either class 2 or class 3: Groundwater levels in a 1% annual probability event are predicted to be within 5 m of the ground surface. However, no groundwater flooding events have been recorded in the area, and much of the highway is elevated on an embankment, reducing the likelihood of groundwater flooding. Mitigation measures as follows have been identified:
  - Undertake intrusive investigations during detailed design phase to determine local groundwater levels and flow directions; and
  - Deep foundations to be designed in accordance with industry standards, taking into account the site-specific water level data obtained from intrusive ground investigation.
- There are no other sources that will have a significant impact on flood risk to the Scheme.

H.3.2 In summary, it is concluded that based on current flood risk understanding and the incorporation of flood risk mitigation/ considerations (as above), the Scheme would be at an acceptable level of flood risk and would not increase flood risk elsewhere. This conclusion remains true, both now and over the lifetime of the Scheme taking climate change into consideration.

Recommendations

H.3.3 It is recommended that the Scheme, with the incorporation of flood risk mitigation/ considerations (as above) is considered acceptable from a flood risk perspective.

H.4 References

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