

Appendices Chapter 9

Environmental Statement: Volume 2

784-B048803

P e l l F r i s c h m a n n

M4 J16 Motorway Rest Area, Swindon

Flood Risk Assessment

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Prepared for

Moto Hospitality Ltd

Toddington Services Area
Junction 11/12, M1 (Southbound)
Toddington, Bedfordshire
LU5 6HR

Prepared by

Pell Frischmann

Suite 4.2 – 1 The Poynt
Wollaton Street
Nottingham
NG1 5FW



Pell Frischmann

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1 Introduction

1.1 Project Brief

- 1.1.1 Pell Frischmann has been appointed by Moto Hospitality to undertake a Flood Risk Assessment (FRA) to support a planning application for a commercial motorway rest area on a site located at Junction 16 of the M4, Swindon.
- 1.1.2 The purpose of this FRA is to review available information and assess the flood risk posed to the site and proposed development from a range of sources, now and in the future. The FRA has been carried out in accordance with the requirements of the National Planning Policy Framework (NPPF) and associated Planning Practice Guidance (PPG), in respect to flood risk and coastal change.
- 1.1.3 To complete the Flood Risk Assessment, the following key stages of work have been undertaken:
- Collation of desk-based information and undertake a review of publicly available flood risk information including Environment Agency mapping and local data, policy, and guidance.
 - Desktop review of other data that has been made available such as topographical surveys, utility plans and proposed development layout options.
 - Consultation with relevant stakeholders to obtain further information on local risks and issues.
 - Provision advice on appropriate flood risk mitigation measures for the proposed development.

1.2 Sources of Information

- 1.2.1 A review of relevant information and guidance from a range of sources has been undertaken and includes the following key documents:
- National Planning Policy Framework (NPPF), September 2023
 - Planning Practice Guidance (PPG), August 2022
 - Environment Agency Flood Map for Planning and Risk of Flooding from Surface Water datasets from the DEFRA Spatial Data Catalogue
 - DEFRA MagicMap, 2023
 - British Geological Survey Geology Viewer, 2023
 - British Geological Survey GeoIndex, 2023
 - Wiltshire Strategic Flood Risk Assessment, May 2019
 - Wiltshire Preliminary Flood Risk Assessment, June 2011
 - Wiltshire County Council Local Plan, January 2015
 - Wiltshire Local Flood Risk Management Strategy, November 2014
 - Wiltshire Council Surface Water Management Plan, November 2011
 - Thames Catchment Flood Management Plan, December 2009
 - Thames River Basin Management Plan, December 2022
- 1.2.2 A request for information was submitted to the Environment Agency on May 2023 to obtain any site-specific flood risk data they may hold. Information was received on June 2023 and is incorporated within this FRA where appropriate.

2 Background & Site Context

2.1 Site Location & Existing Use

- 2.1.1 The site is located to the south of Swindon, on the southern side of Junction 16 of the M4. A site location plan is included for reference as **Figure 2.1**. In total, the site covers approximately 7.3 hectares.

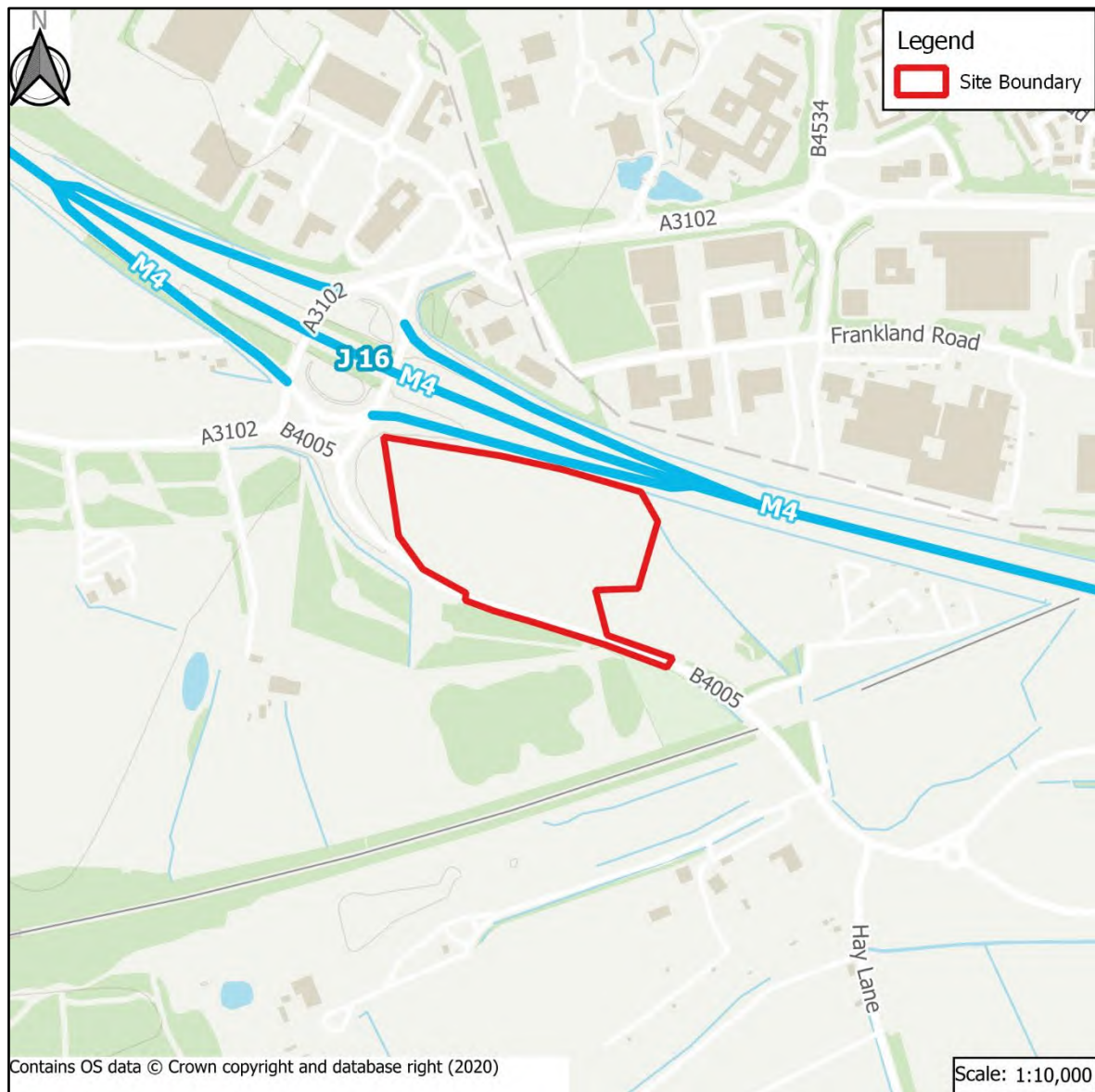


Figure 2.1 Site Location Plan

- 2.1.2 The northern boundary of the site is formed by J16 of the M4, beyond which is Swindon. To the east is open agricultural land and a small unnamed watercourse. The southern boundary is formed by the B4005, beyond which is further agricultural land, and to the west is the B4005, and J16 of the M4.
- 2.1.3 Mapping shows the site to be currently undeveloped. Furthermore, the site is shown to be used primarily for agriculture, therefore, it is considered the Site is subject to a natural regime of drainage involving runoff and infiltration where ground conditions permit.

2.2 Local Watercourses

- 2.2.1 A review of the OS OpenRivers dataset shows a small field drain is found within the site boundary. Found along the eastern boundary of the site, the small watercourse likely served a land drainage function.

Several smaller unnamed watercourses are found immediately surrounding the site boundary and in the wider area. Some of these form part of the highway drainage network, and others provide a land drainage function to the agricultural land, with wider connectivity to watercourses to the east.

2.2.2 **Figure 2.2** shows the locations of local watercourses.

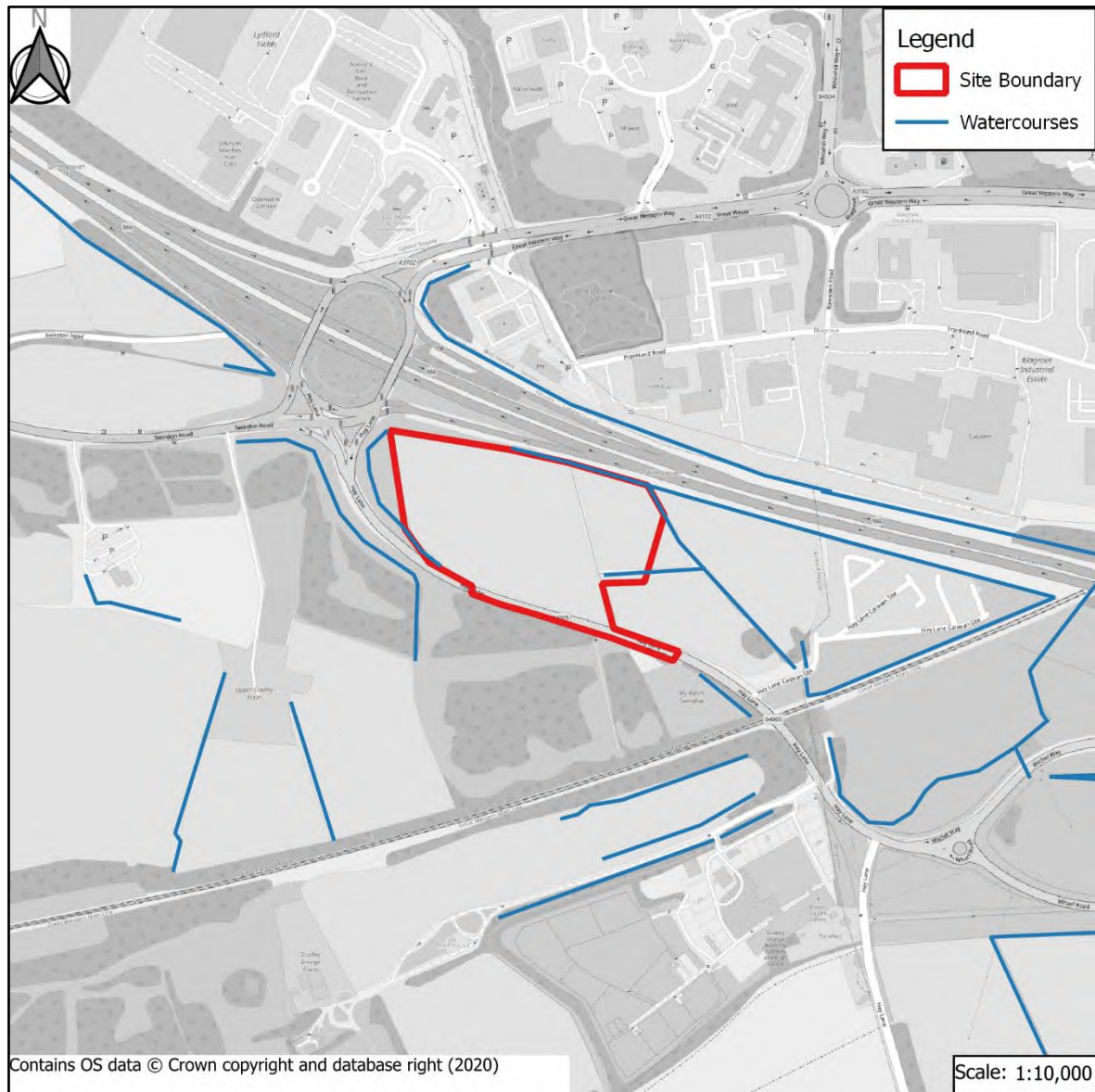


Figure 2.2 Local Watercourses

2.3 Topography

- 2.3.1 The site generally falls from west to east with maximum elevations of approximately 108.14m AOD in the west, falling to a minimum elevation of approximately 103.41m AOD in the east. Approximate elevations have been taken from LiDAR elevation data provided by DEFRA. An extract of which is provided for reference as **Figure 2.3**. The topographic survey for the site has been attached as **Appendix A**.
- 2.3.2 The LiDAR data further shows elevations in the wider area remain consistent with the change in levels within the site boundary, with elevations rising to the west and falling to the east.

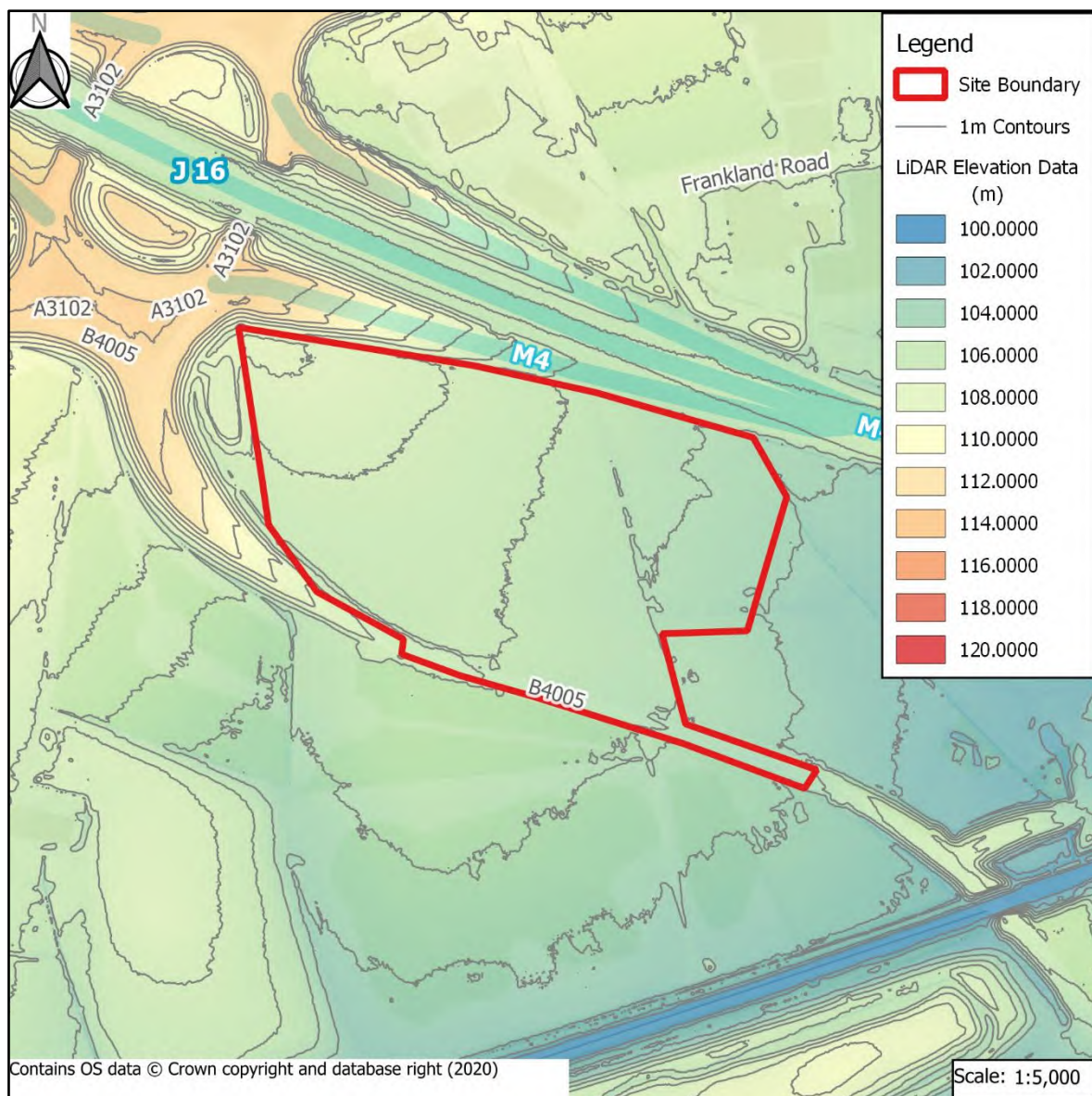


Figure 2.3 LiDAR Elevation Data

2.4 Geology

- 2.4.1 British Geological Survey (BGS) mapping suggests the site is wholly underlain by a bedrock geology comprising Kimmeridge Clay Formation – Mudstone. This suggests limited potential for infiltration.
- 2.4.2 BGS mapping also shows there to be no recorded superficial geology within the site or the surrounding area.
- 2.4.3 There are no freely available borehole records within the site boundary. The nearest can be found immediately to the southwest and northeast of the site (borehole references: SU18SW41 and SU18SW60). Details from the logs made available via the BGS are summarised in **Table 2.1**.

Table 2.1 Borehole Information

Borehole Reference	Date Drilled	Depth (mbgl)	Water Struck (mbgl)
SU18SW41	September 1966	1.2	DRY
SU18SW60	July 1984	5.0	DRY

- 2.4.4 Aquifer designations by DEFRA show both the superficial drift classification and bedrock classification to be Unproductive. This is defined as rock layers and drift deposits with low permeability that have

negligible significance for water supply or river base flow. This suggests very little to no water within the bedrock or superficial strata.

- 2.4.5 The site does not fall within a Source Protection Zone (SPZ), with the nearest SPZ (Zone II – Subsurface Activity) being found approximately 1.5km to the west of the site.

2.5 Development Proposals

- 2.5.1 Development proposals comprise a new amenity building, drive thru, charging areas for electric cars and parking for coaches, caravans & HGV creating a new Motorway Rest Area at J16 of the M4, with associated road infrastructure, landscaping, and SuDS features.

3 Policy Context

3.1 National Planning Policy Framework

- 3.1.1 The National Planning Policy Framework¹ (NPPF) was first published in 2012, with a subsequent revision by the Ministry of Housing, Communities and Local Government appended in July 2018, February 2019, and July 2021 with the most recent update made in September 2023.
- 3.1.2 The NPPF is the primary source of national planning guidance in England, setting out the Government's planning policies for England, and how they are expected to be applied by local councils.
- 3.1.3 'Chapter 14: Meeting the challenge of climate change, flooding and coastal change' outlines the guiding principles for managing flood risk as part of the planning process, notably paragraphs 159-169.
- 3.1.4 The Planning Practice Guidance² (PPG) sets out the vulnerability to flooding of different land uses. It encourages development to be in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off site to the wider catchment.
- 3.1.5 The Planning Practice Guidance also states that alternative sources of flooding, other than fluvial (river flooding), should be considered when preparing a Flood Risk Assessment.
- 3.1.6 The Planning Practice Guidance includes a series of tables that define Flood Zones, the flood risk vulnerability classification of development land uses, and 'compatibility' of development within the defined Flood Zones.
- 3.1.7 Therefore, this Flood Risk Assessment has been completed in line with the guidance and requirements for the NPPF and Planning Practice Guidance.

3.2 Local Plan Policies

- 3.2.1 The Wiltshire Local Plan³ was adopted in January 2015 and sets out how land within the district can be used and developed, providing policies which the council use to determine application and regeneration activities.
- 3.2.2 The plan aims to oversee how the council will manage future growth, encourage sustainable development, and ensure changes are appropriate to local need now, and in the future.
- 3.2.3 More generally, the Local Plan lists policies that influence the design and principles of all development within the district. Those relevant to this FRA are as follows:
- Core Policy 19: Spatial Strategy
 - Core Policy 52: Green Infrastructure
 - Core Policy 67: Flood Risk
 - Core Policy 68: Water Resources

3.3 Local SFRA

- 3.3.1 The Wiltshire Council Strategic Flood Risk Assessment⁴ (SFRA) was published in May 2019. The SFRA was prepared to provide an appropriate evidence base for local policymaking, including a summary of

¹ Ministry of Housing, Communities and Local Government (September 2023); *The National Planning Policy Framework*

² Ministry of Housing, Communities and Local Government (August 2022); *Planning Practice Guidance on Flood risk and coastal change*

³ Wiltshire Council (January 2015); *Wiltshire Local Plan Core Strategy*: prepared by WC

⁴ Wiltshire Council (May 2019); *Wiltshire Council Level 1 Strategic Flood Risk Assessment*; prepared by JBA

flood risk issues across the area and to support the application of the sequential test for suitability of allocated sites.

- 3.3.2 The SFRA also includes relevant background flooding data and a summary of flood risk within the district.

3.4 Local PFRA

- 3.4.1 The Wiltshire Council Preliminary Flood Risk Assessment⁵ (PFRA) was published in June 2011. The PFRA was prepared to assist Wiltshire Council meet their duties to manage local flood risk and deliver any legal requirements placed on them as the LLFA under the Flood Risk Regulations 2009.
- 3.4.2 The PFRA also identifies the past and future flood risk for the County and includes an assessment of where within the County flooding, including overland flow and direct rainfall, will occur along with the number of properties potentially at risk.

3.5 Local Flood Risk Management Strategy

- 3.5.1 The Wiltshire Local Flood Risk Management Strategy⁶ (LFRMS) was produced to comply with Section 9 of the Flood and Water Management Act 2010 and aims to provide a framework for meeting their requirements to develop, maintain, apply, and monitor a local strategy for flood risk management.
- 3.5.2 The LFRMS provides further information regarding surface water runoff, groundwater and sewer flooding and flood risk around the County and the introduction of flood risk alleviation schemes at various scales, including SuDS.

3.6 Surface Water Management Plan

- 3.6.1 The Wiltshire Surface Water Management Plan⁷ (SWMP) was published in November 2011 by URS and Scott Wilson on behalf of Wiltshire Council. It was produced to understand the flood risks that can arise from local flooding, identifying where flood risk issues are, what impact they have, how they can be managed, as well as providing a full history of the plan area. This will provide a baseline for the Wiltshire Council aim to manage and improve surface water flood risks within the council area.

3.7 Thames Catchment Flood Management Plan

- 3.7.1 The Thames Catchment Flood Management Plan⁸ (CFMP) was published in December 2009 by the Environment Agency. The CFMP aims to help the Environment Agency and local councils to understand the scale and extent of flooding now and in the future, whilst also setting policies for managing flood risk within the catchment.
- 3.7.2 The CFMP should be used to inform planning and decision making by key stakeholders including; the Environment Agency, local authorities, IDB's, water companies and utility providers, landowners, and the general public. The CFMP also aims to promote more sustainable approaches to managing flood risk.

3.8 Thames River Basin Management Plan

- 3.8.1 The latest version of the Thames River Basin District Flood Risk Management Plan⁹ (RBPM) was prepared by the Environment Agency and published in December 2022. The purpose of this RBMP is to provide a framework for protecting and enhancing the benefits provided by the water environment.

⁵ Wiltshire Council (June 2011); *Wiltshire Council Preliminary Flood Risk Assessment*; prepared by WC

⁶ Wiltshire Council (November 2014); *Wiltshire Local Flood Risk Management Strategy*; prepared by WC

⁷ Wiltshire Council (November 2011); *Wiltshire Surface Water Management Plan*; prepared by URS and Scott Wilson

⁸ Environment Agency (December 2009); *Thames Catchment Flood Management Plan*; prepared by EA

⁹ Environment Agency (December 2022); *Thames River Basin District Flood Risk Management Plan*; prepared by EA

4 Assessment of Flood Risk

4.1 Desk-Based Information

4.1.1 The NPPF states that all potential sources of flood risk must be identified and appraised. Flooding can occur from a variety of sources individually, or in combination and can result from both natural and artificial processes.

4.1.2 **Table 4.1** provides an initial desk-based review of the level of flood risk from all sources, which are then assessed in further details where the risk is considered significant and merits further investigation.

Table 4.1 Desk-Based Assessment of Flood Risk

Sources of Flood Risk	Degree of Risk			Comments
	Significant	Moderate	Low	
Fluvial			X	The Site is wholly within Flood Zone 1
Coastal & Tidal			X	The site is removed from the extent of tidal flooding, now and in the future
Groundwater			X	Low potential susceptibility to groundwater flooding due to deep groundwater and aquifer designations.
Surface Water			X	Isolated areas of low surface water risk found within and around the site.
Sewers			X	Limited extent of sewers in the immediate vicinity.
Canals			X	Canal found approximately 680m to the south of the site.
Reservoirs & Waterbodies			X	Low risk posed.

4.2 Fluvial Flood Risk

4.2.1 The Environment Agency has produced a resource known as the Flood Map for Planning, which identifies areas at risk of flooding from Main Rivers and the sea. An extract of this mapping is included for reference as **Figure 4.1**.

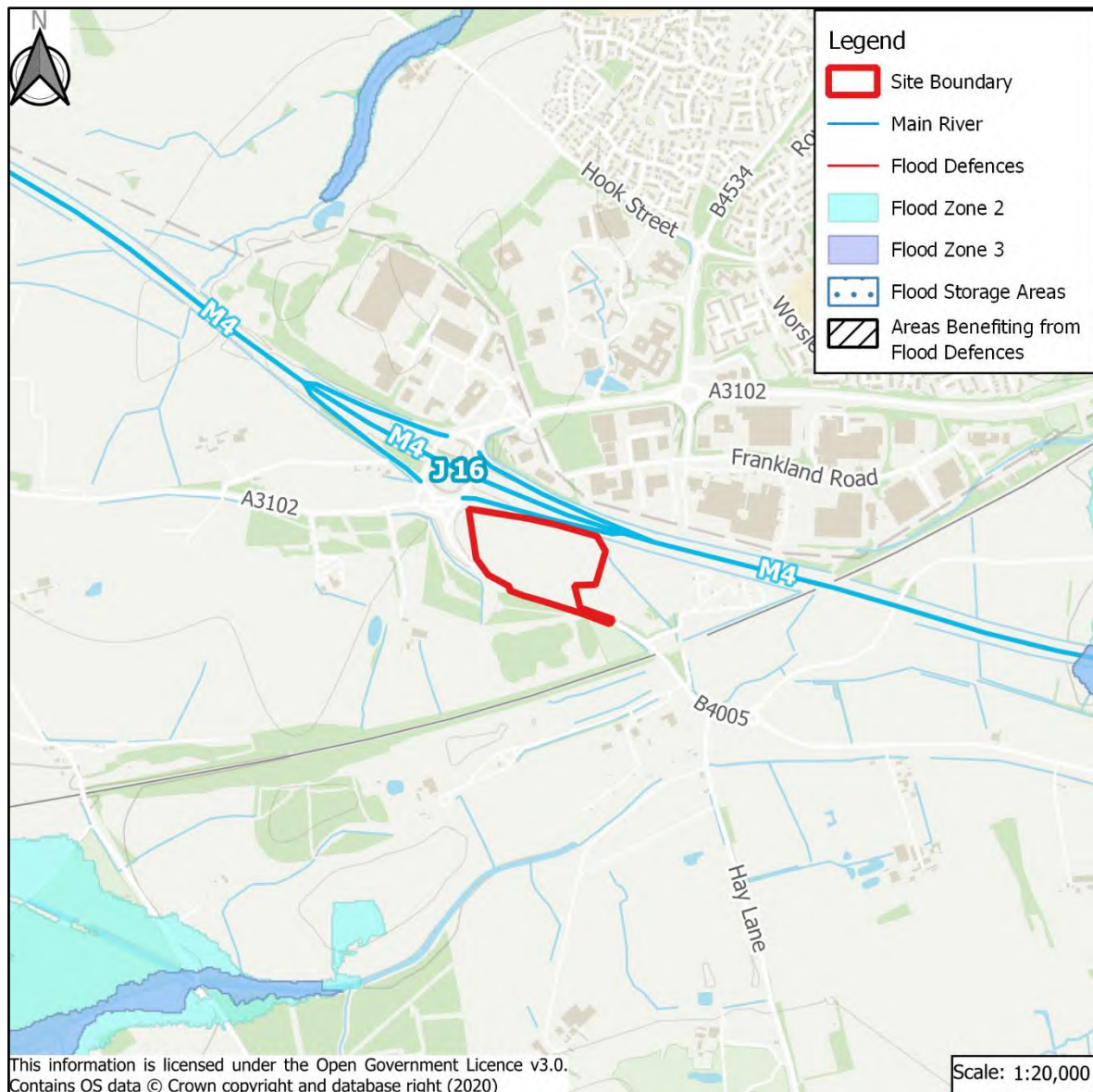


Figure 4.1 Flood Map for Planning

- 4.2.2 The mapping shows the site to be wholly within Flood Zone 1 (Low Probability) which is defined in the NPPF as land having less than 0.1% annual chance of flooding from rivers or the sea.
- 4.2.3 The nearest extent of Flood Zones 2 and 3 (Medium and High Probability respectively) is found approximately 1km to the northwest of the site, associated with an unnamed watercourse running north.
- 4.2.4 Data provided by the EA confirming that the site is not inherently associated with any significant areas of fluvial flooding this is included as **Appendix B**.
- 4.2.5 Several small watercourses can be found around the site boundary. These show connectivity and generally drain toward the south east as discussed in **Section 2.2**.
- 4.2.6 Therefore, based on the published information the site is considered to be at low risk of flooding from fluvial sources, including local watercourses.

4.3 Coastal & Tidal

- 4.3.1 The site is located wholly within Flood Zone 1 and is far removed from the coast and so not affected by tidal influences.

4.3.2 Therefore, the risk of flooding from coastal or tidal related events is negligible.

4.4 Groundwater

- 4.4.1 Groundwater flooding occurs when the water table rises above ground elevations. It is most likely to happen in low lying areas underlain by permeable geology. This may be regional scale chalk or sandstone aquifers, or localised deposits of sands and gravels underlain by less permeable strata such as that in a river valley.
- 4.4.2 Previously mentioned boreholes did not report striking groundwater within their investigations at depths of up to 5mbgl. Alongside a superficial and bedrock aquifer designation of Unproductive, this suggests groundwater within the area will have limited potential to move within the strata.
- 4.4.3 The PFRA provides information on groundwater flooding within the County. It suggests groundwater flooding is more likely to occur within the south of Wiltshire, and that the EA's Areas Susceptible to Groundwater Flooding mapping is not sufficiently detailed to allow firm conclusions to be made regarding this aspect of flood risk within Wiltshire.
- 4.4.4 The 2019 SFRA includes groundwater flooding mapping produced by JBA, this places the site within an area deemed as having a negligible risk of flooding from groundwater due to the nature of the local geological deposits. The area surrounding the site shares the same classification.
- 4.4.5 The site does not fall within a Source Protection Zone (SPZ), with the nearest SPZ (Zone II – Subsurface Activity) being found approximately 1.5km to the west of the site.
- 4.4.6 Overall, considering the aquifer designations, underlying geology and information on groundwater provided within local documentation, the risk of flooding from groundwater is considered to be negligible.

4.5 Surface Water (Pluvial)

- 4.5.1 The risk of flooding from surface water has been mapped by the EA on a strategic scale to understand areas that may be susceptible to ponding of surface water during periods of extreme rainfall. An extract of the latest mapping is included for reference as **Figure 4.2**.
- 4.5.2 The mapping indicates the site to generally be at a low overall risk of flooding from surface water. Areas of low risk are found in the west and east of the site, likely associated with localised topographical depressions.
- 4.5.3 It should be noted, the mapping used by the EA to provide the risk of flooding from surface water does not consider continual losses to the ground through infiltration. Whilst infiltration rates are likely to be low, geology and ground conditions may provide a reduction in flows on site.
- 4.5.4 Furthermore, it is likely the unnamed watercourses around the boundaries of the site would intercept any surface water flows from surrounding land and convey flows away from the site.
- 4.5.5 Given the above, the risk posed to the site from surface water flooding is considered to be low.

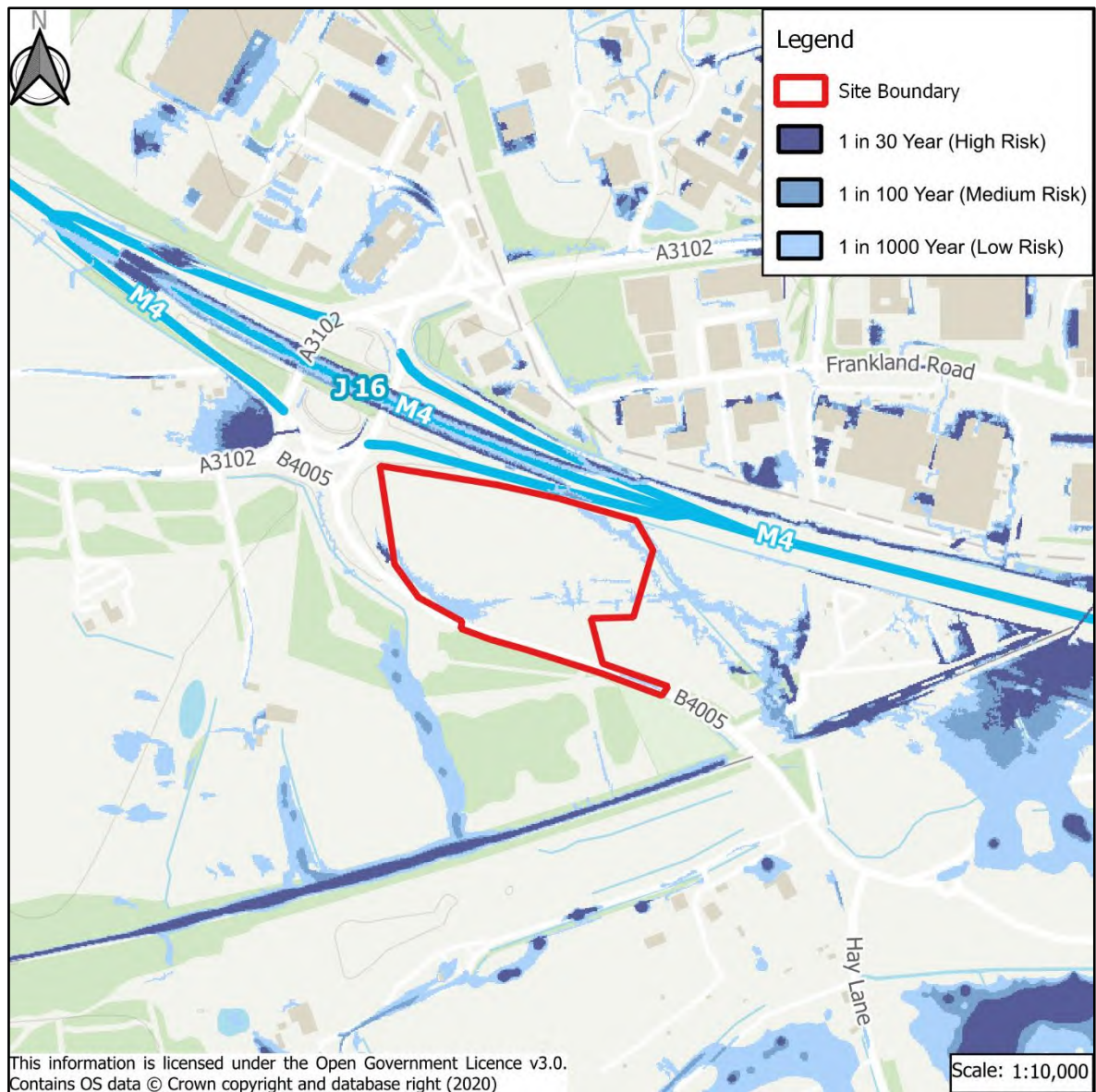


Figure 4.2 Surface Water Flooding

4.6 Sewers

- 4.6.1 Flooding from sewers typically results from the network capacity being exceeded or because of a blockage to key elements. Flooding usually occurs by way of surcharging manholes, gullies or other features that allow water from sewers to reach the surface, resulting in overland flows that can affect nearby properties.
- 4.6.2 Due to the undeveloped nature and previous use of the site, it is unlikely for either public or private sewerage networks to be present within the site boundary. Discussions are ongoing with Thames Water to confirm this.
- 4.6.3 However, due to the topography of the site, it is likely any surcharging would be routed away from the site, or towards areas of lower topography in the vicinity.
- 4.6.4 Therefore, the site is considered to be low risk from flooding from surcharging of the local network.

4.7 Canals

- 4.7.1 The Wiltshire and Berkshire Canal is found approximately 680m to the south of the site. However, due to intervening topography and distance between the site and the canal, the risk of flooding posed from canals is considered to be negligible.

4.8 Reservoirs

- 4.8.1 The EA has produced strategic scale mapping showing the potential risk of flooding from the failure of large waterbodies and reservoirs, if the relevant impounding structure were to fail.
- 4.8.2 This mapping confirms the site is far removed from the extent of any modelled flooding from such sources. Furthermore, a review of OS mapping does not identify any other reservoirs or waterbodies near to the site that could pose a risk of flooding.
- 4.8.3 Therefore, the risk of flooding from reservoirs or large waterbodies is considered to be negligible.

5 Flood Risk Mitigation

5.1 Sequential Arrangement

- 5.1.1 All types of development are considered acceptable uses within Flood Zone 1 in line with the Sequential Test guidance included within the NPPF and PPG. A motorway rest area such as the one proposed (comprising 'car parks' and 'shops') is considered to be 'less vulnerable' to the potential impacts of flooding in line with definitions in Annex 3 of the NPPF.
- 5.1.2 The site is inherently sequentially preferable due to its location within Flood Zone 1 and concluded to be at low risk from other sources and therefore passes the requirements of the Sequential Test.

5.2 Development Levels

- 5.2.1 There are no specific requirements for finished floor levels to address any flood risk. However, it is recommended that appropriate design of external levels and their relation to building thresholds considers the residual risk from overland flows from surface runoff and drainage exceedance from the proposed network.
- 5.2.2 Finished floor levels should be designed so there is a nominal threshold above surrounding ground levels, in accordance with the relevant building regulations and external levels should be designed so any surface flows shed away from buildings and towards positively drained areas.

5.3 Surface Water Drainage Strategy

- 5.3.1 A surface water drainage strategy has been prepared for the submitted scheme, and details are provided as part of the Sustainable Drainage Report by Pell Frischmann (report ref: 107846-PEF-ZZ-XX-RP-CD-000001).
- 5.3.2 The strategy is based on discharging surface water runoff from the site at the equivalent greenfield rate, with the additional volume stored within attenuation basins before being discharged to the local watercourses, following the existing watersheds across the site.
- 5.3.3 Additional SuDS features are recommended to complement the strategic attenuation basins, and could include features such as permeable paving, rainwater butts, tree pits and rain gardens. These will act as source control measures by capturing and managing runoff close to its source, while providing amenity and biodiversity improvements, as well as improving the quality of runoff.
- 5.3.4 Therefore, the development will not have an adverse impact on the flood risk elsewhere subject to the suitable management of surface water generated by the proposed development.

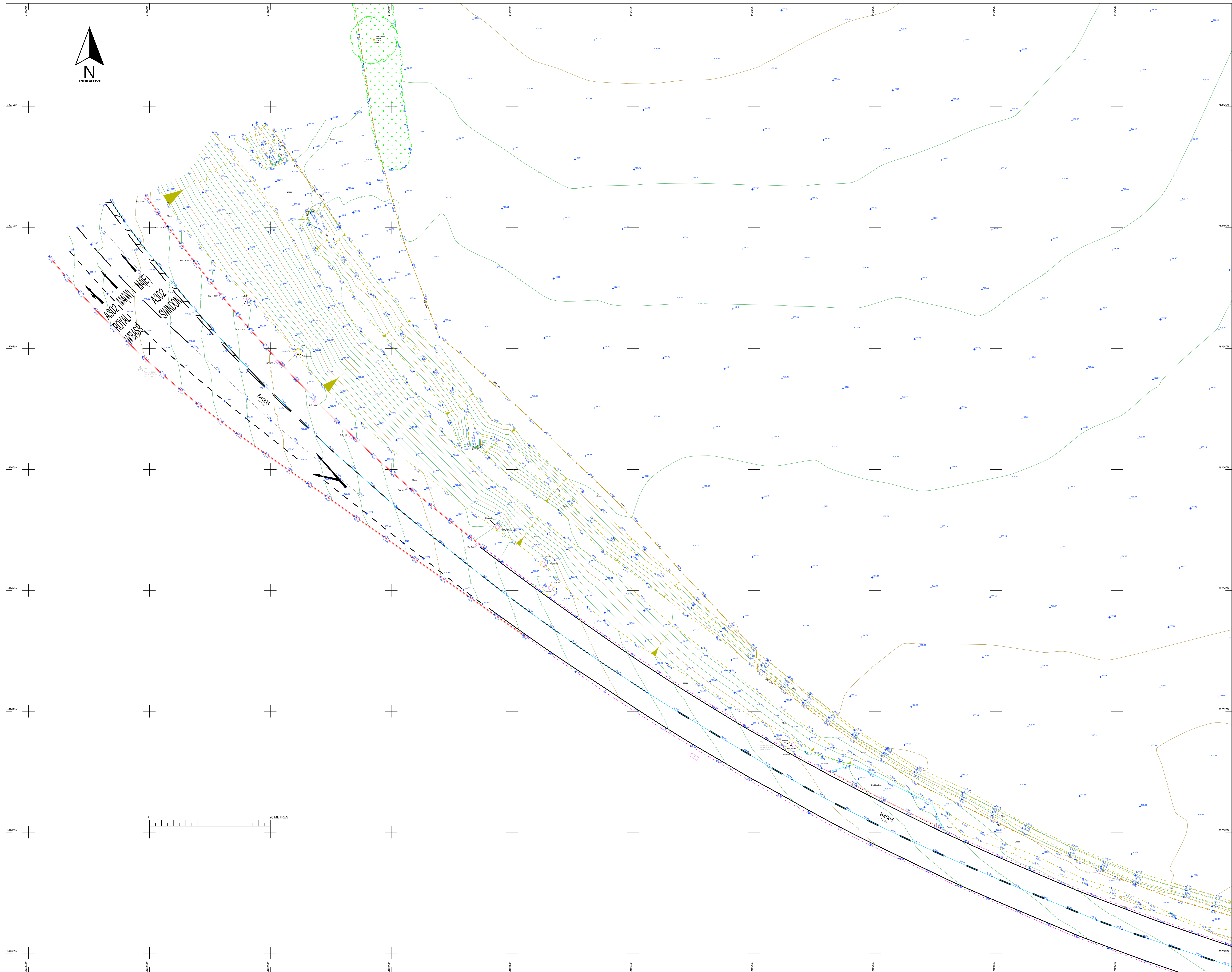
5.4 Watercourse Standoffs

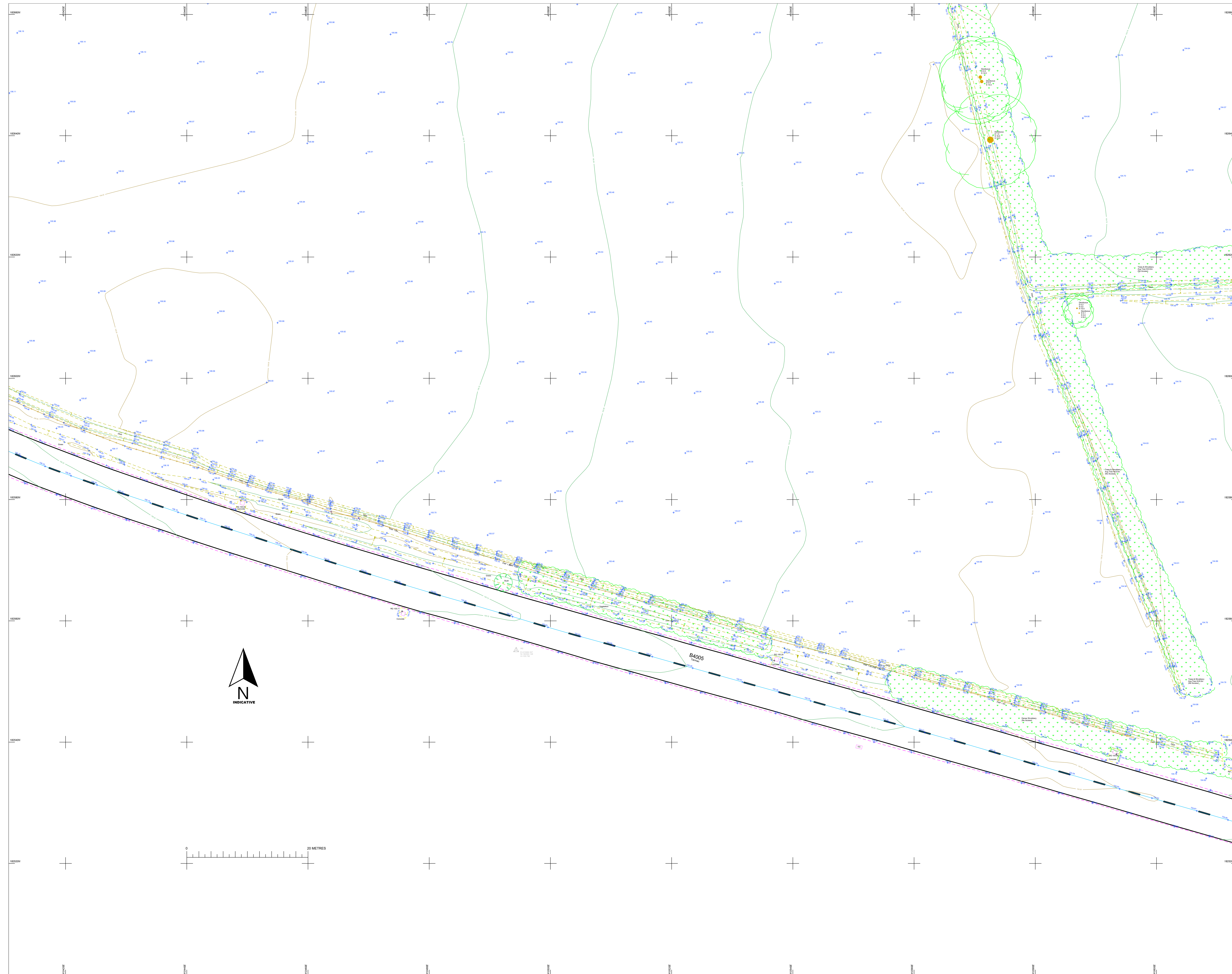
- 5.4.1 A suitable standoff will be required from any watercourses in line with Wiltshire Land Drainage byelaws. 8m free of obstruction is required from the top of bank of any watercourse however it is envisaged that this required can be relaxed due to the nature and catchment of the relevant ditches.

6 Conclusions & Recommendations

- 6.1.1 This Flood Risk Assessment has been written in support of a planning application for the development of a site known as M4 J16 Motorway Rest Area, at J16 of the M4, Swindon. The development is considered a less vulnerable development in flood risk terms and is considered a suitable development for Flood Zone 1.
- 6.1.2 To summarise the findings of the FRA:
- The site is wholly within Flood Zone 1 (Low Probability) and so considered to be at low risk of flooding from Main Rivers and the sea. With the nearest extents of Flood Zone 2 and 3 found approximately 1.2km south west of the site.
 - A number of small unnamed watercourses are found immediately surrounding the site; however, these are relatively small and have limited catchments. It is likely these are used for highway and land drainage and pose a low risk of flooding to the site.
 - The Wiltshire SFRA and PFRA, and BGS geology mapping suggests the site is at low risk of flooding from groundwater.
 - The site is considered to be at low risk of surface water flooding, with small low-risk surface water ponding found within topographic low points of the site. It is likely these will be resolved as part of the development of the site, with the additional surface water being attenuated within attenuation basins on site.
 - It is unlikely public or private sewers will be found within the site boundary. Consultation with Thames Water is ongoing to confirm this. The topography of the site would encourage any surcharging away from the site.
 - Mapping provided by the EA suggests the site is considered to be at low risk of flooding from reservoirs or large waterbodies.
- 6.1.3 Recommendations are made in respect of appropriate consideration of finished floor levels and external level design to manage the residual risk of overland flows by conveying water away from dwellings and towards positively drained areas including suitable watercourse standoff in line with local prevailing guidance.
- 6.1.4 In accordance with the requirements of the National Planning Policy Framework (NPPF), this FRA has demonstrated that development could proceed without being subject to significant flood risk and complies within relevant local plan policies.
- 6.1.5 Furthermore, the development will not result in increased flood risk to third parties if there is suitable management of surface water runoff.

Appendix A Topographical Survey

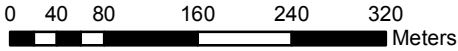
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Appendix B Sewer Records

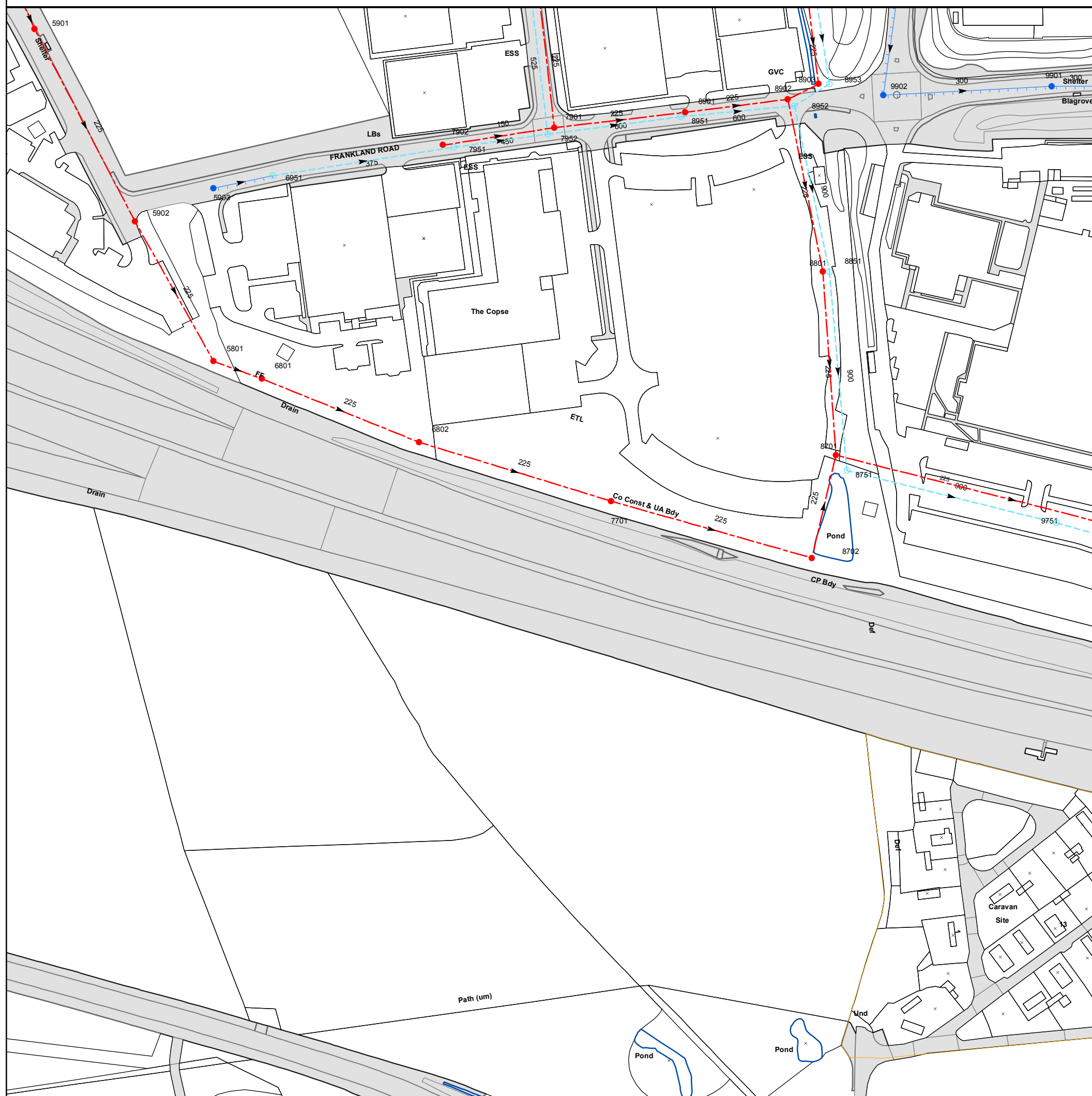


The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale: 1:6440
Width: 1799m
Printed By: Vkumar1
Print Date: 13/04/2017
Map Centre: 410114,182757
Grid Reference: SU1082NW

Comments:

ALS/ALS Standard/2017_3549400



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale: 1:1790
Width: 500m
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Print Date: 13/04/2017
Map Centre: 410750,182750
Grid Reference: SU1082NE

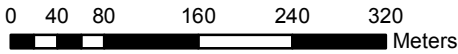
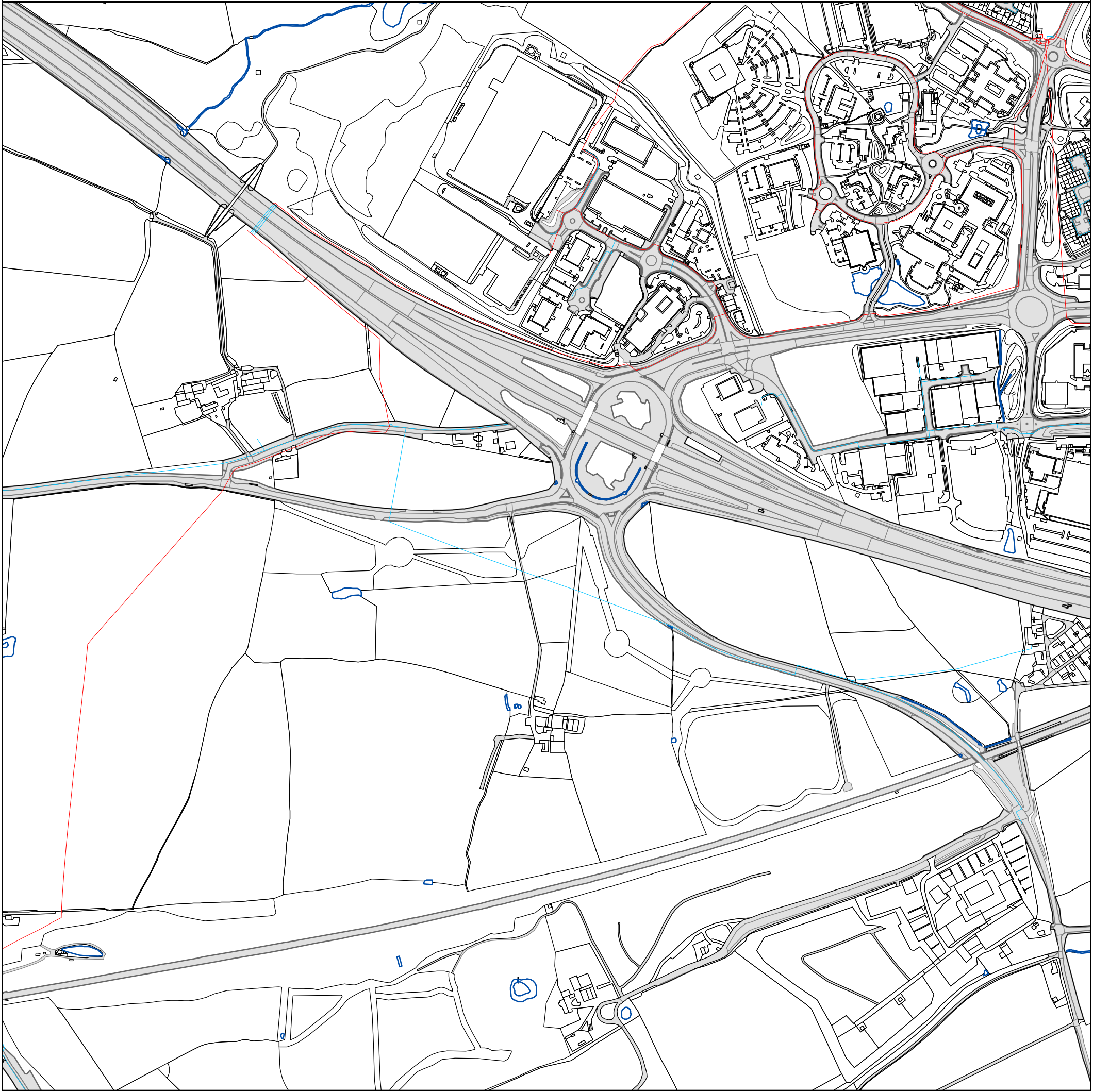
Comments:

ALS/ALS Standard/2017_3549400

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

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8702		
8851	96.49	94.76
8751	95.83	93.9
5901		
7951	98.96	96.73

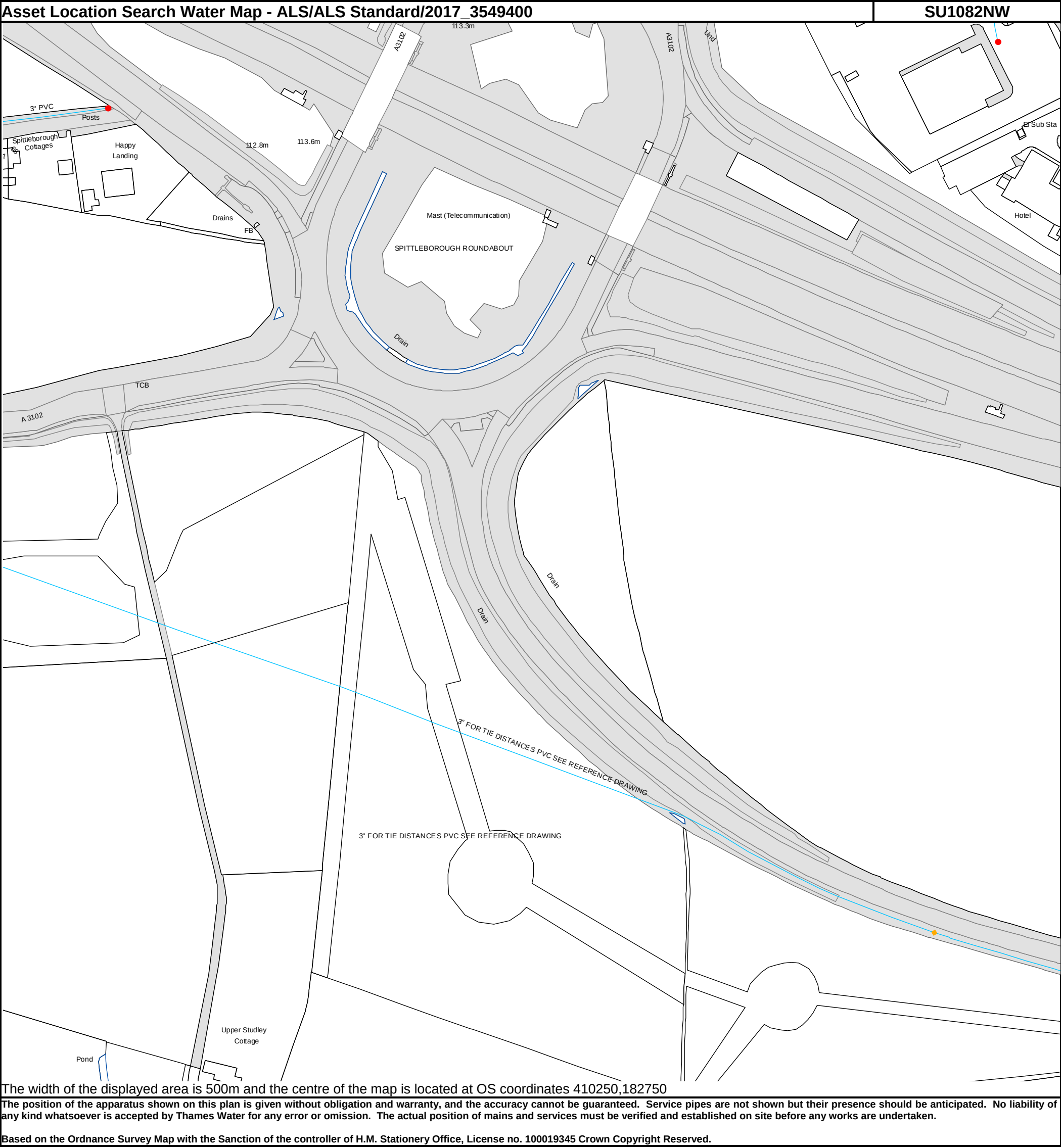
REFERENCE	COVER LEVEL	INVERT LEVEL
8951	98.2	96.04
8902	97.7	94.66
8903		
9902		
5902		
5903		
6951		
7701		
8801	96.49	93.76
8701	95.84	92.91
9751		
7902	98.84	96.41
7952	98.6	96.4

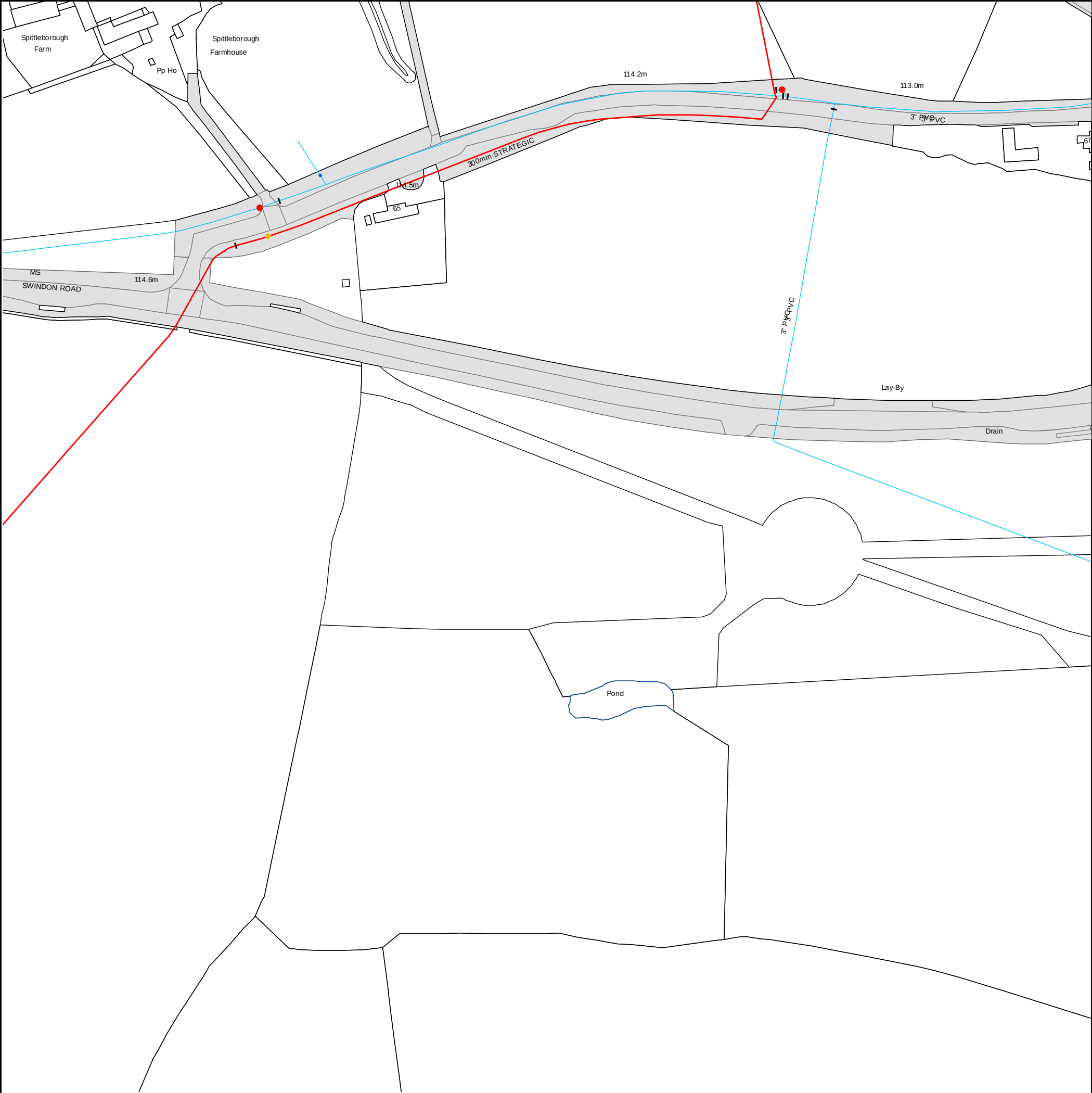


The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale: 1:6440
Width: 1799m
Printed By: Vkumar1
Print Date: 13/04/2017
Map Centre: 410114,182757
Grid Reference: SU1082NW

Comments:





The width of the displayed area is 500m and the centre of the map is located at OS coordinates 409750,182750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

Appendix C Environment Agency Product 4 Request for Information Response

Henry McColl

From: Enquiries_THM <enquiries_THM@environment-agency.gov.uk>
Sent: 15 June 2023 16:43
To: Thomas Sturtridge
Subject: THM313753 - PRODUCT - Request for Information - M4 Junction 16, Swindon - Product 4
Attachments: Site Location Plan Swindon - RFI PDF.pdf



Dear Sturtridge,

Thank you for your email requesting Product 4 data.

Please accept my apologies for the delay in responding.

We unfortunately do not have any detailed flood risk modelling in this location. We are sorry that we are therefore unable to provide modelled flood levels and extents for your site.

The Flood Map for Planning in this location is likely to be based on JFLOW data which is not suitable for use in site specific Flood Risk Assessments. Please advise if you would like to request JFLOW data for this location.

You can access our flood map for planning on our website:

<https://flood-map-for-planning.service.gov.uk/>

You can find more information on the long term risk of flooding for this location on our website:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk>

You can find recorded flood outlines for this location via the link below:

<https://data.gov.uk/dataset/recorded-flood-outlines1>

You can find out the risk of flooding from surface water for this location via the link below:

<https://data.gov.uk/dataset/d5ca01ec-e535-4d3f-adc0-089b4f03687d/risk-of-flooding-from-surface-water-suitability>

You may be interested in the following guidance / information publically available:

- 'Planning Practice Guidance' - provides information about planning considerations in areas at risk of flooding. <https://www.gov.uk/government/collections/planning-practice-guidance>
- 'Planning applications: assessing flood risk' - information about completing Flood Risk Assessments. <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>
- 'Site specific flood risk assessment: Checklist' – a checklist to help ensure you have considered all the relevant factors in your flood risk assessment. <https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section>

Please be aware that from 20th July 2021 the climate change allowances required in flood risk assessments have been updated. Please see <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#contents> for more information.

I hope that we have correctly interpreted your request. Please refer to our Open Government Licence for the permitted use of the supplied data: <http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Please be aware that many of our datasets are now available online. Simply visit environment.data.gov.uk

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely,

Customers & Engagement Team - **Thames**

☎ **External: 0203 0259 804**

✉ enquiries_THM@environment-agency.gov.uk

📍 **Environment Agency** | Red Kite House, Howbery Park, Wallingford, OX10 8BD

ARE YOU AT RISK FROM FLOODING?
Check your flood risk today



From: Thomas Sturtridge <TSturtridge@pellfrischmann.com>

Sent: 26 May 2023 11:59

To: Enquiries, Unit <enquiries@environment-agency.gov.uk>

Subject: Request for Information - M4 Junction 16, Swindon - Product 4

To whom it may concern,

We have been instructed by our client to advise on flood risk and drainage constraints for a proposed development at a site off Junction 16 of the M4, Swindon. A site location plan is provided centred on 410377 , 182730 (nearest postcode: SN5 8UD).

Mapping shows the site to be wholly within Flood Zone 1. I would be grateful if you could supply a Product 4 as a minimum to verify flood extents, levels, and impact of any climate change events and any modelled flood data you may hold.

I trust you find this in order, but should you have any questions, please do not hesitate to contact me on the details below.

Kind regards,

Thomas Sturtridge

BSc (Hons) MSc PIEMA

Graduate Engineer

Suite 4.2 - 1

4th Floor

The Poynt

Wollaton Street

T: 0115784 8960

Nottingham, NG1 5FW

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ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

- 4"** **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 16"** **Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- 3" SUPPLY** **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 3" FIRE** **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 3" METERED** **Metered Pipe:** A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
- Transmission Tunnel:** A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
- Proposed Main:** A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

- Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

P e l l F r i s c h m a n n

M4 Junction 16 Motorway Rest Area

Sustainable Drainage Report

This report is to be regarded as confidential to our Client and is intended for their use only and may not be assigned except in accordance with the contract. Consequently, and in accordance with current practice, any liability to any third party in respect of the whole or any part of its contents is hereby expressly excluded, except to the extent that the report has been assigned in accordance with the contract. Before the report or any part of it is reproduced or referred to in any document, circular or statement and before its contents or the contents of any part of it are disclosed orally to any third party, our written approval as to the form and context of such a publication or disclosure must be obtained.

Report Ref.		107846-PEF-ZZ-XX-RP-CD-000001				
File Path		\\RSBGUKFS01\NOTEngineering\Data\107846 - M4 Junction 16 Motorway Rest Area\01 - WIP\Documents\Drainage\107846-PEF-ZZ-XX-RP-CD-000001-S2-P03_SDR.docx				
Suit	Rev	Description	Date	Originator	Checker	Approver
S2	P01	Preliminary Issue	25/08/2023	H. McColl	D. Allum-Rooney	D. Allum-Rooney
S2	P02	Updated based on client comments	13/09/2023	T. Sturtridge	H. McColl	D. Allum-Rooney
S2	P03	Updated to client comments	02/10/2023	H. McColl	D. Allum-Rooney	D. Allum-Rooney

Ref. reference. Rev revision. Suit suitability.

Prepared for

Moto Hospitality Ltd.

Toddington Service Area
Junction 11/12, M1 (Southbound)
Toddington, Bedfordshire
LU5 6HR

Prepared by

Pell Frischmann

Suite 4.2 – 1, The Poynt
Wollaton Road
Nottingham
NG1 5FW



Pell Frischmann

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Appendix G Exceedance Flow Routes

Appendix H SuDS Simple Index Approach Calculations

Appendix I Impermeable Area Plan

Appendix J Watercourse Connectivity Plans

1 Introduction

1.1 Report Context

- 1.1.1 Pell Frischmann has been commissioned by Moto Hospitality to develop a drainage strategy for a site off Junction 16 of the M4 to support an outline planning application for a proposed new motorway rest area.
- 1.1.2 This Sustainable Drainage Report (SDR) will set out the principles of the proposed drainage strategy and demonstrate how the local and national guidance has been considered. This will include justification of; specific surface water discharge rates, the volume of attenuation required and sustainable drainage systems to be included.

1.2 Sources of Information

- 1.2.1 A review of the relevant information from a range of sources has been undertaken and includes the following:
- National Planning Policy Framework (NPPF), September 2023;
 - Non-statutory technical standards for sustainable drainage systems, March 2015;
 - Water UK, Sewerage Sector Guidance, October 2019;
 - CIRIA, C753 The SuDS Manual Version 6, 2015;
 - HM Government, The Building Regulations 2010, Drainage and Water Disposal (Part H), 2015;
- 1.2.2 The NPPF specifies that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development. Opportunities to reduce the flood risk to the site itself and elsewhere, taking climate change into account, should be investigated. The drainage proposals within this strategy have been prepared to meet planning policy requirements.
- 1.2.3 In their role as Lead Local Flood Authority, Wiltshire County Council have not produced any explicit guidance surrounding the drainage of new developments (outside of adoptable highway works.) The designs and principles outlined in this report therefore follow industry best practice and the legislation and guidance presented above.

1.3 Site Location

- 1.3.1 The site is located between the M4 Motorway and the B4005, just to the east of Junction 16. It is bounded by these two roads (along with associated drainage elements) to the north, south, and west and by further open agricultural space to the east.
- 1.3.2 The site covers a footprint of approximately 7.3 hectares.
- 1.3.3 The site is currently accessed from the south of the B4005.
- 1.3.4 The above can be seen in **Figure 1.1**.

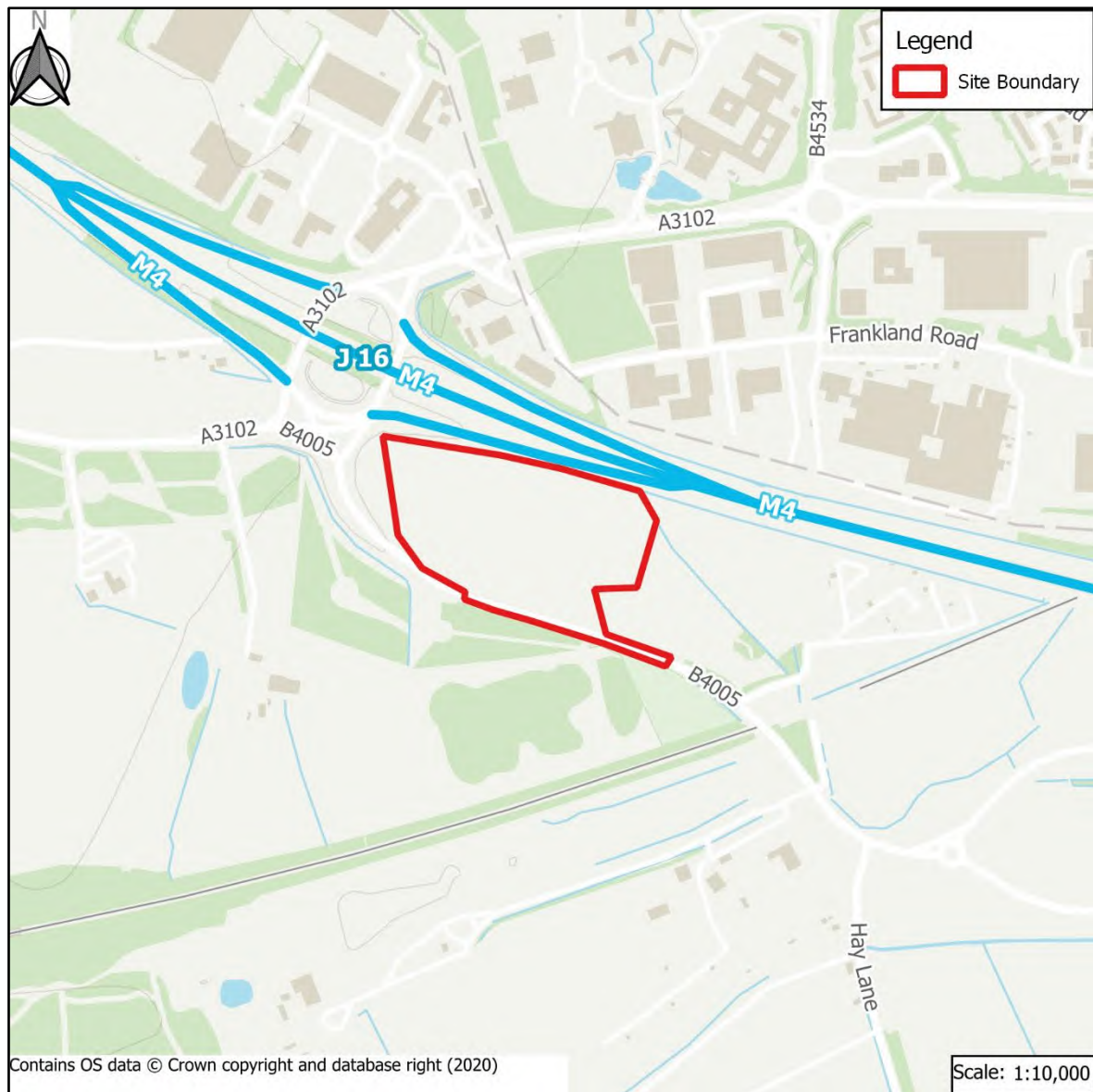


Figure 1.1 Site Location Plan

1.4 Topography

- 1.4.1 The site generally falls from west to east with a small portion of the western edge to the site falling to the south west.
- 1.4.2 Levels range from approximately 108mAOD in the north-western corner of the site and fall to approximately 105mAOD in the south-eastern corner.
- 1.4.3 LiDAR data presented in **Figure 1.2** shows the overall topography of the area and a site-specific topographic survey has been provided in **Appendix A**.

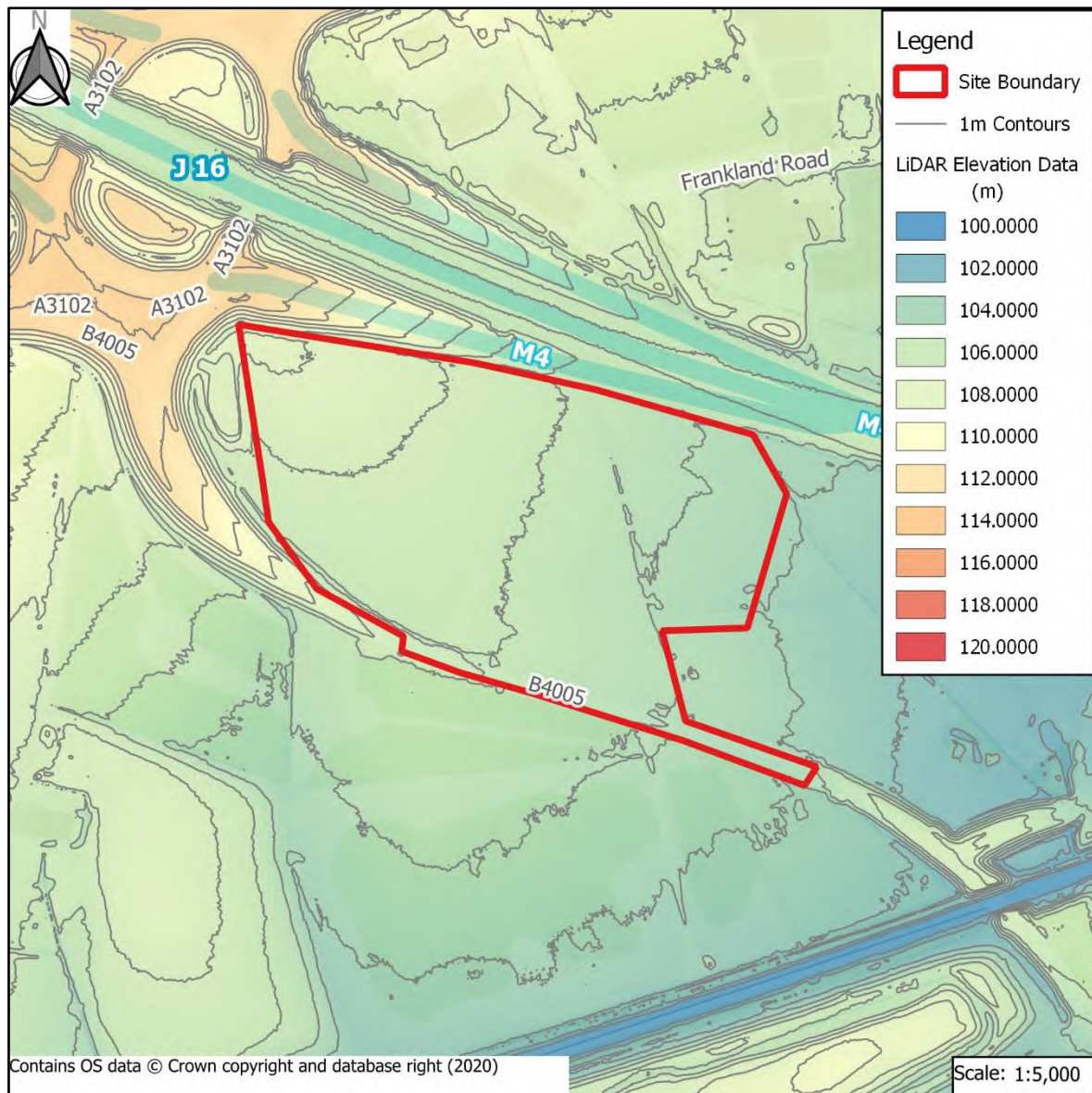


Figure 1.2 LiDAR Elevation Data

1.5 Proposed Development

- 1.5.1 Development proposals comprise of a new amenity building, charging areas for electric cars and parking for coaches, caravans & HGV creating a new Motorway Rest Area at J16 of the M4, with associated road infrastructure, landscaping, and SuDS features. The latest masterplan for the development, on which the drainage strategy is based, can be found in **Appendix B** of this report.

2 Existing Conditions

2.1 Existing site

- 2.1.1 There are no areas of hardstanding located within the site in its current state and is assumed to drain via a network of land drainage ditches toward the south and east. This is shown in **Figure 2.1**.

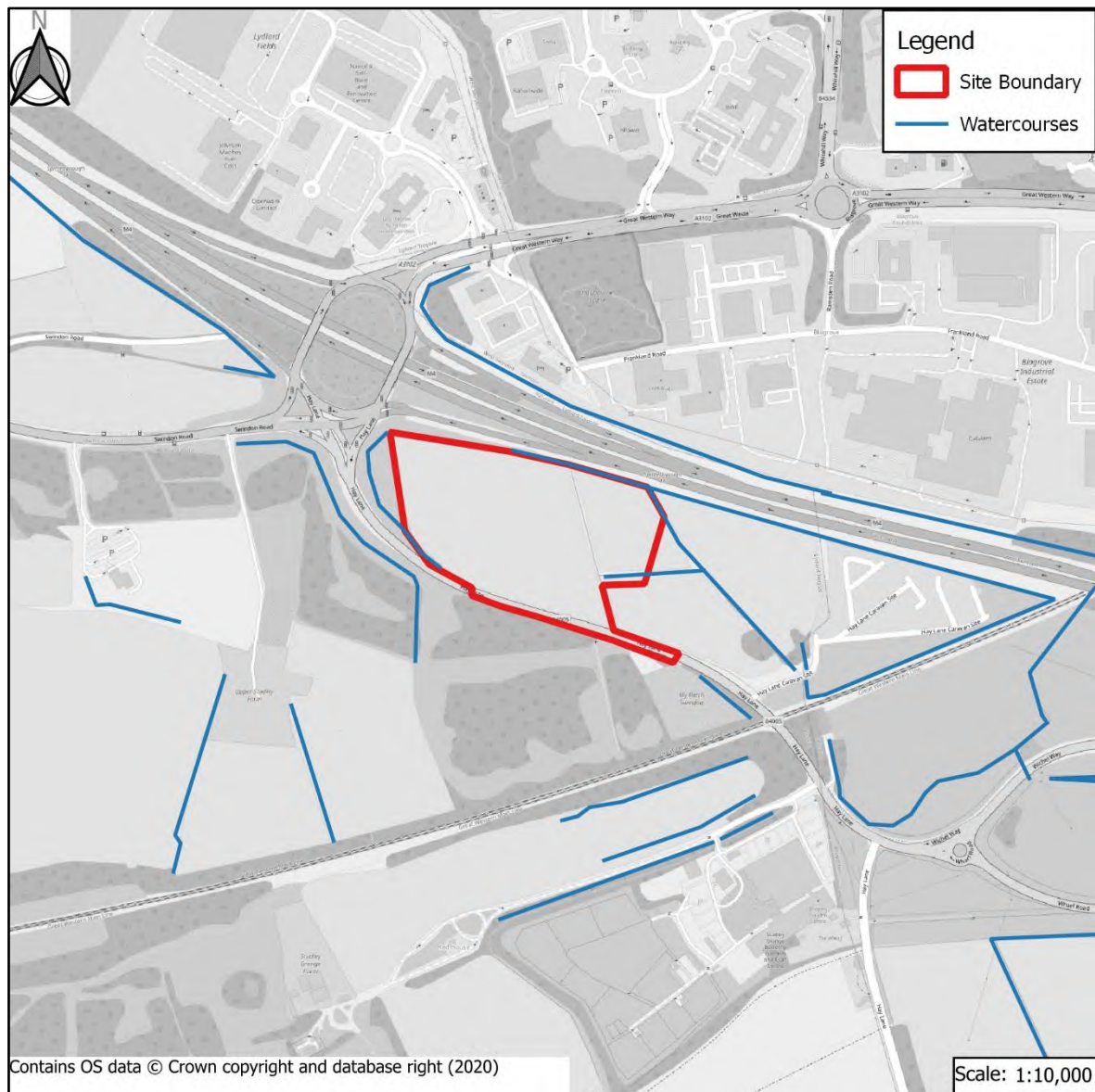


Figure 2.1 Local Watercourses

- 2.1.2 A recently constructed highway balancing pond and conveyance swale is present on the western and southern boundary, providing a conveyance route for runoff generated by the M4 in the immediate area, Continuity of these elements as a watercourse is provided by a culvert running under the B4005 to the south.

2.2 Site Geology

- 2.2.1 British Geological Survey (BGS) mapping suggests the site is wholly underlain by a bedrock geology comprising Kimmeridge Clay Formation – Mudstone. This suggests limited potential for infiltration.
- 2.2.2 BGS mapping also shows there to be no recorded superficial geology within the site or the surrounding area.

- 2.2.3 There are no freely available borehole records within the site boundary. The nearest can be found immediately to the southwest and northeast of the site (borehole references: SU18SW41 and SU18SW60). Details from the logs made available via the BGS are summarised in **Table 2.1**, which suggest no water was struck during drilling.

Table 2.1 Borehole Information

Borehole Reference	Date Drilled	Depth (mbgl)	Water Struck (mbgl)
SU18SW41	September 1966	1.2	DRY
SU18SW60	July 1984	5.0	DRY

2.3 Existing Runoff Rate

- 2.3.1 The following runoff rates in **Table 2.2** have been provided for a range of return period for a 'per hectare' rate and a total rate for the developable site area. These have been calculated using Interim Code of Practice/FSR method.
- 2.3.2 Calculations variables and results are presented in **Appendix C** of this report.

Table 2.2 Summary of Greenfield Runoff Rates

Area	QBAR (l/s)	2 Year Return Period (l/s)	30 Year Return Period (l/s)	100 Year Return Period (l/s)
1ha	3.64	3.2	8.1	11.4
7.05ha	25.1	22.2	57.0	80.2

- 2.3.3 In accordance with all relevant guidance, it is proposed to limit all surface runoff from the site to a flow rate equivalent to the QBAR rate calculated above.

2.4 Existing Runoff Volume

- 2.4.1 In accordance with requirement **S4** presented with the '*Non-statutory technical standards for sustainable drainage systems*', the volumetric runoff for the site must not exceed the existing runoff for a 1 in 100-year, 6-hour rainfall event.
- 2.4.2 As shown in **Appendix D** of this report, the greenfield runoff volume for the aforementioned event is equal to 1,370m³.

3 Surface Water Strategy

3.1 Drainage Hierarchy

3.1.1 Prevailing local and national guidance suggests that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:

- Water reuse, where a need is identified;
- into the ground (infiltration), where ground conditions permit;
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer;

3.1.2 Infiltration should be investigated as a means of surface water disposal as the first priority. Given that investigations are yet to take place, it is proposed that a local watercourse is the most appropriate location of outfall for surface water.

3.1.3 An appropriate receptor is located at the eastern boundary of the site, flowing eastward.

3.2 Surface Water Attenuation

3.2.1 In accordance with national guidance, it is proposed to limit all surface water runoff flow off-site to the equivalent QBAR rate for all events up to the 100-year return period event + 40% climate change. A 40% uplift on the 1% annual probability storm is in line with the allowances for the 'Gloucestershire and the Vale' Management catchment in the latest guidance issued by the Environment Agency¹.

3.2.2 Given this requirement, surface water attenuation is required on site to account for the difference between peak runoff rate and allowable discharge rate, based on the site development area.

3.2.3 Discussion of the calculation of the QBAR greenfield rate can be found in **Section 2.3** of this report.

3.2.4 Given the spatial constraints of the required masterplan for the site and the topographical constraints of outfall location (discussed in **Section 3.3**), various methods of surface water attenuation are currently proposed to be included on-site. These include rain gardens, permeable paving with voided subbase, conveyance swales, green roofs, open basins, and cellular storage. The proposed inclusion of these features can be seen on the conceptual drainage strategy presented in **Appendix E**.

3.2.5 The network calculations presented in **Appendix F** show the following requirements for attenuation on site. An indicative impermeable area plan can be seen in **Appendix I**.

Table 3.1 Summary of Attenuation Required

Impermeable Area (ha)	Allowable Runoff Rate (l/s)	Storage required under 2 year return period (m ³)	Storage required under 30 year return period (m ³)	Storage required under 100 year return period (+40% CC) (m ³)
3.42	25.1	872	1,627	3,272

3.3 Outfall location

3.3.1 In order to satisfy the drainage hierarchy, set out by the CIRIA SuDS Manual C753, it is proposed to outfall surface water runoff generated by the development into an existing drainage ditch running eastward from the eastern boundary of the site.

¹ Environment Agency (2022); *Flood risk assessments: climate change allowances*; available from gov.uk, accessed via <https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall?mgmtcatid=3038>

3.3.2 The downstream connectivity of the receiving watercourse can be seen in **Appendix J**.

3.4 Runoff Volume Control

3.4.1 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6 states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6-hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume. It is proposed that any detailed designs for the surface water management of the site will adhere to this requirement.

3.5 Surface Water Exceedance Flows

3.5.1 In the event of the failure of the surface water network serving the event, e.g. in the event of blockage or a rainfall event that exceeds capacity of conveyance elements.

3.5.2 A surface water exceedance route plan has been included as **Appendix G** of this report, showing flows to be directed toward the eastern boundary of the site, in general accordance with the existing overland flow routes of the site; where topography creates sheet flow to the east.

3.6 SuDS Features

3.6.1 The proposed strategy is based on sustainable drainage principles, employing SuDS features to manage surface water runoff across the site.

3.6.2 Whilst the conveyance swales and attenuation basins are principally designed to address the movement and quantity of water that is to be attenuated, they also have water quality benefits, especially if planted with vegetation. They can also provide additional habitats for wildlife, increasing biodiversity and can increase the amenity value of the service area.

3.6.3 A wide variety of other SuDS features are also proposed to be implemented across the development;

3.6.4 Areas of permeable paving constructed with a voided subbase are proposed to be utilised under large areas of parking. Detailed design will necessitate provision of overflows and baffles to utilise the full area.

3.6.5 Conveyance swales will be used to connect the site where possible to allow flow to progress from west to east.

3.6.6 Rain gardens will be provided at the end of parking areas to provide a visible element of additional surface level storage.

3.6.7 Flood Storage areas will be introduced to hold some of the flooded volume in the most extreme rainfall events.

3.6.8 In order to provide the required attenuation volume on-site, underground features such as cellular storage tanks are required to hold surface water.

3.6.9 Additional measures are likely to be incorporated into the design at the appropriate stage, including oil/petrol interceptors in areas at high risk of pollution.

3.7 Water Quality Assessment

3.7.1 In accordance with the Simple Index Approach presented in CIRIA SuDS Manual C753, it is a requirement to show that there is adequate water treatment within the surface water runoff treatment

train. **Table 3.2** summarises the land hazard use and treatment indices presented within the drainage strategy.

Table 3.2 Summary of Land Use Hazard and Treatment Indices

SuDS Component	Mitigation Indices		
	<i>Total Suspended Solids</i>	<i>Metals</i>	<i>Hydrocarbons</i>
Permeable Paving	0.7	0.6	0.7
Conveyance Swale	0.5	0.6	0.6
Attenuation Basin	0.7	0.7	0.5
SuDS Mitigation Index	>0.95	>0.95	>0.95
Lorry Park	0.8	0.8	0.9
Highly Frequented Road	0.8	0.8	0.9
Mitigation Requirement Met?	Yes	Yes	Yes

3.7.2 It can be seen above that the treatment provided by the train within the development is adequate for the development uses, even when considering the factored treatment index for secondary and tertiary stages. Details of the calculations using the Simple Index Approach are included as **Appendix H**.

3.7.3 Any requirement for specific petrol/oil interceptors will be confirmed at detailed design. It should also be noted that the petrol filling station will have a separate, discrete drainage system designed with suitable monitoring and shut off valves to separate it from the rest of the drainage system, which can be isolated in the event of spills. Pollution prevention plans should also be prepared in line with prevailing guidance and best practice.

3.8 Maintenance and Adoption

3.8.1 For the proposed surface water drainage system to function correctly, it will need to be appropriately maintained. It is proposed that all drainage elements within the site will be owned and maintained by the body responsible for maintenance of the wider motorway service area.

3.8.2 The maintenance schedule for the network must be comprehensive and detail the specific maintenance requirements for each element of the drainage system. The CIRIA SuDS Manual has extensive information relating to the maintenance of SuDS which should be consulted when specifying the requirements.

3.8.3 For pipes, manholes and gullies, both general best practice and specific manufacturer maintenance protocols should be followed.

3.8.4 Requirements for the ongoing maintenance of the infrastructure should form part of the Operation and Maintenance (O&M) manual for the site, clearly detailing the extent of responsibility and features to be maintained. Any specialist or proprietary products specified should have a manufacturer specific maintenance regime which should be included. It is envisaged that the O&M manual will be developed at the detailed design stage. A summary of general best practice maintenance is given below.

- All drainage features should be situated in open areas which are readily accessible.
- Gullies, pipes, manholes and silt traps should be inspected and de-silted at least once per year, where necessary.
- Wherever permeable paving is incorporated it should be swept a minimum of every 6 months to maintain flow capacity of the joints between blocks.
- For any basins which are designed to be dry, they should be seeded with a wildflower grass seed mix that can tolerate wet ground conditions and should be mowed periodically over the summer months to ensure they do not become overgrown.

- For any basins which are designed to be wet, plants which are suitable for growing in permanent water should be used, such as bull rushes and reeds.
- Regular inspections of all basins should be undertaken to remove litter/debris, invasive/colonising vegetation, and silt build-up as necessary.
- Inlet and outlet structures should be regularly inspected with remedial work as required to ensure clear flow of water and the prevention of silt/vegetation build up.

3.8.5 Flow control chambers should be inspected every 6 months to ensure proper function with any litter or debris removed as necessary.

4 Foul Water Drainage

4.1 Existing Foul water provisions

4.1.1 Given the undeveloped nature of the site, there are currently no foul water provisions within the site.

4.2 Proposed Foul water provisions

4.2.1 In order to convey foul water from the site, it is likely that Thames Water will need to requisition an appropriate route to the existing adopted network. It is anticipated that these discussions will take place subsequent to the approval of planning permission.

4.2.2 The estimation of foul water generated by the development is calculated at 2.94l/s. This has been estimated for the developed area of 4.9ha and an assumed 0.6l/s/ha of developed land as presented in Section B3.1 of Design and Construction Guidance.

4.2.3 Any requirements for an onsite pumping station will be determined at detailed design stage.

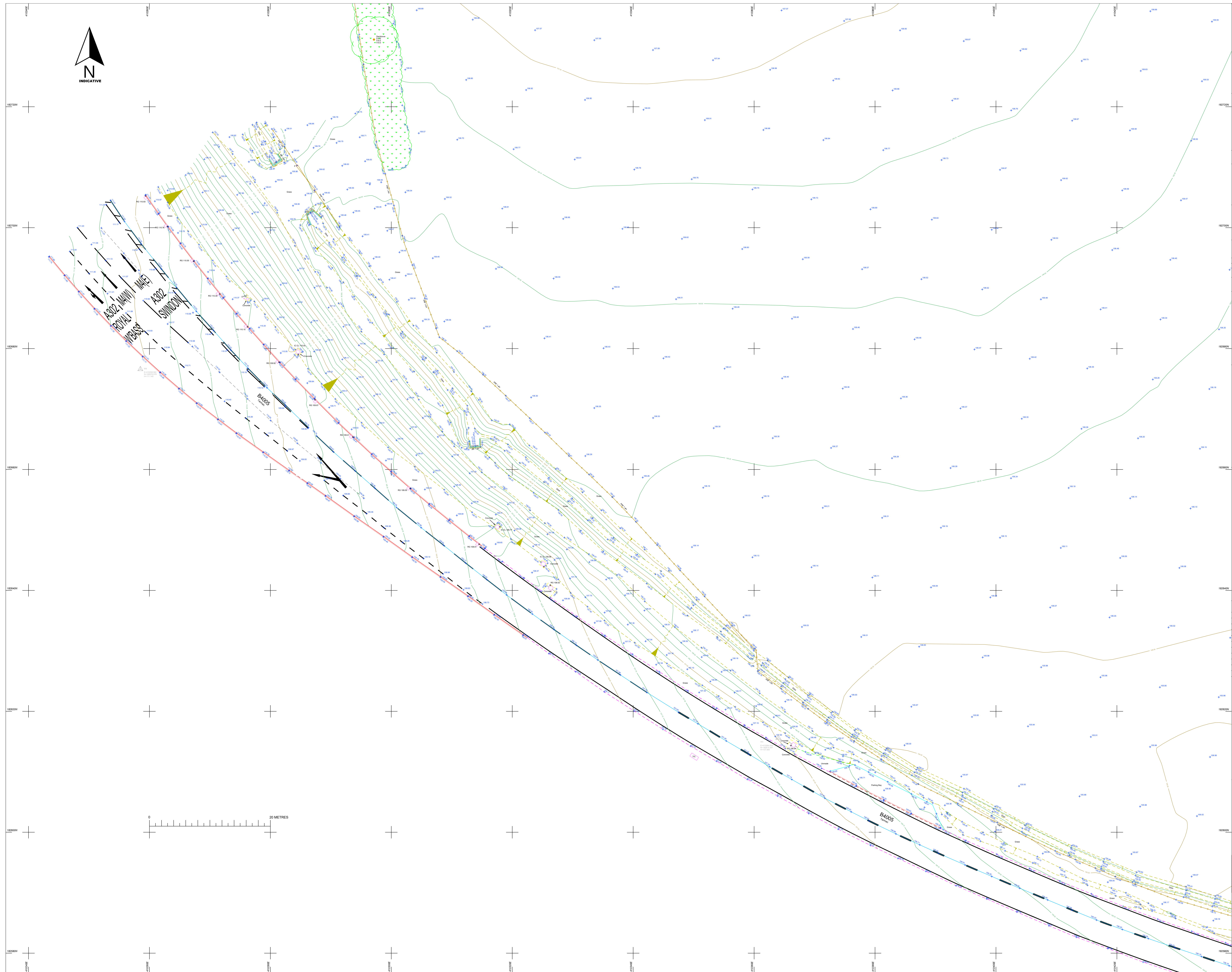
5 Summary

- 5.1.1 This report and supporting appendices demonstrate that an appropriate surface water drainage strategy has been developed for the site based on sustainable drainage principles in line with the relevant local and national policy and standards.
- 5.1.2 This Sustainable Drainage Report is intended to support an outline planning application and as such the level of detail included is commensurate with the nature of the proposals. **Table 5.1** provides a summary of key information included within this report.

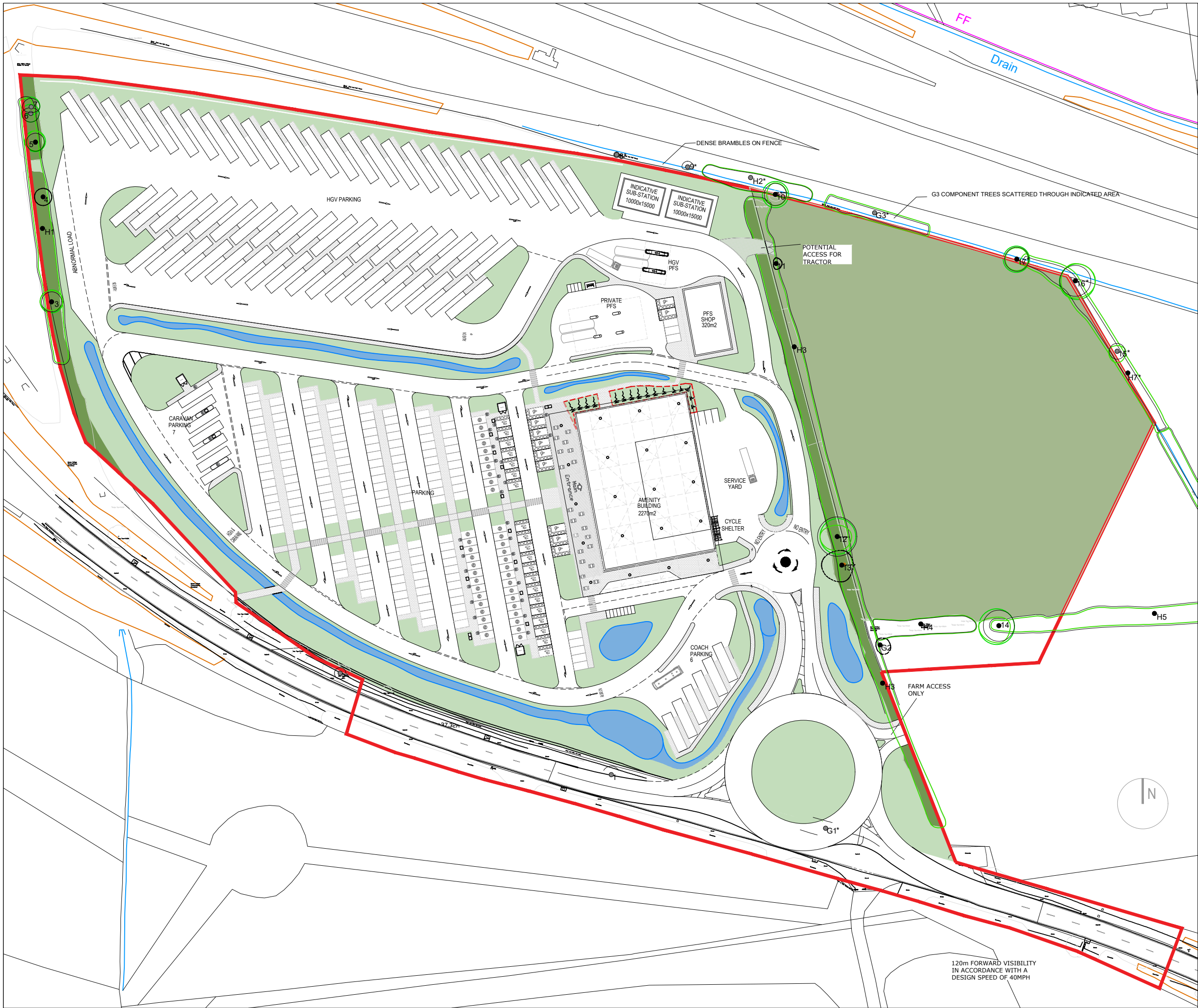
Table 5.1 Summary of Key Information

Topic	Existing Site		Proposed Development
Site Area (hectares)	7.2		7.2
Impermeable Area (hectares)	0		3.42
Number of Sub-Catchments	-		1
Outfall Location(s)			
Peak Runoff Rate (l/s)	1 in 1-year	21.4	Peak Runoff Rate 25.1 (l/s)
	QBAR	25.1	
	1 in 30-year	57.0	
	1 in 100-year	80.2	
	1 in 100-year + CC	112.3	
Proposed Storage Volume (m ³)	-		3,272
SuDS Features	-		Attenuation basin Permeable paving Swales Rain gardens Rainwater harvesting systems Tree Pits Green Roofs
Maintenance Responsibilities	Landowner		MSA Operator

Appendix A Topographic Survey

[illegible]

Appendix B Development Masterplan



GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED
2. ALL LEVELS ARE IN METRES UNLESS OTHERWISE STATED
3. DIMENSIONS ARE NOT TO BE SCALED FROM THE DRAWING
4. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT EDITION OF THE BUILDING REGULATIONS 1991 (INCLUDING AMENDMENTS) AND ALL RELEVANT BRITISH STANDARDS/CODES OF PRACTICE
5. CONTRACTOR IS RESPONSIBLE FOR THE CORRECT SETTING OUT OF THE WORKS ON SITE, ALL DIMENSIONS TO BE CHECKED PRIOR TO FABRICATION OF MATERIALS
6. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND SPECIFICATIONS

PARKING NUMBERS

Cars - 241 spaces*
HGV Spaces - 62 spaces
HGV AL - 1 spaces
Coach - 6 spaces
Caravan - 7 spaces
Motorcycles - 12 spaces

* all spaces sized for EV provision

- Landscaping
- Hard standing
- Biodiversity Enhancements

G	Drainage works	06/09/23	EC	TS	TS
F	Biodiversity Enhancements	04/09/23	EC	TS	TS
E	Tractor access and red line updated	30/08/23	EC	TS	TS
D	Red line amended to include roadworks	25/07/23	TS	TS	TS
C	Red line boundary amended	18/07/23	EC	TS	TS
B	Issue for information	17/07/23	EC	TS	TS
A	Issue for EIA screening	June 2023	EC	TS	TS
REV	DESCRIPTION	DATE	BY	CHK	APRV



MOTO HOSPITALITY

SWINDON SERVICES
PROPOSED LAYOUT PLAN
(ILLUSTRATIVE)

PLANNING

DRAWING STATUS					
DRAWN	EC			CHECKED	EC
APPROVED	TS			DATE	MAY 2023
1:1250	M49_101			G	
SCALE	DRAWING NUMBER			REV	

Appendix C Greenfield Runoff Rate Calculation

Pell Frischmann		Page 1
5 Manchester Square		
London		
W1U 3PD		
Date 23/08/2023 14:20	Designed by JNicholson	
File Qbar.SRCX	Checked by	
Innovyze	Source Control 2020.1	
ICP SUDS Mean Annual Flood Input Return Period (years) 100 SAAR (mm) 750 Urban 0.000 Area (ha) 5.280 Soil 0.450 Region Number Region 6 Results 1/s QBAR Rural 25.1 QBAR Urban 25.1 Q100 years 80.2 Q1 year 21.4 Q30 years 57.0 Q100 years 80.2		
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Appendix D Greenfield Runoff Volume Calculation



Designed by JNicholson
Checked by

Source Control 2020.1

Greenfield Runoff Volume

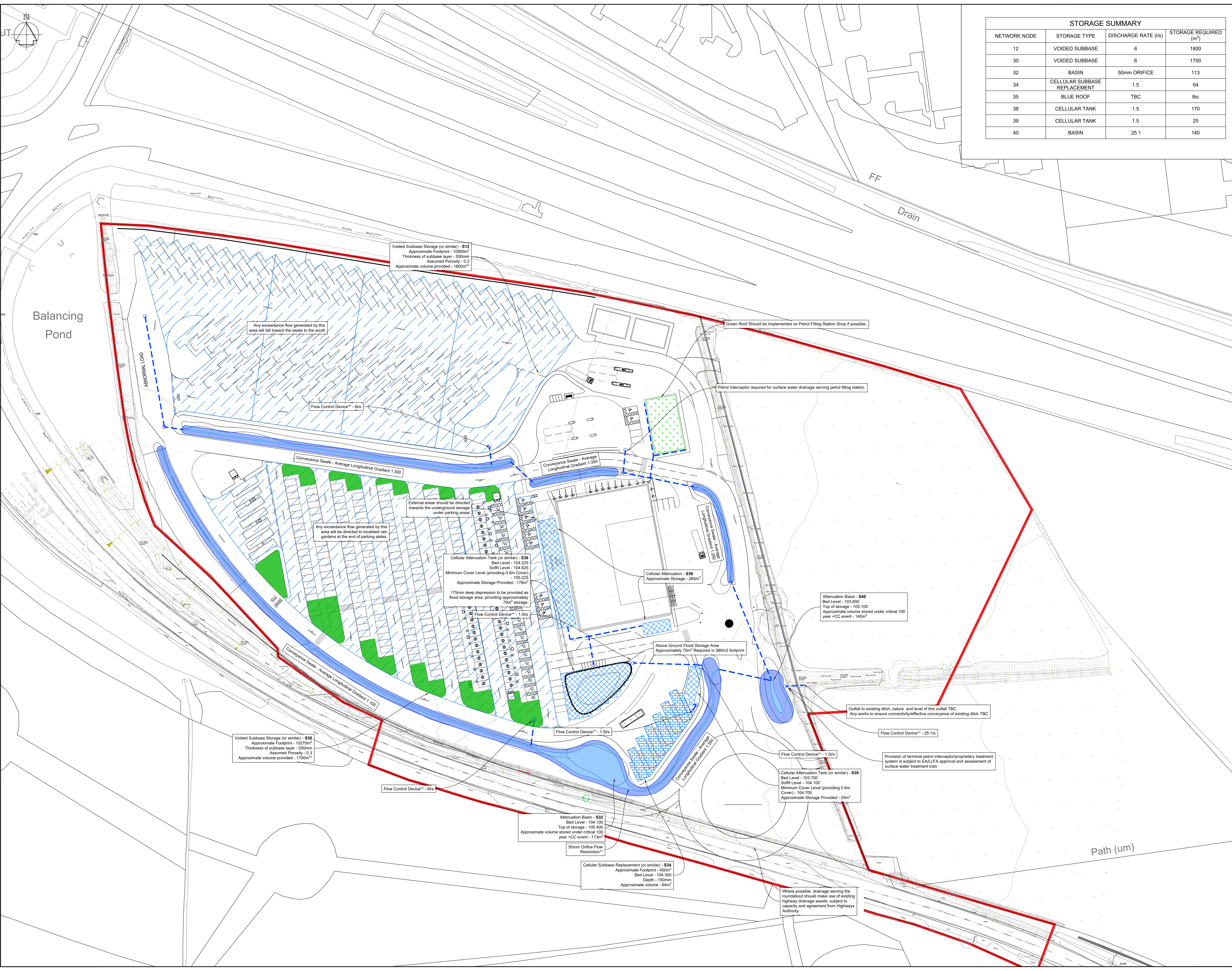
FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.397
Areal Reduction Factor	1.00
Area (ha)	7.050
SAAR (mm)	783
CWI	45.000
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	31.00
Greenfield Runoff Volume (m³)	1370.226

Appendix E Drainage Strategy



STORAGE SUMMARY			
NETWORK NODE	STORAGE TYPE	DISCHARGE RATE (l/s)	STORAGE REQUIRED (m³)
12	VOIDED SUBBASE	6	1800
30	VOIDED SUBBASE	6	1700
32	BASIN	50mm ORIFICE	113
34	CELLULAR SUBBASE REPLACEMENT	1.5	64
35	BLUE ROOF	TBC	tbc
38	CELLULAR TANK	1.5	170
39	CELLULAR TANK	1.5	25
40	BASIN	25.1	140

- GENERAL NOTES
- G1. DO NOT SCALE THIS DRAWING.
- G2. ANY DIMENSIONAL DISCREPANCIES SHOULD BE NOTIFIED TO THE ENGINEER IMMEDIATELY.
- G3. ALL DIMENSIONS ARE IN MILLIMETRES - (mm)
ALL LEVELS ARE IN METRES - (m) AND ARE ABOVE ORDNANCE DATUM AT NEWLYN, CORNWALL UNLESS NOTED OTHERWISE.
- G4. NORTH SHOWN INDICATIVE ONLY
- G5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, DRAWINGS, DETAILS AND OTHER DESIGN INFORMATION.
- G6. ALL DRAWINGS AND WRITTEN MATERIAL CONTAINED WITHIN, CONSTITUTE ORIGINAL AND UNPUBLISHED WORK OF THE ENGINEER AND MAY NOT BE DUPLICATED, USED, REPRODUCED OR DISCLOSED WITHOUT WRITTEN CONSENT OR EXPRESS PERMISSION FROM THE ENGINEER.
- G7. ALL INFORMATION CONTAINED IN THIS DOCUMENT IS COPYRIGHT ©
- G8. WHERE THE CONTRACTOR UNDERTAKES OR ENGAGES A THIRD PARTY TO UNDERTAKE TEMPORARY WORKS DESIGN, OR VARIES THE PELL FRISCHMANN DESIGN IN ANY WAY, THEN THE CONTRACTOR WILL TAKE FULL RESPONSIBILITY AND LIABILITY FOR ALL DESIGN ASPECTS, INCLUDING A DESIGN RISK ASSESSMENT. THE CONTRACTOR SHALL INFORM PELL FRISCHMANN OF ANY PROPOSED VARIANCES TO THE DESIGN.

DRAINAGE STRATEGY NOTES

THIS STRATEGY HAS BEEN PRODUCED TO SUPPORT AN OUTLINE PLANNING APPLICATION. DETAILS PROVIDED ARE CONSIDERED TO BE COMMENSURATE WITH THIS.

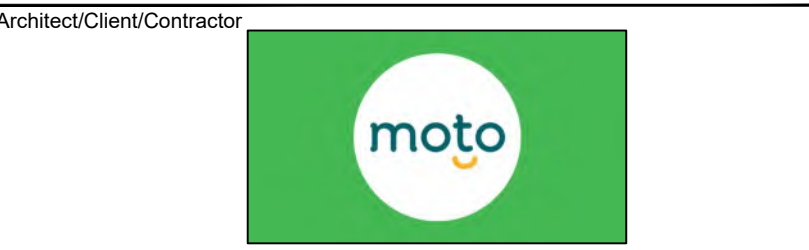
*DETAILED DESIGN OF BAFFLES WITHIN AREAS OF VOIDED SUBBASE WILL BE REQUIRED TO ENSURE UTILITY OF THE STORAGE VOLUME.

**APPROPRIATE BLOCKAGE MITIGATION, MAINTENANCE AND OVERFLOW WILL BE REQUIRED.

- KEY
- SURFACE WATER CONVEYANCE ROUTE
- CONVEYANCE SWALE
- VOIDED SUBBASE STORAGE AREA
- UNDERGROUND CELLULAR ATTENUATION
- PERMAVOID SUBBASE REPLACEMENT
- CAR PARK RAIN GARDENS
- GREEN ROOF

P05	Updated outfall	HM	DAR	DAR	08.08.23
P04	Updated outfall routes	HM	DAR	DAR	06.08.23
P03	Updated to updated layout	HM	DAR	DAR	23.08.23
P02	Updated Outfall Route	HM	RH	DAR	17.08.23
P01	Initial Issue	HM	RH	DAR	27.07.23
REV	DESCRIPTION	DRN	CHK	APP	DATE

Pell Frischmann
4th FLOOR, THE POYNT, WOLLATON STREET, NOTTINGHAM NG1 5PW
Telephone +44 (0)115 784 8800
Email: pfrischmann@pellfrischmann.com
www.pellfrischmann.com



Project
Swindon Services

Drawing Title
Conceptual Surface Water Drainage Strategy

PRELIMINARY			
Name	Date	Status Code	Scale
Drawn	H. McColl	27.07.23	S2
Designed	H. McColl	27.07.23	1:500@A0
Eng Chk	R. Holmes	27.07.23	Revision
Approved	D. Allum-Rooney	27.07.23	P05

Drawing No.
107846 - PEF - ZZ - XX - DR - CD - 0504

Appendix F Surface Water Attenuation Calculations

Pell Frischmann		Page 1
5 Manchester Square		
London		
W1U 3PD		
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Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2	Volumetric Runoff Coeff.	1.000
		PIMP (%)	100
FEH Rainfall Version	2013	Add Flow / Climate Change (%)	0
Site Location	GB 410651 182602 SU 10651 82602	Minimum Backdrop Height (m)	0.200
Data Type	Point	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW

« - Indicates pipe capacity < flow

PN	Length	Fall	Slope	I.Area	T.E.	Base	k	HYD	DIA	Section Type	Auto
(m)	(m)	(1:X)	(ha)	(mins)	Flow	(l/s)	(mm)	SECT	(mm)		Design

Network Results Table

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Network Design Table for SW

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.002	47.021	0.200	235.1	0.040	0.00	0.0	0.600	o	600	Pipe/Conduit	
S7.003	23.072	0.155	148.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S8.000	9.314	0.050	186.3	1.070	5.00	0.0	0.600	o	600	Pipe/Conduit	
S8.001	11.135	0.055	202.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.004	45.755	0.265	172.7	0.026	0.00	0.0	0.600	o	600	Pipe/Conduit	
S7.005	44.370	0.210	211.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S9.000	7.948	0.100	79.5	0.102	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.002	50.00	6.96	104.600	0.122	0.0	0.0	0.0	1.58	447.8	22.0
S7.003	50.00	7.15	104.400	0.122	0.0	0.0	0.0	1.99	563.7	22.0
S8.000	50.00	5.09	104.350	1.070	0.0	0.0	0.0	1.78	503.6	193.2
S8.001	50.00	5.29	104.300	1.070	0.0	0.0	0.0	0.92	36.4	193.2
S7.004	48.86	7.56	104.245	1.218	0.0	0.0	0.0	1.85	523.2	214.9
S7.005	47.44	8.00	103.980	1.218	0.0	0.0	0.0	1.67	472.6	214.9
S9.000	50.00	5.09	104.400	0.102	0.0	0.0	0.0	1.47	58.4	18.4

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5 Manchester Square London W1U 3PD																																		
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<u>Simulation Criteria for SW</u> <table> <tr> <td>Volumetric Runoff Coeff 1.000</td> <td>Manhole Headloss Coeff (Global) 0.500</td> <td>Inlet Coeffiecient 0.800</td> </tr> <tr> <td>Areal Reduction Factor 1.000</td> <td>Foul Sewage per hectare (l/s) 0.000</td> <td>Flow per Person per Day (l/per/day) 0.000</td> </tr> <tr> <td>Hot Start (mins) 0</td> <td>Additional Flow - % of Total Flow 0.000</td> <td>Run Time (mins) 60</td> </tr> <tr> <td>Hot Start Level (mm) 0</td> <td>MADD Factor * 10m³/ha Storage 2.000</td> <td>Output Interval (mins) 1</td> </tr> </table> Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 6 Number of Storage Structures 9 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Summer)</td> <td>1.000</td> </tr> <tr> <td>Site Location GB 410651 182602 SU 10651 82602</td> <td></td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Data Type</td> <td>Point Storm</td> <td>Duration (mins)</td> <td>30</td> </tr> </table>			Volumetric Runoff Coeff 1.000	Manhole Headloss Coeff (Global) 0.500	Inlet Coeffiecient 0.800	Areal Reduction Factor 1.000	Foul Sewage per hectare (l/s) 0.000	Flow per Person per Day (l/per/day) 0.000	Hot Start (mins) 0	Additional Flow - % of Total Flow 0.000	Run Time (mins) 60	Hot Start Level (mm) 0	MADD Factor * 10m³/ha Storage 2.000	Output Interval (mins) 1	Rainfall Model	FEH	Summer Storms	Yes	Return Period (years)	2	Winter Storms	Yes	FEH Rainfall Version	2013	Cv (Summer)	1.000	Site Location GB 410651 182602 SU 10651 82602		Cv (Winter)	0.840	Data Type	Point Storm	Duration (mins)	30
Volumetric Runoff Coeff 1.000	Manhole Headloss Coeff (Global) 0.500	Inlet Coeffiecient 0.800																																
Areal Reduction Factor 1.000	Foul Sewage per hectare (l/s) 0.000	Flow per Person per Day (l/per/day) 0.000																																
Hot Start (mins) 0	Additional Flow - % of Total Flow 0.000	Run Time (mins) 60																																
Hot Start Level (mm) 0	MADD Factor * 10m³/ha Storage 2.000	Output Interval (mins) 1																																
Rainfall Model	FEH	Summer Storms	Yes																															
Return Period (years)	2	Winter Storms	Yes																															
FEH Rainfall Version	2013	Cv (Summer)	1.000																															
Site Location GB 410651 182602 SU 10651 82602		Cv (Winter)	0.840																															
Data Type	Point Storm	Duration (mins)	30																															
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Online Controls for SW

Hydro-Brake® Optimum Manhole: S12, DS/PN: S5.001, Volume (m³): 4.6

Unit Reference MD-SHE-0121-6000-0550-6000	Sump Available	Yes
Design Head (m) 0.550	Diameter (mm)	121
Design Flow (l/s) 6.0	Invert Level (m)	104.950
Flush-Flo™	Calculated Minimum Outlet Pipe Diameter (mm)	150
Objective Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface	

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.550	6.0	Kick-Flo®	0.405	5.2
Flush-Flo™	0.194	6.0	Mean Flow over Head Range	-	5.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	0.600	6.2	1.600	9.9	2.600	12.5	5.000	17.0	7.500	20.7
0.200	6.0	0.800	7.1	1.800	10.5	3.000	13.3	5.500	17.8	8.000	21.4
0.300	5.8	1.000	7.9	2.000	11.0	3.500	14.4	6.000	18.5	8.500	22.1
0.400	5.3	1.200	8.6	2.200	11.5	4.000	15.3	6.500	19.3	9.000	22.7
0.500	5.7	1.400	9.3	2.400	12.0	4.500	16.2	7.000	20.0	9.500	23.4

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Hydro-Brake® Optimum Manhole: S30, DS/PN: S8.001, Volume (m³): 4.0

Unit Reference	MD-SHE-0064-1500-0550-1500	Sump Available	Yes
Design Head (m)	0.550	Diameter (mm)	64
Design Flow (l/s)	1.5	Invert Level (m)	104.300
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.550	1.5	Kick-Flo®	0.362	1.2
Flush-Flo™	0.162	1.5	Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.4	0.600	1.6	1.600	2.4	2.600	3.0	5.000	4.1	7.500	5.0
0.200	1.5	0.800	1.8	1.800	2.6	3.000	3.3	5.500	4.3	8.000	5.2
0.300	1.4	1.000	2.0	2.000	2.7	3.500	3.5	6.000	4.5	8.500	5.4
0.400	1.3	1.200	2.1	2.200	2.8	4.000	3.7	6.500	4.7	9.000	5.5
0.500	1.4	1.400	2.3	2.400	2.9	4.500	3.9	7.000	4.9	9.500	5.7

Orifice Manhole: S32, DS/PN: S7.005, Volume (m³): 15.0

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 103.980

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Orifice Manhole: S37, DS/PN: S10.001, Volume (m³): 1.6

Diameter (m) 0.033 Discharge Coefficient 0.600 Invert Level (m) 104.500

Hydro-Brake® Optimum Manhole: S38, DS/PN: S10.002, Volume (m³): 2.3

Unit Reference	MD-SHE-0066-1500-0400-1500	Sump Available	Yes
Design Head (m)	0.400	Diameter (mm)	66
Design Flow (l/s)	1.5	Invert Level (m)	104.225
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point	(Calculated)	0.400	1.5	Kick-Flo®		0.279	1.3
	Flush-Flo™	0.118	1.5	Mean Flow over Head Range		-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	0.600	1.8	1.600	2.8	2.600	3.5	5.000	4.8	7.500	5.9
0.200	1.4	0.800	2.0	1.800	3.0	3.000	3.8	5.500	5.0	8.000	6.1
0.300	1.3	1.000	2.3	2.000	3.1	3.500	4.0	6.000	5.3	8.500	6.3
0.400	1.5	1.200	2.5	2.200	3.3	4.000	4.3	6.500	5.5	9.000	6.5
0.500	1.7	1.400	2.6	2.400	3.4	4.500	4.6	7.000	5.7	9.500	6.6

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Date 28/07/2023 13:17		Designed by TSturtridge									
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Innovyze		Network 2020.1									
<u>Hydro-Brake® Optimum Manhole: S40, DS/PN: S4.009, Volume (m³): 16.2</u>											
Unit Reference MD-SHE-0217-2510-1200-2510		Sump Available		Yes							
Design Head (m) 1.200		Diameter (mm)		217							
Design Flow (l/s) 25.1		Invert Level (m)		103.600							
Flush-Flo™		Calculated Minimum Outlet Pipe Diameter (mm)		300							
Objective Minimise upstream storage		Suggested Manhole Diameter (mm)		1500							
Application		Surface									
Control Points		Head (m)	Flow (l/s)	Control Points	Head (m) Flow (l/s)						
Design Point (Calculated)		1.200	25.1	Kick-Flo®	0.849 21.3						
Flush-Flo™		0.394	25.1	Mean Flow over Head Range	- 21.3						
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated											
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	0.600	24.4	1.600	28.8	2.600	36.4	5.000	49.9	7.500	60.7
0.200	21.3	0.800	22.5	1.800	30.5	3.000	39.0	5.500	52.2	8.000	62.6
0.300	24.8	1.000	23.0	2.000	32.1	3.500	42.0	6.000	54.5	8.500	64.5
0.400	25.1	1.200	25.1	2.200	33.6	4.000	44.8	6.500	56.6	9.000	66.3
0.500	24.9	1.400	27.0	2.400	35.0	4.500	47.4	7.000	58.7	9.500	68.1
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5 Manchester Square London W1U 3PD		
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 6 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
 FEH Rainfall Version 2013 Cv (Summer) 1.000
 Site Location GB 410651 182602 SU 10651 82602 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status ON
 Analysis Timestep Fine DVD Status OFF

Profile(s) Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880,
 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
				Level (m)	Depth (m)	Volume (m³)						
S4.000	S1 15 minute 2 year Winter I+0%		107.200	104.618	-0.532	0.000	0.03		0.111		8.9	OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 6 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
 FEH Rainfall Version 2013 Cv (Summer) 1.000
 Site Location GB 410651 182602 SU 10651 82602 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status ON
 Analysis Timestep Fine DVD Status OFF

Profile(s) Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880,
 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water		Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)			
S4.000	S1 15 minute	30 year Winter I+0%	107.200	104.665	-0.485	0.000	0.07		0.194	21.7	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 6 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
 FEH Rainfall Version 2013 Cv (Summer) 1.000
 Site Location GB 410651 182602 SU 10651 82602 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status ON
 Analysis Timestep Fine DVD Status OFF

Profile(s) Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880,
 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S4.000	S1 60 minute	100 year Winter I+40%	107.200	104.965	-0.185	0.000	0.06		0.724		20.1	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW

										Water	Surcharged	Flooded			Half Drain	Pipe
US/MH							US/CL	Level	Depth	Volume	Flow /	Overflow	Maximum	Time	Flow	
PN	Name	Event					(m)	(m)	(m)	(m³)	Cap.	(l/s)	Vol (m³)	(mins)	(l/s)	Status
S4.001	S4	60 minute	100 year	Winter	I+40%	106.900	104.963	-0.097	0.000	0.10			5.870		31.0	OK
S4.002	S7	60 minute	100 year	Winter	I+40%	106.700	104.960	0.000	0.000	0.11			10.665		37.9	OK
S4.003	S10	60 minute	100 year	Winter	I+40%	106.100	104.953	0.133	0.000	0.11			12.608		28.0	SURCHARGED
S5.000	S11	15 minute	100 year	Winter	I+40%	106.000	106.017	0.292	17.237	3.53			18.902		733.6	FLOOD
S5.001	S12	720 minute	100 year	Winter	I+40%	106.000	105.261	0.086	0.000	0.08		1018.914		6.0	SURCHARGED	
S4.004	S13	60 minute	100 year	Winter	I+40%	105.800	104.949	0.199	0.000	0.09			12.182		25.1	SURCHARGED
S4.005	S14	60 minute	100 year	Winter	I+40%	105.650	104.945	0.240	0.000	0.11			4.750		30.1	SURCHARGED
S6.000	S15	15 minute	100 year	Winter	I+40%	105.700	105.056	0.006	0.000	1.02			0.645		181.6	SURCHARGED
S6.001	S15	60 minute	100 year	Winter	I+40%	105.700	104.950	0.000	0.000	0.25			2.770		96.1	SURCHARGED
S4.006	S16	60 minute	100 year	Winter	I+40%	105.570	104.939	0.319	0.000	0.31			13.644		99.0	SURCHARGED
S4.007	S17	120 minute	100 year	Winter	I+40%	105.940	104.928	0.408	0.000	0.21			9.989		66.9	SURCHARGED
S4.008	S18	120 minute	100 year	Winter	I+40%	105.300	104.918	0.518	0.000	0.25			13.575		96.9	SURCHARGED
S7.000	S19	15 minute	100 year	Winter	I+40%	107.157	105.285	-0.505	0.000	0.06			0.159		25.0	OK
S7.001	S22	15 minute	100 year	Winter	I+40%	106.800	105.074	-0.436	0.000	0.16			1.183		61.3	OK
S7.002	S25	15 minute	100 year	Winter	I+40%	106.200	104.796	-0.404	0.000	0.23			1.974		88.8	OK
S7.003	S28	480 minute	100 year	Winter	I+40%	105.700	104.713	-0.287	0.000	0.03			4.574		10.8	OK
S8.000	S29	15 minute	100 year	Winter	I+40%	105.300	105.325	0.375	25.462	2.18			27.013		675.5	FLOOD
S8.001	S30	10080 minute	100 year	Winter	I+40%	105.300	104.719	0.194	0.000	0.05		1280.527		1.5	SURCHARGED	
S7.004	S31	480 minute	100 year	Winter	I+40%	105.300	104.713	-0.132	0.000	0.03			5.322		13.4	OK
S7.005	S32	480 minute	100 year	Winter	I+40%	105.400	104.714	0.134	0.000	0.01		130.016		3.8	SURCHARGED	
S9.000	S33	15 minute	100 year	Winter	I+40%	105.000	104.832	0.207	0.000	1.75			0.482		78.0	FLOOD RISK
S9.001	S34	180 minute	100 year	Winter	I+40%	105.000	104.827	0.302	0.000	0.17			65.926		13.4	FLOOD RISK
S7.006	S35	180 minute	100 year	Winter	I+40%	105.000	104.822	0.452	0.000	0.04			95.725		11.1	FLOOD RISK
S10.000	S36	15 minute	100 year	Winter	I+40%	108.000	106.644	-0.156	0.000	0.46			0.157		163.0	OK
S10.001	S37	1440 minute	100 year	Winter	I+40%	105.400	104.663	-0.062	0.000	0.02		244.871		0.9	OK	

Appendix G Exceedance Flow Routes



GENERAL NOTES

G1. DO NOT SCALE THIS DRAWING.

G2. ANY DIMENSIONAL DISCREPANCIES SHOULD BE NOTIFIED TO THE ENGINEER IMMEDIATELY.

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ALL LEVELS ARE IN METRES - (m) AND ARE ABOVE
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KEY:

EXISTING FLOOD ROUTING

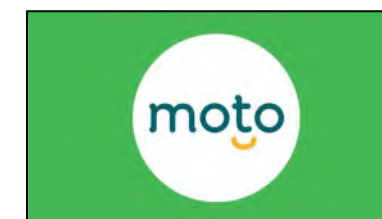
POST DEVELOPMENT EXCEEDANCE FLOW ROUTING

P01	-	JB	JB	JB	00.00.00
REV	DESCRIPTION	DRN	CHK	APP	DATE

Pell Frischmann

4th FLOOR, THE POYNT, WOLLATON STREET, NOTTINGHAM NG1 5FW
Telephone +44 (0)115 784 8960
Email: pfnottingham@pellfrischmann.com
www.pellfrischmann.com

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Project

M4 Junction 16
Motorway Rest Area

	Drawing Title
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Exceedance Flow Routes Plan

	Drawing Status
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PRELIMINARY

	Name	Date	Status Code
Drawn	H. McCOLL	25.08.23	S2
Designed	H. McCOLL	25.08.23	Scale 1:500
Eng Chk	D. ALLUM-ROONEY	25.08.23	Revision
Approved	D. ALLUM-ROONEY	25.08.23	P01

Drawing No.

107846 - PEF - ZZ - XX - DR - CD - 0511

Appendix H SuDS Simple Index Approach Calculations

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type Pollution Hazard Level Pollution Hazard Indices TSS Metals Hydrocarbons	Lorry park High 0.8 0.8 0.9	These indices should only be used if considered appropriate by the required risk assessment and where approved by the regulator. If they are not considered appropriate, the risk assessment should use alternative measures of pollution hazard for the site.	In Scotland and Northern Ireland, the environmental regulator should be consulted as part of the licensing process required for High Risk sites. In England and Wales, the environmental regulator should be consulted prior to design (for pre-permitting advice) to determine the most appropriate design approach and requirements for risk assessment.		
SuDS components proposed					
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 2	Swale				
Component 3	Detention basin				
SuDS Pollution Mitigation Indices TSS Metals Hydrocarbons	>0.95 >0.95 >0.95				
Groundwater protection type Groundwater protection Pollution Mitigation Indices TSS Metals Hydrocarbons	None 0 0 0				
Combined Pollution Mitigation Indices TSS Metals Hydrocarbons Acceptability of Pollution Mitigation TSS Metals Hydrocarbons	>0.95 >0.95 >0.95 Sufficient Sufficient Sufficient	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			

Appendix I Impermeable Area Plan



GENERAL NOTES

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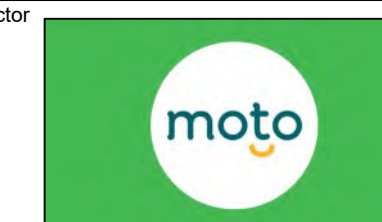
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P02	GENERAL UPDATE	HM	DAR	DAR	13.09.23
P01	INITIAL ISSUE	HM	DAR	DAR	25.08.23
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Pell Frischmann

4th FLOOR, THE POYNT, WOLLATON STREET, NOTTINGHAM NG1 5FW
Telephone +44 (0)115 784 8960
Email: pfnottingham@pellfrischmann.com
www.pellfrischmann.com

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Project

M4 Junction 16
Motorway Rest Area

	Drawing Title

Impermeable Area Plan

	Drawing Status
--	----------------

PRELIMINARY

PRELIMINARY			Status Code
	Name	Date	
Drawn	H. McCOLL	25.08.23	S2
Designed	H. McCOLL	25.08.23	
Eng Chk	D. ALLUM-ROONEY	25.08.23	1:500
Approved	D. ALLUM-ROONEY	25.08.23	
			P02

Approved	
Drawing No.	

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Appendix J Watercourse Connectivity Plans



GENERAL NOTES

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KEY:

OPEN WATERCOURSE

CULVERTED WATERCOURSE

APPLICATION SITE BOUNDARY

P03	DIRECTION SHOWN ONLY ON OUTFALL ROUTE	HM	DAR	DAR	22.09.23
P02	ADDITIONAL INFO ADDED	HM	DAR	DAR	21.09.23
P01	INITIAL ISSUE	HM	DAR	DAR	19.09.23
REV	DESCRIPTION	DRN	CHK	APP	DATE

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4th FLOOR, THE POYNT, WOLLATON STREET, NOTTINGHAM NG1 5FW
Telephone +44 (0)115 784 8960
Email: pfnottingham@pellfrischmann.com
www.pellfrischmann.com

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M4 JUNCTION 16
MOTORWAY REST AREA

Drawing Title

WATERCOURSE
CONNECTIVITY
PLAN

Drawing Status

PRELIMINARY

	Name	Date	Status Code
Drawn	H. McCOLL	19.09.23	S2
Designed	H. McCOLL	19.09.23	Scale
Eng Chk	D. ALLUM-ROONEY	19.09.23	Revision
Approved	D. ALLUM-ROONEY	19.09.23	P03

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P01	INITIAL ISSUE	HM	DAR	DAR	25.09.23
REV	DESCRIPTION	DRN	CHK	APP	DATE

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Telephone +44 (0)115 784 8960
Email: pfnottingham@pellfrischmann.com
www.pellfrischmann.com

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**M4 JUNCTION 16
MOTORWAY REST AREA**

Drawing Title

**HIGH LEVEL WATERCOURSE
CONNECTIVITY
PLAN**

Drawing Status

PRELIMINARY

	Name	Date	Status Code
Drawn	H. McCOLL	25.09.23	S2
Designed	H. McCOLL	25.09.23	Scale
Eng Chk	D. ALLUM-ROONEY	25.09.23	NTS
Approved	D. ALLUM-ROONEY	25.09.23	Revision
			P01

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