# East West Rail Phase 2

## Overarching Surface Water Drainage Assessment

## Addendum to East West Rail Phase 2: Civil Engineering Drainage Principles (Ref: 133735-ATK-REP-EDR-000001)

## Document Number:

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## Overarching Surface Water Drainage Assessment

## August 2020

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# 1. Introduction

## 1.1 Background

East West Rail (EWR) is a project to re-establish a rail link between Cambridge and Oxford to improve rail services between East Anglia, central and southern England, with enhanced connections to main line rail services. Phase 2 (EWR2) of the scheme covers the "Western Section" between Bicester, Bletchley and Bedford and from Claydon to Princes Risborough (via Aylesbury).

A Transport Works Act Order (TWAO) has been approved for EWR2: the Network Rail (East West Rail Bicester to Bedford Improvements) Order 2020. Planning condition 14 of the deemed planning approval accompanying the TWAO states:

(a) No construction of the structures and stations listed in part (c) shall commence until an overarching surface water drainage assessment, based on the principles of sustainable drainage, has been submitted to and approved in writing by the relevant local planning authority.

(b) A surface water drainage scheme for each of the structures and stations listed in part (c) which must comply with the outputs of the approved surface water drainage assessment and include arrangements for the whole life maintenance and management of the drainage scheme, must be submitted to and approved in writing by the relevant local planning authority.

(c) Structures and stations:

- OXD/36AA Charbridge Lane
- OXD/35B Manor Farm
- OXD/34A Station Road Launton
- OXD/33A Marsh Gibbon
- OXD/26B Queen Catherine Road
- OXD/25 Sandhill Road (Middle Claydon)
- OXD/24C Verney Junction
- OXD/14A Moco Farm
- OXD/10AA Salden
- BBM/9B Manor Road
- BBM/8A Marston Road
- BBM/6AA Woodleys Farm
- MCJ2/178A Lower Blackgrove No.1
- MCJ2/177 Fleet Marston
- Ridgmont Station Platform Extensions
- Woburn Sands Platform Extensions
- Aylesbury Vale Parkway Station Platform Extension
- Winslow Station (new station)
- Bletchley Station (2 new High Level Platforms*)*

The development must be implemented and maintained in accordance with the approved surface water drainage strategy and scheme.

This Overarching Surface Water Drainage Assessment has been produced as addendum to the report East West Rail Phase 2: Civil Engineering Drainage Principles (Ref: 133735-ATK-REP-EDR-000001) which was submitted with the TWAO, to support discharge of part (a) of planning condition 14.

For the proposed Winslow Station building and forecourt area, these are outside of the scope of the TWAO and are being managed through a separate planning application to Aylesbury Vale District Council. Consequently, for Winslow Station the surface water drainage assessment will be restricted to the proposed footbridge and platforms only.

Once the detailed design of the structures and stations listed in part (c) above is complete, submissions will be made for each structure and station to discharge part (b) of planning condition 14.

## 1.2 Report Scope

The scope of this report is to provide an Overarching Surface Water Drainage Assessment to discharge part (a) of planning condition 14 associated with the EWR2 TWAO. This will be achieved by summarising the planned works and defining the principles of how surface water will be managed in accordance with local and national guidance. Development of this assessment included the following:

- Review of relevant local and national development guidance stated in Table 2-2.
- Assessment of infiltration potential at proposed structures and stations.
- Identification of potential surface water outfalls.
- Assessment of Sustainable Drainage Systems that can be utilised.
- Definition of water quantity requirements
- Assessment of water quality impacts
- Confirmation of maintenance responsibility for the proposed drainage scheme.

## 1.3 Proposed Development

This assessment relates to the structures and stations listed below. The location and works proposed at each structure and station are summarised in Table 1-1 below:

**Table 1-1 Location and works at proposed structures and stations**

| Structure / Station | Easting | Northing | Proposed Works |
|---|---|---|---|
| OXD/36AA Charbridge Lane | 460130 | 222942 | Online public highway overbridge to replace an existing level crossing. |
| OXD/35B Manor Farm | 460635 | 223122 | Online private highway overbridge to replace an existing level crossing. |
| OXD/34A Station Road Launton | 461885 | 223567 | Offline public highway overbridge to replace an existing level crossing. |
| OXD/33A Marsh Gibbon | 463639 | 224143 | Online private highway overbridge to replace an existing level crossing. |
| OXD/26B Queen Catherine Road | 470853 | 226318 | Offline public highway overbridge to replace an existing level crossing. |

| Structure / Station | Easting | Northing | Proposed Works |
|---|---|---|---|
| OXD/25 Sandhill Road (Middle Claydon), | 472727 | 227306 | Existing public highway bridge deck to be replaced. |
| OXD/24C Verney Junction | 473517 | 227429 | Offline private highway overbridge to replace an existing level crossing. |
| OXD/14A Moco Farm | 479025 | 228985 | Offline private highway overbridge to replace an existing level crossing |
| OXD/10AA Salden | 482148 | 233181 | Offline public highway overbridge to replace an existing overbridge. |
| BBM/9B Manor Road | 502610 | 244840 | Online public highway overbridge to replace an existing level crossing. |
| BBM/8A Marston Road | 499497 | 239449 | Online public highway overbridge to replace an existing level crossing. |
| BBM/6AA Woodleys Farm | 491752 | 236201 | Online private highway overbridge to replace an existing level crossing |
| MCJ2/178A Lower Blackgrove No.1 | 475774 | 217971 | Online private highway overbridge to replace an existing level crossing |
| MCJ2/177 Fleet Marston | 478135 | 216017 | Existing public highway bridge deck to be replaced. |
| Ridgmont Station Platform Extensions | 496528 | 237385 | 85m extension to the western end of the existing station platforms. |
| Woburn Sands Platform Extensions | 492466 | 236376 | 68m extension to the western end of the existing station platforms. |
| Aylesbury Vale Parkway Station Platform Extension | 478663 | 215354 | 106m extension to the rear of the existing station platform. |
| Winslow Station (new station) | 476582 | 228359 | New station to be constructed incorporating 2no. 108m long platforms. |
| Bletchley Station (2 new High Level Platforms) | 486935 | 233723 | 2No. new 108m long platforms to be constructed on the Bletchley Viaduct with a connecting footbridge to the existing Bletchley station, and a new station entrance to be constructed under the viaduct. |

# 2. Policy Context

## 2.1 Rainfall Return Periods

Rainfall is a natural process that can present a range of different risks depending on its form. The Department of Food and Rural Affairs (DEFRA) define the risks presented by rainfall and associated flood risk according to an Annual Exceedance Probability (AEP), or as having a 'return period.'

Return period includes the statistical probability of an event occurring and the scale of the potential consequences. The 10-Year, 50-Year and the 100-Year return periods have a 10%, 2% and 1% chance of occurring in any given year, respectively. However, over a longer period the probability of flooding is considerably greater.

Table 2-1 below provides a summary of the relevant AEP and corresponding return period events of sensitivity.

**Table 2-1 Definition of AEP and 'Return Period' Rainfall Events**

| AEP (%) | Return Period (Years) |
|---|---|
| 100% | 1 in 1 Year |
| 20% | 1 in 5 Years |
| 10% | 1 in 10 Years |
| 2% | 1 in 50 Years |
| 1% | 1 in 100 Years |
| 0.5% | 1 in 200 Years |
| 0.1% | 1 in 1000 Years |

## 2.2 Local Development Policies

In order to inform the assessment, a review has been undertaken of relevant local and national development policies as detailed in Table 2-2.

**Table 2-2 Local Development Policies and National Guidance to Inform the Report**

| Document Name | Published By | Date |
|---|---|---|
| Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire | Oxfordshire County Council | 2018 |
| Developer Advice for Surface Water Drainage Schemes for Major Applications | Buckinghamshire County Council | 2017 |
| Sustainable Drainage Guidance | Central Bedfordshire Council | 2015 |

| Document Name | Published By | Date |
|---|---|---|
| Using Sustainable Drainage in New Development | Central Bedfordshire Council | 2019 |
| Supplementary Planning Document for Sustainable Drainage | Bedford Borough Council | 2018 |
| Surface Water Drainage Guidance for Developers | Milton Keynes Council | 2019 |
| Non-Statutory Technical Standards for Sustainable Drainage Systems | Local Authority SuDS Officer Organisation (LASOO) | 2016 |

## 2.3 Climate Change Allowances

Local and national guidance identifies the need for new developments to mitigate against climate change in order that the development will continue to not increase flood risk to the surrounding area in the future. The latest Environment Agency guidance[1] recommends that the peak rainfall intensity should be increased as shown in Table 2-3 below to allow for the effects of climate change.

**Table 2-3 Environment Agency guidance on increases in Peak Rainfall intensity to allow for the effects of climate change.**

| Applies across all of England | Total potential change anticipated for the '2020s' (2015 to 2039) | Total potential change anticipated for the '2050s' (2040 to 2069) | Total potential change anticipated for the '2080s' (2070 to 2115) |
|---|---|---|---|
| Upper end | 10% | 20% | 40% |
| Central | 5% | 10% | 20% |

Based on a 120 year design life for the proposed structures and stations listed in part (c) of planning condition 14, the Central value for climate change of 20% will be adopted for the design of the proposed structures and stations for up the 1 in 100 year storm event. A sensitivity check will also be performed using the Upper End value of 40% for the 1 in 100 year storm event to ensure any exceedance flows are not routed on 3rd party land, towards proposed railway infrastructure or to critical infrastructure e.g. substations, water supply pumping stations etc.

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

# 3. Drainage Strategy

## 3.1 Introduction

This section outlines the proposed surface water drainage principles which will be adopted for the proposed structures and stations listed in part (c) of planning condition 14. The design of any proposed surface water drainage shall also consider constraints related to geology, flood risk and water quality which are outlined in Volume 4 (Figures) of the Environmental Statement TWAO submission.

## 3.2 Outfall Hierarchy

The Non-Statutory Technical Standards for Sustainable Drainage Systems, state that surface water should be disposed of in accordance with the following hierarchy:

i. Infiltration.

ii. Disposal into an existing watercourse.

iii. Disposal into a surface water sewer.

iv. Disposal into a combined sewer.

Table 3-1 below summarises the infiltration testing undertaken in accordance with BRE 365 at the proposed structures and stations listed in part (c) of planning condition 14. Results of infiltration testing will be included in the submissions to be made for each structure and station to discharge part (b) of planning condition 14.

**Table 3-1 Summary of infiltration potential at proposed structures and stations**

| Structure / Station | Infiltration Potential |
|---|---|
| OXD/36AA Charbridge Lane | Soakaway tests in accordance with BRE 365 have shown infiltration rates between 1.23 x $10^{-5}$m/s and 2.58 x $10^{-5}$m/s. Based on these rates drainage by infiltration only using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| OXD/35B Manor Farm | Soakaway tests in accordance with BRE 365 have shown infiltration rates between 2.71 x $10^{-5}$m/s and 6.78 x $10^{-6}$m/s. Based on these rates drainage by infiltration only using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| OXD/34A Station Road Launton | Infiltration test results not available to due access not being granted to land to undertake the tests. However, based on available ground investigation information in the vicinity of the structure, it is understood to be underlain by Alluvium and Oxford Clay Formation which is classified as unproductive by the Environment Agency, therefore having low infiltration potential. Groundwater monitoring has also shown groundwater to be <1.0m below ground level in the vicinity of this structure. Hence, based on available information using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |

| Structure / Station | Infiltration Potential |
|---|---|
| OXD/33A Marsh Gibbon | Infiltration test results not available due to access not being granted to land to undertake the tests. However, based on available ground investigation information in the vicinity of the structure, it is understood to be underlain by Oxford Clay Formation which is classified as unproductive by the Environment Agency, therefore having low infiltration potential. Hence, based on available information using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. Soakaway tests will be undertaken in accordance with BRE 365 to determine actual infiltration rates at the proposed structure. |
| OXD/26B Queen Catherine Road | Soakaway tests in accordance with BRE 365 have shown infiltration rates of $1.1 \times 10^{-6}$m/s. Based on these rates drainage by infiltration only using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| OXD/25 Sandhill Road (Middle Claydon), | Soakaway tests in accordance with BRE 365 have shown infiltration rates between $2.36 \times 10^{-5}$m/s and $7.09 \times 10^{-6}$m/s. Based on these rates drainage by infiltration only using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| OXD/24C Verney Junction | Soakaway tests in accordance with BRE 365 have shown infiltration rates of $2.81 \times 10^{-5}$m/s. Based on these rates drainage by infiltration only using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| OXD/14A Moco Farm | Soakaway tests in accordance with BRE 365 have shown infiltration rates between $1.09 \times 10^{-5}$m/s and $8.09 \times 10^{-5}$m/s. Based on these rates drainage by infiltration only using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| OXD/10AA Salden | Infiltration test results not available due access not being granted to land to undertake the tests. However, based on available ground investigation information in the vicinity of the structure, it is understood to be underlain by Oxford Clay Formation which is classified as unproductive by the Environment Agency, therefore having low infiltration potential. Hence, based on available information using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. Soakaway tests will be undertaken in accordance with BRE 365 to determine actual infiltration rates at the proposed structure. |

| Structure / Station | Infiltration Potential |
|---|---|
| BBM/9B Manor Road | Infiltration test results not available due to access not being granted to land to undertake the tests. However, based on available ground investigation information in the vicinity of the structure, it is understood to be underlain by Oxford Clay Formation which is classified as unproductive by the Environment Agency, therefore having low infiltration potential. Hence, based on available information using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| BBM/8A Marston Road | Soakaway tests in accordance with BRE 365 have shown infiltration rates between 1.73 x $10^{-5}$m/s and 4.48 x $10^{-6}$m/s. Based on these rates drainage by infiltration only using techniques such as soakaways, infiltration trenches and infiltration basins will not be feasible. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. |
| BBM/6AA Woodleys Farm | Infiltration test results not available due to access not being granted to land to undertake the tests. However, based on available ground investigation information in the vicinity of the structure, it is understood to be underlain by Oxford Clay Formation which is classified as unproductive by the Environment Agency, therefore having low infiltration potential. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls and soakaway tests will be undertaken in accordance with BRE 365 to obtain actual infiltration rates at the proposed structure. |
| MCJ2/178A Lower Blackgrove No.1 | Soakaway tests in accordance with BRE 365 have shown infiltration rates of 0m/s. Based on these rates drainage by infiltration will not be feasible. |
| MCJ2/177 Fleet Marston | Infiltration test results not available due to access not being granted to land to undertake the tests. However, based on available ground investigation information in the vicinity of the structure, it is understood to be underlain by Ampthill Clay Formation which is classified as unproductive by the Environment Agency, therefore having low infiltration potential. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. Soakaway tests will be undertaken in accordance with BRE 365 to obtain actual infiltration rates at the proposed structure. |
| Ridgmont Station Platform Extensions | Infiltration testing not undertaken as soakaways within the track corridor are not a feasible solution. Discharge will be to existing track drainage system to ensure the design does not introduce soft spots under the track which would be detrimental to the safe operation of the railway. |
| Woburn Sands Platform Extensions | Infiltration testing not undertaken as soakaways within the track corridor are not a permitted solution. Discharge from the station platforms will be to the existing track drainage system to ensure the design does not introduce soft spots under the track which would be detrimental to the safe operation of the railway. |
| Aylesbury Vale Parkway Station Platform Extension | Infiltration testing not undertaken as soakaways within the track corridor are not a permitted solution. Discharge from the station platforms will be to the existing track drainage system to ensure the design does not introduce soft spots under the track which would be detrimental to the safe operation of the railway. |

| Structure / Station | Infiltration Potential |
|---|---|
| Winslow Station (new station) | Infiltration testing has not been undertaken as soakaways are not a permitted solution. Runoff from platforms will discharge to the proposed track drainage system to ensure the design does not introduce soft spots under the track, which would be detrimental to the safe operation of the railway. |
| Bletchley Station (2 new High-Level Platforms) | Infiltration testing has not been undertaken as soakaways are not a permitted solution. Runoff from platforms will discharge to the existing track drainage system to ensure the design does not introduce soft spots under the track, which would be detrimental to the safe operation of the railway. |

In line with the Non-Statutory Technical Standards for Sustainable Drainage Systems (SuDS), as infiltration alone cannot be relied upon to drain the proposed structures and stations it is proposed to discharge runoff to existing watercourses. Where direct discharge to an existing watercourse is not feasible it is proposed to discharge to track, land and highway drainage systems which ultimately discharge to existing watercourses. Proposed outfall locations from each structure and station are summarised in Table 3-2 overleaf.

**Table 3-2 Summary of outfall locations for proposed structures and stations**

| Structure / Station | Proposed outfall location | Approval Authority | Local Planning Authority |
|---|---|---|---|
| OXD/36AA Charbridge Lane | Proposed land drainage - Tributary of Langford Brook | Oxfordshire County Council | Cherwell District Council |
| OXD/35B Manor Farm | Proposed land drainage - Tributary of Langford Brook | Oxfordshire County Council | Cherwell District Council |
| OXD/34A Station Road Launton | Tributary of Launton Brook and Launton Brook | Oxfordshire County Council | Cherwell District Council |
| OXD/33A Marsh Gibbon | Launton Brook | Oxfordshire County Council | Cherwell District Council |
| OXD/26B Queen Catherine Road | Proposed land drainage - Tributary of Padbury Brook | Bedford Group of Internal Drainage Boards | Cherwell District Council |
| OXD/25 Sandhill Road (Middle Claydon), | Proposed land drainage - Tributary of Padbury Brook and Tributary of Claydon Brook | Bedford Group of Internal Drainage Boards | Aylesbury Vale District Council |
| OXD/24C Verney Junction | Tributary of Claydon Brook | Bedford Group of Internal Drainage Boards | Aylesbury Vale District Council |
| OXD/14A Moco Farm | Existing Highway Drainage - Tributary of Claydon Brook | Bedford Group of Internal Drainage Boards | Aylesbury Vale District Council |
| OXD/10AA Salden | Proposed land drainage - Tributary of River Ouzel | Bedford Group of Internal Drainage Boards | Aylesbury Vale District Council |
| BBM/9B Manor Road | Proposed land drainage - Tributary of Claydon Brook | Bedford Group of Internal Drainage Boards | Aylesbury Vale District Council |
| BBM/8A Marston Road | Proposed Land Drainage - Tributary of River Ouzel | Buckinghamshire County Council | Aylesbury Vale District Council |
| BBM/6AA Woodleys Farm | Proposed Track Drainage - Tributary of River Great Ouse | Bedford Group of Internal Drainage Boards | Bedford Borough Council |
| MCJ2/178A Lower Blackgrove No.1 | Proposed Track Drainage - Tributary of River Great Ouse | Central Bedfordshire Council | Central Bedfordshire Council |
| MCJ2/177 Fleet Marston | Proposed Track Drainage - Tributary of River Ouzel | Bedford Group of Internal Drainage Boards | Milton Keynes Council |
| Ridgmont Station Platform Extensions | Existing Track Drainage – Tributary of Broughton Brook | Bedford Group of Internal Drainage Boards | Central Bedfordshire Council |
| Woburn Sands Platform Extensions | Existing Track Drainage – Tributary of River Ouzel | Bedford Group of Internal Drainage Boards | Milton Keynes Council |
| Aylesbury Vale Parkway Station Platform Extension | Existing Track Drainage – Tributary of Fleet Marston Brook | Buckinghamshire County Council | Aylesbury Vale District Council |
| Winslow Station (new station) | Proposed track drainage system - Tributary of the Claydon Brook | Buckinghamshire County Council | Aylesbury Vale District Council |
| Bletchley Station (2 new High Level Platforms) | Existing Track Drainage System | Bedford Group of Internal Drainage Boards | Milton Keynes Council |

## 3.3 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) will be used in order to manage surface water in accordance with current best practice. SuDS work through mimicking natural drainage systems, reducing runoff and peak flows from a site and reducing the risk of flooding. In addition to reducing flood risk, SuDS can also improve water quality (which is discussed in Section 3.5). In accordance with the management train set out in the SuDs Manual (C753) the techniques that have been considered for proposed stations and structures are set out in Table 3-3 below.

**Table 3-3 Assessment of Applicable SuDS Features**

| SuDS Group | SuDS Technique | Description | Suitable | Reasons |
|---|---|---|---|---|
| **Source Control** | Site layout & management | Good housekeeping and good design. | Yes | Include provision for SuDS at design stage. Include drainage facilities to control on-site and prevent off-site flooding. |
| | Water butts | Collection of rainwater for reuse. | No | Not appropriate for structures / station platforms as no buildings are proposed. |
| | Rainwater harvesting and re-use | Larger-scale collection of rainwater for attenuation or for reuse in appropriate ways (e.g. toilet flushing or irrigation). | No | |
| | Permeable pavement | Allow inflow of rainwater into underlying soil or construction. | Yes | Not appropriate for public highway structures where asphalt surfacing is required. But this could be suitable solution for private highway structures where surfacing is likely to be granular material.<br><br>Not appropriate for platform construction, where precast concrete slabs are required for structural stability. |
| | Green roofs | Vegetated roofs that reduce runoff volume and rate | No | Not appropriate for structures / station platforms as there are no buildings proposed. |
| **Retention** | Rainwater attenuation | Collection of rainwater within storage tanks to reduce runoff rates (until tank capacity reached). | Yes | This would be a suitable solution for structures and station platforms however the preference is to avoid the construction of tanks. |

| SuDS Group | SuDS Technique | Description | Suitable | Reasons |
|---|---|---|---|---|
| **Detention** | Detention basin | Dry depressions designed to store water for a specified retention time and quantity | Yes | For structures, to reduce land take required and due to the linear nature of these assets preference has been given to the use of linear attenuation features but where sufficient attenuation can't be provided in linear features detention basins will be utilised.<br><br>Not suitable for station platforms due to operational constraints. |
| **Filtration** | Filter drain | Linear drains or trenches filled with permeable material, often with piped drainage in the base. | Yes | For structures preference has been given to the use of open channels to collect runoff but where there is insufficient space for open channels, filter drains will be utilised.<br><br>Pollution/grit/sediments can be settled out, the rate of runoff slowed and retention time for water treatment increased.<br><br>Not suitable for station platforms due to operational constraints. |
| | Filter strip | Vegetated strips of gently sloping ground designed to drain water evenly from impermeable surfaces and filter out particles. | Yes | Appropriate for structures. Pollution/grit/sediments can be settled out, the rate of runoff slowed and retention time for water treatment increased.<br><br>Not suitable for station platforms due to operational constraints. |
| | Bio-retention areas | Vegetated areas for collecting and treating water before discharging or infiltrating | No | Not suitable for anticipated site use of proposed structures or station platforms. |
| | Sand filters | Treatment devices using sand beds as filter media | No | More appropriate for treatment of industrial areas. |

| SuDS Group | SuDS Technique | Description | Suitable | Reasons |
|---|---|---|---|---|
| | Silt removal devices | Manhole or other devices to remove silt | Yes | For structures trapped gullies, catchpits, swales, detention basins and source control are considered to be more effective in managing silt.<br><br>For stations, catchpits and channel drains are considered to be appropriate measures for managing silt. |
| **Infiltration** | Soakaways | Sub-surface storage and infiltration systems | No | Based on a review of infiltration potential in Table 3-1 reliance on infiltration solutions alone is not considered a feasible option to dispose of surface water. However, it is proposed that drainage features are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls |
| | Infiltration trenches | Similar to filter drains but allow infiltration through trench bases and sides | No | |
| | Infiltration basins | Depressions that store and dispose of water via infiltration | No | |
| **Open Channel** | Swales / cut-off ditch | Shallow, vegetated channels to conduct or retain water and provide filtration (permitting infiltration when unlined). | Yes | For structures open channels can be utilised to remove pollutants and for flow conveyance.<br><br>Not suitable for station platforms due to operational constraints. |
| **Wetland** | Ponds | Depressions used for storing and treating water with permanent pool and marginal aquatic vegetation. | No | For structures this is not considered to be an appropriate solution as often they are reliant on a continuous through-flow of water which is unlikely to be available on this site.<br><br>Not suitable for station platforms due to operational constraints. |
| | Shallow pond or pocket wetland | Shallower ponds where runoff flows through aquatic / wetland vegetation for attenuation and infiltration, but which may dry out | No | |
| **Other** | Pipes and subsurface storage | Oversized pipes as conveyance measures and/or storage. Can be combined with sedimentation and filter media systems | Yes | This would be a suitable solution for structures however the preference is to provide attenuation in swales and detention basins.<br><br>Due to spatial constraints under the platforms, this is the preferred method for attenuation at stations. |

An assessment of SuDS features has identified the applicable SuDS measures and has considered their potential applications for the proposed structures and stations. Based on this, the proposed drainage systems for the structures will comprise of a combination of filter strips, open channels/drainage ditches and swales. Where there is insufficient space for attenuation in swales and filter drains, detention basins will be utilised. For station platforms, the proposed drainage system will compromise of a system of channel drains, and oversized carrier drains to attenuate flows.

## 3.4 Water Quantity

**Structures**

The following water quantity principles will be adhered to for each of the proposed structures:

*Peak Runoff Control*

Where an offline replacement of an existing level crossing is proposed and the existing highway and associated drainage infrastructure is to remain, the peak runoff rate from the proposed structure for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

Where an offline or online replacement of an existing level crossing is proposed and the existing highway and associated drainage infrastructure is to be removed, the peak runoff rate from the proposed structure for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the existing highway for that event.

*Volume Control*

Where reasonably practicable, where an offline replacement of an existing level crossing is proposed and the existing highway and associated drainage infrastructure is to remain, the runoff volume from the proposed structure in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

Where reasonably practicable, where an offline or online replacement of an existing level crossing is proposed and the existing highway and associated drainage infrastructure is to be removed, the runoff volume from the proposed structure in the 1 in 100 year, 6 hour rainfall event must be constrained to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the existing highway for that event.

Where it is not reasonably practicable to constrain the volume of runoff in accordance with the above, the runoff volume must be discharged at a rate that does not adversely affect flood risk. If this situation occurs, then fluvial hydraulic modelling of the downstream watercourse would be carried out to ensure there is no increase in flood risk to others.

*Flood Risk Control*

In accordance with CG 501 'Design of Highway Drainage Systems' all carrier pipes and gullies draining the proposed carriageway will be designed to achieve no surcharging during a 1 in 1 year plus 20% for climate change event and no flooding during a 1 in 5 year plus 20% for climate change event. Any flooding in more extreme return periods would be routed to open channels / drainage ditches, filter drains, swales and detention basins located at the toe of proposed embankments.

All open channels / drainage ditches, filter drains, swales and detention basins located at the toe of proposed embankments will be designed to achieve no flooding during a 1 in 100 year plus 20% for climate change event.

During a 1 in 100 year plus 40% for climate change event the surface water drainage system will be designed so that flooding does not occur to any buildings, railway infrastructure, 3rd party land or critical infrastructure susceptible to water (e.g. pumping station or electricity substation) and is retained on Network Rail land.

*Attenuation Storage*

To meet the above water quantity requirements will require attenuation storage, of which volumes can largely be achieved through using linear swales. To maximise the storage volumes of the swales check dams are proposed at regular spacings. Where swales cannot provide the required volume of attenuation, detention basins will also be utilised.

*Flow Control*

To restrict runoff to required rates flow controls will be required. Flow control will be provided through the use of the following hierarchy:

1. Smaller diameter “throttle” pipes.
2. Orifice Plates.
3. Vortex Flow Control Devices.

75mm diameter is considered the minimum practical orifice size which can be achieved with an acceptable risk of blockage of the outlet and maintenance frequency.

*Hydraulic Assessment*

Hydraulic calculations detailing existing discharge rates and demonstrating compliance with the above water quantity requirements will be included as part of submissions to be made for each structure and station to discharge part (b) of planning condition 14.

Existing greenfield runoff rates will be estimated using the Institute of Hydrology 124 ‘Flood Estimation for Small Catchments’ (IH124) method, which is considered appropriate for the small catchments of the proposed structures. A comparison with existing greenfield runoff rates estimated using the Flood Estimation Handbook methods found that the IH124 method produced conservative results.

Existing brownfield runoff rates will be estimated using the ‘Wallingford Procedure - for design and analysis of urban storm drainage’ (modified rational method), which is considered appropriate for the small catchments of the existing structures.

Proposed drainage systems will be modelled in MicroDrainage.

Where necessary hydraulic modelling of the proposed drainage system will make allowance for inflows from groundwater and water levels in receiving watercourses.

**Stations**

Platform drainage systems at each station will be designed to accommodate the 1 in 50 Year storm event with 20% climate change allowance in accordance with Network Rail Standards. As a result of the platform construction, the surface water runoff rate will increase due to the higher impermeability of the platforms compared to the existing ballasted track scenario. To mitigate against increasing discharge rates, surface water runoff from platforms will be attenuated within the platform drainage, and the receiving track drainage systems. The peak runoff rate from the proposed drainage network for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the existing peak runoff rate for the same event.

Flow controls and hydraulic assessments on stations packages will be carried out with an approach consistent with that stated above for structures.

## 3.5 Water Quality

**Structures**

Given the low traffic volumes predicted to use the structures during operation of the project the risk of runoff from the carriageway containing harmful levels of pollutants and risk of spillages occurring is considered low. Notwithstanding this, drainage from all structures will incorporate a combination of trapped gullies, filter strips, swales, filter drains or detention basins which will trap silts and sediments and treat runoff through filtration. The risk of pollution to local surface water receptors will therefore be very low. As such the incorporation of oil interceptors and penstocks in the proposed structure drainage systems is not deemed necessary. This approach is in line with CIRIA C753 'The SuDs Manual'.

It is proposed that drainage features (open channels / drainage ditches, swales, detention basins etc.) are unlined to allow partial infiltration of runoff to reduce the rate and volume of runoff reaching proposed outfalls. As the proposed structures do not lie in Environment Agency Source Protection Zones, the risk of pollution to groundwater receptors will be very low.

To demonstrate compliance with CIRIA C753 'The SuDs Manual' a simple index approach assessment will be included in part (b) submissions for each structure.

**Stations**

As the station platforms and footbridges will be subject to non-motorised traffic only, the risk of surface water runoff containing harmful levels of pollutants is considered very low. Notwithstanding this, as drainage from the platforms will discharge into the track drainage system, which will include filter drains and catchpits to trap silts and sediments, the risk of pollution to local surface water receptors will be very low.

## 3.6 Maintenance

**Structures**

Open channels / drainage ditches, swales, detention basins, filter drains and flow controls will be located within the permanent land to be acquired by Network Rail and will be maintained by Network Rail.

Gullies, and carrier pipes located within the Public Highway will continue to be maintained by the local highway authority.

**Stations**

Platform channel drains, carrier drains and flow controls will be located on Network Rail land and be maintained by Network Rail.

A schedule detailing arrangements for the whole life maintenance and management of the structure or station drainage scheme, will be included as part of submissions to be made for each structure or station to discharge part (b) of planning condition 14.

# 4. Detailed Design

The design of drainage systems for proposed structures and stations will be developed based on the principles of this Overarching Surface Water Drainage Assessment. On the completion of the detailed design of proposed structures and stations, submissions will be made for each structure or station to discharge part (b) of planning condition 14. These submissions will include:

- Ground investigation data.
- Detailed drainage general arrangement drawings.
- Details of flow controls to be used.
- Calculations estimating existing runoff rates.
- MicroDrainage hydraulic model results.
- Maintenance schedules.

**EWR Alliance**

**Floor 2**
**Phoenix House**
**Elder Gate**
**Milton Keynes**
**MK9 1AW**